

A Stronger Span: Perspectives on Ohio's Longest County Route Semi-Integral Bridge



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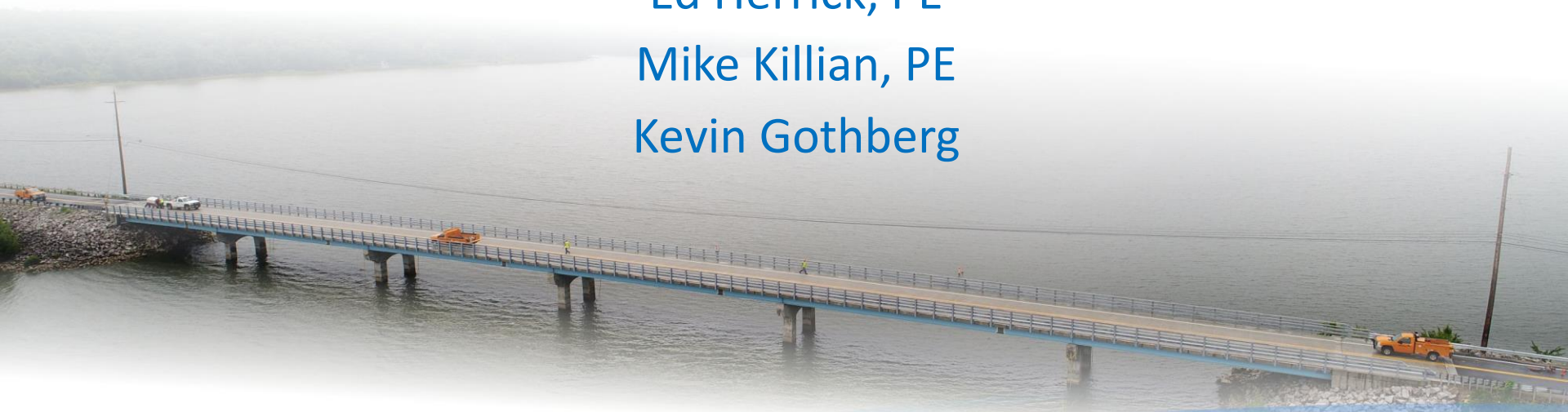
A Stronger Span: Perspectives on Ohio's Longest County Route Semi-Integral Bridge

Smothers Road over Hoover Reservoir

Ed Herrick, PE

Mike Killian, PE

Kevin Gothberg



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Owner's Perspective

Ed Herrick, PE

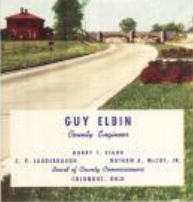
Franklin County Engineer's Office



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**FRANKLIN COUNTY
HIGHWAY MAP
1950**



GUY ELBIN
County Engineer

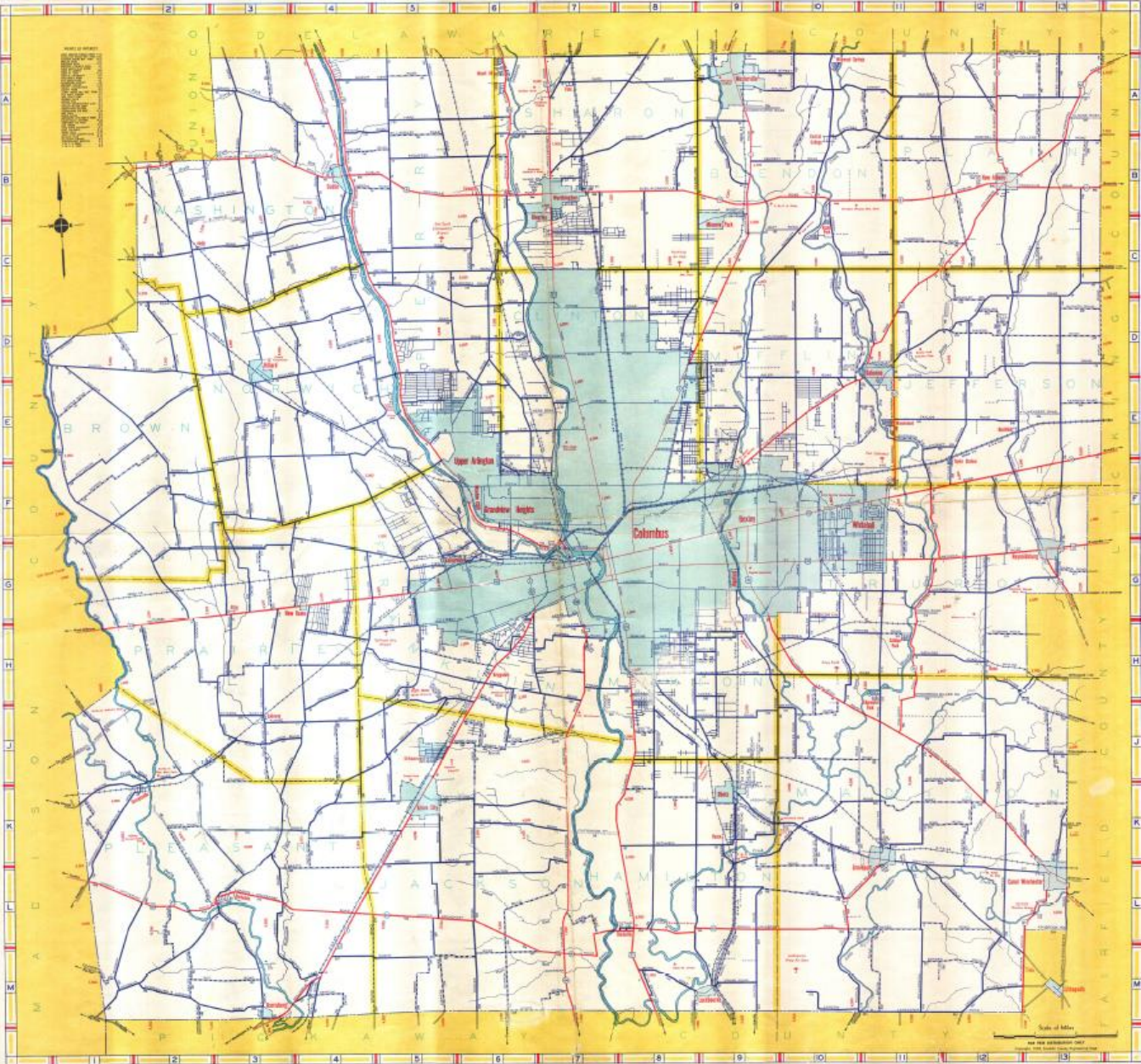
RAY L. VICK
A. R. LUDWIGSON
J. RAYMOND A. NICKL, JR.
Board of County Commissioners
GREENSBORO, N.C.

- LEGEND**
- State Route
 - County Route
 - Local Road
 - Unimproved Road
 - Gravel Road
 - Dirt Road
 - Water
 - Swamp
 - Marsh
 - Clearing
 - Field
 - Forest
 - City
 - Village
 - Hamlet
 - Unincorporated Place
 - Post Office
 - Public Building
 - Church
 - School
 - Hotel
 - Motel
 - Gas Station
 - Telephone Office
 - Fire Station
 - Police Station
 - Prison
 - Penitentiary
 - Asylum
 - Hospital
 - Cemetery
 - Public Utility
 - Railroad
 - Canal
 - Ditch
 - Stream
 - River
 - Lake
 - Reservoir
 - Bay
 - Harbor
 - Port
 - Wharf
 - Dock
 - Shipyard
 - Marina
 - Beach
 - Island
 - Peninsula
 - Point
 - Headland
 - Spit
 - Tongue
 - Neck
 - Isthmus
 - Strait
 - Sound
 - Bay
 - Harbor
 - Port
 - Wharf
 - Dock
 - Shipyard
 - Marina
 - Beach
 - Island
 - Peninsula
 - Point
 - Headland
 - Spit
 - Tongue
 - Neck
 - Isthmus
 - Strait
 - Sound

INTERESTING DATA

Franklin County, N.C., is the largest county in North Carolina by area. It covers an area of 1,000 square miles. The county is bounded on the north by Virginia, on the east by North Carolina, on the south by South Carolina, and on the west by Georgia. The county is divided into 12 municipalities: Columbus, High Point, and 10 unincorporated places. The county is home to several major industries, including agriculture, manufacturing, and services. The county is also home to several major educational institutions, including the University of North Carolina at Greensboro and the North Carolina State University.

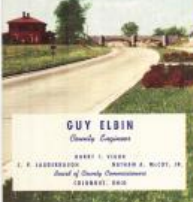
Route No.	Route Name	Surface	Width	Grade	Notes
1	State Route 1	Asphalt	36	Level	Through Columbus
2	State Route 2	Gravel	36	Level	Through High Point
3	State Route 3	Dirt	36	Level	Through High Point
4	State Route 4	Asphalt	36	Level	Through High Point
5	State Route 5	Gravel	36	Level	Through High Point
6	State Route 6	Dirt	36	Level	Through High Point
7	State Route 7	Asphalt	36	Level	Through High Point
8	State Route 8	Gravel	36	Level	Through High Point
9	State Route 9	Dirt	36	Level	Through High Point
10	State Route 10	Asphalt	36	Level	Through High Point
11	State Route 11	Gravel	36	Level	Through High Point
12	State Route 12	Dirt	36	Level	Through High Point
13	State Route 13	Asphalt	36	Level	Through High Point
14	State Route 14	Gravel	36	Level	Through High Point
15	State Route 15	Dirt	36	Level	Through High Point
16	State Route 16	Asphalt	36	Level	Through High Point
17	State Route 17	Gravel	36	Level	Through High Point
18	State Route 18	Dirt	36	Level	Through High Point
19	State Route 19	Asphalt	36	Level	Through High Point
20	State Route 20	Gravel	36	Level	Through High Point
21	State Route 21	Dirt	36	Level	Through High Point
22	State Route 22	Asphalt	36	Level	Through High Point
23	State Route 23	Gravel	36	Level	Through High Point
24	State Route 24	Dirt	36	Level	Through High Point
25	State Route 25	Asphalt	36	Level	Through High Point
26	State Route 26	Gravel	36	Level	Through High Point
27	State Route 27	Dirt	36	Level	Through High Point
28	State Route 28	Asphalt	36	Level	Through High Point
29	State Route 29	Gravel	36	Level	Through High Point
30	State Route 30	Dirt	36	Level	Through High Point



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FRANKLIN COUNTY HIGHWAY MAP 1930



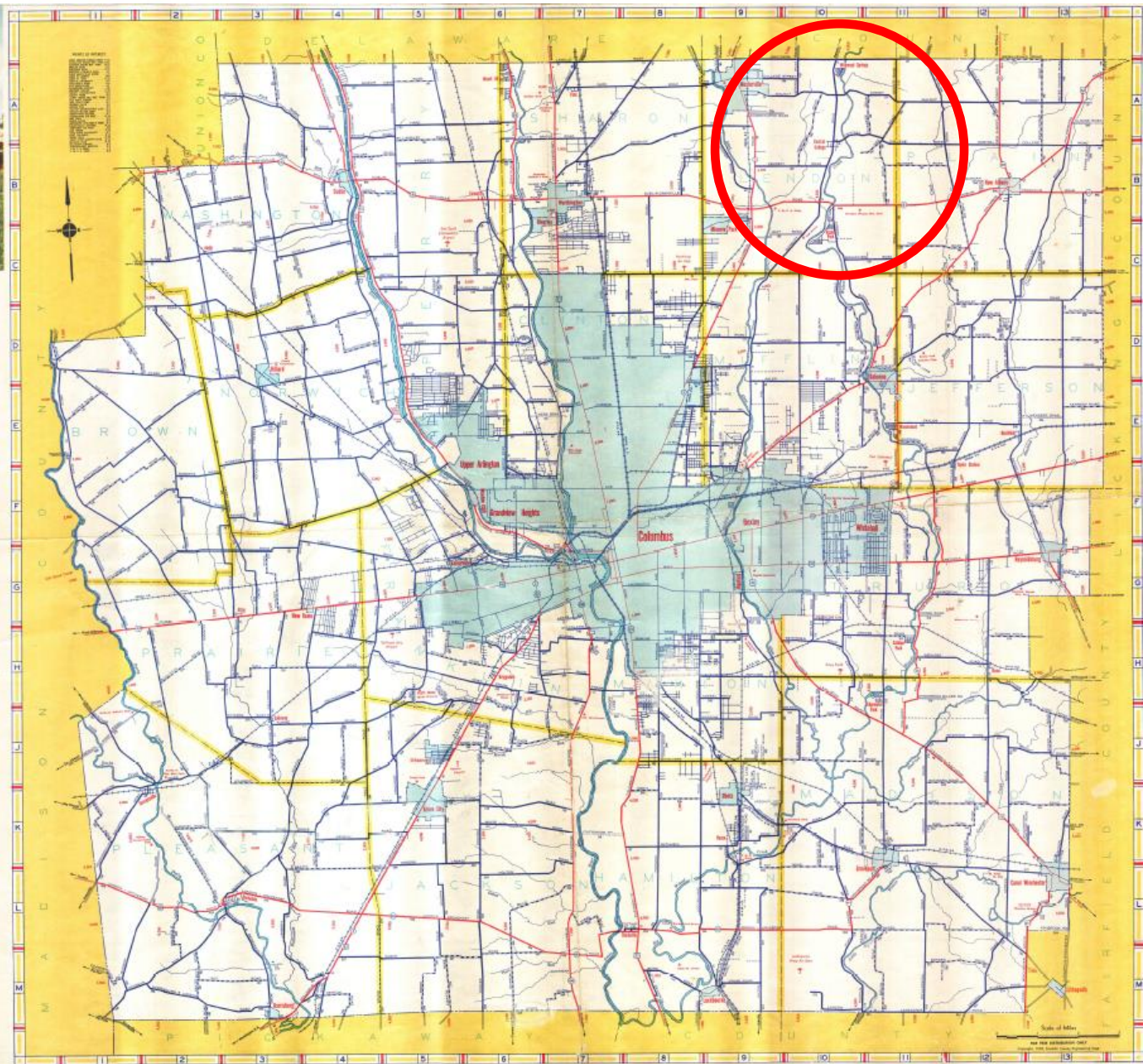
LEGEND

- FEDERAL HIGHWAY
- STATE HIGHWAY
- COUNTY HIGHWAY
- LOCAL ROAD
- RAILROAD
- CANAL
- RIVER
- LAKE
- SWAMP
- UNIMPROVED ROAD
- UNIMPROVED TRAIL
- UNIMPROVED DRIVE
- UNIMPROVED PATH
- UNIMPROVED WALK
- UNIMPROVED BRIDGE
- UNIMPROVED FERRY
- UNIMPROVED TUNNEL
- UNIMPROVED CULVERT
- UNIMPROVED DRAINAGE
- UNIMPROVED IRRIGATION
- UNIMPROVED UTILITY
- UNIMPROVED TELEPHONE
- UNIMPROVED POWER
- UNIMPROVED WATER
- UNIMPROVED GAS
- UNIMPROVED OIL
- UNIMPROVED COAL
- UNIMPROVED IRON
- UNIMPROVED COPPER
- UNIMPROVED ZINC
- UNIMPROVED LEAD
- UNIMPROVED SILVER
- UNIMPROVED GOLD
- UNIMPROVED PLATINUM
- UNIMPROVED DIAMOND
- UNIMPROVED RUBY
- UNIMPROVED EMERALD
- UNIMPROVED PEARL
- UNIMPROVED JEWEL
- UNIMPROVED GEM
- UNIMPROVED STONE
- UNIMPROVED CLAY
- UNIMPROVED LIME
- UNIMPROVED SAND
- UNIMPROVED GRAVEL
- UNIMPROVED CRUSHED STONE
- UNIMPROVED ASPHALT
- UNIMPROVED CONCRETE
- UNIMPROVED BRICK
- UNIMPROVED TILE
- UNIMPROVED GLASS
- UNIMPROVED CERAMIC
- UNIMPROVED POTTERY
- UNIMPROVED TEXTILE
- UNIMPROVED LEATHER
- UNIMPROVED FUR
- UNIMPROVED WOOL
- UNIMPROVED COTTON
- UNIMPROVED LINEN
- UNIMPROVED SILK
- UNIMPROVED HEMP
- UNIMPROVED JUTE
- UNIMPROVED FLAX
- UNIMPROVED RYER
- UNIMPROVED BARLEY
- UNIMPROVED OATS
- UNIMPROVED WHEAT
- UNIMPROVED CORN
- UNIMPROVED RICE
- UNIMPROVED SUGAR BEET
- UNIMPROVED SUGAR CANE
- UNIMPROVED CATTLE
- UNIMPROVED HORSE
- UNIMPROVED SWINE
- UNIMPROVED SHEEP
- UNIMPROVED GOAT
- UNIMPROVED BIRD
- UNIMPROVED FISH
- UNIMPROVED BEES
- UNIMPROVED SILK WORMS
- UNIMPROVED PULP
- UNIMPROVED LUMBER
- UNIMPROVED TIMBER
- UNIMPROVED LOGS
- UNIMPROVED SHEDS
- UNIMPROVED BARN
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- UNIMPROVED CHURCH
- UNIMPROVED SCHOOL
- UNIMPROVED OFFICE
- UNIMPROVED STORE
- UNIMPROVED FACTORY
- UNIMPROVED MILL
- UNIMPROVED BRIDGE
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- UNIMPROVED CULVERT
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- UNIMPROVED MILL

INTERESTING DATA

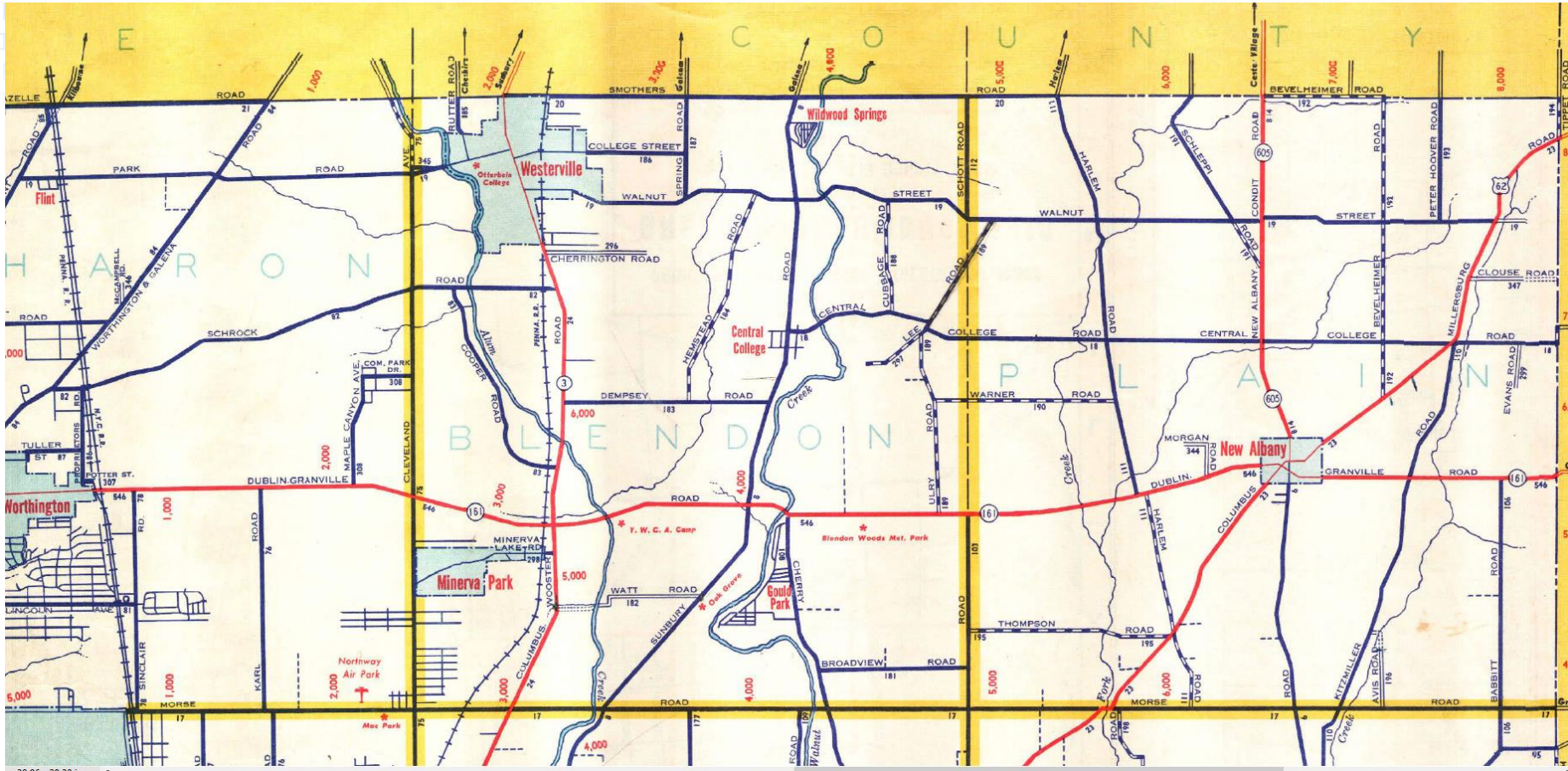
POPULATION OF COUNTY IN 1920
POPULATION OF COUNTY IN 1930
POPULATION OF COUNTY IN 1940
POPULATION OF COUNTY IN 1950
POPULATION OF COUNTY IN 1960
POPULATION OF COUNTY IN 1970
POPULATION OF COUNTY IN 1980
POPULATION OF COUNTY IN 1990
POPULATION OF COUNTY IN 2000
POPULATION OF COUNTY IN 2010
POPULATION OF COUNTY IN 2020

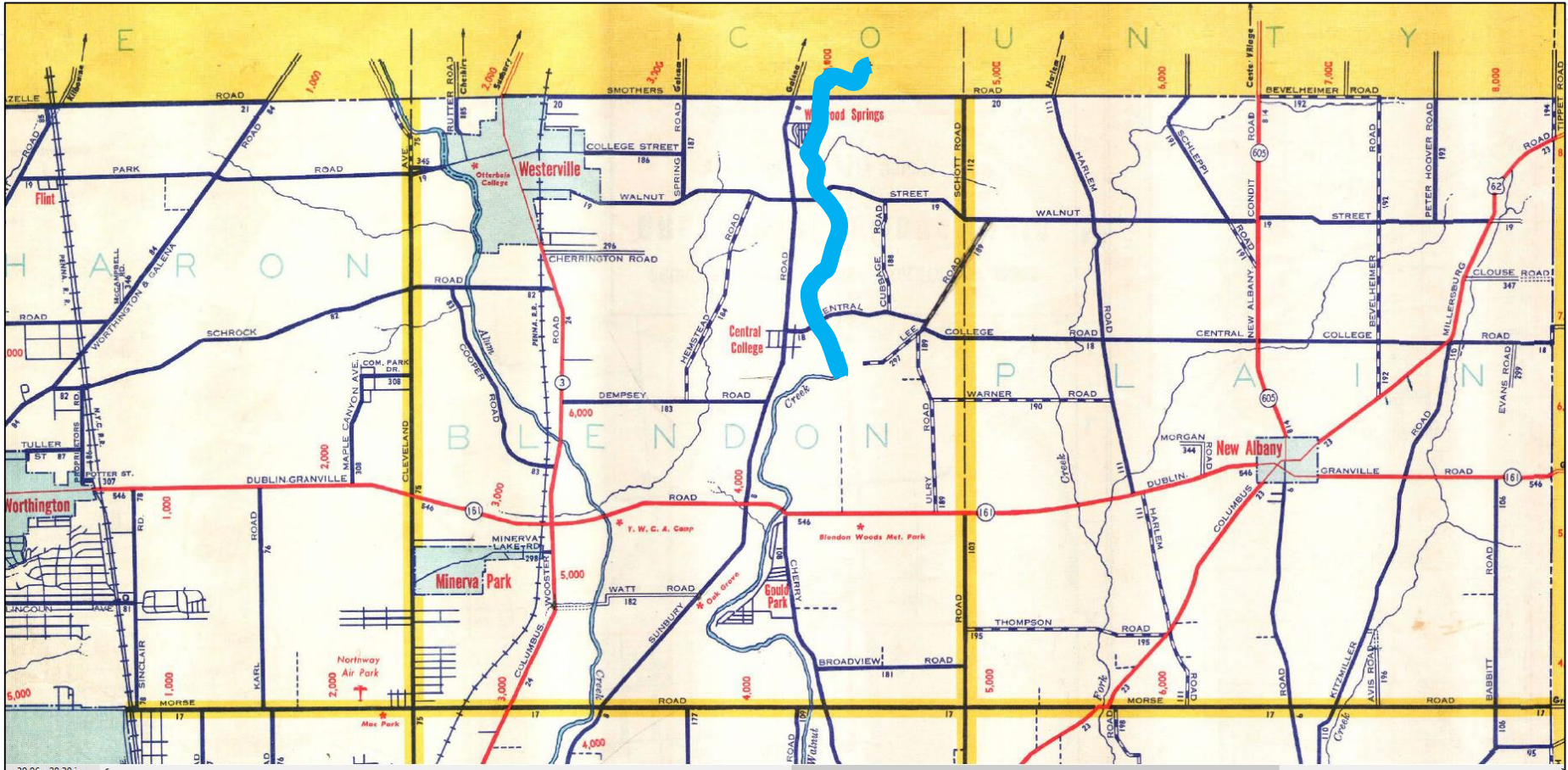
Year	Population
1920	10,000
1930	12,000
1940	15,000
1950	18,000
1960	22,000
1970	28,000
1980	35,000
1990	42,000
2000	50,000
2010	58,000
2020	65,000

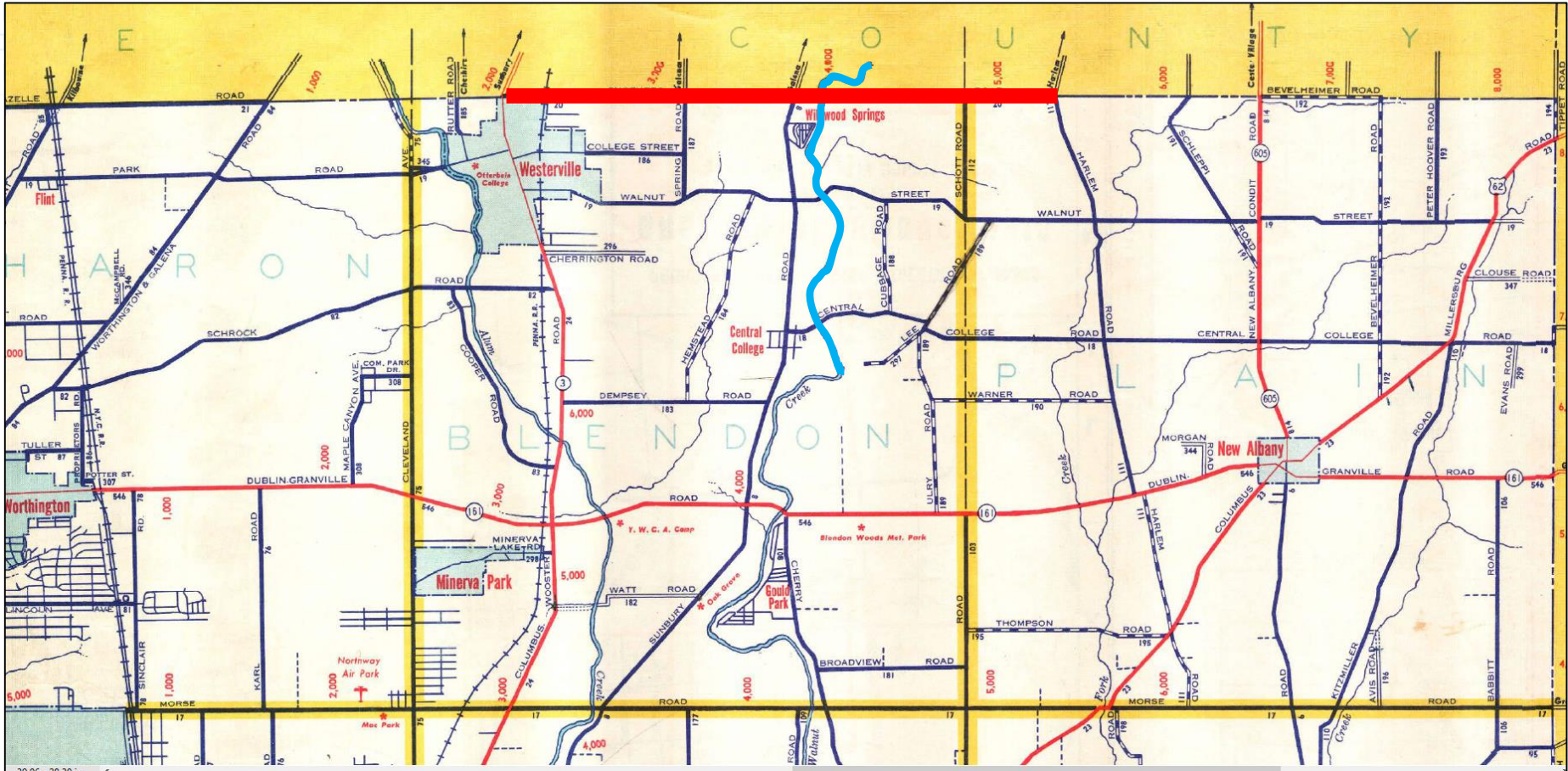


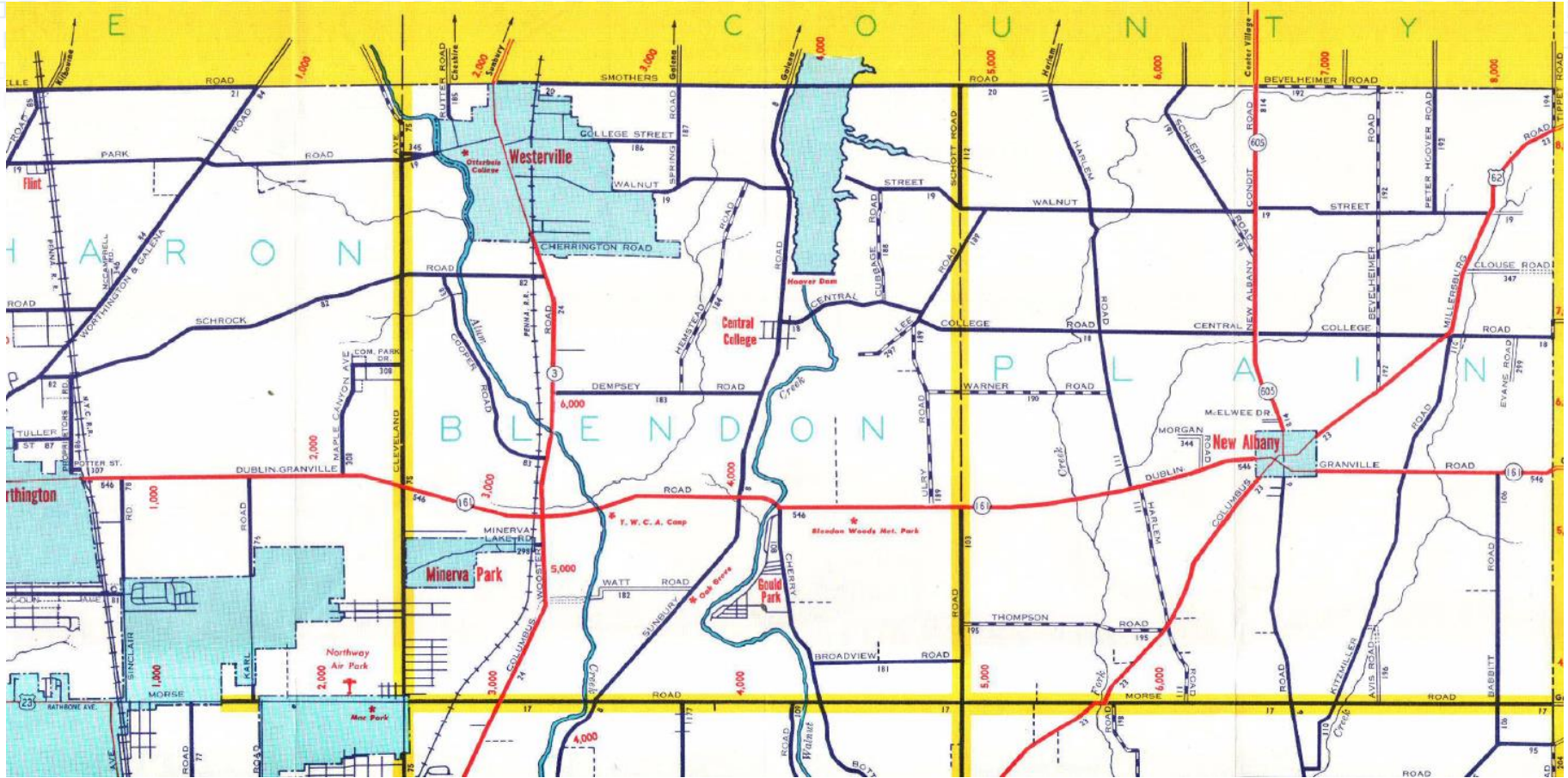
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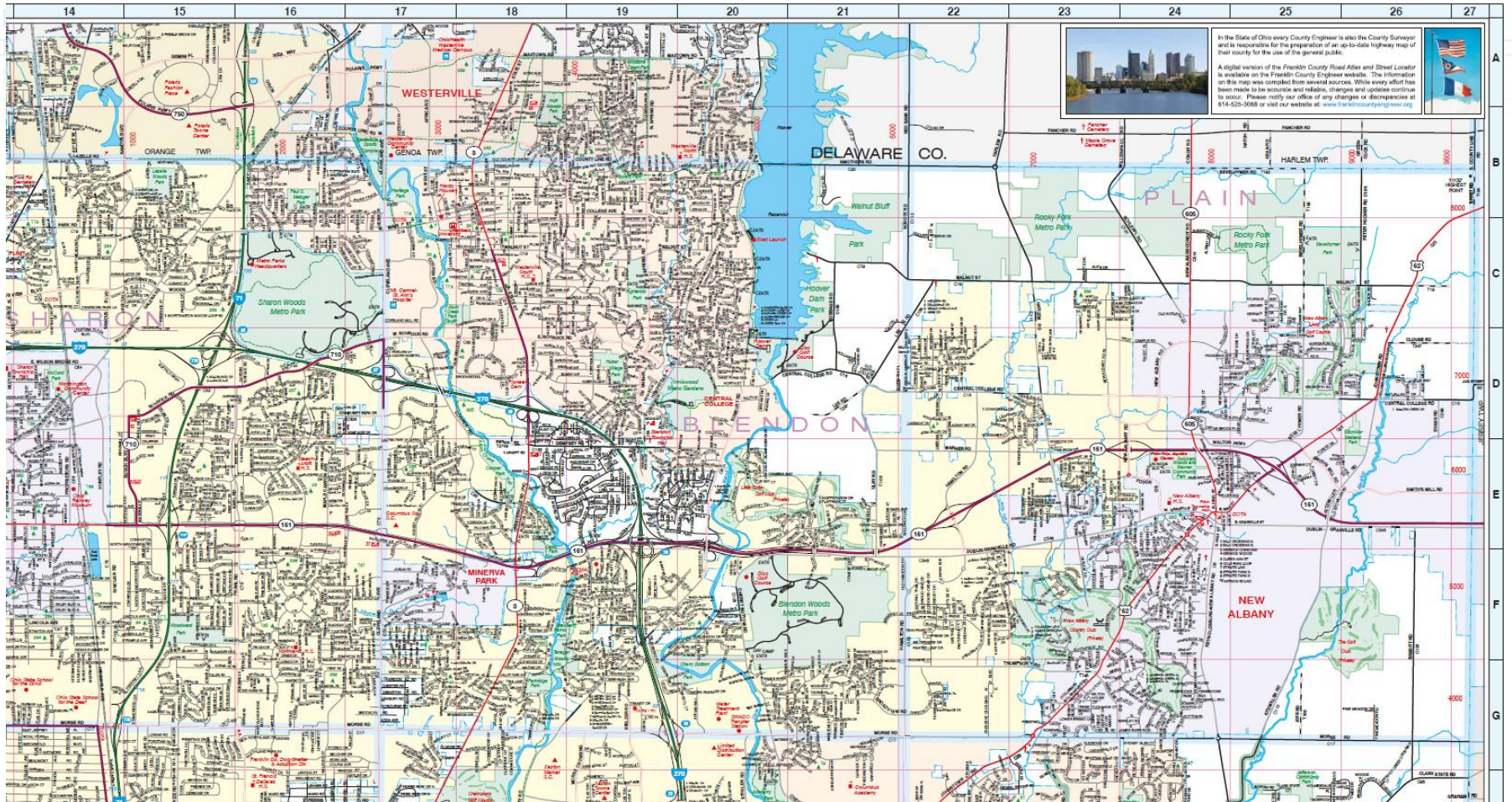
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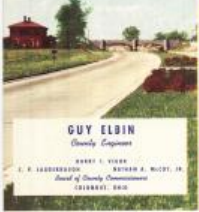
In the State of Ohio every County Engineer is also the County Surveyor and is responsible for the preparation of an up-to-date highway map of their county for the use of the general public.

A digital version of the Franklin County Road Atlas and Street Locator is available on the Franklin County Engineer website. The information on this map was compiled from several sources. While every effort has been made to be accurate and reliable, changes and updates continue to occur. Please notify our office of any changes or discrepancies at 614-625-3088 or visit our website at: www.franklincountyengineer.org



FRANKLIN COUNTY HIGHWAY MAP

1950

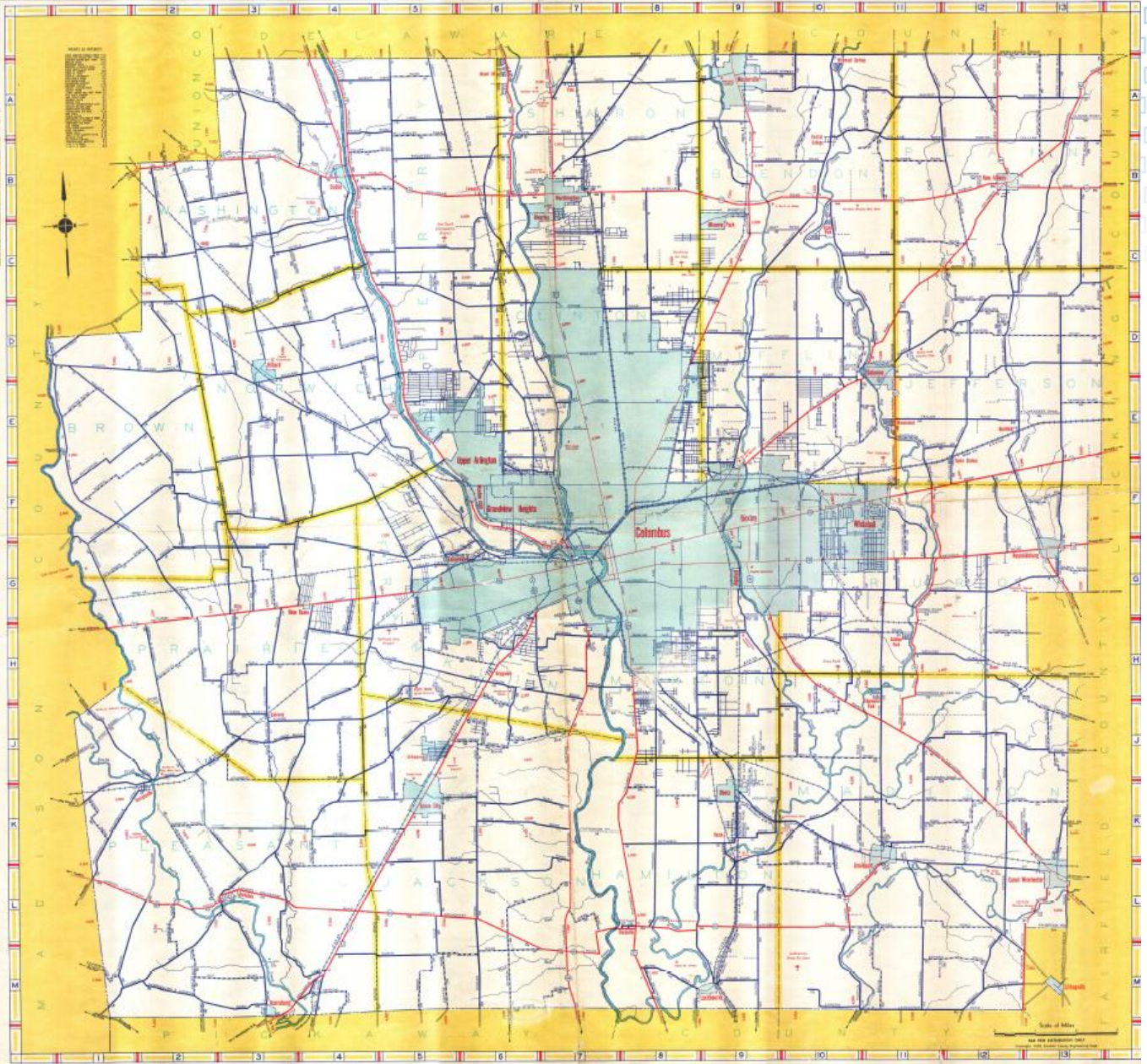


GUY ELBIN

County Engineer

HARRY L. VICKY
L. E. LARSENBERG
E. H. BARNETT
RICHARD A. MURPHY, JR.
Board of County Commissioners
CHERRY, MO.

- LEGEND**
- FEDERAL ROADS
 - STATE ROADS
 - COUNTY ROADS
 - UNIMPROVED ROADS
 - RAILROADS
 - WATERSHEDS
 - LAKE AND RESERVOIR
 - RIVERS AND STREAMS
 - CREEKS
 - SWAMP AND MARSH
 - UNIMPROVED CANALS
 - IRRIGATION CANALS
 - DRAINAGE CANALS
 - RAILROADS
 - AIR LINES
 - TELEPHONE LINES
 - POWER LINES
 - FERRY LINES
 - BRIDGE
 - TUNNEL
 - GRADE CROSSING
 - RAILROAD CROSSING
 - HIGHWAY CROSSING
 - FERRY CROSSING
 - AIR CROSING
 - TELEPHONE CROSSING
 - POWER CROSSING
 - FERRY CROSSING
 - BRIDGE
 - TUNNEL
 - GRADE CROSSING
 - RAILROAD CROSSING
 - HIGHWAY CROSSING
 - FERRY CROSSING
 - AIR CROSING
 - TELEPHONE CROSSING
 - POWER CROSSING
- INTERESTING DATA**
- POPULATION - City of Columbus 17,211
 1940 - 17,211
 1930 - 15,000
 1920 - 12,000
 1910 - 10,000
 1900 - 8,000
 1890 - 6,000
 1880 - 4,000
 1870 - 3,000
 1860 - 2,000
 1850 - 1,500
 1840 - 1,000
 1830 - 800
 1820 - 600
 1810 - 400
 1800 - 300
 1790 - 200
 1780 - 150
 1770 - 100
 1760 - 80
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Franklin County
Ohio
Road Map and Street Locator
2017 - 2019

County Executive
Council E. Robinson, III, M.A.
Franklin County Register

Franklin County
Commissioner
John O'Grady
Franklin County Engineer
Clyde Johnson, P.E.
Franklin County Auditor
Timothy J. Dreyer

Includes the Commission of
Columbus County Board of Workforce
Development Executive Director
Steve Cox - Columbus Board of Workforce
Development Executive Director
Cary
Columbus Board of Workforce
Development Executive Director
Cary

Council E. Robinson, III, M.A.
Franklin County Register

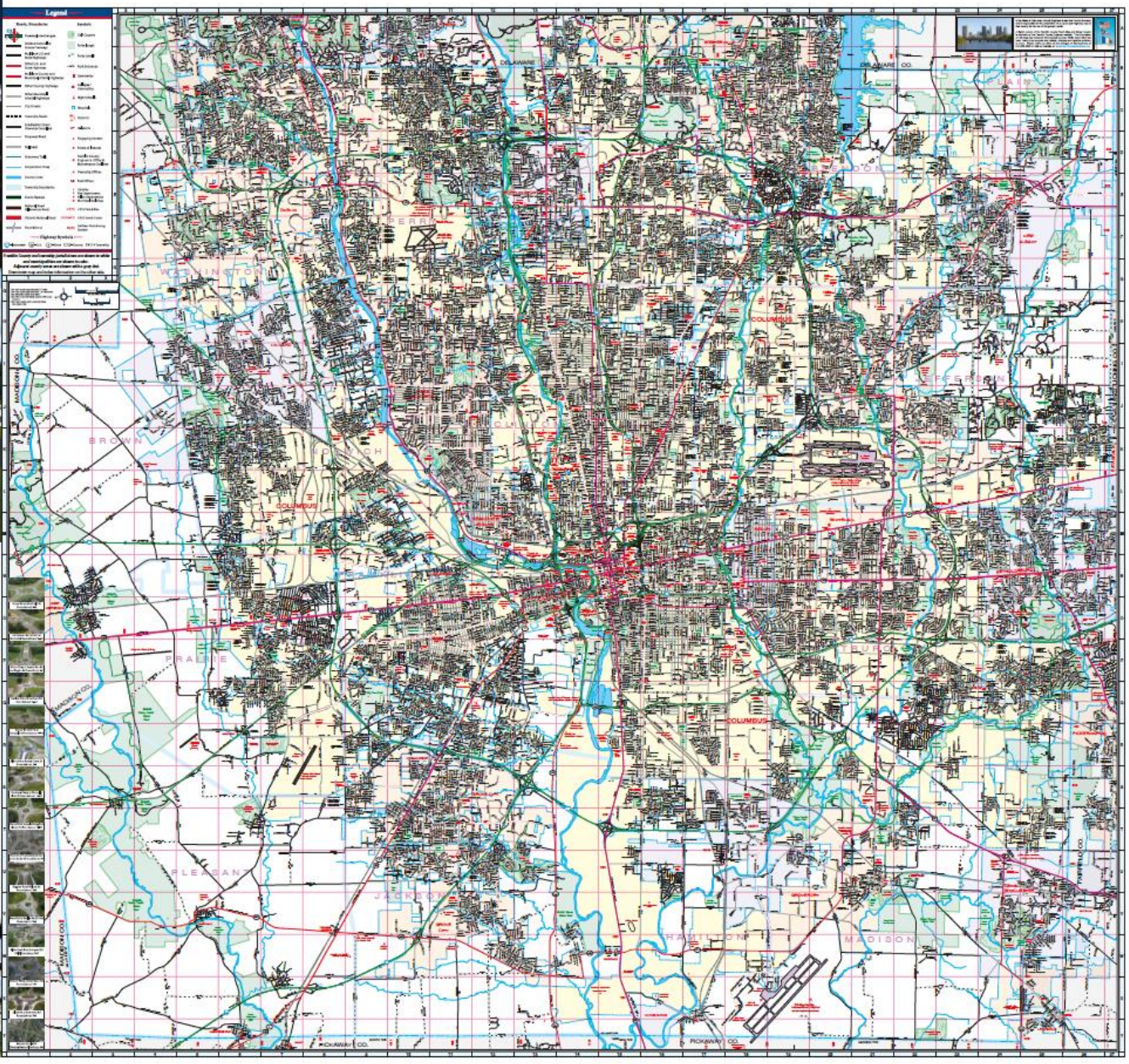
Franklin County
Commissioner
John O'Grady
Franklin County Engineer
Clyde Johnson, P.E.
Franklin County Auditor
Timothy J. Dreyer



Map Notes
This map is based on the 2017 data and does not include
any changes to the map since the last update.
This map is not a substitute for a survey or
other professional engineering or architectural
service. For more information, contact the
Franklin County Register or the Franklin County
Engineering Department.

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Scale	Distance
1:50,000	1 inch = 0.4 miles
1:100,000	1 inch = 0.8 miles
1:150,000	1 inch = 1.2 miles
1:200,000	1 inch = 1.6 miles
1:250,000	1 inch = 2.0 miles
1:300,000	1 inch = 2.4 miles
1:400,000	1 inch = 3.2 miles
1:500,000	1 inch = 4.0 miles
1:600,000	1 inch = 4.8 miles
1:700,000	1 inch = 5.6 miles
1:800,000	1 inch = 6.4 miles
1:900,000	1 inch = 7.2 miles
1:1,000,000	1 inch = 8.0 miles
1:1,200,000	1 inch = 9.6 miles
1:1,500,000	1 inch = 12.0 miles
1:2,000,000	1 inch = 16.0 miles
1:3,000,000	1 inch = 24.0 miles
1:4,000,000	1 inch = 32.0 miles
1:5,000,000	1 inch = 40.0 miles
1:6,000,000	1 inch = 48.0 miles
1:7,000,000	1 inch = 56.0 miles
1:8,000,000	1 inch = 64.0 miles
1:9,000,000	1 inch = 72.0 miles
1:10,000,000	1 inch = 80.0 miles





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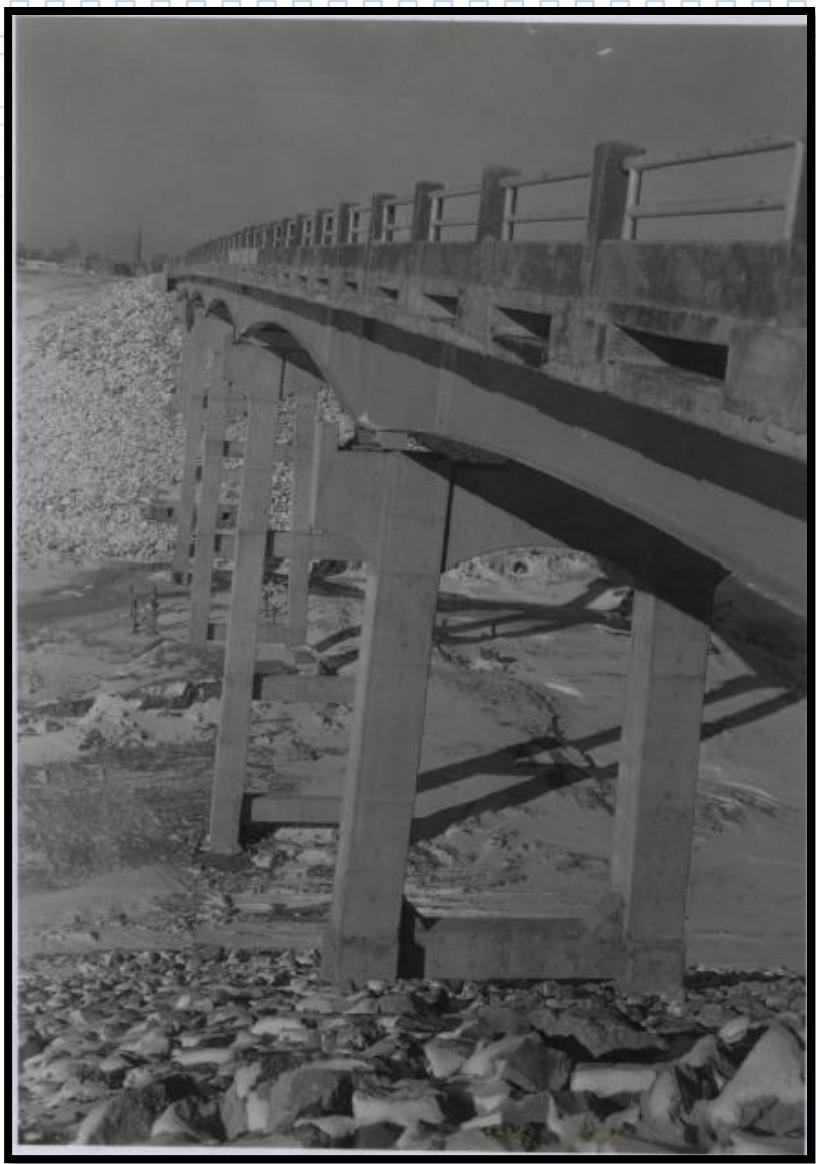
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The Existing Bridge

- Built in 1953 (redecked in 1980)
- 6-spans (72.8, 99.7, 100.1, 100.1, 99.7, 72.8)
- Bridge Limits: 546'-2"
- Reinforced concrete slab on 3-haunched steel girders
- 30'-0" f/f guardrail
- Stub abutments on piles
- 80'+ tall cap-and-column piers on piles and spread footings
- Strip seal expansion joints and rocker type bearings.



Existing Bridge Issues

- Approach causeway and abutment settlement and slope failure
- Fracture critical – 3 girder system
- Fatigue-prone steel detailing
- Limited right shoulder width
- Deteriorated abutment bearing seats
- Deteriorated concrete deck







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Coordination

- ODOT
- CEAO
- COC Division of Water
- COC Dept. of Public Service
- Columbus Recreation & Parks
- Delaware County
- Westerville
- Blendon Twp. (Franklin)
- Genoa Twp. (Delaware)





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Project Design Schedule

- April 2013 – Consultant Authorization
- October 2013 – Preliminary Engineering Study
- January 2014 – Stage 1
- March 2014 – Contractor Constructability Review
- July 2014 – Stage 2
- Project selected for Federal Exchange Process Funding
- February 2015 – Stage 3
- March 2016 – Tracings
- August 2016 – Project Sold



Design Perspective

Mike Killian, PE

Burgess & Niple, Inc.



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Project Design Scope / Goals

- Replace existing bridge deck (detour MOT)
- Replace existing bridge girders (redundant system, no fatigue-prone details)
- Convert abutments to semi-integral and salvage the existing piers (if possible)
- Minimize the approach causeway work
- Minimize disruption to traffic and the surrounding community
- Incorporate provisions for a shared-bike shoulder
- Maintain or improve vertical boating clearance

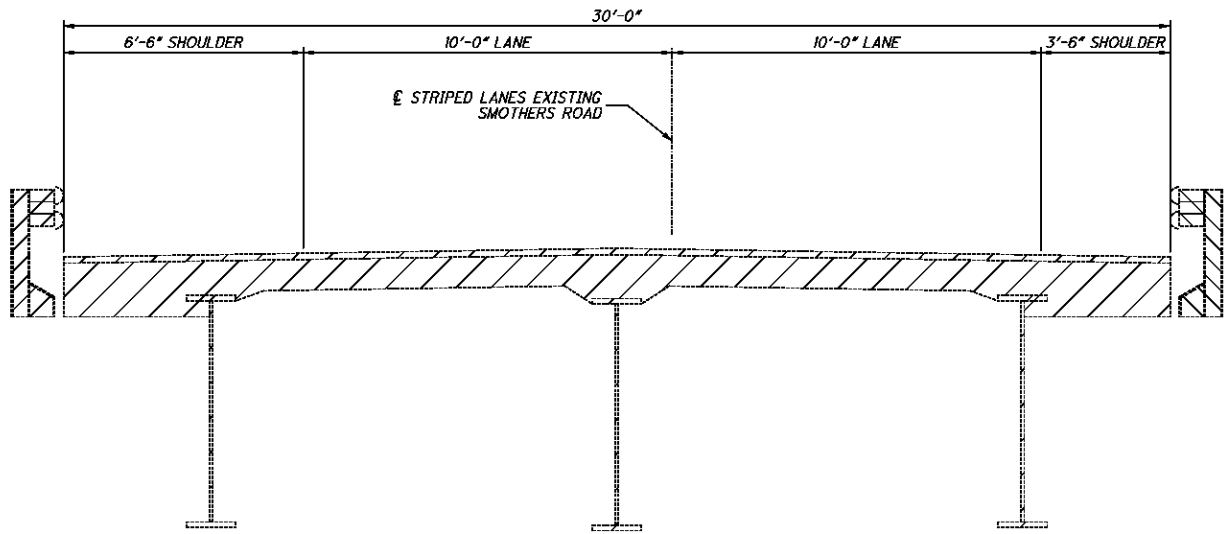


Preliminary Bridge Design –

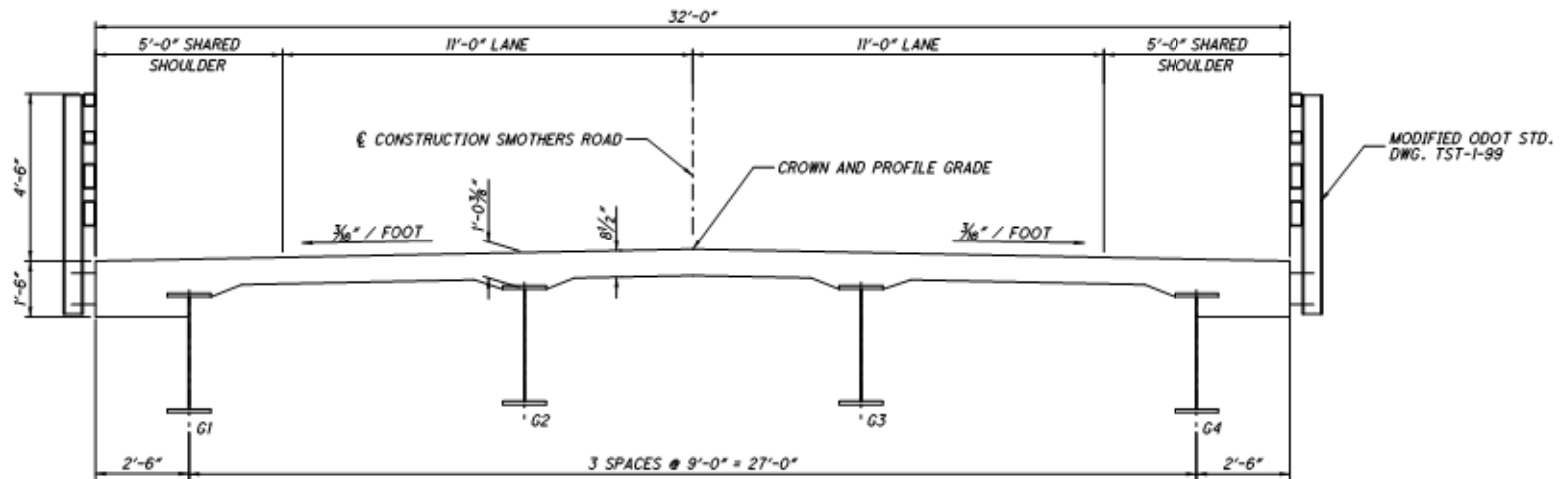
Structure Types Considered

- Haunched steel plate girders
- Rolled steel beams
- Prestressed concrete I-girders
- Prestressed concrete box beams
- Constant depth steel plate girders (selected)





EXISTING TYPICAL SECTION AND REMOVALS



PROPOSED TYPICAL SECTION

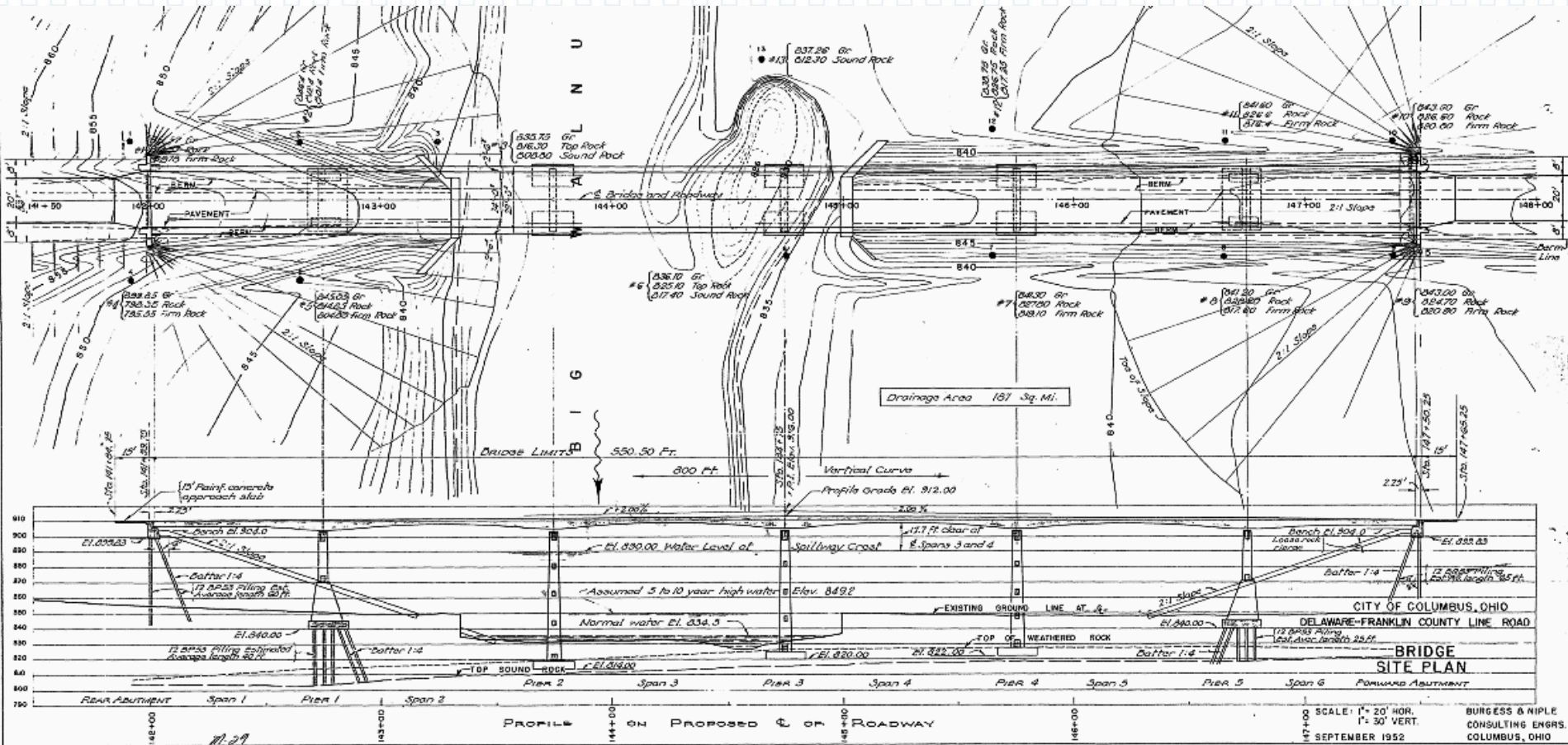


Contractor Constructability Review

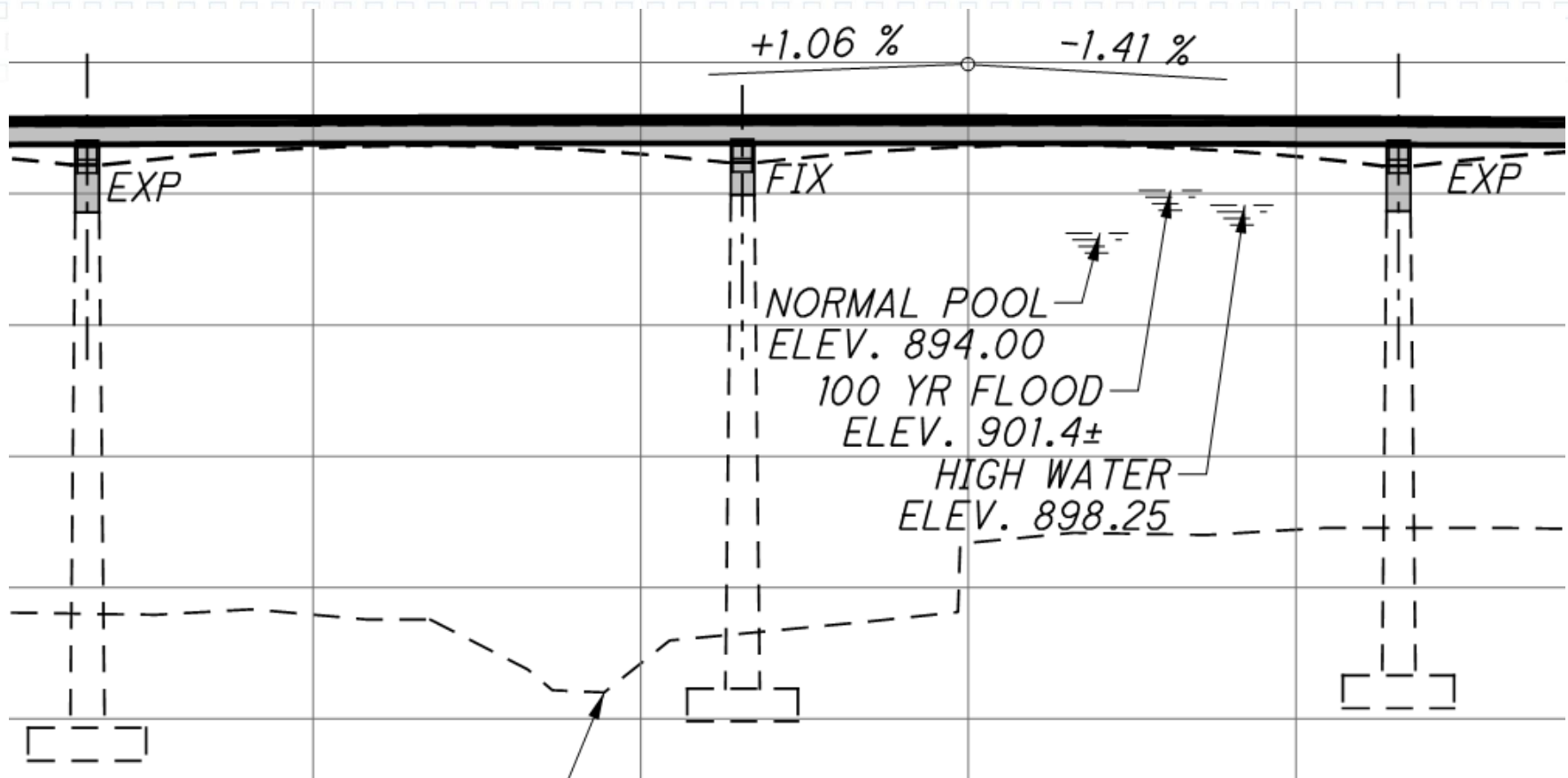
- **Coordinated with Ohio Contractors Association and two different local contractors**
- **Obtained input on:**
 - Constructability
 - Site access
 - Methods for accelerating construction and minimizing impact to surrounding community.
- **Notable outcome:**
 - Minimum closure time = 120-days
 - No to precast elements
 - SIP forms would be the best solution for reducing construction time.
 - Barges would be used for both demo and construction – but that dock location and design should be left up to contractor.



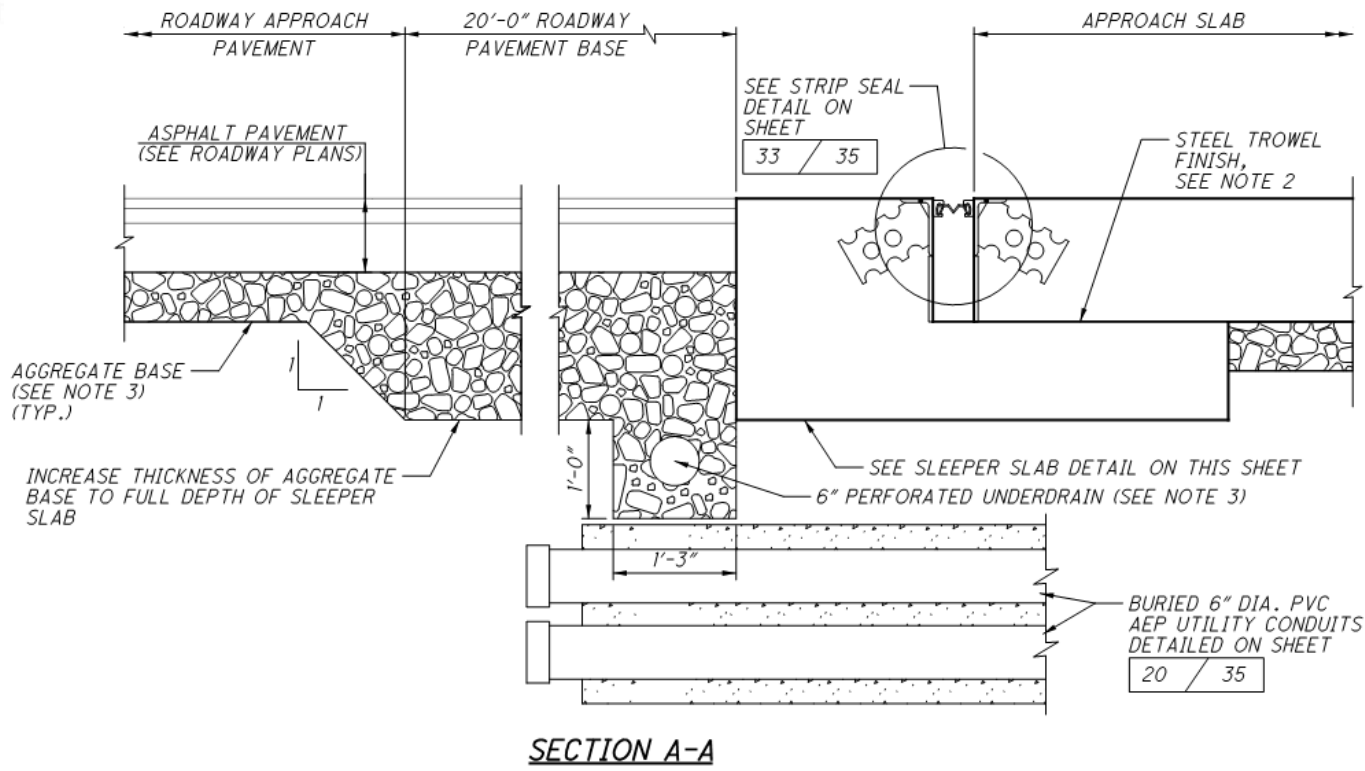
Detail Design – Semi-Integral Conversion Design



Semi-Integral Conversion Design (continued)



Semi-Integral Conversion Design (continued)



Bearing and Seismic design

**AASHTO – LRFD
Bridge Design Specs
- 2012**

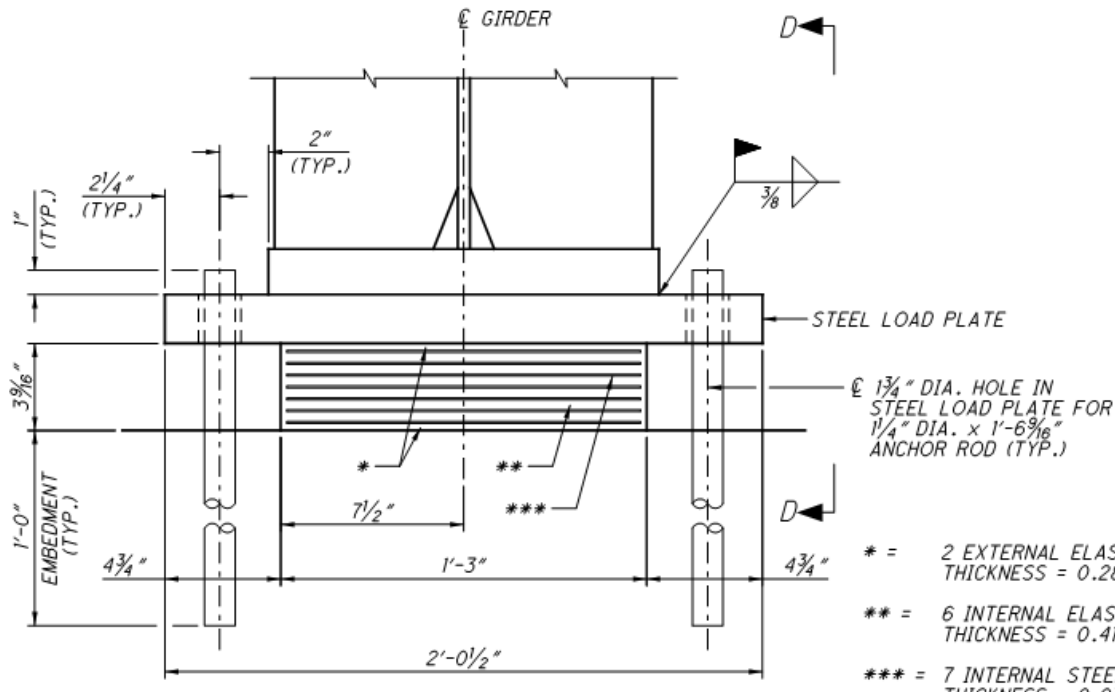
3.10—EARTHQUAKE EFFECTS: *EQ*

3.10.9.2—Seismic Zone 1

The horizontal design connection force shall be addressed from the point of application through the substructure and into the foundation elements.

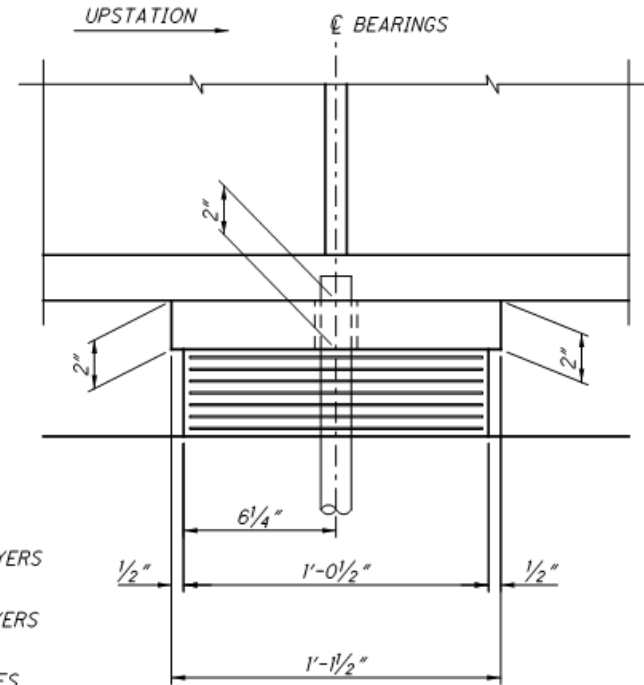


Bearing and Seismic design (continued) (fuse concept)



BEARING DETAIL - PIER 3
(FIXED)

- * = 2 EXTERNAL ELASTOMER LAYERS
THICKNESS = 0.288"
- ** = 6 INTERNAL ELASTOMER LAYERS
THICKNESS = 0.411"
- *** = 7 INTERNAL STEEL LAMINATES
THICKNESS = 0.0747"



VIEW D-D

Bearing and Seismic design (continued)

It should be noted that after the design was completed...

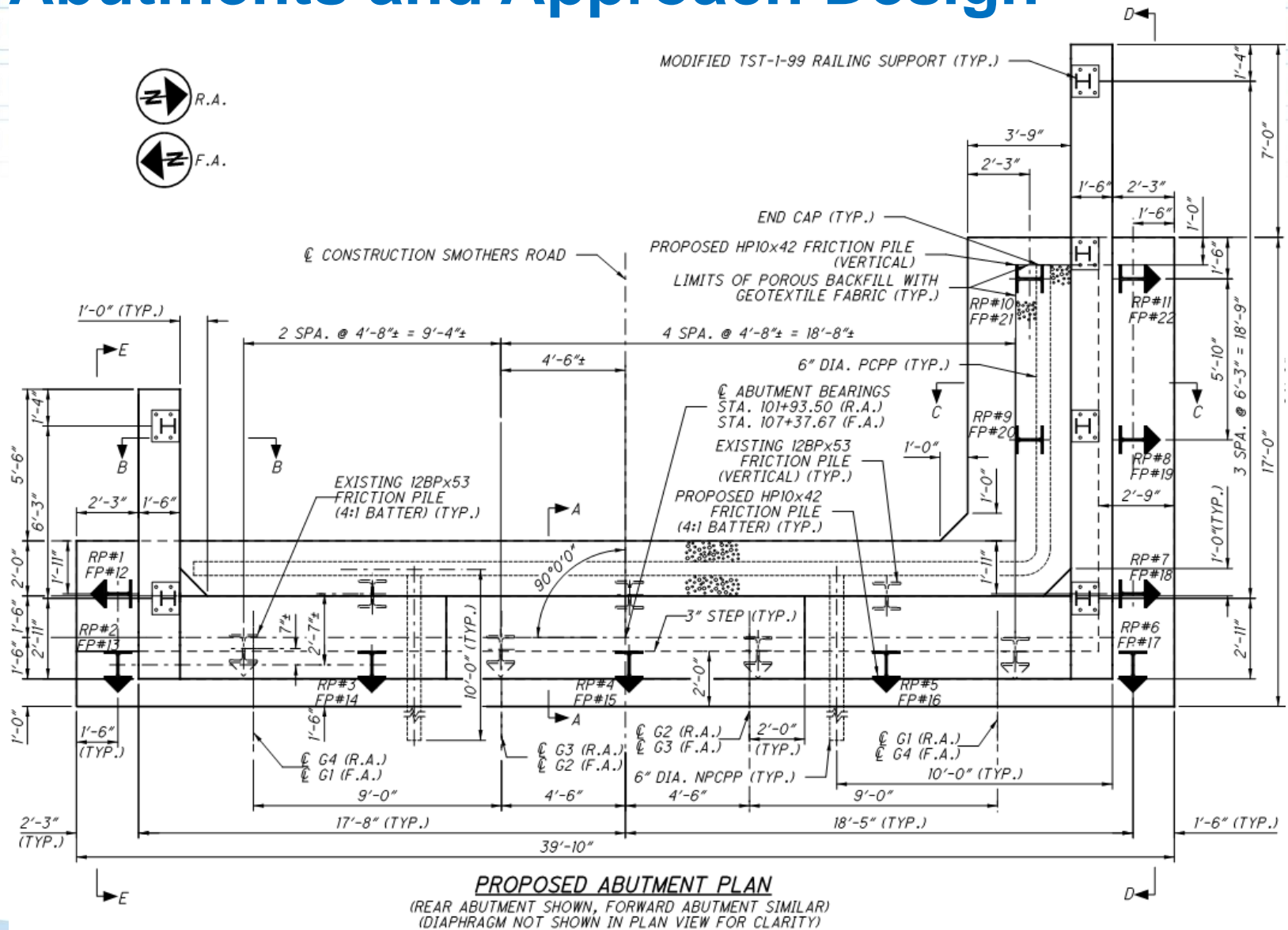
**AASHTO – LRFD Bridge
Design Specs – 2014 –
(2015 Interim)**

3.10.9.2—Seismic Zone 1

Delete paragraph 3 of this Article.



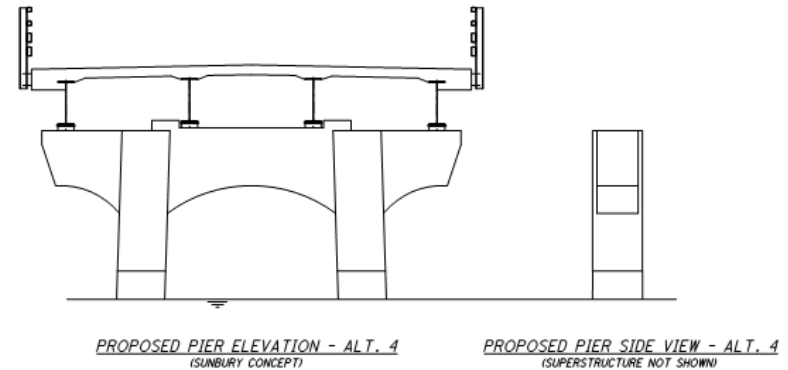
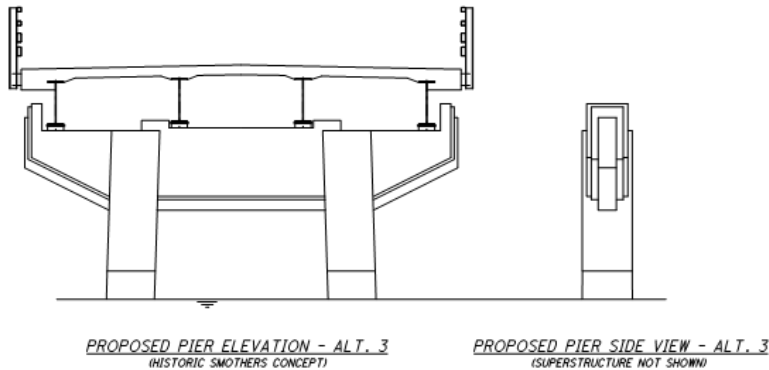
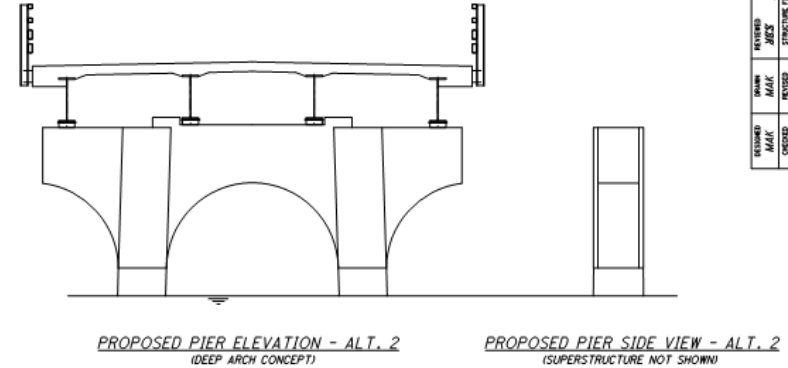
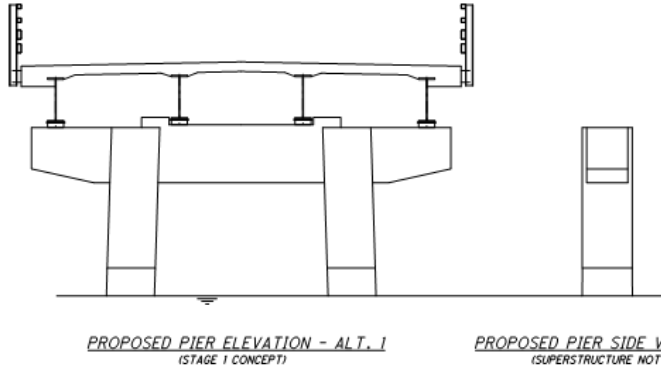
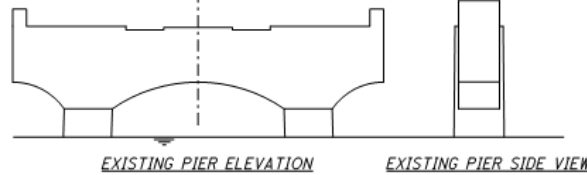
Abutments and Approach Design



Modified TST Railing



Aesthetic Pier Caps



AESTHETIC PIER ALTERNATIVES SMOTHERS ROAD OVER HOOVER RESERVOIR

DATE		6/1/14	
REVISION		STRUCTURE FILE NUMBER	
NO.	BY	NO.	DATE
1	MAK	1	6/1/14
2	MAK	2	6/1/14
3	MAK	3	6/1/14
4	MAK	4	6/1/14
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99	MAK	99	6/1/14
100	MAK	100	6/1/14

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Environmental

- Federal Exchange Process –
 - No NEPA documents required (i.e. 4F, Cultural, Ecological)
- Wetland Delineation Report completed
 - 3 small wetland areas were identified
- 404 permit was not prepared. Existing boat facility to the north available for use. But, each contractor will likely want to do something different.
- Structural Steel
 - Weathering and galvanized steel options were considered
 - Pre-painted with 3-coats (prime, intermediate, finish) (similar to Sunbury Road Bridge)



Construction Perspective

Kevin Gothberg

Kokosing Construction Company



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Challenges

- Tight Schedule
- Weather – Winter Start
- Access – Causeway not feasible, limited roadway width
- Obtain 404 permit
- Overhead utilities at south edge of bridge



Schedule

- 120 day closure with an early road closure date of 2/13. Incentive was \$5,000 per day and disincentive was \$7,000 per day.
- Weather delays were allowed to move the completion date, but did not move the incentive date.
- Internally decided incentive was not realistic. Schedule too linear and weather too uncertain to financially rationalize pursuing incentive.
- Still accelerated by using winter concrete protection, overtime, and 6 day work weeks as needed.
- 3 sets of prefabricated pier forms used.
- Specification allowed for metal deck.



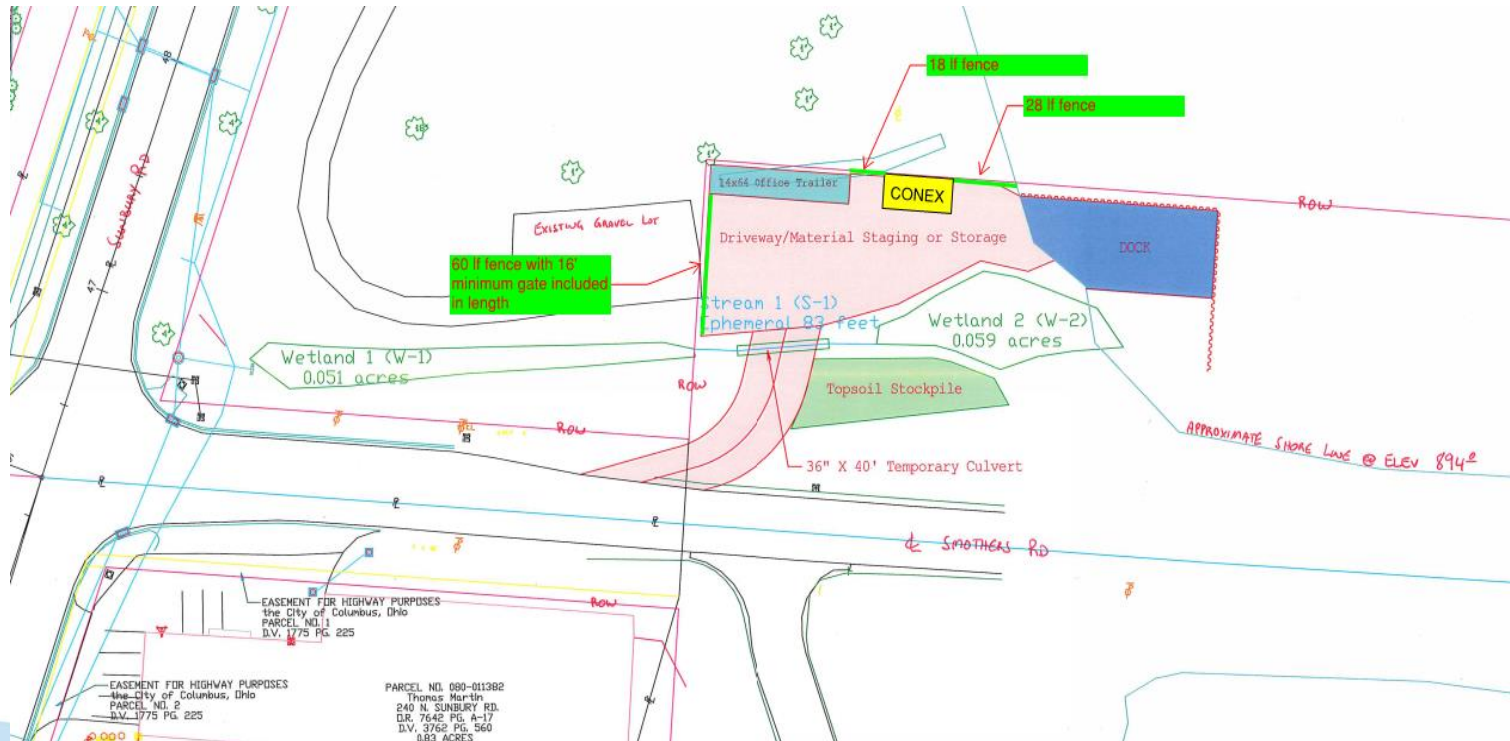
Weather

- Concrete saw, asphalt mill, water freezing, etc.
- Winter Concrete
- Wind impacts on barges and cranes
- Wind on picked members



Access

- Access from closed Smothers to avoid traffic and turns in and out of busy road.
- Had to thread drive through 2 wetlands.
- Access road and dock fill required 404 Permit





Overhead Utilities

- Electrical and Communications
- Required removal for piling, demo, and erection



Overhead Utilities

- Electrical was removed with services back fed from a temporary substation. AEP was fantastic.
- We were able to work around communications lines.



Deck Demolition



Steel Demolition





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Cap Demo and New Column Extensions



New Pier Caps



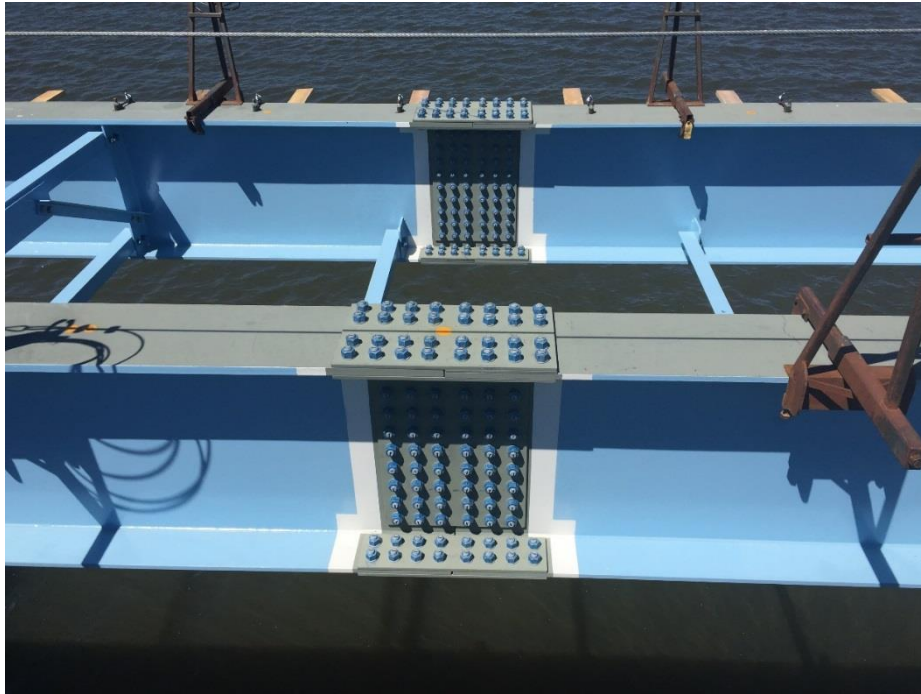
Steel Erection



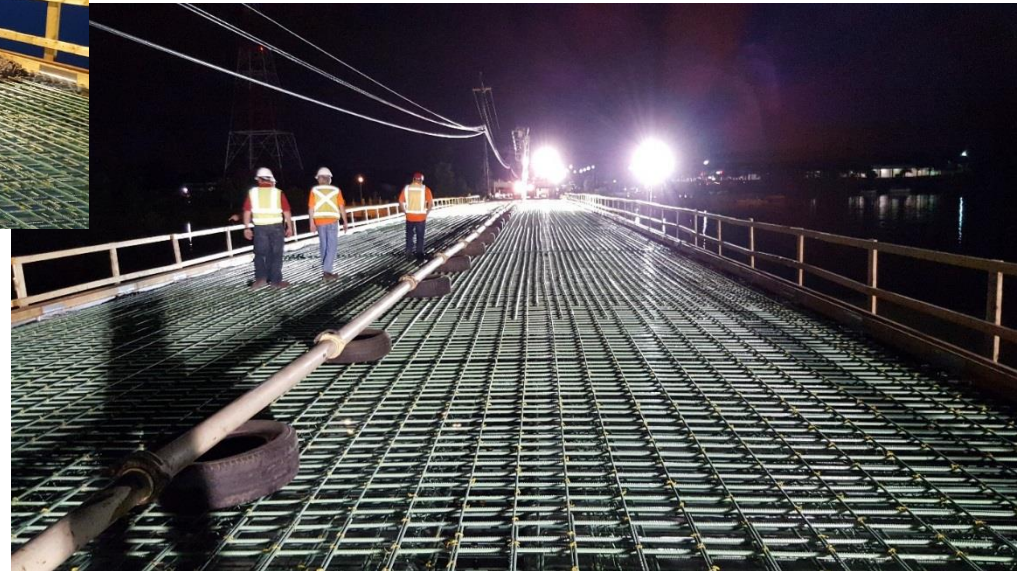
Steel Erection (continued)



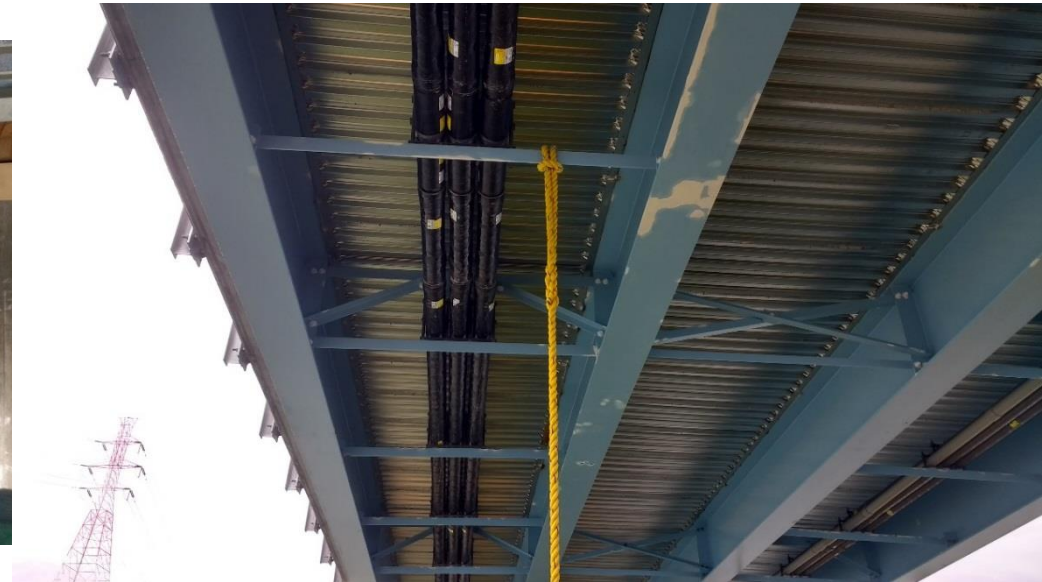
Splices and Decking



Deck Pour



Bridge Mounted Utility Ducts



Pre Painted Steel Splices/Touch Up





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Build it, and he will come!





Thank-you!



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