8 cc

OHIO TURNPIKE COMMISSION

Resolution No. 107 -1952 Adopting Supplemental Design Criteria for Agricultural Drainage

WHEREAS it is urgently required in the public interest that in those areas to be traversed by Ohio Turnpike Project No. 1 where agricultural drainage systems exist, the construction of said project shall not interfere with such drainage systems; and

WHEREAS the Commission's consulting engineer has intensively studied the problems which are presented by the existence as well as the possible future expansion of such agricultural drainage systems, together with the means of preventing interference by Ohio Turnpike Project No. 1 with such systems, present and prospective, and has developed and presented to the Commission's chief engineer, and he has recommended to the Commission the adoption of, supplemental design criteria for agricultural drainage designed to achieve the ends aforesaid;

NOW, THEREFORE, BE IT

RESOLVED that the Commission does hereby adopt the "Supplemental Design Criteria for Agricultural Drainage" which has been presented to the Commission at this meeting on December 2, 1952, and does hereby direct that the plans for the construction of said project shall be prepared in conformity with said design criteria.

Adoption moved by: _____

Motion seconded by: _____

Voting Yes: _____

Voting No: _____

Adopted by Com. at meeting on 12/12/52, by Resol. No. 107

OHIO TURNPIKE

SUPPLEMENTAL DESIGN CRITERIA

FOR AGRICULTURAL DRAINAGE

These supplemental design criteria pertain to the alterations and reconstructions of existing agricultural drainage systems affected by the construction of the Ohio Turnpike; to the considerations which must be given in the designs of Turnpike drainage structures and ditches when agricultural drainage is an influencing factor; and to the provisions which must be made for future agricultural drainage and for improvements to existing systems.

A. Tile Drainage Fields

1. Lateral Drain Tiles - Existing lateral drain tiles crossed by the Turnpike shall be intercepted approximately 25 feet outside the Turnpike right of way line by collector mains and properly outletted. Lateral tile farm drains shall not be outletted into the parallel Turnpike side ditches. Existing ditches or existing collector mains not affected by the Turnpike construction and Turnpike ditches shall be used for outletting such collector mains. Collector mains shall cross the Turnpike where necessary to find an outlet.

2. Collector Mains - Existing tile collector mains crossed by the Turnpike shall be outletted into the Turnpike side ditches, shall be carried parallel to the Turnpike at locations outside the Turnpike right of way to suitable outlets, or shall be carried under the Turnpike in reconstructed conduits and be reconnected to the existing collector mains or be carried to suitable new outlets. Wherever possible, without constructing undue lengths of collector mains or ditches, tile collector mains shall be outletted at points outside the Turnpike right of way.

In general, water from one existing collector main is not to be diverted to another existing collector main. Where diversion of tile water is unavoidable, the collector main receiving the diverted water shall be of adequate capacity to carry all water delivered to it, or it shall be reconstructed with pipes of such adequate capacity.

Surface water from the Turnpike shall not be discharged into existing agricultural tile mains.

3. Future Collector Mains - Collector mains shall be installed crossing under the Turnpike to provide for future agricultural tile drainage in areas where potential agricultural drainage is evident, and where no other outlets are available. The necessity for such provisions for future agricultural drainage shall be determined by surveys of the adjacent lands and by analyses of the soil conditions. The advice and recommendations of the county agents should be obtained at each location where provisions for future drainage may be considered.

The following data will serve as a guide in determining the requirements for future agricultural drainage:

(a) The master soil profile of the Turnpike.

(b) The reconnaisance soil survey of the Turnpike prepared by J.E. Greiner Company.

(c) County soil maps prepared by the Division of Soil Survey, U. S. Department of Agriculture and the Ohio Agricultural Experiment Station. Minor correlation problems arising from revisions of nomenclature shown on older maps can be reconciled by reference to the county soil reports. To supplement county soil maps, and to furnish data in counties not covered by the county maps, soil maps on air photo base for some individual farms are on file at the U.S.D.A. Soil Conservation Service offices at county seats.

(d) Highway Research Board Bulletin No. 22 - "Engineering Use of Agricultural Soil Maps" and Bulletin No. 28 - "Soil Exploration and Mapping".

(e) Known practices on similar soils along the route of the Turnpike.

(f) Figure A - "Soil Identity and Drainage Characteristics" and Figure B - "Ohio Soils" give pertinent information which may serve as a guide.

4. Depths of Collector Mains - Collector mains shall in all cases be installed at sufficient depths to permit the connection of all lateral drains which are intercepted. The minimum depth of the inverts of such collector mains shall be 3.5 feet below field level to insure the collection of tiles of unknown depth. As a provision for future lowering of the drainage systems, collector mains shall be installed at depths of from 4 to 5 feet below average field level where outlets are available. Where existing outlets will not permit the installation of collector mains at depths which will provide for future requirements, the collectors shall be installed at depths which will permit their connection to existing outlets.

Collector mains for agricultural drainage which are installed under the Turnpike or under reconstructed local roads shall have invert depths below average field levels adjacent to the upstream right of way line as follows:

Prevailing Field Slope	Minimum Invert Depth
0 to 0.25%	5.0 feet
0.25% to 0.50%	4.8 feet
0.50% to 1.0%	4.5 feet
Over 1.0%	4.0 feet

Where rock is encountered these depths may be reduced, provided that all existing tile drains are outletted.

Where it is impossible to install collector mains at the minimum depths specified above without the construction of extensive outlet pipes or ditches, provision for future lowering of the drainage fields shall be made by either one of the following methods:

(1) Provide a pipe of a larger size than that required, with the top of the pipe at the elevation of the top of the existing collector main at the downstream side of the Turnpike or reconstructed local road and with the invert of the pipe at the required minimum depth.

(2) Install an additional pipe of adequate size at the required minimum depth and seal both ends.

5. Grades - The minimum grade for tile collector mains and tile outlet mains shall be 0.05 percent, with a desirable grade of not less than 0.10 percent.

The desirable maximum grade for agricultural tile drains is 1.0%. The maximum velocities for tile mains with open joints at design rates of flow shall be as follows:

Type of Soil	Maximum Velocity Feet per Second	
	Agricultural Drain Tile	Bell & Spigot Pipe Unsealed Joints
Sand	4	5
Sandy Loam	5	6
Silty Clay	6	7
Clay Loam	6	7
Clay	6	8

6. Capacity - Tile mains, collecting mains and outlet mains shall be designed for the following drainage coefficients, R, where R is the amount of water in inches that will be removed from the drainage area by the tile in 24 hours:

	Inches of water, R, to be removed in 24 hours	
Soil	Areas with Surface Drainage *	Areas with no Surface Drainage **
Mineral	For 8" or smaller tile 1/2" For 10" or larger tile 3/8"	1"
Muck	1"	2"

* The area requiring tile drainage is here considered the drainage area. Surface water must be removed by natural surface drainage or field ditches.

** The entire contributing water shed of the area having no surface drainage is here considered the drainage area.

The required pipe sizes may be taken from Figure C. For collector mains under the Turnpike, a minimum value of R of 1 inch, and a minimum size of pipe of 12 inches, shall be used.

B. Drainage Ditches

1. Agricultural Drainage - Drainage ditches constructed primarily for agricultural drainage, and whose capacities are not influenced by Turnpike drainage or whose capacities will not affect the adequacy of Turnpike drainage structures, shall be designed to carry the rates of discharge given in Figure D without overflowing of the ditch banks. When such ditches serve as outlets for tile drainage fields, the bottoms of the ditches shall be not less than 1 foot below the minimum elevations, at their outlets, of laterals and collector mains discharging into the ditch. However, when a reconstructed collector main is outletted into an existing ditch the distance from the bottom of the ditch to the invert of the main at its outlet need not be more than that prevailing on the original collector.

2. Surface Drainage - Drainage ditches constructed primarily for surface drainage, such as Turnpike ditches, entrance and outlet ditches at culverts, and stream channels shall be designed in accordance with the Design Criteria of the Engineering Report.

3. Ditch Depths - As a provision for future lowering of or extensions to agricultural drainage systems, ditches in regions of articicially drained land, or where such drainage is a future possibility, shall be constructed to the minimum depths specified below, except where no outlets are available for ditches of these depths, or where rock is encountered, these depths shall be reduced provided that all existing tile mains and ditches are outletted:

(a) For ditches outletting collector mains the minimum depth below average field level shall be 5 feet.

(b) Outlet ditches for Turnpike drainage structures carrying surface water only shall be constructed with the bottoms of the ditches at least 4 feet below the average field level at the right of way line on the upstream side of the Turnpike or reconstructed local road.

(c) Outlet ditches for Turnpike drainage structures which also serve agricultural drainage systems shall be constructed with the bottoms of the ditches not less than the following depths below average field level near the upstream side of the right of way:

Prevailing Slope	Ditch Depth
0.0% to 0.25%	6.0 feet
0.25% to 0.75%	5.5 feet
0.75% to 1.5%	5.0 feet

4. Ditch Design - Ditches designed primarily for agricultural drainage systems shall be designed for the estimated discharge by the Kutter or Manning formula, using a value of "N" of 0.035.

The minimum bottom widths of ditches which are to serve agricultural drainage systems shall be as follows:

Side Slopes	Bottom Width
Flatter than 4:1	2 feet
3:1 to 4:1	3 feet
Steeper than 3:1	4 feet

Side slopes flatter than 2:1 shall not be used if the velocity in the ditch at design flow is less than 2.5 feet per second.

Maximum permissible velocities in ditches without protection against erosion shall be as set forth in the Design Criteria in the Engineering Report.

C. Turnpike Drainage Structures

1. The inverts of culverts and bridge channels under the Turnpike and under reconstructed local roads which serve as outlets for agricultural drainage systems shall be not less than 6 feet below the average field level adjacent to the upstream right of way line. For lands with prevailing slopes toward the Turnpike, this minimum depth may be modified as follows:

Prevailing Slope	Minimum Depth
0.0 % to 0.25%	6.0 feet
0.25% to 0.75%	5.5 feet
0.75% to 1.5 %	5.0 feet

Where rock is encountered these minimum depths shall be reduced to provide only for the existing drainage systems. Where no drainage systems exist, but are future possibilities, the inverts shall be at least one foot below the top of rock in any upstream areas that may be subject to tile drainage. When outlet ditches are not available at these depths, the drainage structures shall nevertheless be constructed

to the depths specified above as a provision for future improvements to the agricultural drainage systems.

The elevation of the inverts of culverts for streams draining more than 2000 acres shall be such as to permit future ditch improvements to provide a non-silting velocity (2-1/2 to 4 feet per second) with 2:1 bank slopes.

2. The inverts of culverts and bridge channels under the Turnpike and under reconstructed local roads shall be at least 3 feet below any low areas of tillable land, which do not have surface drainage, larger than 2 acres on the upstream side of the Turnpike or reconstructed local road, except where rock is encountered. When outlet ditches are not available at these depths, the drainage structures shall nevertheless be constructed to the depths specified above as a provision for future agricultural drainage.

3. Where no agricultural drainage system exists, but future agricultural drainage is evident, drainage structures under the Turnpike and under reconstructed local roads shall be reconstructed to the minimum depths specified in paragraphs 1 and 2 above.

D. Borrow Pits

At various locations along the route of the Turnpike, borrow pits may be used to advantage as outlets for agricultural drainage systems.

Borrow pits used in conjunction with drainage systems shall be outletted to natural stream channels or to other adequate water courses. The outlets shall be at such elevations that the surfaces of the water in the resultant ponds will be at elevations corresponding to the bottoms of any ditches which would be required in lieu of the borrow pits.

Borrow pits where ponding results shall have a normal depth of water of not less than 6 feet over at least 50 percent of the area of the pond.

E. Drainage Details

1. Type and Use of Pipe - Use clay or concrete drain tile for laterals and mains. Use extra quality clay drain tile where the ground water contains 0.3 percent or more of magnesium or sodium sulphates. Use extra quality clay drain tile in muck or peaty soil or when the tile carries the drainage from muck or peaty soil, when the soil or the water from the soil has a ph value of 5.0 or less or a ph value of 8.0 or more.

All pipes installed under the Turnpike for agricultural drainage shall conform to the requirements for pipe culverts set forth in the Design Criteria of the Engineering Report.

Collector mains within 25 feet of water-loving trees which are not to be removed shall be constructed of bell and spigot sewer pipe with mortared joints, or of corrugated metal pipe.

2. Permissible Depths of Drain Tile - The depths of trenches in which drain tile is installed shall not exceed the following amounts for trenches of 24" maximum width; for wider trenches a special design shall be prepared:

Tile Size	Maximum Allowable Depth of Trench	
	Standard Quality Tile	Extra Quality Tile
5"	7.2'	9.5'
6"	6.5'	8.6'
8"	5.1'	7.3'
10"	5.2'	7.5'
12"	5.4'	7.7'
15"	6.2'	8.0'
18"	6.9'	9.7'

3. Alignment - Collector mains may be laid on a curved alignment, with a minimum radius of 50 feet. Where a radius of curvature of 50 feet cannot be obtained, use standard 45 degree and 90 degree bends of bell and spigot pipe, or use junction boxes.

The minimum radius of curvature for drainage ditches with bank protection shall be 100 feet. The necessity for bank protection shall be investigated for all ditches having radii of curvature less than the following:

Width of Ditch at Top	Recommended Minimum Radius of Curvature without Bank Protection
Under 15'	300
15' - 35'	500
Over 35'	600

4. Miscellaneous Structures - The following miscellaneous structures and appurtenances shall be employed as a part of the agricultural drainage systems wherever required to assure the satisfactory operation and maintenance of these systems:

(a) Connect laterals to intercepting collecting mains by means of standard tile fittings with the center line of the collector main not above the center lines of the intercepted laterals. Use Y-branches and bends as required.

(b) Use junction boxes where 2 or more large (12" and over) tile lines join or where several tile lines join at different elevations. Where possible install junction boxes away from cultivated areas. When a junction box is in a cultivated field, construct top of box at least 12 inches below ground surface.

(c) Provide breathers every 1200 feet on collector mains and at abrupt changes in grade. On collector mains crossing the Turnpike, provide breathers on both sides of the Turnpike, inside the right of way line.

(d) The outlet ends of all laterals or collector mains shall be protected by the installation of an endwall for outlet pipes. In lieu of installing an endwall, 20 feet of 16 gauge corrugated metal pipe may be installed at the outlet ends of the laterals or mains. Install gates or gratings on the outlet ends of all pipes serving agricultural drainage to keep small animals out of the pipes.

(e) Where surface water enters a ditch at the location of a tile outlet, either divert the surface water to another location or provide a drop structure to protect the ditch bank and the outlet pipe. Use drop spillways, drop boxes or other suitable structures.

(f) Provide adequate means for lowering surface water at points of concentration from adjoining fields to the drainage ditches. Use ditch paving, drop spillways, drop boxes, or other suitable appurtenances.

(g) Provide stock crossings at locations where cattle cross the course of a drainage ditch or at stock watering locations. Stock crossings shall be located at points where surface water cannot enter the ditch by way of such stock crossings.

Pave stock crossings where warranted by the use of a large number of cattle.

(h) Provide water gates where the Turnpike right of way fences cross drainage ditches, where such water gates are required for the protection of cattle.

F. Record Plans

1. As-built plans shall be prepared showing the alterations made by the Turnpike Commission to the agricultural drainage systems. The plans shall show the locations and elevations of all mains and sub-mains installed, all connections, the sizes of all tiles, the locations, types and elevations of all appurtenances, and the location, sizes and elevations of all ditches serving agricultural drainage constructed or altered by the Turnpike Commission. All elevations shall be referred to U.S.C. & G.S. datum.

O H I O T U R N P I K E

SOIL IDENTITY AND DRAINAGE CHARACTERISTICS

The following soils require artifical drainage, and outlets for existing or future drainage systems should be provided.

1) All soils whose profile numbers are 1, 2, 3, 7, 8, 9 and 0
2) All soils whose profile number is 4 if the adjoining fields have seepy areas

H. H. Morse has correlated Ohio Soils by a series number as shown in Figure B; this will be helpful in identifying soils. It is the key to soil maps of individual farms made by the Soil Conservation Service. The more common soils along the Turnpike are boxed in this Figure.

Series 6086, Brookston silty clay loam, serves as an illustration of the series numbers as follows:

60 - Shown in the horizontal lines, indicates soil origin: i.e., late Wisconsin heavy calcalareous till
8 - Shown in vertical columns, is the profile number indicating its internal drainage
6 - Indicating its texture (silty clay loam)

S O I L I D E N T I T Y

POSITION-usual	Residual S.E.Ohio	Terrace or upland glacial	Upland or terrace or bottom				Upland glacial	Upland or terrace or bottom		
SLOPE - usual	Hilly 50-20%	sloping-flat 25 - 0%	mod.slope 15 - 4%	slight 4 - 2%	rise 2 - 1%	flat 1-0%	0-1%	Depressed 0-1%	0%	0%
PROFILE NO.	6	5	4*	3	2	1	7	8	9	0
Color of plowlayer	yel.to br.	brown	brown	tan	mottled	ash gray	med. grey	dark grey	darker	black
Natural drainage	droughty	excessive	ideal	slow	sluggish	very sluggish	slow	water impounded		

* Profile may require drainage outlet for springs and seepage.

Figure A

OHIO TURNPIKE
OHIO SOILS

Soil characteristic		Shallow	Porous	Deep	Gray-brown	Brown-Gray	Gray	Dark gray	V Dark gray	Gray-black	Organic	Exception
Under drainage		Well	Well	Well	Moderate	Imperfect	Poor	V Poor	V Poor	V Poor	V Poor	
Profile number		6	5	4	3	2	1	7	8	9	0	
FIRST BOTTOMS ASSOCIATED WITH												
Glacial limestone	10			Genesee	Eel	Shoals			Sloan	Wabash	Kerston	18 Algiers
Glacial sandstone & shale	12			Chagrin	Lobdell	( )	Wayland		Papakating			204 Ross
Residual " light/dark	13							Killbuck			Wallkill	
Residual sandstone & shale	14			Pope	Philo	Stendal	Atkins		Elkins			200 Carlisle
Residual limestone	15			Huntington	Lindside	Newark	Melvin		Dunning			Silty muck
Red clay shale	16			Moshannon	( )	Senecaville						
TERRACES ASSOCIATED WITH												
E Wisc calc silt & clay	22				( )	( )			( )			213 Wyatt
Wisc calc till-partly sorted	24			Mill Creek		( )			( )			235 Monclova
Ill calc till-silt & clay	26			Williamsburg	( )							
L Wisc calc gravel & sand	27	Rodman	Fox	Fox (deep)	Bronson	Homer			Westland	Abington		
L Wisc calc silt & clay	28			Markland		McGary		Zipp	Montgomery	Kings		2853 Shandon
Wisc sand & gravel, neutral	29			Nineveh								
Wisc sand & gravel, prairie	30			Warsaw							Edwards	
E Wisc calc sand & gravel	31			Rush								
Wisc acid sand & gravel	32	Orrsville	Chenango	Chenango		Braceville			Atherton			
Wisc acid silt and clay	33			Mentor	Glenford	Fitchville	Sebring		Luray			
Ill acid sand & gravel	34		Hocking	Hocking		( )						
Ill calc. sand & gravel	35			Dunkinsville		( )						
Ohio River sand & gravel	36		Wheeling	Wheeling	Sciotoville	Weinbach	Ginat		Chilo			
Red clay shale	37			Vincent								
Residual limestone	38			Elk	Captina	Taft						
Residual sandstone & shale	39		Holston	Holston	Monongahela	Tyler	Purdy		Blago			393s Zoar
RESIDUAL UPLAND												
Sandstone & shale	40	Muskingum		Wellston	Tilsit	Johnsburg	Mullins					414 Zanesville
Reddish shale	42	Rarden		Coolville								434 Eifort
Yellow, acid clay shale	44	( )			Keene							432 Zaleski
Limestone, S. E. Ohio	45	Brooke		Brooke								
Olive, calc shale	46				Guernsey							
Red clay shale	47	Upshur		Upshur								
Complex-ls, ss. & sh	48	Westmoreland										
Complex-red sh. & ss & sh	49	Meigs		Meigs								
Complex-Meigs & ls	50	Belmont										
Limestone & calc shale	51	Fairmount		Maddox	Ellsberry							Eden
Limestone-high Ca	53	Corydon		Hagerstown	Bedford	Bentonville						526 Heitt
Calc gray shale	54	Otway		Otway								566 Frankstown
Dolomite, porous	55	Cedarville		Cedarville								578 Burgin
Dolomite, dense	57	Bratton		Bratton	Bedford	Jacksonville						583 Fawcett
Black bituminous shale	59	Colyer		Byington								Noceville, Latham
GLACIATED UPLANDS												
L Wisc mod heavy calc	60	Hennepin	Kendallville	Miami	Celina	Crosby	Betner	Pandora	Brookston	Clyde	Carlisle	Conover
L Wisc heavy, calc	60			Miami	Celina	Crosby	Bethel					6046 heavy till ph
L Wisc high lime gravel	61	Rodman	Bellefontaine									Wawaka
L Wisc heavy shaly till	62				(St Clair)	(Nappanee)						(to be correlated)
Lake plain calc v heavy till	63				St Clair	Nappanee	Palmer		Paulding			
L Wisc shallow over ls	64	Milton		Milton	Randolph	Randolph			Millsdale			684 Wynn
L Wisc light tex leached	65				(Spore)	(Gatton)						Field names
L Wisc till on black shale	66			(Lyndon)	(Lyndon)							Field names
E Wisc calc till	67	Hennepin		Russell	Xenia	Fincastle	Delmar	Cope	Brookston			
L Wisc low lime till	69		Olena	Alexandria	Cardington	Bennington	Condit		Marengo			
L Wisc v heavy shaly till	70				Ellsworth	Mahoning	Trumbull		Chippewa			
L Wisc light acid till	71			Wooster	Canfield	Ravenna	Trumbull		Chippewa			725 Massillon
L Wisc heavy acid till	73			Wayne	Rittman	Wadsworth	Trumbull		Chippewa			726 Orrsville
L Wisc shallow on ss & sh	74	Lordstown		Lordstown	Hornell	Allis	Wickliffe		Huron			
Ill heavy calc till	75	Edenton		Cincinnati	Rossmoyne	Avonburg	Clermont	Blanchester	Blanchester			774 Parke
Ill v heavy calc till	76			Jessup	Loudon							775 Bonta
Ill calc till on ls	76			(Belfast)	(Allenville)							Field names
Ill ss & sh till	79		Negley	Hanover		>						814 Fallsburg
Ill shallow on ss & sh	80	Millwood		Millwood								
Ill till on gray shale	82				( )	( )						
Ill till on black shale	83			(Jennings)								Not correlated
L Wisc deep acid sand	84	(Bridgman)	(Coloma)	(Metea)		(Aubbee)						Not correlated
L Wisc deep neutral sand	85	( )	( )	( )								Not correlated
LACUSTRINE												
Calc gravelly beach ridge	90		Belmore		Vaughnsville							
Calc silt, clay & f sand	91			Lucas	Lucas	Fulton			Toledo	Bono		
Neutral to sl acid sands	92		(Galumet)		(Enos)	(Weiss)			(Granby)	Maumee		Not correlated
Deep acid sands	93		Plainfield		Berrien	(Morocco)			Newton	(Dillon)		949 Warners
Sand over calc clay	95			(Ottawa)	Berrien	Rimer			Wauseon	Neapolis		
Sand over acid clay	96								Reynolds			
Lowline silt clay, & f sand	97	Nunda		Painesville		Caneadea	Canadice		Lorain	Monroeville		
Delta on silt & clay	98			Ruggles	Bogart	Wilmer			Olmsted			
Killdeer clay	99					( )		( )	( )			Like Paulding

No	Texture
0	Sand
1	Loamy Sand
2	Loamy fine sand
3	Sandy loam
4	Fine or very fine sandy loam
5	Loam
None	Silt loam
6	[illegible]
7	Clay loam
8	Silty clay
9	Clay
G	Gravelly
S	Stony

Compiled by H. H. Morse, Soil Conservation Service January, 1949 — Revised 3 [illegible]

Prepared and Reproduced by the Regional Cartographic Division, Soil Conservation Service, Milwaukee, Wisconsin

FIGURE B

OHIO TURNPIKE

TILE DRAINAGE CHART

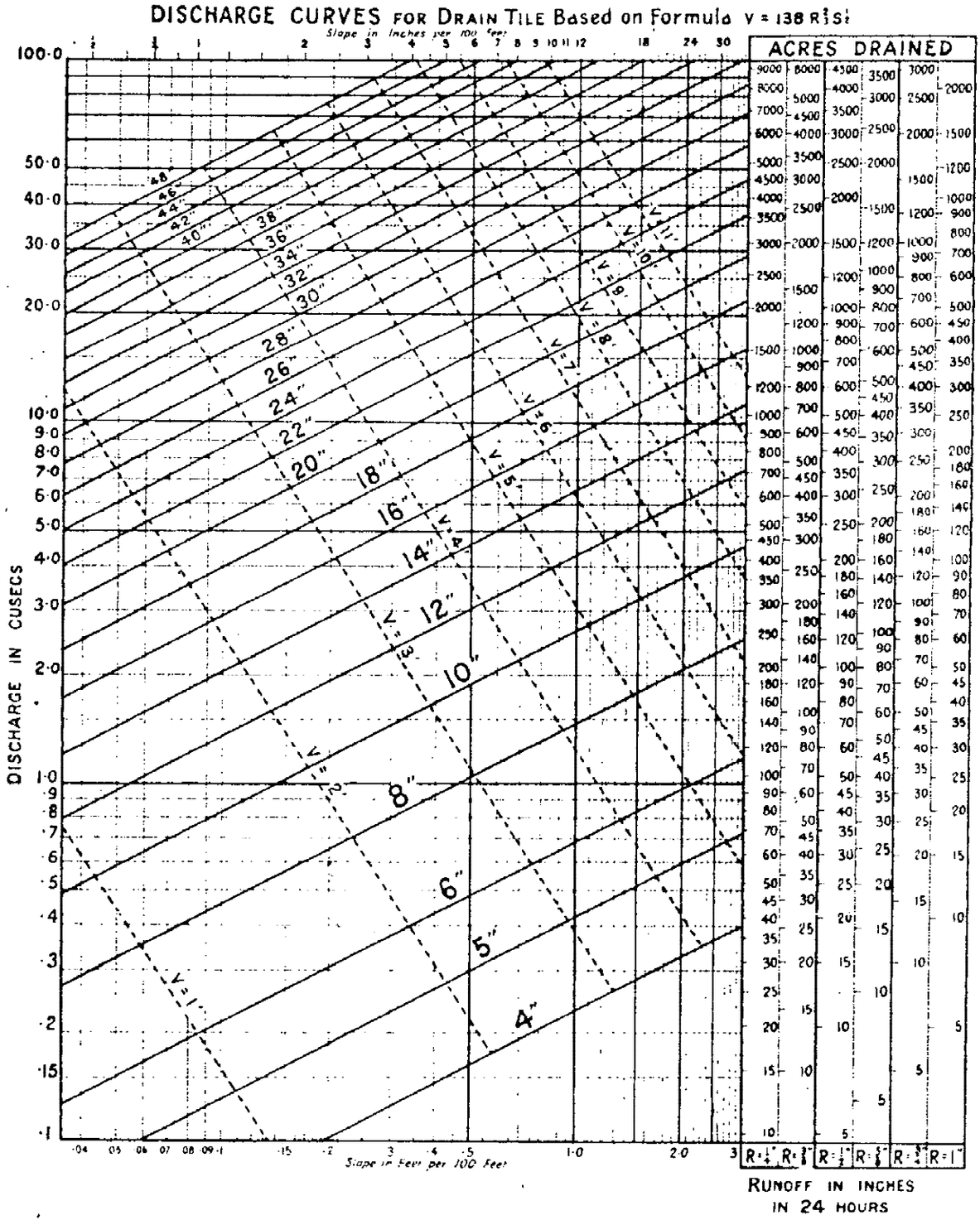

FIGURE C

OHIO TURNPIKE

AGRICULTURAL DRAINAGE DISCHARGE

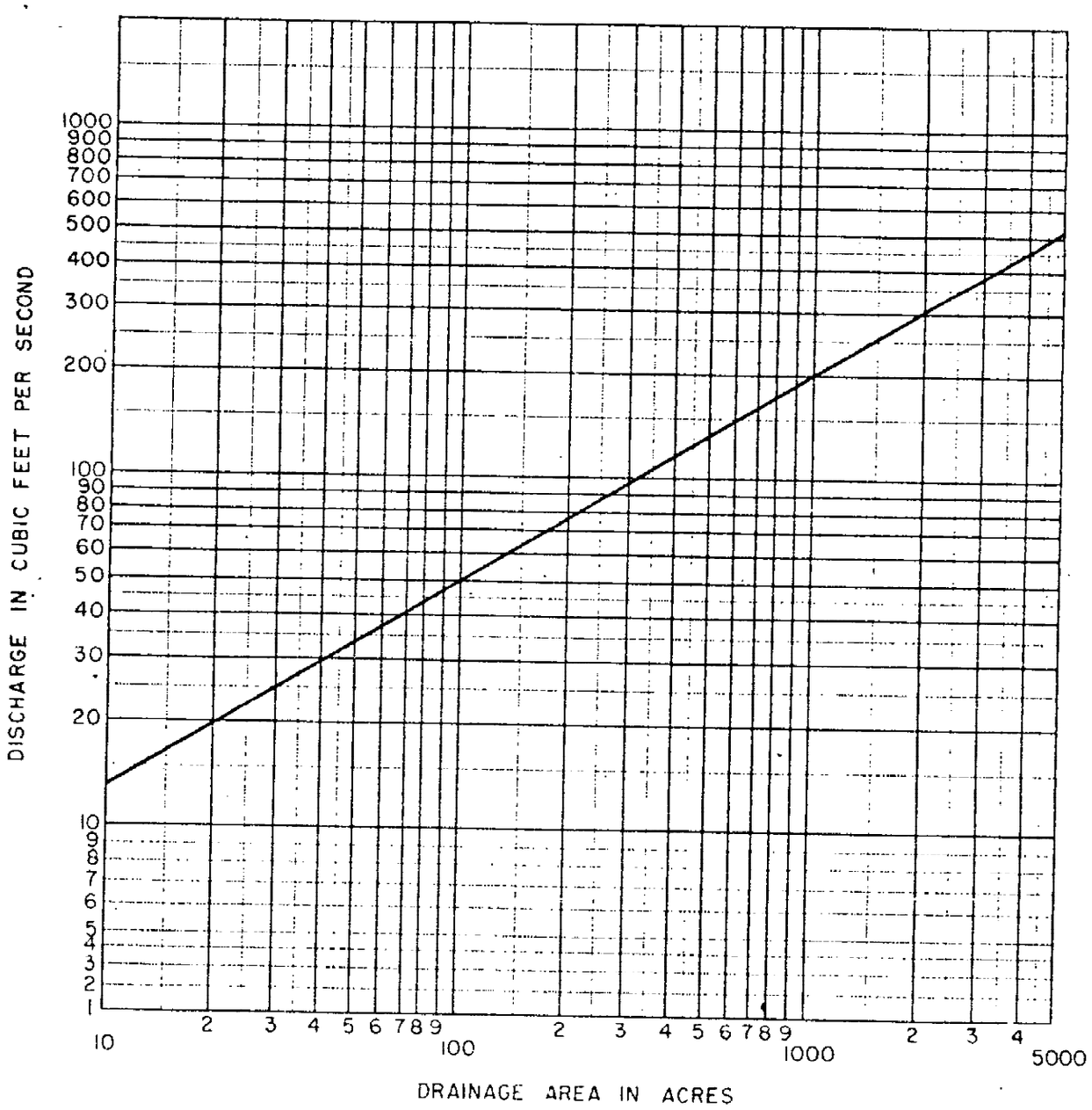

FIGURE D