

Regional Trail Design Report

Prepared for the Scotch Grove Iowa Steering Committee
CEE:4850 Project Design and Management at University of Iowa
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Section I Executive Summary

Our Project Team of four Civil Engineering students at the University of Iowa prepared this design for a regional trail and trailhead on behalf of the Scotch Grove, Iowa Steering Committee. After evaluating multiple trail routes and conducting a feasibility analysis, the final route selection connects several locations of interest in Jones County, Iowa. The locations connected Scotch Grove to Camp Courageous and Monticello, utilizing existing roads such as 116th Ave, 172nd St, Hwy 38, and 190th St. The final design included the trail and a trailhead located in Scotch Grove.

We first gathered data about Scotch Grove and its surrounding natural areas to gain more knowledge for the design process. We researched similar projects to gain insights into multimodal trail design, culminating in the design of a trail and trailhead in Scotch Grove aimed at serving the community and providing an engaging recreational route with multiple points of connectivity to the surrounding area. The provided trailhead location was previously a Train Depot, offering historical significance. The trail was designed for walking, biking, and equestrian use.

The design includes a 2.12-acre trailhead in Scotch Grove at the southwest corner of the intersection of Hwy 38 and E17. The trailhead includes two unisex waterless toilets, two hand sanitizing stations, four bicycle parking spots, two park benches, six solar lights, and a parking lot. The parking lot consists of five standard parking stalls and one accessible parking stall.

Space was left within the trailhead lot to provide opportunity for future art and/or history installations. This space aims to enhance public engagement and provide educational opportunities regarding the history of Scotch Grove. These additional artistic features were outside the project scope for this engineering design project and are therefore not included in the report. The Trailhead site plan can be found in design sheet 7, and the Restroom details can be found in design sheets 8 and 9.

The preliminary design of the trail included a feasibility analysis. The initial desire for the proposed route aimed to extend from the trailhead to 116th Ave, then east along 172nd St, and further along Dale's Ford Road going north to the Maquoketa River. Most of the property along both sides of the river is state-owned land and this alternate was explored both to highlight the natural area and to minimize disruption to private landowners. At the end of Dale's Ford Road, which terminates at the Maquoketa River, there were plans to either construct a bridge across the river or keep the trail on the south side, following the river to connect to Pictured Rocks and then Camp Courageous. The envisioned loop would then return to the trailhead, possibly along Hwy 38.

During this feasibility analysis, we completed a site visit and designed horizontal and vertical alignments of three alternates along the river while staying within state-owned land as much as possible. Images of these three designs can be found in *Figures 5B, 5D and 5G*. After this analysis of the land along the Maquoketa River, we determined that the topography of the land was too extreme to allow for a trail system in this area. Most of the slopes in this area exceeded the state defined standards for maximum slopes found in *SUDAS Chapter 12 - Pedestrian and Bicycle Facilities* significantly. Multiple bridges and/or culverts would be needed as there are a

significant number of ravines and tributaries which are important drainage routes going from the north into the Maquoketa River.

Furthermore, permission to design within state-owned land was not attained. Due to these reasons, other options were explored.

We recommend a trail route along Hwy 38 and 190th St, ensuring connectivity between Scotch Grove, Camp Courageous, and Monticello. This final design of the trail begins at the trailhead and crosses to the east side of Hwy 38 where a short tie-in was designed within the right of way of Hwy 38 to connect to 116th Ave. 116th Ave is utilized as a shared use path, and the trail then travels west in the right of way on the north side of 172nd St to connect to Hwy 38, where it passes within the east side of the right of way of Hwy 38. The trail then crosses 190th St and splits going east and west within the north side of the right of way to connect to both Camp Courageous located to the east and Monticello located to the west.

The connection to Monticello originates from a separate trail managed by the City of Monticello, extending from Monticello High School to the intersection of Hwy 151 and Amber Rd. The Regional Trail will intersect with this Monticello trail at the north end of 190th St where Hwy 151 transitions from north and southbound to east and westbound.

The trail width is 10' in its entirety except for the shared use path along 116th Ave which will remain at its current 22' width. Comprising 5.84 miles of newly paved trail and 0.87 miles of shared-use path, the trail's total length spans 6.71 miles. A visual representation of this recommended route is available in *Figure 6A*.

The final design includes horizontal and vertical alignments, provided in design sheets 10-70. Corridors, trail cross sections, and cut and fill quantities were calculated.

Furthermore, a cost estimate was generated based on three materials: PCC, asphalt, and compacted stone. For the trailhead, the recommended material is 5" asphalt, chosen to ensure a durable surface suitable for adding pavement markings. PCC was not favored due to its higher cost.

As for the trail itself, the recommended material is 6" Class A compacted stone. This decision was driven by cost considerations, as paving the entire 6.71-mile trail length would incur unnecessary expenses.

The design of this trail and trailhead was completed in accordance with existing design standards including but not limited to: The IowaDOT (The Iowa Department of Transportation), AASHTO (American Association of Highway and Transportation Officials), SUDAS (Statewide Urban Design and Specifications), and MUTCD (Manual on Uniform Traffic Control Devices). The comprehensive overview of the final Regional Trail design consists of this design report along with associated Design Sheets.

Section II Organization Qualifications and Experience

1. Organization and Design Team Description

The team consisted of four Civil Engineering students at the University of Iowa- Emily Shie, Jaci Petersen, Kevin Plumb and Christian Harms.

The project managers of this team were Emily Shie and Jaci Petersen, both Civil Engineering majors with a focus in Civil Engineering Practice. As project managers, they guided the alternate route selection and trailhead design and assisted in overall trail design.

Kevin Plumb was the team's technological support member and leader of the modeling in Civil 3D. Christian Harms was technological support for the team and led the 3D modeling of the drawing renderings. They are both Civil Engineering majors with a focus in Civil Engineering Practice as well.

Section III Design Services

1. Project Scope

Our engineering team has evaluated and designed a regional trail and trailhead that begins in Scotch Grove, IA, connects to Camp Courageous, and will tie into a trail being proposed in the City of Monticello just west of Hwy 38. The targeted trail users include pedestrians, cyclists, and equestrians. The trail was designed in the right of way of 190th St, 172nd Ave, and Hwy 38. Horizontal and vertical alignments as well as trail cross sections, corridor models, cut and fill volumes, material volumes, cross section drawings, and plan and profile drawings were created. At the trailhead, waterless restrooms from Romtec, a company focused on prefabricated structures, were incorporated as well as bike racks, solar-powered lighting, benches, and sanitizing stations. A parking lot with six stalls was designed to serve the trailhead. Cost estimates for three trail material options, PCC, asphalt, and Class A compacted stone can be found in *Section VII Engineer's Cost Estimate*.

2. Work Plan

We began with research to compile relevant standards and collect data. Following that, we designed trails for three alternatives. The alternative that was selected for the Regional Trail was chosen based on the feasibility analysis performed. We designed parking for the trailhead and selected prefabricated waterless restrooms from Romtec. We calculated the cost for three different trail materials. This project was completed with a 3D rendering of the trailhead and a specific segment of the trail, 116th Ave. The rendering of 116th Ave was completed to accentuate its unique shared use characteristics and potential for future garden development the right of way. A layout of the complete task list as well as timelines for the work plan can be found in the Gantt Chart of Appendix A.

Section IV Constraints, Challenges, and Impacts

1. Constraints

This project was constrained by several different aspects. The small lot size for the trailhead (2.12 acres) was a constraint. This parcel is also very narrow with a width of less than 150'. The trailhead is located adjacent to a state highway, making safety a greater concern. There is no potable water on this site. Only the parcel currently owned by the client for the trailhead as well as state or county owned land is to be used for this trail. Time was another constraint as we had only fourteen weeks to complete the project from start to finish.

2. Challenges

The trail was desired to cross over the Maquoketa River at the north end of Dale's Ford Road and pass along the river before looping to connect with Pictured Rocks and Camp Courageous. The topography along Dale's Ford Road as well as along the riverbank at the Maquoketa River were very extreme. Areas of fill greater than 50 vertical feet and slopes of greater than 40% were found in numerous locations within these areas.

There was a section along 190th St where the trail route was desired to pass which crosses over Kitty Creek. There is an existing bridge for vehicular traffic in this location.

In some areas along Hwy 38, the ditches which make up the right of way are quite steep. This posed an additional challenge to design in extreme topography.

When speaking with the client, we learned that the one mile stretch of 116th Ave was very important as the first mile of the path. The right of way along 116th Ave did not allow space for the trail because of proximity to homes.

3. Societal Impact within the Community and/or State of Iowa

A public trail system will increase accessibility to Scotch Grove and the surrounding areas. The trail system may bring more attention and publicity to Scotch Grove, showing off its natural beauty and historic significance. The Regional Trail in tandem with the separate trail in Monticello will provide connectivity between Scotch Grove and Monticello. The trail will also connect Camp Courageous to Scotch Grove.

Section V Alternative Solutions That Were Considered

Three alternate routes were considered during design. The first alternate explored the bluffs along the Maquoketa River. A second alternate explored the possibility of a trail through farm fields and a third alternate analyzed a trail utilizing the right of way of several different roads. All alternates began at the trailhead in Scotch Grove and then included the one mile stretch of 116th Ave from the trailhead to 172nd St. This one mile stretch along with the trailhead are shown below depicted in red in *Figure 5A*.



Figure 5A: Location Overview

Alternate 1 Analysis:

Alternate one transitioned into primarily a feasibility analysis with three different designs analyzed. All three designs turned east from the end of 116th Ave and connected into Dale's Ford Road, shown in green in *Figure 5A*. The three designs utilized the right of way of Dale's Ford Road to reach the Maquoketa River. Once the Maquoketa River is reached, the three designs explored three different locations near the river before looping back to connect with Camp Courageous and ultimately back to the trailhead utilizing 190th St and Hwy 38. Design 1 passed along the south side of the Maquoketa River. Design 2 crossed the Maquoketa River and passed along the north side. Design 3 went farther north.

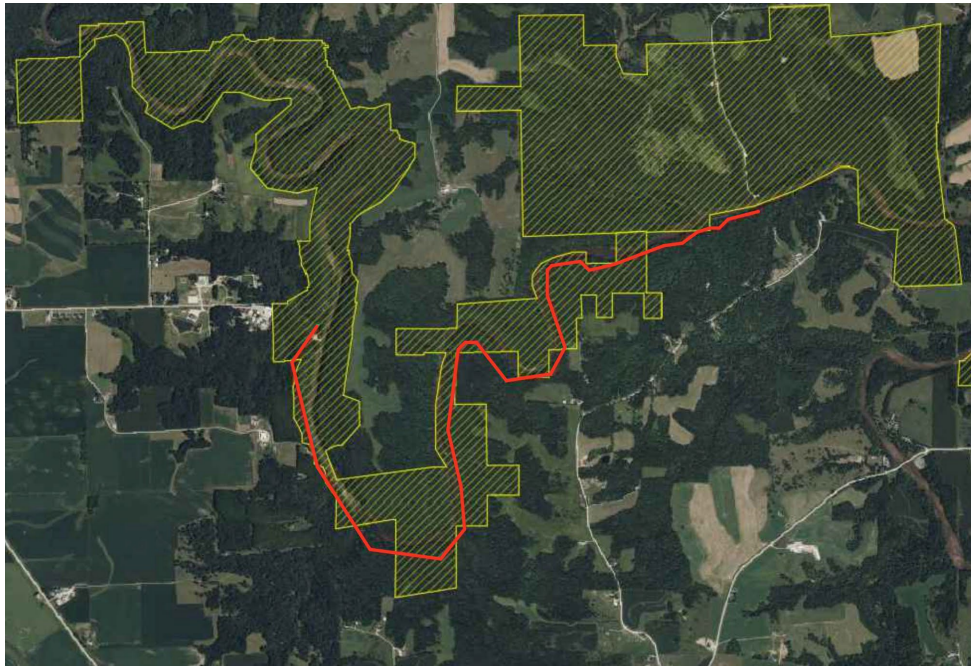


Figure 5B: South Side Aerial View - Design 1

Figure 5B shows this alignment in red. During the three feasibility designs, it was desired to keep the trail within state-owned land as much as possible. The state-owned land is depicted in the above figure with yellow shading.

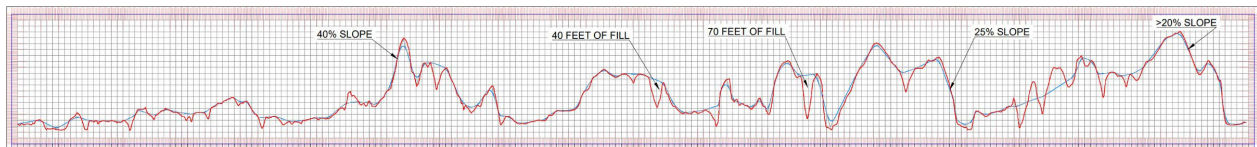


Figure 5C: South Side Vertical Profile - Design 1

As shown in *Figure 5C*, the topography of this path is very extreme. A vertical profile depicts the existing elevations along the chosen path. Viewing from left to right on this profile can be seen: a slope of 40%, 40 vertical ft of required fill, 70 vertical ft of required fill, a 25% slope, and a slope greater than 20%.

The maximum slope for trails based upon required design standards found in *SUDAS Chapter 12 - Pedestrian and Bicycle Facilities* is 12%. The preferred slope is 5%. Most of the slopes in Design 1 along the south side of the riverbank exceed these standards significantly. This design would not meet standards and was therefore discarded as a viable design recommendation. This area also has environmental considerations and approval to design in this area was not granted.

Design 2, shown in *Figure 5D* followed a similar path along the north side of the Maquoketa River.

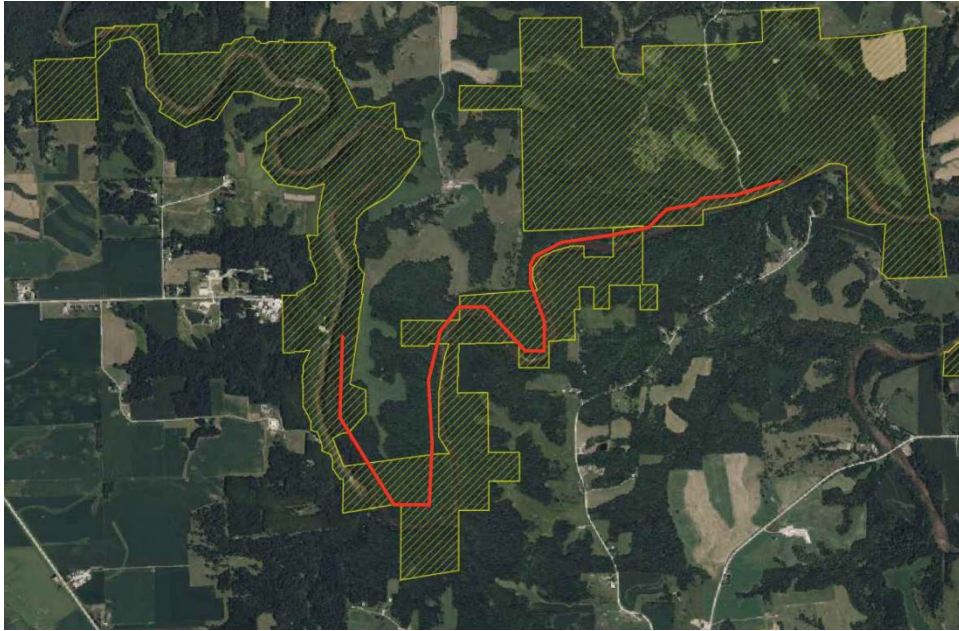


Figure 5D: North Side Aerial View - Design 2

This design crossed the Maquoketa River at the end of Dale’s Ford Road where a bridge had once been but no longer exists. It then passed along the north side of the river as shown and would cross back over the Maquoketa River near Camp Courageous.

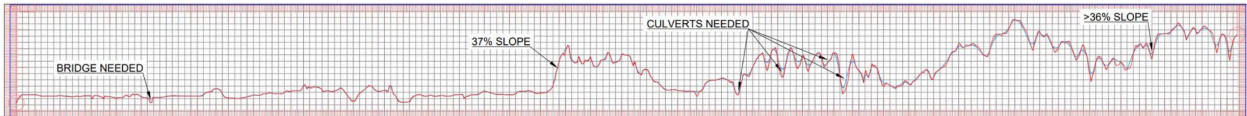


Figure 5E: North Side Vertical Profile - Design 2

As shown in *Figure 5E*, the topography of this path is very extreme as well. At the left side of this profile can be seen a callout for “BRIDGE NEEDED.” This design would have needed a third bridge to cross over this tributary seen in *Figure 5F* as well as the two bridges required to cross the Maquoketa River.



Figure 5F: Tributary

Moving further to the right on *Figure 5E*, a slope of 37% can be seen as well as multiple “CULVERTS NEEDED” callouts. Like the tributary mentioned above, numerous areas in this path would need culverts as they are ravines in which water drains from the north into the Maquoketa River. If these areas of drainage were ignored, the flow of surface runoff could be greatly affected, and erosion of the trail could ensue. In addition, another steep slope of greater than 36% is shown on the right side of this vertical profile.

The absolute slope for trails based upon required design standards found in *SUDAS Chapter 12 - Pedestrian and Bicycle Facilities* is 12%. The preferred slope is 5%. The majority of the slopes in Design 2 also exceed these standards, and this design option was therefore abandoned. This area also has environmental considerations and approval to design in this area was not granted.

We then chose to explore a third design which was farther away from the river while remaining within state-owned land whenever possible. This design is shown in *Figure 5G*.

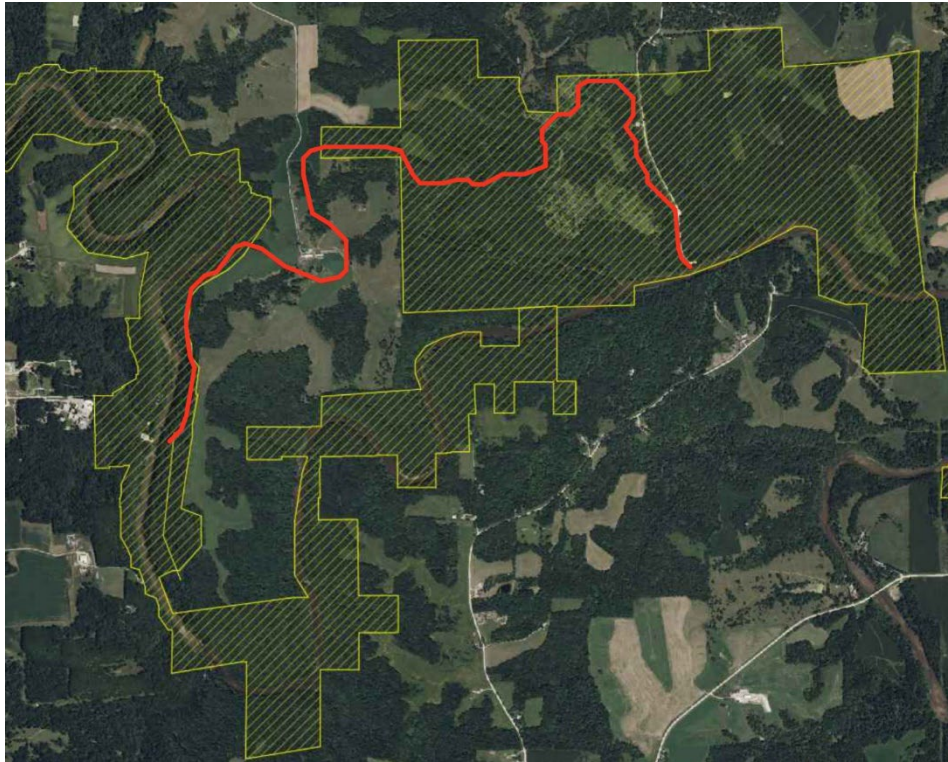


Figure 5G: Northern Aerial View - Design 3

We hoped that moving further from the river would lessen the extreme topography and make the slopes and drainage needs less significant.

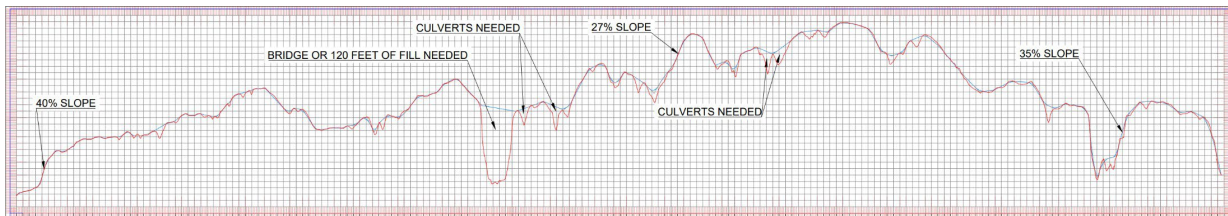


Figure 5H: Northern Vertical Profile - Design 3

The vertical profile of this third design is shown above in *Figure 5H*. Unfortunately, the topography in this northern section was equally as extreme as it was along the riverbank.

Viewing from left to right on this profile can be seen: a slope of 40%, an additional bridge or 120 vertical ft of fill, multiple culverts needed, a 27% slope, additional culverts needed, and a slope of 35%.

The maximum slope for trails based upon required design standards found in *SUDAS Chapter 12 - Pedestrian and Bicycle Facilities* is 12%. The preferred slope is 5%. Most of the slopes in Design 3 also exceed these standards, and this design choice was therefore abandoned.

Alternate 1 of design within state-owned land on the river was abandoned due to the inability to obtain state approval as well as the inability to comply with required standards.

Alternate 2 Analysis:

Alternate 2 was explored as a path from the end of 116th Ave north through farmland before connecting into 190th St and ultimately connecting to Camp Courageous. This alternate was discarded as it was determined that the disruption to private landowners would be too extensive since the farm fields were all within private land.

Alternate 3 Analysis:

The final chosen alternate was a trail that included a shared use path along 116th Ave and followed in the right of way of 172nd St, Hwy 38, and 190th St. This option caused the least disruption to the environment and to existing landowners because it utilized state and county owned right of way. This alternate also provided connection between Scotch Grove, Camp Courageous, and another trail in Monticello. Further details on the chosen alternate can be found in *Section VI: Final Design Details*.

Section VI Final Design Details

Final design includes a trailhead and trail beginning in Scotch Grove, Iowa. An image of the overview is shown in *Figure 6A*.

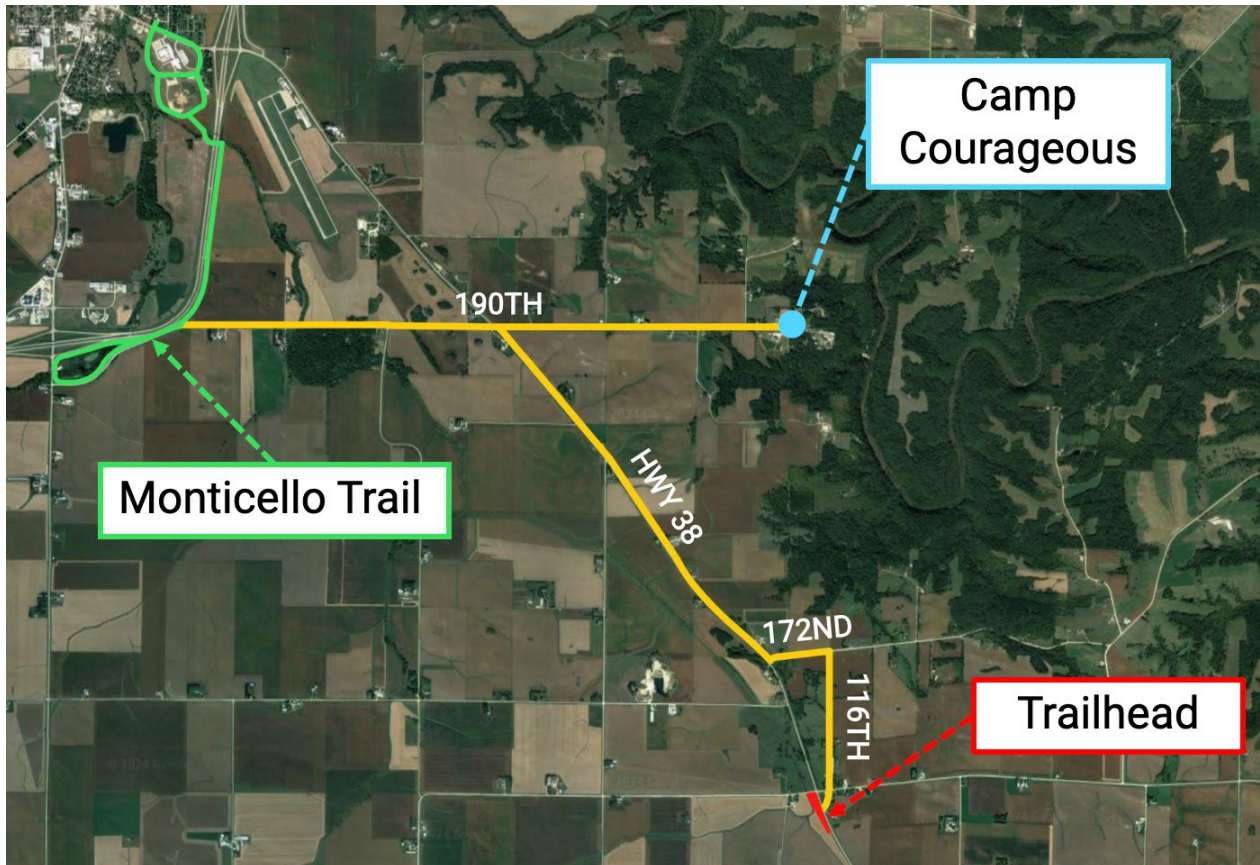


Figure 6A: Trail Plan View

The trailhead was designed on a 2.12-acre lot at the southwest corner of the intersection of E17 and Hwy 38. *Figure 6B* shows a photo of the existing trailhead lot.



Figure 6B: Trailhead – Site Visit

Design of the trailhead includes six parking stalls, two unisex waterless restrooms, sanitizing stations, solar-powered lighting, bike racks, and park benches. A parking lot was designed from an existing grass driveway entering onto Hwy 38. This grass driveway is shown in *Figure 6C*.



Figure 6C: Existing Driveway (Southwestern View)

The parking lot was graded to ensure runoff from the parking lot drains into the same ditch that the highway utilizes for drainage. The trailhead material recommendation is 5" thick asphalt. A six-stall parking lot was designed with five standard stalls (8'6" x 18'), and one van accessible stall (11' x 18') with an access aisle (5' x 18') parallel and immediately to the west of the spot. The parking stalls all have a cement parking stop block at the end of the spaces.

Parking requirements were based upon design standards found in *SUDAS Chapter 8-Parking Lots section B-1 Layout and Design*. Please see Design Sheet 07 for more details. Two medium waterless prefabricated restrooms (12' x 8') were selected from Romtec. The floor plan for these restrooms is shown in *Figure 6D* and a photo of them is shown in *Figure 6*. Please see Design Sheets 08 and 09 for additional details.

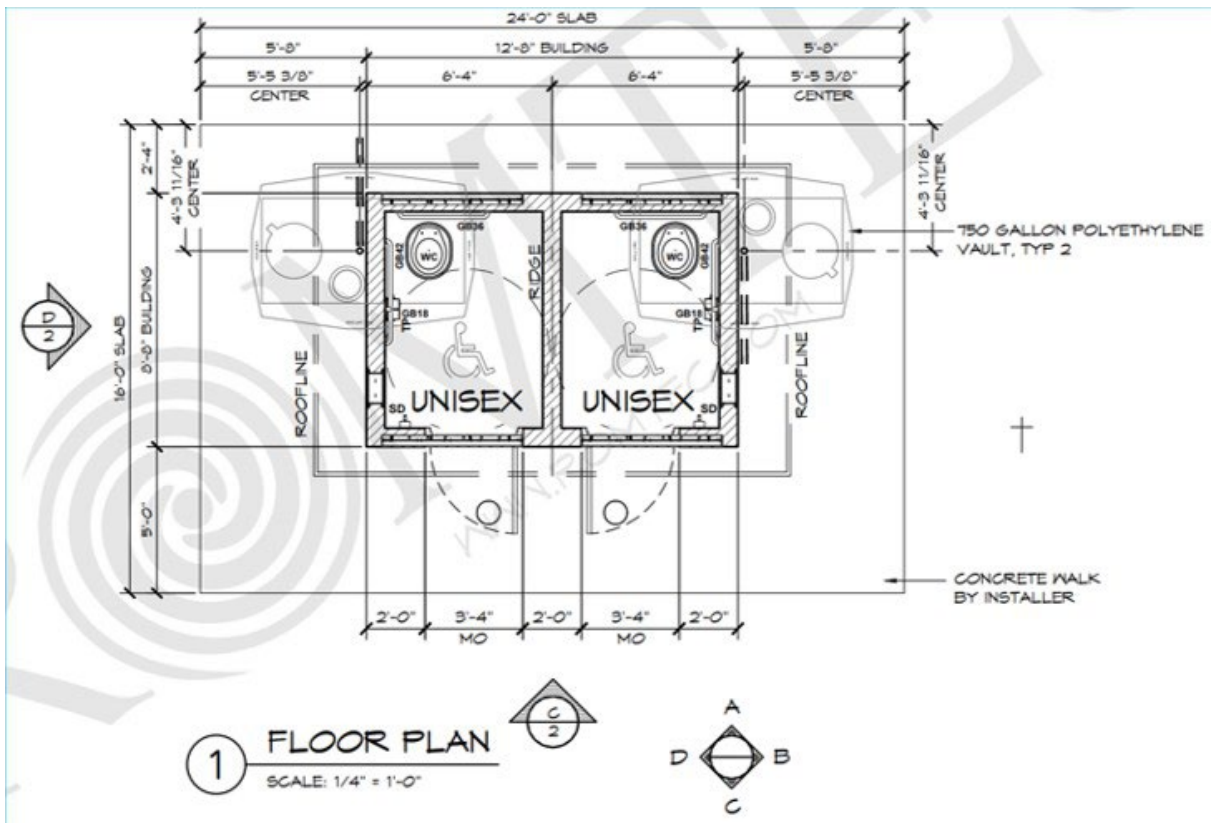


Figure 6D: Restroom Floor Plan



Figure 6E: Restroom Image

Two weatherproof sanitizing stations will be placed on the poles of the restroom pictured above. Two U-rack bicycle racks (32" x 84") were selected from CycleSafe to hold a total of four bicycles. *Figure 6F* shows this detail.

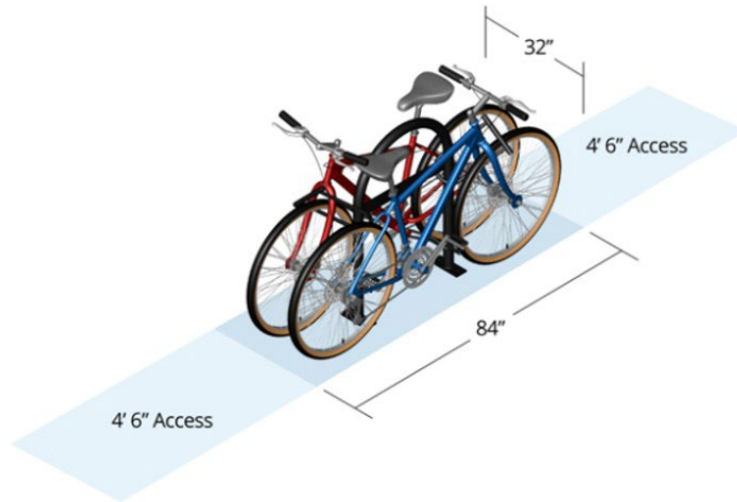


Figure 6F: Bicycle Rack

Two park benches (48" x 25") were selected from TreeTop products. *Figure 6G* shows this detail.



6G: Park Bench

Six solar lights from Engoplant were placed evenly around the trailhead parking lot. *Figure 6H* shows this detail.



Figure 6H: Solar-Powered Light

We recommend the products shown above, but if needed, equivalent items should be found as replacements. The layout of these features is shown below in *Figure 6I*.



Figure 6I: Trailhead Layout

The trail was designed with a width of 10' for the newly paved trail and 22' for the shared use path. The total trail spans 6.71 miles. An example of a trail cross section along Hwy 38 is shown in *Figure 6J*.

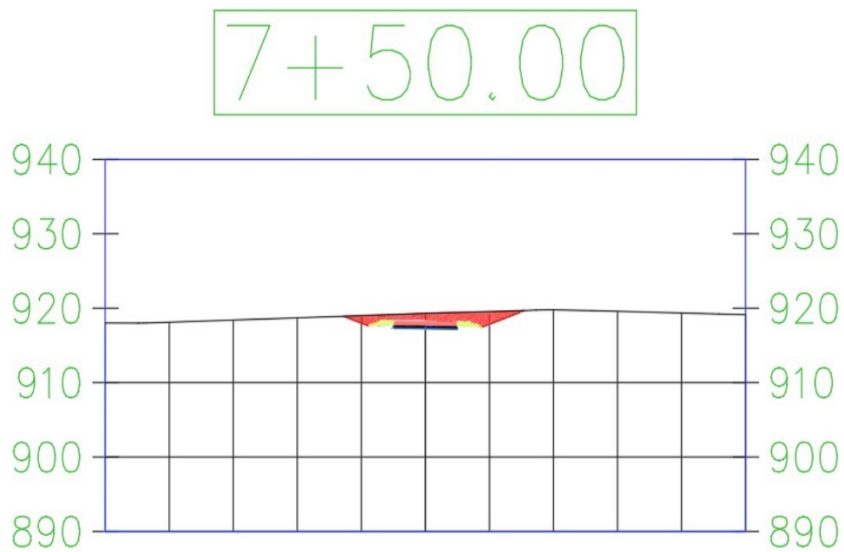


Figure 6J: Cross Section - Hwy 38

5.84 miles of this was designed as newly proposed trail and 0.87 miles of this was designed as a shared use path. No change in the existing pavement of the shared use path will be implemented apart from pavement markings. Both 5" PCC and 5" asphalt were evaluated during design but due to PCC and asphalt having a much higher cost, the recommended material for the proposed trail is 6" Class A compacted stone. Compacted stone is a common material for nature trails. More details on these costs can be found in *Section VII: Engineer's Cost Estimate*.

The trail begins at the east side of the trailhead lot and crosses over Hwy 38 with appropriate pavement markings and signage. There are a total of seven typical crossings along the entire trail. *Figure 6K* illustrates the pavement markings and signage needed for this crosswalk and the other six crossings along the trail. These crossing locations can be seen in *Figure 6L*. *Figure 6K* depicts optional and required signs and pavement markings. The total number of required signs for each crossing is 14. The optional signs can be included or excluded during final design.

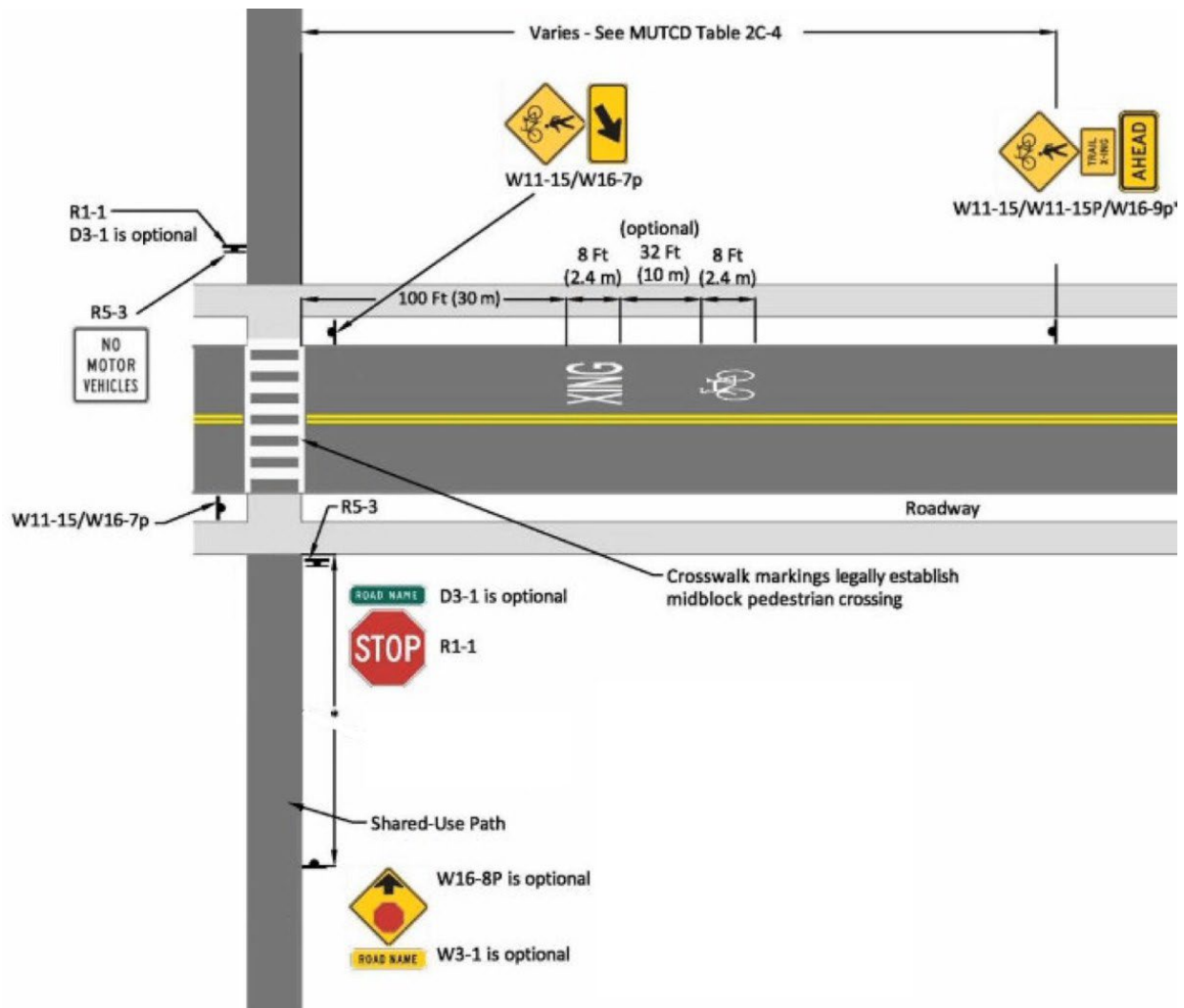


Figure 6K: Typical Crossing Signage and Pavement Markings (AASHTO)

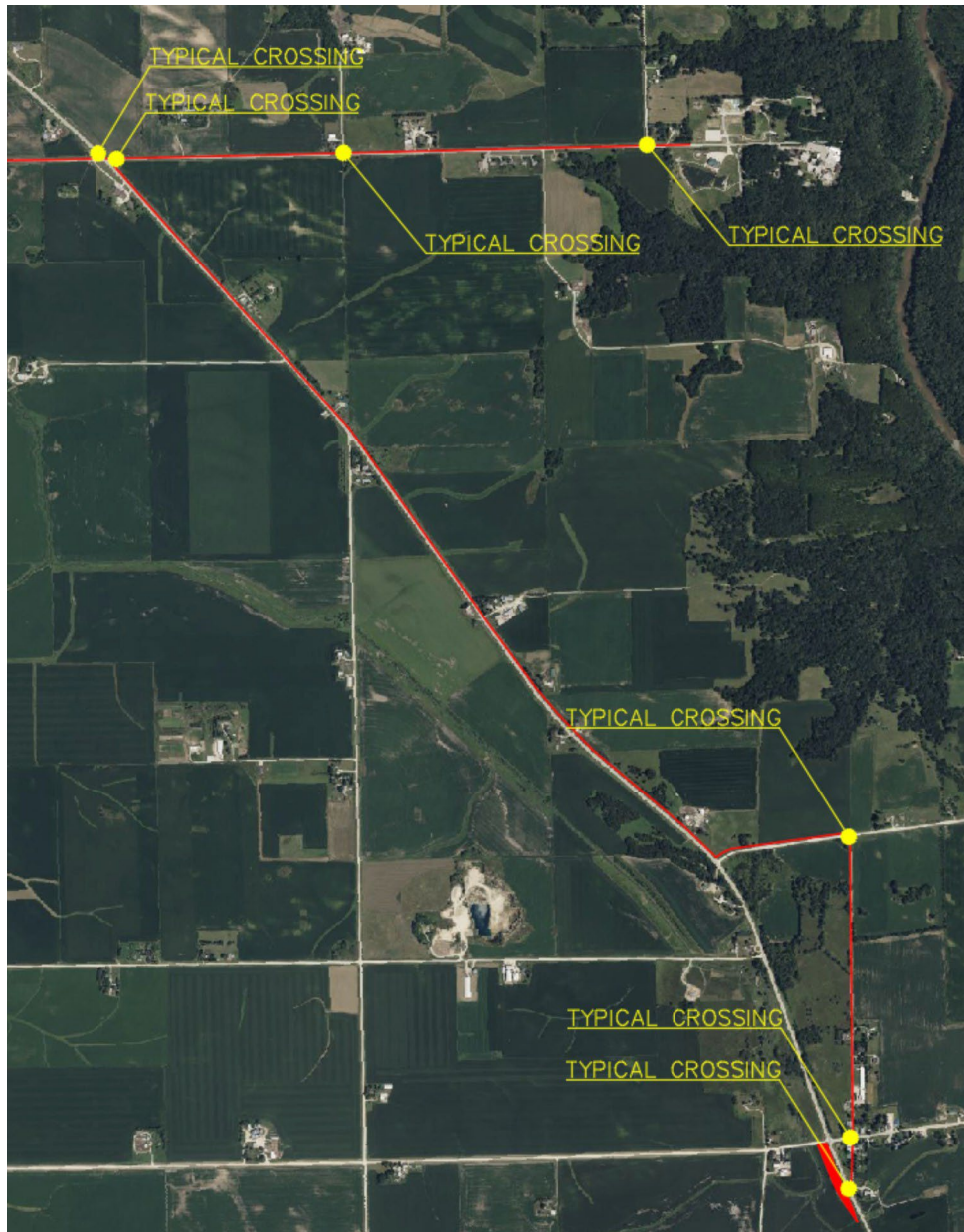


Figure 6L: Crossing Locations

After crossing Hwy 38, the trail then includes a short segment within the right of way of Hwy 38 to connect the pedestrian crossing to the southernmost part of 116th Ave. The segment spans a total of 117' and remains fully within the right of way of Hwy 38. This segment is shown in *Figures 6M* and *6N*.



Figure 6M: Trailhead Tie-in Existing Conditions Northbound



Figure 6N: Proposed Trailhead Tie-in

From there, 116th Ave was repurposed into a shared use path. Share the Road signs, W11-1 and W16-1P, were placed at the beginning and end of 116th Ave as well as at the intersection of 116th Ave and E17 to ensure the safety of trail users. The typical crossing signage and pavement markings were implemented at the intersection of 116th Ave and E17. In addition to the share the road signs, MUTCD shared usage pavement markings were painted at 200' intervals along 116th Ave. Details for these signs can be found in Design Drawing 06.

This shared use path is an exciting project feature as it can later include a garden in the right of way. This trail section with a garden would become a future trail called the Harvest Trail. It would be a great way to get the community involved in sustainability. The first section of the trail has a narrow right of way since it is largely residential with houses quite close to the street but the last .46 miles of 116th Ave shared use path is flanked on both sides by farmland leaving ample opportunity for a garden along this segment of the trail. A 3D rendering of what this garden could look like is illustrated in *Figure 60*. This illustration was designed using Infracore.



Figure 60: Harvest Trail

The crosswalk crossing over 172nd St at the end of the shared use path, Harvest Trail, also follows typical crossing signage and pavement markings.

This project was divided into four phases with the construction of the trailhead to the end of 116th Ave concluding Phase 1. Phase 2 begins at the north end of 116th Ave and includes the trail segment in the right of way along 172nd St and the trail segment in the right of way of

Highway 38. Phase 3 connects to Camp Courageous and Phase 4 connects to the Monticello trail. The phasing plan is shown below in *Figure 6P*.

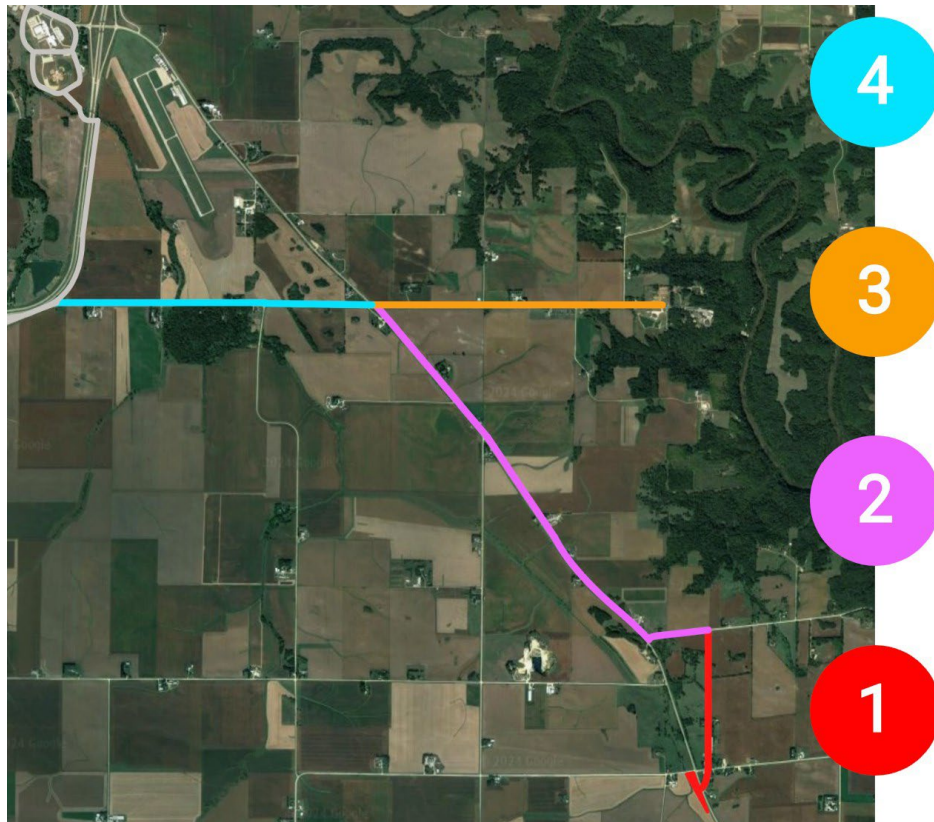


Figure 6P: Phasing Plan

From the north end of 116th Ave, Phase 2 begins, and the trail passes west in the right of way of the north side of 172nd street until Hwy 38 is reached. This segment is about 0.34 miles, and the pavement remains within the right of way. The narrowest part of the right of way along 172nd St is 23' from the edge of pavement. Dedicating an additional 3' offset minimum distance between the edge of pavement on 172nd St and the edge of the trail, this segment was confined to a width of 20'.

Please note: while the pavement remains fully within this 20' width, some areas of daylighting extend past it. In final design, this would need to be addressed and changes may need to be implemented.

At Hwy 38, the trail turns to the north, remaining on the east side of Hwy 38 with the pavement fully within the right of way. *Figures 6Q* and *6R* show sections of the right of way along Hwy 38.



Figure 6Q: Hwy 38 Northbound



Figure 6R: Hwy 38 Southbound

The narrowest right of way along Hwy 38 was 48' from the edge of pavement. A minimum offset distance from the edge of pavement was increased to 6' since Hwy 38 is a heavier trafficked, higher speed state roadway. This left 44' of available area within the right of way which is where this section of trail was designed. This section is 2.32 miles.

Please note: while the pavement remains fully within this 44' width, some areas of daylighting may extend past it. In final design, this would need to be addressed and changes may need to be implemented.

The typical crossing signage and pavement markings were utilized to cross 190th St at the intersection of 190th St and Hwy 38, completing Phase 2 of the project.

Phase 3 then passes east from the intersection of 190th St and Hwy 38 and remains within the right of way along 190th St to then connect into Camp Courageous. Two typical crossings can be found in this phase. One to cross 130th Ave and one to cross 122nd Ave. The trail is designed in the right of way of 190th St which is 30' to the edge of pavement at its narrowest. Leaving a minimum 3f' offset distance between the edge of pavement on 190th St and the edge of the trail, this segment was confined to a width of 27'. This section is 1.47 miles.

Phase 4 then passes west from the intersection of 190th St and Hwy 38 and remains within the right of way along the north side of 190th St. Then it connects into the Monticello trail nearby the location where U.S. Hwy 151 turns from north and southbound to east and westbound. Hwy 38 is crossed at the beginning of this phase following typical crossing signage and pavement markings. This section is 1.69 miles in length.

Please note: while the pavement in Phases 2 and 3 remains fully within this 27' width, some areas of daylighting may extend past it. In final design, this will need to be addressed and changes may need to be implemented.

In this section, 190th St crosses a bridge over Kitty Creek. At this point, on both sides of the bridge the trail connects to the road and trail users will share the bridge with motorists. W11-1 and W16-1P Share the Road signs will be placed near the bridge in both directions to ensure the safety of trail users. This unique section is shown in *Figure 6S*. *Figure 6T* shows the existing bridge. *Figure 6U* depicts 190th St from an eastbound view. This concludes the 6.71 mile Regional Trail and 2.12-acre trailhead connecting Scotch Grove to Camp Courageous and Monticello.

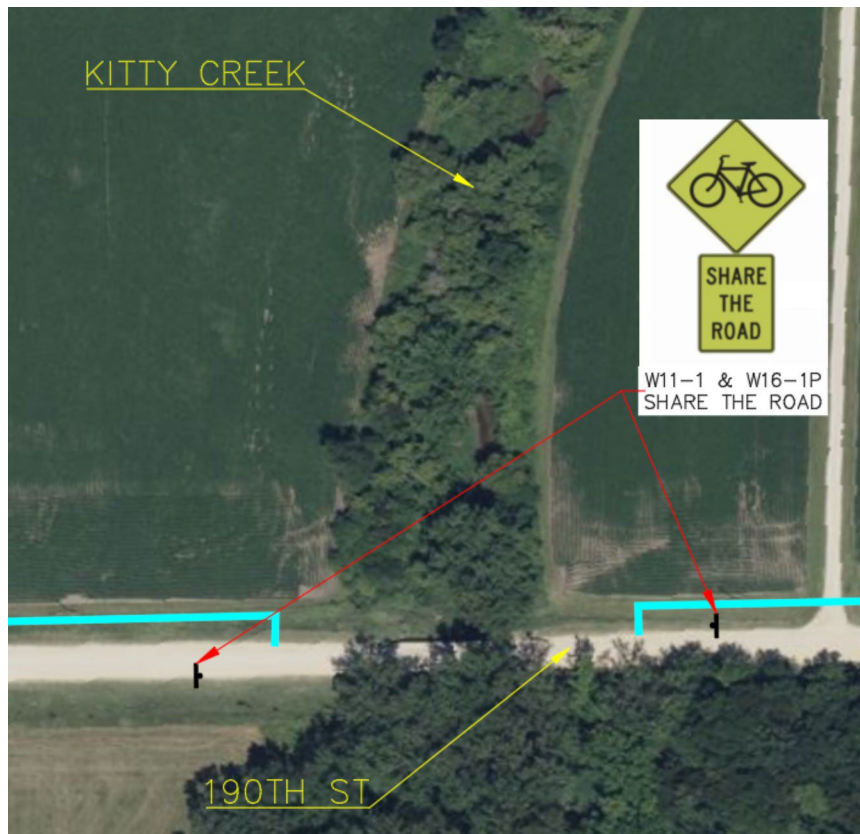


Figure 6S: Proposed Shared Use Bridge – Kitty Creek.



Figure 6T: 190th St Shared Use Bridge Westbound



Figure 6U: 190th St Eastbound

Section VII Engineer's Cost Estimate

PRELIMINARY COST ESTIMATE OF REGIONAL TRAIL AND TRAILHEAD					
ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ROUNDED COST
PHASE 1: TRAILHEAD TO END OF 116TH AVE					
BIKE RACKS	2	UNIT	\$ 269.00	\$ 591.80	\$ 590.00
RESTROOMS (DESIGN, TRANSPORTATION, INSTALLATION)	1	UNIT	\$202,500.00	\$ 202,500.00	\$ 202,500.00
SANITIZING STATIONS	2	UNIT	\$ 135.00	\$ 270.00	\$ 270.00
BENCHES	2	UNIT	\$ 698.00	\$ 1,396.00	\$ 1,400.00
PARKING STOP BLOCKS	6	UNIT	\$ 61.00	\$ 366.00	\$ 365.00
LIGHTING	6	UNIT	\$ 149.99	\$ 899.94	\$ 900.00
SIGNS	47	UNIT	\$ 150.00	\$ 7,050.00	\$ 7,050.00
PAVEMENT MARKING	700	LF	\$ 0.04	\$ 28.00	\$ 28.00
CLEARING AND GRUBBING	0.22	ACRE	\$ 1,000.00	\$ 220.15	\$ 220.00
EXCAVATE CLASS 10	17.91	CY	\$ 4.29	\$ 76.83	\$ 120.00
BACKFILL USING CUT	17.91	CY	\$ 6.25	\$ 111.94	\$ 175.00
GRANULAR BACKFILL	7.86	CY	\$ 52.82	\$ 415.17	\$ 415.00
SOIL COMPACTION	70.01	CY	\$ 1.92	\$ 134.43	\$ 135.00
TOP SOIL	48.38	CY	\$ 6.91	\$ 334.29	\$ 335.00
HYDRAULIC SEEDING	0.03	ACRE	\$ 3,852.07	\$ 115.51	\$ 115.00
AGGREGATE BASE COURSE	105.02	CY	\$ 20.00	\$ 2,100.42	\$ 2,100.00
5" ASPHALT (TRAILHEAD)	501.96	SY	\$ 44.80	\$ 22,487.81	\$ 22,500.00
5" PCC (OPTION 1)	128.17	SY	\$ 47.84	\$ 6,131.49	\$ 6,125.00
5" ASPHALT (OPTION 2)	128.17	SY	\$ 44.80	\$ 5,741.87	\$ 5,750.00
6" CLASS A COMPACTED STONE (OPTION 3)	29.91	TON	\$ 33.09	\$ 989.57	\$ 990.00
PHASE 2: END OF 116TH TO INTERSECTION OF 38TH AND 190TH					
SIGNS	14	UNIT	\$ 150.00	\$ 2,100.00	\$ 2,100.00
CLEARING AND GRUBBING	8.70	ACRE	\$ 1,000.00	\$ 8,698.92	\$ 8,700.00
EXCAVATE CLASS 10	1908.48	CY	\$ 4.29	\$ 8,187.38	\$ 10,000.00
BACKFILL USING CUT	1908.48	CY	\$ 6.25	\$ 11,928.00	\$ 14,500.00
GRANULAR BACKFILL	6109.34	CY	\$ 52.82	\$ 322,695.34	\$ 322,500.00
SOIL COMPACTION	1735.52	CY	\$ 1.92	\$ 3,332.21	\$ 3,325.00
TOP SOIL	2942.56	CY	\$ 6.91	\$ 20,333.10	\$ 20,300.00
HYDRAULIC SEEDING	1.82	ACRE	\$ 3,852.07	\$ 7,025.80	\$ 7,025.00
AGGREGATE BASE COURSE	2603.29	CY	\$ 20.00	\$ 52,065.74	\$ 52,000.00
5" PCC (OPTION 1)	15619.72	SY	\$ 47.84	\$ 747,247.51	\$ 747,000.00
5" ASPHALT (OPTION 2)	15619.72	SY	\$ 44.80	\$ 699,763.56	\$ 700,000.00
6" CLASS A COMPACTED STONE (OPTION 3)	3644.60	TON	\$ 33.09	\$ 120,599.88	\$ 120,500.00

Figure 7A: Preliminary Cost Estimate of Phase 1 and Phase 2

PRELIMINARY COST ESTIMATE OF REGIONAL TRAIL AND TRAILHEAD					
ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ROUNDED COST
PHASE 3: INTERSECTION OF 38TH AND 190TH TO CAMP COURAGEOUS					
SIGNS	28	UNIT	\$ 150.00	\$ 4,200.00	\$ 4,200.00
CLEARING AND GRUBBING	5.55	ACRE	\$ 1,000.00	\$ 5,547.77	\$ 5,550.00
EXCAVATE CLASS 10	1310.89	CY	\$ 4.29	\$ 5,623.72	\$ 8,125.00
BACKFILL USING CUT	1310.89	CY	\$ 6.25	\$ 8,193.06	\$ 11,900.00
GRANULAR BACKFILL	4749.04	CY	\$ 52.82	\$ 250,844.29	\$ 251,000.00
SOIL COMPACTION	956.27	CY	\$ 1.92	\$ 1,836.04	\$ 1,825.00
TOP SOIL	2027.20	CY	\$ 6.91	\$ 14,007.94	\$ 14,000.00
HYDRAULIC SEEDING	1.26	ACRE	\$ 3,852.07	\$ 4,840.23	\$ 4,850.00
AGGREGATE BASE COURSE	1434.41	CY	\$ 20.00	\$ 28,688.11	\$ 28,700.00
5" PCC (OPTION 1)	8606.43	SY	\$ 47.84	\$ 747,247.51	\$ 747,000.00
5" ASPHALT (OPTION 2)	8606.43	SY	\$ 44.80	\$ 699,763.56	\$ 700,000.00
6" CLASS A COMPACTED STONE (OPTION 3)	2008.17	TON	\$ 33.09	\$ 120,599.88	\$ 120,500.00
PHASE 4: CONNECTION TO MONTICELLO TRAIL					
SIGNS	16	UNIT	\$ 150.00	\$ 2,400.00	\$ 2,400.00
CLEARING AND GRUBBING	2.74	ACRE	\$ 1,000.00	\$ 2,743.96	\$ 2,750.00
EXCAVATE CLASS 10	2619.3	CY	\$ 4.29	\$ 11,236.80	\$ 14,900.00
BACKFILL USING CUT	2619.3	CY	\$ 6.25	\$ 16,370.63	\$ 21,700.00
GRANULAR BACKFILL	4713.45	CY	\$ 52.82	\$ 248,964.43	\$ 249,000.00
SOIL COMPACTION	1098.62	CY	\$ 1.92	\$ 2,109.35	\$ 2,100.00
TOP SOIL	377.02	CY	\$ 6.91	\$ 2,605.24	\$ 2,600.00
HYDRAULIC SEEDING	0.23	ACRE	\$ 3,852.07	\$ 900.20	\$ 900.00
AGGREGATE BASE COURSE	1647.93	CY	\$ 20.00	\$ 32,958.52	\$ 33,000.00
5" PCC (OPTION 1)	9887.56	SY	\$ 47.84	\$ 473,020.66	\$ 473,000.00
5" ASPHALT (OPTION 2)	9887.56	SY	\$ 44.80	\$ 442,962.49	\$ 443,000.00
6" CLASS A COMPACTED STONE (OPTION 3)	2307.10	TON	\$ 33.09	\$ 76,341.82	\$ 76,500.00

Figure 7B: Preliminary Cost Estimate of Phase 3 and Phase 4

The detailed cost estimate for each phase of construction including three different paving materials can be shown in *Figures 7A* and *7B*.

- The unit price of the bench was obtained from TreeTopProducts. <https://www.treetopproducts.com/modern-recycled-plastic-bench#specifications>
- The unit price of the bike racks was obtained from Cycle Safe. <https://cyclesafe.com/bike-parking/bike-racks/bike-u-rack-crossbar/>
- The unit price of the sanitizing stations was obtained from Swie sanitizing specialists. <https://swie.com/products/outdoor-hand-sanitizer-soap-dispenser-pole-mounted>
- The unit price of the parking stop blocks was obtained from Nitterhouse Masonry products. <https://www.nitterhousemasonry.com/our-products/concrete-parking-stop-blocks/>
- The unit price of the restroom was obtained from Romtec. <https://romtec.com/restroom-buildings>
- The unit price of all other pay items were obtained from Bid Express. <https://www.infotechinc.com/bidexpress/>

The above products are recommended, and if needed, equivalent items should be found as replacements.

5” asphalt was the chosen paving material for the trailhead lot. It was determined that a hard surface would be required for the parking lot and because asphalt is less expensive than PCC, this is the recommended option. The cost estimates for three different trail materials, 5” PCC, 5” asphalt, and 6” Class A compacted stone were calculated and are shown below in *Figure 7C*.

CONSTRUCTION COSTS	
TRAILHEAD: 5" ASPHALT	\$ 235,603.00
PHASE 1: TRAILHEAD TO END OF 116TH AVE:	
5" PCC (OPTION 1)	\$ 245,343.00
5" ASPHALT (OPTION 2)	\$ 244,968.00
6" CLASS A COMPACTED STONE (OPTION 3)	\$ 240,208.00
PHASE 2: END OF 116TH TO INTERSECTION OF 38TH AND 190TH	
5" PCC (OPTION 1)	\$1,187,450.00
5" ASPHALT (OPTION 2)	\$1,140,450.00
6" CLASS A COMPACTED STONE (OPTION 3)	\$ 560,950.00
PHASE 3: INTERSECTION OF 38TH AND 190TH TO CAMP COURAGEOUS	
5" PCC (OPTION 1)	\$1,077,150.00
5" ASPHALT (OPTION 2)	\$1,030,150.00
6" CLASS A COMPACTED STONE (OPTION 3)	\$ 450,650.00
PHASE 4: CONNECTION TO MONTICELLO TRAIL	
5" PCC (OPTION 1)	\$ 802,350.00
5" ASPHALT (OPTION 2)	\$ 772,350.00
6" CLASS A COMPACTED STONE (OPTION 3)	\$ 405,850.00

Figure 7C: Construction Costs for Three Options

As seen in *Figure 7C*, 6” Class A compacted stone is the most economical choice for pavement especially since the trail spans 5.84 miles of newly paved trail. Because of this, we recommended this choice.

TOTAL COST FOR SELECTED MATERIAL: 6" CLASS A COMPACTED STONE	
CONSTRUCTION SUBTOTAL:	\$1,657,500.00
ENGINEERING AND ADMINISTRATION:	\$ 66,500.00
CONTINGENCIES:	\$ 298,500.00
TOTAL PROJECT COST:	\$2,022,500.00

Figure 7D: Total Project Cost for Recommended Material

The total construction cost for all phases with the recommended materials of 5" asphalt for the trailhead and 6" Class A compacted stone for the trail is shown in Figure 7D. An additional 4% was added for engineering and administration and an additional 18% was added for contingencies. Contingencies are often an additional 10%- 20% and we chose the higher side due to any permits which may be needed as well as the possibility of easements. With these additional costs, this brought the total project cost to \$2,022,500.00.

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Appendix A: Gantt Chart Task Schedule

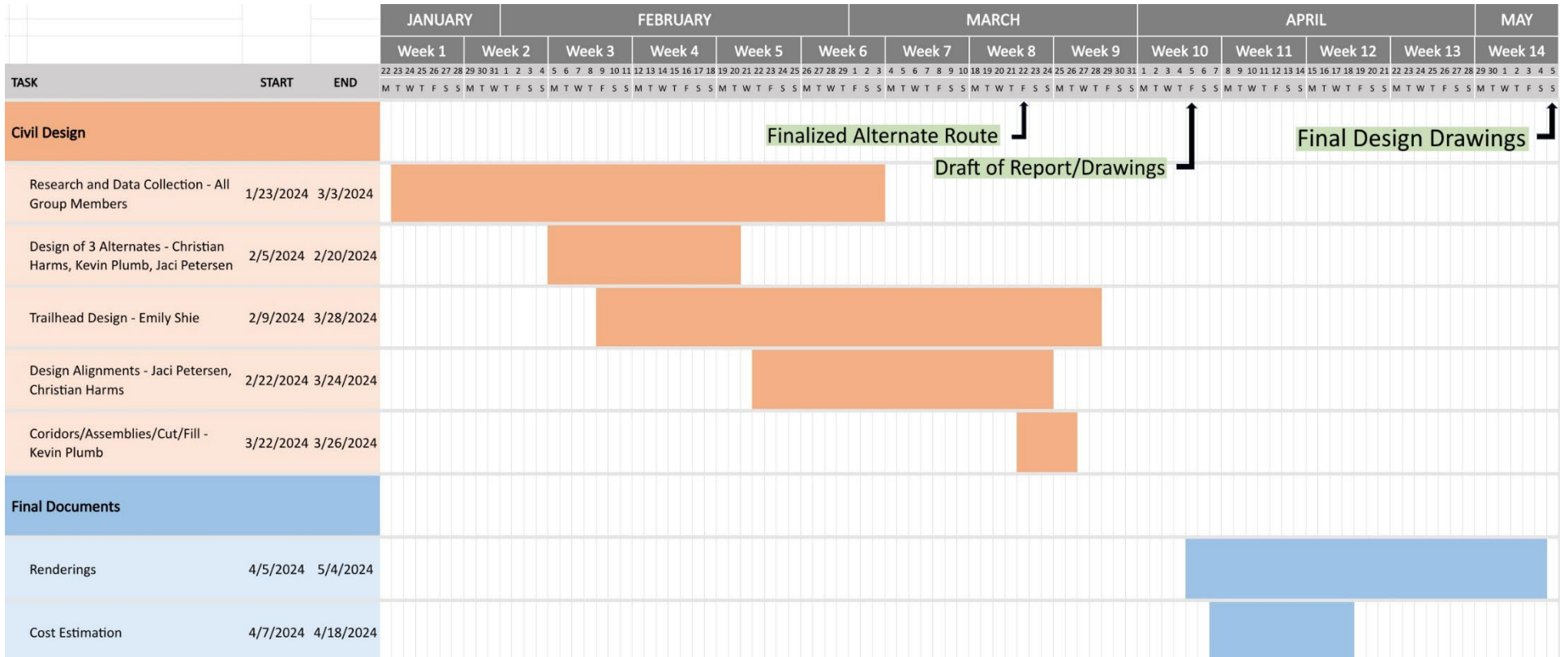


Figure A: Gantt Chart