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Environmental and Climate Change Review

Memorandum

To	Roger Burra
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From	Kate Chivers
Office	Auckland
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Subject	Golden Mile: Carbon Zero Appraisal – Carbon Emission Assessment

1 Introduction

This memo has been prepared by FutureGoup to inform the Golden Mile Single Stage Business Case being developed on behalf of Lets Get Wellington Moving (Waka Kotahi, Wellington City Council, and Greater Wellington Regional Council.)

To establish a climate resilient transport network, whole-of-life (WOL) carbon emissions associated with projects and programmes must be understood from an early stage. Understanding the whole-of-life carbon impact and climate risks of the concept design enables the design process to reduce emissions and climate resilience through detailed design and delivery phases of the project.

This memo includes an assessment of the capital construction, maintenance embodied carbon and user emissions. This is intended to be used as a base case to benchmark and improve upon throughout concept design, detailed design, and delivery. As such, it is recommended that this Carbon Emission Assessment is reviewed as the project design evolves. The climate change risk and adaptation assessment (CCRAA) is provided in a separate memo.

2 Assumptions and Limitations

This report ('Report') has been prepared by WSP exclusively for Let's Get Wellington Moving ('Client') in relation to the Golden Mile Project ('Purpose') and in accordance with NZTA Contract 1851. The findings in this Memorandum are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

3 Methodology

A WOL approach helps design teams consider how their decisions, in any life cycle phase, might influence the ability of future life cycle phases to deliver sustainable outcomes. This enables a more circular and future proofed system. A 30-year design life has been adopted.

To support the understanding of where the largest GHG reductions can be made the whole-of-life assessment included the carbon impact of construction, maintenance, trees and vehicle use. This provides a holistic view of Golden Mile's potential impact on emissions for the central city.

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The construction and maintenance emissions estimate were separated into the four streets: Lambton Quay, Willis Street, Manners Street, and Courtenay Place. This separation enables comparison of whole-of-life emissions for the differing combinations of proposed pavement, design palettes and other infrastructure. The comparison can then be used to inform design decisions considering upfront cost and long-term carbon emissions for the concept design of each street. All calculations are provided in tonnes of carbon dioxide equivalent (tCO_2e).

The data required for this estimate was based on the 'Materiality Strategy' document provided by Boffa Miskell, the projects traffic assessment, and bill of quantities. This assessment will require updating as the design outlined in these documents is updated or changed.

3.1 Boundaries, Sources, and Data

The boundaries of the carbon assessment include the materials, earthworks, construction effort, pavement maintenance over and user emissions 30 years. Within each of these elements the emission sources and their data inputs were mapped against fuel and electricity use (scopes 1 and 2) as well as Materials and User Emissions (Scope 3).

The high-level carbon assessment has been completed for the recommended design. A more in-depth whole-of-life carbon depth assessment are recommended as design progresses and more information is available to inform low-carbon design decisions. Particularly in relation to any detailed impacts of material choices.

Scope 1 & 2: *Fuel and Electricity*	**Scope 3:** *Materials and User Emissions*
Earthworks (m^3)	Pavement (m^3) - Stone - Concrete - Clay - Asphalt
Vehicle movements/ haulage (km)	Drainage: - Concrete (m3) - Steel (t)
Construction effort (L)	Street Furniture (m^3)
	Traffic Services
	User emissions (VKT)

The assessment was based on quantities of materials provided by the project's cost estimators and engineers. User emissions calculations were based on projected mode share out to 2054 based on the project's traffic models and the Climate Change Commissions Final Advice. The scenarios presented for user emissions follow the Climate Change Commissions Advice, the *Demonstration Path* which underpins its recommended emissions budgets. Projections are based on the *Demonstration and Tailwinds* scenarios to understand future mode sensitivity and EV uptake out to 2054:

- *Demonstration* scenario shows the Do Minimum option, whereby some carbon reduction is occurring as mode shifts and increase in EV's occurs in alignment with the Climate Change Commission's advice.
- *Tailwind's* scenario shows the expected Golden Mile project's increase in carbon reduction. Tailwinds is the most optimistic mode shift scenario, which examines a future where there are fewer barriers to technology and behaviour change and integrates a larger mode change for households towards public transport, cycling and walking, with a quicker uptake in EV's. This scenario aligns with the behaviour changes expected from the project, alongside a faster uptake in EV's for Wellington City.

Exclusions

The following was excluded from this assessment due to not being material or suitable data not being available at concept design phase:

- Traffic Services other than lighting
- Street Furniture other than seating
- Other architectural features
- Service relocation
- Clearing vegetation

3.2 User Emissions

User emissions data was based on the reduction in vehicle kilometres expected to result from the traffic restrictions associated with the Golden Mile project. Restricting access to the Golden Mile for private motorists will mean that some journeys become longer and take more time. In response to these changes some motorists, over time, are expected to:

- park their vehicles in a different location thereby reducing the distance they drive;
- change how they travel (i.e. choose walking, cycling or travel by bus); and
- drive less often.

An analysis to estimate the traffic reduction associated with the traffic restrictions found that annually the project is expected to result in a reduction of 21,003,910 km's per annum from Light User Vehicles based on a 2026 model year, when compared to a Do Minimum scenario.

As a sensitivity test a basic analysis was undertaken to estimate the mode shift which might be expected to result from the improvements to level of services for bus services travelling along the Golden Mile. The change in travel behaviour change resulting from traffic restrictions and travel behaviour change resulting from improved bus services are not mutually exclusive which means the forecast tCO_2e reductions cannot be summed. Ignoring the traffic restrictions, the changes to the Golden Mile are expected reduce LUV vehicle-kilometres by 215,961 km's per annum based on bus routes 1 and 2 alone[1].

4 Results

The total 30-year WOL emissions for the Golden Mile are summarised in Table 1 below. Accounting for both LUV mode shift models this results in a faster reduction in carbon emissions under the Tailwinds scenario, **overall decrease in carbon emissions of about 116,147 tonnes over the 30 years** when compared to the Do Minimum Demonstration path scenario (**Error! Reference source not found.**).

The carbon assessment shows that emissions from construction (both materials and fuel burn) total 841 tCO_2e, and the whole of life (WOL) maintenance impact totals 264 tCO_2e (**Error! Reference source not found.**).

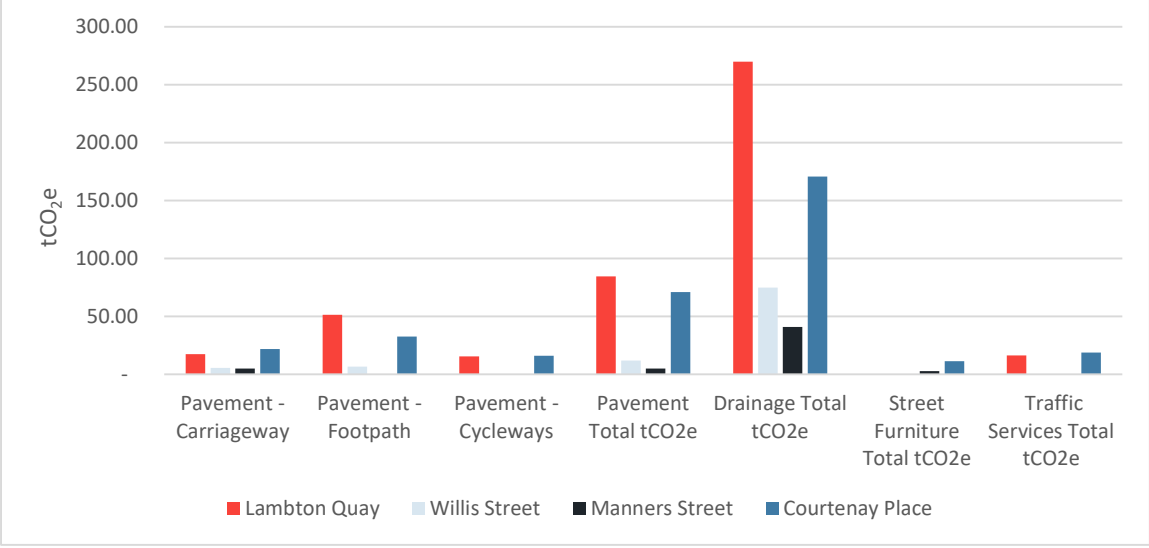

Figure 2 indicates that the largest portion of construction emissions is due to drainage materials 556 tCO_2e, with just under half from Lambton Quay 270 tCO_2e.

Figure 3 shows that of the total WOL maintenance emissions 264 tCO_2e approximately half is from Lambton Quay 134 tCO_2e and just under half from Courtenay Place 103 from the replacement of concrete pavers over a 30-year

[1] Note no other routes were analysed due to limited data availability at the time of assessment.

lifecycle. Construction and maintenance emissions are partially offset by both the tree sequestration -116 (tCO_2e) (Figure 4) and mode shift resulting from the traffic restrictions (

Table 1: 30-year WOL emissions for the Golden Mile under the Tailwinds scenario

Whole of Life Emissions				
Period	**Construction (tCO_2e)**	**Maintenance (tCO_2e)**	**Trees (tCO_2e)**	**User Emissions: Tailwinds Scenario (tCO_2e)**
2022 - 2024	841		-0	219,206
2025 - 2029			-3	178,227
2030 - 2034		88	-9	121,839
2035 - 2039			-16	70,473
2040 - 2044		88	-24	34,799
2045 - 2049			-30	14,458
2050 - 2054		88	-34	3,724
TOTAL	**841**	**264**	**-116**	**642,726**

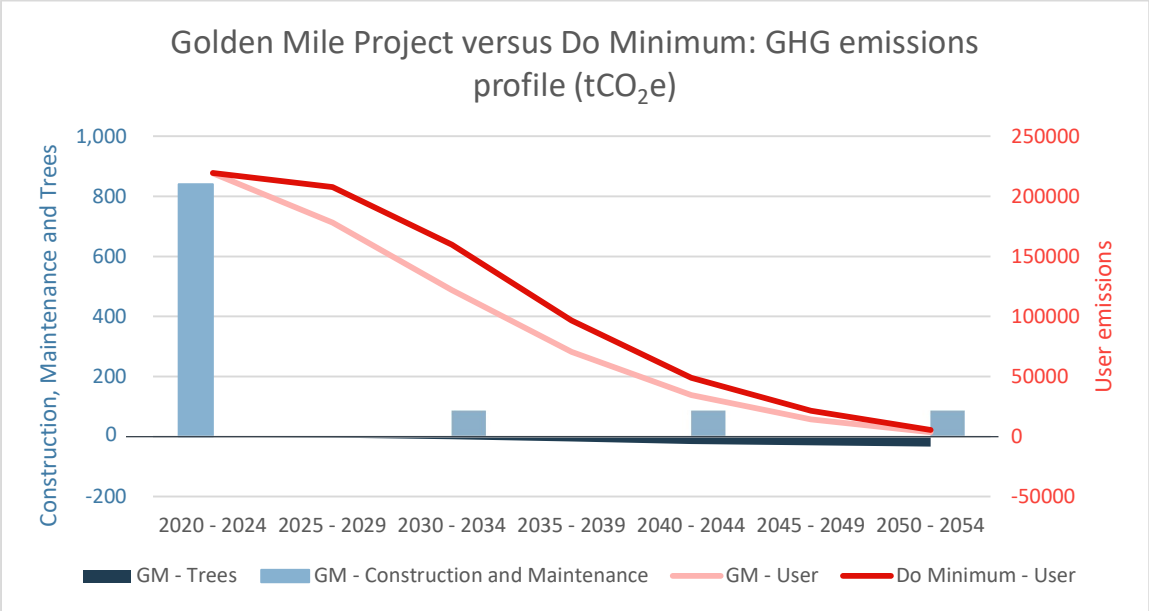

Figure 1. WOL breakdown showing construction and maintenance emissions, with the negative emissions and offsetting from proposed new trees. User emissions from the Do Minimum (Demonstration scenario) and Golden Mile (Tailwinds scenario) show the approximate 117,136 tCO_2e reduction in user emissions from the Golden Mile project across 30 years.

The results show that influencing how people travel can have a much larger impact on reducing emissions in the long term than traditional carbon-reduction construction methods. This is particularly relevant when looking to potential impact of the wider Let's Get Wellington Moving project.

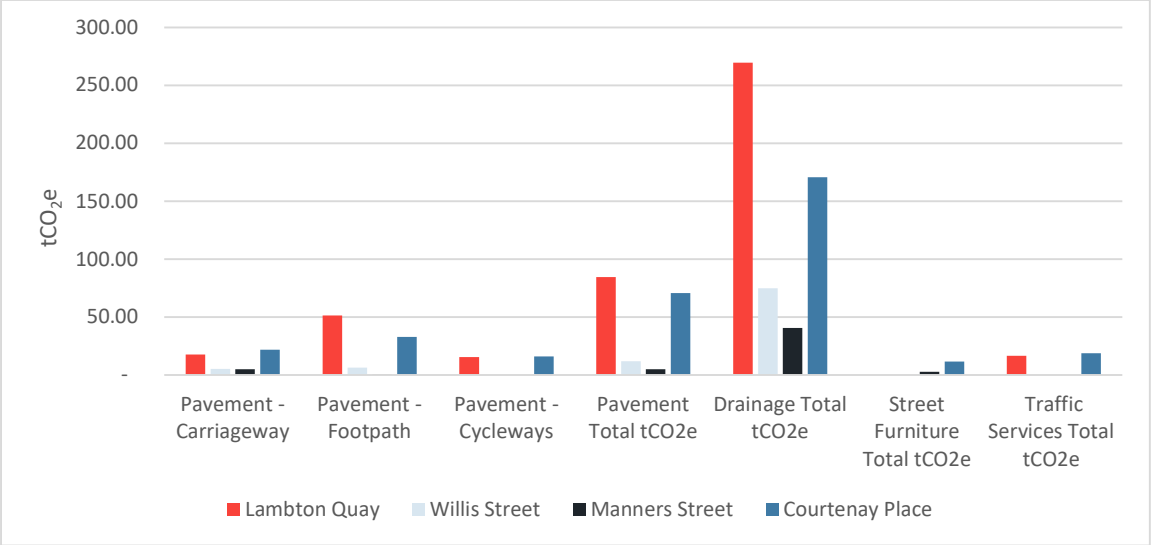

Figure 2. Emissions resulting from Construction Materials per street (tCO_2e)

The emissions impact of each street can be used as the preliminary base case emission scenario. This means that these are the high-level emissions that the project would emit under their business-as-usual construction scenario. Accuracy will need to be improved and updated as design progresses and more data comes available. This is so the project can be confident about its base case as it tracks reductions during construction.

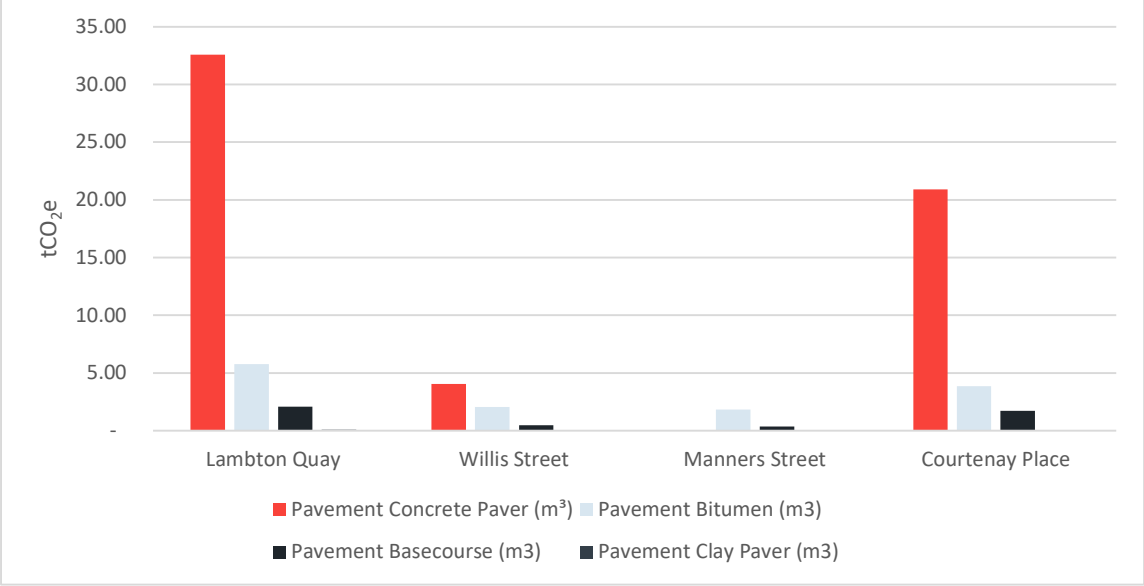

Figure 3. 30-year WOL maintenance materials emissions per street every 10 years (tCO_2e)

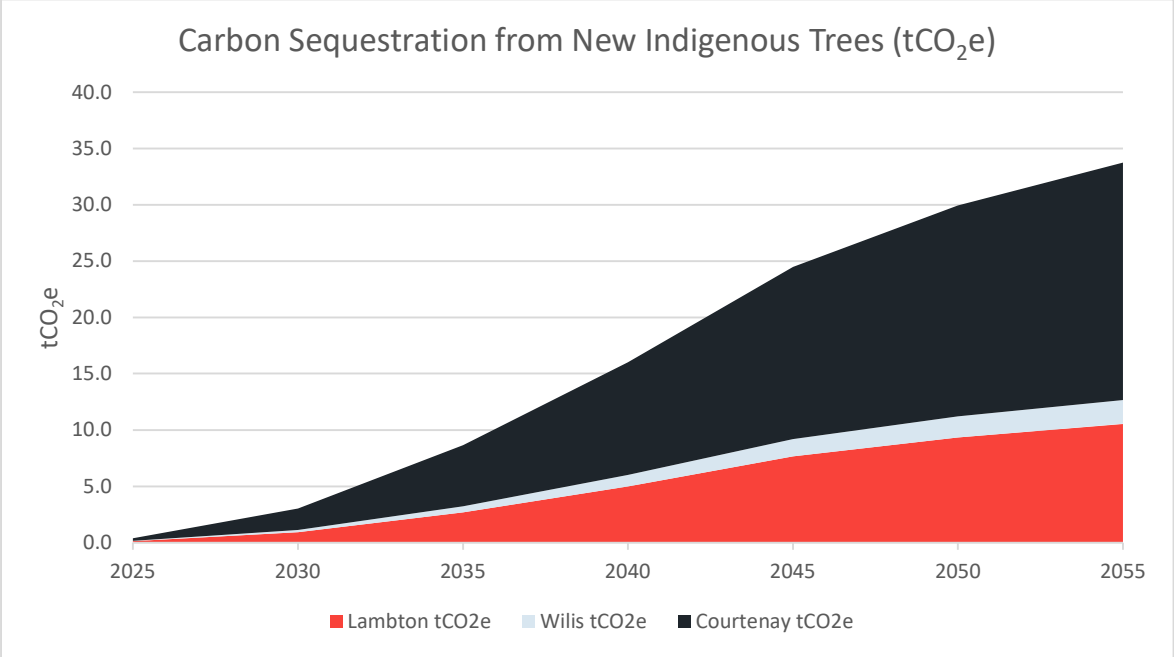

Figure 4. WOL Carbon Sequestration from new indigenous trees per 5 years (tCO_2e).

5 Next Steps

5.1 Low Carbon Optioneering

To reduce emissions in next phases, the Golden Mile project team should align with the PAS 2050:2011 carbon emissions reduction hierarchy. A workshop for low-carbon design should be completed at the beginning of the next project phase to identify opportunities, quantify the expected emission reductions, and the financial cost differential of each initiative. This will help the project team calculate and pursue the most optimal initiatives and opportunities.

PAS 2050:2011 carbon emissions reduction hierarchy:

1. **Build nothing:** evaluate the basic need for an asset and explore alternatives to achieve the set outcomes.
2. **Build less:** evaluate the potential for re-using / refurbishing existing assets to reduce the extent of new construction required.
3. **Build clever:** consider low carbon solutions, including technologies, materials and products, during construction, operation and usage e.g. SCM/ fly ash in all concrete mixes (ready mix and precast).
4. **Build efficiently:** minimise resource consumption during construction and operation

5.2 Strategic Opportunities

Given the rapid and comprehensive climate change and carbon emission policy, regulation, and legislation currently underway it is recommended that strategic and discrete actions are taken with a view to integrate them into the expected requirements from central government. To set Golden Mile up for success, the project should consider:

1. Continuing carbon management through next phases of this project, including:
    - (a) Detailed design workshop of low-carbon design initiatives opportunities to reduce emissions
    - (b) Track and embed low-carbon initiatives during design and alongside designers,
    - (c) Early engagement with construction partners to ensure low-carbon construction phase is secured through procurement, requirements and performance management e.g. through including low carbon outcomes in the design contract, construction contract and engaging in supplier forums,
    - (d) Measure the emissions reduced at the end of design, and

(e) Continue to track emissions through to the end of construction to ensure the projects performance is consistent with the region's ambitions and targets.

5 Set carbon reduction targets for the project.

(a) The international Science Based Targets Initiative (SBTI) is considered best practice guidance on setting carbon emission reduction targets to ensure a safe global climate and the Paris Agreement.
(b) SBTI broadly recommends all activities and projects deliver a 50% reduction in scope 1 and 2 emissions, and 30% reduction in scope 3 emissions.

6 Consider how the sustainability and carbon approach of Golden Mile might benefit existing and future projects as well as Te Atakura – First to Zero. This could include mapping how GHG emissions from infrastructure capex and opex influence:

(a) Community wide GHG reduction targets,
(b) Emissions reporting, tracking and management,
(c) Opportunities for a strategic approach to infrastructure GHG reductions,
(d) Specific actions to achieve reduction targets (such as revisions of long-term plans, capital programmes, design standards, and procurement processes),
(e) Incorporate climate change mitigation and adaptation throughout the city centre, potentially as part of the wider Let's Get Wellington Moving project, to reduce impact on the networks and key user spaces.

Key Assumptions and Inputs

Key Assumptions

- Utilising Climate Change Commissions Final Advice Demonstration Path, and considerations of potential changes against Headwinds and Tailwinds Scenarios.
- Assuming no Supplementary cementing materials (SCMs) has been included within concrete elements
- Materials are sourced locally, within 10km from the project site.
- Construction effort for fuel consumption (other than haulage, earthworks, milling and asphalt laying) during construction is 10% for material installation.
- Assume VKT reduction is constant over time

Data inputs

- 'Materiality Strategy' document provided by Boffa Miskell,
- Golden Miles traffic assessment
- Golden Miles bill of quantities.

Sources

- Climate Change Commissions Final Advice
- Measuring Emissions: Summary of Emission Factors 2020 | Ministry for the Environment
- Carbon sequestration potential of non-ETS land on farms (mpi.govt.nz)
- https://www.alliedconcrete.co.nz/assets/technical-resources/files/Sustainability/Allied-Concrete-Environment-Product-Declaration-2019.pdf?vid=4
- http://www.auslci.com.au/index.php/datasets/Materials