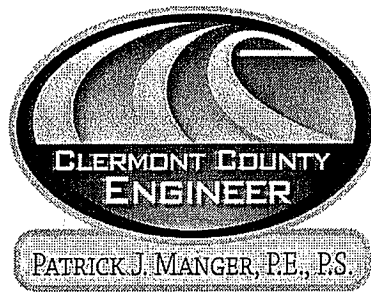


**SUBDIVISION STREET DESIGN AND CONSTRUCTION STANDARDS
FOR
CLERMONT COUNTY, OHIO**



ADOPTED BY THE

Clermont County Board of Commissioners

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ARTICLE 1
CONSTRUCTION PROCEDURE AND MATERIALS

SECTION 100 - GENERAL

- A. Unless otherwise stated in these regulations, the following accepted standards will be enforced by the Clermont County Engineer's office during the review and inspection of all new infrastructure:
- 1) State of Ohio, Department of Transportation, *Construction and Material Specifications*, current edition.
 - 2) Ohio Department of Transportation, *Location and Design Manual, Volumes I and II*, current edition.
 - 3) Ohio Department of Transportation, *Roadway Standard Construction Drawings*, current edition.
 - 4) Ohio Department of Transportation, *Ohio Manual of Uniform Traffic Control Devices*, current edition.
 - 5) Clermont County, Ohio, *Water Management and Sediment Control Regulations*, current edition.
- B. **PRECONSTRUCTION MEETING** - Prior to the start of any/all construction activities, a preconstruction meeting must take place with representatives of the Clermont County Engineer, the Clermont County Sewer and Water District, and the Clermont County Building Department.
- C. **FEE SCHEDULE** - Plan review fees and construction inspection fees are required. The schedule of plan review and inspection fees may be obtained at the Clermont County Engineer's Office or Clermont County's Permit Central. An additional fee will be collected to cover the cost of videotaping the storm sewer system. The fee will be based upon the County's current videotaping contract.
- D. **INSPECTIONS** - Representatives of the Clermont County Engineer's Office shall make Inspections during the installation of improvements to insure conformity with Subdivision Street Design and Construction Standards for Clermont County, as well as, other Clermont County Standards and Specifications.
- E. **MATERIAL TESTING** - Testing of materials shall be performed by an approved geotechnical firm to insure conformity with Subdivision Street Design and Construction Standards for Clermont County. A minimum of twenty-four (24) hour notice shall be required prior to inspection work. The Clermont County Engineer's Office will be responsible for all concrete and asphalt testing unless otherwise specified.
- F. **SOILS** - All soils testing are to be the responsibility of the contractor. An independent geotechnical firm will determine the maximum dry density and percent of compaction. Compaction testing must be performed by a geotechnical firm approved by the Clermont County Engineer prior to testing procedures. While embankment operations are being conducted, the geotechnical firm shall visit the site no less than twice each day (morning and afternoon) to perform necessary compaction tests. The contractor is responsible for supplying the inspector with copies of the test results weekly. From October 1 to April 15, compaction tests on subgrade are required but may be requested anytime during the year by the inspector if they have determined that the tests are needed or if subgrade is questionable.

SECTION 101 - MATERIALS

All work and materials shall conform to the Ohio Department of Transportation Construction and Material Specifications or as otherwise stated within.

SECTION 102 – EARTHWORK

A) EMBANKMENT/EXCAVATION

- (1) All embankment/excavation activities shall adhere to Item 203 of the ODOT Construction and Material Specifications; and as stipulated below:
- (2) All areas in which fill material is to be placed shall be free of unsuitable material.
- (3) The material being used for fill must be free of organic and frozen material.
- (4) The fill shall be placed and compacted in 8 inch lifts.
- (5) If the slope of the existing ground meets or exceeds 8:1, benching is required per ODOT Item 203.05.
- (6) Each lift must be compacted at not less than 98% of the maximum dry density of the soil being compacted.

B) SUBGRADE

- (1) The sub-grade under new pavement and paved shoulders must be free of all organic material to a depth of 24 inches below the surface of the subgrade and to a width of 18 inches beyond the edge of the surface of the pavement or to the back of curb and gutter. Bridging of unsuitable material must be approved by the Clermont County Engineer or a designated representative, prior to construction of and compaction of the subgrade.
- (2) The subgrade surface shall be compacted to not less than 98% of the maximum dry density of the compacted soil (standard proctor) and sealed by using a steel drum roller with a minimum compaction rate of 10 tons. As an alternative, a loaded tandem axle truck or pan shall be utilized to proof roll the subgrade, which shall be witnessed and approved by the Clermont County Engineer or designated representative.
- (3) Soil stabilization techniques will be permitted by the Clermont County Engineer pending written approval from the Clermont County Engineer prior to any construction activities. The applicant must submit the type of soil stabilization and the pertinent calculations with his/her permit request. It is recommended that hydrated lime not be used and that an alternative material be utilized since air born hydrated lime is a respiratory hazard.

- C) **GROUNDWATER** – The presence of groundwater or impermeable native soils may necessitate the use of underdrains or other approved methods to allow for proper subgrade drainage, as determined by the Clermont County Engineer.

SECTION 103 - BASE

- A. **ITEM 301 ASPHALT CONCRETE BASE**- This base must meet ODOT gradation and bitumen content (4 - 8 percent). The minimum temperature of the base when delivered to the paver is to be 250° F. The minimum surface temperature of subgrade is to be 36° F when paving 3 to 6 inches in depth. Base may not be placed on soft and/or frozen subgrade.
- B. **ITEM 304 AGGREGATE BASE**- This base must meet ODOT gradation. The maximum compacted layer shall be 6 inches. Water will be added to bring the base to optimum moisture prior to compaction. The county engineer's inspector shall perform a base grade check before the leveling course of asphalt can be placed. All roadway sections utilizing Item 304 Aggregate Base shall require the use of Item 605 - Shallow Pipe Underdrains to adequately drain the aggregate base. The Clermont County Engineer reserves the right to specify the use of an aggregate base typical section (with

underdrains) in areas that exhibit poor drainage. See Typical Sections for details.

- C. **GENERAL-** A steel drum roller with a minimum compaction rate of 10 tons shall be used to compact the base. The compacted finish is to be within ½ inch of the proposed elevation. The maximum compacted layer shall be 6 inches in depth and extend 6 inches beyond the pavement width except when curb is poured on subgrade. Asphalt testing and pavement coring will be the responsibility of the Clermont County Engineer's Office.

SECTION 104 – PAVEMENT

A. FLEXIBLE PAVEMENT - (See Typical Sections for details)

- 1) **ITEM 448 Asphalt Concrete Intermediate Course, Type 1, PG64-22-** This item shall be used as a leveling course between the base and the final asphalt surface course. The composition must meet ODOT gradation and bitumen content. The maximum depth of any one layer shall be 3 inches and the minimum surface temperature shall be 40°F. The asphalt-leveling course shall not be placed the same day as the bituminous aggregate base.
- 2) **ITEM 448 Asphalt Concrete Intermediate Course, Type 2, PG64-22-** This item shall be used as a leveling course between the base and the final asphalt surface course. The composition must meet ODOT gradation and bitumen content. The minimum and maximum depth of any one layer shall be 1.75 inches and 4.5 inches and the minimum surface temperature shall be 40°F. The asphalt-leveling course shall not be placed the same day as the bituminous aggregate base.
- 3) **ITEM 448 Asphalt Concrete Surface Course, Type 1, PG64-22 –** This item shall be used as a final asphalt wearing course. The composition must meet ODOT gradation and bitumen content. The minimum and maximum depth of any one layer shall be 1.25 inches and 2.0 inches, respectively. The surface temperature shall to be 50° F or greater prior to the placement of any asphalt. A tack coat must be placed between the leveling and final wearing course at a rate of .10 gal/sy and along the face of curb. The leveling course must be pressure washed before the finish course is applied to ensure a clean and cohesive surface. *The contractor must wait a minimum of one year before applying the finish course of asphalt to allow for building construction wear.*
- 4) **GENERAL-** The roller shall have a minimum compaction rate of 10 tons. The compacted finish shall be within ¼ inch of the proposed elevation. Asphalt testing and pavement coring will be the responsibility of the Clermont County Engineer's Office.

B. RIGID PAVEMENT

- 1) **ITEM 451 Reinforced Portland Cement Concrete Pavement –** This item will consist of a single course of pavement composed of Reinforced Portland Cement Concrete. The composition of all materials and construction must be in accordance with the current specifications of the Ohio Department of Transportation for Reinforced Portland Cement Concrete Pavement. In order to facilitate proper placement it is required that at least fifty percent (50%) of the concrete finishers on site will be ACI certified concrete finishers.
- 2) All concrete pavements shall be designed according to the Ohio Department of Transportation, *Pavement Design and Rehabilitation Manual*, current edition and the *Ohio Department of Transportation, Standard Roadway Construction Drawings*, current edition. The following thicknesses shall be used:

Local Street – Class I	6" with Integral Curb
Local Street – Class II	7" with Integral Curb
Collector – Urban	8" with Integral Curb

Refer to Section 208 for street classification details.

- 3) Concrete pavement shall not be used with non-curb and gutter sections.

SECTION 105 – BONDING OF IMPROVEMENTS

A. BOND FOR INSTALLATION OF IMPROVEMENTS

- 1) So that Clermont County has the assurance that the construction and installation of improvements will be completed, the developer shall enter into one of the following agreements:
 - a. To construct all improvements directly affecting the subdivision, as required by the Clermont County Board of Commissioners, prior to the approval of a final plat; or
 - b. In lieu of the completion of the improvements, to execute a combination performance/maintenance bond securing it with a certified check, insurance policy, or letter of credit with the Clermont County Board of Commissioners equal to the cost of construction of the uncompleted improvements based on an estimate by the Clermont County Engineer.

B. CONDITIONS

- 1) At the end of each phase, a list of damaged or incomplete improvements will be sent to the developer to be completed before the bond will be converted or released. This list is to be completed to the satisfaction of the Clermont County Engineer, or his representative, and the appropriate Township representative.
- 2) Before said security is accepted the proper administrative officials must approve it.

C. ACCEPTANCE

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

D. FAILURE TO COMPLY

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

SECTION 106 – VARIANCES

A. The following regulations shall govern the granting of variances:

- 1) Where the Clermont County Engineer's Office finds that extraordinary and unnecessary hardship may result from strict compliance with these regulations, due to exceptional topographic or other physical conditions, it may vary the regulations so as to relieve such hardship, provided such relief may be granted without detriment to the public interest and without impairing the intent and purpose of these regulations or the desirable development of the neighborhood and community. Such variations shall not have the effect of nullifying the intent and purpose of these regulations.

- 2) In granting variances or modifications, the Clermont County Engineer's Office may require such conditions as will, in its judgement, secure substantially the objective of the standards or requirements so varied or modified.
- 3) Variances to these regulations shall be considered only upon receipt by the Clermont County Engineer's Office of a written request from the developer or authorized representative.

ARTICLE 2

CONSTRUCTION REQUIREMENTS AND DESIGN STANDARDS

SECTION 200 GENERAL

- A) All infrastructure improvements shall be designed and constructed in accordance with these regulations, and any other applicable regulation, as stated in Section 100.
- B) The office of the Clermont County Engineer shall be responsible for the approval of the inspection, as well as, construction of public improvement projects such as, roads, streets, alleys, storm drainage and/or other improvements within the right-of-way of a road, street and designated easement in any development within the unincorporated areas of Clermont County.
- C) It is the responsibility of the developer and/or consulting engineer to investigate local conditions that may require additional design/construction improvements. If, prior to or during construction, local conditions dictate additional improvements, as determined by the Clermont County Engineer, such improvements shall be completed as a part of the subdivision project by the applicant.
- D) Upon completion of all the improvements, the developer and/or contractor shall request, in writing, a final inspection walk through with representatives of Clermont County Engineer's Office and a representative from the applicable township(s).

SECTION 201 STREET DESIGN

- A) All proposed and/or new streets shall conform with/or compliment the Clermont County Thoroughfare Plan. All existing and proposed streets shall be classified per the Clermont County Thoroughfare Plan and constructed in accordance with the Subdivision Street Design and Construction Standards adopted by the Clermont County Engineer.

SECTION 202 HORIZONTAL STREET ALIGNMENT

- A) When there is an angle of deflection of more than one (1) degree between two (2) centerline tangent sections of a residential street, the following conditions shall be met:
 - 1) The minimum allowable centerline radius shall be 200 feet.
 - 2) Horizontal sight distance per Table 201-2 E.

SECTION 203 VERTICAL STREET ALIGNMENT

- A) Vertical curves shall be used at all points on the gradient where the algebraic difference is 1.85 percent or greater.
- B) Vertical curve lengths shall be based on ODOT criteria for crest and sag vertical curves per Volume I of the Ohio Department of Transportation Location and Design Manual.
- C) The maximum street grade shall be 12% with a preferred maximum of 10%.

SECTION 204 INTERSECTION DESIGN

- A) All intersections shall be designed according to methods outlined in the current version of the "Manual of Location and Design – Volume I", prepared by the Ohio Department of Transportation (ODOT) and "A Policy on Geometric Design of Highways and Streets", prepared by the American Association of State

Highway and Transportation Officials (AASHTO). The design and improvement standards for intersections are suggested minimums for all street intersections in subdivisions.

- B) Street curb intersections shall be rounded by radii of a minimum of 30'-0" at the back of curb.
- C) The existing county or township road that provides access to a subdivision through an intersection with a proposed subdivision street must meet the guidelines set forth in Section 401 of the Ohio Department of Transportation *Location and Design Manual – Volume I*. If unique topographical conditions warrant a design exception, approval must be granted by the Clermont County Engineer ensuring that safety and drainage criteria are met.

SECTION 205 SIDEWALK

- A) Sidewalk (reference drawing STD01 and STD02) shall be placed within the public right-of-way. The top edge of the sidewalk closest to the curb shall be set 1 inch per foot ("ft) from the top of the curb (*example: If the sidewalk is 7 feet from the curb, the side closest to the curb will be 7 inches higher than the curb*). Sidewalk shall be poured on a compacted and approved base per ODOT Item 608. See reference drawing STD03 for Handicap ramp layout.

SECTION 206 TEMPORARY T-TURNAROUND

- A) A T-turnaround (reference drawing STD04) is required for a residential street that has 5 lots or more fronting a roadway that may be extended in the future. The T-turnaround shall be 40 feet long excluding the radius. The T-turnaround must stop 5 feet from the end of the pavement to allow room for the fire hydrant and valve. The T-turnaround shall slope 1 inch per foot ("ft) to the curb. If a T-turnaround is required on a berm and ditch street, a ¼ inch per foot ("ft) slope away from the street and a culvert placed in the ditch line shall be required.

SECTION 207 CURB AND GUTTER

- A) Curb and gutter are required in all subdivisions where the average lot frontage is equal to or less than one hundred and fifty (150) feet.
- B) For proposed subdivisions where the average lot frontage is greater than 150 feet, curb or curb and gutter may be required by the Clermont County Engineer for, but not limited to, the following:
 - 1) Storm water management concerns,
 - 2) Pavement edge stabilization,
 - 3) Parking area delineation,
 - 4) Storm water routing to drainage inlets,
 - 5) At intersections, corners, and tight radii
- C) Class I and II local streets shall utilize the Clermont County Standard Curb – see reference drawing STD05.
- D) ODOT Type 2 Combination Curb and Gutter shall be used for Urban Collector Streets – see ODOT BP-5.1.
- E) Curb and gutter shall be poured on top of an approved 6 inch 304 aggregate base when using the aggregate base typical section alternative(s), however, the curb and gutter shall be poured directly on top of an approved subgrade when using the full depth asphalt typical sections. See reference drawing STD06 for underdrain details when using the aggregate base typical section.
- F) The curb may be hand formed or poured using a slip form machine. When slip forming is used, the curb string must be checked for line and grade by the inspector prior to pouring.
- G) Use of a 1-inch diameter × 18-inch dowel bars, as well as, 1 inch expansion material are required at the beginning and end of each radius, at all cold joints, and 3 feet from each catch basin. Greased caps are

required on the dowel bars per ODOT BP-2.2.

- H) A 2-inch deep tool joint is to be cut into the curb every 10 feet. A broom finish running perpendicular to the curb is also required.
- I) Curb must cure for 7 days before base or backfill can be placed against it.
- J) When a curb and gutter street connects with a berm and ditch street, a curb transition is to be used

SECTION 208 TYPICAL SECTIONS

A) Urban Street Sections (with curb and gutter)

- 1) Class I local streets shall have a pavement build-up as shown in the Typical Sections section included with this document. The increased pavement section will accommodate increased construction traffic. The Clermont County Engineer shall determine the classification of local streets based on the proposed subdivision layout and expected construction travel patterns. A "spine" road through a proposed subdivision would be an example of a Class I Local Street.
- 2) Class II local streets shall have a pavement build-up as shown in the Typical Sections section included as a part of this document.
- 3) The back-to-back of curb width for both Class I and Class II local streets shall be determined by the table included in Section 504 B.2. of the Clermont County Subdivision Regulations.
- 4) Collector Streets – Urban shall have a pavement build-up and width as shown in the Typical Sections.
- 5) Local streets in proposed Commercial and Industrial subdivisions shall have a pavement build-up and width as shown in the Typical Sections.

B) Rural Street Sections (without curb and gutter)

- 1) See Typical Sections for details.

C) Rural Street Sections for Large Lot Subdivisions (Article VII, *Clermont County Subdivision Regulations*)

- 1) Shall adhere to the Rural Street Typical Section detail.
- 2) Shall be a minimum of 18 feet edge of pavement to edge of pavement.

D) Private Street Design Standards

- 1) Residential Subdivisions with Lots less than Five Acres (Article V, Section 509 of the *Clermont County Subdivision Regulations*)
 - i) Pavement and Ingress/Egress widths shall conform to the minimum requirements set forth in Article V, Section 509.A of the *Clermont County Subdivision Regulations*.
 - ii) All other design specifications (including pavement build-up) shall conform to the design criteria and typical section governing the construction of Local Residential Streets, as indicated in the included Typical Sections.
- 2) Large Lot Subdivisions (Article VII, Section 703.G of the *Clermont County Subdivision Regulations*)
 - i) Pavement and Ingress/Egress widths shall conform to the minimum requirements set forth in Article VII, Section 703.G-2 of the *Clermont County Subdivision Regulations*.

- ii) All other design specifications (including pavement build-up) shall conform to the design criteria and typical section governing the construction of rural Streets, as indicated in the included Typical Sections.
- 3) Five Acre Plus and Hybrid Subdivisions (Article VII, Section 704.F and 705.E of the *Clermont County Subdivision Regulations*)
 - i) Pavement and Ingress/Egress widths shall conform to the minimum requirements set forth in Article VII, Section 704.F and 705.E of the *Clermont County Subdivision Regulations*.
 - ii) Shall have one of the following pavement sections:
 - (a) 12" of Item 304
 - (b) 8" of Item 304 with an asphalt surface course of 2" of Item 448, Type 1, PG64-22
 - (c) 4" of Item 301 with an asphalt surface course of 1-1/2" of Item 448, Type 1, PG64-22

Note: Unless a development is classified as a "Special Development," as provided in Article VII of the Clermont County Subdivision Regulations, any development serving lots less than five acres in size with a private street shall be subject to the provisions of Article V, Section 509 of the subdivision regulations regarding the design and construction of any proposed private street.

SECTION 209 SIGNS

- A) Signs shall conform to and be placed in accordance with the Ohio Manual of Uniform Traffic Control Devices.
- B) Stop signs and street name signs must be erected prior to any residential/commercial construction.
- C) The developer is responsible to install all stop signs and street name signs (reference drawings STD07, STD08) on newly constructed roads.
- D) The stop signs are to be 30 inch x 30 inch reflectorized metal signs mounted 7 feet high from the ground to the bottom of the sign. The post is to be set 4 feet off the side curb or edge of pavement and 6 feet to 12 feet off the intersecting street curb or edge of pavement.
- E) Street name signs are to be 11 feet high from the ground to the bottom of the sign with four (4) inch white letters on a green reflective backing. Street name signs may be mounted on stop sign posts but must be a minimum of 18 inches above the top of the stop sign.

SECTION 210 CUL-DE-SACS & KNUCKLES

- A) The design and improvement standards for cul-de-sacs (reference drawing STD09) are suggested minimums for all residential subdivision streets. Top of curb elevations shall be indicated on construction plans at beginning point of the curve (P.C.), point of return curve (P.R.C.), point of tangent (P.T.), at the center, as well as, at every 30° point around the cul-de-sac.
- B) Knuckles may be used to turn a street 90° and have the same minimum radius requirements as the cul-de-sac. Even though it turns 90°, it is the same street and does not change street names nor does it need a stop sign.

SECTION 211 SURVEY MONUMENTS

Iron Pin Monuments shall be set at all outside corners of the Parent Tract. Railroad spikes or 2 1/2" mag nails shall be set at all centerline intersections, center of all cul-de-sacs and the PC's and PT's of all curves for all streets, alleys, private streets, and common driveways. For corners, reinforcing bars of 5/8" x 30" with caps

identifying the registration number of the surveyor are acceptable. All surveys performed in Clermont County for new Subdivision Plats requiring the construction of new public streets, private streets or creation of new easements of access shall be required to tie into a minimum of two (2) Clermont County Survey Monuments. At least two (2) coordinates of the survey shall be tied to the State Plane Coordinate System. The traverse of the exterior boundaries of the tract of each block, when computed from field measurements of the ground, shall close within a limit of error of one foot to ten thousand (10,000) feet of the perimeter before balancing the survey.

SECTION 212 EROSION AND SEDIMENT CONTROL

The Clermont County Building Department shall enforce the most current edition of the "Clermont County Storm Water management and Sediment Control Regulations" currently administered by the Clermont County Building Department.

SECTION 213 STORMWATER CONVEYANCE SYSTEMS

A) **GENERAL-** All subdivisions shall provide a storm water conveyance system to adequately handle storm water runoff from the entire area being platted and all off-site flows through the platted area, designed according to the design standards contained in this section and in the Clermont County Water Management and Sediment Control Regulations. These specifications shall govern all drainage systems and appurtenances within the existing or proposed public right-of-way and those facilities outside the proposed right-of-way, being within a storm sewer easement, required for drainage purposes.

- 1) The system shall be compatible with systems of all adjacent properties and ~~by being~~ sized to accommodate runoff from all areas upstream, as well as considering the effects of discharge from the site to downstream areas.
- 2) In all cases, the conveyance system shall have a clear, unobstructed outlet, and discharge into a channel, watercourse, or closed conduit system capable of handling the design flow at the expected velocity without causing erosion or damage to the receiving system.
- 3) All storm water conveyance systems must adequately provide for flood routing to pass the 100 year storm event.
- 4) Other improvements may be required to provide adequate hydraulic characteristics of existing watercourses within the existing or proposed public right-of-way, such as removal of obstructions, channel clearing, widening, or bank stabilization.

B) **HYDROLOGY -** Storm runoff volumes may be calculated using the following techniques:

- 1) Rational Method for drainage areas of 25 acres and less.
- 2) The Soil Conservation Service (SCS) TR55 Method shall be used for drainage areas greater than 25 acres.
- 3) Additionally, USGS regression equations (89-4126, Bulletin 45 or 93-135 for rural and urban streams respectively) shall be used for the design of culverts, bridges, and large storm sewers.

C) **OPEN CHANNEL (ditch, swale) DESIGN**

- 1) Ditches shall be designed and constructed to adequately handle the discharge and velocities expected from a 10-year frequency (post development) storm event, for tributary drainage areas less than 25 acres. A 25-year frequency (post development) storm event shall be used for drainage areas of 25 acres or greater.
- 2) The following manning coefficients shall be used in the Manning's Formula for open channel design:

i) Sod	0.05
ii) Paved Lining	0.015
iii) Rock Channel Protection	0.08
iv) Some grass and weeds	0.030 – 0.035
v) Some weeds and light brush	0.035 – 0.050
vi) Some weeds and heavy brush	0.05 – 0.07
vii) Trees in channel	add .01 to .02 to all above

- 3) Ditches shall be designed with maximum side slopes of 3:1, with a minimum 4' rounded bottom.
- 4) All roadway ditches (reference drawing STD10) shall be designed with a depth of flow not to exceed 18 inches. If the depth of flow exceeds this amount, inlets shall be provided to intercept sufficient flow to maintain a depth of less than 18" in the downstream ditch.
- 5) The minimum grade for swales and ditches shall be 1.0%. Low flow conditions must be addressed to prevent stagnation. The minimum ditch velocity (for normal flow conditions) shall not be less than 1.5 fps. Perforated underdrains or french drains may be required if minimum grade or velocity cannot be achieved.
- 6) The maximum grade for swales and ditches shall be determined by the velocity at design conditions.
 - i) Ditches and swales shall be lined with vegetation or other material to provide stable side slopes and bottom. Ditches with design velocities less than 6 feet per second shall have vegetative cover.
 - ii) Staked sod bottoms with seeded and mulched side slopes shall be provided for design velocities between 4 and 6 fps.
 - iii) Design velocities in excess of 6 feet per second, shall require channel protection with rock channel protection (rip-rap), paved inverts, or other approved method.
 - iv) Open channels shall also be provided with rock channel protection at all pipe or culvert inlets and outfalls. Rock channel protection at pipe inlets or outlets shall be designed according to Appendix C, Exhibit IV in the Clermont County Water Management and Sediment Control Regulations.
- 7) If existing soils are incapable of supporting vegetative growth, they shall be modified to a condition capable of supporting seed or sod, or a suitable soil added as top dressing. Sod and seeded areas shall be maintained, and reinstalled if necessary, until established.

D) STORM SEWERS

1) GENERAL

- i) Minimum Time of Concentration shall be 10 minutes for catch basins.
- ii) All storm sewer conduits shall be designed for a 10 year post-development storm event using Manning's equation for full-flow conditions using a Manning's roughness coefficient ("n" value) of 0.015 for plastic, concrete, or non-ribbed metal pipes and suggested manufacturers standard for corrugated metal pipes.
- iii) The storm sewer system shall be checked by determining the hydraulic gradient based on a 25 year post-development storm.
- iv) Minimum storm sewer diameter shall be 12 inches.
- v) Allowable velocities of storm sewers shall be greater than 2.5 fps and less than 12 fps. Key block anchors shall be provided every 20 feet if velocities exceed this maximum. The system should be designed to avoid large differences in velocities between consecutive reaches.

- vi) The minimum grade is to be 0.40%. Any storm run with a grade of over 12% shall have key block anchors every 20 feet.
- vii) The invert of the first storm sewer structure upstream of an outfall structure shall be above the 25 year flood elevation of the receiving watershed. Where a storm pipe outlets into a pond or lake, the invert of the pipe shall be no lower than the normal pool level of the pond or lake.

2) MATERIAL

- i) All pipes used in the storm sewer system shall have watertight joints.
- ii) The following types of pipes shall be permitted:
 - (1) Class IV Reinforced Concrete Pipe – All available sizes 12 inches and over are acceptable. Joints shall be coated with tar and after they are fitted together, the top half of the pipe joint is to be coated with tar. The minimum allowable cover over the bell of the pipe is 3 inches.
 - (2) Aluminized Metal Pipe – All available sizes 12 inches and over are acceptable. The County Engineer's Office reserves the right to disallow metal pipe in high acidic areas (such as near farm animal waste, septic systems, or soils with high acid content). The minimum allowable cover over the pipe is 6 inches.
 - (3) Polyvinyl Chloride Plastic (PVC) Pipe – Pipe sizes shall be permitted as per current Ohio Department of Transportation specifications. The minimum cover for this pipe is 12 inches and the maximum cover is 40 feet.
 - (4) Corugated Polyethylene (HDPE) Smooth Lined Pipe – Pipe sizes shall be permitted as per current Ohio Department of Transportation specifications. The minimum cover for this pipe is 12 inches and the maximum cover is 25 feet.

3) BEDDING AND BACKFILL

- i) Bedding and backfill requirements for storm sewer conduit shall be governed by Item 603 of the ODOT Construction and Material Specifications.
- ii) All storm runs using more than one length of pipe are to be installed using a pipe laser to ensure proper line and grade.
- iii) See Section 218 and Trench Backfill details (STD11-STD13) for backfill requirements for construction within an existing public street or road right-of-way.

E) **MANHOLES** – Shall conform to The Ohio Department of Transportation – Standard Construction Drawings and are required as follows:

- 1) Sewer intersections and termini.
- 2) Changes in sewer size alignment, and slope.
- 3) As required for maintenance, with a maximum distance between structures of 400 feet.

F) **CATCH BASINS** – Shall conform to The Ohio Department of Transportation – Standard Construction Drawings and are required as follows:

- 1) Shall be spaced to accommodate the tributary flow to that inlet taking into account by-pass flow and inlet capacity and shall not exceed 350 feet. Special grates may be required to increase inlet capacity.

on streets with steep gradients.

- 2) Shall be located upstream of street intersections, crosswalks, and driveways.
- 3) ODOT CB-3's shall be required at all low points and sag curves.
- 4) The Clermont County Engineer recommends the use of CB-3 catch basins. When desired, CB-3A catch basins shall be limited to small drainage areas with an expected flow of approximately one (1.5) cfs. The Clermont County Engineer reserves the right to require CB-3 catch basins in-lieu of CB-3A's.
- 5) Shall have bicycle-safe grates.
- 6) Shall have a minimum depth of 3 feet.
- 7) Shall have a minimum sump depth of 6" as a grit trap.
- 8) Clermont County requires the use of a modified Catch Basin – see reference drawings STD14 and STD15 for details.
- 9) Shall display a permanently cast/engraved message and/or logo discouraging anyone from dumping into the inlet. (reference drawing STD16)

G) HEADWALLS – Shall conform to The Ohio Department of Transportation – Standard Construction Drawings and are required as follows:

- 1) At the outfall of all storm sewers. See reference drawings STD17 – STD19 for details.
- 2) At all culvert inlets and outlets. Dependent upon culvert size, proposed grading, existing topography, and stream characteristics, the County Engineer may request wing walls to complement the standard headwall.
- 3) May require grating as a safety feature if the maximum headwater depth exceeds 3 feet.
- 4) Shall be located above the flood elevation of the design year storm within floodplains or watersheds subjected to frequent floods or backwater.
- 5) All pipes at ditch inlets and that outlet to an open channel shall be installed with an approved headwall, including appropriate inlet or outlet protection.

H) INLETS - Shall conform to The Ohio Department of Transportation – Standard Construction Drawings

See reference drawings STD20 – STD23 for construction details.

I) CULVERTS

- 1) Culverts shall be designed according to methods outlined in the current version of the “Manual of Location and Design, Vol. 2”, published by the Ohio Department of Transportation.
- 2) By definition, the maximum span for a culvert shall be restricted to less than 10 feet. Structures having a span greater than ten feet shall be considered bridges.
- 3) Culverts shall be designed and constructed to adequately handle the discharge and velocities expected from a 25-year frequency storm event, for tributary drainage areas less than 50 acres. A 50-year frequency storm event shall be the design criteria for tributary drainage areas of 50 acres or greater. However, the County Engineer reserves the right to apply stricter design standards based on the flooding potential of the proposed culvert.

- 4) The designer shall determine the elevation of the 100 year storm event and, as determined by the Clermont Engineer, include backwater analysis calculations for upstream development.
- 5) Flood routing and emergency overflow paths for the 100 year storm event must be provided and detailed by the designer in the event of a storm event greater than the design storm.
- 6) Calculations shall indicate whether culvert flow is governed by inlet or outlet conditions. Inlet and outlet volumes and velocities shall be provided.
- 7) Headwater depths shall not be higher than 1 foot below the lowest point of the road nor 18 inches below the top of curb above the culvert.
- 8) Rock channel protection shall be provided at culvert inlets and outlets as per the ODOT Location and Design Manual.

SECTION 214 BRIDGES

- A) All structures having a span greater than or equal to 10'-0" shall be considered bridges and designed appropriately. The following factors will be considered when selecting the type, size, and location of bridge structures:
 - 1) Stream hydraulics and flow characteristics.
 - 2) Geotechnical investigations shall be required for each bridge location.
 - 3) Channel characteristics such as slope, bed, and size upstream and downstream of the proposed bridge location.
 - 4) The structure must be designed to pass the flow from the 100 year post-development storm event and provide emergency overflow/flood routing.
 - 5) A backwater analysis may be requested by the County Engineer's office for areas susceptible to flooding as a result of the structure and/or road embankment.
 - 6) The designer shall provide the County Engineer with detailed structural drawings and calculations for review and approval prior to construction.

SECTION 215 OFF-SITE IMPROVEMENTS

- A) **ROAD WIDENING** – If a traffic impact study determines that a new development may adversely impact an existing road and/or intersection, a turn lane or road improvement may be required. Plan Improvements to existing County Roads shall be prepared per the following guidelines:
 - 1) Typical Section showing widening, pavement build-up, and berm/ditch details.
 - 2) Plan/Profile Sheets at a horizontal scale of 1"=20'-0" and a vertical scale of 1"=5'-0".
 - 3) Cross sections at 50'-0" intervals, with additional sections taken at critical locations.
 - 4) Intersection Details
 - 5) Pavement Marking Plan
 - 6) Drainage details including culvert profiles.

The Clermont County Engineer's Office has specific details for residential, commercial, and subdivision entrances onto existing County or Township roads. Please refer to reference drawings STD24 – STD26 for further details.

SECTION 216 GUARDRAIL

This item consists of placing Steel Beam ODOT Types 4, 5, 5-A and Type 5 w/ tubular backup guardrail at such places where the roadway embankment areas are more than 5 feet deep and/or with steeper than 4:1 slopes. Type B anchor assembly with flares shall be used unless otherwise stated (reference drawing STD27).

SECTION 217 ROAD DITCH AND BERMS

See Standard Drawing STD10.

SECTION 218 BACKFILL AND TRENCH DETAILS

- A) **GENERAL** - Refer to Standard Drawings STD11 through STD13 for trench backfill requirements for construction occurring within the right-of-way of a public street
- 1) STD11 should be used when the trench limits for proposed utility construction does not **fall** within three (3) feet of the existing edge of pavement.
 - 2) STD12 should be used when the trench limits for proposed utility construction **falls** within three (3) feet of the existing edge of pavement.
 - 3) STD13 should be used when the trench limits for proposed utility construction falls within the existing pavement and requires the excavation or removal of the existing road base and pavement.
 - 4) Controlled Density Fill (CDF) – This item shall conform to ODOT's low strength mortar backfill specification and/or HAM/CIN CLSM Specification or an approved equal. CDF is required when repairs effect the roadway surface course (existing/final pavement) or when the final surface course is to be placed within 30 days.

SECTION 219 – TRAFFIC CALMING

- A) Traffic calming techniques may be utilized with prior written approval from the Clermont County Planning Commission, the Clermont County Engineer, and the applicable township representative(s).

SECTION 220 INCIDENTAL CONSTRUCTION

- A) **CONCRETE** – All concrete shall be Class "C" in accordance with ODOT Item 609.02. The minimum air temperature for concrete poured at ground level (sidewalk, apron, and curb) is to be 32°F. Concrete may not be poured on frozen base or subgrade. Concrete must be protected from freezing for 7 days after pouring. No more than 1.5-% calcium may be added to accelerate setup time. Curing compound is to applied at 1 gallon /150 sq. ft. The class "C" mixed concrete must obtain a minimum strength of 4000 lbs. per sq. inch after 28 days using compression test. Concrete testing will be the responsibility of the Clermont County Engineer's Office.
- B) **ENTRANCE ISLANDS** - Entrance islands may be permitted with written approval from the township. A landscaping plan must be submitted and documentation on whom is responsible for maintenance.
- C) **HANDICAP RAMPS** -Handicap ramps are required on all curb and gutter streets with sidewalks and shall conform to ODOT's Standard Construction Drawings.
- D) **DRIVEWAY APRONS** - The driveway apron refers to the section of driveway that is located within the

Public Right-of-Way. (reference drawing STD01 - 02 and STD24 – STD26).

- E) Rock Channel Protection shall be provided at all storm sewer outfalls and shall be installed in conformance with the ODOT Location and Design Manual – Volumes I and II.

F) **MANHOLES**

- 1) Storm manholes are to be a minimum of 4 feet inside diameter (pipe size or number of pipes may require a larger diameter).
- 2) The base may be precast, poured or bricked as per ODOT STANDARD DRAWINGS.
- 3) Steps are required when the manhole is 4 feet or deeper.
- 4) To reduce settlement, all manholes in the pavement or within 5 feet of the pavement are to be backfilled with Class “B” fill. All drop manholes are to be backfilled with Class “B” fill under and over the drop.
- 5) The casting elevation can be raised a maximum of 2 feet using donut risers.

G) **CATCH BASINS & INLETS**

- 1) **GENERAL** - For the sake of clarity in these regulations, a “catchbasin” is considered to be in the street and an “inlet” is considered to be outside of the street. The catch basins may be precast or bricked as per ODOT’s STANDARD CONSTRUCTION DRAWINGS. Modified CB -3 (double) and modified CB-3A (single) catch basins are required.
- 2) **BRICKED** - All bricked catch basins and inlets must be plastered on the inside. They are to be built on a 6 inches thick concrete base (Class “C” concrete). The maximum depth of a double catch basin is to be 5 feet. The maximum depth of a single catch basin is 4 feet.
- 3) **PRECAST** – All precast catch basins and inlets must have tongue and groove connecting sections to eliminate shifting. The maximum depth of a 24-inch inlet is 4 feet. The maximum depth of a 36 inch to 74 inch inlet is 10 feet with steps required over 4 feet. Any depth over 10 feet will require a manhole. Inlet grates must be bolted down to discourage vandalism and for homeowner safety.

H) **LANDSCAPING**

- 1) Trees, landscape rocks, shrubs, and any other item that could be considered a traffic hazard or might restrict site distance will not be permitted in the right of way unless prior written permission is obtained and a landscaping plan is **approved by the Township**.
- 2) It is the developer's responsibility to keep the right of way free of obstructions during the bond period.
- 3) When a subdivision has frontage on a county road, all trees and stumps are to be removed from the right of way.

I) **CONSTRUCTION STAKING**

- 1) Centerline stakes may be used during roadway excavation.
- 2) Stakes are to be placed at 50 feet intervals.
- 3) When cutting subgrade, 3 feet offset stakes at 25 feet intervals are required on both sides of the road. Offset stakes are also required at P.C. and P.T. of curves.
- 4) The stakes will reflect top back of curb elevations for curb and gutter streets and centerline elevations

for berm and ditch streets except at intersections and cul-de-sacs where the stakes are to show edge of pavement elevations.

- 5) The project engineer is responsible for setting and replacing stakes.

J) SUMP PUMP COLLECTOR LINE

- 1) A collector line (reference drawing STD28) is an underground line designed to convey sump drainage to a catch basin or storm manhole.
- 2) They are to be PVC SDR 35, 6-inch pipe. As shown in STD28, the sump line connection from the house to the sump pump collector line shall be completed by the builder and inspected by the Clermont County Building Department.
- 3) Refer to the Typical Section(s) for sump line location and depth requirements.
- 4) Downspouts shall not be connected to the sump line. Downspout drainage shall be accomplished as permitted by the Clermont County Building Department.

K) PAVEMENT MARKINGS

- 1) When pavement markings are required, it shall be the responsibility of the developer to complete.
- 2) Pavement markings are required for turn lanes and for a street 33 feet or wider (commercial street width).
- 3) All permanent pavement markings shall conform to Ohio Department of Transportation, Construction & Material Specification for Item 644 - Thermoplastic Pavement Marking.

ARTICLE 3
TYPICAL STREET SECTIONS

ARTICLE 4

CLERMONT COUNTY REFERENCE DRAWINGS

ARTICLE 5
BONDING DOCUMENTS