

University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Melfa Road Walk N' Roll Tactical Urbanism Interventions for Improving Road Safety and Nature Connections

Prepared by: Kristi Ellerbroek, Henry Li, Doula Jiang, Elaine Hu, Wenyao Li, JP Deland

Prepared for:

Course Code: UFOR 401

University of British Columbia

Date: 15 April 2022

Disclaimer: "UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their studies, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this is a student research project and is not an official document of UBC. Furthermore, readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a report".



Melfa Road Walk N' Roll Tactical Urbanism Interventions for Improving Road Safety and Nature Connections



Safety, Children, and Nature

Prepared By:

Kristi Ellerbroek

Henry Li

Doula Jiang

Elaine Hu

Wenyao Li

JP Deland

Prepared For:

Dr. Melissa McHale

Dr. Angela Rout

Prof. Andrew Almas

TA Kaitlyn Pike

TA Yaying Zhou

Date

April 15, 2022

Word Count

3614



THE UNIVERSITY
OF BRITISH COLUMBIA

Table of Contents

| | |
|---|----|
| Introduction | 3 |
| Transportation, Routes, and Ecological Features in Streetscapes | 4 |
| TUIs and Child-Nature Interactions..... | 4 |
| UBC Goals for Pedestrian Safety and Nature Connections | 4 |
| Methods | 5 |
| Site Assessment..... | 5 |
| QGIS Analysis and Maps..... | 6 |
| Results and Discussion | 7 |
| Literature Review | 7 |
| Road Safety and Infrastructure Features | 8 |
| Ecological Features | 9 |
| Physical and Mental Wellbeing | 9 |
| Recommendations | 10 |
| Recommendations Overview and UBC Plan Alignment..... | 10 |
| Road Safety Improvements | 11 |
| Ecological Improvements..... | 11 |
| Children-Nature Connections Improvements | 11 |
| Conclusion | 14 |
| Acknowledgements | 15 |
| References | 16 |
| Appendices | 19 |
| Appendix A - Study Site Images | 19 |
| Appendix B - Nearby Youth Services Map | 20 |
| Appendix C - Site Assessment | 21 |
| Appendix D - Elevation Map | 22 |
| Appendix E - Literature Review Spreadsheet | 23 |
| Appendix F - Literature Mind Map..... | 24 |
| Appendix G – Table of Potential Interventions | 25 |

Executive Summary

The objective of the Melfa Road Project (MRP) is to address inadequacies in street safety in East Acadia neighbourhood while incorporating community ideas for enhancing biodiversity, fostering environmental education, and promoting connections to nature for children.

The MRP inventories all classes of land-use, soft landscapes, canopy cover, and above ground-infrastructure features. Metric outputs show that 52% of land-use types is public land, 18% is residential, 2% is institutional, 66% of soft landscapes are lawns, 22% is wild greenery, and 11% are planting beds. There are 101 trees in the study site, 64% of which are deciduous, and the rest is coniferous, which encompasses a total canopy cover of 13.5%.

Through a site assessment and QGIS analysis, the MRP examines overarching problems associated with Melfa Road, such as lack of street safety signs, unsuitable placement of garbage dumps, and underutilised parking lots. Through an extensive literature review we suggest opportunities for tactical urbanism interventions (TUI) that adhere to UBC land-use plans and initiatives.

Melfa Road is heavily depended on by students, children, and families and is trafficked by vehicles, bicyclists, and pedestrians. There is abundant greenspace accessibility for passive or active recreation, for activities such as walking, playing, bicycling, and lounging. These outdoor areas provide a moment for relaxation but missed opportunities in past designs along with the placement of current roads and parking lots creates a barrier to these beneficial activities.

Introduction

The MRP seeks to ameliorate approximately 100 metres of Melfa Road in the Acadia East neighbourhood in University of British Columbia (UBC) endowment lands (Figure 1; Appendix A). The neighbourhood has a high density of youth facilities such as day-cares, a kids club, and an elementary school. As such, children and families depend on the site for travelling to school, but Melfa Road lacks several safety features. The MRP is an opportunity to incorporate ecological and traffic features onto a busy streetscape, promoting a connection between safety, nature, and youth.

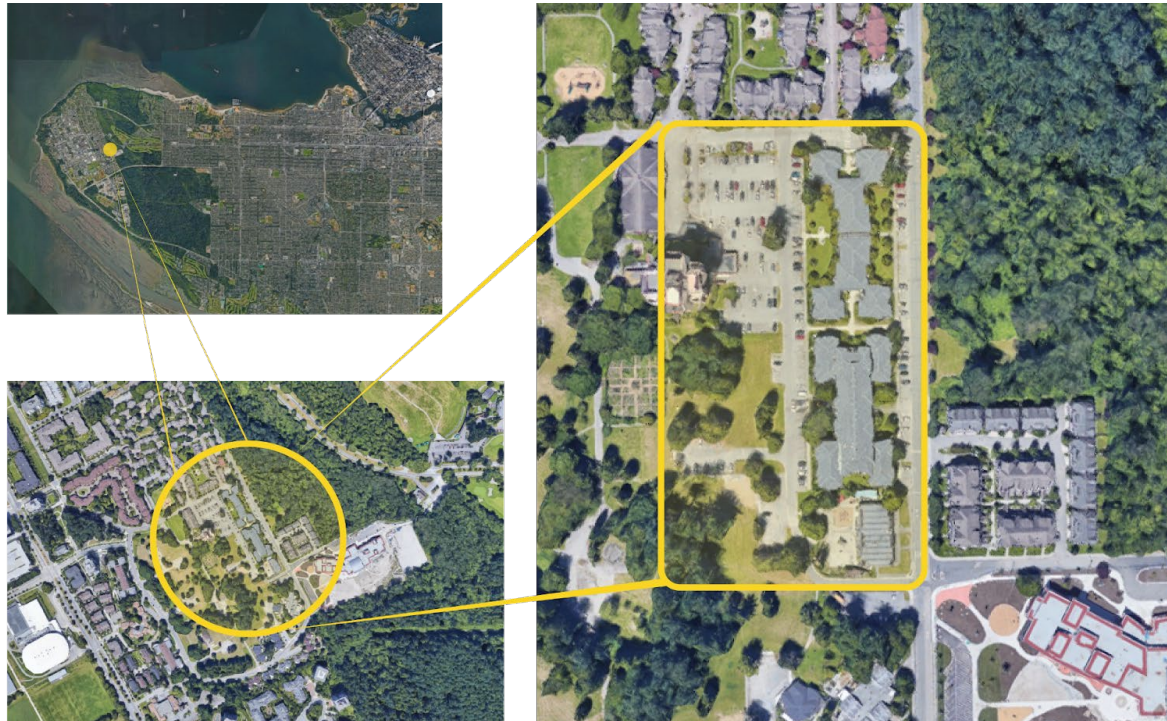


Figure 1: Location of the Melfa Road Project relative at a regional and local scale.
Source: Google Maps, 2022.

Urban streets and pathways near schools are often congested (Petch & Henson, 2000). In many cases, this results in a clash between cars, cyclists, and pedestrians, compromising safety for children (Petch & Henson, 2000). In attempts to improve public safety, cities have introduced a variety of physical design interventions into busy zones, and some of them incorporate landscaping and ecological elements (Audrey & Ferrer, 2015). Additionally, research has shown that exposure to nature in regular daily routines is beneficial for children (Otto & Pensini, 2017).

TUIs can be a tool to achieve this. A TUI is defined as scalable, creative tactics to improve the city condition, which can be citizen-built or city-led (Yassin, 2019). TUIs tend to be seen as temporary or low-cost but serve a higher purpose in improving the urban environment more rigorously than other formal design processes (Yassin, 2019). The MRP aims to discover what small-scale interventions can be implemented on Melfa Road that will benefit both the safety of pedestrians and nature interactions. Our client is UBC Social Ecological Economic Development Studies (SEEDS) as well as Community Development, Campus & Community Planning. The end-users that will receive benefits of the MRP are the students, children, and residents surrounding the East Acadia neighbourhood.

Transportation, Routes, and Ecological Features in Streetscapes

To increase children-pedestrian safety, the factors affecting road safety must be defined and analysed (Petch & Henson, 2000). Several studies, including experimental reports, community interviews and surveys, and epidemiologic strategies, can identify potential factors that pose a risk to children travelling in the urban built environment (Keshia, 2014; Hassen et al., 2021). This includes analysing collision reports and their subsequent safety interventions (Pollack et al., 2014; Audrey & Ferrer, 2015). Multiple studies have specifically focused on children's road safety, such as crossing behaviour, young pedestrian distraction, and visual load thresholds of urban clutter (Tapiro et al., 2019), and the overarching relationship between children's traffic safety and the urban built environment (Petch & Henson, 2000). Furthermore, there are correlations in children's road safety based on age and geography and pedestrian/cyclist casualties and socio-economic status (Petch & Henson, 2000).

TUIs and Child-Nature Interactions

The concept of nature-based education assumes that children learn better through hands-on activities. Nature-based education is defined by Otto & Pensini (2017) as promoting a connection to nature through acquiring environmental knowledge. Nature-based education can be a tool to incorporate families and children's ideas into TUIs, based on a preliminary ecological context (Derr, 2015). Some engagement strategies include photo stories, child tours, art displays (3D models with cardboard boxes, straws, toys, leaves, branches; NACTO, 2020), road design competitions where local children vote (Happy City, 2021), sensory walks, and voluntary trash pick-ups (Barrable et al., 2021; Barrera-Hernández et al., 2020). These nature and community-based activities uncover values, interests, and needs of the community, which can be used to make decisions on what TUIs to incorporate in the area.

Simple urban design interventions, even if they are low-cost, can improve residents' well-being and social competence (Negami et al., 2018). Some examples include community gardens, artistically painted intersections, and greenways (Negami et al., 2018). Colour specifically can be used to delineate the various functional components of the street while calming traffic, prioritising pedestrians, supporting safety initiatives, and enhancing the urban environment (O'Connor, 2021; Negami et al., 2018). Chalk, paint, cones, flex posts, curb stones, games, and playable structures have also been used as temporary TUIs to support a children-safe streetscape (NACTO, 2020). During the COVID-19 pandemic, the degree to which strategies can be achieved is uncertain. The willingness of developers and planners to contribute to child-nature interactions and how they can help will greatly affect the progression of strategies that promote children nature interactions.

UBC Goals for Pedestrian Safety and Nature Connections

UBC has many land-use plans and strategies to support pedestrian safety and enhance nature connections. UBC has stated commitments to increase safety and routes for non-vehicles while encouraging these routes to be well-connected (UBC Board of Governors, 2021). UBC's Child Care Expansion Plan Point Grey Campus (2018) addresses child-care facilities, which are linked to child-transportation safety and children's exposure to greenspace. UBC has plans to build more day-cares on campus, especially for children 3 years and younger, which are required to have accessible outdoor space (UBC, 2018). Some of these future day-cares will be near Melfa Road (UBC, 2018). UBC aims to support and enhance ecological health on campus by goals addressing climate change, single-occupancy vehicle (SOV) emission reductions, and increasing greenways (UBC Vancouver Campus, 2021; UBC Board of Governors, 2021). UBC aims for landscapes that produce a

variety of ecosystem services, including food production, while encouraging Indigenous species planting “rewilding” and biodiversity (UBC Board of Governors, 2021). There is a knowledge gap on the practicality of incorporating these initiatives at the individual road scale. To address this, a comparative analysis on TUIs and UBC plans will be conducted. The MRP team’s goals in this study are to (1) perform a comprehensive site assessment of the Melfa Road area that focuses on routes, safety features, and ecological features; (2) highlight potential TUIs from literature reviews and perform a comparative analysis; and (3) associate opportunities in the site to incorporate TUIs for future designers to consider that are aligned with UBCs goals and initiatives.

Methods

Site Assessment

Our first approach was to conduct a comprehensive site assessment of Melfa Road, focusing primarily on pedestrian, bicycle, and automobile routes, as well as ecological features and potential areas for improvement. For safety features, we recorded routes and specific locations of facilities. Through this site assessment, we were able to identify potential factors that affect safety and nature connections. We recorded routes by observing traffic and footpaths on site and layering the data over satellite images on Google Maps (Figure 2). Facilities data was collected through observation, then tabulated (Appendix C) and marked on a map (Figure 2) to present exact locations on Melfa Road.

To provide a simpler and clearer visual understanding of the current site conditions on Melfa Road, detailed pictures were inserted on the map (Figure 2) to illustrate the safety-related issues that existed on Melfa Road. For ecological features, we collected tree species and diameter at breast height (DBH) information for all trees on Melfa Road and aggregated the data into tables to create QGIS maps (Appendix C). We also assessed tree health conditions by examining trunk wounds, canopy density, etc. (Appendix C).

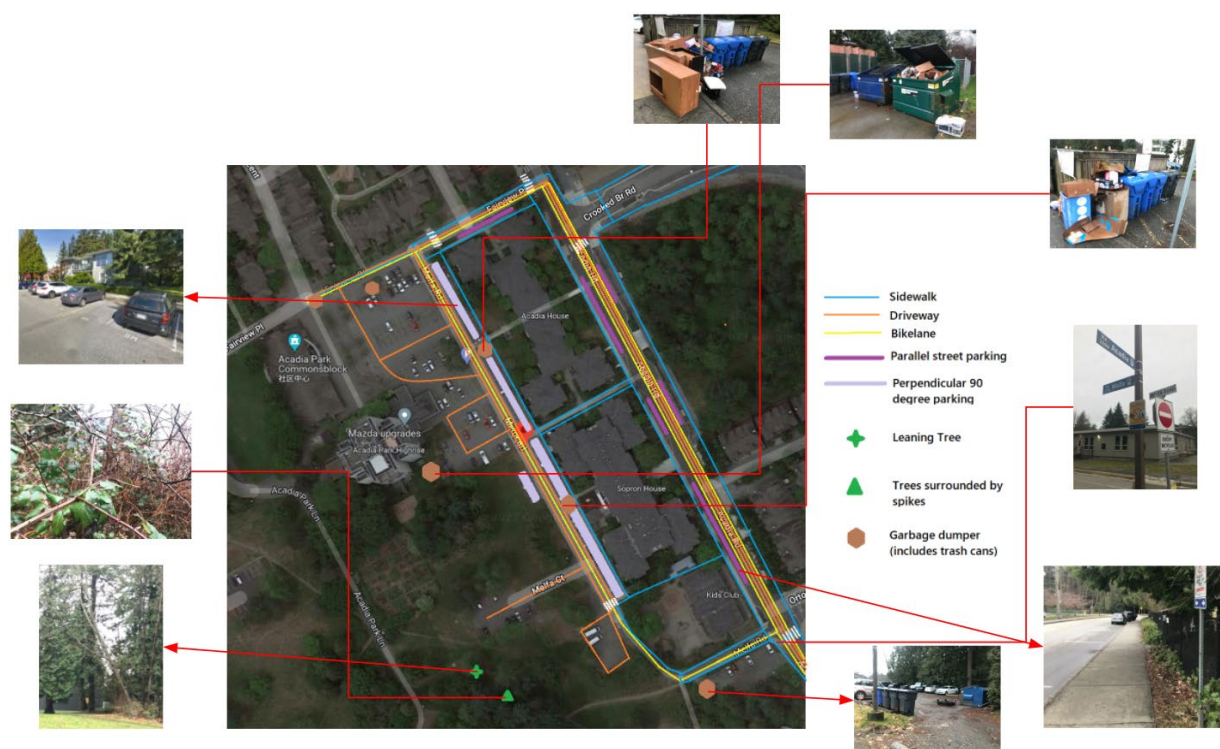
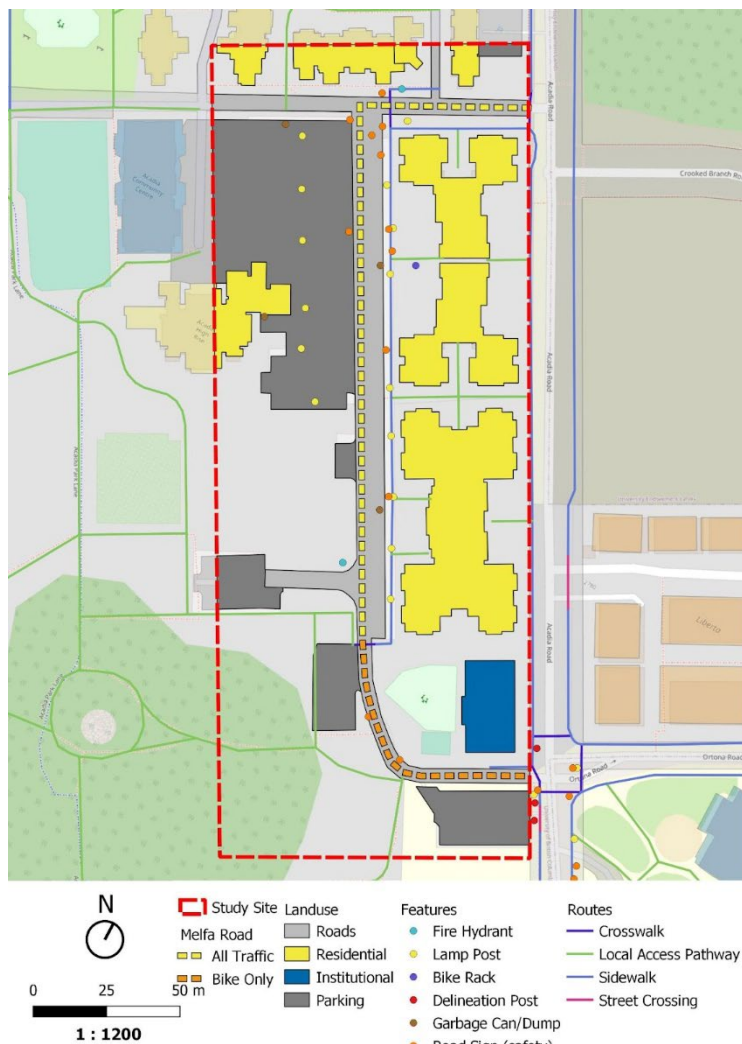


Figure 2: Map showing the various conditions of trees, pathways, parking, and garbage dumps on site.
Source: Google Maps, 2022.

QGIS Analysis and Maps

To start the mapping process, SEEDS provided us with the preliminary GIS data to perform basic analysis of our study site (GitHub, 2022). However, most of the files were incomplete and required supplementary online research to complete the data and begin mapping (Abacus, 2016). To better inform our recommendations for TUIs, we produced two primary maps that each highlight two aspects (infrastructure and ecology) of our study site (Figure 3 & 4). Our infrastructure map details the location of various safety and miscellaneous features, such as lamp posts, fire hydrants, bike racks, delineation posts, garbage cans/dumpsters, and any street signs (speed, children at play, stop, do not enter, crosswalk etc.; Figure 3). This map also features land-use types (residential, institutional, parking lot) and routes (crosswalks, local access ways, sidewalks). The ecology map shows soft landscape types (lawn, planting beds, wild) and urban forest canopy cover in terms of deciduous vs coniferous tree types (Figure 4). There is also a variant of the ecology map highlighting tree condition ratings (Figure 5) and an additional elevation map for planning drainage-based intervention locations (Appendix D).



These maps highlight areas that have higher densities of infrastructure features, canopy cover, and areas with poor tree condition. The suggested TUIs are based on this analysis (Figures 7-12).



Tactical Urbanism Interventions

To better understand the TUIs and allow for subsequent graphic detailing of site development, we conducted an extensive literature review on the topics of road safety, children-nature connections, and TUI. The TUI literature was ranked according to its relevance to the MRP. After reviewing articles and project precedents, key information was extracted and summarised into a spreadsheet (Appendix E). The main themes included are safety, ecology, and features for children. Challenges and opportunities for each design solution are included as well. We organised the information obtained from the literature into a TUI mind map for the study area (Appendix F) and then searched for other tactical urbanism intervention precedents based on the mind map and other information found in the spreadsheet (Appendix E).

Figure 3: Tree health condition map.
Source: QGIS, 2022.

Results and Discussion

Literature Review

From our literature review, precedent searches, and site assessment analysis, we found that there is an issue with the physical and conceptual scale of the MRP, the TUIs, and UBC Plans. We had some challenges with relating high-level plans to actionable recommendations. For example, UBC plans, and plans in general, are broad in nature, so it is difficult to realise UBC plans goals and initiatives into design inventions on the MRP site. As for TUI research and review, it is difficult to decipher what type of interventions could be replicated on the MRP site due to differing safety concerns, project site sizes, intervention budgets, project timeframes, and the balance between pedestrians and other modes of transportation.

Road Safety and Infrastructure Features

Through field observations and data analysis, the overall safety for children on Melfa Road has much room for improvement. Although not within the project boundaries, there are 9 day-cares and 1 elementary school just outside the study site, leading to high youth traffic (Appendix B). Leading problems center around overly dense street signs, street parking that compromise road space, and unmanaged garbage dumps. Firstly, there are 51 road signs in Melfa Road and only 19 of them serve as safety warnings, while the remaining 32 are for private parking rules. There aren't speed limit signs on Melfa Road. The high density of road signs inevitably causes an excessive visual load, especially for drivers who are hesitant in choosing a parking space or are distracted by the content of the signs (Petch & Henson, 2000). Children have a limited attention span compared to adults which limits their ability to make good crossing decisions, especially in the presence of distractions (Tapiro, 2019). There's a possibility children may spend too much time selecting or identifying safe crossing locations, leading to reckless crossing (Tapiro, 2019). Secondly, there are 62 perpendicular parking spaces on Melfa Road, 51 of which are perpendicular spaces and 11 are parallel parking spots. The 51 spots compress the already narrow roads surrounding Melfa Road and the 11 spots near Norma Rose Point School interfere with a child's ability to see oncoming traffic and obstruct the view of motorists (Edquist et al., 2012). This makes it especially dangerous for children crossing into Melfa Road from the narrow Acadia Road.



Figure 4: One of multiple garbage dumps with overflowing refuse.
Source: Kristi Ellerbrook, 2022.

Lastly, there are 5 dumpsters and 13 trash cans on site, with some dumpster lids being left open, allowing wind to blow garbage out. Garbage cans with open lids also attract wildlife, especially raccoons, which can cause harm to curious children. Abandoned furniture was also left next to the dumpsters, blocking the sidewalk (Figure 6). Referring to the infrastructure map (Figure 3), a couple of details were noted. Firstly, there are only two building types found on the MRP site - student residences at 17.6% and an institutional building (kids club) at ~2%. There is an abundance of youth services buildings just outside the MRP area, including 8 child day-cares, 1 youth services administration building, and 1 elementary school. Despite what the metric suggests, there is a high presence of youth on Melfa Road, and the excessive underutilization of parking and overflowing garbage dumps sends a bad environmental message to the youth of the Acadia Neighbourhood.

Ecological Features

Analysis of the canopy cover map revealed that the soft landscape is primarily lawn and wild at 66% and 23%, respectively (Figure 4). There are a total of 101 trees, comprising 18 species from 17 different genera. The most abundant trees are *Acer* at 26%, while *Thuja* comes in a close second at 22%. The trees are 64% deciduous with the remaining 36% being coniferous, providing a canopy cover of 13.5%. This isn't the best cover but in relative terms, it is a small site, and the lack of trees and availability of soft landscape highlights an opportunity to increase vegetation cover to meet UBC canopy cover goals.

Looking at tree health on the site, the majority are in good condition at 76%, while the remainder fall within a fair or poor condition (Figure 5). It's important to note that most fair and poor conditioned trees are primarily located on the NW portion of the MRP site (Figure 5), which are newly planted trees placed in stressful conditions (heavily paved, poor water availability, etc.). These observations were confirmed during the site visit, where a general lack of tree maintenance was also noted. Branch failures were a common occurrence, increasing overhead risks to pedestrians from falling branches, and covered traffic signs, making it unsafe for passing cars.

Stormwater puddles were frequent during heavy rain events, indicating poor drainage and ground infiltration systems. Periodic excess or lack of water can affect plant health as roots cannot supply water to the leaves and cause shoot death of some trees from poor systems (Madzhi & Nor Akhsan, 2021). Those that survive can be stunted, becoming a safety risk to pedestrians. The lack of trees, poor management of trees, and limited availability of soft landscape highlights the opportunity to increase vegetation cover by planting diverse and/or native species that meet UBC canopy cover and diversity goals.

Physical and Mental Wellbeing

In our review of previous projects that address children-nature connections, we found that guiding children's attention to explore nature and its surroundings has mental and physical health benefits (Otto, & Pensini, 2017). Otto and Pensini (2017) suggest that combining the acquisition of environmental knowledge with the promotion of an intrinsic driver serves as a holistic approach for increasing ecological behaviour. Studies on TUI's suggest children care about the aesthetic value of the site and the places they visit (Van Kann, 2015). Therefore, the streets themselves can be developed as destinations for children where they can experience fascination, joy, and education while playing safely without traffic concerns (Duncan et al., 2020).

We found that interventions can cater to different age groups (Tapiro, Oron-Gilad, & Parmet, 2019; White & Stoecklin, 2008). For Melfa Road specifically, outdoor exercise can encourage children to explore their environment, which is important for promoting nature interactions and their personal development (Audrey & Batista, 2017; White & Stoecklin, 2008). Based on the article of designing streets for kids, we highlighted potential areas for change on the Melfa Road (Figure 7). We added outdoor furniture (in green), a playground (in purple), and paths on the grass (in blue) to encourage outdoor activities. Increasing the connection between children and nature will raise the awareness of nature health and develop ecologically friendly behaviour within residents, especially the youth, which is an important step on environment conservation (White & Stoecklin, 2008).



Figure 5: The plan drawing of all possible changes that can be made on the Melfa Road.
Source: Elaine Hu, 2022.

Recommendations

Based on the site assessment, we identified potential areas to enhance on Melfa Road, including excessive perpendicular street parking, littered dumpster areas, and insufficient speed bumps and safety-related traffic signage. During the literature review and precedent review process, we gathered several design solutions that could be applied to the site and mitigate these issues to varying levels. Studies illustrate that TUIs are in most cases not very costly and come in a variety of design forms and presence (Rehan, 2013). The MRP's main objective is to transform significantly underutilised areas of Melfa Road, especially with hard pavement, into places that provide benefits to the natural environment and lead to increased use of the area.

Recommendations Overview and UBC Plan Alignment

Nevertheless, we found that many of our chosen TUI's align with many of UBC plan's values, goals, and initiatives. In Figure 8 & 12, the recommendation to add permeable pavement and widening pedestrian lanes to include a bike lane addresses goals in Climate Action Plan 2030 and Campus Vision 2050 – Preliminary Terms of Reference (UBC Board of Governors, 2021; UBC Vancouver Campus, 2021). In Figure 9, the decision to repurpose a parking lot into a playground addresses recreation and accessibility goals in the Wellbeing Strategic Framework (UBC, n.d). This playground design also promotes a calming aesthetic that encourages discovery and feelings of sense of place addresses goals in Campus Vision 2050 – Preliminary Terms of Reference (UBC Board of Governors, 2021).

In Figure 10 & 12, adding green berms with park furniture addresses accessibility goals in the Wellbeing Strategic Framework (UBC, n.d). This recommendation also provides better accessibility to the community garden, which received note in Campus Vision 2050 – Preliminary Terms of Reference (UBC Board of Governors, 2021). Figure 11 aligns with many of the same plans as Figure 9, but Figure 11 also promotes planting biodiverse shrubs and bushes, which aligns with rewilding goals (UBC Board of Governors, 2021).

Road Safety Improvements

For MRP safety improvements, we recommend increasing and decreasing the number of signs accordingly. This means reducing signs related to parking regulations; increasing traffic signage, especially stop signs, slow-down signs, and no exit signs to prompt drivers to slow down and look for children crossing. We also recommend adding more speed bumps to control vehicular speeds (Audrey & Ferrer, 2015; Figure 8 & 12). As for the shared road portion, we suggest changing the perpendicular street parking into 45° parking, widening the walkway, and adding a separate bike lane (Figure 8 & 12). Acadia Road north-east of Melfa Road is also a safety hazard. Acadia Road is out of our jurisdiction; therefore, further research is needed for developing possible interventions and recommendations, especially at the bend on the south-east side where the two roads intersect near Norma Rose Point Elementary.

Ecological Improvements

For ecological improvements, we recommend adding art drawings on the fences surrounding garbage dumps and install signs reminding residents to keep garbage within the designated area (Figure 8). Referring to the project in New Westminster, kids' drawings are a good reminder for not only children but also the adults (Happy City, 2021). The introduction of small-scale rain gardens beside the dumpster areas can mitigate pungent runoff and improve overall stormwater management (Rehan, 2013; Figure 8 & 12). We also suggest pruning and thinning the larger trees to remove any dead or decaying branches that could become an overhead to risk to users. We recommend adding berms on the turf lawn to separate the road and greenspaces to provide a safer natural environment, while reducing noise and light pollution (Barnes et al., 2020; Figure 10 & 12). Lastly, we recommend adding steppingstones to create distinct paths and plant flowers throughout to improve the biodiversity (Van Kann et al., 2015; Figure 11).

Children-Nature Connections Improvements

To better connect children with nature and encourage them to explore their environment, our recommendations focus on repurposing the parking lot and adding colourful and joyful elements to make the street a safe destination (Duncan et al., 2020). To emphasize a child-friendly theme on Melfa Road, we recommend adding continuous youth elements (Duncan et al., 2020) throughout Melfa Road, also aesthetically enhancing levels of physical activity (Van Kann et al., 2015). Aside from drawings on the garbage fences (Figure 8), colourful installations can also be placed at the enclosing area formed by raised berms as mentioned in ecological recommendations (Figure 10 & 12). Installing colourful chairs captures children's attention and encourages them to stay and enjoy the time spent in nature (Bertolini, 2020; Figure 11). Drawings can be an effective tool for promoting a fun experience children have with nature (Van Kann et al., 2015). For example, we can repurpose the parking lot in front of the kid's club into a playground by guiding children to make ground drawings (Figure 9 & 10). We can also make the entrance to nature on the playground clear by adding steppingstones and planting diverse plants in different colours to inspire children's interest in nature (White & Stoecklin, 2008).



Figure 8: Perspective View 1 illustrates recommendations along the Melfa Rd: (1) Repurpose original perpendicular parking into 45°, expanded area can be used to widen sidewalk and introduce a separate bike lane; (2) use permeable pavement instead of hard pavement; (3) add rain gardens beside dumpsters to improve biodiversity; (4) add paintings on dumpster fences, which could be done by kids; (5) add a speed bump to better moderate vehicular speeds; and (6) add SLOW signages to warn drivers there are kids ahead.

Source: Wenyao Li, 2022.



Figure 9: Perspective View 2 illustrate recommendations over the parking lot: (1) Make the zebra crossing more visible, we recommend adding colourful paintings; (2) repurposing this parking lot into a playground to encourage children to explore the environment and to better use this area; (3) add wooden playground furniture on the lawn; and (4) introduce more vegetation to increase the biodiversity.

Source: Wenyao, Li, 2022.



Figure 10: Perspective View 3 shows the green area in front of the community garden and our recommended changes include: (1) Adding a berm between the road and the green space; (2) adding some chairs in diverse colours; and (3) encouraging people to visit the community garden.

Source: Wen Yao Li, 2022.



Figure 11: Perspective View 4 is a different view of the parking lot in front of the kids club. Recommended changes include: (1) Repurpose the parking lot into a playground; (2) add colourful and joyful drawings to the ground and develop the street as a travel destination; (3) clearly identify the entrance to help guide kids to explore more fun in nature; (4) add bushes to increase biodiversity; and (5) add large stones as seating.

Source: Wen Yao Li, 2022.

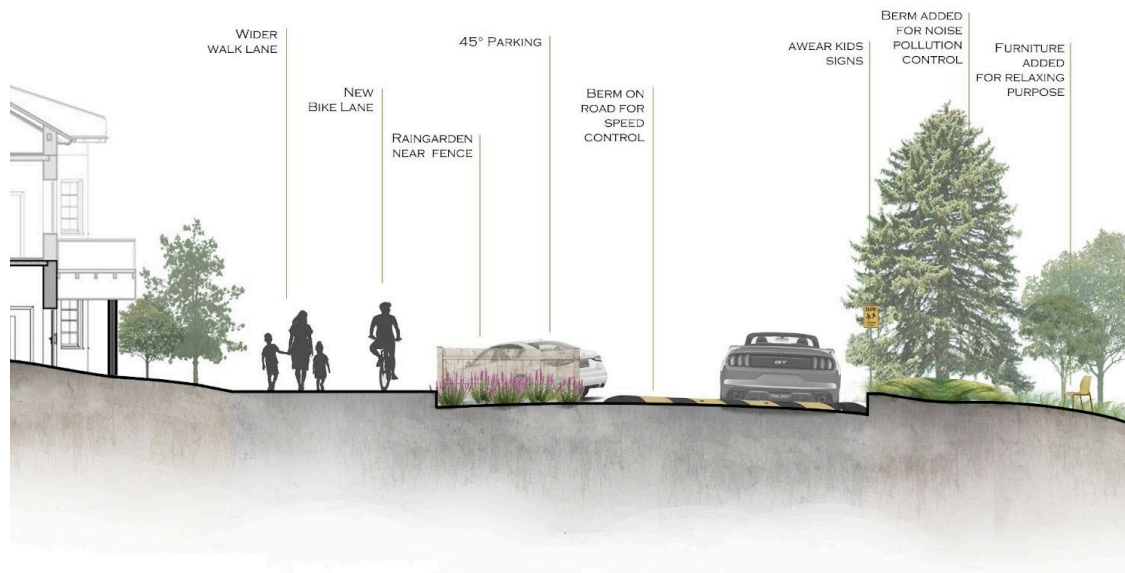


Figure 6: Section view of some interventions made on Melfa Road.
Source: Elaine Hu, 2022.

Conclusion

Recent surveys and research into the situation of Melfa Road have shown that the community has a high density of youth facilities but lacks safety features. Despite the extensive greening of the community, the connection between community residents and nature could be strengthened. The purpose of the MRP is to improve community safety and foster connections between children and nature through TUIs. Through site visits and assessments of relevant forms and GIS maps; literature reviews, collection, and summarization of TUIs; we were able to highlight potential locations for safety features that support children's interaction with nature and link MRP opportunities to our search. The various TUIs found are linked to provide future design ideas.

As UBC grows both in population and density, the need for parks and other recreational opportunities also grows. Growth should not come at the expense of the natural environment, but rather development should be used as a tool to protect natural and cultural resources and enhance the overall quality of life for local users. The MRP's vision is to support and encourage outdoor habits and imprint a sustainable mindset in the youth.

Acknowledgements

As the MRP draws to a close, we would like to express our deep gratitude to the clients who gave us this opportunity to participate in the MRP, as well as the mentors and classmates who helped us throughout the process.

First, we are immensely grateful to Gabriella Scali, Benjamin Scheufler, as well as the whole SEEDS team for giving us the opportunity to do this wonderful MRP on the topic and giving invaluable feedback every time, we had a meeting. Secondly, we would also like to show our gratitude to Dr. Rout, Dr. McHale, and Professor Andrew for their guidance and help throughout the MRP. Despite their busy schedules, they still took the time to coach us and answer the questions we raised during the MRP, providing ideas and methods to make the direction of our MRP clear. Here we would like to express our sincerest gratitude to them. We would also like to express our special thanks to our TAs, Kaitlyn Pike and Yaying Zhou for their feedback and patient guidance for each stage of our MRP, which is very helpful for us to improve and perfect the MRP. Finally, we thank Group 2 in this capstone class for working with us to complete the MRP. Their efforts and work have made the whole MRP more complete and diverse and allowed us to analyse and draw conclusions from more aspects.

References

- Abacus. (2016). Ubcv_trees.geojson. [online]. [Accessed 18 Feb 2022]. Retrieved from <https://abacus.library.ubc.ca/file.xhtml?persistentId=hdl:11272.1/AB2/S15BIR/MIZXP1&version=1.0>
- Audrey, S., & Ferrer, H. B. (2015). Healthy urban environments for children and young people: A systematic review of intervention studies. *Journal of Transport & Health*, 5, S64. DOI: 10.1016/j.healthplace.2015.09.004
- Barnes, M. R., Nelson, K. C., Kowalewski, A. R., Patton, A. J., & Watkins, E. (2020). Public land manager discourses on barriers and opportunities for a transition to low input turfgrass in urban areas. *Urban Forestry & Urban Greening*, 53, 126745.
- Barrable, A., Booth, D., Adams, D., & Beauchamp, G. (2021). Enhancing nature connection and positive affect in children through mindful engagement with natural environments. *International Journal of Environmental Research and Public Health*, 18(9), 4785, pp. 1-11. <https://doi.org/10.3390/ijerph18094785>
- Barrera-Hernández, L. F., Sotelo-Castillo, M. A., Echeverría-Castro, S. B., & Tapia-Fonllem, C. O. (2020). Connectedness to nature: its impact on sustainable behaviours and happiness in children. *Frontiers in Psychology*, 11, pp. 276. <https://doi.org/10.3389/fpsyg.2020.00276>
- Bertolini, L. (2020). From “streets for traffic” to “streets for people”: can street experiments transform urban mobility? *Transport reviews*, 40(6), 734-753.
- Cramer, J. R. (2008). Reviving the connection between children and nature through service-learning restoration partnerships. *Native Plants Journal*, 9(3), pp. 278-286. <https://doi.org/10.2979/NPJ.2008.9.3.278>
- Derr, V. (2015). Integrating community engagement and children's voices into design and planning education. *CoDesign*, 11(2), pp. 119-133. DOI: 10.1080/15710882.2015.1054842
- Duncan, S., Chachra, A., Peyton, A., Siprikova, A., & Gowland, K. (2020). Designing streets for kids. New York, NY: *Global Designing Cities Initiative, National Association of City Transportation Officials*, nd.
- Edquist, J., Rudin-Brown, C. M., & Lenné, M. G. (2012). The effects of on-street parking and road environment visual complexity on travel speed and reaction time. *Accident Analysis & Prevention*, 45, pp. 759-765. DOI: 10.1016/j.aap.2011.10.001
- GitHub. (2022). UBCGeodata. [online]. [Accessed 24 Nov 2021]. Retrieved from https://github.com/UBCGeodata/ubc-geospatial-opendata/blob/master/ubcv/planning/geojson/ubcv_landuse.geojson
- Hassen, R., Koski, J., & Street, S. (2021). *Reimagining active school transportation in the Acadia Park neighbourhood*. SEEDS Sustainability Program. [online]. [Accessed 22 Mar 2022]. Retrieved from https://sustain.ubc.ca/sites/default/files/seedslibrary/RES_505_Reimagining%20Active%20School%20Transportation%20in%20the%20Acadia%20Park%20Neighborhood_FinalReport.pdf

- Ниязова, С. (2021). Ecological education of children in primary school. ЦЕНТР НАУЧНЫХ ПУБЛИКАЦИЙ (buxdu. uz), 5(5).
- Madzhi, N. K., & Nor Akhsan, M. A. (2021). Control of plant growth by monitoring soil moisture, temperature and humidity in dry climate. IOP Conference Series. Materials Science and Engineering, 1192(1), 12027. DOI: 10.1088/1757-899X/1192/1/012027
- NACTO. (2020). Designing streets for kids. [online]. [Accessed 3 Feb 2022]. Retrieved from <https://nacto.org/publication/designing-streets-for-kids#:~:text=Designing%20Streets%20for%20Kids%20was,is%20now%20an%20independent%20initiative>
- Negami, H. R., Mazumder, R., Reardon, M., & Ellard, C. G. (2018). Field analysis of psychological effects of urban design: A case study in Vancouver. *Cities & health*, 2(2), pp. 106-115. <https://doi.org/10.1080/23748834.2018.1548257>
- O'Connor, Z. (2021). Tactical urbanism: Colour interventions with purpose. *Color Research & Application*, 46(3), pp. 516-523. <https://doi.org/10.1002/col.22613>
- Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, 47, pp. 88-94. <https://doi.org/10.1016/j.gloenvcha.2017.09.009>
- Petch, R. O., & Henson, R. R. (2000, June 22). Child road safety in the urban environment. *Journal of Transport Geography*, 8(3), pp. 197-211. DOI: [https://doi.org/10.1016/S0966-6923\(00\)00006-5](https://doi.org/10.1016/S0966-6923(00)00006-5)
- Pollack, K., Gielen, A., Mohd Ismail, M., Mitzner, M., Wu, M., & Links, J. (2014). Investigating and improving pedestrian safety in an urban environment. *Injury Epidemiology*, 1(11), pp. 1-9. DOI: 10.1186/2197-1714-1-11
- Rehan, R. M. (2013). Sustainable streetscape as an effective tool in sustainable urban design. *HBRC Journal*, 9(2), pp. 173-186. <http://dx.doi.org/10.1016/j.hbrj.2013.03.001>
- Tapiro, H., Oron-Gilad, T., & Parmet, Y. (2019, December 31). Pedestrian distraction: The effects of road environment complexity and age on pedestrian's visual attention and crossing behaviour. *Journal of Safety Research*, 72, pp. 101-109. <https://doi.org/10.1016/j.jsr.2019.12.003>
- University of British Columbia. (n.d). Wellbeing Strategic Framework. Retrieved from https://wellbeing.ubc.ca/sites/wellbeing.ubc.ca/files/u9/wellbeing_strategic_framework_FINAL_0.pdf
- University of British Columbia. (2018). UBC Child Care Expansion Plan Point Grey Campus. [online]. [Accessed 9 Mar 2022]. Retrieved from https://planning.ubc.ca/sites/default/files/2019-11/PLAN_UBC_ChildcareExpansion.pdf
- University of British Columbia Board of Governors. (2021). Campus Vision 2050 – Preliminary Terms of Reference. [Online]. [Accessed 9 March 2022]. Retrieved from https://bog3.sites.olt.ubc.ca/files/2021/11/4_2021.11_Campus-Vision-2050-Preliminary-Terms-of-Reference.pdf

- UBC Vancouver Campus. (2021). Climate Action Plan 2030. [online]. [Accessed 9 Mar 2022]. Retrieved from https://planning.ubc.ca/sites/default/files/2021-12/UBCV_CAP2030_FINAL.pdf
- Van Kann, D. H. H., Kremers, S. P. J., Gubbels, J. S., Bartelink, N. H. M., De Vries, S. I., De Vries, N. K., & Jansen, M. W. J. (2015). The association between the physical environment of primary schools and active school transport. *Environment and Behaviour*, 47(4), pp. 418-435. <https://doi.org/10.1177/0013916513519644>
- White, R. & Stoecklin, V. L. (2008). Nurturing children's biophilia: Developmentally appropriate environmental education for young children. *Collage: Resources for early childhood educators*, pp. 1-11.
- Wilson, C. (2011). Effective approaches to connect children with nature. [online]. [Accessed 10 Feb 2022]. Retrieved from <https://www.doc.govt.nz/globalassets/documents/getting-involved/students-and-teachers/effective-approaches-to-connect-children-with-nature.pdf>
- Yassin, H. H. (2019). Livable city: An approach to pedestrianisation through tactical urbanism. *Alexandria Engineering Journal*, 58(1), pp. 251-259. <https://doi.org/10.1016/j.aej.2019.02.005>

Appendices

Appendix A - Study Site Images



Appendix A1: Location of Melfa Road Project at local scale.
Source: Google Maps, 2022.

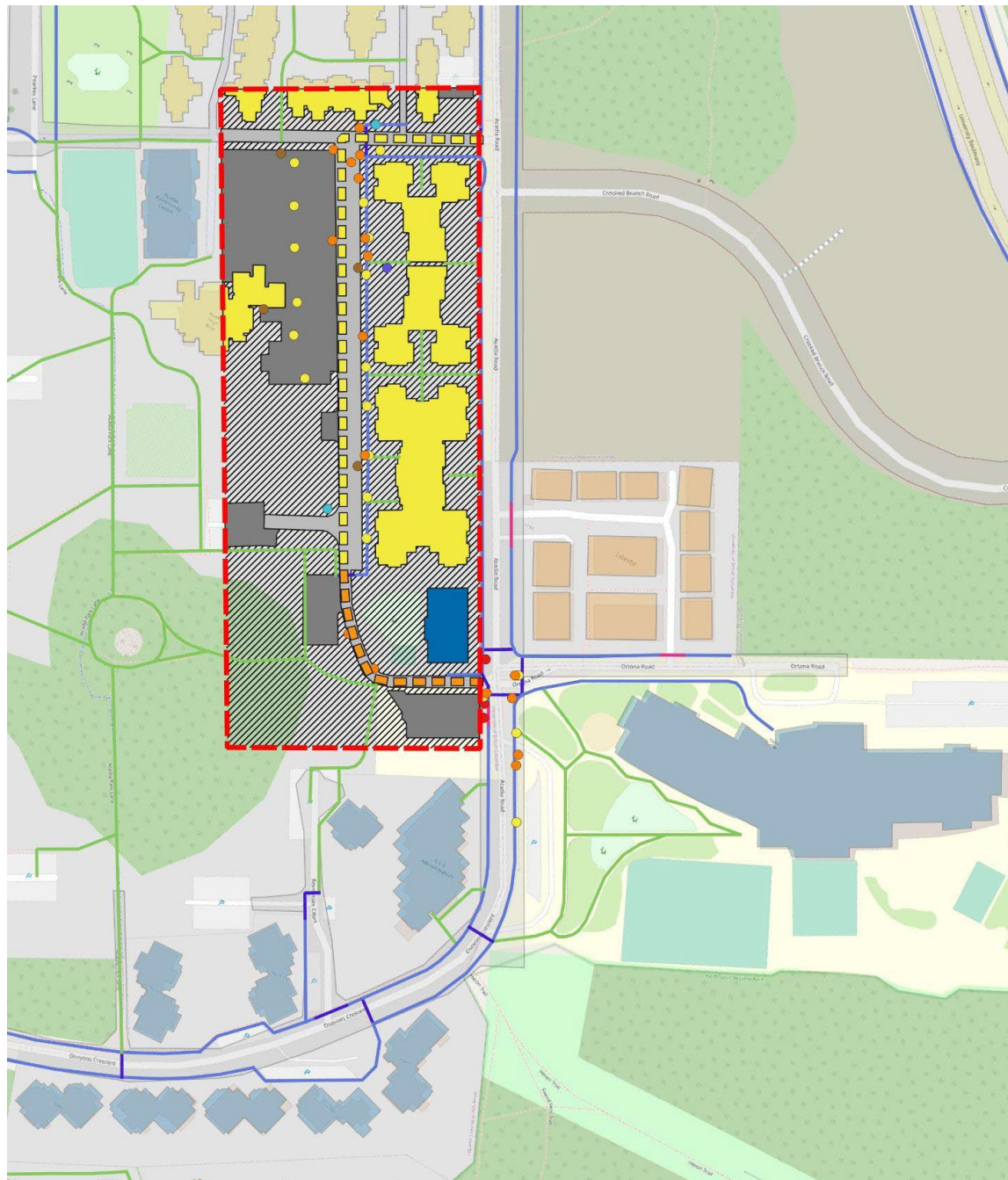


Appendix A2: Oblique view of Melfa Road.
Source: Google Maps, 2022.



Appendix A3: Oblique view of Melfa Road.
Source: Google Maps, 2022.

Appendix B - Nearby Youth Services Map



Appendix B1: Smaller scaled image of MRP site showing additional youth services building outside of site boundaries.

Source: QGIS, 2022.

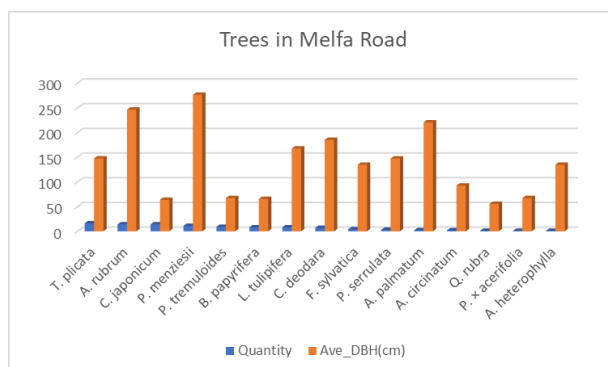
Appendix C - Site Assessment

| | In the community | Near Norma Rose School |
|------------------------------|------------------|------------------------|
| Road signs (Safety warning) | 11 | 8 |
| Road signs (unrelated) | 26 | 6 |
| Street parking spots | 51 | 11 |
| Exposed trash cans placement | 2 | 1 |
| Garbage dumpers | 4 | 1 |

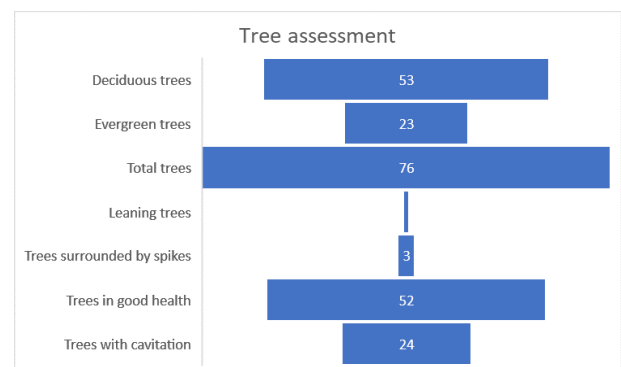
Appendix C1: Table of various safety features noted during site visits.

| Species | Quantity | Ave_DBH(cm) |
|------------------------|----------|-------------|
| <i>T. plicata</i> | 16 | 147.6 |
| <i>A. rubrum</i> | 14 | 246.5 |
| <i>C. japonicum</i> | 14 | 63.8 |
| <i>P. menziesii</i> | 11 | 276.4 |
| <i>P. tremuloides</i> | 9 | 67.2 |
| <i>B. papyrifera</i> | 8 | 65.5 |
| <i>L. tulipifera</i> | 8 | 167.6 |
| <i>C. deodara</i> | 7 | 185.2 |
| <i>F. sylvatica</i> | 4 | 134.7 |
| <i>P. serrulata</i> | 3 | 147.4 |
| <i>A. palmatum</i> | 2 | 220.4 |
| <i>A. circinatum</i> | 2 | 92.6 |
| <i>Q. rubra</i> | 1 | 55.6 |
| <i>P. × acerifolia</i> | 1 | 67.3 |
| <i>A. heterophylla</i> | 1 | 134.7 |

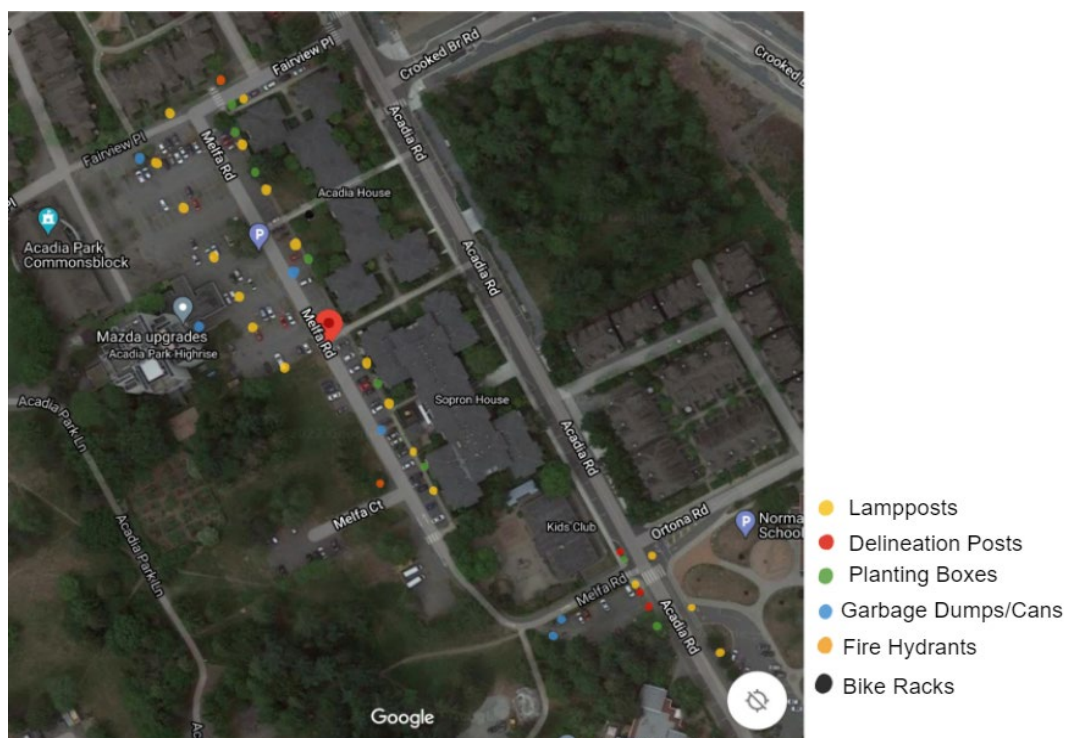
Appendix C2: Table of species and their quantity and average DBH.



Appendix C3: Bar graph of Appendix C2.

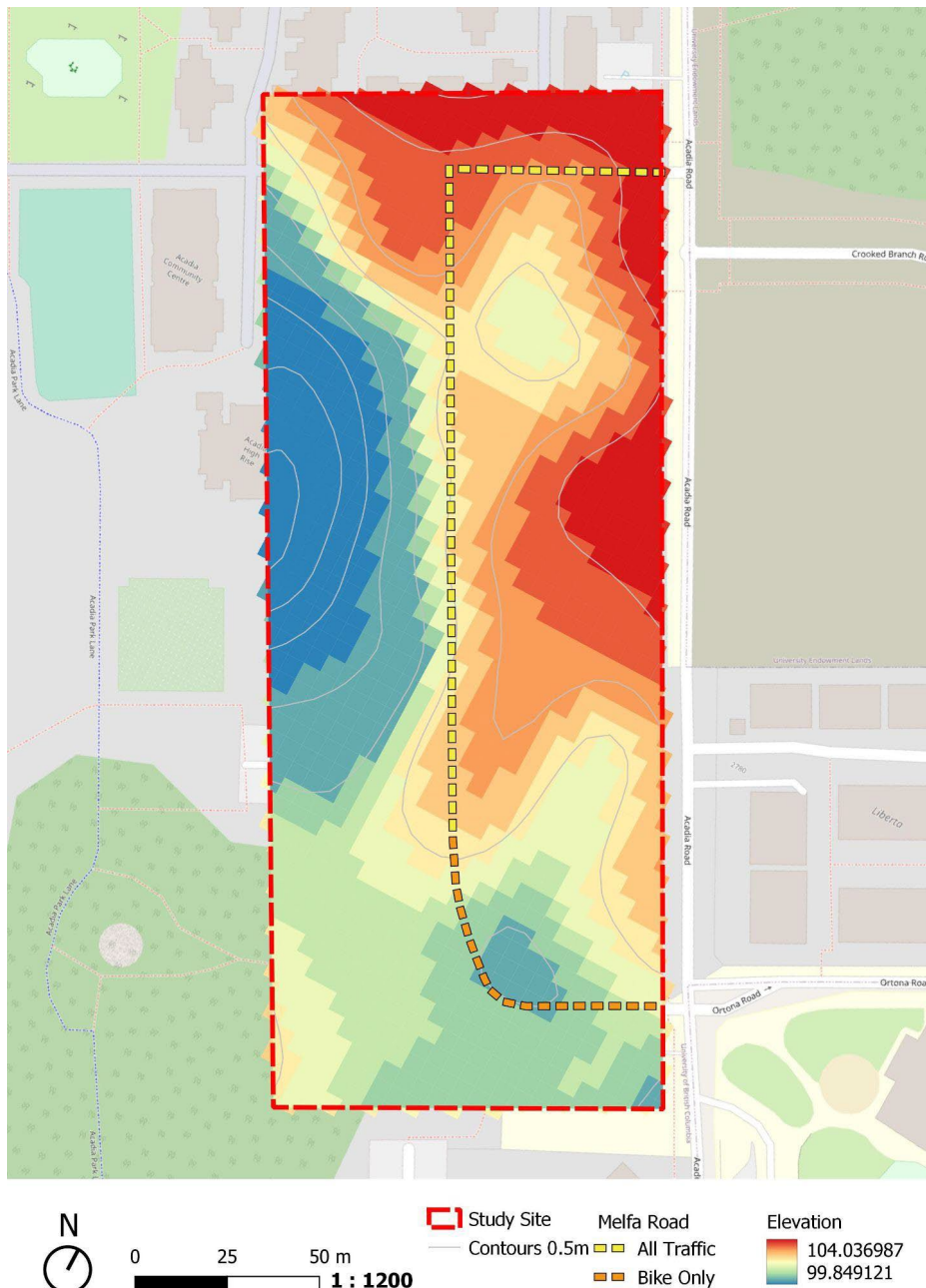


Appendix C4: Graph of tree assessment (type, health, and hazards).



Appendix C5: Map of infrastructure features found during site visits.

Appendix D - Elevation Map



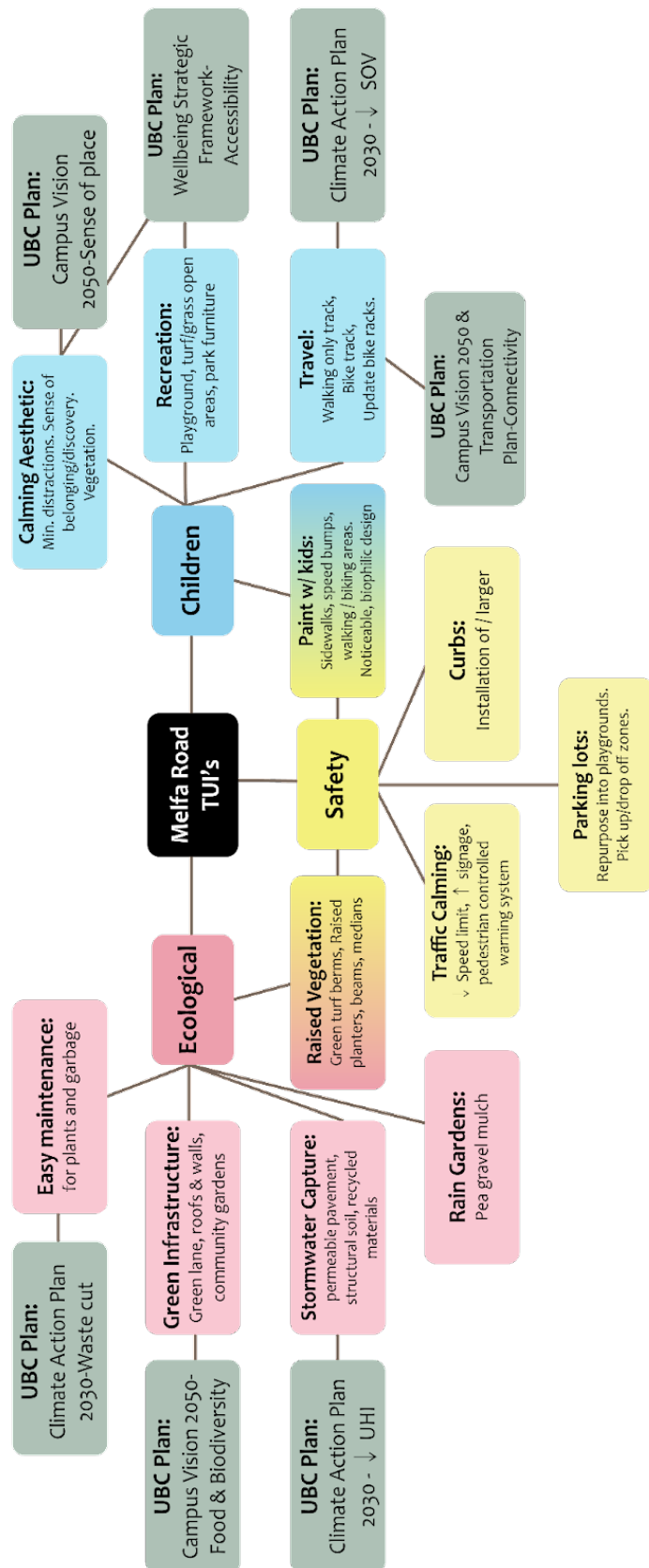
Appendix D1: Map of elevation change (~4m) in the MRP.
Source: QGIS, 2022.

Appendix E - Literature Review Spreadsheet

| High Relevance Literature | | | | | | | | | |
|-----------------------------|------------------------------------|---------------------------|--|---|---|---|---|--|---|
| Citation Number | First Author | Year | Title | Summary | Relevance (High, Med, Low) | Utility (Intro, Definitions, Data, Examples) | Citation | Other Notes 1: | Other Notes 2: |
| KME2_2 | The University of British Columbia | 2014 | UBC Transportation Plan | -Policies and Actions on: Walking, Cycling, Transit, Driving, Accessibility, Circulation, Access and Other Issues | High, will be helpful when thinking about shifting modes of transport to favour pedestrians | -"UBC neighbourhoods have grown to include nearly 9,000 residents as of 2013." -"By 2021, UBC estimates the Vancouver campus will be home to approximately 22,500 residents" | The University of British Columbia. (2014). UBC Transportation Plan. Cramer, J. R. (2008). | This paper pointed out a new idea that connecting children with nature is not only good for children but also is a useful tool to | https://planning.ubc.ca/sites/default/files/2019-11/PLANS_UBC_TransportationPlan.pdf |
| EH1_2 | Cramer, J. | 2008 | REVIVING THE CONNECTION BETWEEN CHILDREN AND NATURE through service-learning | This article introduced a service-learning program as a powerful tool to rebuild the relationship between children and nature. | High | DEFINITIONS: Service-learning program: "a teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic values, and develop a sense of social responsibility." - Sharing a range of international experiences involving children's participation in urban transport planning and design - Children should also have the right and opportunity to walk or cycle | REVIVING THE CONNECTION BETWEEN CHILDREN AND NATURE through service-learning | | https://www.proquest.com/docview/222295866?accountid=14656&pg-origsite=summon |
| DLJ1_2 | Placemaking Europe | n.d. | RECAP - Let children rule the street webinar | Kids, discussing child mobility in cities and the project is being carried out by Happy City in partnership with the City of New Westminster and Glenbrook Secondary | High | - Raise the profile of Glenbrook/Rotary Crosstown Greenway. - Make student routes safer by slowing down vehicular traffic | Recap - let children rule the streets webinar, Placemaking Europe. (n.d.). Retrieved from https://placemaking-europe.eu/listing/recap-let-children-rule-the-streets-webinar/ | | https://placemaking-europe.eu/listing/recap-let-children-rule-the-streets-webinar/ |
| DLJ1_3 | Happy City | 2021 | Crosstown Greenway: Youth-led placemaking for safer streets | "This article focuses on environmental education, one of the most important areas of educational work in schools. Considering it | High | 1. Try to show and find attractive sides in nature, make you think about the phenomena that are happening, their causes and effects. 2. To acquaint with works of art | YOUTH-LED PLACEMAKING FOR SAFER STREETS. Happy City. (2021). Retrieved from https://thehappycity.com/project/crosstown-greenway-youth-led-placemaking-for-safer-streets/ | | http://journal.buxdu.uz/index.php/journal_s_buxdu/article/view/2620 |
| EH2_2 | Ниязова, С. | 2021 | ECOLOGICAL EDUCATION OF CHILDREN IN PRIMARY SCHOOLS | "This book examines child-nature definitions through two related concepts: The need for connecting to nature and the processes by | High | INTRO: This book covered the comprehensive information that we need for our project, chapters include children and nature interactions, and different ways to interact talked about the | ECOLOGICAL EDUCATION OF CHILDREN IN PRIMARY SCHOOLS. Niyazova, S. (2021). | This article has useful and specific suggestions with nature education for children | http://journal.buxdu.uz/index.php/journal_s_buxdu/article/view/2620 |
| EH1_3 | Freeman, C. | 2018 | Children, Nature and Cities: Rethinking the Connections | In this paper, the effects of typical urban visual confusion caused by objects and elements near the road (e.g. billboards) on the | High | INTRO: This study gives us information on the impact of visual clutter in urban road environments on children's and adults' crossing behaviour. We learned that adults and children aged 9-13 years | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | I noticed these search terms could be useful for us - the keywords they used were: Road crossing, Visual clutter, Distraction, Urban | https://www.taylorfrancis.com/books/memo/10.4324/9781315673103/children-nature-cities-claire-freeman-yolanda |
| XLL2_3 | Tapiro, H. | 2020 | Children, Nature and Cities: Rethinking the Connections | Redefining the child pedestrian safety paradigm: identifying high fatality concentrations in | High | OBJECTIVES: Child pedestrians are some of the most vulnerable users of our transportation systems, and they deserve particular attention when we consider traffic safety. The objective of this work is to | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | | https://www.science.org/doi/10.1016/j.sbspro.2019.06.007 |
| XLL2_5 | Ferenchak, N.N. | nd | Children, Nature and Cities: Rethinking the Connections | urban areas | High | | | | https://injuryprevent.ion.bmj.com/content/23/6/364.short |
| Medium Relevance Literature | | | | | | | | | |
| Citation Number | First Author | Year | Title | Summary | Relevance (High, Med, Low) | Utility | Citation | Other Notes 1: | Other Notes 2: |
| DLJ1_4 | Happy City | 2020 | Streets for People in 2020 - Active transportation activations for people with the City of New Westminster | The project seems to accelerate the planned reallocation of road space to support more staying, walking, cycling and increasing access to the city of New Westminster | Med | Creating opportunities and spaces through participatory methods such as pop-ups, and conducting research and surveys into public life, it was concluded that the interventions supported people's sense of safety, which is an important creative outcome as rain-activated paint along the greenway, with a two-way protected bike lane, improved sidewalks, and street furniture, trees and plants. | Streets for people in 2020. Happy City. (2020). Retrieved from https://thehappycity.com/project/streets-for-people-in-2020/ | | https://thehappycity.com/project/streets-for-people-in-2020/ |
| DLJ3_1 | Happy City | 2021 | Agnes Street Greenway - City of New Westminster | Agnes Street Greenway - City of New Westminster | Med | Develop self-guided walking tours through the city of New Westminster, using practice principles for connecting children with nature, effective approaches for different ages, effective approaches to connecting children to nature through arts education | Agnes Street Greenway. Happy City. (2021). Retrieved from https://thehappycity.com/project/agnes-street-greenway/ | | https://thehappycity.com/project/agnes-street-greenway/ |
| JPD2_1 | Wilson, C. | 2011 | Effective approaches to connect children with nature | importance of children and young people connecting with nature, and developing conservation knowledge, values and | Med | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | Effective approaches to connect children with nature. Department of Conservation. Pg. 1-20. | | http://www.gpcpervs.nic.in/Kids-Student/Effective_approaches_to_connect_children_with_nature.pdf |
| WYL1_1 | O'Connor, Z. | 2021 | Tactical urbanism: Colour interventions with purpose | This article reports on two proposed small-scale colour interventions that aim to calm traffic, prioritize pedestrian traffic, | Med | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | O'Connor, Z. (2021). Tactical urbanism: Colour interventions with purpose. Color Research & Application, 46(3), 446-450. | | https://online.library.wiley.com/doi/full/10.1002/color.122613 |
| KME2_1 | The University of British Columbia | Amended to April 30, 2018 | UBC Child Care Expansion Plan Point Grey Campus | Services is the main provider of child care on the academic campus." | Medium, good info on future of site and types of child-care facilities by our site. | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | The University of British Columbia. (2018). UBC Child Care Expansion Plan Point Grey Campus. Retrieved from https://planning.ubc.ca/sites/default/files/2019-11/PLAN_UBC_ChildcareExpansionPlan.pdf | | https://planning.ubc.ca/sites/default/files/2019-11/PLAN_UBC_ChildcareExpansionPlan.pdf |
| WYL1_3 | Bertolini, L. | 2020 | From "streets for traffic" to "streets for people": can street experiments transform urban mobility? | From "streets for traffic" to "streets for people": can street experiments transform urban mobility? | Med | Children, Nature and Cities: Rethinking the Connections. Freeman, C. (2018). | From "streets for traffic" to "streets for people": can street experiments transform urban mobility? Transport reviews, 2020. | Several examples in this paper, re-marking streets, re-purposing parking spaces, re-purposing portions of streets, and play streets, provide ideas | https://www.tandfonline.com/doi/full/10.1080/01441647.2020.1761907 |

Appendix E1: Excel spreadsheet of literature bibliography with attached link.

Appendix F - Literature Mind Map



Appendix F1: Literature mind map of ecology, safety, and children themes with respective UBC policy and guideline documents.

Appendix G – Table of Potential Interventions

| Ecology | | | Safety | | | Children | | |
|--|---|---|--|--|---|---|--|---|
| Features | Opportunities | Challenges | Features | Opportunities | Challenges | Features | Opportunities | Challenges |
| Green Lanes  | - Increase biodiversity | - Pest impacts - Require maintenance | Repurpose parking lot  | - Provide activity area designed for children | - The level of green in the site limited by budget | Playground  | - Emphasize the play area for children - Connect children with nature | - High expenses |
| Roofs & walls  | - Increase green area - Mitigate microclimate | - Hard to maintain - Plants' death due to lack of soil | Green turf berms  | - Protect people who use green areas from cars driving on the road | - Topographical design needed - Safety issues | Turf/grass open areas  | - Diverse activities provided by turf grass | - Budget limitation |
| Community gardens  | - Provide activities area | - Take up space - Require maintenance | Raised planters  | - Protect pedestrians and lower the speed by narrowing the road | - Plants planted inside might not live long - Affect original road | Park furniture  | - Space allows people to stay longer in nature - Attractive color and shapes for children | - Require maintenance - Barriers for plants growth |
| Permeable pavement  | - Provide permeable land | - Plants may be hard to maintain and die easily | Pedestrian controlled warning signs  | - Slow speed reminder - Pedestrian controlled | - Too many signs may cause confusion - Traffic uncertainty | Bicycle shelter  | - Eco-friendly - Provide more bike racks | - Budget limitation - Space limited |
| Structural soil & filtration planter  | - Provide permeable land - Less flooding | - Extra expenses - Hard to maintain | Street light  | - Increase safety at night | - Require enough space | Paint with kids/Sidewalks  | - Engage children - Reminders for drivers that this is children hang out area | - Covid time will restrict children engagement - Hard to maintain - Safety issues |
| Rain garden  | - Water collection and illustration - Increase biodiversity - Structural complexity | - Space limited - Require maintenance | Intelligent warning systems  | - Increase safety | - High expenses on construction and maintenance | Walking track  | - Provide outdoor activities - Connect with nature | - Require space and regular maintenance |

Appendix G1: Potential interventions and their features, opportunities, and challenges for themes of ecology, safety, and children.