Final Sustainability Report

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Engineering a better future

In response to climate change, the concept of sustainability is becoming popular. Organizations promote their sustainability initiatives to appear more attractive and environmentally responsible. What is sustainability? In brief, it is the practice of maintaining something so it can be preserved – or "sustained" – for the future. As defined by Dr. John Ayers, a professor of environmental sciences at Vanderbilt University, sustainability is the integration of the health of the economy, society, and the environment (Ayers, 2017). Thus, a sustainable city is one that balances these elements as it relates to the development and life of the city. Sustainable cities look different depending on the specific circumstances of the city. Common sustainable measures in cities are the use of renewable energy, planting more greenery, and the use of public transportation and pedestrian/bike usage over the use of automobiles.

Civil engineers, government leaders, and citizens are all responsible for shaping our cities. Government leaders plan and provide framework, engineers design systems, and citizens are the end users. All are responsible for implementing sustainability in cities. Civil engineers must ensure best practices in design and materials selection and keep sustainability in mind. Civil transportation engineers can design efficient and accessible public transportation, and bicycle and pedestrian transport. Civil structural engineers can design buildings with features such as green roofs, solar panels, and use the right materials to reduce the carbon footprint of their buildings. Citizens engage in sustainability at the city level by voting with their dollars. Using public transportation, walking, riding a bike – or not – reflects the level of popular support for sustainable transportation initiatives. Citizens alone cannot change building design or transportation systems. They can advocate for these measures, but governments and civil engineers must be the ones to implement them. Everyone has a role to play in creating a more sustainable world, and, in the face of climate change, everyone *must* do their part. In the words of Dr. Seuss's Once-Ler, "Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."

Successful sustainable strategies

In May of 2022, 18 students and four faculty from Gonzaga University's Civil Engineering department traveled to the city of Delft in the Netherlands to learn about the Dutch

approach to sustainability. Over the course of three weeks, the group took field trips, toured many facilities, and had classroom lectures and discussions. The course was conducted with Spokane's Sustainability Action Plan (SAP) in mind. This paper will focus on the transportation and land use sector, and applications to Spokane's goals (see Figure 1) will be discussed subsequently. Specific attention will be given to reducing carbon emissions generated by transportation and land use in Spokane (Figures 2 and 3).

Transportation & Land Use	
Goal 1: Encourage land use policies that support walkable, livable, sustainable communities for all	
TL 1	Advance land use planning to minimize vehicle miles traveled (VMT)
TL 2	Encourage sustainable land use that promotes varied housing options and infill development
GOAL 2. Reduce motor vehicle miles traveled (VMT) and promote active transportation modes	
TL 3	Increase transit ridership
TL 4	Increase adoption of walking, cycling, and micromobility
TL 5	Improve transportation safety
TL 6	Support existing & new programs to reduce VMT
GOAL 3. Advance alternative and low carbon fuel in regional transportation	
TL 7	Increase adoption rate of Zero Emission Vehicles (ZEVs) including electric bicycles
GOAL 4. Integrate Sustainability Action Plan goals, strategies, and actions into City planning	
TL 8	Update comprehensive plan to incorporate climate action and updated sustainability goals
TL 9	Ensure the City's process for approving development and service extensions addresses and prevents impacts to prime agricultural lands, critical wildlife habitats, and other natural areas in and around the city

Figure 1: Transportation and land use goals, Sustainability Action Plan

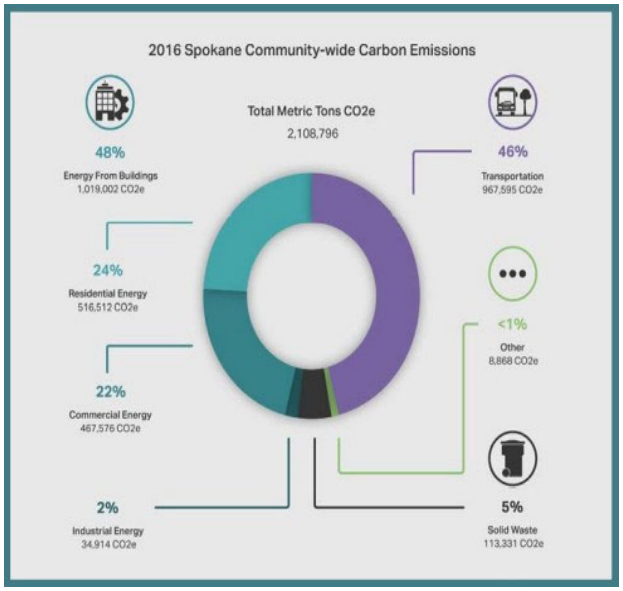

Figure 2: Spokane carbon emissions, Sustainability Action Plan

Transportation Type	Percent of Total
Passenger Vehicles and Motorcycles	44%
Light Duty Trucks	18%
Railroad	11%
Heavy Duty Vehicles	10%
Regional Airports (Spokane & Geiger Field)	16%
Public Transportation (STA)	1%
Other	1%
Total	100%

Figure 3: Transportation emissions by type, Sustainability Action Plan

The Netherlands is very focused on protecting the environment, and the country has many sustainable features and initiatives. Collectively, the Dutch have focused on the environment for a long time due to the constant danger of flooding. Much of the country is below sea level, and there are many large rivers flowing through the country. The Netherlands' long history of dealing with environmental issues provides meaningful context for explaining their response to climate change, and their incorporation of sustainability into their infrastructure. This section will discuss sustainable features of Dutch transportation and land use.

Transportation and land use refer to the ways people move through and use the physical environments in which they live. Within the context of a city, transportation often means public

transportation and land use often means city building regulations and zoning, as well as housing developments. Integrated mobility is a big part of Dutch transportation and land use. To define integrated mobility, an example is most helpful. One place where integrated mobility is especially evident is in the city of Utrecht. The city's population is expected to grow to 450,000 by 2040 (Toussaint, 2020). The city has set the ambitious goal of planning for this growth so that the number of car trips remains constant. For this to happen, the city needs to make using public transportation, walking, and cycling as convenient as driving. The Merwede housing project close to the city center will be key to manage the city's growth. Merwede will be a new neighborhood in a former industrial area capable of housing 12,000 residents. The goal for this development is to have a car ownership rate of 3 cars for every 10 people. In the United States, car ownership is closer to 8 cars for every 10 people (U.S. Department of Energy, 2017). Besides a limitation on total parking spaces, planners have set parking spaces aside solely for shared vehicles. Merwede will not allow cars within the center of this neighborhood, but limit traffic to pedestrians and bicycles. Parking will be in underground parking garages, and spaces above ground will be green areas. The parking strategy and green areas are intended for residents to live in a more enjoyable neighborhood, as well as to mitigate the urban heat island effect. The city is expanding the transportation network to include new stops around the neighborhood. This development exemplifies how transportation and land use are "integrated" to proactively create an efficient neighborhood.

Automobiles are responsible for a significant part of total carbon emissions. Choosing to commute by bike is one of the best ways an individual can reduce their carbon footprint. Expansive bicycle networks and high bicycle ridership are definitive characteristics of the Netherlands. The country boasts everything from a nationwide system of bike highways to bike lanes in every city and town (Figure 4). Cycling in the Netherlands is seen as an equally viable transportation option. Despite high ridership and the fact that few Dutch wear helmets, cycling is not considered dangerous. Dutch children take mandatory cycling education, just as drivers' education is mandatory in the United States. Cyclists often have separate facilities such as

greenways or protected lanes, and drivers are aware of cyclists when they are sharing the same road (Figure 5).

Figure 5: A walking path, bike path, and road (right to left) in Delft

Transportation systems that are less auto centric have benefits beyond reducing emissions. Biking and using public transportation increase social engagement, because people are physically closer together and share traffic interactions face to face. Driving is often a solitary affair. When in cars, people are not facing others in the same way as they are on bikes or public transportation. Those who bike to work are generally happier and more engaged in their communities than those who drive. Elderly people who bike also enjoy more social connection. Disabled people are allowed to use Dutch bike facilities as well. This greatly increases accessibility. Disabled people can go anywhere a bike can, which is most places. Biking can help neighborhoods grow and increase community engagement. The Dutch are some of the happiest people in the world (Hunter, 2022). Quality of life is a significant factor when making housing and transportation decisions. High volume thru-traffic is diverted away from residential areas, and traffic calming measures, are used to keep neighborhoods quiet, safe, and enjoyable. Increased bike ridership can have economic benefits as well. The cost of owning and maintaining a bicycle is much less than the cost of owning and maintaining a car. Bikers spend more overall in local businesses (Badger, 2012). The Dutch also seek equity. They want all communities to be desirable places to live, regardless of income status. High quality transportation facilities are not limited to higher income areas, as is common in the United States. Cycling is a very beneficial practice, environmentally, socially, and economically, and one that is widely practiced in the Netherlands.

Finally, The Netherlands also has a robust public transport and national railway system. Public transportation is centralized, and connections between long distance trains, city buses, and everything in between are relatively easy. The availability and ease of these systems incentivizes people to use them instead of cars. Many Dutch use the railway, and some even have bikes in

multiple cities for the first and last parts of their journey, rather than using automobiles. Train stations large and small have bicycle parking areas in addition to car parking.

The Dutch have many innovative solutions to transportation and land use issues. Integrated mobility is a concept which the Netherlands practices very well. The Netherlands has a nationwide system of bicycle transportation, and many Dutch ride bicycles. These solutions have many benefits beyond reducing environmental impact.

"Build Back Biker"

As a group, the students of the Gonzaga in Delft program learned a lot about sustainability and saw many applications to the situation in the United States, specifically in Spokane. The city can meet health, environmental, and economic goals through implementation of sustainable transportation and land-use strategies. This section will discuss potential sustainable strategies the City of Spokane can adopt to meet the goals outlined in the SAP.

Transportation accounts for 46% of Spokane carbon emissions, and passenger vehicles account for 44% of this total, making them responsible for a little over 20% of all emissions in Spokane (Figure 1). Clearly, this should be a major area of focus. Reducing the amount of vehicle miles traveled (VMT) is a key part of reducing carbon emissions. The city of Spokane has listed reducing VMT as a major goal. Not everything that works in the Netherlands will work in Spokane. Some Dutch solutions to reducing VMT are beyond the scope of the city, such as the nationwide bicycle highway system. However, the city can build new and improve existing bicycle infrastructure. Bicycle infrastructure is a broad term which can refer to everything from a bike lane painted on a regular road to a multi-use bike and walking path, to a designated bicycle route. What infrastructure is appropriate in which location is an open question. A question, perhaps, with multiple answers. This paper does not argue for one type of facility over another, but sees expansion of facilities as an improvement in general, no matter the type. A more bike-friendly Spokane is a more sustainable Spokane.

The expansion of biking facilities would not only help Spokane meet its transportation and land use goals but could also help meet goals for economic prosperity, natural environment, and health & wellbeing. As previously mentioned, cyclists tend to spend more in local businesses. Increased cycle traffic due to expanded bicycle networks will benefit local businesses. Goals 3 and 4 of the health & wellbeing section of the SAP are to "Create community engagement around sustainability & climate action" and "Increase community awareness of climate change risks and impacts." Spokane could organize community events such as bike-to-work days, or car-free days when certain streets are blocked to cars for community events such as a block party. These can educate people about climate change and sustainability, while also teaching people about the new facilities and encouraging their use. Expanding bike infrastructure also aligns with Goals 2 and 3 of the natural environment section. Higher quality bicycle facilities are ones separated from the main roadway by physical barriers. These facilities are safer for cyclists. Physical barriers can consist of greenery, as seen in Figure 6. Bicycle facilities will help create a more sustainable Spokane. Expanding infrastructure will help fulfill many goals of the SAP.

Figure 6: Another example of a separate, protected bike path in Delft

Expanding bicycle infrastructure presents challenges. There is little precedent, and potentially little demand for such a project. Construction and maintenance of said infrastructure will be considerable. Spokane is much hillier than the Netherlands, a flat country with little variation in terrain. In the U.S., biking is viewed more as exercise, not as transportation. Elderly and disabled people will likely be more hesitant to adopt cycling as a method of transportation. Finally, safety is a major concern, perhaps greater than any others listed here.

Potential low demand is an important consideration. Citizens should always be prioritized in good government. However, the fact that there is little precedent for this type of infrastructure could be the reason for there being little demand. If citizens are presented with cycling as a more feasible transportation method, perhaps demand and usage will follow. "If you build it, they will

come." Construction and maintenance costs should be seen as the cost of becoming more sustainable. Terrain and accessibility concerns are partially resolved with electric bicycles. The city has listed increased adoption of electric bicycles as a goal. Safety is very important. The safest bicycle facilities are those which are separate from cars. Some challenges have simple answers, although the answers won't necessarily be easy to implement. The challenges do have answers, though.

Overall, creating new bicycle facilities will be good for the city of Spokane.

Pedaling Forward

In review, Gonzaga University civil engineering students traveled to Delft, Netherlands to learn about sustainability. The program kept in mind the Spokane SAP, viewing sustainable Dutch initiatives through the lens of transferability to Spokane. One sustainable feature of the Netherlands is the widespread adoption of cycling. Cycling is beneficial in multiple ways: as a mode of transportation, and as a means for improving the environment, economy, and society. This paper is intended to serve as an introduction to and overview of cycling as it relates to sustainability. Cycling as transportation can help the city of Spokane achieve many of its sustainability goals as outlined in the SAP.

This report can be used as a planning resource for city officials: to provide ideas for wider adoption and implementation of cycling and cycling facilities in Spokane.

Works Cited

Ayers, J. C. (2017). *Sustainability: An environmental science perspective*. CRC Press.

Badger, E. (2012, December 5). *Cyclists and Pedestrians Can End Up Spending More Each Month Than Drivers*. Bloomberg.com. https://www.bloomberg.com/news/articles/2012-12-05/cyclists-and-pedestrians-can-end-up-spending-more-each-month-than-drivers

Herranz, A. (2020, March 25). *Merwede, the Dutch neighbourhood where there will be one shared car for every 3 households*. SmartCity: Expo world congress 2. https://tomorrow.city/a/merwede-car-free-neighborhood

Hunter, M. (2022, March 18). *The world's happiest countries for 2022*. CNN. https://edition.cnn.com/travel/article/worlds-happiest-countries-2022-wellness/index.html

Sustainability Action Plan. Sustainability Action Subcommittee - City of Spokane, Washington. (2020, February 21). https://my.spokanecity.org/bcc/committees/public-infrastructure-environment-and-sustainability/sustainability-action-subcommittee/

Toussaint, K. (2020, January 31). *In this new Dutch neighborhood, there will be 1 shared car for every 3 households*. Fast Company. https://www.fastcompany.com/90457158/in-this-new-dutch-neighborhood-there-will-be-1-shared-car-for-every-3-households