

APPENDIX B

SUPPLEMENTAL SPECIFICATIONS

Supplemental Specifications for Projects using City of Columbus CMS
(See Article II, Section 203 for use of these specifications)

Supplemental Specifications for Projects using ODOT CMS
(See Article II, Section 203 for use of these specifications)

Supplemental Specification 1501 - Compaction Testing of Soils, Granular Materials, and Other Materials

Supplemental Specification 1502 - Soil Modification

Supplemental Specification 1503 - Soil Stabilization

Supplemental Specification 1523 - Roller Compacted concrete (RCC) Pavements

Supplemental Specification 1542 - In-Place Density of Hot Mixed Asphalt

Supplemental to Article III - Pre-Development Stormwater Management Map Requirements

Supplemental to Article IV - Additional Detention Basin Criteria, Pre and Post-Development Stormwater Management Map Requirements, and Other Stormwater Report Requirements

Supplemental to Article V – Construction Performance Guarantees

Supplemental to Article VI - Street Naming Procedures

Supplemental to Article VII – Allowable Minimum Pavement Composition

Supplemental to Article VIII - Outlets from Household or Small Flow Onsite Sewage Treatment Systems

Supplemental to Article IX - Sections 903 & 904 General Design Criteria, Additional Tributary Map Requirements

Supplemental to Article X – Surveying Standards

Supplemental to Article XII - Additional Requirements for Temporary Sediment Basins

Video Taping Requirements of Existing Conditions within the Project Limits

**DELAWARE COUNTY ENGINEER
CONSTRUCTION & MATERIAL
SUPPLEMENTAL SPECIFICATIONS
(CMS)**

**City of Columbus
(COC)**

**CHRIS BAUSERMAN, P.E., P.S.
COUNTY ENGINEER
Effective Date January 30, 2008
Revised June 30, 2010**

INTRODUCTION AND PURPOSE

The latest edition of the “City of Columbus Construction and Material Specifications” (COC CMS) shall be applicable to all projects as defined in Article II, Section 203 constructed under the jurisdiction of the Delaware County Engineer. The Delaware County Engineer herein after shall be referred to as the “County Engineer”. English Units will be used except where supplemented or superseded by these supplemental specifications or amendments.

No deviation from these specifications or this supplement shall be permitted unless the County Engineer has approved a written request for a variance.

SECTION 100 - GENERAL PROVISIONS

General Delaware County Board of Commissioners. The Delaware County Board of Commissioners is the contracting authority and agent for all projects under the jurisdiction of the County Engineer. The Delaware County Engineer shall act as the project administrator and function in every other capacity as set forth under the term “Director” in COC’s CMS.

Delaware County Engineer’s Design, Construction, and Surveying Standards (Standards). These Standards are considered an integral part of these supplemental specifications. Should there be a conflict between COC’s

CMS, this supplement and the Standards the most restrictive shall be applied.

- 101.23 Department-** Shall indicate the Office of the County Engineer.
- 101.24 Director-** For projects under the jurisdiction of the Delaware County Engineer the term Director shall refer to and is hereby replaced with the term “County Engineer”. The County Engineer shall include the Delaware County Engineer and/or the Chief Deputy County Engineer.
- 101.25 Engineer-** The Project Engineer designated by the County Engineer assigned to administer the day to day administration of the construction project.
- 101.31 Inspector-** The County Engineer’s authorized representative to make detailed inspections of contract work performance.
- 101.59 State-** Shall mean Delaware County
- 105.06 Work Hours-** The contractor agrees that all work on this contract, which includes any and all sub-contractors, shall be done only during the period from one-half an hour before sunrise and one-half an hour after sunset as determined by the U.S. National Weather Service, **or as directed by the County Engineer**. If the Township the work is being performed in has a more restrictive work day, than the Township work day shall be adhered to. The Owner or his contractor, shall schedule, through the Inspector, the County Engineer provided geo-technical service no later than 2:00 PM the preceding day. All work scheduled for Saturday shall be scheduled no later than 2:00 PM the proceeding Thursday; this includes the geo-technical service.
- 105.07 Night Work, Work on Sundays and Holidays-** Work at night, on Sundays or Holidays is discouraged. If work is desired, then the Owner shall request in writing, permission to work at night, on Sundays or holidays. This request shall be from the Owner and should provide detail as to what type of work is to be performed. This work requires a pre-approval (three-working days in advance); in which case

the provisions of 105.06 shall apply with equal force. The Owner shall not assume their request will be approved. Each request is subject to the County Engineer having staff available to work. The Saturday proceeding or following a Monday or Friday holiday is considered part of the holiday. In these instances, written approval to work shall be required from the Engineer.

County observed Holidays are listed below.

Holidays observed by Delaware County

NEW YEARS DAY

MARTIN LUTHER KING DAY

PRESIDENTS DAY

MEMORIAL DAY

INDEPENDENCE DAY

LABOR DAY

JUG DAY

VETERANS' DAY

THANKSGIVING DAY AND DAY AFTER

CHRISTMAS EVE DAY

CHRISTMAS DAY

NEW YEAR'S EVE DAY

105.22 Moving Equipment- Non-rubber tired vehicles or equipment shall not be operated on County or Township roads.

201.02 Clearing and Grubbing- The following materials shall be removed from the proposed right-of-way or from the construction limits **(including all storm water management basins)** whichever is greater, regardless of the amount of embankment to be constructed. This undesirable material includes, but is not limited to, topsoil, vegetation, trees, stumps, roots, organic materials or excessively wet materials.

203.03 Restrictions for Suitable Material- The maximum laboratory dry weight shall not be less than 100 pounds per cubic foot for all approved embankment material.

The use of recycled materials shall be approved by the Engineer. Use of stockpiled materials for embankment meeting the requirements of 203 as certified by a laboratory may be used when approved by the Engineer. Request for use of recycled and/or stockpiled materials shall be submitted to (in writing) and approved by the Engineer prior to use.

203.062 Shale- Shale shall not be placed for embankment.

203.063 Rock- If bedrock is encountered in the top 2-feet of a cut area at the subgrade elevation, then this area shall be undercut to a minimum depth of 2-feet and replaced with a suitable embankment material.

Random Materials- The use of random materials shall be approved by the County Engineer.

204.03 Compaction of Subgrade- Test sections shall not be used.

204.06 Proofrolling- The Owner shall provide a tandem axle dump truck with a minimum weight of 65,000 pounds. A weight ticket shall be provided to the Inspector prior to performing the proofroll. The dump truck shall be used to evaluate the subgrade for the suitability of placing pavement. The dump truck shall be operated in a pattern so that all proposed pavement areas are loaded a minimum of one pass. This pattern is at the discretion of the Inspector.

204.07 Test Rolling- This section shall not be used.

301.31 Use of Reclaimed Pavement- The maximum amount of reclaimed asphalt concrete pavement shall be 20 percent.

- 304.04 Spreading-** Vibratory compaction equipment shall be mandatory.
- 304.05 Compaction-** The provision of this section shall apply except that the County Engineer does not use test sections or test densities. The density requirement for 304 shall be 100 percent of the maximum dry weight at optimum moisture as determined by a laboratory using AASHTO T-99. Refer to standard drawing DCED-R100.
- 401.04 Use of Reclaimed Pavement-** The maximum amount of reclaimed asphalt concrete pavement (RACP) shall be 20 percent in the intermediate course. No RACP shall be permitted in the surface course.
- 401.06 Weather Limitations-** Asphalt paving temperatures are as follows:
1. Paving on granular subbase or subgrade on pavement- ~~40~~ **35** degrees(F) surface temperature and rising
 2. 3-inch compacted thickness or greater- 35 degrees(F) surface temperature and rising
 3. 3-inch compacted thickness or less- 40 degrees(F) surface temperature and rising
 4. Less than 1-1/2 compacted thickness- 50 degrees(F) surface temperature and rising.
 5. Thickness refers to the compacted amount of asphalt-concrete.
 6. Paving shall not be performed during inclement weather.
- 512.09 Type 2 Membrane Waterproofing-** Primer shall be used at all times.
- 602.03 General-** Use of precast headwalls shall be permitted once an ODOT approval letter for the manufacturer has been submitted to the County Engineer. Precast headwalls and

endwalls conforming **to** Standard Drawings DCED-**S167**, S168 and S169 are also permitted. Shop drawings for all precast endwalls and headwalls using DCED- **S167**, S168 and S169 shall be submitted to the County Engineer and be approved prior to construction.

603 Pipe Culverts and Driveway Pipes- The approved materials for use as **pipe culverts** ~~conduits~~ are 706.02, 706.04, 706.05, 706.051, and 706.052, **and for driveway pipes are 706.02 and 720.12.**

Bedding and backfill requirements for ~~sewer~~ **pipe culverts and driveway pipes** shall be in conformance with City of Columbus Construction and Material Specification Item 901 and Standard Drawing DCED-S149.

604.061 Precast Rings and Slab Tops- Precast rings and slab tops not having tongue and groove connections shall be set in at least a ½-inch mortar bed.

604.11 Construction considerations- The mixing of precast and cast in place structures shall not be permitted without submission of shop drawings that clearly define how the structure is to be built. These shop drawings are to be submitted to the County Engineer and be approved prior to construction.

605.02 Materials- The ~~only~~ approved material is 720.12 corrugated polyethylene drainage tubing.

605.03 Pipe Underdrains – The underdrains may be raised in grade to achieve positive drainage at the direction of the County Engineer.

609.03 Curb and Gutter – Expansion joints shall be placed at 300-foot intervals (**maximum** ~~minimum~~) and at all PC's, PT's, and **five feet either side of all** storm structures.

609.09 Dropped curbs and drainage outlets- The full curb section as shown in the plans shall be constructed throughout the project. Curb cuts and drainage outlets through the curb shall not be built. The curb cuts may be constructed by removal and reconstruction of the curb or by

an approved curb cut method. The curb cut method is the preferred method.

609.10 Contraction and expansion joints- Transverse contraction joints shall be placed at 10-foot intervals by sawing or other approved method. Joints shall be constructed to a minimum depth of 2 inches and at right angles to the centerline of the pavement. When concrete bases are used every other joint shall align with the contraction joints of the base. Expansion joints shall be required at all PCs and PTs, between existing and new curb at a phase line, and **5** ~~10~~-feet on both sides of a curb inlet. **Expansion joints shall have a maximum spacing of 300 feet.**

609.11 Marking of Utility crossings- Each roadway utility crossing shall be marked by stamping or other method approved by the County Engineer on the face of curb as follows:

Water services “W” and Water Mains “WM”

Other utility crossings “X”

Sanitary “S”

609.12 Curing- All curb shall cure for a minimum of 48 hours or a test specimen shall meet 70 percent of the design strength.

616.011 General- For development projects the requirements of this section shall apply to the entire limits of the project.

623.23 Grade stakes- Pavement boxout or curb stakes shall be set at 50-foot intervals. For horizontal and vertical curves and grades in excess of one percent stakes shall be at 25-foot intervals. Storm lines shall be staked at 50-foot intervals, provided laser equipment is used in construction. When laser equipment is not used storm line shall be staked at 25-foot intervals. Cut sheets for proposed storm sewer work shall be provided to the County Engineer prior to installation. Inspectors may request additional staking if

they deem it necessary. All staking shall be of a sufficient height to facilitate string line checking of grades.

- 636.04 Mix Proportioning-** Only Type III or IV FCDF shall be used.
- 636.08 FCDF Fast Setting, Type III and IV-** FCDF shall be used for all trenches when the trench width does not permit the proper use of compaction equipment.

- 637 Street Name Signs and Supports** – All signs shall be placed 10-feet above the finished grade (measured to the bottom of the blade). This requirement applies to all road classifications.
 - 637.04 Street Name Sign Fabrication** – All signs shall provide retroreflectivity that complies with the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), current edition. Sheeting Type I (Reflective Sheeting Type F, 730.18) per ASTM D4956-04 is not permitted on any sign.
 - 637.05 Installation** – The County Engineer may require testing of the bands to insure adequate resistance to rotation by wind loads.

- 642 Traffic Paint-** Item 642 shall not be used without prior approval of the Engineer.

- 643 Polyester-** Item 643 shall not be used without prior approval of the Engineer.

- 645 Preformed Marking Material-** Item 645 shall not be used without prior approval of the Engineer.

- 646 Heat Applied Preformed Marking Material-** Item 646 shall not be used without prior approval of the Engineer.

659

Seeding and Mulching –

Topsoil should be stockpiled and reused for any areas that are to be seeded (e.g. basins, flood routes, open space areas) and placed at a sufficient depth to promote growth.

The following grass seed mixtures shall be used on all projects. The County Engineer shall determine which grass seed mixture is to be used.

Seed Mix No. 1	Origin	Germ
29.55% Ken Blue Kentucky Bluegrass	ID	85%
19.89% Transist 2200 Int. Ryegrass	OR	90%
14.89% Jasper II Creeping Red Fescue	OR	85%
9.86% Crest Kentucky Bluegrass	OR	85%
8.52% Spirit Perennial Ryegrass	OR	90%
8.09% Charisma Perennial Ryegrass	OR	90%
7.29% Expres Perennial Ryegrass	OR	90%
1.01% Inert Matter		
0.78% Other Crop		
0.12% Weed Seed		
Seed Mix No. 2	Origin	Germ
49.34% Crossfire II Tall Fescue	OR	85%
34.71% Annual Ryegrass*	OR	90%
15.03% Perennial Ryegrass*	OR	90%
0.07% Crop Seed		
0.78% Inert Matter		
0.07% Weed Seed		

* Variety Not Stated

706.10 Bituminous and Butyl Rubber Pipe Joint Material-
Preformed butyl rubber material shall not be used.

706.13 Precast structures – All precast structures shall be cured in the casting yard for a minimum of 7 days.

720 General – Plastic pipe conforming to ASTM F2736-10 and F2764 -10 are limited to areas outside the pavement only.

720.08 Polyvinyl Chloride Plastic Pipe - This pipe shall be used for all utility crossings, underdrain outlets and other miscellaneous small drain connections as approved by the County Engineer.

~~**720.12 Corrugated Polyethylene Pipe and Drainage Tubing-** Item 720.12 is the only approved plastic pipe material.~~

901.02 Materials and Materials Handling- The following materials are approved for use:

1. Concrete for encasement, cradle, backing and backfill - Class C
2. Reinforced Concrete Pipe - 706.02
3. Reinforced Elliptical Concrete Pipe - 706.04
4. Precast Reinforced Concrete Box Sections - 706.05
5. High Density Polyethylene Pipe (HDPE) - 720.12

HDPE pipe is not permitted under pavement.

901.11 Bedding and Embedment

1. **Type I, 1&2** - Minimum bedding shall be 6-inches.
- Material shall be No. 57 stone only.
2. **Type II** - Class C concrete shall be used for cradles and backing.

901.12 Laying Pipe- Class C concrete only.

901.21 Deflection- The deflection test for HDPE storm sewer 720.12 shall be performed a minimum of 30 days after installation or at the discretion of the Engineer. All major earthwork operations must be complete prior to the mandrel testing. All HDPE storm sewer ~~placed within the right-of-way~~ shall have a second mandrel test performed prior to final acceptance.

905 Concrete- Class C concrete only

908.02 Materials- Class C concrete only.

910 Concrete Encasement for Sewers- Class C concrete only.

911.02 Materials- The maximum laboratory dry weight shall not be less than 100 pounds per cubic foot for all approved material.

The following table has been revised as to show front lot and rear lot easement widths for non-flood routes.

Minimum Permanent Easement Width for all Storm Sewers

Depth (Feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	12-inch		15-inch		18-inch		21-inch	
2	25	10	-	-	-	-	-	-
3	30	11	30	12	30	12	30	12
4	30	12	30	12	30	12	30	12
5	30	12	30	12	30	12	30	12
6	30	12	40	12	40	12	40	12
7	40	12	40	12	40	12	40	12
8	40	12	40	12	40	12	40	12
9	40	12	40	12	40	12	40	12
10	40	12	40	13	45	13	45	13
	24-inch		27-inch		30-inch		36-inch	
3	30	12	-	-	-	-	-	-
4	30	12	30	12	30	12	30	13
5	30	12	30	12	30	12	40	13
6	40	12	40	12	40	12	40	13
7	40	12	40	13	40	13	40	13
8	40	13	40	13	40	13	40	13
9	40	13	45	13	45	13	45	13
10	45	13	45	13	45	13	45	13
11	45	13	45	13	45	13	45	13

Minimum Permanent Easement Width for all Storm Sewers

Depth (Feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	42-inch		48-inch		54-inch		60-inch	
5	35	13	35	13	-	-	-	-
6	35	13	35	13	35	14	35	14
7	35	13	35	13	35	14	35	14
8	45	13	45	14	45	14	45	14
9	45	14	45	14	45	14	45	14
10	45	14	45	14	45	14	45	14
11	45	14	45	14	55	14	55	15
12	55	14	55	14	55	14	55	15

- * Minimum distance from centerline of pipe to either side of easement.
- Table values are in feet unless otherwise noted.
- For pipes greater than 60 inches in diameter the minimum easement width shall be submitted to the County Engineer for approval.
- For pipe depths exceeding those listed in this table, the easement width shall be submitted to the County Engineer for approval.

Minimum Rear Lot (RL) & Front Lot (FL) Easement Widths – Non- flood routes

Depth (Feet)	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset
	12-inch		15-inch		18-inch		21-inch	
2	25/15	10	-	-	-	-	-	-
3	30/15	11	30/15	12	30/15	12	30/15	12
4	30/15	12	30/15	12	30/15	12	30/15	12
5	30/15	12	30/15	12	30/15	12	30/15	12
6	30/15	12	40/20	12	40/20	12	40/20	12
7	40/20	12	40/20	12	40/20	12	40/20	12
8	40/20	12	40/20	12	40/20	12	40/20	12
9	40/20	12	40/20	12	40/20	12	40/20	12
10	40/20	12	40/20	13	45/25	13	45/25	13
	24-inch		27-inch		30-inch		36-inch	
3	30/15	12	-	-	-	-	-	-
4	30/15	12	30/15	12	30/15	12	30/15	13
5	30/15	12	30/15	12	30/15	12	40/20	13
6	40/20	12	40/20	12	40/20	12	40/20	13
7	40/20	12	40/20	13	40/20	13	40/20	13
8	40/20	13	40/20	13	40/20	13	40/20	13
9	40/20	13	45/25	13	45/25	13	45/25	13
10	45/25	13	45/25	13	45/25	13	45/25	13
11	45/25	13	45/25	13	45/25	13	45/25	13

Minimum Rear Lot (RL) & Front Lot (FL) Easement Widths – Non- flood routes

Depth (Feet)	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset
	42-inch		48-inch		54-inch		60-inch	
5	35/20	13	35/20	13	-	-	-	-
6	35/20	13	35/20	13	35/20	14	35/20	14
7	35/20	13	35/20	13	35/20	14	35/20	14
8	45/25	13	45/25	14	45/25	14	45/25	14
9	45/25	14	45/25	14	45/25	14	45/25	14
10	45/25	14	45/25	14	45/25	14	45/25	14
11	45/25	14	45/25	14	55/30	14	55/30	15
12	55/30	14	55/30	14	55/30	14	55/30	15

- * Minimum distance from centerline of pipe to either side of easement.
- Table values are in feet unless otherwise noted.
- For pipes greater than 60 inches in diameter, the minimum easement width shall be submitted to the County Engineer for approval.
- For pipe depths exceeding those listed in this table, the easement width shall be submitted to the County Engineer for approval.
- # Allowable front lot minimum easement width when adjacent to the street R/W. The centerline of the pipe or ditch must be within the easement.
- For flood routing easement requirements see Article IX, Sections 902 and 903 of these Standards.

Side Yard Minimum Storm Sewer Easement Widths – Non-flood Routes

Easement width	Depth of Trench	Pipe diameter	* Minimum Distance to Centerline Pipe Offset
20 feet	≤ 7 feet	≤ 24 inches	7 feet
30 feet	> 7 feet	≤ 24 inches	10 feet
30 feet	≤ 7 feet	≥ 27 inches but ≤ 60 inches	11 feet
40 feet	> 7 feet	≥ 27 inches but ≤ 60 inches	15 feet

- * Minimum distance from centerline of pipe to either side of easement.
- For pipes greater than 60 inches in diameter, the minimum easement width shall be submitted to the County Engineer for approval.
- For flood routing easement requirements see Article IX, Sections 902 and 903 of these Standards.

MAXIMUM HEIGHT OF COVER FOR ROUND CONCRETE PIPE

DIA. Inches	IN ROADWAY CLASS OF PIPE				OUTSIDE ROW CLASS OF PIPE			
	II	III	IV	V	II	III	IV	V
12	X	X	X	20	X	X	16	20
15	X	X	16	20	X	X	16	20
18	X	X	16	20	X	9	16	20
21	X	X	16	20	X	9	16	20
24	X	X	16	20	X	9	16	20
27	X	X	16	20	X	11	16	20
30	X	11	16	20	8	11	16	20
36	X	11	18	28	8	11	18	28
42	X	12	18	28	8	11	18	28
48	X	12	18	28	8	11	18	28
54	9	12	18	*	9	12	18	*
60	9	12	18	*	9	12	18	*
72	9	12	18	*	9	12	18	*
78	9	12	*	*	9	12	*	*
84	9	12	*	*	9	12	*	*
90	9	12	*	*	9	12	*	*
96	9	12	*	*	9	12	*	*

“X” indicates cannot be used

If the minimum depth of cover outside right-of-way is less than 30-inches, refer to DCED S-155.

In no case shall the cover be less than 18-inches.

Cover shown in table is in feet unless otherwise indicated.

The Class of pipe shall be shown in the storm sewer profiles.

**MAXIMUM HEIGHT OF COVER FOR
THERMOPLASTIC PIPE FOR STORM SEWER APPLICATIONS**

See Table 903 of the Supplemental Sections of Article IX for minimum and maximum height of cover for thermoplastic pipe.

**MAXIMUM HEIGHT OF COVER
FOR HORIZONTAL ELLIPTICAL PIPE**

		IN ROADWAY CLASS OF PIPE			OUTSIDE ROW CLASS OF PIPE		
RISE & SPAN (inches)	EQUIV. DIA. (inches)	II	III	IV	II	III	IV
14 X 23	18	X	12	14	10	12	14
19 X 30	24	X	12	14	10	12	14
24 X 38	30	X	10	12	6	10	12
29 X 45	36	X	10	12	6	10	12
34 X 53	42	8	11	14	8	11	14
38 X 60	48	8	11	*	8	11	*
43 X 68	54	7	11	*	7	11	*
48 X 76	60	7	8	*	7	8	*
53 X 83	66	7	8	*	7	8	*
58 X 91	72	6	8	*	6	8	*
63 X 98	78	6	8	*	6	8	*
68 X 106	84	5	8	*	5	8	*

“X” indicates cannot be used

Table values are in feet unless otherwise noted.

NOTES FOR HEIGHT OF COVER TABLES

1. The design of the proper class of concrete pipe is based on the ASCE Standard L= Direct Design of Buried Concrete Pipe Using Standard Installation (SIDD).
2. The installation type used for all fill height cases is Type 2 as listed in ASCE Standard for "Standard Embankment Installation Soils and Minimum Compaction Requirements".
3. The pipes in roadway and outside of roadway are designed for an AASHTO HS-25 live load condition **or loading as required by the County Engineer.**
4. The fill height table assumes a soil density equal to 140 pounds per cubic foot.
5. For all pipe marked with an asterisk (*) and for pipes at greater depths than what are listed, the pipe manufacturer is required to provide a design and shop drawing to the County Engineer for review and approval. All special designs for concrete pipe shall use the ASCE Standard Direct Design of Buried Concrete Pipe Using Standard Installations (SIDD).
6. The height of cover is measured from the top of the pipe to the top of the subgrade.
7. The classes of concrete pipe are per ASTM C-76 Specification for Reinforced Concrete Sewer Pipe for round pipe and per ASTM C-507 Specification for Horizontal Elliptical Concrete Pipe for horizontal elliptical pipe.
8. The Delaware County Engineer developed the Height of Cover Tables for use. They shall be used for specifying concrete pipe for storm sewer systems under the jurisdiction of the Delaware County Engineer.

**DELAWARE COUNTY ENGINEER
CONSTRUCTION & MATERIAL
SUPPLEMENTAL SPECIFICATIONS
(CMS)**

ODOT

**CHRIS BAUSERMAN, P.E., P.S.
COUNTY ENGINEER**

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- 101.03 State-** Shall mean Delaware County
- 101.03 Work Day-** The contractor agrees that all work on this contract, which includes any and all sub-contractors, shall be done only during the period from one-half an hour before sunrise and one-half an hour after sunset as determined by the U.S. National Weather Service **or as directed by the County Engineer**. If the Township the work is being performed in has a more restrictive work day, than the Township work day shall be adhered to. Night work is discouraged and requires a written request to and approval by the County Engineer. The Owner or his contractor shall schedule, through the Inspector, the County provided geo-technical service no later than 2:00 PM the preceding day. All work scheduled for Saturday shall be scheduled no later than the 2:00 PM the proceeding Thursday; this includes the geo-technical service.
- 105.19 Work on Sundays, Holidays and at Night-** If work is desired, then the Owner shall request in writing, permission to work at night, on Sundays or holidays. This request shall be from the Owner and should provide detail as to what

type of work is to be performed. This work requires a pre-approval (three-working days in advance); in which case the provisions of 101.03 shall apply with equal force. The Owner shall not assume their request will be approved. Each request is subject to the County Engineer having staff available to work. The Saturday proceeding or following a Monday or Friday holiday is considered part of the holiday. In these instances, written approval to work shall be required from the Engineer.

Holidays observed by Delaware County

NEW YEARS DAY

MARTIN LUTHER KING DAY

PRESIDENTS DAY

MEMORIAL DAY

INDEPENDENCE DAY

LABOR DAY

JUG DAY

VETERANS' DAY

THANKSGIVING DAY AND DAY AFTER

CHRISTMAS EVE DAY

CHRISTMAS DAY

NEW YEAR'S EVE DAY

105.20 Moving Equipment- Non-rubber tired vehicles or equipment shall not be operated on County or Township roads.

201.01 Clearing and Grubbing- The following material(s) shall be removed from the proposed right-of-way or from the construction limits **(including all storm water management basins)** regardless of the amount of embankment to be constructed. This undesirable material includes, but is not limited to, topsoil, vegetation, trees, stumps, roots, organic material or excessively wet material.

203.03 Restrictions for Suitable Material- The maximum laboratory dry weight shall not be less than 100 pounds per cubic foot for all approved embankment material.

The use of recycled materials shall be approved by the Engineer. Use of stockpiled materials for embankment meeting the requirements of 203 as certified by a laboratory may be used when approved by the Engineer. Request for use of recycled and/or stockpiled materials shall be submitted to (in writing) and approved by the Engineer

203.D Shale- Shale shall not be placed for embankment.

203.06 Shale/Bedrock- Shale shall not be placed for embankment. If shale or bedrock is encountered within the top 2 feet of a cut area, then this area shall be undercut and replaced with a suitable embankment material or as directed by the engineer.

Use of stockpiled materials for embankment meeting the requirements of 203 as certified by a laboratory may be used when approved by the County Engineer. Request for use of these stockpiled materials shall be submitted to (in writing) and approved by the County Engineer prior to use.

204.03 Compaction of the Subgrade- Test sections shall not be used.

204.06 Proofrolling- The Owner shall provide a tandem axle dump truck with a minimum weight of 65,000 pounds. A weight ticket shall be provided to the Inspector prior to performing

the proofroll. The dump truck shall be used to evaluate the subgrade for the suitability of placing pavement. The dump truck shall be operated in a pattern so that all proposed pavement areas are loaded a minimum of one pass. This pattern is at the discretion of the Inspector.

304.04 Spreading- The material shall be placed with the use of a spreader (stone) box, paver or other approved mechanical equipment. A grader or a dozer without a spreader box shall not be permitted.

304.05 Compaction- The provision of this section shall apply except the County does not use test sections or test densities. The density requirement for 304 shall be 100 percent of the maximum dry weight at optimum moisture as determined by a laboratory using AASHTO T-99.

401.04 Reclaimed Asphalt Concrete Pavement (RACP)- A total of 20 percent RACP is permitted in the base and intermediate courses. No RACP is permitted in the surface course.

401.06 Weather Limitations- Asphalt paving temperatures are as follows:

1. Paving on granular subbase or subgrade on pavement- 40 ~~40~~ **35** degrees(F) surface temperature and rising
2. 3-inch compacted thickness or greater- 35 degrees(F) surface temperature and rising
3. 3-inch compacted thickness or less- 40 degrees(F) surface temperature and rising
4. Less than 1-1/2 compacted thickness- 50 degrees(F) surface temperature and rising.

Thickness refers to the compacted amount of asphalt-concrete.

Paving shall not be performed during inclement weather.

602.03 Use of precast headwalls for pipe diameters of 36-inch or less shall be permitted once an ODOT approval letter for the manufacturer has been submitted to the County Engineer.

Precast headwalls and endwalls for pipe diameters greater than 36-inch may be used at the discretion of the County Engineer. Shop drawings shall be submitted to the County Engineer prior to construction.

603 **Pipe Culverts, Storm Sewers, Driveway Pipes and Drains - The approved materials for use as Type A conduits are 706.02, 706.04, 706.05, 706.051, and 706.052.** The ~~only~~ approved materials for use as Type B, Type C and Type D conduits are 706.02, 706.04, ~~707.32 and 707.33,~~ **and as noted here.**

~~Additional requirements for 707.32 and 707.33 pipe:~~

1. **707.33 pipe:** Only bell and spigot type connections (push-joints) are permitted.
2. **707.33 pipe:** Transitions between conduit types shall be done only at structures.
3. **707.33 pipe: Not permitted for Type B applications.**
4. **Plastic pipe conforming to ASTM F2736-10 and F2764-10 is permitted for Type C applications.**

The approved material for Type E, Type F and Utility Crossings is 707.45.

604.061 **Precast Rings and Slab Tops-** Precast rings and slab tops not having tongue and groove connections shall be set in at least a ½-inch mortar bed.

604.062 **Steps – Number 3 and Number 3A structures deeper than 28” shall provide steps at 14” (min.) spacing. Steps**

shall be per current Delaware County Supplemental Specifications.

- 604.10 Construction considerations-** The mixing of precast and cast-in-place structures shall not be permitted without submission of shop drawings that clearly define how the structure is to be built. These shop drawings are to be submitted to the County Engineer and be approved prior to construction.
- 605.02 Materials – The ~~only~~ approved material is 707.31 corrugated polyethylene drainage tubing.**
- 605.03 Pipe Underdrains – The underdrains may be raised in grade to achieve positive drainage at the direction of the County Engineer.**
- 609.04A Dropped curbs and drainage outlets-** The full curb section as shown in the plans shall be constructed throughout the project. Curb cuts and drainage outlets through the curb shall not be built. The curb cuts may be constructed by removal and reconstruction of the curb or by an approved curb cut method. The curb cut method is the preferred method.
- 609.04B Contraction and expansion joints-** Transverse contraction joints shall be placed at 10-foot intervals by sawing or other approved method. Joints shall be constructed to a minimum depth of 2 inches and at right angles to the centerline of the pavement. When concrete bases are used every other joint shall align with the contraction joints of the base. Expansion joints shall be required at all PCs and PTs, ~~and~~ between an existing and new pour and **5** ~~10~~ feet either side of a curb inlet. **Expansion joints shall have a maximum spacing of 300 feet.**
- 609.04C Marking of Utility crossings-** Each roadway utility crossing shall be marked by stamping or other method approved by the County Engineer on the face of curb as follows:
- Water services “W” and Water Mains “WM”
 - Sanitary “S”

Other utility crossings “X”

- 613.01 Flowable Controlled Density Fill (FCDF)-** FCDF shall be used for all trenches when the trench width does not permit the proper use of compaction equipment.
- 613.03 Mix Proportioning-** Only Type 3 shall be used.
- 623.04 Grade stakes-** Pavement boxout or curb stakes shall be set at 50-foot intervals. For horizontal and vertical curves and grades in excess of one percent stakes shall be at 25-foot intervals. Storm lines shall be staked at 50-foot intervals, provided laser equipment is used in construction. When laser equipment is not used storm line shall be staked at 25-foot intervals. Cut sheets for proposed storm sewer work shall be provided to the County Engineer prior to installation. Inspectors may request additional staking if they deem it necessary. All staking shall be of a sufficient height to facilitate string line checking of grades.

ITEM 630 – TRAFFIC SIGNS AND SIGN SUPPORTS

The item shall be used as the standard for traffic signs, including street name signs, and supports. The work associated with this item, including, but not limited to, materials, equipment, and labor, shall be in compliance with these Standards and Supplemental Specifications, and be approved by the County Engineer prior to Final Engineering Plan approval. In addition to the requirements of these Standards and Supplemental Specifications, the following shall apply:

Street Name Signs and Supports - All signs shall be placed 10-feet above the finished grade (measured to the bottom of the blade).

Street Name Sign Fabrication – All signs shall provide retroreflectivity that complies with the Ohio Manual of

Uniform Traffic Control Devices (OMUTCD), current edition. Sheeting Type I (Reflective Sheeting Type F, 730.18) per ASTM D4956-04 is not permitted on any sign.

Installation - The County Engineer may require testing of the bands to insure adequate resistance to rotation by wind loads.

~~ITEM 637 - STREET NAME SIGNS AND SUPPORTS~~

~~Note: This item is to be used as the standard for street name signs and supports when no township standards exist. Variances to these standards may be granted if approved in writing by the appropriate township for installation on township roads.~~

~~637.01 Description-~~ This work shall consist of furnishing all material, equipment, and labor necessary for the installing of street name signs and supports, complete and ready for service, in conformance with the types, locations, and sizes shown in the plans.

~~637.02 Materials-~~ The Contractor shall supply adequate documentation that the items quoted meet the specifications, if so required. Acceptance of materials and products will be based upon specific tests in accordance with the following:

Street Name Sign Supports	737.01
Aluminum Sign Blanks.....	737.02
Reflective Sheeting, Type G	730.19
Cantilevered Offset Brackets	737.03

~~637.03 Street Name Sign Supports-~~ Supports for double faced street name signs shall be either 2.5 inch nominal post size (NPS) (2.875 OD x 0.203 inch wall) x 14 foot (4.3 m) long post, or 4 inch NPS (4.0 OD x 0.226 inch wall) x 21 foot (6.4 m) long post fabricated from new, hot dipped galvanized steel pipe in accordance with section 730.26.

~~All supports shall be embedded in concrete in accordance with 499 Class C and 511. 2.5 inch NPS supports shall be concreted in a hole with a minimum depth of 3 feet, and a diameter of 10 inches. The post shall have a minimum of 10 feet above ground level. 4.0 inch NPS supports shall be concreted in a hole with a minimum depth of 4 feet, and a diameter of 10 inches. The post shall have a minimum of 10 feet above ground level.~~

~~The maximum allowable sign area for a two sign installation is 10 square feet. If the total street name sign area is greater than 10 square feet, 1 sign support per sign shall be used.~~

~~**637.04 Street Name Sign Fabrication** Sign faces shall be bonded to 0.063 inch thick sign blanks according to the sheeting manufacturer recommendation. There shall be two sign faces on each sign blank, one on each side, unless otherwise noted. All sheeting shall be Type G in accordance with 730.19. The street name legend shall be either reverse screened green on silver, or precut silver letters hand applied to green sheeting. For screening, the Transparent Process Color ink and "Clear Coat" to be used shall be Scotchlite Brand Series 800 or approved equal. The finished sign face shall be "clear coated". All sheeting inks and clear coat must be compatible.~~

~~Street name legends shall be printed in stroke width "C" and in heights of 4, 6, and 8 inch upper case (Standard FHWA Alphabet including spacing). Prefixes and suffixes shall be printed in stroke width "C" and in heights of 2, 3, and 4 inch upper case (Standard FHWA Alphabet including spacing). All letters shall be centered on the vertical dimension and the legend will be centered on the various sign blades horizontally. If a message will not fit on a 72-inch blade, stroke width "B" may be used. Street name letter heights will be as follows: 4 inch legend with 2 inch prefix and suffix on a 9 inch blade, 6 inch legend and 3 inch prefix and suffix on a 12 inch blade, and an 8 inch legend and 4 inch prefix and suffix on an 18 inch blade. The space between the prefix or suffix and the street name~~

~~shall be the same width as the letter "O" in the smaller size alphabet. The minimum distance between the edge of the sign and the first or last letter of the street name, prefix, or suffix shall be 4 inch.~~

~~The finished street name sign blanks shall be riveted to 2 cantilevered offset bracket assemblies with universal saddle clamps and double tee sections. For signs greater than 48-inch in length, a special assembly is required. This assembly shall consist of two cantilevered offset brackets, separated by a spacer, riveted to the appropriate double tee section. The signs shall be attached to the sign supports using a stainless steel buckle strap combination.~~

~~**637.05 Installation**—When street name signs are to be installed at the intersection of two arterial streets, 18-inch blades and 4.0-inch NPS posts shall be used. The signs shall be mounted 10 feet above ground level. Only one street name sign per post shall be used. Signs shall be located near left and far right at all locations unless otherwise specified.~~

~~At the intersection of a local street and an arterial or collector street, 12-inch blades and 4.0-inch NPS posts shall be used. The signs shall be mounted 10 feet above ground level. Signs shall be located far right for the arterial or collector street with two signs per post. If the combined square footage of both signs exceeds 10 square feet; a separate post shall be used for each sign as for the intersection of two arterial streets.~~

~~At the intersection of two local streets, 9-inch blades and 2.5-inch NPS posts shall be used. The signs shall be mounted 10 feet above ground level. Signs shall be located in such a manner as to minimize the obstruction of other traffic control signs.~~

~~All signs shall be banded to the posts with sufficient tightness to prevent rotation due to wind loads. **The County Engineer may require testing of the bands to insure adequate resistance to rotation by wind loads.**~~

~~637.06 Inspection- After erection, signs will be inspected under both day and night conditions and any deficiencies in lateral position or visibility shall be corrected to the satisfaction of the Inspector.~~

~~637.07 Method of Measurement- Street name sign supports shall be measured as the size and number of pipe supports, including excavation and concrete embedment. Street name signs will be measured as square footage of sign blank, including mounting fittings and hardware.~~

~~637.08 Basis of Payment- Quantities of specific items measured as provided above, in place, complete, and accepted will be paid for under:~~

Item	Unit	Description
637	Each	2.5 inch NPS Street Name Sign Support
637	Each	4.0 inch NPS Street Name Sign Support
637	Square Feet	Street Name Sign

706.000 Shipping of Concrete Pipe- Concrete pipe 6 inch to 27-inch shall not be moved from the cast yard before such pipe has aged a minimum of seven days and meets the 0.01 inch (0.3 mm) crack test or may be moved after 48 hours upon meeting 115 percent of the 0.001(0.03 mm) crack test.

Concrete pipe 30 inch and larger shall not be moved from the cast yard before such pipe has aged a minimum of fourteen days and meets the 0.01 inch (0.3 mm) crack test or may be moved after four days upon meeting 115 percent of the 0.01 inch (0.03 mm) crack test and the minimum concrete strength requirement as verified by core testing. Pipe strength may be tested to 115 percent in lieu of core testing.

706.001 Shipping of Structures- Concrete structures shall not be moved from the cast yard before the structure has aged a minimum of seven days.

The following table has been revised as to show front lot and rear lot easement widths for non-flood routes.

Minimum Permanent Easement Width for all Storm Sewers

Depth (Feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	12-inch		15-inch		18-inch		21-inch	
2	25	10	-	-	-	-	-	-
3	30	11	30	12	30	12	30	12
4	30	12	30	12	30	12	30	12
5	30	12	30	12	30	12	30	12
6	30	12	40	12	40	12	40	12
7	40	12	40	12	40	12	40	12
8	40	12	40	12	40	12	40	12
9	40	12	40	12	40	12	40	12
10	40	12	40	13	45	13	45	13
	24-inch		27-inch		30-inch		36-inch	
3	30	12	-	-	-	-	-	-
4	30	12	30	12	30	12	30	13
5	30	12	30	12	30	12	40	13
6	40	12	40	12	40	12	40	13
7	40	12	40	13	40	13	40	13
8	40	13	40	13	40	13	40	13
9	40	13	45	13	45	13	45	13
10	45	13	45	13	45	13	45	13
11	45	13	45	13	45	13	45	13

Minimum Permanent Easement Width for all Storm Sewers

Depth (Feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	42-inch		48-inch		54-inch		60-inch	
5	35	13	35	13	-	-	-	-
6	35	13	35	13	35	14	35	14
7	35	13	35	13	35	14	35	14
8	45	13	45	14	45	14	45	14
9	45	14	45	14	45	14	45	14
10	45	14	45	14	45	14	45	14
11	45	14	45	14	55	14	55	15
12	55	14	55	14	55	14	55	15

- * Minimum distance from centerline of pipe to either side of easement.
- Table values are in feet unless otherwise noted.
- For pipes greater than 60 inches in diameter the minimum easement width shall be submitted to the County Engineer for approval.
- For pipe depths exceeding those listed in this table, the easement width shall be submitted to the County Engineer for approval.

Minimum Rear Lot (RL) & Front Lot (FL) Easement Widths – Non- flood routes

Depth (Feet)	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset
	12-inch		15-inch		18-inch		21-inch	
2	25/15	10	-	-	-	-	-	-
3	30/15	11	30/15	12	30/15	12	30/15	12
4	30/15	12	30/15	12	30/15	12	30/15	12
5	30/15	12	30/15	12	30/15	12	30/15	12
6	30/15	12	40/20	12	40/20	12	40/20	12
7	40/20	12	40/20	12	40/20	12	40/20	12
8	40/20	12	40/20	12	40/20	12	40/20	12
9	40/20	12	40/20	12	40/20	12	40/20	12
10	40/20	12	40/20	13	45/25	13	45/25	13
	24-inch		27-inch		30-inch		36-inch	
3	30/15	12	-	-	-	-	-	-
4	30/15	12	30/15	12	30/15	12	30/15	13
5	30/15	12	30/15	12	30/15	12	40/20	13
6	40/20	12	40/20	12	40/20	12	40/20	13
7	40/20	12	40/20	13	40/20	13	40/20	13
8	40/20	13	40/20	13	40/20	13	40/20	13
9	40/20	13	45/25	13	45/25	13	45/25	13
10	45/25	13	45/25	13	45/25	13	45/25	13
11	45/25	13	45/25	13	45/25	13	45/25	13

Minimum Rear Lot (RL) & Front Lot (FL) Easement Widths – Non- flood routes

Depth (Feet)	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset	Total Min. Width RL/FL #	* Min. Dist. C.L. Offset
	42-inch		48-inch		54-inch		60-inch	
5	35/20	13	35/20	13	-	-	-	-
6	35/20	13	35/20	13	35/20	14	35/20	14
7	35/20	13	35/20	13	35/20	14	35/20	14
8	45/25	13	45/25	14	45/25	14	45/25	14
9	45/25	14	45/25	14	45/25	14	45/25	14
10	45/25	14	45/25	14	45/25	14	45/25	14
11	45/25	14	45/25	14	55/30	14	55/30	15
12	55/30	14	55/30	14	55/30	14	55/30	15

- * Minimum distance from centerline of pipe to either side of easement.
- Table values are in feet unless otherwise noted.
- For pipes greater than 60 inches in diameter, the minimum easement width shall be submitted to the County Engineer for approval.
- For pipe depths exceeding those listed in this table, the easement width shall be submitted to the County Engineer for approval.
- # Allowable front lot minimum easement width when adjacent to the street R/W. The centerline of the pipe or ditch must be within the easement.
- For flood routing easement requirements see Article IX, Sections 902 and 903 of these Standards.

Side Yard Minimum Storm Sewer Easement Widths – Non-flood Routes

Easement width	Depth of Trench	Pipe diameter	* Minimum Distance to Centerline Pipe Offset
20 feet	≤ 7 feet	≤ 24 inches	7 feet
30 feet	> 7 feet	≤ 24 inches	10 feet
30 feet	≤ 7 feet	≥ 27 inches but ≤ 60 inches	11 feet
40 feet	> 7 feet	≥ 27 inches but ≤ 60 inches	15 feet

- * Minimum distance from centerline of pipe to either side of easement.
- For pipes greater than 60 inches in diameter, the minimum easement width shall be submitted to the County Engineer for approval.
- For flood routing easement requirements see Article IX, Sections 902 and 903 of these Standards.

MAXIMUM HEIGHT OF COVER FOR ROUND CONCRETE PIPE

DIA. Inches	IN ROADWAY CLASS OF PIPE				OUTSIDE ROW CLASS OF PIPE			
	II	III	IV	V	II	III	IV	V
12	X	X	X	20	X	X	16	20
15	X	X	16	20	X	X	16	20
18	X	X	16	20	X	9	16	20
21	X	X	16	20	X	9	16	20
24	X	X	16	20	X	9	16	20
27	X	X	16	20	X	11	16	20
30	X	11	16	20	8	11	16	20
36	X	11	18	28	8	11	18	28
42	X	12	18	28	8	11	18	28
48	X	12	18	28	8	11	18	28
54	9	12	18	*	9	12	18	*
60	9	12	18	*	9	12	18	*
72	9	12	18	*	9	12	18	*
78	9	12	*	*	9	12	*	*
84	9	12	*	*	9	12	*	*
90	9	12	*	*	9	12	*	*
96	9	12	*	*	9	12	*	*

“X” indicates cannot be used

If the minimum depth of cover outside right-of-way is less than 30-inches, refer to DCED S-155.

In no case shall the cover be less than 18-inches.

Cover shown in table is in feet unless otherwise indicated.

The Class of pipe shall be shown in the storm sewer profiles.

**MAXIMUM HEIGHT OF COVER FOR
THERMOPLASTIC PIPE FOR STORM SEWER APPLICATIONS**

See Table 903 of the Supplemental Sections of Article IX for minimum and maximum height of cover for thermoplastic pipe.

**MAXIMUM HEIGHT OF COVER
FOR HORIZONTAL ELLIPTICAL PIPE**

		IN ROADWAY CLASS OF PIPE			OUTSIDE ROW CLASS OF PIPE		
RISE & SPAN (inches)	EQUIV. DIA. (inches)	II	III	IV	II	III	IV
14 X 23	18	X	12	14	10	12	14
19 X 30	24	X	12	14	10	12	14
24 X 38	30	X	10	12	6	10	12
29 X 45	36	X	10	12	6	10	12
34 X 53	42	8	11	14	8	11	14
38 X 60	48	8	11	*	8	11	*
43 X 68	54	7	11	*	7	11	*
48 X 76	60	7	8	*	7	8	*
53 X 83	66	7	8	*	7	8	*
58 X 91	72	6	8	*	6	8	*
63 X 98	78	6	8	*	6	8	*
68 X 106	84	5	8	*	5	8	*

“X” indicates cannot be used

Table values are in feet unless otherwise noted.

NOTES FOR HEIGHT OF COVER TABLES

1. The design of the proper class of concrete pipe is based on the ASCE Standard L= Direct Design of Buried Concrete Pipe Using Standard Installation (SIDD).
2. The installation type used for all fill height cases is Type 2 as listed in ASCE Standard for "Standard Embankment Installation Soils and Minimum Compaction Requirements".
3. The pipes in roadway and outside of roadway are designed for an AASHTO HS-25 live load condition **or loading as required by the County Engineer.**
4. The fill height table assumes a soil density equal to 140 pounds per cubic foot.
5. For all pipe marked with an asterisk (*) and for pipes at greater depths than what are listed, the pipe manufacturer is required to provide a design and shop drawing to the County Engineer for review and approval. All special designs for concrete pipe shall use the ASCE Standard Direct Design of Buried Concrete Pipe Using Standard Installations (SIDD).
6. The height of cover is measured from the top of the pipe to the top of the subgrade.
7. The classes of concrete pipe are per ASTM C-76 Specification for Reinforced Concrete Sewer Pipe for round pipe and per ASTM C-507 Specification for Horizontal Elliptical Concrete Pipe for horizontal elliptical pipe.
8. The Delaware County Engineer developed the Height of Cover Tables for use. They shall be used for specifying concrete pipe for storm sewer systems under the jurisdiction of the Delaware County Engineer.

DELAWARE COUNTY ENGINEER'S OFFICE

**SUPPLEMENTAL SPECIFICATION 1501
COMPACTION TESTING OF SOILS, GRANULAR MATERIALS, AND OTHER
MATERIALS**

- 1501.01 General**
- 1501.02 Compaction Testing for Soils**
- 1501.03 Compaction Testing Requiring an Aggregate Correction Factor**
- 1501.04 Compaction Testing for Granular Material**
- 1501.05 Compaction Acceptance**
- 1501.06 Minimum Number of Tests**

COMPACTION TESTING OF SOILS, GRANULAR MATERIALS, AND OTHER MATERIALS

1501.01 General Perform all compaction testing of soils, granular material, bases or backfill in accordance with the supplement for all applicable work items within the County.

Perform the in-place density tests by utilizing a nuclear gauge according to ASTM D-2922.

A nuclear gauge standard count shall be performed daily and a record of results maintained.

Nuclear gauges shall be verified for calibration at twelve month intervals.

The Contractor will be responsible for surface preparation of the section to be tested.

It is the Contractor's responsibility to provide and maintain access to the area selected for testing.

The Contractor shall cooperate to the fullest extent to accommodate compaction testing and no extra payment will be allowed for delay or time lost due to the verification of compaction.

1501.02 Compaction Testing for Soils For nuclear gauge operations, use the direct transmission method. The tested depth will correspond to the compacted depth of the layer of material being tested.

Perform a one-point proctor test in accordance with AASHTO T-272, Method C, if a laboratory-established curve had not been previously developed, a change in soil type is observed, or if test results indicate a verification of materials is required.

Use the Family of Curves prepared by the Ohio State Highway Testing and Research Laboratory or Delaware County Family of Curves.

Plot the proctor wet density and the moisture percent indicated by the nuclear gauge to determine the compaction curve to be used. When the intersection point is between two curves, choose the higher of the curves.

All compaction percentages will be calculated based on the dry densities of the material.

1501.03 Compaction Testing Requiring an Aggregate Correction If the material contains by weight, more than 5 percent and less than 30 percent over size material (material retained on the $\frac{3}{4}$ inch sieve), this procedure must be followed. If the material contains more than 30 percent retained, utilize a Test Section (1501.05).

Obtain a representative sample of the material from directly below gauge. Sieve the material through a ¾ inch (19 mm) sieve. Divide the weight of the material retained on the ¾ inch (19 mm) sieve by the weight of the total sample.

Use this percentage to calculate the aggregate correction factor in accordance with AASHTO T-224.

1501.04 Compaction Testing for Granular Material Follow the same procedure set forth in section 1501.02 with the following exception:

If required to perform a field one-point proctor test, use Method C of AASHTO T-99 if using the Ohio State Highway Testing and Research Laboratory curves, Delaware County Family of Curves, or Method D if applied to a laboratory established curve.

1501.05 Compaction Acceptance Once the initial control data has been established, the remainder of the installation will be verified for specification compliance based on these results.

If a test fails to meet the requirements, the moisture content shall be adjusted, if required, and further compaction effort applied.

1501.06 Minimum Number of Tests The number of test will be determined by the project inspector. Normally, each twelve (12”) lift will be tested.

DELAWARE COUNTY ENGINEER'S OFFICE

**SUPPLEMENTAL SPECIFICATION 1502
SOIL MODIFICATION**

1502.01	Description
1502.02	Materials
1502.03	Laboratory Testing Requirements
1502.04	Equipment
1502.05	Storage and Handling
1502.06	Construction Methods
1502.07	Curing and Protection
1502.08	Maintenance Of Defective Areas
1502.09	Proof roll
1502.10	Basis of Payment

COMPACTION TESTING OF SOILS, GRANULAR MATERIALS, AND OTHER MATERIALS

1502.01 Description This supplemental specification outlines the requirements for construction an inplace modified soil structure by uniformly mixing an approved chemical modifier, such as Lime, Fly-Ash and/or Cement with the inplace soil and compacting the resulting mixture.

The intended purpose is to modify the soil to aid compaction by drying out wet areas, and to provide an improved working platform for subsequent construction. No credit will be accorded for this process in pavement design.

1502.02 Materials The materials used shall meet the following requirements:

Lime. Hydrated lime and quicklime shall meet the requirements of section 712.04 (B) of the CMSC.

Cement Cement shall meet the requirements of section 701 of the City of Columbus Construction and Material Specifications.

Fly Ash Fly Ash, Class C or F, shall meet the requirements of section 705.13 and ASTM C 618. Fly ash not conforming to these requirements may be considered provided performance requirements of AASHTO T 26.

Other Materials It is not the intent of this document to limit the use of other materials, however, it is beyond the scope of this document to focus on materials for which AASHTO and ASTM standards have not been developed.

1502.03 Laboratory Mixture Design Proposed admixture proportions, along with moisture-density relationship curve(s), shall be submitted to the County by a geotechnical firm, selected by the Owner, sufficiently in advance of the work for review and approval. A sufficient number of samples shall be taken to account for any changes in soil type.

1502.04 Equipment The Contractor shall use equipment that will produce results meeting the requirements for application of materials, compaction, and finishing as controlled by these Specifications. All equipment necessary for the proper construction of the modified course shall be on the project and in satisfactory condition before construction begins. All equipment shall be subject to approval by the County.

1502.05 Storage and Handling Modifiers shall be properly stored and handled in closed weatherproof containers until immediately before distribution. Hydrated lime, quicklime, or cement in bags shall be properly stored in weather –

protected conditions with adequate protection from ground dampness, and the facility shall be approved by the County prior to commencement of any work.

If a test fails to meet the requirements, the moisture content shall be adjusted, if required, and further compaction effort applied.

1502.06 Construction Methods

Temperature and Weather Limitations Modification shall be performed only when ambient air temperature is above 40° F, and when the soil is not frozen. Do not perform this work during wet or unsuitable weather.

Preparation of Existing Roadway Prior to starting the modification process all unsuitable materials, such as stumps, roots, and organic material shall be removed.

Spreading of Material The modifier shall be spread using equipment that will provide uniform distribution over the entire repaired area and in such a manner as to limit scattering and loss by wind.

Tailgate spreading of materials will not be permitted.

The material may be spread in either a slurry or dry form per the recommendation of the Owner's Geotechnical Engineer.

Mixing Immediately after spreading, the soil and modifier shall be uniformly mixed with blades, disks, harrows, or other suitable mechanical equipment. Water shall be uniformly applied to the soil mixture as needed to maintain optimal moisture content for the process.

Mixing operations shall be such that all ingredients are distributed evenly throughout the desired depth and provide a uniform mixture, free of segregation, satisfactory to the Engineer. The moisture content of the mixture should be maintained at $\pm 2\%$ of the optimum content.

Compaction Immediately upon completion of the spreading/mixing operations, the mixture shall be compacted to C.O.C. 203.12 of the maximum dry density established by the laboratory in section 1502.03. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

If during the compaction operation depressions, defective areas or soft spots develop, they shall be corrected immediately.

After each section is completed, field density tests shall be made in accordance with Delaware County Supplemental Specification 1501. If the compacted mixture fails to meet the specified density requirements, the County may require that area to be reworked

as necessary to meet these requirements and may require the Contractor to change his compaction methods to obtain required density.

Finishing When compaction of the modified soil is nearing completion, the surface shall be shaped to the required lines, grades and cross section: and compaction continued until uniform and required compaction is obtained. Once completed, the surface shall be sealed to protect against drying or damage due to inclimate weather.

1502.07 Curing and Protection After the subgrade has been finished as specified, it shall be cured for a period of at least 24 hours above 40° F. If the temperature is less than 40° F, the cure time shall be determined by the County.

1502.08 Maintenance of Defective Areas The contractor shall maintain, at his expense the entire modified area in a manner satisfactory to the County. Maintenance shall include immediate repairs of any defective or damaged portions of the area.

1502.09 Proof roll Upon approval of the subgrade density testing, a proof roll of the subgrade shall be performed. Any deficiencies shall be corrected by the contractor.

1502.10 Basis of Payment The accepted quantities of modified soil will be paid for at the contractor unit price per square yard or cubic yard, (*square meter or cubic meter*), which price and payment shall be full compensation for furnishing and placing all materials.

Item	Unit	Description
1502	Square Yard (<i>Square Meter</i>) Cubic Yard (<i>Cubic Meter</i>)	Soil Modification

DELAWARE COUNTY ENGINEER'S OFFICE

**SUPPLEMENTAL SPECIFICATON 1503
SOIL STABILIZATION**

1503.01	Description
1503.02	Materials
1503.03	Laboratory Mixture Design
1503.04	Equipment
1503.05	Storage and Handling
1503.06	Construction Methods
1503.07	Curing and Protection
1503.08	Maintenance/Defective Areas
1503.09	Proof roll
1503.10	Basis of Payment

SOIL STABILIZATION

1503.01 Description This supplemental specification outlines the requirements for constructing a stabilized soil structure by uniformly mixing an approved chemical stabilizer, such as Lime, Quicklime, Fly-Ash and/or Cement with the soil and compacting the resulting mixture.

1503.02 Materials The Materials used shall meet the following requirements:

Lime. Hydrated lime and Quicklime shall meet the requirements of section 712.04 (B) of the CMSC.

Cement Cement shall meet the requirements of section 701 of the City of Columbus Construction and Material Specifications.

Fly Ash Fly Ash, Class C or F, shall meet the requirements of section 705.13 and ASTM C 618. Fly Ash not conforming to these requirements may be considered, provided performance requirements of this specification can be proven.

Water. Water shall be clean and clear. If the water is of questionable quality, it shall be tested in accordance with the requirements of AASHTO T 26.

Other Materials It is not the intent of this document to limit the use of other materials, however, it is beyond the scope of this document to focus on materials for which AASHTO and ASTM standards have not been developed. Materials not conforming to the above, may be considered, provided performance requirements of this specification can be proven.

1503.03 Laboratory Mixture Design Proposed mix design proportions and recommended depth of application shall be submitted to the County by an approved geotechnical firm, selected by the Owner, sufficiently in advance of the work for review and approval. A sufficient number of samples shall be taken to insure control data, {moisture-density relationship curve (s)}, developed in the laboratory, represents field conditions, and to account for any changes in soil type. A mix design shall be submitted for each anticipated soil type.

The proposed mix design shall yield a minimum CBR value of 20 and a minimum average unconfined compressive strength of at least 100 psi at 7 days, and at least 150 psi at 28 days.

1503.04 Equipment The Contractor shall use equipment that will produce results meeting the requirements for application of materials, compaction, and finishing as controlled by these Specifications. Mixing shall be performed using an approved power driven rotary type mixer. Prior to construction, all equipment shall be in satisfactory working condition, and available for inspection by the County.

1503.05 Storage and Handling Admixtures shall be properly stored and handled in closed weatherproof containers until immediately before distribution. Hydrated lime, Quicklime, or Cement in bags shall be properly stored in weather-protected conditions with adequate protection from ground dampness. The storage facilities shall be approved by the County.

1503.06 Construction Methods

Temperature and Weather Limitations Stabilization shall be performed only when ambient air temperature is above 40° F, and when the soil is not frozen. Do not perform this work during wet or unsuitable weather, or when freezing weather is anticipated within 24 hours of mixing/compaction.

Preparation of Existing Roadway Prior to starting the stabilization process all unsuitable materials, such as stumps, roots, and organic materials shall be removed. Construct the area to be stabilized to an elevation such that, upon completion of the operations, the subgrade will conform to the lines, grades, and cross-section shown on the plans.

Spreading of Material The admixture shall be spread using equipment that will provide uniform distribution over the entire repaired area and in such a manner as to limit scattering and loss by wind.

Tailgate spreading of material will not be permitted.

The material may be spread in either a slurry or dry form per the recommendation of the Geotechnical Engineer.

Mixing Mixing operations shall be such that all ingredients are distributed evenly throughout the required depth, and provide a uniform mixture, free of segregation, that is satisfactory to the Engineer. The moisture content of the mixture shall be maintained at \pm 2% of the optimum moisture content.

The material shall be pulverized so that 100% passes the 1 inch sieve and 60% passes the #4 sieve.

Compaction Immediately upon completion of the spreading/mixing operations, the mixture shall be compacted to 100% of the maximum dry density established during the preparation of the laboratory mix design. All soil subgrade shall be compacted to 100% The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

If depressions, defective areas or soft spots develop during the compaction operation, they shall be corrected immediately.

After each section is completed, field density tests shall be made in accordance with Delaware County Supplemental Specification 1501. The County may require the area to be reworked as necessary to meet these requirements and may require the Contractor to change compaction equipment and/or methods to obtain the required density.

Finishing When compaction of the stabilized soil is nearing completion, the surface shall be shaped to the required lines, grades and cross section within the tolerances of item 203. Compaction should continue until the required density is obtained.

1503.07 Curing and Protection After the subgrade had been finished as specified, it shall be cured for a period of at least 5 days above 40° F. If the temperature is less than 40° F, the cure time shall be determined by the County.

During the curing period, the subgrade shall be protected against drying by applying an approved prime coat or polymer solution to prevent moisture loss.

All traffic or equipment other than curing equipment shall not be allowed on the finished subgrade until completion of curing, unless permitted by the Engineer.

1503.08 Maintenance/Defective Areas The contractor shall maintain, at his expense the entire stabilized area in a manner satisfactory to the County. Maintenance shall include immediate repairs of any defective or damaged portions of the treated subgrade.

1503.09 Proof roll Upon completion of the curing period, a proof roll of the subgrade shall be performed. Any deficiencies shall be corrected by the contractor.

1502.10 Basis of Payment The accepted quantities of stabilized soil will be paid for at the contractor unit price per square yard or cubic yard, (*square meter or cubic meter*), which price and payment shall be full compensation for furnishing and placing all materials.

Item	Unit	Description
1502	Square Yard (<i>Square Meter</i>) Cubic Yard (<i>Cubic Meter</i>)	Soil Modification

DELAWARE COUNTY ENGINEER'S OFFICE
SUPPLEMENTAL SPECIFICATON 1523
ROLLER COMPACTED CONCRETE PAVEMENTS
(RCC)

1523.01	Description
1523.02	Materials Requirements
1523.03	Mix Design
1523.04	Equipment
1523.05	Placing RCC
1523.06	Compaction and Finishing
1523.07	Small Areas
1523.08	Joints
1523.09	Curing
1523.10	Tolerances
1523.11	Quality Assurance and Control
1523.12	Defective RCC
1523.13	Asphalt Surfacing/Opening to Traffic
1523.14	Warranty
1523.15	Basis of Payment

**ROLLER COMPACTED CONCRETE PAVEMENTS
(RCC)**

1523.01 Description This Supplement Outlines the requirements for production and construction of Roller Compacted Concrete (R.C.C.) pavement for County streets. In addition to this supplement, items 305, 306, 401, 407, 451, and 700 of the City of Columbus Construction and Material Specifications (CMSC) apply where applicable. **Written approval of the applicable township shall also be required in each case where RCC is proposed.**

1523.02 Materials Requirements All materials to be used shall be from approved sources.

Cement: Portland Cement shall conform to the standard specification for Portland Cement Type 1, ASTM C 150 (latest edition).

Fly-Ash: Fly Ash shall conform to ASTM C 618 Class F and section 705.13 of the CMSC.

Aggregates: Fine and course aggregates shall meet the requirements of section 703.02 of the CMSC for Portland Cement Concrete, item 305 and 306. The aggregates shall be well graded to conform to the following composite gradation.

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
¾"	85-100
½"	70-90
3/8"	60-85
#4	50-70
#16	20-40
#100	5-20
#200	2-8

Water: Clean, potable and free from oil, acid, and strong alkalies of organic materials.

Admixtures (other than fly ash): Meet applicable ASTM standards.

1523.03 Mix Design The Contractor / Supplier shall develop an R.C.C. mixture such that the pavement's Flexural and Compressive strengths are equal to or greater than that of ODOT's Class **QC1 Concrete (minimum strength of 4000 psi)**. **The minimum allowed thickness of RCC shall be 4 inches and shall be based on a pavement design calculations.** The Mix Design shall be submitted to the Delaware County Engineer's Office for review prior to the Pre-Construction Meeting. At the County's direction, the contractor shall saw cut and retrieve beams for testing by the County or its representative.

Fly Ash may only be used between April 1 and November 1 unless otherwise authorized by the County Engineer.

1523.04 Equipment

Mixing Plants: Mixing plants shall be of a design that can produce an R.C.C. pavement mixture of the proportions defined in the approved mix design and within the Stationary Continuous-Mixing Twin-Shaft Pugmill mixer. The plant shall have a minimum manufacturer's rated capacity of 200 tons per hour.

Paver: An asphalt type paver modified or equipped with dual tamping bars and vibrating screed, capable of laying down the R.C.C. mix to at least 85% of the required density. The paver shall be of suitable weight and stability to spread and finish the concrete without segregation to the required thickness, smoothness, surface texture, cross-section, and grade required by the criteria in section 451 of the CMSC.

Pneumatic Rollers: Pneumatic rollers shall be self-propelled, double drum, steel wheel vibratory rollers having a static weight of at least 10 tons. Each roller drum shall be equipped with a properly operating scraper and brush. The rollers shall transmit a dynamic impact to the surface through smooth steel drums by means of revolving weights, eccentric shafts or other equivalent methods. The roller drum shall be between 4 and 5-1/2 foot in diameter and 5-1/2 to 8 feet in width.

Finish Rollers: Finish rollers shall be self-propelled, double drum, steel wheel vibratory rollers having a static weight of at least 10 tons. Each roller drum shall be equipped with a properly operating scraper and brush.

Equipment for Vertical Cuts in R.C.C. Pavement: To cut vertical joints in fresh R.C.C. pavement, equipment such as a wheel cutter or other approved equipment capable of cutting vertically, the full depth of the layer, shall be used. If the Contractor waits until the R.C.C. hardens to make vertical cuts, concrete sawing equipment shall be used to make the vertical cuts.

1523.05 Placing RCC

Cold Weather Limitations: R.C.C. shall not be placed on any surface containing frost or frozen material. R.C.C. shall only be placed when the ambient temperature is a minimum of 40° F and rising. When the ambient temperature is expected to fall below 40° F, the Contractor must follow the procedures set forth in section 451.061 of the CMS>

Hot Weather Precautions: During periods of hot weather or windy conditions, special precautions shall be taken to minimize moisture loss due to evaporation. Precautions may include cooling of aggregate stockpiles by the use of water spray, protective covers on dump trucks, temporary windbreaks to reduce wind velocity, cooling of concrete mix water, decreasing the allowable time between mixing and final compaction, and keeping

the surface of the newly placed R.C.C. pavement damp with a light spray during compaction and finishing operations.

Rain Limitations: No placement of R.C.C. pavement shall be done while it is raining. The Engineer will be the sole judge as to when placement must be stopped due to rain.

Subgrade Preparation: Prepare the subgrade according to Section 204 of the CMSC. ~~If required,~~ A 4" thick granular base shall be required that complies with Section 304.

Transporting: Transport the R.C.C. mixture to the site in dump trucks with boxes cleaned out before loading and providing with protective covers properly secured in place until discharge. The trucks shall dump directly into the hopper of the paver unless placement is by hand as directed by the Engineer. Hauling over the freshly placed R.C.C. will not be permitted.

Continuity: Co-ordinate R.C.C. delivery so the mix can be spread and rolled within the specified time limit and to ensure uniform progress of the paver until the paving operation is complete. The time between mixing, and compacting shall not exceed sixty (60) minutes. The time limit may be increased or decreased by the Engineer dependent upon ambient conditions of temperature and humidity.

Spreading: Spread the material to a sufficient depth that will produce the specified thickness when compacted and conform to the required cross-sections and grade. Operate the paver in a manner that will prevent segregation and will produce a smooth continuous surface without tearing, pulling or shoving. Placing of the R.C.C. mix shall be done in a pattern so that the water from previously placed R.C.C. will not affect the fresh surface or subgrade.

Segregation: If segregation occurs, suspend the paving operation until the cause is determined and corrected. Rake off segregated coarse aggregate before rolling. Broadcasting or fanning of R.C.C. mixture onto areas being compacted is not permitted.

Length of Spread: Limit the length of R.C.C. spread to that which can be compacted and finished within the appropriate time limit under the prevailing air temperature, wind and other climatic conditions.

Placing Adjacent Lanes: Not more than 45 minutes shall elapse between placement of R.C.C. in adjacent lanes, unless a cold joint is provided. Joints shall be made to assure continuous bond between old and new sections of pavement. The time limit may be increased or decreased depending on ambient conditions of temperature and humidity.

1523.06 Compaction and Finishing

Required Density: The Contractor is responsible for achieving 98% of the maximum wet density, as determined in the laboratory according to ASTM D 1577.

Start of Rolling: Begin compaction operations within fifteen (15) minutes after spreading of the R.C.C. mix. Any additional delay will result in the coring of the affected area at the Contractors expense to ensure that it meets the requirements of this specification.

Rolling Pattern: Establish a rolling pattern that will achieve the required density with a minimum number of roller passes.

Vibratory Rolling: During vibratory compaction, the roller shall not be started, stopped, or left standing in vibratory mode. Stagger the stopping point of successive rolling passes to avoid forming depressions on the surface.

Surface Check: Continually check the R.C.C. surface while still plastic to ensure surface and grade tolerances are met. Immediately correct excessive variations.

Intermediate Rolling: Upon request of the Engineer, immediately follow vibratory compaction with passes of a rubber-tire roller so that surface voids and fissures are closed to form a tight surface texture.

Finish Rolling: Remove any roller marks on surface using a steel drum roller in static mode.

Lane Edge: Each edge of each lane shall be constructed with a vertical or a 15-degree from vertical configuration.

1523.07 Small Areas Spread RCC mix by hand in areas not accessible by the paver as directed by the Engineer.

Compact the mix to the required density using suitable vibratory compaction equipment.

1523.08 Joints

Fresh Joints: A fresh joint is made when an adjacent R.C.C. lane is placed within 45 minutes after placing the previous lane. Ensure that the contact face is moist and not segregated. Before rolling, hand-finish the joint as necessary to produce a tight surface. Roll extra passes as necessary to achieve the required density and smoothness in the joint area.

Cold Joint: A cold joint is made when an adjacent R.C.C. lane is placed more than 45 minutes after placing the previous lane. Sawcut the edge of previous lane back to sound R.C.C. to form a vertical face. Trimming by grader blade may be permitted if done at the end of the workday or the first thing the following day. Place fresh grout on the vertical face just before placing fresh R.C.C. against it. Before rolling, hand-finish the joint as necessary to produce a tight surface. Roll extra passes as necessary to achieve the required density and smoothness in the joint area. Every effort shall be made to maintain longitudinal joints as a fresh joint as described in “Fresh Joint” above.

Transverse Joint: May be a Fresh Joint or Cold Joint as described above. They shall be spaced at a maximum of 30 foot intervals, and cut to depth 1/3 of the specified pavement thickness.

Longitudinal Joint: Leave the outer 12 to 18 in. of the paving lane uncompacted during the initial rolling operation. This uncompacted edge is then used to set the height of the paver screed for paving the adjacent lane. After the adjacent lane is placed, the joint is compacted by centering the roller drum over the joint and compacting the adjacent lane edges simultaneously.

1523.09 Curing R.C.C. without Asphalt Surfacing applies within 72 hours: Keep the R.C.C. surface continuously moist by water, fog spray, wet burlap, or an approved membrane-forming curing compound, for a period of 7 days. Apply curing compound at 1-1/2 times the rate specified by the manufacturer.

R.C.C. with Asphalt Surfacing applied within 72 hours: Immediately after final rolling, apply an asphalt emulsion per item 407 of the CMS. Apply at 1-1/2 times the rate specified by the manufacturer.

1523.10 Tolerances R.C.C. pavement construction shall be subject to Section 451 of the CMSC.

1523.11 Quality Assurance and Control

Responsibility: Testing at the plant and the paving site is the responsibility of the Owner and shall be performed by The County. The Contractor and Supplier shall provide safe and convenient access, acceptable to the Engineer, for the inspection and sampling of the R.C.C. and constituent materials, at both the production plant and the paving site, and shall cooperate in the inspection and sampling process at all times.

Pre-placement: The Contractor shall ensure quality control at the plant, by controlling materials, obtaining test samples and ensuring segregation is not occurring while loading haul trucks.

The private Testing Laboratory will develop a moisture/density relationship of the actual job materials in accordance with ASTM D 1557. Optimum moisture content, maximum dry and wet densities will be established.

Compressive Strength Testing: Compressive strength testing shall be in accordance with ASTM C 39. The County shall perform all testing at the plant and the project site. This testing shall be used to perform the 28 day compressive strength test of the material to verify the mix conformance.

During Placement: The Contractor, in cooperation with the County shall ensure that compaction and grade specifications are met and time limits are adhered to.

Field Density: The County shall perform density testing of the R.C.C. in accordance with ASTM C 1040, direct transmission mode, as soon as possible, but no more than 30, minutes, after completion of rolling. Only wet density shall be used for evaluation. The required density shall be a minimum of 98% of the maximum wet density. At least 5 tests shall be performed for each 250 cubic yards placed. The Contractor shall be responsible for verifying required densities are achieved by the paver.

If density tests indicate that the material does not meet the required density, the Engineer, in collaboration with the Contractor and the County's Testing Laboratory, shall determine the source of the problem, whether mix properties, segregation, or gauge calibration. If mix properties have changed, or the concerns cannot be resolved, placement shall be suspended until the problem is corrected.

After Placement: The County shall core at least nine (9) 4 ½ inch diameter cylindrical specimens from the interior of the slab for compliance verification. Length measurements of the cores and compressive strength testing shall be in accordance with ASTM C 42. The actual number of cores will be determined as defined in section 451.16 of the CMSC. Testing will be conducted as follows:

Compressive Strength Testing: Three (3) of the cores obtained for thickness verification will be tested for compressive strength at 28 days.

Splitting Tensile Strength: Three (3) of the cores obtained for thickness verification will be tested for splitting tensile strength at 14 days.

Density Test: The three (3) core samples obtained for splitting tensile strength will also be tested for density PCF.

The remaining three cores will be held for backup testing and/or further review as necessary.

Flexural Strength Testing: The County shall have at least four (4) rectangular beams from the interior of the slab, in accordance with ASTM C 42, to perform a 14 day flexural strength test of the material. Additional tests at different ages may be required by the Engineer.

1523.12 Defective RCC

Repairs: All repairs are subject to the Engineers approval. Correct deficiencies while R.C.C. is still plastic; otherwise do repairs after seven (7) days. After seven (7) days, the R.C.C. shall be removed by saw cutting full depth before removal. Replace the R.C.C. utilizing a Cast-in-Place concrete meeting the requirements of section 499: Class C Concrete as directed by project Engineer. The new concrete shall be doweled into the existing R.C.C. utilizing epoxy coated reinforcing bars.

Remove and replace R.C.C. if determined deficient in thickness by following the procedure set forth in section 451.16 of CMSC.

Any R.C.C. pavement found to be of unacceptable thickness, or deficient in any testing done according to 1523.11, may be subject to removal and replacement by the contractor, at no cost to the County, including removal and replacement of any intermediate and surface asphalt course.

Grind off high surface variations to a finish acceptable to the Engineer.

Filling of low areas with fresh R.C.C. is not permitted.

If asphalt surfacing is specified, low areas shall be made up with additional surfacing material without extra payment.

1523.13 Asphalt Surfacing/Opening to Traffic

The R.C.C. pavement may be asphalted surfaced as surfaced as specified on the plans once the requirements of Section 1523.06 have been met and all transverse contraction joints have been constructed.

If the R.C.C. pavement is not to be asphalt surfaced immediately, all traffic shall be restricted from using the R.C.C. until seven (7) days has elapsed or all strength requirements of Section 15123.03 have been met. At any time prior to the expiration of the above mentioned (7) day period, The R.C.C. may be asphalt surface as specified on the plans and then opened to traffic.

1523.14 Warranty This new process is being evaluated on a preliminary approval basis for use as base pavement on County projects. The preliminary approval shall begin after the first installation of the new product and extend for a period of five (5) years thereafter. During this period, a five (5) year unlimited warranty shall be provided by the Contractor for each and every installation of this product.

In order for this warranty to take effect, the installation must have been performed in accordance with this supplemental specification and the applicable sections of the City of Columbus, Construction and Material Specifications.

At any time during the five (5) year evaluation period, and in the judgment of the County, the product had failed to meet the specification requirements, the Owner shall, at his expense, remove and replace the R.C.C. base with the applicable 305 or 306 base pavement and any intermediate/surface course(s).

1523.15 Basis of Payment The accepted quantities of R.C.C. pavement will be paid for at the contract unit price per square yard (*square meter*), which price and payment shall be full compensation for furnishing and placing all materials including reinforcing steel, dowels, and joint materials.

No additional payment over the unit contract bid price will be made for any pavement which has an average thickness in excess of that shown on the plans.

Payment for accepted quantities, complete in place, will be paid for at the contract price for item Supplemental Specification 1523.

<u>Item</u>	<u>Unit</u>	<u>Description</u>
1523	Square Yard (<i>Square Meter</i>)	Roller Compacted Concrete

**Delaware County Engineer's Office
Supplemental Specification 1542
In-Place Density of Hot Mixed Asphalt**

1542.01	Description
1542.02	Procedure
1542.03	Testing

1542.01 Description This supplemental shall be used for the testing of the density for In-Place Hot-Mixed Asphalt. This supplemental shall be used for privately funded subdivision roads.

1542.02 Procedure The Owner shall submit a Job Mix Formula (JMF) a minimum of one week prior to paving operations for review and comment. The Owner shall notify the project inspector of paving operations 24-48 hours prior to asphalt placement. Testing shall be performed by the County or its representative.

1542.03 Testing The asphalt testing shall be performed with the use of a nuclear densometer. One sample shall be obtained per every four hours of asphalt placement. Additional samples shall be obtained if the JMF or asphalt type changes during the course of the day. The lab shall perform the following testing on each sample; Marshall Pill, Extraction, Gradation, Rice and temperature. Testing locations shall be determined by the County Engineer. A minimum compaction section of 96% of the Marshall Pill shall be used for the testing.

Supplement to Article III

301 PROCEDURE

B. Step 2 - The standard wording for approval (or disapproval) of preliminary engineering plans shall be as outlined below:

1. Standard plan review deadline: 21 days
2. Subsequent plan review deadline: 14 days

E. Preliminary Plan Approval: Add the following sentence to the end of the last paragraph - **The County Engineer may require a field meeting to discuss the comments with the design engineer.**

302 PLAN REQUIREMENTS

B. General Information:

Add the following new item (No. 7)

7. Copy of the approved zoning plan and text (Electronic Format – PDF)

D. Street and Structure Plan:

Add the following sentence at the end of Item 1 - In lieu of pavement design calculations, Delaware County pavement composition sections per Article VII may be used.

Add the following sentence at the end of Item 9 - The USGS website <http://water.usgs.gov/osw/streamstats/ohio.html> may be used as a preliminary aid in determining watershed characteristics for the site.

Add the following sentence at the end of Item 11 – See Article VI for more information regarding terrain classification.

Add the following sentence at the end of Item 13 – A preliminary profile of all storm sewers and/or culvert crossings under the proposed R/W is required to insure adequate cover per Article IX is provided. It is the County Engineer’s intent to provide the minimum cover as outlined in Article IX. If the site conditions, e.g. flat terrain, shallow depth outlet, etc. require a cover depth less than the minimum, a variance can be requested. The variance shall be requested as part of the Preliminary Engineering Plan submission.

Supplement to Article III

E. Storm Water Tributary Map Requirements:

The following items outline the basic requirements of the Pre-Development Storm Water Tributary Map of Existing Site Conditions to be submitted with the Preliminary Plans. See Article III for additional information on Preliminary Plans submittal. Please refer to Article IX for the minimum standards and specifications for design.

1. This map shall be of appropriate scale (1"= 500 ft maximum) and graphically show the boundaries of the entire drainage area. In addition, the existing general topography and ground contours for the following items shall be shown:
 - The development area.
 - The adjacent land within one hundred (100) feet of the development area.
 - Any other adjacent areas which affect or may be affected by the proposed development.
2. Boundary lines of the development area shall be clearly delineated.
3. Drainage structures, culverts, storm sewers, etc. (including those in the entire drainage area).
4. Highways, railroads, parks and other recreational areas.
5. Known subsurface drainage systems.
6. Existing topography (specify source datum) at the following specified contour intervals:
 - Two-foot minimum contour intervals based on actual field obtained data for subdivision lots utilizing centralized sewer systems.
 - One-foot minimum contour intervals based on actual field obtained data for subdivision lots utilizing on-site sewage treatment systems.

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- Larger contour intervals (5-foot intervals maximum) may be approved by the County Engineer for sites with existing topography of 12% slopes or steeper.
 - Contour intervals provided in the Delaware County Auditor's website (DALIS) are acceptable.
7. 100-year flood plain for any FEMA NFIS watercourse.
 8. Existing pond or ponding areas.
 9. Any existing above ground structures, buildings, facilities, etc. on or in the development area.
 10. An adequate drainage outlet is of primary importance to the County; therefore on the map provide identification of the existing drainage outlet(s) for the site including size, material type, slope, and condition of any storm sewer or culverts. This information shall be based on an onsite investigation and observation of the outlet(s). The County Engineer shall require supporting evidence (e.g. videotape, field data, photographs, etc.) of the existing drainage outlet(s) be included with the submission of the Preliminary Plans.
 11. Provide on the map an analysis of the capacity of the drainage outlet(s) for the site and a determination of the adequacy of the outlet(s) under the predevelopment conditions. Please refer to the Appendix E (Design Aids) of the Supplemental Specifications for an example.
 12. Any underground facilities (e.g. leach fields, storage tanks, wells, etc.) on or in the development area.
 13. If an existing subdivision is located directly downstream of the proposed development, see Articles IV, IX and the Supplemental Specifications for additional requirements if ~~major~~ overland flood routing will be routed through the existing subdivision.
 14. Along with the map, provide drainage calculations (See Supplemental Specifications, Table 901 -Acceptable Methods of Calculations): Calculations of the predevelopment peak flows from the drainage areas delineated in Section E., Part 1, for the 1, 2, 5, 10, 25, 50

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and 100 year frequency, 24 hour storms. List the peak flows on the map.

Supplement to Article IV

401 PROCEDURE

A. Step 1

A copy of the approved ODOT R/W permit must be submitted to the County Engineer prior to final engineering and construction plan approval for all projects that access ODOT R/W.

Flood Route: When there are **buildings, such as single family, multi-family, commercial, etc. located** ~~is a subdivision~~ ~~are~~ directly downstream of the **proposed** site, the narrative shall include a description of the existing lots and **buildings** ~~houses~~ affected, their finished floor elevations, drainage easements (or lack thereof), and shall include photographic evidence of the offsite flood route through the existing **development** ~~subdivision~~. Cross sections of the flood route at the spillover points shall also be provided. In addition, the County Engineer may require additional information. The flood routing information should also be on the final plans.

Requirements for **limiting the height and spread of water** for flood routing ~~requirements~~ downstream of the **proposed site** ~~development~~ shall be as determined by the County Engineer on a case-by-case basis.

The final storm water management report (Both CD and Paper Copy) must contain the following items:

- a) Report Summary/Narrative
- b) Table of Contents
- c) Pre and Post Tributary Maps
- d) Storm Sewer Tributary Maps
- e) Pond Calculations
- f) Culvert Calculations
- g) Storm Sewer Calculations
- h) Spread of Water Calculations
- i) Inlet capacity Calculations
- j) Flood routing Calculations
- k) Water quality Calculations
- l) Ditch Capacity Calculations
- m) Drainage Maintenance Exhibit "C"

The narrative will need to describe the site, method of calculation used, allowable release rates, computed release rates, design storm inflow, design

Supplement to Article IV

storm outflow and identification of any Jurisdictional Streams and/or Archeological Artifacts on the site.

B. Step 2

The standard wording for approval (or disapproval) of final engineering plans shall be as outlined below:

1. Standard plan review deadline: 28 days
2. Subsequent plan review deadlines are as follows:

For final plans, 7, 21 or 28-day review deadline will be required for a backcheck review. The length of the subsequent review will be based on the number of comments documented in the initial reviews. For example, a 28-day review will be required for a plan submittal that is not approved. A 21-day review will be required for a plan that is approved but the number of comments is significant, in the opinion of the County Engineer. A 7-day review applies to projects where the number of comments are few and minor in nature, in the opinion of the County Engineer.

Final Engineering Plan Review Comments: The County Engineer will compile comments from the Delaware County SWCD, Delaware County Engineer's **Permit Department**, Map Department, ~~Delaware County Engineer's~~ Storm Water Department and other review agencies (if applicable) for incorporation into the review letter and marked checked prints. **At the discretion of the County Engineer, a field meeting may be scheduled with the design engineer and representatives of the County Engineer's Office to discuss the comments.**

Exhibit "C" shall use the approved Master Grading Plan as the base sheet to show all items that will be on the County's Drainage Maintenance Program. The Design Engineer shall contact Delaware Soil and Water Conservancy District to schedule a meeting to discuss what items will be required to be on the County's Drainage Maintenance Program.

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C. Step 3

Sanitary Plans: If the Owner desires to commence construction of the sanitary sewer plans prior to approval of the Final Engineering and Construction Plan, maintenance of traffic plan sheet(s) shall also be included with the sanitary plans, if necessary.

All sanitary lines shall provide minimum separation between the sanitary and storm sewers, waterlines and other underground utilities per current Delaware County Regional Sewer District standards.

E. Step 5 – As-built plan requirements:

Please refer to Article X, Section 1004 of the Standards and the Supplemental Specifications for additional requirements for the final as-built plan requirements.

402 TITLE SHEET

A. Location Map

In addition to the Location Map, an Index Map (to scale) showing the subdivision layout shall be provided.

A sample Title Sheet (Standard Drawing) is included in **Supplemental Specifications** ~~Appendix C~~ of these **Standards** ~~Supplemental Specifications~~.

403 REQUIREMENTS

A. 4. General Summary/Table of Estimated Quantities

A sample General Summary/Table of Estimated Quantities (Standard Drawing) is included in **Supplemental Specifications** ~~Appendix C~~ of these **Standards** ~~Supplemental Specifications~~.

The quantity for Item 203, Embankment shall be based on the volume of embankment as per Standard Drawing DCED-R100. The limits to determine the embankment volume shall be measured from R/W line to R/W line.

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B. 2. f) Plan Items – Intersection and Cul-de-sac details – The intersection and cul-de-sac details shall comply with the applicable DCEO standard drawing(s) **located in the Supplemental Specifications of these Standards. See Appendix C of these Supplemental Specifications for these drawing(s).**

B. 3 d) Profile Items –The Normal Pool Elevation and 100-year pond elevations shall be shown on all applicable storm profiles.

B. 4. Cross Sections – The limits of the cross sections shall extend to the R/W line, except for cut or fill exceeding 3 feet. In this case, the cross section shall extend to meet the existing ground.

The foreslope for all cross sections shall be 4:1 or flatter. The backslope for all cross sections shall be 3:1 or flatter.

Add the following sentence to Item d)

d) Requirements for Cross-sections: **The number of cross-sections required for curb and gutter streets may be adjusted at the discretion of the County Engineer. The County Engineer should be contacted prior to starting the cross-section sheets to determine the number of cross-sections required for curb and gutter streets.**

B. 5. Drainage Structures – The use of precast wingwalls, headwalls and footings shall be at the discretion of the County Engineer. The design engineer (or precaster) shall submit proposed plan sheets, specifications and design calculations for the proposed precast units to the County Engineer for approval. Shop drawings for all precast units shall be submitted to the County Engineer for review and approval. The shop drawings shall be signed and sealed by a registered professional engineer.

B.6. Emergency Access Drive(s) - **The design of any emergency access drive(s), including, but not limited to, the pavement width, horizontal and vertical alignment, pavement cross slope, pavement composition, etc. shall be approved by the County Engineer and the respective Township Emergency Medical/Fire Department. An approval letter from the Township for the emergency access drive(s) is required to be submitted to the County Engineer prior to approval of the Final Engineering and Construction Plan.**

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C. Master Grading Plan – The master grading plan shall provide the same road stationing as shown on the Plan Sheets. All proposed mounding shall be located so that the toe of slope is a minimum of 10-feet from any adjacent property line or R/W line.

C. Master Grading Plan Item 3 - All structures used to outlet sump pumps and roof drains shall be cored. Blind taps will not be permitted. Front yard roof drains should outlet into the rear lot storm sewer system into a structure, unless there is a structure in close proximity in the front yard, or another means is found acceptable to the County Engineer. Sump pumps will be permitted to outlet into a front yard structure or the curb if a rear lot storm system is not available.

D. Detailed Retention/Detention Basins – For allowable peak runoff rates for sizing storm water basins, see Section 904.G.2 (Article IX) of the Supplemental Specifications.

E. Storm Water Tributary Map Requirements:

Following are the requirements for the Pre- and Post-Development Storm Water Tributary Maps to be included with the Final Engineering and Construction Plan.

1. Pre-Development Storm Water Tributary Map: The following items outline the basic requirements of the Pre-Development Storm Water Tributary Map of existing site conditions to be submitted with the Final Engineering and Construction Plan. The Map shall include all the items listed under Section 302 E for the Pre-Development Storm Water Tributary Map submitted with the Preliminary Engineering Plan, with the map having more engineering detail than what was provided on the Preliminary Engineering Plan map. The map shall show the overall existing pre-developed site including on-site drainage subbasins, off-site tributary basins with offsite water flowing through the site, and downstream receiving water or outlet. The map shall include the subbasin acreages, description of ground cover, overland flow paths and flow lengths, and related times of concentrations.

Supplement to Article IV

2. Post-Development Storm Water Tributary Map: The Post-Development Storm Water Tributary Map shall include all items shown on the Pre-Development Plan which are not planned to be altered or removed, and all proposed improvements affecting drainage, including but not limited to:
- a) lot lines,
 - b) streets,
 - c) surface and subsurface drainage structures, including:
 - (1) the sizes and locations of those structures in the entire drainage area, and
 - (2) the sizes, locations, types, structure dimensions and materials of those in the development area.
 - d) Proposed contours on the development area with the same interval as specified for the Pre-Development Plan (See Art. III). Proposed elevations shall also be shown at all lot corners and at break points.
 - e) Clear identification of the proposed outlet(s) for the drainage and documentation to prove its adequacy to function.
 - f) This map shall also include subbasin acreages, description of ground cover, overland flow paths and flow lengths, related times of concentrations for the Post-Developed areas, and the peak flows from the Storm Water Management Report for each of the sub drainage areas (similar to the requirements in Article III of these Standards).
 - g) Note that the combined total drainage area of the Post-Development and Pre-Development maps should agree.
 - h) In cases where existing **buildings, such as single family, multi-family, commercial, etc.** subdivisions are located directly downstream of the development along the proposed flood route, this map shall provide details of the downstream offsite

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flood route. In areas with more relief, Delaware County Auditor's two-foot contours (DALIS) may be adequate depending on the existing terrain. In some cases, additional topography data including spot elevations along the ditch bottom and on the ditch banks may need to be provided at the discretion of the County Engineer.

Where the **downstream offsite** flood route is between existing **buildings-houses** (or **routes through an existing lot, such as** through the back yards of existing **buildings-houses**), clearly indicate the location of the 100 year spillover points and label the related spillover elevations.

Please also refer to Article IX for additional minimum standards and specifications for design.

G. Road Widening, Shoulder and Ditch Improvements

1. Typical Section and Pavement Width: All road widening plans shall comply with Standard Drawing DCED R-2130. A copy of the standard drawing is included in ~~Appendix C of these~~ **the Supplemental Specifications of these Standards**. The use of clear zone grading may be required at the discretion of the County Engineer. Clear zone grading shall comply with the ODOT L&D Manual, current edition.

The pavement design shall comply with Article VII of these Standards and the ODOT Pavement Design and Rehabilitation Manual, current edition.

3. Proposed and existing road profile at the existing profile grade line: **Elevations at the edge of pavement (each side) and the centerline of the roadway (e.g. existing profile grade line) are required at 50-foot intervals. A table of the existing and proposed elevations at each point surveyed (each edge of pavement and centerline of roadway) shall be included in the Final Engineering and Construction Plans. Please see the sample Table of Pavement Elevations found near the bottom of the Design Resource Page which can be found at <http://www.co.delaware.oh.us/engineer/drpf.htm>**

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Alternate methods in lieu of a table of elevations may be permitted at the discretion of the County Engineer.

5. All driveways where the Owner has frontage along the existing County/Township Road shall be paved to the proposed R/W line (see ~~Appendix I of these~~ **Proposed R/W widths provided** in the Supplemental Specifications ~~for further information~~). All remaining driveways within the proposed road improvements shall be paved for a 5-foot length (minimum).
6. At the discretion of the County Engineer, culvert lengths will need to be determined using clear zone grading criteria as outlined in the ODOT L&D Manual, current edition.
8. Maintenance of Traffic for Road Widening Plans: All road widening plans shall provide maintenance of traffic plan sheet(s). The plan sheet(s) shall comply with the current edition of the ODOT Location and Design (L&D) Manual and the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). A plan insert sheet (Sheet Number 2010190) has been prepared by ODOT Office of Traffic Engineering that details ODOT's policy for the treatment of drop-offs that develop during construction operations. This plan insert sheet must be included with all road widening plans submitted to this office for review and approval. A copy of this plan insert sheet can be obtained from ODOT's website using the following link:

[http://www.dot.state.oh.us/traffic/DRRC/Traffic%20Control/PIS-Index/traffic plan insert sheets.htm](http://www.dot.state.oh.us/traffic/DRRC/Traffic%20Control/PIS-Index/traffic%20plan%20insert%20sheets.htm)

Temporary pavement shall be provided for any proposed work beyond the existing pavement. The temporary pavement shall comply with current ODOT CMS requirements. The County Engineer shall determine the limits of the temporary pavement.

404 COMMON ACCESS DRIVES, COMMERCIAL, INDUSTRIAL, & MULTI-FAMILY PLAN DEVELOPMENT AND APPROVAL PROCEDURE

Supplement to Article IV

During the Final Engineering and Construction Plan review, the County Engineer will determine if the project is to be placed onto the County's Drainage Maintenance Program. **The Final Engineering and Construction Plan will not be approved without Exhibit "C" incorporated into the plans. A sample Exhibit "C" is included in the Supplemental Specifications.**

For projects **not** to be on the County's Drainage Maintenance Program:

The County Engineer's Permit Department will review the plans for permits required and fees. Prior to the County Engineer signing the Final Engineering and Construction Plan, all permits and fees must be applied for and paid. These projects will be inspected and tracked by the Permit Department.

For projects to be placed **on** the County's Drainage Maintenance Program:

1. An Engineer's Estimate shall be required for only the improvements to be publicly maintained. This could include storm sewer and/or right-of-way work. **The Final Engineering and Construction Plan shall separate the items placed on County Maintenance from the items that will be privately maintained. Please refer to Article IV for additional requirements for the Engineer's Estimate. Do not include the 10% maintenance surety amount on the estimate. Please refer to the Supplemental Specifications for a sample Engineer's Estimate.**
2. Upon approval of the Engineer's Estimate, the following items are required:
 - a. Construction Surety in the amount of 100% of the costs for the publicly maintained improvements,
 - b. Owner's Agreement,
 - c. Deposit of an inspection fund in the amount of 8% of the approved Engineer's Estimate.
3. A preconstruction conference may be scheduled; the Owner will be notified during the processing of Item No. 2.
4. After the requirements of Item No. 2 have been met, the Final Engineering and Construction Plan may be signed.

Upon completion of the improvements, the project shall be inspected and a letter of remedial items shall be sent to the Owner. Upon completion of the **remedial** items, the construction surety and remaining inspection funds shall be returned to the owner. **Upon completion of these items, building permits**

Supplement to Article IV

can be released and the plat can be submitted to the County Commissioner's for approval (if applicable). The County Engineer reserves the right to alter this policy if necessary on a site-by-site basis.

At this time, the project shall be placed onto the County's Drainage Maintenance Program. Please refer to ~~Appendix H of these Supplemental Specifications~~ for further information on the Drainage Maintenance Program.

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504 CONSTRUCTION PERFORMANCE GUARANTEE

Samples of the various types of construction performance guarantees can be obtained from the County Engineer's Office.

Supplement to Article VI

601 STREET DESIGN

Add the following sentence under the heading, STREET DESIGN:

The ITE Manual, current edition, provides guidelines to determine the percentage of ADT based on AM and PM peak traffic counts. These guidelines shall be used to determine the ADT for all streets.

601 C. LOCAL STREETS

All cul-de-sacs shall be designed per the DCEO Standard Drawing provided in the Supplemental Specifications to these Standards. ~~Appendix C of these Supplemental Specifications.~~

601 I. DESIGN SPEEDS

The design speed on any arterial (major or minor), collector (major or minor), commercial or industrial street may be increased at the discretion of the County Engineer. The design speed for any existing County/Township Road shall be the posted speed limit plus 5 mph.

601 L. VERTICAL ALIGNMENT

For all open ditch streets, a minimum slope of 0.3% shall be maintained within 50-feet of the low point in a sag vertical curve.

601 O. MEDIANS AND BOULEVARDS

All medians shall be designed per the DCEO Standard Drawing provided in ~~Appendix C of these~~ the Supplemental Specifications of these Standards.

601 P. SHOULDERS – Add the following sentence to the end of Paragraph 1

Alternate guardrail types, such as wooden guardrail with steel reinforced backing, may be considered at the discretion of the County Engineer. Any alternate guardrail section proposed for use shall comply with current Federal Highway Administration (FHWA) crash testing standards for highway use.

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The following paragraphs shall be added at the end of paragraph 2

Please refer to Tables 601 to 603 for additional requirements for shoulder treatments. Standard drawings for the reinforced shoulder and graded shoulder are included in the Supplemental Specifications to these Standards. In lieu of the reinforced shoulder detail provided in the Standard Drawings, alternate shoulder reinforcement may be considered at the discretion of the County Engineer.

601 R. SIDEWALKS, BIKEPATHS, PEDESTRIAN CROSSINGS AND HANDICAP RAMPS

The ADA detectable warning system shall comply with current ADA standards and be approved by the County Engineer. Please contact the County Engineer for guidance regarding current ADA standards.

601 W. MISCELLANEOUS

~~For all ODOT curb and gutter sections a 3/8" lip shall be provided.~~
A standard drawing for a Type 2 Heavy Duty curb (modified ODOT Type 2) is included in the Supplemental Specifications to these Standards.

All utilities shall be located outside the R/W, unless approved by the County Engineer. Please refer the Delaware County Standard Drawings (Street Typical Sections) located in the Supplemental Specifications to these Standards for further information on utility locations.

TABLE 601-1

The proposed horizontal radius may be increased at the discretion of the County Engineer.

The minimum length between reverse curves on a cul-de-sac shall be 50-feet or as determined by the County Engineer.

The minimum cul-de-sac bulb radius may be increased to accommodate emergency vehicles. The design engineer will need to contact the Township Fire Department regarding their specific requirements.

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TABLE 601-2

The proposed horizontal radius may be increased at the discretion of the County Engineer.

The 27-foot wide street is permitted only when parking is restricted to one side. Parking will not be permitted on the side of the street where the fire hydrants are located.

The minimum length between reverse curves on a cul-de-sac shall be 50-feet or as determined by the County Engineer.

The County Engineer shall approve the minimum spacing of all proposed intersections (e.g., 3-way and 4-way).

TABLE 602-1

Parking will not be permitted on Minor Rural Collector Streets.

TABLE 602-2

The curbed pavement width may be reduced to 27 feet wide when parking is restricted on both sides of the street.

The curbed pavement width may be reduced to 32 feet wide when parking is restricted on one side of the street. Parking will not be permitted on the side of the street where the fire hydrants are located.

TABLE 603

The proposed horizontal radius for all commercial and industrial streets shall be approved by the County Engineer during the Preliminary Engineering Phase.

TABLE 604

The minimum curb radius (or drive approach radius) for a commercial drive is 35 feet. A larger radius may be required at the discretion of the County

Supplement to Article VI

Engineer. A standard drawing for commercial drive entrances is included in ~~Appendix C of these~~ the Supplemental Specifications of these Standards.

The median nose detailing shall comply with the DCEO standard drawing(s) ~~included in Appendix C of these Supplemental Specifications.~~ located in the Supplemental Specifications to these Standards.

602 D INTERSECTION GRADES, ELEVATIONS and PAVEMENT THICKNESSES

Intersection details (such as, maximum and minimum grades and drainage at intersections, etc.) shall ~~should~~ comply with the ODOT Location and Design Manual, current edition. A detail of the intersection design may be submitted to the County Engineer for review and approval prior to submitting the Final Engineering and Construction Plan. A standard drawing for intersection detailing is included in the Supplemental Specifications to these Standards.

602 E 1. INTERSECTION SIGHT DISTANCE

The 90-foot clear sight distance triangle is a minimum requirement. This 90-foot requirement also includes intersections of local streets (local/local) at the discretion of the County Engineer. If more than 90-feet is required to provide the required intersection (or stopping) sight distance, then this amount shall be shown on the Final Engineering and Construction Plan.

The sight distance exhibit for the intersection of the subdivision entrance street onto the existing County/Township Road, including any emergency access, shall be provided on a separate sheet within the Final Engineering and Construction Plan at the discretion of the County Engineer.

Where turn lane(s) are required to be constructed, the design shall include intersection sight distance as well as decision sight distance. Intersection sight distance shall be provided as previously discussed. Decision Sight Distance shall be provided as follows:

Decision sight distance, calculated per table 201-6E of the ODOT Location & Design Manual, shall be provided for vehicles turning left from the through road using a design speed of 40mph for a vehicle positioned in the

Supplement to Article VI

left turn lane 200' from the intersection of the centerline of the intersecting roads.

607 TRAFFIC CONTROL DEVICES AND PAVEMENT MARKINGS

After the last paragraph on Stop Signs, please add the following:

Street Naming Procedure:

Please utilize the following procedure when developing street names.

- Submit a list of proposed street names to the Map Department for review and approval. The list of street names shall be submitted to the Map Department prior to the initial submittal of the Final Engineering and Construction Plan.
- After the list of proposed names is approved by the Map Department, prepare and submit an exhibit showing street layout with approved names back to the Map Department for review.
- Any use of the subdivision name as a street name should be used for the main entrance.
- No loop street should continue across another street.
- No loop street should connect back on itself if another street intersects it within the loop.
- Submit the exhibit that is approved by the Map Department to the appropriate fire department for concurrence.

The Fire Chiefs' Association also has asked for consideration of the following items:

- Break up the naming pattern so similar sounding names are not grouped together.
- Names should be easy to spell and pronounce.

Approval of the Final Engineering and Construction Plan will be withheld until all street names have been approved by the Map Department.

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Stub Street Signage: All stub streets shall require reflective signage (minimum of 3 signs). At the discretion of the Township, a sign may be required at the end of all stub streets designating that this street shall be extended in the future, with the phone number of the township zoning inspector included on the sign.

Intersection Details: The location of stop signs, stop bars and handicap ramps shall be evaluated at each intersection to insure they comply with current OMUTCD standards.

No Parking Signs: The spacing of No Parking Signs shall comply with current OMUTCD standards. In general, No Parking Sign spacing shall be 50-feet (minimum) and 200-feet (maximum).

Schools Site(s) within a Development: The Owner shall provide a cash contribution to the Township for all school zone signs (e.g. pavement markings, cross walks, signs, etc.) if the school is not constructed as part of the development. The amount of the contribution shall be based on the costs included in the approved engineer's cost estimate as outlined in Article IV. This contribution shall be made prior to the County Engineer's approval of the final plat for the development.

Supplement to Article VII

704 Allowable Minimum Pavement Composition

The values provided in the Delaware County Residential Pavement Design Criteria Table are based on the ODOT Pavement Design & Rehabilitation Manual, current edition. If there is a discrepancy between the Delaware County Residential Pavement Design Criteria Table and the ODOT Pavement Design & Rehabilitation Manual, the higher standard shall apply.

Supplement to Article VIII

801 General

Traffic shall be maintained for all utility work within the R/W unless approved by the County Engineer. Open cuts of roadways will not be permitted except for storm sewer construction. All permits shall include a Maintenance of Traffic plan that complies with these Standards, Supplemental Specifications and the ODOT MUTCD, current edition.

802 A. Profile Grades

The profile for driveways shall be set so that the minimum clearance per the ODOT L&D Manual, current edition is provided. **The maximum and minimum slopes permitted for all residential and commercial driveways are provided on the respective DCED Standard Drawings.**

802 B. Composition

1. Non-curbed Streets - Add the following sentences to the end of Item Number 1:

For an existing drive improvement within the R/W ~~is desired~~, the following procedure shall be followed:

- 1) The Property owner (Owner) or Contractor employed by the Owner shall complete a Drive Permit Application and submit to the County Engineer's Permit Department, along with the appropriate inspection fees.**
- 2) The existing drive condition will be reviewed prior to construction by the County Engineer to determine three major concerns:**
 - a. The Owner's culvert is adequately sized, graded, and not deteriorated.**
 - b. The proposed drive grade and dimensions are appropriate.**
 - c. The proposed drive composition meets current County Standards based on drive classification.**
- 3) Where the composition of the drive is proposed as concrete in the public R/W, the Owner/Contractor shall provide a three to five feet**

Supplement to Article VIII

gap between the existing edge of the pavement and the proposed edge of concrete for the following reasons:

- a. This area will create a buffer between the concrete drive and the edge of existing pavement within the public R/W.
 - b. The Owner/Contractor is required to contact the County Engineer's Permit Department for an inspection of the forms a minimum of 24 hours prior to placing concrete in the public R/W.
 - c. The Owner/Contractor shall remove the forms, provide a compacted subgrade in the buffer area per current County Standards, and sawcut the existing road pavement when directed.
 - d. The governing authority, be it township or county, will remove the sawed asphalt when applicable and overlay this section with 2" of asphalt or match existing road composition at no expense to the Owner.
 - e. The buffer area will be maintained by the governing authority only when public road improvements are required.
- 4) When asphalt is proposed for the drive in the public R/W:
- a. Items 1) and 2) listed above apply.
 - b. No buffer area will be required. The buffer section will be constructed by the Owner. In addition, the Owner is responsible for all future maintenance of the drive.
- 5) Existing aggregate drives being top dressed do not require a permit.

802 F. Drainage, Erosion, and Sediment Control

2. Outlets from Household Sewage Treatment Systems (HSTS) or Small Flow Onsite Sewage Treatment Systems (SFOSTS): Outlets from gradient or interceptor drains from HSTS or SFOSTS are only permitted to discharge within road right-of-way or easements if these systems have written approval from the Delaware County Engineer's Office and a Permit to Install (PTI) is issued by the Delaware General

Supplement to Article VIII

Health District. Outlets from discharging HSTS are only permitted to discharge within road right-of-way or easements if these systems have written approval from the Delaware County Engineer's Office and a PTI is issued by the Delaware General Health District in compliance with NPDES requirements, or in the case of a commercial discharging system, an NPDES permit issued by the Ohio Environmental Protection Agency.

802 G. Drive Approach Locations

Drives shall not encroach into any side yard drainage easement.

Drives that use curb and gutter shall be constructed flush with the existing curb face along the public road.

All shared drives shall be installed by the Owner prior to NPA (lot split) approval by the County Engineer. For shared drives that have an asphalt surface, the NPA may be approved without the construction of the surface course of asphalt on the driveway.

802 H. Driveway Pipes

All shared drives that are part of a proposed development shall be constructed at the time the improvements in the development are built.

Drive pipes for Common Access Drives (CADs) shall be designed using local street standards.

TABLE 801
Section Requirements for Driveways

	Curb & Gutter (see note 2)	Open Ditch (see note 1 & 2)
Single or Shared (1 or 2 Residences)	6" concrete	11" 304*
		6" 304 2" 404
Common Access Drive (3 or more Residences)	8" Concrete	9" 301 9" 304 2" 404
Commercial	8" Concrete	7" Concrete 1 1/2 " 404 w/ Tack Coat (407)
		9 1/2" 301 9 1/2" 304 1 1/2" 402 1 1/2" 404
		8" Concrete

*Non improved County & Twp Roads Only

1. All Item number references (e.g. 304, 404, etc.) are listed per Delaware County Supplemental Specifications.
2. Concrete shall be Class "C" per Delaware County Supplemental Specifications.

Adopted January 22, 2008

Revised June 30, 2010

Table 802
Pavement Widths for Driveways (within Right-of-Way)

DRIVE WIDTHS (A)	
Single or Shared Approach (1 or 2 Residences) Drive Way Width	10' MIN To 20' MAX
Common Access Drive (3 Or More Residences) Drive Way Width	12' Minimum
Commercial Drive Way Width	20' MIN To 35' MAX

APPROACH WIDTH (B)	
Single or Shared Approach (1 or 2 Residences) Approach Width At Pavement	Drive Width + 2' to 5' Flair * or a 15' To 20' Radius ** on both sides of drive.
Common Access Drive (3 Or More Residences) Approach Width At Pavement	Drive Width + 5' Flair * or a 20' Radius ** on both sides of drive.
Commercial Approach Width At Pavement	Drive Width + 35' To 50' Radius on both sides of drive.

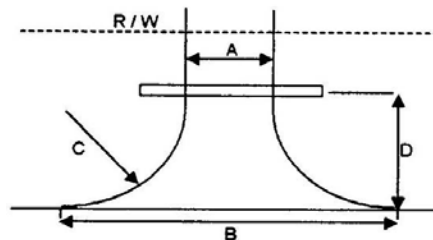
* A Flair is for applications with a speed limit 25 MPH or less. (C)

** A Radius Return is for applications with a speed limit greater than 25 MPH (C)

10' min. set back of drive pipe or to the center of ditch if greater than 10' (D)

See DCED-R2202 for a commercial approach detail.

For pipe length refer to Article 802 Sec H Pt 3.



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**TABLE 901
ACCEPTABLE METHODS OF CALULATION**

STORM WATER QUANTITY					
		PEAK DISCHARGE AND TOTAL RUNOFF VOLUME		STORAGE VOLUME	
Drainage area (acres)	Peak discharge only	Homogeneous	Non- homogeneous	Homogeneous	Non- homogeneous
Less Than 200	Peak Discharge	Peak Discharge	(*) Tabular Hydrograph	Graphical	(*) Storage- Indication
200 to 640	Peak Discharge	Peak Discharge	(*) Tabular Hydrograph	Graphical	(*) Storage- Indication
Greater Than 640	(*) Tabular Hydrograph	(*) Tabular Hydrograph	(*) Tabular Hydrograph	(*) Storage- Indication	(*) Storage- Indication

(*) **Note:** the “Tabular Hydrograph” and the “Storage-Indication” methods are preferred and are normally used to check drainage calculations submitted to the County Engineer.

METHOD REFERENCES:

Graphical and Storage Indication: Mid-Ohio Regional Planning Commission (MORPC), Stormwater Design Manual, current edition

Peak Discharge and Tabular Hydrograph: U.S. Department of Agriculture, **National Resources Conservation Services (NRCS)** Soil Conservation Service (S.C.S.), Urban Hydrology for Small Watersheds, Technical Release No. 55, current edition.

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**TABLE 902
DESIGN COEFFICIENTS FOR ROADWAY CULVERTS**

TYPE OF STRUCTURE	MANNING'S ROUGHNESS COEFFICIENT (n)	LOSS ENTRANCE COEFFICIENT (Ke)
CONCRETE PIPE	0.012	0.2
BOX CULVERT	0.012	0.2 to 0.5
FLAT TOP & THREE- SIDED ARCH CULVERTS	0.03 to 0.05	0.2 to 0.5

This table applies for culvert crossings only and is not applicable for storm sewers.

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TABLE 903

THERMOPLASTIC PIPE FOR STORM SEWER & CULVERT				
APPLICATIONS				
(SEE NOTE 4)				
Type	Minimum Depth below Subgrade Type A & B (See Note 1)	Minimum Depth below Top of Ground Type C (See Note 1, 2, and 3)	Minimum Depth below Top of Drive Type D (See Note 3)	Maximum Depth (See Note 2)
ODOT 707.33 Or COC 720.12	Plastic Pipe not permitted for Type A applications, nor under the pavement for Type B applications.	18" for pipes less than 60" in diameter (See Note 1, 2 & 3); 24" for pipes 60" diameter and larger (See Note 1, 2 & 3)	12"	20'

1. Delaware County Engineer's Design, Construction and Surveying Standards Manual, Current Edition (Article IX, Section 904, B., 4).
2. ODOT Location and Design Manual, Volume 2, Current Edition (Section 1008.3).
3. Manufacturer's Recommendation (i.e. minimum cover 12" for pipes less than 60" diameter; 24" cover for pipe diameters 60" or larger).
Cover is measured from top of ground to top of pipe.
4. Types A, B, C and D as defined in ODOT Construction and Materials Specifications (CMS) are shown. Use of Types E and F as defined in ODOT CMS may be required at the discretion of the County Engineer, and shall comply with ODOT 707.45 or COC 720.08. Definitions for Types A through F per the ODOT CMS shall apply to the City of Columbus (COC) CMS.

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Article IX – DRAINAGE DESIGN STANDARDS

901 ADEQUATE DRAINAGE OUTLET –Add the following sentence to the end of the second paragraph:

Two copies of the video tape shall be submitted to the County Engineer with the Preliminary Engineering Plan submittal.

902 Drainage Easement

A. Drainage easements shall be provided for all areas where offsite water passes across or through a parcel.

903 A. Acceptable Methods of Calculation

See Table 901 of the Supplemental Specifications for Acceptable Methods of Calculation.

For drainage calculation requirements, see Section 904.G.2 of the Supplemental Specifications.

903 B. Design Storms

1. Runoff Numbers and CN Factors: In undeveloped areas, a runoff number of CN=77 shall be used as a maximum for on site predevelopment. In other cases, the appropriate “CN” factor may be determined by using Technical Release No. 55 [National Resources Conservation Services (NRCS)] (S.C.S.) current edition, and its Ohio Supplement, current edition. The post developed runoff number cannot exceed 79 for low density developments. Detention/Retention ponds shall use a CN of 98 ~~90 or greater~~. CN values used for all conservation subdivisions shall be approved by the County Engineer at the Preliminary Engineering Plan phase.

903 C. Drainage Area Determination

Please refer to the Supplement to Article IV, Section 403 E., Storm Water Tributary Map Requirements.

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The USGS website <http://water.usgs.gov/osw/streamstats/ohio.html> may be used as a preliminary aid in determining watershed characteristics for the site.

903 D. 3. Intent in Providing Flood Routing Paths:

In cases where existing buildings, such as single family, multi-family, commercial, etc subdivisions are located directly downstream along the proposed flood route, details of the downstream offsite flood route must be provided. Also see Article IV of the Supplemental Specifications.

9. Flood Route Calculation/Capacity:

The weir formula = $CLH^{1.5}$ shall be used unless otherwise approved by the County Engineer.

903 I. Temporary Sediment Basins was incorrectly labeled. It should be labeled 904 I. This section has now been moved to Section 904 I.

904 A. Roadway Culverts: ~~This section is now part of Appendix A. Conduit types are limited to those specified in the Supplemental Specifications of these Standards.~~

904 A. 3. Structure Types: Culvert sizes for precast three-sided and four-sided structures shall be limited to those provided in the ODOT L&D Manual, current edition. The design (e.g., foundation and footing design, allowable live load, cover limitations, wingwall design etc.) of all precast three-sided and four-sided structures shall comply with the ODOT L&D Manual, current edition (Section 1008).

904 A. 5. Inlet Elevation: The flowline elevation at the culvert inlet ~~should~~ shall be set deep enough to provide an adequate outlet for future storm sewer and/or channel improvements upstream. The County Engineer shall provide final approval of the proposed flowline elevation(s). For structures that encounter a rock or unyielding

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foundation, additional excavation and granular material shall be provided at the direction of the County Engineer.

904 A. 6. Design Storm Frequency (Roadway Culverts):

The minimum storm frequency to be used shall be as follows:

- a. Local Streets - Ten (10) year
- b. Minor Urban Collector Streets - Twenty-five (25) year
- c. Minor Rural Collector, Major Collector, and Minor and Major Arterial Streets – See ODOT L&D Manual, Current Edition for ~~Design Storm Frequency~~ Frequency

904 A. 8. Minimum Cover to Subgrade:

A preliminary profile of all culvert crossings under the proposed R/W is required at the Preliminary Engineering Plan submittal (See Appendix to Article III) to insure adequate cover is provided. It is the County Engineer's intent to provide the minimum cover. If the site conditions, e.g. flat terrain, shallow depth outlet, etc. require a cover depth less than the minimum, a variance can be requested. The variance shall be requested as part of the Preliminary Engineering Plan submission.

904 A. 11. Headwater Elevations:

The maximum allowable headwater elevations shall comply with the ODOT L&D Manual current edition. (~~Vol. 2, Drainage Design, Sections 1004—1006~~).

The finished floor elevations of all structures upstream of the culvert must be shown on the plan.

The hydraulic calculations for all roadway culverts shall comply with the ODOT L&D Manual, current edition.

904 B. 3. Design (Storm Sewers):

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All storm sewer systems are to be designed using the Manning's Equation.

Storm sewer tributary maps shall be included in the storm water management report.

904 B. 3. Combination of Storm Sewer and Open Ditch (Minimum Design Criteria):

If a combination of a storm sewer and open ditch are used to convey storm flow, the minimum storm sewer size shall comply with these Standards and Supplemental Specifications. The ditch may be sized for the design year storm flow minus the flow conveyed in the storm sewer. Credit for up to the 10-year storm will be considered for the storm sewer. The 100-year storm elevation shall be checked for the ditch to insure no property damage occurs. Please refer to Article IX, **Section** 904 A. 11. for further information regarding the flooding of property.

904 B. 4. Material (Storm Sewers):

Requirements for thermoplastic pipe shall be per Table 903.

The following paragraph is now part of Appendix A.

~~The Material Section is revised as follows (*in italics*):~~

~~**Material:** The storm sewer material shall meet the requirements of these Standards (See Art. II, Sect. 203) and the Supplemental Specifications to these Standards. No plastic pipe (*ODOT 707.33, COC 720.12, etc.*) shall be permitted under the pavement. Where plastic pipe is used, 100% of the pipe will be mandrelled 30 days after installation. At the end of the maintenance period, all plastic pipe shall be mandrelled again. All plastic pipe failing the mandrel test shall be retested and/or replaced per these Standards and Supplemental Specifications.~~

904 B. 7. Pipe Junctions:

The use of manholes at curb inlets must be approved by the County Engineer. A special casting is required for this application. Please refer to the DCEO standard drawing(s) located in the Supplemental Specifications.

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The allowable angle (measured from centerline of curb inlet to centerline of pipe) for a pipe entering a curb inlet shall be as shown in the drawing provided at the end of this supplement.

<u>Pipe Diameter (inches)</u>	<u>Pipe Angle (degrees)</u>
12	47.5
15	57.6
18	65.8
21	72.8

904 B. 13. Pipe Roughness Coefficient (n):

The pipe roughness coefficient of $n = 0.015$ should be used to account for head losses, etc. unless otherwise approved by the County Engineer.

904 B. 14. Minimum Cover to Subgrade:

A preliminary profile of all storm sewers crossings under the proposed R/W is required at the Preliminary Engineering Plan submittal (See Appendix to Article III) to insure adequate cover is provided. It is the County Engineer's intent to provide the minimum cover. If the site conditions, e.g. flat terrain, shallow depth outlet, etc. require a cover depth less than the minimum, a variance can be requested. The variance shall be requested as part of the Preliminary Engineering Plan submission.

The minimum cover for all pipes outside the R/W is 1.5 feet.

904 B. 16. Minimum Velocity (Storm Sewers):

The minimum pipe slope shall ~~comply with the following~~ to provide a minimum velocity of 3 fps. **A chart is provided at the end of this supplement that shows the minimum pipe slope for pipe sizes ranging from 12" to 48". The following values are based on $n = 0.012$:**

<u>Pipe Dia.</u>	<u>Slope</u>
(inches)	(percent)
12	0.37
15	0.28

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18	0.22
21	0.18
24	0.15
27	0.13
30	0.11
33	0.10
36	0.09
42	0.07
48	0.06

904 C. 2. Drainage (Maintenance) Easements (Open Water Courses):

These easement widths shall be not less than fifteen (15) feet in width on each side (bank). This distance is measured horizontally from the top of the bank, exclusive of the width of the ditch, channel, etc. Maintenance easements are to be kept free of obstructions. Final determination of the easement width is subject to approval by the County Engineer.

904 C. 3. Plan Approval Requirements for all Open Water Courses:

The following information shall be included in the Final Engineering and Construction Plan for all open watercourses:

- a) Complete hydraulic computations shall be submitted to the County Engineer for review and approval, including low flow analysis.
- b) Adequate erosion protection is to prevent erosion at times of peak flow. The type of erosion protection shall comply with these Standards and Supplemental Specifications.
- c) All open watercourses shall be placed on the County's Drainage Maintenance. This is done through a ditch petition process as set forth in the Ohio Revised Code. A copy of the procedure is in

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the Supplemental Specifications of these Standards.

904 C. 4. a) Design Storm Frequency – The 100-year storm shall be checked to insure no property damage occurs. Please refer to Article IX, **Section** 904 A. 11., for further information regarding the requirements for flooding of property.

904 C. 4. b) Design Flow – The design flows shall be calculated using the ODOT Location and Design Manual, current edition.

904 C. 4. d) Minimum Slope – At the discretion of the County Engineer a modified ~~ditch~~ channel section may be required for any ~~ditch~~ channel with a slope of less than 0.4%.

904 E. Curb Inlet

Curb inlet capacity and spread of water calculations shall be included in the storm water management report. Curb inlets shall be located at or near the lowest point of a sag.

904 G. 1. Storm Water Management Retention/Detention Facilities:

For **Storm Water Management** ~~detention/retention~~ requirements for Conservation Subdivisions, the ~~detention/retention~~ requirements shall be determined on a case-by-case basis (100 year post-development peak discharge released at the 2 year predevelopment peak discharge, or matching storm for storm depending on the specific case). The County Engineer shall make the final determination as to which release rate shall be required.

For sites which contain multiple sections and/or phases, the County Engineer shall determine the **Storm Water Management** ~~detention~~ requirements for each section and/or phase.

Use of existing streams as **Storm Water Management** ~~detention~~ facilities shall only be permitted if approved by the Army Corps of Engineers, Ohio EPA and ODNR.

The maximum depth of detention in parking lots is 12 inches. The County Engineer may limit the depth of detention in parking lots to less than 12 inches if site conditions dictate a shallower depth. The maximum rooftop storage is 3 inches.

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For ~~Large Commercial and Mixed-Use Developments~~ sites with multiple lots, such as a large commercial site (e.g., larger commercial lots with smaller outparcel lots), a mixed-use site (e.g., a combination of commercial, office, multi-family), etc. the use of centralized basins are encouraged. In general, basins will be required for each watershed within the development. Centralized basins are required for sites which will be publicly maintained through the drainage maintenance petition process. The peak discharges for the post-development 100-year storm, predevelopment 2-year storm as well as any other peak storm discharges required by the County Engineer shall be provided for each lot or outparcel on a summary master storm water plan exhibit. **This exhibit shall be included in the final Storm Water Management Report.** The design engineer is ~~encouraged~~ **required** to contact the County Engineer prior to preparing the final Storm Water Management Report to discuss the detention requirements for the site.

904 G. Retention and Detention Facilities

2. a) (1) Design Criteria –Release rates:

Calculations shall be provided for each surface and subsurface drainage structure for the pre and post-developed condition. The rational method shall not be permitted for determination of storage volume.

1. Low Density Residential only - The peak rate of runoff under post-development conditions shall not be greater than the peak runoff rate from an equivalent size storm under predevelopment conditions over the entire development area. Consideration of the one (1), two (2), five (5), ten (10), twenty-five (25), fifty (50), and one-hundred (100) year frequency, twenty-four (24) hour storms shall be considered adequate in designing and developing to meet this standard.
2. Medium and High Density Residential and All Commercial, Multi-Family and Industrial - The post-development one-hundred (100) year frequency, twenty-

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four (24) hour storm peak rate of runoff shall not be greater than that of the pre-development two (2) year frequency, twenty-four (24) hour storm peak rate of runoff over the entire development area. Calculations for other storm frequencies (e.g., one, five, ten, etc.) for the predevelopment and post-development conditions shall be required at the discretion of the County Engineer. The determination of the allowable release rate must be based on the density of each specific section, phase or part of the project, even if section, phase or part lines are added after approval of the Final Engineering and Construction Plan has been made. Using an overall density calculation for the entire subdivision/project to determine the allowable release rate will not be permitted.

3. The design criteria for the DESC permit may be more restrictive than the requirements in this section. Please refer to Article XII of these Standards.

904 G. 2. a) (2) Times of Concentration: Times of Concentration for Residential, Multi-family, Common Access Drives, Commercial, Industrial, and Mixed Developments for sizing detention/retention ~~ponds~~ **facilities** shall be as follows (with the exceptions listed below):

Times of Concentration shall be calculated by the procedures used in Table 901 (Acceptable Methods of Calculations) with the exception that the maximum sheet flow length used shall not be greater than 100 feet.

The following paragraph was moved to 904 G. 1.

~~For Large Commercial and Mixed Use Developments the use of centralized basins are encouraged. The peak discharges for the post-development 100-year storm, predevelopment 2-year storm as well as any other peak storm discharges required by the County Engineer shall be provided for each lot or outparcel on a summary master storm water plan exhibit. The design engineer is encouraged to contact the County Engineer prior to~~

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~~preparing the final Storm Water Management Report to discuss the detention requirements for the site.~~

904 G. 4. a). Design Specifications – Detention Area Surface:

The surface of a detention area shall be constructed with sufficient slopes (minimum of: 2% - grassed surfaces, 1% - paved surfaces, and 0.5% - paved channels) to drain properly so that all the runoff is removed following a storm. In lieu of a paved channel, **the basin shall be detailed per the current DCEO Standard Drawing.** ~~the surface of detention basins shall have perforated pipe (6" min. diameter) with an adequate outlet, placed beneath the surface to keep the bottom of the basin dry during low flow periods. The County Engineer shall approve the size, number of perforated pipes, and outlet elevation.~~

904 G. 4. b). Design Specifications – Maximum Depth of Ditch:

The maximum depth of the ditch shall be limited to three (3) feet. If perforated pipes are used, the need for a ditch will be determined by the County Engineer.

904 G. 4. d). Design Specifications – Maximum basin side slopes:

- (1) For a detention facility slopes shall be no steeper than 4:1, and
- (2) For a retention facility, the slopes shall be 4:1. The minimum depth of the normal pool water level to the bottom of the side slope shall be 2 feet. A safety bench is **recommended** ~~required~~ for retention facilities. The bench shall **be detailed per the current DCEO Standard Drawing.** ~~a minimum of 5 feet in width and be located 2.5 feet below the normal water elevation.~~ The bench shall be provided around the entire perimeter of the retention facility. ~~Slopes as steep as 2:1 are permitted below the safety bench as long as erosion control mats or~~

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~~other means acceptable to the County Engineer are provided.~~ A standard drawing for detention and retention ponds is included in ~~Appendix C~~ of the Supplemental Specifications.

904 G. 4. e). Design Specifications – Freeboard:

Provide a minimum of 1’ of freeboard above the 100 year flood on all basins.

904 G. 4. f). Design Specifications – Method for Determining Rock Channel Protection Requirements:

See ODOT L&D Manual current edition (~~Figure 1107-1~~) for determining required rock type and minimum box out depth to be shown on the plans (based on velocity at pipe outlet). Please also refer to **the Supplemental Specifications Appendix E** (Design Aids) for further information.

The following information from **the ODOT L&D Manual current edition** ~~Figure 1107-1~~ is repeated here simply as a courtesy.

Legend

Area on graph	Minimum Boxout Depth to be shown on plans	Rock Type
Area 1	48” minimum depth of 18” rock	A
Area 2	36” minimum depth of 18” rock	A
Area 3	30” minimum depth of 12” rock	B
Area 4	18” minimum depth of 6” rock	C

The use of Type A Rock must be approved by the County Engineer. The rock channel protection shall not protrude above the top of the ground surface. Other erosion protection

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methods, such as paved concrete mats, may be used at the discretion of the County Engineer. Paved concrete mats shall be used where storm water management facilities are located near a parking lot, etc.

904 G. 4. g). Design Specifications – Debris-Control Structures:

The procedure recommended for use is the Hydraulic Engineering Circular No. 9, available from the Superintendent of Documents, U.S. Government Printing Office, Washington DC.

904 G. 4. j). Design Specifications – Maximum height of water in Detention Facilities:

The height should be limited to three (3) feet. If provisions for safety of children near the detention basin are provided, a variance to increase the height may be considered. The County Engineer shall review and approve the proposed safety measures. In no case shall the height exceed six (6) feet.

904 G. 7. Design Specifications – Existing Pond Investigation Requirements:

When existing pond(s) are proposed to become part of a storm water control system to be incorporated into a development that will have the storm water control system maintained by the Delaware County Engineer's Office (DCEO) and/or the Delaware Soil and Water Conservation District (DSWCD), a geotechnical report containing the following information must be submitted for evaluation by DCEO and DSWCD:

Subsurface Investigation:

1. The geotechnical report shall include photos of existing pond(s) and detailed boring locations. **The location of the borings shall be approved by the County Engineer prior to the work being completed. The County Engineer shall be contacted a minimum of 3 business days prior to the time the borings are to be completed so a representative from the County Engineer's Office is present during this work.**

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2. Discuss the current conditions, including presence of trees, inlet/outlet structures, etc.
3. Include a proposed usage description outlining any changes, including increased embankment height, inlet/outlet structures, pump station, etc.
4. Provide standard penetration borings along every 400 feet of existing embankment with a minimum of two borings on the downstream side. In addition, a minimum of one boring should be drilled on all other existing embankments.
5. There shall be continuous sampling through embankments and 2-1/2' sampling below the original ground surface.
6. More borings may be needed if unsuitable materials are encountered.

Laboratory Testing and Analysis:

1. Samples must be classified by a geologist or geotechnical engineer based upon the Unified Classification System according to ASTM D2488.
2. There shall be hand penetrometer readings taken on every cohesive sample.
3. Press tube samples shall be taken for existing embankments and the following testing performed:
 - Unconfined compression
 - Unit weight
 - Moisture contents
 - Grain-size analysis
 - Atterberg limits
 - One point proctor
 - Loss on Ignition (at 750°C) if organic material is encountered
4. Each soil strata not sampled by press tubes shall have the following testing performed:
 - Atterberg limits
 - Moisture contents
 - Grain-size analysis

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- Loss on Ignition (at 750°C) if organic material is encountered
5. If topsoil or organic material is encountered, quantify thickness and perform Loss on Ignition at 750 degrees Celsius.
 6. Retain all samples for review.
 7. Perform seepage analysis on the existing embankments as it affects storm water detention time.
 8. Perform stability analysis on the existing embankments.
 9. Discuss how the requirements of Article IX, Section 904 pertaining to the internal pond safety bench will be addressed. This applies to ponds that have dwelling units contiguous to them. Isolated ponds (e.g. golf course ponds) will not be subject to this requirement.
 10. If there are trees and/or stumps on the existing embankments, they must be identified for removal, including the root system, and backfilled with suitable soils that are compacted to 95% Proctor.
 11. The report shall contain the recommendations and signature of an Ohio Registered Professional Engineer.
 12. Three copies of the report shall be submitted to DCEO for review and comment. One copy of the report on CD (PDF format) shall also be provided.

The following paragraph has been relocated from Section 903:

~~903~~ 904 I. Temporary Sediment Basins

For projects that require temporary sediment basins to be maintained beyond the one-year maintenance period, the County Engineer shall require the Owner to provide a cost estimate for these future improvements. The cost estimate shall include all proposed work, including all future grading, future pipe installation, etc. The estimate shall use the current Delaware County Unit Prices per the County Engineer's website. This estimate will be reviewed and approved in conjunction with final engineering plan approval by the County Engineer. The Owner shall provide a bond for the costs associated with the temporary sediment basins. This bond shall not expire until the temporary sediment basins are removed. No letters of credit will be accepted.

904. G. Storm Water Management (Retention and Detention) Facilities

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4. 1) Miscellaneous - Additional requirements for all proposed and existing **Storm Water Management (Retention and Detention) Facilities** ~~PONDS~~ are as follows:

1. A clay core of sufficient thickness is required for all detention and retention ponds in cut areas. The County Engineer shall field approve the core thickness or the condition of the existing soils as a substitute for a clay core (e.g., existing clay material).
2. Anti-seep collars are required for all pond outlets. A minimum of two collars are required. A Standard Drawing for the anti-seep collars is included in Appendix C of these Supplemental Specifications.
3. Outlet pipe slope shall be limited to 4 percent.
4. Maximum Embankment slope is 4:1 in the vicinity of the outlet structure for maintenance purposes.
5. Trees and landscaping shall not be permitted on embankment surfaces.
6. Requirements for Pre- and Post- Development Storm Water Tributary Maps. Please see Section 403 E for additional requirements.

The following Item is now part of Section 904 G. 1 of this supplement.

7. ~~For Large Commercial and Mixed Use Developments~~ sites with multiple lots, such as a large commercial site (e.g., larger commercial lots with smaller outparcel lots), a mixed use site (e.g., a combination of commercial, office, multi-family), etc. the use of centralized basins for detention/retention are encouraged. The design engineer should shall contact the County Engineer to discuss the design concepts during the Preliminary Engineering Plan phase. See 904 G. 1 of this supplement.

904. J. Orifice Plates:

1. Vertical orifice plates cannot be attached to endwalls.
2. Horizontal orifice plates shall be approved by the County Engineer. The area of horizontal orifice shall not be less

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than 1.4 square feet. Horizontal orifice shall be located on outside top of structure (i.e. clearly visible for maintenance and debris removal).

BASIN DATA

A. STORM EVENT RELEASE RATES FOR BASIN NO. _____

STORM EVENT	(A) OFFSITE FLOW (PASS THROUGH) FLOWS * ROUTED THROUGH BASIN, IF ANY, (CFS)	(B) ONSITE POST-DEVELOPED PEAK DISCHARGE (CFS)	(A+B) TOTAL ONSITE & OFFSITE DISCHARGE ROUTED TO BASIN (CFS)	(C) ONSITE PRE-DEVELOPED PEAK DISCHARGE (CFS)	(D) ALLOWABLE ONSITE RELEASE RATE (CFS)	(E=D+A) ALLOWABLE BASIN RELEASE RATE INCLUDING OFFSITE FLOWS (CFS)	(LESS THAN E) DESIGN RELEASE RATE (CFS)	PONDING ELEVATION FOR GIVEN STORM (FEET)
1 YEAR								
2 YEAR								
5 YEAR								
10 YEAR								
25 YEAR								
50 YEAR								
100 YEAR								

* NOTE TO DESIGNER: WHERE BASINS INCLUDE OFFSITE FLOW AND ARE TO BE UTILIZED TO MEET WATER QUALITY, OFFSITE AREAS MUST BE INCLUDED WHEN CALCULATING REQUIRED WATER QUALITY VOLUME.

B. BASIN VOLUMES AND RELEASE RATES BASED ON ELEVATION FOR BASIN NO. _____

ELEVATION (FEET)	BASIN STORAGE VOLUME (CU FT)	CUMMULATIVE STORAGE VOLUME (CU FT)	DISCHARGE RATE AT GIVEN WATER SURFACE ELEVATION (CFS)

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1001 GENERAL STANDARDS

The process for preparing a no-plat subdivision (lot split) is outlined in a flow chart contained on the County Engineer's website. A checklist for preparing a no-plat subdivision is included in the Appendix E of these Supplemental Specifications.

B. Plat Approval: The County Engineer's Map Department approves all new street names. Please refer to the Appendix for Article VI for the street naming procedure adopted by the County Engineer.

Three copies of the final plat shall be submitted to the County Engineer for approval. The County Engineer will include comments from the Map Department as part of the final plat review comment letter (if applicable). The County Engineer shall have 14-days to review the final plat.

1003 PROPERTY AND PLAN SURVEYING

Add the following sentence to Section B, Item 5.

B. 5. Approval of the Individual DESC permit for the lot will not be released until all the iron pins for the lot are set. Setting of such markers may be made after construction of the house and final lot grading at the discretion of the County Engineer.

1004 PLAT AND FINAL AS-BUILT PLAN REQUIREMENTS

Add the following items to Section C:

C. 2. All drainage easements required for the storm water facilities maintained by Delaware County shall be approved by the County Engineer and recorded prior to acceptance of the as-built plan.

C. 4. The plan view (Basin Proof Survey) submission is required for all projects, and shall be approved by the County Engineer before DESC permits (General and/or Individual) will be released.

C. 5. Add the following to the end of the first paragraph:

The following as-built information shall be submitted to the County Engineer:

- **Top of casting shall be submitted for all storm structures.**
- **Station and offsets for all storm structures and culverts.**
- **Invert elevations all storm structures and culverts.**
- **As-built radii for all horizontal curves.**

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- As-built radii for all cul-de-sacs.
- Flood Route Verification (all)
- Grading Plan
- Sight Distance Exhibit
- Basin Proof Survey Verification Letter
- Emergency Access – Alignment, Profile, Drainage, Composition, etc.

Add the following to Section C. 5. a): The County Engineer may request the final as-built plans be submitted in AutoCAD format. At the discretion of the County Engineer, an electronic file containing the station and offset (or GPS coordinates) for all structures shall be included with the as-built information.

1005 ENGINEERING AND TOPOGRAPHIC SURVEYING

Add the following to Section C. “As-built” Surveys:

The County Engineer may require as-built information to be provided in a format compatible with current GIS standards/technology.

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1202 GENERAL SPECIFICATIONS

Sumps shall not be permitted in catch basins.

1203 GENERAL DESC PERMIT PROCESS

6. Erosion and Sediment Control Surety

Temporary Sediment Basins – See Supplemental Specifications, Article IX for further requirements.

VIDEO TAPING OF EXISTING CONDITIONS WITHIN THE PROJECT LIMITS

For the purpose of documenting the existing conditions at the site prior to the proposed construction, the contractor shall perform a video inspection of the existing conditions within the entire project limits. The owner shall be responsible for all incurred video taping costs.

The inspection shall be video recorded and shall meet the following requirements:

All video recording shall be done in color on VHS ½ inch tape cassettes or digital DVD's. The recording shall be of high quality, in good focus, and have adequate lighting. The footage from the video shall be steady, clear, and not shaking. The view shall be clear of water drops or condensation building up on the lens.

The recording tape or DVD shall be clearly labeled with the project name, location, township, developer's name, subdivision or street name, date of the video, along with the name and address of the company who prepared the video.

The beginning of the video shall include a vocal description of the above information as well as a brief description of the proposed project and the existing areas to be affected by the project. Showing an overall plan and zooming in on and along the detailed areas of the project would be helpful for those viewing the tape to understand where the area where the footage is filmed.

Starting at the beginning of the project, the video shall show the existing conditions along the entire project including the limits of construction up to the end of the project. The video shall show continuous coverage of the project and not skip any areas. The recording shall be augmented with audio voice recording describing what is being seen and approximately where on the site the area or item being viewed is located. (Example: "This is an existing storm manhole located at Sta. 101+75 approximately 70 feet north of the centerline of the proposed road and approx. 150 feet east of a mail box located at 202 Delaware Street", etc.). The voice shall be clear, concise, and loud enough to overcome any background noise from machinery or equipment.

If filming is done from a moving vehicle, the footage shall be dampened from the oscillation (or shaking) of the vehicle. Also, the video shall not be taken at a speed faster than 5 miles per hour. Inferior quality video will not be accepted by the County.

The video shall document all existing man-made structures such as roads, bridges, driveways, sidewalks, mailboxes, trees, fences, buildings, bushes, landscaping, and other items within the project limits. All visible existing utilities such as electric, telephone, water, sewers, and gas lines shall be filmed. The video shall also show all existing ditches, drainage swales, storm sewers and structures, and visible drainage tiles. Any unusual feature shall also be filmed.

The contractor shall provide 2 copies of the VHS tapes or DVDs in labeled protective cases to the Delaware County Engineer's Office.

Payment for video taping of existing conditions within the project limits shall be included with Item Special, Video Taping of Project Site.