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CENG 440

Delft Final Report

### Sustainable Cities from a Civil Engineering Perspective:

The workings of our cities and lives must be adapted to fit the sustainable action needed to support our future. Our cities need to be able to last this impending future of a growing population and decreasing number of resources. As civil engineers, we are dealing with the development, construction, and operation of infrastructure, private buildings, transportation, and water systems within the city. This makes it the job of civil engineers to develop a sustainable city that can run on its given resources indefinitely. Sustainability is crucial in all cities and will set into effect the upcoming future of this world.

Sustainability is having a system that can be upheld or maintained at a constant level without compromise or damage to the overall system. This is applied to cities by being self-sufficient and able to rely on itself to continue. There are several different aspects that work together to make a city sustainable. A city must be sustainable in the areas of transportation, building development, energy usage, water resource management, and waste management. These aspects of a city help determine its prosperity in terms of the economy, well-being and health of the citizens, and natural environment of the area. Sustainable infrastructure in a city gives all members of the city equal access to a clean and prosperous environment. This includes clean drinking water, local parks and greenery, and non-polluted air. A sustainable city focuses on equitable infrastructure for all income levels across neighborhoods. This includes not only safe and accessible transportation but close access to stores, schools, hospitals, and other important services. Sustainability in a city must be able to withstand the future. This means that the infrastructure in place must be able to withstand population growth, expansion, heavy usage, and technology advancement.

With each city being sustainable, the hope is that they will work as a whole to promote a sustainable nation or network of communities. Within our cities is where greenhouse gas emissions are highest and where people interact the most creating negative environmental situations which is why it is the most important location to promote sustainability and a green

future. The city government is in charge of public transportation, road layouts, and city planning which all effect the amount of greenhouse gases used to get from place to place. Cities can adequately develop public transportation and bike lanes that allow easier travel between the urban areas of a city which decrease the individualized need for a car decreasing greenhouse gas emissions. Similarly, city developers from the city are often in charge of designing the layout of many large buildings along with the rules and regulations that must be in place in the construction of these buildings. City laws can be set in place that limit the energy usage in the building and require it to pass green certifications making sure it is a sustainable building that is self-reliant and meeting the guidelines of the city not adding greenhouse gas emissions or waste into the city system. These systems embedded in our cities can have a large negative effect on the environment which is why sustainability needs to be solved at the city level.

Sustainability at a city level can be accomplished through civil engineers working on sustainable infrastructure. Civil engineers work in the fields of transportation, construction, and water resource management. These fields are highly contributed to the greenhouse gas effects on the environment and waste that goes into our communities. Civil engineers can help construct public transportation systems that are reliant on renewable energy such as electric vehicles with an energy source coming from solar, wind, or water turbine energy. By creating infrastructure that can support green technologies, a green based economy can develop. This can be accomplished through civil engineering establishing green jobs such as workers in the public transportation sector or construction workers building green buildings that for example rely on natural lighting and heating through the design of the building and access to windows.

Sustainability can be maximized to be the most effective for the environmental, social, and economical factors of a city through the help of civil engineers promoting rules and regulations for the design and implementation of sustainable infrastructure within a city. The implementation of sustainable practices that acknowledge these three pillars of sustainability sets up a city to withstand crises and problems in the near future while remaining prosperous. A sustainable future is made with help from civil engineers creating sustainable cities that are able to be self-reliant for the days ahead. One aspect that Civil Engineers partake in is the role of creating transportation systems in our cities.

## Transportation in Spokane vs. The Netherlands:

Transportation is the backbone of our society. It is a daily activity that every member of our community partakes in whether via carpool, solo travel, or public transport to get to where they need to go and back home. Along with this it is a constant in our life that will always be needed to keep our communities running smoothly and in a coherent like manner. The key to a sustainable future is reworking our backbone of society to establish guidelines that promote green forms of transportation. The transportation systems that we have established today rely on the use of fossil fuels which not only contribute to climate change and the warming of our planet but are also destined to run out in the near future. This is what makes transportation highly relevant in terms of sustainability within a city. Transportation is also sustainable when it can reach all communities of varying income levels. Transportation gets people where they need to go every day which makes switching our transportation even more drastic in terms of having a high sustainability affect within our cities for all people.

The City of Spokane has a large number of cars on the road compared to the Netherlands. Cars are the most popular form of transportation in Spokane due to the city structure and layout. Neighborhoods often don't have easy and close access to schools, stores, and other services requiring transportation to further distances. The public transportation system in Spokane is also inefficient and outdated. For example, let's say you live in the South Hill area and are trying to commute to your job at Gonzaga University. From Manito Park, it would take you approximately seven minutes by car while via public transportation you would have to take a twenty-three-minute bus ride that included a bus change downtown. Not only is the route by car three times as efficient but it also is the simplest with no vehicle changes needed to get to your final destination. Biking is somewhat popular within Spokane but has major strides to gain more popularity. There are bike lanes in many roads, but due to the older streets some of them are not wide enough to fit bike lanes on the road making it unsafe for bikers and having less draw. Spokane also deals with harsh winters that make it challenging to ride in harsh snowy conditions.

Although the City of Spokane does not have the most sustainable forms of transportation as other cities and nations, it is making strides to become more sustainable.


 <b>Transportation &amp; Land Use</b>	
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

Table 1: Transportation and Land Use Goals

*Source: Spokane Sustainability Action Plan*

In the Spokane Sustainability Action Plan, made to create agenda and policies to guarantee a sustainable future, it addresses ways to promote green sustainability through decreased vehicle miles traveled, increased transit ridership, and heavy adoption of walking and cycling (see Table 1 above). A few examples of ways to accomplish this are “Ensure bike lanes and sidewalks are properly maintained including snow and debris removal throughout the year and prioritizing repairs as required, and plan and prioritize construction of downtown protected ‘micromobility lanes.’” Through these two agenda items the city of Spokane hopes to prioritize sustainable travel through bicycling.

After having been in the Netherlands, it has become highly prevalent of the advanced sustainable transportation the Dutch people have instituted into their cities. First and foremost, the Netherlands has adapted a bike majority transportation system. Within many of the cities the biker takes priority over the car. This means that bikers not only have the right of way in traffic, but they are also favored in many other ways. When a car can only go one way down a road, often bikes can go either way down the road. Bike lanes are on every street and are often separate from the road for the safety of the bike riders. Biking is supported by the transportation officials through making it quicker and more efficient to bike as a form of transportation compared to taking a car. When planning out a city or local

neighborhood/development, thought is put into close locations to schools, stores, hospitals, and other services by bike. The Dutch government also has plenty of bike storage present across its cities, especially near major thoroughfares such as train stations. The Dutch government takes these actions because biking is the most sustainable form of transportation. It not only releases no fossil fuels into the air, but also is more affordable and easier to manage than cars. The Netherlands is very successful in its biking infrastructure and enthusiasm in place and is a very easily adaptable approach of sustainable transportation by the city of Spokane.

The Netherlands has an excellent layout and structure of public transportation in addition to its bike heavy transportation. The public transportation between local Dutch cities makes it incredibly accessible to commuter jobs and the resources of neighboring cities. Trains and metro systems have a routine schedule with trains every five to fifteen minutes to local cities. This gives a huge amount of flexibility to work schedules and what times people need to be in these different cities. Public transportation such as trains or metros rely on electricity which can come from fossil fuels, but usually is a much more sustainable form of transportation compared to an individualized car. The Dutch people are brought up being comfortable with these forms of public transportation and know them very well to the point where it is an integral part of their daily life.

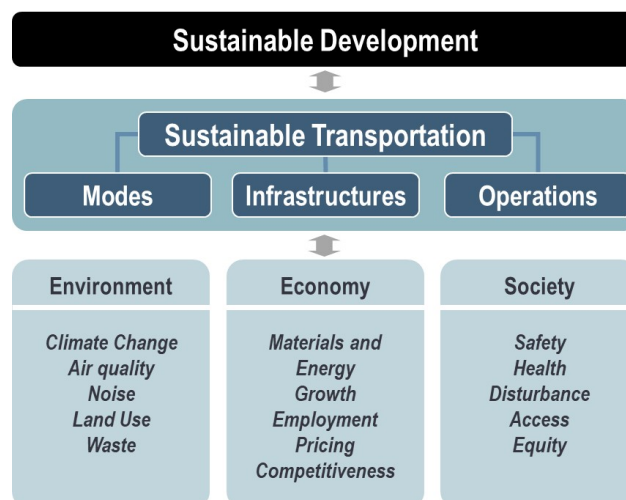


Table 2: Pillars of Sustainable Transportation:

*Source: The Geography of Transport Systems*

The transportation systems we have in place dramatically affect our environment. Not only do they have an effect on the natural environment through the release of greenhouse gases, but it also has major effects on the economy and well-being/health of a city. This is represented through three main categories that make up sustainable transportation: the environment, economy, and society (see Table 2 above). Each one of these categories plays an equal part in sustainable transportation. This is represented in the Spokane Sustainability Action Plan through various goals. One goal laid out by the Spokane Sustainability Action Plan is to “Prioritize and invest in all communities to ensure equitable outcomes.”

Transportation is directly related to this because equal access to transportation must be guaranteed in order to get citizens to their jobs, school, and other services. The development of sustainable transportation to all parts of the community will help make affordable and sustainable transportation accessible for all income levels. In Spokane there are disproportionate amounts of transportation in lower income neighborhoods making it more challenging to commute to jobs, work, and other services. Implementing sustainable transportation will not only get the members of these neighborhoods to where they need to go, but it also establishes a healthy neighborhood with lower pollution in the air and water along with less congestion on roads.

The economy can be heavily affected and improved upon by a city's transportation system. Transportation that can get all members of a community to local shops and stores boosts the local economy. Similarly, investing in sustainable transportation can decrease an individual's purchase on transportation such as gasoline for an automobile. A transportation system focused on bicycling can have numerous health benefits that benefit the members of the community. Riding a bicycle as a form of transportation “reduces the risk of serious diseases and depression: 40% less for Cancer, 52% less for heart diseases and over 40% less for Premature death.” (Bicycle Dutch World Press) Not only does having a bike-based form of transportation improve physical health, but studies have been done where it improves your mental health making you happier and makes workers less likely to call out sick. Transportation is a key part of heading towards a sustainable society. It not only can play a fundamental role in the sustainability of our world, but also has numerous effects on our

economy, well-being, and natural environment. The Spokane Sustainability Action Plan lays out the main goals to accomplish a sustainable transportation system. In order to keep all neighborhoods equitable with access to sustainable transportation that keeps neighborhoods full of happy, healthy, and prosperous individuals the Spokane Sustainability Action Plan must be set in motion.

#### Land Developments based on Transportation Systems:

One strategy that can be adapted in the transportation sector of the Spokane Sustainability Action Plan is the development of housing, stores, and other services around the existing or soon to be built transportation systems. These housing developments are not only built around green transportation lines, but they are also in close proximity to any major service or store you could need access to. The idea behind these housing developments is to utilize public transportation that is close to your home to access farther away services such as going to work every day or going into city center. These land developments will decrease car usage due to many everyday services being in close walking or biking distance.

In the Netherlands, they are capitalizing on the planning of transportation and land use together. One of these major developments is being built in Utrecht Netherlands and is focusing on the idea of adding a population of approximately 350,000 to 450,000 people to the city without adding any extra car trips to the current amount today. Utrecht hopes that with the addition of this neighborhood housing development it will help battle climate change by keeping the car trips for the city constant as population is growing. Housing developments such as these lay just outside city center to help decrease inner city car density. These developments will have schools, banks, medical offices, and other major services all within close walking distance. This will also cut down on car usage greatly. This housing development will only have one car for every three households which puts a further push on people using the public transportation systems along with biking and walking to get where they need to go.

Spokane has one major goal in the Spokane Sustainability Action Plan that aligns with the housing developments such as in Utrecht that are being built. As shown above goal TL 1 from the Transportation and Land Use section (see Table 1 above) demonstrates how Spokane hopes to reduce VMT through land use. Spokane can accomplish this goal through developing housing developments near services and resources that promote walking and biking to stores,

restaurants, and shops. This could be easily applied to the City of Spokane with the development being built near the new bus City Line so residents of the Housing Development would have quick and easy access to Downtown Spokane and Brown's Addition. This development would utilize walking and biking to nearby services along with the bus line when needing to get downtown for work or access to other services.

These developments not only benefit the environment through its green practices, but they also improve the health and well-being of residents of the community through a biking and walking focused transportation system. Although it is still in construction in the Netherlands and the ramifications and acceptance of these developments within the community is unknown, the Netherlands has a green based economy and lifestyle which make it more likely to be accepted and appreciated in their community. Spokane does not have large environmental and sustainable support from its citizens as the people of the Netherlands do. This could prove difficult and would need lots of persuasion and advertising in support of housing developments that benefit the economy and make the city more sustainable.

#### Residents of Spokane Support for the SSAP:

The Spokane Sustainability Action Plan lays out all the right steps to establish Spokane as a sustainable city. The environment and how we treat it will be won or lost in our cities which is why this Action Plan is so significant. With the help of Civil Engineers, Spokane can be looked up to as a green based economy. Through the development of green infrastructure such as public transportation, bike and walking-based mobility, and energy efficient buildings Spokane can dramatically decrease its carbon footprint whilst boosting its economy and health of its citizens. For Spokane to become a sustainable city it needs to convince its residents of why a sustainable lifestyle is good for our economy, well-being, and environment. The Netherlands has had decades of time to convince its citizens of the benefits of sustainability and now has active participation in its green initiatives. The fight of sustainability will be won when the citizens of Spokane truly believe and encourage the goals and ideas outlined in the Spokane Sustainability Action Plan.



## References

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Odegard, K. (2021). *Spokane Sustainability Action Plan* [Review of *Spokane Sustainability Action Plan*]. City of Spokane.