An Active Transportation Pathway from Lakestone to Downtown Lake Country

Executive Summary

Considering the pressing issue of global climate change and the substantial carbon dioxide emissions from automobiles, it is imperative to seek sustainable transportation solutions. A new fully separated active transportation pathway, seamlessly connecting existing infrastructure from Lakestone to downtown Lake Country, encompassing walking, cycling, and other non-motorized means, emerges as a promising remedy to this challenge.

Opportunity

Active transportation offers numerous benefits, including promoting physical and mental health, reducing traffic congestion and pollution, fostering community bonds, and generating cost savings. The implementation of active transportation pathways aligns with broader objectives, such as those outlined in Lake Country's Master Mobility Plan, which aims to extend pedestrian and cycling networks. The surge in population growth, exemplified by developments like Lakestone, necessitates addressing mobility challenges promptly to accommodate future residents and promote sustainable transportation options. Embracing active transportation not only enhances

individual well-being but also contributes to the creation of sustainable communities, aligning with the district's transportation aspirations and principles of transportation equity.

Solution

Our solution is to construct a multi-modal separate active transportation pathway that can be used by e-bikers, bikers, pedestrians, and wheelchair users. To enhance connectivity between existing infrastructure such as the Okanagan Rail Trail and Tyndall Road Multi-Use Trail, a new separated 3.8km pathway is proposed alongside existing roads. Additionally, a 200m pathway connecting Glenmore Rd to Read Rd will cross public land, serving as a naturalized corridor to promote plant habitat conservation while facilitating active transportation. Furthermore, improvements to the highway 97 crossing at Berry Road are suggested to align with the District's goals.

Timeline and Cost

Our plan is to dedicate one year to completing the remaining tasks outlined in the 'Further Work' section. Based on international norms, once the final pathway direction is determined, the exploration and construction phase of our project should span approximately five years. The estimated cost for implementing our active transportation pathway amounts to nearly $600,000, as derived from the findings presented in Part 2: Solution and Actors.

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1. Introduction

As the severity of global warming and other related issues continues to escalate, carbon emissions have emerged as a critical concern. Citing an authoritative study, it has been revealed that human-induced emissions have now surged to their highest point in almost 800,000 years (Lüthi et al., 2008). The effects of global warming are widespread and profound, impacting various aspects of the environment, societies, and economies worldwide. One of the most visible consequences is the accelerated melting of polar ice caps and glaciers, leading to rising sea levels. This phenomenon threatens coastal communities with increased flooding, erosion, and saltwater intrusion into freshwater sources. Changes in precipitation patterns result in more frequent and severe droughts in some regions and increased rainfall and flooding in others. Extreme weather events, including hurricanes, heatwaves, and wildfires, are becoming more intense and frequent, posing risks to human lives, infrastructure, and ecosystems. Furthermore, global warming disrupts ecosystems, leading to shifts in species distributions, loss of biodiversity, and increased vulnerability of ecosystems to diseases and invasive species.

Additionally, the impacts on agriculture, fisheries, and water resources threaten food security and livelihoods, particularly in vulnerable communities.

Responding to the impacts of global warming demands urgent measures to address greenhouse gas emissions, adapt to shifting climates, and fortify the resilience of communities and ecosystems. A key strategy in curbing greenhouse gas emissions lies in reducing car usage, given that transportation activities are the primary contributors to urban greenhouse gas emissions. Recent research indicates that driving behavior and mood can also influence emissions (Xia et al., 2023). Prolonged congestion or driving with heightened stress levels notably escalates carbon emissions. Hence, active transportation emerges as an exceptionally effective alternative, particularly for short-distance commuting within city or county areas.

Figure 1. Reduce the Risks. Source: https://www.cam.ac.uk/research/news/daily-11-minute-brisk-walk-enough-to-reduce-risk-of-early-death

Active transportation, which includes walking, cycling, and other non-motorized modes of travel, offers numerous benefits for individuals, communities, and the environment. Firstly, it promotes physical health by incorporating exercise into daily routines, thus reducing the risk of obesity, heart disease, and other chronic illnesses. Additionally, active transportation enhances mental well-being by lowering stress levels and uplifting mood through outdoor activity. Numerous medical studies (Celis-Morales et al., 2017;

Garciahas et al., 2023) have confirmed that individuals who walk or cycle to work decrease their likelihood of developing chronic diseases by 11%. Economically, it can result in cost savings for individuals through reduced expenditure on fuel and transportation expenses. From a societal standpoint, active transportation cultivates stronger community bonds, as people engage more with their surroundings and one another while walking or cycling. Furthermore, it reduces traffic congestion and pollution, leading to enhanced air quality and minimized environmental impacts.

The officials' report demonstrates active transportation pathway offers more transport capacity and efficiency (National Association of City Transportation Officials, n.d.). Ultimately, embracing active transportation not only enhances individual health and well-being but also contributes significantly to the creation of sustainable communities.

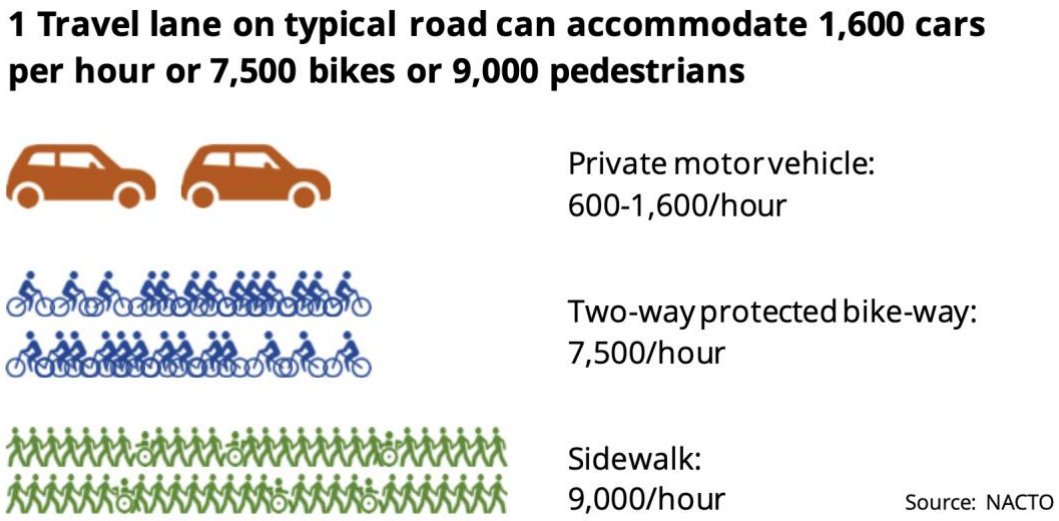


Figure 2. Traffic Capacity. Source: https://nacto.org/publication/transit-street-design-guide/introduction/why/designing-move-people/

According to the population census (DLC Municipal Profile, 2023), the population increased by 22.4% (from 12,922 to 15,817) in Lake Country between the most recent

years from 2016 to 2021. Lake Country's remarkable population surge is expected to persist and potentially intensify in the coming years. Consequently, it is imperative to address the mobility challenges now, lest the arrival of more residents exacerbates the situation further. Notably, the Lakestone development along Okanagan Lake is a prime example of this rapid growth, representing a new residential endeavor by the MacDonald Development Corporation. This development comprises nearly 200 available lots for sale, in addition to a sizable high-occupancy condominium building.

This initiative aligns seamlessly with the district's pre-existing objectives, particularly those outlined in the Master Mobility Plan of 2021. One of the primary goals of this plan is to augment active transportation networks, aiming to extend pedestrian and cycling pathways by 50km each by the year 2030. Studies have demonstrated a notable surge in the adoption of active transportation modalities when pathways are entirely segregated from vehicular traffic. Furthermore, transportation equity has been underscored as a cornerstone principle in the district's transportation aspirations.

2. Solution and Actors

Lake Country's sparse population density presents challenges for establishing effective public transportation options such as buses and trains. Additionally, the prospect of running empty buses could exacerbate greenhouse gas emissions compared to individual car usage. Despite the presence of a public transportation system in Lake Country, its adoption remains low (District of Lake Country, n.d.). Consequently, there exists a distinct opportunity to introduce a novel transportation mode aligning with the recommendations outlined in the Transportation for Tomorrow report (Strategic

Infrastructure Management, 2014). My suggested active transportation pathway has the potential to advance sustainability and resilience objectives within Lake Country.

I propose to construct a multi-modal active transportation pathway that can be used by e-bikers, bikers, pedestrians, and wheelchair users. As previously discussed, active transportation has many health benefits. Moreover, the characteristics of active transportation itself are sustainable and environmentally friendly. We designed the proposed active transportation pathway using three main factors: sustainability, feasibility, and economy.

Building our active transportation pathway involves navigating through a specific set of political and legal considerations unique to the province. Some actors (Note: I use the ChatGPT to find some resources here as I lack some background) should be paid attention to in our subsequent analysis:

1. Provincial Government Authority: The provincial government of British Columbia holds primary responsibility for our pathway infrastructure within its jurisdiction. The Ministry of Transportation and Infrastructure oversees the planning, funding, construction, and maintenance of provincial highways and major roads

2. Environmental Regulations: Pathway projects in BC must comply with provincial environmental regulations, including the Environmental Assessment Act and the Water Sustainability Act. Environmental assessments are often required to evaluate potential impacts on air and water quality, wildlife habitats, and ecosystems. The

Environmental Assessment Office (EAO) manages the environmental assessment process for major projects.

3. Land Acquisition: Through our proposal in midterm, the main problem is the land type. Acquiring land for road construction in Canada involves negotiations, land use planning, and potential expropriation if necessary. The Ministry of Transportation and Infrastructure manages rights-of-way and land acquisition processes according to provincial laws and regulations.

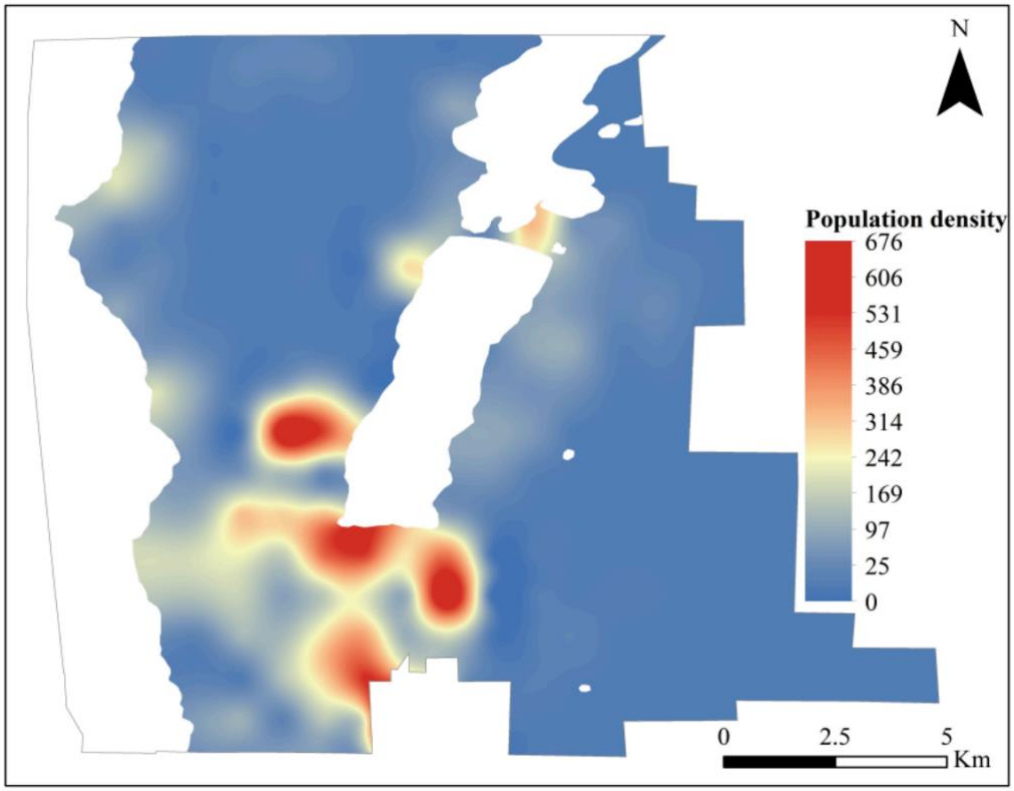
4. Funding and Financing: Funding for the active transportation pathway in BC comes from a combination of government budgets, dedicated infrastructure funds, and partnerships with the federal government and local municipalities. BC also utilizes public-private partnerships (P3s), some environmental protection funds, and user fees like tolls to finance road projects.

5. Indigenous Rights and Consultation: Indigenous peoples in BC have constitutionally protected rights and titles to land and resources. Our pathway project may affect Indigenous territories, requiring meaningful consultation, and accommodation as per legal obligations outlined in treaties and agreements such as the BC Declaration on the Rights of Indigenous Peoples Act.

2.1 Sustainability: population and ecology

In our sustainability considerations, we prioritize both population density and ecological protection. Population density significantly influences the necessity and design of our

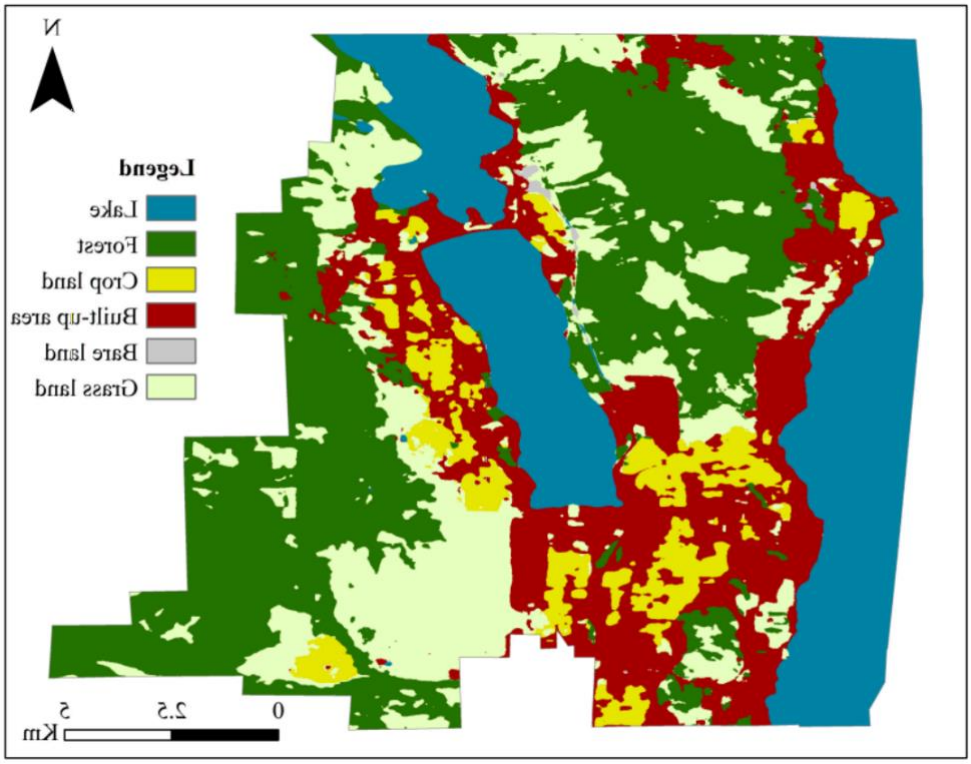
active transportation pathway. Higher population densities typically drive greater demand for transportation infrastructure to facilitate the movement of individuals and goods. Regions with larger populations often experience elevated traffic volumes, potentially ensuring continuous usage of our active transportation pathway. Consequently, situating the pathway through densely populated areas could enhance its utilization and extend its benefits to a larger populace.



Map 1. The distribution of population density in Lake Country, source: https://landscan.ornl.gov/

By analyzing the distribution of population density on Map 1, we can identify situated near Okanagan Lake areas such as Lakestone, Okanagan Centre, and Pixie Beach as having substantial needs for connectivity to downtown Lake Country near Wood Lake. This recognition enables us to strategically plan the pathway's route, ensuring it

effectively serves the transportation needs of these communities while promoting sustainable transportation options.

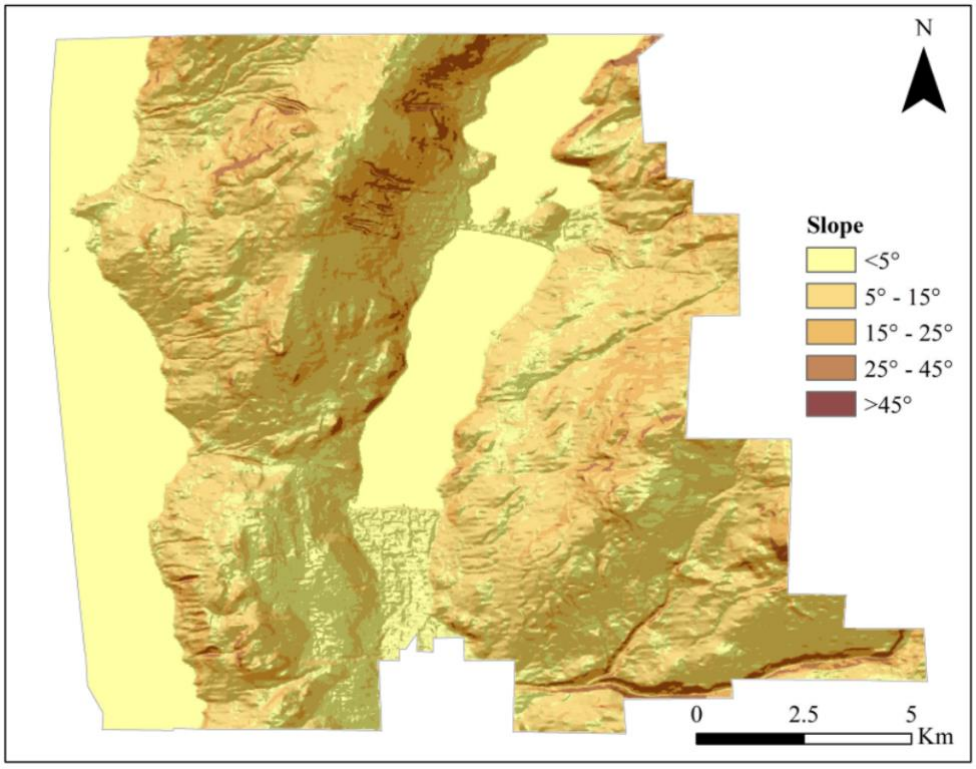


Map 2. Land types within Lake Country, source: https://livingatlas.arcgis.com/landcoverexplorer/#mapCenter=105.759%2C40.327%2C4&mode=step &timeExtent=2022%2C2022&year=2022

When building this project, ecological protection is an important factor to consider in achieving our goal of sustainability. The proposed path cannot cut through forest lands as the construction and usage of the path will negatively impact the ecology of the forest. For ecological reasons as well as funding constraints, we cannot build the path over bodies of water. Map 2 illustrates lake and forest lands in Lake Country, we extracted non-forest and non-water areas from the land type data by using the reclassification function of ArcGIS. We could get the possible areas for construction under the condition: do not cross forests or water bodies.

2.2 Feasibility: slope and land type

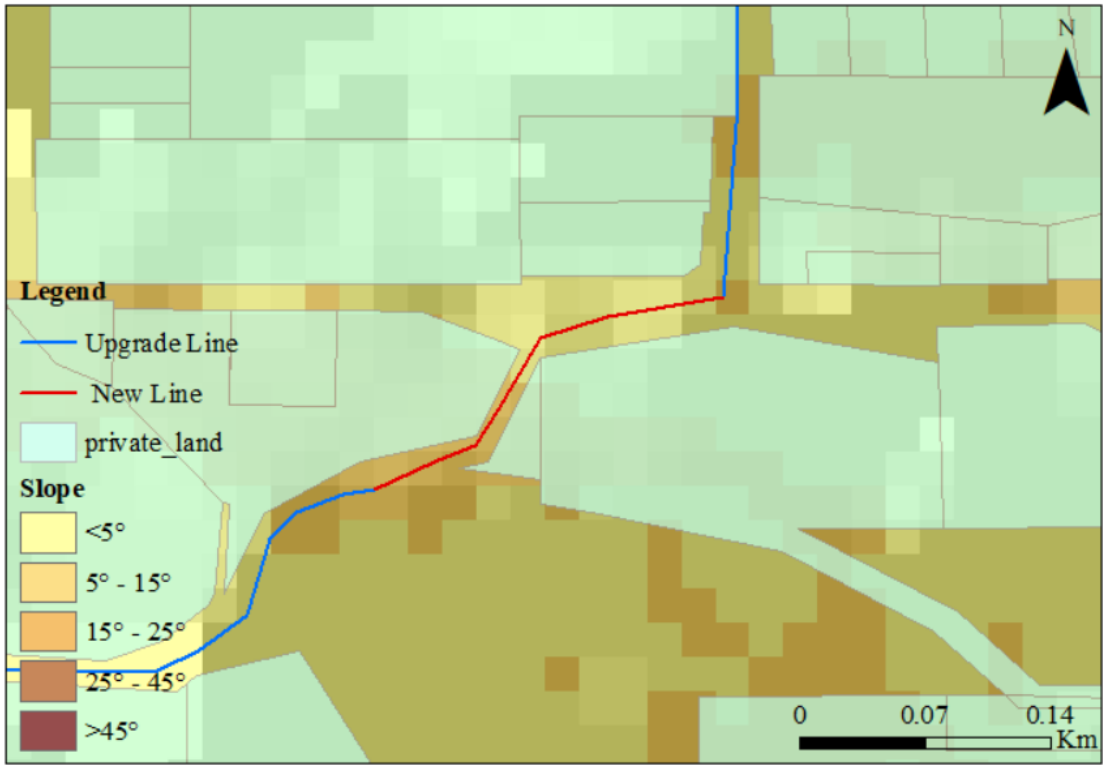
Terrain conditions are the most important factor in demonstrating the feasibility of a path. In urban planning and geography, the slope of 15° is considered the maximum suitable slope for active transportation. If the slope of the area is more than 15°, it will make people feel tired and uncomfortable when walking or cycling which will reduce the frequency of use. Moreover, a slope larger than 15° would increase the construction costs of the path. This creates the condition: that pathway construction must be on a slope of less than 15°.



Map 4: distribution of terrain conditions and slope, source: https://earthexplorer.usgs.gov/

As highlighted in the actor section earlier, it's crucial to take into account the type of land involved. In Canada, the government is reluctant to intervene on private land due to the extensive negotiation processes it entails. Therefore, in planning for the

construction of part of our newly built pathway, we need to minimize the need for crossing private land. luckily, there is no need to use private land through our analysis of land type in this project and Map 5 illustrates the only newly built part of our active transportation pathway.



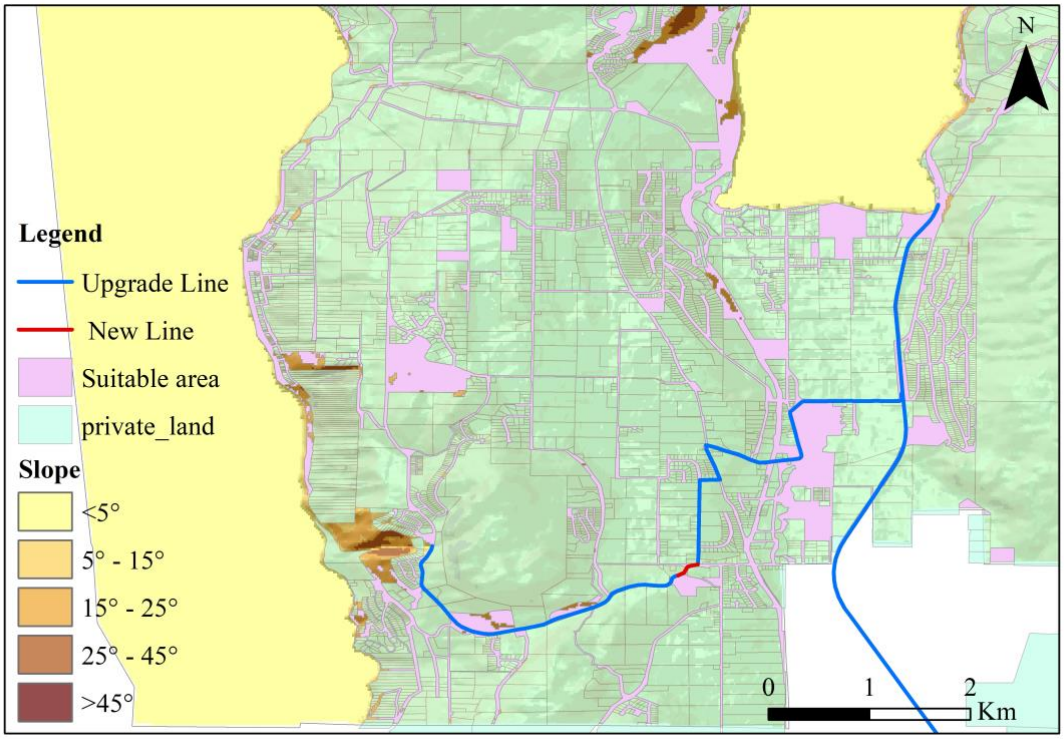
Map 5: the land type and the newly built part. Source: https://www.arcgis.com/apps/mapviewer/index.html?layers=ce7fd87476b54100a3b158c9dae7e9b7

2.3 Economy: cost and potential benefits

We firmly believe that finance is of vital importance, and conducting thorough cost-benefit analyses is imperative. Despite government allocations for construction funds and plans, we prioritize minimizing construction costs. Moreover, we could struggle some relevant funds for environment, future, and ESG, such as B.C. Active Transportation Infrastructure Grants Program (Government of British Columbia, n.d.).

Therefore, we opted to construct along existing roads to keep expenses minimal, akin to sidewalk construction costs. The provided map 6 delineates road directions, highlighting upgraded parts of existing roads and a newly built 200-meter section.

Beyond the project's primary advantages of environmental enhancement and promoting public health, it generates positive economic externalities. For instance, Quebec's active transportation project attracts tourists, significantly bolstering the local tourism industry. In the subsequent case study, we will delve into a novel business model it spawned - a cyclist hotel. These materials underscore how potential profits can sustain future project operations financially. This ethos epitomizes our commitment to sustainable development.



Map 6: Our proposed multi-modal active transportation pathway

Based on the estimation guidelines (Government of British Columbia, 2013), there isn't a designated construction cost for active transportation. However, the construction cost for a standard 1.5-meter-wide concrete sidewalk is $67 per square meter. Considering that our modal and separated active transportation pathway requires a width double or triple that of a sidewalk, the estimated cost per meter is at least $150.

Our plan involves constructing a 200-meter newly built pathway and upgrading a 3.8-kilometer line alongside the existing road. Therefore, the construction fee totals $150 * (3,800 + 200) = $600,000.

3. Examples from elsewhere and relevant literature

3.1 Chengdu, China

The Tianfu Greenway is located in Chengdu, Sichuan Province, China, with a planned total length of approximately 16,900 kilometers (International Association of Horticultural Producers, n.d.). It consists of three levels of greenways, with the elements of mountain and river, including Panda Greenway, Ring Ecological Greenway, and Rural Greenway. Along the path, it connects scenic spots such as Chengdu Ring Ecological Park (Jincheng Park), Guixi Ecological Park, Qinglong Lake Park, and Jincheng Lake Park, etc.

Image 1: A photograph of the Greenway in Chengdu. (International Association of Horticultural Producers, n.d.)

The Tianfu Greenway is the world's largest greenway system and a modern display of the cultural heritage of western China. It was the winner of the World Green City Awards in 2022 and is a good demonstration of the sustainability and resilience impacts of a large-scale urban active transportation project. The Chengdu Belt Greenway is built along the Fourth Ring Highway (Ring Expressway) of Chengdu. The entire greenway has 78 "one bridge, one scenery" landscape bridges, connecting 121 characteristic ecological parks. As of March 2023, a total length of 100 kilometers has been built, with stop points such as Wetland Little White House along the greenway. The Greenway is not purely designed for cycling but is a racetrack for many famous world-

class cycling races. Our path needs to cross Highway 97 in Lake Country at Berry Road and we could learn from Chendu's experience in building bridges for active transportation projects (AviatorGS, 2022).

Image 2: The neglected public land.

Unlike most people's imagination of Chinese-style infrastructure, the construction of Tianfu Greenway did not occupy many private lands (Peng et al., 2020). Situated near downtown, the Tianfu Green Way was formerly a neglected expanse of public land marred by industrial waste (See Image 2). Compounded by the presence of a high-speed ring highway generating considerable noise, the area held little allure for prospective residents. However, through strategic land adjustments, the Tianfu Greenway has

undergone a remarkable transformation. What was once deemed an eyesore has evolved into a vibrant green space of recreational amenities, and sustainable infrastructure. This journey from abandoned to revitalization stands as a testament to the project's extraordinary success. Hence, our proposal to develop an active transportation route along roads, particularly along non-private land, is feasible.

3.2 London, UK

The Chengdu case exemplifies innovative strategies for repurposing abandoned public land, whereas London's example showcases how to birth, upgrade, and build an active transportation pathway with very limited available land. As London nearly does not own undeveloped space and the city is quite crowded (Griffith and Jefferys, 2013), readjusting existing land becomes imperative. In Image 3, we witness a central London thoroughfare converted from existing street-side greenery into a bustling active transport pathway. This underscores the importance of leveraging and modernizing existing infrastructure roads in densely populated areas. Unlike London, where space is a premium, Lake Country offers ample opportunities for transformation and development, alleviating concerns of overcrowding. Thus, our proposed active transportation pathway have more space and advantages with separated designs.

Someone may argue that this separated active transport pathway will take up public resources and roads, causing traffic congestion. However, a study from Imperial College London (Bhuyan et al., 2021) showed no evidence that London’s cycle superhighways worsen traffic congestion. Compared with a fully newly built pathway, the separated pathway could offer the following potential benefits:

Image 3: London's Cycle Superhighways

Firstly, we could control urban sprawl management. Controlled development within the existing road can help manage urban sprawl by directing growth into designated areas. This can prevent cities from spreading uncontrollably and encroaching on valuable agricultural land or natural habitats outside the green belts. Secondly, it could improve transportation efficiency with the larger traffic capacity (see Figure 2 in the introduction part). This, in turn, can lower carbon emissions and alleviate traffic congestion. Finally, the separated active transportation pathway provides emergency access for need. Active transportation pathways through existing roads can provide emergency access routes for fire, medical, and law enforcement services. Having multiple access points can improve

response times during emergencies, potentially saving lives and minimizing property damage.

3.3 Quebec, Canada

If the lessons from Chengdu and London tell us how to design active transportation routes better, then the case of Quebec provides evidence of how many benefits a well-designed active transportation project can generate. An active transportation pathway could provide access to natural and recreational areas, promoting tourism and outdoor activities. This can generate revenue for local businesses and communities while fostering appreciation for nature and biodiversity.

Image 4: Bienvenue cyclistes (welcome cyclists) establishments at Québec

The tourism industry plays a pivotal role in advancing active transportation, particularly through its efforts to bolster regional development by expanding bicycle tourism opportunities. This involves providing various accommodations, packages, and activities tailored to attract cyclists. Recent studies (Transat et al., 2016) highlight Québec's robust support for cyclists, boasting a network of 500 "Bienvenue cyclistes!" (welcome cyclists) establishments, ensuring cyclists can easily find suitable accommodations. In 2015, tourism spending related to bicycling in Québec amounted to an impressive $700 million, with 1.6 million overnight stays recorded.

Québec also hosts several businesses specializing in bicycle production and accessories, even though the manufacturing sector has largely shifted to Asia like many other industries. However, domestic consumption remains strong, with over 600,000 bicycles sold annually in Québec, surpassing per capita sales in the United States by 1.5 times. This sector accounts for 3,400 jobs. Additionally, Québec cyclists contribute significantly to the bicycle and equipment market, with annual expenditures reaching $500 million, totaling a substantial $1.2 billion in yearly spending.

Lake Country has a very similar situation but lacks some facilities and clubs like the Quebec offers. Lake Country has two amazing lakes, Okanagan Lake and Wood Lake, which attract a large number of tourists coming here every summer. If we can upgrade existing roads and connect our active transportation pathway to the Okanagan Rail Trail, we could also provide a long enough scenic pathway for users. It will definitely attract many cycling enthusiasts to come here like Quebec and drive the sustainable development of related industries.

Image 5: Bienvenue cyclistes (welcome cyclists) establishments at Québec

4 Further work

To make sure our feasible. We need to have further discussions with three sectors of society. A sustainable operating strategy is also particularly important, and we plan to consider the possibility of PPP (public- private- partnerships) mode and ESG funding support.

For the government, we plan to know the government's fiscal surplus and its priorities and preferences for building public facilities. We also need to know more details about relevant funding like the B.C. Active Transportation Infrastructure Grants Program (Government of British Columbia, n.d.) that could be offered by governments. Through

further discussion, we could align our active transportation project plans toward relevant preferred themes.

For commerce, we could try our best to make our active transportation pathway into the ESG programs and follow the principles of ESG (Environmental, Social, Governance). There are abundant needs for social entrepreneurship within companies and they have a responsibility to meet this spirit whether they want or not. This means that if our project is a profitable and sustainable social welfare project, there will be a lot of resources and funds to support us. Based on Quebec's experience, our project is not far from this goal.

ESG principles play a crucial role in shaping sustainable transportation initiatives, particularly in the realm of active transportation, which includes modes such as walking and cycling. Firstly, active transportation offers significant environmental benefits by reducing greenhouse gas emissions and lessening reliance on fossil fuels. By promoting walking and cycling, communities can mitigate their carbon footprint and contribute to the fight against climate change. Secondly, beyond environmental impacts, active transportation positively influences public health, community well-being, and social equity. Increased physical activity, improved air quality, and enhanced access to transportation options foster healthier and more connected communities, thereby addressing social disparities and promoting inclusivity. Thirdly, effective implementation of active transportation initiatives requires robust governance structures and supportive policies. Governments, businesses, and communities could collaborate to establish frameworks like the PPP mode that prioritize sustainable transportation solutions and align with broader ESG goals.

For civil society, we need to further communicate with residents along the route. Understand their transportation needs through questionnaires and interviews, which could help us our better designs for the active transportation pathway. We also need to proactively introduce the environmental protection and low-noise features of our projects to enhance their understanding and support.

5 Conclusion

In sum, amidst the urgent need to address global climate change and the significant carbon dioxide emissions stemming from automobiles, the pursuit of sustainable transportation solutions becomes paramount. Our proposed solution lies in the creation of a separated active transportation pathway, seamlessly linking existing infrastructure from Lakestone to downtown Lake Country. This pathway would accommodate various non-motorized modes of transportation, including walking and cycling, offering a promising remedy to the health problems and environmental challenges posed by traditional vehicle transport.

Our active transportation pathway fully considers sustainability, feasibility, and economy. Our proposed existing cases in Chengdu, London, and Quebec not only support the necessity of these three factors (i.e., sustainability, feasibility, and economy), but also offer a unique perspective to solve traffic safety and traffic congestion. We plan to implement the thoughts of PPP mode and ESG in the next step of work to make it become truly a sustainable solution.

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