

*The City Of*

*Opelika*

*Alabama*

# **PUBLIC WORKS MANUAL**

**OPELIKA, ALABAMA**

**THE CITY OF OPELIKA, ALABAMA**

**&**

**THE OPELIKA CITY PLANNING COMMISSION**

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## **SECTION I**

### **AUTHORITY AND JURISDICTION**

#### **1.1 AUTHORITY**

From and after the date of adoption, the regulations contained herein shall be known as the City of Opelika Public Works Manual. Said regulations shall govern are related works occurring within the corporate limits of the City of Opelika and its Planning Jurisdiction as it relates to the development of new subdivisions as now or hereafter established. These regulations supersede any and all regulations in conflict with any part of these regulations or public works performed by the City or intended for public maintenance.

Any owner of land within the limits of said jurisdiction as stated above wishing to develop or improve his property in such a way as to require any construction improvements regulated herein, shall submit plans and specifications as required to the City Engineer for his review and approval. No such improvements shall be accepted for public maintenance unless constructed to the standards contained herein and accepted and approved by the City Engineer.

If any approved improvements are not completed and accepted for maintenance by the City of Opelika within two (2) years from the date of plan approval by the City Engineer, then the plans must be resubmitted to the City Engineer for approval prior to construction. All improvement plans submitted for approval must comply with current Public Works Manual requirements.

#### **1.2 PENALTIES**

Failure to comply with these regulations will result in the denial of acceptance for maintenance by the City of Opelika until such improvements comply with the requirements contained herein. In addition, no utilities shall be connected, no building permit, certificate of occupancy, or equivalent shall be issued until such time as the improvements have been approved by the City Engineer and accepted by the City of Opelika.

#### **1.3 SEVERABILITY**

If any section, subsection, clause or phrase of this regulation is for any reason held to be unconstitutional, void or invalid, the validity of the remaining portions of this regulation shall not be affected thereby, it being the intent of the Planning Commission in adopting these regulations that no portion hereof or provision of the regulations contained herein shall become inoperative or failed by reason of the unconstitutionality or invalidity of any section, subsection, sentence, clause, phrase, or provisions of these regulations.

## SECTION II

### TRAFFIC CONSIDERATIONS IN SUBDIVISION PLANNING AND LAYOUT

NOTE: The majority of Sections II and III are taken from the Institute of Transportation Engineers (ITE) "Recommended Guidelines for Subdivision Streets." These requirements are intended as minimum standards. However, the City Engineer is empowered to review other methods of application that meet as equal standards, and to approve their use.

#### 2.1 OBJECTIVES IN SUBDIVISION PLANNING

The primary objective of subdivision design is to provide maximum livability. This requires a safe and efficient access and circulation system connecting homes, schools, playgrounds, shops, and other subdivision activities for people living there.

Transportation considerations in subdivision design may be classified in two general areas: (a) the actual layout of the streets and pedestrian systems as related to land use, and (b) the engineering dimensions for vehicular, pedestrian, and any bicycle facilities. However, neither the street system nor the individual design element should be analyzed separately. They must both be considered in order to design a safe and efficient transportation system.

#### 2.2 CLASSIFICATION OF STREETS

There are three broad functional classifications of streets within urban areas, as reviewed below:

##### 2.2.1 Residential

Residential streets represent the lowest category. Their primary function is to serve abutting land use and provide access to residential uses. All residential streets are intended to accommodate relatively low traffic volumes at slow speeds in order to minimize the basic incompatibility of vehicles and the pedestrians and children who characterize residential neighborhoods. Residential streets have historically been considered homogeneous. Depending upon the type and density of development served by these streets, however, they are more accurately subcategorized as follows:

- a. **Lane:** a residential street or cul-de-sac which serves a maximum of six (6) dwelling units or has an Average Daily Traffic (ADT) of fewer than sixty (60) vehicles (whichever is less).
- b. **Court:** a residential street which provides access for individual units. A court serves fewer than fifteen (15) dwelling units or has an ADT of one hundred and fifty (150) vehicles (whichever is less). Courts may be cul-de-sacs, loops, or small cross-streets in a block system.

- c. **Way:** a residential street which provides access for individual dwelling units. It serves sixteen (16) to thirty (30) dwelling units or has an ADT of three hundred (300) vehicles (whichever is less). Ways may be cul-de-sacs, loops, or minor cross-streets. They do not function as collector roads.
- d. **Minor Street:** a residential street which collects traffic from courts or ways, as well as to give access to individual dwelling units. A minor street serves from thirty-one (31) to one hundred fifteen (115) dwelling units or has an ADT of twelve hundred (1200) vehicles (whichever is less).
- e. **Major Street:** a street to which individual residential streets take direct access. It provides access to minor streets, ways, and courts and serves from one hundred sixteen (116) to one hundred sixty (160) dwelling units or has an ADT of sixteen hundred (1600) vehicles (whichever is less).

The following rules and procedures shall be applied in order to determine the number of dwelling units served by a street. This number shall then be used to determine the residential street subtype and, therefore, the standards which shall be applied.

- a. A street segment is the length of a street between intersections or between points which define a change in street configuration.
- b. The number of dwelling units served by a street segment includes all units having frontage on that street segment and all units which have frontage on other segments of that street or other streets which contribute to the traffic volume of that segment.
- c. When more than one route of access is available to a dwelling unit, that unit shall be counted as served by the street segments most likely to provide the access point for that unit. In order to determine this, either of the following methods may be used: (1) a direction-preference analysis shall be conducted to determine directional preference for trips, or (2) the development shall be divided into trip areas based on the shortest exit route, taking into account any directional preferences.

### 2.2.2 Collector

Collector streets have the primary purpose of intercepting traffic from intersecting residential streets and handling this movement to the nearest arterial roads. A secondary function is service to abutting land use. Collector streets form barriers between neighborhoods and are designed for higher speeds and traffic volumes than residential streets. Collector streets are classified into two types as follows:

- a. **Minor Collector:** A minor collector is a local collector street which may be residential, commercial, or industrial in character and on which parking may be permitted. ADTs for minor collectors are between sixteen hundred (1600) and thirty-two hundred (3200) vehicles and include any street serving more than one hundred sixty (160) dwelling units.

- b. Major Collector: This road services major regional facilities and may carry non-local traffic. ADTs are between thirty-two hundred (3200) and seven thousand (7000) vehicles, and no parking is permitted.

### **2.2.3 Arterial**

Arterial streets are intended to provide for high-speed travel between or within communities or to and from collectors and expressways. Access is controlled so that only regionally significant land uses may take direct access to these streets. ADTs are usually over seven thousand (7000) vehicles.

These guidelines are limited to design characteristics of local and collector type streets in residential subdivisions. The street needs to service other types of denser uses, such as retail, office, or industrial, vary widely in operational requirements. The design shall be based upon detailed traffic analyses, which more closely approximates design procedures for major streets except for lower speeds and strong emphasis on access to abutting properties. All ranges in ADT may, of course, overlap, and the above figures are not intended as absolute design criteria.

## **2.3 PRINCIPLES OF SYSTEMS LAYOUT**

Basic principles exist that should be recognized and used in designing circulation and access systems in new residential subdivisions of conventional layout. These principles concern the design of entire street systems rather than individual elements of the system, and so express concepts rather than specific dimensions. In applying them, however, specific guidelines for pavement widths, intersection design, and related design features are desirable.

The design of local transportation systems must recognize the factors of: (a) safety - for both vehicular and pedestrian traffic. (b) efficiency of service for all users, (c) livability or amenities especially as affected by traffic elements in the circulation system, and (d) economy of land use, construction, and maintenance, again as affected by or related to the circulation system.

Each of the following principles is an elaboration on one or more of these four factors. Although instances may occur where certain principles conflict, each principle shall be considered as a criteria for design. The principles should, therefore, be used as concepts for proper systems layout, as illustrated in Figure 1.

FIGURE 2.1  
STREET LAYOUT PRINCIPLES

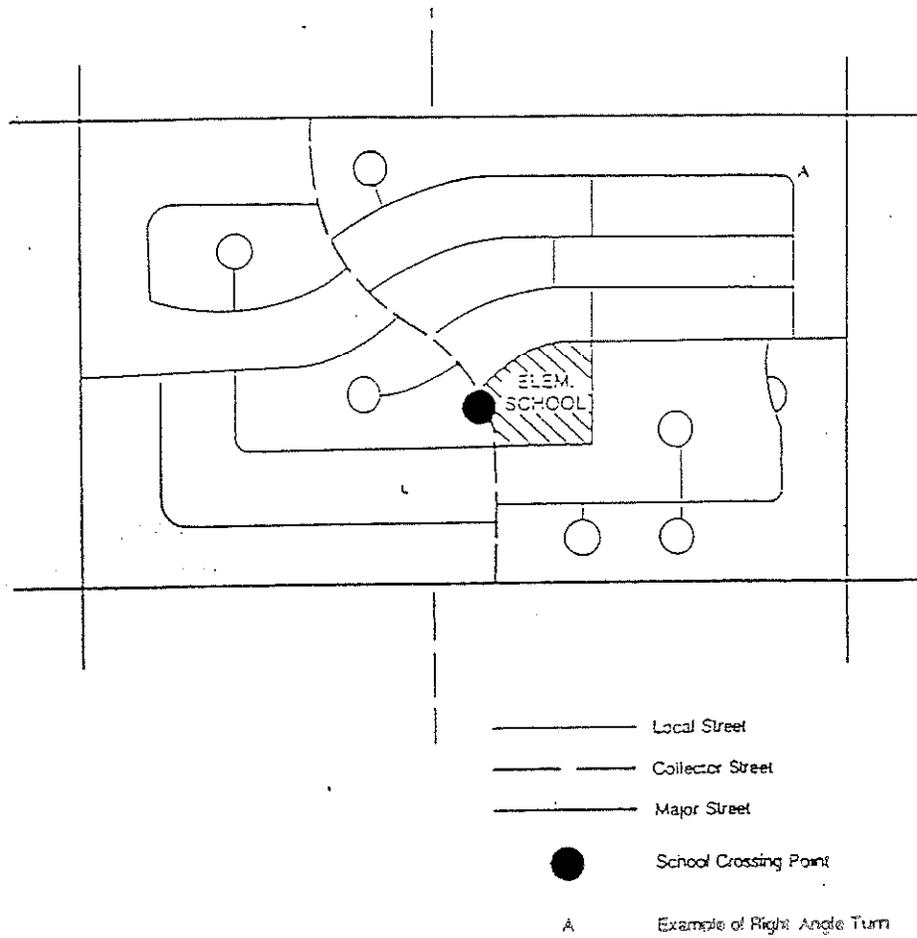


FIGURE 1. Illustration of Layout Principles

**1. Adequate Vehicular and Pedestrian Access Shall Be Provided to All Parcels.**

The primary function of local streets is service to abutting properties. Street widths, placement of sidewalks, pattern of streets, and number of intersections are related to safety and efficiency of access to abutting lands.

**2. Local Street Systems Shall Be Designed to Minimize Through Traffic Movements.**

Through traffic on residential and collector streets increases the average speed and volume and thus the accident potential, thereby reducing residential amenities. This can be attributed sometimes to inadequate peripheral major street capacity, but often the fault lies with improper residential street design. Through traffic may be discouraged by creating discontinuities in the local street pattern, by offsetting local street intersections, and by channelizing or controlling median crossings along peripherals major streets. (See Table 3.4 - Intersection Design Guidelines, for limitations.)

**3. Street Patterns Shall Minimize Excessive Vehicular Travel.**

Ideally, every part of a residential area should be interconnected with every other part, and with peripheral developments, as directly as possible. Although strict application of this principle may conflict with other principles, excessive indirect travel is annoying to the individual area's livability. Moreover, the added vehicle miles of travel within the neighborhood increases gasoline consumption and air pollution. It also increases midblock frictions, such as with parked cars, driveways, and pedestrians, with resultant increased hazards.

Street layout and location of access points along abutting major traffic streets should include consideration of the expected directional distribution of at least peak hour volumes. To the extent consistent with other planning principles, orientation should favor the minimum vehicle miles of travel to reach home sites.

**4. Local Street Systems Shall Be Logical and Comprehensible and Systems of Street Names and House Numbers Shall Be Simple, Consistent, and Understandable.**

The pattern of local streets, their names, and the house-numbering system shall be designed to satisfy the needs of visitors, delivery trucks, and emergency vehicles as well as local residents. A reasonable repetition in the street pattern, or conformance to topography can help in achieving an understandable street system. Streets which wander directionally or which turn back on themselves tend to be confusing, and should be avoided, except in small cluster developments.

**5. Local Circulation Systems and Land-Development Patterns Shall Not Detract from the Efficiency of Bordering Major Streets.**

This principle may involve control of driveways, intersection placement, and full or partial control of access. Ideally, land development should occur so that no parcels require direct access to major streets. Intersections of collector streets along major streets should be properly placed to facilitate signal progression.

**6. Elements in the Local Circulation System Shall Not Have to Rely on Extensive Traffic Regulations in Order to Function Efficiently and Safely.**

Consideration of the type and intensity of land use, off-street parking areas, zoning and subdivision requirements, off-street maneuver areas, and other accessory circulation elements concurrently with street design guidelines will minimize the need for traffic regulation and enforcement. Development controls should be sufficient to provide the circulation amenities necessary to keep the need for enforcement to a minimum.

**7. Traffic Generators Within Residential Areas Shall Be Considered in the Local Circulation Pattern.**

Schools, shopping facilities, and churches may cause traffic congestion on the local street system. To the extent necessary, they should serve as focal points for circulation, not only from within the area but from adjacent neighborhoods as well.

**8. Planning and Construction of Residential Streets Shall Clearly Indicate Their Local Function.**

These streets should have an appearance commensurate with their function as local streets. They should not be over-designed or overbuilt. Appurtenances should be in keeping with the residential character.

**9. The Local Street System Shall Be Designed for a Relatively Uniform Low Volume of Traffic.**

To the extent possible, the design of the residential and collector street system should recognize the need for residential amenities along all streets in the neighborhood. This suggests that the street system should be designed for uniformly low volumes on all streets after contiguous land development is complete. Where traffic volumes tend naturally to be higher, as along collectors, then variations in the land development pattern (i.e., permissible land uses, building setbacks, etc.) might be considered to compensate for the reduction in amenities.

**10. Local Streets Shall be Designed to Discourage Excessive Speeds.**

Residential streets should be designed to discourage fast movement (more than 25 to 30 MPH) through the use of curvilinear alignment and discontinuities in the street system.

**11. Pedestrian-Vehicular Conflict Points Shall Be Minimized.**

Pedestrian travel within the area (such as home to school) or from within the area to points outside should require a minimum of street crossings. Sometimes this may be achieved through proper design of street patterns, land-use arrangements, school district boundaries, and pedestrian routes. Typical methods include use of cul-de-sac and looped streets, special pedestrian routes or walkways, and the proper placement of high pedestrian traffic generators. In general, while

vehicular flow must be outward-oriented to the peripheral major streets, pedestrian travel should be inward-oriented to avoid these heavier vehicular flows.

**12. A Minimum Amount of Space Shall Be Devoted to Street Uses.**

It is desirable to minimize local street mileage and pavement area to reduce construction and maintenance costs, as well as to permit the most economic land use.

**13. There Shall Be a Minimum Number of Intersections.**

Within the subdivision and especially along abutting major streets, intersections pose an accident potential. The fewer intersections there are, consistent with other requirements, the fewer accidents there will be. From the standpoint of hazards, however, the use of two T-type intersections with proper offset is preferable to using one cross-type, within the subdivision.

**14. The Arrangement of Local Streets Shall Permit Economical and Practical Patterns, Shapes, and Sizes of Development Parcels.**

Streets as a function of land use must not unduly hinder the development of land. Distances between streets, angles of intersections, numbers of streets, and related elements all have a bearing on efficient lot layout of an area.

**15. Local Streets Shall Be Related to Topography from the Standpoint of Both Economics and Amenities.**

Local streets will be more attractive and economical (minimize cut and fill) if they are constructed to closely adhere to topography.

**16. Utilities necessary to serve users of streets shall be carefully planned.**

Streets and Intersections must be designed to allow present and future instillation of drainage, sanitary sewer, water, gas, phone, cable and electricity within the existing right-of-way.

## **SECTION III**

### **DESIGN ELEMENTS FOR SUBDIVISION STREETS**

#### **3.1 INTRODUCTION**

Standards for residential subdivision street design vary with terrain and with population densities. They address three general groupings: local (or residential) street, collector (or feeder) street, and intersection.

#### **3.2 RESIDENTIAL STREET DESIGN**

Recommended dimensions are shown in Tables 3.1 and 3.2. The following explanatory notes are intended to amplify and clarify specific values. They may also guide the designer in his or her individual interpretation and evaluation.

##### **3.2.1 Right-of-Way Width**

Sufficient right-of-way is required to contain the elements:

- a. Pavement and curbing, where required.
- b. Sidewalks, where required.
- c. Street utilities customarily installed in border areas, such as street lights, traffic signs, street trees, utility lines (overhead and underground).
- d. A moderate amount of cross-section grading, including shoulders where utilized

A 60-foot minimum basic right-of-way width shall be used for all residential streets where the width of the asphalt is greater than twenty-four (24) feet. A fifty (50) foot minimum basic right-of-way width shall be used for all residential streets where the width of the asphalt is twenty-four (24) feet or less. In no case is it recommended that full grading of the entire right-of-way width be mandatory.

**TABLE 3.1**  
**PAVEMENT WIDTHS FOR RESIDENTIAL STREETS**

<u>STREET TYPES</u>	<u>LANE</u>	<u>COURT</u>	<u>WAY</u>	<u>MINOR STREET</u>	<u>MAJOR STREET</u>
Number of D.U.s:	1-6	7-14	15-30	31-115	116-160
Design Speed:	25 MPH	25 MPH	25 MPH	30 MPH	35 MPH
Street Frontage of Abutting Lots:					
120 Feet or More:	22' (50')	22' (50')	22' (50')	22' (50')	22' (50')
90-119 Feet:	22' (50')	22' (50')	23' (50')	25' (50')	27' (50')
60-89 Feet:	22' (50')	23' (50')	24' (50')	26' (60')	28' (60')
Less Than 60 Feet:	22' (50')	31' (60')	32' (60')	34' (60')	36' (60')

NOTE: D.U. = Dwelling Unit  
(Number) = Minimum Right-of-Way Width

**TABLE 3.2  
RESIDENTIAL STREET DESIGN STANDARDS**

<b><u>STREET TYPE:</u></b>	<b><u>LANE</u></b>	<b><u>COURT</u></b>	<b><u>WAY</u></b>	<b><u>MINOR ST.</u></b>	<b><u>MAJOR ST.</u></b>
Design Speed (MPH)	25	25	25	30	35
Right-of-way Width			See Table 3.1		
Pavement Width			See Table 3.1		
Type of Curb					
C = Curb & Gutter					
V = Valley Gutter	C/V/N	C/V/N	C/V/N	C/V	C/V
N = None					
Sidewalks & Bicycle Paths (Feet)	4	4	4	4-6	4-6
Sidewalk Distance from Curb Face (Feet)	6	6	6	6	6
Minimum Sight Distance (Feet)			See Section 3.2.6		
Maximum Grade (Percentage)	15	10	10	8	8
Maximum Cul-de-Sac Length (Feet)	1000	1000	700	N/A	N/A
Maximum Cul-de-Sac Radius (right-of-way)(Feet)	50	50	50	N/A	N/A
Minimum Centerline Radius of Curves (Feet)	175	175	175	250	350
Minimum Centerline Radius of Non-Superelevated Curves (Feet)	280	280	280	430	580
Minimum Tangent Between Reverse Curves (Feet)	50	50	50	100	100
Alley Policy and Width			See Section 3.2.10		
Off-Street Parking			See Section 3.2.14		
Street Lighting			See Section 3.2.15		
Driveways			See Section 3.6		

### **3.2.2 Pavement Width**

A minimum pavement width must allow safe passage of moving traffic in each direction exclusive of other interferences, such as conventional curb parking. Curb parking will occur occasionally within all residential subdivisions. The rate of occurrence will be a function of density, off-street parking code requirements, and local ordinances. In very low-density developments, large lots with two-car garages and circular driveways are commonplace. However, vehicle breakdowns and occasional overflow parking indicate that even in the low-density area, provision should be made for the occasional standing vehicle. This can be done by means of a shoulder on one or both sides of the street. Such shoulder development requires that curbs either be omitted or be of the mountable or role-type, when a narrow – such as 22-foot – road is used.

A second function of the shoulder is to provide for pedestrians and bicycle riders. Curb parking is infrequent in very low-density areas and conflict should not normally develop between shoulder parking and pedestrian or bicycle rider usage.

When a school or park is located within a single-family residential area, the adjacent street may require a greater width to accommodate increased traffic and possibly added curb parking.

Pavement widths for residential streets are a function of the number of dwelling units served and the street frontage width of abutting lots. Widths for various conditions are shown in Table 3.1.

If a developer builds a residential street where the Engineering Department has determined the need for that street to be possibly widened in the future due to reclassification as a collector or arterial, or even a higher classification of residential street, then the cost for any additional widening of the street beyond the width necessary to serve in its present use shall be paid by the City of Opelika.

### **3.2.3 Type of Curb**

As may be expected, a wide divergence of opinion exists with respect to curb design. The advantages of vertical curb are:

- a. Pedestrians, street trees, utilities, and signs are best protected by the vertical curb.
- b. A positive limit of vehicle encroachment on the border area is established. This minimizes parkway erosion and also reduces the probability of vehicles sliding off the roadway under unfavorable pavement and weather conditions.
- c. Depression of curb is required at driveways. Such depression is desirable for clear identification of driveway, which minimizes blockage by curb parkers.
- d. Excellent drainage control may be maintained by either variable height or standard height curb.
- e. Provides improved control of potential parked runaway vehicles.

Advantages of the roll-type curb are:

- a. It is slightly less expensive than the vertical type.
- b. Some persons feel that the roll-type is the more aesthetically pleasing.
- c. Cheap driveway construction can be employed without curb depression. This allows the subdivider and developer certain flexibilities in their construction, in that driveway locations are not required to be determined prior to curb installation.

A discussion of curb types would not be complete without consideration of gutter design. In Table 3.1, the term "Pavement Width" is intended to be a practical driving width available within the width of the paved asphalt area. This width does not include any gutter surface area. In the case of large V-gutters or high-slope gutters, the width also must be measured across only the pavement area within which the average driver operates.

The complete elimination of curbs poses a number of disadvantages as follows:

- a. No protection is given to pedestrians, street trees, and utilities.
- b. Border area erosion is prevalent.
- c. The roadway is poorly defined at night under rainy weather conditions when asphalt surfacing is used.
- d. Positive control of drainage is totally lacking. Open ditch-type adjacent drainage facilities are customarily employed, which leaves the subdivision with a rural appearance.
- e. Where asphalt surface is used, pavement edge raveling poses a maintenance problem.

Curb and gutter or varey gutter on residential streets shall be required in all zoning districts, except for lanes, courts, or ways in rural residential zones with lot sizes of one (1) acre or greater, in which the curb and gutter or valley gutter is optional.

### **3.2.4 Sidewalks and Bicycle Paths**

In today's typical subdivision, sidewalks have the following function:

- a. Providing for maximum safety of children playing on their block.
- b. Protection of children walking to and from schools and neighborhood parks.
- c. Provision for adults to walk to and from neighborhood shopping and transit stops (if any).

Sidewalks should ordinarily be provided along streets used for pedestrian access to schools, parks, shopping areas, and transit stops. Paved sidewalks should also be provided within pedestrian ways giving midblock access to these types of generators. Wider sidewalks may be considered next to higher density pedestrian generators, such as schools, transit stops, and churches.

In the very low-density subdivisions, walking distance to regular elementary schools is often excessive. In communities where all such travel is by way of school buses, there will be less need for sidewalk construction as a standard policy.

The need for bicycle paths is a function of subdivision density, area of the country, and proximity to bicycle-oriented generators such as educational institutions or parks.

### **3.2.5 Sidewalk Distance from Curb Face (See Figure 3.1)**

Maintain a standard location for sidewalks one (1) foot from right-of-way line. This location has the following advantages where proper right-of-way width and attendant border area of five- (5-) foot minimum remain between the street edge of sidewalk and curb face:

- a. Children walking and playing side-by-side have increased safety from street traffic.
- b. Conflict between the pedestrians and garbage or trash cans awaiting pickup at the curb is eliminated by using the border area for such temporary storage.
- c. The warped area necessary for a proper driveway gradient is minimized by having a major portion of this gradient fall within the border area.
- d. Danger of collision by runoff-road vehicles is minimized by placement of the walk at maximum practical distance from the curb, and with further separation by tree plantings.
- e. Pedestrians are less likely to be "splashed" by passing vehicles.

When right-of-way restrictions result in a sidewalk next to the curb, an additional width of one (1) to two (2) feet is desirable.

Depending on utility placement, a meandering of the sidewalk placement within the border area may be considered. Such alignment may be more visually appealing, and may allow saving of trees or other major plantings, avoid rock outcroppings, etc. However, this should not be regarded as a justification for locating long sections of walk near the street edge.

In addition to sidewalk width and placement, several physical factors should be considered:

- a. Provide proper transition by use of a roughened surface.
- b. Establish a maximum grade consistent with local conditions.

- c. Provide a minimum lateral drainage slope (normally one (1) to two (2) percent).
- d. Avoid use of steps where sidewalk ramps can be substituted.
- e. Provide proper access from street for handicapped.

FIGURE 3.1  
TYPICAL STREET CROSS-SECTION

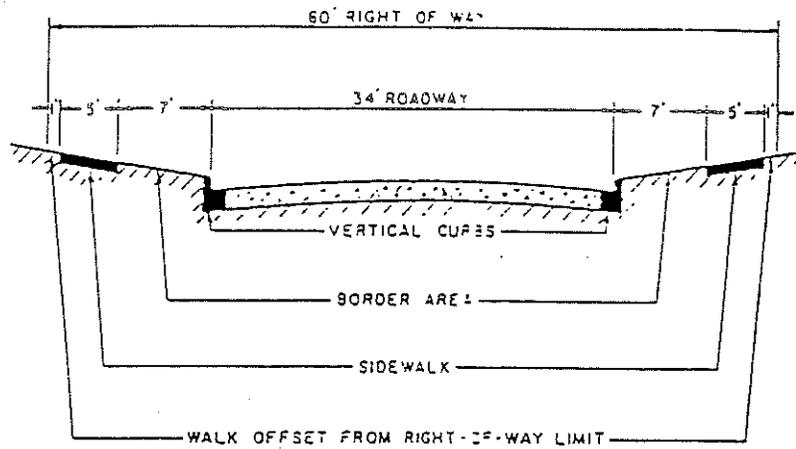


FIGURE 2. Typical Cross-Section  
1 ft. = 0.3m

### **3.2.6 Minimum Sight Distance**

Minimum design values for safe stopping sight distance are as shown below. They are calculated for wet pavement conditions at the various design speeds listed in Tables 3.1 and 3.2. These sight distances should be provided on both horizontal and vertical curves. For horizontal curves, the distance is normally checked by direct scale from the midpoint of the curb lane. The minimum vertical curve length required is readily calculated by multiplying the algebraic difference in grades times a K factor. Rounded K factors for the speed ranges in Tables 3.1 and 3.2 are as follows:

25 MPH, K = 20 for crest and 20 for sag curve

30 MPH, K = 28 for crest and 35 for sag curve (with proper street lighting, K = 20 for sag)

35 MPH, K = 40 for crest and 45 for sag curve (with proper street lighting, K = 27 for sag)

### **3.2.7 Maximum Grade**

The maximum permissible grade represents a compromise between construction costs and traffic safety. This allowable grade is allowed to increase as average daily traffic and speed limits decrease. The eight (8) percent for minor and major streets, ten (10) percent for ways and courts, and fifteen (15) percent for lanes are provided as minimum design values.

### **3.2.8 Maximum Cul-de-Sac Length**

A 1,000-foot length is allowed as a maximum for cul-de-sacs on lanes and courts and 700 feet for ways. This is proposed for the ordinary type of subdivision layout, and obviously does not apply to a cluster-type development, nor to one involving a single road winding up a mountain, for example.

Research suggests that cul-de-sacs be designed for ADTs of up to 200. For a typical single-family subdivision, each home has been found to generate an average of about ten (10) trips per day. A 200 ADT is equivalent to a 20-home generation. If an average lot width of 70 feet is assumed, with development along both sides of the street, a length of 700 is produced. A 100-foot lot width gives a length of 1,000 feet, and is typical of low-density development.

A high-density cluster development may involve several apartment buildings with hundreds of total dwelling units. Use of only a single roadway to provide access to such sites should be allowed only after a careful consideration of alternative treatments, and with fur regard for the potential problems. As the number of persons exclusively served by a given roadway increases, the potential hazard of temporary roadway blockage also increases. Blockages can result from numerous causes, such as vehicular accident, utility break, falling tree or pole, and pavement repairs. While such occurrences are exceptional, they must still be regarded in terms of their effect on access to the development by emergency police, fire, or ambulance equipment. In addition to this problem, it is even possible to run into capacity limitations. As an extreme example, consider a 1,000-unit development. Daily weekday trips would likely range from six (6) to ten (10) per unit. If only five (5) percent of this traffic would be expected to exit during the peak hour, the flow would reach 300 to 500 vehicles per hour. Depending on characteristics of

the boundary roadway, signal control warrants might be reached. In this case, consolidation of exit traffic at a single point would be a desirable design feature.

Joint consideration of the factors of both emergency access and capacity suggest alternative layouts for access to a high-density development, as follows:

- a. Provide at least two separate roadways, fully connected to the internal system of roadways or parking access drives, or
- b. Provide a divided-type entrance roadway, with median of sufficient width to largely ensure freedom of continued emergency access by lanes on one side. Depending on location and height of nearby poles or trees, the required median width would range between twelve (12) and thirty (30) feet.

### **3.2.9 Minimum Cul-de-Sac Radius**

The minimum right-of-way radius for circular cul-de-sac design is fifty (50) feet. The desirable outside turning radius for passenger cars is thirty (30) feet. For the smaller truck, and a small piece of fire apparatus, a forty- (40-) foot curb radius shall be required. Within cul-de-sacs, sidewalks may be placed slightly closer to the curb, with attendant reduction in border area dimensions. Similarly, curb parking is often prohibited by the community, or is artificially inhibited by the pie-shaped lot construction and small distances between adjacent driveways. On very large lots, frontage space may exist for curb parking. When this occurs, the design may call for a larger radius cul-de-sac right-of-way and curb, in order to accommodate parking plus the necessary movement of service trucks and fire equipment. Curb radii of forty (40) feet or greater create large expanses of pavement which may be unsightly. The use of center islands may be considered, but care must be given to keep adequate maneuver space around the island. The minimum pavement width around the island shall be twenty-five (25) feet.

Under certain conditions, a "hammerhead" or "tee"-type of turnaround may be considered. This is most applicable where blocks are very short and the number of dwelling units to be served is very small. Furthermore, lots are usually not platted at the cap or ends of the turnaround.

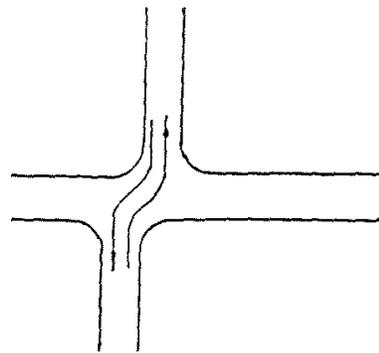
### **3.2.10 Alley Policy and Width**

In modern subdivision design, there is a strong trend to eliminate alleys. In lower density areas of 4.0 and lesser dwelling units per acre, lot widths are ample to provide building width plus side drives to open pads, carports, or garages. As density increases, such construction becomes progressively more difficult. At a density of between 5.5 and 6 dwelling units per acre, with 10 percent sideyards, buildable width is reduced to 30 to 34 feet. A mandatory provision for front driveways, therefore, would impose severe architectural limitations. Common driveways and off-center home construction on lots may not be particularly desirable solutions. The use of alleys is a preferable alternative.

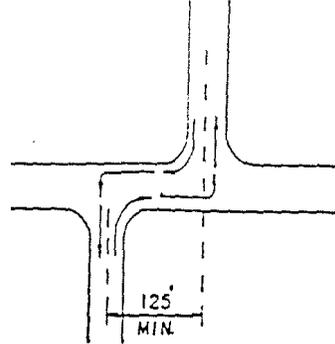
In higher density and conventional apartment developments, alleys may provide access to rear lot parking spaces, becoming, in effect, a common driveway. The alley also affords secondary access for fire equipment, service trucks, and maintenance access to rear line overhead utilities. The alley may be an asset if provided with proper width of twenty- (20-) foot minimum,

adequate radii at street intersections of twenty (20) feet, an all weather (paved) surface, and protected by building and parking bay setback limits. Alleys meeting these minimum standards may be approved by the Engineer and Planning Commission.

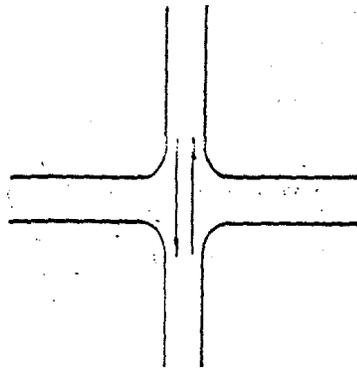
**FIGURE 3.2**  
**STREET GEOMETRY STANDARDS**



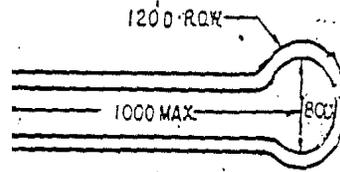
NOT PERMITTED



MINIMUM PERMITTED

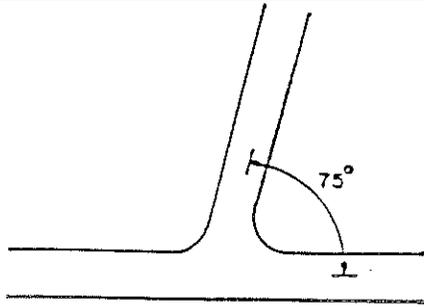


IDEAL CONDITION

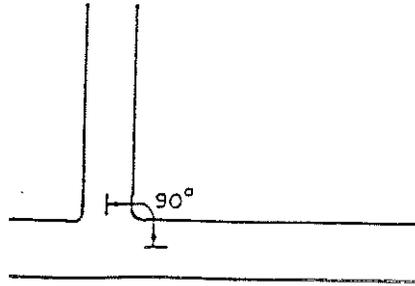


PERMAMENT TURN-AROUND  
(CUL-DE-SAC)

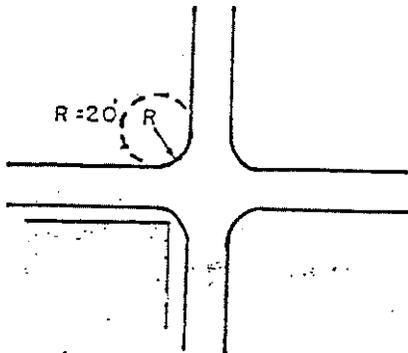
**FIGURE 3.3  
STREET GEOMETRY STANDARDS**



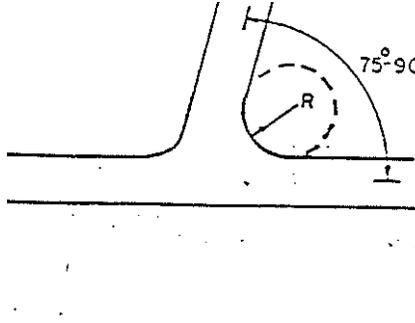
LESS THAN 75° NOT PERMITTED



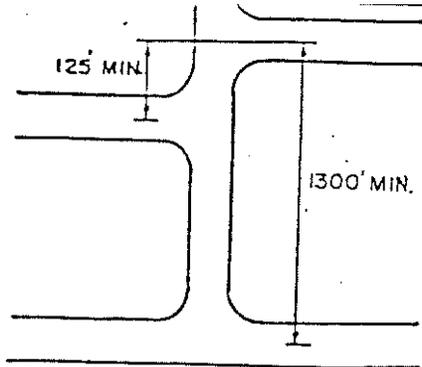
A 90° INTERSECTION IS IDEAL



MINIMUM RADIUS OF 20' IS REQUIRED FOR BOTH PAVEMENT AND PROPERTY LINES



GREATER THAN 20' RADIUS MAY BE REQUIRED



MINIMUM INTERSECTION SEPERATION  
FOR COLLECTOR OR MAJOR ARTERIAL STREETS

### 3.2.11 Design Speed

The following minimum design speeds shall be used when determining horizontal and vertical alignment on residential streets: 35 MPH for major streets, 30 MPH for minor streets, and 25 MPH for lanes, courts, and ways. Higher design speeds are desirable for the additional safety provided to the motorists and pedestrians. Actual speed limits shall be set by local ordinance.

### 3.2.12 Minimum Centerline Radius of Curves

The values shown are based on a super elevation rate not to exceed 0.08 feet per foot. This allows use of super elevation without danger of side sliding under icy pavement conditions. A side friction factor ranging from 0.15 at 35 MPH to 0.16 at 30 MPH and 0.17 at 25 MPH is recommended in the formula:

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

Where V = speed in MPH

e = super elevation in foot per foot

f = side friction factor

R = radius in feet

The centerline values relate to midblock curves and not to intersection radii. When a street makes a right-angle-type turn, much shorter radii will apply. See point "A" on Figure 1.

If the curves are not super elevated, then the appropriate radii for the adverse crown are 580 feet for 35 MPH, 430 feet for 30 MPH, and 280 feet for 25 MPH.

### 3.2.13 Minimum Tangent Between Reverse Curves

A minimum tangent of fifty (50) feet on 25 MPH design streets and one hundred (100) feet on 30 MPH and 35 MPH design streets is required between reverse curves to facilitate steering and control.

### 3.2.14 Off-Street Parking

The minimum width of twenty-two (22) feet for a curbed roadway in a low-density area is predicated upon no off-street parking spaces being provided per dwelling unit.

In the high-density developments, parking demand per dwelling unit will vary with locale, size of dwelling unit, and convenience of public transportation.

Typical needs for off-street parking are:

- a. 1.5 spaces per dwelling unit for duplexes and apartments having less than two bedrooms.
- b. 2.0 spaces per dwelling unit for larger apartments and single-family homes.

Angle parking along the curbs of local streets shall not be allowed. Accidents tend to be much higher than with parallel parking, when the through traffic lanes are used for parking and unparking maneuvers. Therefore, all such bays and lots allowing any parking other than parallel shall be physically separated from the roadway and confined by barrier curbing beyond the house side of the sidewalks.

A serious restriction of off-street parking use will occur unless access to each stall is unobstructed. Thus, a requirement of two spaces is met only by a two-car garage or parking pad twenty (20) feet or more wide, if serving a single-family home.

### **3.2.15 Street Lighting**

Modern street lighting is required at every intersection. In medium- and high-density areas, midblock street lighting also is desirable in accordance with the latest recommendations of the Illuminating Engineering Society. These are published from time to time as an American National Standard Practice. The 1977 edition of this Practice provides for 0.4 horizontal footcandle (4 lux) maintained average, with a maximum uniformity ratio of one to six. Design guides for such illumination values may be found in the referenced text. A simple specification for a given number of lights of a given size is inadequate. The effectiveness of illumination is a direct product of the distribution type selected for the luminaire, coupled with mounting height, bracket length, and luminaire orientation with respect to the geometries of the roadway.

As a general rule, the use of underground wiring installed by the subdivider during construction of the subdivision is the preferred method of providing energy to the lights. This design should be prepared in consultation with the City of Opelika Light and Power Department with review by the City Engineer.

## **3.3 COLLECTOR STREET DESIGN**

Collector street dimensions will vary from those of local streets. Collector streets are intended to serve traffic moving between connecting residential streets and peripheral arterials. Therefore, increased traffic volumes and slightly higher speeds are to be expected. Data in Table 3.3 are predicated upon these variations where they exist.

### **3.3.1 Right-of-Way Width**

The minor collector street right-of-way width shall be sixty (60) feet and the major collector street right-of-way width shall be eighty (80) feet. These widths shall be used when curb and gutter is constructed at the edge of the asphalt. When curb and gutter is not used, then the minimum right-of-way width shall be increased an additional twenty (20) feet to allow for proper drainage ditches on both sides of the road.

### **3.3.2 Pavement Width**

Minimum pavement widths of twenty-eight (28) feet and forty-eight (48) feet are required on minor and major collector streets, respectively. When a median is constructed between each direction of travel, the minimum width shall be twelve (12) feet. When the centerline radius is less than 600 feet, consideration should be given to increase the minor collector street width to thirty-two (32) feet, unless curb parking is prohibited.

The minor collector street provides space for one (1) lane of moving traffic in each direction plus accommodation for curb parking and, by prohibiting curb parking, the provision of an added turn lane at points where required. Examples of such points include approaches to intersections along major traffic routes and sections between adjacent offset intersections, so that through traffic would not be impeded by left-turning vehicles. Curb parking shall not be allowed on minor collector streets with a center median.

### **3.3.3 Type of Curb**

When used, a vertical curb approximately six (6) inches high is required for all collector streets to ensure positive drainage control.

### **3.3.4 Sidewalk Width**

Sidewalks shall be placed along ar collector streets where curb and gutter is also used. These form natural walking routes to pedestrian generators such as schools and neighborhood shopping.

### **3.3.5 Sidewalk Distance from Curb Face**

A minimum border area of ten (10) feet between curb and sidewalk edge is required as a practical method of retaining setback of residential property from the street.

### **3.3.6 Minimum Sight Distance**

Stopping sight distance is required to conform with the design speeds shown in Table 3.3. The rounded K factors for 35 MPH are 40 for crest and 45 for sag curves (27 for sag if good street lighting is available). The rounded K factors for 40 MPH are 60 for both sag and crest curves.

### **3.3.7 Minimum Spacing Along Major Traffic Route**

Collector streets frequently generate traffic volumes requiring signalization at intersections with arterial roads. Such points of signalization should be established in terms of providing progressive traffic flow. A 1,300-foot spacing will provide progressive flow at a design speed of approximately 30 MPH. If higher adjacent major route speeds are desired, the minimum intersection spacing may be increased.

In the larger-scale developments, when tracts on both sides of major streets are concurrently planned, collector street volumes can be held below signal requirements by providing more intersections. Such intersections can be channelized for high efficiency entry and exit. They can also be made discontinuous by a barrier median on the artery.

**TABLE 3.3****COLLECTOR STREET DESIGN STANDARDS**

<b>COLLECTOR TYPE:</b>	<b>MINOR COLLECTOR</b>	<b>MAJOR COLLECTOR</b>
Design Speed (MPH)	35	40
Right-of-Way Width with Curb & Gutter (Feet)	60	80
Right-of-Way Width without Curb & Gutter (Feet)	80	100
Pavement Width (Feet)	28	48
Type of Curb (see notes for key)	C/N	C/N
Sidewalk Width (Feet)	4-6	4-6
Sidewalk Distance from Curb Face (Feet)	10	10
Minimum Sight Distance (Feet)	See Section 3.3.6	
Maximum Grade (Percent)	8	6
Minimum Spacing Along Major Traffic Route (Feet)	1300	1300
Minimum Centerline Radius of Curves (Feet)	350	480
Minimum Centerline Radius of Non-Superelevated Curves (Feet)	580	N/A
Minimum Tangent Between Reverse Curves (Feet)	100	150
Street Lighting	See Section 3.3.11	

**NOTES: C= Curb & Gutter and N=None**

### **3.3.8 Design Speed**

Design speed shall be 35 MPH for minor collectors and 40 MPH for major collectors. These design speeds will more nearly reflect desires on the part of drivers for improved movement. Higher speed posting will encourage use of the collectors for access to and from the adjacent major traffic routes.

### **3.3.9 Minimum Centerline Radius**

Increases shown in the minimum curvature are predicated upon the increased design speed recommendation. If super elevation is not used, the 35 MPH minimum radius shall be 580 feet. All curves with 40 MPH design speed or greater shall be super elevated.

### **3.3.10 Minimum Tangent Between Reverse Curves**

Minimum distance is one hundred (100) feet for 35 MPH street design and one hundred fifty (150) feet for 40 MPH street design.

### **3.3.11 Street Lighting**

Because of the higher traffic volumes on the collector streets, adequate street lighting is desirable. The 1977 edition of the American National Standard Practice for Roadway Light- in recommendation of 0.6 maintained horizontal footcandles (6 lux), and a uniformity not to exceed one in three (low point not less than one-third average) is the minimum allowed.

## **3.4 INTERSECTION DESIGN**

Recommended design standards are shown in Table 3.4. These standards shall govern for all residential-residential, residential-collector, and collector-collector intersections.

### **3.4.1 Approach Speed**

A minimum approach design speed of 25 MPH is desirable for all intersections. The safe approach speed involves safe stopping distance on vertical and horizontal curves, beginning about one hundred (100) feet from the intersection, plus clear sight distance.

### **3.4.2 Clear Sight Distance**

The intersection of two (2) streets shall be theoretically designed to operate without any control device. The best way to achieve this is to design and maintain proper sight distance. This usually can be attained at intersections by restrictions on height of lot embankment, location of buildings and any screening shrubbery, fences, or low-growing trees. Minimum sight triangle distances as shown in Table 4 are required at all intersections.

### **3.4.3 Vertical Alignment Within Intersection Area**

Intersection areas shall be designed with a flat grade. In the more difficult terrains, this becomes economically impractical. An allowance of two (2) percent in hilly terrain is permitted with approval of the City Engineer.

In addition, approach grades within fifty (50) feet of the intersection shall be considered, with three (3) percent representing the maximum approach grade for rolling terrain.

#### **3.4.4 Minimum Angle of Intersection**

It is desirable for all intersection approaches to meet at approximately a 90-degree angle. Skewed intersections should be avoided, and in no case shall the angle be less than seventy-five (75) degrees.

#### **3.4.5 Minimum Curb Radius**

As the curb radius is increased, paving costs and intersection area required for a pedestrian to traverse are increased, and higher turning speeds are encouraged. Substandard radii result in unnecessary lane encroachment and increased traffic conflict and accident potential. Reasonable design values of twenty (20) feet are allowed for intersection radii of two (2) residential streets, based on curb clearance of three (3) feet, and without lane encroachment for a typical width street, using the AASHTO design passenger vehicle. This design will also accommodate garbage trucks and moving vans, with wide swings. An increased radius of twenty-five (25) feet for the residential-collector or collector-collector intersection is predicated upon a desire to slightly improve the driving speed of a vehicle in entering or leaving the collector. A collector intersection with an arterial shall have a thirty- (30-) foot radius.

**TABLE 3.4**  
**INTERSECTION DESIGN STANDARDS**

<b>INTERSECTION TYPE</b>	<b>RES/RES</b>	<b>RES/COL</b>	<b>COL/COL</b>
Approach Speed (Each Leg)(MPH)	25/25	25/30	30/30
Clear Sight Distance (Length Along Each Approach)(Feet)	90/90	90/120	120/120
Vertical Alignment Within Intersection Area (Percent)	4	2	0
Minimum Angel of Interdection (Degrees)		75 (90 Preferred)	
Minimum Curb Radius (Feet)	20	25	25
Minimum Centerline Offset of Adjacent Intersection (Feet)	125	150	200
Minimum Tangent Length Approaching Intersection (Each Leg)(Feet)	50/50	50/75	75/75
Drainage Structures		See Section 3.4.8	

**NOTES: RES= Residential Street & COL=Collector Street**

### **3.4.6 Minimum Centerline Offset of Adjacent Intersection**

Several studies of intersection design types have shown T-type intersections to be far safer than cross-type. Extensive use of T-type intersections in residential subdivisions is strongly recommended. One disadvantage, however, is "corner-cutting" when inadequate offset exists between adjacent intersections. To reduce this hazardous practice, offsets of at least 125 feet between centerlines shall be required. In the case of two collector-street intersections, this offset shall be increased to at least 150 feet in order to allow for left-turn storage between intersections.

Offset intersections have disadvantages when one or both such streets is a collector intersecting an arterial, if volumes will be such to warrant traffic signals. Operations at such locations are more complicated than those for normal cross-type intersections. Therefore, other design solutions shall be sought if signalization might otherwise be required. When offset intersections are used at an arterial, they should be located to avoid conflicting left turns (this is especially important where 2-way left-turn slots are used in a fairly narrow median). Such left-turn conflicts exist when an intersection offsets to the right rather than to the left.

Multi-leg intersections (over four) are undesirable from a control and safety standpoint and shall not be used.

### **3.4.7 Minimum Tangent Length Approaching Intersection**

It is desirable to provide a tangent section of roadway approaching intersections, when the street leg has a minimum or near-minimum radius curve. The guideline values in Table 3 would not apply to a collector, for example, with a 1,000-foot radius that is intersected by a residential street. It would apply to an intersecting residential street with a 200-foot radius leg.

### **3.4.8 Drainage Structures**

Inlets or catch basins shall not be located within the corner radius or within six (6) feet of either end. Clearance is needed to keep the area relatively dry and to allow space for streetlights, name signs, utility poles, etc. All grates shall provide for safety of bicycle traffic.

## **3.5 TURNOUT REQUIREMENTS<sup>1</sup>**

All entrance and exit driveways shall be located to afford maximum safety to traffic, provide for safe and convenient ingress and egress to and from the site, and to minimize conflict with the flow of traffic.

Where commercial or residential turnouts access Federal or State Highways, turnout design and permit information shall also be as required for approval by the Alabama Department of Transportation.

### **3.5.1 Sight Distance**

All exit driveways or driveway lanes shall be so designed in profile and grading and shall be located to provide the following minimum sight distance measured in each direction along the roadway. The measurements shall be from the driver's seat (3-1/2 feet above the pavement) of a

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<sup>1</sup> Date Amended: July 1, 1997  
Ordinance # 114-97

vehicle positioned on the portion of the exit driveway that is immediately outside the edge of the road right-of-way.

<u>Roadway Speed</u>	<u>Required Sight Distance</u>
25 MPH	150 ft.
30 MPH	200 ft.
35 MPH	250 ft.
40 MPH	300 ft.
45 MPH	350 ft.
50 MPH	400 ft.
55 MPH	450 ft.

### 3.5.2 Turnout and Street Intersection Spacing

The minimum spacing between adjacent turnouts for private commercial or residential turnouts along the same side of the street shall be as follows:

<u>Street Classification</u>	<u>Turnout Spacing (feet)</u>
Arterial	400
Major Collector	200
Minor Collector	100
Local	(See Below)

Note: Connection spacing on local streets shall be dependent upon zoning densities and lot widths.

Spacing distance shall be measured from the projected edge of the turnout to the closest projected edge of the neighboring turnout, and shall be measured along the edge of street pavement.

### 3.5.3 Corner Clearance at Intersections for Isolated Corner Properties

For commercial parcels located at the intersection of two streets, the minimum distance from the turnout to the intersection on a principal arterial, minor arterial, or collector shall be as follows:

<u>Position</u>	<u>Access Allowed</u>	<u>Spacing (feet)</u>
Without Restrictions:		
Approaching Intersection	Full Access	125
Approaching Intersection	Right In Only	100
Departing Intersection	Full Access	125
Departing Intersection	Right Out Only	100
With Restrictions:		
Approaching Intersection	Right In/Out	100
Approaching Intersection	Right In Only	75
Departing Intersection	Right In/Out	200
Departing Intersection	Right In Only	100

The minimum distance from the turnout to the intersection on a local street, for both commercial and residential land parcels, shall be 125 feet.

Note: Distances shall be measured from the closest projected edge of the turnout connection to the closest projected edge of the parallel roadway, and shall be measured along the edge of roadway.

Access restrictions are raised concrete medians, grassed medians, and stacking lanes at intersections for left turns. The minimum length of the left turn stacking lane at an intersection shall be 200 feet (100' taper + 100' vehicle storage), and shall be measured from the stop bar in the stacking lane. A reversible left turn lane in the center of the roadway shall not be considered as an access restriction, except where a stacking lane is marked for left turns.

### 3.5.4 Turnout Width

The dimensions of turnouts shall be designed to adequately accommodate the volume and character of vehicles anticipated to be attracted daily onto the land development for which a site plan is prepared. The required maximum and minimum dimensions for turnouts are indicated below. Driveways serving large volumes of daily traffic or traffic with over fifteen percent (15%) truck traffic shall be required to utilize maximum dimensions.

<u>Type of Development</u>	<u>Two-Way Operation Driveway</u> <u>Width</u>	<u>One-Way Operation Driveway</u> <u>Width</u>
Commercial	24-36 ft.	15-24 ft.
Multi-Family Residential	24-36 ft.	15-24 ft.
Single-Family Residential	(Not Allowed)	10-12 ft.

### 3.5.5 Turnout Radius Entering Commercial Developments

The minimum curb radius for a perpendicular turnout entering a commercial development shall be as follows:

<u>Street Classification</u>	<u>Radius</u>
Arterial	30 feet
Major Collector	25 feet
Minor Collector	20 feet
Local/Residential	15 feet

For non-perpendicular turnouts where the vehicle must maneuver a turn greater than 90 degrees, the radius of the acute angle shall be increased by one foot per degree from perpendicular. The maximum acute angle shall be 75 degrees, which shall require a 45-foot curb radius.

### 3.5.6 Turnout Radius Exiting Commercial Developments

The minimum curb radius for a perpendicular turnout exiting a commercial development shall be as follows:

<u>Street Classification</u>	<u>Radius</u>
Arterial	20 feet
Major Collector	20 feet
Minor Collector	15 feet
Local/Residential	15 feet

For non-perpendicular turnouts, the radius shall be increased as specified above for turnout radii into the development.

### **3.5.7 Deceleration Lanes into Commercial Developments**

A full deceleration lane shall be required at the approach to a turnout when the peak right turn traffic volume exceeds 60 vehicles per hour (vph). A taper between the edge of pavement and the turnout radius shall be required at the approach to a turnout when the peak right turn traffic volume exceeds 30 vph. The minimum taper length shall be 50 feet and the taper width shall be one full traffic lane.

### **3.5.8 Exclusive Left Turn Lanes into Commercial Developments**

An exclusive lane for left turns shall be required at the approach to a commercial turnout when one or more of the following conditions are present:

1. Left turn volumes exceed 20 percent of the total approach volume.
2. Left turn volumes exceed 100 vehicles per hour in the peak hour.
3. Intersection geometrics result in inadequate stopping sight distance. Minimum stopping sight distances are listed in Section 3.5.1.

### **3.5.9 Turnout Throat Lengths into Commercial Developments**

Turnouts into commercial developments shall provide a throat, or a restricted access lane area. A throat reduces the probability of inbound traffic blocking the intersection, which reduces confusion and indecision for both entering and exiting drivers. Throat lengths shall be established at the rate of 20 feet (one passenger car length) per 20,000 square feet of gross leasable floor space in the development. The minimum throat length shall be 40 feet (2 passenger car lengths), while the maximum throat length shall be 200 feet (10 passenger car lengths). The throat length may be adjusted at the discretion of the Engineer if unusual site conditions warrant a reduction.

### **3.5.10 Turnout Grades**

Turnouts shall be designed so a vehicle will rest on a fairly even grade where the turnout connects into the street. The turnout grade within the right-of-way area shall not exceed eight (8) percent. To avoid bumper scraping on the pavement, sag curves in turnouts shall be designed so the change in grade shall not exceed twelve (12) percent within any ten (10) feet of distance. To avoid bottoming on the pavement, crest curves in turnouts shall be designed so the change in grade shall not exceed eight (8) percent within any ten (10) feet of distance. These grade changes are minimum standards for passenger cars and small trucks; grade changes for large trucks and buses shall be less.

### **3.5.11 Driveways for Single-Family Residences**

The minimum width for driveways into single-family residential lots shall be ten (10) feet. The maximum width of the driveway at the street shall be twelve (12) feet. The minimum driveway radius at the connection to the street shall be six (6) feet. A flare width of five (5) feet may be used in place of the radius. "Loop-type" driveways on residential lots shall be allowed when their spacing meets the minimum requirements in Section 3.5.

Where commercial and industrial turnouts access State or Federal Highways, driveway design and permits shall also be as required by the Alabama Highway Department.

**A P P E N D I X**  
**STREET CLASSIFICATION SYSTEM**  
**ADOPTED MARCH, 1997**

**Arterials:**

2nd Avenue - 16th Street to 6th Street

6th Street - 2nd Avenue to Torbert Boulevard

10th Street - 2nd Avenue to East Avenue

Birmingham Highway - western city limits to Pepperell Parkway

Columbus Parkway - South 4th Street to eastern city limits

Crawford Road - Marvyn Parkway to southern city limits

Fox Run Parkway - Columbus Parkway to Samford Avenue

Gateway Drive - Pepperell Parkway to 1-85

Geneva Street - East Avenue to McCoy Street

Interstate Highway 85 - western city limits to northern city limits

Lafayette Parkway - Samford Avenue to northern city limits

Marvyn Parkway - McCoy Street to Crawford Road

"Oak Bowery Connector Road<sup>2</sup>"-Pepperell Parkway to Oakbowery Road

Pepperell Parkway - western city limits to 16th Street

"Perimeter Road<sup>3</sup>"-complete road

Torbert Boulevard - South 6th Street to South 4th Street

**Major Collectors:**

1st Avenue - 30th Street to 6th Street

2nd Avenue - 6th Street to South Railroad Avenue

N. 3rd Street - 2nd Avenue to 6th Avenue

4th Avenue - Fitzpatrick Avenue to North 3rd Street

N. 10th Street - 2nd Avenue to Bonita Avenue

30th Street - First Avenue to Pepperell Parkway

Auburn Street - South Long Street to Magazine Avenue

Avenue B - Magazine Avenue to South 10th Street

East Avenue - Clanton Street to Geneva Street

Fitzpatrick Avenue - Pleasant Drive to 4th Avenue

Frederick Road - western city limits to South Long Street

Gateway Drive - Interstate 85 to Society Hill Road

Hamilton Road - western city limits to Gateway Drive

S. Long Street - Williamson Avenue to Auburn Street

Marvyn Parkway - southern city limits to Crawford Road

M. L. King Boulevard - Auburn Street to Clanton Street

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<sup>2</sup> Under construction. Official name to be adopted.

<sup>3</sup> Proposed with segments under construction. Official name to be adopted.

**Major Collectors (Continued):**

Morris Avenue - Oakbowery Road to Lafayette Parkway  
Oakbowery Road - Bonita Avenue to Morris Avenue  
Old Columbus Road - Marvyn Parkway to eastern city limits  
Rocky Brook Road - 6th Avenue to Morris Avenue  
Samford Avenue - South Railroad Avenue to Fox Run Parkway  
Society Hill Road - southern city limits to Williamson Avenue  
S. Uniroyal Road - Columbus Parkway to southern city limits  
Waverly Parkway - Birmingham Highway to Pleasant Drive  
West Point Parkway - Fox Run Parkway to eastern city limits

**Minor Collectors:**

S. 4th Street - Avenue E to South Railroad Avenue  
5th Street - 2nd Avenue to Denson Drive  
6th Avenue - 10th Street to 3rd Street  
7th Street - Torbert Boulevard to 2nd Avenue  
8th Street - Torbert Boulevard to Renfro Avenue  
14th Street - 2nd Avenue to Magazine Avenue  
20th Street - Pepperell Parkway to 1st Avenue

Airport Road - Pepperell Parkway to Old Opelika Road  
Avenue A - 10th Street to 4th Street  
Avenue B - 10th Street to 4th Street  
Avenue C - 6th Street to Darden Street  
Avenue E - South 6th Street to South 4th Street  
Bonita Avenue - Laurel Street to Oakbowery Road  
Collinwood Street - Oakbowery Road to McLure Avenue  
Country Club Road - western city limits to Airport Road  
Cunningham Drive - Frederick Road to 30th Street  
Darden Street - Avenue C to Jeter Avenue  
Denson Drive - 5th Street to McLure Avenue  
S. Fox Run Parkway - McCoy Street to Columbus Parkway  
Grand National Parkway - Birmingham Highway to Oakbowery Road  
Jeter Avenue - Darden Street to Fox Run Parkway  
Magazine Avenue - 14th Street to Auburn Street  
McCoy Street - Geneva Street to Torbert Boulevard  
McLure Avenue - Collinwood Street to Rocky Brook Road  
Oakbowery Road - Morris Avenue to Grand National Parkway  
Old Opelika Road - Airport Road to Frederick Road  
Pleasant Drive - Pepperell Parkway to Fitzpatrick Avenue  
Priester Road - Waverly Parkway to West Thomason Circle  
S. Railroad Avenue - South 4th Street to Samford Avenue  
Renfro Avenue - 8th Street to Oakbowery Road  
Ridge Road - North Uniroyal Road to eastern city limits

**Minor Collectors (Continued):**

Stonewall Road - western city limits to Grand National Parkway  
Terracewood Drive - Waverly Parkway to Laurel Street  
West Thomason Circle - Priester Road to Pepperell Parkway  
Torbert Boulevard - South 6th Street to Geneva Street  
N. Uniroyal Road - Columbus Parkway to West Point Parkway  
Williamson Avenue - South Long Street to Marvyn Parkway

**Notes:**

1. All streets not listed are classified as local/residential streets.
2. All street classifications taken from 1992 Functional Classification System Map, as prepared by the Alabama Department of Transportation. The following classification name changes were made to conform with the City's Public Works Manual:

Opelika Name  
Arterial  
Major Collector  
Minor Collector

ALDOT Name  
Principal Arterial  
Minor Arterial  
Collector

### 3.6 DRIVEWAYS

Because they are deceptively simple in appearance, driveways often do not receive the design consideration that they merit. Common deficiencies include:

- a. Inadequate radii at street.
- b. Excessive grades and grade differences (breakover angles).
- c. Inadequate width.

The typical residential driveway shall be designed for passenger-car operation only. For a 90-degree turn, an inside radius of eighteen (18) feet and an outside swept path of a 30-foot radius are required.

A minimum width of ten (10) feet is required for single-lane driveways. At the narrowest street width of 22 feet, such a driveway will require 12-foot radii to avoid lane encroachment. At a 34-foot street width, the radius required to avoid lane encroachment drops to only four (4) feet. Temporary encroachment on the wrong side of a minor street while entering or leaving a private driveway is generally considered allowable. This suggests a design value of about six (6) feet for the driveway radius. At higher volume driveways of school or apartment parking lots, increased widths, plus radii requirements of ten (10) to fifteen (15) feet are required.

The common design fault of excessive break over angle (see Figure 3) and rear bumper dragging at the gutter line can be avoided by proper grading of right-of-way cross section. The driveway grade should not exceed eight (8) percent within the right-of-way area. Of greater importance is the change in grade, which shall not exceed twelve (12) percent within any ten (10) feet of distance. Car "bottoming" on the crest can be avoided by use of eight (8) percent maximum change per ten (10) feet as required.

**FIGURE 3.4  
RESIDENTIAL DRIVEWAY DETAILS**

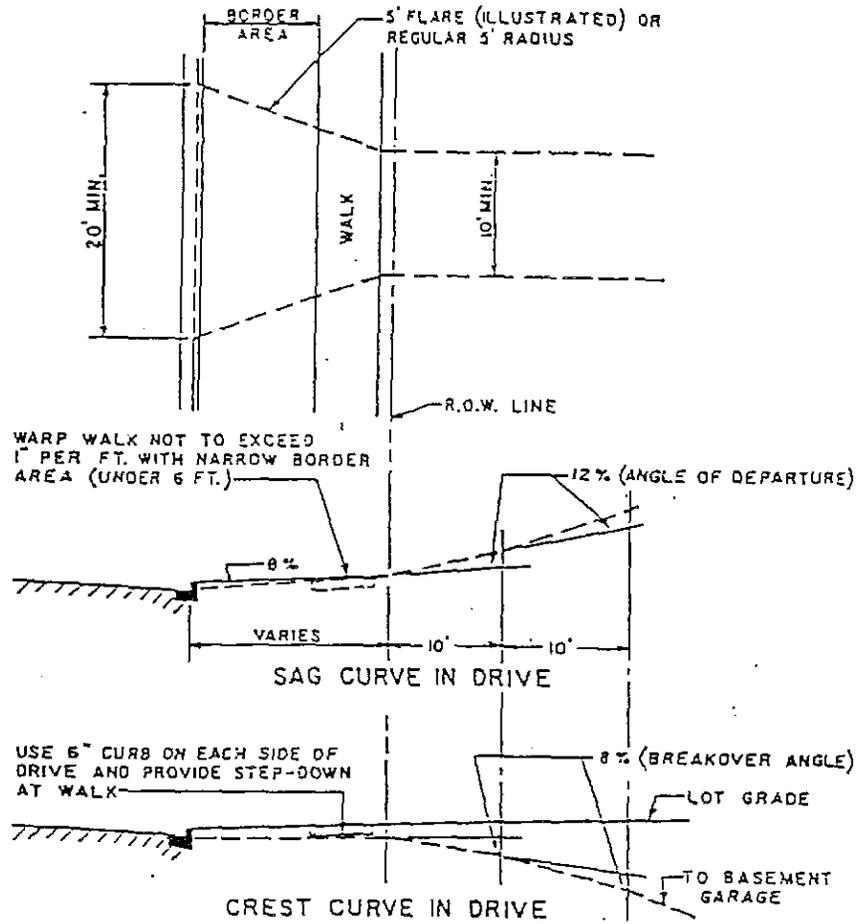
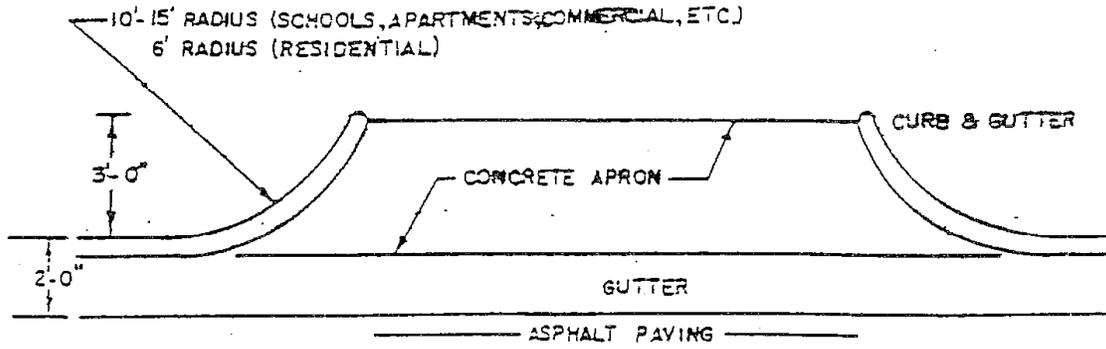


FIGURE 3. Residential Driveway Details

**FIGURE 3.5**  
**TYPICAL DRIVEWAY TURNOUT**



EXTRA DRIVEWAY WIDTH REQUIRED FOR  
GREATER THAN TEN FAMILY RESIDENTIAL  
OR COMMERCIAL

TYPICAL DRIVEWAY TURNOUT

## SECTION IV

### STREET CONSTRUCTION STANDARDS

#### 4.1 ASPHALT ROAD SPECIFICATIONS

The specifications for construction of roads within the City of Opelika include the latest edition of the Alabama Highway Department (AHD) Standard Specifications for Highway Construction. The following is a general discussion of these standards, as well as additional standards determined by the City. If any conflict exists, the stricter standards shall apply.

##### 4.1.1 Site Work and Grading

All streets, roads and service drives shall be graded so that the entire right-of-way can be constructed to the required cross section. Before grading is started, the entire right-of-way shall be first cleared of all stumps, roots, brush and other objectionable materials, along with all trees and other topographic features not intended for preservation.

The stumps, boulders, and other obstructions shall be removed to a minimum depth of four (4) feet below existing grade when encountered and scarified to a depth of twelve (12) inches below the sub grade.

Stump holes and trenches shall be carefully backfilled and tamped. Heavy sod and all soft, yielding, or otherwise unsuitable materials shall be removed and replaced with acceptable fill material.

All suitable materials from roadway cuts may be used in the construction of fills, approaches, or at other places as needed. The fill shall be spread in layers and compacted. Compacted layers shall not exceed six (6) inches in thickness. Fills shall be rolled in accordance with Alabama Highway Department standards. The top twelve (12) inches of soil in both cut and fill sections shall have a dry weight density equal to or greater than ninety-five (95) percent of that obtained by AASHTO Designation T-99, Method A or C.

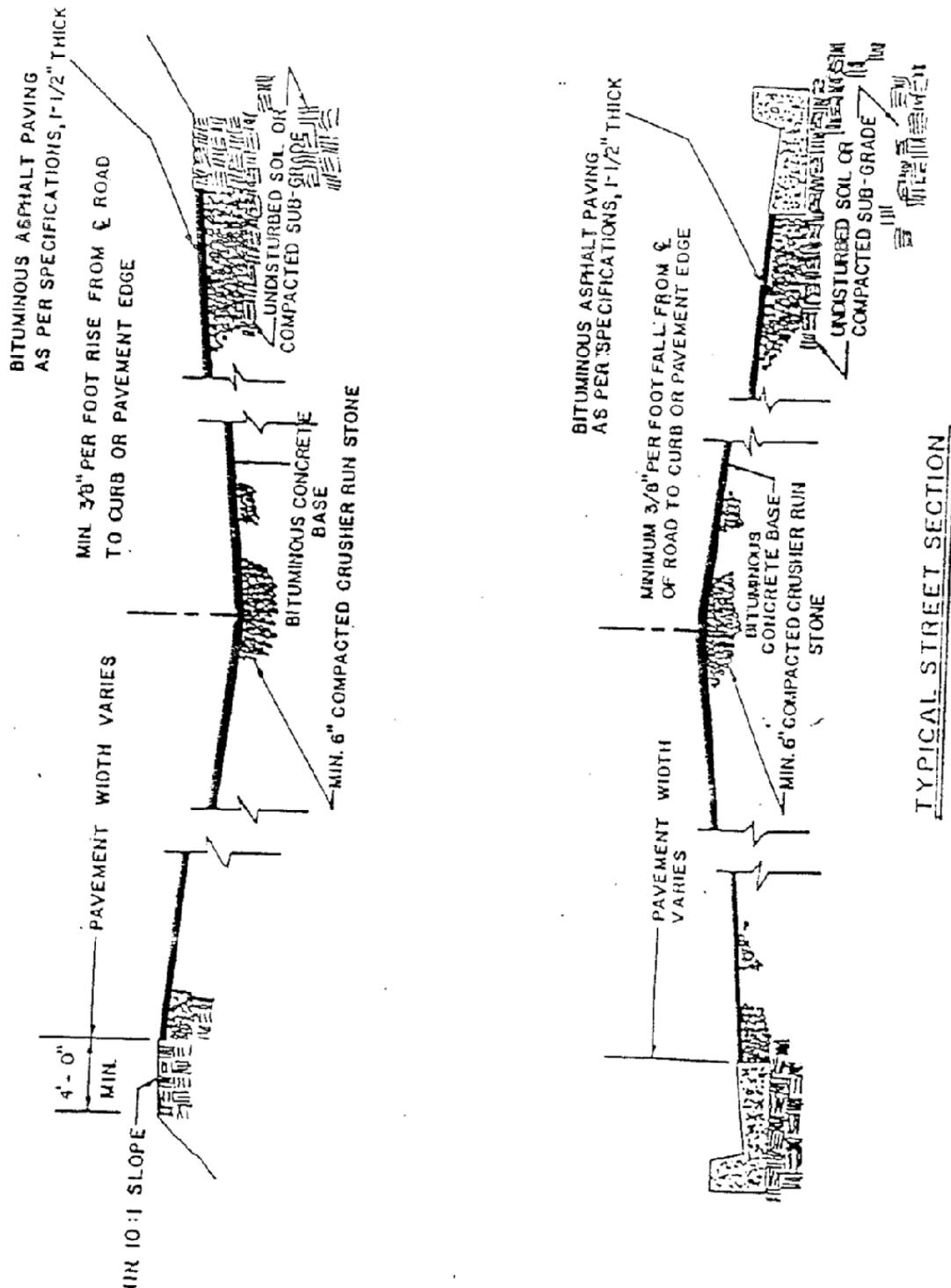
All compaction testing shall be performed to the satisfaction of the Engineer, and no base materials shall be placed over the subgrade until all test results have been approved by the Engineer.

Grading shall progress so as to insure good drainage and prevent formation of depressions where water may collect.

A transverse slope or crown shall be provided to expedite surface drainage. On residential streets, up to one-half (1/2) inch per foot is permissible. As traffic speeds increase, the crown shall be decreased, but a minimum of one-eighth (1/8) inch per foot shall be maintained. When the natural soil cannot be made stable enough to support construction traffic, sub grade modification shall be accomplished by incorporating course graded crushed stone in the top six- (6-) inch layer and recompacting. The sub grade shall have provisions to intercept groundwater from springs and seepage plains that prevent saturation of the sub grade. The finished sub grade shall be true to grade, free from roots, and uniformly firm.

All underground utilities crossing paved streets shall be installed prior to final grading. Electrical and telephone cables crossing public streets shall be placed in adequately-sized conduits.

FIGURE 4.1  
TYPICAL STREET SECTION



#### 4.1.2 Material Thicknesses

The Contractor shall have the option of constructing the base with either a crusher run stone layer, a bituminous concrete layer, or a combination of both the crusher run and bituminous concrete layers. The crusher run layer shall be compacted to one hundred (100) percent density and placed on the prepared sub grade, while the bituminous concrete layer shall consist of a hot-mix, hot-laid bituminous base constructed on the prepared underlying primed base or sub grade.

Thicknesses of the crusher run, bituminous base, and bituminous surfacing layers proposed to be used shall be multiplied by strength factors and added to create a structural number (SN), which determines the relative strength of the pavement. This calculated SN must exceed the minimum SN for the type of road to be constructed. The minimum SNs for each type of street are:

Residential: SN = 1.70

Collector: SN = 2.40

Arterial: SN = 2.80

where  $SN = (0.14)(\text{Thickness of crusher run layer, inches}) +$   
 $(0.44)(\text{Thickness of bituminous base, inches}) +$   
 $(0.44)(\text{Thickness of bituminous surfacing, inches}).$

In no case shall there be less than six (6) inches of crusher run, when used, or less than two (2) inches of bituminous material in the pavement design.

For residential streets, the minimum SN can be achieved through the construction of a six-(6-) inch layer of crusher run base overlaid with a two- (2-) inch layer of bituminous wearing surface. The Contractor may substitute a two- (2-) inch layer of bituminous base in place of the six- (6-) inch layer of crusher run base, if he chooses to do so.

All proposed material thicknesses shall be submitted to the City Engineer for approval prior to construction. No placement of materials shall commence until the City Engineer has granted approval.

#### 4.1.3 Aggregate Base Course

The aggregate base course shall consist of a dense graded aggregate material placed upon a compacted subgrade and overlain with a bituminous base course or and/or a bituminous wearing surface course. Aggregate for crushed aggregate base course shall meet the requirements as specified in Section 825 of the Alabama Highway Department Standard Specifications. The aggregates shall be well graded between the limits specified and shall conform to the following gradation requirements:

<b><u>Sieve</u></b>	<b>Percent Passing by Weigh</b>	
	<b><u>Type A</u></b>	<b><u>Type B</u></b>
2 Inch		100
1-1/2 Inch		90-100
1 Inch	100	75-95
3/4 Inch	86-100	
1/2 Inch		60-85
No. 4 Mesh	26-55	40-65
No. 8 Mesh	15-41	28-54
No. 16 Mesh		19-42
No. 50 Mesh	3-18	9-27
No. 200 Mesh	0-10	4-18

For Type "A", the fraction passing the No. 40 Sieve shall not have a liquid limit in excess of 25. For Type "B", the fraction passing the No. 40 Sieve shall not have a plasticity index in excess of 6 nor a liquid limit in excess of 25, and contain not more than 2/3 by weight passing the No. 200 Sieve.

Crushed stone base material shall be placed in layers of uniform thickness with an approved spreader. Layer thicknesses generally shall not exceed six (6) inches after compaction. When vibrating or other approved types of special compacting equipment are to be used, approval may be given to increasing the permissible thickness of layers, provided the ability of such equipment to achieve acceptable compaction to the full layer depth is demonstrated. When the base course is constructed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter. The water content of the material shall be maintained during the placing method at the optimum percentage ( $\pm 1.5\%$ ) as determined by ASTM D-1557.

While at the optimum moisture ( $\pm 1.5\%$ ) the crushed stone base shall be compacted with equipment capable of obtaining the desired density to the full depth. The rolling shall continue until the base is compacted to not less than one hundred percent (100%) of the maximum laboratory density as determined by ASTM D-1557, Method D. In-place density shall be measured by ASTM D-2167 or other approved methods.

The surface of the compacted crushed stone base shall be finished by balding or with automated equipment especially designed for this purpose and rolled. In no case will thin layers of fine materials be added to the top layer of the base course in order to meet the grade.

The surface of the completed base shall not show any deviation in excess of one-half (1/2) inch when tested with a ten- (10-) foot straightedge. The completed thickness of the base shall be within +3/4 inch or -1/2 inch of the thickness indicated, and the average thickness shall not be less than the design thickness.

The base shall be maintained in a condition that will meet all specification requirements until the work is accepted.

#### 4.1.4 Bituminous Base Course

The blended mineral aggregate shall be graded and combined to meet the general composition limits by weights for the dry mix. Fine aggregate shall be local sand and gravel, crushed limestone or crushed slag.

Course aggregate shall be local or commercial gravel, crushed gravel, crushed slag, crushed stone, or a combination of these.

The blend of course and fine aggregate shall meet the following gradation, combined so as to produce a mix that will develop not less than 1,000 pounds Marshall Stability at 75 blows, or as shown on the approved plans or specified in the proposal. This aggregate gradation is equivalent to "Mix A" standards in Section 327 of the AHD Standard Specifications.

<u>Sieve</u>	<u>Percent Passing by Weight</u>
1-1/2 Inch Sieve	100
3/4 Inch Sieve	70 - 100
3/8 Inch Sieve	45 - 90
No. 4 Mesh Sieve	25 - 70
No. 8 Mesh Sieve	20 - 57
No. 50 Mesh Sieve	7 - 24
No. 100 Mesh Sieve	2 - 14
No. 200 Mesh Sieve	0 - 8
Bitumen (AC-20) 85-100 Penn 4	3.5 - 6.5

Local source material (pit run) shall have a P.I. of 6.0 or less.

The proportion of bitumen to total aggregate by weight will be fixed in the job mix formula. The grade of asphalt shall be (AC-20) 85-100 penetration as directed by the Engineer.

Sampling and testing by an independent testing firm may be required at the discretion of the Engineer.

All placement equipment of bituminous mixture, rollers, and other required equipment shall be approved by the Engineer.

No bituminous mixture shall be placed unless the temperature is at least forty (40) degrees Fahrenheit and rising in the shade or during any severe weather conditions or seasons unless approved by the Engineer.

The depth of the base courses shall be as determined in Section 4.1.2 utilizing sound engineering practices based on the following:

1. Soil Support - The inherent ability of the native subgrade soil to support loads transmitted through the pavement.

2. Traffic Intensity - The weight and relative frequency of anticipated wheel loads.

For satisfactory run-off, 3/8 inch rise per foot of pavement width is the minimum required crown.

#### **4.1.5 Prime Coat**

Prime shall not be applied until the base has been approved by the Engineer. Before applying the prime, the surface shall be swept and prepared.

Loose material, dust, dirt, caked clay, and any foreign material that might prevent proper bond with the existing surface shall be removed for the full width of the treatment by means of revolving brooms, mechanical sweepers and blowers. Dust and other loose material not removed by mechanical means shall be removed with hand brooms. All sweeping shall be removed before any bituminous material is applied.

The base shall be sprinkled with water if the Engineer so directs.

Prime shall be applied at the rate of 0.25 gallons per square yard consisting of grades MC, RC, or RT, as approved by the Engineer. Prime coats shall be applied at the following temperatures:

Cut-back Asphalt: 70 degrees - 180 degrees

Emulsified Asphalt: 60 degrees - 140 degrees

Cleaning equipment, pressure distributor and bitumen heating equipment for application of prime coats and tack coats shall be approved by the Engineer.

#### **4.1.6 Wearing Surface**

The wearing surface shall consist of a hot-mix, hot-laid bituminous concrete pavement wearing layer. It shall be constructed in one layer, at not less than an average weight of 162 pounds per square yard, on a designated surface, to conform to the lines, grades, cross sections, and at a minimum average finished thickness of one and one-half (1-1/2) inches.

The mineral aggregate shall be limited to siliceous aggregates such as crushed gravel, crushed granite, crushed slag, natural sand, slag screening, or a combination of the proper size of these materials that will produce an acceptable job mix within the gradation limits shown. The aggregate fines shall contain concrete sand in an amount equal to at least thirty (30) percent by weight of the total mineral aggregate. If local fine sand is not available in the immediate vicinity of the project, the addition of aggregate of limestone or stone screening will be allowed in an amount of not greater than ten (10) percent by weight of the total mineral aggregate to provide additional fines, if needed. The use of limestone is permitted; however, the use of carbonate stone such as dolomite or other aggregates that tend to polish under traffic will not be permitted.

The blended mineral aggregate shall be combined to meet the general limits by weights. Mineral aggregate shall be submitted to the Testing Laboratory for a job mix formula and no bituminous mixture shall be produced until the job mix formula has been approved by the Engineer; no

bituminous material is to be produced during the absence of an inspector assigned by the Laboratory. The Contractor shall give the Laboratory at least twenty-four (24) hours notice prior to producing aggregate mixtures.

The following bitumen mixture shall be proportioned to total aggregate by weight:

<u>Sieve</u>	<u>Percent Passing by Weight</u>
3/4-Inch Sieve	100
1/2 Inch Sieve	95 - 100
3/8 Inch Sieve	75 - 95
No. 4 Mesh Sieve	52 - 80
No. 8 Mesh Sieve	36 - 64
No. 50 Mesh Sieve	6 - 24
No. 100 Mesh Sieve	4 - 14
No. 200 Mesh Sieve	2 - 8
Bitumen (AC-20) 85-10 Penn 4	5-10

This aggregate gradation is equivalent to "Mix A" standards in Section 416 of the Alabama Highway Department Standard Specifications.

Crushed gravel for use in the bituminous mixture noted above shall be crushed from aggregate retained on a 3/4-inch screen.

Slag shall consist of clean, tough, durable pieces of air-cool blast or electric furnace slag, reasonably uniform in density and quality, free from thin or elongated pieces, and free from deleterious substances. The use of "open-hearth" slag re-drained from cold piles and processed use shall be allowed.

Aggregate for bituminous mixture shall be graded, or a combination of the aggregate specified for the type of bituminous mixture involved. It shall be uniformly graded so as to meet the gradation required for the size designated to be used. The aggregate shall be of such nature that when once thoroughly dried and coated with the bituminous materials proposed for construction, the coating will not strip off upon contact with water. All aforementioned aggregates and minerals shall meet ASTM requirements (latest edition) unless specified elsewhere.

Asphalt cement shall be AC-20, 85-100 Penetration, or other grades approved by the Engineer. Tack coat bitumen shall be the same type and grade used in the mix, except that a lighter grade may be used with written permission from the Engineer.

Preparation of the bituminous mixture shall be subject to sampling and plant inspection as determined by the testing firm under the direction of the Engineer.

A tack coat shall be applied to the binder course, including all contact surfaces such as curbs, manholes, and adjacent pavement edges wherever encountered, and to the extent as directed by the Engineer.

Tack coat material shall be heated or otherwise prepared to insure uniform distribution as directed by the Engineer in the amount specified and shall be distributed as directed by the Engineer in an amount of 0.1 gallons per square yard on a clean, dry prepared surface. Tack coat material shall be applied only far enough in advance to permit construction to progress uniformly and continuously after the curing period. Tack coat material shall not be applied so far in advance that the viscous quality will be reduced by traffic before being covered. Tack coat that has lost its viscous quality before being covered shall be renewed and any which has been damaged shall be replaced.

Loads will be dumped into the spreader and immediately spread and screened to such uniformity that the average depths or weight per square yard of the mixture will be secured. Spreading shall proceed at a speed adjusted to the output of the plant so that spreading shall be as nearly continuous as possible and so that the adjacent spread can be made before the edge of the prior spread hardens or cools, and before hardening occurs under the stopped spreader. In cases where delay is unavoidable, the transverse and longitudinal joints shall be treated utilizing an overlap rolling technique, followed by compaction with a vibrating roller. Alignment of the outside edge of the paving shall be controlled by pre-set control lines, gutters, or cords.

For areas inaccessible to other spreading equipment, and when approved by the Engineer, hand spreading of bituminous mixture will be permitted. When hand spreading is permitted or becomes necessary due to project conditions, the mixture shall be dumped on approved steel dump sheets outside of the area which is to be spread, and shall be distributed immediately and in a uniform loose layer of such depth as will result in a compacted layer having the weight and depth required. In lieu of the use of steel dump sheets, the mixture may be shoveled by hand directly from the truck into place, or the Engineer may direct that other means of placing be used to insure better control of the depth of mixture and the surface finish.

The finished surface of the base and surface layer shall not vary more than 1/4 inch from a ten- (10-) foot straight edge and not more than 3/8 inches from a taut string twenty-five (25) feet in length placed parallel to the center line at points where directed. The rate of variance from the straight edge and string shall not exceed 1/16 inches per foot. The finished general surface shall not vary more than 1/2 inches at any point of the required grade elevation taken from the Engineer's elevation stakes. These tests for surface smoothness shall be made continuously during and immediately after rolling so that irregularities may be eliminated to the extent possible by rolling while the mixture is still hot. Otherwise, difference in smoothness shall be by removing or adding material as needed.

Hot bituminous surface layers shall be thoroughly compacted to not less than ninety-five (95) percent of density as established by the Seventy-Five Blow Marshall Test. The required Seventy-Five Blow Marshall Test will be determined by the average of a minimum of three (3) test specimens. After the mixture and spreading operation has started, the City may elect to establish the required density by performing the Seventy-Five Blow Marshall Test on material taken from the spreading hopper or loaded truck.

The submission of the job mix formula shall, upon approval and thereafter, require the furnishing of the type paving mixture not only in the master range given, but as a further requirement also meeting the exact formula set up for the project within the following job tolerances:

Plus or Minus 7 Percent for the No. 4 and larger screen requirements.

Plus or Minus 4 percent from No. 8 through No. 100 Sieve requirements.

Plus or Minus 2 percent for the No. 200 Sieve requirements.

Plus or Minus 20 degrees Fahrenheit for temperature of mixture at the plant.

Plus or Minus 0.4 percent for Bitumen Content.

The temperature of the mixture shall, in no case, be outside the following limits unless otherwise specified:

325 degrees Fahrenheit Maximum

225 degrees Fahrenheit Minimum for asphalt cement

The desired temperature within these limits shall be specified and each batch shall be within twenty (20) degrees Fahrenheit of the specified temperatures. Should a change in source of material be made, a new job mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, a new job mix formula will be established. No change in the properties or proportion of any ingredient of the mix shall be made without written permission of the Engineer.

#### **4.1.7 Widening**

The subgrade should be prepared as carefully for the widening of pavement as it is for new construction. It should be compacted adequately and graded to a smooth surface before the asphalt mixture is placed.

Materials and construction procedures used for widening are the same as used for any other asphalt pavement construction. The equipment, however, is different, unless full-width lanes ten (10) feet or more are being added.

For narrow widening, trenchers should be used to excavate to the depth and width required by the pavement design. This should be done, if possible, after the leveling course is applied to the old pavement in order to achieve uniform thickness of the widening. Small self-propelled pavers, or attachments to full-sized paver and motor graders, should be used for placing the mixture. Special trench rollers or vibratory rollers usually should be used for the compaction of mixes in narrow widening.

#### **4.1.8 Overlays for Asphalt Roads**

The major reasons for overlaying otherwise adequate pavements are excessive permeability, surface raveling, surface roughness, and surfaces with low skid resistance. The overlay thickness is designed to correct a below-average pavement condition, not to provide the extra structural strength needed for localized weak areas.

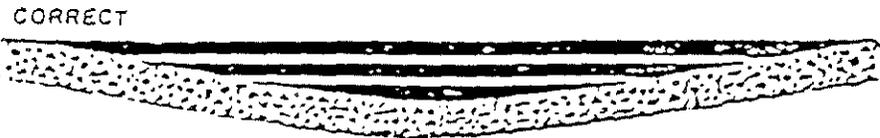
All weak areas should be repaired with proper patches. Structural patches should be designed and constructed with full-depth asphalt concrete to ensure strength equal to or exceeding that of the surrounding pavement structure. When the surface is distorted, the constructions of leveling courses or leveling wedges is required to restore proper lines and cross-sections. Leveling wedges are patches of asphalt plant-mix used to level sags and depressions in an old pavement prior to the surfacing operation.

In placing multiple layers, the shortest length layer should be placed first, with the successive layer or layers extending over or covering the short ones. If the correct method were reversed, as shown in the illustration, there would be a tendency for a series of steps to develop at each joint because of the difficulty of feathering-out asphalt mixtures at the beginning and end of a layer. Where wedging of dips requires multiple layers, sufficient levels should be taken to plot profiles and cross-sections accurately. From these, the grade of the proposed correction and lineal limits of the successive layers can be given definite stationing for starting and terminating the spreader or motor grader passes.

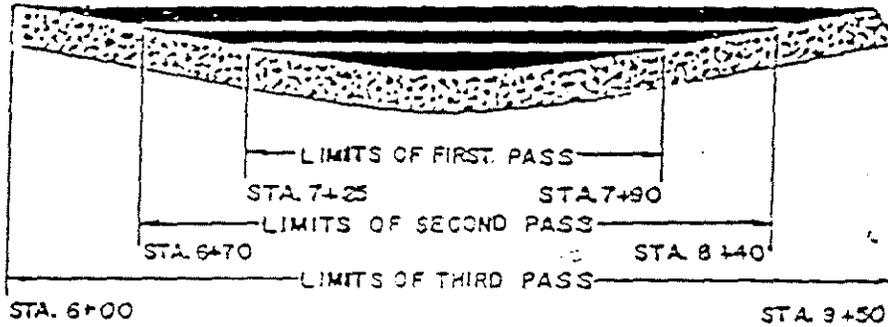
When repairs are completed, the surface to be overlaid must be thoroughly cleaned. A tack coat of asphalt must then be applied to ensure uniform and complete adherence of the overlay.

Vertical faces of pavement, curbs, gutters, drainage gratings, manholes, and other contact surfaces should be sprayed or painted with a uniform coating of asphalt, preferably emulsified asphalt. This work shall be done in such a way as not to stain exposed curb or gutter surfaces. Asphalt coatings on vertical surfaces shall be protected from dust and dirt. This should be done immediately prior to pavement construction. When the pavement has been prepared, placing the overlay to the predetermined thickness, whether for surface improvement or structural improvement, should proceed without delay. Construction procedures for asphalt overlays are the same as for asphalt pavement construction described earlier.

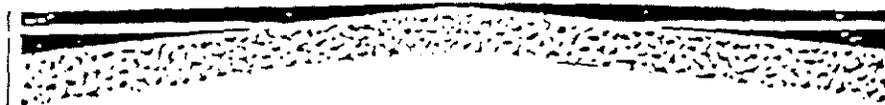
FIGURE 4.2  
PAVEMENT LEVELING



CORRECTLY PLACED LEVELING WEDGES  
ENSURE SMOOTHER PAVEMENTS



LIMITS FOR MULTIPLE-LAYER LEVELING WEDGES  
SHOULD BE DETERMINED BY LEVEL



CORRECTLY PLACED LEVELING WEDGES FOR  
OVERCOMING EXCESSIVE CROWN

## **4.2 CONCRETE ROAD SPECIFICATIONS**

### **4.2.1 Site Work and Grading**

All streets, roads, and service drives shall be graded in the same manner as previously described for asphalt roads. The area shall be cleared of any unsuitable materials and filled with suitable materials. Compaction shall be accomplished in layers as described, with the grading progressing so as to ensure good drainage. Before placing concrete, the subgrade shall be checked for conformity with the cross-section shown on the plans. If necessary, adjust the subgrade to the correct elevation and recompact if required. Concrete shall not be placed on any portion of the subgrade which has not been checked. Concrete shall not be placed around manholes or other structures until they have been brought to the required grade and alignment. Concrete shall not be placed on soft, spongy, frozen, or otherwise unsuitable subgrade. The subgrade shall be moist when the concrete is placed. All underground utility crossing paved streets shall be installed prior to final grading. If possible, all utilities should be placed in the right-of-way outside the pavement area.

### **4.2.2 Pavement Design**

The design and depth of concrete pavement shall be determined by utilizing sound engineering practices based on soil support and traffic intensity. For satisfactory run-off, 3/8 inch rise per foot of pavement width is recommended.

The following references are recommended for concrete design:

1. U.S. Army Technical Manual TM-5-822-6, April, 1977. "Rigid Pavements for Roads, Streets, Walks & Open Storage Areas."
2. Portland Cement Association Publications, "The Design of Concrete Pavements for City Streets, R 153-3, 1963.

The City Engineer shall review all concrete pavement design prior to construction.

### **4.2.3 Concrete**

Concrete shall be manufactured and delivered in accordance with the latest revised Standard Specification for Ready Mixed Concrete, ASTM C-94.

- a. All concrete shall have a minimum 28-day compressive strength of 3,500 psi.
- b. The air content of the plastic concrete shall be 5.5 percent plus or minus 1.5 percent.
- c. Slumps shall be maintained so as not to exceed 4.5 inches for non-vibrated placement and 3.0 inches for vibrated placement.
- d. Cement shall conform to requirements for ASTM C-150. Aggregates shall conform to requirements of ASTM C-33. Air-entraining admixture shall conform to requirements of ASTM C-260. Water-reducing admixtures shall conform to

requirements of ASTM C-494. Fly ash shall conform to requirements of ASTM C-618, Class F, except that the loss of ignition shall not exceed 6.0 percent.

- e. The actual proportions of cement, water, fine aggregate, coarse aggregate, and admixtures to be used for various mixes shall be determined by an approved testing laboratory, in accordance with the latest edition of ACI Standard 318.

#### **4.2.4 Forming**

Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment they support, without springing or settlement. The method of connection between sections shall be such that the joint formed shall be free from play or movement. When set to grade and staked in place, the maximum deviation of the top surface of any section shall not exceed one-eighth inch (1/8") in ten (10) feet from a straight line. The alignment and grade elevations of the forms shall be checked and the necessary corrections be made before placing the concrete. Forms shall be cleaned after each use and coated with a form release agent to ensure separation from concrete without damage.

As an alternate to using fixed forms, concrete may be placed with a slipform paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine. If any traffic is allowed to use the prepared subgrade, it shall be checked and corrected immediately ahead of the placing of the concrete.

#### **4.2.5 Placing, Finishing, Texturing, and Curing**

The concrete shall be deposited on the grade in such a manner as to require as little rehandling as possible. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Concrete shall be thoroughly consolidated against and along the face of the forms and along the full length and on both sides of all joint assemblies.

The sequence of finishing operations shall be the strikeoff and consolidation, floating (if necessary), straightedging, and surfacing texturing.

The pavement shall be struck-off and consolidated with a mechanical finishing machine, vibrating screed, or hand finishing methods when approved by the Engineer. A slipform paver may also be used. After the pavement is struck-off and consolidated, and joints formed, it shall be checked with a ten- (10-) foot long straight-edge having a handle to permit operation from the edge of the pavement. The straightedge shall be operated parallel the center line of the pavement and shall be moved forward one-half its length after each pass. Irregularities shall be corrected by adding or removing concrete. The use of long handle bullfloats shall be kept to a minimum; they may be used in areas not accessible to finishing equipment and for compacting concrete in the vicinity of formed joints. In general, adding water to the surface of the concrete to assist in finishing operations shall not be permitted. If permitted, it shall be applied as a fog spray.

Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edge of the radius shown in the plans.

A burlap drag or broom shall be used for texturing. The burlap drag shall be at least three (3) feet wide and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the pavement and dragged in the direction in which the pavement is being placed. For a broom finish, brooming shall generally be parallel to transverse joints by drawing a stiff-bristled broom from the center to the edge of the pavement with adjacent strokes slightly overlapping to produce surface corrugations of uniform appearance approximately 1/16 inch in depth.

After finishing operations have been completed and immediately after the free water has left the surface, the entire pavement surface shall be covered with a white pigmented liquid membrane curing compound complying with ASTM C-309 at the rate specified by the manufacturer, or by the three- (3-) day coverage with waterproof paper or white polyethylene sheeting complying with ASTM C-171. When forms are removed, curing compound shall be applied to the sides of the pavement.

#### **4.2.6 Joints**

Unless shown on the plans, a jointing plan shall be prepared and approved by the Engineer before paving begins. All control joints, isolation (expansion) joints, and construction joints shall be placed as indicated on the approved plans or approved jointing plan.

Isolation (expansion) joints shall be used to isolate fixed objects abutting or within the paved area. Isolation joints shall contain premolded joint filler for the full depth of the slab and shall be installed only where specifically shown on the plans or approved jointing plan.

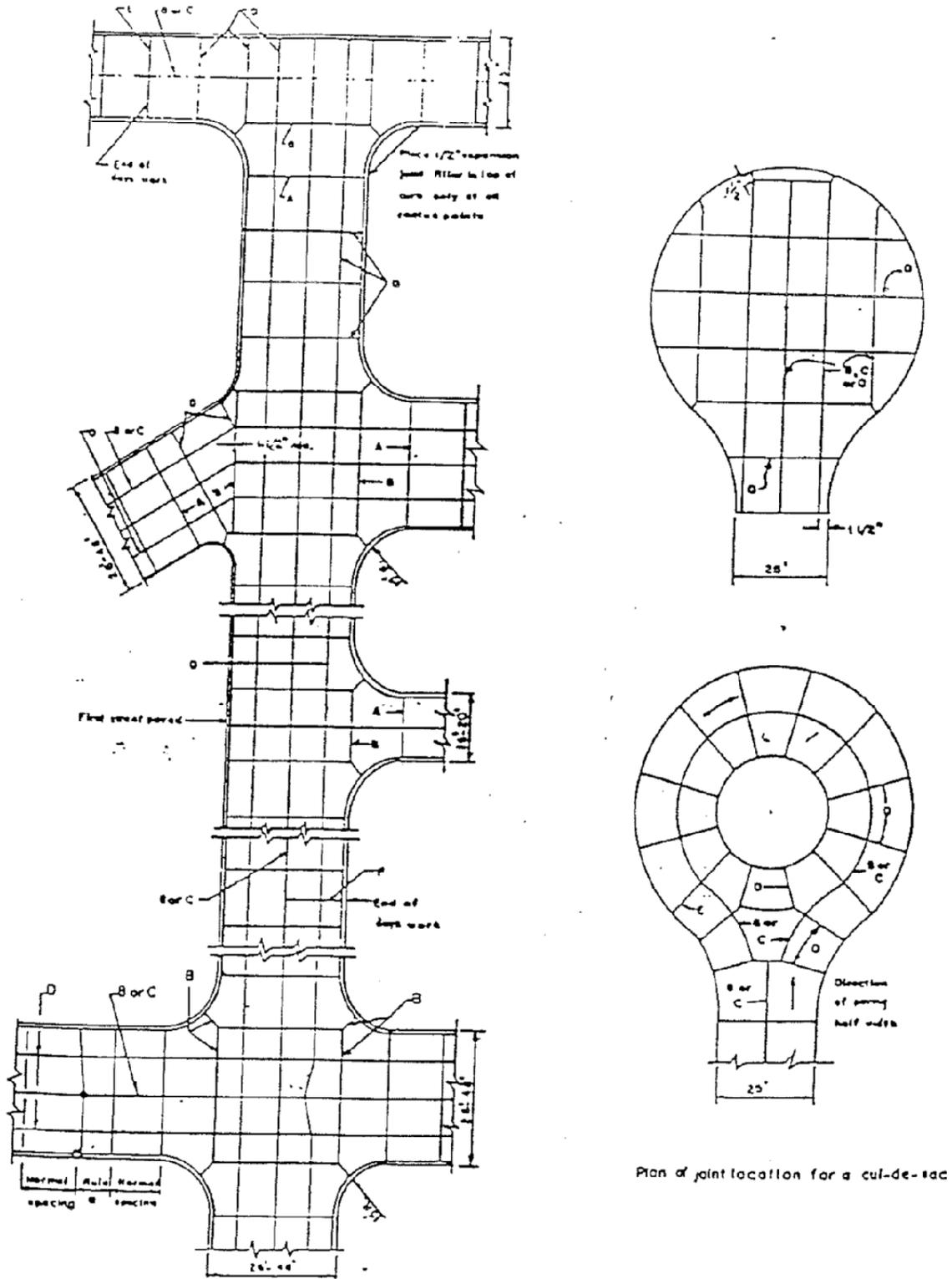
Control (contraction) joints shall be formed by one of the following methods:

1. Forming by hand
2. Forming by approved insert or sawing

Joint depth shall be a minimum of one-fourth the slab thickness. Hand-formed joints shall have a maximum edge radius of one-fourth (1/4) inch. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually four (4) to eighteen (18) hours. All jointing shall be completed before uncontrolled shrinkage cracking occurs.

Transverse construction joints of the type shown on the plans shall be installed whenever the placing of concrete is suspended a sufficient length of time that the concrete may begin to harden.

FIGURE 4.3  
 TYPICAL JOINT PLAN  
 TYPICAL JOINT PLAN



Pavement joints and cross section details

FIGURE 4.4  
TYPICAL JOINT SECTION

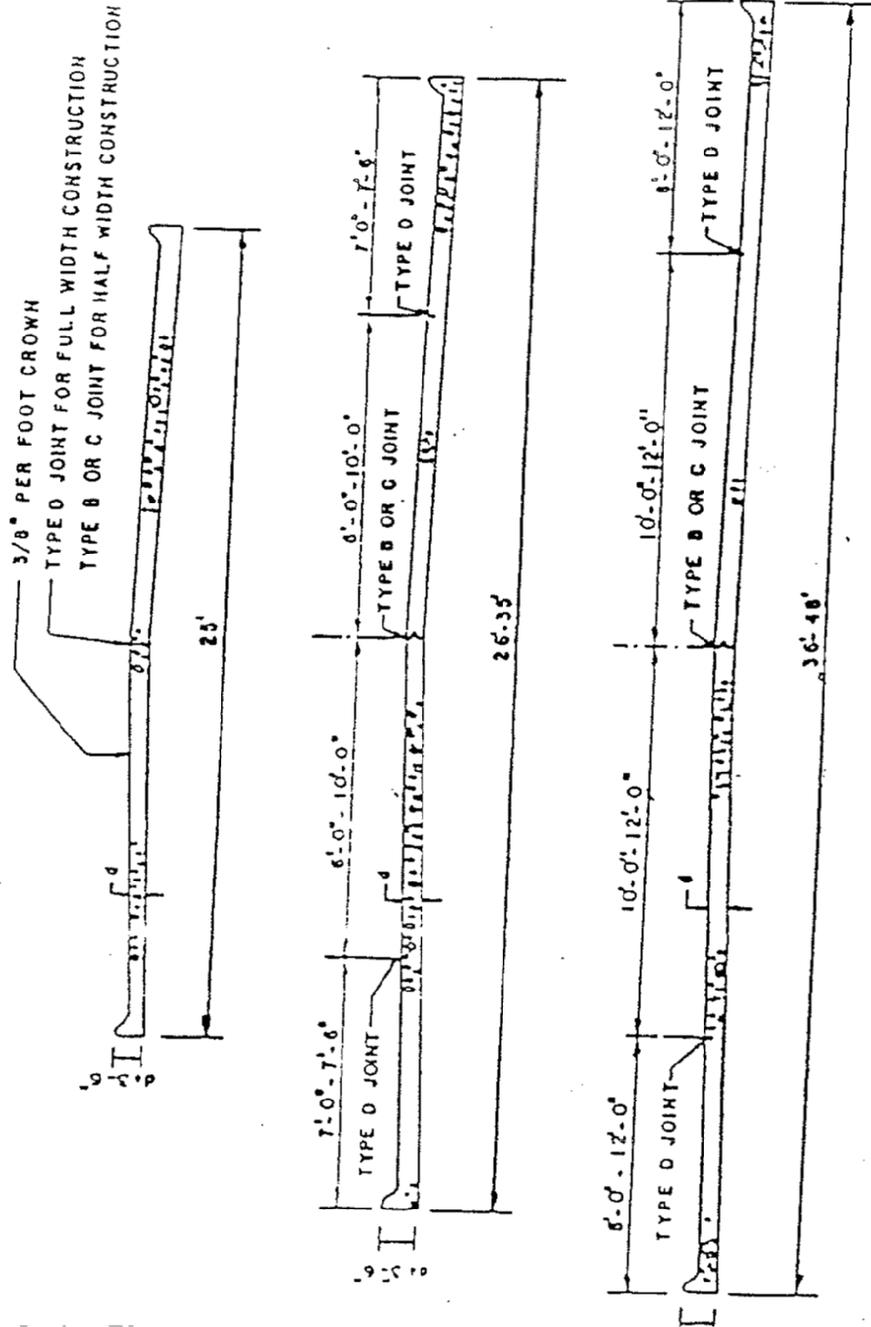


FIGURE 4.5  
TYPICAL JOINT DETAILS

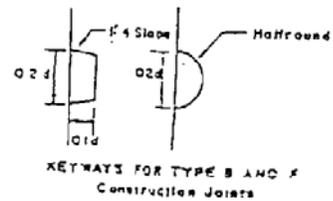
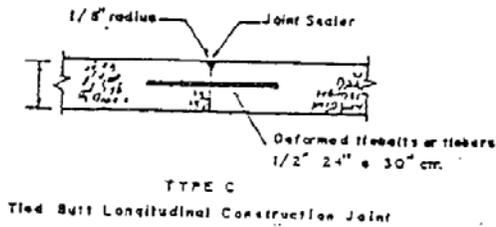
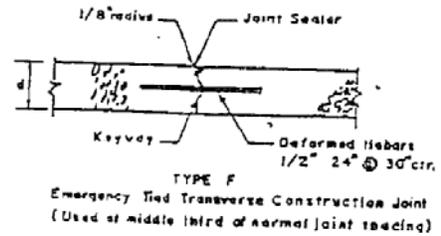
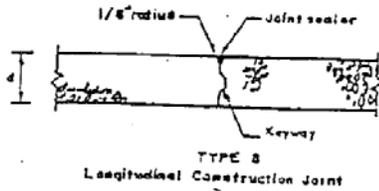
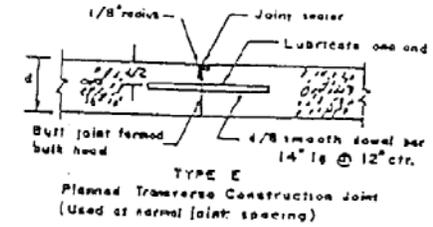
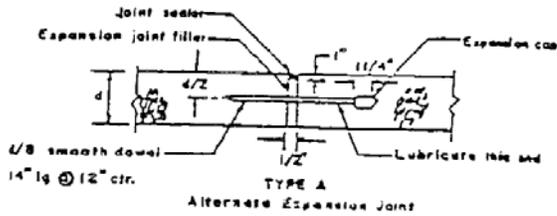
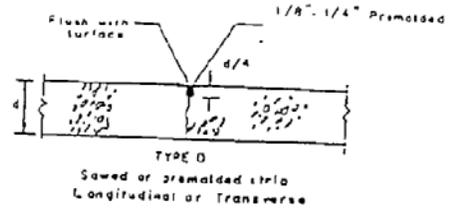
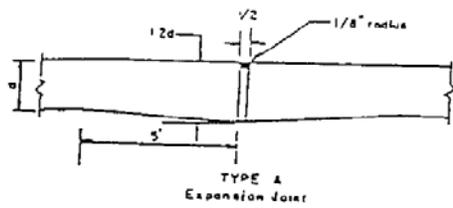
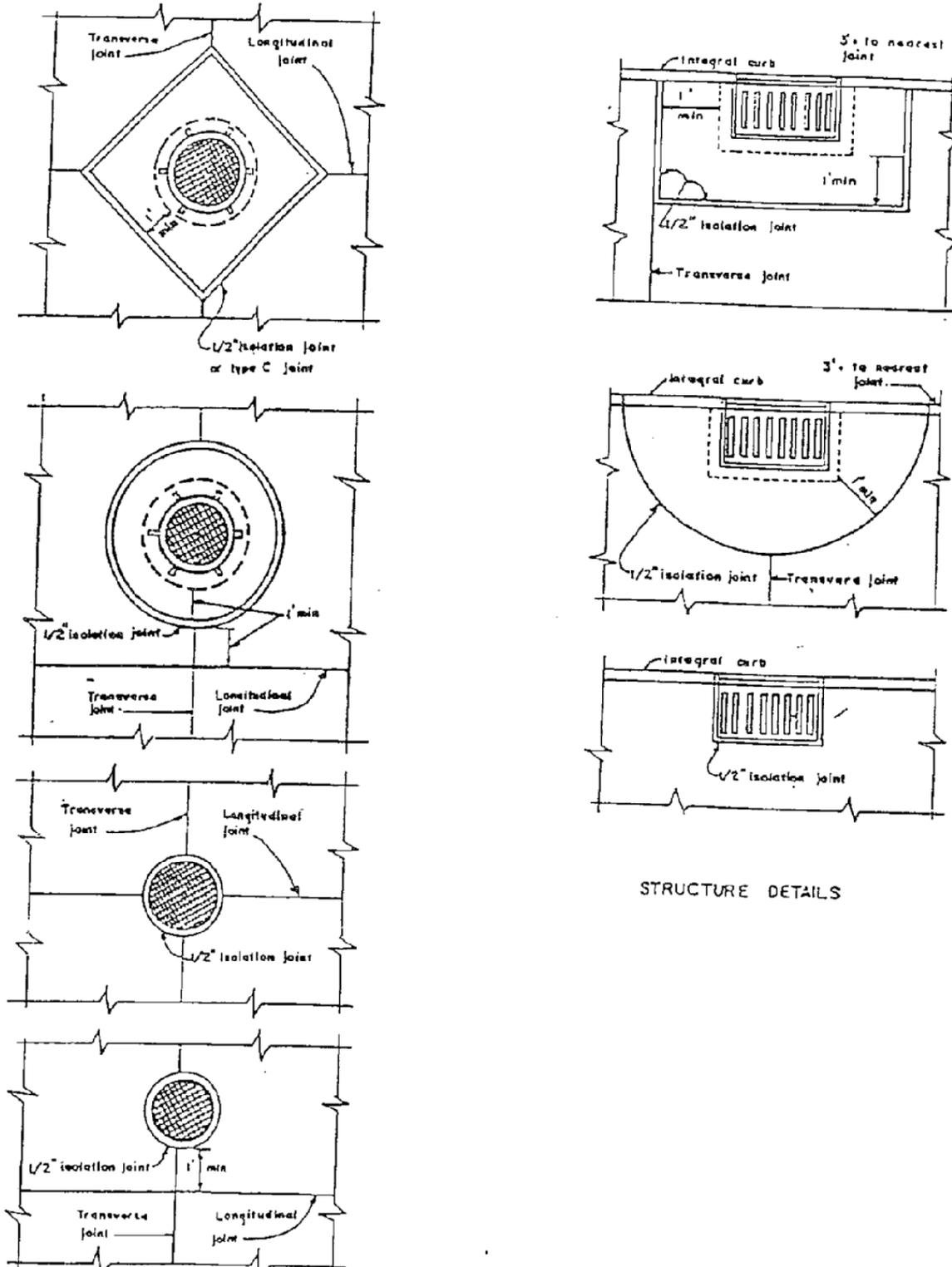


FIGURE 4.6  
TYPICAL STRUCTURE DETAILS



STRUCTURE DETAILS

Longitudinal joints shall be installed to control longitudinal cracking. They should be spaced to coincide with lane markings at eight (8) to twelve- (12-) foot intervals. Joint spacing should not be greater than thirteen (13) feet unless local experience has shown that the pavements will perform satisfactorily.

Transverse joint spacing shall be at regular intervals of approximately twelve (12) to fifteen (15) feet. Where required, joint spacing may vary slightly to make them coincide with drainage or other structures. Joints shall be continuous across the slab, unless interrupted by full-depth premolded joint filler.

Joints shall extend completely through the curb. In general, load-transfer devices are not required for the recommended joint spacing.

In general, joints do not require sealing. Where required, joints shall be filled with a joint-sealing material that conforms to the requirements of ASTM D-1190. Other types approved by the Engineer may be used.

The pavement shall be closed to passenger-car traffic for at least three (3) days. Traffic shall be restricted to passenger cars and light trucks for at least seven (7) days after concrete is placed. In all cases, approval of the Engineer shall be obtained prior to opening of the pavement to traffic.

#### **4.2.7 Replacing Concrete Pavement**

Where concrete pavement in streets, sidewalks, paved ditches or other areas is removed, it shall be replaced with the same type and thickness as that removed, including finish. A six- (6-) inch compacted base course shall be provided under new concrete paving subject to vehicular traffic as specified above. Existing pavement shall be cut back a minimum of nine (9) inches from edge of trench.

### **4.3 CURB AND GUTTER**

As required, curbs and gutters shall be placed along the edges of all street pavements and shall be formed to the cross-section shown on the plans. Whenever practical, the curbs shall be constructed integrally with the pavement using slipform or extrusion equipment, or placed immediately after finishing operations by hand forming or using face forms.

Curbs shall be constructed of Portland Cement Air-entrained Concrete, Class B, having a standard strength of three thousand (3,000) pounds per square inch. If it is not feasible to install curb and gutter, the Engineer may allow valley curb to be installed at the pavement edge.

**FIGURE 4.7  
CURB & GUTTER DETAIL**

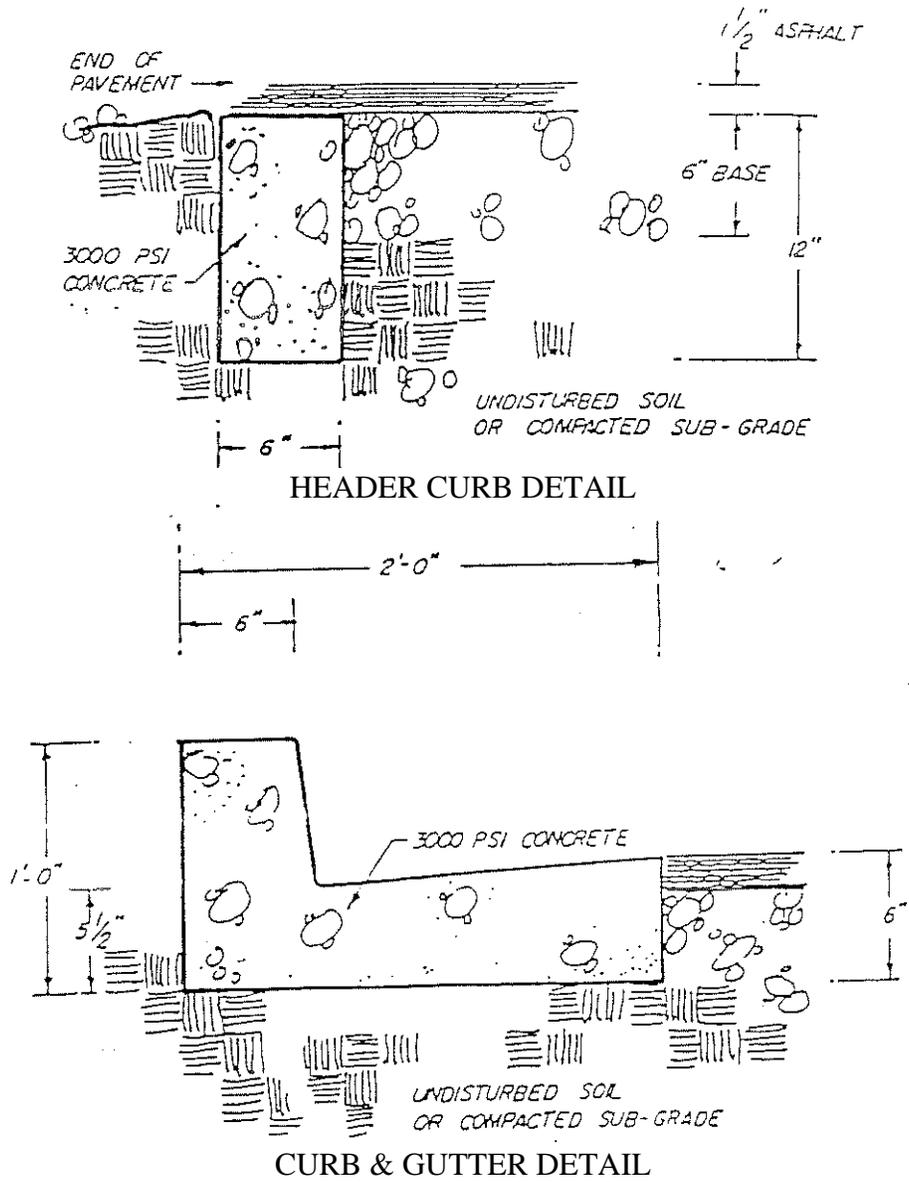
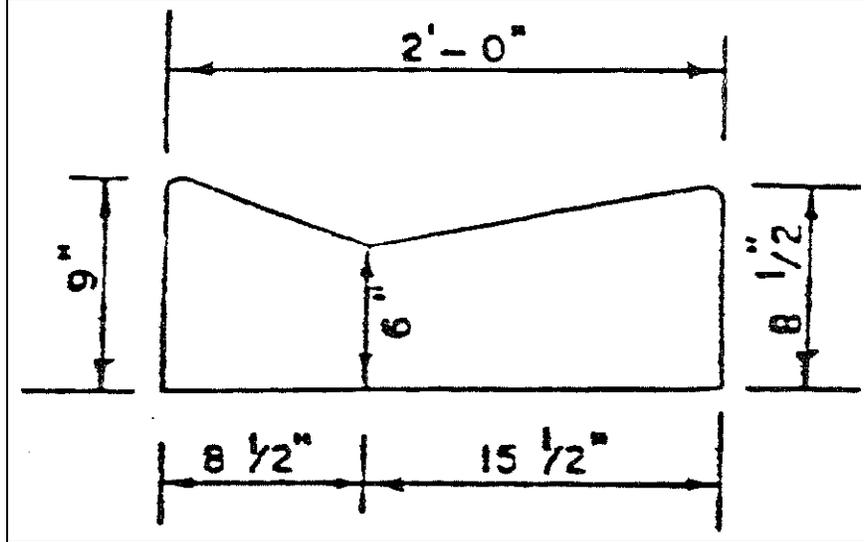


FIGURE 4.8  
VALLEY CURB DETAIL



#### **4.3.1 Joints**

Weakened plane joints shall be straight and shall be at regular intervals not to exceed twenty (20) feet. Where curb and gutter is adjacent to concrete pavement, the joints shall be aligned with the pavement joints where practical.

Expansion joints shall be filled with premolded joint filler and the filler shall completely fill the joints to within one-fourth (1/4) inch of any surface of the concrete. Excess filler material shall be trimmed off to the specified dimension in a neat and workmanlike manner. All expansion joints shall be installed vertically and perpendicular to the line of the curb. No expansion joints shall be constructed in access ramps or driveways, except as may be approved by the Engineer.

#### **4.3.2 Driveway Entrances**

Driveway entrances shall be provided in new curb at all existing driveways along the line of work, at locations shown on the plans, and at such other locations as may be designated by the Engineer.

The furrow-depressed curb opening at driveway entrances shall be one (1) inch above gutter flowline at the curb face. The top of the fully-depressed portion of the curb shall be finished to a transverse slope toward the gutter of 3/4 inch.

### **4.4 SIDEWALKS**

#### **4.4.1 Construction Specifications**

Sidewalks shall be constructed on compacted subgrade with Portland Cement Air-Entrained Concrete, Class B, having a standard strength of three thousand (3,000) pounds per square inch (psi). All sidewalks shall be scored at five- (5-) foot intervals with expansion joints at a maximum spacing of thirty (30) feet. Cross-slopes shall be a minimum of 1/8 inch per foot to prevent puddling or ponding of water. The concrete surface shall be finished with a nonslip broom finish immediately after trowel finishing.

For design criteria and location policy, see Section III - "Design Elements for Subdivision Streets."

#### **4.4.2 Standards for Handicap Access**

All sidewalks constructed shall be accessible to the handicapped. At least one accessible walk having no steps or abrupt changes in level, and complying with all criteria specified within this section, shall be provided from a parking space for disabled people. An accessible walk shall also be provided from a public sidewalk and a public transportation stop, if provided, into each accessible primary building entrance. Accessible walks shall also be provided between buildings on a common site.

Accessible walks shall have a minimum clear width of forty-eight (48) inches. The slope of an accessible walk shall not exceed one (1) in twenty (20) or five (5) percent gradient; otherwise the walk is considered to be a ramp. The cross-slope of an accessible walk shall not exceed 1:48. Accessible walks less than sixty (60) inches in width shall have level zones, suitable for wheelchair passage or rest, spaced at no more than two hundred (200) feet apart, and measuring a minimum of 60" x 60"

Wherever accessible walks cross other walks, driveways, or parking lots, they shall blend to a common level, by use of grading, curb cuts or ramps. Level changes greater than 1/4 inches and less than 1/2 inches shall be beveled with a slope no greater than 1:2. Level changes exceeding 1/2 inches shall be treated as a ramp.

Whenever possible, gratings should not be located within or along walks. When gratings must be located in accessible walks, the clear openings shall not exceed 1/2 inches in one direction. If grating openings are elongated, the long dimension shall be perpendicular to the predominant direction of travel.

Doors swinging onto or away from walks shall have level areas. Walk surfaces shall be stable, firm and of sufficient texture to resist slippage.

#### **4.4.3 Curb Ramps**

A curb ramp shall be provided whenever a walk crosses a curb. Curb ramps at street intersections shall be located within and to one side of marked crossings, unless adequate and safe maneuvering space (48 inches minimum clear space), permits positioning of curb ramps at diagonal corner locations. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles or street furnishings.

The maximum slope of curb ramps shall be 1:12, except for existing sidewalks, where a maximum slope of 1:8 may be used if it is impractical to install a more gradual slope.

A flush, smooth transition shall be provided at the juncture of a curb ramp with grade or street level. The minimum width of a curb ramp shall be 36 inches, exclusive of flared sides. If a curb ramp is positioned where pedestrian traffic is likely to walk across the ramp, then it shall have flared sides with a maximum slope of 1:8. Where pedestrians are prevented from walking across the ramp, flared sides may be omitted.

Built-up curb ramps are the least preferred method of curb ramping, and should only be used when no other alternative is available. Built-up curb ramps shall be located so they do not project into vehicular traffic lanes. Built-up curb ramps shall have flared sides.

The surface of curb ramps shall be the same as for walking surfaces.

**FIGURE 4.9  
HANDICAP ACCESS DETAILS**

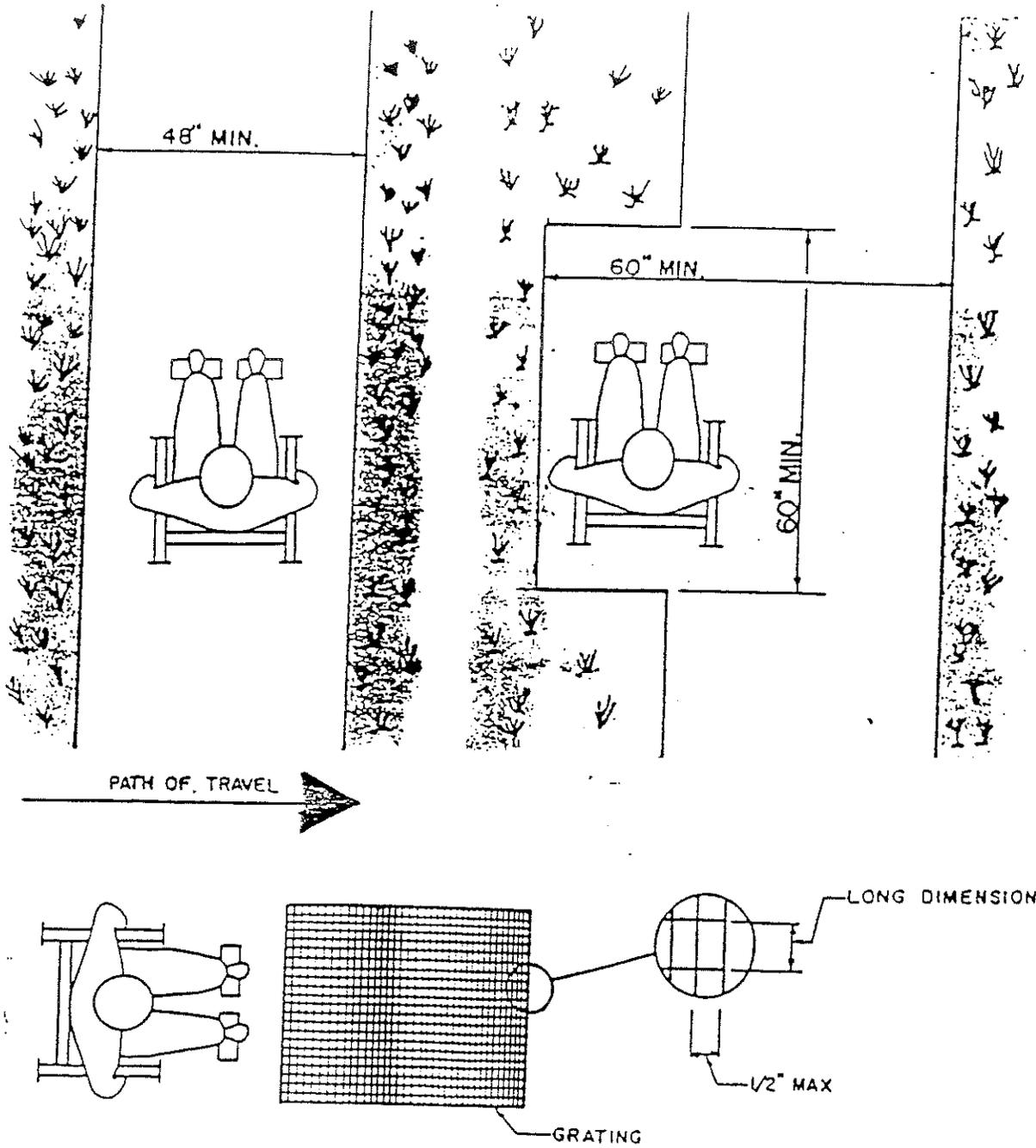
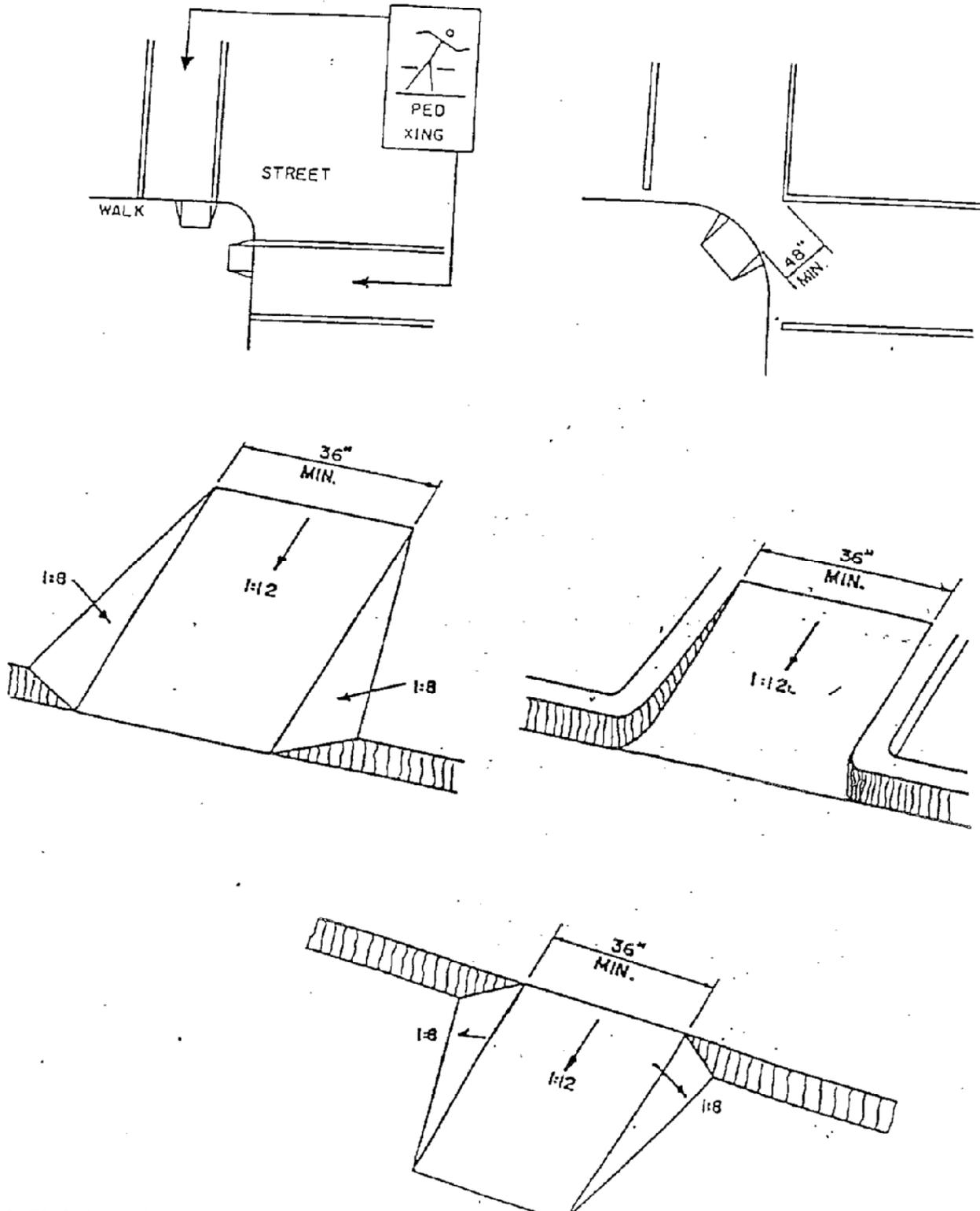


FIGURE 4.10  
HANDICAP RAMP DETAILS



## **4.5 SAFETY REQUIREMENTS**

Obviously, every street should be designed and constructed in the safest possible manner. Every precaution shall be taken both during the construction and operation phases of each street to insure the safety of the public. The safe operation of a roadway depends, to an increasingly important degree, on the proper use of traffic control devices. These devices include:

1. Pavement markings
2. Traffic signs
3. Traffic signals
4. Temporary signs utilized during construction, etc.

Since the motorized traveler should and does depend upon traffic devices as a guide in their driving, it is important that these devices be used uniformly, whether they be new highways, detours or temporary routes. Traffic devices shall be completely installed or constructed before the roadway is open to traffic. Devices which are no longer applicable or those that may create confusion in the mind of vehicle operators shall be removed as soon as possible. Other devices required by road conditions or restrictions shall be removed when those conditions cease to exist or the restrictions are withdrawn.

The application of all types of traffic devices, whether they be of a permanent or temporary nature, shall be governed by the requirements and principles set forth in the Alabama Manual of Uniform Traffic Control Devices (AMUTCD).

### **4.5.1 Pavement Markings**

Pavement, curb, and object markings may utilize a variety of materials. The basic requirements of the materials are that they provide the specified colors both during daylight and night hours and that they maintain the required visibility throughout their lifetime. All pavement marking shall be completed prior to the acceptance of the street by the City.

For night visibility of pavement markings, glass "beads" shall be embedded in the pavement marking material to produce a retrodirective reflecting surface. All pavement markings, except parking space markings, shall be reflectorized.

Plastic markings should be used where heavy traffic rapidly destroys painted markings.

Permanent built-in pavement markings in white or colored concrete or inlaid bricks or blocks shall not be used.

Large "mushroom" buttons or bars of cast iron or concrete several inches high, with or without reflectors, light, symbols or messages, shall not be used. They may be used designate pedestrian islands or to assist in channelizing traffic. In these applications they function as curbs or islands and they should be restricted to each application.

Pavement markings shall be white, yellow or red in color. Through consistent use of markings, the colors should transmit to vehicle operators a consistent meaning. Yellow shall be used to delineate the separation of traffic flows in opposite directions, to mark left edge lines on divided highways, one-way roads and ramps or to mark objects that traffic must pass on the right. The use of yellow markings shall include:

1. Center lines that separate traffic flows in opposite direction
2. Left pavement edge lines on multi-lane divided highways and interchange ramps
3. No-passing zone lines on two-lane and three-lane two-way roadways
4. Pavement width transitions (only between opposing lanes of traffic and the no-passing zone line)
5. Approaches to obstructions (only between opposing lanes of traffic)
6. Approaches to railroad crossings (only the no-passing zone line or center line portion)
7. Curb markings to indicate parking prohibitions covered by signs and/or ordinances
8. Curb markings to outline islands in the line of traffic.

White markings shall be used to delineate the separation of traffic flows in the same direction or to mark objects that can be passed on the left or on both sides. The use of white markings shall include:

1. Lane lines
2. Right pavement edge lines
3. Paved shoulder markings (unless otherwise specified)
4. Pavement width transitions (except transitions between traffic in opposing directions)
5. Channelizing lines
6. Approaches to obstructions (if obstruction is between lanes where travel is in the same direction)
7. Turn markings
8. Stop lines
9. Crosswalk lines

10. Approaches to railroad crossings (except center lines and no-passing zone lines)
11. Parking space limits
12. Word and symbol markings
13. Lane use control markings.

Red delineators may be used to indicate that the vehicle operator is traveling in the wrong direction. The use of red markings shall include:

1. Delineation of roadways that shall not be centered or used by the viewer of those markings.

Stop lines shall be used where it is desirable to indicate the point at which vehicle operators are required to stop in compliance with a stop sign, traffic control signal or other legal requirements. Stop lines shall be placed five (5) feet in advance of, and parallel to, the near crosswalk line. In the absence of a marked crosswalk, the stop line shall be placed at the required or desired stopping point. In no case shall it be placed more than thirty (30) feet or less than five (5) feet from the nearest edge of the intersecting roadway.

If a stop line is used in conjunction with a stop sign, it should ordinarily be placed in line with the stop sign. If the sign cannot be located exactly where vehicles are expected to stop, the stop line should be placed at the correct stopping point. Stop lines shall not be used with yield signs.

#### **4.5.2 Traffic Signs**

Traffic signs shall be used only where necessary and where justified by facts and field studies. Each sign shall conform to the standards set forth in the Alabama Manual on Uniform Traffic Control Devices. Each standard sign shall be displayed only for the specific purpose described in the manual. A conservative use of regulatory and warning signs is strongly recommended. Non-standard signs shall be replaced with standard signs as soon as possible.

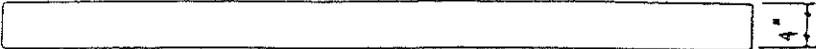
Traffic signs should ordinarily be located on the right side of the road where the vehicle operator is in the habit of looking for them. Under some circumstances, signs may advantageously be placed on channelizing islands and, for sharp curves to the right, signs may be placed on the left shoulder of the road directly in front of approaching vehicles. A supplementary sign located on the left of the road is often helpful on a three- (3-) or four- (4-) lane road, or on a one-way roadway, where traffic in the right lane interferes with the vehicle operator's view to the right. In these cases, the supplementary signs should be definitely more conspicuous than the signs normally placed.

**FIGURE 4.11**  
**PAVEMENT STRIPING STANDARDS**

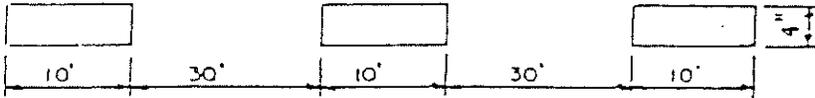
YELLOW - LEFT EDGE ON MULTILANE DIVIDED  
ROADWAYS AND NO-PASSING LINE AND RAMPS



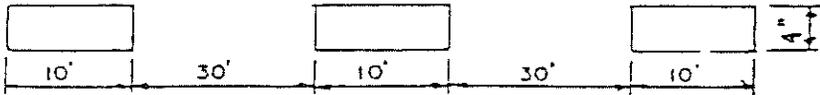
CONTINUOUS WHITE EDGE LINE  
(EXCEPT AS NOTED)



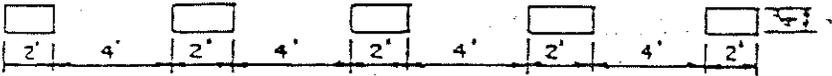
BROKEN YELLOW CENTER LINE



BROKEN WHITE LANE LINE



DOTTED WHITE LINE



CHANNELIZING LINE



CROSSWALK LINE

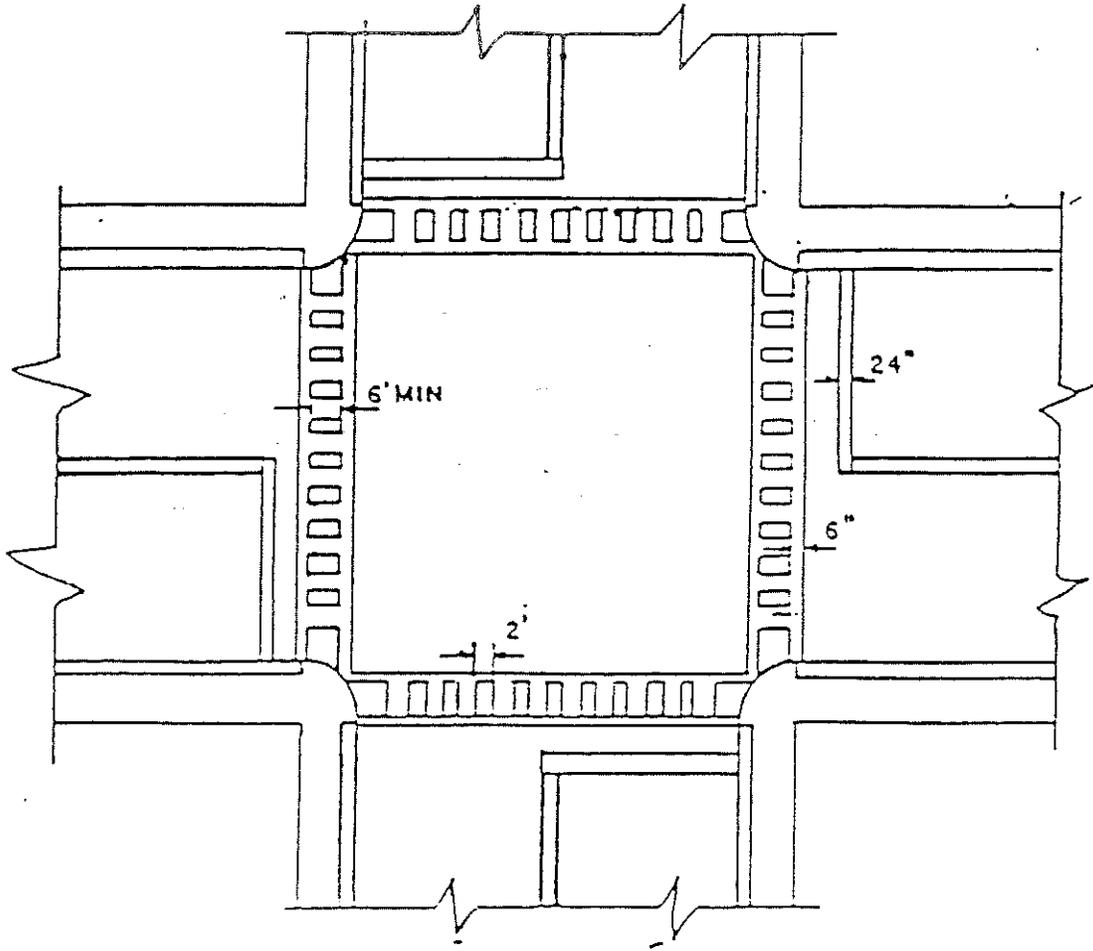


STOP LINE



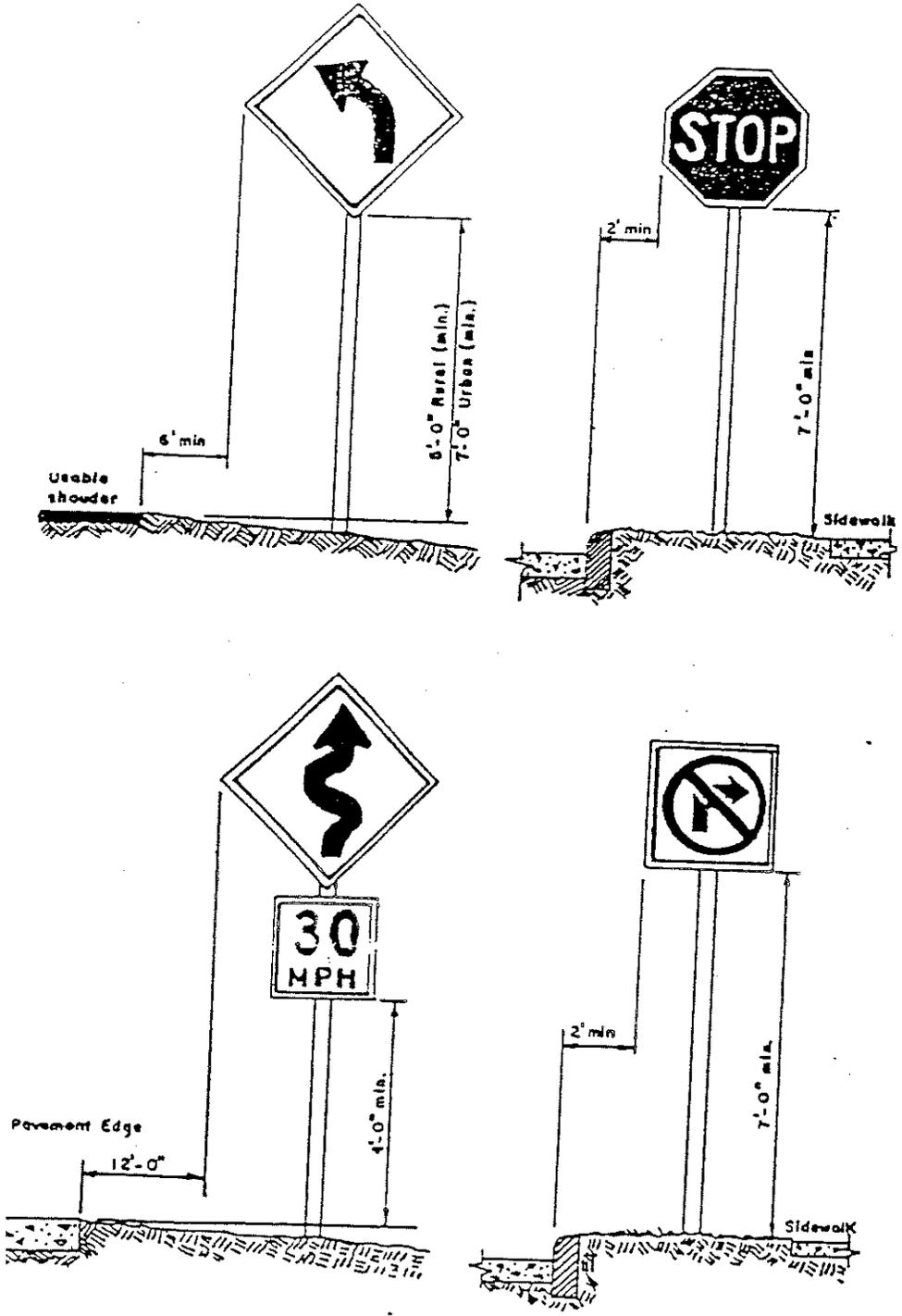
LINE SPECIFICATIONS

**FIGURE 4.12**  
**CROSSWALK & STOP MARKINGS**



CROSSWALK AND STOP MARKINGS

**FIGURE 4.13**  
**TRAFFIC SIGN PLACEMENT**



HEIGHT AND LATERAL CLEARANCE OF SIGNS

Signs should be located to optimize night visibility and in conformance with safety factors related to fixed obstacles near the roadway. Signs shall not be located where they may obscure other signs or where they may be hidden from view by roadside objects. Signs requiring different decisions by vehicle operators shall be spaced sufficiently far apart for the required decisions to be made safely. The spacing shall be determined in units of time as determined by the expected vehicle approach speed.

Stop signs shall not be erected at intersections controlled by traffic control signals.

Normally, signs should be individually erected on separate posts or mountings, except where one sign supplements another, or where route or directional signs must be grouped. Signs erected at the side of the road where rural conditions exist shall be mounted at a height of at least five (5) feet above the level of the near roadway edge of pavement measured to the bottom of the sign. In business and residential areas, and in cases where there are other obstructions to the view, the height shall be at least seven (7) feet.

Signs should have the maximum practical lateral clearance from the edge of the traveled way for the safety of vehicles who might leave the roadway and strike the sign supports. Normally, signs should not be closer than six (6) feet from the edge of the shoulder, or if no shoulder exists, twelve (12) feet from the edge of the traveled way, except where physical conditions prevent such placement. Where a raised curb, a guardrail, or a paved shoulder is present, a sign shall be placed with its nearest edge at least two (2) feet from the vertical face of the curb, guardrail or paved shoulder. (See diagrams included in this section).

Sign posts and their foundations and sign mountings shall be constructed to hold signs in a proper and permanent position, to resist swaying in the wind, and to resist displacement by vandalism.

Special care shall be taken to see that weeds, shrubbery, and construction materials are not allowed to obscure the face of any sign.

#### **4.5.3 Street Name Signs**

Street name signs of the type normally existing within the City shall be installed by the developer and should be installed at an intersection corner not containing a stop sign (unless the intersection is controlled by a 4-Way stop). Street name signs shall be installed prior to the acceptance of the street for public use. These signs may be constructed by the City at the expense of the developer.

#### **4.5.4 Traffic Signals**

Traffic signals shall be installed only after a thorough engineering study of the roadway and traffic conditions, and careful consideration of the warrants described in the Alabama Manual of Uniform Traffic Control Devices. When the engineering study has determined that a street or development requires the installation of a traffic signal for safe traffic operation, then the developer or contractor shall be responsible for all costs associated with the installation of the signal equipment.

To ensure that drivers are provided with a clear unmistakable indication of a right-of-way assignment, the use of more than one signal head on each approach shall be mandatory. The use of more than one signal face for each approach will provide a signal indication in the event of bulb burnout and obstruction of the vehicle operator's view of a particular signal head by some obstacle such as overhanging tree limbs or large trucks.

#### **4.5.5 Temporary Safety Requirements**

All temporary traffic control devices shall be governed by the following basic principles described in the Alabama Manual of Uniform Traffic Control Devices:

1. Traffic safety in work areas shall be an integral part and high-priority element of every project from planning through design and construction. Similarly, maintenance work shall be planned and conducted with the safety of vehicle operators, pedestrians and workers kept in mind at all times.
2. Traffic movement shall be inhibited as little as practicable.
3. Traffic movement shall be guided in a clear and positive manner while approaching and traversing work areas.
4. To insure acceptable levels of operation, routine inspection of traffic control elements shall be performed.
5. The maintenance of roadside safety requires constant attention during the life of a construction work area due to the potential increase of hazard.

The closing of portions of any street shall be coordinated with the Engineering, Public Works, and Public Safety Departments so as to interfere with traffic as little as possible. Suitable barricades and signs to direct traffic shall be provided and appropriately placed and maintained as long as necessary. Such barricades and signs shall be promptly removed when no longer needed. The City Fire Department and Police Department shall be notified in advance of the closing and of the re-opening of any street.

Specific criteria described in the manual (AMUTCD) for the temporary closing of streets shall be strictly adhered to.

#### **4.6 STREET DRAINAGE**

All gutters, drains, culverts, sewers and inlets shall be kept clean and open at all times for surface drainage. No damming or ponding of water in gutters or other waterways will be permitted, except to a very limited extent where the City Engineer shall consider the same necessary. Flow of water across or over public streets, except through approved pipe or properly constructed troughs, shall not be allowed. Inlets shall be located at the upgrade side of all public road intersections.

The ultimate pipe drainage system should begin where the quantity of water in the street gutter approximately equals the capacity of a curb opening inlet. Thereafter, inlets shall be placed where projected flow exceeds gutter capacity. The City of Opelika requires the use of an "S" type inlet as shown on the following pages. Both single-wing and double-wing inlets shall be used to meet the required drainage needs.

All pipe shall be laid on straight lines and grades. The grade of the main pipe shall be carried through the invert of structures unless a greater drop is required by hydraulic conditions. A minimum drop of 0.1 feet shall be provided through the invert of any structure. (Also See Section VII - "STORM DRAINAGE SYSTEM").

#### **4.7 ON-STREET PARKING**

In addition to the minimum required pavement widths, an additional eight (8) feet of pavement shall be constructed for each side of the street in which the City of Opelika permits or requires on-street parking. However, this policy may not be applied to residential streets where driveways are typically utilized. See Section 3.2.2 for minimum pavement widths on residential streets.

Parking is prohibited for a minimum distance of thirty (30) feet from any signalized intersection and twenty (20) feet from any other intersection and must also comply with sight triangle restrictions noted earlier. Distances from intersections shall be measured from the convergence point of the roadway edges.

The City of Opelika encourages the use of well designed off-street parking in lieu of on-street parking whenever feasible.

#### **4.8 STREET NAMES**

Proposed streets obviously in alignment with existing and named streets shall bear the names of existing streets. New street names shall not duplicate or be similar to existing street names. Naming shall be consistent with the directional line of the street as follows:

Through streets lying east and west	Avenues
Through streets lying north and south	Street
Through streets lying other than what can be determined north, south, east, or west	Roads
Cul-de sacs running east and west	Courts
Cul-de-sacs running north and south	Places
Cul-de-sacs winding	Lanes
Multi-directional (continuous)	Drives and Parkways
Semi-circles and wind loops	Circles

The Planning Commission, based upon recommendations from the Police and Fire Departments, shall approve all street names or changes to names.

#### **4.9 STREET LIGHTING**

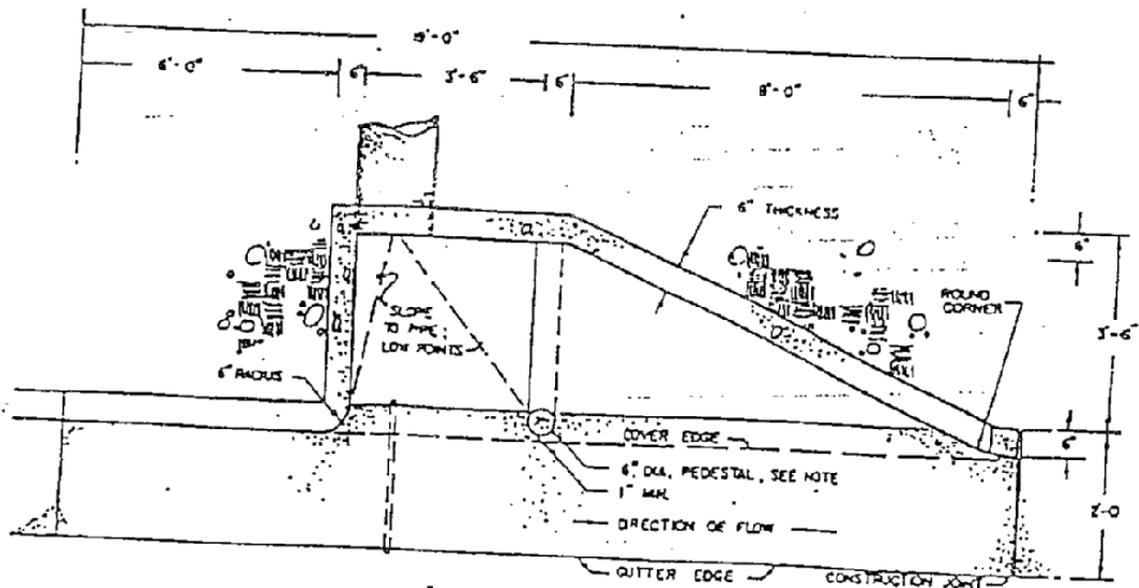
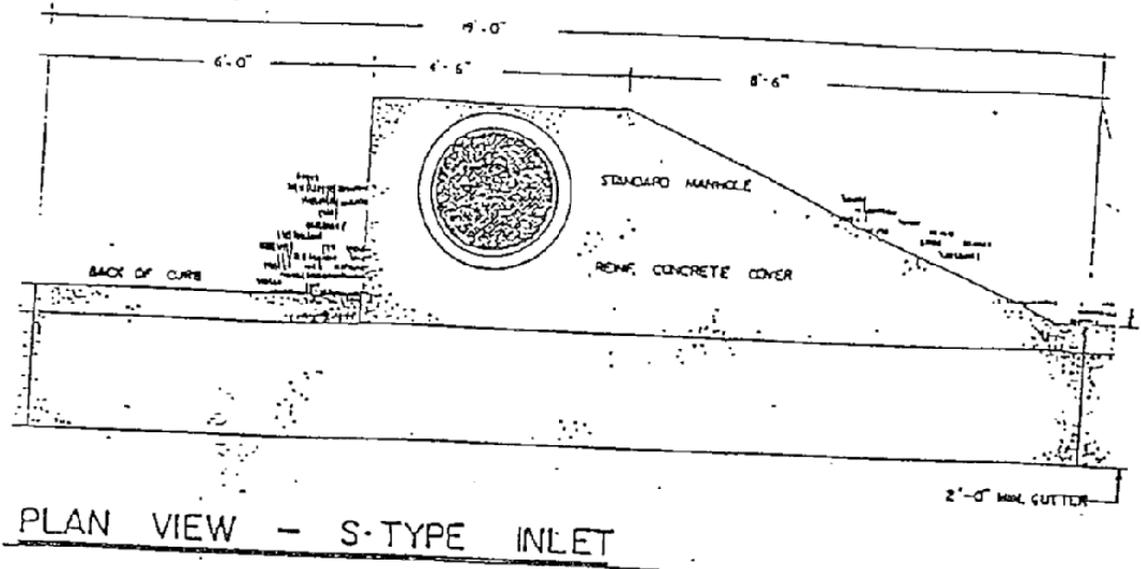
Street lighting should be installed at every intersection. In medium and high density areas, mid-block street lighting also is highly desirable.

Street lighting design and standards shall be in accordance with the latest recommendations of the Illuminating Engineering Society, as well as the Opelika Light and Power Department. Additional information on Street Lighting can be found under Sections 3.2.15 and 3.3.11.

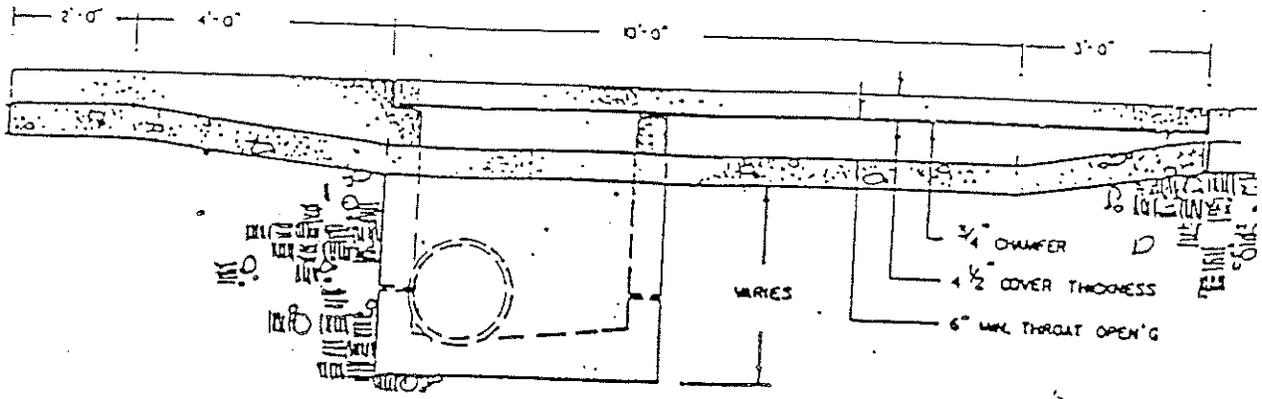
#### **4.10 THOROUGHFARE PLAN**

All proposed streets, roads, and developments must conform with the City of Opelika Thoroughfare Plan, which is a part of the Opelika Comprehensive Plan. This plan should be consulted prior to any development. Copies of the Opelika Comprehensive Plan may be examined or obtained at the office of the Opelika City Planner.

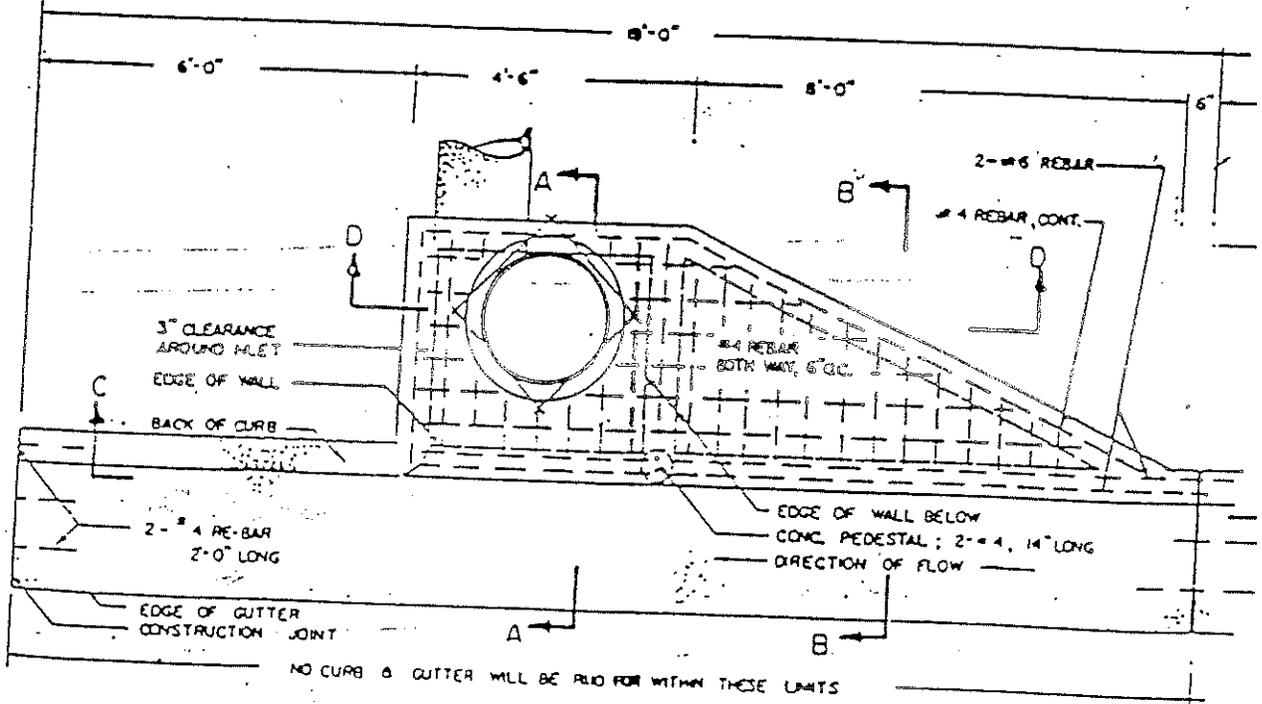
FIGURE 4.14  
S-TYPE INLET - PLAN VIEW



**FIGURE 4.15**  
**S-TYPE INLET - RE-BAR PLAN**

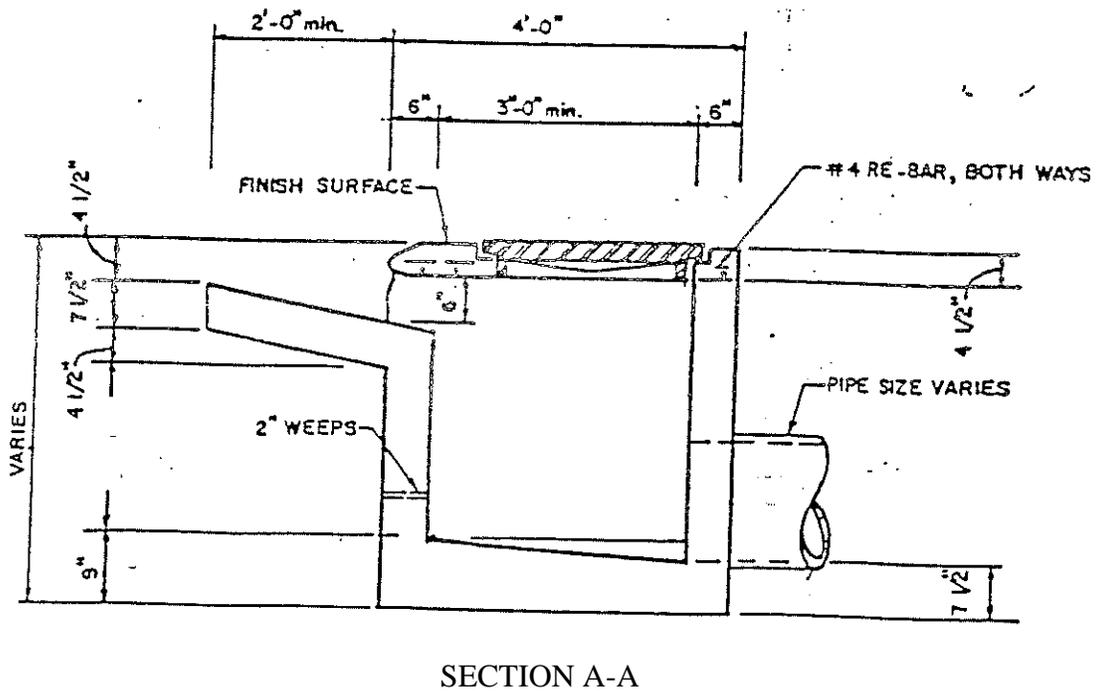
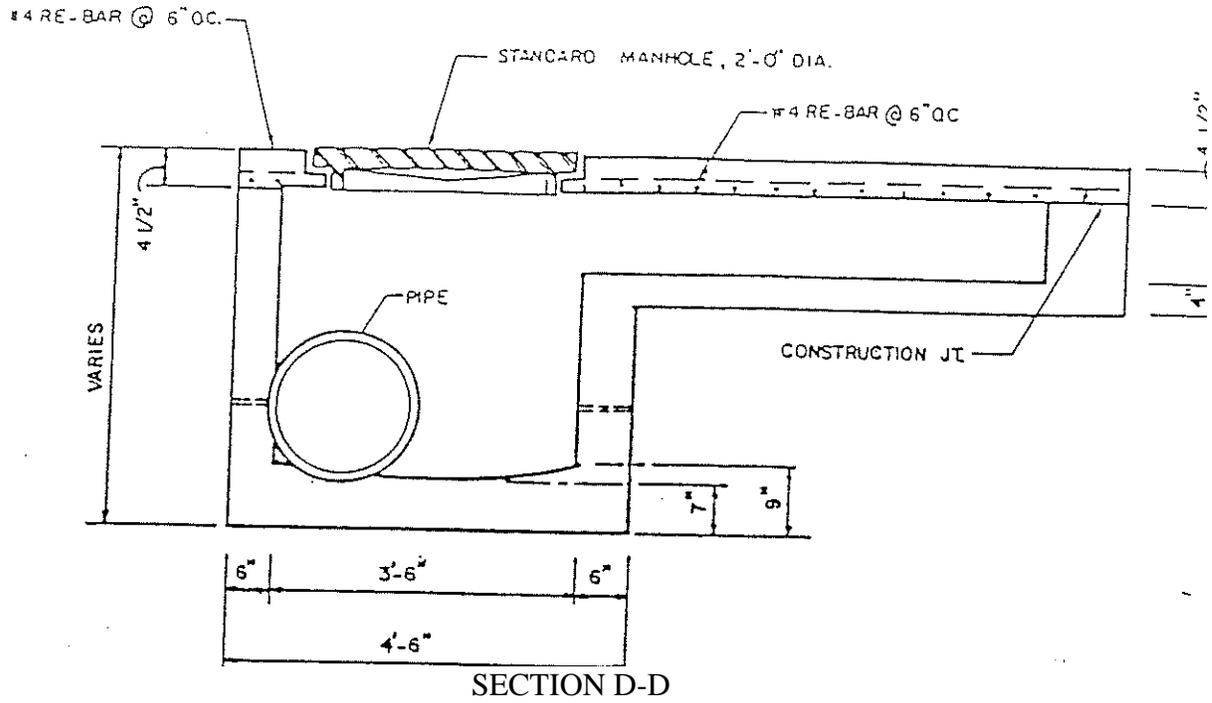


**SECTION C-C**

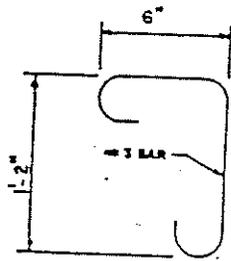
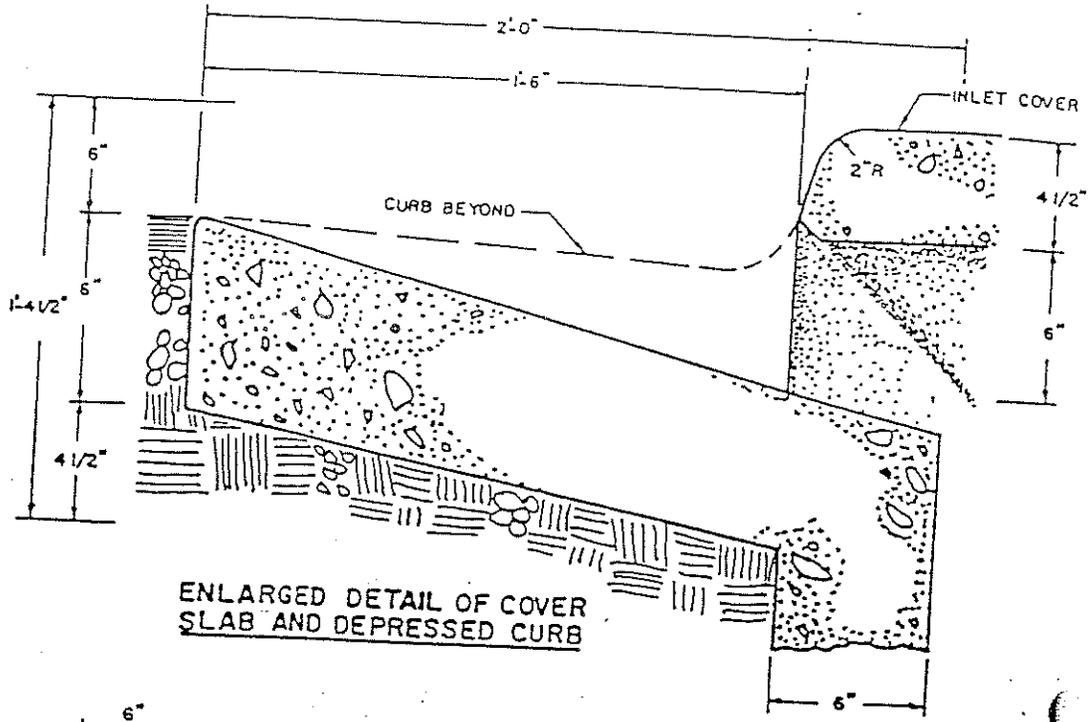


**RE-BAR PLAN**

**FIGURE 4.16**  
**S-TYPE INLET - SECTIONS**



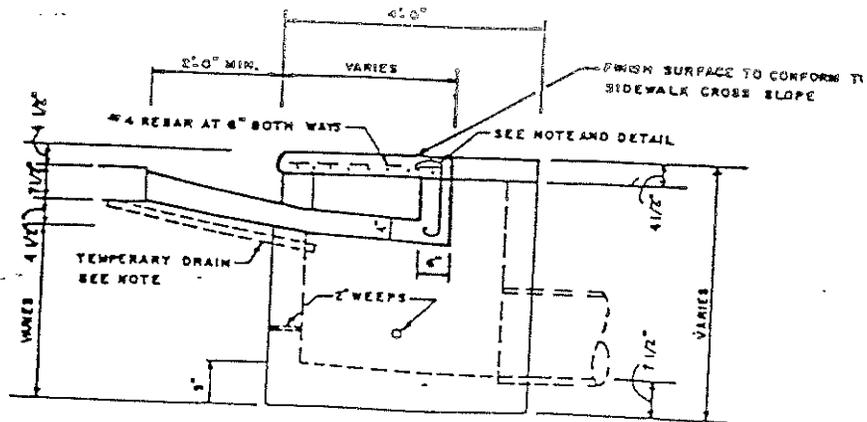
**FIGURE 4.17**  
**S-TYPE INLET - DEPRESSED CURB**



DETAIL

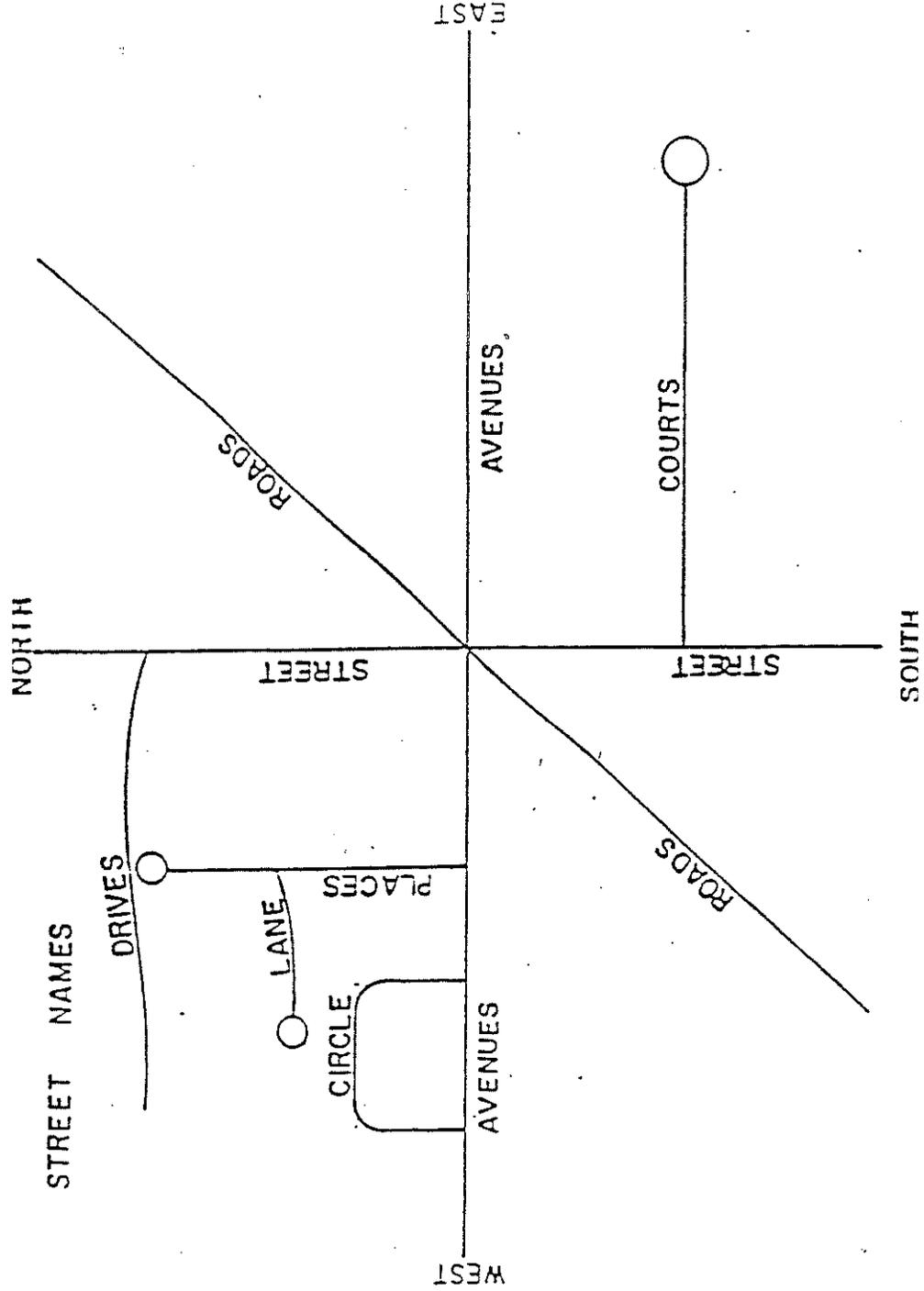
**NOTE:**

THE CONTRACTOR MAY POUR THE INLET COVER AFTER WALLS AND CENTRAL PEDESTAL ARE IN PLACE, IF CONTRACTOR POURS INLET TOP ON LAST, HE WILL BE REQUIRED TO PLACE EXTRA #3 BARS AT 12" O.C. AROUND INLET DUE TO CONSTRUCTION JOINT BETWEEN WALLS AND COVER. SEE DETAIL.



SECTION B-B

**FIGURE 4.18  
STREET NAMES**



## SECTION V

### SANITARY SEWER SYSTEM

Where a public sanitary sewer system is within three hundred (300) feet and reasonably accessible to a subdivision or development, the developer shall install a sanitary sewer system which meets the requirements of the City and shall connect such system at his expense to the public sanitary sewer. Stub-outs shall be provided for each subdivision lot and shall extend from the sewer line to the property line.

#### 5.1 DESIGN CRITERIA

Sanitary sewers shall be sized to insure that estimates of quantities of wastewater flows based upon present and future populations, along with projected infiltration and inflow, do not exceed pipe capacity. However, in no case will pipe less than eight (8) inches in diameter be allowed for collector or interceptor lines. Special consideration shall be given to pipe diameter if commercial and industrial customers are anticipated to contribute to the system.

Sanitary sewer velocities shall be sufficient to prevent deposition, yet not cause erosive damages to the pipe. In order to accomplish this, the sewer shall be sloped to achieve a minimum velocity of two (2) feet per second when the conduit is flowing half-full. The slope should also be designed so that the velocity will not exceed ten (10) feet per second.

#### **Recommended Slop to Achieve Minimum Velocity of 2.0 ft/sec, N=0.013**

<u>Pipe Size (Inches)</u>	<u>Slope (Ft/100 Ft.)</u>
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

Infiltration into the sewer shall not exceed two hundred (200) gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours in any section between successive manholes. The amount of leakage shall be measured by a weir or other suitable device. This measurement shall be made between 12:00 AM and 6:00 AM, unless line segments are plugged to prevent a normal sewage flow.

If the infiltration exceeds the above specified amount, necessary corrections shall be made to bring it within the acceptable limits. All visible leaks or points of infiltration shall be repaired, even if the infiltration is below the specified maximum.

Manholes are used to facilitate the maintenance and operation of sewerage systems. They shall be located at the end of each line; at each change in grade, direction, size of sewer or alignment; at each street intersection; and at a distance not to exceed four hundred (400) feet.

## **5.2 CONSTRUCTION MATERIALS**

### **5.2.1 Vitrified Clay Pipe**

Vitrified clay sewer pipe shall be used, unless the approved plans indicate other materials are to be used. The pipe shall conform to the following specifications:

- a. Extra Strength - ASTM C-700-77 (Designated in proposal as ESVC sewer pipe.)
- b. Wyes and tees shall be made of the same strength as the line in which they are installed.

In addition to the requirements of the ASTM Specifications, the annular space between spigots and sockets shall be not less than 3/8 inch.

### **5.2.2 Ductile Iron Pipe**

Ductile iron pipe and fittings can be used as hereinafter specified for gravity sewers. The minimum wall thickness shall be as specified in ASTM A746 for thickness Class 52. Extra thickness shall be provided where required by deep cover in accordance with ASTM A-746, Table 12, for Type 2 laying conditions.

Ductile iron pipe for gravity sewers shall be mechanical joint or push-on joint, unless specified otherwise, conforming to ANSI/AWWA C-151/A21.51. Ductile iron pipe and fittings shall have a cement-mortar lining conforming to ANSI/AWWA C-104/A21.4. A standard bituminous coating shall be applied to the exterior of all ductile iron pipe and fittings.

Ductile iron lock joint pipe shall meet the requirements of ANSI/AWWA C-151/A21.51 for ductile iron pipe and may be of the bolted or boltless type suitable for 150 psi working pressure. If bolted type pipe is used, all bolts shall be Corten Steel.

Ductile iron fittings shall be designed for a pressure rating of 250 psi and shall be in accordance with ANSI/AWWA C-110/A21.10. Fittings shall be mechanical joint.

Cutting of ductile iron pipe shall be by saw, cutter, abrasive wheel or other approved means. In no case shall ductile iron pipe be cut by burning.

Marking of ductile iron pipe shall include the pressure rating, metal thickness, net weight of pipe without lining, length of pipe, name of manufacturer and letters "DI", which shall be clearly marked on each length of pipe.

Transitions from ductile iron pipe to vitrified clay pipe shall be made using approved adapters specifically designed for this purpose. Joining of dissimilar pipes with concrete collars will not be permitted except at such places where specifically approved.

Polyethylene sheath shall be on ductile iron pipe where indicated on the Plans and where directed in the field. The exterior of ductile iron pipe shall be covered with a sealed polyethylene sheath in accordance with AWWA Specification C105. Polyethylene sheath shall be "Polytube" as manufactured by Polytube Corporation, or an approved equal. Backfill shall be as specified elsewhere in these Specifications. Care shall be taken not to damage the polyethylene sheath during the backfill operation. Any polyethylene sheath which is damaged shall be replaced or repaired by the Contractor at no additional expense to the Owner.

### **5.2.3 Cast Iron Pipe**

Cast iron pipe shall be mechanical joint, conforming to Federal Specifications WW-P-421c. Fittings shall be "Class 150", or its equivalent, for the mechanical joint pipe, or slip-on joints, if approved by the Engineer. The interior and exterior of all cast iron pipe and fittings shall be coated with coal tar pitch.

In general, this cast iron pipe will be used at wet area crossings and at other points specifically designated on the plans, including force mains.

### **5.2.4 Polyvinylchloride (PVC) Pipe**

Plastic gravity sewer pipe and fittings shall be unplasticized polyvinylchloride (PVC), meeting or exceeding ASTM D-3034, classification SDR 35, for smooth-wall pipe, or ASTM F-794 for ribbed sewer pipe. Ribbed sewer pipe shall be homogeneous and have a smooth interior with a solid cross-sectional rib exterior. Exterior ribs shall be open profile and perpendicular to the axis of the pipe to allow placement of the sealing gasket.

Pipe lengths shall not exceed twenty (20) feet and provisions shall be made at each joint to accommodate expansion and contraction.

All pipe and fittings shall be joined by means of an integral wall bell and spigot and sealed with a rubber gasket. This joint shall be capable of withstanding an internal hydrostatic pressure of twenty-five (25) psi for one (1) hour with no leakage.

### **5.2.5 Jointing Materials for Vitrified Clay Pipe**

Jointing materials for vitrified clay pipe shall be as specified below or an approved equal. All materials shall be placed and used in accordance with the manufacturer's recommendations.

Sewer joints shall be Dickey PEP Coupling as manufactured by the W. S. Dickey Clay Manufacturing Company, or an approved equal.

### **5.2.6 Gravel, Slag, or Reef Shell**

Reef shall be washed dead oyster shells and shall not contain any live shells. A screen washer shall be used for washing shell, the mesh of which shall not be smaller than 1/4 inch. The foreign matter content, as determined by washing, shall not exceed ten (10) percent by weight when dry. Gravel or slag shall be screen washed and shall be 100 percent retained by a 1/4 inch screen. Foreign matter shall not exceed three (3) percent by weight when dry.

### **5.2.7 Running Boards and Saddle Piles**

Running boards and saddle piles shall be two- (2-) inch piles cypress or treated Southern pine.

### 5.2.8 Pipe Encasement

Pipe encasement shall be used where shown on the approved drawings and as directed. The encasement used shall be bituminous-coated welded steel pipe of wall thickness and size shown on the drawings, or an approved equal. Pipe shall conform to ASTM A-252, Grade 2. Encasement shall conform to AASHTO Standards and Alabama Highway Department Standards where placed under highways and to AREA 1-A-13 where placed under railroads.

## 5.3 CONSTRUCTION METHODS

### 5.3.1 Clearing and Grubbing

Clearing and grubbing shall be confined to the limits of the easement and to the minimum width required for installation of the pipe. All trees, stumps, roots and debris shall be disposed in an approved manner.

### 5.3.2 Earthwork and Grading

All grading work must conform to the grades as shown on the approved plans. Any variation from the grade will be deemed sufficient reason to cause the work to be rejected and rebuilt.

### 5.3.3 Excavation

Perform all excavation of every description and of whatever substance encountered to the depth specified on the approved plans and as staked in the field. The Contractor shall be responsible for compliance with all proper trenching safety and construction methods. All excavated material not required for filling shall be removed from the site and deposited in a manner and location as directed by the Engineer. The sides of the trench shall be as nearly vertical as possible. Sloped sides may be used only in open country and then only as approved by the Engineer. If sloped sides are approved by the Engineer, the trench sides shall be vertical from the invert of the trench to a minimum of one (1) foot above the top of the pipe.

The width of trench shall be kept to the minimum consistent with proper placement and backfilling of the pipe, measured to trench walls and to the far side of sheeting, and shall not exceed the sum of the distance of the outside diameter of pipe plus sixteen (16) inches. Based on this maximum trench width, the maximum depths at which the various sizes of standards strength vitrified clay pipe may be laid are as follows:

<u>Pipe Size (Inches)</u>	<u>Depth of Cut (Feet)</u>
8	10
10	10
12	10
15	10
18	12
21	12
24	12
30	12
36	14
48	14

If actual trench widths at these depths exceed the specified maximum, then extra strength pipe shall be substituted for standard vitrified clay pipe.

The bottom of the trench shall be carefully graded, formed and aligned before any sewers are laid therein.

Where the natural soil at the bottom of the trench makes 'a satisfactory foundation' for the sewer, it shall be shaped to the bottom quadrant of the pipe and slightly hollowed under each bell to allow the body of the pipe to have a uniform contact and support throughout its entire length.

Where the bottom of the trench does not, in the opinion of the Engineer, make a suitable foundation for the sewer, the trench shall be deepening and backfilling with gravel, slag, or reef shell and shaped, or the pipe shall be placed on running boards.

A berm at least two (2) feet in width shall be placed between the trench and the excavated material.

No more than three hundred (300) feet of trench shall be opened at any one time in advance of the completed sewer, nor left unfilled for more than two hundred (200) feet in the rear thereof, except by written permission of the Engineer.

Excavation for manholes or other structures shall be of sufficient size to leave at least one (1) foot in the clear between their outer surfaces and the embankment, or timber which may protect it.

Overcut in depths of manholes and sewer trenches shall be backfilled with gravel.

#### **5.3.4 Shoring and Sheeting**

When the material through which the trench is excavated, in the opinion of the Engineer or City Safety Officer, tends to fall in, run, or cave, the sides of the trench shall be braced either with open sheeting or closed sheeting to render the sides secure. Every precaution shall be exercised in removing the sheeting in order to avoid damaging the pipe. Should there be evidence that the removal of sheeting would damage the pipe, the sheeting shall be left in place. The top of the sheeting left in place shall be at least twelve (12) inches below natural ground.

#### **5.3.5 Laying Sewer Pipe**

The pipes and specials shall be so laid in the trench that after the sewer is completed, the interior surface of the bottom thereof shall conform accurately to grade and alignment. Sewers shall be laid in the direction opposite to the direction of flow with spigot ends of pipe pointing down grade.

While the pipes and specials are being laid between adjoining manholes in each straight or working section of the sewer, a round circle of light from the finished or other end of the section shall remain constantly in plain view throughout the entire length of such section and shall show the true character and shape of the interior surface of the sewer. The same test shall be applied for each working section after the sewer is completed in all respects and before it is accepted.

Before setting in place, each pipe must be thoroughly cleaned and freed of all dirt. All surplus jointing material and earth which may bind entrance into the pipe in making the joint shall be removed by a suitable scraper. In pipes of twelve (12) inches or smaller in diameter, scraping shall be followed by a firm and stiff swab, firing the entire bore of the pipe and drawn forward as the work progresses.

The swab shall be removed at short intervals to be properly cleaned and to permit the removal of any foreign matter that may have accumulated. When pipe laying is completed, the swab shall be removed. Suitable firing for swab shall always be kept on the work.

When the size of the pipe permits, the inside of the joint shall be pointed with a suitable trowel.

The smoothness of the interior joint shall be determined by some suitable device, and no pipe shall be finally set until the inverts coincide. Maximum size spigots permitted by ASTM Specifications shall not be joined with the minimum size sockets permitted.

Wyes and tees will be inserted or proper opening provided in the sewer lines wherever the Engineer may direct. All branches thus inserted, unless connected with a service lateral, shall be closed by means of vitrified stoneware covers or plugs or PVC plugs provided by the pipe manufacturer.

After a cover or plug has been placed in any way or tee, it shall be completely sealed with jointing compound so as to be watertight. All pipe for laterals shall be marked with metalized tape buried between eighteen (18) and twenty-four (24) inches under the surface. The pipe trench shall be backfilled to approximately twenty-four (24) inches below the ground surface and then the metalized tape shall be placed flat and directly over the pipe.

In sewers over eight (8) feet in depth, or whenever the Engineer may direct, stacks of an approved material shall be extended from the tee or wye connections at an angle of forty-five (45) degrees from vertical, and the end shall terminate a minimum of four (4) feet below the ground surface. Where laterals are specified on the plans, or as required by the Engineer, they shall be laid to the existing property line, or as the Engineer may direct. The ends of the stacks or laterals shall be closed with covers as specified for wye branches. A metal strip shall be placed as for wyes and tees.

Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud or other obstructing matter, and shall be secured in such a manner as to prevent the end pipe from being dislodged by sliding or other movement of the backfiring.

Any groundwater or accumulate found in the trenches shall be pumped, bailing or otherwise removed. The Contractor shall perform all work necessary to keep the pipe clear of water while laying foundations, constructing masonry, or laying pipe.

Where pipe is laid under railroad tracks which are in service and cannot be removed for this reason, the construction shall be handled in a manner completely satisfactory to the proper

authoritative railroad officials. Methods agreed upon with such officials shall also meet the approval of the Engineer prior to performance of such work. Pipe laid under the railroad tracks shall meet the same requirements in construction as to line and grade, character of joints, and other characteristics as the remainder of the system.

Wherever service laterals are intercepted by the excavation for the new sewer, connection shall be maintained temporarily to the old sewer until the particular section of the new sewer is completed and tested to the satisfaction of the Engineer. The service lateral shall then be broken and re-connected to the new sewer through a wye, tee or opening which would have been placed in the sewer for that purpose.

The dead end of the service lateral shall be capped with a vitrified stoneware plug and Portland Cement mortar as close as is practical to the side of the excavation from which it emerges. If considered necessary by the Engineer, a special concrete support will be designated by the Engineer.

After each joint is laid, it shall be partly backfilled and made secure before the joint is poured or made.

Workmen shall not walk or stand upon the newly laid pipe until the necessary backfill has been placed and tamped to prevent the displacement of the pipe.

Rubber boots shall be installed at the pipe/manhole connection as well as where two different types of pipe are connected.

### **5.3.6 Backfilling**

Before backfilling any trench, the Engineer shall be notified.

No trenches or excavations shall be backfilled until concrete in the structures placed therein has acquired a suitable degree of hardness, and the work shall be prosecuted expeditiously after it has been commenced.

After the pipe has been installed, selected material from excavation shall be placed alongside the pipe in layers not exceeding four (4) inches in depth. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted by hand tamping with iron tampers, the tamping face area of which shall not exceed fifty (50) square inches. This method of filling and compacting shall be continued until the fill has reached a depth of at least two (2) feet above the top of the pipe. All material shall be deposited carefully in the trench to avoid damaging the sewer. The operation of heavy equipment shall be conducted so that no damage to the sewer will result.

The remainder of the trench above an elevation of two (2) feet higher than the top of pipe shall be backfilled uniformly in layers not exceeding six (6) inches in thickness. Mechanical backfilling shall be permitted only if material being placed with dragline or crane has a free fall of one (1) foot or less from the bucket. Each six- (6-) inch layer shall be completed by mechanical tamping, except as hereinafter permitted.

The Contractor shall not connect any newly-installed lines to existing lines or manholes until all sediment and water in the new lines has been removed.

#### **5.4 MANHOLE CONSTRUCTION SPECIFICATIONS**

Every manhole is to be fully and completely built as the work progresses, and as each is reached, and shall be carried up to the grade as given by the Engineer. Manholes shall be neatly and accurately built, according to the approved plans, of proper materials and in a workmanlike manner. Standard construction diagrams are included in this section. The walls shall be precast concrete or brick. Brick manholes shall be plastered to a one-half (1/2) inch thickness on the inside and outside.

Brick shall be hard-burned common brick meeting ASTM Specifications C-32-58, Grade NA, or concrete brick meeting ASTM Specifications C-55-55, Grade A. The minimum compressive required for concrete used in the construction of manholes shall be 3,000 pounds per square inch at twenty-eight (28) days. Field specimens for laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed six (6) U.S. Gallons per sack of cement.

Manhole bottoms shall be either cast-in-place concrete or integral with the lower section of riser walls as hereinafter specified.

Poured-in-place bottoms shall be a minimum of eight (8) inches thick and shall be not less than twelve (12) inches in diameter larger than the outside diameter of the riser section. The invert of the manhole shall be built up with cement grout as shown for brick manholes.

The invert and bottom curves of all manholes shall be neatly and accurately built, and so formed as to facilitate the entrance and flow of sewage over them.

Joints in riser and cone sections shall have rubber gaskets or an approved equal.

When required, single lengths of pipe of required size shall be built into manholes to receive either present or future branch lines. To relieve pressure, the brick is to be arched over all such pipe. Where there is no intent to construct the branch lines at once, the pipe thus inserted must be securely closed in such a manner that future connections can be made without breaking the pipe.

Where manholes intercept existing laterals connected to existing manholes, the lateral service to the existing manhole shall be kept intact until the next adjacent section of new sewer is completed and approved. The laterals shall then be broken and fed to the new sewer and the dead end of the laterals plugged at the manhole wall with a stoneware stopper and mortar.

Drop manholes shall be avoided; however, where sewers must enter manholes at points more than twenty-four (24) inches above the invert of the manhole. drop connections shall be installed. Drop connections shall be neatly and accurately constructed of proper materials and in a workmanlike manner, in strict accordance with the details shown on the plans.

All castings shall be made of clean, even grain, tough gray cast iron. The quality of iron in the castings shall conform to the current ASTM Specification A-48 for Class 30 Gray Iron Castings. Frames and covers shall weigh not less than 420 pounds and be M-530 type or equivalent. The castings shall be smooth, true to pattern and free from projections, sand holes, or defects. A raised letter "S" shall be cast on the upper surface of all manhole covers. The portion of the frame and cover which forms the cover seat shall be machined so that no rocking of the cover is possible. The castings shall be coated with coal tar pitch varnish. On paving streets, the frame and cover shall be set flush with and in the plane of the paved surface. In other locations, they shall be set to the grades determined by the Engineer.

## **5.5 PUMP STATIONS**

The City of Opelika typically encourages the construction of above-ground pump stations. However, below-ground pump stations have been allowed in special instances. All pump stations shall be constructed to the City of Opelika Engineering Department Standard Specifications and approved by the Engineer prior to construction.

## **5.6 FORCE MAINS**

Force mains shall be of ductile iron pipe and shall be constructed to the alignment and depth required and only so far in advance of pipe laying as the Engineer shall permit. Force mains shall have at least thirty (30) inches cover. Trenches shall be braced and drained so that workmen may work safely therein. The widths of the trench shall be at least one (1) foot greater than the normal diameter of the pipe and the maximum clear width of the trench shall be not more than two (2) feet greater than the pipe diameter. The trench shall have a flat bottom with bell holes of ample dimensions to allow jointing and so that the barrel of the pipe will have a bearing for its full width.

All pipe, fittings, etc., shall be lowered into the trench by means of derrick, ropes or other suitable tools, and under no circumstances shall pipe be dropped into the trench. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective pipe shall be rejected. Joints shall be installed in strict accordance with the recommendations of the pipe manufacturer.

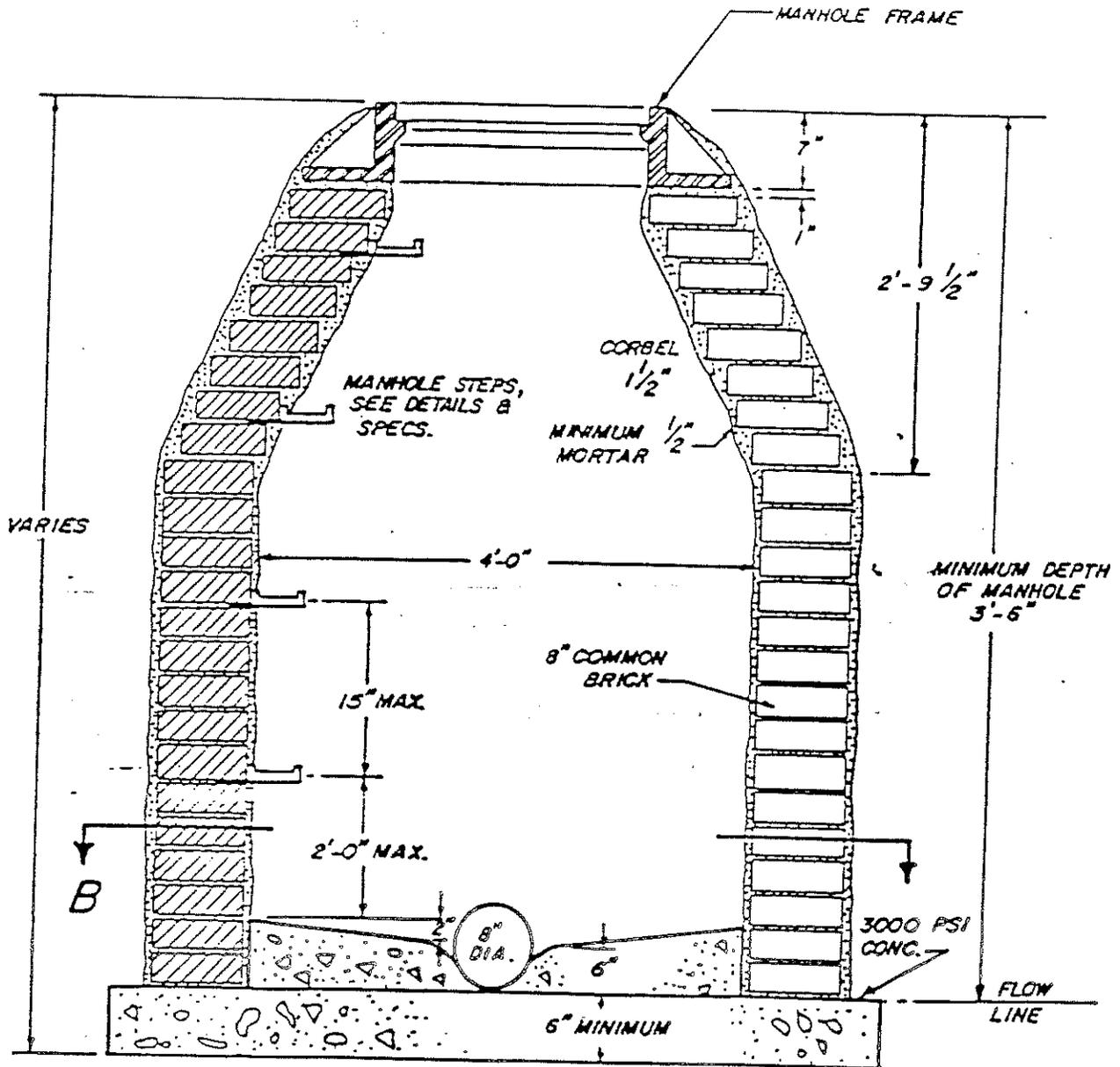
Concrete thrust blocks shall be installed at all bends. The concrete shall be a mix not leaner than one (1) part cement, two (2) parts sand, and four (4) parts stone, and shall have a minimum compressive strength of 2,000 psi. The blocking shall be poured against undisturbed earth.

After the pipe has been laid and partially backfilled to a height which leaves the joints visible where possible, all pipe or any valved section shall, unless otherwise specified, be subjected to a hydrostatic pressure of 150 psi. The pressure test shall be for at least two (2) hours or until the line has been completely inspected for visible leaks, whichever is longer. Before testing, all air shall be expelled from the line. All necessary taps to expel the air shall be made and then all taps shall be plugged watertight.

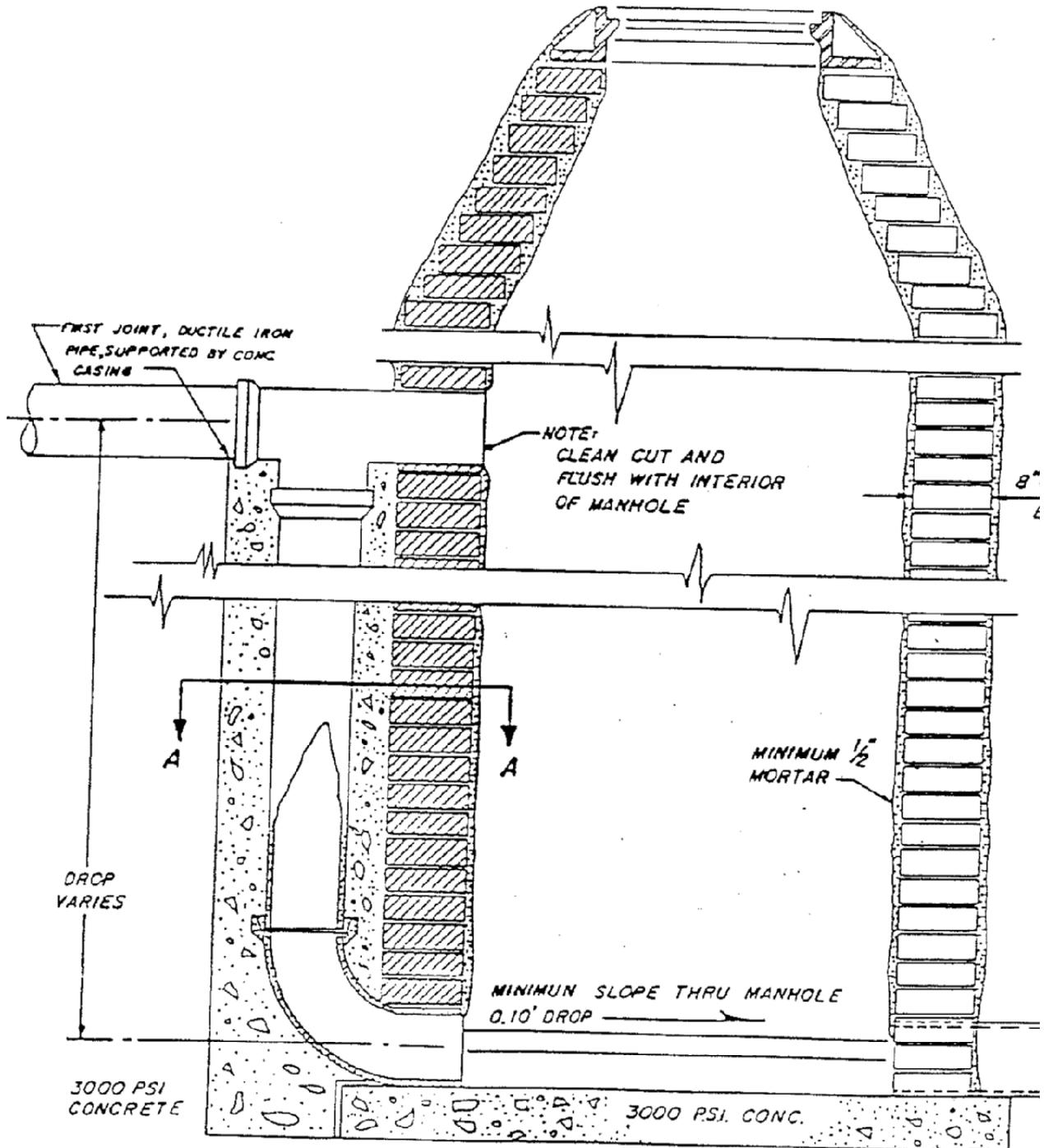
Approved and suitable means shall be provided for determining the quantity for water lost by leakage. No pipe installation will be accepted until or unless the leakage (evaluated on a pressure basis of 150 psi) is less than twenty-five (25) U. S. Gallons per twenty-four (24) hours per mile of pipe per inch nominal diameter of pipe. Any observed leaks shall be repaired, whether within or outside the prescribed limits.

**FIGURE 5.1  
TYPICAL MANHOLE**

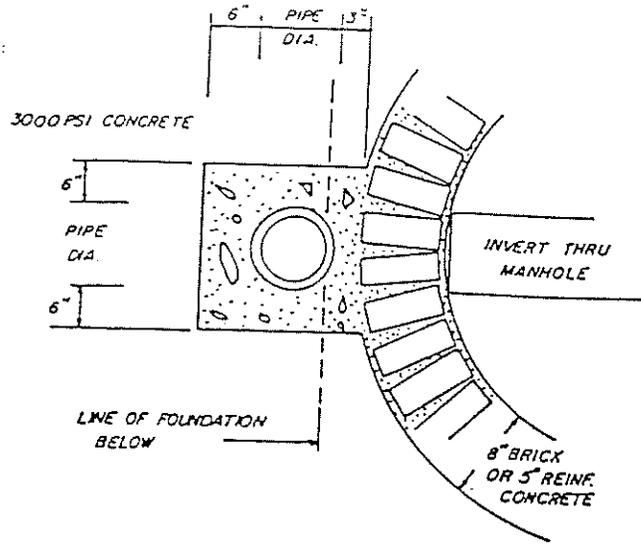
NOTE: WALL THICKNESS  
8" TO 12" DEPTH  
12" OVER 12" DEPTH



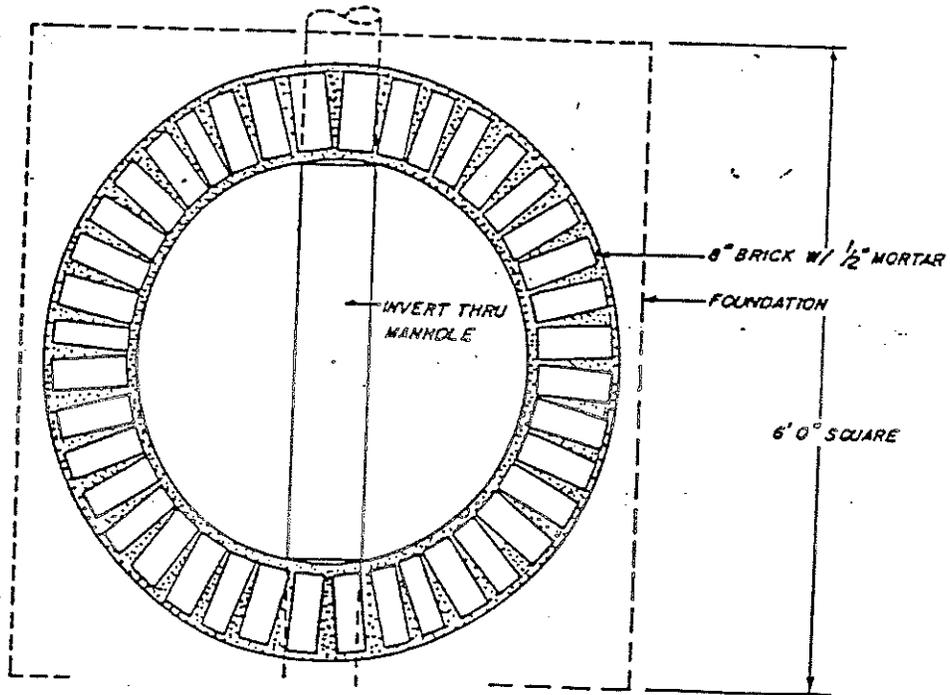
**FIGURE 5.2  
TYPICAL DROP MANHOLE**



**FIGURE 5.3  
MANHOLE SECTIONS**

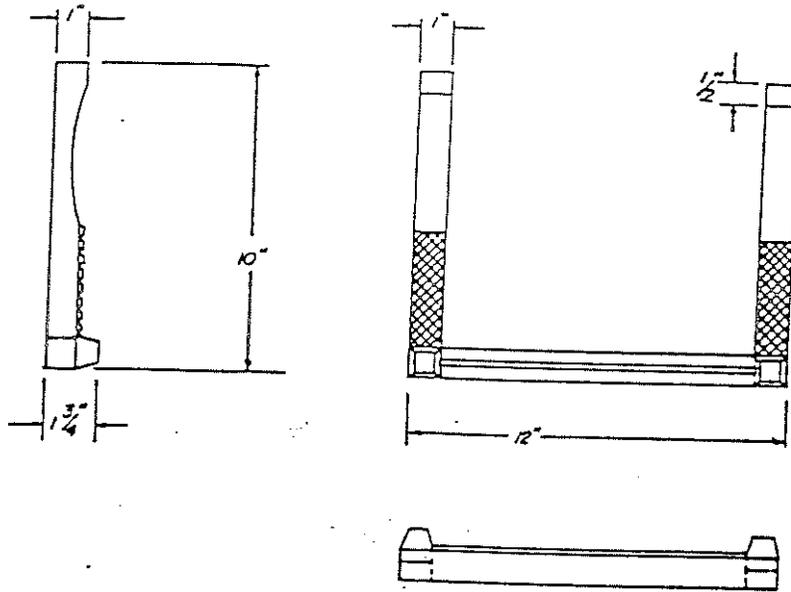


SECTION A-A

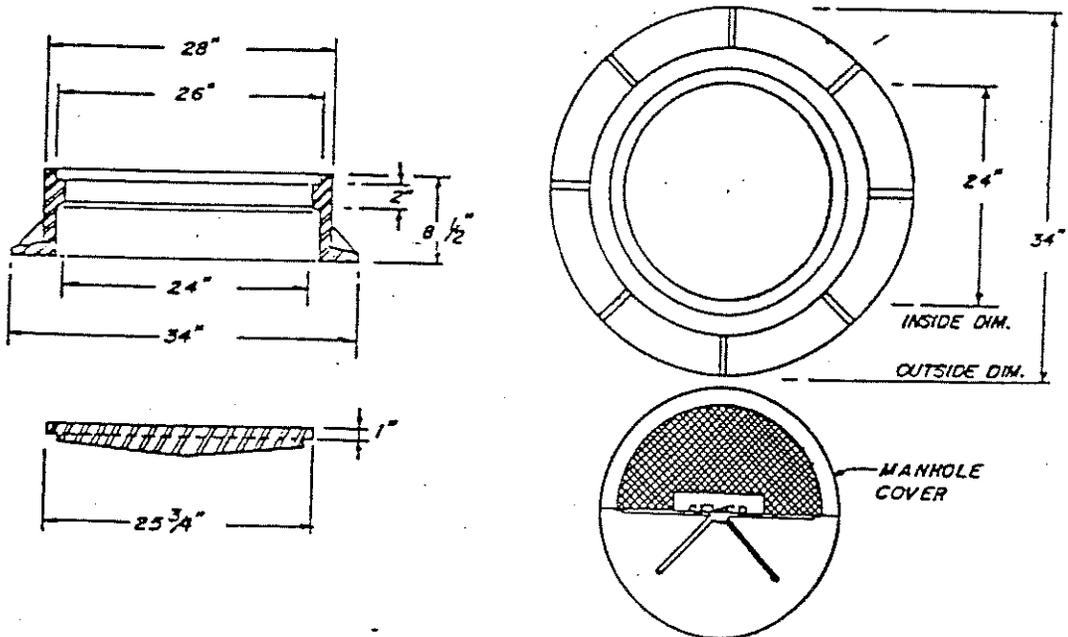


SECTION B-B

**FIGURE 5.4  
MANHOLE DETAILS**

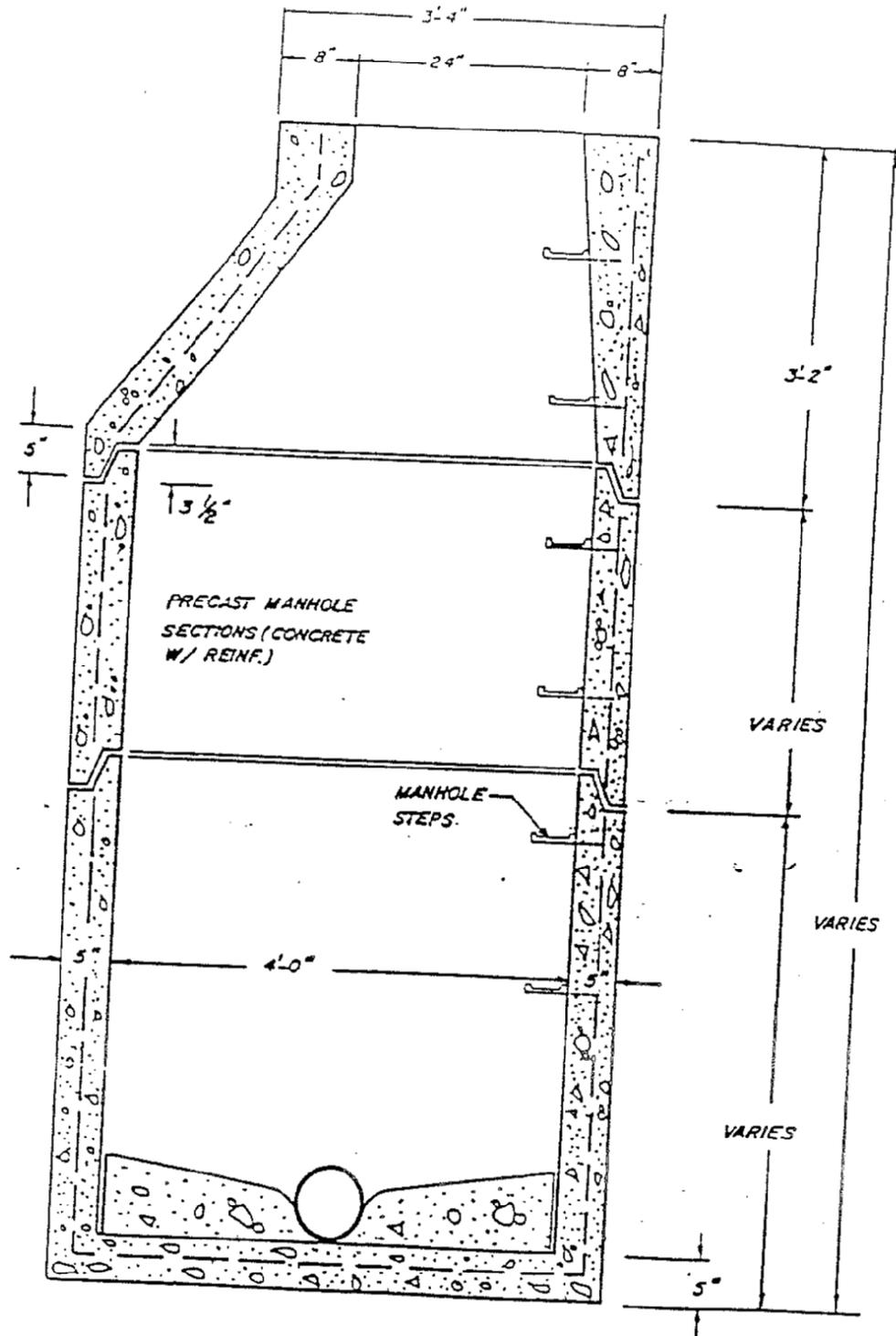


**MANHOLE STEP DETAIL**

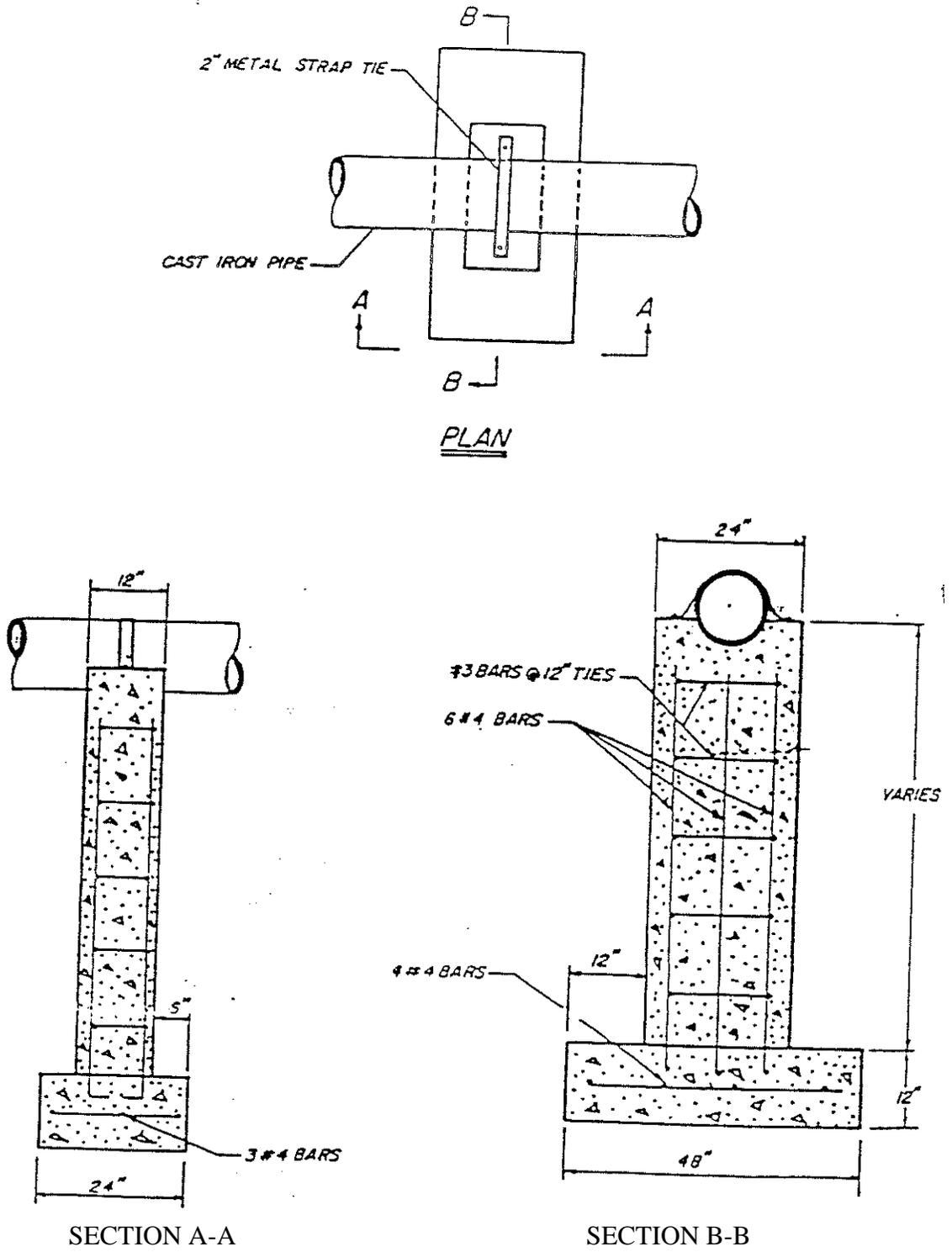


**MANHOLD DETAIL**

**FIGURE 5.5  
PRECAST CONCRETE MANHOLE**



**FIGURE 5.6  
TYPICAL PIER DETAIL**



## SECTION VI

### STORM DRAINAGE SYSTEM

All storm drainage systems shall be installed so that all storm water is led to and confined in natural drainage channels without causing erosion. No storm drainage shall empty into a sanitary sewer.

If a development lies within the municipal limits of the City of Opelika and a public storm water sewer system is reasonably accessible, the developer shall connect with such storm drainage systems and shall do all grading and provide all drainage structures which are necessary to properly carry the water to the storm drainage system.

Where a storm drainage system is not accessible, the developer shall do all grading and provide all drainage structures that are necessary to properly carry water to locations which are acceptable to the City of Opelika Engineering Department.

#### 6.1 GENERAL CRITERIA

All storm drainage systems shall be designed in such a way so that the natural drainage patterns of an area are not significantly altered, erosion is not accelerated, accumulation of eroded soil particles in the storm water system is avoided, and the design storm event is accommodated. The criteria for selecting this design storm event shall be as follows:

	Type of Drainage System	Design Storm Return Period
1.	Property systems for areas less than 15,000 square feet.	10-year storm for confined conveyance capacity, with provisions made to route the 25-year storm when the conveyance capacity is exceeded.
2.	Systems that receive drainage from basins whose total size is greater than 15,000 square feet, but less than 25 acres.	25-year storm for confined conveyance capacity, with provisions made to route the 100-year storm when the conveyance capacity is exceeded.
3.	Systems that receive drainage from basins whose total size is greater than 25 acres	100-year storm for confined conveyance capacity

No land shall be developed in the City of Opelika without first considering the effects of this design storm event. If, in the opinion of the City Engineer, drainage from the design storm event will adversely affect the proposed development, confined conveyance of the drainage will be required. If it is determined that this drainage should be conveyed by pipe forty-two (42) inches in diameter or less, then an underground structure will be required to transport this flow. Otherwise, a properly designed ditch will be required.

However, an underground structure will be required on buildable lots, between road rights-of-way and the building line. Drainage parallel to an uncurbed roadway and drainage that flows through parks or lots greater than one (1) acre may be excepted from this if it can be shown that utilizing a drainage ditch will not adversely affect the development.

Special consideration shall be given to innovative drainage designs that would not adversely affect the quality of development in a particular area.

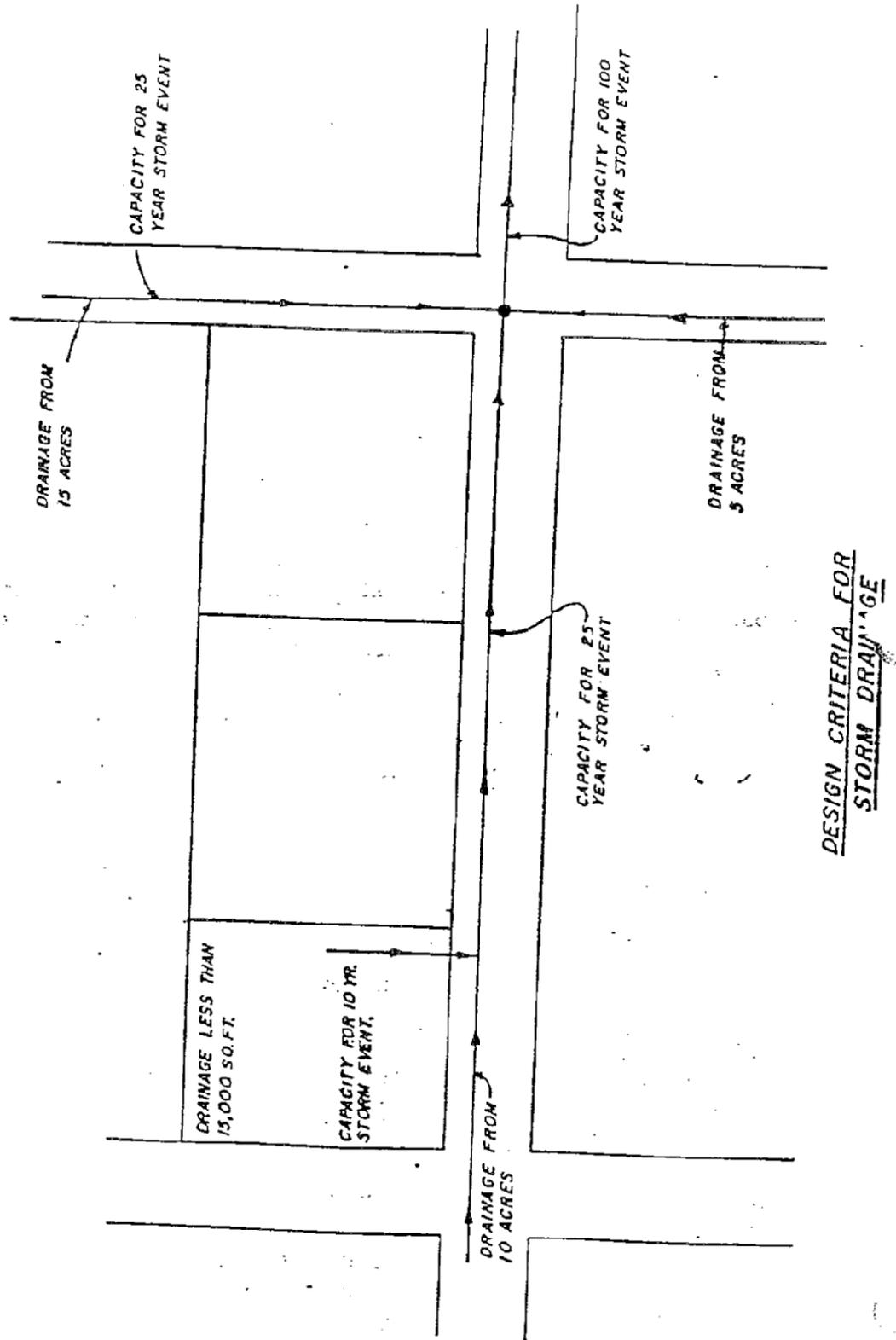
If it is determined that drainage ditches are required to convey the storm drainage and it is necessary that these ditches be constructed to contain water draining at a velocity of three (3) feet per second or greater, then these ditches shall be suitably paved.

Developments shall be designed so that the total drainage after development will not exceed the total drainage prior to development. This can be accomplished by the construction of detention basins that will control and delay the release of storm water, retention storage that will permanently store the runoff, the effective use of appropriate vegetation, or any other suitable means approved by the Engineer.

Subdivision lots shall be laid out so as to provide positive drainage away from all buildings and individual lot drainage shall be coordinated with the general storm drainage pattern for the area. Drainage shall be designed so as to avoid concentration of storm drainage water from each lot to adjacent lots.

In addition to being constructed to control flooding, a manhole, junction box, or inlet shall be constructed at any point where a storm sewer pipe is located at a street intersection or changes directions, grade, size, or alignment. The maximum length of storm sewer pipe between such structures shall be four hundred (400) feet. Headwalls shall be constructed at both ends of all drainage ditches.

FIGURE 6.1  
STORM DRAINAGE DESIGN CRITERIA



## 6.2 STREET DRAINAGE

Every effort shall be made to prevent surface water from crossing streets at intersections. The water shall be intercepted prior to the near corner by inlets of sufficient capacity to remove the drainage. Drainage, if permitted to cross the intersection, can create very hazardous icing conditions during the winter months. The street depression necessary to permit drainage to cross the intersection is further objectionable in that it restricts vehicular movement due to the very slow speed necessary to negotiate it.

It is important to consider carefully the natural drainage features of the development and the limits of the flood water level. All lots and streets should be located outside of the flood plain.

The storm drainage system must have the hydraulic characteristics to accommodate the maximum expected flow of storm waters, which consists of: (1) The off-site and on-site storm waters including storm water coming into a tract from upstream, (2) The discharge of water into the natural drainageway, and (3) The means to convey water to a point where it will flow by gravity downstream into a stream, water channel or drainageway, or where it can be connected into adequate existing facilities.

Drainage structures shall be constructed so as to be maintained at reasonable cost. Systems shall be designed on the basis of "ultimate" known or projected developments for the tributary watershed. The minimum pipe size to be a component part of a public storm drainage system shall be fifteen (15) inches in diameter.

Where the Rational Formula,  $Q=CIA$ , is used to determine quantities of runoff, the composite "C" factors for typical developments listed below shall be used as a guide:

<u>Type of Development</u>	<u>"C" (Slopes 7% &amp; Flatter)</u>	<u>"C" (Slopes Steeper Than 7%)</u>
Commercial	0.85	0.85
Industrial	0.60-0.85	0.60-0.85
Garden-type Apartments, Schools, Churches, etc.	0.60	0.60
Semi-detached Residential	0.45	0.55
Detached Residential (5,00 to & 7,000 sq. ft. lots)	0.40	0.50
Quarter-acre Lots	0.38	0.48
Half-acre Lots	0.35	0.45
One-acre Lots and Larger	0.30	0.40

## 6.3 PIPE CONSTRUCTION

All concrete and polyvinylchloride (PVC) pipe to be installed as storm sewers, except existing pipe required to be removed and relaid, shall be unused pipe conforming with the following specifications and latest revisions:

Concrete Sewer, Storm Drain and Culvert Pipe	ASTM C-14-68
Reinforced Concrete Culvert Pipe	ASTM C-76-69
Polyvinylchloride (PVC) Plastic Pipe	ASTM D-3034, SDR 35

In certain situations and upon approval of the Engineer, PVC pipe may be used in sizes of eighteen (18) inch diameter or less; however, PVC pipe shall not be used in locations where vehicular traffic passes directly over the pipe, such as under public streets, parking lots, or driveway turnouts.

Trenches shall be as narrow as practicable, but shall provide space as necessary on each side of the pipe for thoroughly tamping the bedding material under and around the pipe. The bottom of the trench on which the pipe is to be laid shall be free from projecting stones, roots or any inequalities, and shall be brought to a true grade and so shaped as to conform to the contour of the bottom of the pipe for at least one fourth (1/4) of its circumference to provide a firm, uniform bearing for the entire laying length of the pipe. Recesses shall be formed in the trench to receive the bells of the pipe, or to provide ample space for making joints for tongue and groove pipe.

If, in the opinion of the Engineer, the material at the bottom of the trench excavation is of such character as to result in unequal settlement of the pipe after backfilling, the trench shall be excavated below grade to the depth directed by the Engineer and backfilled with gravel or select material and thoroughly tamped to insure a stable foundation. Gravel shall conform to the specifications for concrete aggregate and select material shall be pit run sand-gravel or clay-gravel, approved by the Engineer.

If rock is encountered in excavating the trenches, it shall be removed to a depth of at least six (6) inches below grade and the trench brought to grade by refilling with suitable material thoroughly tamped to the contour of the bottom of the pipe as above directed.

Sheeting, bracing, and wales, etc., are required as may be necessary to properly support the sides of trench excavations and to prevent any movement thereof which may in any way injure the pipe, diminish the width of the excavation, or otherwise injure or delay the work or endanger adjacent pavement or other structures. Care shall be used to prevent voids outside the sheeting, but if voids occur they shall be immediately filled with suitable material which shall be compacted to the satisfaction of the Engineer.

Upon written order of the Engineer, sheeting or bracing may be left in place, to be embedded by the backfilling of the trench. The sheeting so left in place shall be cut off at the elevation directed by the Engineer and shall, in no case, be less than three (3) feet below the finished grade of the street, or, in the absence of any street grade, from the surface of the ground.

All sheeting and bracing not ordered left in place shall be removed in such a manner as to not endanger the constructed sewer, or other public or private structures, or utilities. All voids left or caused by the withdrawal of sheeting shall be immediately refilled and compacted by ramming tools adapted for the purpose, by puddling, or otherwise, as directed.

When it is necessary that sheeting be driven to a depth of two (2) feet or more below the invert elevation of the pipe for the protection of the bottom portion of the trench, the sheeting shall be cut off at the level of the top of the pipe, leaving the lower portion in place.

Pumping shall be conducted as may be necessary to permit the construction to proceed in an expeditious and workmanlike manner. Removed water shall be disposed and excavations shall be constructed in such a manner as not to cause any nuisance or any injury to public health or public or private property or to any portion of the work completed or in progress, or to the surface of the streets or any impediment to the use of the streets by the public.

In no case is water to be allowed to run over the foundation, the invert, or through the pipe until the pipe joints have hardened to the satisfaction of the Engineer.

All sewers shall be laid to lines and grades shown on plans or designated by the Engineer.

No section of pipe shall be laid which has not been inspected by the Engineer or his authorized representative after it has been placed alongside the right-of-way, or line of sewer.

Lowering pipe into trenches shall be done with ropes or such other proper facilities as will prevent damage to the pipe during handling. Dropping pipe into place, or rolling, except controlled rolling on plank in the case of shallow trenches, will not be permitted. The pipe shall be laid starting at the downstream end with the hub or receiving ends upgrade. The spigot shall be inserted into the hub or receiving end of the adjacent section with the spigot end hard against the shoulder of the bell. Each section shall be carefully bedded in place in close contact with the adjoining section with the invert true to line and grade.

No jointing of pipe on the bank or out of position as to line and grade will be permitted without prior written approval of the Engineer.

Not later than twenty-four (24) hours prior to joining bell and spigot pipe, the ends to be joined shall be coated with prime in accordance with the instructions of the manufactures of the joint material. The prime shall be placed only on clean, dry surfaces.

When pipes are to be joined, a gasket of closely twisted, long fiber hemp or oakum, of suitable diameter and of sufficient length to shape around the pipe and lap at the top, shall be placed on the spigot end of the pipe being laid and this pipe shall be pushed home into the bell of the adjacent pipe. The gasket shall then be thoroughly caulked to the back of the bell with a suitable caulking tool. A runner shall be placed around the pipe to close the socket opening. The joint compound shall then be placed in accordance with the manufacturer's recommendations in such a manner that the annular space will be completely filled.

Joint material shall be "G.K.Compound", "Jointite", or approved equal. Handling and preparation of the joint material shall be in accordance with the manufacturer's recommendations.

Tongue and groove pipe joints shall be constructed using a stiff mortar composed of one (1) part Portland cement and not more than two (2) parts clean, sharp sand. The mortar shall be used

within thirty (30) minutes from the time that the ingredients are mixed with water.

The first pipe shall be bedded carefully to the established grade line with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the second pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned carefully with a wet brush, and while in a horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall then be inserted in the groove end of the first pipe, until mortar is squeezed out on the interior and exterior surfaces. Sufficient mortar shall be used to completely fill the joint and to form a bead on the outside. The interior surface of the pipe at the joint shall then be brushed smooth. The mortar on the outside shall immediately be protected from the air and sun with a cover of wetted burlap or earth, and shall be kept protected until the mortar is satisfactorily cured.

Tongue and groove pipe joints may be constructed by use of "diaper bands" in lieu of the above-specified method, provided the method of installation is approved by the Engineer.

All backfilling material shall be carefully selected to insure that it is free from roots, rock or other unsuitable material and shall have a moisture content which will facilitate compaction.

Special care shall be used when backfilling around the pipe and a distance of two (2) feet above its top surface. The material shall be deposited in uniform layers not to exceed four (4) inches in thickness, solidly tamped and rammed with proper tools to insure thorough compaction and at the same time avoid injury to or disturbance of the pipe.

Where backfilling is done within the limits of roads, streets, alleys or other thoroughfares, the backfill, except as specified above, shall be placed in layers of not more than six (6) inches and each layer thoroughly compacted with mechanical rammers or by hand tamping with heavy tampers, the tamping face of which shall not exceed twenty-five (25) square inches. Except for that part of the trench below a line two (2) feet above the top of the pipe, backfilling done outside the limits of public thoroughfares may be placed in twelve- (12) inch layers and tamped.

#### **6.4 SPECIAL DRAINAGE STRUCTURES**

The materials and method of construction of the concrete portion or portions of manholes, inlets, junction boxes, wingwalls, spillways, headwalls, and other similar structures shall conform to the applicable portions of this manual. All concrete for drainage structures shall have a minimum compressive strength of 3000 psi at twenty-eight (28) days.

If the construction of a portion or portions of manholes, inlets, junction boxes, headwalls and other similar structures requires less than the equivalent of one carload of brick, such brick shall be supplied from a source approved by the Engineer and shall be all hard-burned and reasonably free from such cracks, pebbles, particles of lime and deleterious substance as would affect their serviceability and strength.

However, if the work requires the equivalent of a carload or more, such brick shall conform to

the requirements of ASTM C-32, Grade MA. The Contractor shall furnish to the Engineer certificates by the manufacturer of the brick evidencing that the brick supplied meets the requirements of these specifications.

Mortar for brickwork shall consist of one (1) part Portland cement and two (2) parts clean, sharp sand with not more than twenty (20) pounds of hydrated lime added per sack of cement.

All courses shall be laid as header courses. Each brick shall have full mortar joints on the bottom and sides which shall be formed in one operation by placing sufficient mortar on the bed and shoving the brick into it. Horizontal joints shall not exceed three-eighths ( $3/8$ ) of an inch and the vertical joints on the inside shall not exceed one-fourth ( $1/4$ ) of an inch. All brick shall be thoroughly drenched with water immediately before being laid.

Brick manholes shall have a plaster coat of 1:2 mortar not less than one-half ( $1/2$ ) of an inch in thickness on the outside and inside.

That portion of all manholes, inlets, junction boxes and other similar structures below the center line of the largest pipe or box culvert entering or leaving the particular structure shall have a "streamlined" contact surface. This shall be accomplished by hand-placing concrete in such a manner as to provide a smooth contact surface, without angular breaks, from upstream conduit or conduits to downstream conduit or conduits.

Bricks may be used to construct part of the "streamline" fill provided each brick is completely embedded in concrete or a stiff mortar of one (1) part Portland cement and two (2) parts sand, and further provided that no portion of the brick work be closer than one (1) inch from the contact surface.

All castings shall conform to the latest requirements of ASTM A-48, Class 30.

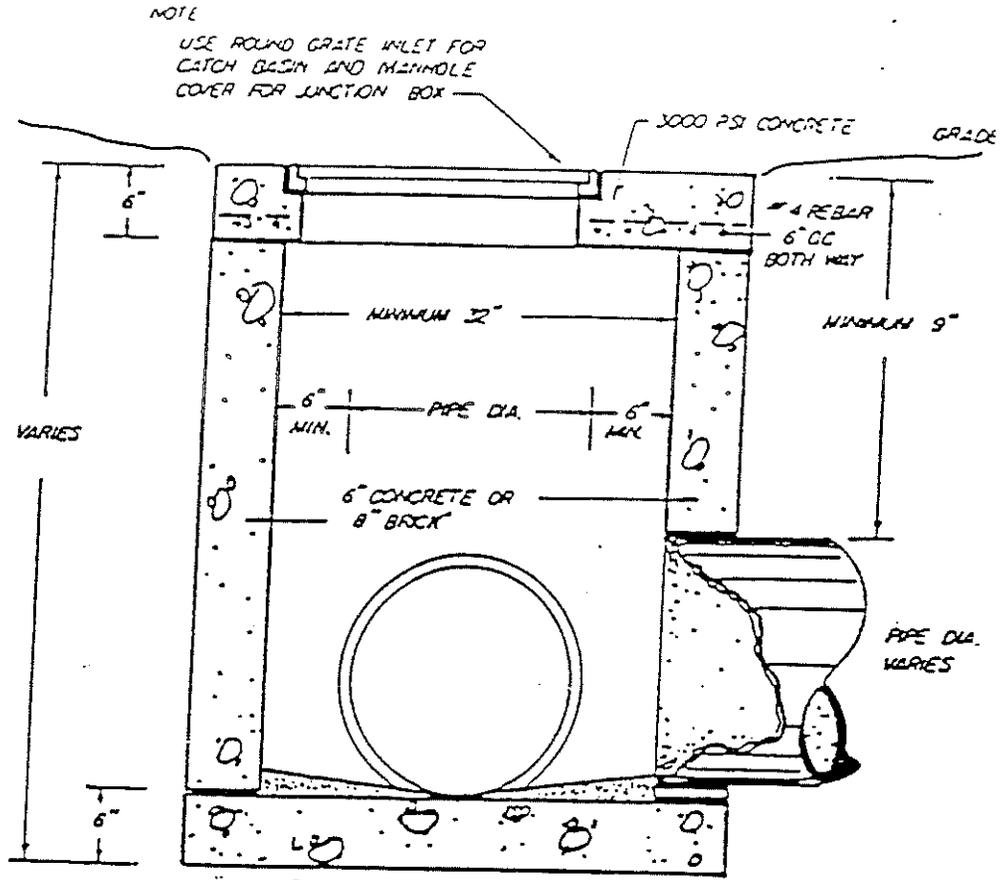
Gray iron castings shall be made in accordance with detail drawings furnished and shall be of tough, close-grained iron, true to pattern, free from blow holes, cold-shots and unsightly or other defects which would render them unsuitable for the purpose intended.

Manhole covers shall be fitted to manhole frames by chipping, grinding or other means, in such manner as to prevent rocking of the cover when an eccentric load is applied to its top. Any tendency to rattle, as determined by test before or after installation, will be sufficient cause for rejection of the cover, frame, or both.

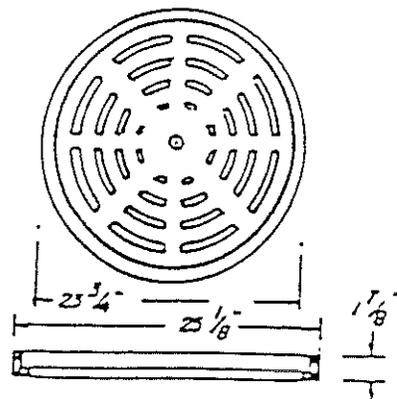
All surfaces of castings shall be thoroughly cleaned and given one coat of asphaltum or coal tar pitch varnish before being shipped from the foundry. The varnish shall be of good quality, tough and tenacious when cold, and have no tendency to scale off.

Grates not required to be fitted into frames shall be given a thick coating of coal tar pitch or grease on the contact surfaces which are to be seated into masonry so as to prevent bonding thereto.

**FIGURE 6.2  
CATCH BASIN DETAIL**

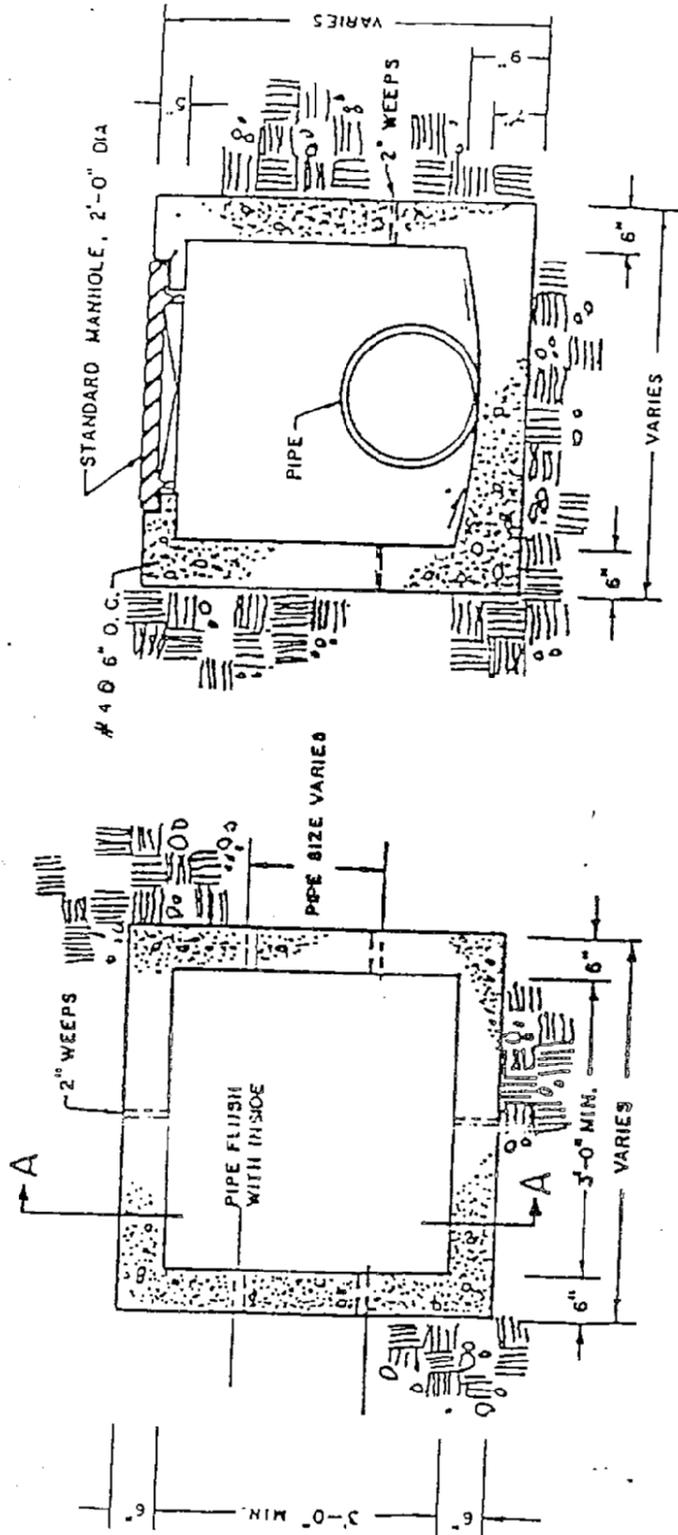


**CATCH BASIN & JUNCTION BOX DETAIL**



**ROUND GRATE FOR CATCH BASIN**

FIGURE 6.3  
STANDARD BOX INLET



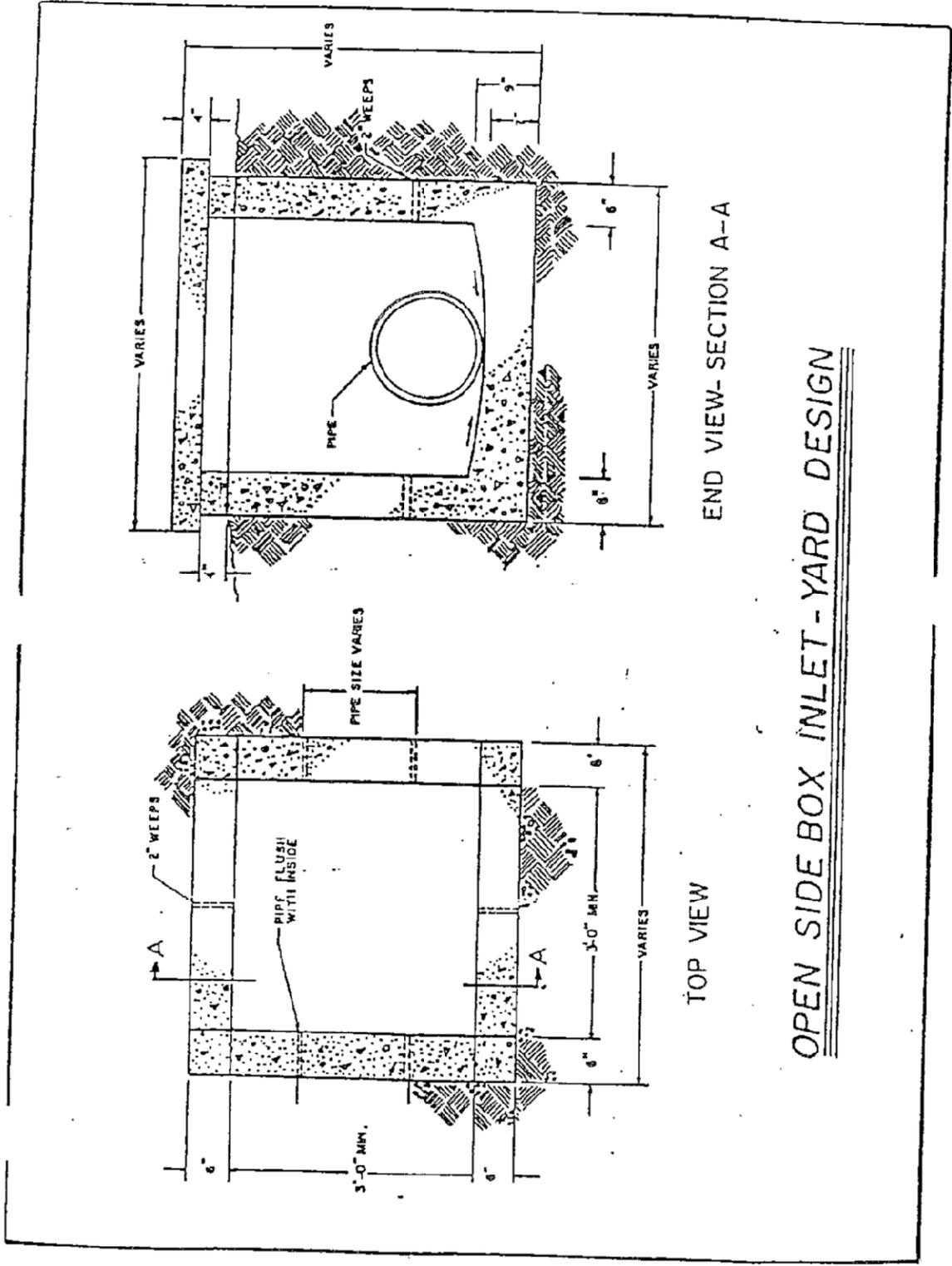
TOP VIEW

END VIEW - SECTION A-A

STANDARD BOX INLET - PAVEMENT DESIGN

NO SCALE

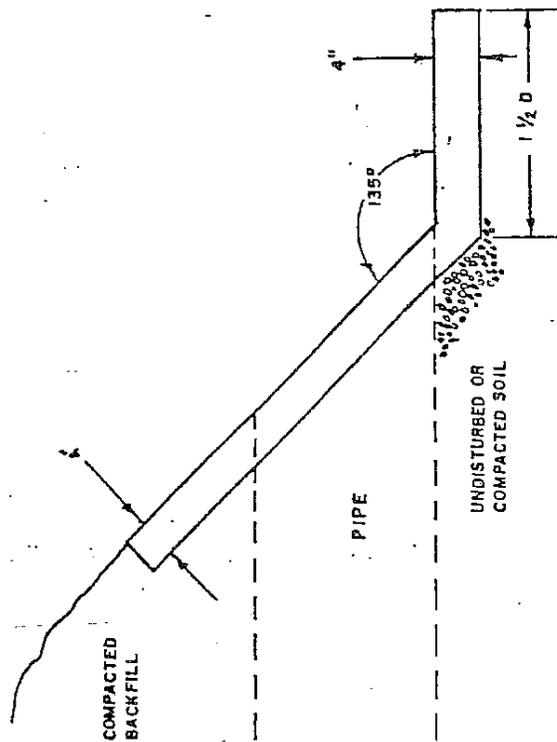
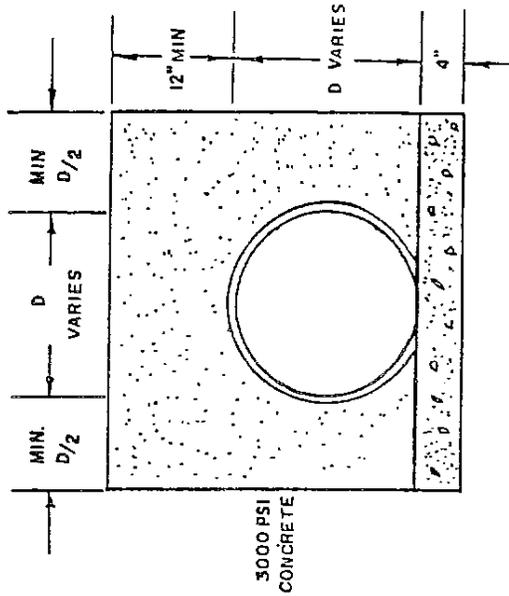
FIGURE 6.4  
OPEN SIDE BOX INLET



OPEN SIDE BOX INLET - YARD DESIGN



FIGURE 6.6  
HEADWALL AT BEVELLED PIPE



HEADWALL AT BEVELLED PIPE

## 6.5 OPEN DITCHES

Drainage ditches shall be constructed as noted on the typical drawing shown on the following page. As this drawing indicates, the bottom shall be a minimum of two (2) feet in width and the sides shall be constructed to a slope of three (3) horizontal to one (1) vertical.

If it necessary to stockpile the excavation along the bank or banks of a ditch, it shall be placed so that the top of the slope of the stockpiled dirt will not be less than five (5) feet from the top of the ditch bank and shall have openings as required to permit surface water to drain to the ditch and prevent the ponding of water in back of the stockpiled dirt.

In those cases where the slope of the ditch allows drainage water to exceed a velocity of three (3) feet per second, the ditch shall be lined with concrete or suitably paved.

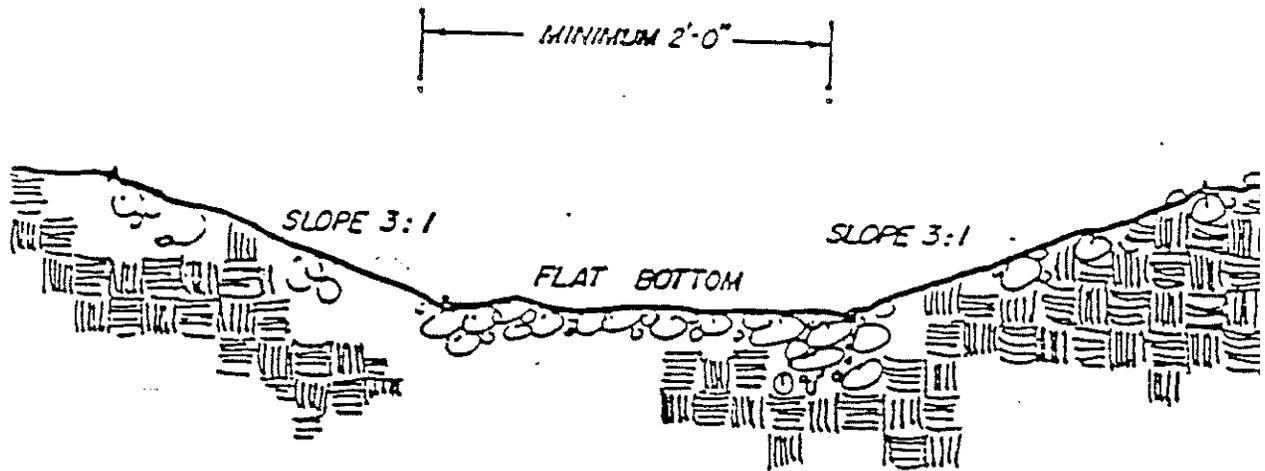
The materials and method of construction of the concrete lining and slope paving for open ditches shall conform to the applicable portions of this manual. The exposed base width portion of concrete-lined ditches shall be finished with steel trowel.

A dry mix will be permitted for the concrete ditch lining and slope paving; however, the concrete shall have sufficient water to assure proper mixing and bonding of concrete. Forming will not be required, but the concrete shall be thoroughly tamped and consolidated. The bottom of the concrete-lined ditches shall be given a trowel finish and the bank slopes of concrete-lined ditches and slope paving shall be given a sidewalk brush finish. Wire mesh shall not be placed on the ground and the concrete poured on top of the mesh. Approximately two (2) inches of concrete shall first be placed and the wire mesh then placed on the concrete, after which the final two (2) inches of concrete shall be placed on top of the mesh, or the wire mesh may be supported on small concrete blocks wired to the mesh to hold the mesh in proper position in the slab. Wire mesh shall lap three (3) inches on side joints and six (6) inches on end joints.

Two horizontal lines of weep holes shall be constructed in all slope paving and concrete lining on ditch banks and the lines shall be located six (6) inches above the flow line of ditch and approximately midway between flow line of ditch and top of slope paving or bank concrete ditch lining. Weep holes shall be spaced twenty (20) feet on centers and shall be staggered between top and bottom lines.

Weep holes shall be formed by driving a tapered wooden pin with a minimum diameter of two (2) inches through the concrete and approximately one (1) inch into dirt bank. The wooden pin shall be clean and oiled and shall be placed immediately after the concrete has been screened off and shall be removed after the concrete has set hard enough to permit removal of the pin without damage to the concrete around the weep hole.

**FIGURE 6.7**  
**TYPICAL DRAINAGE DITCH**



## SECTION VII

### UTILITIES

#### 7.1 UTILITY COMPANY REQUIREMENTS

##### 7.1.1 General Criteria

Every pipe or conduit for water, sewage, gas, drainage, communication, or any other use shall have a minimum cover of twenty-four (24) inches.

Each utility should provide the City of Opelika with an up-to-date map of their system. This map should indicate the location and depth of each structure, along with its relationship to other existing features such as paved areas, structures, and other utility structures.

Each utility shall provide the City of Opelika with a complete set of construction plans prior to receiving a construction permit.

Where feasible and appropriate, utility companies shall indicate the locations of their under-surface structures by means of "surface markings". For instance, curb markings would be considered an excellent method of indicating where a pipe intersects the pavement.

##### 7.1.2 Permits

No person, except in the case of an emergency, shall make any tunnel, opening, or excavation of any kind in or under the surface at any street maintained by the City of Opelika without first securing a permit from the City for each separate undertaking. In the case of an emergency, this permit shall be applied for on the next regular business day.

##### 7.1.3 Excavations

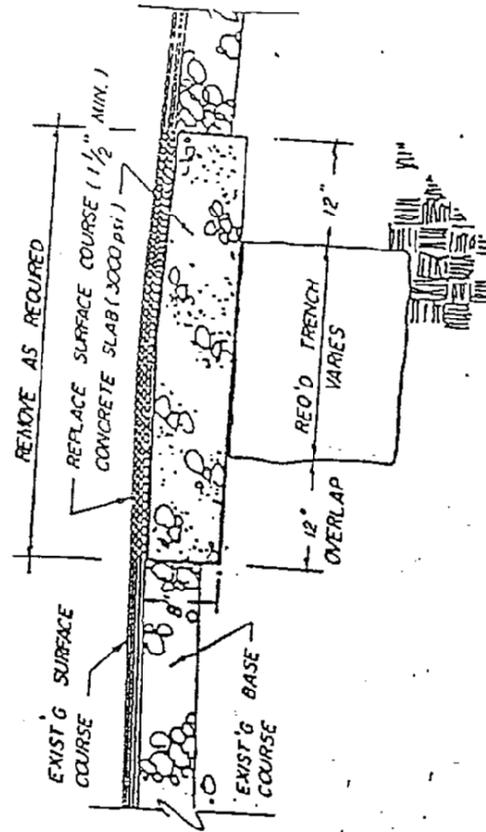
No opening or excavation in any street shall extend beyond the center line of the street before being backfilled and the surface of the street temporarily restored. Streets will not be completely closed to traffic except when approved by the Director of Public Works with proper prior notice given to the Police and Fire Departments and noted on the permit.

No more than 250 linear feet, measured longitudinal, shall be opened in any street at any one time.

All utility facilities shall be exposed sufficiently ahead of trench excavation work to avoid damage to those facilities and to permit their relocation, if necessary.

Pipe drains, pipe culverts, or other facilities encountered during excavation work shall be protected.

FIGURE 7.1  
EXCAVATION REPLACEMENT ON STREETS



- 1) DITCH TO BE TAMPED TO 95 % COMPACTION;
- 2) LAYERS NOT TO EXCEED 6\"/>

DETAIL FOR REMOVAL AND REPLACEMENT OF...  
FLEXIBLE PAVEMENT FOR UTILITY CROSSINGS.

Monuments of concrete, iron, or other lasting material set for the purpose of locating or preserving the lines of any street or property subdivision, or a precise survey reference point or a permanent survey reference point or a permanent survey bench mark within the City of Opelika shall not be removed or disturbed or caused to be removed or disturbed unless permission to do so is first obtained in writing from the Director of Public Works.

When any earth, gravel, or other excavated material is caused to roll, flow, or wash upon any street, the permittee shall cause the same to be removed from the street within eight (8) hours after the deposit.

Every permittee shall place around the project such barriers, lights, warning flags and danger signs as shall be determined by the Director of Public Works, as well as the Alabama Manual of Uniform Traffic Control Devices, to be necessary for the protection of the public.

Access to private driveways shall be provided except during working hours when construction operations prohibit provision of such access. Free access must be provided at all times to fire hydrants.

Excavated materials shall be laid compactly along the side of the trench and kept trimmed up so as to cause as little inconvenience as possible to public travel. In order to expedite the flow of traffic or to abate a dirt or dust nuisance, toe boards or bins may be required. If the excavated area is muddy and causes inconvenience to pedestrians, temporary wooden plank walks shall be installed. If the street is not wide enough to hold the excavated material without using part of the adjacent sidewalk, the permittee shall keep a passageway at least one-half the sidewalk width open along such sidewalk line.

All pavement cuts, openings, and excavations shall be properly made, backfilled and temporarily surfaced by the permittee according to City of Opelika specifications.

Work shall be performed during daylight hours Monday through Friday between the hours of 7:00 AM and 5:00 PM, local time.

## **7.2 CONSTRUCTION IN THE VICINITY OF EXISTING UTILITIES**

Every effort shall be made to provide any existing maps or information concerning existing utilities to any one wishing to excavate. However, it remains the Contractor's or Developer's responsibility to confirm the location of these utilities prior to excavation.

Every pipe or conduit for water, sewage, gas, drainage, communication or any other use which may be encountered in trenching shall be carefully protected from injury or displacement and all damage caused to such structures shall be completely repaired to the satisfaction of the owner of the structure. All costs associated with repairing the structure shall be paid by the party causing the damage.

## SECTION VIII

### OFF-STREET PARKING

#### 8.1 GENERAL CRITERIA

The location of and the minimum number of off-street parking spaces shall be as described in the City of Opelika Zoning Ordinance. All parking plans shall be approved by the City Engineer prior to construction.

Parking areas shall be suitably landscaped to minimize noise, glare and other nuisance characteristics as well as to enhance the environment and ecology of the site and surrounding area. All required open parking areas and accessways thereto shall be properly drained and all such areas shall be paved surface.

Pavement shall consist of the following minimum requirements:

- a. Ninety-five (95%) percent compacted base soil.
- b. Six (6) inches of ninety-five (95%) percent compacted crushed stone.
- c. One and one-half (1-1/2") inches of an asphalt wearing surface.

The requirements listed above are for the off-street parking of cars and light trucks. In areas where heavier vehicles and large trucks will load, unload, or park, the material thicknesses shall be increased to accommodate the greater loads.

Concrete may be used for required parking areas as an optional surface with the approval of the City Engineer. Standards may be found in reference manuals noted for Concrete Roads.

To provide proper drainage, the minimum slope of a parking lot shall be one (1%) percent. The maximum slope shall be ten (10%) percent.

Where it can be demonstrated, at the time of planning board review, that the parking requirements of the zoning ordinance will result in more parking spaces than actual needs require, the planning commission may permit a portion of the proposed parking areas to remain unpaved, but landscaped. Such unpaved area shall remain reserving for such future facilities needs and, if conditions in use or actual operation of the proposed use vary, the planning board may require such space to be paved.

Parking space allocations should be oriented to specific buildings. All parking shall be so arranged that cars and trucks may be turned on the lot so that it is not necessary to back into any street.

Use of the following criteria shall provide optimum use of available parking area:

- a. Use rectangular areas.
- b. Make the parking area's long sides parallel.
- c. Use parking stalls along the perimeter.
- d. Use traffic lanes that serve two (2) rows of stalls.

Consideration should be given to the flow of traffic into and out of the area as well as within. Pedestrian traffic must be also taken into consideration for safety and convenience.

The width of all aisles providing direct access to individual parking stalls shall be in accordance with the requirements set forth below:

<u>Parking Angle (Degrees)</u>	<u>Aisle Width (ft.) One-Way Traffic</u>	<u>Aisle Width (ft.) Two-Way Traffic</u>
0 (Parallel)	12	24
30	12	24
45	14	24
60	18	24
90 (Perpendicular)	24	24

A one-way car movement to the left, or counter-clockwise, should be encouraging. A loop drive should be developed around the parking areas.

Parking areas or lots providing for more than sixty (60) motor vehicle spaces shall, where possible, be subdivided into modular parking bays or lots of not greater than sixty (60) spaces each.

Parking lots shall be curbed with permanent and durable curbing to confine cars to striped parking, without overhang or projection onto sidewalks, driveways, bicycle parking areas, planting areas or adjacent landscaped areas. Curbing shall be curb and gutter and, where allowed by the Engineer, raised pre-cast concrete curbs attached to the parking surface. Parking stripes shall be four (4) inches wide and shall be white. The parking area should be clearly marked with symbols, words and numbers to direct traffic flow.

Every parking space shall measure not less than nine (9) feet in width, measured perpendicularly between parking stripes, and not less than eighteen (18) feet in length.

Parking spaces shall be on the same lot or tract of land as the building or use to be served unless

the Engineer, in connection with site plan review, shall approve collective off-street parking facilities for two (2) or more buildings or uses on adjacent or contiguous lots. The total of such collective off-street parking facilities shall be not less than the sum of facilities required for the individual uses computed separately.

Sidewalks between parking areas and principal structures, along aisles and driveways, and wherever pedestrian traffic shall occur, shall be provided with a minimum width of four (4) feet of passible area and be raised six (6) inches or more above the parking area, except when crossing streets or driveways.

Parked vehicles shall not overhang or extend over sidewalk areas, unless an additional sidewalk width of two and one-half (2-1/2) feet is provided to accommodate such overhang.

All required parking areas shall be lighted to provide a minimum of three (3) footcandles at driveway intersections with main roads and a total average illumination of one-half (1/2) foot candles throughout the parking area. Such lighting shall be shielded in such a manner as not to create a hazard or nuisance to the adjoining properties or the traveling public.

Unobstructed access to and from a street shall be provided. Paved access drives or driveways shall be provided in accordance with the criteria provided in Section III. Should exterior curb and gutter not exist, curb and gutter, where required, shall be constructing as per provisions of Section III.

No public or private parking area or access roads thereto shall be constructed, altered or added to until there shall have been filed with the City Engineer an application for a building permit, which shall include a plan, drawn to scale, showing the actual dimensions of the lot or lots to be built upon, the exact size and location on the lot or lots of the building or structure and accessory buildings already existing or to be erected, and containing such other information as shall be deemed necessary.

## **8.2 ANDICAP REQUIREMENTS**

The City of Opelika encourages the placement of handicap parking spaces at each off-street parking lot and at selected on-street parking locations throughout the city. The City will install and maintain handicap parking places at public parking locations. Where there is a requirement for businesses to install handicap parking spaces, the City will provide the appropriate sign(s). The business must install the sign(s) and paint the spaces. Any business choosing to participate in this program will be required to pay the actual material costs incurred by the City.

Each parking space reserved for the handicapped shall be painted as per the drawing shown in this Section. In addition, a sign denoting the handicapped parking space shall be installed which meets the requirements set out in the "Alabama Manual on Uniform Traffic Control Devices".

The following standards shall determine the number and placement of handicap parking spaces in all parking lots.

### 8.2.1 Handicapped Passenger Arrival

A safe place, located either on or off the street, shall be designated for handicapped passengers to get into and out of cars. It shall be:

- a. As near as possible to the building entrance provided for the handicapped.
- b. Zoned to prohibit parking.
- c. Provided with a ramp to sidewalk level, if located at curbside.
- d. Protecting from weather by a canopy over the entrance.

### 8.2.2 Parking

A parking lot servicing each entrance provided for the physically handicapped shall have a number of level parking spaces as set forth in the following table:

<u>Total Parking in Lot</u>	<u>Required Number of Accessible Spaces</u>
Up to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
Over 1000	20 plus 1 for each 100 over 1000

Spaces shall be:

- a. As near as possible to the building entrance provided for the handicapped with a maximum travel distance of two hundred (200) feet.
- b. Identified (wheelchair symbol) and controlled for use by individuals with physical disabilities.
- c. A minimum of nine (9) feet in width, with a four- (4-) foot wide pedestrian access aisle on one side of the space.

(Note: Spaces parallel to a curb (4 inches high maximum) on the building side of the parking area are desirable. If perpendicular parking is necessary, four (4) foot wide access aisles between every other bay will be required.)

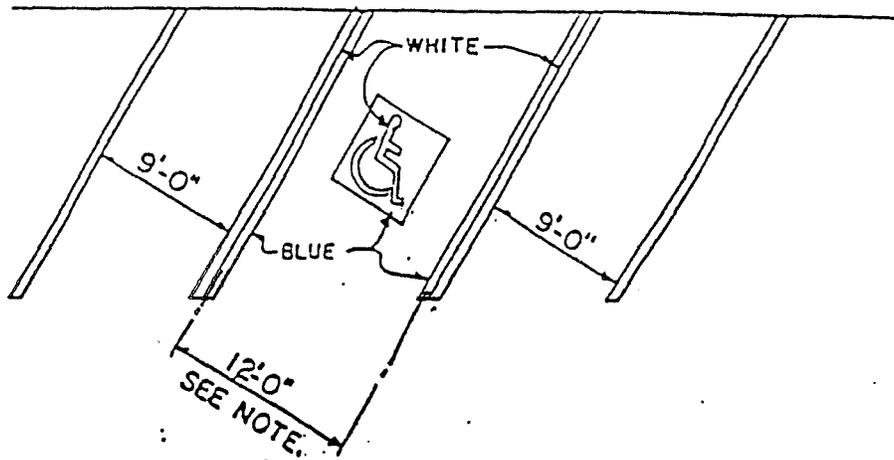
Spaces shall be substantially level (1/8 inch per foot slope for drainage), suitable for wheeling and walking, and accessible to the building by a clear, level or ramped path of travel.

### **8.3 FIRE LANE REQUIREMENTS**

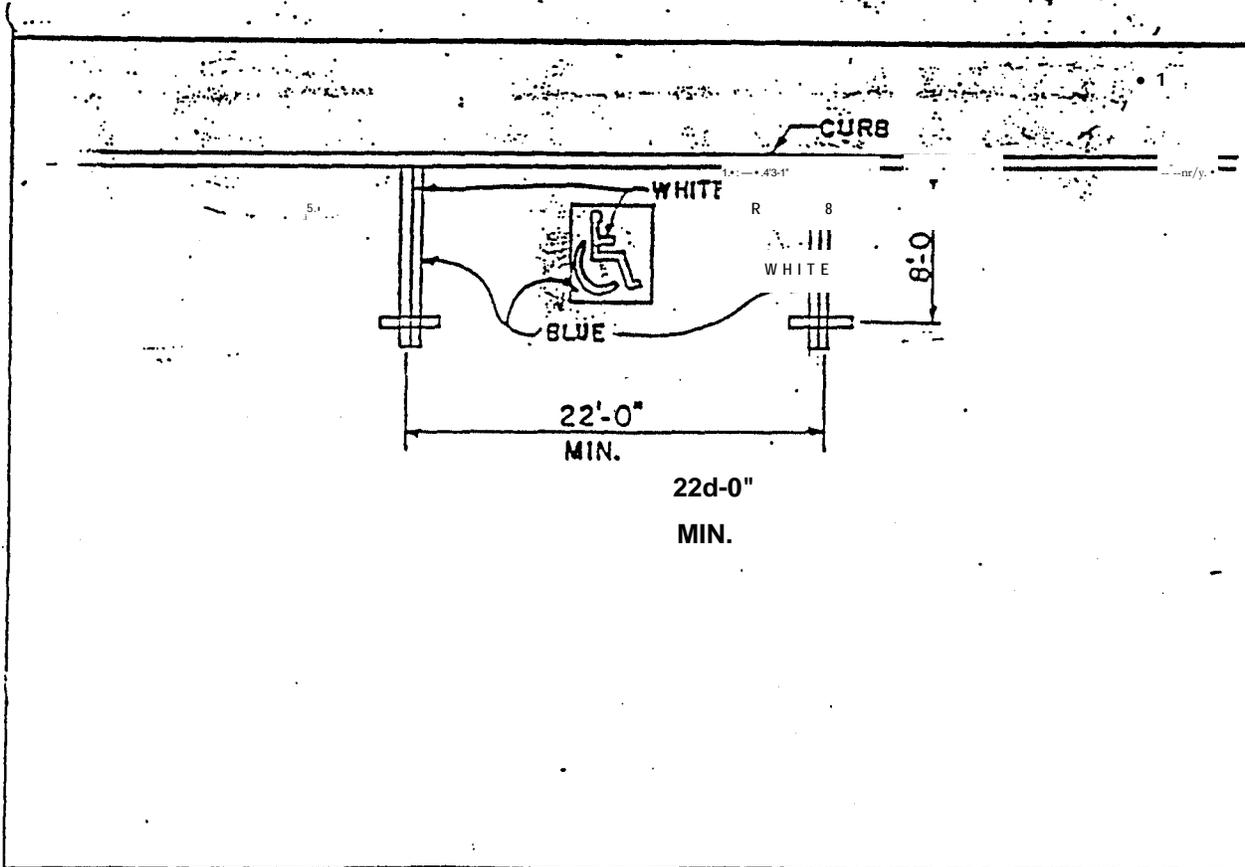
All off-street parking areas provided for shopping centers, malls, large mercantile businesses, large apartment complexes, industries, storage warehouses, or other businesses, as determined by the City Engineer and/or the fire department, shall have fire lanes for providing adequate access for emergency vehicles and equipment to and from the buildings and structures. Fire lanes shall be established as required by the City of Opelika Fire Code and at other locations as deemed necessary by the Fire Chief. It is the responsibility of the building Owner to paint, sign, and mark all required fire lanes in a manner approved by the Fire Department.

Fire lanes shall be marked with approved yellow painting on the pavement and curbing, and approved signs indicating "Fire Lane" shall be installed adjacent to the fire lane.

FIGURE 8.1  
HANDICAP PARKING STANDARDS



**NOTE:** IF THERE IS NO PARKING SPACE OR OBSTRUCTION ON ONE SIDE OF THE HANDICAPPED PARKING SPACE, IT MAY BE 9'-0" WIDE.



**SECTION IX**  
**GENERAL POLICY**

**9.1 SUBDIVISION SURVEY STANDARDS**

At least one corner of the subdivision shall be designated by course and distance from a readily discernible reference marker, such as a section or quarter section marker. If a corner lies within one-half (1/2) mile of triangulation or traverse station of the Alabama coordinate system, then this corner shall be marked with a monument so designated by computed X and Y coordinates, which shall also appear on the map with a statement identifying the location of this station or monument to an accuracy of 1:1000.

Concrete monuments four (4) inches in diameter or square and three (3) feet long, with a flat top, shall be set at all points where the street lines intersect the exterior boundaries of the subdivision at angle points, and at each corner of the outside boundary of the subdivision. The top of the monument shall have an indented cross to identify properly the location and shall be set flush with the finished grade. All other intersection and lot corners shall be marked with iron pipe not less than three-fourths (3/4) inch in diameter or iron rebar not less than one-half (1/2) inch in diameter. Both marker types shall be not less than twenty-four (24) inches long and driven so as to be flush with the finished grade. The above standards shall also apply to any revision or addition to an existing subdivision.

**9.2 EASEMENT STANDARDS**

Except where alleys are provided for the purpose, easements at least twenty (20) feet wide, ten (10) feet wide on each side of rear lot lines and along side lot lines shall be provided for utilities and sewers (sanitary and storm) where, in the opinion of the Planning Commission, they are necessary or advisable. Easement placement and widths will be determined by the Planning Commission. No half easements will be accepted unless the adjacent property owner dedicates the other half at the time the plat is approved.

Where a subdivision is traversed by a water course, drainage way, natural channel, or stream, there shall be provided an easement conforming substantially to the limits of such water course plus additional width as necessary to accommodate future construction and maintenance as recommended by the City Engineer. All lots shall be graded so that drainage goes to the easements.

Lots and easements shall be arranged in such a manner as to eliminate unnecessary easement jogs or offsets, and to facilitate the use of easements for power distribution, telephone service, drainage, water, and sewer services.

**9.3 PRESERVATION CONSIDERATIONS**

Wherever possible, subdividers shall preserve trees, groves, waterways, scenic points, historic spots, and other community assets and landmarks.

Although not required by these regulations, the preservation of existing trees is recommended for all subdivision development. Also, in the absence of existing trees, the planting of street trees is considered a responsibility of the subdivider as well as good business practice. Street trees protect against excessive heat and glare, and enhance the attractiveness and value of abutting property.

It is recommended that trees be planted five (5) feet inside (behind) the property lines where they will be less subject to injury, decrease the chances of motor vehicle accidents, and enjoy favorable conditions for growth. If trees are to be planted within a planting strip in the right-of-way, their proposed locations and species to be used must be approved by the Planning Commission, since the public inherits the care and maintenance of such trees.

#### **9.4 CHEMICAL USE**

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with manufacturer's instructions.

#### **9.5 PROTECTION TO AREAS IN VICINITY OF DEVELOPMENT**

In the event it is necessary to haul soft or wet materials over the streets or pavements of the city, the Developer or Contractor shall provide suitable tight vehicles, approved by the Public Works Director, to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles of the Developer or Contractor, he shall clean-up the same as often as directed and keep the streets clean and free from any dirt or mud, due to his operations.

The Developer shall, at all times, provide for the control of dust within residential areas and such other areas where dust is a nuisance to the public by sprinkling with water

Any operation, use, or any activity involving the manufacture, utilization, or storage of flammable, combustible and/or explosive materials shall be conducted in accordance with the regulations required by the City of Opelika.

All flammable, explosive and/or combustible material shall be stored in accordance with the Fire Prevention Code of the City of Opelika.

All outdoor storage facilities for fuel, raw materials, and products stored outdoors shall be enclosed by an approved safety fence and suitable landscaping to screen such areas from public view and shall conform to all yard requirements imposed by the City of Opelika.

No materials, wastes, or other substance shall be stored or maintained upon a lot in such a manner that natural run-off from such areas on a site with an approved storm water drainage plan can impair the existing water quality of a stream, watercourse or aquifer more than the primary use intended for the lot.

All materials or wastes which might cause fumes or dust or which constitute a fire hazard or which may be edible or otherwise attractive to rodents or insects shall be stored outdoors only if enclosed in containers which are adequate to eliminate such hazards.

All sewers, gutters, storm drains, and the like shall be kept clear of any trash, mud, or other residue that may result in an obstruction to normal flow in these structures.

## **9.6 EROSION CONTROL**

Development shall proceed so as not to adversely affect the quality of the land to be developed or properties in the vicinity of the land to be developed. This policy, of course, may restrict what the City of Opelika will consider to be buildable land.

Development shall proceed in such a way that erosion is controlled. When feasible, land shall be cleared in stages so that a particular section of land is cleared only as required for its development, with the remainder of the undeveloped land left in its natural state. Where land has been cleared, erosion shall be controlled by such means as grassing, mulching, etc. Silt screens and/or retention basins shall be constructed to control the erosion run-off, unless the City Engineer determines that this is not necessary. Erosion shall be controlled to the extent that erosion both during and after development is not increased over erosion that naturally occurred prior to development.

## **9.7 PROPERTY CONTROL**

Adequate provisions shall be made for the flow of sewers, drains and water courses and the operation of other utilities encountered during construction. The lines and structures which may have been disturbed shall be immediately restored to their original condition.

Trees, grass, fences, signboards, poles, and all other property shall be protected, unless their removal is authorized, and any property damage shall be satisfactorily restored.

## **9.8 CLEAN-UP, SILK. RESTORATION, AND SUE MAINTENANCE**

Project sites shall be kept clean at all times. Loose dirt shall not be allowed to clog ditches or cover sidewalks. Soft clay or other undesirable material removed from the trenches shall be removed from the streets, sidewalks, or ditches.

All pavement, sidewalks, driveways, curb, gutter, drains or similar items removed or damaged during or by construction shall be replaced with construction of first-class materials and workmanship. All pavement shall be replaced in accordance with provisions in other sections of this manual.

Following otherwise satisfactory completion of required improvements, the subdivider shall post with the City of Opelika a surety bond, effective for one year, in an amount equal to ten (10) percent of the street and utility improvement cost for the street for which acceptance is sought. Said bond is to guarantee the City that said street has been installed properly and free from

defects caused by faulty material or workmanship, and that said street will remain in acceptable condition for a period not to exceed one (1) year. If, at the end of the one (1)-year period, the street or portion of the street is found unacceptable because of faulty workmanship or material, said defect shall be repaired at a cost to the subdivider up to the amount of the surety bond. Upon his failure or refusal to make adequate repairs within ninety (90) days after demand is made of him by the City of Opelika, then the City shall make such repairs as are reasonably necessary and recover the cost with the bond.

## **9.9 FIRE HYDRANT REQUIREMENTS**

All buildings located within the city limits of Opelika shall be provided with fire hydrants capable of supplying the required fire flow for the buildings being protected. Any building or structure located more than one hundred fifty (150) feet from a public fire hydrant system or more than five hundred (500) feet from a public fire hydrant (other than single family dwellings) shall be provided with fire hydrants per all Fire Code requirements as adopted by the City and approved by the fire department and the water department. In no case shall the required fire hydrants be more than five hundred (500) feet from the buildings. Spacing of the fire hydrants shall be approved by the fire department and the City Engineer. The water department shall approve all materials and installations of fire hydrants.

## **9.10 DEVELOPMENT PLAN REVIEW**

Prior to issuance of a building permit, a site plan for all developments (except for single-family dwellings) shall be submitted to the City Engineer for review and approval. The site plan shall indicate all proposed improvements for the development, and shall, as a minimum, show the following:

- a. Lot and building dimensions
- b. Public and private easements
- c. Setbacks
- d. Size and location of water mains
- e. Hydrant locations (existing and proposed)
- f. Curb cut locations
- g. Parking surfaces and layout
- h. Ingress and egress dimensions
- i. Drainage detail
- j. Location, height, and materials for fences and walls
- k. Finished floor elevation
- l. Handicap access and parking

For large developments which may have a significant traffic impact upon the area surrounding the development, the Engineer may require a traffic impact study. The site plan shall preferably be stamped by an engineer or architect registered in the State of Alabama.

## **SECTION X**

### **APPEALS**

#### **10.1 APPEALS BOARD**

There is hereby established a Board to be called the Board of Appeals, which shall consist of seven (7) members. The composition of the Board shall be the Public Works Director, the City Engineer, the City Planner, the Building Official, the Mayor, and two (2) members of the City Council to be selected by it.

Five (5) members of the Board shall constitute a quorum. In varying the application of any provisions of the Public Works Manual, affirmative votes of the majority present, but not less than three (3) affirmative votes shall be required. A Board member shall not act in a case in which he has a personal interest.

The Building Official shall act as Secretary of the Appeal Board and shall make a detailed record of all its proceedings, which shall set forth the reasons for its decisions, the vote of each member participating therein, the absence of a member and any failure of a member to vote.

The Board shall establish rules and regulations necessary to conduct its affairs. Meetings shall be held at the car of the Chairman or at the request of two members. The Board shall provide public notice of all meetings by publication of its agenda in a newspaper of general circulation in the City.

#### **10.2 VARIANCE**

Any person may request a variance from the specific provisions of the Public Works Manual by filing a Petition for Variance with the Board. Such Petition must be filed in writing with the Building Official and must contain at least the following information:

- a. Identification of property concerned by street address or legal description.
- b. A statement identifying the legal interest of the Petitioner.
- c. A statement identifying the specific provision of the Public Works Manual being appealed.
- d. A statement identifying the special conditions and circumstances which should qualify the Petitioner for a variance.

The Petitioner must prove that the variance will not be contrary to the public interest and that practical difficulty and unnecessary hardship will result if it is not granted. There must be proof of unique circumstances and proof that the granting of the variance will achieve the same quality and integrity of construction as that standard contained in the Public Works Manual.

Upon receipt of any petition for a variance, the Board of Appeals shall schedule a public hearing on the proposed variance to be held not less than five (5) days after public notice has been published in a newspaper of general circulation in the City. After the close of a public hearing and within ten (10) days of the date of said hearing, the Board shall render a written opinion setting forth the reasons for all decisions. All such decisions shall be final and binding upon the parties, subject, however to such remedies as any aggrieved party might have in law or in equity.

On matters of road design and layout reviewed by the Planning Commission in its Subdivision or Site Plan approval process, the Planning Commission approval shall constitute a variance from the standards where necessary and no further review or approval is required. Such variance shall be so noted in the minutes with the reasons for so doing stated.

ORDINANCE NO. 125-91

BE IT ORDAINED by the City Council of the City of Opelika, Alabama, as follows:

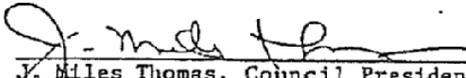
Section 1. ADOPTION OF PUBLIC WORKS MANUAL. There is hereby adopted by the City of Opelika for the purpose of prescribing regulations for construction and/or installation of streets, sanitary sewers, storm drainage systems, sidewalks, and other public works improvements, the Public Works Manual, September, 1991 edition, a copy of which is on file in the Office of the City Clerk, and the same is hereby adopted and incorporated as fully as if set out at length herein, and from the date on which this Ordinance shall take effect, the provisions thereof shall be controlling within the corporate limits of the City of Opelika.

Section 2. ENFORCEMENT. The Engineering Department of the City of Opelika shall be responsible for the enforcement of the provisions of the Manual hereby adopted.

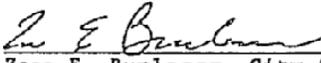
Section 2. REPEAL OF EXISTING MANUAL. The Public Works Manual, October, 1986 edition, is hereby repealed.

Section 4. EFFECTIVE DATE. This Ordinance and the Public Works Manual hereby adopted shall take effect and be enforced immediately upon its adoption, approval, and publication as required by law.

ADOPTED and APPROVED by the City Council of the City of Opelika, Alabama, this the 17<sup>th</sup> day of September, 1991.

  
\_\_\_\_\_  
J. Miles Thomas, Council President  
City of Opelika

ATTEST:

  
\_\_\_\_\_  
Zane E. Burlison, City Clerk

TRANSMITTED to the Mayor this the 18<sup>th</sup> day of September, 1991.

  
\_\_\_\_\_  
Zane E. Burlison, City Clerk

ACTION BY MAYOR

APPROVED this the 18<sup>th</sup> day of September, 1991.

  
\_\_\_\_\_  
Bobby J. Freeman, Mayor

ATTEST:

  
\_\_\_\_\_  
Zane E. Burlison, City Clerk