

BEFORE THE BOARD OF COUNTY COMMISSIONERS  
FOR COLUMBIA COUNTY, OREGON

In the Matter of Adopting the )  
Columbia County Uniform Road )  
Improvement Design Standards )  
\_\_\_\_\_ )

ORDINANCE NO. 92-12

The Board of County Commissioners for Columbia County, Oregon ordains as follows:

SECTION 1. TITLE.

This ordinance shall be known as Ordinance No. 92-12.

SECTION 2. AUTHORITY.

This ordinance is adopted pursuant to the authority of ORS 203.035 and ORS Chapter 368.

SECTION 3. PURPOSE.

The purpose of this ordinance is to adopt the Columbia County Uniform Road Improvement Design Standards.

SECTION 4. ADOPTION.

The Columbia County Uniform Road Improvement Design Standards, a copy of which is attached hereto, labeled Exhibit "A" and incorporated herein by this reference, are hereby adopted.

SECTION 5. AMENDMENT.

Section 905.L of the Columbia County Subdivision and Partitioning Ordinance is amended to read as follows:

"L. Street Surfacing and Improvements. Public streets, including alleys, within developments shall be improved in accordance with the requirements of the Columbia County Uniform Road Improvement Design Standards."

SECTION 6. REPEALER.

- A. Ordinance No. 91-10 is repealed.
- B. Resolution No. 29-75 is repealed.

SECTION 7. SEVERABILITY.

The provisions of this ordinance, including Exhibit "A", are severable. If any provision of this ordinance is determined to be invalid by a court of competent jurisdiction, such provision shall be considered a separate, distinct and independent provision and the decision shall not affect the validity of the remaining portions hereof.

SECTION 8. EMERGENCY CLAUSE.

This ordinance being immediately necessary for the public health, safety and welfare of the citizens of Columbia County, an emergency is declared to exist and this ordinance shall take effect on October 14, 1992.

ADOPTED this 14th day of October, 1992.

BOARD OF COUNTY COMMISSIONERS  
FOR COLUMBIA COUNTY, OREGON

By:   
Chairman

By:   
Commissioner

By:   
Commissioner

Approved as to form

By:   
Office of County Counsel

Attest:

By:   
Recording Secretary

First Reading: 10/14/92

Second Reading: 10/14/92

Effective Date: 10/14/92

COLUMBIA COUNTY UNIFORM ROAD IMPROVEMENT DESIGN STANDARDS

Prepared by:

The Columbia County Board of Commissioners,  
the Columbia County Roadmaster,  
the Columbia County Land Development Services Department  
the City of St. Helens,  
the City of Scappoose, and  
the Columbia County Road Standards Committee

Based upon the standards prepared by:

The Department of Land Use and Transportation  
Engineering/Surveying Division  
156 North First Avenue  
Hillsboro, Oregon 97124  
Adopted: July 22, 1986

Adopted by Columbia County on:  
October 14, 1992



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## EXECUTIVE SUMMARY

The Columbia County Uniform Road Improvement Design Standards are intended to establish and implement a uniform set of engineering technical design standards for road improvements that will meet the transportation needs of today as well as the Year 2000. These Standards are intended to provide specific technical direction and guidance to the private sector and staff for the design and construction of all public roads and associated improvements for the County's transportation system.

These Standards have been developed in response to the Board of County Commissioners' goal to develop Uniform City/County Standards. The development of these Standards during the past year represent a balance between the present economic realities, local governments' responsibilities to protect the safety of the traveling public, and the need to protect County taxpayers from the burden of undue maintenance costs. These Standards represent the culmination of numerous meetings and discussions between the Land Development Services staff, the Columbia County Road Department, Cities' technical staff, fire marshalls, and numerous other interested parties.

The Columbia County Board of Commissioners, by adopting these Standards, will implement modern construction practices on County Roads funded by private enterprise, County/State/Federal sources and local improvement districts.

The 1980 Standard Specifications and Drawings for Public Works Construction of the Oregon Chapter of the American Public Works Association, as currently modified are hereby adopted as the physical standards for the construction of streets and roads except as provided herein or by amendment within each contract. A.P.W.A. manuals can be purchased from Kramer, Chin and Mayo, 7110 SW Fir Loop, Portland, Oregon 97223.

## DEFINITIONS

This section contains only those definitions which may have more than one definition. The definition presented will govern. Not only is the definition stated, but in some cases, further information is given.

- Alley** A street or road primarily intended to provide secondary access to the rear or side of lots or buildings and not intended for normal through vehicular traffic. An alley shall have a minimum twenty (20) foot turning radius.
- CBE** Crushed base equivalent (CBE) is the number that directly relates the traffic coefficient to the required number of inches of rock for street structural sections.
- County Road** A public road incorporated into the County road system by formal action of the Board of County Commissioners. These roads are assigned numbers and the County assumes maintenance responsibility.
- Design Speed** The minimum design speed for each road classification shall be as shown in Table I. The design speed can be the eighty-five (85) percent vehicle speed unless the road improvement will increase the eighty-five (85) percent speed. If road improvement increases the eighty-five (85) percent speed, the design speed will be based on the County's recommendation.
- Director** The Director of the Land Development Services Department.
- Intersection** Refers to the area joined by two (2) or more roads intersecting. For design purposes, an intersection is not formed by naming two (2) approaches of a continuous street at a curve or some other point with different street names.
- Public Road** A road dedicated for use by the public. These roads are for the most part not accepted for maintenance by the County, but are the responsibility of the adjoining property owners.

Road

That portion or portions of the right-of-way used for vehicular traffic, and includes areas two (2) feet behind the curb or two (2) feet beyond the edge of the shoulder. Streets and roads are synonymous.

Traffic  
Coefficient

A number used in determining the structural section of a street.



CHAPTER I

GENERAL SPECIFICATIONS

110 REQUIREMENTS FOR PUBLIC IMPROVEMENT

110.01 GENERAL

Road and drainage improvements are conditioned through the development review process, this Ordinance, and other County policies adopted by the Board of County Commissioners. No road, bridge, drainage or utility construction shall commence prior to County approval of the construction plans. Designs submitted shall be stamped by a Registered Professional Engineer licensed to practice in the State of Oregon.

120 SUBMITTAL REQUIREMENTS

120.01 GENERAL

Submittal requirements consist of design plans, grading plans (where required), erosion control plans (where required), drainage calculations and other information as required.

120.02 DESIGN PLAN FORMAT

The plans shall be submitted on sheets 24" x 36".

Vicinity Maps shall be located on the first sheet of all plans and shall show the location of the project in respect to the nearest major street intersection.

A north arrow shall be shown on each plan view sheet of the plans and adjacent to any other drawing which is not oriented the same as other drawings on the sheet.

The scale shall be 1"= 2', 4', 5', or 10' vertically and 1"= 10', 20', 40', 50' or 100' horizontally for all drawings except structural drawings, which are exempt.

Letter size shall not be smaller than 0.10 of an inch high.

The location and elevation of a National Geodetic Survey, United States Geological Survey, State Highway, or Columbia County bench mark shall be shown. No other datum shall be used without permission of the County Surveyor. Temporary bench marks shall be shown on the plans.

A title block shall appear on each sheet of the plan set and shall be placed in the lower right-hand corner of the sheet, across the bottom edge of the sheet or across the right-hand edge of the sheet. The title block shall include the names of the project, the engineering firm, the owner and the sheet title.

A seal of the Registered Professional Engineer responsible for preparation of the plans shall appear on each sheet.

The description and date of all revisions to the plans shall be shown on each sheet affected, and shall be approved and dated by a Registered Professional Engineer as evidenced by signature or initial.

120.02.1 PLAN VIEW

Plan Views shall show the following:

Right-of-way, property, tract, and easement lines.

Subdivision name, lot numbers, street names and other identifying labels. Street names are subject to the approval of the County.

Location and stationing of existing and proposed street centerlines and curb faces.

Horizontal curve data of street centerlines and curb returns.

Utilities and vegetation in conflict with the construction or operation of the street and drainage facilities.

Location, stationing and size of drainage facilities. Drainage facility stationing shall be located in relationship to the street stationing at all manholes or other key locations. Show drainage facilities both above and below the project.

Match lines with sheet number references.

Top of curb elevations along curb returns at quarter-points.

Location of the low points of street grades and curb returns.

Sidewalk ramp locations.

Crown lines along portions of streets transitioning from one typical section to another.

Centerline stationing of all intersecting streets.

Location and description of existing survey monuments, including but not limited to, section corners, quarter corners and donation land claim corners.

Legend.

Developer's name, address and phone number.

Any additional information that the County deems necessary.

#### 102.02.2 PROFILE VIEW

Profile Views shall show the following:

Stationing, elevations, vertical curve data and slopes for center of streets or top of curbs. For off-set or superelevation cross-sections, both curbs shall be profiled. Where curbs are not to be constructed, centerline of street and ditch inverts shall be shown.

Original ground along the center line, and if necessary, at the edges of the right-of-way if grade differences are significant.

Centerline of existing streets for a distance of at least three hundred (300) feet each way at intersections with proposed streets. Show original ground beyond existing streets, if necessary.

Extension of the profile of streets that will be extended in the future (stub streets). The extended profile shall be at least two hundred (200) feet for local and minor streets and as required for streets with higher classifications and be designed to be compatible with the restraints of the terrain.

Vertical alignment of streets.

The top of curb for all cul-de-sacs, eyebrows and intersection curb returns.

All proposed drainage facilities, their types, all invert and top elevations, slopes, materials, bedding and backfill.

Existing drainage facilities, including off-site facilities, upstream and downstream that affect the design (e.g., downstream restrictions that back water on to project site).

Profiles for ditch and creek flowlines shall extend a minimum of two hundred (200) feet beyond the project, both upstream and downstream. Typical cross sections at fifty (50) foot intervals shall also be submitted.

All existing and proposed sanitary and storm lines crossing the profile.

#### 120.03 DRAINAGE CALCULATIONS

Drainage calculations shall be presented in a clear, concise and complete manner. These calculations shall address all runoff into the drainage system; areas contributing flow to each inlet must be computed separately and each inlet with contributing area shall be designated and shown on an accompanying contour map work sheet.

Initial time of concentration calculation with assumptions listed and charts or monographs used shall also be included with drainage calculations.

#### 120.04 OTHER REQUIREMENTS

Other information to be shown on the construction drawings or the other submittals include:

The design assumptions for each street (i.e., traffic coefficient).

The design elements such as:

- (1) Street classification;
- (2) Design speed;
- (3) Superelevation;
- (4) Average Daily Traffic (ADT) or Design Hourly Volume (DHV).

Structural construction plans and the necessary calculations shall be submitted for proposed structures (i.e., walls, box culverts, bridges, etc.).

Any additional information that the County deems necessary.

#### 120.05 REVIEW PROCEDURE

Two (2) sets of complete plans shall be submitted for a cursory review. This review is to check that all the required information has been submitted. The required information includes drainage calculations, and a list of requested variances from these Road Standards. If the submittal is adequate, a detailed review will begin based on a first-in, first-out approach. If the submittal is not complete, notification will be given by the County to the private engineer specifying what is needed.

Upon completion of the detailed review by the County, the County will return one (1) set of plans with "Red Line" comments and calculations. After the private engineer has completed all revisions, five (5) revised plans and the original "Red Line" plans shall be returned to the County for approval. If approved, one (1) set will be returned and stamped approved by the County.

Plan review priority will be given to plans submitted for final review. This plan review and approval is valid for two (2) years from the date of the approval stamp. Extensions can be made as part of the Development Permit extension process, see the Columbia County Community Development Code.

#### 120.06 AS-BUILT DRAWINGS

Following completion of construction and approval by the County, three (3) sets of as-built drawings shall be submitted for preliminary review. Drawings shall describe any and all revisions to the previously approved construction plans. If this submittal is acceptable, the engineer shall submit the as-built drawings on 3 mil minimum thickness mylar or a print of contrast quality suitable for reproducing and microfilming. If the first submittal was not acceptable, the County will give the engineer notice of what is required for re-submittal.

### 130 ROAD REQUIREMENTS

#### 130.01 ACCESS

Access to County and Public Roads shall conform to the Columbia County Approach Road Ordinance, or as modified by UGB Management Agreements.

#### 130.02 WIDTH

Table I is a summary of road width standards by the functional classification of the road. It should be noted that public utility easements beyond the right-of-way are required in some instances. For rural roads as well as interim urban roads, six (6) foot wide shoulders are required.

#### 130.03 NUMBER OF LANES

The number of lanes for each class of road means the number of lanes between intersections, widening at an intersection may be required in addition to those lanes shown in Table I.

Right-of-way may be needed in addition to that shown in Table I to accommodate the increased number of lanes at intersections.

#### 130.04 DESIGN SPEED

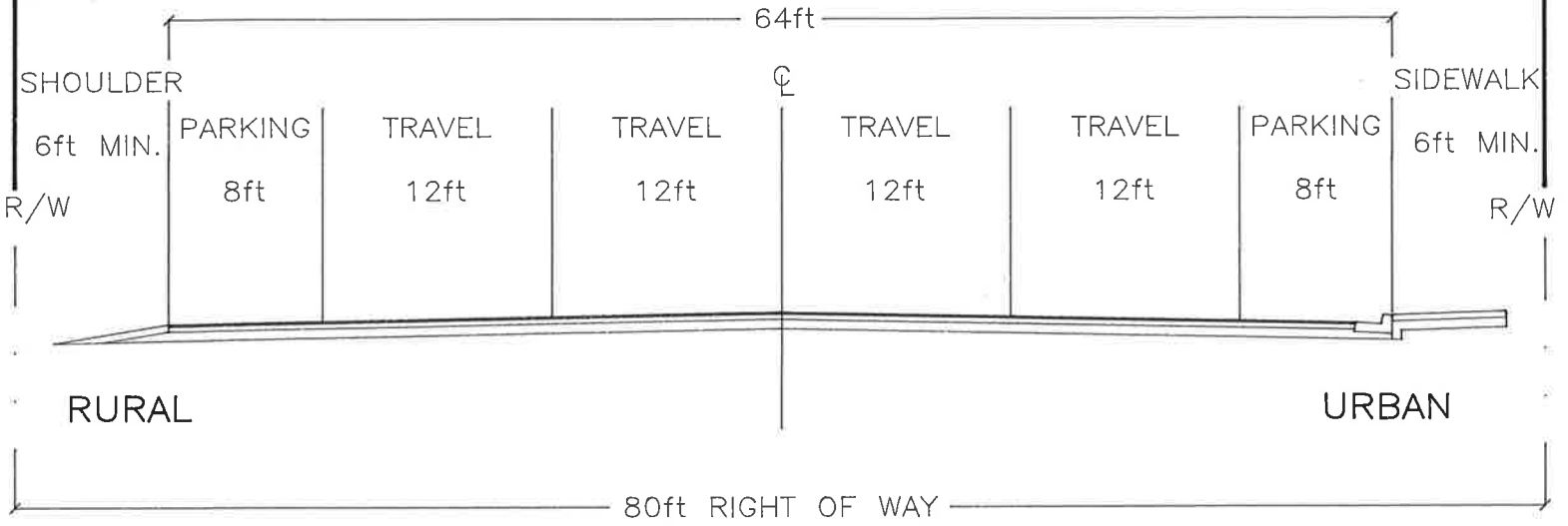
The minimum design speed for each road classification shall be as shown in Table I. The design speed can be the eighty-five (85) percent vehicle speed unless the road improvement will increase the eighty-five (85) percent speed. If road improvement increases the eighty-five (85) percent speed, the design speed will be based on the County's recommendation.

#### 130.05 UTILITY EASEMENTS FOR RESIDENTIAL SUBDIVISIONS

The minimum requirement shall be as follows:

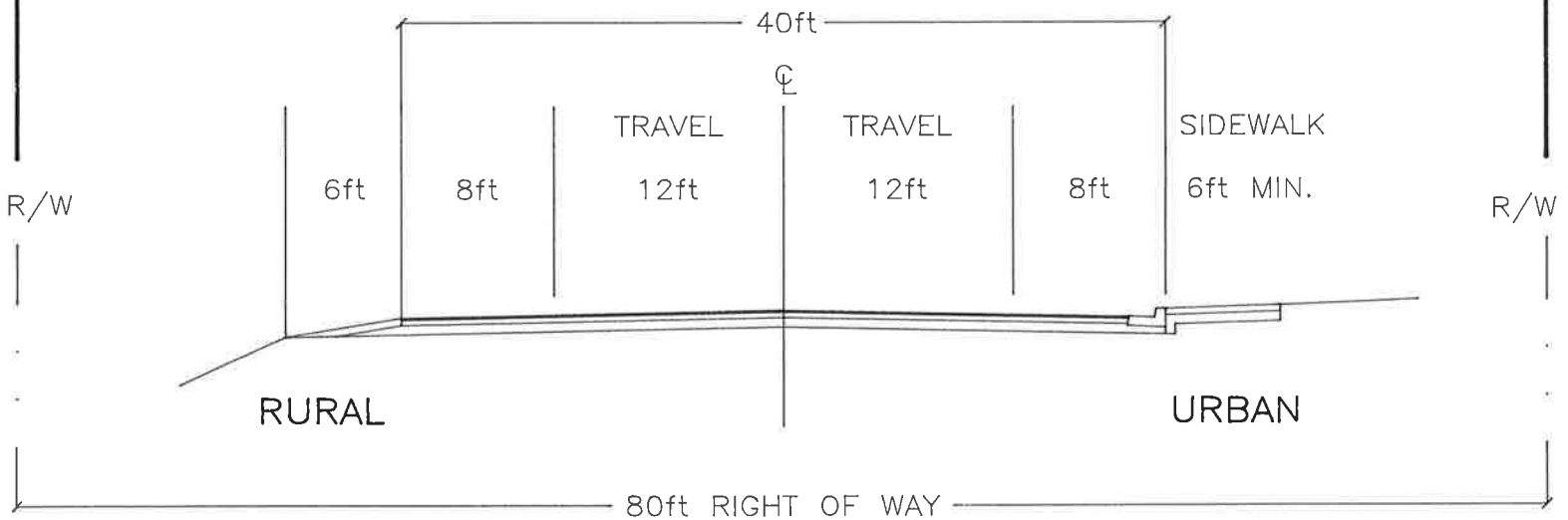
- A six (6) foot utility easement along all front lot lines, as shown on Table I Local Road Section.
- An additional five (5) foot utility easement along all side lot lines extending eight (8) feet from the right-of-way. See Standard Drawing M-408.

# MAJOR ARTERIAL



DESIGN SPEED 45 MPH

# MINOR ARTERIAL



DESIGN SPEED 35 MPH

SEE SECTION 210 FOR  
CROSS SECTION INFORMATION

COLUMBIA COUNTY

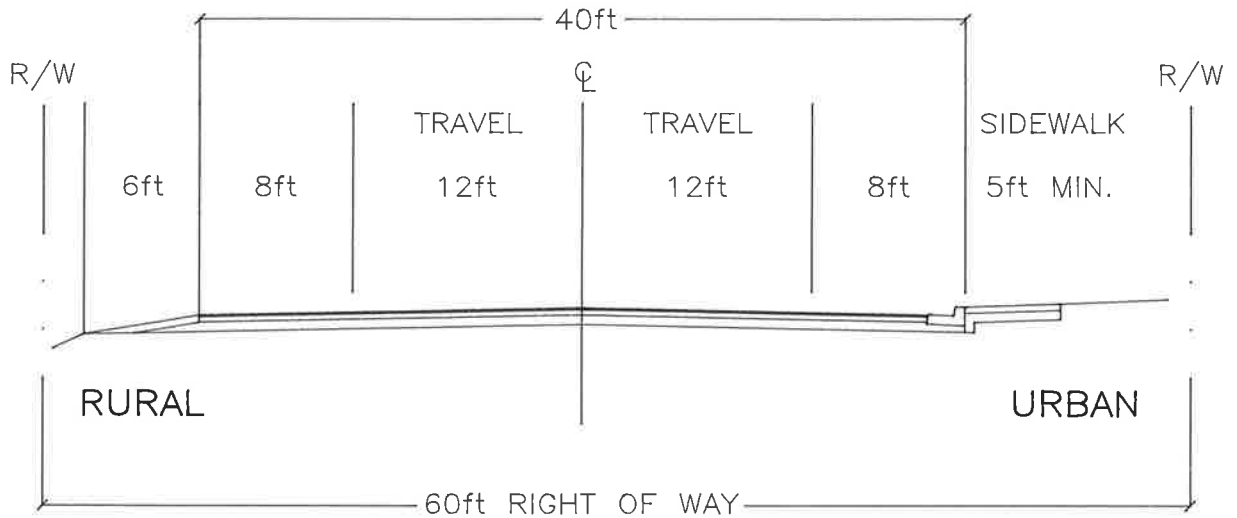
MAJOR ARTERIAL  
MINOR ARTERIAL  
ROAD STANDARDS

DATE  
APR. 1992

SHEET NO.  
1-2

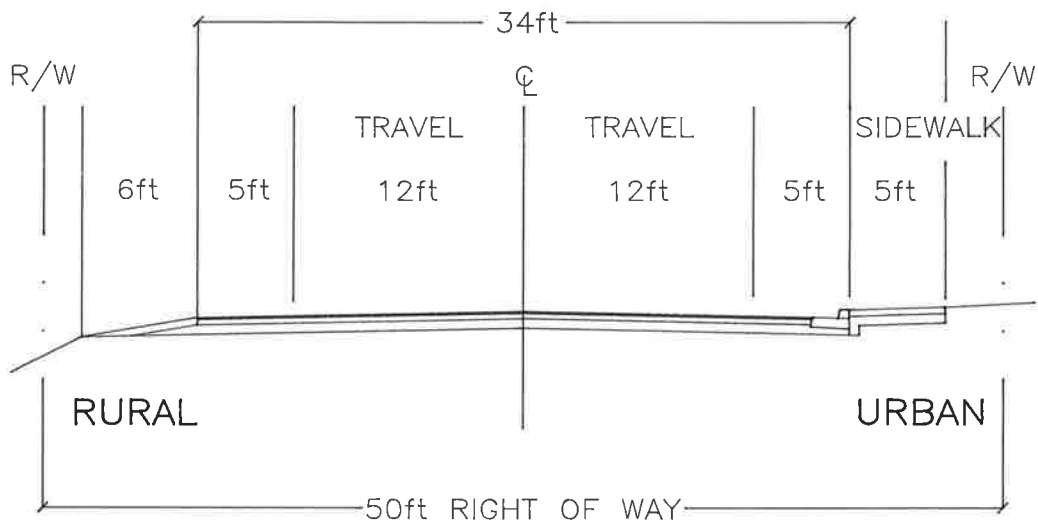


### COLLECTOR ROAD



DESIGN SPEED 35 MPH

### LOCAL ROAD



DESIGN SPEED 25 MPH

SEE SECTION 210 FOR  
CROSS SECTION INFORMATION

COLUMBIA COUNTY

COLLECTOR ROAD  
LOCAL ROAD

ROAD STANDARDS

DATE  
APR. 1992

SHEET NO.  
2-2

CHAPTER II

DESIGN SPECIFICATIONS

## 210 STREET DESIGN

### 210.01 SUBGRADE EVALUATION

Soil testing to obtain the strength of the soil is required for all roads to analyze and design the road structural section. Soil tests are needed on undisturbed samples of the subgrade materials that are expected to be within three (3) feet of the planned subgrade elevation. Samples are needed for each one thousand (1,000) feet of roadway and for each visually observed soil type. Soil tests are required for a minimum of two (2) locations.

The selected design structural strength of the soil needs to be consistent with the subgrade compaction requirements. That is, the strength and compaction moisture content at optimum to slightly over optimum needs to be specified. This soils report shall address subgrade drainage and ground water considerations for year round conditions. Recommendations for both summer and winter construction shall be included.

### 210.02 STRUCTURAL SECTION

Streets may be constructed of:

full depth asphaltic concrete, or

asphaltic concrete with crushed rock base or treated bases, or

portland cement concrete with cushion course of crushed rock or on a base of crushed rock or treated base.

#### 210.02.1 ASPHALT PAVEMENT DESIGN

The wearing surface of asphalt concrete (A.C.) streets shall be Type C. Minimum total thickness of asphalt concrete shall be three (3) inches in two (2) lifts. If thickness of asphalt concrete is three (3) inches or more, placement shall be in at least two (2) lifts.

Asphalt pavement may be designed using any nationally recognized procedure, both the ODOT and the Asphalt Institute methods are discussed below.

#### Oregon State Highway Division Method

Test the soil to determine the R-value by AASHTO 190. Design and testing guidelines are available from the state offices in Salem or the County's Land Development Services Department staff.

Determine the 18 kip Equivalent Axle Load (EAL) constant. Use a Traffic Analysis Worksheet (See Figure 1) to calculate 18 kip EAL and the Traffic Coefficient. The 2-way traffic should be based on vehicle classification counts and functional classification of the street. The expansion factor for a twenty (20) year period and the daily traffic for each project should be determined by a traffic study or by the County.

Calculate the total structural thickness for the roadway section in terms of the crushed aggregate base. This is the Crushed Base Equivalent in inches, (CBE).

$$\text{CBE} = 0.03546 (\text{TC}) (100-\text{R})$$

Choose the structural section for the street using Table II.

#### Asphalt Institute Method

Design of asphalt concrete pavement structures by this method shall conform to the guidelines of The Asphalt Institute Publication, Thickness Design - Asphalt Pavements for Highways and Streets, Manual Series No. 1.

The Equivalent Axle Load (EAL) for design of streets shall be determined by a traffic analysis considering traffic growth, truck distribution determined on the basis of local traffic data and load equivalency factors as set forth in the above referenced manual, MS-1. For minor collectors and local roads, the EAL may be determined using simplified procedures which relate the EAL to the average daily number of eighteen thousand (18,000) lb. single axle loads estimated for the design lane during the design period.

Test and evaluate the subgrade soil strength for the pavement design. Testing methods shall include, but not be limited to:

The Asphalt Institute Publication, Method of Test for Resilient Modulus of Soil, Manual Series No. 10 or

AASHTO T-193 (CBR Method), or

AASHTO T-190 (R-Value Method).

If the CBR value of the subgrade exceeds twenty (20) or the R-value of the subgrade exceeds sixty (60), then CBR and R-Value methods shall not be used.

210.02.2 DESIGN EXAMPLE

A.C. STRUCTURAL SECTIONS EXAMPLE (ODOT METHOD)

FIND: STRUCTURAL SECTION (Asphaltic Concrete)

GIVEN: 24 HOUR TRAFFIC MIX (90-2 axle trucks, 45-3 axle trucks, 5-4 axle trucks, 90-5 axle trucks, 0-6 axle trucks, 25 buses)

R = 6 (ODOT Method)

STEP I. Complete the traffic analysis worksheet, Figure I, as shown in Figure II.

STEP II. TC = 9.2 (from Step I).

STEP III. Go to Table II, with R = 6, and TC = 9.2, find CBE = 31.8".

STEP IV. Using CBE factors from Table II, go to CBE factors Table II and find that:

Alternative I

4" "AC" x 2 = 8.0" CBE  
2" 3/4"-0 x 0.8" = 1.6" CBE  
13" CTB x 1.8" = 23.4" CBE  
33.0" CBE

or we find an alternative structural section could be:

Alternative II

8" "AC" x 2 = 16.0" CBE  
2" 3/4"-0 x 0.8" = 1.6" CBE  
18" 2"-0 x 0.8" = 14.4" CBE  
32.0" CBE

FIGURE I - TRAFFIC ANALYSIS WORK SHEET

PRESENT ADT \_\_\_\_\_  
 PRESENT NUMBER OF:  
 2 Axle trucks \_\_\_\_\_  
 3 Axle trucks \_\_\_\_\_  
 4 Axle trucks \_\_\_\_\_  
 Tri-Met Buses \_\_\_\_\_  
 5 Axle trucks \_\_\_\_\_  
 6 Axle trucks \_\_\_\_\_

STREET \_\_\_\_\_  
 FROM \_\_\_\_\_  
 TO \_\_\_\_\_  
 $D = B \times C$   
 $E = \frac{B+D}{2}$

$F = \text{One-Way Annual}$   
 $G = E \times F$   
 $18 \text{ Kip EAL}$   
 $TC = 9 \times \frac{20 \text{ Year } 18\text{Kip EAL}}{1,000,000}$  0.119

| A    | B | C    | D | E | F     | G |
|------|---|------|---|---|-------|---|
| 2    |   | 1.48 |   |   | 36.5  |   |
| 3    |   | 1.48 |   |   | 119.5 |   |
| 4    |   | 1.48 |   |   | 157.0 |   |
| 5    |   | 1.48 |   |   | 296.0 |   |
| 6    |   | 1.48 |   |   | 325.0 |   |
| TMB* |   | 1.48 |   |   | 540.0 |   |

TOTAL - AVG. ANNUAL 18 Kip EAL = \_\_\_\_\_  
 18 Kip EAL/day = \_\_\_\_\_  
 20 Year 18 Kip EAL = \_\_\_\_\_  
 Traffic Coefficient, TC = \_\_\_\_\_

\* TMB abbreviates Tri-Met Buses

FIGURE II - TRAFFIC ANALYSIS WORK SHEET (EXAMPLE)

PRESENT ADT 3800  
 PRESENT NUMBER OF:  
 2 Axle trucks 90  
 3 Axle trucks 45  
 4 Axle trucks 5  
 Tri-Met Buses 25  
 5 Axle trucks 90  
 6 Axle trucks 0

STREET A Street  
 FROM X Road  
 TO Y Road

D = BxC

E =  $\frac{B+D}{2}$

F = One-Way Annual

G = ExF

18 Kip EAL  
 TC =  $g \times \frac{20 \text{ Year } 18\text{Kip EAL}}{1,000,000}$  0.119

| A    | B  | C    | D     | E     | F     | G        |
|------|----|------|-------|-------|-------|----------|
| 2    | 90 | 1.48 | 133.2 | 111.6 | 36.5  | 4,073.4  |
| 3    | 45 | 1.48 | 66.6  | 55.8  | 119.5 | 6,668.1  |
| 4    | 5  | 1.48 | 7.4   | 6.2   | 157.0 | 973.4    |
| 5    | 90 | 1.48 | 133.2 | 111.6 | 296.0 | 33,033.6 |
| 6    | 0  | 1.48 | 0     | 0     | 325.0 | 0        |
| TMB* | 25 | 1.48 | 37.0  | 31.0  | 540.0 | 16,740   |
|      |    |      |       |       |       | 61,488.5 |

TOTAL - AVG. ANNUAL 18 Kip EAL = 61,488.5  
 18 Kip EAL/day = 168.5  
 20 Year 18 Kip EAL = 1,229,770.0  
 Traffic Coefficient, TC = 9.2

\* TMB Abbreviates Tri-Met Buses

TABLE II - CRUSHED BASE EQUIVALENT ALL ROADS

| TRAFFIC<br>COEFFICIENT | R=4<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R=8<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R=12<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R=18<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R=22<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R=26<br>MINIMUM<br>"CBE"<br>REQUIREMENT | R-30<br>MINIMUM<br>"CBE"<br>REQUIREMENT |
|------------------------|--|--|---|---|---|---|---|
| 12.0-13.0              | 42.5"                                  | 41.0"                                  | 39.0"                                   | 36.5"                                   | 34.5"                                   | 33.0"                                   | 31.0"                                   |
| 11.0-12.0              | 39.0"                                  | 37.5"                                  | 36.0"                                   | 33.5"                                   | 32.0"                                   | 30.0"                                   | 28.5"                                   |
| 10.0-11.0              | 36.0"                                  | 34.5"                                  | 33.0"                                   | 30.5"                                   | 29.0"                                   | 27.5"                                   | 26.0"                                   |
| 9.0-10.0               | 32.5"                                  | 31.0"                                  | 29.5"                                   | 27.5"                                   | 26.5"                                   | 25.0"                                   | 24.0"                                   |
| 8.0-9.0                | 29.0"                                  | 27.5"                                  | 26.5"                                   | 24.5"                                   | 23.5"                                   | 22.5"                                   | 21.0"                                   |
| 7.0-8.0                | 25.5"                                  | 24.5"                                  | 23.5"                                   | 22.0"                                   | 21.0"                                   | 20.0"                                   | 18.5"                                   |
| 6.0-7.0                | 22.0"                                  | 21.0"                                  | 20.0"                                   | 19.0"                                   | 18.0"                                   | 17.0"                                   | 16.0"                                   |
| 4.8-6.0                | 18.5"                                  | 17.5"                                  | 17.0"                                   | 15.5"                                   | 15.0"                                   | 14.0"                                   | 13.5"                                   |
| Below 4.8              | 16.5"                                  | 15.5"                                  | 15.0"                                   | 14.0"                                   | 13.5"                                   | 12.5"                                   | 12.0"                                   |

CBE Factors

|   |   |                     |
|---|---|---------------------|
| 1.0" Asphaltic Concrete Wearing Surface or Base | = | 2.0" Aggregate Base |
| 1.0" Emulsion Treated Wearing Surface or Base   | = | 2.0" Aggregate Base |
| 1.0" Cement Treated Base                        | = | 1.8" Aggregate Base |
| 1.0" Plant Mix Bituminous Base                  | = | 1.8" Aggregate Base |
| 1.0" Oil Mat                                    | = | 1.8" Aggregate Base |
| 1.0" Cement Treated Existing Roadway Material   | = | 1.5" Aggregate Base |
| 1.0" Lime or Cement Treated Subgrade            | = | 1.0" Aggregate Base |
| 1.0" Aggregate Subbase                          | = | 0.8" Aggregate Base |

Above Factors apply to materials that comply with the Oregon Department of Transportation's (ODOT) Standard Specifications and Special Provisions.

Use fabric mat where moisture is present in the subgrade, or use fabric mat plus excavate an additional 12" and replace with rock for unusually wet subgrade conditions.



### 210.02.3 PORTLAND CEMENT CONCRETE STRUCTURES

Design portland cement concrete streets using the guidelines and requirements of the Portland Cement Association (PCA) design procedures found in the below listed publications:

Concrete Streets: Typical Pavement sections and Jointing Details (1S211.01P).

Thickness Design for Concrete Highway and Street Pavements (EB109.01P).

Joint Design for Concrete Highway and Street Pavements (1S059.03P).

Test the subgrade and determine the Modulus of Subgrade Reaction,  $k$ , to design the street structure. A correlation of CBR to  $k$  may be made using Figure 2, Thickness Designs for Concrete Highway and Street Pavements.

Minimum thickness of portland cement concrete shall be five (5) inches. Design modulus of rupture (MR) shall be five hundred twenty-five (525) psi. A higher value of modulus of rupture shall be allowed if adequately supported by test data.

Use a twenty (20) year design period.

### 210.03 HORIZONTAL ALIGNMENT

Alignments shall meet the following requirements:

Centerline alignment of improvements should be parallel to the centerline of the right-of-way.

Centerline of a proposed street extension shall be aligned with the existing street centerline.

Horizontal curves in alignments shall meet the minimum radius requirements as shown in Table III.

### 210.04 VERTICAL ALIGNMENT

Alignments shall meet the following requirements:

Minimum tangent street gradients shall be one-half (0.5) percent along the crown and curb.

Maximum street gradients shall be fifteen (15) percent for minor collectors, and local streets, and ten (10) percent for all other streets. Grades in excess of fifteen (15) percent must be approved by the County Roadmaster on an individual basis.



TABLE III - DESIGN SPEED/CENTERLINE RADIUS-MINIMUMS

MAJOR COLLECTORS/ARTERIALS STREETS/ALL RURAL ROADS

| Design Speed(MPH) | Friction Factor(F) | Slope/R min. |          |        |         |        |        |
|-------------------|--------------------|--------------|----------|--------|---------|--------|--------|
|                   |                    | (e)-4%       | (e)-2.5% | (e) 0% | (e)2.5% | (e) 4% | (e) 6% |
| 25                | .165               | 335'         | 300'     | 255'   | 220'    | 205'   | 185'   |
| 30                | .160               | 500'         | 445'     | 375'   | 325'    | 300'   | 275'   |
| 35                | .155               | 710'         | 630'     | 530'   | 455'    | 420'   | 380'   |
| 40                | .150               | 970'         | 855'     | 710'   | 610'    | 560'   | 510'   |
| 45                | .145               | 1285'        | 1125'    | 930'   | 795'    | 730'   | 660'   |
| 50                | .140               | 1665'        | 1450'    | 1190'  | 1010'   | 925'   | 835'   |
| 55                | .130               | 2240'        | 1920'    | 1550'  | 1300'   | 1190'  | 1060'  |
| 60                | .120               | 3000'        | 2525'    | 2000'  | 1655'   | 1500'  | 1335'  |

MINOR COLLECTORS/LOCAL STREET

| Design Speed(MPH) | Friction Factor(F) | Slope/R min. |          |        |         |        |        |
|-------------------|--------------------|--------------|----------|--------|---------|--------|--------|
|                   |                    | (e)-4%       | (e)-2.5% | (e) 0% | (e)2.5% | (e) 4% | (e) 6% |
| 25                | 0.252              | 195'         | 185'     | 165'   | 150'    | 145'   | 135'   |
| 30                | 0.221              | 330'         | 305'     | 270'   | 245'    | 230'   | 215'   |
| 35                | 0.197              | 520'         | 475'     | 415'   | 370'    | 345'   | 320'   |

NOTES:

For Table III - off right-of-way runoff shall be controlled to prevent concentrated cross flow in superelevated sections.

Where superelevation is used, street curves should be designed for a maximum superelevation rate of 0.04. If terrain dictates sharp curvature, a maximum superelevation of 0.06 is justified if the curve is long enough to provide an adequate superelevation transition.

On local streets, requests for design speeds less than 25 mph shall be based on topography, R.O.W., or geographic conditions which impose an economic hardship on the applicant. Requests must show that a reduction in centerline radius will not compromise safety. There will be posting requirements associated with designs below 25 mph.

TABLE IV - DESIGN CONTROLS FOR CREST VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

| DESIGN SPEED | K         |
|--------------|-----------|
| 25           | 20 - 20   |
| 30           | 30 - 30   |
| 35           | 40 - 50   |
| 40           | 60 - 80   |
| 45           | 80 - 120  |
| 50           | 110 - 160 |
| 55           | 150 - 220 |

$$K = \frac{L}{A} = \frac{\text{Feet}}{\text{Percent}}$$

A = Algebraic Difference in grades, percent.  
 L = Length of vertical curve, feet.

TABLE V - DESIGN CONTROLS FOR SAG VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

| DESIGN SPEED* | K         |
|---------------|-----------|
| 25            | 30 - 30   |
| 30            | 40 - 40   |
| 35            | 50 - 50   |
| 40            | 60 - 70   |
| 45            | 70 - 90   |
| 50            | 90 - 110  |
| 55            | 100 - 130 |

WHERE:  $K = \frac{L}{A} = \frac{\text{Feet}}{\text{Percent}}$

A = Algebraic Difference in grades, percent.

L = Length of vertical curve, feet.

\* Values may be reduced if street lighting is present for sag vertical curves. AASHTO publication, An Informational Guide for Roadway Lighting shall serve as a guide.

Local streets intersecting with a minor collector or greater functional classification street or streets intended to be posted with a stop sign, shall provide a landing averaging five (5) percent grade or less. Landings are that portion of the street within twenty (20) feet of the edge of the intersecting street at full improvement.

Grade changes of more than one (1) percent shall be accomplished with vertical curves.

Street grades, intersections and superelevation transitions shall be designed to not allow concentrations of stormwater to flow over the pavement.

Off-set crowns shall be allowed and must conform to Standard Drawing M-403.

Streets intersected by streets not constructed to full urban standards shall be designed to match both present and future vertical alignments of the intersecting street. The requirements of this manual shall be met for both present and future conditions.

Vertical curves shall conform to the values found in Tables IV and V.

Slope easements shall be dedicated or obtained for the purposes of grading outside of the rights-of-way.

#### 210.05 INTERSECTIONS

The following specify the minimum requirements for intersections:

The interior angle at intersecting streets shall be kept as near to ninety (90) degrees as possible and in no case shall it be less than seventy-five (75) degrees. A tangent section shall be carried a minimum of twenty-five (25) feet each side of intersecting right-of-way lines.

Curb radii at intersections shall be as shown in Table VI for the various function classifications. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way to curb spacing as the lower classified street.

Sidewalk access ramps shall be provided at all corners of all intersections, regardless of curb type, and shall conform to Standard Drawing CS-306.

TABLE VI - TURNING RADII (FEET)

Edge of Pavement/Curb - Minimums\*

| Street Classification        | Maj/Min Arterial Street | Major Collector Street | Minor Collector Street | Transit Street | Commercial Industrial Street | Local Street |
|------------------------------|-------------------------|------------------------|------------------------|----------------|------------------------------|--------------|
| Major/Minor Arterial Street  | 55                      | 40                     | 30                     | 40             | 40                           | 25           |
| Major Collector Street       | 40                      | 40                     | 30                     | 40             | 40                           | 25           |
| Minor Collector Street       | 30                      | 30                     | 30                     | 30             | 30                           | 25           |
| Transit Street               | 40                      | 40                     | 30                     | 40             | 40                           | 25           |
| Commercial Industrial Street | 40                      | 40                     | 30                     | 40             | 40                           | 25           |
| Local Street                 | 25                      | 25                     | 25                     | 25             | 25                           | 25           |

\* If bike lane or on-street parking exists, above radii maybe reduced by five (5) feet.

#### 210.06 CUL-DE-SACS, EYEBROWS, TURNAROUNDS

The following specifies the minimum requirements for cul-de-sacs, eyebrows, and turnaround areas. Other turnaround geometrics may be used when conditions warrant and the County Roadmaster approves the design and application of its use.

Cul-de-sacs, eyebrows and turnaround areas shall be allowed only on local streets and commercial/industrial streets.

Cul-de-sacs shall not be more than six hundred (600) feet in length. The length of a cul-de-sac shall be measured along the centerline of the roadway from the near side right-of-way of the nearest through traffic intersecting street to the farthest point of the cul-de-sac right-of-way.

The minimum curb radius for cul-de-sac bulbs shall be forty-five (45) feet and the right-of-way radius shall be sufficient to maintain at least the same right-of-way to curb spacing as in the adjacent portion of the road.

Option - 42' radius with mountable curb and 4' sidewalks.

Cul-de-sacs, eyebrows and turnaround areas shall have a six (6) foot public utility easement extending outside the right-of-way around the cul-de-sac continuously.

The optional cul-de-sac (as shown in Standard Drawing M-405.1) shall have a minimum of a 48' radius accompanied by a 10' sidewalk and P.U.E. easement.

The minimum curb radius for transitions into cul-de-sac bulbs shall be twenty-five (25) feet and the right-of-way radius shall be sufficient to maintain the same right-of-way to curb spacing as in the adjacent portion of the road.

An Eyebrow Corner maybe used on a local street where expected ADT will not exceed five hundred (500) vehicles per day. See Standard Drawing 405.5.

#### 210.07 SIGHT DISTANCE

The sight distance requirements shall conform to County requirements Aprox 300.

#### 210.08 DRIVEWAYS

The following specifies the minimum requirements for driveways:

Driveways shall conform to Standard Drawings DW-200 through DW-205.

Driveways shall not be permitted on streets with existing or proposed non-access reserve strips.

Concentrated surface runoff shall not be allowed to flow over commercial driveways or sidewalks.

Driveways constructed on streets without curbs shall meet the minimum intersection sight distance requirements.

Driveways greater than 150' in length shall meet all fire code requirements.

#### 210.09 CURBS AND GRADING

The following specifies the requirements for curbs and cross-slope grading for streets:

Urban arterial and major collector roads shall include curbs on both sides except in the situations of interim width improvements. Interim designs shall have shoulders and ditches. Emergency mountable curb and gutter shall be required on urban arterial and major collector roads.

Rural streets or interim width urban streets shall have six (6) foot wide shoulders adjacent to the street at a two and one-half (2-1/2) percent cross-slope and roadside ditches each side of the shoulders with a maximum side-slope of two (2) to one (1). The six (6) foot shoulder area may consist of a section of pavement and/or a section of crushed rock. The pavement section shall be a minimum of two (2) feet wide and a maximum of six (6) feet wide.

Grading outside the improved areas shall be as follows:

Minor collectors or higher functional classifications shall have a two and one-half (2-1/2) upward grading to the right-of-way line and no steeper than one and one-half (1-1/2) to one (1) up or two (2) to one (1) down outside the right-of-way.

Local street functional classifications shall have a two and one-half (2-1/2) upward grading to the right-of-way line, a five (5) to one (1) upward or downward grading within the public utility easement and no steeper than one and one-half (1-1/2) to one (1) up or two (2) to one (1) down outside the public utility easement.



Retaining walls shall be used if slopes are greater than the one and one-half (1-1/2) to one (1) requirement in the paragraphs above. Retaining walls shall be constructed to a height where the slope is no more than one and one-half (1-1/2) to one (1).

Cross-slope of the street section shall be no less than two and one-half (2-1/2) percent and no greater than five (5) percent. Whenever possible, the crown of the street shall be the same elevation as the top of the curbs.

#### 210.10 SIDEWALKS

The following specifies the requirements for sidewalks:

Sidewalks shall be constructed according to Standard Drawing CS-305. The location and width of the sidewalks shall be as required by the land development review.

Where clustered mailboxes or other objects larger than single mailboxes are within a sidewalk, the walk shall be widened to provide clearance equal to the required sidewalk width.

In the instances where it is required to install sidewalks and a permanent sidewalk cannot be constructed or standards met, a temporary walkway may be constructed. The temporary sidewalk may consist of an asphaltic concrete or portland cement concrete to a width, location and structure approved by the County Roadmaster.

#### 210.11 BIKEWAYS

The need for bikeways shall be determined by the County. Bikeway facilities shall meet the requirements of this document and the American Association of State Highway and Transportation Officials publication, Guide for Development of New Bicycle Facilities, as amended and adopted by the Oregon Department of Transportation. SOURCE: REFERENCE 11.

A bikeway may be constructed adjacent to the curb within the pavement area.

Structural sections of bikeway facilities on streets shall conform to that of the street or be integral with the curb. Bikeway facilities off street (Standard Drawing CS-307, shall be constructed over a sterilized, (if covered by asphalt concrete) compacted subgrade with one of the following structures:

Four (4) inches of asphalt concrete (full depth), or three (3) inches of asphalt concrete with four (4) inches

of three-quarter (3/4) inch minus rock base, or four (4) inches of portland cement concrete with two (2) inches of three-quarter (3/4) inch minus rock base.

Design standards regarding horizontal alignment, grade, sight distance, intersections, signing, marking, structures, drainage and lighting shall conform to the AASHTO standards. When bikeways are integrated with a curb, all inlet grates shall be designed to protect the bicyclist from the grate or opening.

#### 210.12 RAISED MEDIANS

The following specifies the minimum requirements for raised medians:

Raised medians are allowed on certain streets.

Where raised medians are allowed, the following criteria must be met:

The raised median shall be set back at least two (2) feet from the median lane on both sides.

Street lighting shall be sufficient to provide illumination of the raised median.

Objects, such as trees, shrubs, signs, light poles, etc., shall not physically or visually interfere with vehicle or pedestrian traffic in the travelway.

The style and design of the raised median shall be site specific. The raised median shall be safe for the design speed. Raised median designs shall be subject to County approval, see Standard Drawing CS-301.

#### 210.13 SUBSURFACE DRAINAGE

Subsurface street drainage must be considered in the design of each street. Subsurface drains shall be designed and constructed per the recommendations of the soils report. In the event that no subsurface drainage is required, based on the soils report, a transverse perforated drain pipe shall be installed below the subbase rock at the point of each sag vertical curve, see Standard Drawings D-116 and D-117. The subsurface drains are for the purpose of collecting and conveying subsurface water only, not surface runoff. They are not to be considered part of the storm drainage system for storm drain pipe sizing purposes.

Subsurface drains shall connect and drain into the storm drainage system at catch basins, curb inlets, gutter inlets, manholes or road side ditches. Surcharge from the storm drainage system shall not be allowed to back up into the subsurface drains. Alternative subsurface drainage measures may be used, if approved by the County Roadmaster.

#### 210.14 GUARDRAILS

The following specifies the minimum requirements for the location and type of guardrails:

The decision of whether to install a guardrail or not shall be based on information found in AASHTO publication, GUIDE FOR SELECTING, LOCATING, AND DESIGNING TRAFFIC BARRIERS.

#### 210.15 TRANSITIONS

Street width transitions from a narrower width to a wider width shall be designed with a three (3) to one (1) taper. Delineators, as approved by the County, shall be installed to define the configuration.

Street width transitions from a wider width to a narrower width, the length of transition taper shall be determined as follows:

$$L = S \times W \quad \text{for } S = 45 \text{ MPH or more}$$

$$L = \frac{W \times S}{60} \quad \text{for less } S \text{ than } 45$$

Where L = minimum length of taper (ft.)

S = Design speed (MPH)

W = EP to EP offset width

Delineators, as approved by the County, may be installed to define the configuration. Maximum spacing of delineators shall be the numerical value of the design speed, in feet (i.e. thirty-five (35) foot spacing for thirty-five (35) MPH).

In situations where a tapered transition cannot be provided, a barricade shall be installed at the end of the wider section of the street and a taper shall be appointed and delineated as approved by the County. The barricade shall conform to Standard Drawing M-402. If the wider section does not provide an additional travel lane, only a barricade is required without the transition.

#### 210.16 SUPERELEVATION CROSS-SECTIONS

Off-set crown cross-sections are not acceptable as superelevation sections.

#### 210.17 STUB STREETS

Stub streets allow for future extensions and a reserve strip at the terminus of the right-of-way shall be provided. Said reserve strip shall be a least one (1) foot in width and extend the full length of the right-of-way.

#### 210.18 PRIVATE STREETS

Private streets are subject to the requirements in this document (see the attached Exhibit "A").

#### 210.19 UTILITIES

Utilities shall be located outside of the paved road, if at all possible, to avoid future cuts in paved roads. On all phased (interim) road improvements, the necessary utilities shall be stubbed across the interim improvement to assure cuts are not necessary when the road is expanded to its full width.

Except for sanitary sewers, underground utilities intended to provide direct service to adjacent properties with future connections shall not be located in the full-width paved section of a street to be constructed. If all service connections are installed and extended beyond the full-width section prior to paving the street, underground utilities can be located in the paved section, if approved by the County.

Underground utilities being constructed along existing paved streets shall not be located under the existing pavement unless approved by the County. Underground utilities that must cross an existing paved street shall not be installed by any method which cuts the pavement, unless approved by the County.

Underground utilities shall be buried a minimum depth of thirty (30) inches, as measured from finished grade to top of utility.

Street lights shall be located as required to provide proper illumination, but shall not physically or visually interfere with vehicle or pedestrian traffic.

## 220 DRAINAGE DESIGN

### 220.01 GENERAL

The following establishes the requirements for the design of facilities intended to protect the public health, safety and welfare from damage due to flooding. Provisions must be made to provide for surface drainage on and crossing the development. A specific level of protection from all damage is encompassed in this chapter. Beyond that level of protection, additional measures are specified which should minimize the potential damage.

Provisions must be made for gravity drainage for roofs and foundation drains for new homes and offices in a development. For commercial or industrial developments, these drains shall be piped directly to a storm drain system. In residential developments, these drains shall be piped to the street gutter or directly to the storm drain system. The connection to the street gutter must be through a three (3) inch plastic pipe set in the curb during construction or cut through an existing curb, see Standard Drawings CS-300 and CS-301. In residential developments where topography prevents connecting foundation and roof drains as required above, these drains for two (2) lots or more shall be piped to the public storm drain system through a dedicated drainage easement; pipe and easement requirements shall conform to these standards.

These requirements shall apply to all storm drainage facilities in existing and proposed County Road rights-of-way, public rights-of-way, public drainage easements and tracts of common ownership in unincorporated areas. Storm drainage systems include, but are not limited to: inlets, pipes, ditches, creeks, rivers and runoff detention facilities.

### 220.02 SYSTEM COMPONENTS

#### 220.02.1 CATCH BASINS, CURB INLETS AND GUTTER INLETS

The spacing between catch basins and curb or gutter inlets shall be as required hydraulically by the street gutter and the basin for local roads. Flow shall not run deeper than four (4) inches against a curb. For all other road classifications, gutter flow shall not run in the travel lane or deeper than four (4) inches against a curb. Catch basins and gutter inlets shall be of sufficient size to accept the inflows without backing up water on the street.

Catch basins with curb inlets or gutter inlets shall be provided just prior to curb returns on streets with a centerline gradient of three (3) percent or more and a street gutter drainage run of one hundred (100) feet or more.

Standard catch basins shall have a maximum height from top of grate to flowline of pipe of three and one-half (3-1/2) feet and shall be used with a maximum pipe diameter of twenty-seven (27) inches in the side walls and twelve (12) inches in the end walls. Minimum depth shall be pipe diameter plus twelve (12) inches.

Oversize catch basins, and gutter inlets shall have a maximum height from top of grate to flowline of pipe of six (6) feet and shall be used with a maximum pipe diameter of twenty-seven (27) inches in the side walls and twenty-seven (27) inches in the end walls. Gutter Inlet-4A Manholes (Standard Drawing C-113) shall conform to the requirements for manholes in this section.

Catch basins with curb inlets, either standard or oversize, shall be used on all streets with curbs.

Oversize catch basins with curb inlets or gutter inlets shall be installed at the low point of all sag vertical curves in streets. For streets without curbs, oversize catch basins shall be used.

Catch basins shall normally connect to a receiving conveyance pipe with a manhole or another catch basin, or gutter inlet. Where the conveyance pipe is thirty-six (36) inches or larger, tee connections are allowed. Wye connections are not allowed.

Pavement tapers are required for all catch basins and gutter inlets and shall conform to the Standard Drawing CS-304.

Catch basins, curb and gutter inlets shall conform to the Standard Drawings D-100 through D-108 and D-113 through D-115.

#### 220.02.2 PIPES AND CULVERTS

All pipes and culverts shall be a minimum of ten (10) inches in diameter. For pipes and culverts not of circular cross-section, the minimum clear dimension that crosses the centroid shall be ten (10) inches.

All pipes and culverts shall have sufficient slope to maintain a minimum flow velocity of three (3.0) feet per second when flowing just full; two and one-half (2-1/2) feet per second may be allowed with sufficient justification.

Tongue and groove joints are preferred and shall be used when commercially available in the size required. Joints used shall meet the manufacturer recommendations.

All pipe and culvert type shall be as required by size, loading, bedding and trench conditions.

No curved storm drain pipes shall be allowed by joint displacement or deflection if it results in a joint that allows the adjacent soil material to enter the pipe. Joints with rubber gaskets shall be used for all curved storm drains. Minimum radii shall be as shown in Table XVI.

All pipe and culvert outlets with exit velocities in excess of four (4) feet per second shall be examined with respect to soil type to guarantee adequate erosion control. Where grades require, all end pipes shall be supported by tie downs, end walls or aprons, etc., to prevent the separation and dislodging of pipe sections.

### 220.02.3 MANHOLES

Manholes shall not have open grate lids with the intent to receive surface flows. Catch basins or curb inlets must be used.

Manholes shall have a maximum spacing such that no pipe has a continuous run of five hundred (500) feet without access from a catch basin, curb inlet, ditch inlet, open end pipe or manhole. Four hundred (400) feet is the desired maximum.

Manholes, shall be required at, but not limited to, the following locations:

Abrupt change in vertical grade or horizontal alignment of storm drain pipes.

Change in size or abrupt change in elevation of storm drain pipes.

Uppermost extent of storm pipe not open (daylighted) to receive ditch or other open conveyance flows. Cleanouts are not allowed in this situation.

Manholes with pipe horizontal alignment changes of more than thirty (30) degrees in angle shall have the outlet pipe invert at least two-tenths (0.20) of a foot in elevation lower than all inflow pipe inverts, in addition to the normal grade crossing the manhole.

Catch basins and curb inlets may be used instead of manholes if the above are satisfied and the catch basin and curb inlet criteria are also satisfied. For pipes of forty-eight (48) inch diameter and larger, fabricated bends are allowed.

Manholes shall have two hole lids; in some locations, tamper proof lids may be required. Heavy duty frames and covers shall be used on all manholes.

Manholes and catch basins deeper than four (4.0) feet, measured from top of frame to flowline, shall have steps installed.

Offset manholes shall be used with pipes larger than thirty-six (36) inches.

Manholes and appurtenances shall conform to Standard Drawings D-109 through D-112.

#### 202.02.4 DITCHES AND CHANNELS

Proposed roadside ditches shall be properly sized to pass all required flows, have a maximum depth of no more than two (2) feet as measured from the shoulder of the road, side slopes no steeper than two (2) to one (1) and have a minimum flow velocity of three (3) feet per second when flowing full. All other ditches shall be properly sized to pass all required flows but are not limited to the geometric restrictions of roadside ditches. Any proposed roadside ditch improvement that does not meet this requirement above shall be piped.

All proposed or modified channels shall have adequate erosion control provisions to prevent damage to the shoulder of the adjacent road or the water course channel. Side slopes no steeper than two (2) to one (1) will be allowed unless soil/rock conditions substantiated by a geotechnical report demonstrates that erosion control is adequate. Four (4) to one (1) is the desired channel side slope.

No protruding pipes, culverts or other structures which reduce or hinder the flow characteristics of the ditch channel or creek will be allowed.

#### 220.02.5 STANDARD DRAWINGS

Drainage structures shall conform to the applicable Standard Drawings in this Manual. Materials for all structures shall be as specified on the Standard Drawings. Allowable materials for pipes and culverts are specified in the HYDRAULICS section of this chapter.

#### 220.03 HYDROLOGY

The following specifies the minimum requirements for the hydrologic criteria necessary for design of storm drains and culverts:

##### Methodology

The Rational Method ( $Q=CIA$ ) is the standard method for calculations related to the peak discharge and other



related hydrologic information for drainages of less than four hundred (400) acres. For reference to the concepts and theories of the Rational Method, see "The American Society of Civil Engineers", Design and Construction of Sanitary and Storm Sewers or others. If other hydrologic methods are used, calibration or comparison to the Rational Method is required prior to acceptance by the County.

#### Drainage Basin Areas (A)

The drainage area used in the design or analysis of storm drainage facilities shall include all areas that are or will be tributary (both on and off the project site) to the location under consideration.

#### Runoff Coefficients (C)

The runoff coefficients used in the design or analysis of storm drainage facilities shall vary depending on existing land uses and the maximum potential zoning of all land tributary to the location under consideration. Table VII shows minimum acceptable values for the coefficients. The composite runoff coefficients shall be the acceptable form and standard for this parameter.

In some instances, the use of individual characteristic runoff coefficients is more appropriate than composite coefficients. Project-specific composite coefficients can be calculated from an area-weighted-average basis using characteristic coefficients. Table VIII shows minimum acceptable values for the coefficients. The characteristic runoff coefficients shall only be used when required by the County.

The general guidelines and the specific methods found in the Drainage Master Plan shall prevail if a conflict is found between this manual and the Drainage Master Plan.

#### Rainfall Intensity (I)

The rainfall intensity used in the design and analysis of storm drainage facilities shall vary depending on the time of concentration for the drainage basin that is tributary to the location under consideration. Tables IX and X show a tabular representation of the rainfall intensities for the 2, 5, 10, 25, 50 and 100 year storm events as a function of time of concentration. Interpolate for values not shown.

TABLE VII - COMPOSITE RUNOFF COEFFICIENT CHART

| Existing Land Use<br>or<br>Maximum Potential Zoning    |       | Values of coefficient, C    |          |              |
|--|-------|-----------------------------|----------|--------------|
|  |       | Average Gradient of Terrain |          |              |
|  |       | Less than 2%                | 2% to 7% | More than 7% |
| Use  | Zone* |                             |          |              |
| Commercial or Industrial                               | 4     | 0.70                        | 0.80     | 0.90         |
| Multiple Family  | 3     | 0.60                        | 0.65     | 0.70         |
| Duplexes, Single Family                                | 2     | 0.50                        | 0.55     | 0.60         |
| Single Family & Schools                                | 1     | 0.40                        | 0.45     | 0.50         |
| Parks, golf courses,<br>Agricultural<br>or undeveloped | 5     | 0.20                        | 0.25     | 0.30         |

\* These are to be used as a guide in evaluating undeveloped land based on current zoning and where no information is available defining a proposed development.

| ZONE | PRIMARY LAND USE DISTRICT            |
|------|--------------------------------------|
| 1    | R-5 (Residential 5 units per acre)   |
| 1    | R-6 (Residential 6 units per acre)   |
| 2    | R-9 (Residential 9 units per acre)   |
| 3    | R-15 (Residential 15 units per acre) |
| 3    | R-24 (Residential 24 units per acre) |
| 3    | R-25 (Residential 25 units per acre) |
| 4    | NC Neighborhood Commercial           |
| 4    | CBD Community Business District      |
| 4    | GC General Commercial                |
| 4    | OC Office Commercial                 |
| 4    | IND Industrial                       |
| 2    | INS Institutional                    |
| 5    | Undeveloped, Rural                   |
| 4    | SID Special Industrial District      |

TABLE VIII - CHARACTERISTIC RUNOFF COEFFICIENT CHART

| Values of coefficient, C |                             |          |              |
|--------------------------|-----------------------------|----------|--------------|
| Land Characteristic      | Average Gradient of Terrain |          |              |
|                          | Less than 2%                | 2% to 7% | More than 7% |
| Asphalt or concrete      | 0.85                        | 0.90     | 0.95         |
| Roofing                  | 0.85                        | 0.90     | 0.95         |
| Grassy surface           | 0.20                        | 0.25     | 0.30         |
| Bare soil                | 0.30                        | 0.35     | 0.40         |

TABLE IX

## RAINFALL INTENSITIES FOR NORTH COLUMBIA COUNTY

Rainfall Intensity (inches/hr)

| TIME OF<br>CONCENTRATION<br>(MIN) | STORM EVENT - YR/(PROBABILITY) |            |             |            |            |             |
|-----------------------------------|--------------------------------|------------|-------------|------------|------------|-------------|
|                                   | 2<br>(50%)                     | 5<br>(20%) | 10<br>(10%) | 25<br>(4%) | 50<br>(2%) | 100<br>(1%) |
| 0                                 | 2.50                           | 3.30       | 3.80        | 4.20       | 5.00       | 5.50        |
| 5                                 | 2.50                           | 3.30       | 3.80        | 4.20       | 5.00       | 5.50        |
| 10                                | 1.50                           | 2.20       | 2.80        | 3.25       | 3.80       | 4.30        |
| 15                                | 1.25                           | 1.80       | 2.20        | 2.60       | 3.10       | 3.50        |
| 20                                | 1.00                           | 1.40       | 1.75        | 2.10       | 2.50       | 2.80        |
| 30                                | 0.80                           | 1.10       | 1.30        | 1.60       | 1.80       | 2.10        |
| 40                                | 0.65                           | 0.95       | 1.10        | 1.35       | 1.55       | 1.80        |
| 50                                | 0.55                           | 0.80       | 0.95        | 1.15       | 1.30       | 1.55        |
| 70                                | 0.50                           | 0.70       | 0.85        | 1.00       | 1.15       | 1.30        |
| 100                               | 0.45                           | 0.60       | 0.75        | 0.87       | 1.00       | 1.10        |
| 180 or<br>more                    | 0.40                           | 0.50       | 0.60        | 0.75       | 0.90       | 0.95        |

TABLE X

## RAINFALL INTENSITIES FOR SOUTH COLUMBIA COUNTY

Rainfall Intensity (inches/hr)

| TIME OF<br>CONCENTRATION<br>(MIN) | STORM EVENT - YR/(PROBABILITY) |            |             |            |            |             |
|-----------------------------------|--------------------------------|------------|-------------|------------|------------|-------------|
|                                   | 2<br>(50%)                     | 5<br>(20%) | 10<br>(10%) | 25<br>(4%) | 50<br>(2%) | 100<br>(1%) |
| 0                                 | 1.90                           | 2.50       | 3.00        | 3.40       | 4.00       | 4.50        |
| 5                                 | 1.90                           | 2.50       | 3.00        | 3.40       | 4.00       | 4.50        |
| 10                                | 1.30                           | 1.70       | 2.20        | 2.50       | 3.00       | 3.50        |
| 15                                | 1.10                           | 1.40       | 1.80        | 2.10       | 2.50       | 2.90        |
| 20                                | 0.90                           | 1.20       | 1.50        | 1.80       | 2.10       | 2.40        |
| 30                                | 0.75                           | 0.95       | 1.20        | 1.40       | 1.65       | 1.90        |
| 40                                | 0.60                           | 0.75       | 1.00        | 1.15       | 1.30       | 1.60        |
| 50                                | 0.55                           | 0.70       | 0.85        | 1.00       | 1.15       | 1.35        |
| 70                                | 0.45                           | 0.55       | 0.70        | 0.82       | 0.95       | 1.10        |
| 100                               | 0.40                           | 0.45       | 0.55        | 0.67       | 0.75       | 0.90        |
| 180 or<br>more                    | 0.35                           | 0.40       | 0.50        | 0.60       | 0.70       | 0.85        |

TABLE XI

OVERLAND FLOW TRAVEL TIME OF CONCENTRATION  
(MIN)

| LENGTH OF<br>OVERLAND FLOW<br>(FT) | AVERAGE GRADIENT OF TERRAIN |     |    |    |      |     |      |      |     |     |     |     |                |    |   |
|------------------------------------|-----------------------------|-----|----|----|------|-----|------|------|-----|-----|-----|-----|----------------|----|---|
|                                    | 1% or<br>less               |     |    | 2% |      |     | 4%   |      |     | 7%  |     |     | 10% or<br>more |    |   |
|                                    | A                           | B   | C  | A  | B    | C   | A    | B    | C   | A   | B   | C   | A              | B  | C |
| 50                                 | 11                          | 6.5 | 4  | 10 | 5.5  | 3   | 8.5  | 4    | 2   | 7.5 | 3.5 | 2   | 7              | 3  | 2 |
| 100                                | 15                          | 8.5 | 5  | 13 | 7.5  | 4   | 11.5 | 6.5  | 3   | 10  | 5.5 | 2   | 9              | 5  | 2 |
| 200                                | 20                          | 11  | 6  | 17 | 9.5  | 5   | 15   | 8.5  | 4   | 13  | 7.5 | 3   | 12.5           | 7  | 2 |
| 300                                | 23                          | 13  | 7  | 20 | 11.5 | 6   | 18   | 10   | 5   | 16  | 9   | 4   | 14             | 8  | 3 |
| 400                                | 26                          | 15  | 8  | 22 | 12.5 | 6.5 | 20   | 11   | 6   | 18  | 10  | 5   | 16             | 9  | 4 |
| 500                                | 28                          | 16  | 9  | 24 | 14   | 7   | 22   | 12.5 | 6.5 | 19  | 11  | 6   | 18             | 10 | 5 |
| 700                                | 33                          | 18  | 10 | 28 | 16   | 8   | 25   | 14   | 7.5 | 22  | 12  | 6.5 | 20             | 11 | 6 |

This Table is to be used for Sheet Flow conditions only.

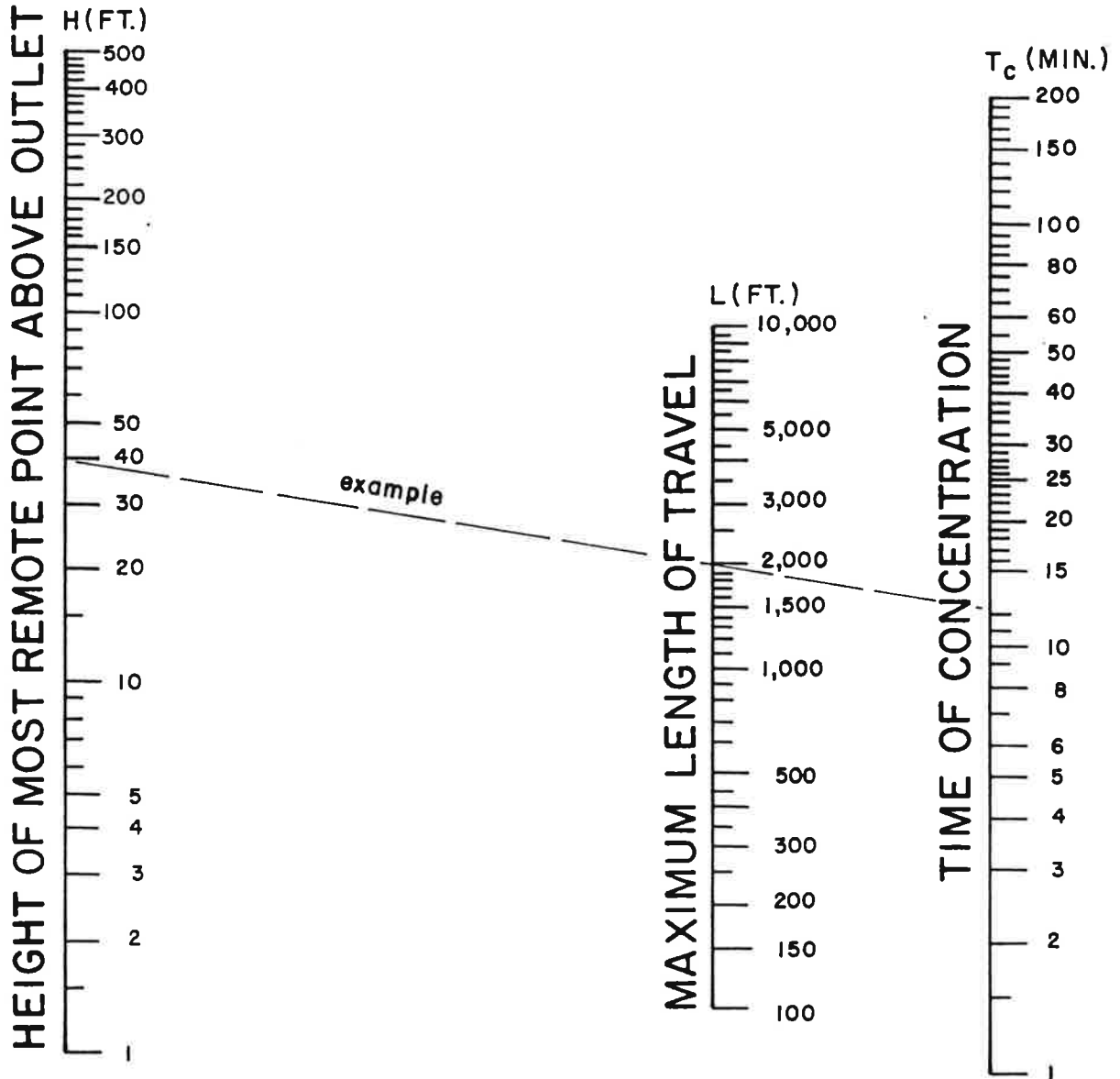
## SURFACE TYPE:

- A Grassy
- B Bare Soil
- C Rooftop/Paved

FIGURE III

# TIME OF CONCENTRATION

NOTE: USE NOMOGRAPH  $T_c$  FOR NATURAL BASINS WITH WELL DEFINED CHANNELS.



KIRPICH, P.Z., "TIME OF CONCENTRATION OF SMALL AGRICULTURAL WATERSHEDS", CIVIL ENGINEERING, 29, 60, 1959.

The time of concentration shall be calculated as the time required for all portions of the drainage basin to contribute to the location under consideration assuming the most extensive land use possible. This time is the addition of the travel time for overland flow from the most remote part of the drainage basin to the headwaters of the conveyance system. For drainage basins not yet fully developed, the anticipated conveyance system must be incorporated to generate the shortest possible time of concentration.

Table XI shows the acceptable values for the overland flow travel time. For residential developments use the nominal travel time of ten (10) minutes from roof to gutter or use Table XI; whichever is less.

Figure III may be used to compute time of concentration in rural areas, Zone 5 (ref. Table VII).

The travel time in a conveyance system shall be based on the full-flow velocity of the conveyance facilities.

The benefits of upstream detention systems shall not be accounted for in determining the time of concentration for any storm drain system.

#### Design Event

The following specifies the design event for sizing storm drainage facilities:

All conveyance components (such as catch basins, curb inlets, manholes, pipes, culverts, ditch inlets, ditches, swales, etc.) shall be designed to provide a level of protection from all damages due to flooding for all storm events with a four (4) percent or greater probability of occurrence in any one (1) year (twenty-five (25) year event). Beyond this level of protection, additional measures shall be designed to minimize the potential damage incurred as stated under HYDRAULICS.

Design flows shall be based on the maximum runoff created by existing land uses, the maximum potential zoning (according to the Comprehensive Plan) or a combination thereof.

### 220.04 HYDRAULICS

#### 220.04.1 GENERAL

The following specifies the minimum requirements for various hydraulic criteria necessary for the design and



## construction of storm drains:

All conveyance components shall be designed to provide a level of protection from all damage due to flooding for the 25th year storm event. Hydraulically, "a level of protection from all damage due to flooding" means that all surface runoff waters must pass through a conveyance system without flooding streets, rights-of-way, public and private property and other items of value not normally publicly acceptable to be flooded. Surcharge in below-ground facilities shall be allowed provided that it will not cause surface flooding. Surcharge in below-ground facilities shall not be allowed if it will cause subsurface seepage flooding in any portion of a habitable structure, including the below-floor crawl spaces.

Beyond the level of protection stated above, additional measures must be designed to minimize the potential damage incurred for more intense rainfall. Hydraulically, "additional measures must be designed to minimize the potential damage incurred" means that surface runoff may surcharge the flood and cause damage, but this damage must be minimized as far as practicable. This level of minimization shall include making all attempts, as far as practicable, to reduce potential damage due to flooding in regards to loss of life, public safety, public and private property, structures and other items of value. Methods to minimize potential damage may include, but are not limited to, site grading, overflow structures (such as ditches), etc.

The benefits of upstream detention systems shall not be accounted for in designing a conveyance system.

### 220.04.2 IMPACT CONSIDERATIONS

#### Overall System Design Considerations

Improvement projects shall address more than just the on-site drainage concerns. The off-site concerns, both upstream and downstream of a project, are critical to the development of proper improvements. The requirements in this section address most of those concerns.

#### Impacts on Upstream Off-site Property

Modifications to the existing on-site storm drainage facilities shall not restrict flows creating backwater onto off-site property to levels greater than the existing situation.

#### Impacts on Downstream Off-site Property

Proposed storm drainage facility modifications shall not move the location of the runoff's outflow without executing properly recorded agreements with all affected downstream property owners.

Proposed concentration of outflows shall not be allowed without executing properly recorded agreements with all affected property owners between the release point and an existing defined receiving conveyance facility such as a pipe, culvert, ditch, creek, river, etc.

Agreements described above shall include, but are not limited to, execution of the proper easements in favor of the public and construction of conveyance facilities satisfactory to all property owners and the County.

Siltation of receiving streams due to construction of streets, drainage facilities and other utilities shall be prevented through the use of temporary on-site siltation detention systems. Such systems shall be subject to County approval. Erosion control plans and details may be required by the County as part of regular plan submittal.

#### Upstream Impacts on On-site Property

Storm drainage facilities shall be designed and constructed to accommodate all flows generated from upstream off-site property (assuming no upstream detention) for the most extensive land-use possible, be it the existing land-use, the maximum potential zoning of the off-site property or a combination thereof.

#### Downstream Impact on On-site Property

The design of storm drainage facilities shall take into account the impact of downstream restrictions on the project site. These restrictions that create on-site backwater shall either be removed by the development or their impact incorporated into the on-site design.

#### 220.04.3 FLOW CAPACITIES

The following describes the detailed procedures required for the calculation of flow capacities of drainage



facilities. This section also specifies the capacities for most common hydraulic components. If hydraulic components other than those discussed in this section are proposed or encountered, the method of hydraulic calculations shall be subject to County approval. If other methods of hydraulic calculations are used for components discussed in this section, calibration or comparison to the methods in this section is required prior to acceptance by the County.

The maximum acceptable intake flowrate for catch basins, curb inlets and gutter inlets shall be as shown in Table XII.

The maximum acceptable intake flowrate for area drains shall be as shown in Table XIII.

#### Pipes and Culverts

For inlet control, pipe and culvert capacities shall be shown in Table XV. This inlet control table assumes worst case entrance condition. For various improved entrances, the Oregon State Highway Division, Hydraulics Manual is acceptable for capacity determinations.

For outlet control, Manning's Formula with proper consideration for entrance, exit and other minor losses shall be the accepted method of calculation. See Table XIV for the acceptable values of Manning's "n" and minor loss coefficients.

#### Ditches and Creeks (open channels)

For inlet control (upstream control), flow depths and elevations shall be based on critical depth calculations.

For outlet control (downstream control), the Standard Step Method using Manning's Formula with proper consideration for entrance, exit, contraction, expansion and other minor losses shall be the accepted method for calculating flow elevation profiles. See Table XIV for the acceptable values of Manning's "n" and minor loss coefficients.

#### 220.04.4 MATERIALS

Pipes and culverts may be constructed of the following materials:

- concrete
- asphalt coated corrugated steel

TABLE XII - CATCH BASIN & CURB INLET CAPACITIES

| Structure<br>Style                             | Maximum Allowable Intake Flowrate (cfs) |             |           |
|--|---|-------------|-----------|
|  | Centerline Street Gradient (%)          |             |           |
|  | 0 (SAG)                                 | Less than 6 | 6 or more |
| *Standard Catch Basin<br>w/pavement taper      | N/A                                     | 3.0         | N/A       |
| *Oversize Catch Basin<br>w/pavement taper      | 8.0                                     | 4.5         | N/A       |
| Standard Curb Inlet<br>w/pavement taper        | N/A                                     | 3.5         | 2.5       |
| Oversize Curb Inlet<br>w/pavement taper        | 8.0                                     | 5.0         | 3.5       |
| Gutter Inlet 2 1/2A<br>w/pavement taper 2 1/2" | 4.2                                     | N/A         | N/A       |
| Gutter Inlet 4A<br>w/pavement taper 2 1/2"     | 6.7                                     | N/A         | N/A       |

N/A - Not allowed in this situation.

\* - Not allowed on streets with curbs.

TABLE XIII - AREA DRAIN, TYPE II CAPACITIES

|                      |  | Grate Angle 30° |     |      |      |      |      |      |      |      |      |
|----------------------|--|-----------------|-----|------|------|------|------|------|------|------|------|
| Hydraulic Head (ft)* |  | 0.5             | 1.0 | 1.5  | 2.0  | 2.5  | 3.0  | 4.0  | 5.0  | 7.0  | 10.0 |
| Flowrates C          |  | 2.0             | 5.6 | 10.3 | 11.9 | 13.3 | 14.6 | 16.8 | 18.8 | 22.3 | 26.6 |

\*Measured from bottom of grate to headwater.

TABLE XIV - FRICTION AND MINOR LOSS COEFFICIENTS

Friction Coefficients

| <u>Conveyance Facility</u>   | Manning's n (FT <sup>1/6</sup> ) |
|--|----------------------------------|
| Concrete Pipe . . . . .  | 0.012                            |
| Polyvinyl Chloride (PVC) pipe . . . . .                                | 0.008                            |
| Corrugated Polyethylene (CPE) pipe . . . . .                           | 0.026                            |
| Ductile or cast iron . . . . .   | 0.014                            |
| Corrugated aluminum or steel pipe                                      |                                  |
| Annular (2-2/3" x 1/2") . . . . .                                      | 0.025                            |
| Helical (2-2/3" x 1/2")  |                                  |
| not full flow . . . . .  | 0.025                            |
| 10", 12" flowing full . . . . .  | 0.013                            |
| 18" flowing full . . . . .   | 0.015                            |
| 24" flowing full . . . . .   | 0.017                            |
| 36" flowing full . . . . .   | 0.019                            |
| 48" flowing full . . . . .   | 0.021                            |
| 54" flowing full . . . . .   | 0.022                            |
| Annular (3" x 1") . . . . .  | 0.025                            |
| Helical (3" x 1")  |                                  |
| not full flow . . . . .  | 0.025                            |
| 36" flowing full . . . . .   | 0.020                            |
| 48" flowing full . . . . .   | 0.020                            |
| 54" flowing full . . . . .   | 0.021                            |
| 60" flowing full . . . . .   | 0.021                            |
| 66" flowing full . . . . .   | 0.021                            |
| 72" flowing full . . . . .   | 0.022                            |
| Fully paved . . . . .  | 0.012                            |
| Earth ditches; straight, uniform, clean . . . . .                      | 0.025                            |
| Earth ditches; rough, grass . . . . .                                  | 0.035                            |
| Stream channels; fine gravel, straight, grass . . . . .                | 0.030                            |
| Stream channels; coarse gravel, straight, clean banks . . . . .        | 0.035                            |
| Stream channels; fine gravel, slightly winding, grass . . . . .        | 0.045                            |
| Stream channels; fine gravel, slightly winding, weeds . . . . .        | 0.048                            |
| Stream channels; fine gravel, slightly winding, obstructions . . . . . | 0.055                            |
| Stream channels; obstructed, very winding . . . . .                    | 0.080                            |

For overbanks flooding and other characteristics refer to Ven Te Chow's, Open-Channel Hydraulics

TABLE XIV - FRICTION AND MINOR LOSS COEFFICIENTS (CONTINUED)

Minor loss coefficients

| <u>Situation</u>                    | <u>k-factor</u> |
|-------------------------------------|-----------------|
| <b>Pipes:</b>                       |                 |
| Entrance . . . . .                  | 0.5             |
| Exit . . . . .                      | 1.0             |
| Expansion . . . . .                 | 1.0             |
| Contraction . . . . .               | 0.5             |
| 10° bends . . . . .                 | 0.04            |
| 20° bends . . . . .                 | 0.10            |
| 30° bends . . . . .                 | 0.15            |
| 45° bends . . . . .                 | 0.25            |
| 60° bends . . . . .                 | 0.35            |
| 90° bends . . . . .                 | 0.50            |
| <b>Open channel:</b>                |                 |
| Abrupt contractions . . . . .       | 0.6             |
| Abrupt expansions . . . . .         | 0.8             |
| Gradual contractions . . . . .      | 0.1             |
| Gradual expansions . . . . .        | 0.3             |
| Abrupt direction changes . . . . .  | 0.4             |
| Gradual direction changes . . . . . | 0.2             |



TABLE XV - PIPE/CULVERT CAPACITIES FOR INLET CONTROL

| Hydraulic Head (feet)* | Flowrates, Q (cfs) |      |      |      |      |      |      |      |
|------------------------|--------------------|------|------|------|------|------|------|------|
|                        | Diameter (in)      |      |      |      |      |      |      |      |
|                        | 10                 | 12   | 15   | 18   | 21   | 24   | 27   | 30   |
| 1.00                   | 2.1                | 2.4  | -    | -    | -    | -    | -    | -    |
| 1.25                   | 2.4                | 3.3  | 4.2  | -    | -    | -    | -    | -    |
| 1.50                   | 2.7                | 3.8  | 5.5  | 6.7  | -    | -    | -    | -    |
| 1.75                   | 3.0                | 4.2  | 6.3  | 8.5  | 9.8  | -    | -    | -    |
| 2.00                   | 3.3                | 4.6  | 6.9  | 9.5  | 12.3 | 13.6 | -    | -    |
| 2.25                   | 3.6                | 5.0  | 7.5  | 10.4 | 13.6 | 16.9 | 18.3 | -    |
| 2.50                   | 3.8                | 5.3  | 8.1  | 11.2 | 14.8 | 18.5 | 21.5 | 23.8 |
| 3.00                   | 4.2                | 6.0  | 9.1  | 12.8 | 16.9 | 21.4 | 26.2 | 31.2 |
| 3.50                   | 4.6                | 6.5  | 10.0 | 14.1 | 18.8 | 23.9 | 29.5 | 35.4 |
| 4.00                   | 5.0                | 7.1  | 10.8 | 15.3 | 20.5 | 26.2 | 32.4 | 39.2 |
| 4.50                   | 5.3                | 7.6  | 11.6 | 16.5 | 22.0 | 28.3 | 35.1 | 42.6 |
| 5.00                   | 5.6                | 8.0  | 12.4 | 17.5 | 23.5 | 30.2 | 37.7 | 45.7 |
| 6.00                   | 6.2                | 8.9  | 13.7 | 19.5 | 26.2 | 33.8 | 42.2 | 51.5 |
| 7.00                   | 6.7                | 9.6  | 14.9 | 21.3 | 28.6 | 37.0 | 46.4 | 56.6 |
| 8.00                   | 7.2                | 10.4 | 16.0 | 22.9 | 30.9 | 40.0 | 50.2 | 61.4 |
| 9.00                   | 7.7                | 11.0 | 17.1 | 24.4 | 33.0 | 42.8 | 53.7 | 65.8 |
| 10.00                  | 8.1                | 11.6 | 18.1 | 25.9 | 35.0 | 45.4 | 57.0 | 69.9 |
| 12.00                  | 8.9                | 12.8 | 19.9 | 28.5 | 38.6 | 50.1 | 63.1 | 77.4 |
| 15.00                  | 10.1               | 14.4 | 22.4 | 32.1 | 43.5 | 56.6 | 71.3 | 87.6 |

\*Measured from invert to headwater.

TABLE XV - PIPE/CULVERT CAPACITIES FOR INLET CONTROL (CONTINUED)

| Hydraulic<br>Head<br>(feet)* | Flowrates (cfs) |      |      |     |     |     |     |
|------------------------------|-----------------|------|------|-----|-----|-----|-----|
|                              | Diameter (in)   |      |      |     |     |     |     |
|                              | 36              | 42   | 48   | 54  | 60  | 66  | 72  |
| 3.00                         | 37.6            | -    | -    | -   | -   | -   | -   |
| 3.50                         | 48.1            | 55.3 | -    | -   | -   | -   | -   |
| 4.00                         | 53.8            | 69.4 | 77.2 | -   | -   | -   | -   |
| 4.50                         | 58.9            | 76.8 | 95.6 | 104 | -   | -   | -   |
| 5.00                         | 63.6            | 83.5 | 105  | 127 | 135 | -   | -   |
| 5.50                         | 68.0            | 89.7 | 113  | 138 | 159 | 171 | -   |
| 6.00                         | 72.2            | 95.4 | 121  | 148 | 177 | 177 | 201 |
| 7.00                         | 79.8            | 106  | 135  | 167 | 200 | 236 | 272 |
| 8.00                         | 86.7            | 116  | 148  | 184 | 222 | 262 | 304 |
| 10.00                        | 99.2            | 133  | 171  | 213 | 259 | 308 | 360 |
| 12.00                        | 110             | 148  | 191  | 239 | 391 | 348 | 408 |
| 15.00                        | 125             | 169  | 218  | 273 | 334 | 400 | 471 |

\*Measured from invert to headwater.

**TABLE VI - TONGUE & GROOVE PIPE ON CURVED ALIGNMENT**

| Pipe Diameter<br>in<br>Inches | **MINIMUM RADIUS OF CURVATURE in FEET |     |       |       |     |     |     |     |     |     |     |
|-------------------------------|---------------------------------------|-----|-------|-------|-----|-----|-----|-----|-----|-----|-----|
|                               | *Length of Pipe Section - in feet     |     |       |       |     |     |     |     |     |     |     |
|                               | 3 1/2                                 | 4   | 6 1/2 | 7 1/2 | 8   |     |     |     |     |     |     |
| 10                            | 128                                   |     |       |       |     |     |     |     |     |     |     |
| 12                            | 149                                   |     | 277   |       |     |     |     |     |     |     |     |
| 15                            |                                       | 208 |       | 390   |     |     |     |     |     |     |     |
| 18                            |                                       | 245 |       | 460   | 121 |     |     |     |     |     |     |
| 21                            |                                       | 283 |       | 530   | 160 | 176 | 192 |     |     |     |     |
| 24                            |                                       | 320 |       | 600   | 195 | 215 | 234 | 254 | 273 | 292 | 311 |
| 27                            |                                       | 357 |       |       | 230 | 253 | 276 | 299 | 322 | 346 | 369 |
| 30                            |                                       | 395 |       |       | 265 | 292 | 318 | 345 | 371 | 398 | 425 |
| 36                            |                                       | 469 |       |       | 300 | 330 | 360 | 390 | 420 | 450 | 480 |
| 42                            |                                       | 560 |       |       | 335 |     | 402 |     | 469 |     | 536 |
| 48                            |                                       | 635 |       |       | 370 |     | 444 |     | 518 |     | 592 |

NOTE! \*\*1. Table is based on a maximum joint deflection of 3/8 inch.  
 \*2. Check with Manufacturer on pipe lengths available.  
 3. Table is based on R=32xDxL as derived by CPAW Bulletin U-11 and Supplement of 4/15/69  
 R=min radius, in feet D=pipe o.d. in feet L=pipe section in feet.

- polymer coated corrugated steel
- corrugated aluminum
- polyvinyl chloride
- corrugated polyethylene
- cast iron
- ductile iron

The material used shall be adequate to carry anticipated dead and live loads within deflection limits specified by the manufacturer. All pipes and culverts shall have a minimum design service life of seventy-five (75) years based on manufacturer recommendations and be per the applicable ASTM (American Society of Testing Materials) standards. All pipes and culverts shall be strong enough to withstand the stresses created by cleaning equipment. Installation techniques shall be documented and follow manufacturers recommendations.

Pipes of different metals shall be connected together properly to avoid damaging chemical interaction between the two metals.

#### 220.04.5 MISCELLANEOUS DRAINAGE REQUIREMENTS

All portions of the storm drainage system shall preferably be located in right-of-ways, but if necessary, may be located in easements or common tracts.

All common tracts for open drainage facilities such as ditches and creeks shall be ten (10) feet wider than the width necessary to carry the flows of a ten (10) year storm. This additional width shall be on one side only, be usable for maintenance equipment and have adequate access to a right-of-way.

Easements and Common Tracts that are not straight shall provide space at the corners adequate to allow maintenance vehicles to negotiate the required turns.

### 230 SURVEYING

#### 230.01 GENERAL

This document, Section 105 of the APWA specifications and ORS 209.140-150, define the requirements for protection of



existing survey monuments during any construction and setting new survey monuments following construction of new streets and roads.

#### 230.02 EXISTING SURVEY MONUMENTS

Whenever an existing section corner, quarter corner or donation land claim corner monument or accessory, appears to be in danger of damage or destruction by an construction, the County Surveyor shall be notified in writing, not less than ten (10) working days prior to construction. The County Surveyor shall reference the monument prior to construction and replace it following construction. The County Surveyor shall be reimbursed for all expenses from said replacement by the party responsible for the construction.

As per ORS 209.150, no person shall willfully or negligently remove, destroy or deface any existing survey monument. If damage cannot be avoided, the monument shall be referenced and replaced, under the direction of a Registered Professional Land Surveyor, according to state law. A copy of the field notes referencing such monuments shall be provided to the County Surveyor. Failure to comply with this provision is subject to penalty according to ORS 209.990.

#### 230.03 NEW SURVEY MONUMENTS

Centerline monuments, as shown on Standard Drawing M-404, shall be installed at all centerline intersections of streets (including intersections with existing streets), P.C.'s and P.T.'s of each curve, and at all centers of cul-de-sacs, turn arounds or as required by the County Surveyor to sufficiently monument the right-of-way. Monuments shall be set by a registered Professional Land Surveyor or by the County, at the option of the County. If monuments are set by a registered Professional Land Surveyor, they shall file a record of survey complying with ORS 209.250 and any additional requirements set forth by the County Surveyor. If a monument box is used, or required to be used by the County, it shall not be less than eight (8) inches inside diameter and shall be approved by the County Surveyor before its installation.

### 240 STRUCTURAL DESIGN

#### 240.01 GENERAL

Structures not included in the Standard Drawings of this document shall be designed and constructed in accordance with the requirements of the Structural Design Section of the Oregon State Highway Division of ODOT. These Standards are referenced in ODOT's BRIDGE DESIGN MANUAL AND ACCOMPANYING STANDARD DRAWING, STANDARD SPECIFICATIONS FOR HIGHWAY

CONSTRUCTION, and STANDARD DRAWINGS FOR DESIGN AND CONSTRUCTION.

The project special provisions shall specify the APWA or ODOT requirements for bridges and other structures that apply to the specific project.

250 DESIGN MODIFICATIONS

250.01 GENERAL - REQUEST TO MODIFY SPECIFICATIONS/STANDARDS

To seek approval, non-compliant specifications/standards must be sent through the following process. It is to be noted that if the requested modification involves public safety, the County will rule in the direction of safety.

250.02 MODIFICATION PROCESS

250.02.1 SUBMITTAL

Requests to modify shall be submitted in writing to the County Roadmaster. This written request shall state the desired modification(s), the reason(s) for the request(s) and a comparison between the specification(s)/standard(s) and the modification(s) as far as performance, etc.

Any modification or variance of these Standards should be documented and reference nationally accepted specifications/standards. The use thereof shall not compromise public safety or the intent of the County's standards.

250.02.2 REVIEW

The request to modify shall be reviewed by the County Roadmaster who shall make one of the following decisions:

Approve as is,

Approve with changes, or

Deny with an explanation.

Approval of a request shall not constitute a precedent.

250.02.3 APPEAL

An applicant may appeal the County Roadmaster's decision to the Board of County Commissioners.

250.02.4 CRITERIA FOR MODIFICATION OF SPECIFICATIONS/  
STANDARDS

The County Roadmaster may grant a modification to the adopted specifications or standards when any one of the following conditions are met:

The specification or standard does not apply in the particular application.

Topography, right-of-way or other geographic conditions impose an economic hardship on the applicant and an equivalent alternative which can accomplish the same design is available.

A minor change to a specification or standard is required to address a specific design or construction problem, which, if not enacted, will result in an undue hardship.



CHAPTER III

CONSTRUCTION SPECIFICATIONS

## 310 CONSTRUCTION INSPECTION

### 310.01 GENERAL

All public construction falling under the jurisdiction of the County shall be inspected by an Oregon registered engineer or a qualified individual under the supervision of an Oregon registered engineer. The Road Department will not authorize work to begin on public roads without designation of an inspecting engineer by the owner, developer, or the County.

If the owner or developer does not designate an inspecting engineer, the County shall do so, selecting from a current list of engineers who have indicated their desire to perform such services. All inspection costs, including required testing, shall be paid by the owner or developer directly through service contracts or agreements. The County will require inspection costs be included in the bond or contract assurances as a percent of the total construction costs and in accordance with prevailing professional fee schedules.

An engineer whose firm, or any member of the firm, has a corporate, partnership or any form of real property interest in the development for which the improvements are required, cannot be designated inspecting engineer. The inspecting engineer's relationship to the project must be solely that of a professional service nature.

It shall be the policy of the County not to provide full inspection services for non-public funded public improvements. However, the County may perform limited inspection services upon request, if the project scale is such that the retention of a private inspecting engineer is not warranted. These inspecting requirements are not applicable to individual sidewalk, driveway or utility permits.

### 310.02 COUNTY ACTIVITIES

Inspecting services provided by the County shall include:

1. Liaison between the inspecting engineer and the County;
2. Monitoring of work progress and performance testing as deemed desirable;
3. The performance of administrative and coordinative activities as required to support the processing and completion of the project; and

4. The issuance of stop work orders upon notifying the inspection engineer of the County's intention to do so.

#### 310.03 INSPECTING ENGINEER'S ACTIVITIES

The following minimum activities are required of the designated inspecting engineer:

- 1.\* Execute a form accepting responsibility;
2. Maintain a project log book which contains at least the following information:
  - A. Job number and name of engineer and designees;
  - B. Date and time of site visits;
  - C. Weather conditions, including temperature;
  - D. A description of construction activities;
  - E. Statements of directions to change plans, specifications, stop work, reject materials or other work quality actions;
  - F. Public agency contacts which result in plan changes or other significant actions;
  - G. Perceived problems and action taken;
  - H. General remarks;
  - I. Final and staged inspections;
  - J. Record all material, soil and compact tests.
3. The inspecting engineer shall obtain and use a copy of County-approved construction plans and specifications;
4. Review and approve all pipe, aggregate, concrete, A.C. and other materials to ensure their compliance with County standards;
- 5.\* Approve all plan or specification changes in writing and obtain County approval;
6. Monitor and concur in construction activities to ensure end products meet County specifications;
- 7.\* Perform or have performed material, composition and other tests required to ensure County specifications are met;
8. Periodically check that curb, storm sewer work and pavement and detention pond grades are in accordance with adopted plans;
9. For pavement construction, perform the following stage inspections and record date of each:
  - A. Curbs are built to line and grade;
  - B. Subgrade meets grade and compaction specifications;

- C. Base rock meets grade and compaction specifications;
  - D. Leveling course meets grade and compaction specifications; and
  - E. Wearing course meets grade and compaction specifications. The County shall be given twenty-four (24) hour notice of impending stage inspections.
- 10.\* Periodically certify to the County the amount of work completed to enable release of monies or a reduction of assurance amount;
- \* The inspecting engineer of record must be registered to practice engineering in the State of Oregon. He must personally perform all activities marked by an (\*) and must supervise all individuals performing delegated activities. Material testing not performed by the inspection engineer must be accomplished by a recognized testing firm or another registered engineer.
11. File a completion report which contains:
- A. The original of the project completion certification;
  - B. A complete copy of the log book initialed by the inspecting engineer;
  - C. A complete set of as-built plans; and
  - D. The results of material tests, compaction tests and soil analysis as detailed in the log book.
12. Call to the County's attention within two (2) working days all plan changes, material changes, stop work orders or errors or omissions in the approved plans or specifications.

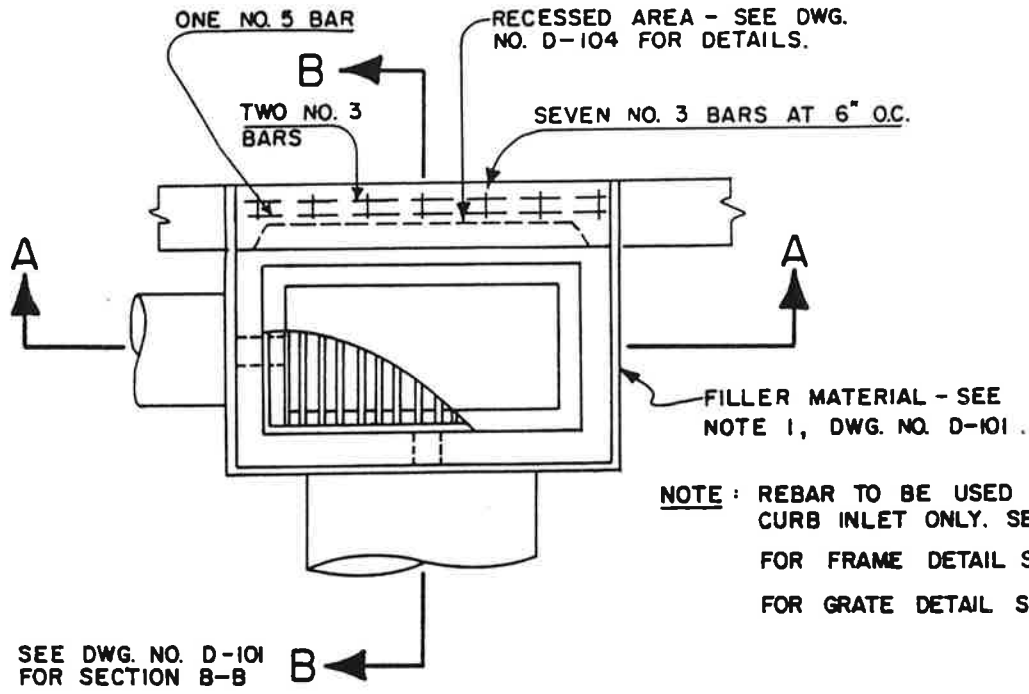
## 320 AS-BUILT DRAWINGS

### 320.01 GENERAL

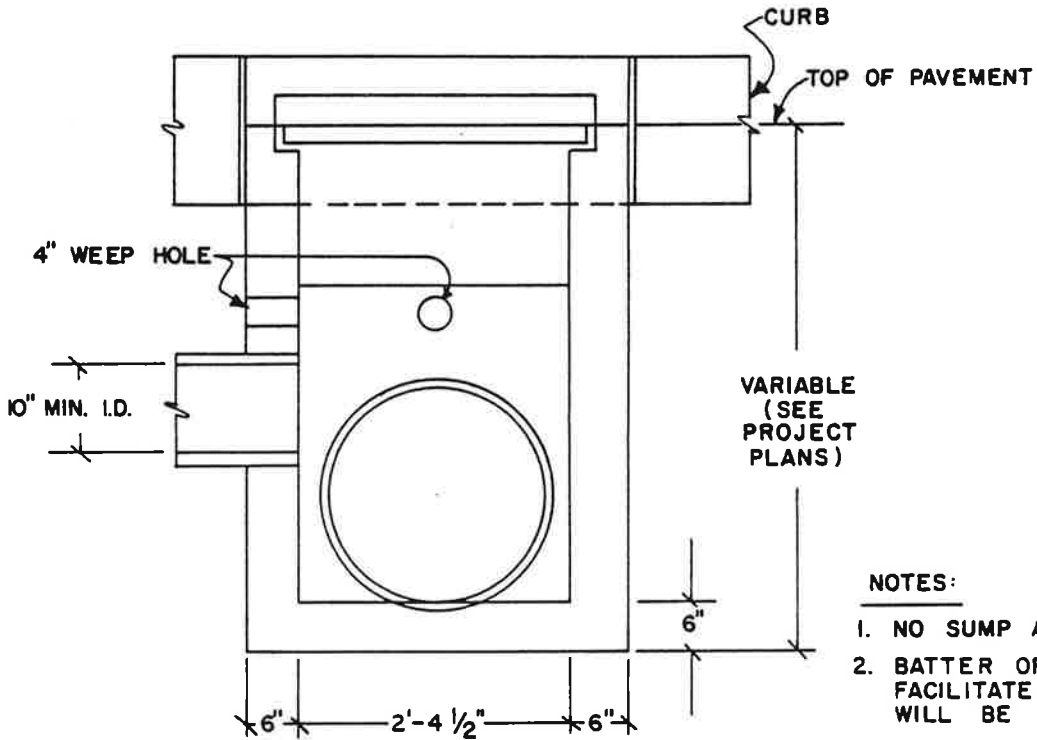
Following completion of construction and approval by the County, three (3) sets of as-built drawings shall be submitted for preliminary review. Drawings shall describe any and all revisions to the previously approved construction plans. If this submittal is acceptable, the engineer shall submit the as-built drawings on 3 mil minimum thickness mylar or a print of contract quality suitable for reproducing and microfilming. If the first submittal was not acceptable, the County will give the engineer notice of what is required for re-submittal.

CHAPTER IV

STANDARD DRAWINGS



**PLAN**



**SECTION A-A**

- NOTES:**
1. NO SUMP ALLOWED.
  2. BATTER OF 1/4" TO 1" TO FACILITATE FORM REMOVAL WILL BE ALLOWED.
  3. TOP OF WEEP HOLE AT SUBGRADE.

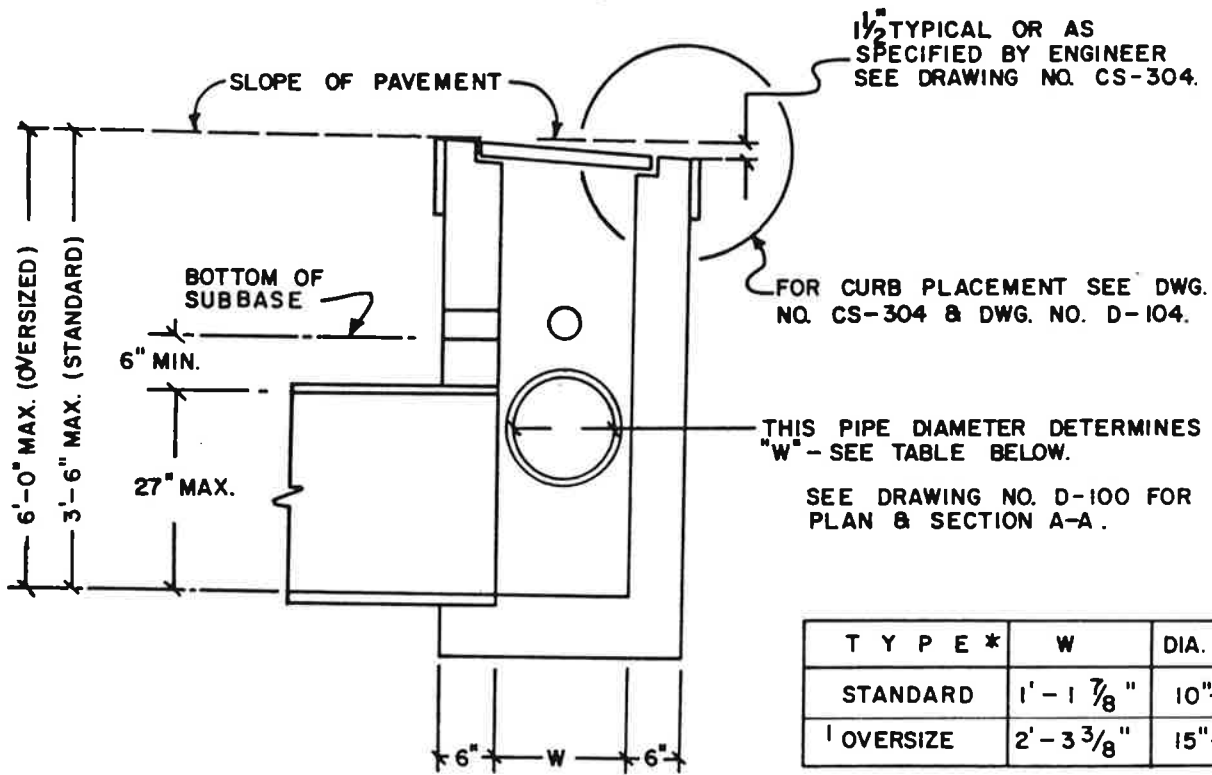
COLUMBIA COUNTY

Catch Basin  
also see Dwg. No.  
D-101 & Dwg. No. 104

Col. Cty. Standard  
Drawing No. D-100

**NOTES :**

1. 3/4" PREFORMED JOINT FILLER MATERIAL TO BE USED AS SPECIFIED BY ENGINEER ONLY IN CONC. PAVEMENT OR GUTTER, AND TO EXTEND THROUGH THICKNESS OF CONCRETE.
2. CONST. CATCH BASIN PER DETAIL, BUT WITH DIMENSION "W" TO ACCOMMODATE LARGEST PIPE DIA. SPECIFIED.
3. CONCRETE SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I. IN 28 DAYS.
4. IF APPROVED BY ENGINEER, WALLS MAY BE POURED AGAINST UNDISTURBED EARTH, EXCEPT FOR THE TOP 8", WHICH SHALL BE FORMED.
5. BACKFILL SHALL BE COMPACTED TO 95% DENSITY THROUGHOUT.
6. OVERSIZE CATCH BASINS : STEPS ARE REQUIRED FOR DEPTH GREATER THAN 4 FEET. INSTALL 2 FT. FROM TOP TO WITHIN 1 FT. OF BOTTOM.



**SECTION B-B**

| T Y P E *             | W           | DIA. PIPE |
|-----------------------|-------------|-----------|
| STANDARD              | 1' - 1 7/8" | 10" - 12" |
| <sup>1</sup> OVERSIZE | 2' - 3 3/8" | 15" - 27" |

FOR GRATE TYPE SEE DWG. NO. D-103

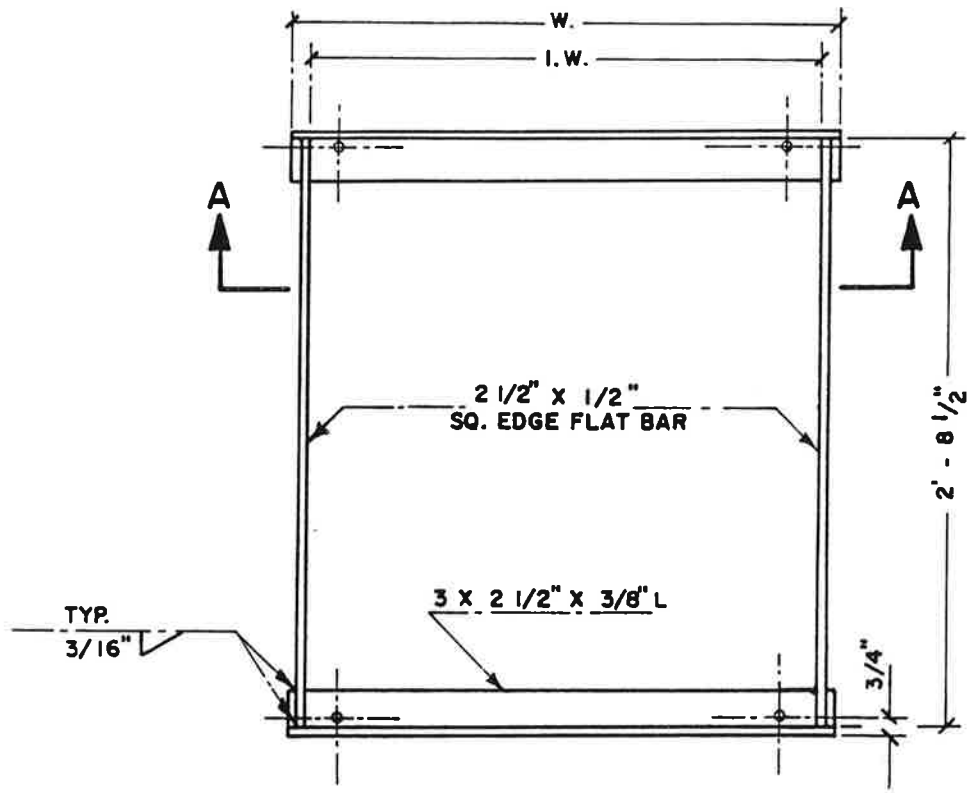
<sup>1</sup> REQUIRES TWO GRATES. SEE DRAWING NO. D-102.

\* "STANDARD" & "OVERSIZE" ARE Columbia CO. DESIGNATIONS.

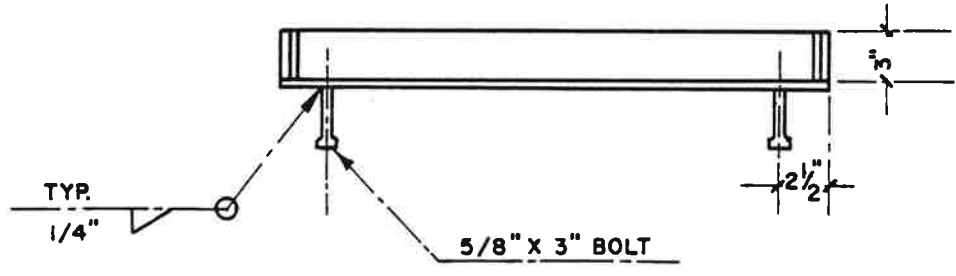
COLUMBIA COUNTY

Catch Basin  
also see Dwg. No.  
D-100 & Dwg. No. D-104

Col. Cty. Standard  
Drawing No. D-101



**PLAN**



**SECTION A-A**

| * TYPE     | DIA. PIPE | W.          | I. W.       |
|------------|-----------|-------------|-------------|
| STANDARD   | 10" - 12" | 1' - 3 1/4" | 1' - 1 7/8" |
| 1 OVERSIZE | 15" - 27" | 2' - 4 3/4" | 2' - 3 3/8" |

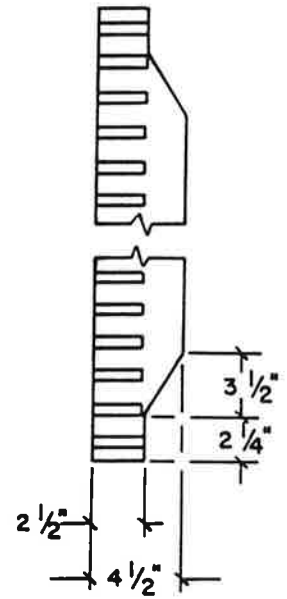
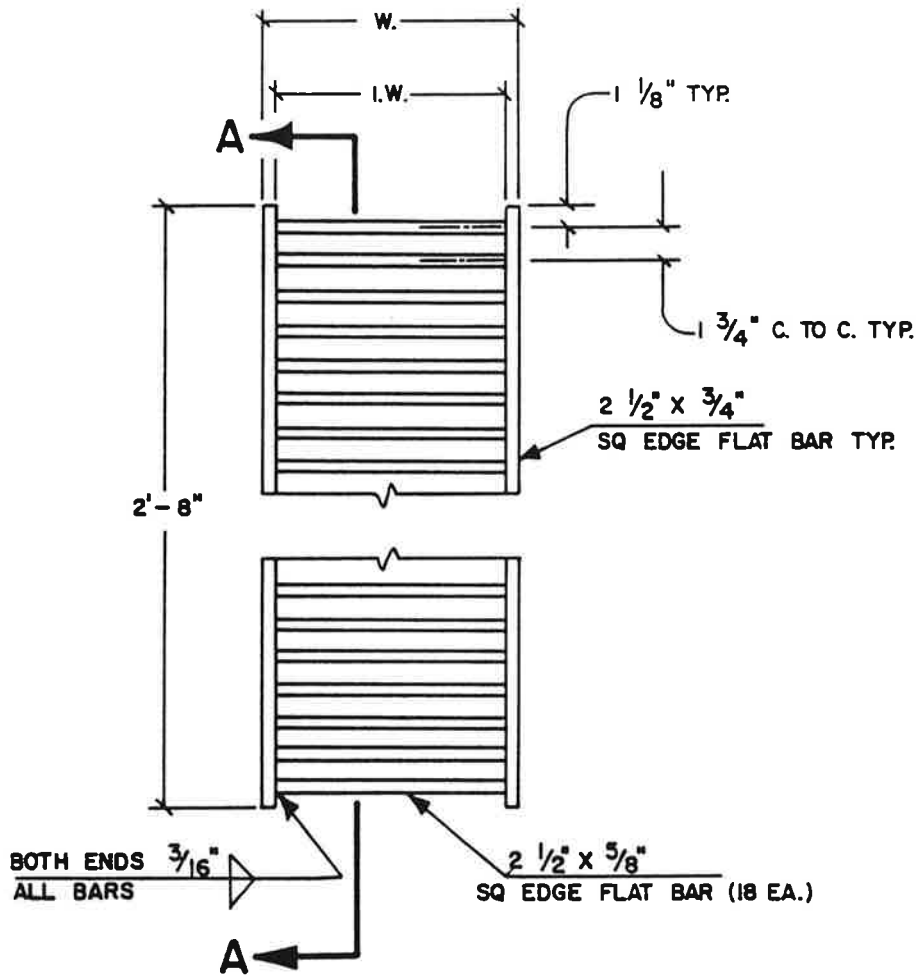
1 REQUIRES TWO GRATES  
 \* STANDARD & OVERSIZE ARE Col. CO. DESIGNATIONS

COLUMBIA COUNTY

Frame

Col. Cty. Standard  
 Drawing No. D-102





**SECTION A-A**

**PLAN**

| T Y P E * | W.          | I.W.    |
|-----------|-------------|---------|
| STANDARD  | 1' - 1 1/2" | 1' - 0" |
| OVERSIZE  | 1' - 1 1/2" | 1' - 0" |

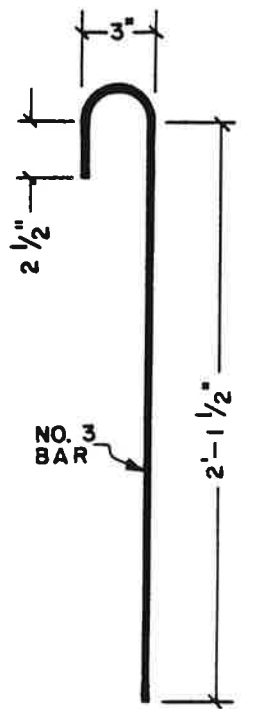
1 REQUIRES 2 GRATES.

\* "STANDARD" AND "OVERSIZE" ARE Columbia COUNTY DESIGNATIONS.

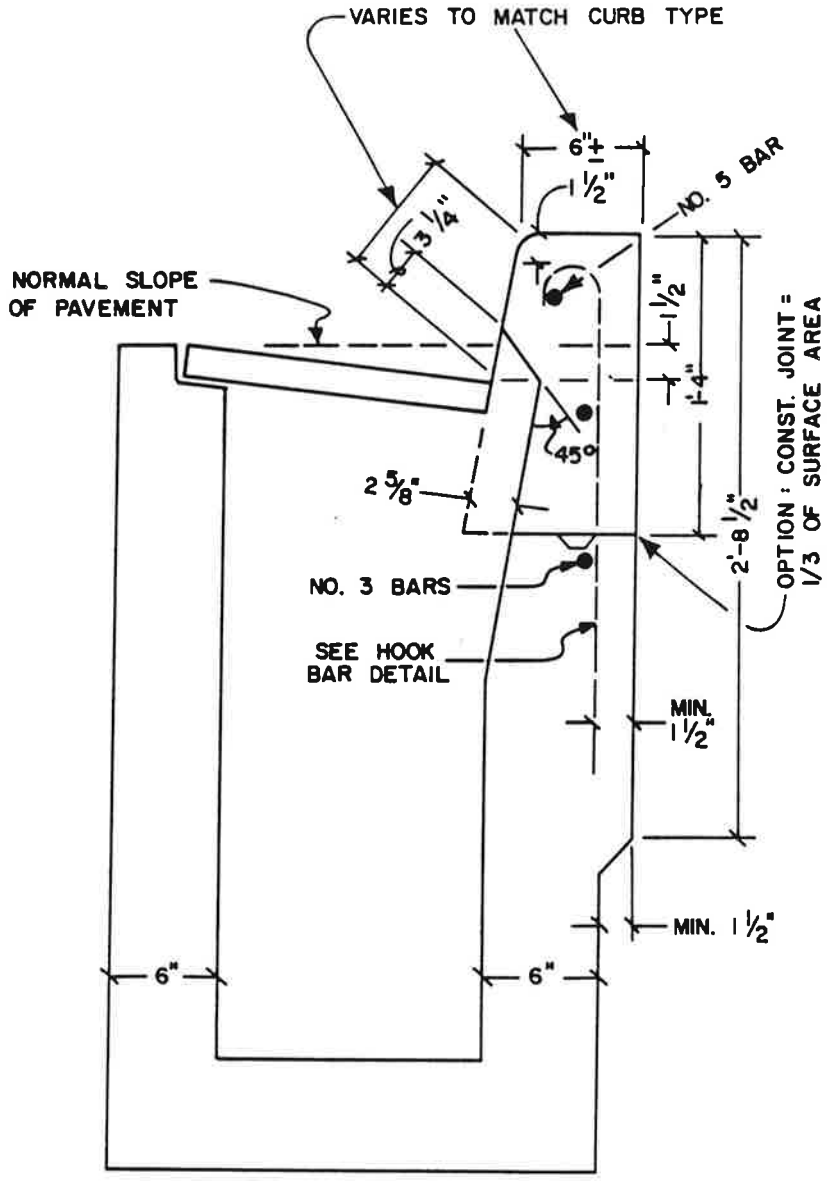
COLUMBIA COUNTY

Grate

Col. Cty. Standard  
Drawing No. D-103



**HOOK BAR  
DETAIL**



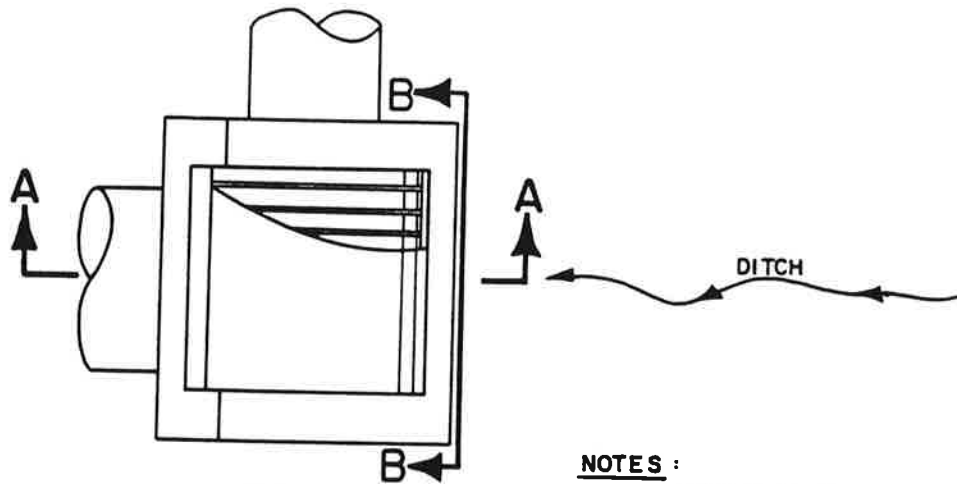
**SECTION B-B**

**NOTE:** FOR PLAN & ELEVATION SEE  
DWG. NO. D-100 & D-101.

COLUMBIA COUNTY

Recessed Curb Inlet

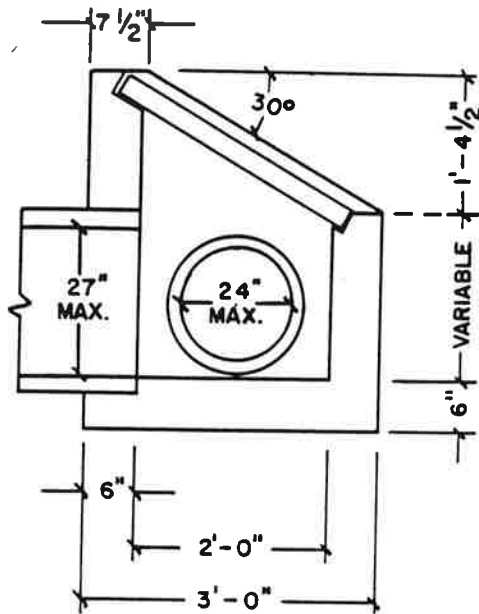
Col. Cty. Standard  
Drawing No. D-104



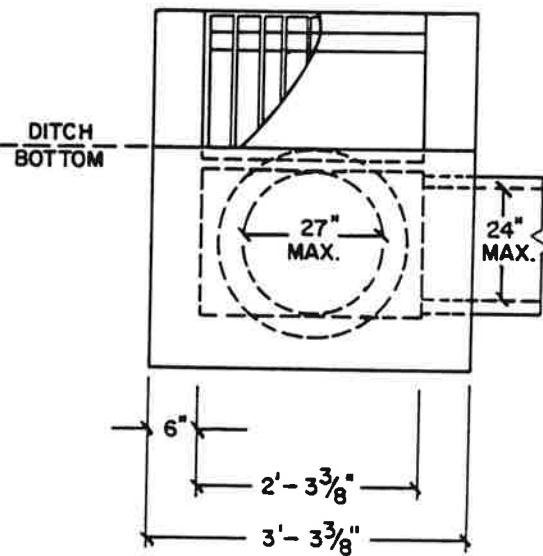
**PLAN**

**NOTES :**

1. CONCRETE SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I. IN 28 DAYS.
2. FOR FRAME DETAIL, SEE DWG. NO. D-107.
3. FOR GRATE DETAIL, SEE DWG. NO. D-108.



**SECTION A-A**



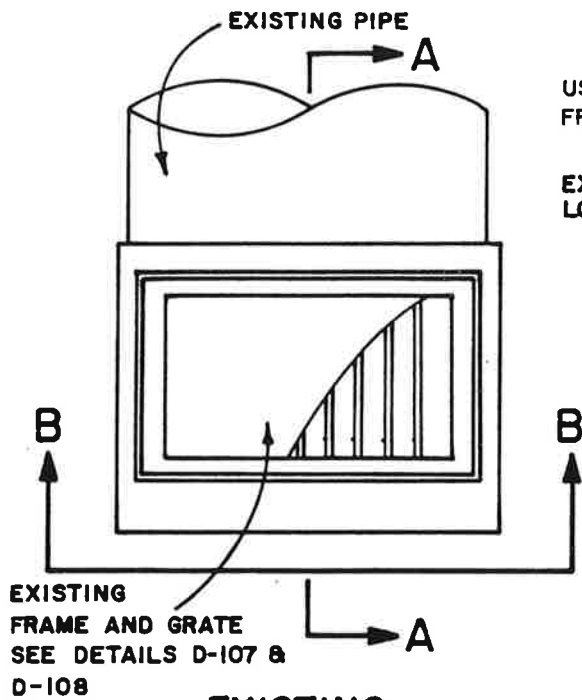
**ELEVATION B-B**

COLUMBIA COUNTY

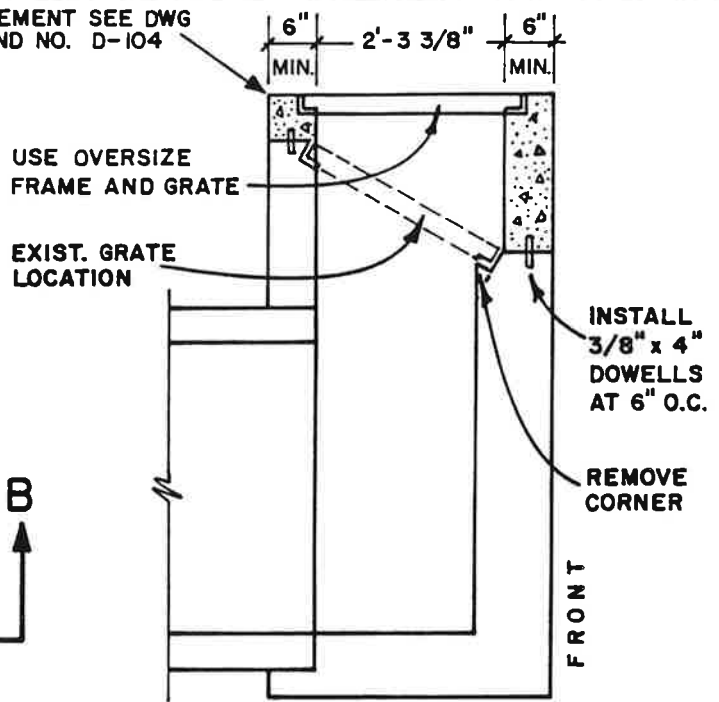
Area Drain, Type II

Col. Cty. Standard  
Drawing No. D-105

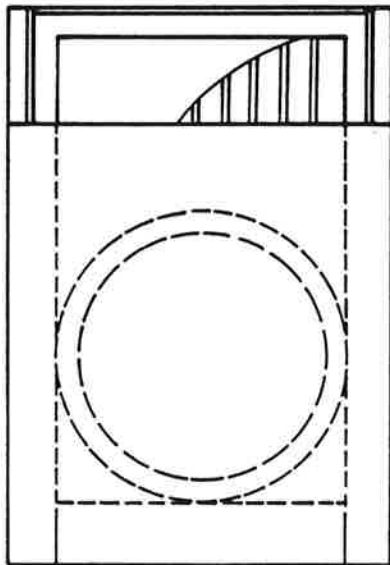
FOR CURB PLACEMENT SEE DWG  
NO. CS-304 AND NO. D-104



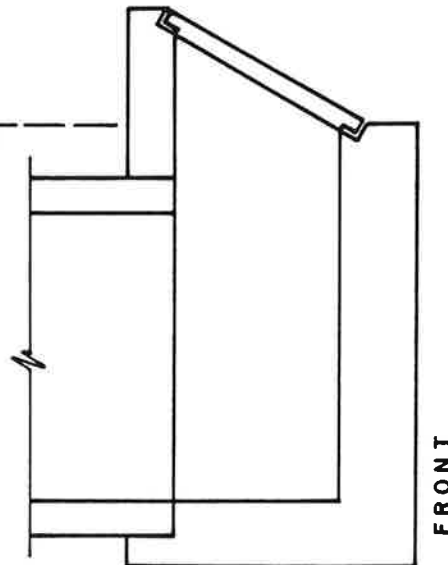
**EXISTING  
PLAN VIEW**



**SECTION A - A  
DITCH INLET RAISED TO MAKE  
OVERSIZE CATCH BASIN**



**EXISTING ELEVATION B - B**



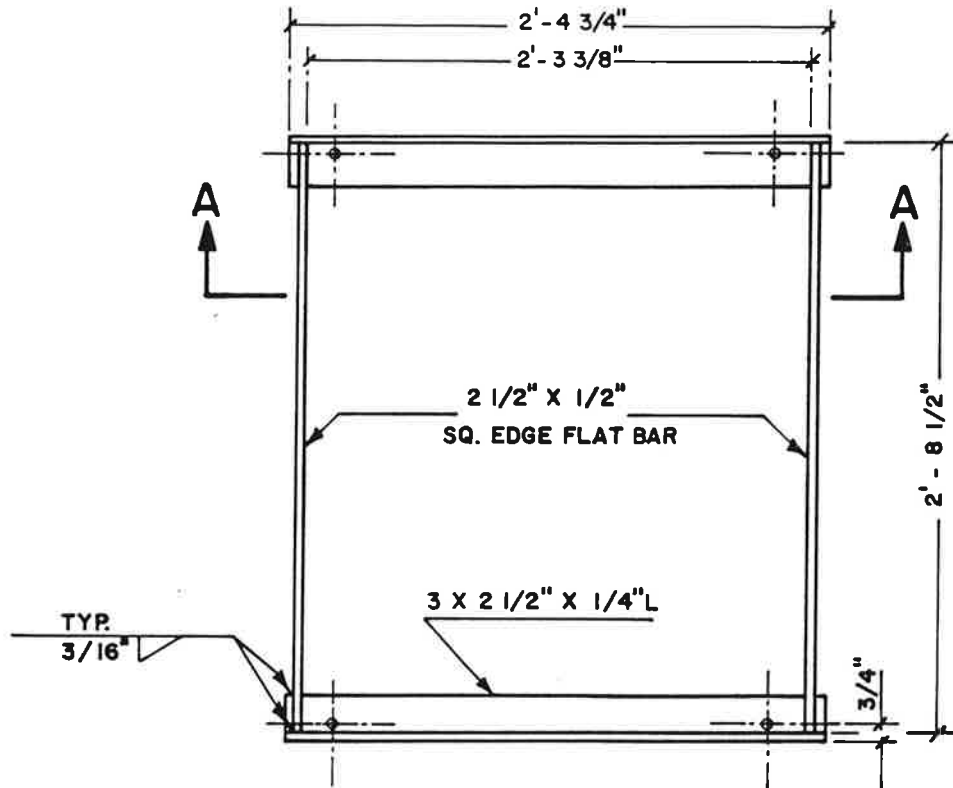
**EXISTING ELEVATION A - A**

CONCRETE TO BE 3000 P.S.I. - 28 DAYS - 6 SACK MIX

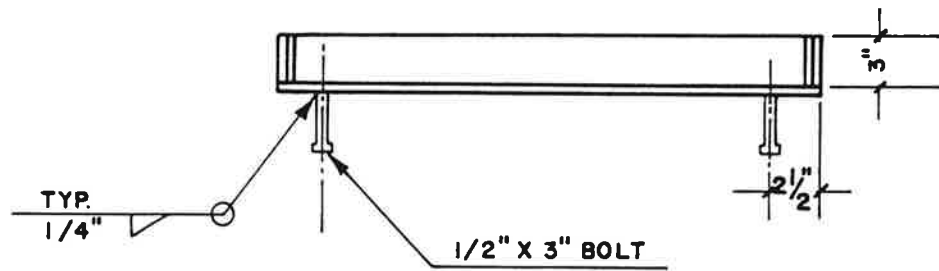
COLUMBIA COUNTY

Raised Area Drain

Col. Cty. Standard  
Drawing No. D-106



PLAN

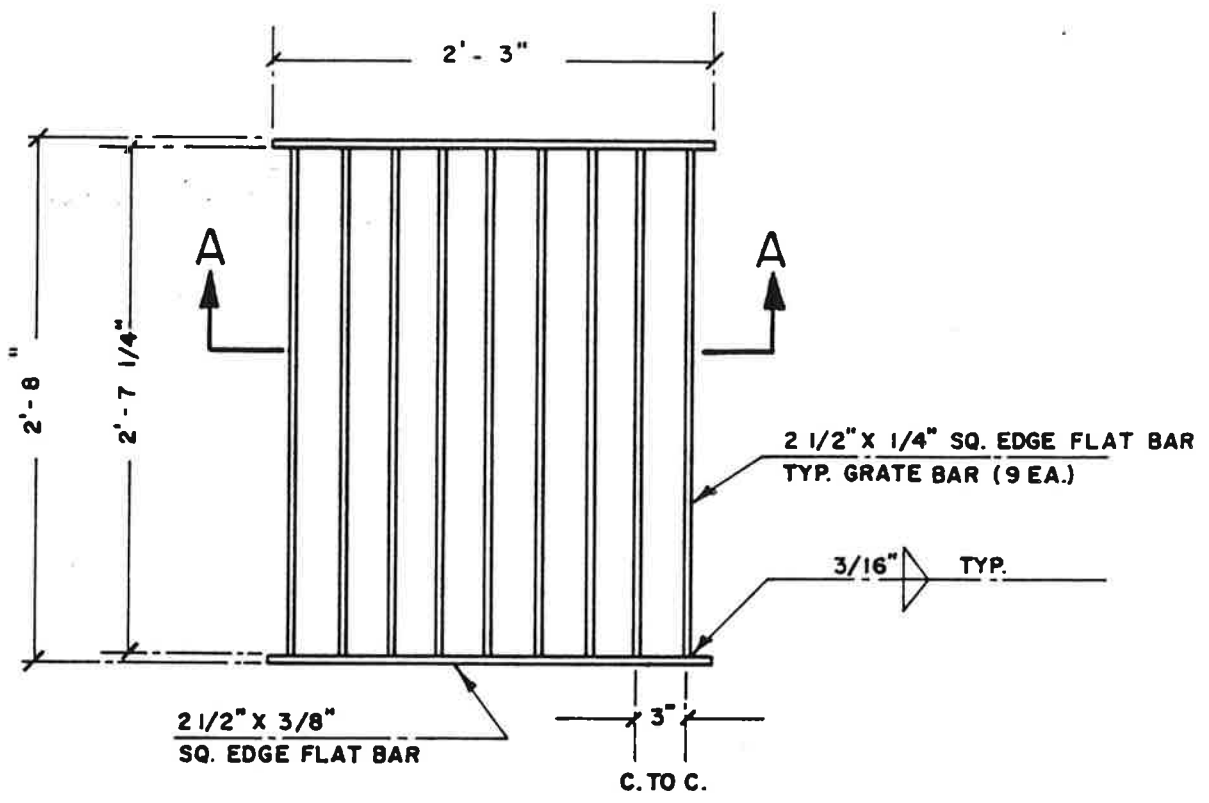


SECTION A-A

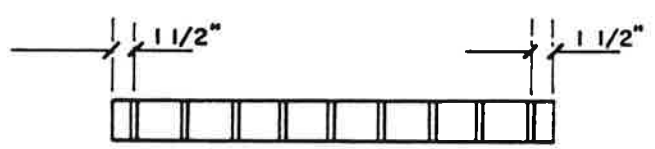
COLUMBIA COUNTY

Frame Area Drain, Type II

Col. Cty. Standard  
Drawing No. D-107



PLAN

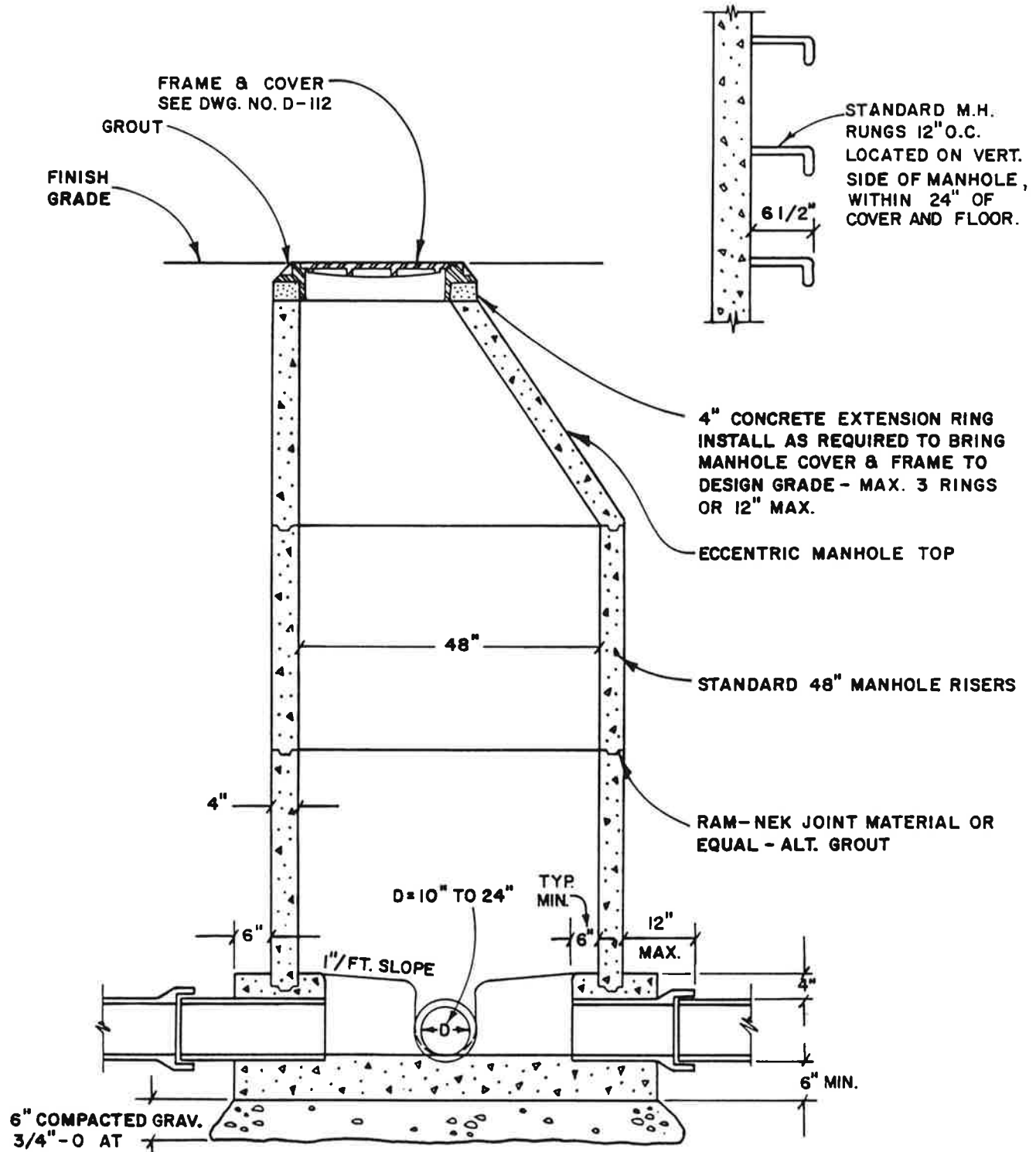


SECTION A - A

COLUMBIA COUNTY

Grate Area Drain, Type II

Col. Cty. Standard  
Drawing No. D-108



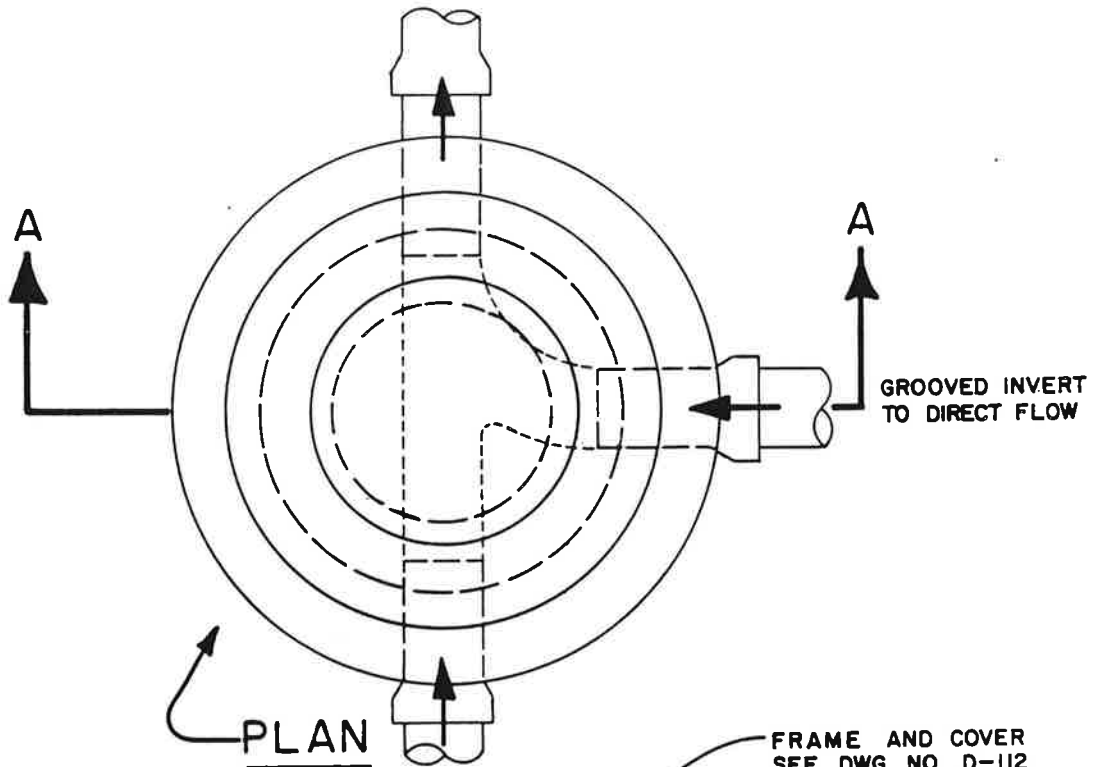
**NOTES:**

1. POURED CONCRETE BASE - 5 SACK MIX, 2500 P.S.I. AT 28 DAYS.
2. FORM GROOVED INVERT AND MAKE SURFACE SMOOTH TO DIRECT FLOW.

COLUMBIA COUNTY

Standard Manhole

Col. Cty. Standard  
Drawing No. D-109



FINISHED GRADE

SECTION A-A

FRAME AND COVER  
SEE DWG NO. D-112

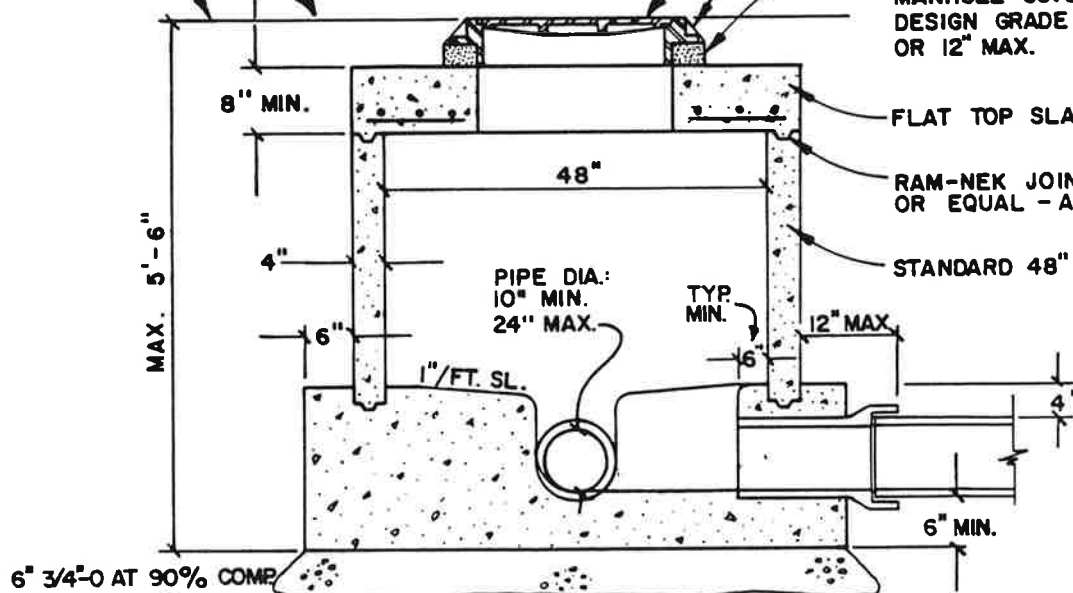
GROUT

4" CONCRETE EXTENSION RING,  
INSTALL AS REQUIRED TO BRING  
MANHOLE COVER & FRAME TO  
DESIGN GRADE - MAX. 3 RINGS  
OR 12" MAX.

FLAT TOP SLAB

RAM-NEK JOINT MATERIAL  
OR EQUAL - ALT. GROUT

STANDARD 48" MANHOLE RISERS



**NOTES:**

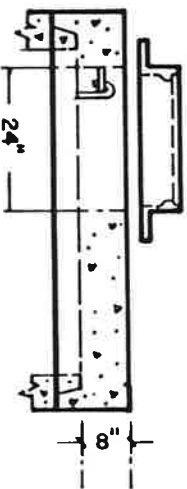
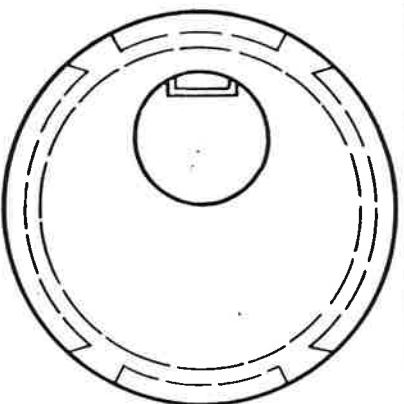
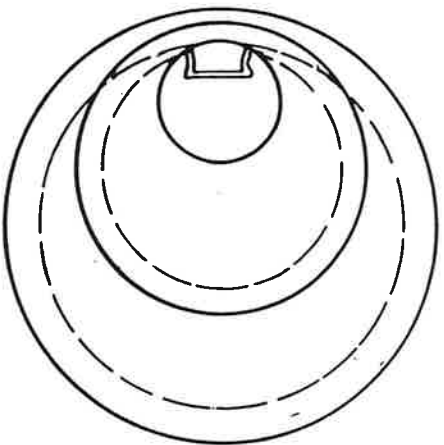
1. POURED CONCRETE BASE - 5 SACK MIX, 2500 P.S.I. AT 28 DAYS.
2. FORM GROOVED INVERT AND MAKE SURFACE SMOOTH TO DIRECT FLOW.

COLUMBIA COUNTY

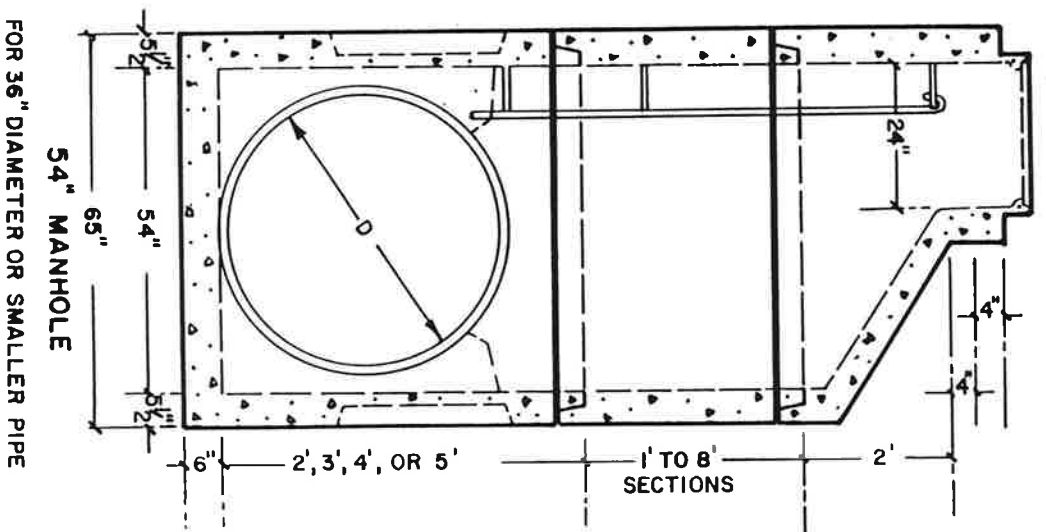
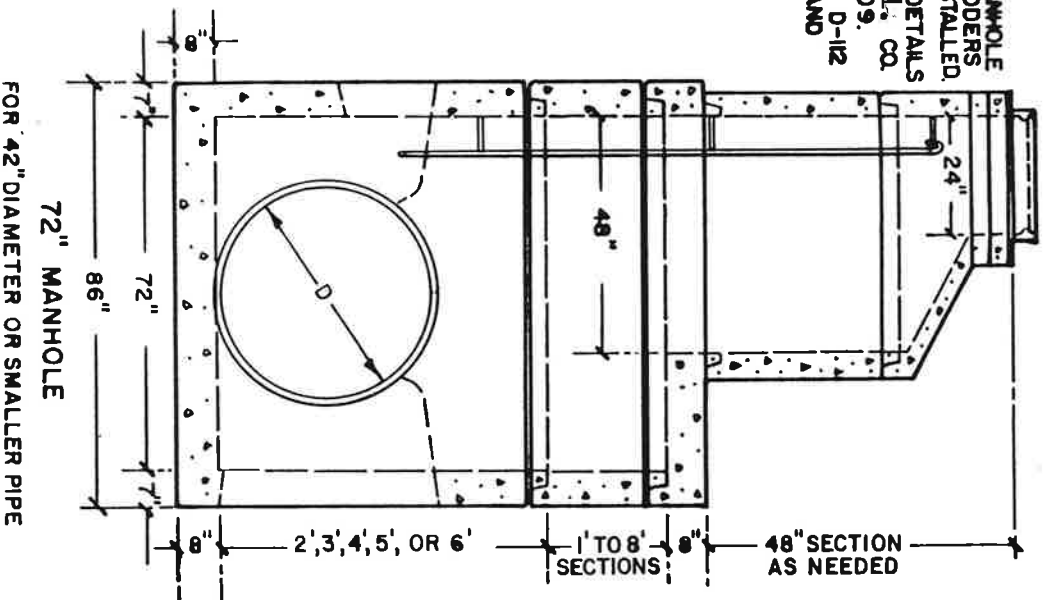
Shallow Manhole

Col. Cty. Standard  
Drawing No. D-110





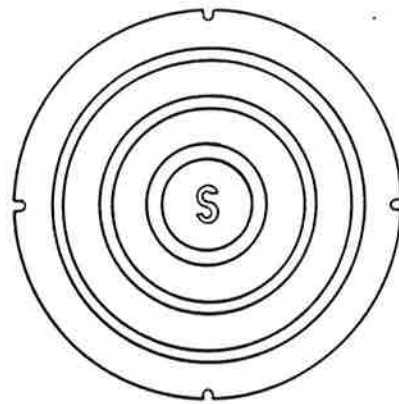
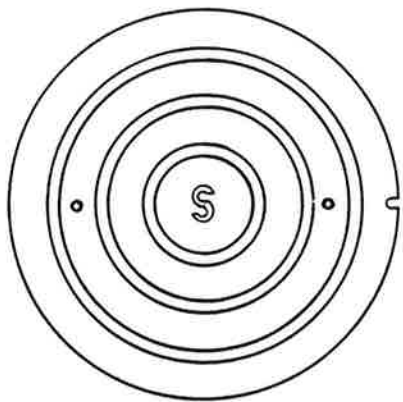
- NOTES:**
1. STANDARD MANHOLE STEPS OR LADDERS SHALL BE INSTALLED.
  2. FOR OTHER DETAILS REFER TO COL. CO. DWG. NO. D-109.
  3. SEE DWG. NO. D-112 FOR FRAME AND COVER.



COLUMBIA COUNTY

Special Oversize Manhole

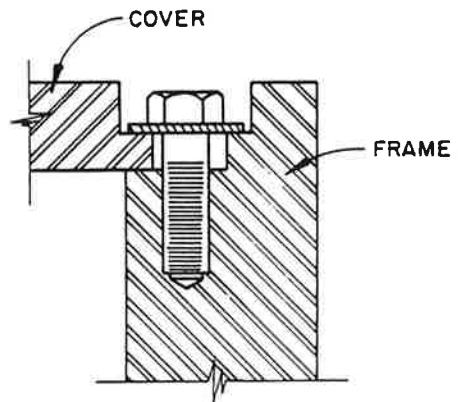
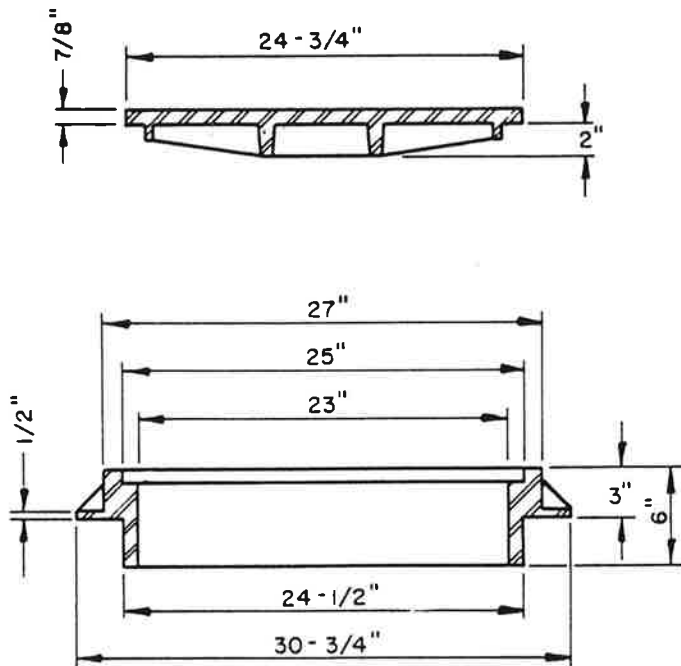
Col. Cty. Standard  
Drawing No. D-111



NOTE: LID CENTER MARKING SHALL BE "W" IF USED FOR WATER

**STANDARD COVER**  
**PLAN VIEW**

**WATERTIGHT COVER**  
**PLAN VIEW**



CAPSCREW  
4 REQ'D. - 1/2" x 1-1/2"  
CADMIUM PL.  
HEX HEAD

**FRAME & COVER**  
**SECTION**

**WATERTIGHT**  
**FRAME & COVER DETAIL**

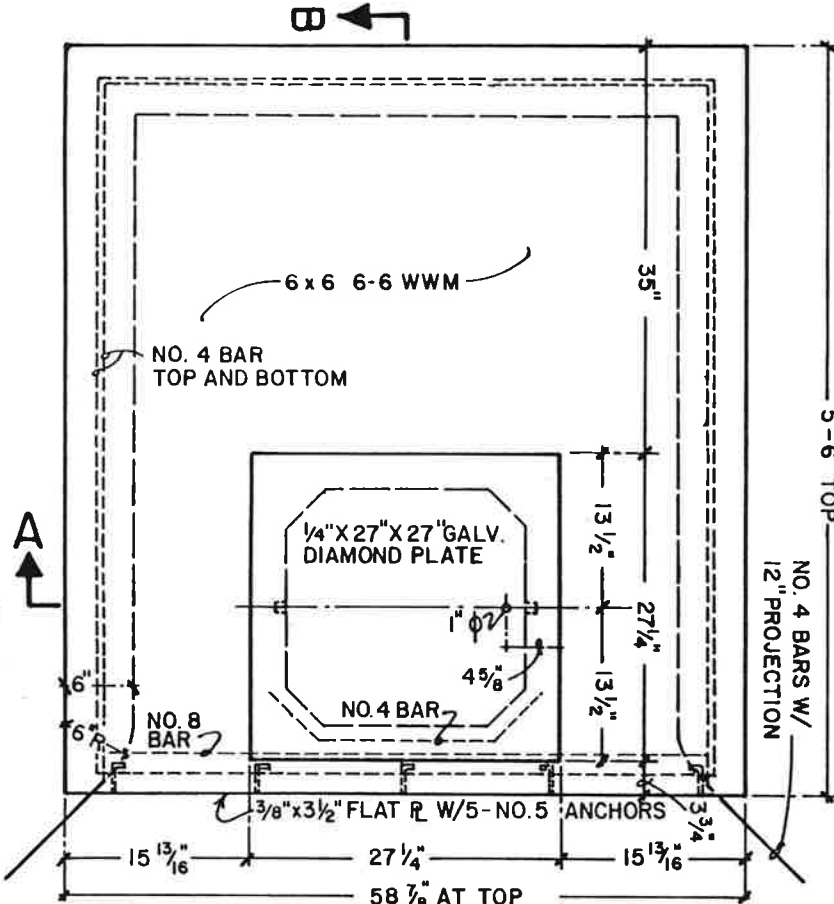
COLUMBIA COUNTY

Manhole Frame & Cover

Col. Cty. Standard  
Drawing No. D-112

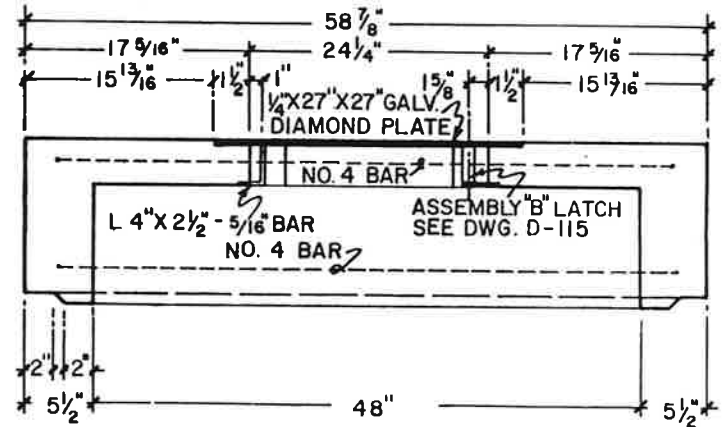
Gutter Inlet - 4A

COLUMBIA COUNTY

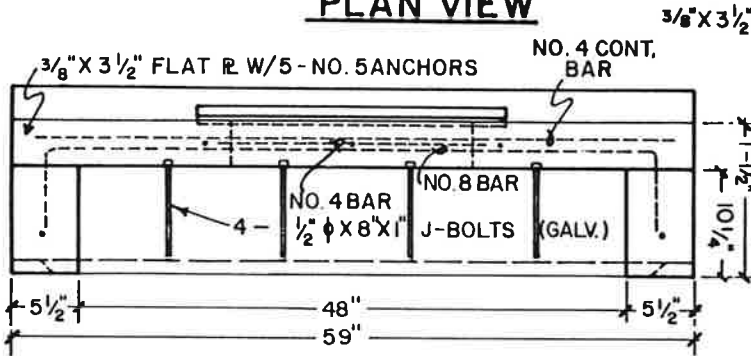


PLAN VIEW

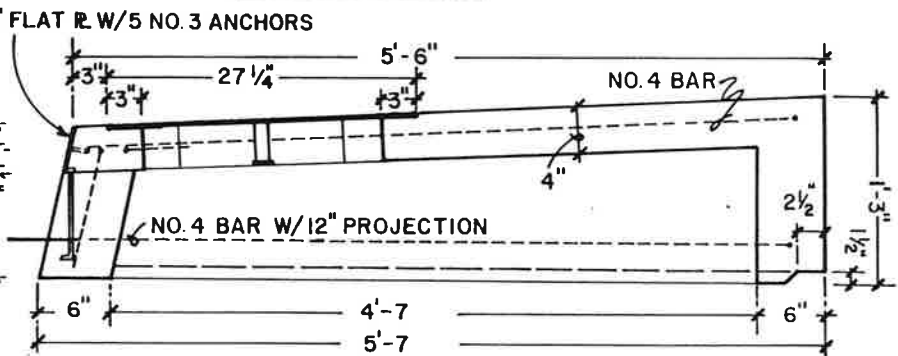
NOTE: ALL CONC. MIN. 3500 P.S.I. AT 28 DAY TEST



SECTION - A



FRONT ELEVATION



SECTION - B

Col. Cty. Standard  
Drawing No. D-113

STANDARD M.H. RUNGS REQUIRED  
12" O.C. OR ALT. OSHA APPROVED  
STEPS OR LADDER

WALT'S CONCRETE CURB INLET  
MODEL 4A-MH OR EQUIVALENT

SLOPE TOP TO MATCH  
SIDEWALK SLOPE

CURB FACE

5'-6"

DEPRESS GUTTER BAR  $2\frac{1}{2}$ " BELOW  
NORMAL AT FACE

PAVED ROAD SURFACE

24"  
MAX.

$6\frac{1}{2}$ "

12" O.C.

UPPER SECTION TO BE 48" STORM  
DRAIN INLET BY WALT'S CONC. OR  
EQUIVALENT.

4" MIN.

6" MIN.

POURED CONCRETE BASE - 2500  
P.S.I. AT 28 DAYS.

6" MIN  $\frac{3}{4}$ "-0  
AT 90% COMP.

STANDARD 48" REINFORCED CONC.  
MANHOLE SECTIONS

ALL JOINTS TO BE RAM-NECK JOINT  
MATERIAL OR EQUIVALENT - ALT.  
GROUT

48"

12"  
MAX.

PIPE DIA. :  
10" MIN.  
24" MAX.

$1'$ /FT. SLOPE

MAX.  
24"

12"  
MAX.

6"  $\frac{3}{4}$ "-0 AT  
90% COMP.

POURED CONCRETE BASE - 5 SACK MIX, 2500 P.S.I.  
AT 28 DAYS

COLUMBIA COUNTY

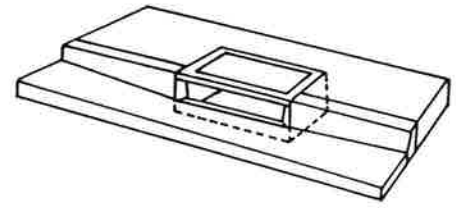
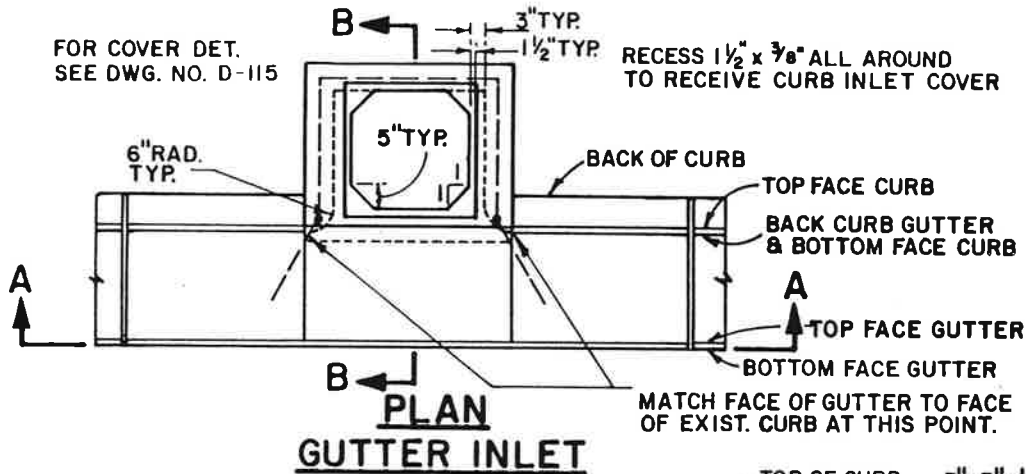
Gutter Inlet - 4A (modified)

Col. Cty. Standard  
Drawing No. D-113.1

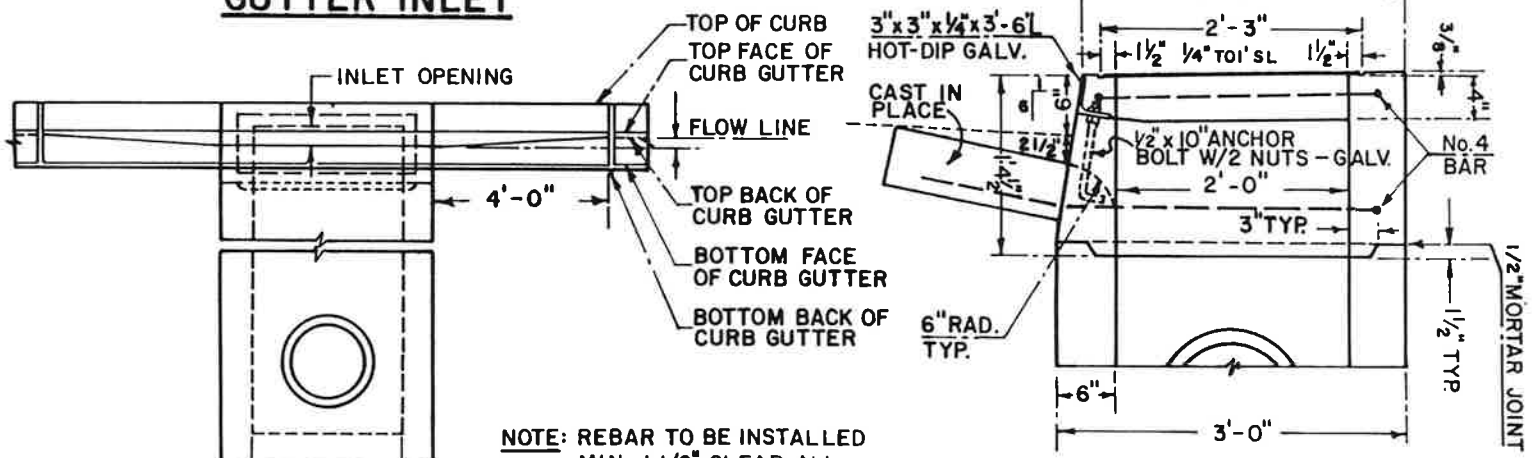
Gutter Inlet - 2-1/2A

COLUMBIA COUNTY

Col. Cty. Standard  
Drawing No. D-114



**ISOMETRIC VIEW**



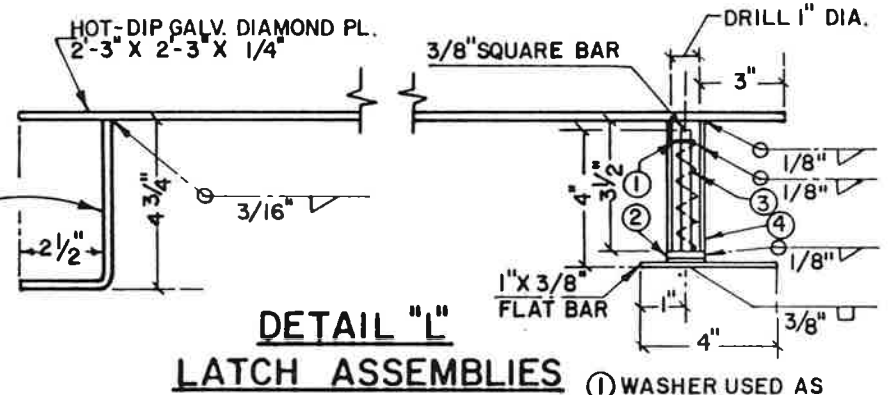
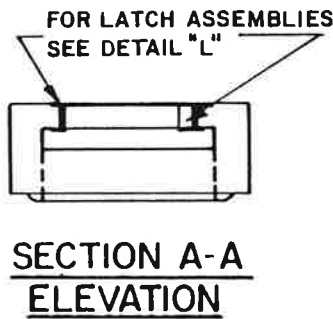
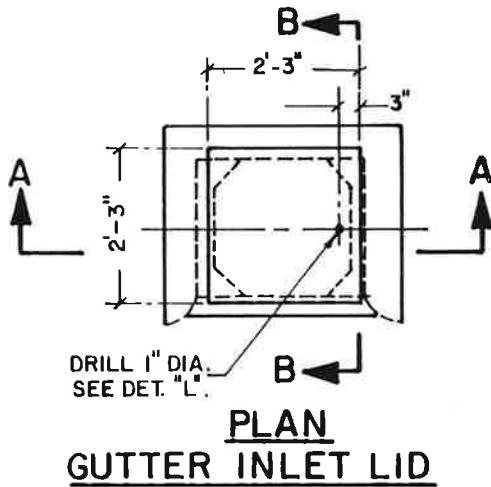
**NOTE:** REBAR TO BE INSTALLED MIN. 1 1/2" CLEAR ALL AROUND UNLESS SPECIFIED OTHERWISE.

**SECTION B - B**

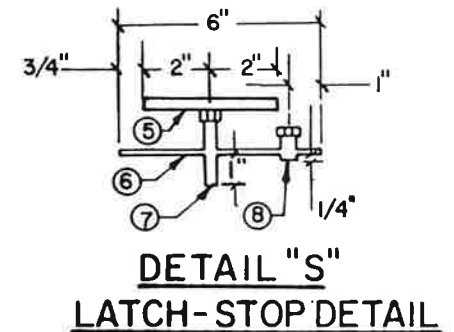
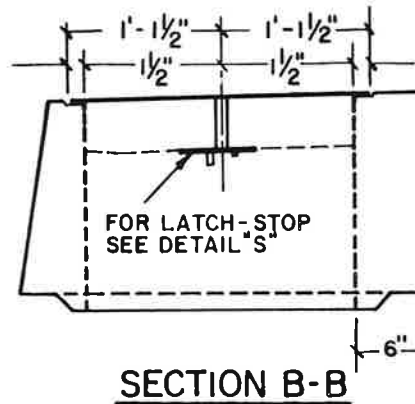
**ELEVATION A-A**

Gutter Inlet Cover

COLUMBIA COUNTY



- ① WASHER USED AS SPRING STOP. WELD WASHER TO 3/8" SQ. BAR, 3/8" FROM END.
- ② 1/4" DIA. WASHER USED AS TUBE PLUG. WELD TO PIPE.
- ③ 50 LB. COMP. SPRING
- ④ 1 1/4" I.D. TUBING

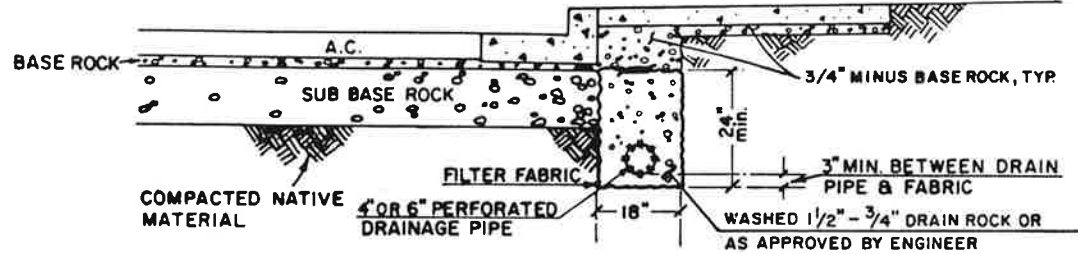


- ⑤ 3/8" DIA. ROD, WELD TO BOLT.
- ⑥ 1" FLAT BAR, PLACE FLUSH W/ BOTTOM EDGE OF CONCRETE.
- ⑦ 3/8" X 2" HEX. HEAD BOLT, WELD TO C OF FLAT BAR.
- ⑧ 3/8" X 3/4" HEX. HEAD BOLT, WELD TO C OF FLAT BAR.

NOTE: ALL FABRICATED METAL PARTS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.

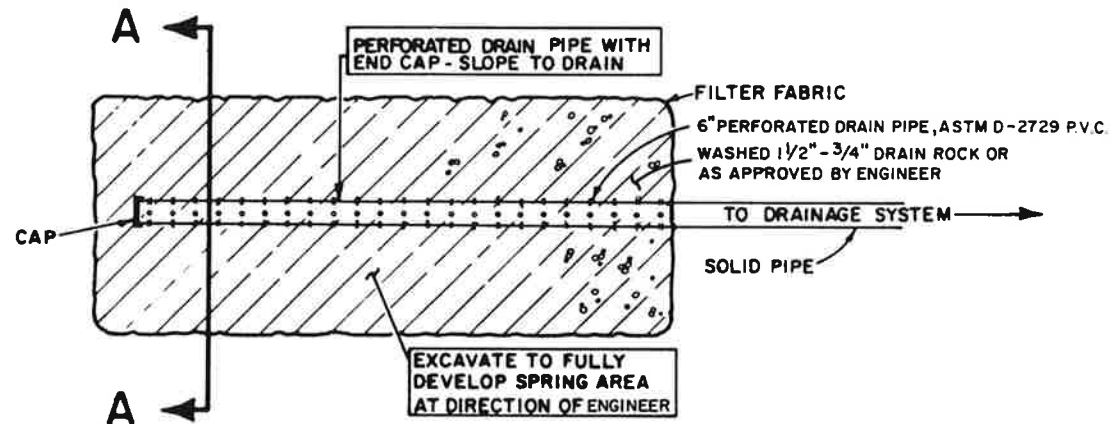
Col. Cty. Standard  
Drawing No. D-115

- NOTES: 1.) PROVIDE DIRECT DRAINAGE CONTACT BETWEEN BASE ROCK, SUB BASE ROCK & SUBGRADE DRAIN.  
 2.) LOCATE SUBGRADE DRAIN ON UPHILL SIDE OF ROAD OR AS DIRECTED BY ENGINEER  
 3.) SHOW PROPOSED LOCATION ON PLANS  
 4.) USE ASTM D-2729 PERFORATED P.V.C.

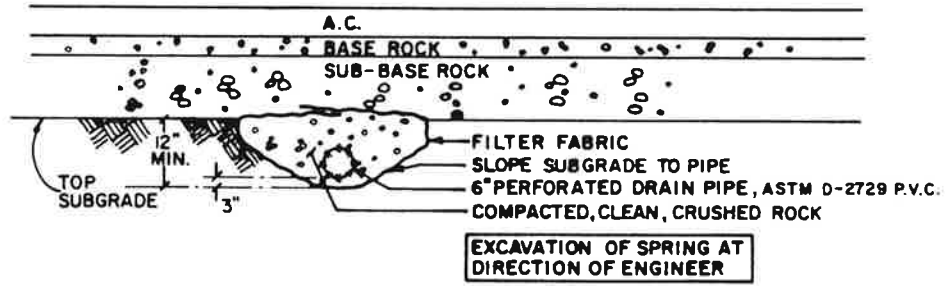


**TYPICAL SUBGRADE DRAIN**

**SPRING CATCHMENT DETAIL**



**PLAN**

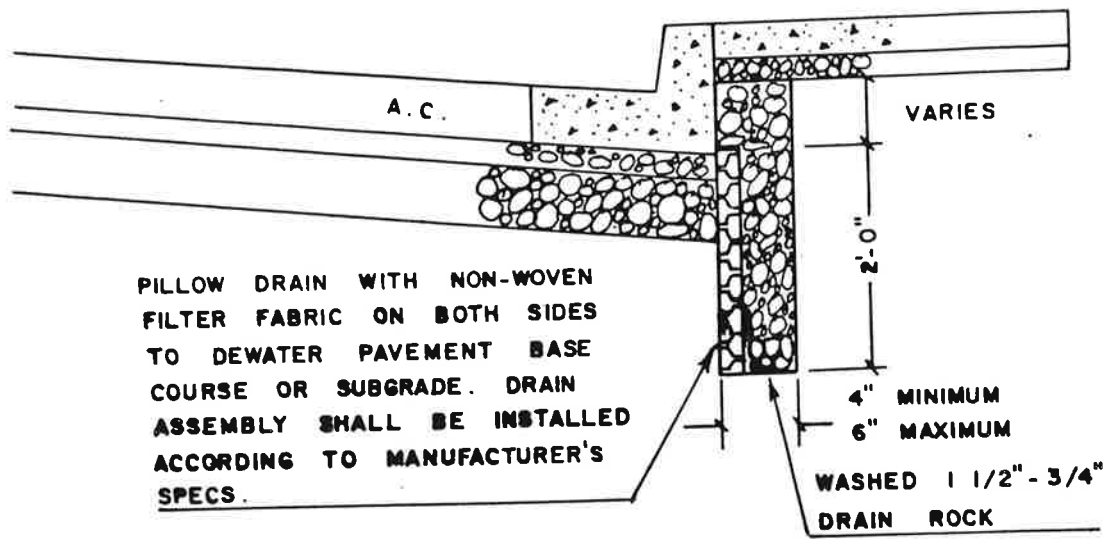


**SECTION A-A**

COLUMBIA COUNTY

Subgrade & Spring Catchment Drain

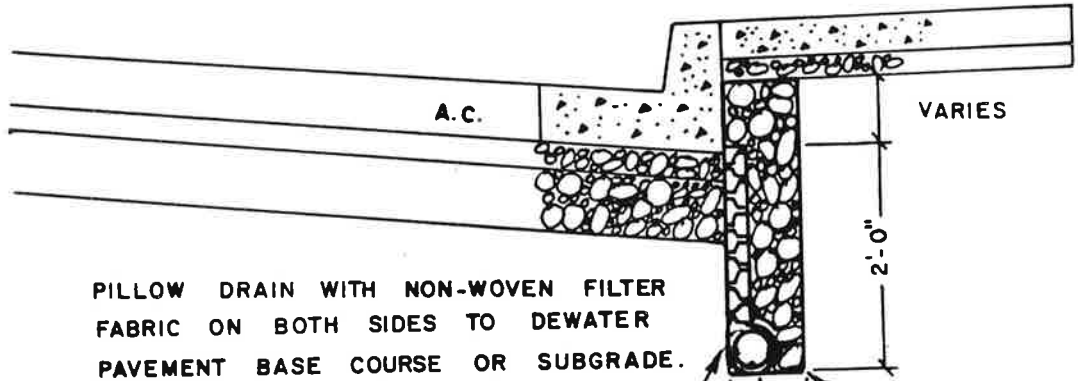
Col. Cty. Standard  
 Drawing No. D-116



PILLOW DRAIN WITH NON-WOVEN FILTER FABRIC ON BOTH SIDES TO DEWATER PAVEMENT BASE COURSE OR SUBGRADE. DRAIN ASSEMBLY SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECS.

VARIES  
2'-0"  
4" MINIMUM  
6" MAXIMUM  
WASHED 1 1/2" - 3/4"  
DRAIN ROCK

WITHOUT DRAIN PIPE



PILLOW DRAIN WITH NON-WOVEN FILTER FABRIC ON BOTH SIDES TO DEWATER PAVEMENT BASE COURSE OR SUBGRADE. DRAIN ASSEMBLY SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECS.

VARIES  
2'-0"  
4" MINIMUM  
6" MAXIMUM  
WASHED 1 1/2" - 3/4"  
DRAIN ROCK  
4" OR 6" ASTM D-2729 P.V.C. PERFORATED P.V.C. CONNECT TO STORM DRAIN SYSTEM AS DIRECTED BY ENGINEER.

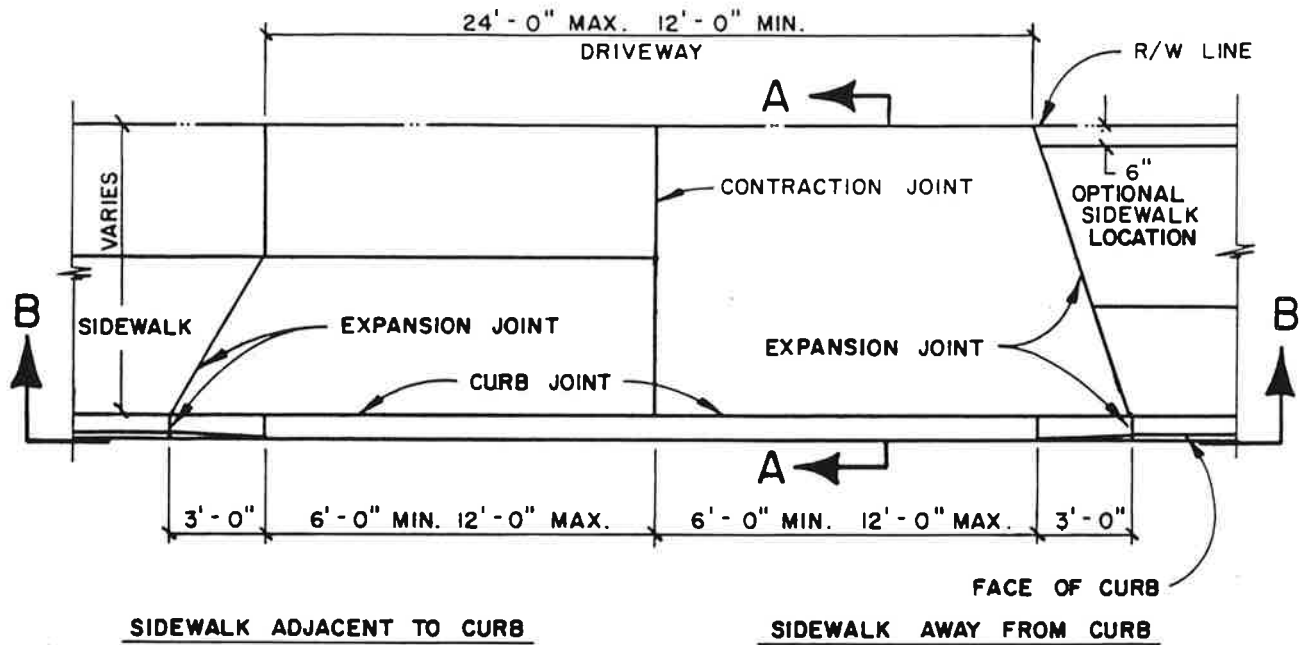
WITH DRAIN PIPE

COLUMBIA COUNTY

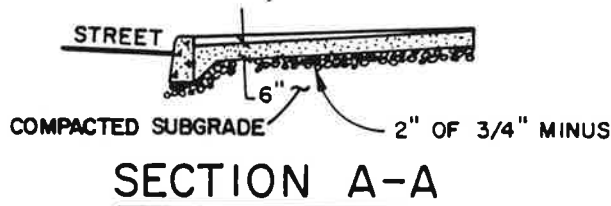
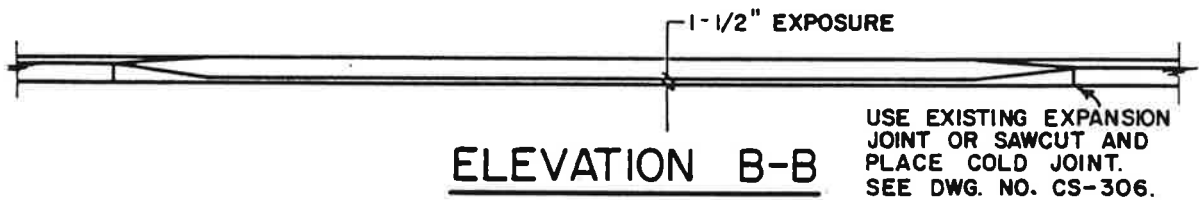
Alternate Subgrade Drain

Col. Cty. Standard Drawing D-117





PLAN



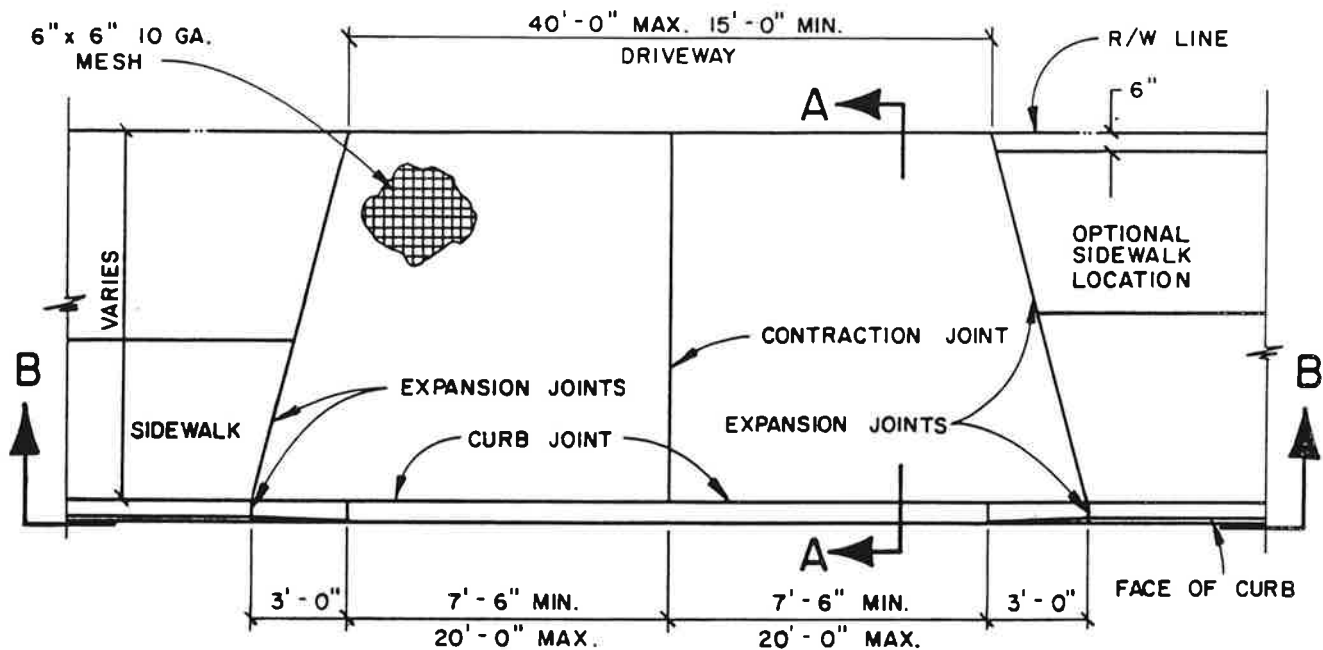
NOTES :

1. CONCRETE SHALL HAVE A MINIMUM BREAKING STRENGTH OF 3000 P.S.I. AFTER 28 DAYS, 6 SACK MIX.
2. CURB JOINT SHALL BE A TROWELED JOINT WITH A MINIMUM 1/2" RADIUS ALONG BACK OF CURB.
3. EXPANSION JOINTS SHALL BE 1/2" PREMOLDED ASPHALT IMPREGNATED MATERIAL OR EQUAL, EXTENDING FROM SUBGRADE TO FINISHED GRADE.
4. SEE DWG. NO. CS-300 AND NO. CS-305.

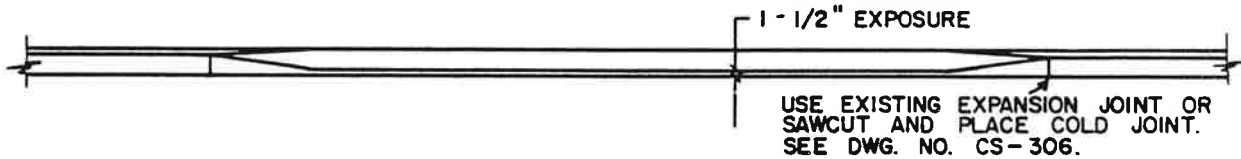
COLUMBIA COUNTY

Residential Driveway

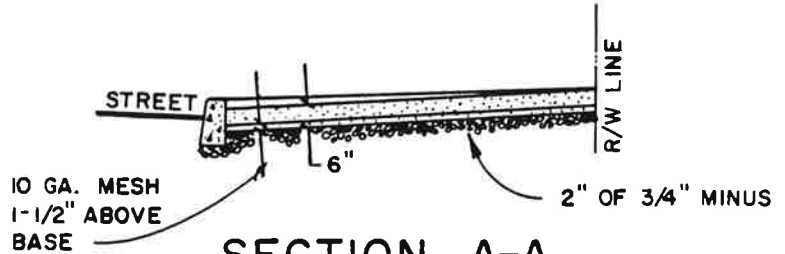
Col. Cty. Standard  
Drawing No. DW-200



**PLAN**



**ELEVATION B-B**



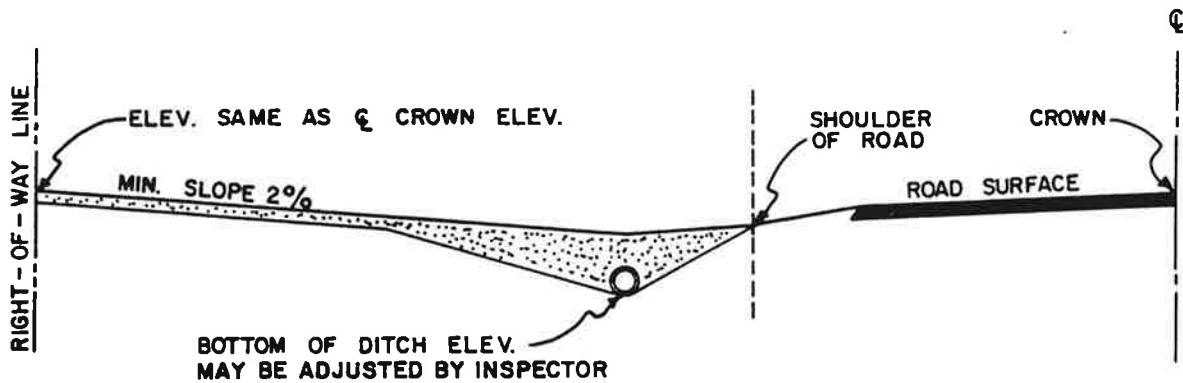
**SECTION A-A**

1. CONCRETE SHALL HAVE A MINIMUM BREAKING STRENGTH OF 3000 P.S.I. AFTER 28 DAYS , 6 SACK MIX .
2. CURB JOINT SHALL BE A TROWELED JOINT WITH A MINIMUM 1/2" RADIUS ALONG BACK OF CURB.
3. EXPANSION JOINTS SHALL BE 1/2" PREMOLDED ASPHALT IMPREGNATED MATERIAL OR EQUAL, EXTENDING FROM SUBGRADE TO FINISHED GRADE.
4. SEE DWG. NO. CS-300 AND NO. CS-305.

COLUMBIA COUNTY

Commercial Driveway

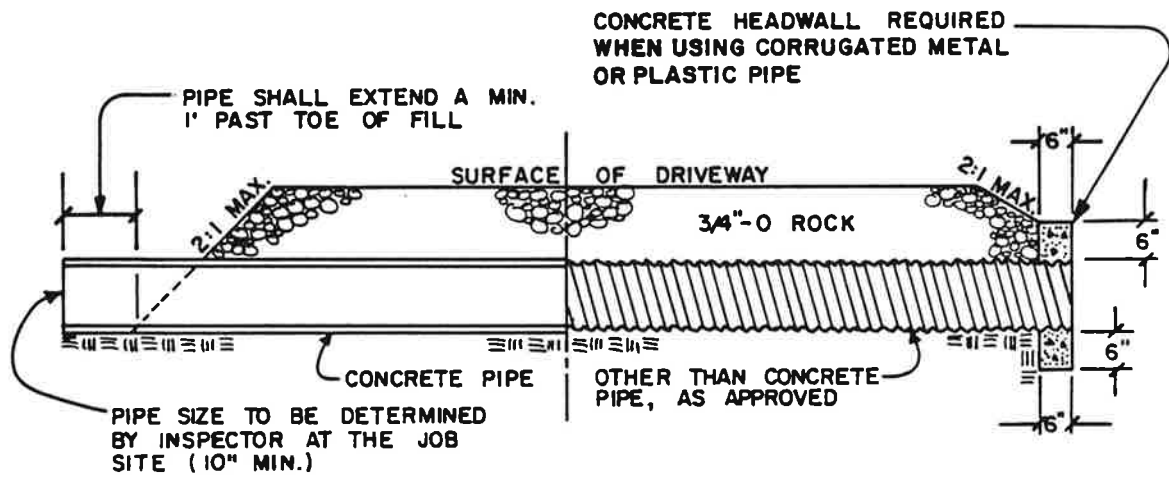
Col. Cty. Standard  
Drawing No. DW-201



**NOTES:**

1. SEE DWG. NO. 205 FOR ALTERNATIVE
2. IF AC DRIVEWAY IS TO BE CONSTRUCTED, USE 2" OF CLASS "C" MIX ON APPROVED BASE

**PROFILE**



PIPE TO BE LAYED AT EXISTING GRADE OF DITCH - NO SLUMPS

**CROSS-SECTION**

COLUMBIA COUNTY

Driveway for Streets  
Without Curbs

Col. Cty. Standard  
Drawing No. DW-202

FOR CURB & GUTTER  
SEE DWG.  
NO. CS-300  
OR CS-301

R/W

25' MIN. RADIUS

← 2% SLOPE

SECTION A-A

1-1/2" EXPOSURE

CONCRETE APRON

STRUCTURAL SECTION  
TO CONFORM TO DWG.  
NO. DW-201

VARIES

PRIVATE ROAD

PUBLIC ROAD

A

A

B

B

← 2% SLOPE

S/W

SECTION B-B

FOR WHEELCHAIR RAMP  
SEE DWG. NO. CS-306

25' MIN. RADIUS

FOR S/W  
SEE DWG.  
NO. CS-305

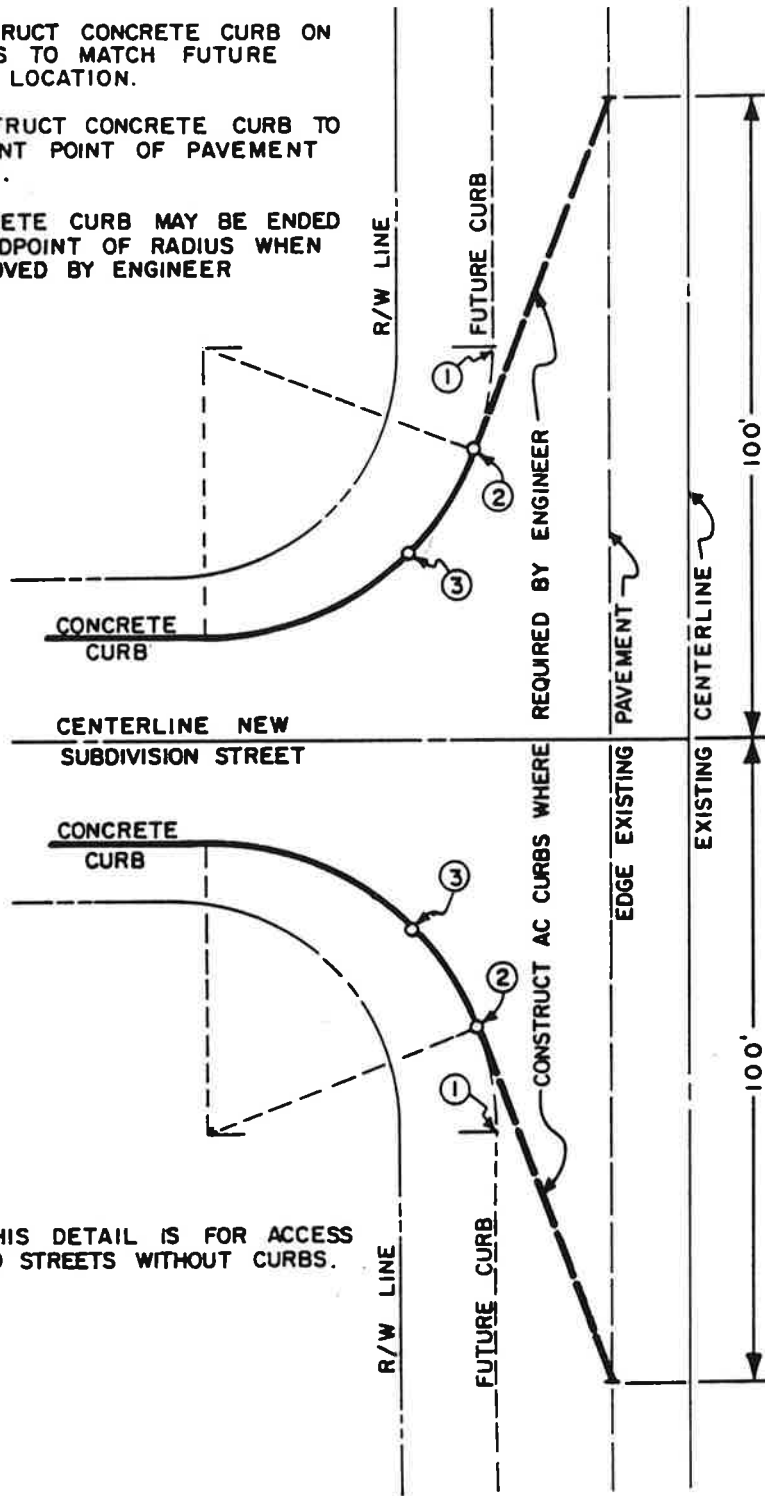
R/W

COLUMBIA COUNTY

Private Road Entrance Off  
of Public Road With Curbs

Col. Cty. Standard  
Drawing No. DW-203

- ① CONSTRUCT CONCRETE CURB ON RADIUS TO MATCH FUTURE CURB LOCATION.
- ② CONSTRUCT CONCRETE CURB TO TANGENT POINT OF PAVEMENT TAPER.
- ③ CONCRETE CURB MAY BE ENDED AT MIDPOINT OF RADIUS WHEN APPROVED BY ENGINEER

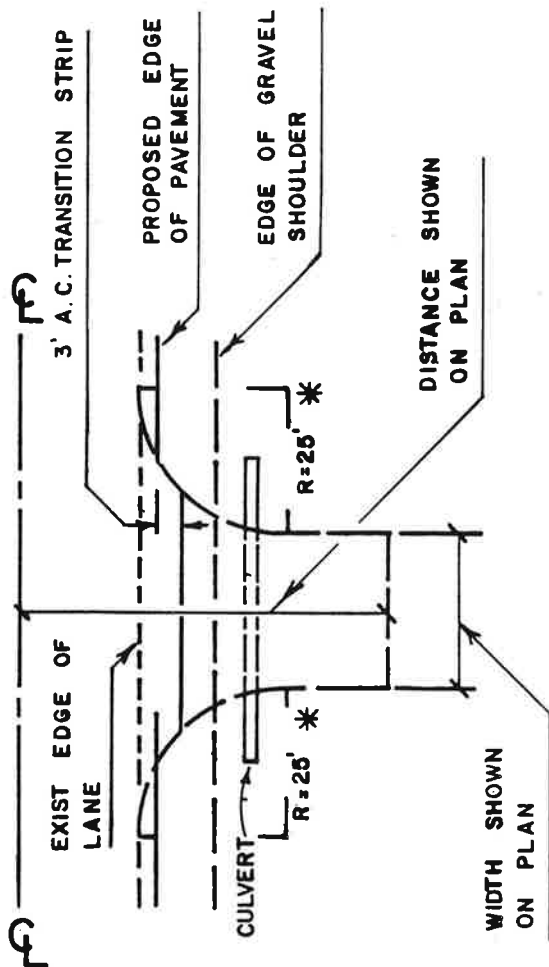


**NOTE :** THIS DETAIL IS FOR ACCESS TO STREETS WITHOUT CURBS.

COLUMBIA COUNTY

Temporary Entrance

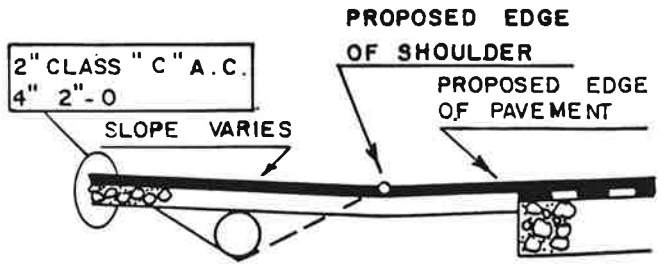
Col. Cty. Standard  
Drawing No. DW-204



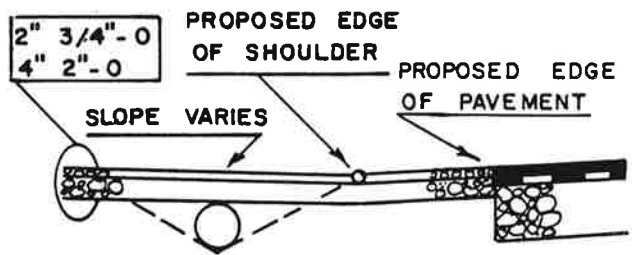
**TYPICAL PLAN  
A.C. OR GRAVEL DRIVEWAY**

\*UNLESS OTHERWISE NOTED

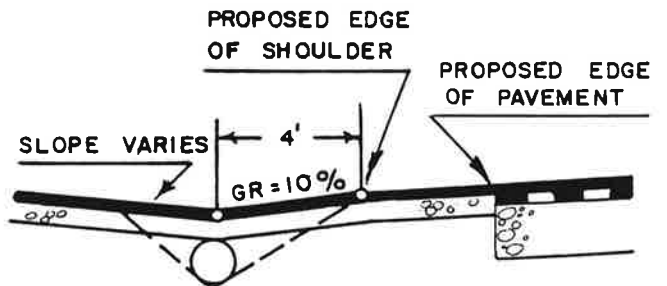
SEE DWG. NO. DW-202



**TYPICAL SECTION  
A.C. DRIVEWAY**



**TYPICAL SECTION  
GRAVEL DRIVEWAY**

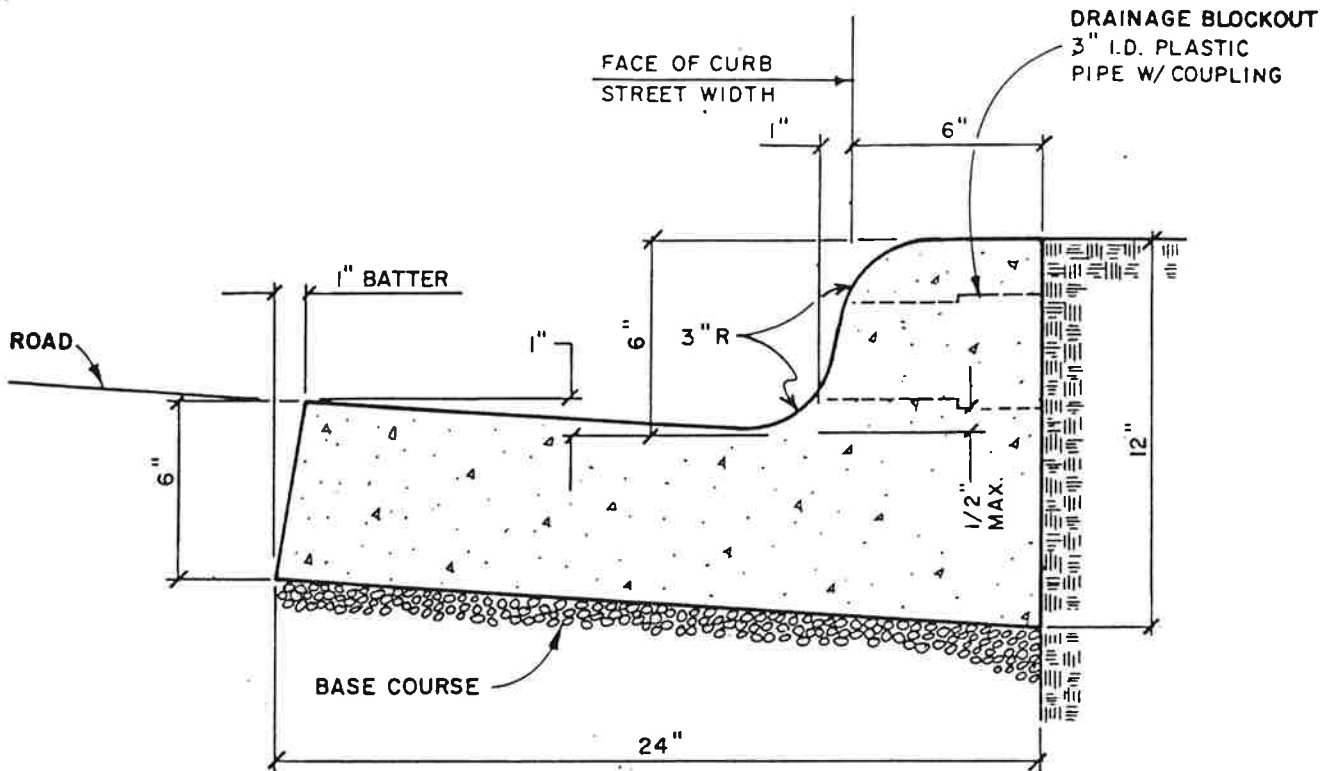


**TYPICAL SECTION  
ALTERNATE**

Columbia County

Driveway Details for  
Non-Curbed Areas

Col. Cty. Standard  
Drawing No. DW-205

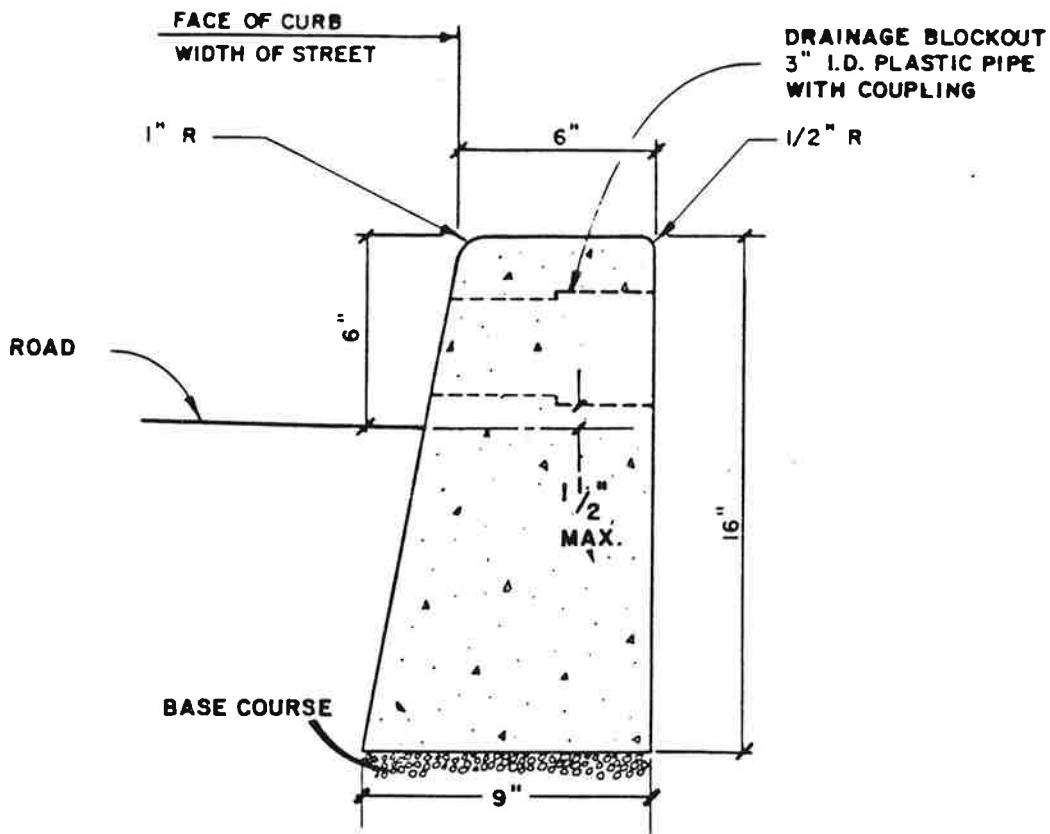


1. FOR USE ALONG MEDIANS, GUTTERS MAY BE REDUCED WITH PRIOR APPROVAL FROM THE ROAD ENGINEER.
2. CONCRETE TO HAVE A BREAKING STRENGTH OF 3000 P.S.I. AFTER 28 DAYS .
3. EXPANSION JOINTS
  - A. TO BE PROVIDED:
    - 1) AT EACH POINT OF TANGENCY OF THE CURB .
    - 2) AT EACH COLD JOINT .
    - 3) AT EACH SIDE OF INLET STRUCTURES.
    - 4) AT EACH END OF DRIVEWAYS .
    - 5) AT LOCATIONS NECESSARY TO LIMIT SPACING TO 45 FEET .
  - B. MATERIAL TO BE PRE-MOLDED, ASPHALT IMPREGNATED, NON EXTRUDING, WITH A THICKNESS OF 1/2 INCH.
4. CONTRACTION JOINTS
  - A. SPACING TO BE NOT MORE THAN 15 FEET .
  - B. THE DEPTH OF THE JOINT SHALL BE AT LEAST 1/2 INCHES .
5. BASE ROCK - 2'-0 OR 3/4'-0 , 95 % COMPACTION . BASE ROCK SHALL BE TO SUBGRADE OF STREET STRUCTURE OR 4" IN DEPTH , WHICHEVER IS GREATER .
6. DRAINAGE BLOCKOUT - 3" DIAMETER PLASTIC PIPE
  - A. I.D. PLASTIC PIPE WITH COUPLING
  - B. DRAINAGE ACCESS THROUGH EXISTING CURBS SHALL BE CORE DRILLED OR CURB SAW CUT VERTICALLY 18" EACH SIDE OF DRAIN AND REPOURED TO FULL DEPTH OF CURB.

COLUMBIA COUNTY

Curb & Gutter Emergency Mountable

Col. Cty. Standard  
Drawing No. CS-300



1. FOR DESIGN SPEEDS GREATER THAN 40 MPH THE EMERGENCY MOUNTABLE CURB CS-300 SHALL BE USED.
2. CONCRETE TO HAVE A BREAKING STRENGTH OF 3000 P.S.I. AFTER 28 DAYS.
 

EXPANSION JOINTS.

  - A. TO BE PROVIDED :
    - 1) AT EACH POINT OF TANGENCY OF THE CURB .
    - 2) AT EACH COLD JOINT .
    - 3) AT EACH SIDE OF INLET STRUCTURES.
    - 4) AT EACH END OF DRIVEWAYS .
    - 5) AT LOCATIONS NECESSARY TO LIMIT SPACING TO 45 FEET .
  - B. MATERIAL TO BE PRE - MOLDED, ASPHALT IMPREGNATED, NON-EXTRUDING, WITH A THICKNESS OF 1/2 INCH.
3. CONTRACTION JOINTS .
  - A. SPACING TO BE NOT MORE THAN 15 FEET .
  - B. THE DEPTH OF THE JOINT SHALL BE AT LEAST 1 1/2" INCHES .
4. BASE ROCK - 2"-0 OR 3/4"-0 , 95 % COMPACTION. BASE ROCK SHALL BE TO SUBGRADE OF STREET STRUCTURE OR 4" IN DEPTH, WHICHEVER IS GREATER .
5. DRAINAGE BLOCKOUT - 3" DIA. PLASTIC PIPE .
  - A. I.D. PLASTIC PIPE WITH COUPLING.
  - B. DRAINAGE ACCESS THROUGH EXISTING CURBS SHALL BE CORE DRILLED OR CURB SAW CUT VERTICALLY 18" EACH SIDE OF DRAIN & REPOURED TO FULL DEPTH OF CURB.

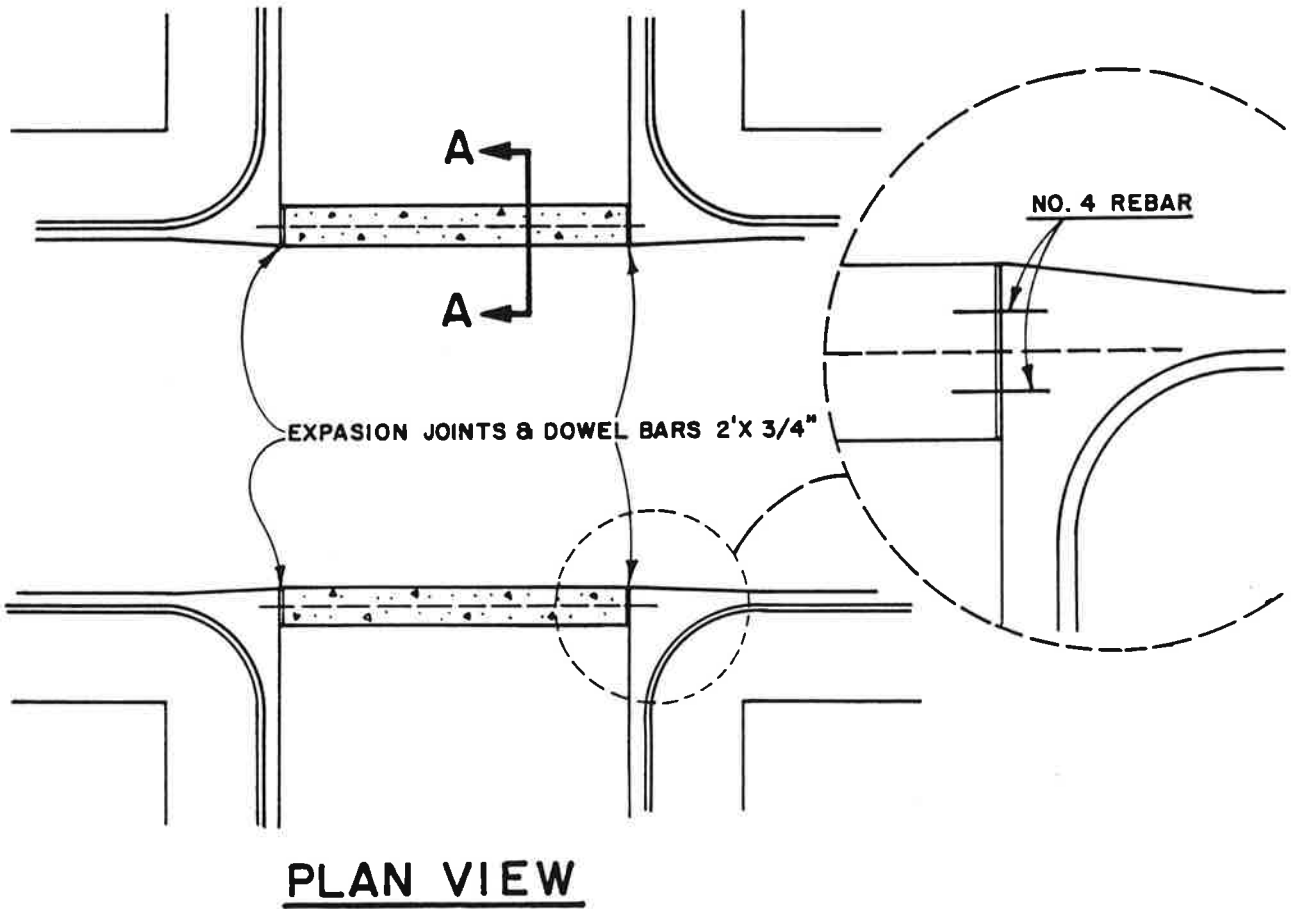
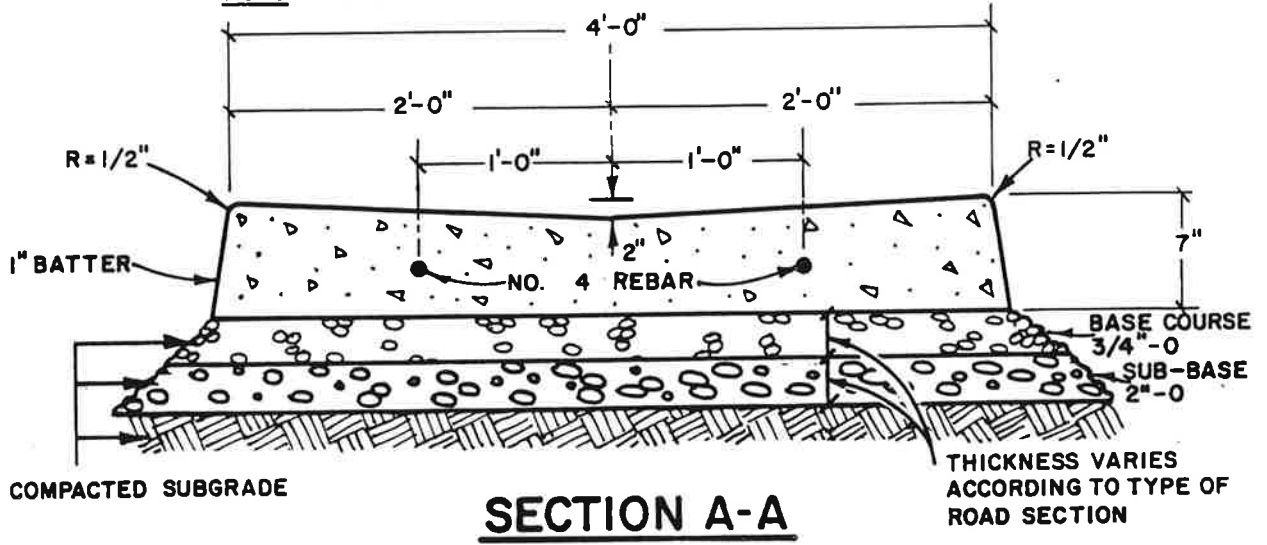
COLUMBIA COUNTY

Curb Non-Mountable for  
Use on Medians

Col. Cty. Standard  
Drawing No. CS-301



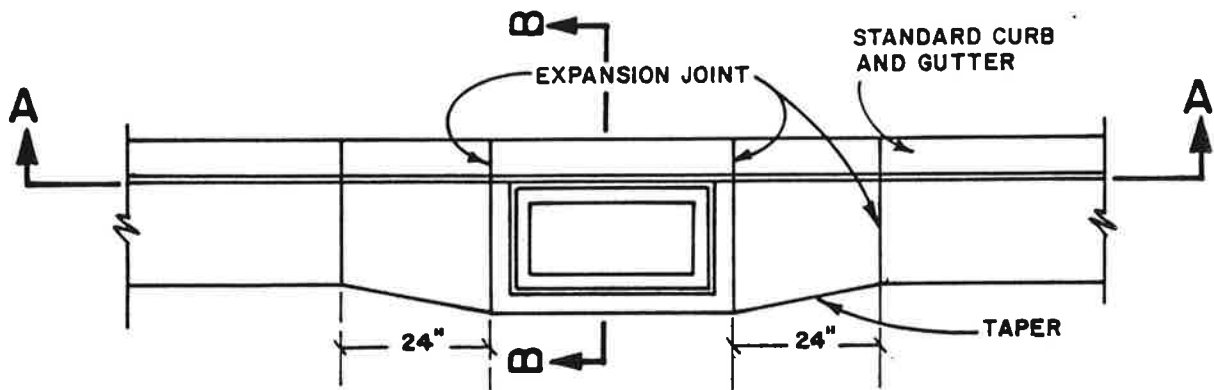
NOTE: CONCRETE TO BE 3000 P.S.I. AT 28 DAYS, 6 SACK MIX



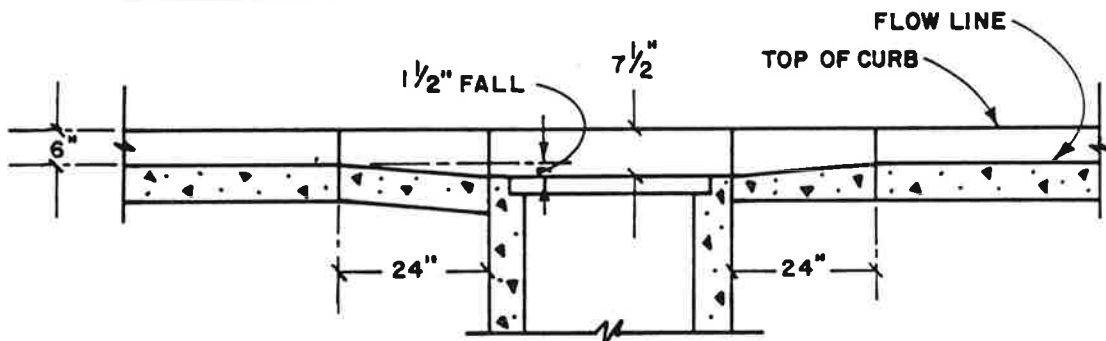
COLUMBIA COUNTY

Cross Gutter

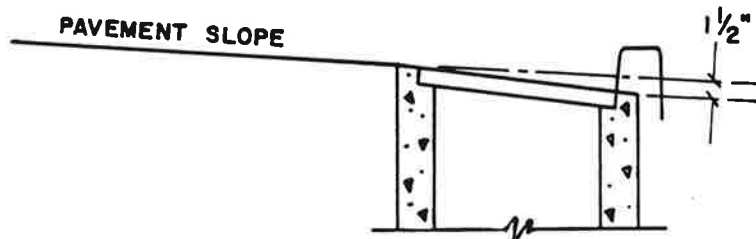
Col. Cty. Standard  
Drawing No. CS-303



**PLAN VIEW - STANDARD CURB & GUTTER**



**SECTION A - A**

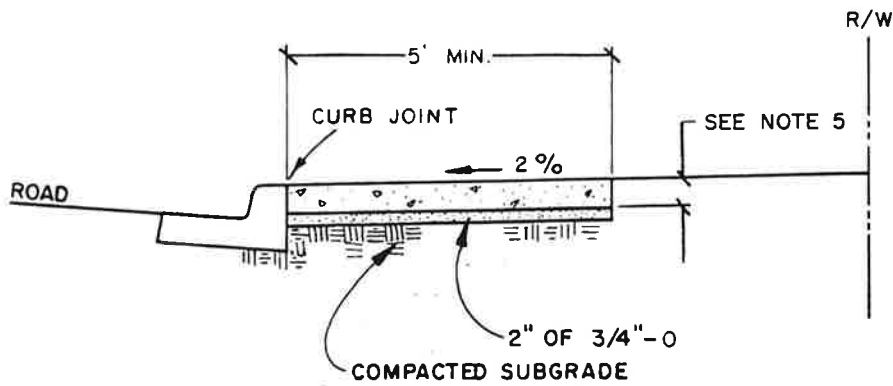


**SECTION B - B**

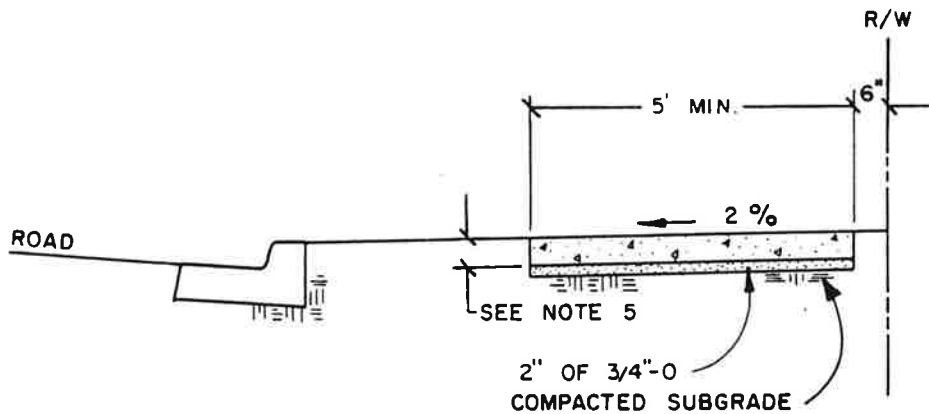
COLUMBIA COUNTY

Catch Basin - Pavement Taper

Col. Cty. Standard  
Drawing No. CS-304



## SIDEWALK ADJACENT TO CURB



## SIDEWALK AWAY FROM CURB

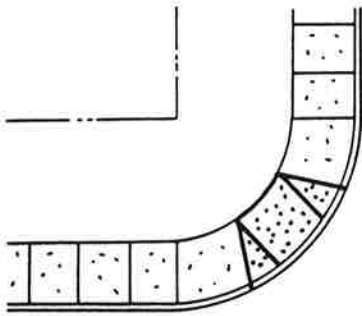
### NOTES :

1. CONCRETE SHALL BE 3000 P.S.I. AT 28 DAYS , 6 SACK MIX , SLUMP RANGE OF 1 1/2" TO 3"
2. PANELS TO BE 5 FEET LONG
3. EXPANSION JOINTS TO BE PLACED AT SIDES OF DRIVEWAY APPROACHES , UTILITY VAULTS , WHEELCHAIR RAMPS , & AT SPACING NOT TO EXCEED 45 FT.
4. FOR SIDEWALKS ADJACENT TO THE CURB & POURED AT THE SAME TIME AS THE CURB, THE JOINT BETWEEN THEM SHALL BE A TROWELED JOINT WITH A MIN. 1/2" RADIUS.
5. SIDEWALK SHALL HAVE A MINIMUM THICKNESS OF 6 INCHES IF MOUNTABLE CURB IS USED OR IF SIDEWALK IS INTENDED AS PORTION OF DRIVEWAY . OTHERWISE SIDEWALK SHALL HAVE A MINIMUM THICKNESS OF 4 INCHES .
6. DRAIN BLOCKOUTS IN CURBS SHALL BE EXTENDED TO BACK OF SIDEWALK WITH 3" DIA. PLASTIC PIPE AT 2% SLOPE . CONTRACTION JOINT TO BE PLACED OVER PIPE.

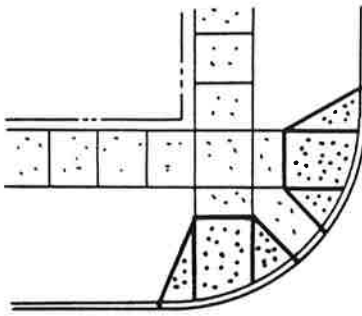
COLUMBIA COUNTY

Concrete Sidewalk

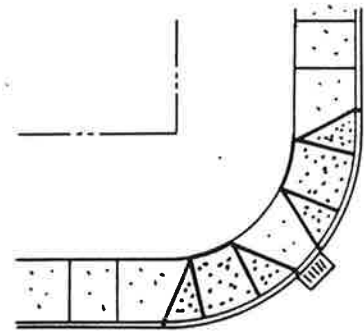
Col. Cty. Standard  
Drawing No. CS-305



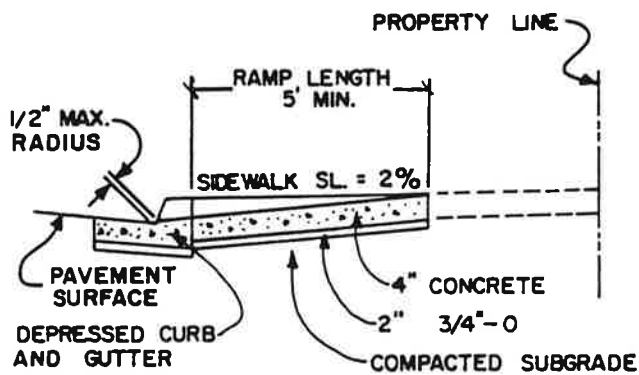
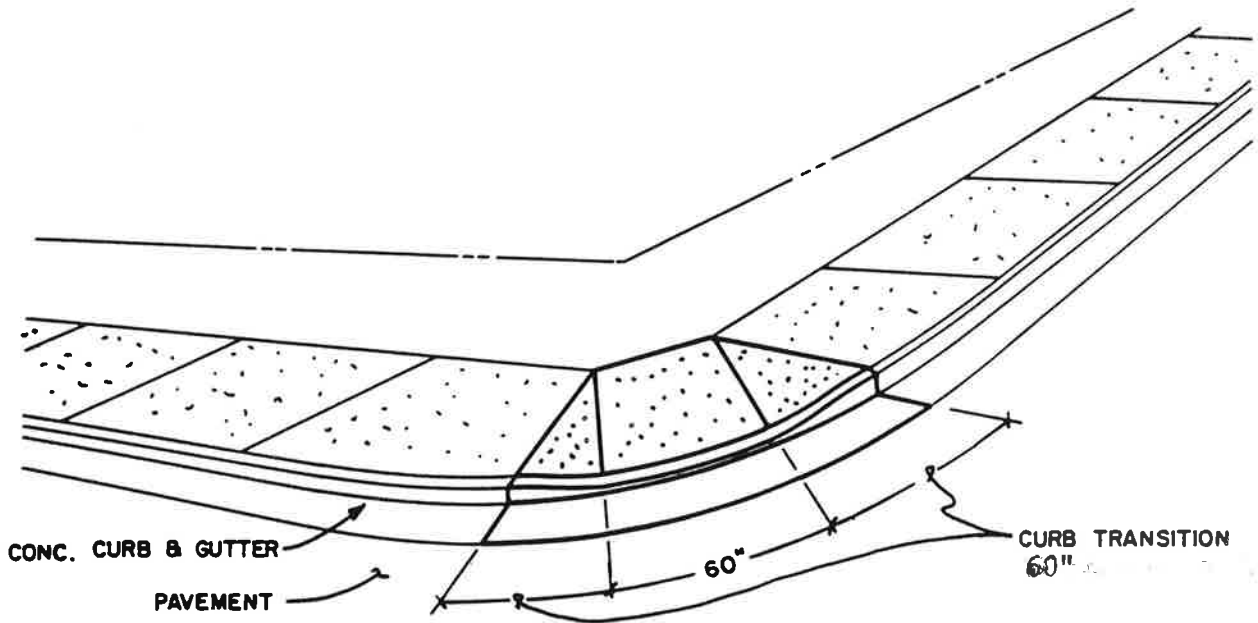
**CENTER RAMP**  
(CURB LINE WALKS)



**END RAMPS**  
(PROPERTY LINE WALKS)



**SIDE RAMPS**  
(WHERE CATCH BASIN IS WITHIN RADIUS)



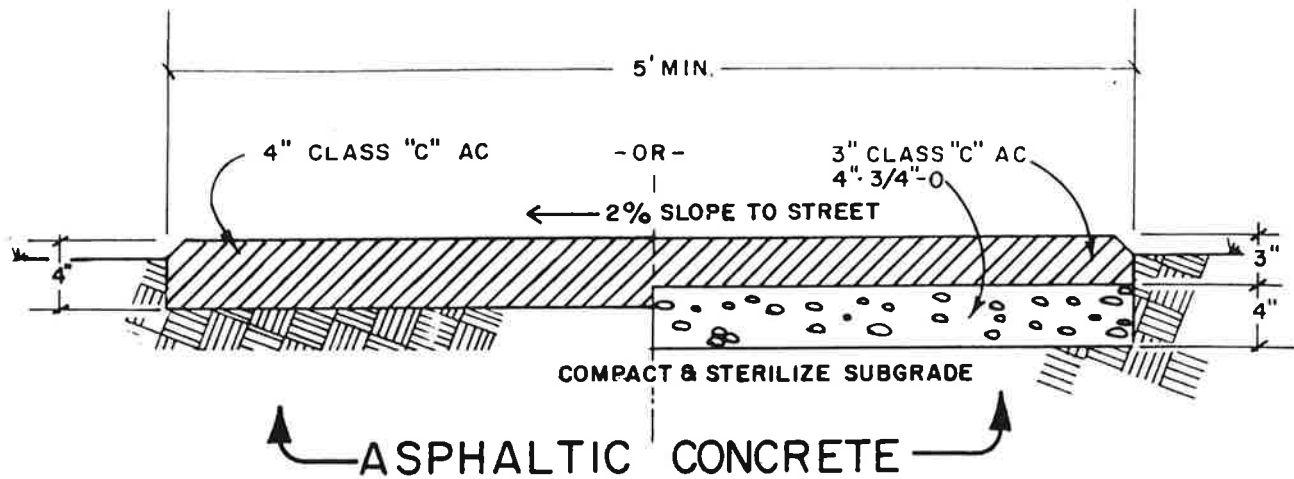
**NOTES**

1. FOR SIDEWALK DETAIL, SEE DWG. NO. CS-305.
2. SEE DWG. NO. CS-300 FOR CURB AND GUTTER DETAIL, OR SEE DWG. NO. CS-301 FOR CURB DETAIL.
3. RAMP WIDTH SHALL BE AS SHOWN HEREON UNLESS OTHERWISE APPROVED BY THE ENGINEER.
4. CONCRETE SHALL BE 3000 P.S.I. AT 28 DAYS, 6 SACK MIX, SLUMP RANGE 1-1/2" TO 3".
5. PROVIDE EXPANSION JOINT ON EACH SIDE OF RAMP.

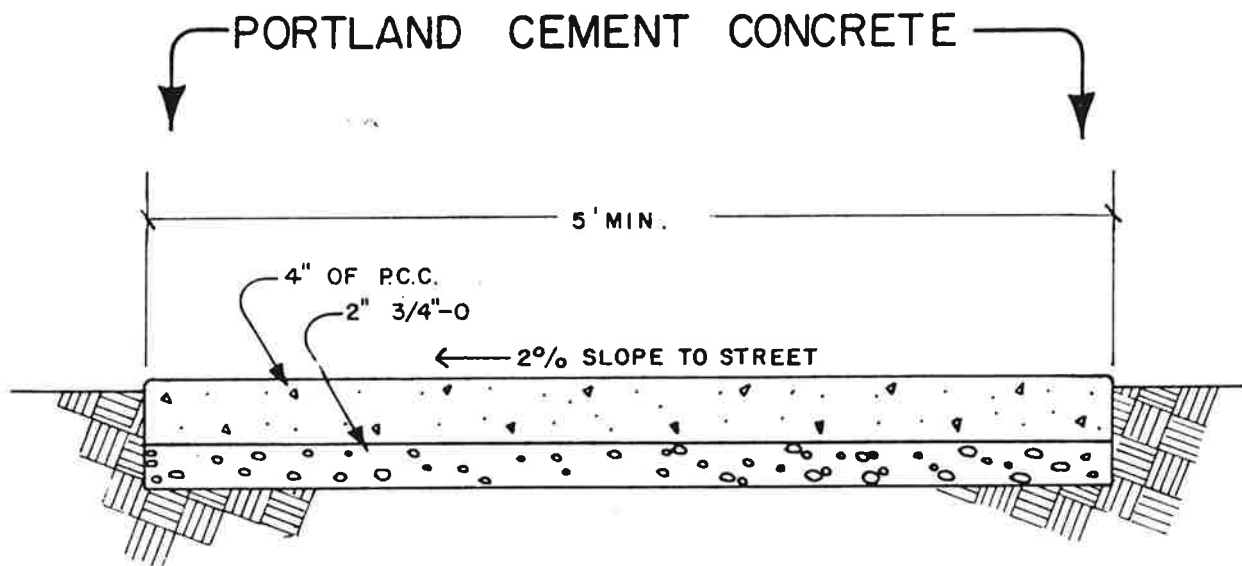
COLUMBIA COUNTY

Sidewalk Ramp

Col. Cty. Standard  
Drawing No. CS-306



OR



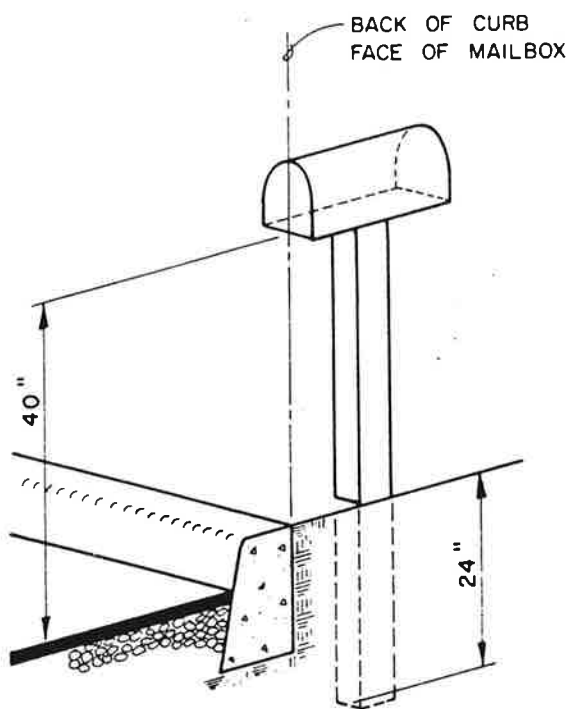
**NOTES :**

1. CONCRETE SHALL BE 3000 P.S.I. AT 28 DAYS, SIX SAC MIX, SLUMP RANGE OF 1 1/2" - 3"
2. SIDEWALK PANELS SHALL BE SQUARE, 3/4" DEEP SCRIBES AT JOINTS 5 FEET APART, EDGED ON 4 SIDES & HAVE A LIGHT BROOM FINISH.

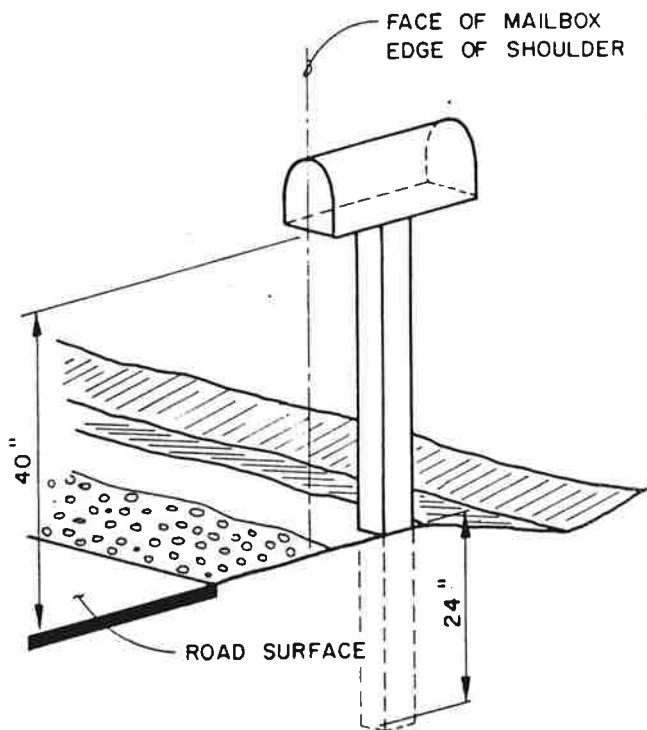
COLUMBIA COUNTY

Pedestrian Path or Bikeway

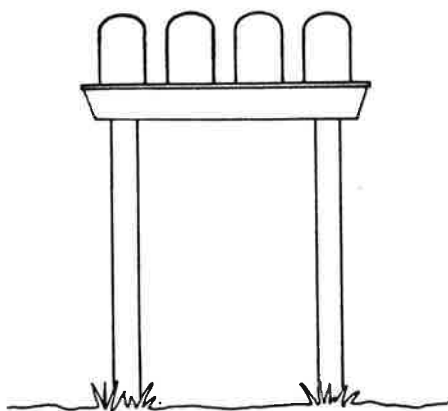
Col. Cty. Standard  
Drawing No. CS-307



STREETS WITH CURBS



STREETS WITHOUT CURBS



GROUP BOXES

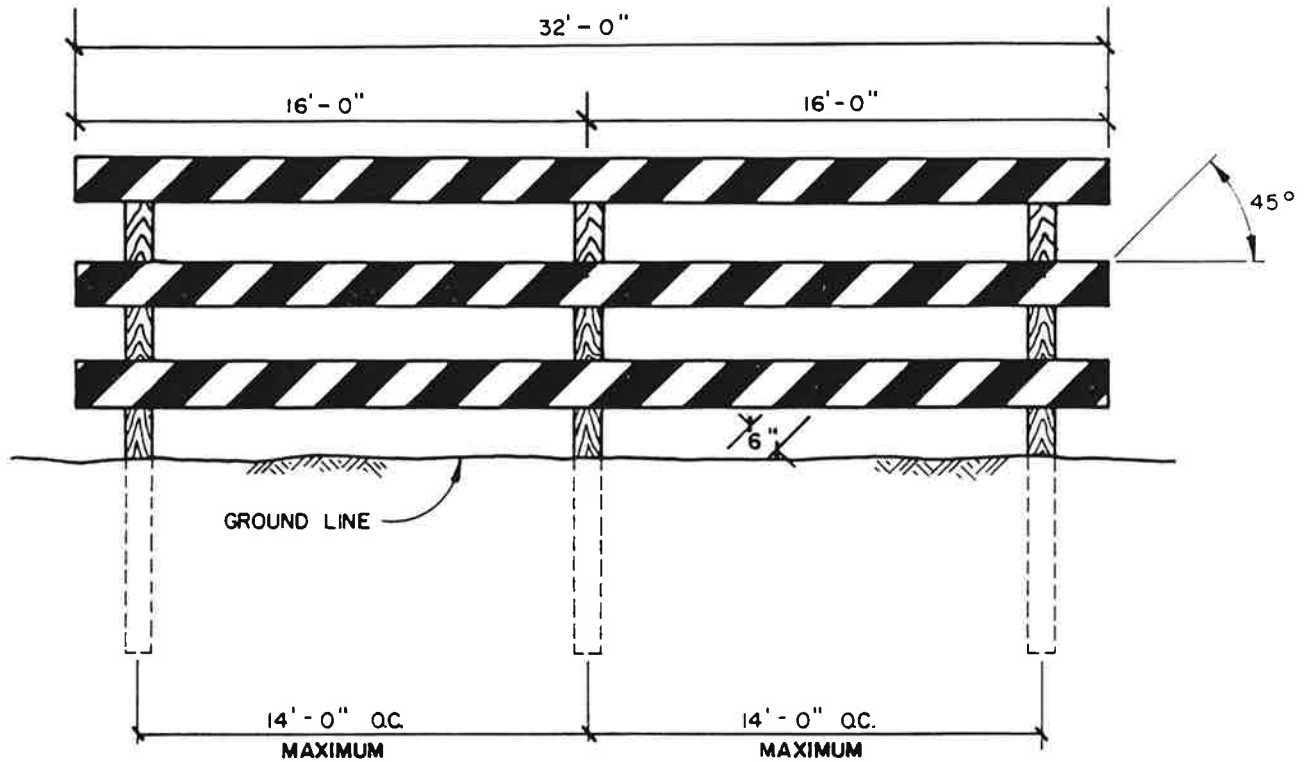
NOTE :

1. BOX NUMBER AND NAMES SHALL BE NOT LESS THAN ONE INCH HIGH.
2. POSTS MUST BE NEAT AND OF ADEQUATE STRENGTH AND SIZE .
3. ALL MAILBOX LOCATIONS AND CLUSTERS MUST CONFORM TO REQUIREMENTS OF THE UNITED STATES POSTAL SERVICE.

COLUMBIA COUNTY

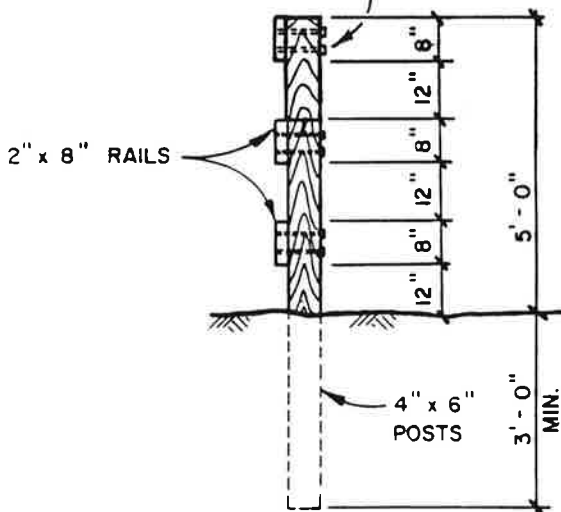
Mailbox Location

Col. Cty. Standard  
Drawing No. M-400



## ELEVATION

5/8" GALVANIZED SQ. HD.  
MACHINE BOLTS / WASHERS



## END VIEW

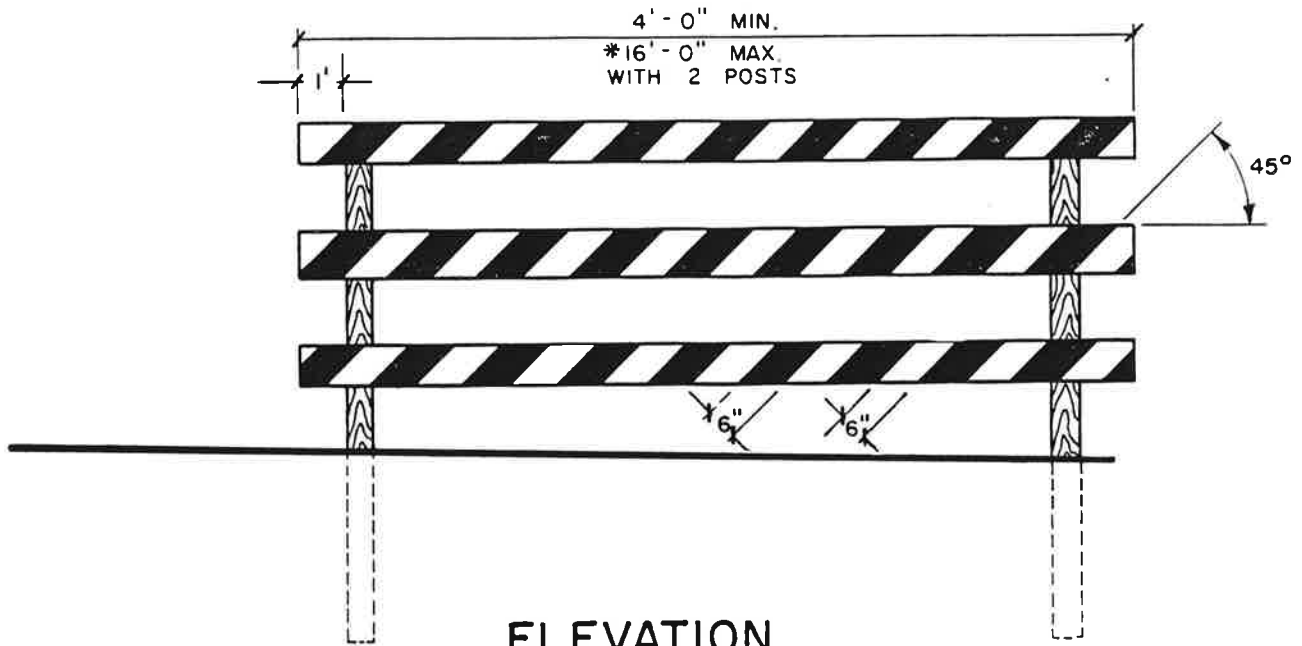
### NOTES:

1. RAILS TO BE PAINTED BLACK WITH WHITE STRIPES. THE WHITE STRIPES SHALL BE REFLECTORIZED \* FOR WIDER APPLICATIONS, MULTIPLE SECTIONS AS SHOWN SHALL BE USED.
2. SEE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS AND THE OREGON SUPPLEMENT.  
3F-1 BARRICADES  
6C-8 BARRICADE DESIGN  
6C-9 BARRICADE APPLICATION
3. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE CURRENT STATE OF OREGON STANDARD SPECIFICATIONS FOR HWY. CONSTRUCTION.

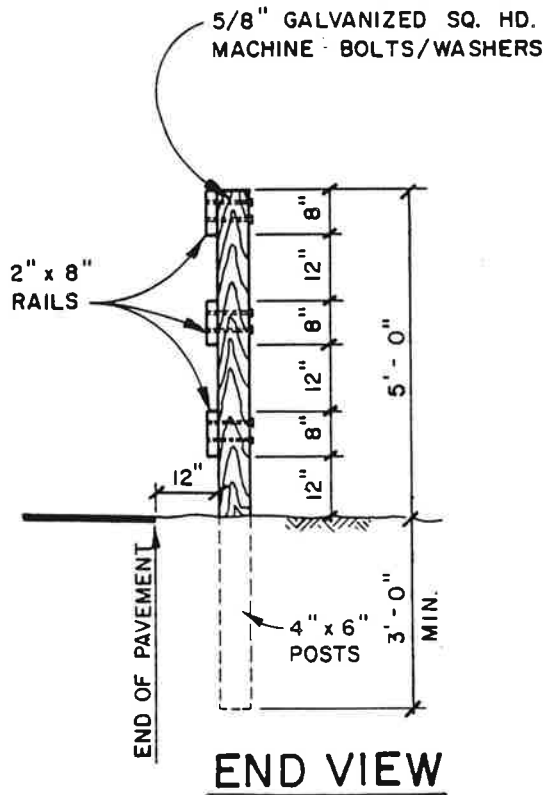
COLUMBIA COUNTY

Street Barricade - Type III

Col. Cty. Standard  
Drawing No. M-401



ELEVATION



END VIEW

NOTES:

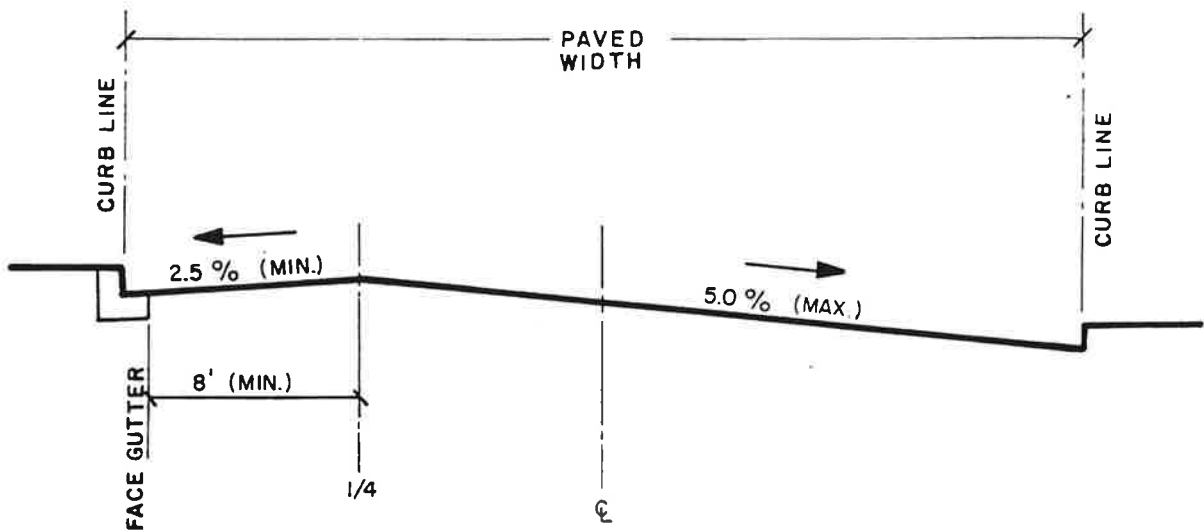
1. RAILS TO BE PAINTED BLACK WITH WHITE STRIPES. THE WHITE STRIPES SHALL BE REFLECTORIZED  
\* FOR WIDER APPLICATIONS, MULTIPLE SECTIONS AS SHOWN SHALL BE USED.
2. SEE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS AND THE OREGON SUPPLEMENT.  
3F-1 BARRICADES  
6C-8 BARRICADE DESIGN  
6C-9 BARRICADE APPLICATION
3. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE CURRENT STATE OF OREGON STANDARD SPECIFICATIONS FOR HWY. CONSTRUCTION.

COLUMBIA COUNTY

Street Barricade - Type III  
at Width Transitions

Col. Cty. Standard  
Drawing No. M-402





**NOTES:**

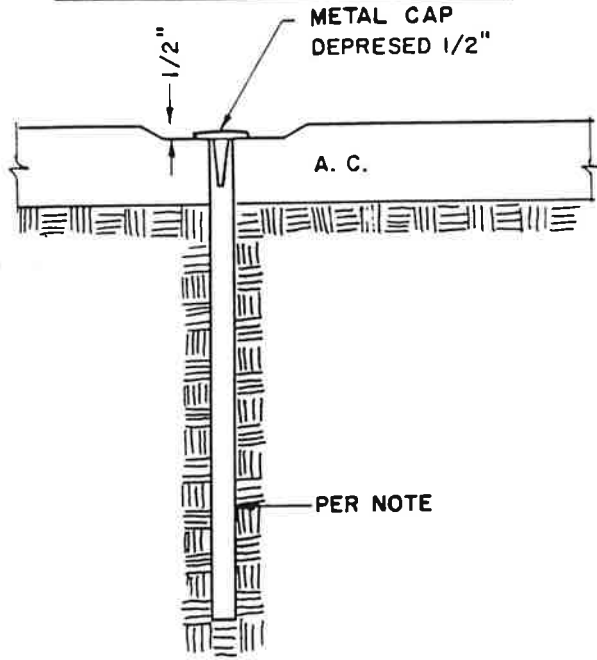
1. OFFSET CROWN CROSS-SECTIONS MAY BE USED IN AREAS OF SUBSTANTIAL CROSS SLOPE, AT THE DISCRETION OF THE ENGINEER.
2. OFFSET CROWN CROSS-SECTIONS SHALL NOT BE USED TO INCREASE DESIGN SPEED IN HORIZONTAL CURVES. SUPERELEVATION SECTIONS SHALL BE USED FOR THAT PURPOSE.
3. MAXIMUM ELEVATION DIFFERENCE OF CURBS (OR EDGE OF PAVEMENT) IS DETERMINED BY CROSS-SLOPES AND WIDTH OF STREET.

COLUMBIA COUNTY

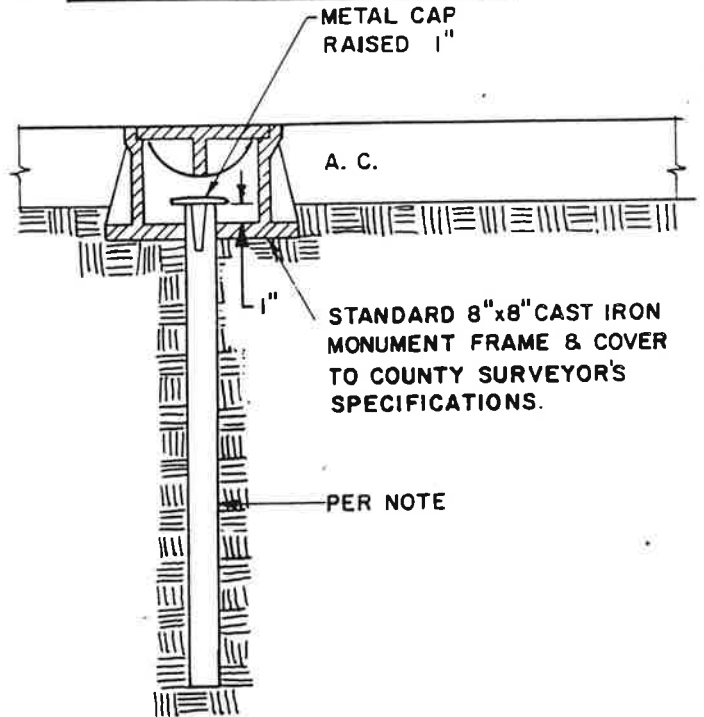
Offset Crown

Col. Cty. Standard  
Drawing No. M-403

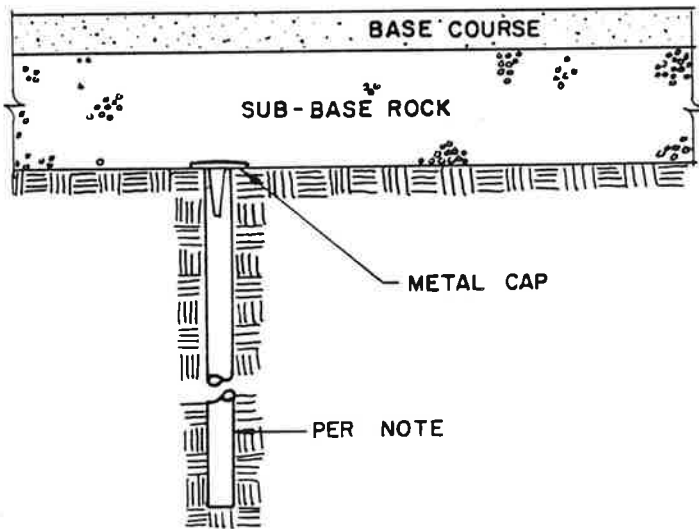
**A. FOR USE IN PAVED ROADS**



**B. FOR USE IN PAVED ROADS**



**C. FOR USE IN GRAVEL ROADS**

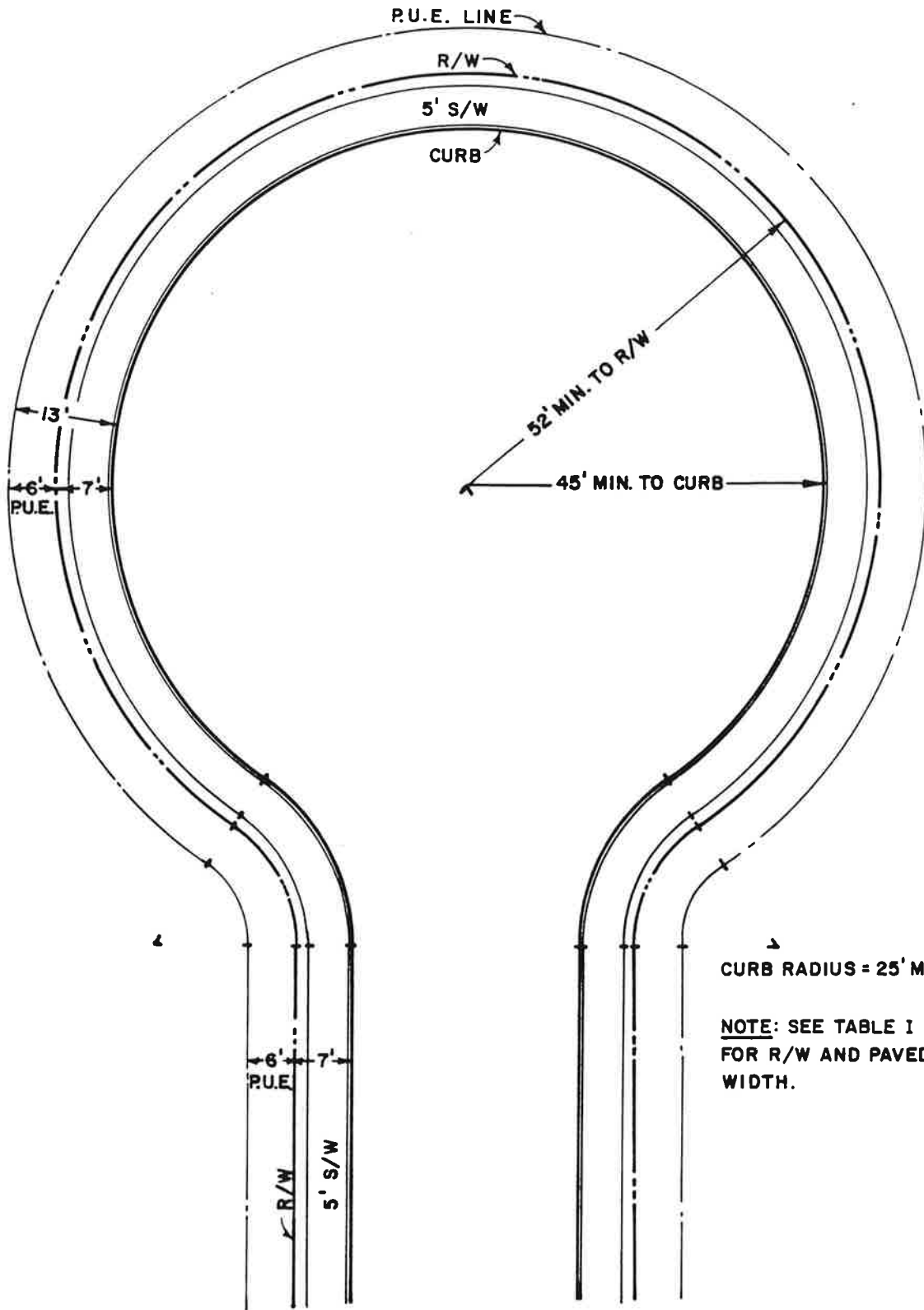


**NOTE:** ALL MONUMENTS SHALL USE EITHER  
5/8" DIA. X 30" LONG IRON ROD OR  
3/4" I. DIA. X 30" LONG IRON PIPE.  
ALL MONUMENTS SHALL BE IN  
ACCORDANCE WITH ORS 209.250(4).

COLUMBIA COUNTY

Centerline Survey Monuments

Col. Cty. Standard  
Drawing No. M-404



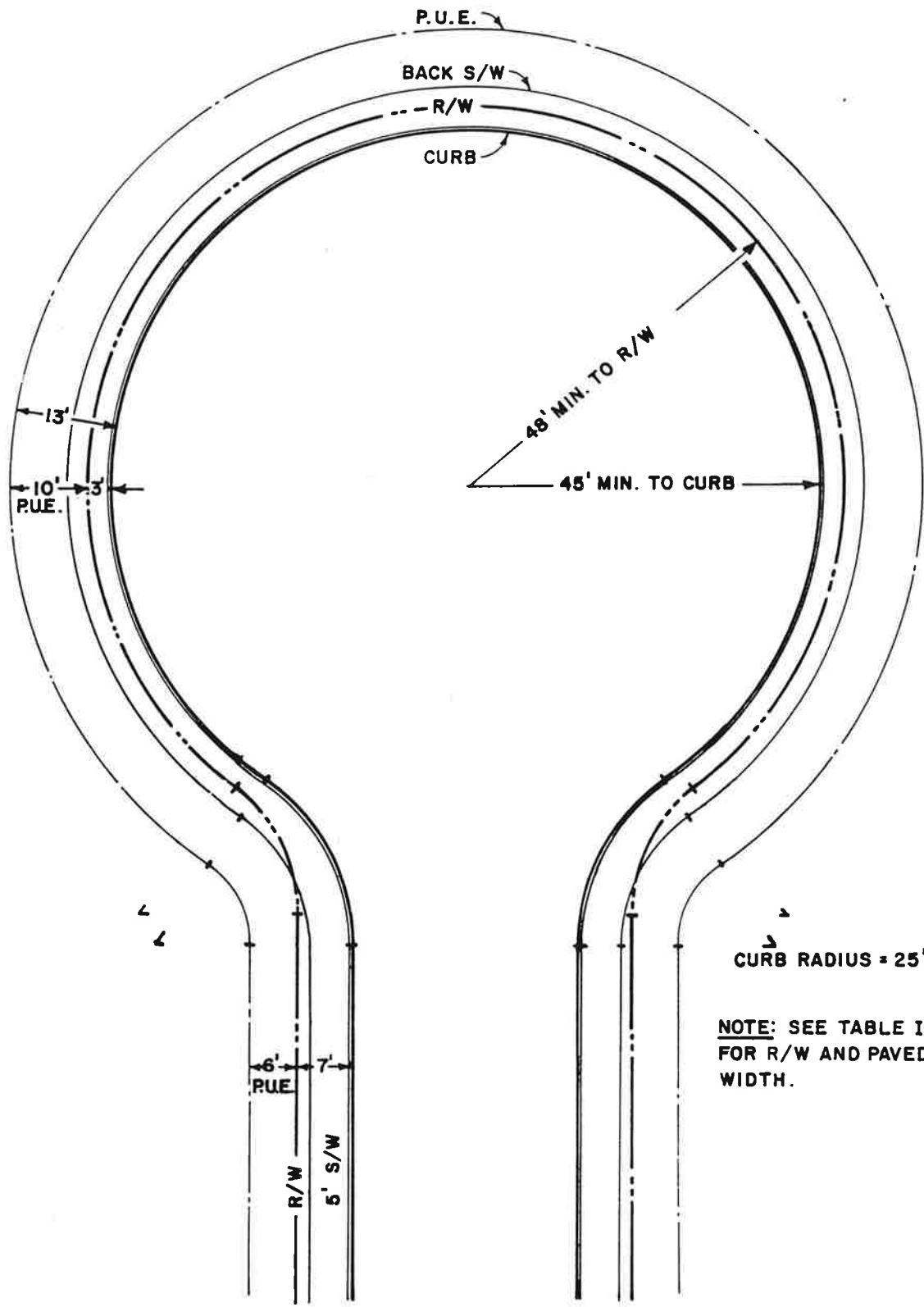
CURB RADIUS = 25' MIN.

**NOTE:** SEE TABLE I  
FOR R/W AND PAVED  
WIDTH.

COLUMBIA COUNTY

Standard Cul-De-Sac

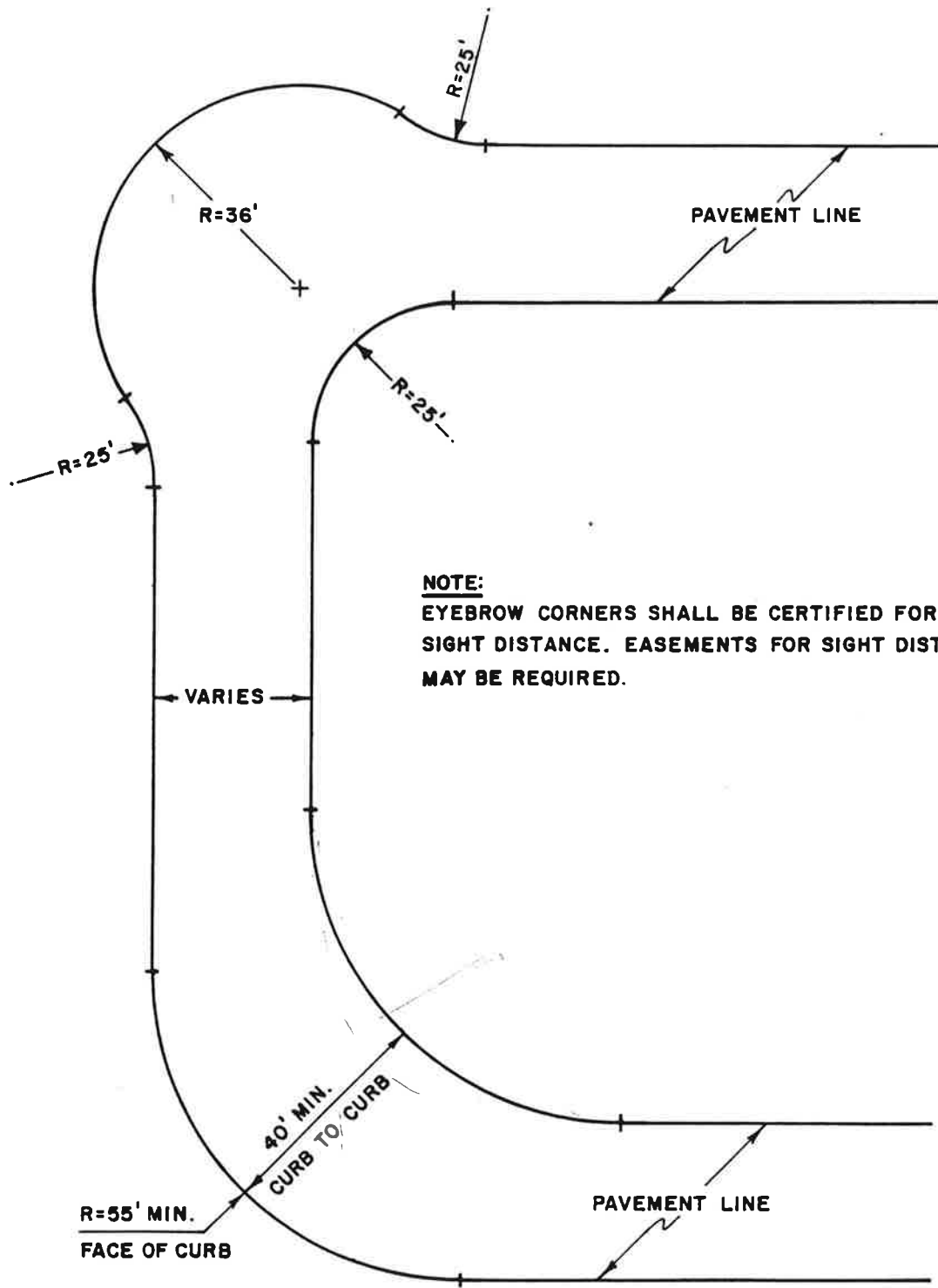
Col. Cty. Standard  
Drawing No. M-405



COLUMBIA COUNTY

Optional Cul-De-Sac

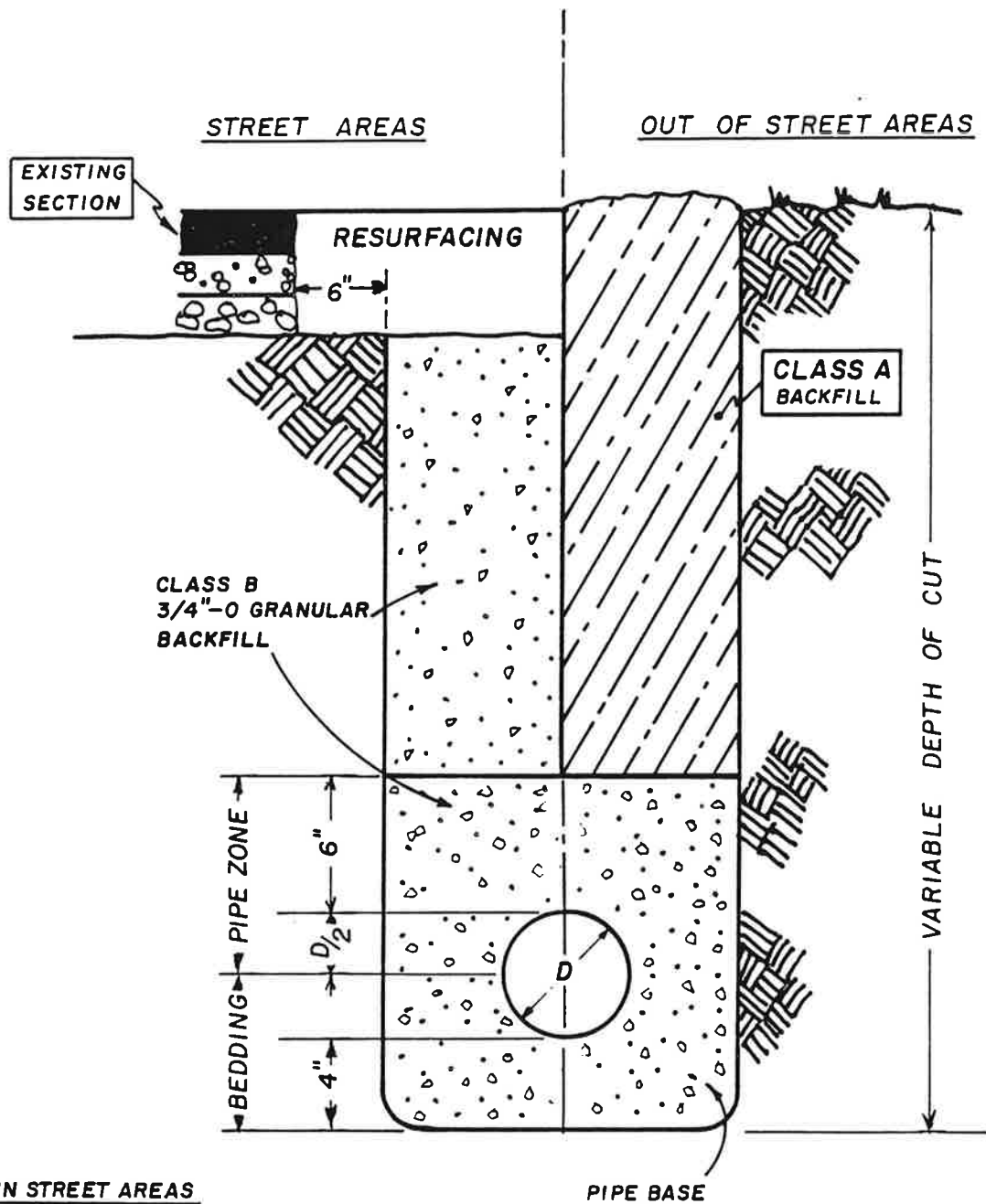
Col. Cty. Standard  
Drawing No. M-405.1



COLUMBIA COUNTY

Eyebrow-Corner

Col. Cty. Standard  
 Drawing No. M-405.5



**BACKFILL IN STREET AREAS**

1. IF S/W IS AGAINST CURB, FILL ROCK TO BACK OF S/W
2. IF S/W IS NOT AGAINST CURB, FILL ROCK 2' BACK FROM CURB

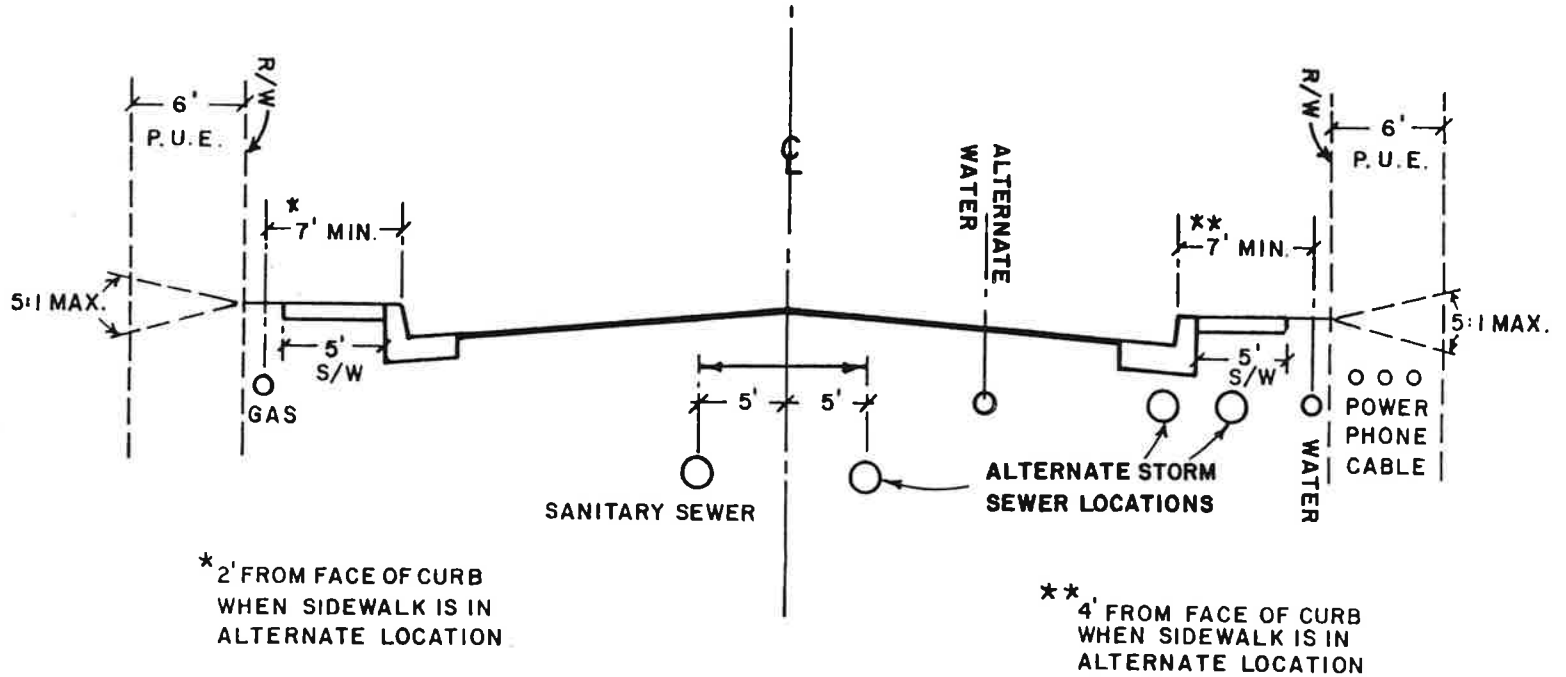
COLUMBIA COUNTY

Pipe Bedding & Backfill Details

Col. Cty. Standard  
Drawing No. M-406

Utility Location

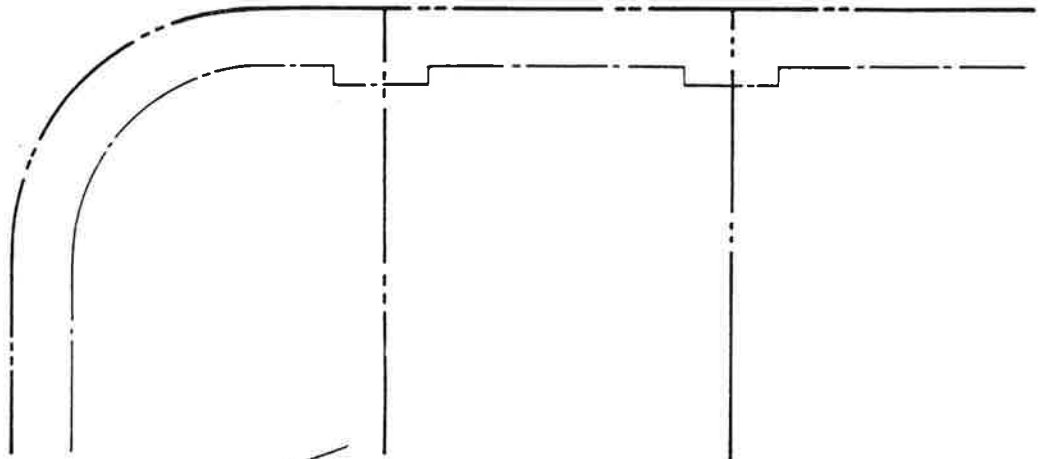
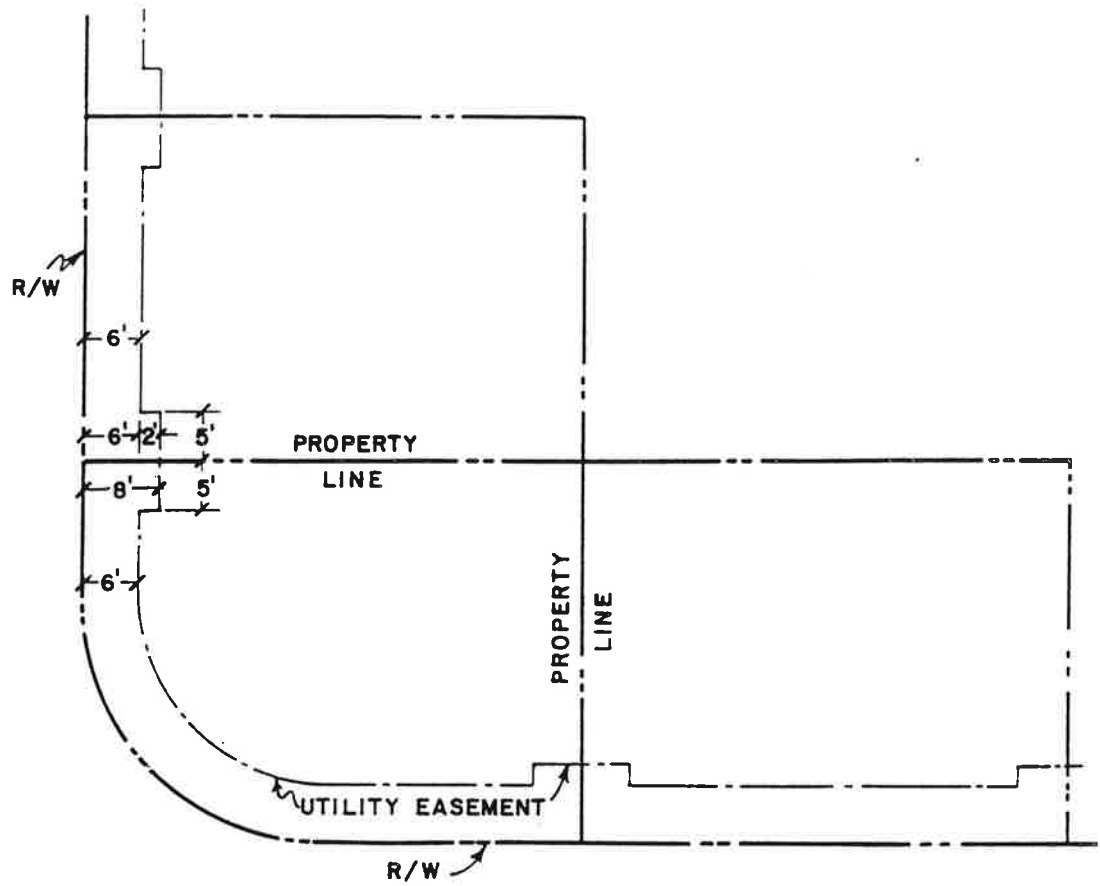
COLUMBIA COUNTY



**NOTES :**

1. GAS AND SANITARY SEWER ON THE NORTH AND WEST, WATER AND STORM SEWER ON THE SOUTH AND EAST.  
HOWEVER, IF GAS LINES ARE OF NON - FERROUS MATERIAL THEN POWER AND GAS MAY BE LOCATED ON THE SAME SIDE.
2. ALTERNATE WATER LOCATION SHOWN ABOVE BY COUNTY APPROVAL ONLY. SEE UTILITIES, SECTION 210.19 OF THESE STANDARDS.
3. MAINTAIN MINIMUM REQUIRED SEPARATION BETWEEN SANITARY SEWER AND WATER.
4. SEE TABLE I FOR P. U. E. REQUIREMENTS.

Col. Cty. Standard  
Drawing No. M-407



COLUMBIA COUNTY

Residential Utility Easement

Col. Cty. Standard  
Drawing No. M-408





**COLUMBIA COUNTY FIRE SERVICES**

**FIRE APPARATUS ACCESS ROADS & DRIVEWAYS STANDARD**

**10.0 INTRODUCTION**

This Standard shall apply within the unincorporated areas of Columbia County. It is the purpose of this Standard to foster unity of understanding in areas where there may be difficulty in understanding the intent of the Uniform Fire Code language, as well as promote the public's health, safety and welfare through the installation regulation of fire apparatus access roads and driveways as required by the Uniform Fire Code, Article 10 Section 10.207.

The Columbia County Fire Services have the authority and responsibility to process requests for review and approval of all fire apparatus access roads and driveways. Outside Rural Fire District boundaries, Oregon State Forestry and/or County Rural Fire Districts may be contacted and used as a resource.

**10.1 DEFINITIONS**

**All Weather Driving Surface:** A firm, uniform road surface designed and maintained to bear the imposed loads of fire apparatus.

**Columbia County Fire Services:** Any rural fire protection district, the Oregon Department of Forestry, the State Fire Marshal and their authorized representatives.

**Cul-de-sac:** A permanently maintained, clear, unobstructed road space at least 90 feet in diameter at the end of a dead-end street.

**Curb:** A border forming part of a gutter along the edge of a street.

**Driveway:** When OVER 150 feet long, a required twelve (12) foot wide firm, uniform all weather road surface with a clear and unobstructed twenty (20) foot right-of-way. Can be used when there are not more than two (2) Group R, Division 3 (private dwellings) served.

**Fire Apparatus Access Road:** A required road which is at least twenty (20) feet wide, has a firm, uniform all weather road surface with an unobstructed height of 13'6", which is used by fire apparatus and other vehicular traffic.

**Grade:** The degree of inclination of a slope, road, or driveway.

**Turnaround:** A permanently maintained, clear, unobstructed road space used for turning around fire apparatus.

**Turnout:** A section of road wide enough to permit the passing of two vehicles.

**Street Intersection:** Place where two or more roads cross.

## 10.2 FIRE APPARATUS ACCESS ROADS

Fire apparatus roadways shall be provided so that no portion of an exterior wall of the first story is located more than 150 feet from an approved fire department vehicle access as measured by an unobstructed route around the exterior of the building. Fire apparatus access roads for outside storage areas shall be provided in accordance with applicable provisions of the Uniform Fire Code or in accordance with nationally recognized standards, see UFC 10.207(b).

Fire apparatus access roads shall be provided as required by the Uniform Fire Code and meet the following conditions:

- A. All fire apparatus access roads in excess of 150 feet in length shall be provided with an approved turnaround (see 10.4 of this interpretation and UFC 10.207(h)).
- B. All fire apparatus access roads shall be at least twenty (20) feet wide, a minimum curve radius of forty-five (45) feet and have a clear height of 13 feet, 6 inches (13'6"), and be maintained clear of debris/obstructions, see UFC 10.207(c) and 10.207(d).
- C. Grade for fire apparatus access roads shall not exceed an average of twelve (12%) percent with a maximum of fifteen (15%) percent on short pitches. Where there are existing conditions, particularly topography, which cause non-negotiable conditions, the Fire Chief may require additional fire protection. This additional fire protection may include an approved fire sprinkler system

and/or other fire protection devices as specified in UFC 10.301(b). In considering a variance of this interpretation and Fire Code, see UFC 10.207.

- D. Fire apparatus access roads shall be designed and maintained to support loads of fire apparatus and sustain a minimum wheel load of 12,500 pounds and gross vehicle load of 50,000 pounds and be provided with a firm, uniform all weather driving surface, approved by an Oregon Registered Engineer. Otherwise, written verification of compliance shall be provided by the applicant, see UFC 10.207(f).
- E. Private bridges shall be constructed in accordance with the Uniform Building Code and be capable of sustaining a minimum wheel load of 12,500 pounds and a gross vehicle load of 50,000 pounds. Such plans shall bear the stamp and/or seal of an Oregon Registered Professional Engineer. Otherwise, written verification of compliance shall be provided by the applicant, see UFC 10.207(i).
- F. Approved signs and/or notices shall be provided and maintained to identify such roads and prohibit the obstruction thereof. They shall comply with the manual on Uniform Traffic Control Devices, 1988 Edition, see UFC 10.207(l). "No Parking" and "Fire Lanes" shall be signed and marked as follows:
  - 1. Fire lane markings on curbs or road surface shall be painted bright red with white letters. The stroke shall be one (1) inch with letters six (6) inches high to read "No Parking Fire Lane". Spacing for signage shall be every twenty-five (25) feet.
  - 2. Vertical signs shall be mounted no lower than four (4) feet and no higher than eight (8) feet.
  - 3. Vertical signs shall be twelve (12) inches wide and eighteen (18) inches high. Signs shall have red letters and border on a white background. The word "NO" shall be presented in a reversed color arrangement in the upper left hand corner. Spacing shall not exceed every twenty-five (25) feet.

### 10.3 DRIVEWAY STANDARDS

Driveway standards for private roads in excess of 150 feet in length, accessing two or less residences, shall be provided as required by the Uniform Fire Code (10.207(b)3) and shall meet the following conditions:

- A. Driveways shall be built and maintained to provide a minimum twelve (12) foot width of firm, uniform all weather surface capable of supporting gross vehicle weights of 50,000 pounds, minimum wheel load of 12,500 pounds and approved by an Oregon Registered Engineer. Otherwise, written verification of compliance shall be provided by the applicant. The twenty (20) foot right-of-way shall consist of a twelve (12) foot firm, uniform all weather travel lane bordered by a four (4) foot section on each side which shall be maintained clear of debris and obstructions. Driveways shall have a minimum curve radius of forty-five (45) feet and a vertical clearance of thirteen (13) feet six (6) inches (13'6"), see 10.207(f), 10.207(g) and 10.207(d).
- B. Driveways in excess of 200 feet shall provide twenty (20) foot wide by forty (40) foot long turnouts at a maximum spacing of 1/2 the driveway length or 400 feet, whichever is less. Wherever visibility is limited, these distances should be reduced appropriately.
- C. Dead-end driveways are defined as dead-end roads over 150 feet in length serving a single residence. Dead-end driveways shall have turnarounds such as a cul-de-sac, hammer head etc., as shown in diagram, section 10.4, see also UFC 10.207(h).
- D. Bridges, culverts, and other structures in the road bed shall be constructed and maintained to support gross vehicle weights of 50,000 pounds. If bridges or culverts are involved in the construction of a road or driveway, written verification of compliance with the 50,000 gross vehicle weight standard shall be provided from an Oregon Registered Professional Engineer. Otherwise, written verification of compliance shall be provided by the applicant, see UFC 10.207(i).
- E. Driveway grades shall not exceed an average of ten (10%) percent, with a maximum of fifteen (15%) percent on short pitches. Where there are existing conditions,

particularly topography, which cause non-negotiable conditions, the Fire Chief may require additional fire protection. This additional fire protection may include an approved fire sprinkler system and/or other fire protection devices as specified in UFC 10.301(b). In considering a variance of this interpretation and Fire Code, see UFC 10.207(j).

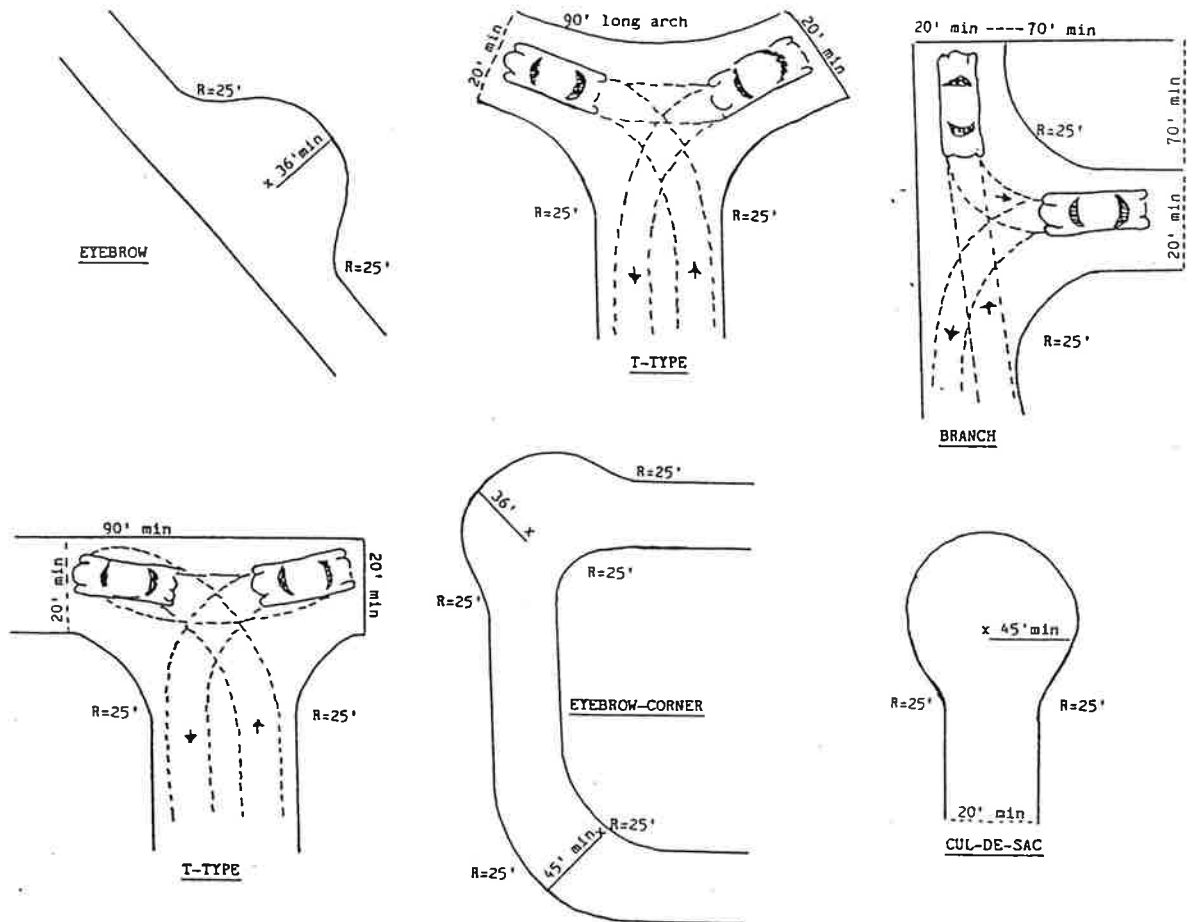
- F. Driveways shall be marked with the residence's address unless the residence or building is in such a position as to be plainly visible from the roadway. The residence or building address must be legible from the street or road fronting the property. Letters or numbers should be a minimum of three (3) inches in height and constructed of reflectorized material; or, as required by the Columbia County Addressing Ordinance, see UFC 10.208(a).
- G. If the driveway has a road name it shall be identified with approved signs, see UFC 10.208(b).

#### 10.4 TURNAROUNDS

Turnarounds, cul-de-sacs, and other turnaround configurations shall be provided as required by the Uniform Fire Code 10.207(h), and meet the following conditions (refer to diagrams on page 6):

- A. Maintain unobstructed clearance for bumper overhang on right-of-ways.
- B. Curb height not to exceed six (6) inches.
- C. No parking areas shall be designated by the Traffic Engineer or Fire Chief and comply with the manual of Uniform Traffic Control Devices, 1988 Edition. If curbs are not present, "No Parking" signs shall be used.
- D. "No Parking, Fire Lane, Tow Zone" sign locations will be determined by the Traffic Engineer or Fire Chief and comply with the manual of Uniform Traffic Control Devices, 1988 Edition.

- E. The structural section of the road shall be designed to support 50,000 pounds of vehicle weight, 12,500 pounds wheel load and be approved by an Oregon Registered Engineer or written verification of compliance shall be provided by the applicant.
- F. Drainage shall be required to prevent ponding.
- G. The area of the turnarounds shall be permanently maintained, kept clear, and unobstructed at all times.
- H. The creation of the turnarounds shown in this interpretation at any specific site, must be approved by the Fire Chief, an Oregon Registered Professional Engineer and the Land Development Services Department on apparatus access roads. On driveways, the Fire Chief shall approve all proposed turnarounds with verification as described in "E" above.



10.5 EMERGENCY ACCESS/SECURITY GATES

When access to or within a structure or an area is unduly difficult because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the Fire Chief may require a key box to be installed in an accessible location. The key box shall be a type approved by the Fire Chief and shall contain keys to gain necessary access as required by the Fire Chief, see UFC 10.209.

10.6 PLANS AND SPECIFICATIONS

Plans for fire apparatus access roads/driveways shall be received by the Rural Fire District or Oregon State Forestry in accordance with the Uniform Fire Code 10.301(f). These plans shall contain all of the following information:

- A. Right-of-way width;
- B. Width of all weather surface;
- C. Turnouts;
- D. Turnarounds;
- E. Grades;
- F. Curves;
- G. Bridges;
- H. Culverts;
- I. Structures in relation to roadways;
- J. Addressing;
- K. Intersections;
- L. Existing structures and driveways on roadway;
- M. Location of hydrants/hydrant reflectors, if required; and
- N. Approval stamp of an Oregon Registered Engineer or written verification compliance from applicant for 50,000 pound vehicle weight and 12,500 per wheel load weight.

10.7 INSPECTION FOR COMPLIANCE

In order to insure that access roads/driveways are improved to the required standards, an inspection form must be signed by a Fire District or Oregon State Forestry official before a building permit is issued. This will assure that road improvements are adequate for fire protection equipment to reach the site not only during the beginning construction phase, but also to ensure continued access throughout the existence of the structure(s), see UFC 10.301(3).



**FIRE SERVICE IMPROVEMENT REQUIREMENTS**  
**FOR ROADS OVER 150 FEET IN LENGTH WITH**  
**ONE AND TWO FAMILY DWELLINGS**

If this is a new access connecting to a county road, please contact the Columbia County Land Development Services Department to obtain a road approach permit or a sign-off indicating that no permit is required.

The Uniform Fire Code 10.207, the Columbia County Zoning Ordinance and Subdivision and Partitioning Ordinance require roadway/driveway improvements to a construction or mobile home installation site prior to the issuance of a building permit. One reason for this requirement is to assure that road improvements will allow fire protection equipment to reach the site, not only during the construction phase, but throughout the existence of the structure. In order to assure that the access road meets the required standards, **this form must be signed by a local Fire Service official, and a copy of the signed form must be attached to your application for a dwelling, construction or mobile home placement permit.**

Minimum standard roadway approval requires a twelve (12) foot wide, uniform all weather travel lane, with a twenty (20) foot wide right-of-way maintained clear of debris and obstructions four (4) feet on each side of the travel lane. Driveways shall sustain a minimum wheel load of twelve-thousand five-hundred (12,500) pounds per wheel and a gross vehicle load of fifty-thousand (50,000) pounds. Turnouts twenty (20) feet wide and forty (40) feet long may be required on any access road exceeding four-hundred (400) feet in length. The unobstructed width must be maintained for not less than twenty (20) feet. Vertical clearance shall be maintained at no less than thirteen (13) feet, six (6) inches (13'6"). All access roads over one-hundred-fifty (150) feet in length shall be provided with a turnaround area at or near the end, improved to the above standards and of a design approved by the local Fire Service. Proper drainage must be provided. Bridges and culverts shall be capable of supporting a minimum of fifty-thousand (50,000) pounds. Average road grade shall not exceed ten (10%) percent and no grade shall exceed fifteen (15%) percent. Maximum curve centerline shall be not less than forty-five (45) feet radius. Any new access connecting to a Columbia County road requires a Columbia County Approach Road Permit.

Please deliver this form to the local Fire Service and assist them in locating and inspecting the roadway/driveway providing access to the proposed development site. Maps to assist you in this effort may be obtained from the Columbia County Assessor's Office or the Columbia County Land Development Services Department.

**TYPE AND LOCATION OF PROPOSED DEVELOPMENT:**

-----  
-----  
-----  
-----

Name: \_\_\_\_\_ Tax Lot: \_\_\_\_\_

-----**THIS SECTION TO BE COMPLETED BY FIRE SERVICE**-----

\_\_\_\_\_ I have inspected the above property and determined that road improvements to the proposed development site are suitable for access by Fire Service equipment.

\_\_\_\_\_ The following improvements must be completed prior to permit issuance:

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-----  
-----  
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Fire Service: \_\_\_\_\_ Date: \_\_\_\_\_

- White Copy - Fire District
- Canary Copy - Land Development Services Department
- Pink Copy - Applicant