

Best Practice Sustainable Infrastructure Construction

Sarah Sutherland 2023, Submitted May 2024

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Introduction

In October 2023, the Churchill Fellowship enabled me to travel to Singapore, England, France, and Australia to connect and engage with sustainability leaders on high-performing major infrastructure projects, as well as industry and other leading organisations to understand factors that contribute to best practice sustainable infrastructure construction. The research objective was simple, observe and learn from some of the best, and then bring those ideas back to Aotearoa.

The countries visited were primarily selected for their depth of experience in delivering sustainability ratings on major infrastructure projects and therefore maturity of process around integrating sustainability effectively into a project (e.g., UK and Australia), something which is still in its infancy in New Zealand; their leadership in specific technical sustainability fields (e.g., Vinci/Exergy - France); or to provide a comparison to another industry sector (e.g., Singapore). Site visits included Ecopark South, High Speed 2 (HS2) sites in London and Birmingham, Thames Tideway Tunnel, Paris Olympics Athletes Village, Sydney Metro, and the North Western Program Alliance, involving engagements with over fifty sustainability professionals.

This report highlights common factors contributing to successful sustainability programs and outlines recommendations for the New Zealand construction industry to leverage these learnings.

Key Learnings

I encountered many passionate and inspiring sustainability leaders across various organizations and projects, all tackling similar sustainability challenges (Appendix A lists all projects visited and individuals interviewed). Broken down by main theme I have summarised the twelve most prevalent factors contributing to successful sustainability programmes on infrastructure construction projects:

Governance

- 1. Client Leadership and Bold Targets:** Client leadership is pivotal in shaping project outcomes. Clients who establish bold sustainability targets and mandates integrated into project requirements, provide a framework that guides the entire project lifecycle, empowering contractors to steer results at the project level. For instance, HS2's targets included achieving diesel-free sites by 2029. These bold targets foster innovation, encouraging contractors to explore innovative solutions and technologies that can help achieve these goals, and collaboration between the client and contractor as they work together on common sustainability objectives.
- 2. Senior Leadership Buy-In:** Successful sustainability outcomes require strong buy-in from senior leadership. Having a regular forum to engage with senior leaders on the big-ticket sustainability decisions, for example the Sustainability Steering Group seen on Skanska Costain STRABAG Joint Venture (SCS Railways), is pivotal for success. Including sustainability metrics in executive performance scorecards also sends a strong signal of commitment at the Project level, and motivates executives to take ownership of sustainability initiatives, drive progress towards sustainability goals and prioritise sustainability in decision making.
- 3. Economic Structures and Green Finance:** Projects like the Thames Tideway Tunnel in London used green finance mechanisms, such as sustainability-linked loans and green bonds, to fund their initiatives. These financial structures can incentivize sustainable practices and provide models for New Zealand projects.
- 4. Procurement Process Used to Leverage Sustainability Outcomes:** The procurement process is essential for achieving sustainability outcomes, signalling to the market to invest and innovate. Similar sustainable procurement frameworks were observed overseas to that developed on the City Rail Link Project in New Zealand. The workload associated with implementing such frameworks was a noted challenge, addressed by embedding sustainability supply chain managers within procurement teams, as seen in SCS Railways. Regular supply chain engagement events facilitated collaboration and knowledge sharing and mechanisms like the information packs used on HS2 help align the supply chain with project sustainability targets.
- 5. Focus and Investment in Training:** Projects overseas demonstrated a greater focus and investment in environmental and sustainability training compared to New Zealand, often providing targeted training for senior leaders on environmental risk and carbon literacy, as well as general environmental awareness and carbon awareness training for all staff. These programs could be replicated in New Zealand to raise awareness and encourage action within an employees' zone of influence. Projects often had specific training targets, ensuring a broad reach and impact. Supply chain training was also prioritised ensuring they have the capacity, capability, and competency to meet project targets and foster a legacy of green skills for future projects.
- 6. Industry Wide Knowledge Sharing of Best Practises:** Knowledge sharing was emphasized across projects, organizations, and globally to drive industry progress. Examples included HS2's Learning Legacy website, Tideway East's best practice case studies, Vinci's Environment Prize, and the Green Book for environmental best

practices. Incentivizing knowledge sharing through competitions was demonstrated as a successful approach which could be applied here.

- 7. Clients Investing in and Driving Innovation:** Clients play a crucial role in fostering innovation with most client organisations administering innovation funds to enable uptake of new and innovative approaches, often overcoming initial cost barriers.

Environmental and Social Aspects

- 8. Action to Decarbonise Construction is a Key Focus:** Decarbonizing construction is a critical focus area, involving fuel switching, using low/zero emission equipment, and adopting low carbon concrete. Key actions and considerations include:
 - Hydrotreated Vegetable Oil (HVO) is being successfully used in the UK as a diesel alternative, achieving near diesel-free operations due to affordable supply. While HVO is not available in New Zealand limiting its current applicability, it could be considered as a transitional fuel if it could be sourced sustainably at a reasonable cost in the future.
 - A framework to assess site-specific decarbonization efforts, such as the Decarbonising Construction Activities (DCA) framework utilized by SCS Railways in the UK, could be adapted for use in New Zealand considering local decarbonisation options.
 - Emission targets and low emission zones in cities like London incentivize the adoption of electric, hybrid, or hydrogen machinery. New Zealand might face similar pressures in the future. Successful trials of electric heavy construction equipment and hydrogen dual-fuel systems in the UK provide a basis for adoption in New Zealand. The high cost of low/zero emission machinery is a barrier without emissions standards. However, benefits like improved air quality and reduced noise should be factored into cost-benefit analyses. Client-held innovation funds have supported trials in the UK, a practice that would be of benefit in New Zealand to encourage the uptake of low/zero emission plant.
 - There is a strong focus on low/zero carbon concrete overseas; New Zealand can leverage these advancements. Overseas trials focus on the use of innovative concrete mixes in temporary works structures, to avoid extensive client approvals needed for permanent works. While zero-cement concrete has been demonstrated, it is not considered a smart option due to the limited availability of some Supplementary Cementitious Material (SCMs). New Zealand's limited supply of fly ash and Ground-Granulated Blast Furnace Slag (GGBS) necessitates exploring locally available SCMs like limestone filler and calcined clay or alternative locally available waste byproducts. Importing silica fume, used in small quantities to enhance durability, is another option.
- 9. Sustainable Transport and Beneficial Reuse of Excavated Material is a Priority:** Sustainable transport of materials delivers multiple benefits including reduced emissions, improved material movement efficiency, reduced road congestion, improved air quality, and increased safety. Developing sustainable transport solutions requires expertise in the field, beyond the environment/sustainability team's scope. Clients can mandate sustainable transport in procurement contracts and project specifications. Beneficial reuse options should be identified early, with dedicated

resources to implement solutions. Direct reuse and linking solutions to biodiversity legacy outcomes enhance impact.

- 10. Other Environmental Dimensions are Valued:** Nature-based solutions, aimed at boosting biodiversity, were an integral part of many projects visited. There is potential for New Zealand projects to give more consideration to our built structures, so they are serving a dual purpose, looking for opportunities to enhance biodiversity by providing nature-based solutions alongside hard civil engineering solutions. Leaving a lasting legacy and the desire to deliver wider sustainability benefits is a common mandate for large infrastructure projects across the world and in New Zealand, where the scale of the project presents a historic legacy opportunity. Quantifying social value through social return on investment can demonstrate the impact of legacy programs.

Other Matters of Importance to Drive Outcomes:

- 11. Resourcing Critical Roles:** Ensuring alignment of the sustainability team with the delivery structure is vital for effective integration. Combining site-based or area-based Environmental & Sustainability Advisors with technical leads focused on critical sustainability issues shows promise for achieving desired outcomes. However, in New Zealand, this approach may be feasible only for large-scale projects with adequate scope and budget. Additionally, engaging Subject Matter Experts (SMEs) within the contractor team offers potential for cost savings and deeper technical ownership.
- 12. The Emergence and Importance of Internal Tools:** The emergence of internal tools to drive and reward sustainable outcomes at the organizational level is notable. While not yet common in New Zealand, these tools offer a means for companies to achieve sustainability goals independently or in conjunction with existing rating frameworks, potentially providing significant benefits.

Universal challenges such as sustainability data management and a shortage of sustainability skills are evident globally, including in New Zealand. Key themes include:

- **Data Management Shift:** There is a need for a fundamental shift in how sustainability data is collected and managed. This entails supporting data management platforms that integrate with internal and external systems, allowing data capture at the source, and maximizing automation and artificial intelligence utilization.
- **Pathways into Construction:** Exploring alternative pathways into the construction sector is essential. This could involve industry collaboration with tertiary providers to establish apprenticeship programs aimed at attracting and retaining talent in the construction industry as observed on HS2.

Conclusions and Next Steps

Based on the extensive research conducted through this Fellowship, several critical insights have emerged. The report emphasizes common factors contributing to successful sustainability programs, spanning governance, environmental and social aspects, and resourcing critical roles. Key themes identified include client leadership in setting bold targets, senior leadership buy-in, innovative economic structures such as green finance, and the importance of sustainable procurement processes. Furthermore, the report highlights the

significance of industry-wide knowledge sharing, investment in training, and client-driven innovation to foster sustainability.

Environmental and social aspects, including decarbonizing construction, sustainable transport, and beneficial reuse of materials, are underscored as critical areas for improvement. Innovative approaches such as the use of low/zero emission equipment and advanced concrete technologies offer promising avenues for advancement. Additionally, the importance of nature-based solutions and quantifying social value to leave a lasting legacy are highlighted as integral components of sustainable infrastructure projects.

The report also highlights universal challenges such as sustainability data management and the shortage of sustainability skills, advocating for a fundamental shift in data management practices and exploring alternative pathways into the construction sector.

The insights gathered from this Fellowship present a unique opportunity for the New Zealand construction industry to drive meaningful change. By leveraging these learnings there is an opportunity for the industry to enhance the success of sustainability programs and improve project outcomes across the country.

To implement the findings from this fellowship, I plan to undertake the following actions:

1. **Advocacy and Awareness:** Sharing the insights and success stories from the fellowship through presentations and workshops within Downer Group and at industry conferences to inspire other projects to adopt similar practices. This will include a presentation at the annual Infrastructure Sustainability Conference in Auckland on 20 June 2024, as well as many other engagement opportunities.
2. **Partnerships and Collaboration:** Establish partnerships with key stakeholders, including clients, suppliers, and industry bodies, to drive collaborative efforts towards sustainability. Engaging with a broader network can enhance resource sharing and collective impact.
3. **Pilot Projects:** Initiate pilot projects within Downer Group that incorporate the best practices observed during the fellowship. These will serve as models for broader implementation and provide practical examples of sustainability in action.

By taking these steps, I aim to drive meaningful change within the New Zealand construction industry, improving the success of sustainability programmes and the quality of the outcomes on projects across Aotearoa.

Appendix A: Fellowship Itinerary

Table 1 List of sites and persons visited and interviewed for this research Fellowship in September-October 2023.

Date	Person		Role	Organisation/Project
29-Sep-23	Gerald Ng	Meeting	Vice President Sustainability	Changi Airport Group
29-Sep-23	Rachel Hill	Online Meeting	Environmental consultant for SV3	Old Oak Common Station HS2
2-Oct-23	Amirul Islam	Site Visit	Sustainability Manager, Vinci Construction UK	Ecopark South, Waste to Energy Plant
	Sihaam Ahmed		Environmental Advisor Taylor Woodrow	
3-Oct-23	Lauren Arnott	Site Visit	Environmental Advisor	SCS Railways, Victoria Road Crossover Box Site, Area Central
3-Oct-23	Joseph de la Fuente	Site Visit	Senior Environmental Advisor	SCS Railways, Atlas Road Site, Area Central
3-Oct-23	Samantha Freelove	Meeting	Legacy & Sustainability Manager	Thames Tideway Tunnel
3-Oct-23	Grace McCormack	Meeting	Sustainability Consultant, Jacobs	Transpennine Route Upgrade Project
3-Oct-23	Pallab Chatterjee	Meeting	Principal Consultant (Sustainable Design and Construction Management, Jacobs)	High Speed 2 Project
	James Langstraat		Senior Associate Director, Sustainable Infrastructure, Jacobs	
4-Oct-23	Geri Badura	Meeting	Environment & Sustainability Director	SCS Railways
4-Oct-23	Anna Fish	Site Visit	Senior Environmental Advisor	SCS Railways, Euston
5-Oct-23	Matthew Gardiner	Site Visit	Environmental Manager	Tideway East, Chambers Wharf
6-Oct-23	Papa-Samba Drame & team	Meeting	Head of Environment & Sustainability Design	BBVJV HS2 Project
6-Oct-23	Papa-Samba Drame	Site Visit	Head of Environment & Sustainability Design	BBVJV HS2 Project Sublot 4 & 5
9-Oct-23	Cédric Ruelland,	Meeting	QSE Manager	Vinci Construction
10-Oct-23	Laurene Pietri	Meeting	Environmental Engineer	Vinci Construction Grand Projets
10-Oct-23	Ariyada Souvanlasy	Meeting	Environmental Project Manager	Vinci Construction
11-Oct-23	Ariyada Souvanlasy	Site Visit	Environmental Project Manager, Vinci Construction	Paris Olympics Village
	Karen Bernard		Environmental Manager, Vinci Construction	
12-Oct-23	Mouna Boumaaza	Meeting	Concrete technologist	Vinci Construction Grands Projets
12-Oct-23	Cyriane Fournier	Meeting	Research, Development & Innovation Manager	Vinci Construction Grands Projets

	Bruno Daunay		AI Lead at Leonard	
12-Oct-23	Ian Nicholson	Online Meeting	Senior Sustainability Leader Stantec & Value Delivery Lead for Construction Innovation Hub	Construction Innovation Hub
16-Oct-23	Meg Wrixon	Meeting	CPB Contractors	Western Sydney Airport
	Albert Ng			Warringah freeway upgrade project
17-Oct-23	James Stevens	Site Visit	Senior Associate Sustainability Consultant	Sydney Metro, Central Station
	Alyssa Staney		Project Sustainability Manager, Laing O'Rourke	
17-Oct-23	James Stevens	Online Meeting	Senior Associate Sustainability Consultant	Sydney Metro/CRL knowledge share session
	Jo Haggerty		Associate Director Sustainability	
19-Oct-23	Viv Heslop	Meeting	Manager, Sustainability Culture + Strategy, Spark NEL D&C	Knowledge share session between CRL, NELP, and Suburban Rail Loop
	Rachael Lee		Sustainability Director, North East Link Tunnels Package: Spark D&C	
	Ross Brookshaw		Sustainability Manager, Acciona	
	Sarah Reid		Principal Advisor – Sustainability, Suburban Rail Loop Authority	
	Rob D Harper		Senior Sustainability Advisor, North East Link Program	
	Steph Rich		Climate Change and Strategic Sustainability Specialist, John Holland Group	
	Julia Rodgerson		Sustainability Advisor at SPARK Consortium - North East Link	
	Lucy Whalen		Senior Sustainability Advisor, Webuild	
	Jessamine Welsh		Senior Sustainability Advisor, Spark North East Link Tunnels D&C	
	Jo McArdle		Spark-DC Health, Safety & Wellbeing Director at Webuild	
20-10-23	Fiona Bowie		Director Transformation and Sustainability, John Holland Group	LXRP North Western Program Alliance, Preston Station/Bell Station