

1. EXECUTIVE SUMMARY

The West Gate Tunnel Project (WGTP) is a partnership between the State Government and Transurban to deliver an alternative to the West Gate Bridge through construction of a tunnel, additional elevated roadways and bridges. The project will also deliver several new and upgraded paths to enhance the journeys of pedestrians and cyclists from Werribee to the city. The project first came to fruition after Transurban's proposal to alleviate traffic congestion on the M1 corridor, which has been forecasted to worsen as a result of the steep population growth in the western suburbs. The project will be built by a joint venture between construction contractors CPB Contractors and John Holland and is due to be completed in 2022.

Our task as part of the University of Melbourne Creating Innovative Engineering class focuses on sections of the Capital City Trail Shared Use Path (SUP) along Moonee Ponds Creek that will need to be closed off during the construction of the West Gate Tunnel elevated road works running above the centre of Footscray Road, connecting the new tunnels with CityLink, the Port of Melbourne and the city. Our group aims to assist the WGTP in coordinating and engaging with the local community and involved stakeholders (e.g. Friends of Moonee Ponds Creek, Bicycle Network Victoria and Melbourne Water) to develop one in-depth solution that ensures the SUP will remain open and usable during this period. Furthermore, this innovative solution seeks to raise awareness and increase community and stakeholder sentiment towards the project by demonstrating a commitment to minimising impacts and maintaining communication and transparency with the community during construction.

Through conducting interviews with relevant stakeholders, site visits and extensive online research, the key insights gained included the need for an alternative solution that is as similar to the original path as possible, meaning the option should not deviate too far from Capital City Trail, and enable cyclists and pedestrians to continue riding and walking through the area. Other aspects required to remain the same are segregation from fast moving vehicles, ensuring the route remains smooth and uninterrupted, and that there is minimal impact on the surrounding green space. The main challenges stakeholders were most concerned about was the difficulty in getting pedestrians and cyclists to cross Dynon Road without compromising their safety and finding existing spaces and infrastructure to meet path guidelines and required queueing areas at intersections. The opportunity to use pontoon bridges to cross Moonee Ponds Creek enabled us to create an innovative solution due to its appeal as a temporary structure, low cost and minimal impact to the natural environment.

Our proposal comprises the main aspiration of an easily accessible and convenient detour, through the use of two pontoon bridge crossings, slight modification to an existing signalised intersection, and implementation of a zebra crossing and appropriate signage for cyclists and pedestrians to safely circumvent the construction site. The detour is supported by two additional recommendations aimed to complement and improve the efficiency and method of communicating with the shared path users. These include the Bike ID used to push notifications directly to users, and an online community forum to provide a direct communication channel between staff members and the local community.

The value created by the detour, Bike ID and community forum addresses the main points derived from the insights; accessibility, safety, visibility, comfort, time, preservation of the natural environment and communication. The needs of the relevant stakeholders are addressed, and we believe that our solutions will positively benefit WGTP as it remains applicable on a long-term basis and can be implemented for future projects. We hope that our combined solution will fulfil the communication team's aims for zero complaints and provide other complimentary ways of communicating to the public.

Our recommended next steps are to conduct a cost analysis of our proposal (as this was not in the original scope of our project), and traffic simulation modelling to determine the delays and impacts between travel modes due to the modified intersection at Dynon Road. Furthermore, we believe that elements of our proposal may be applied to future projects of a similar nature.

2. TEAM PROFILES



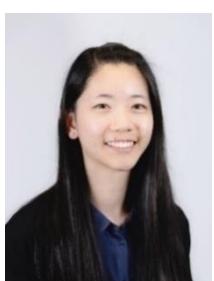
Samantha Siah

I am a final year Master of Engineering (Civil) student with a strong interest in the fields of infrastructure, oil and gas and renewable energy. I have previously graduated with a Bachelor of Science majoring in Civil Systems from Melbourne University in 2017. I am also working part-time at a structural engineering firm as a student engineer responsible for the design and documentation of residential projects by producing structural engineering drawings and computations. In my free time I enjoy exploring Melbourne and I'm currently on a mission to find the best coffee and avo toast in Melbourne.



Miru Kim

I am a final year Master of Civil Engineering student at the University of Melbourne and looking to start my career next year as a structural engineer. I have had two international internship experiences, one at a structural engineering firm and another at a transport consulting firm. In my free time, I enjoy watching sports and playing soccer.



Stephanie Liu

I am currently undertaking my final semester of study in Master of Engineering (Civil) and have a particular interest in transport and construction. I am also working with the Transport Advisory and Planning team at WSP as a student intern. Ultimately, my career objective is to create better, liveable cities through sustainable transport, as well as to further explore innovative ways to seamlessly integrate various modes of transport.



Guoxin Xuan

I am a Master of Software Engineering student, and this is my third semester studying at Melbourne University. I have gained a bachelor degree in software engineering and have had an internship as a junior system architect in an IT company in the final year of my undergraduate stage. This year, I am working on a project team on-campus developing an app for nurses in Melbourne Royal Hospital. In my free time I like traveling and classical music and sometimes do some small IT projects based on personal interest.



Harrison Cottrell

I'm in my first year of studying full time as a Master of Engineering (Mechatronics) student after completing my bachelor of science with a Major in Mechatronics last year. I am currently enjoying learning as much as I can while I'm at university, but am excited to join the workforce and try new things after completing my Masters next year. During university holidays I work on my family's citrus farms in Mildura and in my free time I enjoy movies, books, playing guitar, as well as watching and participating in sports.

3. PROJECT JOURNEY AND METHODOLOGY

The overall project journey followed the double diamond design process (Figure 1), consisting of two sets of divergent and convergent stages. These stages represent the initial expansion of insights, data and ideas, before undergoing the convergent stage of selecting and refining these ideas until an appropriate solution is finalised. This process was repeated to eliminate any notable problems during each iteration, and to ensure the solution was optimised. The main steps taken will be explained in detail below.

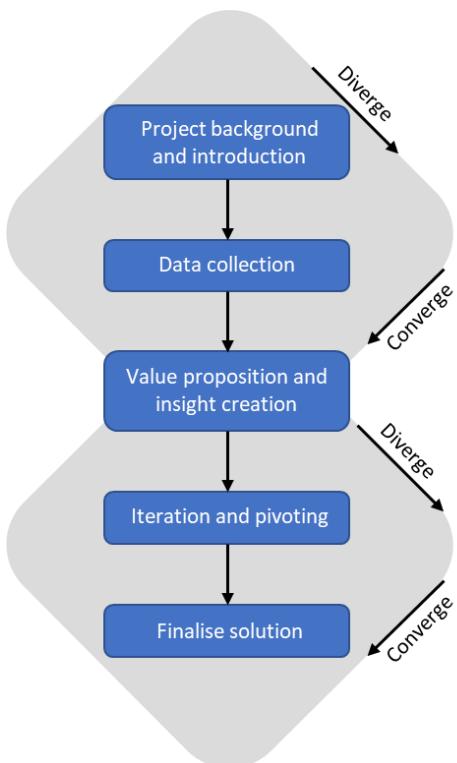


Figure 1 Project methodology

PROJECT BACKGROUND AND INTRODUCTION (WEEK 2 TO 3)

An introduction to the project was provided by WGTP's Stakeholder & Community Relations Advisor – Port to City, Vesna Newman detailing the main problem, the general extent of the construction area (project boundary), key stakeholders specific to the project, and external resources which may assist our team in deepening our understanding of the task to be completed (e.g. Edithvale and Bonbeach Level Crossing Removal Project EES). This was followed by an explanation of the West Gate WGTP business model canvas

given by our sponsor Tim Holmes (Stakeholder & Community Director) to provide us with an overview of the organisation's value proposition, customers, resources and activities, providing context as to how our project would fit in with the values of WGTP.

Following this, the team underwent an extensive exploration of the project background through online research. This included searching for the definition of keywords in our project description, such as types of shared use path and construction works involved with building elevated roadways, and looking up the relevant section of Capital City Trail on Google Maps to gain a better understanding of the shared use path alongside the surrounding road and public transport network.

Milestone: Project Brief

DATA COLLECTION (WEEK 3 TO 7)

The data collection phase involved using various research methods to obtain information on the project outcomes, objectives and scope, as well as identifying jobs to be completed.

These research methods include:

- Resource materials from WGTP

Further detail on the new express bike path (known as a Veloway) and other planned pedestrian / cyclist infrastructure were obtained to determine whether these could be used as part of the potential solution. Other resources that helped to identify potential limitations to the solution include detailed plans of the construction works (i.e. drawings showing crane and beam lift layouts, exact project boundary) and the project timeline (including start date and duration of path closure).

- Desktop browsing

Online research involved searching for past case studies that cleverly implemented an alternative solution to a shared use path closure. Google Maps was used to help determine which sections of the surrounding transport network (e.g. roads, paths, bridges) could be safely accessed by cyclists and pedestrians, as well as VicRoads and Austroads design guidelines on bicycle infrastructure and road design.

- Site visits

Site visits were used to visually identify potential risks and problems that may be encountered within the project area. This included the proximity of the shared use path to busy roads (Dynon Road and CityLink), volume and speed of cyclists riding on the path during peak hour, percentage split between pedestrians and cyclists, height clearance of the elevated rail and roadways over Moonee Ponds Creek, and the overall nature of the green space surrounding the area. Existing infrastructure (e.g. traffic signals) that may be utilised in our potential solution were also noted.

- Interviewing the local community and key stakeholders

Following the above three mentioned research tasks, a list of interview questions was compiled and confirmed by Vesna.

As agreed by the team, an emphasis was made on interviewing people of high importance and relevance to our project rather than focusing on completing a certain quantity of interviews. Subsequently, interviewees were carefully chosen based on experience and knowledge in various fields.

List of interviewees:

- Francisca Araneda (Friends of Moonee Ponds Creek, regular user of path as a pedestrian)
- Gary Brennan (Bicycle Network Victoria)
- Ryan Eade (WGTP Construction Team)
- Harry Ly (avid cyclist)
- Jeremy Peters (WGTP Traffic Team)
- Michael Thompson (Melbourne Water)
- Mario Urban (WGTP Stakeholder & Community Manager)

Through these interviews, we aimed to engage with the stakeholders as much as possible by first ensuring we understood their problems and concerns, and then stepping them through our own potential approach to the solution (depending on the time of interview) to gauge their opinion and receive feedback to help with the 'Iteration and Pivoting' stage.

Milestone: Mind map

VALUE PROPOSITION AND INSIGHT CREATION (WEEK 8)

After organising the information obtained from the data collection phase, the main insights and gaps where value could be added to the project were noted down and grouped by theme (e.g. safety, functionality etc.). These were then used to form a basic skeleton of a few proposed solutions.

Milestone: Concept diagram

ITERATION AND PIVOTING (WEEK 8 TO 10)

We presented our most feasible solution to an audience of students and mentors, from which we received valuable feedback that we used to pivot and refine our solution. Other previously brainstormed solutions were revisited to eliminate problems in our chosen solution. This was done by identifying and determining how advantages of the other solutions could be implemented into our recommended solution.

Milestone: Practice pitch

FINALISE SOLUTION (WEEK 11 TO 12)

This stage involved undergoing the detailed design phase of our innovative solution until approval was granted by Vesna.

Milestone: Final report and presentation

4. KEY INSIGHTS

Key insights gained from interviews, site visits and online research included the following main points:

- Accessibility
- Safety
- Visibility
- Comfort
- Time
- Preservation of the natural environment
- Communication

These will be explained in more detail in the subsequent sections by unmet needs, problems and challenges, and opportunities.

4.1. UNMET NEEDS

Discussions with regular users of the path and the surrounding bicycle network indicated to us that there was a strong need to keep our solution as similar to the original path as possible. Users understandably preferred for nothing to be changed, but in this event where this was not possible, they felt it best to keep any changes as minimal as possible. This applies especially in terms of distance, as a lengthy detour will be a great inconvenience and will likely cause complaints and prevent people from using the trail due to the significant increase in travel time. This becomes especially relevant when we consider pedestrians using the path, as they will clearly be the ones most inconvenienced by additional distance.

Similarly, we realised people probably did not use the path because it is their most direct route, but because of the qualities unique to this track. Discussing with users of the trail as well as our own assessment revealed that these qualities are that the trail circumvents the need to ride alongside traffic, is reasonably smooth, mostly uninterrupted by intersections and is surrounded by some natural wildlife. Considering the need to keep our solution similar to the original where possible, we had to prioritise (where we could) retaining these aspects of the trail.

We also were made to understand the need to communicate the existence of the interruption to users of the path when speaking with Jeremy (Traffic Engineer at WGTP), and Mario (Stakeholder & Community Manager at WGTP). In an area where cyclists are often travelling at high speeds it is especially important to communicate a disruption to users well in advance, to prevent potential accidents through increased awareness, and also provide users with enough time to organise and prepare to take alternative routes or options if needed.

4.2. PROBLEMS AND CHALLENGES

Our immediate priority was finding ways to keep the trail useable during the construction period, and our initial discussions with the construction team indicated clearly that a detour was likely to be the only feasible solution. This was largely due to how cramped this particular section would become during construction, with the creek, the Capital City Trail and Dynon Road in such close proximity, as well as the

need for two piers to be placed on the trail itself and on the service road off Dynon Road (Figure 2). Additionally, the operation of heavy machinery (i.e. cranes) during the construction period deemed this section of the trail a high-risk zone and having cyclists and pedestrians anywhere near the construction area would be a concerning safety risk to both path users and workers on site. The construction team made it clear that there would be no possibility of making any changes to the construction sequence or work site, leading us to decide to try and find a detour.

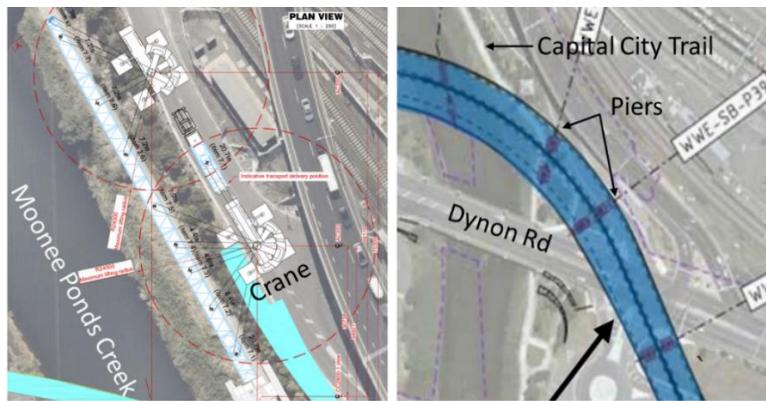


Figure 2 High risk zone: heavy machinery operating on trail (left), piers to be built on trail (right)

The construction team also noted that the crossing of Dynon Road would be a serious obstacle that would be difficult to circumvent during a detour. The road stretches east to west with the only route accessible by pedestrians and cyclists that avoids having to cross it being the closed area of the Capital City Trail that tunnels under the bridge. There is a pedestrian crossing east of the bridge, though it is at a crowded intersection that will only become more so once construction begins. The nearest crossing to the west of the bridge is too far away to be useable.

Speaking with Gary Brennan from Bicycle Network Victoria provided the understanding that the high volume of traffic on the trail during peak hour will mean we have to account for the space occupied by the riders banking up, if they are forced to stop at an intersection. For example, if riders must stop for one minute at an intersection, then it is entirely possible for 30 or more riders to bank up during that time. If each rider occupies approximately 1.5 square meters (2 meters long, 0.75 meters wide), then 45 or more square meters will be needed to accommodate the riders. Knowing this, it was difficult for us to see how the intersection east of the creek could be used (less than 20 square meters of space), given how crowded the area will be during construction. Furthermore, the section between the Capital City Trail and service road south of the intersection (blue shaded region in Figure 3) will not be publicly accessible during the construction period, making it extremely difficult and unsafe for users of the detour to return back on the shared use path as this would require them to cross two railway tracks.

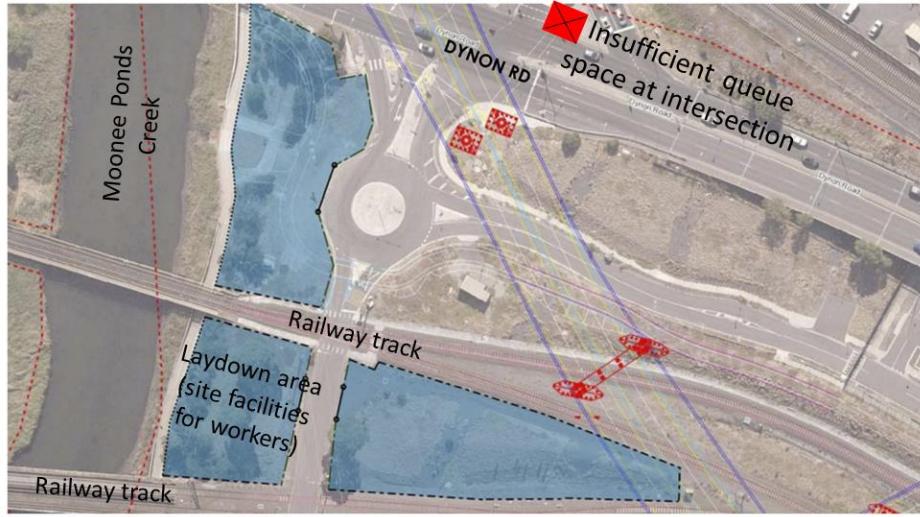


Figure 3 Limitations of crossing Dynon Road east of Moonee Ponds Creek

Researching the regulations from VicRoads regarding shared use paths placed some clear limitations on our solution. Most notable was that the path must be at least 2.5 meters wide, and for a busy path like this one a minimum of 3 meters would be preferable ("Design Guidance for strategically important cycling corridors", 2016). This is to allow for riders travelling in both directions as well as allowing room for riders to overtake pedestrians. This was particularly relevant as it meant that we could not use the walkways on Dynon Road bridge, as they are too narrow to satisfy this regulation.

Mario brought to our attention the current challenges in communicating upcoming disruptions and planned works to the public, emphasising the difficulty in reaching out to the correct target audience. He explained that although some communications methods worked well, such as posts on social media, other methods such as having people on site handing out flyers along a bicycle path proved near impossible as cyclists would be travelling at high speeds and be unwilling to stop. As such, there was no direct means of only sending notifications to those who actually use the shared use path.

4.3. OPPORTUNITIES

From speaking with Michael Thompson from Melbourne Water, we were pleased to learn that building a crossing over the creek was an acceptable option. This allowed us to consider utilising the west side of the creek in our solution, as it is significantly less crowded, and essentially only requiring the detour to cross Dynon Road to navigate around the construction.

Knowing a water crossing was a possibility, we raised the idea to Gary Brennan from Bicycle Network Victoria who mentioned a pontoon bridge that had been used in similar situations (e.g. along the Yarra River) when travelling over smaller bodies of water. This idea was very attractive to us, as a pontoon bridge is a relatively cheap and easy way to cross the creek that is also suitable as a temporary structure. Similar bridges have been composed of a concrete slab on the base of the creek, with a large spring attached to the floating pontoon to keep it in place while allowing it to rise and fall with the water level. Melbourne Water informed us that based on flood modelling results, there should not be any issues with flooding in the area over the next year, so a pontoon bridge seems like a practical option.

Through surveying the area, we noted that while there is no intersection on the west side of the Dynon Road bridge, there is a period where vehicles travelling west stop to allow eastbound vehicles to turn right

onto CityLink. This would mean the only vehicles in the way of a potential crossing are those travelling east along Dynon Road, so if that obstacle could be navigated, we saw it as a possible option for crossing Dynon Road that would cause relatively minimal alteration to traffic patterns (Figure 4).

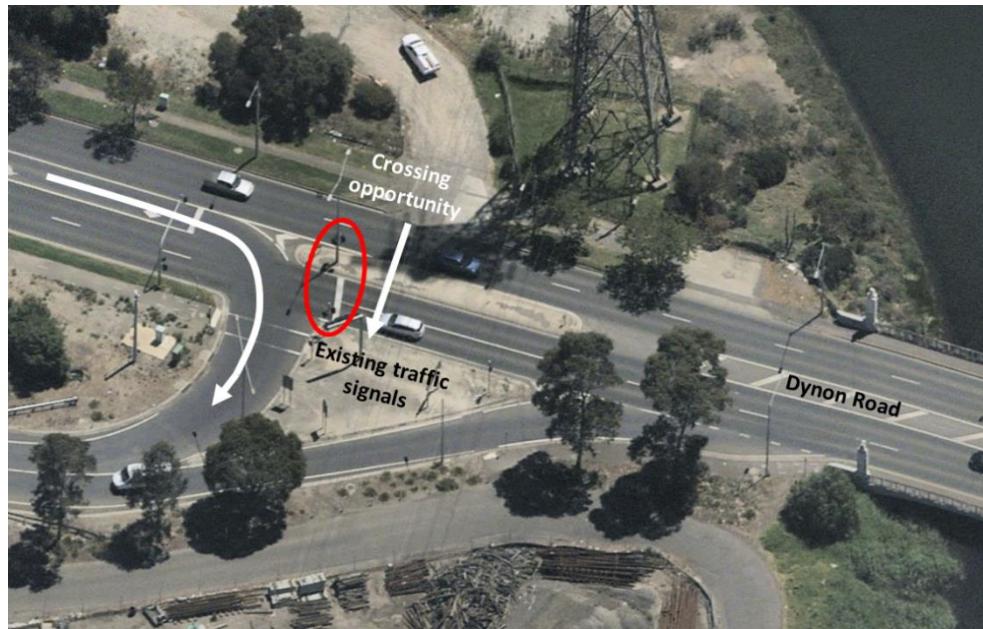


Figure 4 Potential to create a signalized intersection using existing infrastructure

5. PROPOSAL

5.1. OPTIONS CONSIDERED

Primarily two potential solutions were considered, these included:

- Replacement / shuttle bus service to transport shared use path users around construction area
- Detour around construction area (recommended)

However, as explained in Section 4.1, cyclists who frequently utilise Capital City Trail preferred a solution as similar to the original path as possible. So the detour option was explored in further detail as the preferred option.

Several variations of the detour were also considered, in particular the section along Dynon Road. These included:

- Utilising the existing pedestrian path running parallel with Dynon Road – this was not considered due to the inadequate width of the path.
- An elevated bridge crossing over Dynon Road – the grade requirements and extensive construction works needed to build an elevated path was deemed unfeasible, as the detour is only required for a relatively short period of time.
- Unsignalised crossing for cyclists and pedestrians on Dynon Road – believed to be too dangerous due to fast-moving traffic along the road (particularly during peak hour).

- Directing cyclists away from Dynon Road through use of a pontoon bridge (recommended).

The use of a pontoon bridge was selected, as this would segregate cyclists away from fast-moving vehicles along Dynon Road and prioritise their comfort and safety.

5.2. PROPOSED SOLUTION

Our proposal consists of the detour as our main solution, followed by two supporting solutions to help initiate a smooth transition when construction works begin.

Our proposal consists of the following:

- Detour: an easily accessible and safe alternative route to the closed section of Capital City Trail.
- Bike ID: an efficient and convenient method of notifying path users of planned works and disruptions ahead of time.
- Community forum: an online platform that initiates transparency and encourages two-way communication.

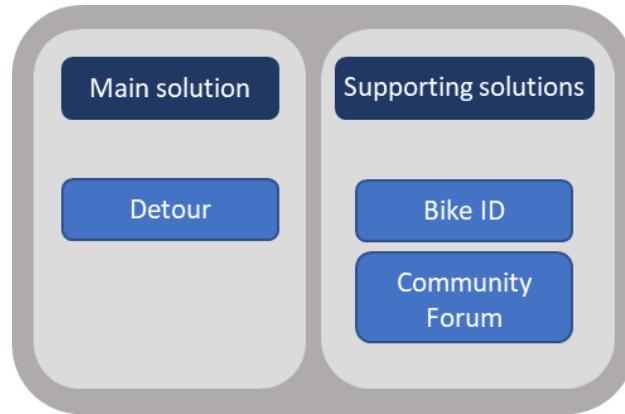


Figure 5 Structure of proposal

These solutions will be explained in further detail in the subsequent sections.

5.2.1. DETOUR

Figure 6 shows currently orientation of the existing Capital City Trail in yellow lines and the proposed detour route in green lines. The proposed detour consists of two crossings of water by utilising pontoon bridges and two crossings of the road.

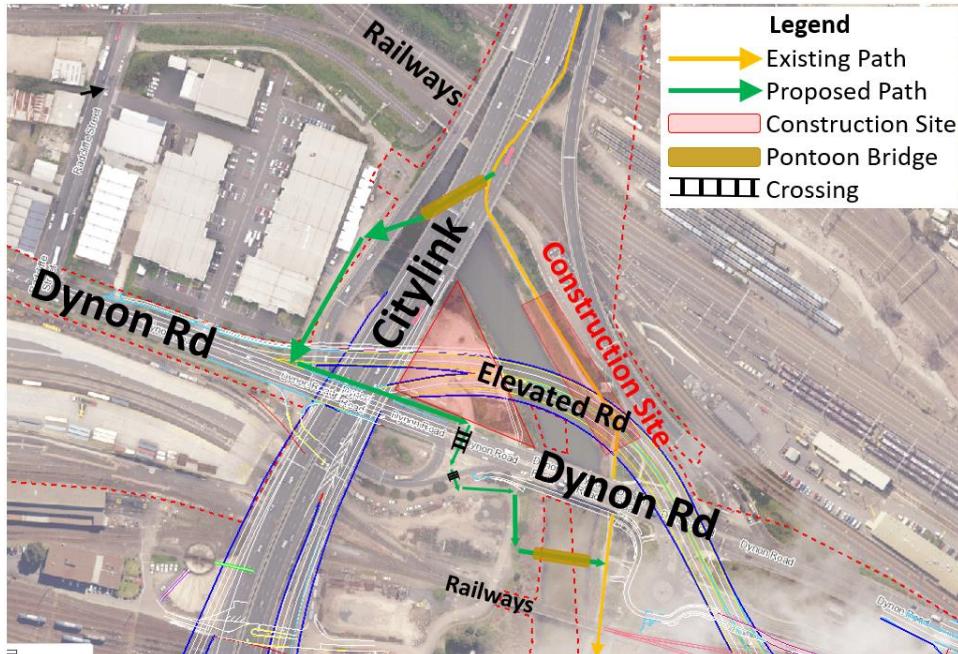


Figure 6 Final detour solution

The first pontoon bridge is to be built just after the railway lines (north of Dynon Road), as there is barely any available space or gap under the railway bridge. The direction of the bridge should also align with the existing trail in order to maximise or even eliminate the turning radius. After crossing the creek, cyclists will be directed away from the construction site, but towards Dynon Road. Once the cyclists reach the road, they can continue to ride along Dynon Road as the walkway next to the road has sufficient width for path requirements. Cyclists will cross the road at the T-intersection as mentioned in the previous section. Signals would need to be adjusted slightly so that both straight lanes are stopped when eastbound vehicles turn right onto CityLink and cyclists cross the road, but we believe that this is the best way to ensure safety of the cyclists and minimise the impact on the vehicles on this intersection. There is another crossing through a slip lane where westbound vehicles enter CityLink. As we have to account for the space occupied by the riders banking up if they are forced to stop at an intersection, we propose a zebra crossing, giving cyclists and pedestrians priority to cross first. The speed limit would have to be adjusted at this intersection to provide a safe crossing. However, stopping left turning vehicles at the crossing can cause major delays on Dynon Road. So we intentionally placed the crossing some distance from the slip lane entrance, in order to increase the storage length of this lane and minimise the impact on the other lanes (Figure 7). The second pontoon bridge is to be built also just before the railways so that cyclists can safely cross back to the creek and rejoin the original path.

Values generated from implementing this are explained in Section 5.3.1.



Figure 7 First and second crossing

5.2.2. BIKE ID

The Bike ID serves as a supporting solution to the detour to primarily help improve the efficiency and method of communication with path users, this is mainly targeted to cyclists, however, can include pedestrians as well. Values generated from implementing this are explained in Section 5.3.2.

This solution involves the placement of sensors at key locations along the shared use path prior to its closure, both within and in the vicinity of the planned construction works. By partnering with Bicycle Network Victoria, radio frequency transponders in the form of a small ID tag will be distributed to cyclists (which can be easily clipped to clothing or bicycles). These sensors will be able to read the transmitters and record information on who uses the path, and ultimately send out push notifications to the user's mobile device through text or email a week before the works are scheduled to start. Notifications can include information on the estimated timeframe of the disruption, area of path closure, the impact on the user, and alternative routes or options that will be made available to the user, such as the recommended detour. This method of notification is to be implemented in conjunction with existing communication methods such as posts on social media platforms, radio broadcasts, posters and signage.

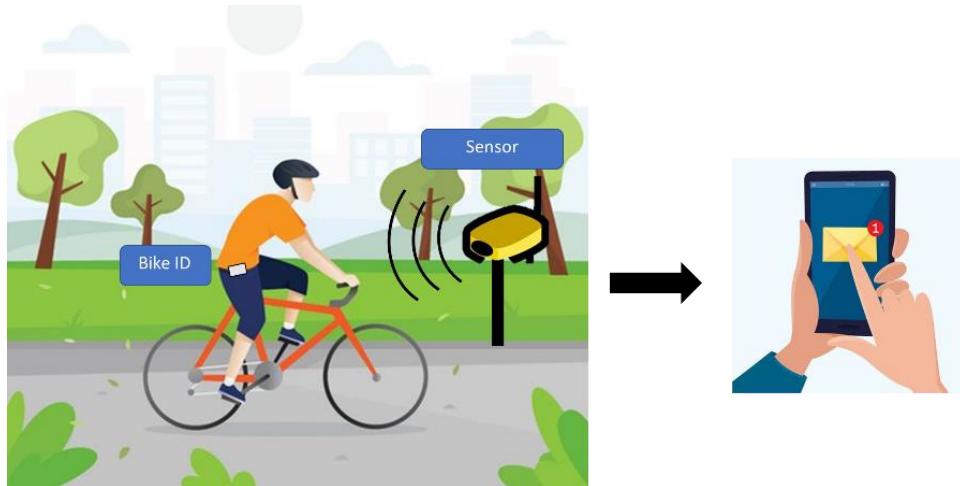


Figure 8 Bike ID System

Furthermore, real-time traffic data obtained from the Bike ID system can be utilised to gain an insight into the path's current performance, which can be used to assist in the detailed design of the detour (e.g. design load capacity, adjustments to path width and queueing space at the intersection) and any future works that may be required. Volume counts of any cyclists or pedestrians without a Bike ID should be verified and accounted for using a traffic counter, essentially a tube sensor laid on the ground that counts traffic as cyclists or pedestrians move over it. As such, it is recommended that this system be implemented several months prior to the commencement of the closure to maximise full utilisation of the system.

5.2.3. COMMUNITY FORUM

In addition to the Bike ID, an online community forum is proposed as a supporting solution to the detour as it forms an alternative method of communication with the public. Values generated from implementing this are explain in Section 5.3.3.

The online community forum comprises of the following methods of communication and is moderated by staff from the WGTP communications team:

- Announcements page
- Discussion board
- Live chat
- Interactive map (Figure 9)

The discussion board provides a platform for community members to discuss their thoughts and concerns about the project. The live chat system and interactive map allows the community to make urgent enquiries regarding the project on a one-to-one basis. This combined system allows them to report problems encountered with the detour and allows the WGTP communication team to respond on a real-time basis. The announcement page allows WGTP to post the latest news about the project, post status updates, and inform the community regarding disruptions ahead of time. Lastly, an interactive map will be included on the website so that any member of the public who has identified any issues with the detour, shared use path or the construction works (in particular safety risks) is able to directly pinpoint the location and provide an explanation of their concern (or compliment).

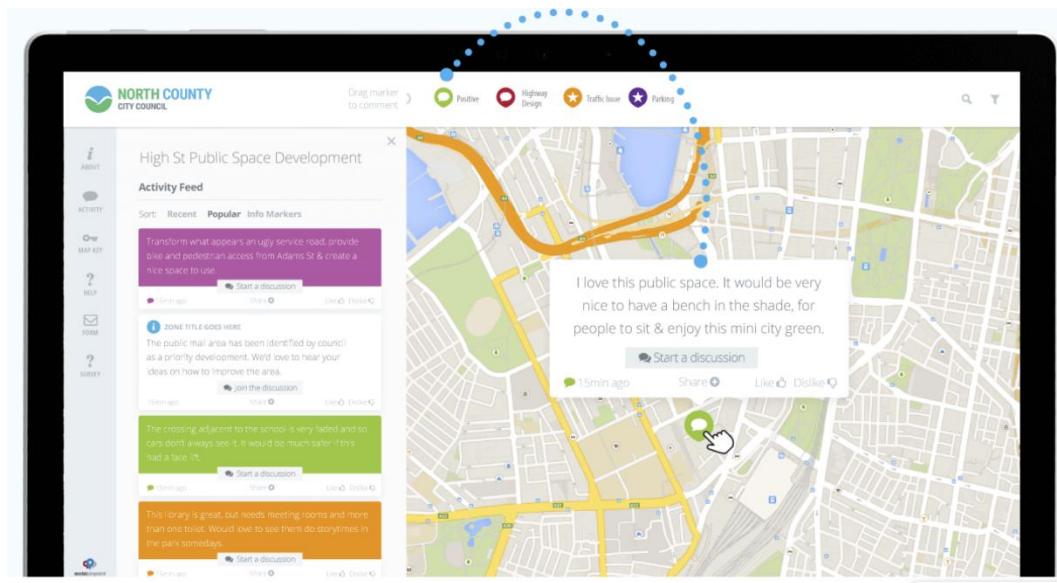


Figure 9 Interactive map

5.3. VALUE GENERATED BY PROPOSAL

5.3.1. DETOUR

The value created by the detour aims to address the challenges arising from the construction of the shared use path. This detour creates value by addressing the following points gained from the interviews:

- Accessibility

The detour creates value as it allows sections of the Capital City Trail to remain usable to the pedestrians and cyclists as part of their commute, without too much change to their current lifestyle and habits. This is important, as construction works will be ongoing until 2022 which can significantly alter their chosen mode of commute if sections of the Capital City Trail are blocked off. The detour functions as a like-for-like replacement for cyclists and pedestrians and enables continued accessibility for them to travel and reach their intended destination.

- Safety

The detour directs the cyclists and pedestrians further away from the construction site to; 1) minimise their exposure to the risks that may arise within the close proximity of the site, and 2) contributes to their need to feel safe which allows them to clear doubts regarding their personal safety while riding. We also must account for the overall safety of cyclists / pedestrians and road users within the vicinity during peak hour with a high volume of riders and the impact of cyclists / pedestrians banking up the two-way traffic flow as the detour cuts across Dynon Road. As we need to consider the space required by the cyclists whilst banking up, the installation of the signalised and unsignalized crossing that operates at a fixed cycle time that is deemed safe to operate as determined by the traffic engineer.

- Visibility

To ensure that the detour is still practical during day and night, clear signage and lighting is to be installed to ensure visibility is always provided addressing the needs of the cyclists and pedestrians.

- Comfort

We ensured that adequate path width is provided, preferably 3 meters to allow enough space for overtaking and to allow cyclists and pedestrians to travel in both directions. The road grade for the detour is relatively flat which is much more manageable for varying fitness levels.

- Time

We ensured that the implementation of the detour is not a major inconvenience to cyclists and pedestrians and allows them to reach their destination without significantly adding to their normal travel time.

- Preservation of the natural environment

The natural landscape is preserved by making use of the existing road network and making sure the detour blends with the environment and that there is no interference with Melbourne Water

assets. This is important as the Moonee Ponds Creek region is one of the few green open spaces in the North Melbourne region as mentioned by Fran Araneda from Friends of Moonee Ponds, and that it is not a recreational creek with no watercraft use permitted. As the risk of flooding is low according to Michael Thompson from Melbourne Water, and to ensure that there is minimal impact to existing flora and fauna in the region, a non-invasive pontoon for each water crossing is recommended to allow cyclists and pedestrians to cross the creek and ride along the road opposite the construction site.

5.3.2. BIKE ID

The implementation of the Bike ID system creates value by addressing the needs of the cyclists / pedestrians in terms of providing clear, consistent and timely communication between them and WGTP regarding possible disruptions that arise through construction works. This system intends to improve communication between the two parties by simplifying existing communication practices of continually updating social media platforms by providing a direct communication channel to cyclists / pedestrians that use the shared use path. Whenever the cyclist / pedestrian goes past the affected area of the Capital City Trail within radius of the sensor, the tag containing their personal information will be detected. This allows for the generation of a push notification system whereby an SMS or email is sent to the cyclists / pedestrians' phone to inform them of early notice of disruptions and status updates arising from construction works.

As the operation of the Bike ID system is similar to a traffic counter system, the adoption of this system creates value for the WGTP traffic team in terms of the generation of real-time traffic data from cyclists and pedestrians along the affected area. This is beneficial as the traffic generation and prediction data from the cyclists and pedestrians can be obtained to provide a continual review of changes in traffic as construction works progress, as well as to monitor and measure congestion in the path to determine whether it is safe to be used by the community, allowing the traffic team to engineer solutions that can best meet their needs.

5.3.3. COMMUNITY FORUM

The development of a public access online community forum addresses the needs of the Stakeholder & Community Management team of WGTP in terms of their communication with the public. This platform creates value by addressing the following needs:

- Creates a centralised communication platform.
- Addresses the concerns of the public without going through third-party channels such as external media outlets.
- Provides a direct communication channel between the staff member and the public where enquiries can be openly shared to be eventually clarified by the staff member.
- Allows problems encountered with the detour to be directly handled / managed by WGTP on a real-time basis.
- Easier for the WGTP team to proactively address immediate complaints.

The development of this centralised communication platform for the public fills any gaps within the existing community engagement strategy of announcements in various social media platforms and its own

website, as there is direct two-way real-time communication between WGTP and members of the forum. This process also simplifies the communication process itself where the WGTP communications team can collectively address the needs of the community and on a case-by-case basis at a time through this centralised platform, increasing the overall efficiency of the team. This system will also allow us to redirect enquiries to relevant individuals in the company by providing their phone numbers on the forum, allowing the community to directly contact them.

The implementation of this system can be beneficial to combat negative publicity that may arise from construction works as it significantly reduces the likelihood of misinterpretation of information through media outlets that can eventually be blown up in the media, as announcements from WGTP can be posted on the forum. This encourages transparency and honest communication between both parties to ensure that all relevant communication is provided before and during construction which will also increase the public's trust in WGTP's efforts as it provides opportunities for the members of the community to be involved with the project, allowing them to convey their needs with the assurance of a response from a WGTP staff member.

6. NEXT STEPS

6.1. FURTHER RESEARCH

- Conduct further research on pontoon design and testing the signals in Dynon Road for the signalised crossing that can be applicable to this context.
- Traffic signalling modelling. Obtain survey data (traffic counts) for existing traffic along Dynon Road and calibrate the model when designing the signalised and unsignalized crossing to see how it affects the traffic volume in terms of delays and travel times. This can be done by the traffic engineer.
- Testing signals for the signalised crossing on Dynon Road to ensure that it will not cause too much of a disturbance to drivers. This can probably take place at night or midnight where there is a significantly reduced traffic volume compared to peak hour.
- Conduct further research on sensors / receivers to be used for Bike ID in terms of the value of data received from the system relative to its usability.
- Cost-benefit analysis on the development of the Bike ID system to determine whether it is financially beneficial to implement.
- Gain understanding of the community sentiments from similar cycling detours that are impacted by the construction of the West Gate Tunnel Project (Federation Trail, Whitehall Street and Kororoit Creek Trail) prior to the development of the community forum
- Consider going through an engineering final year project with the University or a WGTP funded internship to which the student can effectively build on the solutions.

6.2. APPLICABILITY OF SOLUTION

Upon the assessment of the benefits of the detour for cyclists and pedestrians, we believe that on a long-term basis this detour configuration could potentially be implemented for other projects with a similar context. However, it would be best for WGTP to assess and address any difficulties in the current

construction process for the proposed detour as mentioned in Section 6.1 to ensure further improvements can be made prior to future applications.

Our recommendations for the Bike ID are currently proposed as a trial to provide a direct communication channel to cyclists and pedestrians, however if it is successfully implemented for the shared use path, it is recommended that this system be adopted state-wide. This can be through increased distribution of the tag through Bicycle Network Victoria and installation of sensor system through WGTP. As there is currently no push notification systems being used in the industry, our Bike ID solution can function as a first-time trial. If our trial is successful, the Bike ID system can be applied to future transport related projects as increased uptake of this system on a state-wide basis will provide a database that allows for a collection of traffic generation data to form relatively accurate predictions of cyclists and pedestrian traffic volume along multiple bike paths in Victoria. The collection of traffic data over time will allow for the understanding and awareness of the needs of the local cycling community that can be used for the development of projects of a similar nature.

The implementation of the public access online community forum can form the basis of a long-term technology plan for WGTP to address their communication management needs. If this system is to be taken up by WGTP for upcoming projects, it will be able to further increase the efficiency of the communications team in responding to the community as it is able to streamline the existing WGTP public communication system to a single platform. If this communication system is to be used by WGTP for future construction works, this will allow WGTP to gain an insight into the public's perspective on the construction works prior to the construction, to which they can improve their reputation and relationship with the community. On a long-term basis we hope that this system will fulfil the WGTP communication team's aims for zero complaints and provide a smoother transition in its communication efforts to the public.

7. REFLECTION

Below are some points that we learned through the process of delivering the project:

- Teamwork: We worked efficiently as a team as we gradually got to know each other better through this journey. In the teamwork, we helped individuals find roles that fit their natural strengths and divided tasks according to different roles. In this way, every team member made full use of their strengths and could contribute to the project as much as possible.
- Communication skill: Team members kept close contact with each other, which helped us all to remember the tasks to be done. It also enabled each team member to raise issues immediately and ask for help. Good communication in the team helped us solve the problems which could not be handled by individuals and made sure every task could be finished in time.
- Choose the right methodology: We followed the double diamond design process in the project, which consists of two sets of divergent and convergent stages. Divergent stages include collecting data, iteration; convergent stages include value proposition and insight creation after the data collection and finalizing the solution.
- The importance of collecting data: One of the most important stages in our process is data collection. We applied various methods to obtain information on the project outcomes, objectives, and scope, as well as identifying jobs to be done, includes viewing resource materials from WGTP, online research, site visits and interviewing the local community and key

stakeholders. That enabled us to have enough information to use in the solution generation stage and consider the problem in as many aspects as possible to avoid missing key points.

- Interview skill: From our interviews with the local community and stakeholders, we learned several techniques, such as how to prepare interview questions to collect the most useful information, how to handle unexpected issues and always have control of the interview as well as what to do to gather information after the interview.

Overall, we gained invaluable experience from the project and practiced what we have learned at university, and a more important point is that we also learned some new skills that we could not obtain in the university. But if we have an opportunity to do this project again, there are still some things that we could try or improve.

- Have more interviewees to gather more information. For example, have more cyclists involved in the interviews since the needs and expectation for the different individuals can be different.
- Having some professional management tools to manage tasks and project documents. We planned to use Trello to manage tasks at the beginning of the semester, but we did not end up implementing it. So, trying to use it or some other tool similar to it next time, like Confluence, would be a good option.

8. REFERENCES

Design Guidance for strategically important cycling corridors. (2016). Retrieved 20 October 2019, from <https://www.vicroads.vic.gov.au/-/media/files/technical-documents-new/traffic-engineering-manual-v3/tem-vol-3-part-218--vicroads-design-guidance-for-strategically-important-cycling-corridors.ashx>

9. APPENDIX

Project Brief – West Gate Tunnel Joint Venture - Innovative alternatives to a shared use path during construction works

Sponsor organisation: West Gate Tunnel Joint Venture

Project mentor: Vesna Newman

Cluster code: MK1

Team members: Harrison Cottrell, Miru Kim, Stephanie Liu, Samantha Siah, Guoxin Xuan

Strategic context and background information about the organisation:

The West Gate Tunnel Project (WGTP) is a partnership between the state government and Transurban to deliver an alternative to the West Gate Bridge through additional elevated roadways and bridges. The project first came to fruition after Transurban's proposal to alleviate traffic congestion on the M1 corridor, which has been forecasted to worsen as a result of the steep population growth in the western suburbs. The project will be built by a joint venture between construction contractors CPB Contractors and John Holland, and is due to be completed in 2022.

Project Summary and Objectives:

The WGTP will deliver a much needed second river crossing facilitating faster and safer journeys. It will provide an alternative route from the West Gate Freeway to the CBD, and slash congestion as well as travel times.

Our task focuses on sections of the Capital City Trail Shared Use Path (SUP) along Moonee Ponds Creek that will be closed off during the construction of elevated road works. Our group aims to assist the WGTP in coordinating and engaging with the local community and involved stakeholders (e.g. City of Melbourne, Bicycle Network Victoria and Melbourne Water) to develop one in-depth solution that ensures the area will remain usable during this period. Furthermore, this innovative solution seeks to raise the current community and stakeholder sentiment towards the project by demonstrating a commitment to minimising impact to the community during construction.

Project Tasks:

Together we will perform a review and analysis of construction processes and activity sequences of the bridge and elevated road segments to be built within Zone 403 to determine areas of potential impact along the Capital City Trail affected by construction.

Together we will conduct research with the affected community and stakeholders to understand their opinions on how their recreational and commuting experience will be disturbed by the partial closure of the shared use path, as well as finding out their expectations and preferences for an alternative solution. These stakeholders include:

- Bicycle Network Victoria
- Engineering, traffic, community and stakeholder teams (WGTP)
- Melbourne Water
- Path users (i.e. pedestrians and cyclists) within the local community
- Friends of Moonee Ponds Creek

Together we will translate insights from stakeholders and community into ideas in order to develop innovative solutions which enable the Capital City Trail shared use path to remain usable during the construction works. We will also identify ways where through our insights we can increase local community and stakeholder satisfaction with the project by looking at options that reduce disruption from the construction process.

Together we will communicate and validate our solutions with stakeholders by demonstrating that our innovative solution will cause as little disruption to both the build and the general public as realistically possible. This should ideally keep relations between the community, local council and stakeholders positive.

Project Deliverables:

- We will prepare one innovative structured solution to be completed to detailed design level
- We will present our interim findings to our sponsor in week 12
- We will prepare and submit a detailed report outlining our recommended solution

Project Scope:

Solution scope:

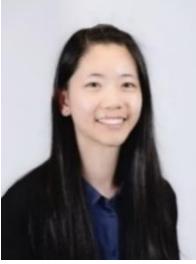
- Very limited ability to alter the planned design for the project, if at all
- Should not inhibit the construction process
- Does not cause further damage to the areas with vegetation and wildlife
- Preparation of at least one deliverable that can be investigated further by the WGTP JV team
- Solution should be somewhat applicable to other areas of the project
- Solution should ideally improve community outlook on the construction process

Group scope:

- Interviews conducted must be highly relevant
- Residents interviewed should be people who use the area on a regular basis
- Employees of WGTP should also be interviewed to gain an understanding of the construction works

Team Profile

	<p>Samantha Siah</p> <p>I am a final year Master of Engineering (Civil) student with a strong interest in the fields of infrastructure, oil and gas and renewable energy. I have also previously graduated with a Bachelor of Science majoring in Civil Systems from Melbourne University in 2017. I am also working part-time at a structural engineering firm as a student engineer responsible for the design and documentation of residential projects by producing structural engineering drawings and computations. In my free time I enjoy exploring Melbourne and I'm currently on a mission to find the best coffee and avocado toast in Melbourne.</p>
	<p>Miru Kim</p> <p>I am a final year Master of Civil Engineering student at the University of Melbourne and looking to start my career next year as a structural engineer. I have had two international internship experiences, one at a structural engineering firm and other at transport consulting firm. In my free time, I enjoy watching sports and in particular, I regularly play soccer.</p>

	<p>Stephanie Liu</p> <p>I am currently undertaking my final semester of study in Master of Engineering (Civil) and have a particular interest in transport and construction. I am also working with the Transport Advisory and Planning team at WSP as a student intern. Ultimately, my career objective is to create better, liveable cities through sustainable transport, as well as to further explore innovative ways to seamlessly integrate various modes of transport.</p>
	<p>Guoxin Xuan</p> <p>I am a master of software engineering student, and this is my third semester studying at Melbourne University. I have gained a bachelor degree in software engineering and have had an intern as a junior system architect in an IT company in the final year of my undergraduate stage. This year, I am working on a project team on-campus developing an app for nurses in Melbourne Royal Hospital. In my free time I like traveling and classical music, sometimes do some small IT projects based on personal interest.</p>
	<p>Harrison Cottrell</p> <p>I'm in my first year of studying full time as a Master of Engineering (Mechatronics) student after completing my bachelor of science with a major in mechatronics last year. I am currently enjoying learning as much as I can while I'm at university, but am excited to join the workforce and try new things after completing my masters next year. During university holidays I work on my family's citrus farms in Mildura and in my free time I enjoy movies, books, playing guitar as well as watching and participating in sports.</p>

Project Charter

- We agree to meet every Thursday 9:00am-11:30am at the mentor's office
- We agree to complete works by the relevant internal deadline to allow the sponsor to give feedback prior to submission
- We agree to resolve any conflicts or differences in opinion by consensus
- We agree to be accountable to each other
- Should there be any unexpected interruptions like illness, Nat and the sponsor will be the first point of contact, we will ensure all team members are also informed of any unavoidable absences
- The different personalities of each member should be managed through constant communication with each other in the group chat to ensure all opinions are heard

Document Control System

- Google Drive and OneDrive - file management between team

- Google Docs - used to write documents and ensures consistency in document management as a team
- WhatsApp group chat (x2) - First group chat is the main source of communication between the team and the mentor; Second group chat between members allows for collaboration on tasks

Quality Management

- Discuss and plan each piece of work in advance to ensure sufficient time can be spent on individual parts of the project
- Informing all changes to work that may overlap with or affect the work allocated to another team member, this must be communicated within the group chat
- Compilation of the final document should involve the input of the entire group
- Document formatting may be reworked using Microsoft Word prior to submission