Final Project Deliverable

Due Jul 1, 2022 by 11:59pm   **Points** 300   **Submitting** a file upload

ENGR 180: Final Project

Accessibility for All: Compliant Route Design and Report

All final projects must be delivered as a single PDF.

Project Overview

UC Merced is interested in sponsoring the design and construction of a recreational trail in the Yosemite region, shown in Figure 1. UC Merced has hired your Engineering Company to map out an ADA compliant route, 2 ADA compliant parking spaces, and one informational sign. The University has already provided you with a high-resolution TIF file for you to get started on analysis right away! (The University has agreed with the Park to focus on the popular Yosemite Valley area.) Your company must deliver a professional report format (see guidance), from the perspective of a professional engineer (*not* a student).

Note: This is a hypothetical scenario to test various skills learned this semester. You may not digitize an existing true hiking route or road. (e.g. Mist Trail, Valley Loop, etc)! You can design your route anywhere undeveloped within the given region of interest – just be sure to meet the requirements listed below.

Requirements

You must route a recreational trail that is at least 1 kilometer in length in the region of interest.

- The route must maintain compliance given requirements from ABA Accessibility Standards Chapter 10, section 1017 "Trails" from the United States Access Board
- The site must accommodate 2 (and ONLY 2) ADA compliant parking spaces in compliance with https://adata.org/factsheet/parking. [do not design an entire parking lot layout]
- At least one location with informational signage along route must be mapped
- Bring in two additional data layers of your choosing that contribute to where/why you choose your route, e.g. campgrounds. There is extensive geospatial data available for Yosemite National Park on Portal and the internet.

Provided Data

1**[Folder on Catcourses (https://catcourses.ucmerced.edu/courses/24848/files/folder/FinalProjectData)](https://catcourses.ucmerced.edu/courses/24848/files/folder/FinalProjectData)** called FinalProjectData containing

- 1 bare earth LiDAR DEM file, via CatCourses Final Data Folder (output_be)
- 1 Yosemite Boundaries Feature Class
- CA10_Zimmer_metadata.xml (Project Critical Metadata)
- CA10_Zimmer_metadata.txt (Project Critical Metadata)

- You MUST (2) incorporate layers from other sources for supplemental information and analysis.

Delivery and Grading

This project will be delivered in a PDF report format. All included map products must be full production quality with all key map elements included along with map balance, attention to detail. Screenshots may be used to detail geoprocessing steps but are not required. Spelling and grammar will be heavily graded along with formatting and cartography.

Students will be graded on addressing each key section of the required report along with the quality of the content. The project should demonstrate cohesive understanding of themes and GIS skills learned throughout the course. Students will be graded on following the prescribed format, word limits, spelling and grammar, professional writing style, as well as production quality maps. A separate rubric is available at the end of the Assignment page.

ADA Compliance

You as the consultant are responsible for reading and interpreting compliance of your trail with ADA rules and regulations.

Historic routes "grandfathered in" and certain different-purposed routes (eg wilderness) do not have to be ADA accessible. This has led to a limited number of accessible routes for people with mobility differences, such as those who use assistive devices, such as a wheelchair. This new route MUST be ADA compliant to be inclusive of people who are already subject to limited options in outdoor spaces.

Parking Design Guidance: **Accessible Parking | ADA National Network (adata.org)** ⤏ **(https://adata.org/factsheet/parking)**

Trail Design: Section 1017 "Trails": **Architectural Barriers Act (ABA) Standards (wbdg.org)** ⤏ **(https://www.wbdg.org/FFC/USAB/ABAstandards.pdf)**

Required Components

Cover Page

- Your company name and contact information
- Delivery date
- Visual component: company logo or relevant visual

Table of Contents

- Traditional Table of Contents including each of the following sections and corresponding page numbers

Introduction and Background (<500 words)

- Background justification for use of the specified region for proposed route and the objectives of the project. (i.e. WHY you're doing the project)
- Explanation of the region: E.g., site description, existing infrastructure, terrain, climate, fauna and flora, watercourses etc.
- You must include a two sentence written land acknowledgement for the original inhabitants dispossessed from the area now identified as Yosemite National Park. Learn more about land acknowledgement **here** ⇨ **(https://nativegov.org/news/a-guide-to-indigenous-land-acknowledgment/)** .

ADA Specifications

- Describe specifications defined by your client and specifications you defined (e.g. proximity to another trail, within XX meters of a campground). Be sure to address any regulatory requirements (e.g., ADA specifications, this will require some external research).
- In a written segment, include background information on why National Park trails do not all have to be ADA compliant, and why this route should be designed and built in Yosemite National Park, specifically regarding compliance and existing route options. This section will need to be accomplished through external research. (300 words max for this written segment)

Datasets

General description introducing data used for modeling. (150 words max)

- Source of existing data, metadata, and uncertainty of any and all layers used - properly cited (no limit)
- Details of original data created for this project - full metadata (no limit)

Methods

Your methods should be a short narrative of the overall approach you took in your modeling and geoprocessing. (500 words max)

Be sure to include...

- Data Management
- Map Projection
- Geoprocessing Tasks

Workflow Diagram

Include a visual component showing a workflow diagram detailing the geoprocessing tasks described in the Methods section.

Selection of Suitable Sites

- Uncertainty Discussion: Consideration of errors and **uncertainty**, any steps taken to reduce errors or uncertainty, or incorporate them into the modeling or site selection?
- Be sure to address the uncertainty of the DEM data
- Criteria for selection - should explicitly discuss ADA criteria and other criteria used in final design selection (e.g. proximity to restrooms, campgrounds, or other student-selected datasets.
- Identify suitable sites
- Students should use a ranking scheme to identify multiple design solutions and justify the final design (e.g. accessibility versus conservation? Is path curvature important? Is user experience important?)
- What conditions were evaluated for the informational sign?

Ethical Considerations

Identify and discuss two engineering-specific ethical considerations related to the design and development of your recreational route. (300 words max)

Code of Ethics | National Society of Professional Engineers (nspe.org) ⬏ (https://www.nspe.org /resources/ethics/code-ethics)

GIS Code of Ethics | URISA ⬏ (https://www.urisa.org/about-us/gis-code-of-ethics/)

Final Recommendations (500 words max)

What is the final plan? Where do you recommend placing the path? Where will you place the sign, and what is the general content of the informational sign? Did you have to make any trade-offs between routing for the general content of the informational sign? Did you have to make any trade-

offs between routing for sensitive areas and accessibility?

Final Designs should explicitly address and communicate the uncertainty of their data and the impacts on the final recommendations.

Final Visuals (Exactly 2)

These should be full production quality maps with all key map elements and following cartographic best practices.

- Production Quality Map: recreational route overview with key details labelled (materials, length) AND point location of information sign, labelled in the map. One full page (8.5 x 11) map.
- Production Quality Map: Parking area overview with two parking spaces mapped and labelled with dimensions. One full page (8 x 11) map.

References

References should be done in APA format in accordance for best practices for engineers.

HYPERLINKS ARE NOT CITATIONS

Resources

- **Project Files on Catcourses (https://catcourses.ucmerced.edu/courses/21633/files/folder /FinalProjectData)**
- **A guide to Indigenous land acknowledgment - Native Governance Center** ⮕ **(https://nativegov.org/news/a-guide-to-indigenous-land-acknowledgment/)**
- **Accessible Parking | ADA National Network (adata.org)** ⮕ **(https://adata.org/factsheet/parking)**
- **Architectural Barriers Act (ABA) Standards (wbdg.org)** ⮕ **(https://www.wbdg.org/FFC/USAB /ABAstandards.pdf)**
- **ArcGIS Online OpenData** ⮕ **(https://hub.arcgis.com/search)**
- **Code of Ethics | National Society of Professional Engineers (nspe.org)** ⮕ **(https://www.nspe.org/resources/ethics/code-ethics)**
- **GIS Code of Ethics | URISA** ⮕ **(https://www.urisa.org/about-us/gis-code-of-ethics/)**
- American Society for Photogrammetry and Remote Sensing: Standards

Skills You'll Use

- Project Planning and Design
- Report Creation and Formatting
- Research and Data Collection
- ADA Compliance

- Geoprocessing
- Data Management
- Critical Thinking
- Ethics and Uncertainty Recognition and Analysis
- Written and Visual Communication Skills
- Media and Visual Analysis
- Quantitative and Numeric Analysis
- Practical and Applied Knowledge

ENGR180_FinalProject_S22

Criteria	Ratings			Pts
Background and Justification The introduction includes background and justification for use of the specified region for proposed route and the objectives of the project. It also should contain an explanation of the region: e.g., site description, existing infrastructure, terrain, climate, fauna and flora, watercourses etc. A two sentence written land acknowledgement for the original inhabitants dispossessed from the area now identified as Yosemite National Park.	**20 to >13.33 pts** **Excellent** The student sufficiently described the project background, justified their use of the region for the route, and the objectives of the project. Contains a comprehensive site description and includes land acknowledgement.	**13.33 to >6.67 pts** **Good** The introduction was present but the justification or objectives is unclear. There is sufficient background, contains a site description and land acknowledgement.	**6.67 to >0 pts** **Fair** The introduction was present but the justification or objectives is unclear. There is sufficient background, contains a site description and land acknowledgement.	20 pts

Criteria	Ratings				Pts
Specifications and constraints Specifications Describe specifications defined by your client and specifications you defined (e.g. proximity to another trail, within XX meters of a campground). Be sure to address any constraints (health and safety, social, political, cultural) and regulatory requirements (e.g., ADA specifications). This will require some external research. In a written segment, make sure to include background information on why National Park trails do not all have to be ADA compliant, and why this route should be designed and built in Yosemite National Park, specifically regarding compliance and existing route options. (300	**20 to >16.0 pts** **Excellent** Identified all specifications and provided specific, quantifiable requirements for each. Full consideration of constraints were made. Background material was provided on the historical driver for the lack of ADA compliant infrastructure in the park.	**16 to >10.67 pts** **Good** Specifications are provided, and a discussion of some constraints is contained. Background is provided on why national park trails do not need to meet ADA requirements. .	**10.67 to >0.0 pts** **Fair** Some specifications are provided, but they are not well quantified, or do not lay out clear design requirements. Constraints are not considered, or only minimally considered. No background provided on ADA compliance in National Parks.	**0 pts** **No Marks** Specifications and constraints are missing	20 pts

Criteria	Ratings				Pts
words max)					
Datasets General description introducing data used for modeling. (150 words max) Source of existing data, metadata, projection, and uncertainty of any and all layers used - properly cited (no limit) Details of original data created for this project - full metadata, projection and uncertainty (no limit) Acquisition description of novel data (250 words max)	**20 to >15.0 pts Excellent** For each data set, the student identified the source, critical metadata including projection, and novel data collection processes. Data are properly cited (not just URL).	**15 to >10.0 pts Good** The student identified all dataset sources and identified the source and relevant metadata and projection, but may be missing some information about quality. Data are cited, but may not be compliant.	**10 to >5.0 pts Fair** The student identified dataset sources but with insufficient information for an reader to identify source and quality. Data are not fully cited.	**5 to >0 pts Poor** No description of datasets is present, no citations.	20 pts
Methods - description and approach Methods Methods should be a short narrative of	**20 to >15.0 pts Excellent** Key processes clearly outlined, including geo-	**15 to >10.0 pts Good** Geo-processing tasks and modeling were done, but	**10 to >5.0 pts Fair** Geo-processing and modeling tasks were not	**5 to >0 pts Poor** Geo-processing and	20 pts

Criteria	Ratings				Pts
the overall approach taken with modeling and geo-processing. (500 words max)/. It should address all data management and transformations, map projection and geoprocessing tasks.	processing tasks and modeling steps. Choices for geo-processing are logical and reflect understanding of GIS principles. GIS terminology is employed and used appropriately in the narrative. Contains information about data management, including all data transformations made and addresses projections.	description could be improved. Choices for geo-processing are mostly logical, but may be missing a logical piece or step. Data management and projections are addressed, but not with sufficient detail.	performed or the tasks selected did not contribute to the overall project appropriately. Little understanding of GIS was demonstrated in the choice of methods and approach. Data management was not discussed.	modeling tasks were not performed. Description is missing or incomplete.	
Workflow diagram Includes a visual component showing a workflow diagram detailing the geo-processing tasks described in the Methods section	**15 to >12.0 pts Full Marks** Provides a visual summary of the steps taken in analysis. The workflow diagram presents all information needed for a user to reproduce the workflow. Inputs, actions, and outputs and clearly labelled, and the order of operations in the workflow is clear. Dependencies are	**12 to >8.0 pts Good** The workflow diagram contains all steps in the workflow, and the order is correct. Inputs, outputs and actions may not be clearly distinguishable. Visual elements could be improved.	**8 to >0.0 pts Fair** The workflow diagram is incomplete, missing critical processing steps, or the processes are out of order. Inputs, outputs and actions are not clearly labeled and the visual elements need improvement.	**0 pts No Marks** Missing	15 pts

Criteria	Ratings				Pts
	identified. The diagram is visually pleasing and all text elements are legible.				
Selection of suitable sites - criteria and ranking. The student addressed why criteria for selection were utilized, and how any ranking schemes were used (or why not used). This should explicitly discuss ADA specifications and other requirements and constraints used in final design selection. Used a ranking scheme to identify multiple design solutions and justify the final site selection and design. Conditions were evaluated for the informational sign.	**30 to >22.5 pts Excellent** Full description of site selection and supports the selection with logic and technical skills. Demonstrates clear and complete understanding of the design requirements. All design constraints were considered and met. The final design is achieved after well-justified and evidenced-based review of reasonable alternatives.	**22.5 to >15.0 pts Good** Demonstrates understanding of the design problem and requirements. Specifications are defined and procedures followed do not significantly impair the solution. AI constraints were considered and most were met. Alternative approaches were identified and analyzed to some degree.	**15 to >7.5 pts Fair** Demonstrates some understanding of the requirements and specifications. Shows major defniciencies in the procedure that impacts the quality of the solution. Some constraints were considered, but the design did not meet, or only minimally met some constraints. Some analysis of alternative designs was performed, but large parts of the analysis were missing or incorrect. Reasoning for the selected design is unclear.	**7.5 to >0 pts Poor** No evidence of understanding of the design problem or requirements. Design procedures not followed. No constraints were considered in the design. No analysis of alternative design solutions was done, or clearly infeasible alternatives were given.	30 pts
Selection of suitable sites - description of	**30 to >22.5 pts Excellent** Fully and	**22.5 to >15.0 pts Good** Explains different	**15 to >7.5 pts Fair** Shows some	**7.5 to >0 pts Poor** Cannot	30 pts

Criteria	Ratings				Pts
uncertainty and error. Consideration of errors and uncertainty, any steps taken to reduce errors or uncertainty, or incorporate them into the modeling or site selection. This should address the uncertainty of the DEM data, and consider how it propagates through the remainder of the analysis and final design.	accurately explains different probability and statistical methods, including demonstrating an understanding of different statistical methods.	probability and statistical methods in a fashion that is basically correct, but some minor details are missing or inappropriately included.	understanding of the basic principles of probability and the general use of statistics but is missing critical details and methods.	explain different probability and statistical methods.	
Final Recommendations Description of final plan and fully justified and explained routing, parking, and signage selection. The student addressed whether any trade offs needed to be made and why.	**25 to >18.75 pts Excellent** The final recommendations are fully and logically justified by technical criteria. The design is highly suited for its intended purpose and will function very well.	**18.75 to >12.5 pts Good** Criteria were addressed in their final recommendations but does not justify them with supported logic and technical skills. The design is well suited for its purpose and should function well.	**12.5 to >6.25 pts Fair** The design mostly serves the intended purpose, but may function poorly.	**6.25 to >0 pts No Marks** The design choice is unsuitable for its intended purpose or the design is conceptually flawed.	25 pts
Professional Ethics - Identify two ethical considerations Identify and	**40 to >30.0 pts Full Marks** Can identify critical issues and components of	**30 to >20.0 pts Good** Problem is recognized and stakeholders are	**20 to >10.0 pts Fair** Can recognize the problem and Shows some	**10 to >0 pts Poor** Cannot recognize an ethical	40 pts

Criteria	Ratings				Pts
discuss two engineering-specific ethical considerations related to the design and development of your recreational route.	new knowledge. Considers multiple points of view in their analysis and takes a global and local view.	identified. Can provide a clear argument supported by evidence that considers multiple points of view (e.g., employers, clients, professions, society).	capability for providing relevant information for the case at hand, but may fail to consider multiple points of view, and cannot form a coherent argument.	dilemma. Cannot identify stakeholders (those impacted by the problem).	
Spelling and Grammar Professional grammar and correct spelling	**20 pts** **Full Marks** Minimal spelling or grammar errors	**10 pts** **Fair** The student's spelling and grammar in the document need improvement and distract from the message of the deliverable	**0 pts** **Poor** Spelling and grammar errors majorly detract from the quality of the report and would not be accepted in a professional environment		20 pts
References Uses APA citation style, including in-line citations for text.	**20 to >10.67 pts** **Full Marks** The students reference list indicates the type of reference, complete citations, and appropriate formatting, as well as appropriate choices utilized as references. In-line citations are used. All datasets are cited following APA guidelines.	**10.67 to >0.0 pts** **Fair** The references are included but not properly cited, e.g. only show a hyperlink. Some reference choices are inappropriate (e.g., a website versus primary source).	**0 pts** **No Marks** The student did not include any references		20 pts
Static Map Trail The static map features the full trail and 5 key map elements through production quality cartographic design	**15 to >7.5 pts** **Full Marks** The map follows best cartographic practices, includes all key map elements and associated best practices - eg clarity of naming, "easy to math" scale increments (0.5 instead of 0.47), has pleasing aesthetics, and communicates key points of project.	**7.5 to >0.0 pts** **Partial Credit** The map is present but is not production quality. There are 3 or more issues with the key map elements.	**0 pts** **No Marks** The trail map is not present		15 pts

Criteria	Ratings			Pts
Static Map Lot The static map features two parking spaces and 5 key map elements through production quality cartographic design	**15 to >7.5 pts** **Full Marks** The map follows best cartographic practices, includes all key map elements and associated best practices - eg clarity of naming, "easy to math" scale increments (0.5 instead of 0.47), has pleasing aesthetics, and communicates key points of project.	**7.5 to >0.0 pts** **Partial Credit** The map is present but is not production quality. There are 3 or more issues with the key map elements.	**0 pts** **No Marks** The parking lot map is not present	15 pts
Cover Page Company name, contact info, logo, delivery date	**10 pts** **Full Marks**	**0 pts** **No Marks**		10 pts
			Total Points: 300	