Article VII

PAVEMENT DESIGN

700 PURPOSE

This article specifies the pavement design criteria to be used in determining minimum pavement composition and thickness. All pavement materials and construction shall conform to these Standards including any supplemental specifications, unless the County Engineer determines that additional requirements are needed for a particular project. In the case of any question as to the required street classification, pavement composition, construction and materials specifications, the County Engineer shall make the final determination. Please refer to Article II and Article VI of these Standards for street classification definitions, construction and material specification clarifications, and additional design requirements.

701 SOIL SUPPORTING STRENGTH

The subgrade strength California Bearing Ratio (CBR value) shall be determined by a testing laboratory using current ASTM standards. The County also permits the assumption of poorest soil conditions. For Delaware County, a CBR value equal to 2.9, Modulus of Subgrade Reaction (K) equal to 100, or Soil Support Value (SSV) equal to 2.7 may be assumed. The Soil Supporting CBR value used in the design shall be clearly shown on the typical section for each street. The CBR value shall be determined for each street in the proposed subdivision.

Some sites may require additional strengthening in order to provide an adequate subbase for the proposed pavement section. In those cases the County Engineer may require the use of a subgrade reinforcing material. Determination of the need for subgrade reinforcing shall be based on evaluation of soils testing for the site. Pavement reinforcing may be required by the County Engineer to insure adequate pavement strength. A contingency quantity and plan notes for the pavement and subgrade reinforcing material shall be included in the Final Engineering and Construction Plan. The County Engineer shall give final approval of the need for, type, and quantity of subgrade and/or pavement reinforcing required.

702 TRAFFIC AND EQUIVALENT LOADING

Pavement design shall be based on equivalent daily 18,000 pound single axle application. Actual or estimated traffic counts shall be required for each street. All residential local streets shall be designed using 5 % trucks at full legal load per lane per day for a thirty (30) year design period. All minor urban collector streets shall be designed for no less than 5 % trucks at full legal load per lane per day for a thirty-year design period. All local commercial and industrial, minor rural collector, major collector and major and minor arterial streets shall be designed based on an approved traffic study that is to include the percentage of trucks for a

thirty-year design period. The County Engineer shall approve the percentage of trucks used for local commercial and industrial, minor rural collector, and major and minor arterial streets.

To account for design uncertainties a Reliability factor of 85% (Z_R = -1.037) shall be used. In addition, the minimum allowable standard deviation S_O for flexible pavement is 0.44 and for rigid pavement is 0.34. Design calculations shall be based on current AASHTO design methods and submitted with a copy of indicated soil test for written approval by the County Engineer. Sites that contain schools and/or embedded commercial or industrial sites will need to account for the increased traffic loading(s) due to these special uses (vs. conventional residential traffic loading).

703 MATERIAL COEFFICIENTS

The following coefficients for various types of materials shall be used with current AASHTO design equations for all residential local, commercial, industrial, and minor urban collector streets:

ITEM*	MATERIAL	Coefficient
Item 404, 402 and 301	Asphalt Concrete	0.35
Item 304	Aggregate Base	0.14

*City of Columbus Construction & Materials Specifications, Current Edition

The following coefficients for various types of materials shall be used with current AASHTO design equations for all minor rural collector, major collector, and major and minor arterial streets:

ITEM*	MATERIAL	Coefficient
Item 448 (Surface and Intermediate Course), and Item 301	Asphalt Concrete	0.35
Item 304	Aggregate Base	0.14

*Per ODOT Construction and Materials Specifications, Current Edition

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704 ALLOWABLE AND MINIMUM PAVEMENT COMPOSITION

In lieu of an AASHTO Engineered Pavement Design the following pavement design for residential local and minor urban collector streets may be used. These designs have been developed using the AASHTO pavement design methods for flexible and rigid pavements. If the pavement sections shown in this section are used, an internal traffic study is not required for pavement design but the ADT values must be provided on the plans for each street. Under no circumstances shall a pavement composition have an SN of less than 2.66.

Pavement designs submitted shall not include the surface course layer (404 or 448) as part of the strength computations.

On any projects with paving operations occurring after October 31, the surface course layer shall not be placed until the following construction season. This will allow for the release of building permits provided all other building permit items are complete.

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DELAWARE COUNTY RESIDENTIAL PAVEMENT DESIGN CRITERIA					
		Local Streets		**Minor Urban Collector Streets**	
Design formula symbol	Description	Flexible	Rigid	Flexible	Rigid
	Design Life	30 years			
	Percent of Trucks	5%		5%	
ESAL's (E_{18}) or (W_{18}) in ESAL/ Vehicle	18-kip Equivalent Single Axle Loads	0.0134	0.0179	0.0155	0.0216
Z_R	Standard normal deviate	85 % Reliability Factor = (-1.037)			
S_O	Standard error	0.44	0.34	0.44	0.34
S'_c	Modulus of rupture	N/A	650 psi	N/A	650 psi
Δ PSI	Difference in serviceability index	2.2		1.95	
p_t	Design terminal serviceability index	2		2.25	
D_i	i^{th} layer thickness	0.161	1.1	0.161	1.1
J	Load transfer coefficient	N/A	4.2	N/A	4.2
Mr	Resilient Modulus	2700	N/A	2700	N/A
k	Modulus of subgrade reaction (pci)	N/A	100	N/A	100
CBR		2.9			

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The County Engineer permits the following pavement compositions for use in Delaware County without further design calculation.

The shaded area of the table also represents the “Minimum Pavement Composition” permitted for use on residential local and minor urban collector streets regardless of subsurface conditions or other design factors.

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Street Classification	Flexible Pavement Composition	Rigid Pavement Composition (Requires Written Approval by Township Trustees)
Minimum Pavement Composition SN=2.66		
Residential Local ADT ≤ 200	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 3 inches of 301 on 4 inches of 304 SN = 2.66	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 5 inches of 305 4 inches of 304
Residential Local ADT > 200 but ≤ 1500	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 6 inches of 301 on 4 inches of 304 SN = 3.71	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 6 inches of 305 4 inches of 304
Minor Urban Collector ADT >1500 but ≤ 3500	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 7.5 inches of 301 on 4 inches of 304 SN = 4.24	1 ½ inches of 404 Surface Course on 1 ½ inches of 402 Intermediate Course on 8 inches of 305 4 inches of 304
All Local Commercial, Local Industrial, Rural Collector, Urban Collector with ADT > 3500, and Major and Minor Arterials	Pavement Design Based on Traffic Volumes, Type of Development, etc. Pavement design must be approved in writing by the County Engineer.	

Item 404-Asphalt Concrete Surface Course per Delaware County Supplemental Specifications
Item 402-Asphalt Concrete Intermediate Course per Delaware County Supplemental Specifications
Item 301 - Bituminous Aggregate Base per Delaware County Supplemental Specifications
Item 304 - Aggregate Base per Delaware County Supplemental Specifications
Item 305 - Portland Cement Concrete Base – ODOT Class “C” Concrete per Delaware County Supplemental Specifications.

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Notes:

1) A prime coat (Item 408) (0.40 gallons per square yard) may be required between Item 304 and Item 301 at the discretion of the County Engineer in the field.
2) A tack coat (Item 407) (0.10 gallons per square yard) between Item 305 and Item 402 Intermediate Course may be required at the discretion of the County Engineer in the field.
3) Minimum asphalt concrete thickness for any flexible pavement with aggregate base shall be three (3") on all Local Streets, four (4") on all Major and Minor Collector Streets with ADT's > 3500, and all Arterial Streets.
4) Item 404 Asphalt concrete surface course shall be not less than l.5 inches nor more than 1.75 inches in thickness.

705 SOIL TESTS

If the Owner desires to perform soil testing rather than assuming a CBR value of 2.9, a meeting shall be held with the County Engineer and the design engineer prior to the Preliminary Engineering Plan phase. Soils testing shall be furnished for a minimum of every 1,000 square yards of pavement surface and in all low areas, with a minimum of one test per street. Additional testing may be required at the discretion of the County Engineer. These tests shall be made at the design subgrade elevation and to a minimum depth of five (5) feet below the design subgrade elevation. The test shall include the following:

A. Soil samples at subgrade elevation and depth by boring.

B. Moisture determination and maximum dry weight of soil.

C. AASHTO classification and group index for each sample.

   1. Liquid limit
   2. Plastic limit
   3. Plasticity index

D. Mechanical analysis of the subgrade soil.

E. Laboratory CBR values as determined by ASTM D1883

The CBR value(s) shall be approved at the Preliminary Engineering plan phase. The Final Engineering and Construction Plan shall not be submitted without the written acceptance of these CBR value(s).