

About Emma Olson



My name is Emma Olson and I am a Civil Engineering major with minors in Sustainable Engineering and Humanitarian Engineering at Villanova University. Throughout my undergraduate years, I have focused on the Grand Challenge of restoring and improving urban infrastructure.

I am from Portland, Oregon where I have always enjoyed exploring the city and taking note of how the infrastructure excels and where it could be improved. Taking in urban infrastructure is crucial to understanding how a city functions and how specific groups are in need of more support. I love exploring new cities and noting the differences in infrastructure across different states and countries. I believe one of the most important aspects of urban infrastructure projects is the involvement and communication with the local community to ensure those affected are included. I am passionate about the social aspect of engineering projects in addition to analyzing the sustainable options in detail. As an engineer, I hope to apply my Sustainable Engineering and Humanitarian Engineering minors in my future work through involving the public when possible and taking into account how this project will impact the surrounding community.

I hope to continue my passion for urban infrastructure through social and sustainable lenses at my job as a Water Resources Engineer with Jacobs Engineering following my graduation in May.

Talent

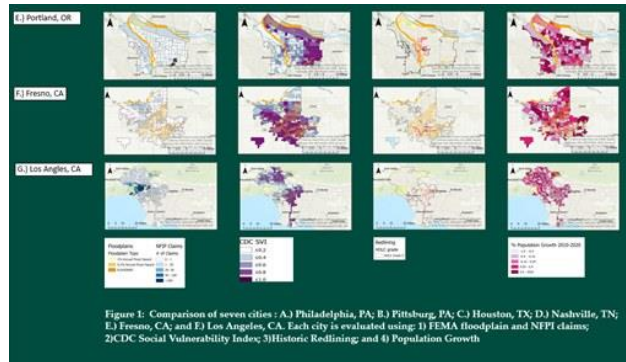


During my junior and senior year, 2022-2024, I worked with Dr. Virginia Smith and Dr. Bridget Wadzuk on expanding research on redlining and urban flooding through a social lens in cities across the United States. I worked closely with Dr. Achira Amur and Dr. Peleg Kremer in analyzing the data and compiling the ArcGIS layers for each city. This research focused on urban infrastructure within a variety of cities and examining how cities were initially developed in comparison to how they presently function. I focused on providing visuals for how NFIP flood claims, FEMA floodplains, redlining, and the CDC Social Vulnerability Index (SVI) relate to one another upon layering the data in ArcGIS. Through this data evaluation, there are connections between flood risk and social vulnerability in historically redlined areas of a city in addition to outlier cases.

Through this research experience, I was able to better examine how a city functions in relation to stormwater management in relation to historic decisions. I learned more about the complexity of public projects in a city and additional considerations of maintaining urban infrastructure including littering. I learned more about different Green Stormwater Infrastructure present in Philadelphia including rain gardens and bioswales. Through this project I discovered more about the role of the local community and the importance of communicating effectively with the public. This experience was crucial to further developing my understanding of urban infrastructure and the role of civil engineers.

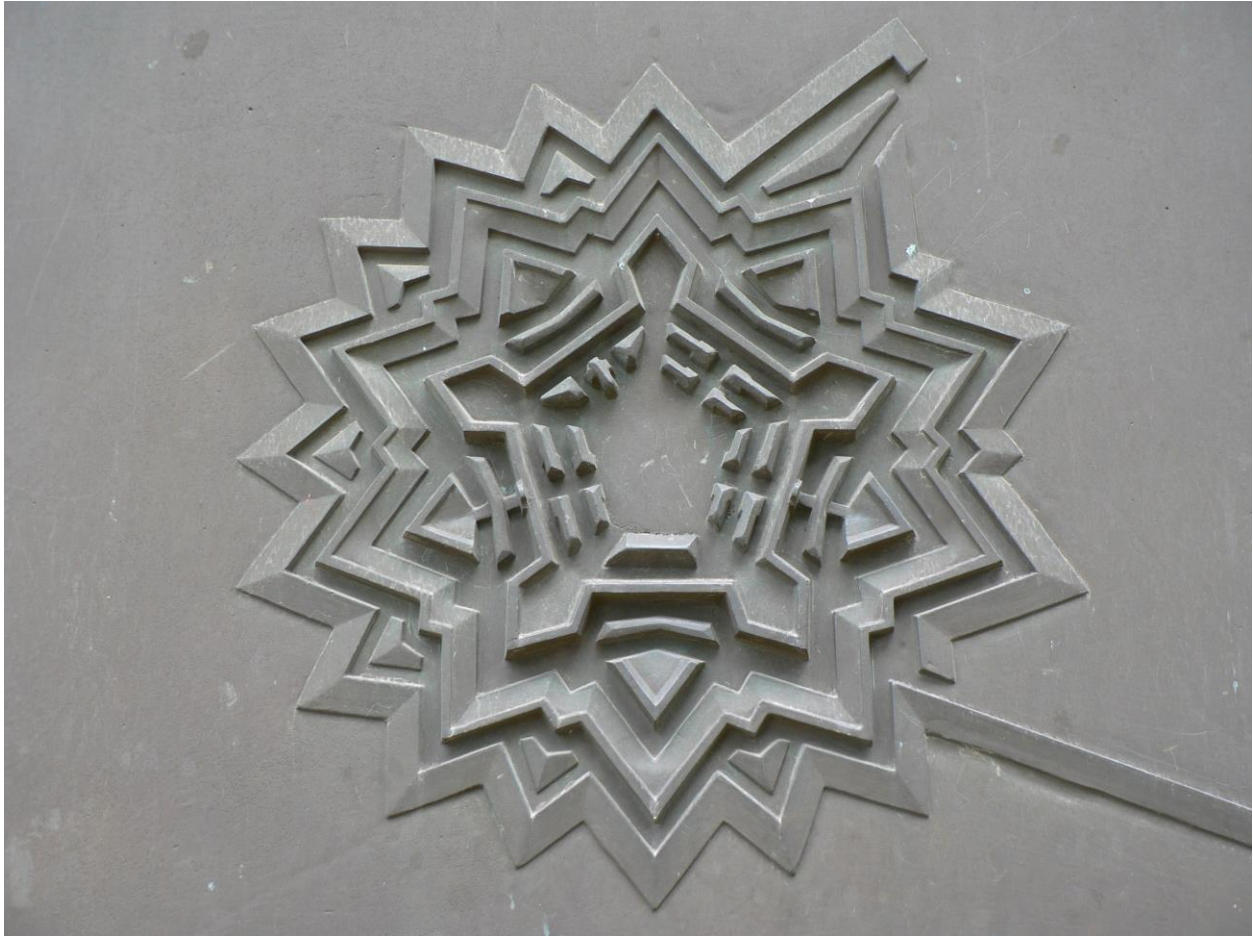


1 - Figure 1. Contributed to ArcGIS Layering for a Research Poster of Different Cities



2 - Figures 2. Contributed to ArcGIS Layering for a Research Poster of Different Cities

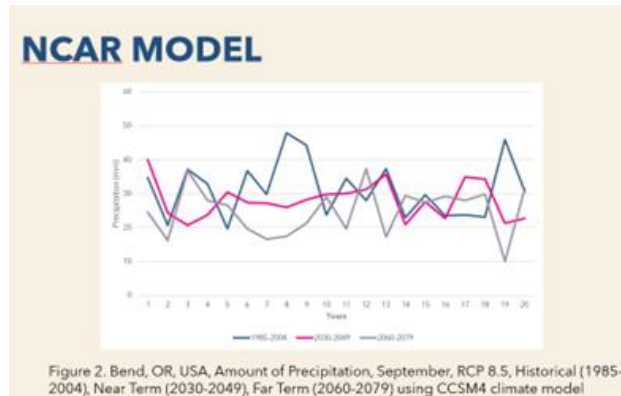
Multidisciplinary



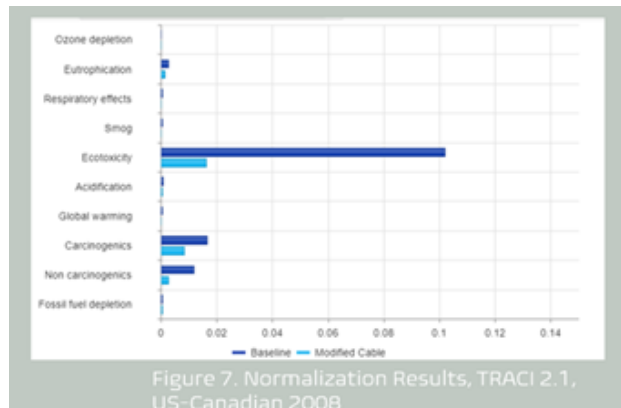
In the summer following my first year at Villanova, the College announced the new Sustainable Engineering Minor which immediately caught my eye. I was initially going to pursue a Sustainability Studies Minor, but then I wanted to pursue the Sustainability Engineering Minor knowing it would directly apply to my engineering studies. I have always been passionate about sustainability and conserving the Earth's resources. As an engineer, I hope to create a positive environmental impact. The two required courses of Risk & Opportunities and Life-Cycle Assessment & Circular Economy taught by Dr. Mary McRae taught me key concepts in sustainable engineering.

In Risk & Opportunities, I learned the importance of analyzing every sustainable engineering solution for both positive and negative impacts. Through this evaluation, I discovered that although there is no perfect solution, there are many methods that do have potential in their application. For our final project of this class, we analyzed the future climate impacts of a specific city and a potential adaptive strategy the city could take. I focused on a more rural city of Bend, Oregon where there is an increase in wildfires and drought where drip irrigation could be effective. However, many people presented on urban areas such as Miami, Florida or Barcelona, Spain where I learned about the climate threats for these cities and how the city could spearhead an infrastructure initiative. Specifically in Miami, a stormwater management plan would be beneficial due to the rising sea water in the city.

In the Life-Cycle Assessment & Circular Economy class, the content focused more on the impact of a product after its use and how materials can be cycled through a loop instead of a linear economy. This class introduced me to the software SimaPro where I learned how to analyze specific products to determine which materials cause the greatest environmental impact and alternative materials such as recycled metal that lessen the environmental impact. Through this class, I understood the value of considering different material options in infrastructure projects to ensure the most effective and environmentally-friendly approach.



3 - Figure 3. Slide from Final Presentation for Risks and Opportunities Course, Analysis of Future Precipitation Amounts and the Impact on Local Infrastructure



4 - Figure 4. Slide from Final Presentation for Life-Cycle Assessment and Circular Economy Class, Analysis of Environmental Impacts of Specified Material through the SimaPro Software

Business/Entrepreneurship

In the Fall 2023, I took the Engineering Entrepreneurship class Feasibility Analysis for Entrepreneurs where I learned how to evaluate an entrepreneurial venture in the context of marketability and possibility of success. Through this class, I worked on a team to put together a product focusing on keeping a person warm in extreme weather, specifically while skiing and snowboarding. I learned how to determine a beachhead market profile for a product to ensure that the idea can take off. We analyzed different personas to determine who would be our target persona and end user profile for our product. These concepts of the end user profile and beachhead market taught me how I can think more about

who will be impacted by urban infrastructure project and how the infrastructure's functioning can address a person's needs. Through this class, I learned how to modify the goal features of a product to fit the persona's needs which relates to slightly changing an infrastructure design to ensure the impacts match the target audience.

Through the Feasibility Analysis for Entrepreneurs class, I learned how to evaluate our product against our competitors in the market. This evaluation is important as an engineer to understand your competitor companies and what projects they are completing. I learned the significance of providing an easy to understand visual to present to others when explaining the functioning and purpose of our product, translating to an infrastructure project. Throughout this class, I presented on my product at least once a week, which greatly improved my presentation skills and ability to answer questions confidently through the question session that followed each presentation. These presentation skills helped me understand the importance of an effective presentation to a boss in addition to a local community in which the presentations will be modified to be effective for the related audience. Through this class, I learned the importance of the community aspects when developing an urban infrastructure project and ensuring the project will meet the needs of the community.



5 - Figure 5. Slide from Final Presentation of the Target Persona for the Product



6 - Figure 6. Slide from Final Presentation of the Competitive Landscape

Global/Multicultural Experience



I spent the Spring Semester of 2022 in Galway, Ireland, studying at the University of Galway (formerly known as the National University of Ireland, Galway). At the university, I took the Strength of Materials and Civil Engineering Materials & Design courses. Through the Strength of Materials course, I learned about structural concepts including bending, deflection, shear stress, Mohr's Circle, and buckling. The Civil Engineering Materials & Design course taught me about specific materials including concrete, timber, and engineered wood in addition to concrete testing. This class helped me understand what materials Irish companies focus on in construction and their national standards. In this class, we also researched a specific unique building constructed recently in which I focused on a tall wooden building built in a city where there were many sustainability goals. This project helped me understand how sustainability goals are incorporated into construction and alternative materials that can be used. These two classes I took had a different grading policy where the majority of our grade was based on assessment and not homework assignments. With this different policy, I worked to stay on top of my work even without homework deadlines in order to be prepared for the test and exams. These classes helped me consider urban infrastructure from a different view with a more international lens as the examples explained in class were often from other European countries.

Outside of the classroom, I spent my time exploring the lovely city of Galway. Within the city, I noted sandbags and construction presented in the Latin Quarter where they were working on the River Corrib walls. With the rising water levels due to climate change, the city was taking action to prevent flooding in the city. Additionally, each time I crossed the River Corrib to enter the city there was a sign promoting the construction of a new pedestrian bridge that would span the river. Although I did not see start of the

construction of the bridge, during my short time in Galway I noticed the need for a pedestrian bridge as the existing bridge had narrow sidewalks that were nearly impossible to pass by other pedestrians. Through these experiences within Galway, I noticed the development of updated and new infrastructure within the city and how the city explained the projects to the general project.



7 - Figure 7. Image of Lab During the Materials & Design Course



8 - Figure 8. Sign for Proposed Bridge in Galway Spanning the River Corrib

<https://www.nwra.ie/news/sod-turned-on-new-world-class-bridge-in-galway-city/>

Social Consciousness



The summer before starting at Villanova, I received an email announcing the brand new Humanitarian Engineering Minor. I immediately knew I wanted to pursue this degree as I already planned on being involved in service learning through the College and wanted to take classes that were also related. Through the required class Introduction to Humanitarian Engineering, I learned about how to better understand engineering through a social lens and how to properly address stakeholder concerns. Our final project for this class focused on developing more resources for asylum seekers living near the U.S. Border in Matamoros, Mexico. Through this project, I learned how to better evaluate different decisions when constructing a residential area with limited resources. Additionally, through this analysis I learned how to evaluate different stakeholders based on monetary influence and value of time. While designing the layout of this project, I learned the importance of the placement of a waste storage compared to water storage to ensure clean water. I learned more about urban infrastructure planning and design through this class in prioritizing specific goals.

In addition to the Humanitarian Engineering Minor, I participated in the Villanova Engineering Service Learning (VESL) for four semesters. I was involved in 3 different projects. In the Fall of 2021, I participated in the Navajo Nation project which focused on determining possible irrigation systems for feed for cattle of a community farm. Through traveling with this project I learned how to perform preliminary research and analysis when visiting a site for the first time to determine possible solutions. In the Fall of 2022, I participated in the Madagascar project which focused on developing low-cost remote monitoring system utilizing telemetry devices for water tanks in rural communities to improve water management. Through traveling to Madagascar in the winter, I took note of the different urban infrastructure of their capital Antananarivo that had a high population density. The third project I was involved in was the Ghana project which focused on continuing to improve effectiveness of an asset management tool for hand pump and well installation in rural communities. I traveled to Ghana twice,

the second time as the leader of the group. Through these travel experiences, I learned more about the importance of sustainability and maintenance in international development in addition to the value of software tools including ArcGIS Survey123 and FieldMaps in providing accurate locations for specific project sites. Although these projects often focused on rural infrastructure, learning about rural infrastructure helped me better understand how to approach urban infrastructure in learning about the differences and similarities between urban and rural infrastructure. Additionally, these rural infrastructure projects were often located close to the local town center which provided aspects similar to urban infrastructure with considering local residents and the town functioning.



9 - Figure 9. The Madagascar Team in the Field Analyzing Existing Water Tanks



10 - Figure 10. Working in the Team Helping Install the Handpump of an Existing Borehole in Ghana



11 - Figure 11. Working with the Local Pump Mechanics in Ghana to Review Updates to the Maintenance Survey