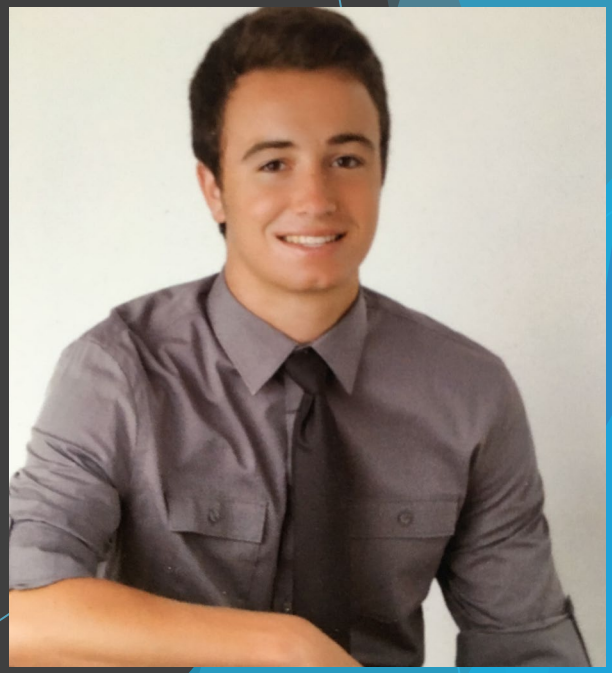
Road Evaluation and Redesign

City of Manchester, Iowa
F.S.B.G. Engineering
May 11th, 2021

University of Iowa Civil Engineers -- Project Team Introductions

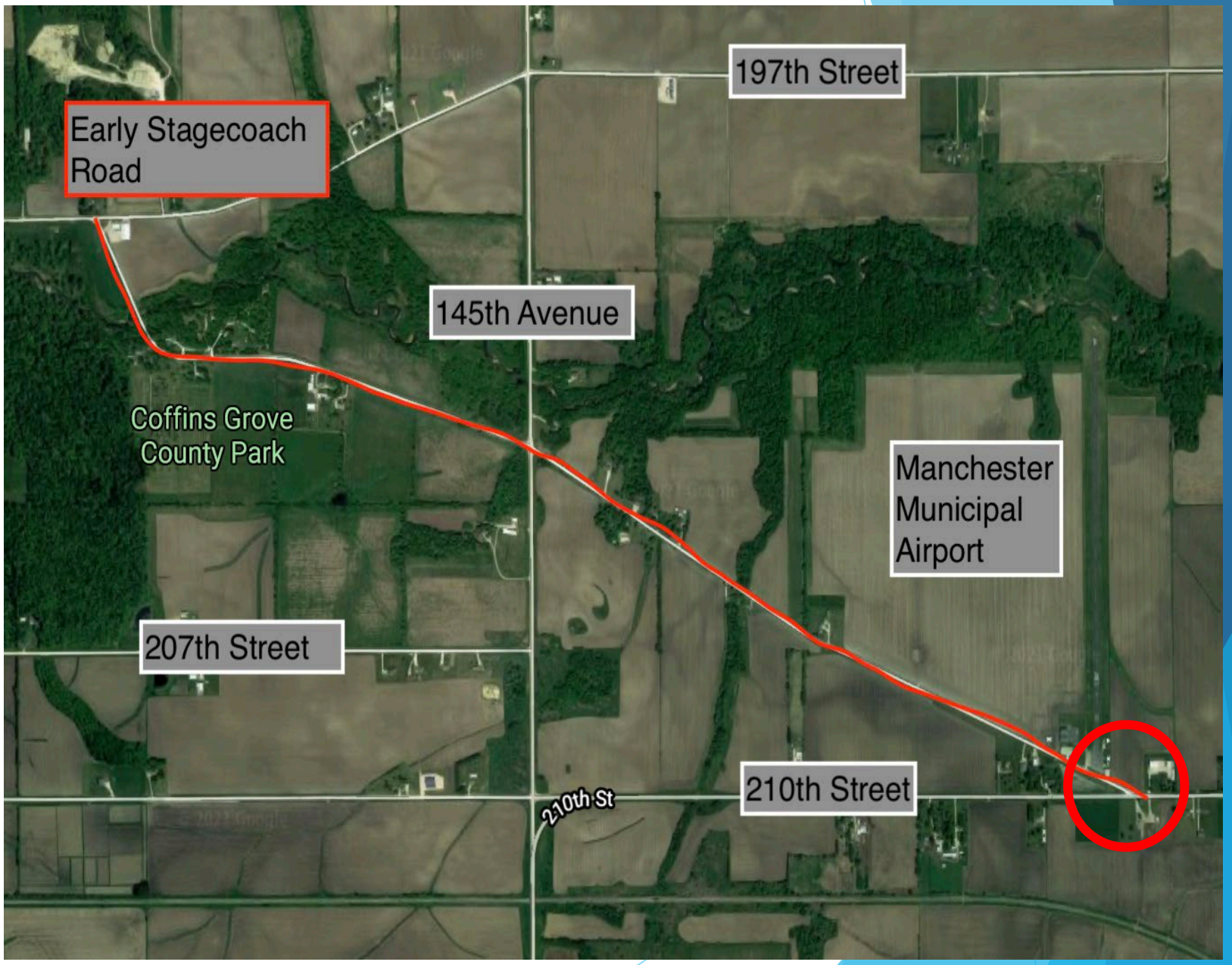
- Claire Fienup
  - EFA in Transportation and Geography
- Brian Shanahan
  - EFA in Transportation
- Daniel Garza
  - EFA in Management
- Mason Boyer
  - EFA in Transportation



Outline

- Project Area
- Scope of Work
- Design Standards
- Design Details
- Cost Estimation

Project Area



Site Photographs

Scope of Work

- Relocation of the roadway so the airport meets the 305' distance threshold.
- Site design and roadway layouts developed based on property lines.
- Removal of existing intersection at Early Stagecoach Road and 210th Street to allow for the airport's expansion.

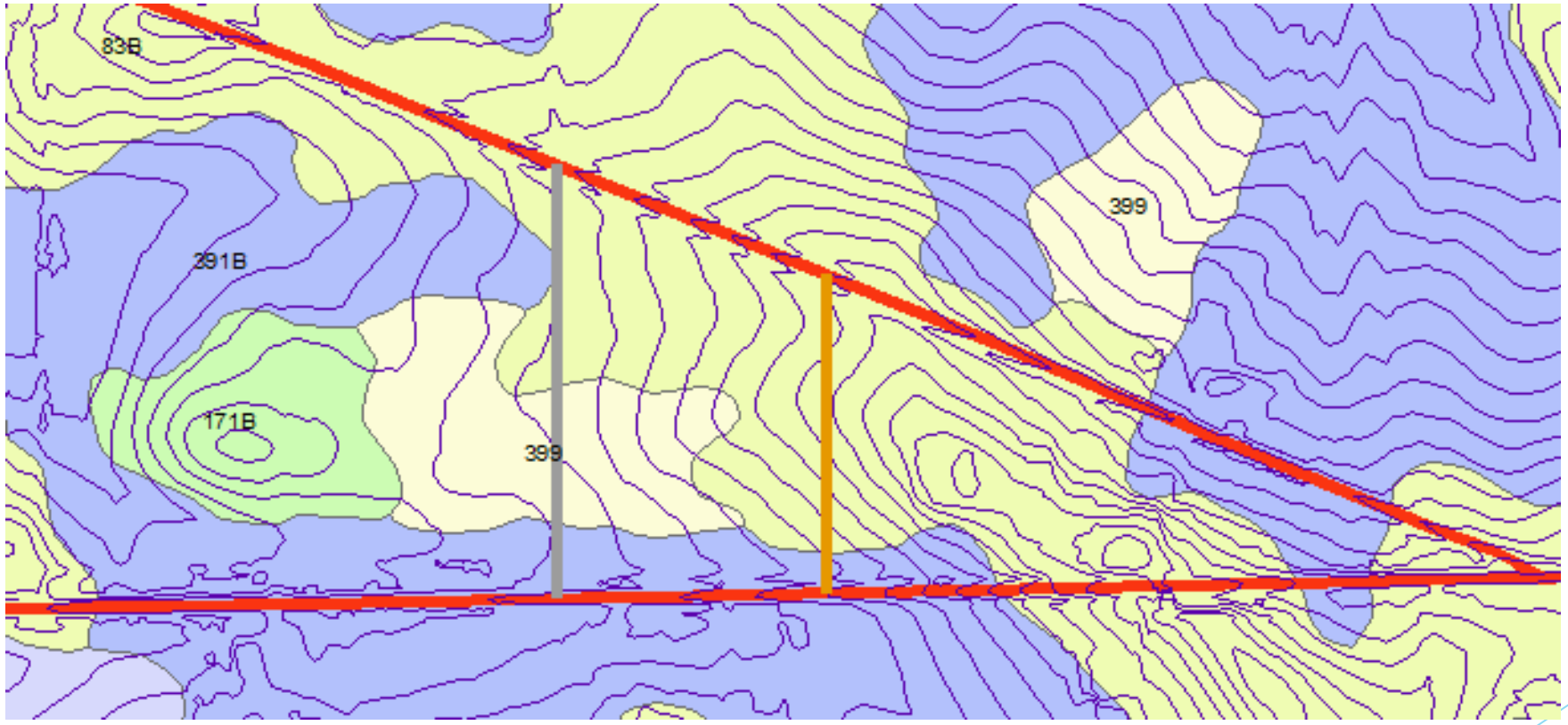
Design Standards

- Iowa DOT
  - Chapter 4, Section 4A
  - 2016 Asphalt Binder and Mix Specification update Reference Guide
- SUDAS
  - Table 5C-1.01: Preferred Roadway Elements
  - Table 6A-2.02: Minimum center turning radii for common design vehicles
- Iowa Asphalt Pavement Association (APAI)
  - Low Volume Roadway Design Manual
  - I-PAVE

Soil Data

- (83B): Kenyon loam soil

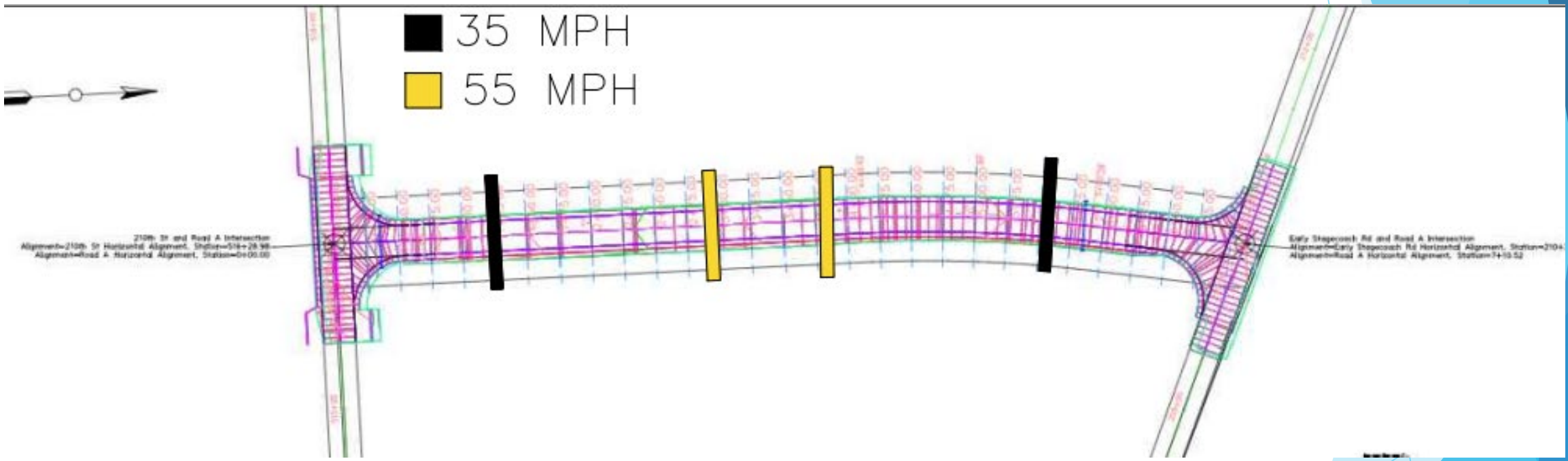
- (391B): Clyde-Floyd Complex soil



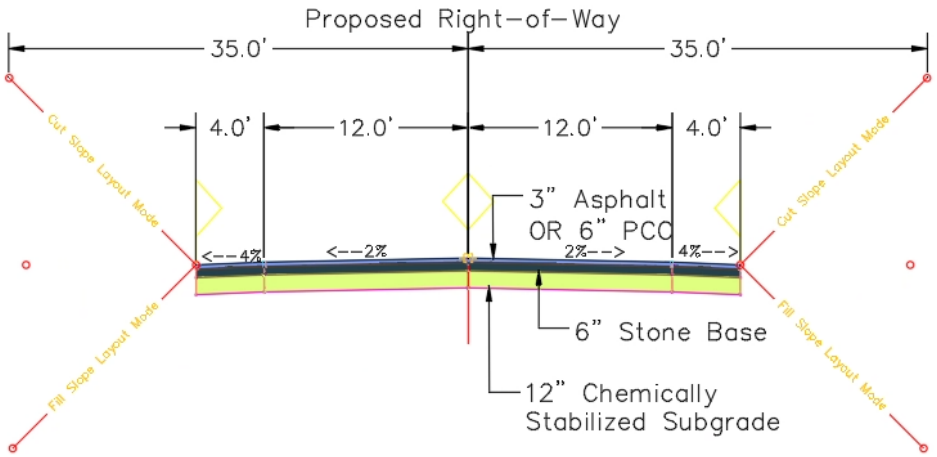
Right of Way


Road
Centerline
70.0000
225.0000
Meyer, Ann Mary
1543 210th St
Hill, James W
1545 210th St
Hill, James W
1551 210th St

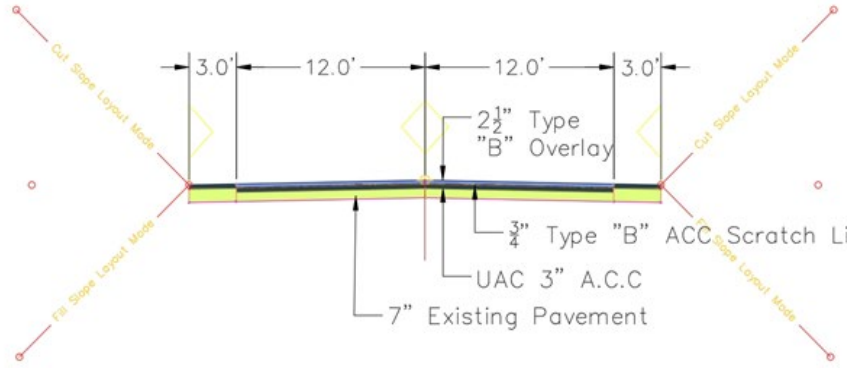
Sight Distance Analysis



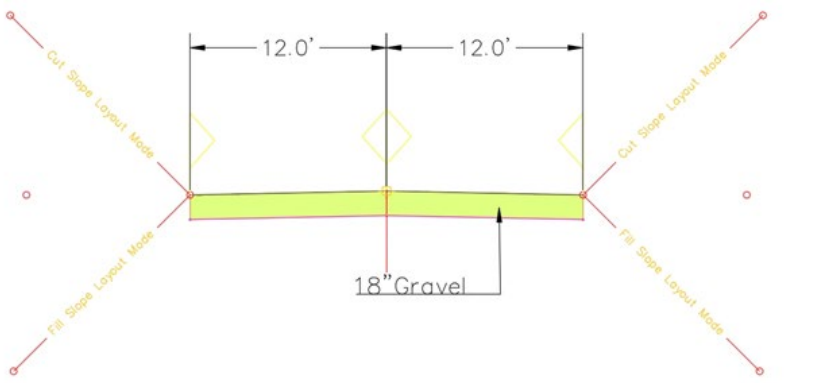
Road Cross Section



Road A Standard Cross Section



210th St Standard Cross Section



Early Stagecoach Road
Standard Cross Section

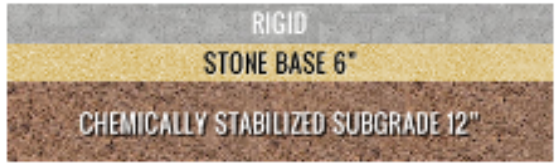
Pavement Thickness Design

I-PAVE
LOW VOLUME ROAD DESIGN GUIDE

Project Name	Early Stagecoach Road
Location	Manchester
County	Delaware
Pavement Design Period (years)	20

Flexible Thickness = 3.0"
Flexible ESALS = 4,353

Rigid Thickness = 6"
Rigid ESALs = 4,192



TRAFFIC

Total Number of Lanes (Both Directions)	2
Roadway Classification/Truck Distribution	Low (Residential)
Annual Average Daily Traffic (AADT)	110
Percent of Trucks (T)	6
Design Lane Traffic	55
Annual Growth Rate (%)	1

STRUCTURE

	Flexible	Rigid
Stone Base Thickness, in	6	6
Subbase Stabilization Depth, in	12	12
Subbase Soil Type	Unsuitable (CBR 3)	

Date 03/17/2021

Company _____

Login

INPUT FLEXIBLE RIGID SOIL DATA TRAFFIC PRINT CONTACT

Relative Quality of Roadbed Soil

Iowa Soil Type	CBR	Resilient Modulus, psi	Effective Resilient Modulus, psi	k-value (psi/in)	Losss of Support k-value (psi/in)
Select	7	8,877	6,776		
Suitable	5	7,157	5,482	information	information
Unsuitable	3	5,161	3,965		

*For resilient modulus calculation, the following equation was used:

$$M_r = 2555 * CBR^{0.64}$$

Where
M_r = Unbound Material Resilient Modulus, psi
CBR = California Bearing Ratio, %

From: Guide for Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures, APPENDIX GG-1 pg. GG 1.52
http://onlinepubs.trb.org/onlinepubs/archive/mepdg/2appendices_GG.pdf

*For stabilized soils, the following equations are used to characterize the material

$$M_r = 30000\left(\frac{a_i}{0.14}\right)(20)$$

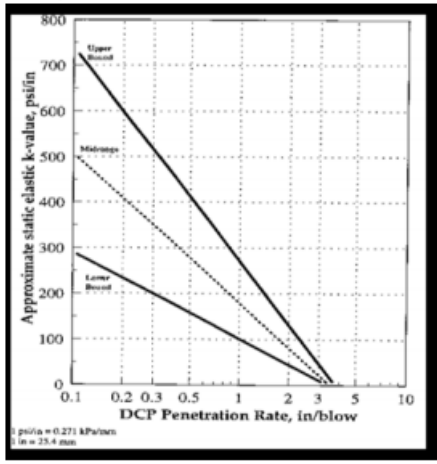
Mr, psi

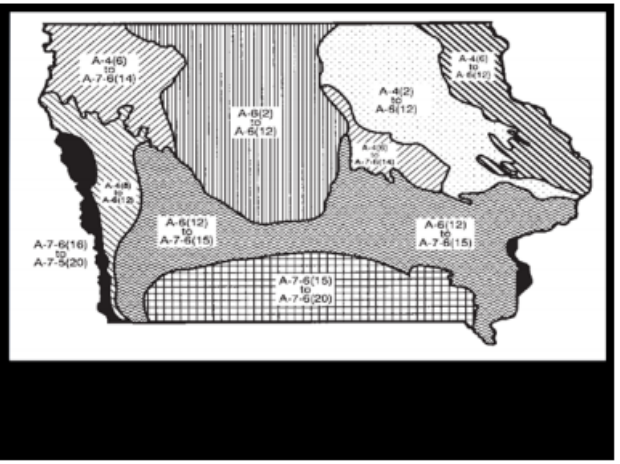
*This equation is solved for M_r
M_r fly ash = 17,500 psi
http://www.intrans.iastate.edu/reports/White%20et%20al.%202005_Stab_Vol21.pdf

*Effective Modulus of Subgrade Reaction, psi/in

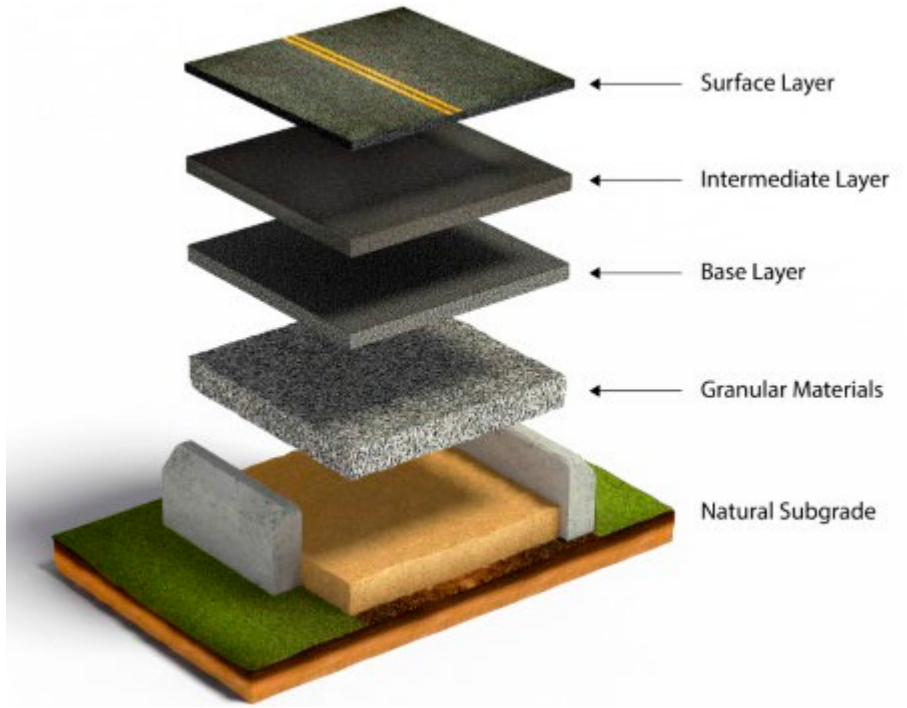
$k = M_r/19.4$

Common AASHTO Soil Type(s) in Delaware
A-4 A-6





Asphalt Binder of ST Mix
Class I = PG 58-28S



2016 ASPHALT BINDER AND MIX SPECIFICATION UPDATE REFERENCE GUIDE

Beginning in October of 2016, the Iowa DOT will be changing the nomenclature and recommended asphalt binder grades for Iowa's roadways. In addition, the current ESAL mix design levels will have new N design levels and nomenclature under the new specifications. The following handy reference guide will provide guidance on the new classifications and the new bid items developed by the Iowa DOT.

ASPHALT MIXTURE		PG BINDER					
DESIGN TRAFFIC (1 X 10^6 ESALS)	MIX DESIGNATION	DESIGN TRAFFIC (1 X 10^6 ESALS)		DESIGN SPEED (MPH)	CLASS I PROJECTS		CLASS II PROJECTS
≤ 1 M	ST	≤ 1 M	AND/OR	> 45	58-28S	58-34S	58-28S
1-10 M	HT	1-10 M	AND/OR	15-45	58-28H	58-34H	58-28H
>10 M	VT	>10 M	OR	<15	58-28V	58-34V	58-28V
		>10 M	AND	<15	58-28E	58-34E	58-28E

S = Standard H= High V = Very High E = Extremely High

CLASS I PROJECTS: Full Depth Hot-Mix Asphalt | HMA + Cold-in-place Recycling | HMA + Rubblization | HMA + Crack and Seat HMA Overlay >4" | HMA + Full Depth Reclamation (FDR)

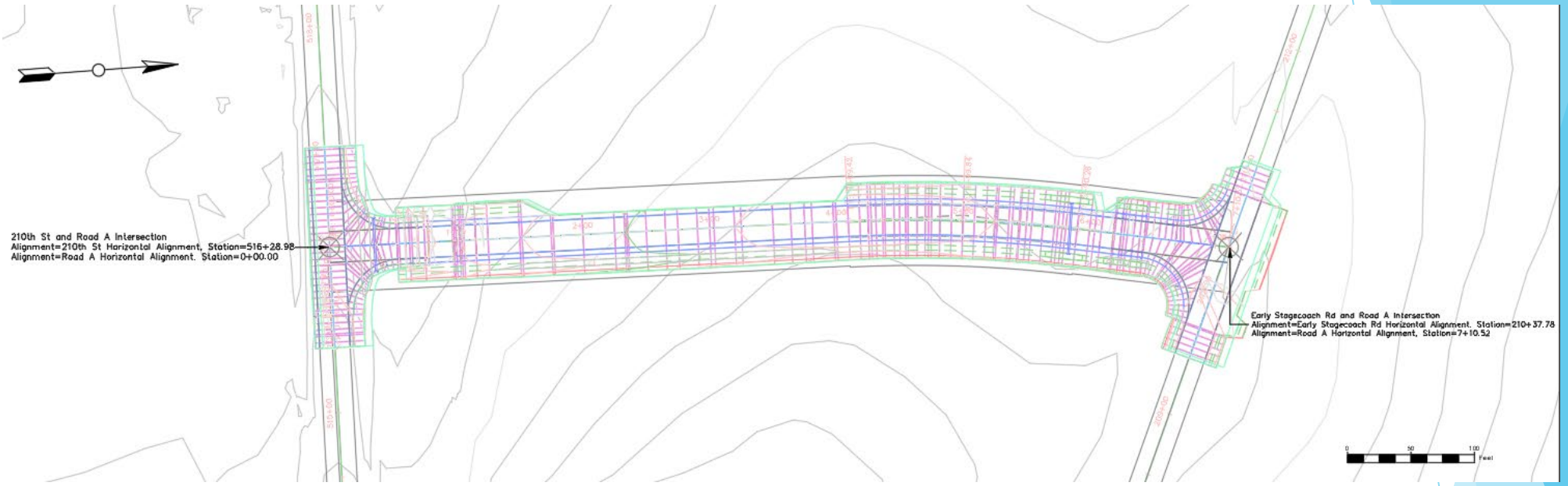
CLASS II PROJECTS: Overlay ≤ 4" | Parking Lot Secondary | Trails

Link to IDOT New Binder Designation Webinar:
http://iowadeptoftransport.adobeconnect.com/p9u69f7atxj/

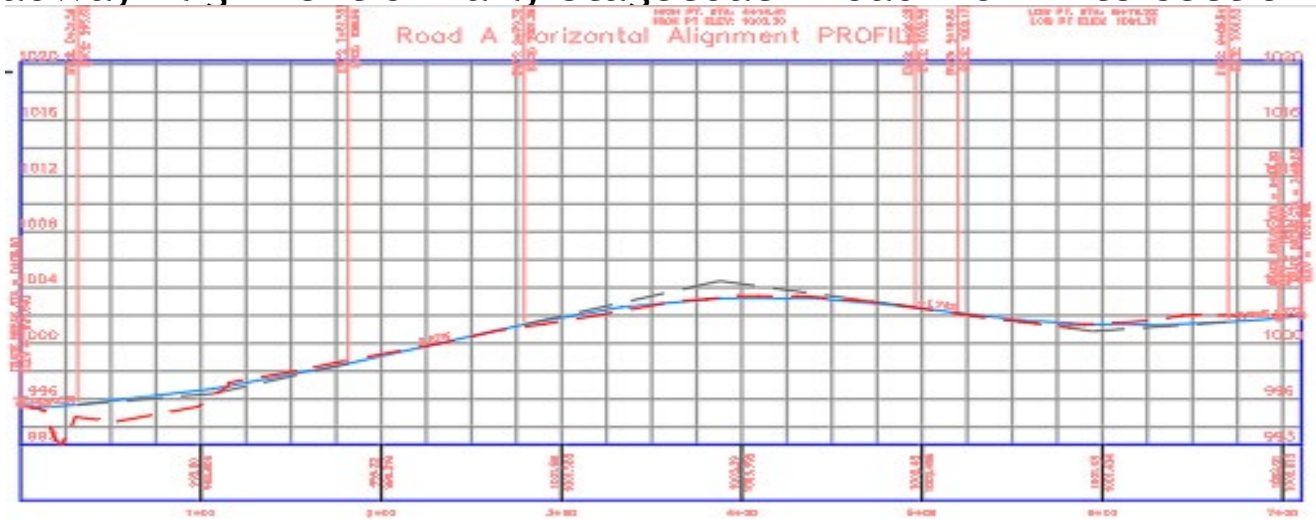
IOWA DOT — **IOWA DEPARTMENT OF TRANSPORTATION**
www.iowadot.gov/ | 515.239.1101

APAI — **ASPHALT PAVING ASSOCIATION OF IOWA**
www.apai.net | 515.233.0015

Plan and Profile Sheets



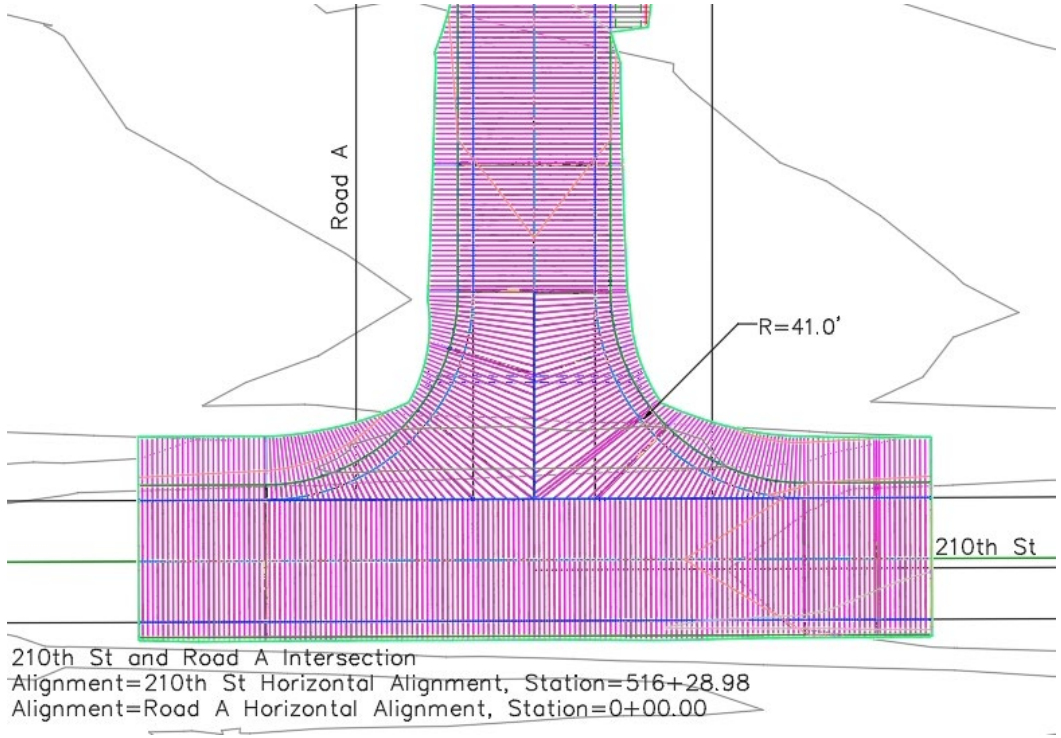
Horizontal Roadway Alignment of Early Stagecoach Road from intersection to intersection: 710.52’ Total



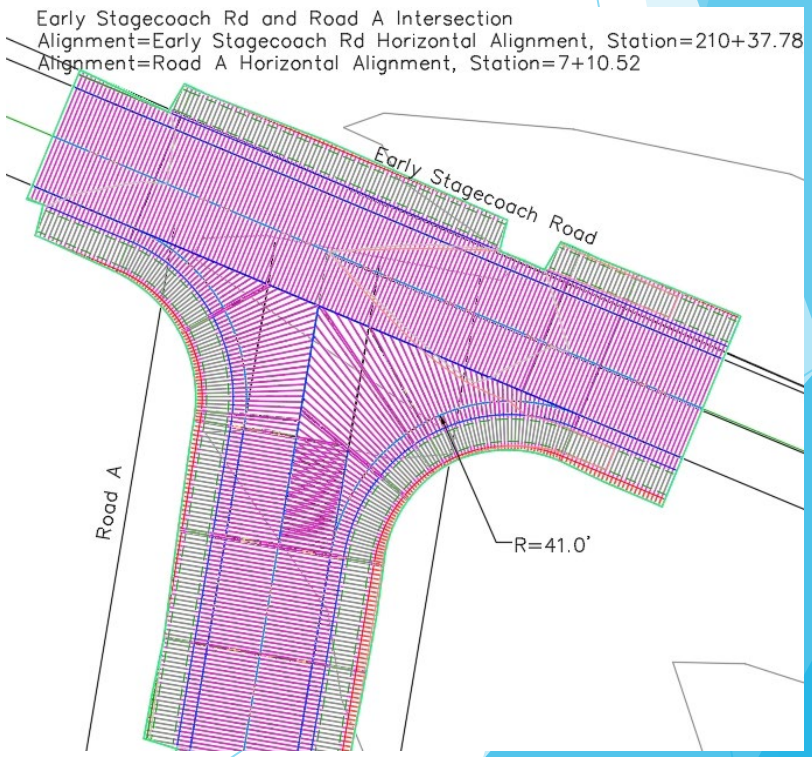
Roadway Alignment Profile View

Intersection

- 2 Intersection designs
- WB-67 Design Vehicle with radius of 41 feet
- SUDAS Table 6A-2.02: Minimum center turning radii for common design vehicles

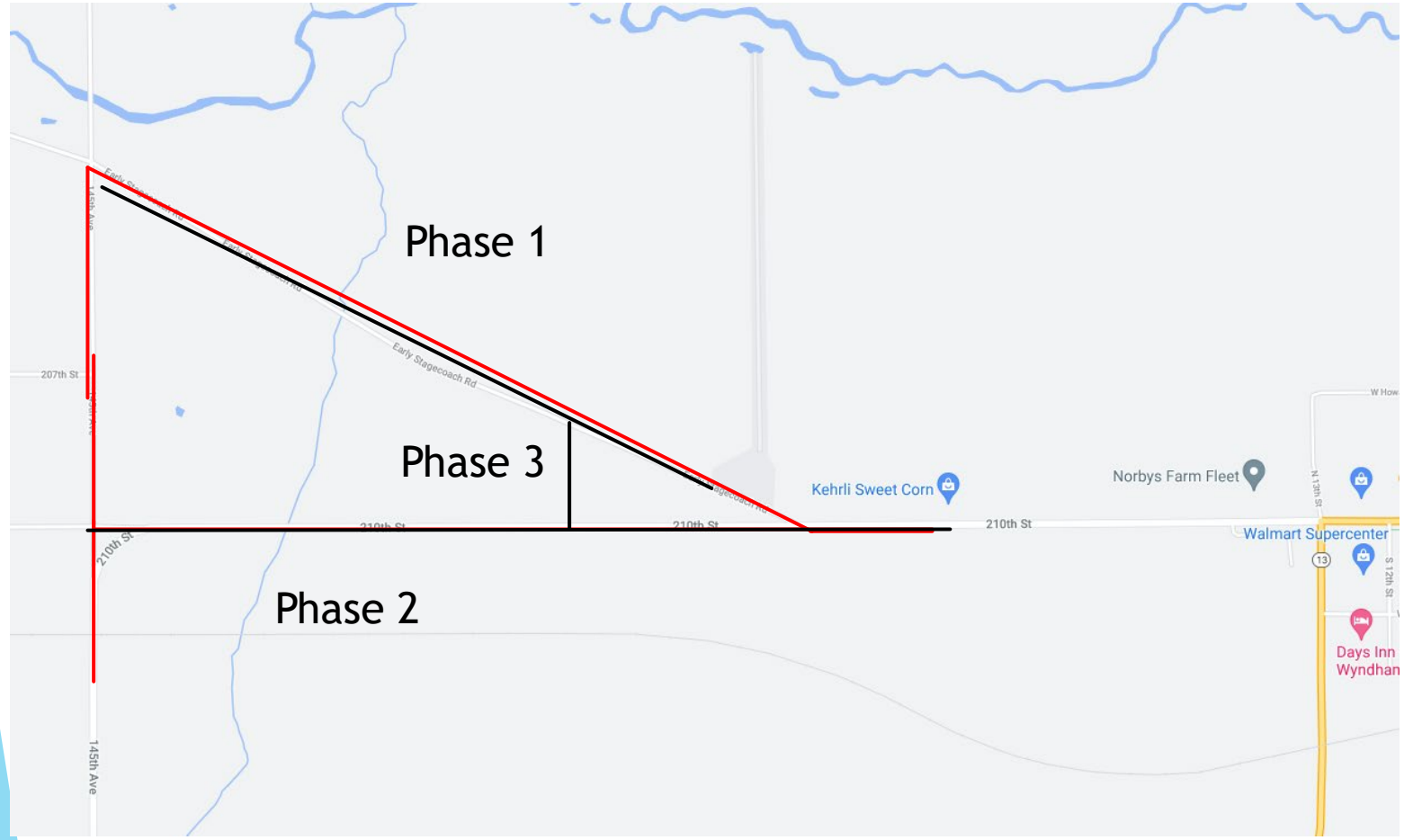


210th St and Road A



Early Stagecoach Rd and Road A

Road Removal/Traffic Control

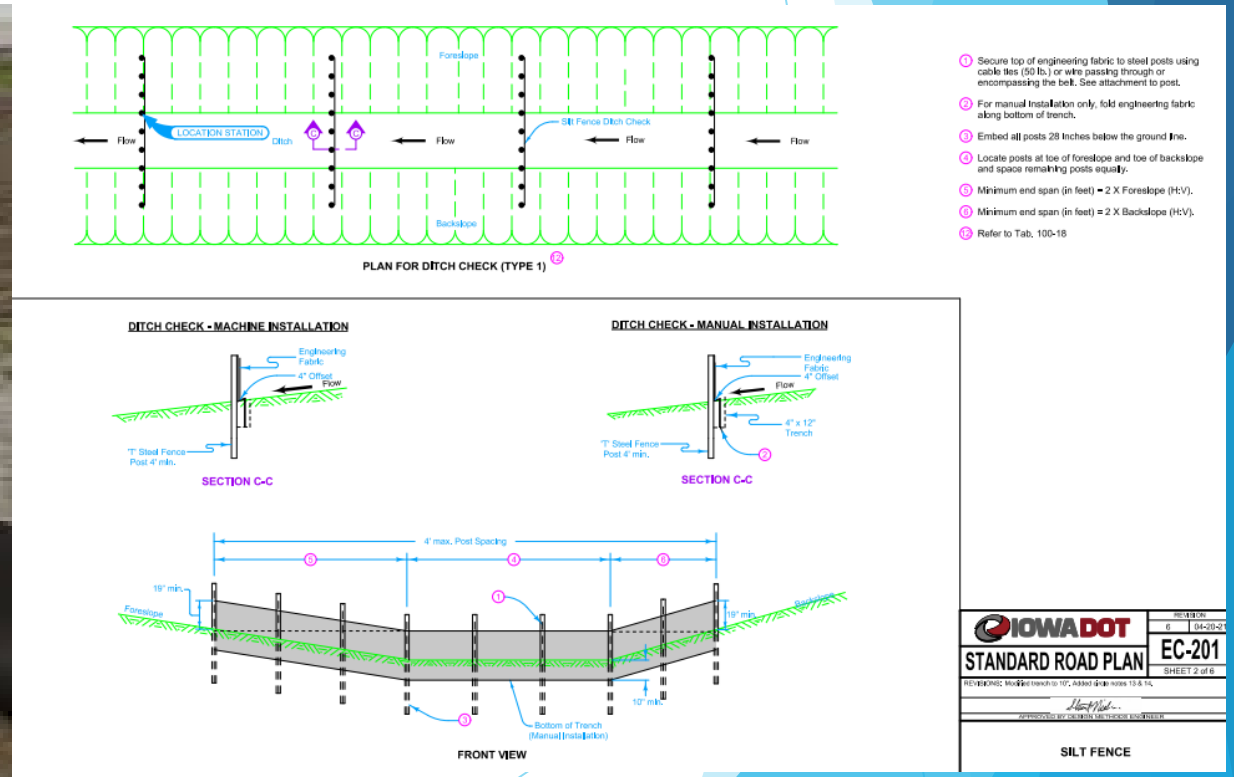


Erosion Control

- Mulching & Seeding
- Transition Mats

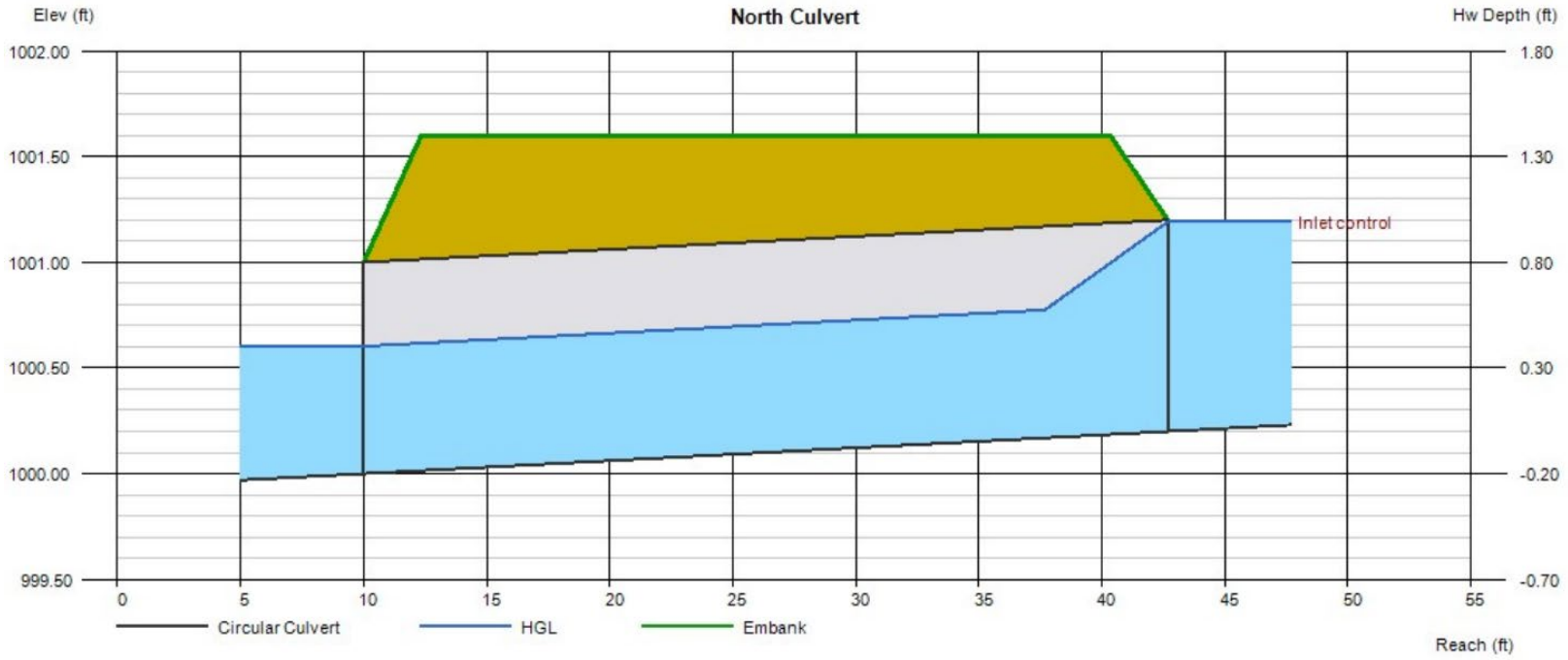
Sediment Control

- Silt Fences



Culvert Design

- 2 culverts
  - At Sta. 0+50, Sta 5+84



Culvert shown at 2.0 cfs

Construction Costs

Project:	Early Stagecoach Road--Road Evaluation and Redesign				
Item	**Unit**	**Dollars**	**Quantity**	**Cost**	**Rounded Cost**
Clearing and Grubbing	Acre	$ 5,140.85	0.4	$ 2,012.49	$ 2,000
Excavation - Class 10 Roadway and Borrow					
Cut/Fill	CY	$ 5.46	686.4	$ 3,747.74	$ 3,750
Soil Compaction	CY	$ 1.73	631.6	$ 1,092.62	$ 1,100
Granular subbase	Ton	$ 26.36	1151.0	$ 30,341.48	$ 30,300
Pavement					
6" pcc	SY	$ 84.05	1894.72	$ 159,251.22	$ 159,500
3" asphalt	SY	$ 12.15	1894.7	$ 23,020.85	$ 23,000
Subbase/Subgrade					
Granular Subbase 12"	SY	$ 7.23	1894.7	$ 13,698.83	$ 13,700
Soil Compaction -Subgrade	STA	$ 932.26	14.2	$ 13,247.79	$ 13,200
Traffic Control	LS	$ 16,727.00		$ 16,727.00	$ 16,700
Road Removal	ST	$ 437.43	5.0	$ 2,187.15	$ 2,175
Top soil	Cy	$ 5.87	631.6	$ 3,707.34	$ 3,700
Hydraulic Seeding	Acre	$ 1,553.22	0.4	$ 608.04	$ 610
Pavement Marking	STA	$ 14.68	14.2	$ 208.61	$ 210
Signage	SF	$ 25.00	42.0	$ 1,050.00	$ 1,050
Signage (posts)	Unit	$ 100.00	6.0	$ 600.00	$ 600
Erosion/Sediment Devices	LF	$ 3.21	1421.0	$ 4,561.54	$ 4,562
Culverts	LF	$21.00	113	$2,373.00	$ 2,375
Option 2 PCC				$ 255,414.84	$ 255,500
Option 1 Asphalt				$ 119,184.47	$ 119,000
PCC					
Contigency Costs -- 10%	0.1			$ 25,541.48	$ 25,500
Admin & Engneering	LS			$ 23,836.89	$ 23,800
Asphalt					
Contigency Costs --10%	0.1			$ 11,918.45	$ 11,900
Admin & Engneering	0.2			$ 23,836.89	$ 23,800
Total Project Cost - PCC				$ 304,793.22	$ 305,000
Total Project Cost - Asphalt				$ 154,939.81	$ 155,000

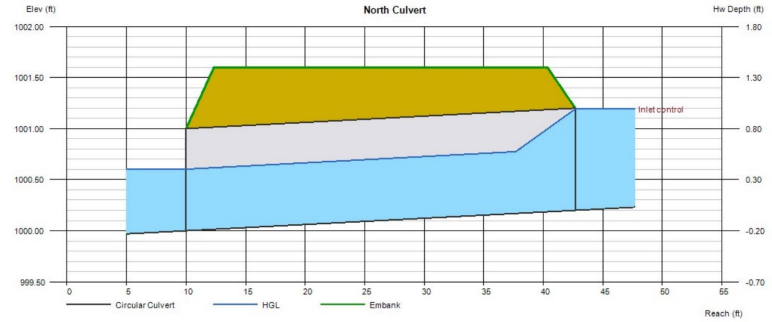
Total Project Costs:

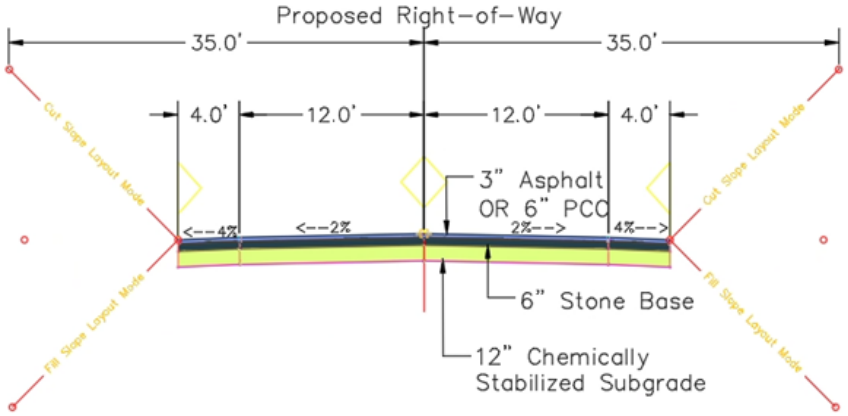
Concrete: $305,000

Asphalt: $155,000

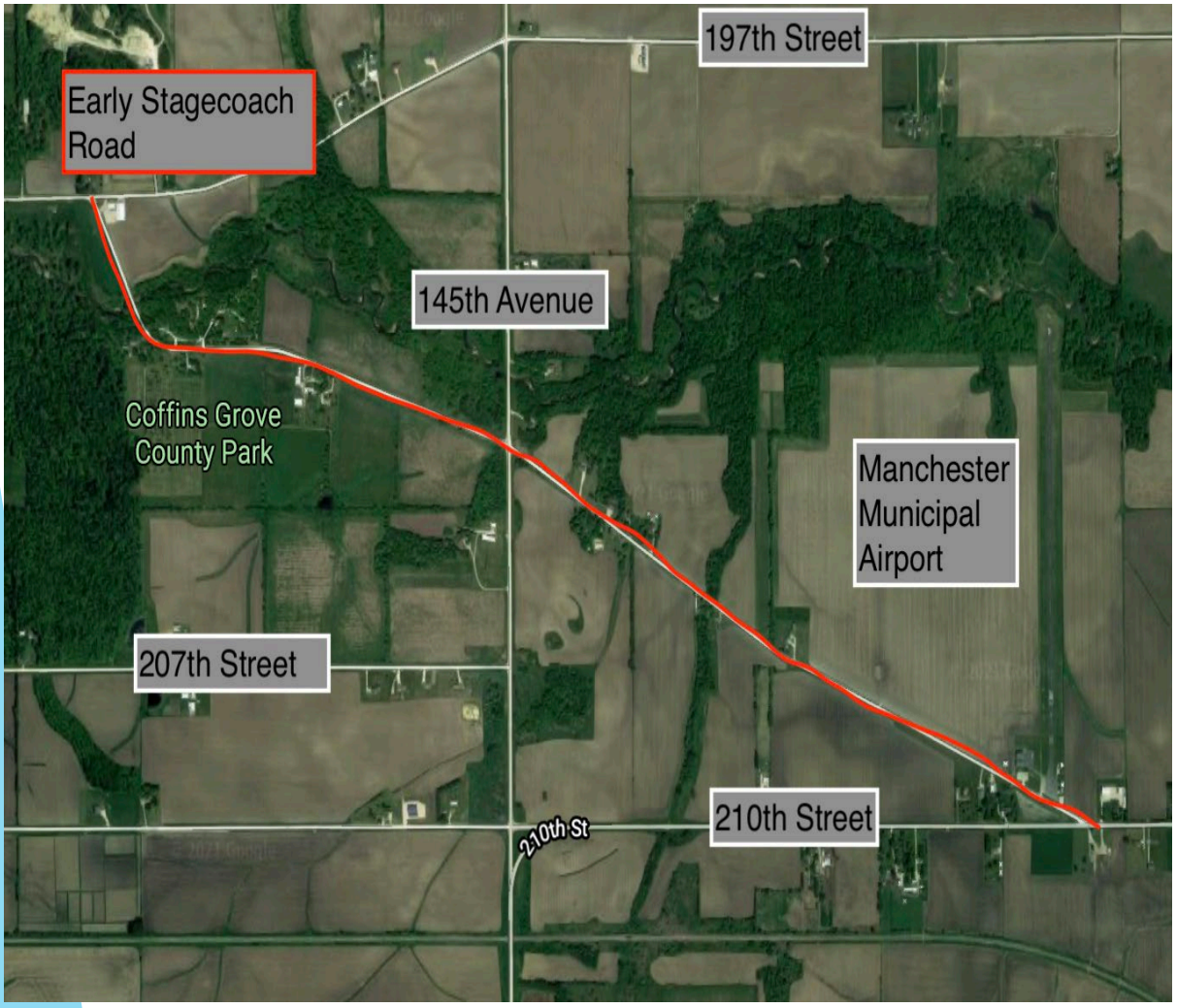
Overview

- Soil Information
- Right-of-Way
- Pavement
- Road Layout/Intersection
- Erosion Control
- Culvert





Questions?


197th Street
Early Stagecoach Road
145th Avenue
Coffins Grove County Park
Manchester Municipal Airport
207th Street
210th St
210th Street


Manchester Municipal Airport
Alternative 2
Alternative 3
Alternative 1
Early Stagecoach Rd
210th St
Google