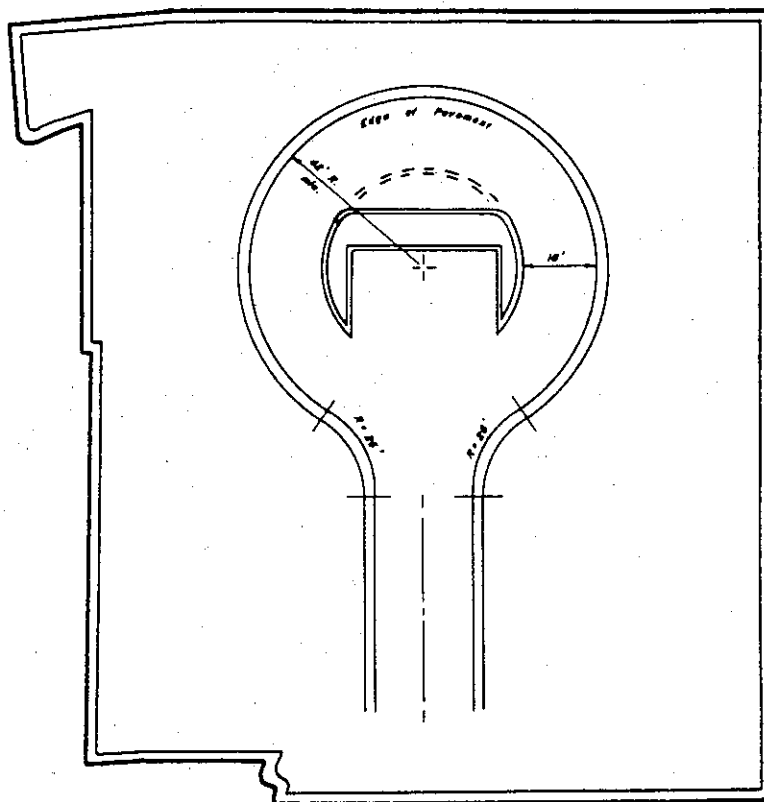


Requirements and Standards
for the Design and Construction of
STREETS AND ROADWAY FACILITIES

Warren County, Ohio



Warren County Board of Commissioners

Larry Crisenbery
C. Michael Kilburn
Pat Arnold South



**REQUIREMENTS AND STANDARDS
FOR THE DESIGN AND CONSTRUCTION OF
STREETS AND ROADWAY FACILITIES**

Warren County, Ohio

May 20, 1986

**Amended
April 3, 1990
August 9, 1994
June 27, 1995**

Warren County Board of Commissioners

**Larry Crisenbery
C. Michael Kilburn
Pat Arnold South**

320 East Silver Street, Lebanon, Ohio

WARREN COUNTY BOARD OF COMMISSIONERS

WARREN COUNTY ADMINISTRATION BUILDING, 320 EAST SILVER STREET, LEBANON, OHIO 45036

TELEPHONE (513) 932-4040
424-7705 Franklin Area
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GEO. E. TERWILLEGER
C. MICHAEL KILBURN
O.H. "PETE" EGLESTON

RESOLUTION #86-305 ADOPT REQUIREMENTS AND STANDARDS FOR THE DESIGN AND CONSTRUCTION OF STREETS AND ROADWAY FACILITIES

WHEREAS, Section 711.101 of the Ohio Revised Code authorizes a board of county commissioners to adopt rules and regulations setting standards and requiring and securing the construction of improvements shown on plats required by Section 711.10 of the Ohio Revised Code; and,

WHEREAS, the Warren County Board of Commissioners has prepared a complete revision to the regulations currently titled Engineering Design Standards and Construction Regulations; and,

WHEREAS, a public hearing on said revised regulations was held by the Warren County Board of Commissioners on March 20, 1986; and,

NOW, THEREFORE, BE IT RESOLVED by the Warren County Board of Commissioners to adopt the revised regulations under the title: Requirements and Standards for the Design and Construction of Streets and Roadway Facilities.

BE IT FURTHER RESOLVED that these regulations shall become effective on June 9, 1986, and that all prior rules and regulations are hereby rescinded as of this date.

Mr. Egleston moved for passage of the above resolution, seconded by Mr. Terwilleger, and upon call of the roll the following vote resulted:

Mr. Kilburn - yea
Mr. Terwilleger - yea
Mr. Egleston - yea

Resolution duly adopted this 20th day of May 1986.

BOARD OF COUNTY COMMISSIONERS

Margaret Breuninger
Clerk

The Incredible County

WARREN COUNTY BOARD OF COMMISSIONERS

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GEO. E. TERWILLEGER
C. MICHAEL KILBURN
O.H. "PETE" EGLESTON

RESOLUTION #86-306 AUTHORIZE WARREN COUNTY REGIONAL PLANNING COMMISSION TO ADMINISTER REGULATIONS

WHEREAS, Section 711.101 of the Ohio Revised Code authorizes a board of county commissioners to adopt rules and regulations setting standards and requiring and securing the construction of improvements shown on plats required by Section 711.10 of the Ohio Revised Code; and,

WHEREAS, the Warren County Board of Commissioners has adopted such regulations under the title: Requirements and Standards for the Design and Construction of Streets and Roadway Facilities; and,

WHEREAS, Section 711.101 of the Ohio Revised Code authorizes a board of county commissioners to delegate the administration of said regulations to the regional planning commission having platting jurisdiction over the land affected;

NOW, THEREFORE, BE IT RESOLVED by the Warren County Board of Commissioners to appoint the Warren County Regional Planning Commission to administer the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities.

BE IT FURTHER RESOLVED that the Warren County Regional Planning Commission is authorized to modifying said regulations in specific cases where unusual or exceptional factors or conditions require such modification.

Mr. Egleston moved for passage of the above resolution, seconded by Mr. Terwilleger, upon call of the roll the following vote resulted:

Mr. Kilburn - yea
Mr. Terwilleger - yea
Mr. Egleston - yea

Resolution duly adopted this 20th day of May 1986.

BOARD OF COUNTY COMMISSIONERS

Margaret Draeniger
Clerk

The Incredible County™

**BOARD OF COUNTY COMMISSIONERS
WARREN COUNTY, OHIO**

Resolution

Number 90-397

Adopted Date April 3, 1990

**ADOPT AMENDMENTS TO THE REQUIREMENTS AND STANDARDS FOR THE DESIGN
AND CONSTRUCTION OF STREETS AND ROADWAY FACILITIES**

WHEREAS, a public hearing was conducted on March 6, 1990 and continued to April 3, 1990 to consider proposed amendments to the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities regarding the bonding of improvements (Section 300); and

NOW THEREFORE BE IT RESOLVED, on the motion of Mr. Egleston, seconded by Mr. Terwilleger, it is hereby resolved to close the public hearing and adopt the following amendments to the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities regarding the bonding of improvements (Section 300):

1. Section 300 Installation/Bonding of Improvements is to read as follows:

300 BOND FOR INSTALLATION OF IMPROVEMENTS

- A. In order that Warren County has the assurance that the construction and installation of improvements will be completed, the subdivider shall enter into one of the following agreements:
 1. To construct all improvements directly affecting the subdivision, as required by the Warren County Board Commissioners, prior to the approval of a final plat; or
 2. In lieu of the completion of the improvements, to execute a performance bond or surety bond, certified check, escrow account letter of credit or other means of security with the Warren County Board of Commissioners equal to the cost of construction of the uncompleted improvements, plus thirty (30) percent of such uncompleted improvements as shown on plans, and based on an estimate approved by the Warren County Engineer.
- B. The following improvements shall be installed, constructed or bonded: earthwork, landscape restoration, new streets, improvements to existing streets, street signs, traffic control signs, sidewalks and other walkways/bicycle paths, stormwater drainage facilities, monuments and lot corner pins, street lights, mail pickup/dropoff facilities, sanitary sewer facilities, and water facilities.

301 CONDITIONS

- A. The security shall run to Warren County for a period of time, not to exceed two (2) years, as determined by the Warren County Engineer from date of execution, and shall provide that the subdivider, his heirs, successors and assigns, their agent or servants, will comply with all applicable terms, conditions, provisions and requirements of these regulations, and will faithfully perform and complete the work of constructing and installing such facilities or improvements in accordance with such laws and regulations. Sidewalks may be bonded separately and for a period of up to three (3) years or until such time as eighty (80) percent of the development in the subdivision is completed.
- B. Before said security is accepted, it shall be approved by the proper administrative officials.
- C. Whenever a cash deposit is made, the same shall be made to the County Treasurer of Warren County.
- D. Preceding the acceptance of the developer's security, an itemized list of materials and their cost shall be submitted to the Warren County Engineer. Construction cost estimates shall reflect realistic and current bid prices.

302 COMPLETION OF WORK

As required improvements are completed, approved, and accepted, the Warren County Board of County Commissioners may, with the concurrence of the Warren County Engineer, reduce the amount of the security.

303 MAINTENANCE BOND

Upon acceptable completion of installation of the required improvements, the subdivider shall execute a maintenance bond or certified check, escrow account, letter of credit or other means of security with the Board of County Commissioners equaling ten (10) percent of the cost of construction. At the end of the two (2) year maintenance period, the Warren County Engineer shall issue a letter to the Board of County Commissioners, and such letter shall be sufficient evidence for the release of the security by Warren County.

304 ACCEPTANCE

When the proper administrative officials, following final inspection of a subdivision, certify to the Warren County Board of County Commissioners, that all improvement have been constructed in accordance with County specifications, the Warren County Board of County Commissioners may proceed to accept the facilities for which the security was posted.

305 FAILURE TO COMPLY

Whenever public improvements have not been constructed in accordance with the agreement, and with specifications as established, the Warren County Board of County Commissioners may exercise its rights of foreclosure under the security agreement.

2. Section 300 of the Table of Contents is to read as follows:

Section 300	Bond for Installation of Improvements
301	Conditions
302	Completion of Work
303	Maintenance Bond
304	Acceptance
305	Failure to Comply

Upon call of the roll, the following vote resulted:

Mr. Kilburn - absent
Mr. Terwilliger - yea
Mr. Egleston - yea

Resolution adopted this 3rd day of April 1990.

BOARD OF COUNTY COMMISSIONERS


Margaret Groeniger, Acting Clerk

/RPC

cc: RPC (file)
Engineer (file)
Amendments file

**BOARD OF COUNTY COMMISSIONERS
WARREN COUNTY, OHIO**

Resolution

Number 95-789

Adopted Date June 27, 1995

**ADOPT AMENDMENTS TO THE REQUIREMENTS AND STANDARDS FOR THE DESIGN
AND CONSTRUCTION OF STREETS AND ROADWAY FACILITIES**

WHEREAS, a public hearing was conducted on May 23, 1995, June 6, 1995 and continued to June 27, 1995 to consider proposed amendments to the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities as specified in this resolution;

NOW THEREFORE BE IT RESOLVED to close the public hearing and adopt the following specified amendments to the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities;

(Deleted wording crossed out, added wording capitalized and boldfaced, added numbering underlined, added and revised drawing plates attached)

1. Table of Contents (pg. x) shall be revised to read as follows:

TABLE OF CONTENTS

SECTION 100 CONSTRUCTION PROCEDURE AND MATERIALS

Section 100	Construction Procedure and Materials	1
101	Pre-Construction Meeting	1
102	Materials	1
103	Street Subgrade	1
104	Inspections	1
105	Testing	2
106	Responsibility	2
107	Final Inspection	2

SECTION 200 SUBMISSION OF PLANS

Section 200	Plans and Profiles	3
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SECTION 300 INSTALLATION/BONDING OF IMPROVEMENTS

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301	Conditions	6
302	Completion of Work	7
303	Maintenance Bond	7
304	Acceptance	7
305	Failure to Comply	7

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AND IMPROVEMENT DESIGN STANDARDS**

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(Page numbers shall be revised as necessary)

2. Section 104 Inspections (pp. 1 & 2) shall read as follows:

104 INSPECTIONS

A. Inspections during the installation of improvements shall be made by an approved independent testing laboratory, or the design consulting engineer, to insure conformity with the approved plans and specifications as required by these regulations. The items that require inspection are as follows.

1. Storm sewers and appurtenances.
2. 301 base thickness and tack coat (by measurement of cores).
3. 404 surface thickness (by measurement or cores).
4. Utility excavation, granular backfill.
5. ~~Monument and lot corner pin placement, (certification).~~

5 6. Placement of signs, (street name and stop).

B. INSPECTIONS DURING THE INSTALLATION OF ROADWAY MATERIALS SHALL BE PERFORMED BY THE COUNTY ENGINEERS OFFICE. ITEMS THAT REQUIRE INSPECTION ARE AS FOLLOWS:

1. STREET SUBGRADE, 24 HOURS PRIOR TO INSTALLATION OF THE 301 BASE COURSE.
2. STREET BASE, 301, 24 HOURS PRIOR TO INSTALLATION OF THE 404 SURFACE COURSE.

C B. All inspection costs shall be paid by the subdivider. If during construction or within the maintenance period, deficiencies occur in design, workmanship, or materials, the Warren County Board of Commissioners reserves the right to require additional improvements.

3. Section 105 Testing (pg. 2) shall read as follows:

105 TESTING

- A. Testing of materials shall be performed by an approved independent testing laboratory to insure conformity with specifications. The following items shall be tested by a private testing company.
 - 1. Subgrade compaction (100%).
 - 2. 301 base material.
 - 3. 404 surface material
 - 4. Curb/gutter and-sidewalk (cylinders every 50 yards).
- B. Inspection and test reports shall be in writing and copies to the County Engineers Office. The reports shall clearly identify the subdivision name, the location of applicable test areas, and street names. Said reports are the basis for performance bond reductions, and/or street acceptance.

4. Section 304 Acceptance (pg. 7) shall read as follows:

304 Acceptance

When the proper administrative officials, following final inspection of a subdivision, certify to the Warren County Board of County Commissioners, that all improvements have been constructed in accordance with County specifications AND THE DESIGN CONSULTING ENGINEER/SURVEYOR CERTIFIES THE COMPLETION OF MONUMENTS AND LOT CORNER PINS, the Warren County Board of County Commissioners may proceed to accept the facilities for which the security was posted.

4. Section 411 Sidewalks (pg. 12) shall read as follows:

411 SIDEWALKS

- A. Sidewalks shall be provided in new subdivisions as a system of pedestrian circulation which is separate from streets. All sidewalks shall be located in the public utility easement which adjoins the road right-of-way.
- B. All sidewalks shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.
- C. WHERE SIDEWALK IS REQUIRED ON BOTH SIDES OF A CUL-DE-SAC STREET, THE SIDEWALK SHALL BE CONTINUOUS AROUND THE CUL-DE-SAC.
- D. WHERE SIDEWALK IS REQUIRED ON ONE SIDE OF A CUL-DE-SAC STREET, THE SIDEWALK MAY TERMINATE INTO THE CUL-DE-SAC.

E 6. All sidewalks shall be designed in accordance with the following standards:

1. Sidewalks along local streets shall be four (4) feet in width. They shall be located a minimum of six (6) feet from the back of the street curb or **NINETEEN (19) FEET FROM THE** edge of the street pavement (if no curbs are required).
2. Sidewalks along collector and arterial streets shall be six (6) feet in width. They shall be located a minimum of ~~ten~~ **NINE (9)** feet from the back of the street curb or **NINETEEN (19) FEET FROM THE** edge of the street pavement (if no curbs are required).
3. All walkways not located within the "public utility easement" adjoining a public street shall be a minimum of six (6) feet in width.
4. Intersections of sidewalks and collector or arterial streets shall be regulated by traffic control devices where necessary.
5. A curb ramp shall be provided where a sidewalk intersects a street.
6. Sidewalks shall be constructed of Portland cement concrete. All other walkways shall be constructed of Portland cement concrete or asphaltic concrete.

F D. The construction of required sidewalks shall be completed prior to acceptance by Warren County of the public improvements in the subdivision.

5. Table 9 (pg. 23) shall read as follows:

TABLE 9

STREET DESIGN STANDARDS

Cul-de-sacs and Mid-block Turnarounds

Right-of-way (ROW) radius	45 feet FOR <u>C/G</u> AND 60 FEET FOR DITCH
Outside pavement radius	42 feet
Lane width with central island	18 feet
Curb return radius (FACE OF CURB)	25 feet
Public utility easement	15 feet outside of ROW

6. Table 10 (pg 24) shall read as follows:

TABLE 10

INTERSECTION DESIGN STANDARDS

Intersection sight distance	:	private I streets	- 250 feet
		private II streets	- 250 375 feet
		local I streets	- 250 375 feet
		local II streets	- 250 375 feet
		collector I streets	- 350 500 feet
		collector II streets	- 450 625 feet
		arterial streets	- 550 750 feet
Street pavement grades at intersections (See Note 3 below)	:	8% maximum for the major street within 100 feet of the centerline intersection.	
Angle of intersection	:	90 degrees (75 degrees minimum when justified)	
Minimum curb radius (higher street classification determines radius)	:	private I streets	- 25 feet
		private II streets	- 35 feet
		local I streets	- 35 feet
		local II streets	- 35 feet
		collector I streets	- 50 feet
		collector II streets	- 50 feet
		arterial streets	- 50 feet

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984; and Transportation and Traffic Engineering Handbook, Second Edition - Institute of Transportation Engineers, 1982.

- 2 - 'Major' and 'minor' streets shall be determined by street classification. Where both streets are of the same classification, the major street shall be the 'through' street or the street which connects to another street in a higher classification. In most cases, the minor street will be controlled at intersections.
- 3 - Sight distance is measured from a point on the minor road at least (15) feet from the edge of the major road pavement and measured from an eye height of 3.5 feet on the minor road to an object height of 4.25 feet on the major road.
- 4 - The centerline grade of the major street shall be maintained through the intersection. The point of vertical intersection between the pavement cross slope grade of the major street and the centerline grade of the minor street shall be a minimum of fifty (50) feet from the centerline intersection of the two streets.

7. Plate 1 (pg. 29) shall be revised (see attached) to:

- a. Add "15' Public Utility Easement" to the typical section drawing.

- b. Add "18" MIN." on the typical ditch section drawing.
- 8. Plate 2 (pg. 30) shall be revised (see attached) to:
 - a. Remove the "G" located over the label "GRASS AREA".
 - b. Add "SEE SECTION 411-SIDEWALKS".
 - c. Change 4' to 6' as to the required width of a sidewalk ("w") for a "Collector-Class I" street.
- 9. Plate 5 (pg. 33) shall be revised (see attached) to change present note #1, which reads "See Table 10 for curb radii requirements" to read "PAGE 24, TABLE 10 GIVES THE REQUIRED (RC) RADIUS OF CURB BASED ON STREET CLASSIFICATION."
- 10. Plate 6 (pg. 34) shall be revised (see attached) to:
 - a. Remove 1' dimensioning label from section A-A.
 - b. Change 5'-0" to 6'-0" in Section A-A.
- 11. Plate 7 (pg. 35) shall be revised (see attached) to replace present notes regarding dimensions, location and type with the new notes shown on the revised plate drawing.
- 12. Plate 8 (pg. 36) shall be revised (see attached) to:
 - a. Add RIGHT OF WAY (R/W), PUBLIC UTILITY EASEMENT and the dimensions for each on the cul-de-sac drawing.
 - b. Show one half of the cul-de-sac drawing as with CURB/GUTTER and the other half as with a DITCH SECTION.
- 13. Plate 10 (pg. 38) shall be revised (see attached) to:
 - a. Add 18' to the dimension line indicating lane width.
 - b. Add 60' to the dimension line indicating right-of-way (R/W) width.
- 14. Plate 17 (pg. 45) shall be revised (see attached) to:
 - a. Delete 24' overall pavement width.
 - b. Delete 5' berm width on plate and on Note #1.
- 15. Plate 18 (pg. 46) shall be revised (see attached) to add NOT REQUIRED ON ASPHALT STREETS in reference to the apron shown on the plan drawing of the catch basin.
- 16. Plate 19 (pg. 49) shall be revised (see attached) to add NOT REQUIRED ON ASPHALT STREETS in reference to the apron shown on the plan drawing of the catch basin.
- 17. Plate 33 (pg. 65) shall be revised (see attached) to add 3'-6' to show post location from edge of pavement.


18. Plate 35 (pg. 67) shall be revised (see attached) to be completely replaced by an entirely new drawing.
19. Plate 36 (pg. 68) shall be revised (see attached) to be completely replaced by an entirely new drawing.
20. Plate 42 (pp. 74 & 75) ITEM 605 - SHALLOW UNDERDRAIN shall be added (see attached) consisting of a page of drawings and another page of notes.

Mr. Kilburn moved for adoption of the foregoing resolution, being seconded by Mrs. South. Upon call of the roll, the following vote resulted:

Mr. Crisenbery - absent
Mrs. South - yea
Mr. Kilburn - yea

Resolution adopted this 27th day of June, 1995.

BOARD OF COUNTY COMMISSIONERS


Tina Davis, Clerk

/RPC

cc: RPC (file)
Engineer (file)
Amendments file

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SECTION 100

CONSTRUCTION PROCEDURE AND MATERIALS

100 CONSTRUCTION PROCEDURE AND MATERIALS

- A. The subdivider shall design and construct improvements not less than the standards outlined in these regulations. The work shall be done under Warren County supervision and shall be completed within the time fixed or agreed upon by the Warren County Board of Commissioners.
- B. It is the responsibility of the developer and his engineer to investigate local conditions that may require additional improvements.

101 PRE-CONSTRUCTION MEETING

A pre-construction meeting with the Warren County Engineer is required. The subdivider, his contractor, and the testing laboratory shall be present at the meeting.

102 MATERIALS

All work and materials shall conform to the Ohio Department of Transportation, Construction and Material Specifications, and to the Standards and Specifications of Warren County, Ohio. Ohio Department of Transportation Standards are acceptable and may be required at the discretion of the County Engineer.

103 STREET SUBGRADE

- A. The subgrade shall be free of sod, vegetative or organic matter, soft clay, and other objectionable materials for a depth of at least two (2) feet below the finished surface. The subgrade shall be properly rolled, shaped, and compacted, and shall be subject to the approval of the Warren County Engineer.
- B. The presence of groundwater may necessitate the use of subdrains, and poor subgrade material may require the use of subbase material.

104 INSPECTIONS

- A. Inspections during the installation of improvements shall be made by an approved independent testing laboratory, or the design consulting engineer, to insure conformity with the approved plans and specifications as required by these regulations. The items that require inspection are as follows.
 - 1. Storm sewers and appurtenances.
 - 2. 301 base thickness and tack coat (by measurement of cores).

3. 404 surface thickness (by measurement or cores).
 4. Utility excavation, granular backfill.
 5. Placement of signs, (street name and stop).
- B. Inspections during the installation of roadway materials shall be performed by the County Engineer's office. Items that require inspection are as follows:
1. Street subgrade, 24 hours prior to installation of the 301 base course.
 2. Street base, 301, 24 hours prior to installation of the 404 surface course.
- C. All inspection costs shall be paid by the subdivider. If during construction or within the maintenance period, deficiencies occur in design, workmanship, or materials, the Warren County Board of Commissioners reserves the right to require additional improvements.

105 TESTING

- A. Testing of materials shall be performed by an approved independent testing laboratory to insure conformity with specifications. The following items shall be tested by a private testing company.
1. Subgrade compaction (100%).
 2. 301 base material.
 3. 404 surface material
 4. Curb/gutter (cylinders every 50 yards).
- B. Inspection and test reports shall be in writing and copies to the County Engineers Office. The reports shall clearly identify the subdivision name, the location of applicable test areas, and street names. Said reports are the basis for performance bond reductions, and/or street acceptance.

106 RESPONSIBILITY

The work shall be under the control and supervision of the subdivider until written final acceptance is given by the Warren County Engineer.

107 FINAL INSPECTION

Upon completion of all the improvements the subdivider shall request, in writing, a final inspection by the Warren County

Engineer and/or Warren County Sanitary Engineer as required under
Section 711.091 of the Ohio Revised Code.



SECTION 200

SUBMISSION OF PLANS

200 PLANS AND PROFILES

- A. Complete plans and profiles, signed and approved by a registered engineer, shall be made for all new streets and other improvements to be constructed in any subdivision subject to these regulations. Three (3) sets of prints of the plans and profiles and estimated quantities shall be filed with the Warren County Regional Planning Commission, who shall forward two (2) sets to the Warren County Engineer.
- B. The plan and profile shall be on 22" x 36" plan profile sheets, or a size approved by the Warren County Engineer and/or the Warren County Sanitary Engineer. Plans and profiles shall show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.
- C. All grade elevations shall be based on U.S.G.S., or Miami Conservancy District datum.
- D. More specifically, all plans and profiles shall show and include the following items.

GENERAL

PLAN

1. Show all proposed, lots, streets and curbs, etc.
2. Existing pavements, headwalls, piers, etc.
3. Typical street and curb sections.
4. Construction notes.
5. Structural details.
6. North arrow (preferably up or to the right.)
7. Street names.

PROFILE

1. Existing centerline and proposed top of curb profiles.
2. Centerline stations.
3. Curb elevations at minimum 50 foot stations.
4. Label proposed centerline and top of curb profile.
5. Profile of sewers and utilities in easements through lots.
6. Stations and centerline elevations intersecting streets.
7. Label "curb elevations intersecting streets"

8. Centerline stations (south to north and west to east where possible.
 9. Easements for utilities and storm drainage.
 10. Pavement and right-of-way widths.
 11. Lot numbers and dimensions.
 12. Curb radius at intersections (if not covered in notes).
 13. Curve data; station of PC, PT, PCC.
 14. Sheet reference.
 15. Plat section lines (boundary lines) show stations.
 16. Dimension utility locations. Location and/or statement of adequate outlet for storm sewer as approved by the Warren County Engineer.
8. Insert title box in lower right corner.

STORM SEWER

PLAN

1. Show proposed storm sewers, manholes, laterals, catch basins, headwalls, etc.
2. Label each span length and pipe size).

PROFILE

1. Show length of span, size, grade and class of pipe.
2. Label storm water manholes, junction boxes, etc., and show centerline of streets and stations for each.

3. Station low points of grade and manholes.

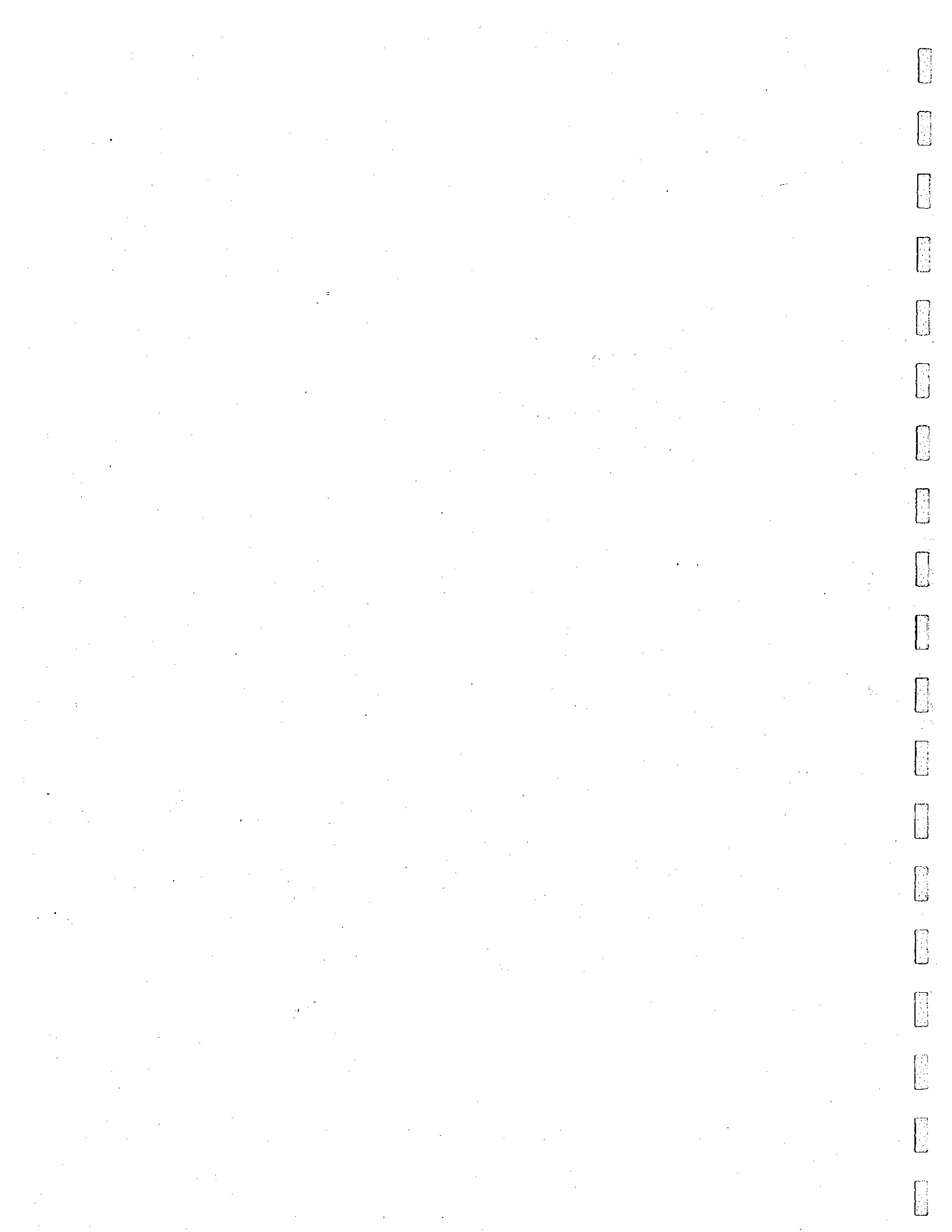
3. Show invert elevations of all pipe at manholes, headwalls, junction boxes, etc., except laterals to catch basins.

4. Show elevation on top of manhole or catch basin, when not in paved street or when in vertical curve portion of street.

201 APPROVAL OF PLANS

A. Construction drawings are to be approved and signed by the Warren County Engineer. If a minimum of twenty-five (25) percent of the bonded amount of construction has not taken place within a period of one (1) year from his plan approval date, the approval shall be void and re-approval shall be required.

B. Construction drawings shall be approved prior to the approval of a final plat.



SECTION 300
INSTALLATION/BONDING OF IMPROVEMENTS

300 BOND FOR INSTALLATION OF IMPROVEMENTS

- A. In order that Warren County has the assurance that the construction and installation of improvements will be completed, the subdivider shall enter into one of the following agreements:
1. To construct all improvements directly affecting the subdivision, as required by the Warren County Board of Commissioners, prior to the approval of a final plat; or
 2. In lieu of the completion of the improvements, to execute a performance bond or surety bond, certified check, escrow account letter of credit or other means of security with the Warren County Board of Commissioners equal to the cost of construction of the uncompleted improvements, plus thirty (30) percent of such uncompleted improvements as shown on plans, and based on an estimate approved by the Warren County Engineer.
- B. The following improvements shall be installed, constructed or bonded: earthwork, landscape restoration, new streets, improvements to existing streets, street signs, traffic control signs, sidewalks and other walkways/bicycle paths, stormwater drainage facilities, monuments and lot corner pins, street lights, mail pickup/dropoff facilities, sanitary sewer facilities, and water facilities.

301 CONDITIONS

- A. The security shall run to Warren County for a period of one time, not to exceed two (2) years, as determined by the Warren County Engineer from date of execution, and shall provide that the subdivider, his heirs, successors and assigns, their agent or servants, will comply with all applicable terms, conditions, provisions and requirements of these regulations, and will faithfully perform and complete the work of constructing and installing such facilities or improvements in accordance with such laws and regulations. Sidewalks may be bonded separately and for a period of up to three (3) years or until such time as eighty (80) percent of the development in the subdivision is completed.
- B. Before said security is accepted, it shall be approved by the proper administrative officials.
- C. Whenever a cash deposit is made, the same shall be made to the County Treasurer of Warren County.
- D. Preceding the acceptance of the developer's security, an itemized list of materials and their cost shall be submitted to the Warren County Engineer. Construction cost estimates shall reflect realistic and current bid prices.

302 COMPLETION OF WORK

As required improvements are completed, approved, and accepted, the Warren County Board of County Commissioners may, with the concurrence of the Warren County Engineer, reduce the amount of the security.

303 MAINTENANCE BOND

Upon acceptable completion of installation of the required improvements, the subdivider shall execute a maintenance bond or certified check, escrow account, letter of credit or other means of security with the Board of County Commissioners equaling ten (10) percent of the cost of construction. At the end of the two (2) year maintenance period, the Warren County Engineer shall issue a letter to the Board of County Commissioners, and such letter shall be sufficient evidence for the release of the security by Warren County.

304 ACCEPTANCE

When the proper administrative officials, following final inspection of a subdivision, certify to the Warren County Board of County Commissioners, that all improvement have been constructed in accordance with County specifications and the design consulting engineer/surveyor certifies the completion of monuments and lot corner pins, the Warren County Board of County Commissioners may proceed to accept the facilities for which the security was posted.

305 FAILURE TO COMPLY

Whenever public improvements have not been constructed in accordance with the agreement, and with specifications as established, the Warren County Board of County Commissioners may exercise its rights of foreclosure under the security agreement.

SECTION 400

SUBDIVISION IMPROVEMENT REQUIREMENTS AND IMPROVEMENT DESIGN STANDARDS

400 STREETS

- A. The subdivider shall be responsible for the construction of all new streets within a subdivision.
- B. A land use change or development on existing road frontage or a previously approved street, which increases traffic volumes, involves safety or new entrances or exits, shall be reviewed for any improvements to adjoining, existing streets which may be required for the changed conditions.
- C. Whenever the developer changes the grade of an existing street outside the limits of the plat and the grade changes require adjustment of existing improvements, such adjustments as are necessary will be the responsibility of the developer. If such changes affect private property, the developers shall be responsible for all costs associated with the acquisition of the necessary easements or right-of-way.

401 STREET DESIGN

All existing and proposed streets shall be classified as one of the following: local I, local II, collector I, collector II, arterial, private I and private II.

- A. Local I Streets: A street used primarily for providing access to abutting properties. This street can connect other local streets or be a cul-de-sac, loop, or marginal access street. Design speed is twenty five (25) miles per hour. The design standards for local I streets are specified in Table 1.
- B. Local II Streets: A street which provides access to abutting properties, and also carries traffic from other local streets to collector or arterial streets. This street may function as the major collector street within a subdivision. Design speed is twenty five (25) miles per hour. The design standards for local II streets are specified in Table 2.
- C. Collector I Streets: A low speed collector street, which carries traffic from local streets to other collector or arterial streets. Direct vehicular access to abutting properties is not provided except in cases of major commercial or industrial developments (i.e. shopping centers or industrial parks). Design speed is thirty five (35) miles per hour. The design standards for collector I streets are specified in Table 3.
- D. Collector II Streets: A high speed collector street which carries traffic from local or other collector streets to other collector or arterial streets. Direct vehicular access to abutting properties is not provided. This street is also

designed to accommodate short to intermediate distance travel between communities. Design speed is forty five (45) miles per hour. The design standards for collector II streets are specified in Table 4.

- E. Arterial Streets: The major street in the hierarchy, which is designed to accommodate intermediate to long distance travel between communities. Direct vehicular access to abutting properties is not provided. Design speed is generally fifty five (55) miles per hour. Arterial streets shall be designed and constructed in accordance with the standards of the Ohio Department of Transportation.
- F. Private Streets: The design standards for private streets shall be specified in Table 6 and Table 7. If owners of private streets request that the streets be accepted for public maintenance in the future, the owners shall bear the full expense of any reconstruction or any other action necessary to make the streets fully conform to the requirements applicable at that time for public streets, prior to dedication and acceptance.

402 SPECIAL STREET TYPES

The following requirements shall apply to special street classifications:

- A. One Way Streets: The design standards for one-way streets are contained in Table 5.
- B. Marginal Access Streets: The design standards for marginal access streets shall be the same as those required for local I streets or one-way streets as specified in Table 1 or Table 5.
- C. Dead-End Streets: A 'T' type temporary turnaround shall be provided at the end of a street that is to be extended for future development within a subdivision. The temporary turnaround shall be designed in accordance with the standards specified in Table 8.

A turnaround shall be provided when a street is constructed to a property line, for future access to the adjacent property, and it provides access to more than one lot on each side. If it is determined by the Regional Planning Commission that the street will ultimately connect to another street in the roadway network, a 'T' type temporary turnaround shall be provided at the end of the street. The temporary turnaround shall be designed in accordance with the standards specified in Table 8. If it is determined by the Regional Planning Commission that the street will ultimately become a cul-de-sac street, a permanent mid-block turnaround may be required in lieu of the 'T' type turnaround. The location of the mid-block turnaround shall be determined during the review of the preliminary plat for the subdivision. The mid-block turnaround shall be designed in accordance with the standards specified in Table 9.

403 HORIZONTAL STREET ALIGNMENT

When there is an angle of deflection between two (2) centerline tangent sections of a street, a curve of adequate radius shall connect them. The minimum centerline curve radii for local I, local II, collector I, one-way, private I, and private II streets are specified in Tables 1, 2, 3, 5, 6 and 7 respectively. Curve radii for Class II collector streets shall be determined using the following formula:

$$R = \frac{135}{(.35 + e)}$$

Where: R = radius of curve, feet
e = rate of superelevation, feet/feet

Note: a standard roadway section has a superelevation of + .02, depending on the direction of curve.

404 VERTICAL STREET ALIGNMENT

The minimum length of a vertical curve shall be computed from the following formula:

$$L = KA$$

Where L = Length of vertical curve in feet
K = A constant for design
A = The algebraic difference in percent of grades

The values to be used for the constant K are provided in Tables 1, 2, 3, 4, 5, 6 and 7.

405 INTERSECTIONS

The design standards for all intersections are specified in Table 10.

406 CUL-DE-SACS AND MID-BLOCK TURNAROUNDS

- A. The location requirements for mid-block turnarounds on cul-de-sac streets, based on street length, are specified in Table 1. Mid-block turnarounds may also be used on other local streets.
- B. The design standards for cul-de-sacs are specified in Table 9.
- C. The design standards for mid-block turnarounds are specified in Table 9.
- D. Central islands may be included in the design of cul-de-sacs or mid-block turnarounds. Specific uses for central islands shall be approved during the review of the preliminary plat for a

subdivision. Uses for central islands include but are not limited to:

1. Landscaping for aesthetic purposes.
2. Vehicle speed reduction.
3. Vehicle parking (recommended if front yard building setbacks are less than fifty (50) feet).
4. Postal facilities.

407 CURBS AND GUTTERS

- A. Combination curbs and gutters may be required for stormwater drainage. A determination of the necessity for curbs and gutters in lieu of roadway side ditches shall be made as part of the stormwater drainage design review.
- B. Curbs and gutters shall be provided for the following special roadway features:
 1. Cul-de-sacs: Where a cul-de-sac contains a central island, a curb shall be provided along the inside pavement edge, around the central island.
 2. Mid-block turnarounds: Where a mid block turnaround contains a central island, a curb shall be provided along the inside pavement edge, around the central island.
 3. Medians: A curb shall be provided along the inside pavement edge at all median openings and at the beginning and end of a median area.

408 POSTAL FACILITIES

- A. Vehicle parking or waiting facilities shall be provided to serve combined postal delivery and collection units when they are employed to provide postal service to a subdivision.
- B. All such facilities shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.

409 SIGNS

All signs within a development are the responsibility of the developer and shall be made and placed in accordance with the standards and requirements of these regulations.

410 SUMP PUMPS

- A. No person shall install any pump, piping, device, apparatus, or other such system for discharging sump pump effluent into a public right-of-way without approval of the Warren County

Engineer. The discharge of sump pump effluent onto a public road surface is specifically prohibited.

- B. Sump pump effluent discharge systems shall conform with one of the following modes of construction: direct connection to a public storm sewer; direct discharge into an approved natural drainage ditch, connection to a yard inlet; direct connection to a public storm drainage culvert. The installation of a master sump pump drainage system may be required where other means of effluent removal are not available or feasible.

411 SIDEWALKS

- A. Sidewalks shall be provided in new subdivisions as a system of pedestrian circulation which is separate from streets. All sidewalks shall be located in the public utility easement which adjoins the road right-of-way.
- B. All sidewalks shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.
- C. Where sidewalk is required on both sides of a cul-de-sac street, the sidewalk shall be continuous around the cul-de-sac.
- D. Where sidewalk is required on one side of a cul-de-sac street, the sidewalk may terminate into the cul-de-sac.
- E. All sidewalks shall be designed in accordance with the following standards:
 - 1. Sidewalks along local streets shall be four (4) feet in width. They shall be located a minimum of six (6) feet from the back of the street curb or nineteen (19) feet from the edge of the street pavement (if no curbs are required).
 - 2. Sidewalks along collector and arterial streets shall be six (6) feet in width. They shall be located a minimum of nine (9) feet from the back of the street curb or nineteen (19) feet from the edge of the street pavement (if no curbs are required).
 - 3. All walkways not located within the "public utility easement" adjoining a public street shall be a minimum of six (6) feet in width.
 - 4. Intersections of sidewalks and collector or arterial streets shall be regulated by traffic control devices where necessary.
 - 5. A curb ramp shall be provided where a sidewalk intersects a street.
 - 6. Sidewalks shall be constructed of Portland cement concrete. All other walkways shall be constructed of Portland cement concrete or asphaltic concrete.

F. The construction of required sidewalks shall be completed prior to acceptance by Warren County of the public improvements in the subdivision.

412 STREET AND WALKWAY LIGHTING

- A. Street and walkway lighting shall be provided in all subdivisions.
- B. All street lighting facilities shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.
- C. The design of street lighting facilities shall be as follows:
 - 1. Street Intersections: An average horizontal illumination shall be maintained in the area described by a circle, the center of which is the centerline intersection, and the radius of which is the distance between the centerline intersection and the furthest point of curb return.
 - 2. Street and Mid Block Walkway Intersections: An average horizontal illumination shall be maintained in the area described by a circle, the center of which is the centerline intersection of the street and walkway, and the radius of which is forty (40) feet.
 - 3. Cul-de-sac Streets: An average horizontal illumination shall be maintained to the edge of pavement of the cul-de-sac turnaround area.
 - 4. Mid Block Turnaround: An average horizontal illumination shall be maintained to the edge of pavement of the turnaround area.
- D. The standards for minimum average horizontal illumination shall be as specified in Table 11.
- E. Street lighting equipment shall be obtained from the electric utility which serves the subdivision.
- F. All street lighting facilities shall become part of a street lighting district, subject to approval of said district by the trustees of the township in which the subdivision is located.

413 SURVEY MONUMENTS

- A. A minimum of four (4) permanent reference monuments shall be located and placed within the subdivision, and their location noted on the record plat. These monuments shall be placed immediately after final grading of lots is completed and the cost of monuments will be included in the cost of improvements. Additional monuments may be required for subdivisions which involve more than ten (10) lots.
- B. Specifications for permanent reference monuments are as follows:
 - 1. An iron rod one (1) inch in diameter and thirty-six (36) inches in length with an identification cap which specifies

the name and registration number of the surveyor who set the monument.

2. A concrete monument six (6) inches square and thirty-six (36) inches in length with a suitable center point.
- C. A solid iron pin monument, one-half (1/2) inch in diameter and thirty-six (36) inches long, shall be placed by the surveyor at all points on boundary lines where there is a change of direction, at all lot corners and along all new street centerlines where there is a change of direction. All iron pins shall have an identification cap which specifies the name and registration number of the surveyor who set the pin.
- D. There shall be a certification of placement of all monumentation by the surveyor who set them filed with the County Engineer prior to their release from the performance security.

414 STORM SEWERS AND STORM WATER DRAINAGE

Where an adequate public storm sewer is available at the plat boundary, the subdivider shall construct a storm sewer system and connect with such storm sewer line. If such a storm sewer system is not accessible, natural drainage channels shall be provided.

415 OFF-SITE IMPROVEMENTS

- A. The developer or subdivider may be required to contribute to the improvement of streets not within the boundary of the proposed subdivision, if such improvements are necessary to serve the proposed subdivision.
- B. If streets are not available at the boundaries of a proposed subdivision, the developer or subdivider shall be required to obtain the necessary right-of-way and to construct extensions of such streets.

416 OVER-SIZING AND EXTENSION OF IMPROVEMENTS

- A. The streets and other land improvements required for the proposed subdivision shall be designed to serve adjacent lands if it is determined that such improvements would provide for the most desirable development pattern for the area.
- B. The subdivider shall be required to extend the necessary improvements to the boundary of the proposed subdivision to serve adjoining unsubdivided land.

417 VARIANCES

The following regulations shall govern the granting of variances:

- A. Where the Warren County Board of Commissioners finds that extraordinary and unnecessary hardship may result from strict compliance with these regulations, due to exceptional

topographic or other physical conditions, it may vary the regulations so as to relieve such hardship, provided such relief may be granted without detriment to the public interest and without impairing the intent and purpose of these regulations or the desirable development of the neighborhood and community. Such variations shall not have the effect of nullifying the intent and purpose of these regulations, the comprehensive plan, or the zoning resolution, if such exists.

- B. In granting variances or modifications, the Warren County Board of Commissioners may require such conditions as will, in its judgement, secure substantially the objective of the standards or requirements so varied or modified.
- C. Variances to these regulations shall be considered only upon receipt by the Warren County Board of Commissioners of a written request from the subdivider.



TABLE 1
STREET DESIGN STANDARDS
Local I Streets

Right-of-way (ROW)	: 30 feet for streets with curbs and gutters : 60 feet for streets without curbs and gutters
Public utility easement	: 15 feet on each side of ROW
Pavement width	: 2 lanes - 12 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 12.0%
Minimum stopping sight distance	: 150 feet
Minimum centerline radius	: 175 feet
Vertical curve 'K' values	: 20 for 'crest' curves : 27 for 'sag' curves
Maximum bridge length on a cul-de-sac street	: 10 feet
Additional 'turnarounds' required on cul-de-sac streets for a street length of	
0 to 1199 feet	: None
1200 to 1799 feet	: 1
1800 to 2399 feet	: 2
2400 to 2999 feet	: 3
3000 feet or greater	: 4

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.

2 - Parking is permitted along one side of the street.

3 - Design speed = 25 MPH

4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.

5 - See TABLE 9 for cul-de-sac turnaround design standards.

TABLE 2
STREET DESIGN STANDARDS
Local II Streets

Right-of-way (ROW)	:	30 feet for streets with curbs and gutters 60 feet for streets without curbs and gutters
Public utility easement	:	15 feet on each side of ROW
Pavement width	:	2 lanes - 12 feet per lane
Minimum street grade	:	1.0%
Maximum street grade	:	12.0%
Minimum stopping sight distance	:	150 feet
Minimum centerline radius	:	175 feet
Vertical curve 'K' values	:	20 for 'crest' curves 27 for 'sag' curves

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.

2 - No on-street parking is permitted

3 - Design speed = 25 MPH

4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.

TABLE 3

STREET DESIGN STANDARDS
Collector I Streets

Right-of-way (ROW)	:	42 feet for streets with curbs and gutters 72 feet for streets without curbs and gutters
Public utility easement	:	15 feet on each side of ROW
Pavement width	:	2 lanes and 1 turning lane (as required) - 12 feet per lane
Minimum street grade	:	1.0%
Maximum street grade	:	8.0%
Minimum stopping sight distance	:	250 feet
Minimum centerline radius	:	350 feet
Vertical curve 'K' values	:	42 for 'crest' curves 45 for 'sag' curves

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.

2 - No on-street parking is permitted

3 - Design speed = 35 MPH

4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.

TABLE 4
STREET DESIGN STANDARDS
Collector II Streets

Right-of-way (ROW)	:	66 feet for streets with curbs and gutters 96 feet for streets without curbs and gutters
Public utility easement	:	15 feet on each side of ROW
Pavement width	:	4 travel lanes and 1 turning lane (as required) - 12 feet per lane
Median width	:	12 feet
Minimum street grade	:	1.0%
Maximum street grade	:	8.0%
Minimum stopping sight distance	:	390 feet
Minimum centerline radius	:	See HORIZONTAL STREET ALIGNMENT
Vertical curve 'K' values	:	80 for 'crest' curves 70 for 'sag' curves

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.

2 - No on-street parking is permitted

3 - Design speed = 45 MPH

4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height and 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.

5 - See Section 411 for vertical curve computation formula

TABLE 5
STREET DESIGN STANDARDS
One-Way Streets

Right-of-way (ROW)	:	15 feet for streets with curbs and gutters 30 feet for streets without curbs and gutters
Public utility easement	:	15 feet on each side of ROW
Pavement width	:	12 feet
Minimum street grade	:	1.0%
Maximum street grade	:	12.0%
Minimum stopping sight distance	:	150 feet
Minimum centerline radius	:	175 feet
Vertical curve 'K' values	:	20 for 'crest' curves 27 for 'sag' curves

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.

2 - No on-street parking is permitted

3 - Design speed = 25 MPH

4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.

TABLE 6
STREET DESIGN STANDARDS
Private I Streets

Lot/Easement width	: 30 feet minimum
Utility easement	: 15 feet on each side of lot/ easement
Pavement width	: 2 lanes - 10 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 15.0%
Minimum stopping sight distance	: 75 feet
Minimum centerline radius	: 50 feet
Vertical curve 'K' values	: 10 for 'crest' curves 18 for 'sag' curves
Maximum bridge length on a cul-de-sac street	: 10 feet
Additional 'turnarounds' required on cul-de-sac streets for a street length of	
0 to 1199 feet	: None
1200 to 1799 feet	: 1
1800 to 2399 feet	: 2
2400 to 2999 feet	: 3
3000 feet or greater	: 4

-
- Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.
- 2 - No on-street parking is permitted
- 3 - Design speed = 15 MPH
- 4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance
- 5 - See TABLE 9 for cul-de-sac turnaround design standards.

TABLE 7
STREET DESIGN STANDARDS
Private II Streets

Lot/Easement Width	: 30 feet for streets with curbs and gutters : 60 feet for streets without curbs and gutters
Public utility easement	: 15 feet on each side of ROW
Pavement width	: 2 lanes - 10 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 12.0%
Minimum stopping sight distance	: 150 feet
Minimum centerline radius	: 175 feet
Vertical curve 'K' values	: 20 for 'crest' curves : 27 for 'sag' curves
Maximum bridge length on a cul-de-sac street	: 10 feet
Additional 'turnarounds' required on cul-de-sac streets for a street length of	
0 to 1199 feet	: None
1200 to 1799 feet	: 1
1800 to 2399 feet	: 2
2400 to 2999 feet	: 3
3000 feet or greater	: 4

-
- Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984.
- 2 - No on-street parking is permitted
- 3 - Design speed = 25 MPH
- 4 - Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 0.5 feet. This criteria shall apply to both horizontal and vertical sight distance.
- 5 - See TABLE 9 for cul-de-sac turnaround design standards.

TABLE 8
STREET DESIGN STANDARDS
"T" Type Turnarounds

Pavement width	:	20 feet
Width of 'T' section	:	50 feet + street pavement width
Curb radius	:	15 feet
Street extension beyond 'T'	:	15 feet

TABLE 9
STREET DESIGN STANDARDS
Cul-de-sacs and Mid-block Turnarounds

Right-of-way (ROW) radius	45 feet for C/G and 60 feet for ditch
Outside pavement radius	42 feet
Lane width with central island	18 feet
Curb return radius (face of curb)	25 feet
Public utility easement	15 feet outside of ROW

TABLE 10

INTERSECTION DESIGN STANDARDS

Intersection sight distance	:	private I streets	- 250 feet
		private II streets	- 375 feet
		local I streets	- 375 feet
		local II streets	- 375 feet
		collector I streets	- 500 feet
		collector II streets	- 625 feet
		arterial streets	- 750 feet
Street pavement grades at intersections (See Note 3 below)	:	8% maximum for the major street within 100 feet of the centerline intersection.	
Angle of intersection	:	90 degrees (75 degrees minimum when justified)	
Minimum curb radius (higher street classification determines radius)	:	private I streets	- 25 feet
		private II streets	- 35 feet
		local I streets	- 35 feet
		local II streets	- 35 feet
		collector I streets	- 50 feet
		collector II streets	- 50 feet
		arterial streets	- 50 feet

Notes: 1 - Adapted from: Recommended Guidelines for Subdivision Streets - Institute of Transportation Engineers, 1984; and Transportation and Traffic Engineering Handbook, Second Edition - Institute of Transportation Engineers, 1982.

- 2 - 'Major' and 'minor' streets shall be determined by street classification. Where both streets are of the same classification, the major street shall be the 'through' street or the street which connects to another street in a higher classification. In most cases, the minor street will be controlled at intersections.
- 3 - Sight distance is measured from a point on the minor road at least (15) feet from the edge of the major road pavement and measured from an eye height of 3.5 feet on the minor road to an object height of 4.25 feet on the major road.
- 4 - The centerline grade of the major street shall be maintained through the intersection. The point of vertical intersection between the pavement cross slope grade of the major street and the centerline grade of the minor street shall be a minimum of fifty (50) feet from the centerline intersection of the two streets.

TABLE 11
AVERAGE MAINTAINED HORIZONTAL ILLUMINATION
(Footcandles/Lux)

<u>Roadway Classification</u>	<u>Commercial/ Industrial</u>	<u>Land Use</u>	
		<u>Residential 1 Unit/Acre or Greater</u>	<u>Residential Less Than 1 Unit/Acre</u>
Arterial	1.4/15	1.0/11	0.7/8
Collector	0.9/10	0.7/8	0.5/5
Sub-Collector	0.9/10	0.7/8	0.5/5
Local	0.7/8	0.6/6	0.4/4

- 1 - Taken from American National Standards Practice for Roadway Lighting, Illuminating Engineering Society of North America, 1983.
- 2 - Conversion factors: one (1) footcandle equals 10.76 lux; one (1) lux equals 0.0929 footcandles.
- 3 - Illumination shall be based on the highest classification of street in the intersection.

APPENDIX A
Improvement Bond Checklist



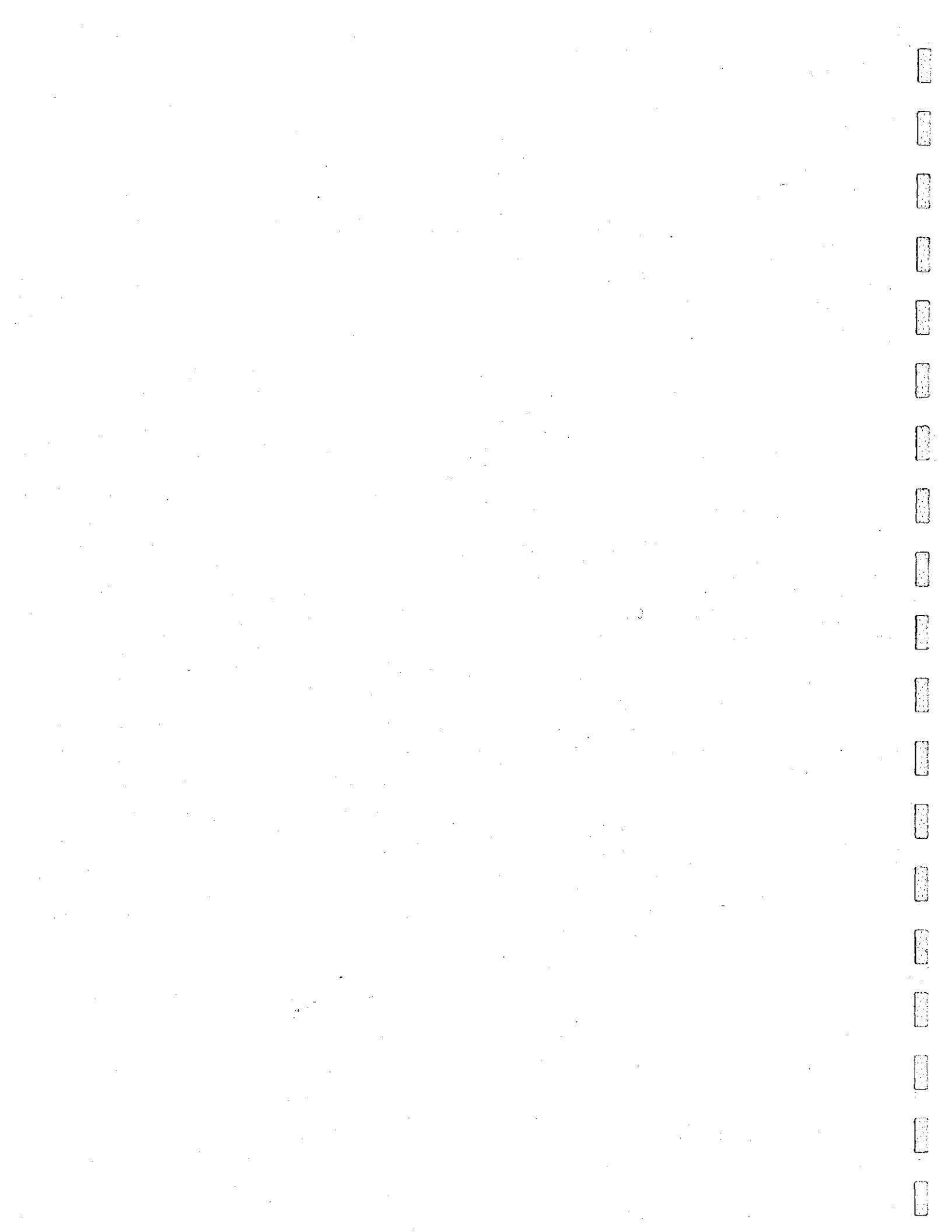
CONSTRUCTION ITEM CHECK LIST

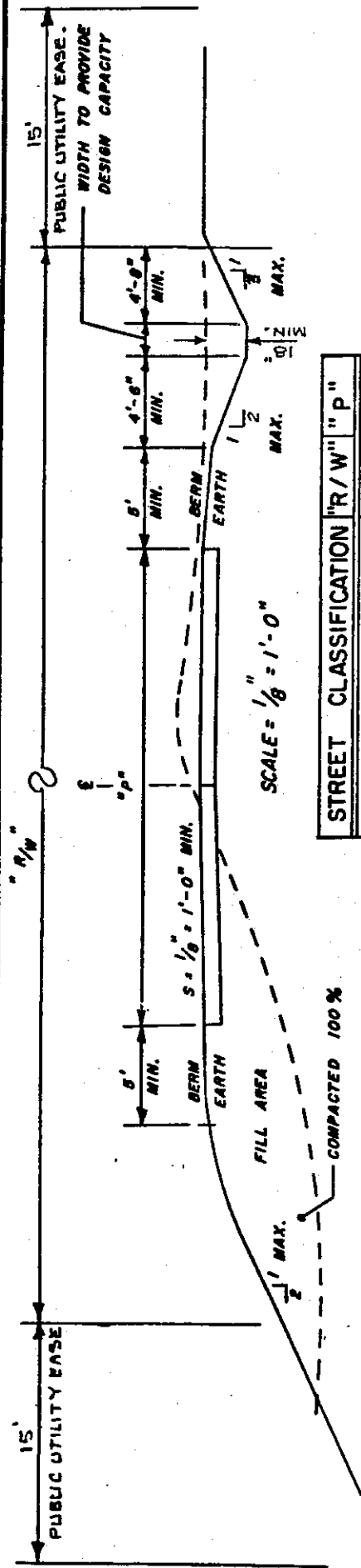
NOTE: Quantities and unit prices are to be listed for the relevant items listed below, Regardless of bonding or not.

[illegible]



APPENDIX B
Standard Drawings





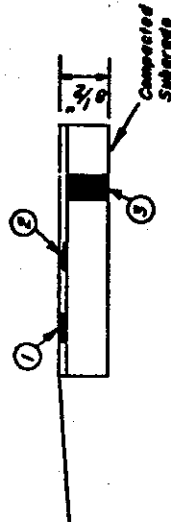
STREET CLASSIFICATION	"R/W" "P"
LOCAL - CLASS I & II	60' 24'
COLLECTOR - CLASS I	72' 24'-36'
COLLECTOR - CLASS II	96' 48'-60'
PRIVATE - CLASS I & II	60' 20'

NOTES

- (1) Minimum Street Grade is 1.0 %
- (2) Maximum Street Grade is 12.0 %
- (3) Flow line of ditch to be added. If the ditch grade is greater than 5 % the road shall be added.
- (4) The berm and side slopes shall be seeded and strewed.
- (5) All trenches under, and/or within five feet of the pavement shall be backfilled with thoroughly compacted granular material. The County Engineer may require the installation of "K-Crete" or equal material where he deems it necessary.

STANDARD PAVEMENT COMPOSITION

Scale: 3/8" = 1'-0"



FLEXIBLE PAVEMENT LEGEND

- ① 1 1/2" Thickness of Item 404, Asphalt Concrete Surface Course - Installation a minimum of 6 months after the 404 or 301 application unless otherwise specified by the W.C.E.
- ② 7" Thickness of Item 301, Bituminous Base Course.
- ③ 4" Thickness of Item 301, Bituminous Base Course.

NOTE

All letter-number designations refer to the current edition of the Ohio Department of Transportation, Construction and Material Specification.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

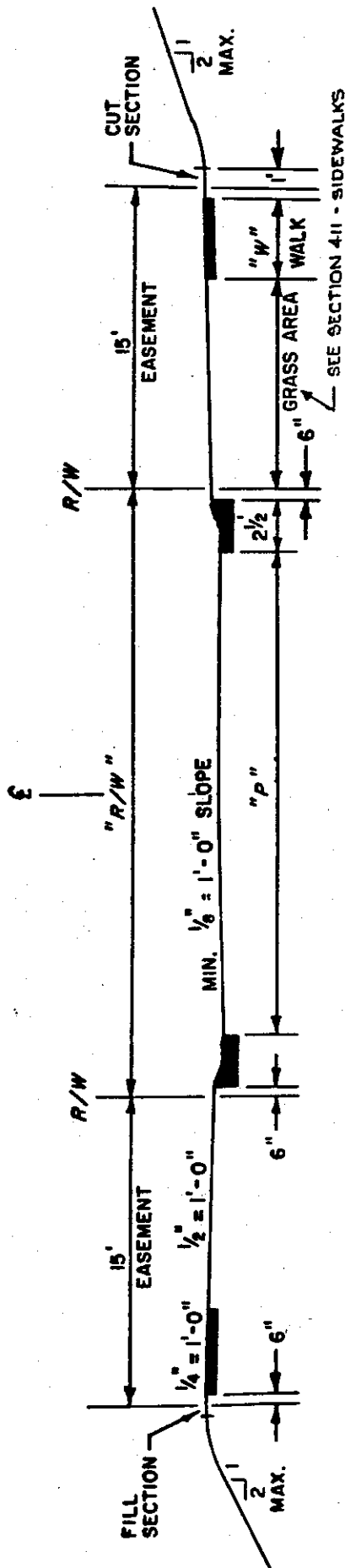
TYPICAL SECTION -
WITHOUT CURB & GUTTER

PLATE I

Scale: As Shown

REVISED: 6/21/75

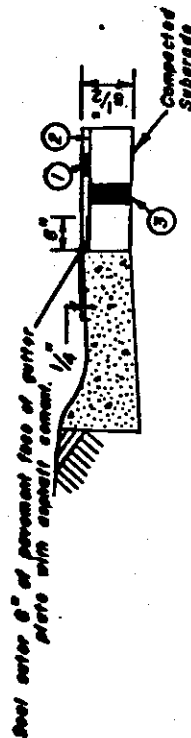
JAN. 1986



SCALE: $\frac{1}{8}'' = 1'-0''$

STANDARD PAVEMENT COMPOSITION

Scale $\frac{3}{8}'' = 1'-0''$



FLEXIBLE PAVEMENT LEGEND

- ① $1\frac{1}{2}''$ Thickness of Item 404, Asphalt Concrete Surface Course - Installation a minimum of 6 months after the 404 or 301 application unless otherwise specified by the W.C.E.
- ② Total Coat MS-2, RS-1 or RC 250
- ③ $7''$ Thickness of Item 301, Bituminous Base Course

NOTE

All letter-number designations refer the current edition of the Ohio Department of Transportation Construction and Material Specification.

STREET CLASSIFICATION	R/W	"P"	"W"
LOCAL - CLASS I & II	30'	24'	4'
COLLECTOR - CLASS I	42'	24'-36'	6'
COLLECTOR - CLASS II	66'	48'-60'	6'
PRIVATE - CLASS I & II	30'	20'	

NOTES

- (1) Minimum street grade is 1%
- (2) Maximum street grade is 12%
- (3) All trenches under and/or within five feet of curb and gutter shall be backfilled with thoroughly compacted granular material. The County Engineer may require the installation of "K-Crete" or equal material where he deems necessary.

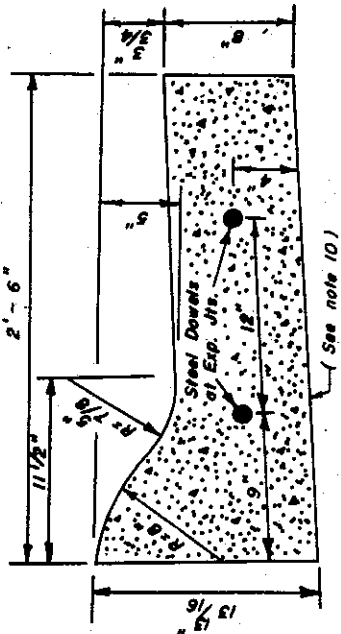
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

TYPICAL SECTION - CURB & GUTTER

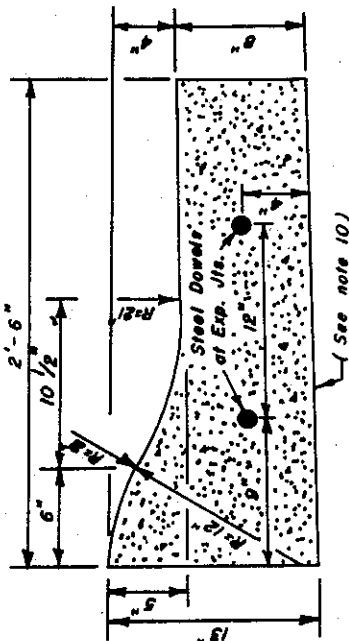
PLATE 2

SCALE: As Shown
REVISED: 6/27/95

JAN. 1986



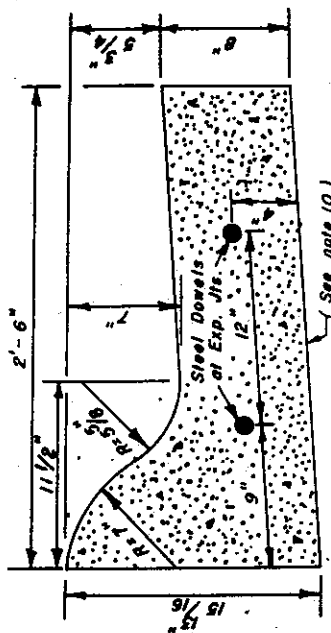
TYPE A CURB AND GUTTER



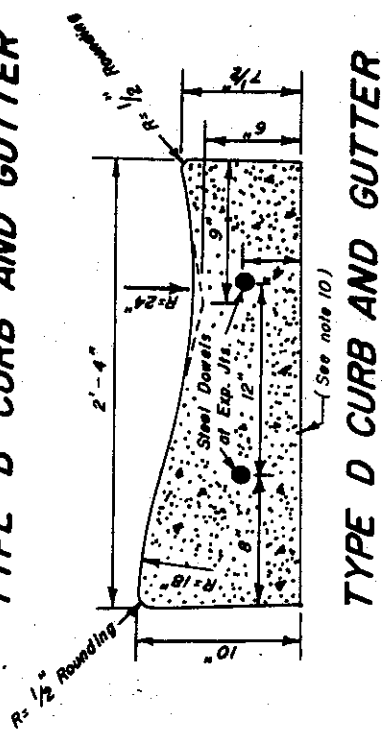
TYPE C CURB AND GUTTER

NOTES FOR CURB & GUTTERS

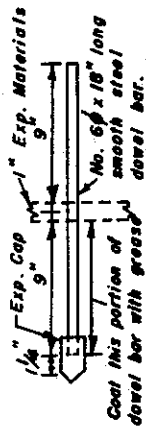
1. Concrete for curbs and gutters shall be ODOT Class C, an approved curing agent shall be applied after finishing.
2. Flexible forms shall be used on all curves having radii of 275' or less.
3. 1" Expansion Joints shall be installed at 40' intervals and at points of curvature. Two smooth steel dowel bars, No. 6 @ x 18" long, with expansion caps shall be installed at each expansion joint as shown on the detail.
4. Dummy joints shall be provided at 10' intervals.
5. All joints shall be vertical and either perpendicular or radial to the back of curb.
6. All exposed edges shall be rounded to 3/8" radius. Type D (See plan.)
7. All curbing shall be backfilled before pavement work is begun.
8. Unless otherwise specified, Type A, B, C, D may be used for Private Subdivision Projects.
9. Place dowel bars as shown at all construction joints.
10. A one inch sand leveling course shall be placed between compacted subgrade and curb.



TYPE B CURB AND GUTTER



TYPE D CURB AND GUTTER



DOWEL BAR DETAIL

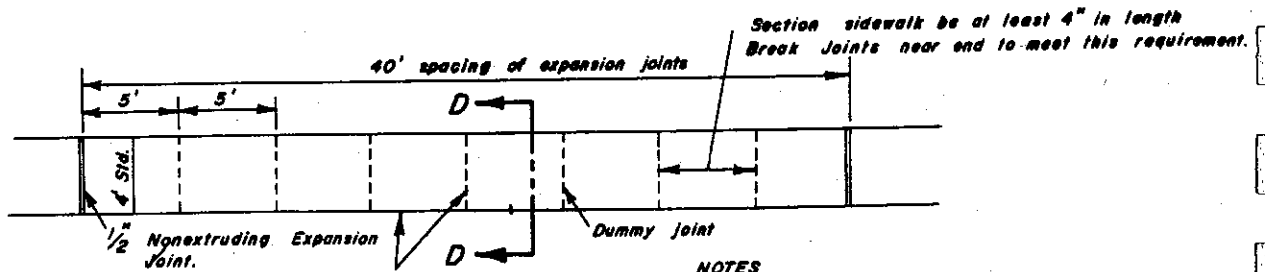
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

CURB & GUTTER

SCALE: 1" = 1'-0"

PLATE 3

JAN. 1986

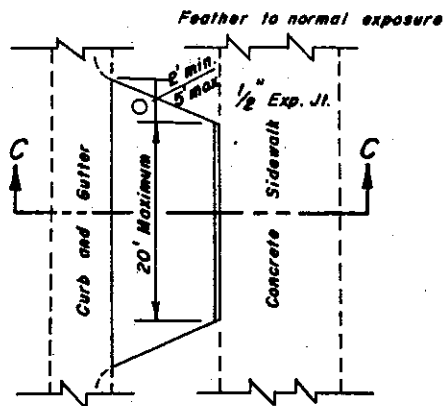


All exposed edges shall be rounded $\frac{3}{8}$ radius with an edger.

Scale: $\frac{3}{32}$ " = 1'-0"

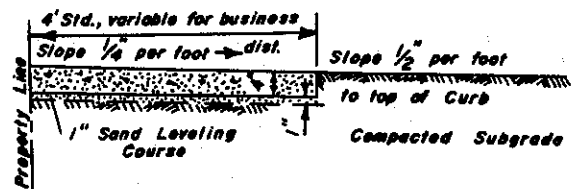
NOTES

1. Concrete for sidewalk shall be ODOT Class C.
2. Flexible forms shall be used on all curves having radii of 275' or less.



NOTE
Cutting or depressing curb is not necessary when Type C Curb and Gutter is used.

Scale: None

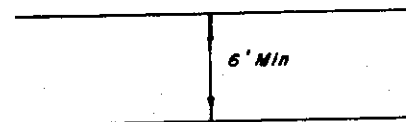


Sidewalks shall be continuous with no separation at driveways.

SECTION D-D

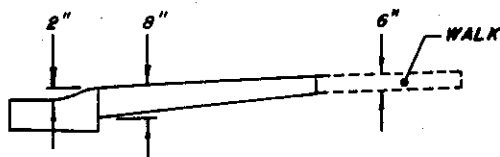
Scale: $\frac{3}{8}$ " = 1'-0"

ASPHALT WALK HIKER-BIKER SYSTEM ONLY



NOTES

1. Asphalt for hiker-biker system shall be ODOT item 404-4" th.
2. Typical cross slope (see Section D-D above).



SECTION C-C Scale: $\frac{3}{16}$ " = 1'-0"

DRIVEWAY RAMP

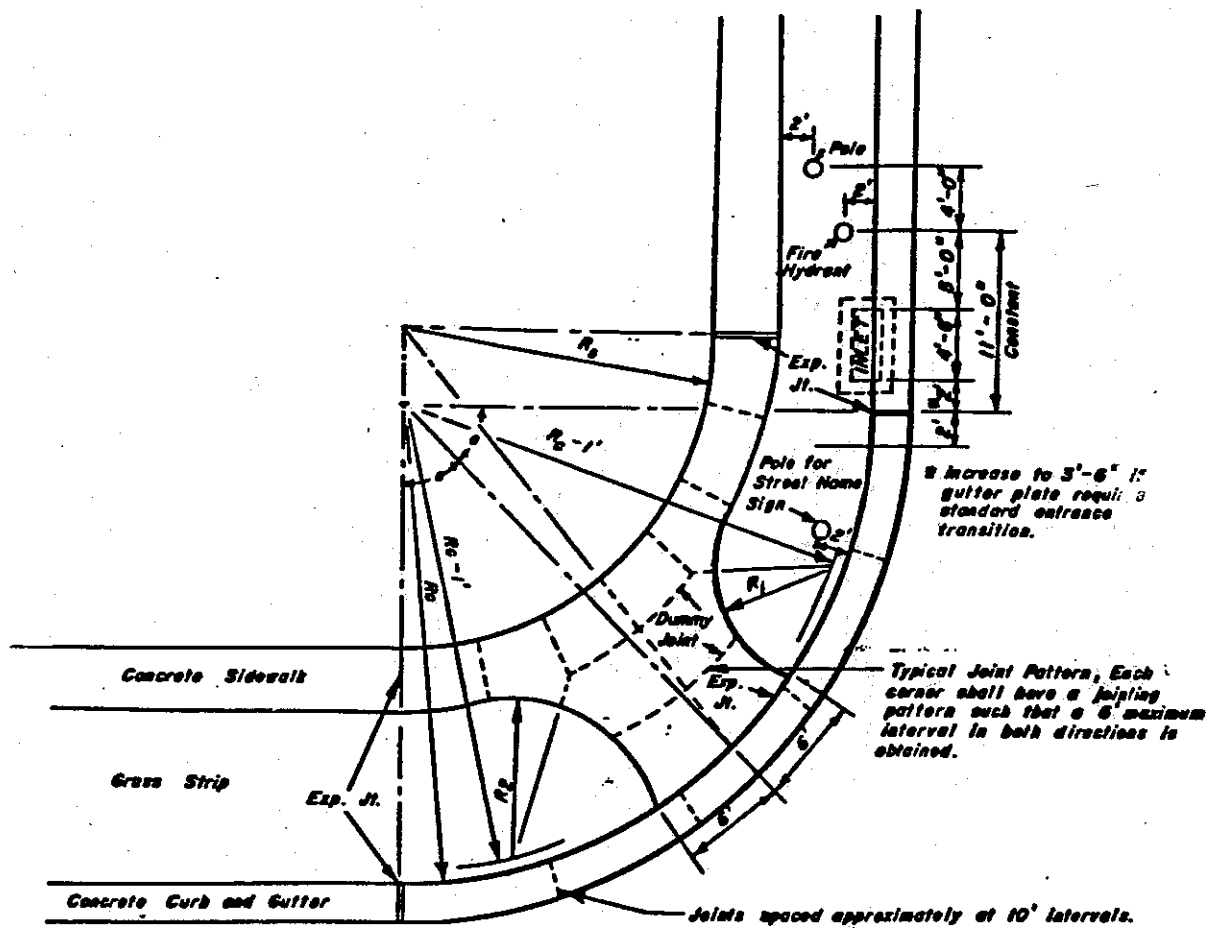
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

SIDEWALK Concrete
Asphalt

PLATE 4

Scale: As Shown.

JAN. 1986



1. Page 24, table 10 gives the required (RC) radius of curb based on street classification.

2. R_0 is the radius of the back of sidewalk and the property line and shall be a minimum of 20'.
3. R_1 and R_2 are variable and directly dependent upon the widths of the grass strips. R_1 and R_2 shall not be less than 2'.
4. Flexible forms shall be used on all curves having radii 275' or less.

* This detail applies to Local Subdivision Streets. All other intersections will require individual corner design based upon location of pedestrian crosswalks, and each must be approved by the County Engineer.

WARREN COUNTY ENGINEERS OFFICE DESIGN STANDARDS

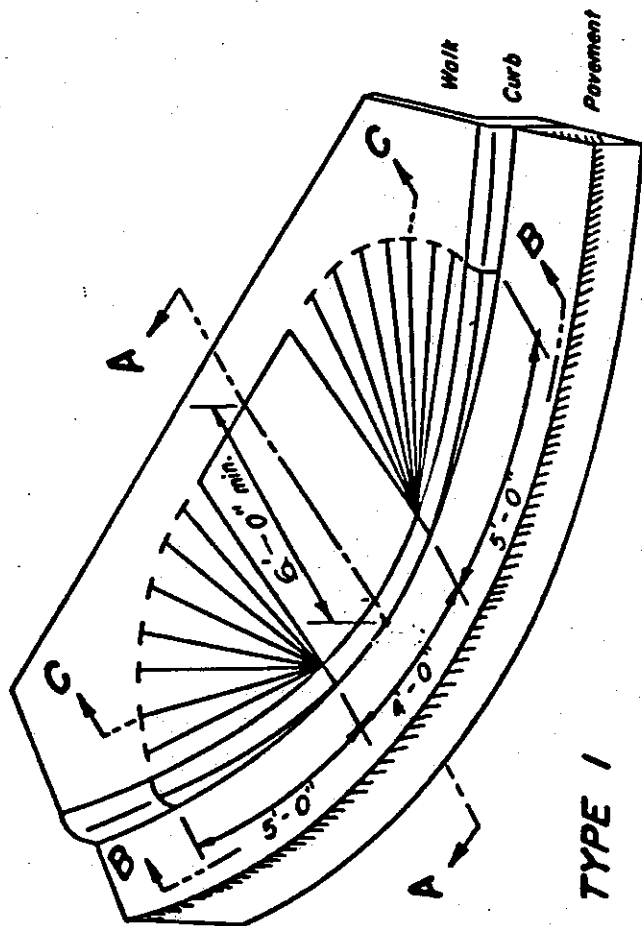
STREET CORNER DETAIL

Scale: $\frac{3}{32}'' = 1'-0''$

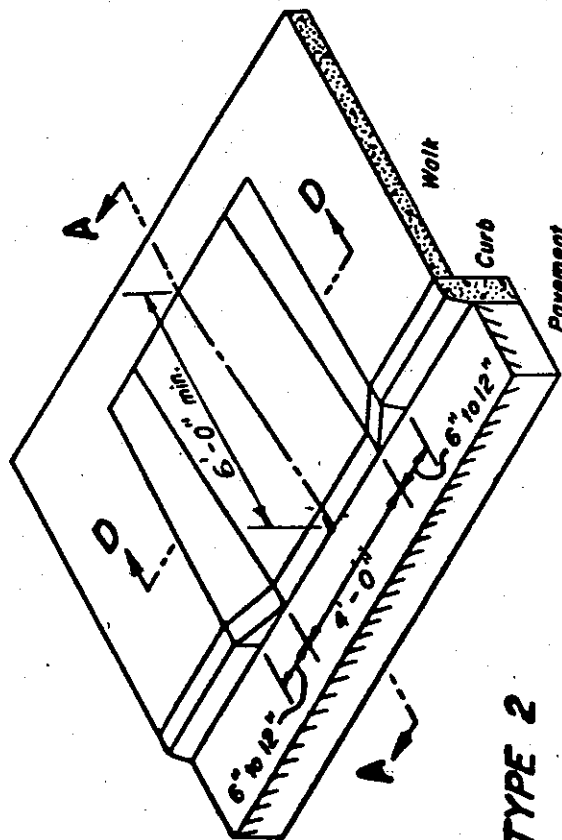
REVISED: 6/27/95

PLATE 5

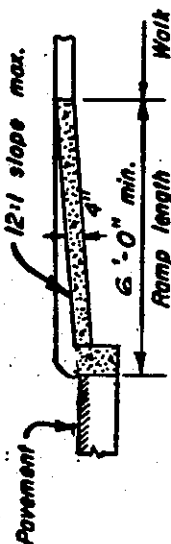
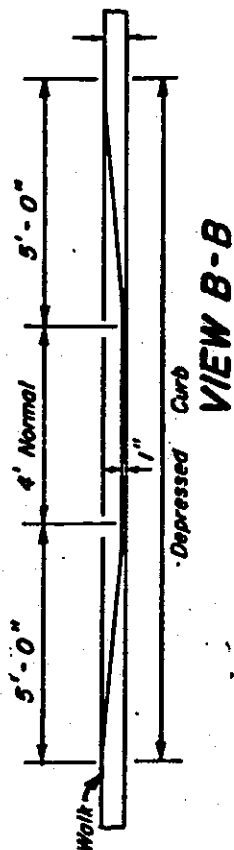
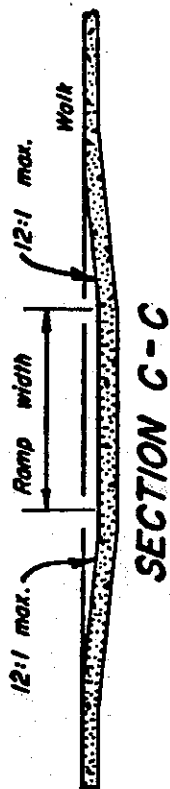
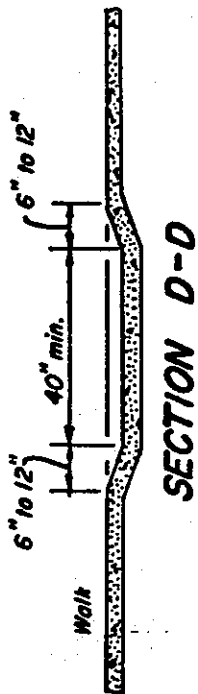
JAN. 1986



TYPE 1



TYPE 2



SECTION A-A

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

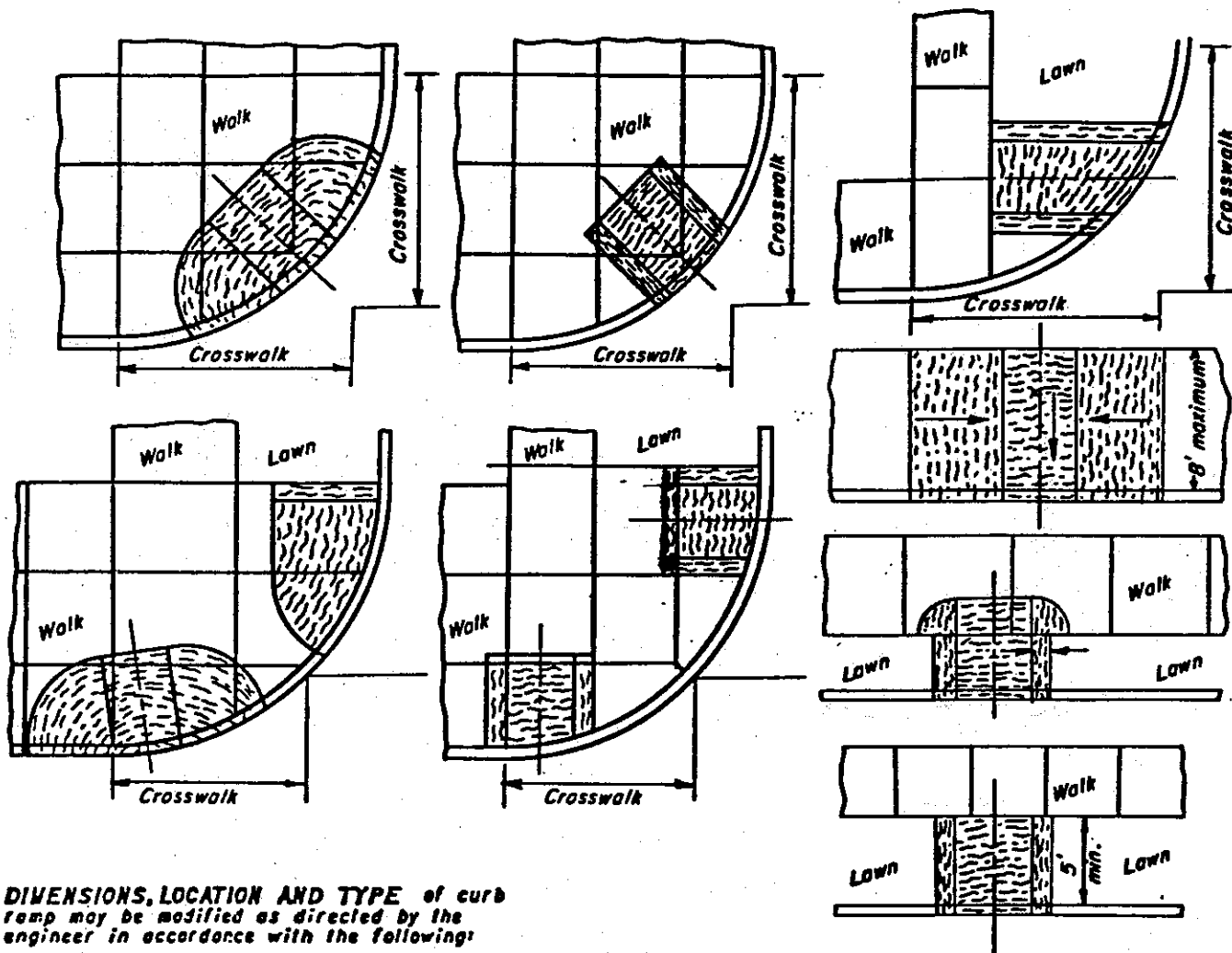
CURB RAMP DETAIL

PLATE 6

SCALE: 1/4" = 1'-0"

REVISED: 6/27/95

JAN. 1986



DIMENSIONS, LOCATION AND TYPE of curb ramp may be modified as directed by the engineer in accordance with the following:

- **TYPE** of curb ramp built shall be the type that best fits the location unless a type is specified in the plans.

Type 1 is preferred because of the flatter side slopes. Any combination of Type 1 and 2 side slopes on opposite sides of a ramp may be used to best fit the site conditions.

TYPE 1 Curb Ramps (Flared sides) should be used at locations where pedestrians must walk across the ramp at an angle. Typical Curb Ramps (a), (b), and (c) are examples.

TYPE 2 Curb Ramps (Steep sides) should be used where pedestrians would not normally walk across or perpendicular to the centerline of the ramp. Sides of these ramps must be parallel to the pedestrian flow. Typical Curb Ramps (d), (e), (f) and (g) are examples.

- **SLOPE** of the ramp toward the curb is preferred to be 12:1 or flatter related to the horizontal but the maximum slope shall be 12:1 relative to the existing or proposed walk slope. The minimum ramp length is 6 ft. from the back of a 6 in. curb and may be increased where feasible to obtain a flatter ramp slope or to better blend with the walk configuration.

- **WIDTH** of ramp shall normally be 4 ft. but a minimum width of 3 ft. may be used to better fit the walk configuration or where site conditions are restricted by narrow walks, pole foundations, drainage inlets, etc. The width may be tapered.

- **WALK THICKNESS** in the ramp slopes shall be 4 in. minimum or thicker as necessary to match adjacent walk thickness.

JOINTS shall be provided in the curb ramp as extensions of walk joints for new concrete walks. A $\frac{1}{2}$ " expansion joint filler shall be provided around the edge of ramps built in existing concrete walk. Lines shown on this drawing to indicate the ramp edge and slope changes are not necessarily joint lines.

WARREN COUNTY ENGINEERS OFFICE DESIGN STANDARDS

CURB RAMPS LOCATION AND NOTES

PLATE 7

SCALE: None
REVISED: 6/27/95

JAN. 1986

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WITHOUT
SIDEWALK

Optional

$R = 42'$

$R = 40'$

$R = 22'$

$R = 25'$

$R = 25'$

15' Easement

30' R/W

15' Easement

WARREN CO. Type "D" curb / gutter

WITH
SIDEWALK

Optional

$R = 25'$

$R = 10'$

2'

7'

18'

4' Sidewalk

$R = 47'$

WARREN CO. Type "D" curb / gutter

$R = 25'$

$R = 10'$

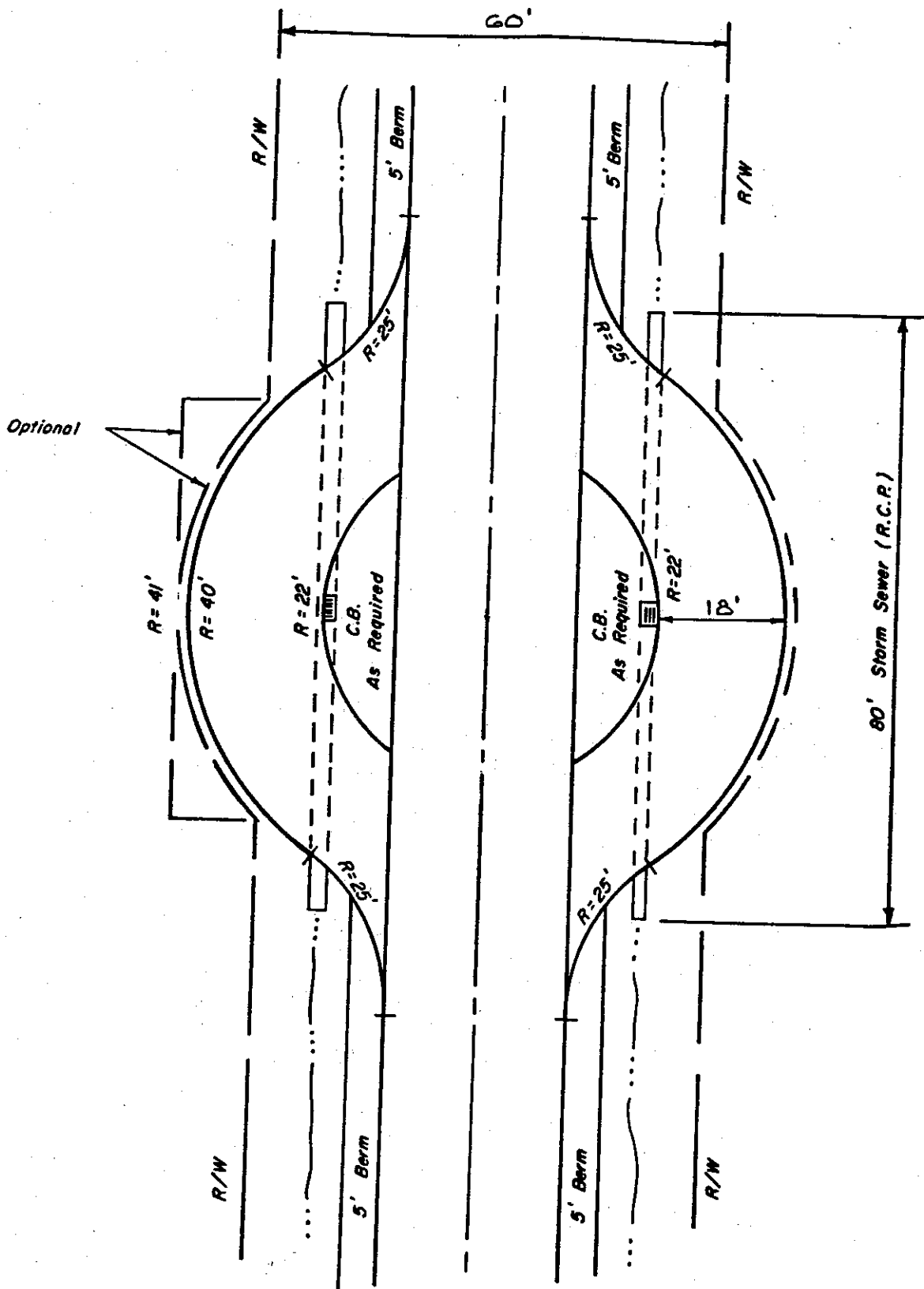
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MID - BLOCK TURNAROUND
(Curb & Gutter Section)

SCALE: 1" = 20'

PLATE 9

JAN. 1986



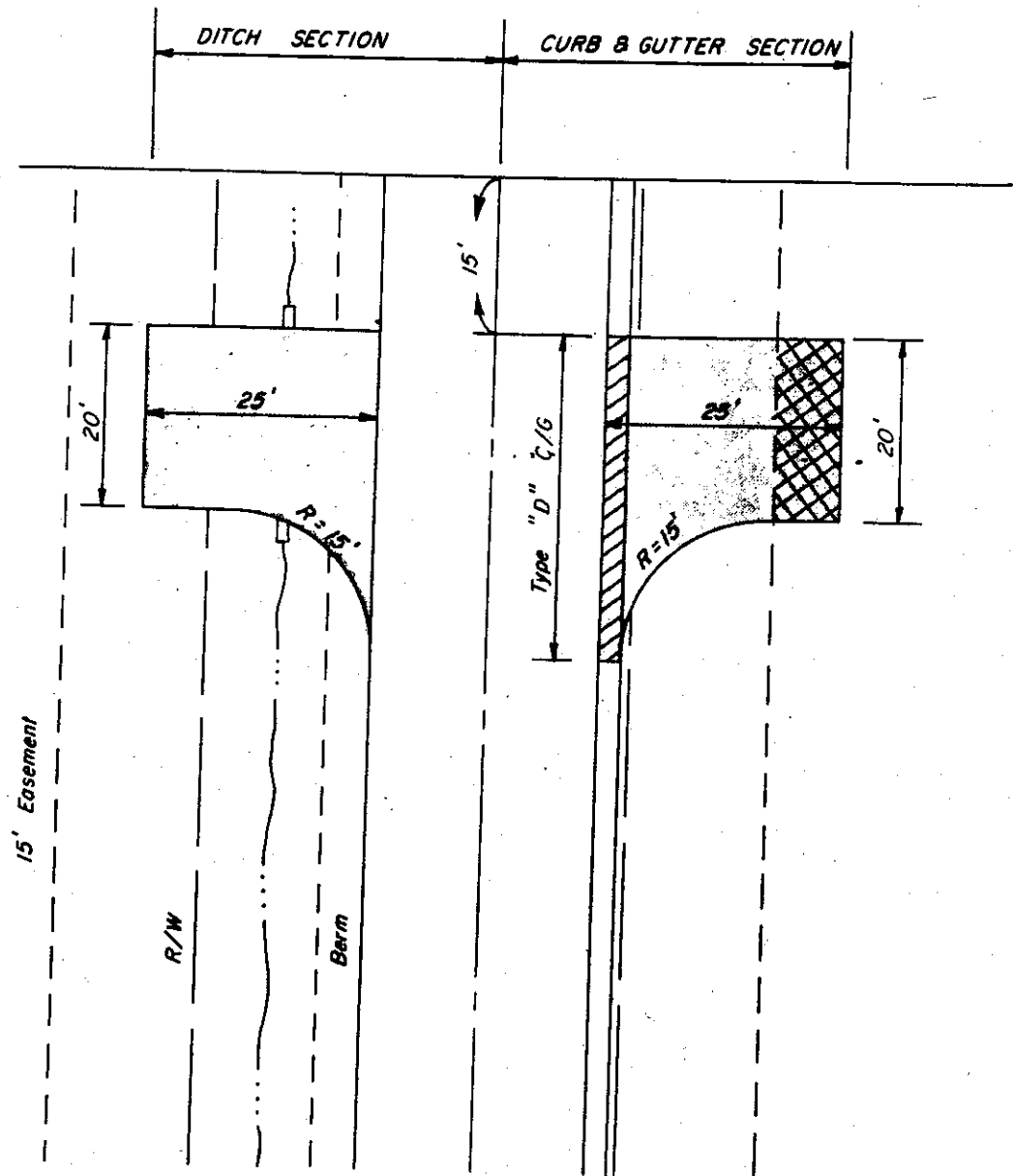
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MID - BLOCK TURNAROUND
(Ditch Section)

SCALE : 1" = 20'
REVISED : 6/27/95

PLATE 10

JAN. 1986



Material : 4" - 404

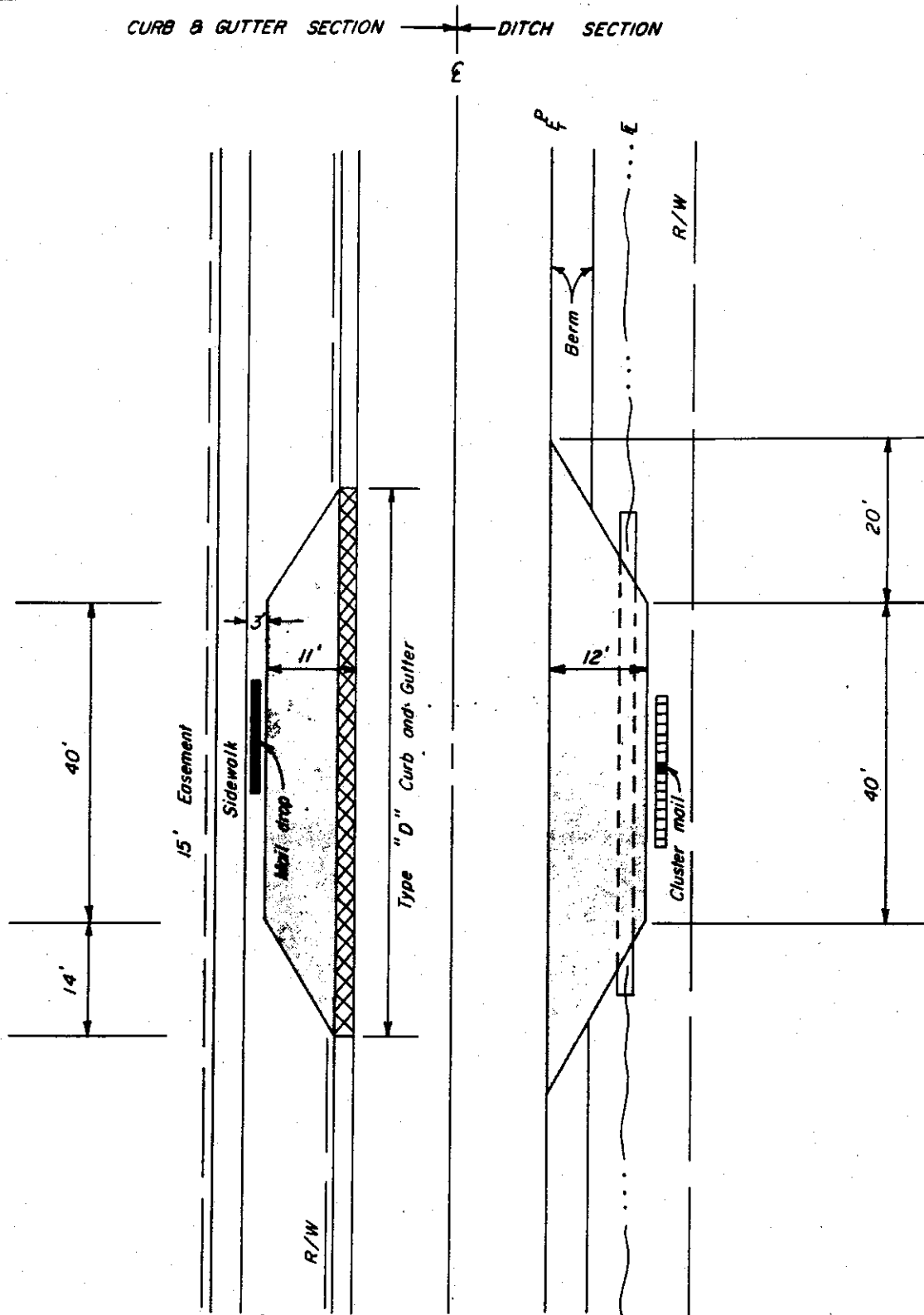
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

TEMPORARY TURN - A - ROUND

SCALE : 1" = 20'

PLATE 12

JAN. 1986



Material: 4" - 404
Compacted Subgrade

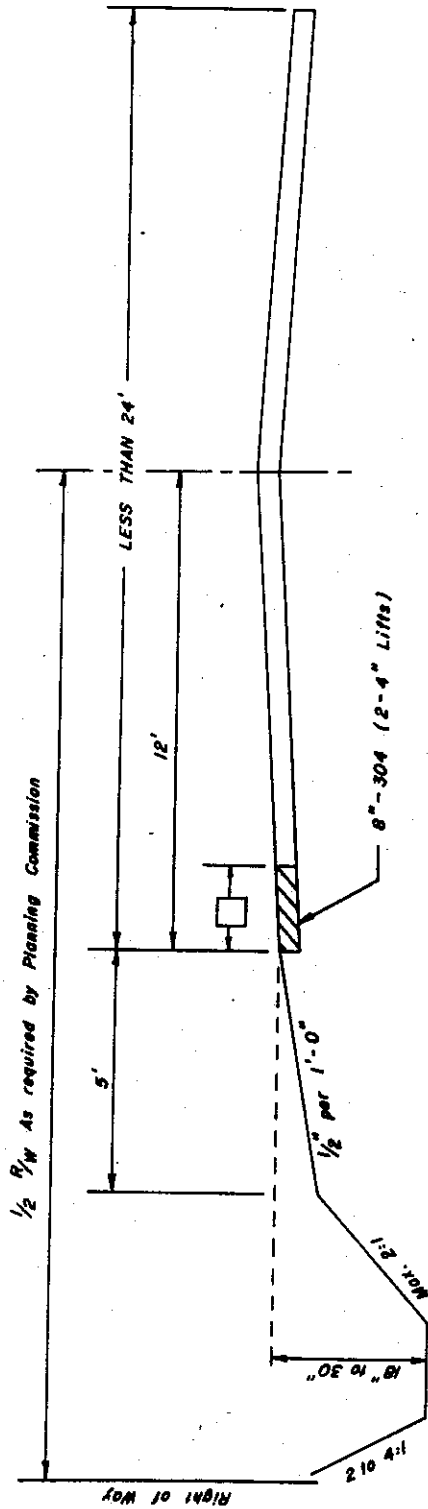
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MAIL DROP PULL OFF

SCALE: 1" = 20'

PLATE 13

JAN. 1986



NOTES

1. Widen roadway to 12 feet on your half with 8"-304 (8-19) and seal the total surface.
2. Five feet wide berm.
3. Reditch for roadside drainage or install curb and gutter and storm sewer.
4. Curb and gutter requirements may be waived by Planning Commission on recommendation of the County Engineer.
5. Dedicate required Right of Way from the center of the existing road.

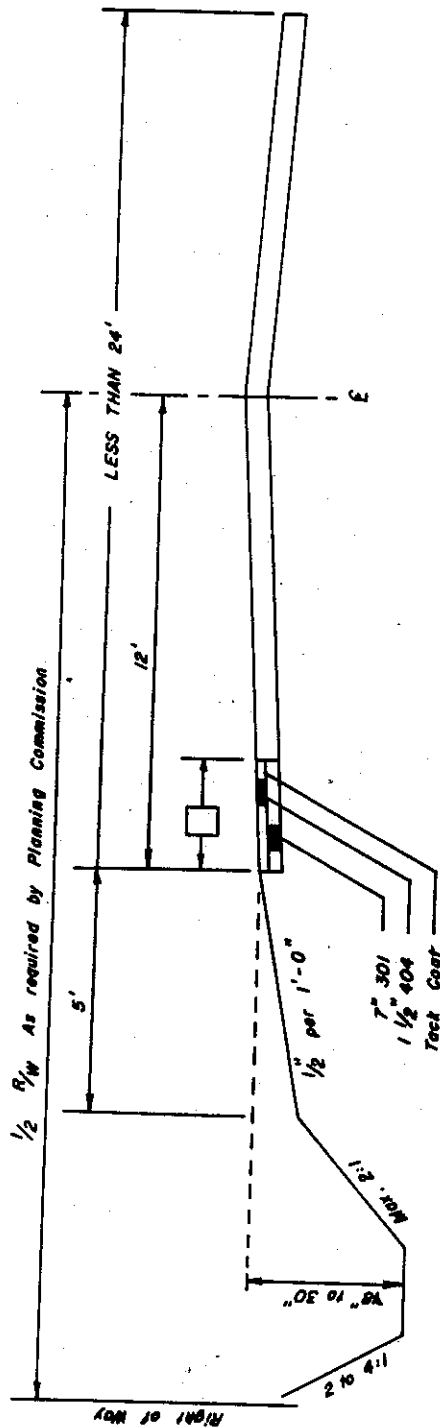
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

FRONTAGE SUBDIVISION
ROAD IMPROVEMENTS (GRAVEL)

SCALE: None

PLATE 14

1986



NOTES

1. Widen roadway to 12 feet on your half as indicated above.
2. Five feet wide berm.
3. Reditch for roadside drainage or install curb and gutter and storm sewer.
4. Curb and gutter requirements may be waived by Planning Commission on recommendation of the County Engineer.
5. Dedicate required Right of Way from the center of the existing road.
6. Seal edge of existing pavement.

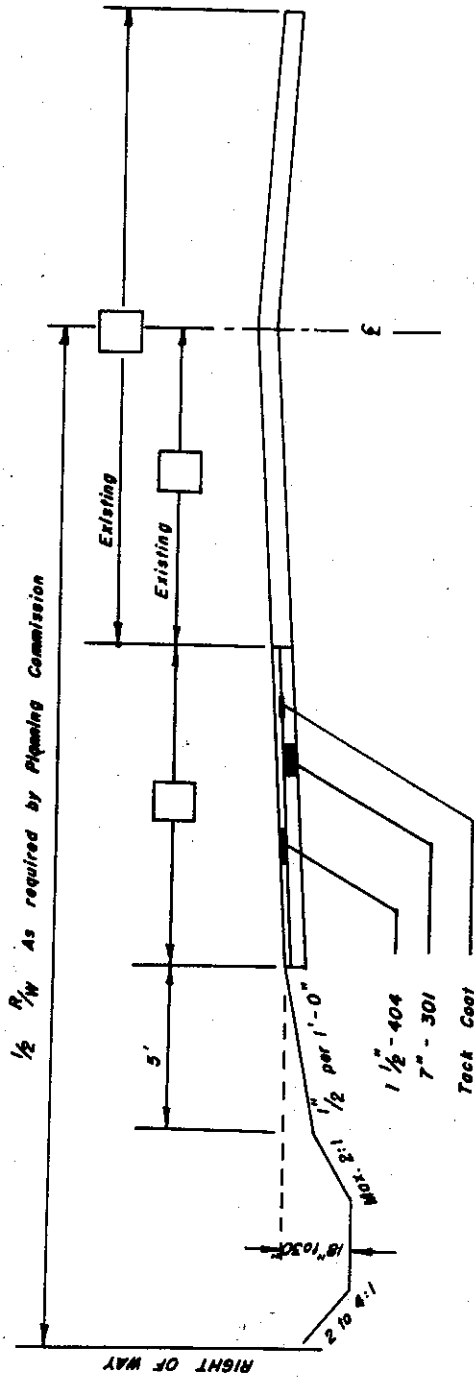
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

FRONTAGE SUBDIVISION
ROAD IMPROVEMENT

SCALE: None

PLATE 15

JAN. 1986



1. A ——— foot wide turning lane constructed to above standard.
2. Five foot wide berm.
3. Reditch for roadside drainage or install curb and gutter and storm sewer.
4. Curb and gutter requirements may be waived by Planning Commission on recommendation of the County Engineer.
5. Dedicate required Right of Way from the center of the existing road.
6. Seal edge of existing pavement.

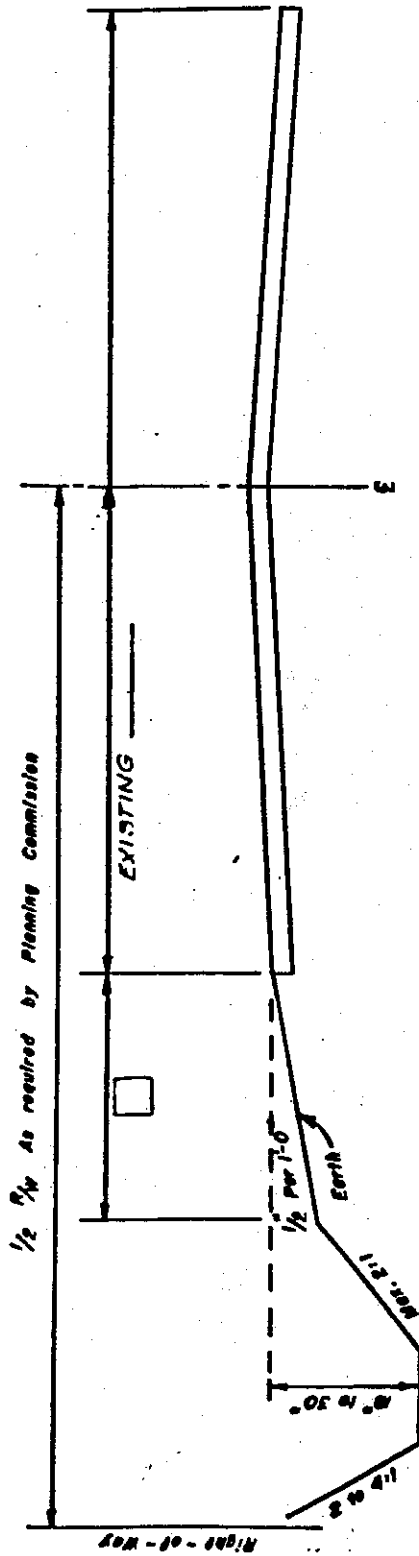
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

FRONTAGE SUBDIVISION
TURNING LANE

PLATE 16

SCALE: None

1986



NOTES

1. Foot wide berm.
2. Method for roadside drainage or install curb and gutter and storm sewer.
3. Curb and gutter requirements may be waived by Planning Commission on recommendation of County Engineer.
4. Dedicate required right-of-way from the center of the existing road.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

FRONTAGE SUBDIVISION
ROAD IMPROVEMENT

PLATE 17

SCALE: None

REVISED: 6/27/95

JAN 1986

STANDARD GRATE as shown in the plan view shall be provided unless the plans specifically require grate L. Place grate so the diagonal bars direct drainage flow toward the curb. All bar edges to be rounded $\frac{1}{8}$ radius.

CASTINGS shall meet the requirements of 604. The design shall be essentially the same and equally as strong as those shown hereon.

WEIGHTS, minimum—

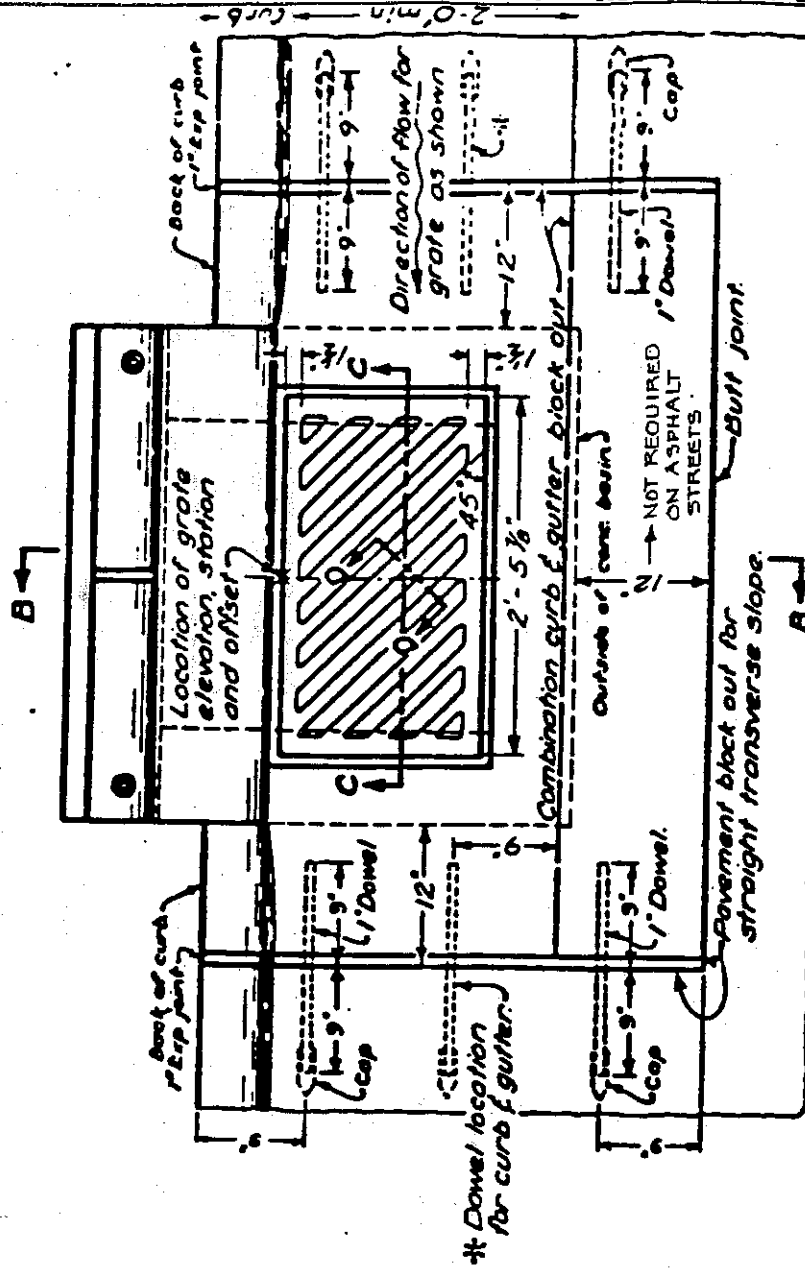
Curb casting 170 pounds.
Gutter grate 127 pounds.
Gutter frame 320 pounds.
DEEPENING AREAS of frame and grate shall be so fitted and finished as to provide a firm and even seat for all portions of the grate in the frame. No projections shall exist on bearing areas of either casting and the grate shall seat in its frame without rocking.

DOWELS: Four 1" x 18" dowels are required for concrete pavement or gutter blockout. See BP-4 for dowel details.

BRICK OR CONCRETE BLOCK side walls, when used in place of concrete, shall be 8 inches nominal thickness.

BLOCKOUT shall be paved with Class C concrete in ACC pavement or gutter and paid for as part of the pavement or gutter with no deduction in pavement, curb or gutter quantities because of the castings. A Class C concrete apron the size of the 2' gutter blockout shall be cast in place in asphalt pavement (no dowels required) with the cost included in the catch basin curb quantities. No deduction to be made in curb quantities.

PRECAST construction is permitted, except for the apron, and concrete shall meet the requirements of 706.13 with 6" x 2" entrained air. Steel reinforcement shall be sufficient to permit shipping and placement without damage.



PLAN OF CATCH BASIN AND PAVEMENT JOINTS

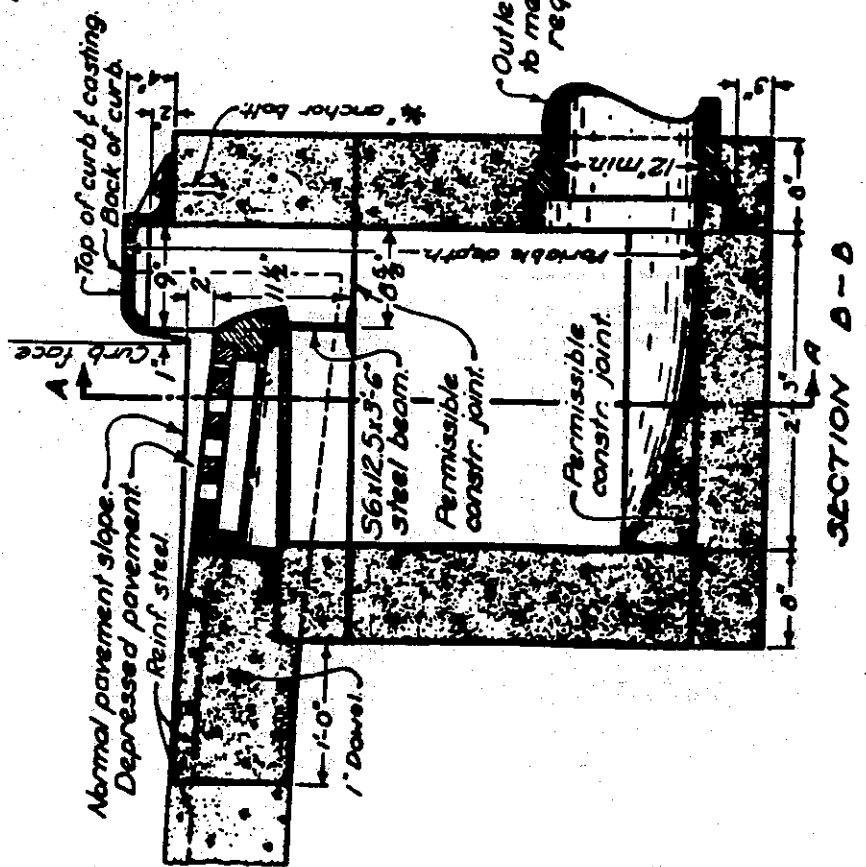
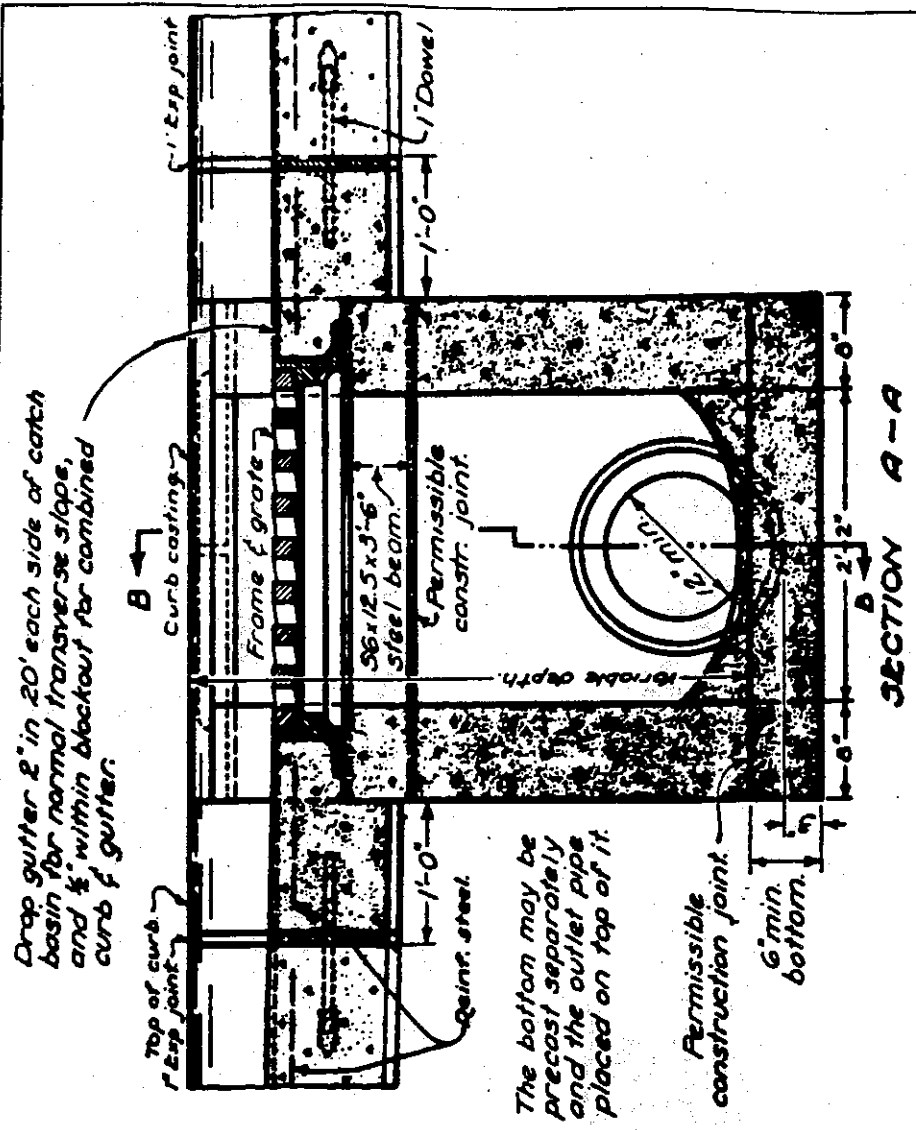
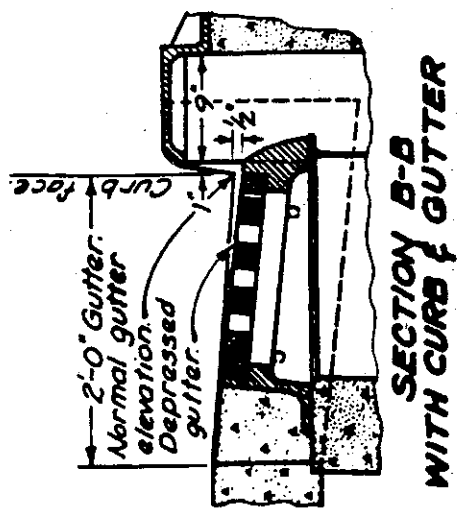
NOTE : Number or letter designations, refer to O.O.O.T.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

CATCH BASIN - TYPE I

SCALE: $\frac{3}{4}$ " = 1'-0"
REVISED: 6/27/95

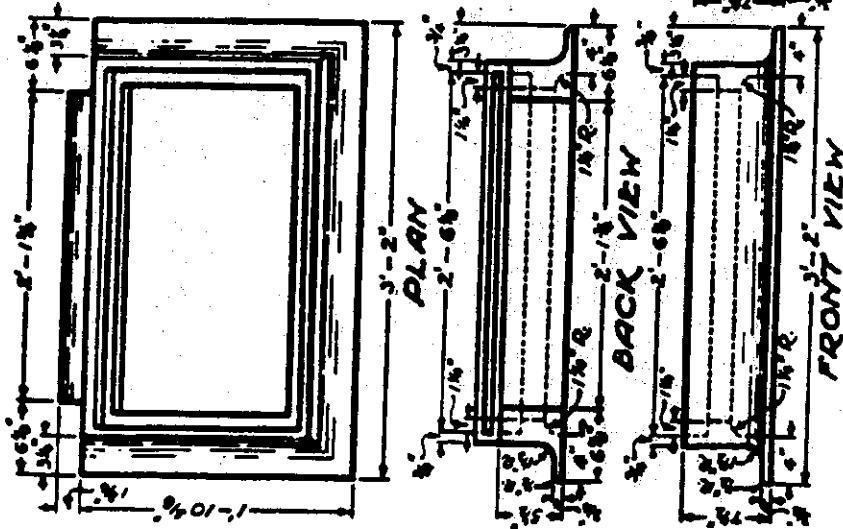
PLATE 18
JAN. 1986



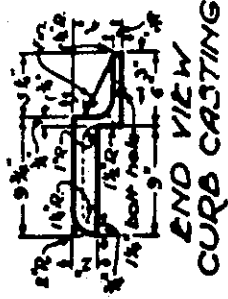
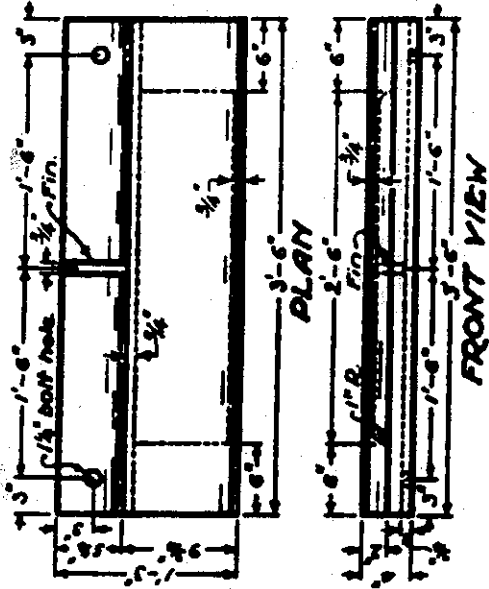
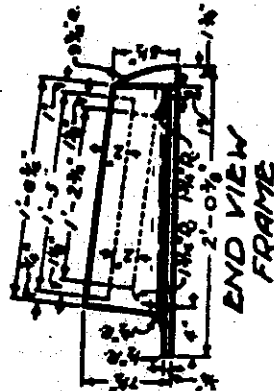
CATCH BASIN

NOTE: Number or letter designations, refer to O.O.O.T

WARREN COUNTY ENGINEERS OFFICE DESIGN STANDARDS
CATCH BASIN - TYPE 1
SCALE: 3/4" = 1'-0"
PLATE 18
JAN. 1986



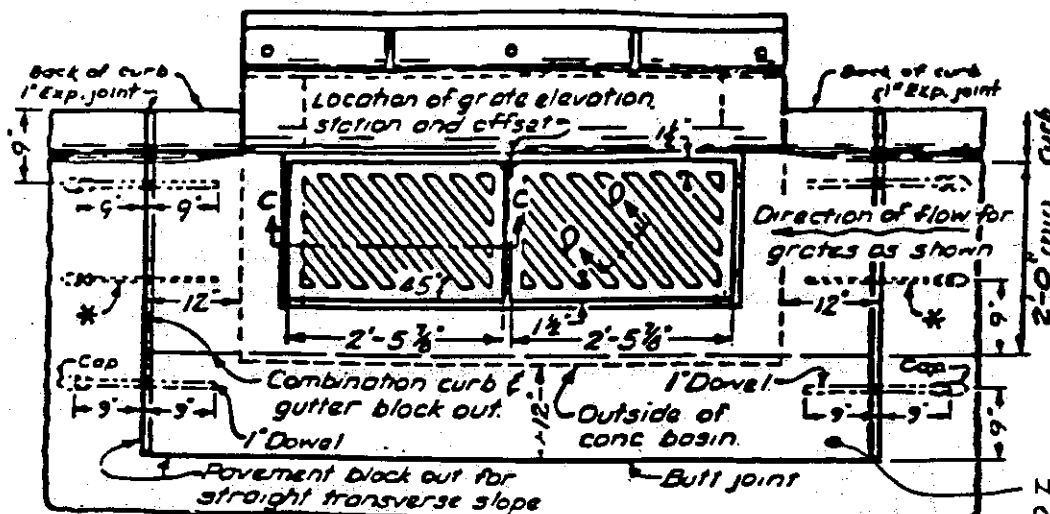
FRAME



CURB CASTING

NOTE : Number or letter designations, refer to O.O.O.T.

WARREN COUNTY ENGINEERS OFFICE DESIGN STANDARDS	
CATCH BASIN - TYPE 1	
SCALE : 3/4" = 1'-0"	PLATE 18
JAN. 1986	



NOT REQUIRED
ON ASPHALT
STREETS.

PLAN OF CATCH BASIN AND PAVEMENT JOINTS

* Dowel location for curb & gutter
SCALE $\frac{1}{2}" = 1'-0"$

STANDARD GRATE as shown in the plan view shall be provided unless the plans specifically require grate L. Place grate so the diagonal bars direct drainage flow toward the curb. All bar edges to be rounded $\frac{1}{8}"$ radius.

CASTINGS shall meet the requirements of 604. The design shall be essentially the same and equally as strong as those shown hereon. Minimum weights are: curb casting 305 lbs., two grates 254 lbs., and frame 590 lbs.

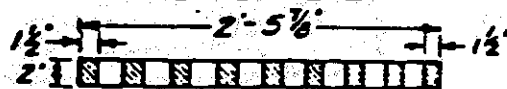
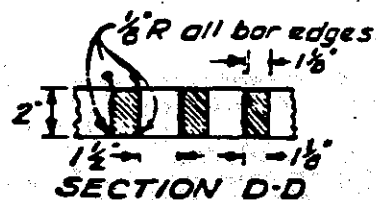
BEARING AREAS of frame and grate shall be so fitted and finished, without projections, as to provide a firm and even seat for all portions of the grate in the frame without rocking.

DOWELS: Four $1" \times 18"$ dowels are required for concrete pavement or gutter blockout. See BP-4 for dowel details.

BRICK OR CONCRETE BLOCK side walls, when used in place of concrete, shall be 8" nominal thickness.

BLOCKOUT shall be paved with Class C concrete in PCC pavement or gutter and paid for as part of the pavement or gutter with no deduction in pavement, curb or gutter quantities because of castings. A Class C concrete apron the size of the 2' gutter blockout shall be cast in place in asphalt pavement (no dowels required) with the cost included in the catch basin bid price. No deduction to be made in curb quantities.

PRECAST construction is permitted, except for apron, and concrete shall meet requirements of 706.13 with $6 \pm 2\%$ entrained air. Steel reinforcement shall be sufficient to permit shipping and placement without damage.



SECTION C-C

Grate size $2'-5 \frac{3}{8}" \times 1'-4 \frac{1}{2}" \times 2"$
(2 required)

STANDARD GRATE

SCALE: $\frac{3}{4}" = 1'-0"$

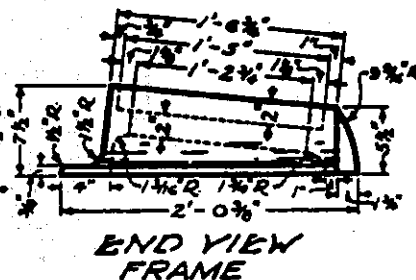
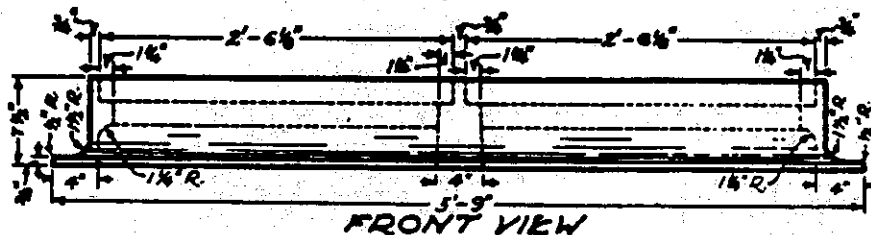
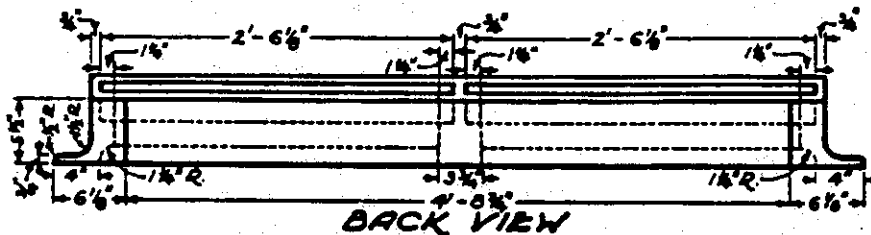
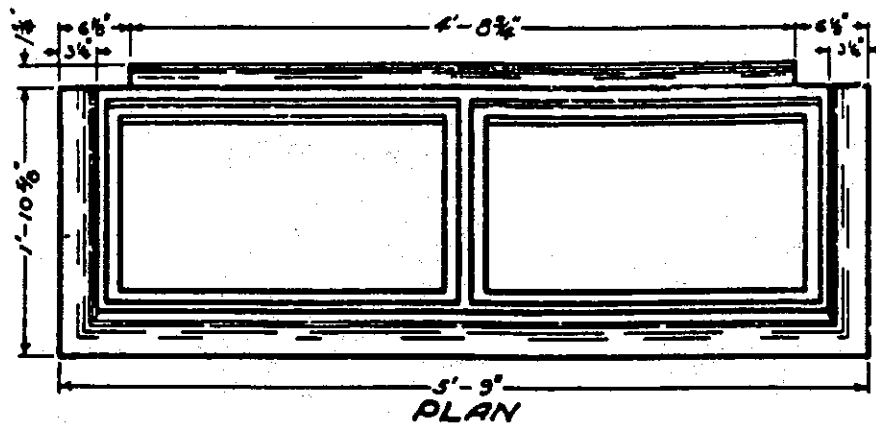
NOTE: Number or letter designations, refer to D.O.D.T.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

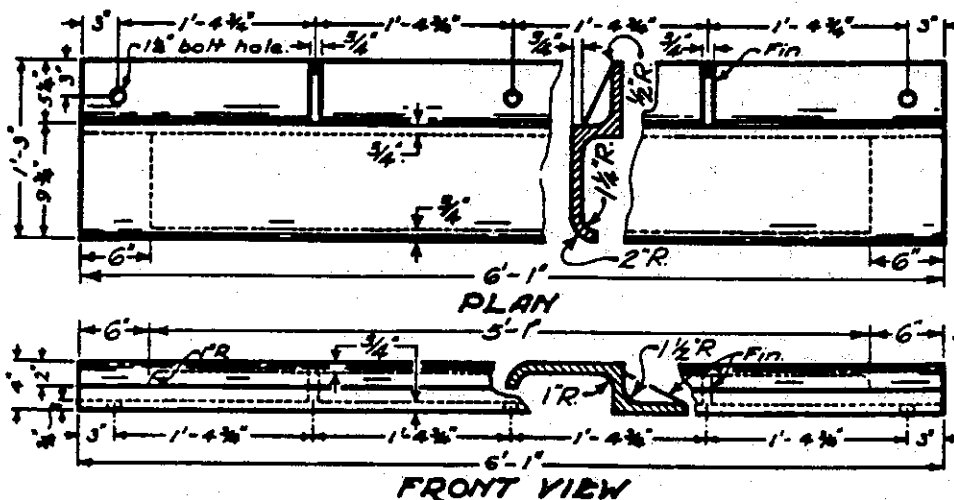
CATCH BASIN - TYPE 1A

SCALE: AS SHOWN
REVISED: 6/27/95

PLATE 19
JAN. 1986



FRAME



CURB CASTING

NOTE : Number or letter designations,
refer to O. D. O. T.

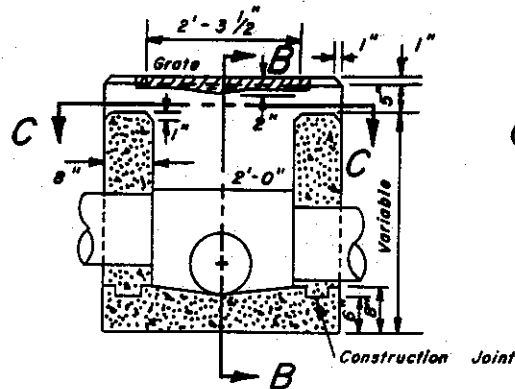
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

CATCH BASIN - TYPE 1 A

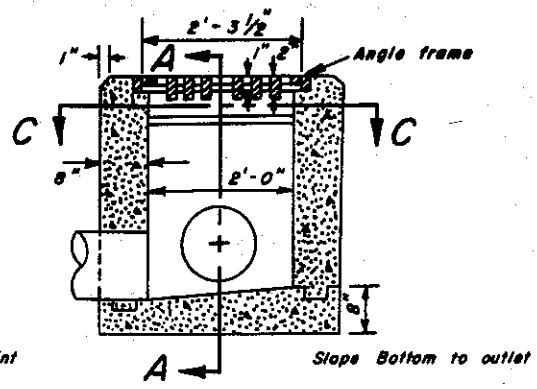
SCALE : 3/4" = 1'-0"

PLATE 19

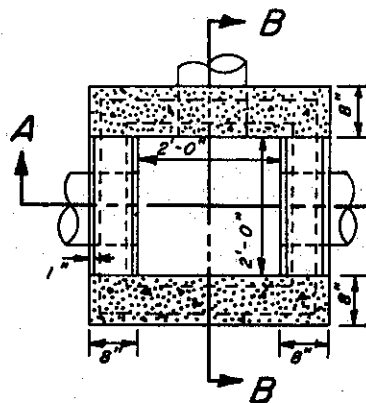
JAN. 1986



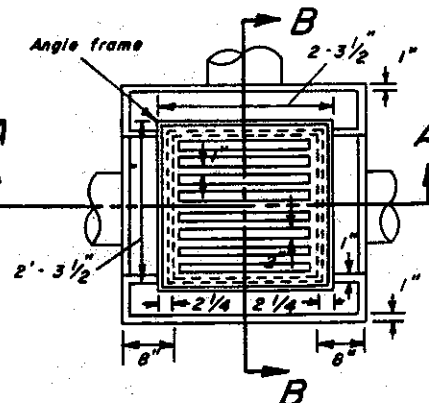
SECTION A-A



SECTION B-B



SECTION C-C



PLAN

NOTES FOR TYPE 2 CATCH BASIN

1. Basins to be constructed of ODOT Class C Concrete only.
2. Bottom of Basin to have 6" minimum thickness and shall extend beneath sidewalls. Provide keyed construction joint beneath sidewalls.
3. Side Inlets shall be provided on both sides of the Type 2 Basin in sags and on upstream side only where the ditch has a continuous down grade past the catch basin. Side inlets to be placed 4 to 6 inches below normal elevations of ditch flow line, returning to normal 10 ft. each side of basin.
4. Type 3 grate elevation to be 4 to 6 inches below normal ditch elevation, returning to normal 10 ft. each side of basin.
5. A precast concrete basin of this type may be used when approved by the engineer.
6. See this sheet for details of grates and frames.
7. Maximum distance between catch basins shall not exceed 400 feet.

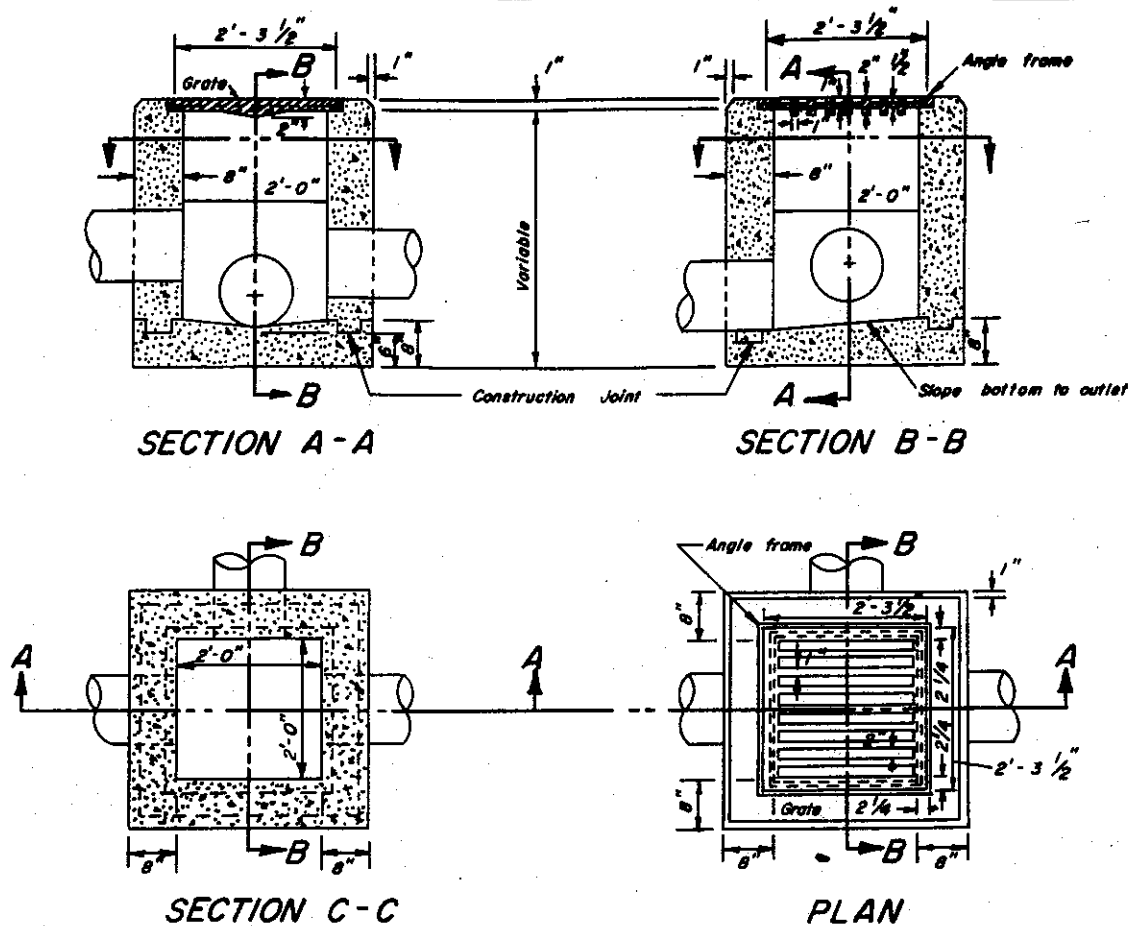
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

CATCH BASIN - TYPE 2

Scale: $\frac{3}{8}" = 1' - 0"$

PLATE 20

JAN. 1986



NOTES FOR TYPE 3 CATCH BASIN

1. Basins to be constructed of ODOT Class C Concrete only.
2. Bottom of basin to have 6" minimum thickness and shall extend beneath sidewalls. Provide keyed construction joint beneath sidewalls.
3. Side inlets shall be provided on both sides of the Type 2 basin in sags and on up-stream side only where the ditch has a continuous down grade past the catch basin. Side inlets to be placed 4 to 6 inches below normal elevations of ditch flow line, returning to normal 10 feet each side of basin.
4. Type 3 grate elevation to be 4 to 6 inches below normal ditch elevation, returning to normal 10 feet each side of basin.
5. A precast concrete basin of this type may be used when approved by the engineer.
6. See this sheet for details of grates and frames.
7. Maximum distance between catch basins shall not exceed 400 feet.

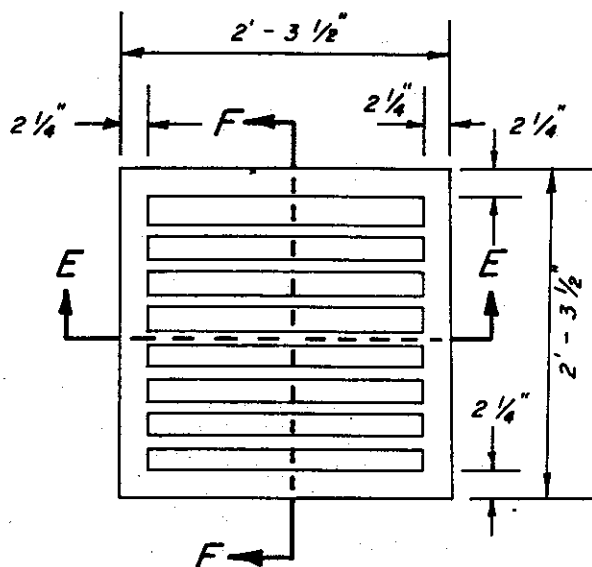
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

CATCH BASIN - TYPE 3

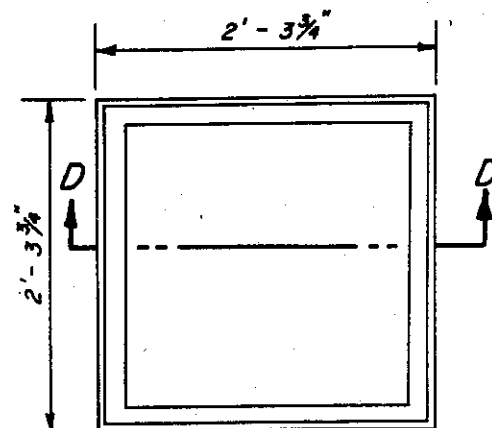
SCALE: $\frac{3}{8}" = 1'-0"$

PLATE 21

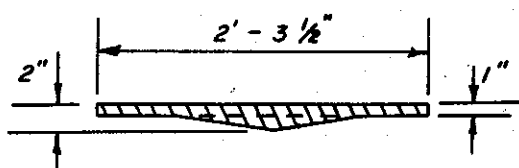
JAN. 1986



PLAN

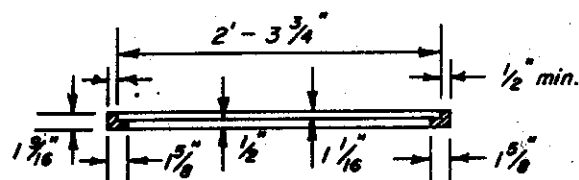


PLAN



SECTION F-F

GRATE



SECTION D-D

ANGLE FRAME

NOTES

1. Grate and Frame shall meet the requirements of ODOT Specification Sec. 711.12, Gray Iron Castings, or approved equal.

Weight of Grate = 120# min.

Weight of Frame = 40# min.

2. All grate edges shall be rounded to $\frac{1}{4}$ " radius.
3. Grate and Frame shall be bituminous coated.

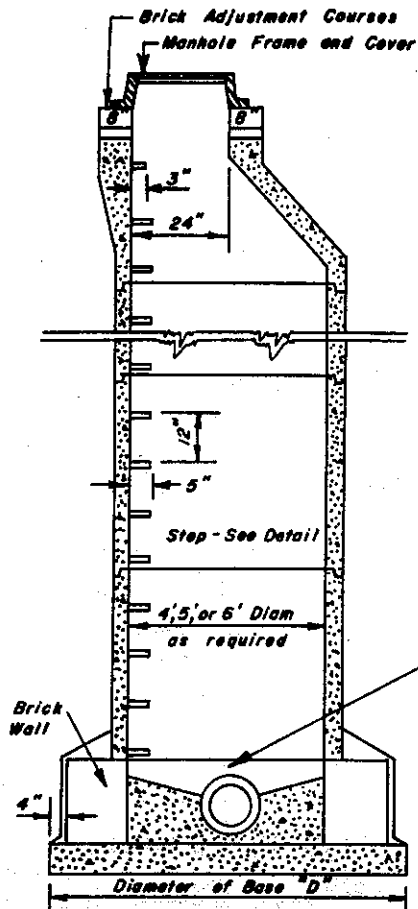
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

GRATE & ANGLE FRAME
For Catch Basins - Type 2 & 3

SCALE: $\frac{3}{4}$ " = 1'-0"

PLATE 22

JAN. 1986



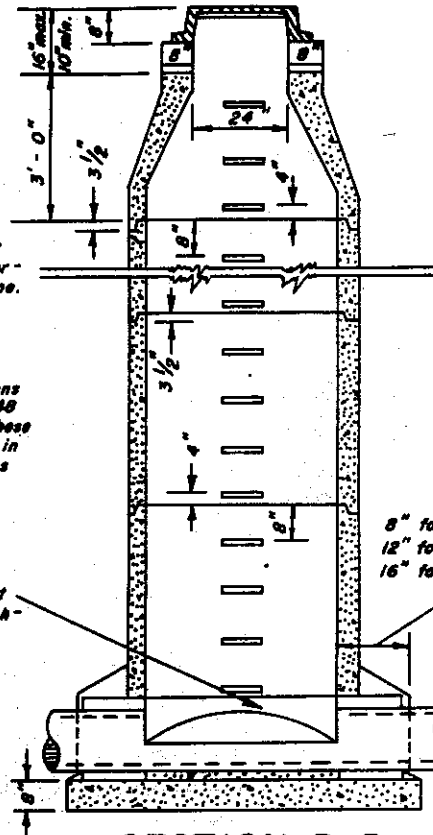
SECTION C-C

Precast manhole sections shall meet the requirements of ASTM Spec. C-478-63T.

Joints to be completely filled with cement mortar before setting pipe.

Manhole barrel sections to be in 12, 24, 36, & 48 inch laying lengths. These sections shall be used in such combinations as is necessary to fit each field condition.

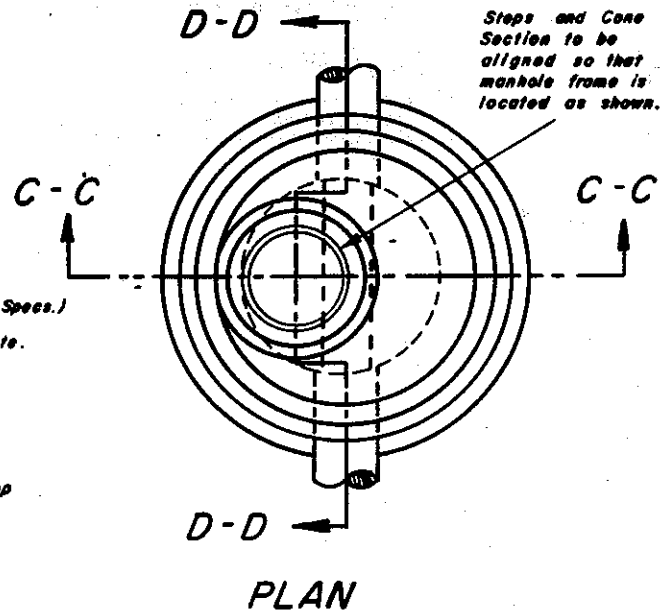
Brick wall to at least one course above highest pipe in manhole.



SECTION D-D

GENERAL NOTES

1. Manhole bases to be constructed of Class C Concrete and shall extend at least 4" beyond walls. Base to be reinforced if manhole depth exceeds 14' (Cl. C refers to ODOT Specs.)
2. Manhole inverts to be constructed of ODOT Class C Concrete.
3. Steps to be placed over outlet pipe.
4. Manhole frame to be set in bed of mortar.
5. All masonry construction of manholes to be smoothly skim coated on interior.
6. Slab top manhole to be used when the distance from the top of the highest pipe to finished grade is less than 4'-0".
7. The depth of a manhole is measured from the top of casting to the flow line of sewer.
8. Manhole shall be constructed to allow for no more than 3 brick adjustment courses under the frame.
9. Castings shall be 8" depth (round) or approved equal.
10. Slab tops for manholes to be precast, Class C Concrete only.



PLAN

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

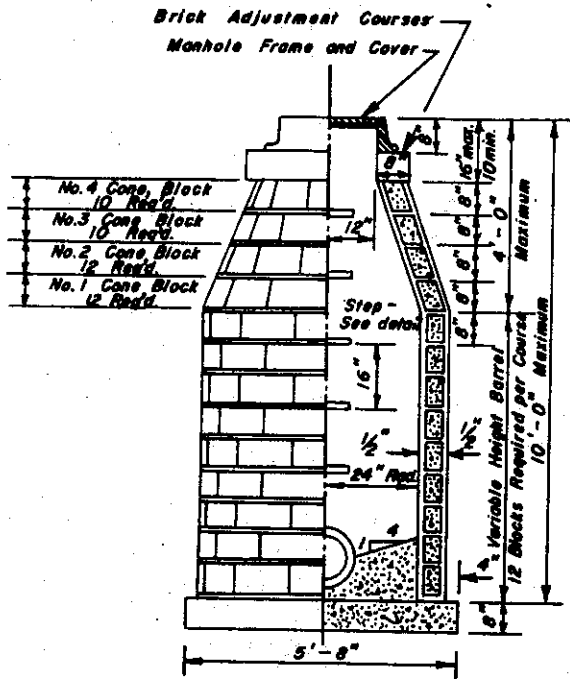
PRECAST CONCRETE MANHOLE

Scale: $\frac{1}{4}" = 1' - 0"$

PLATE 23

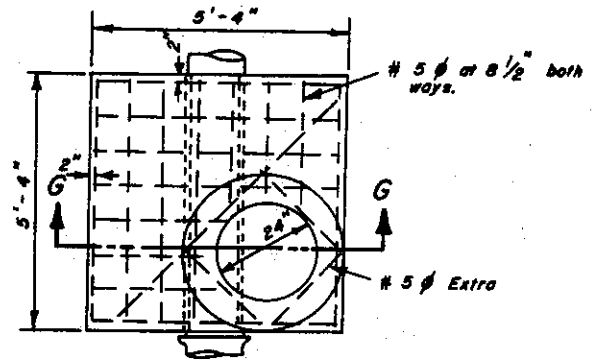
JAN. 1986

NOTE: Manhole blocks to be the type manufactured by Price Brothers Company or approved equal.

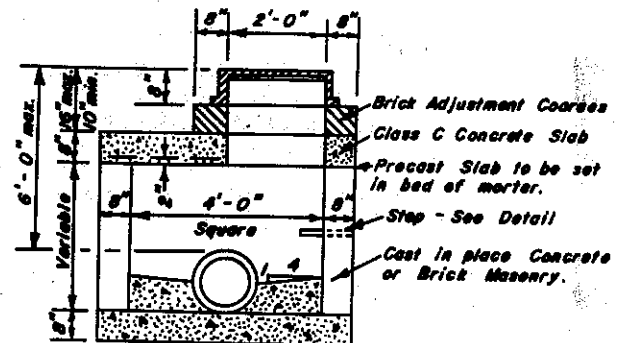


NOTES

1. Only whole barrel blocks and cone blocks shall be used.
2. Chinks around pipe inlets shall be filled with 2" x 4" x 8" Concrete Block.
3. Concrete Block Manhole Construction is permitted only for 4' diameter storm sewer manholes, 10' or less in depth.



PLAN



SECTION G - G

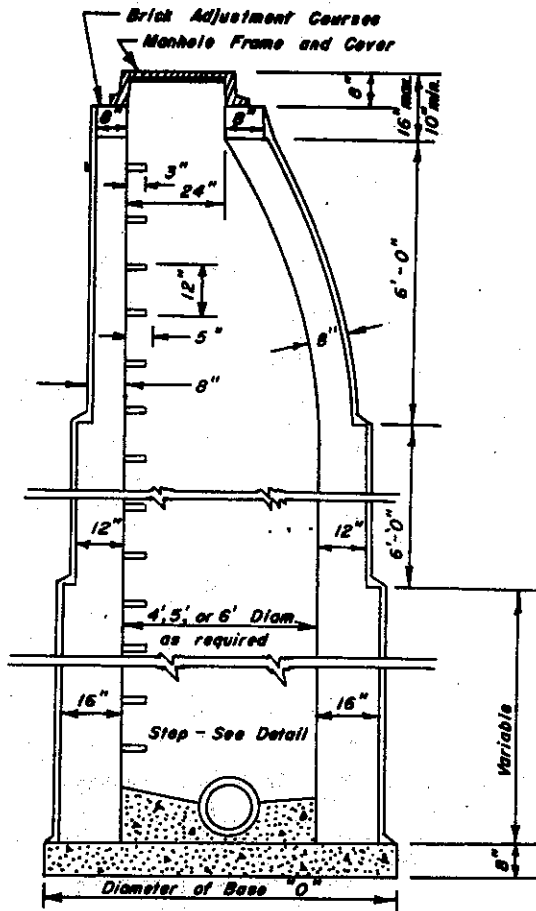
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MANHOLES
CONCRETE BLOCK & SQUARE

PLATE 24

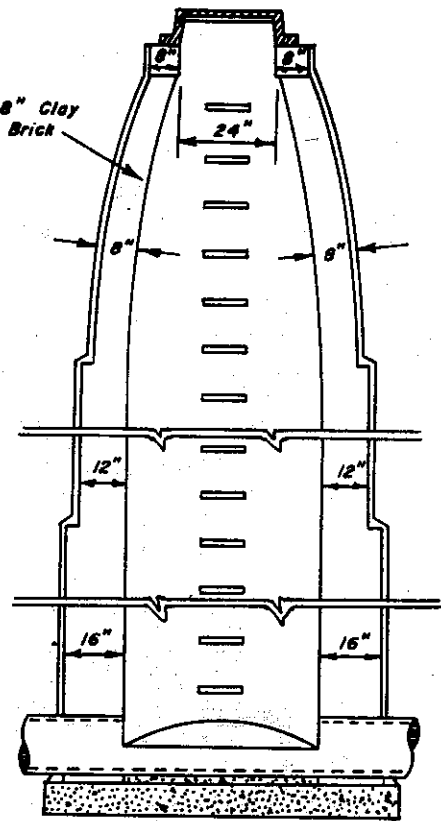
SCALE: 1/4" = 1'-0"

JAN. 1986



NOTE: Brick Manholes to be used only on Storm Sewers.

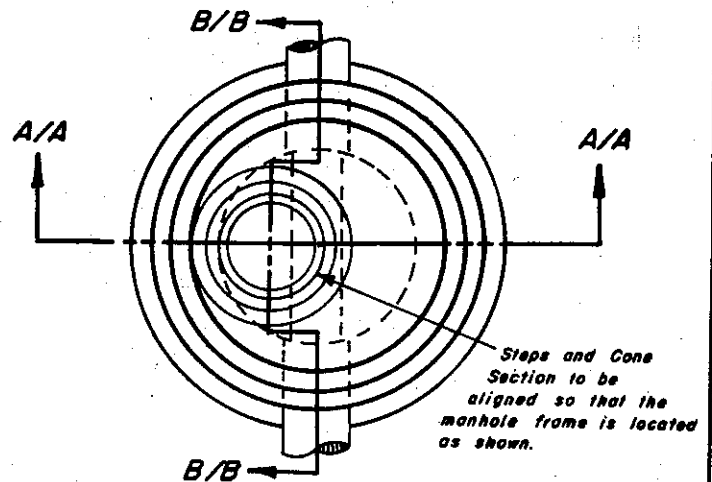
SECTION A - A



SECTION B - B

GENERAL NOTES

1. Manhole bases to be constructed of Class C Concrete and shall extend at least 4" beyond walls. Base to be reinforced if manhole depth exceeds 14' (Cl. C Cons. refers to ODOT Spec's.)
2. Manhole inverts to be constructed of ODOT Class C Concrete.
3. Steps to be placed over outlet pipe.
4. Manhole frame to be set in a bed of mortar.
5. All masonry construction of manholes to be smoothly skim coated on interior.
6. Slab top manhole to be used when the distance from the top of the highest pipe to furnished grade is less than 4'-0".
7. The depth of a manhole is measured from the top of the casting to the flow line of sewer.
8. Manhole shall be constructed to allow for no more than 3 brick adjustment courses under the frame.
9. Castings shall be 8" depth (round) or approved equal.
10. Slab tops for manholes to be precast, Class "C" Concrete only.



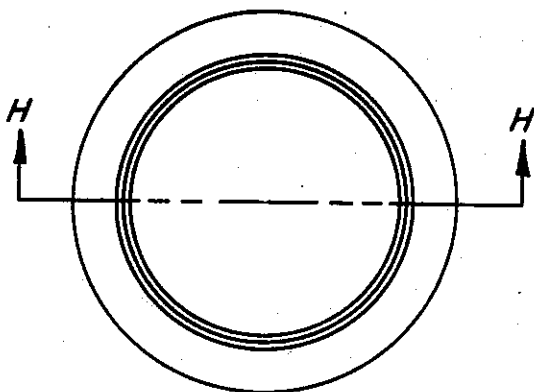
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

BRICK MANHOLE

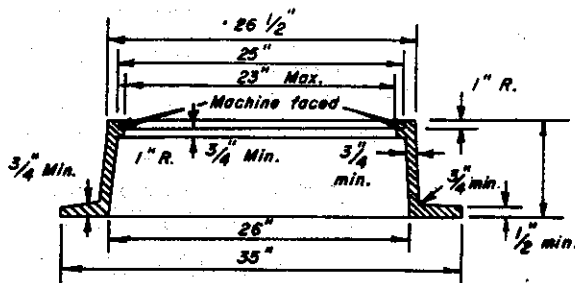
Scale: $\frac{1}{4}$ " = 1'-0"

PLATE 25

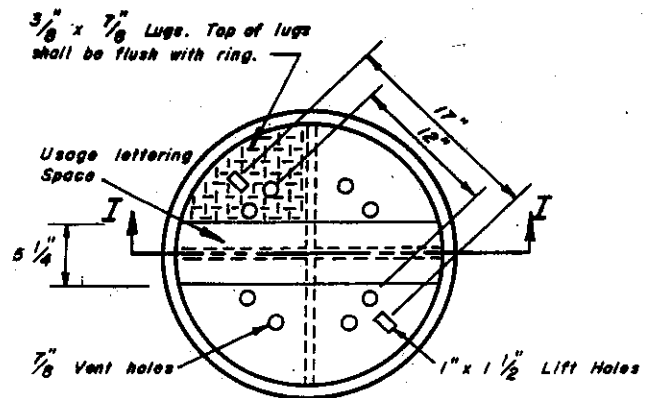
JAN. 1986



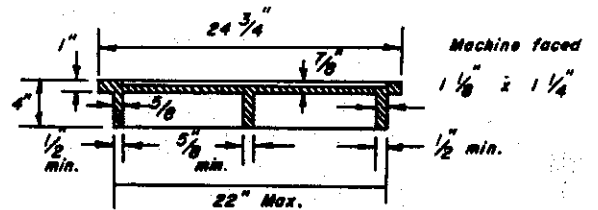
PLAN



SECTION H-H
ROUND FRAME



PLAN



SECTION I-I
ROUND COVER

NOTES (Round)

1. Round Frame and Cover shall be of the best quality grey cast iron and shall be free of pits and other imperfections.
Weights: Cover 150 - 160
Frame 210 - 220
2. Frame and cover shall be bituminous coated.
3. Usage lettering shall be $4\frac{3}{8} \pm$ in height, having a line thickness of $\frac{3}{8} \pm$ in width and having a line depth of $\frac{1}{8}$. Lettering shall read "STORM" for storm sewers.

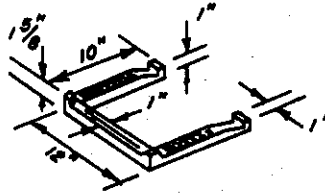
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MANHOLE - Frame and Cover

SCALE: None

PLATE 26

JAN. 1986

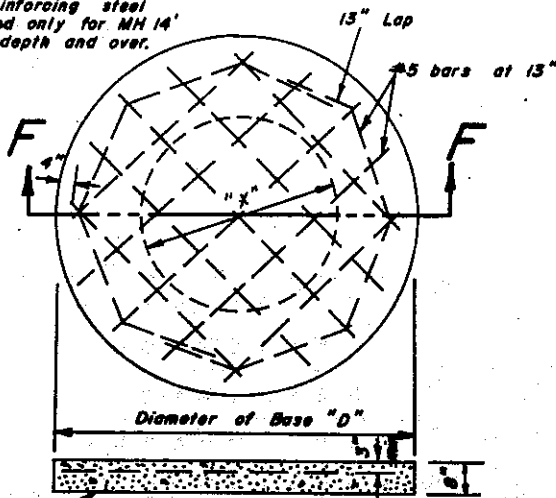


NOTE: Manhole step shall be a Neenah R-1981-J or approved equal.

MANHOLE STEP

No Scale

NOTE: Reinforcing steel used only for MH 14' in depth and over.



SECTION F-F

MANHOLE BASE DIAM. "D"			
Dia. of MH	8" Walls	12" Walls	16" Walls
4'	72" Dia.	80" Dia.	88" Dia.
5'	84" "	92" "	100" "
6'	96" "	104" "	112" "

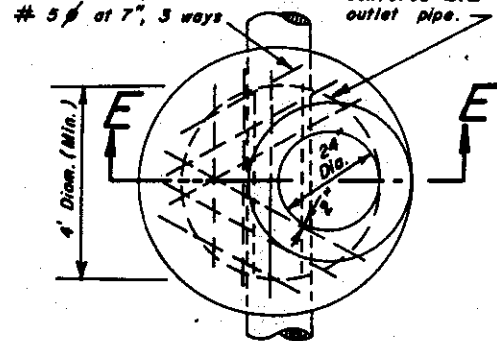
NOTE: If a number of pipes enter a manhole, the manhole diameter shall be increased above the minimum tabular value so that proper clearance is obtained.

MANHOLE DIAM. "X"	
Pipe Size	Manhole Diam.
8" - 24"	4'
27" - 42"	5'
48" - 54"	6'

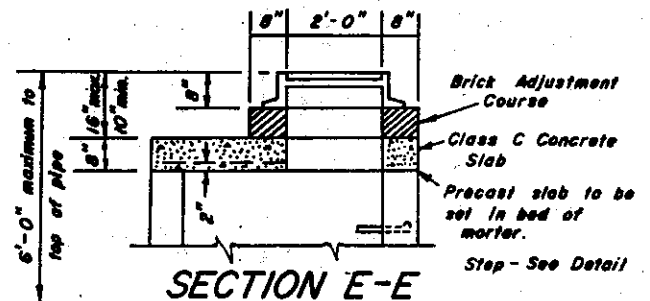
MANHOLE BASE

Scale: $\frac{1}{4} = 1' - 0"$

Manhole Opening to be centered over main sewer outlet pipe.



PLAN



SECTION E-E

SLAB TOP FOR ROUND MANHOLE

Scale: $\frac{1}{4} = 1' - 0"$

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

MANHOLE
STEP - BASE - SLAB

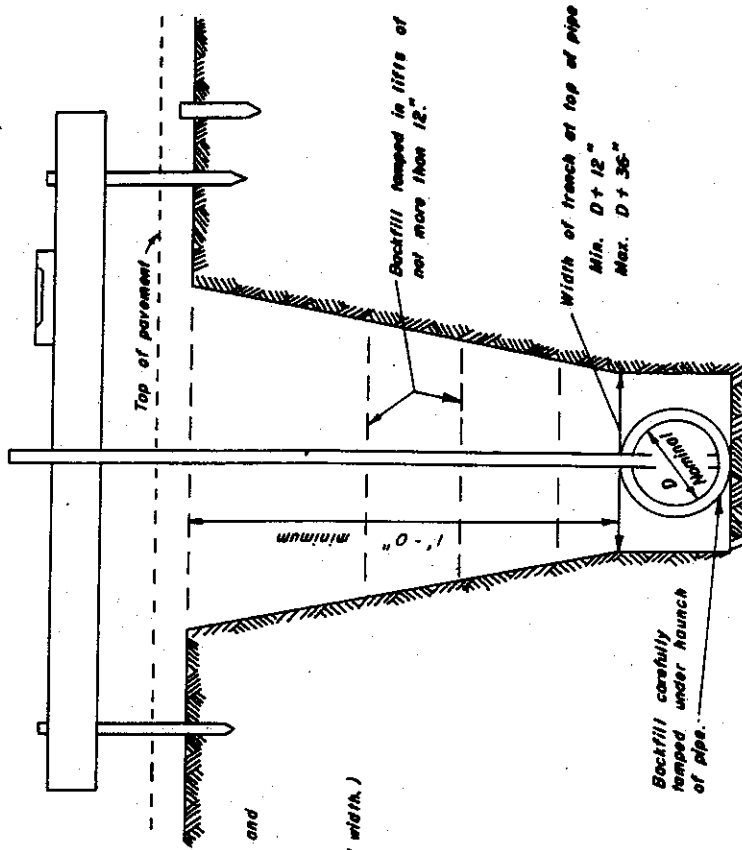
PLATE 27

SCALE: As Shown

JAN 1986

FLEXIBLE PIPE

Design based on H-10 loading for local street.
 Design based on H-20 for secondary and primary thoroughfares.
 Minimum pipe size for storm water 12" diameter.
 Pipe to be corrugated metal, coated and paved invert for sizes 12" & 15" (N = .020).
 Pipe to be corrugated metal, coated and full paved for sizes 24" and larger (N = .020).
 Pipe joints shall be corrugated metal, coated and paved invert or coated and full paved for sizes 18" & 24".
 all full paved pipe which shall have 16 gage bands.
 Bands shall be of the following types:
 (A) For coated and paved invert pipe -
 (1) Armo type P1 - 3C or approved equal for 30" diam. and under (7" minimum band width.)
 (2) Armo type P1 - 5C, P2 - 5C or approved equal for 36" diam. through 60" diam. (12" minimum band width.)
 (3) Armo type P2 - 10C or approved equal for 66" diam. and over (24" minimum band width.)
 (B) For coated and full paved pipe -
 (1) Armo type S1 - 7 - U or approved equal (band width 6 3/8 inches.)
 Bands shall be bituminous coated.



Line and grade transferred by batter boards and string line.
 Batter boards installed every 25 ft. for grades less than 0.70 % and every 50 ft. for grades 0.70 % and greater.
 A minimum of three batter boards shall be in place while sewer construction is in progress.

GAGES OF CORRUGATED METAL SEWER PIPE		FOR H-20 LIVE LOAD TRENCH CONDITION											
Dia. in.	Height of cover above top of pipe - in feet	FOR H-10 LIVE LOAD TRENCH CONDITION											
		10-23	16-25	16-25	16-25	16-25	16-25	16-25	16-25	16-25	16-25	16-25	16-25
12	16	16	16	16	16	16	16	16	16	16	16	16	16
15	16	16	16	16	16	16	16	16	16	16	16	16	16
18	16	16	16	16	16	16	16	16	16	16	16	16	16
21	16	16	16	16	16	16	16	16	16	16	16	16	16
24	16	16	16	16	16	16	16	16	16	16	16	16	16
30	16	16	16	16	16	16	16	16	16	16	16	16	16
36	16	16	16	16	16	16	16	16	16	16	16	16	16
42	16	16	16	16	16	16	16	16	16	16	16	16	16
48	16	16	16	16	16	16	16	16	16	16	16	16	16
54	16	16	16	16	16	16	16	16	16	16	16	16	16
60	16	16	16	16	16	16	16	16	16	16	16	16	16
66	16	16	16	16	16	16	16	16	16	16	16	16	16
72	16	16	16	16	16	16	16	16	16	16	16	16	16
78	16	16	16	16	16	16	16	16	16	16	16	16	16
84	16	16	16	16	16	16	16	16	16	16	16	16	16

NOTE: Pipe in gages shown below line shall be struttled.

WARREN COUNTY ENGINEERS OFFICE
 DESIGN STANDARDS

DITCH CONDITIONS FOR FLEXIBLE PIPE

SCALE: As Shown

PLATE 28

JAN 1981

RIGID PIPE

CONCRETE PIPE - MINIMUM SIZE 12"

Pipe joints shall be of the type known by the trademarks as Tycor, Amseel, Press-Seal or approved equal, and shall meet the requirements of ASTM C-443.

Simultaneous plastic content, which meets the requirements of D.O.T. Spec. 705.10 and which is applied in conformance with the requirements of D.O.T. Spec. 603.06 will be accepted as a jointing material equal to the above mentioned joint.

Minimum depth from top of pavement to top of pipe to be 2 feet.

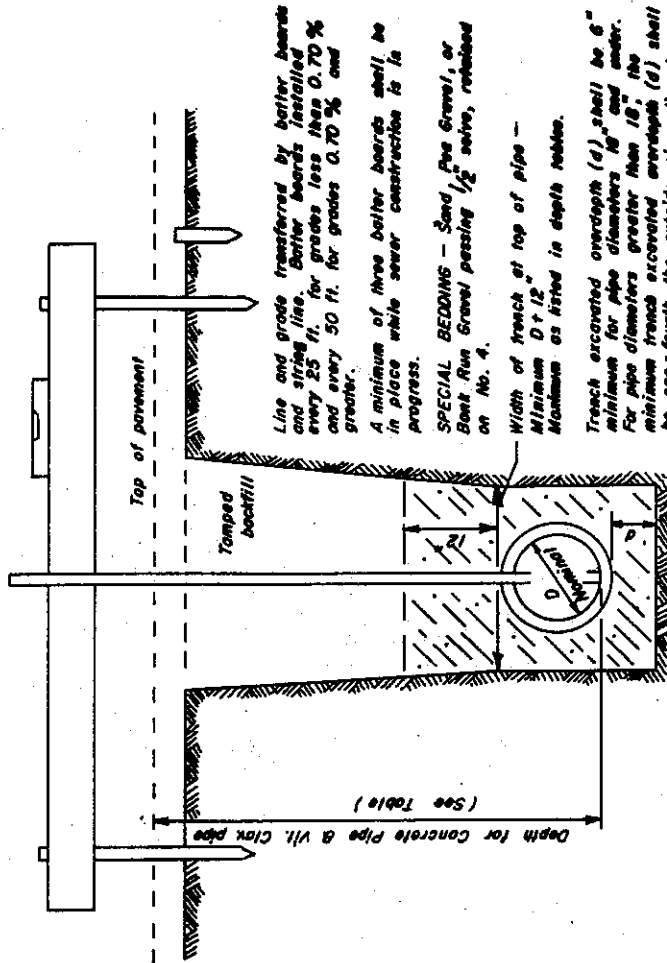
Dia. of Pipe	Minimum Width of Trench at Top of Pipe	MAXIMUM DEPTH		BOTTOM OF PIPE IN FEET				
		Standard Strength C-14-57	Extra Strength C-14-57	Reinforced Concrete Pipe C-76-57				
				Class I	Class II	Class III	Class IV	Class V
12	0.0+16"	12	26		8.3	12.2	30.5	No Limit
15	"	12	26		9.9	14.9	33.0	"
18	"	12	29		11.0	16.5	38.3	"
21	"	12			11.8	17.4	39.4	"
24	"	12			12.5	18.3	39.3	"
30	"				13.9	19.4	38.4	"
36	0.0+24"				13.1	17.1	27.0	64.4
42	"				13.9	18.3	28.8	61.7
48	"				14.9	19.3	30.0	60.2
54	"				15.8	20.2	30.7	59.0
60	0.0+24"			14.0	16.6	21.2	31.5	57.2
66	"			14.7	17.2	21.8	31.9	56.4
72	"			15.6	17.9	22.6	32.8	56.7
78	"			16.1	18.6	23.5	33.5	
84	"			16.7	19.3	24.1	33.9	

NOTE

These values are for average conditions assuming ditch conditions, compacted granular bedding with tamped backfill, Class B-2 (as defined by ASCE-WPCF "Design and Construction of Sanitary and Storm Sewers" - Joint Committee.) Load Factor = 1.9, Safety Factor = 1.25 for C-14-57, Safety Factor = 1.00 for C-76-57. (Safety Factor is based on minimum load to produce 0.01 inch crack.) Weight of soil = 130 lbs./cu. ft.

If conditions are different those stated, the maximum depth shall be computed by methods used as described in Concrete Pipe Handbook or "Loads and Supporting Strengths for Concrete Pipe Lines" and "Design and Installation Criteria for Reinforced Pipe Culverts" as published by the American Concrete Pipe Association.

For depths greater than shown in table, concrete cradles or concrete encasement shall be used.



NOTE

This item may be omitted only by specific authority of the County Engineer and only when excavation is in sand or gravel soil.

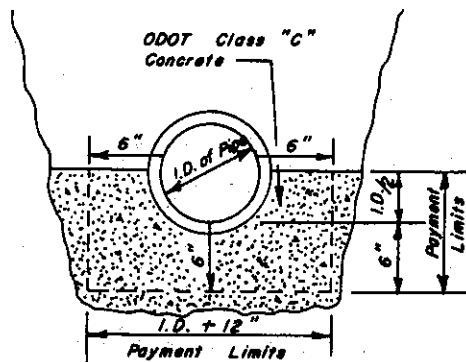
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

DITCH CONDITIONS FOR RIGID PIPE

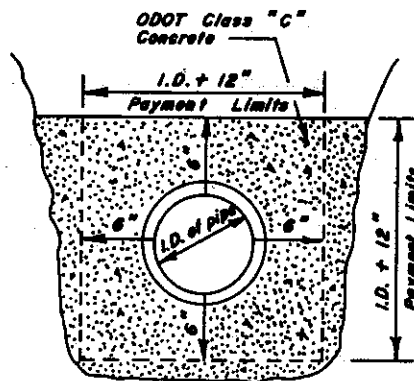
PLATE 29

SCALE : As Shown

JAN. 1986



PIPE CRADLE



PIPE ENCASEMENT

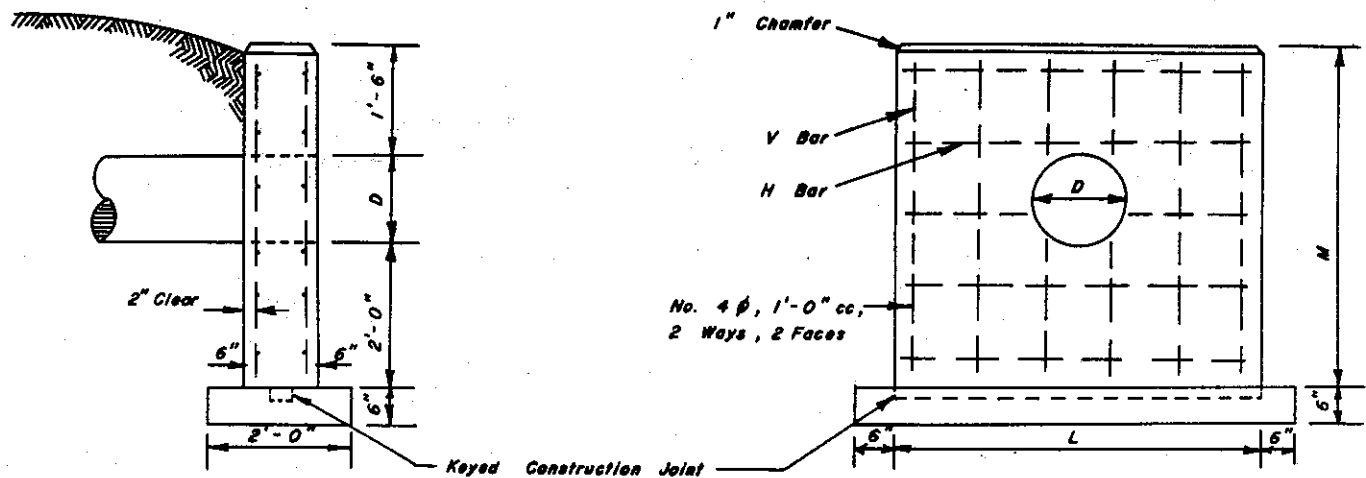
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

PIPE ENCASEMENT & CRADLE

SCALE: NONE

PLATE 30

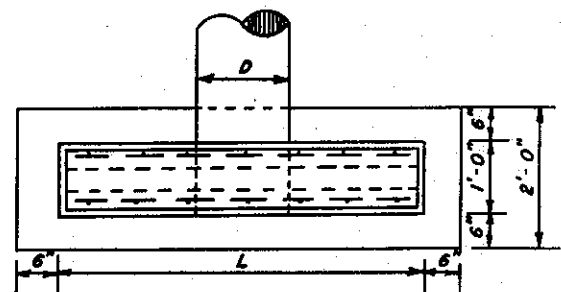
JAN. 1986



SIDE

ELEVATION

Concrete shall be Class "C"
ODOT Specs.



PLAN

MATERIAL REQUIRED FOR ONE HEADWALL										
D Diam. of pipe	L	N	H BAR			V BAR			TOTALS	
			NO.	Length	Weight lbs.	NO.	Length	Weight lbs.	RE. bars lbs.	Conc. cu. yds.
15"	5'-0"	4'-0"	10	4'-6"	30	12	4'-3"	34	64	1.06
18"	5'-9"	5'-0"	12	5'-3"	42	12	4'-6"	36	78	1.25
21"	6'-9"	5'-3"	12	6'-3"	50	14	4'-9"	44	94	1.51
24"	7'-6"	5'-6"	12	7'-0"	56	16	5'-0"	53	109	1.73
27"	8'-6"	5'-9"	12	8'-0"	64	18	5'-3"	63	127	2.02
30"	9'-3"	6'-0"	14	8'-9"	82	20	5'-6"	73	155	2.25
36"	11'-0"	6'-6"	14	10'-6"	98	24	6'-0"	96	194	2.83

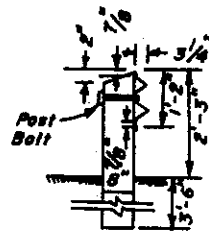
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

HEADWALL - REINFORCED CONCRETE

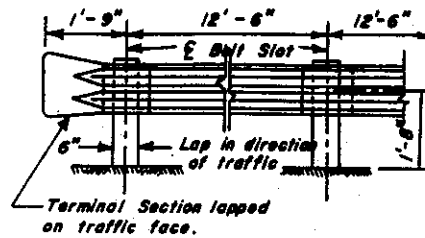
Scale: $\frac{3}{8}" = 1'-0"$

PLATE 31

JAN. 1985

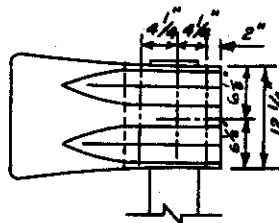


SECTION

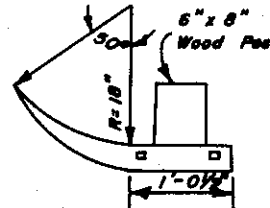


ELEVATION

Scale: $\frac{1}{4}'' = 1'-0''$



ELEVATION



PLAN

TERMINAL SECTION

Scale: $\frac{1}{2}'' = 1'-0''$

NOTES

1. Posts shall be 6"x8"x5'-9" long, meeting the requirements of Sec. 710.12 of ODOT Specs. Posts shall be entirely pressure treated with pentachlorophenol in accordance with the requirements of Sec. 710.14 of the ODOT Specs.
2. Rail shall be galvanized steel beam, deep type, not less than 12 gage in thickness and meet the requirements of Sec. 606.01 Type 4, 710.06 of the ODOT Specs.
3. Construction methods shall conform to the applicable portions of item 606, ODOT Specs.
4. All holes in posts, all cuts and all abrasions shall be pentachlorophenol pressure treated as specified in Sec. 606.03 ODOT Specs.
5. Splice Bolt shall be $\frac{5}{8}'' \phi$ - Splice Holes shall be slotted $\frac{29}{32} \times \frac{1}{8}''$ post Bolt Slots shall be $\frac{3}{4}'' \times 2 \frac{1}{2}''$ - Post Bolts shall be $\frac{5}{8}'' \phi \times 10 \frac{1}{2}''$ long.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

STANDARD GUARD RAIL

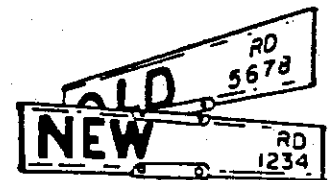
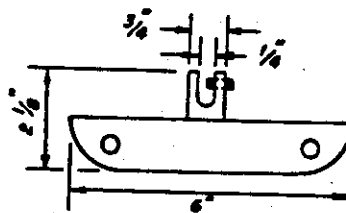
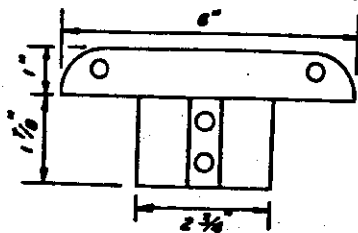
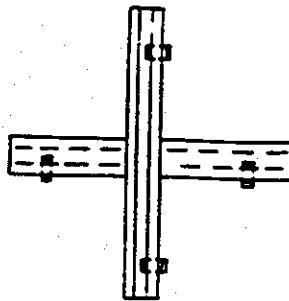
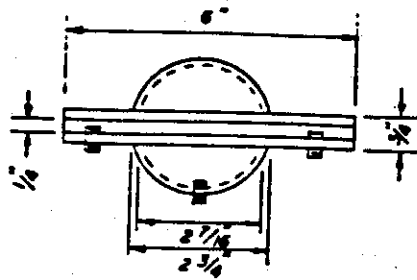
SCALE: As Shown

PLATE 32

JAN. 1986

BOTTOM MOUNTING BRACKET

TOP MOUNTING BRACKET



STREET SIGNS - BRACKETS & POSTS No Scale

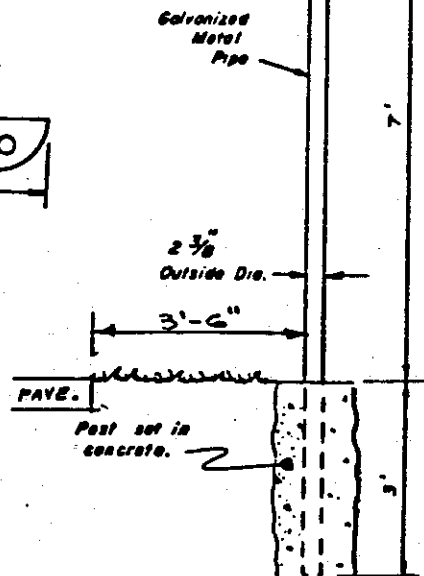
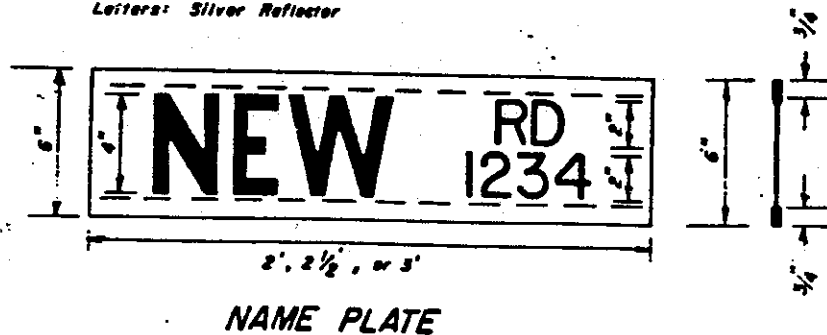


Plate: Green Reflector Coat
Letters: Silver Reflector

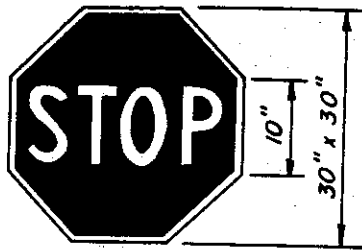


WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

SIGNS - Name and Post

SCALE: None
REVISED: 6/27/95

PLATE 33
FEB. 1995



The Stop sign shall be octagonal in shape, shall have a red background, and shall carry the word "STOP" in white letters at least one-third the height of the sign. Secondary messages shall not be used on STOP sign face.

Height of Signs

Signs erected at the side of the road where rural conditions exist shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the edge of pavement. In business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet. The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the appropriate height specified above.

Posts

Signs to be mounted on No. 2 channel post, painted green.

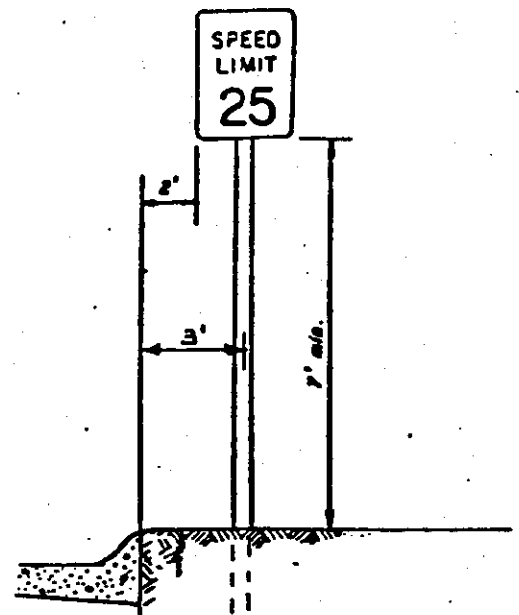
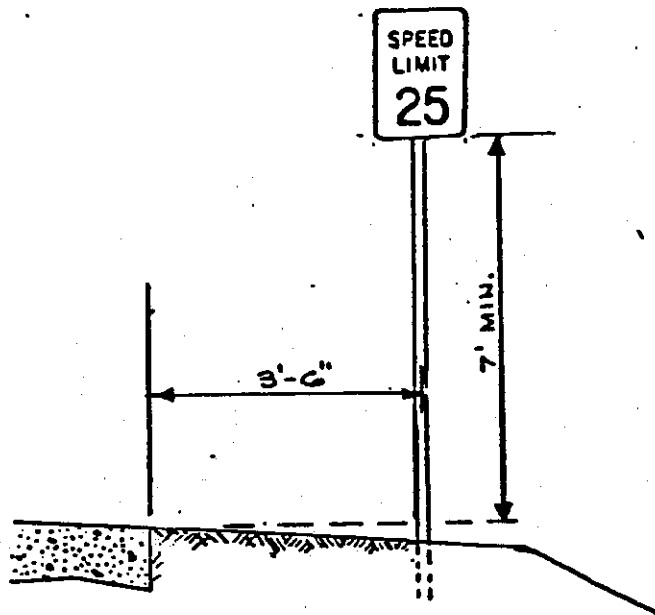
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

STOP SIGN AND HEIGHT REQUIREMENT

SCALE : None

PLATE 34

JAN. 1986



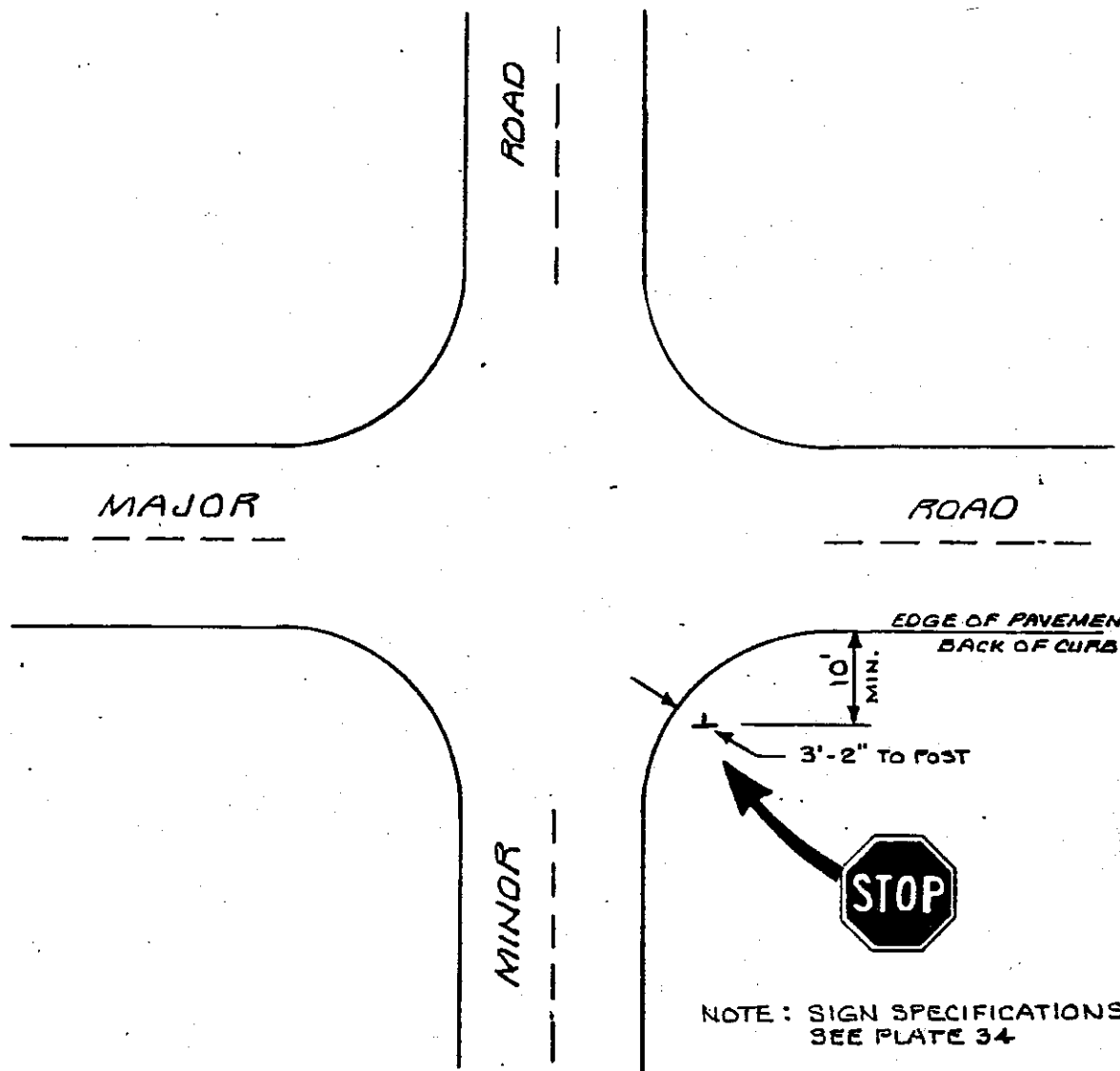
RESIDENTIAL AND BUSINESS
ODOT R-10 (24" x 30")

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

TYPICAL LOCATION - SPEED LIMIT SIGN

PLATE 35

SCALE: None
 REVISED: 6/27/95



WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

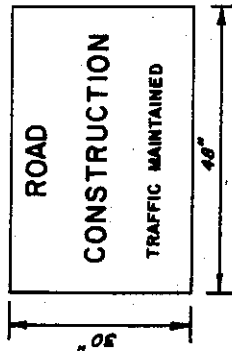
TYPICAL LOCATION - STOP SIGN

SCALE: None

PLATE 36

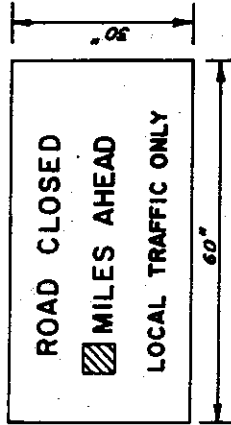
REVISED: 6/27/95

OC - 4



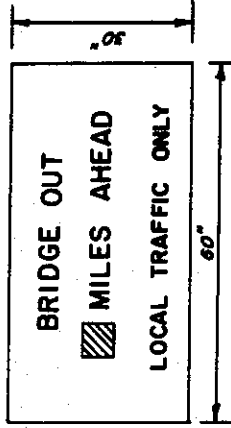
SEE NOTES - B & C

R - 76 A



SEE NOTES - B & C

R - 76 B

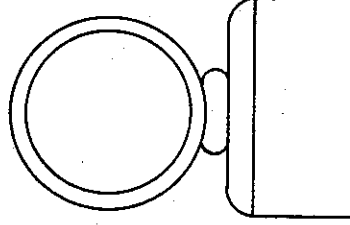


SEE NOTES - B & C

NOTES

- A. The R-75 sign shall be attached to the gate, centered vertically and horizontally on the 6" x 12" x 1" boards.
- B. The R-76 A or R-76 B sign shall be attached to the Type III barricade and centered vertically and horizontally on the 6" x 12" x 1" boards.
- C. The R-75, R-76 A, and R-76 B signs shall be fabricated on 0.80 gauge aluminum blanks and have a reflective white background with black lettering and numerals.
- D. Barricades shall be painted white and orange on a 45° angle.
- E. Barricades shall be constructed with spikes long enough to clinch and made secure.
- F. Type III and IV barricades shall have two (2) flashers on each side 2 x 4 at the highest point.
- G. The Type III barricades with proper sign on it shall be placed in the center of the roadway at the nearest intersection.
- H. The Type IV barricade shall be along the berm of the roadway when road-side work is being done.
- I. The Type III barricade may be substituted for the commercial equivalent.
- J. The Type II and gate shall have one (1) flasher each centered horizontally on top of boards.
- K. Flasher shall have red lenses.
- L. The gate shall be a standard farm gate with 2" O.D. pipe as a frame with wire fence filling center.
- M. The OC-4 sign shall be used on the Type I barricade centered vertically and horizontally on the 6" x 12" x 1" boards when the type barricade is used for establishing a construction zone.
- N. When the Type I barricade is used to establish a construction zone, one will be placed on each side of the roadway facing traffic with the inside post installed one foot from from the berm.

FLASHER



NOTE:
2 Lens faces
55-75 flashes
per minute.
10% deviation.
8" dia. lens
M.D.U.T.C. spec.

SEE NOTES - F, J, & K

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

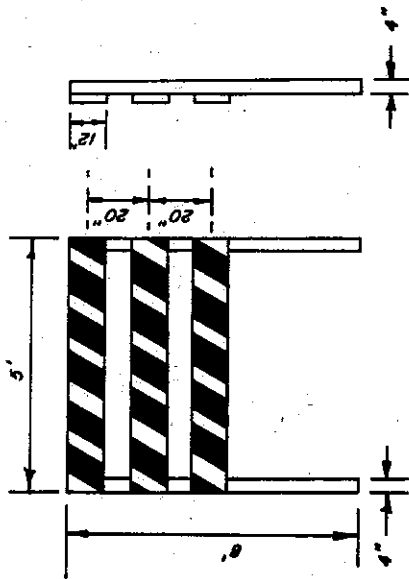
TRAFFIC CONTROL DURING CONSTRUCTION
SIGNS - FLASHERS - GENERAL NOTES

PLATE 37

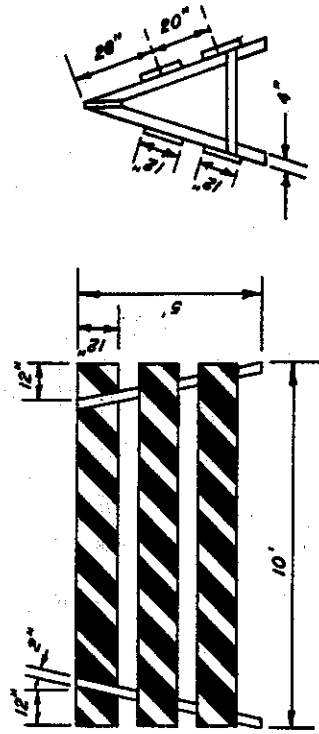
SCALE: $\frac{3}{8}$ " = 1'-0"

JAN. 1986

TYPE I

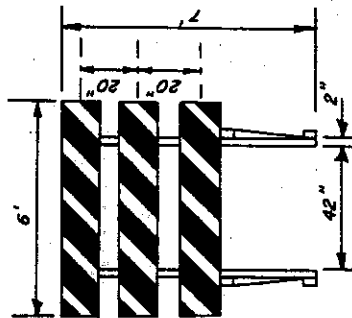
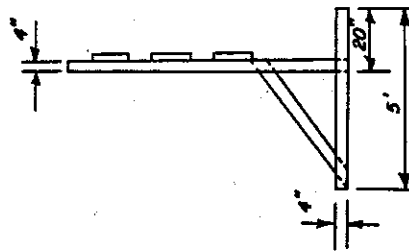


TYPE II

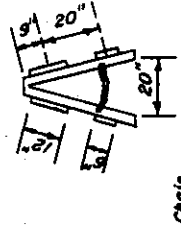
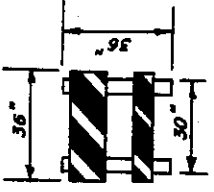


SEE NOTES - D, E, J & K PLATE 37

TYPE III



TYPE IV

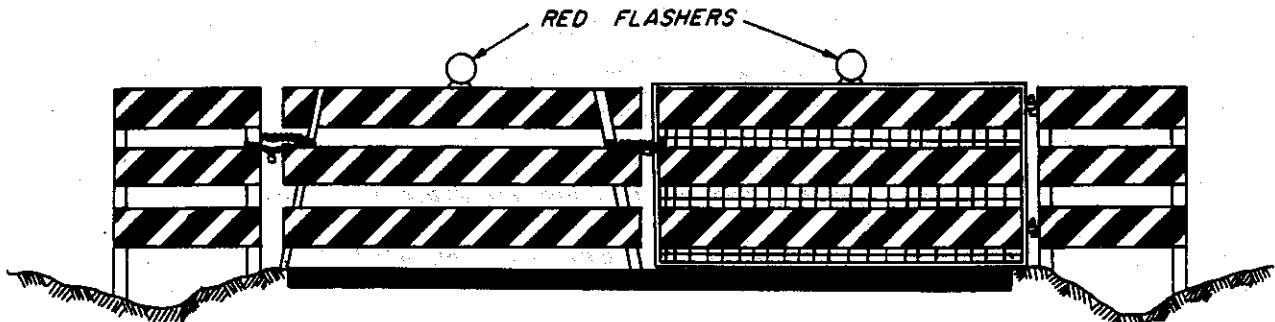


SEE NOTES - D, E, F & H. PLATE 37

SEE NOTES - B, D, E, F, G & K. PLATE 37

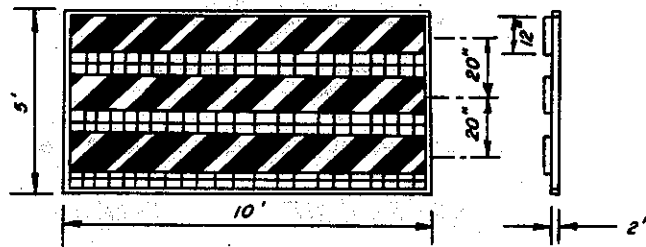
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS
TRAFFIC CONTROL DURING CONSTRUCTION
Type I - II - III & IV
SCALE: $\frac{3}{16}$ " = 1'-0"
PLATE 38
JAN. 1986

ASSEMBLY



SCALE: $\frac{3}{16}" = 1' - 0"$

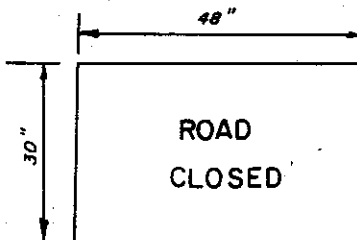
GATE



SEE NOTES - A, D, J, K & L PLATE 37

SCALE: $\frac{3}{16}" = 1' - 0"$

SIGN R - 75



SEE NOTES - A & C PLATE 37

SCALE: $\frac{3}{16}" = 1' - 0"$

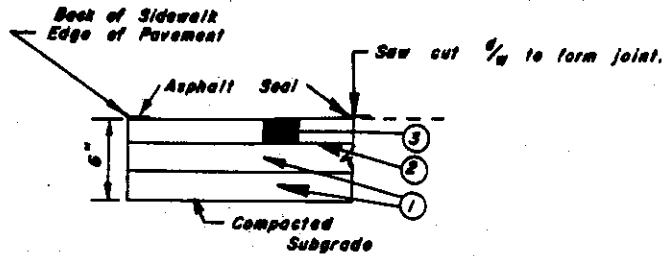
WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

TRAFFIC CONTROL DURING CONSTRUCTION
ASSEMBLY - GATE - SIGN

SCALE: AS SHOWN

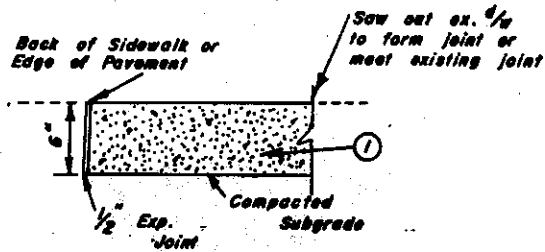
PLATE 39

JAN. 1986



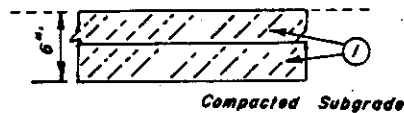
- ① Two $2\frac{1}{2}$ " thick layers of Item 304 Aggregate Base Course.
- ② 0.6 - 0.8 gallons per square yard prime, RT-2 or RT-3, or approved equal.
- ③ 2" Thickness of Item 404, Asphalt Concrete.

ASPHALTIC CONCRETE



- ① 6" Thickness of ODOT Class "C" Concrete.

PORTLAND CEMENT CONCRETE



- ① Two 3" thick layers of Item 304 Aggregate Base Course thoroughly compacted.

GRAVEL

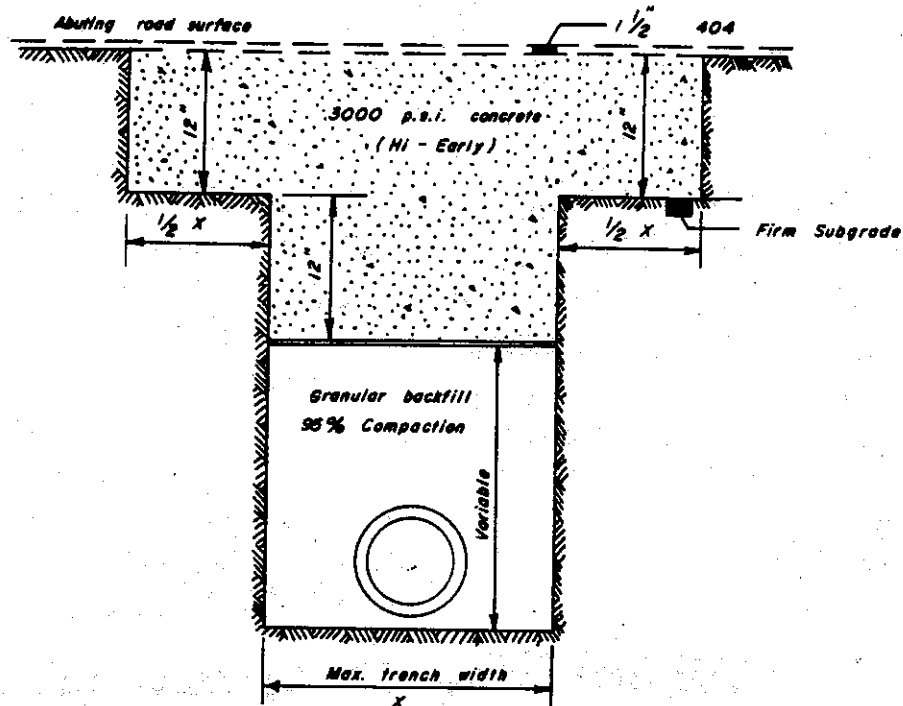
WARREN COUNTY ENGINEER OFFICE
DESIGN STANDARDS

DRIVEWAY REPLACEMENT

SCALE : None

PLATE 40

JAN. 1986



- (1) Traffic must be maintained at all times; lights, signs, barricades, and if necessary watchmen be on job for protection of the public.
- (2) The trench must be backfilled with ODOT Item 310 granular material to a minimum distance of 5 feet beyond the edge of pavement.
- (3) The concrete shall be 3000 p.s.i. "Hi-Early" (Not to exceed 4" slump) and shall be bridged over by steel "street plates" for a period of 72 hours.
- (4) After the 72 hour curing period the existing pavement edges shall be neatly and squarely trimmed, the 404 placed and compacted and the joints sealed with asphaltic cement.

NOTE: Roadway open cut requires special permission by the County Engineer.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

ROADWAY OPEN CUT RESTORATION

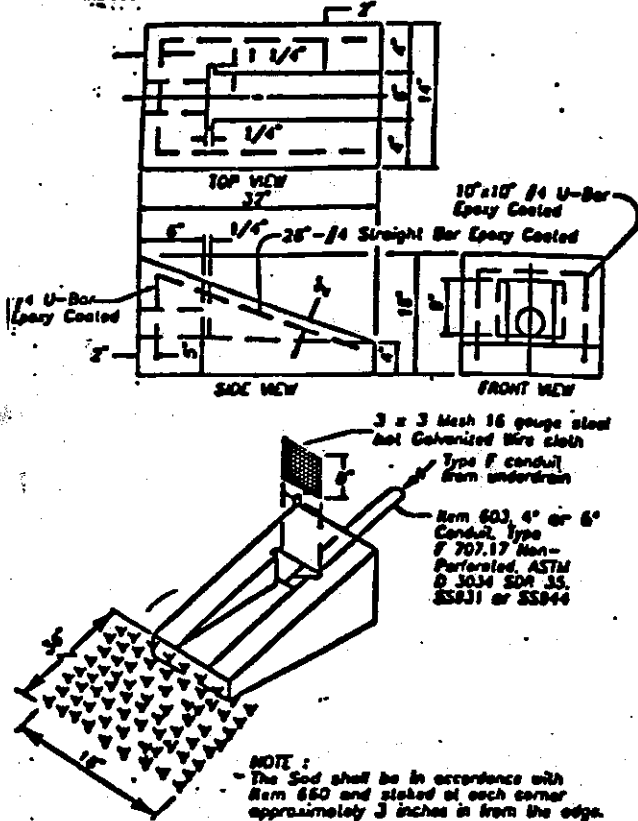
SCALE: $\frac{3}{4}" = 1'-0"$

PLATE 41

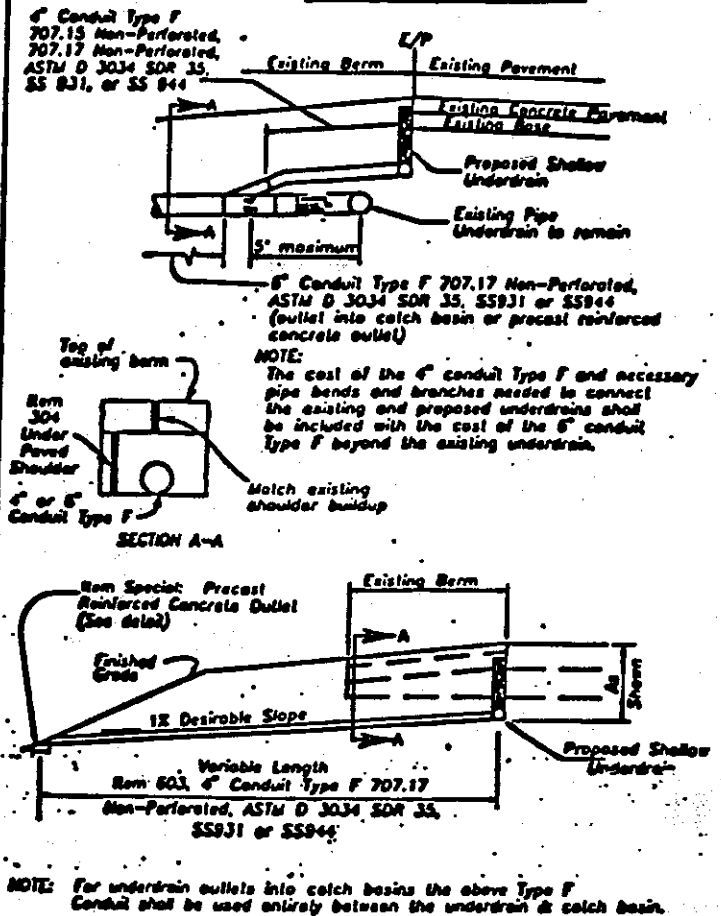
JAN. 1986

ITEM SPECIAL - PRECAST REINFORCED CONCRETE OUTLET

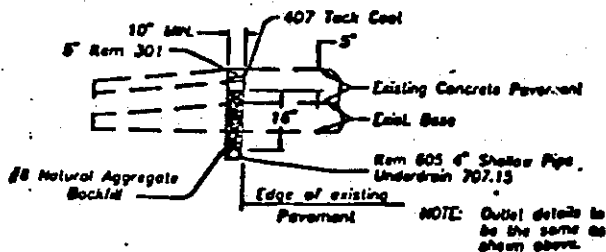
The Concrete outlet shall meet the requirements of Item 604 in the Construction & Materials Specifications. Payment shall be made on an Each basis. Payment shall include the cost of the Sed & Wire Cloth.



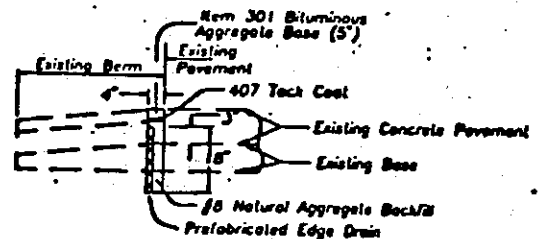
OUTLET DETAILS



PIPE UNDERDRAIN SYSTEM



PREFABRICATED EDGE DRAIN SYSTEM



NOTES : SEE PAGE 75

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

ITEM 605 - SHALLOW UNDERDRAIN

Scale : None

REVISED: 6/27/95

PLATE 42

JAN. 1995

DESCRIPTION: This item shall consist of furnishing and installing a pipe underdrain system or prefabricated edge drain system in accordance with the specifications, details as shown on the plans, and as directed by the Engineer.

MATERIALS: The underdrain shall be a pipe underdrain system per Item 605 or a prefabricated edge drain system meeting the following requirements. The prefabricated edge drain shall consist of a polymeric core with a minimum thickness of one inch wrapped in fabric meeting 712.09 Type A. The drain shall be flexible, rectangular in shape and of hollow construction. The core material shall be resistant to petroleum based chemicals, natural occurring soil chemicals, and road de-icing agents.

The core material shall have sufficient flexibility to withstand installation bending and handling without damage. Side walls of the core shall provide at least 5% open area to permit unobstructed flow through the filter and wall to the core.

The core shall have a minimum open area (in the plane of flow) of 10.5 square inches.

The composite structure shall be tested using the Kentucky Vertical Compression Test Procedure For Geocomposite Panel Drains on file at the Ohio Department of Transportation Testing Laboratory. The performance, under load, of the composite structure shall be such that no more than a 10% loss in core open area occurs at a maximum vertical load of 22 PSI tested in a loose, dry sand.

The prefabricated edge drain manufacturer's certified test results shall be furnished in accordance with 101.061.

CONSTRUCTION: The prefabricated edge drain shall be installed against the outside wall of the trench as shown and backfilled adjacent to the pavement with No. 8 natural aggregate. The No. 8 aggregate shall be placed in one (1) or more lifts with a vibratory compactor run over the final lift to consolidate the aggregate prior to placing the asphalt plug. The first layer of the backfill material shall be placed simultaneously with the trenching operation to hold the edge drain flush against the trench wall.

The prefabricated edge drain shall be spliced as required prior to placement in the trench, using material furnished by the manufacturer and in accordance with the manufacturer's directions. All material required for the splices will be supplied by the manufacturer, but any equipment required shall be furnished by the Contractor. Splices shall prevent separation of adjoining sections of the prefabricated edge drain panels.

The underdrain outlets shall be placed in accordance with Item 603 using outlet fittings. The manufacturer shall supply outlet fittings which will make the transition between the prefabricated edge drain and the outlet pipe.

The outlets for the underdrain system shall be constructed as soon as possible after placement of the underdrain. The underdrain and outlets on crack & seal projects shall be in place and functional prior to cracking and sealing the existing pavement.

METHOD OF MEASUREMENT: Completed and accepted underdrains will be measured by the linear foot in place.

BASIS OF PAYMENT: Work completed and accepted under this item and measured will be paid for at the contract unit price bid per linear foot for item 605 - Shallow Underdrain, as per plan. Which price shall be full compensation for excavation and backfill; removing and disposing all surplus excavation in accordance with 203; for furnishing materials, including material for splices; outlet fittings and Item 301; for all labor, tools, equipment, and incidentals necessary to complete the work.

WARREN COUNTY ENGINEERS OFFICE
DESIGN STANDARDS

ITEM 605 - SHALLOW UNDERDRAIN

Scale : None
REVISED : 6/27/95

PLATE 42
JAN. 1995

