Undergraduate Thesis Prospectus

Sustainable Features Optimizing the Space and Productivity of the Ivy Corridor Project

(Technical research project in Civil Engineering)

Engineers and Architects apply Behavioral Design to Favor Walking and Cycling

(Sociotechnical research project)

by

Eduardo Corro

October 27, 2022

On my honor as a university student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Eduardo Corro

Technical Advisor: Culver T. Advisor, Department of Civil and Environmental Engineering

STS advisor: Peter Norton, Department of Engineering and Society

General Research Problem:

How can the behavioral design affect structure's users?

Behavioral design can affect everything that has to do with human decision-making. When the correct behavioral design technics are applied to structures, the users will make choices that are better for the community. People are inclined to behave according to what is easiest for them. These behavior form habits which generally contribute to large amounts of energy consumption and contamination. Most of the cities and towns in the world are designed for motorized vehicles. Pedestrian walkways and cycling systems are usually inefficient, leaving the users with little room or choice. A city with an effective transportation system is not one that encourages low-income families to buy a motorized vehicle, it is one that encourages high-income individuals to use public transportation. The Behavioral design used in most modern urban planning has inculcated the idea that owning personal motorized vehicles is the ultimate option. However, many countries have started developing and improving pedestrian and cycling systems (Murray, 2021), but the transition to a non-motorized vehicle dominated society is not that simple.

Sustainable Features Optimizing the Space and Productivity of the Ivy Corridor Project

How can sustainable features optimize the space and productivity of the Ivy Corridor Project?

The technical advisor is Teresa Culver from the Civil Engineering department. This technical research problem is a capstone project for CE 4990 "Research and Design". The project collaborators are all from the same department as the technical advisor. The team members are Eduardo Corro, Cameron Murie, Soojin Jang, Lex Clements and Noah Magee. The project is a continuation of The Ivy Corridor Phase 1, which is under construction right now. It

had land with great potential that was barely being utilized. The corridor is a designated entrance for both UVA and the city of Charlottesville, so this location will be the first impression of many visitors arriving (Charlottesville Tomorrow, 2017). This is why the UVA facilities management council requested a complete renovation of the site.

UVA requested for the designs for phase 2 of the project: a 5-acre site located at the intersection of Ivy Road and Copley Road. The site currently holds some UVA-owned facilities which have no current use and a Seven-Eleven convenience store (which can be found within UVA-owned land too). It is adjacent to Phase 1 of the project that already has the designs ready for the School of Data Science, a vehicular bridge, the Emmet Ivy Garage, the UVA hotel, and all the utilities that will be providing these structures (UVA Office of Architecture, 2018). In a certain way, this adjacent phase of the project limits our relatively open-ended task because Phase 2 must connect aesthetically with Phase 1. Since the two parts of the project need to complement each other, it is imperative to use the blueprints for the existing conditions and the approved designs of Phase 1. The professional mentor assigned to our project is Marshall Agee, a professional engineer working for VHB. The mentor will be guiding us through the project when needed and will also provide us with the necessary information and documents about the existing conditions. The UVA facilities management council also set some specific gross square footage of facilities required. Phase 2 needs three hundred thousand GSF for residential buildings, a hundred thousand GSF of academic space, and fifty GSF for a dining facility. Even after demolishing the existing UVA facilities and the convenience store, the space is still very limited. The goal of the project is also to provide a multi-phase stormwater management facility that meets state and local regulations for water quantity and quality control, infrastructure-level

utility planning for the future on-site buildings, and multimodal transportation – including mass transit, pedestrians, and cyclists.

As of now, Phase 2 of the project site is not using about eighty percent of the structures and spaces; 4 acres of land are not being used. The current transportation system is highly inefficient. It has no bicycle lane, and the nearest bus stop is more than half a mile away from the intersection, which encourages students and staff to use their own motorized vehicles for transportation instead. In addition, the sidewalks just go alongside Ivy Corridor Street and a short path for the Ivy Corridor Garage. This lack of walking installations does not make the location pedestrian-friendly, therefore it also sends a message that motorized vehicles are suggested.

Most of the project-proposed designs will be created in AutoCAD Civil-3D including the layout, grading, and elevations needed. The stormwater multi-phase system will be calculated with a GIS software using a Charlottesville map as a reference. The schedule of all the tasks and research needed in order to complete the designs and construction processes was created so that every member of the group knows how much each activity should take to keep up with all the deadlines. The designs required to create the layout with all the facilities requested look promising and the individual tasks have been assigned to each member of the group. The next step is to focus on the construction process of the project. The cost estimation of all these renovations is necessary before presenting the project to UVA. Also, all the Virginia codes and regulations for the ADA (American Act of Disabilities) compliances and safety measurements during the construction period should be reviewed and incorporated. When the final design for Phase 2 is ready, UVA will have an entrance that is attractive for visitors, sustainable, and has an efficient transportation system with enhanced walkability.

Engineers and Architects apply Behavioral Design to favor Walking and Cycling

How can advocacies favor walking and cycling in U.S. transportation systems, while discouraging motorized vehicles?

The transportation system in America is designed for motorized vehicles, which increases the demand for cars. Since its popularization, the average number of vehicles per family in America has increased consistently through the years. The growing supply of vehicles has created an equal demand for miles of road construction. In 2020 the amount of money spent on road construction was 1.15 billion dollars and the year after that, the number grew to 1.5 billion dollars (Statista, 2022). Road infrastructure spending will keep increasing if mass automobile production – induced by growing car demand – persists. A 2015 article published an alarming fact: 76 percent of the country's population travel to work on their cars (Ritcher, 2022). The dependence on motorized vehicles will only keep growing unless the transportation system in America improves pedestrian and cycling features.

The demand for walkable neighborhoods has been steadily increasing over the last few years. The transition back to a walkable society, however, is difficult, because driving has been prioritized almost everywhere. A society that is heavily dependent on automobile use is not sustainable in the long run. The demand for more roads is growing faster than the mass-produced car supply can endure or match. In addition, 41 percent of the carbon dioxide detected in the atmosphere was produced just by passenger cars (Statista, 2021). There are many obstacles in the process of making a community more walkable, especially for the low-income class in America. According to the research journal Cityscape, crime, poor market strength, and racial segregation decreased the effectiveness of walkable neighborhoods. The U.S. Department of Housing and Urban Development (2016) found very poor walking access in most U.S. communities.

Participants include the tenants living in the communities, the urban city planners, advocacy groups that want to change politics into more walkable and cycling communities, and the U.S. Department of Housing and Urban Development. The tenants living in the communities that need improvement are affected directly by the walking accessibility. Since universities are always looking forward to improving, on-grounds housing tenants are a great example. University of Minnesota is highly renowned for its remarkable walkable characteristics. Alumni from the university describe the usefulness of the multiple bridges exclusively designed for foot traffic, as well as the pedestrian sidewalks that enhance inter-building mobility. University of Minnesota students regard their campus in a very positive light. One stated they "could just walk to [their] friends' house for dinner or studying in 5 minutes" (Quednau 2016). The advocacy group League of American Bicyclists – which has the improvement of the US cycling system at the top of its agenda – focuses on local funds and passing cyclist protection laws in an effort to build a bicycle-friendly America for everyone (Bikeleague, 2006). The government agency that oversees the progress of the community's civil development throughout America is the Department of Housing and Urban Development. The HUD has a goal to help low-income families in America by making affordable and efficient neighborhoods. The department focuses on small to medium-sized communities by making sure important locations in the community have walkable access and the land use for the street designs and public transportation systems are used properly. A famous planning engineer that has innovated ways to make cities more walkable is Jeff Speck. He states that "cars are the prosthetic of transportation", which means that you should only use cars if you have something missing (Engineer.com, 2017). Speck indicates that the commuter needs things to take the ideal walk: a good reason to do it, the walk needs to be safe, comfortable, as well as interesting. Some of his innovations to accomplish these

goals include strategically more compact towns, which will allow the resident to walk wherever he needs to. Another method used to increase safety is reducing the width of oversized streets to enlarge the sidewalks to include features that may seem attractive to the pedestrian or the simple bystander. Additionally, it can increase safety, which is of utmost importance to anyone who walks to get by on a regular basis.

References

Dodson, T. (2017, May 12) UVA planning students seek trail network connecting city, Monticello. *Charlottesville Tomorrow*. https://www.cvilletomorrow.org/uva-planning-studentsseek-trail-network/

Janks, D. (2018) Ivy Corridor Planning. *UVA Office of architect.* https://officearchitect.virginia.edu/ivy-corridor-planning

Koschinsky, J; Talen, E (2015) Affordable Housing and Walkable Neighborhoods: A National Urban Analysis. *Cityside 17*, 13-56.

League of American Bicyclists (2006) The League supports the efforts of state and local advocates nationwide. *The League of American Bicyclists since 1880*. https://www.bikeleague.org/

Murray, M. (2021) These 8 cities around the world are putting their focus on biking and walking. *Ideas.Ted.Com. https://ideas.t ed.com/these-cities-around-the-world-are- focusing-on-biking-and-walking-instead-of-cars/*

Quednau, Rachel (2016, September 16) Strong Towns. The Wonderful Walkability of College Campuses. https://www.strongtowns.org/journal/2016/9/13/college-campuseswalkability

Ritcher, F (2022, May 19) Cars still dominate the American commute. *Statista*. https://www.weforum.org/agenda/2022/05/commute-america-sustainability-cars/

Speck, Jeff (2017, March 2) 4 Ways to Make a City More Walkable. *YouTube*. Uploaded by TED. https://www.youtube.com/watch?v=6cL5Nud8d7w&ab_channel=TED

Spendlove, T (2017, February 18). Designing and Building a More Walkable City. *Engineering.com.* https://www.engineering.com/story/designing-and-building-a-more-walkablecity

Statista (2021, December 14) Distribution of carbon dioxide emissions produced by the transportation sector worldwide in 2020. https://www.statista.com/statistics/1185535/transportcarbon-dioxide-emissions-breakdown/

Statista (2022, July 25) Value of federal highway and street construction put in place in the U.S. from 2008 to 2021. https://www.statista.com/statistics/615654/us-federal-construction-spendingon-highway-and-street-projects/

U.S. Department of Housing and Urban Development. (2016, December 22). Creating Walkable and Bikeable Communities. *Office of Policy Development and Research.* https://www.huduser.gov/portal/publications/Creating-Walkable-Bikeable-Communities.html