ZOFNASS PROGRAM
FOR SUSTAINABLE INFRASTRUCTURE

Making the Business Case for Planning Sustainable Infrastructure

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Research Hypothesis

Sustainable projects have a higher **risk-adjusted return on investment (ROI)**

Research Questions

1. Does it make business sense to plan sustainable infrastructure for (a) the owner and (b) the financiers?
2. Can we quantify the direct financial benefits of sustainable infrastructure?

Establish a Common Base

1. What constitutes sustainable infrastructure in our research?

   for both completed projects and projects considered for initiation

   - **Envision rated**, or self-assessed according to **Envision**
   - with distinct sustainable features, **clearly identifiable** and **simple to communicate**.

2. How financial benefits are measured?

   - **Direct** revenues and direct costs **to the project owner**
   - Revenues and costs **during the lifecycle of the project**
   - **Upfront costs** (critical for initiating the project)

Note: Project-based externalities (external benefits and external costs) will be not used for the financial analysis of the project. However, we will document the externalities of each project.

Establish a common base

3. Itemize and quantify the financial benefits of the sustainability features

- The financial **benefits and costs will be linked** to each distinct **sustainable feature of the project.**
- They will be **compared to a baseline of common practice**.
- Often sustainability features of a project provide “the license to operate.” When a project would not happen otherwise, we will consider the entire benefit of the project due to sustainability.

Research steps

1. **Part I**: Literature review
2. **Part II**: Establish the hypotheses why planning sustainable infrastructure makes a financially sound business decision
3. **Part III**: Field research to prove the hypotheses based on
   - interviews and
   - case studies of projects

Part I – Literature review

- The literature review summarizes prior research.
- It provides the context for a financial frame-of-reference
- Determines the knowledge gap.

Part I – Literature review

Classification of Resources

1. per **main stream of research**

- **Theoretical studies**
- **Empirical/Descriptive studies**

2. per type of **source**

- Academic sector
- Development banks
- Investors – insurers
- Infrastructure operators
- Contractors
- Commercial banks
- Non-profit organizations
- Government agencies
- Engineers/designers

3. per **main theme**

- Corporate Sustainability
- Infrastructure Investment
- Cost-benefit Measuring Methods
- Systemic Approach
- Infrastructure-type Specific
- Innovative Approaches
- Determinants of Direct Cost

The most relevant observations/findings of the Literature Review are organized and presented **in thematic groups**

Part II – Why planning sustainable infrastructure makes a financially sound business decision

- Based on the **literature review** and the **collective expertise** of the researchers and the advisors of the Zofnass Program:
  - we have identified potential reasons on **why planning sustainable infrastructure makes a financially sound business decision.**
  - we have adopted a **strawman approach** based on our own experiences and observations.
  - the field research will enrich our initial assumptions with findings, **either validating** or **abandoning** elements of the strawman approach.

The Strawman Approach

Sustainable infrastructure makes business sense because of:

1. Regulations
2. Project-level optimization
3. Portfolio/System-level optimization
4. External Market Forces
5. Broader Societal Benefits

1. Because of Regulations

I. Regulations require sustainable infrastructure (similar case with the GSA requiring LEED certification for buildings)

II. Sustainable infrastructure has a higher profit margin due to regulations

III. Sustainable infrastructure has reduced risk for facing restrictive regulations in the future

IV. Sustainable infrastructure will look at possible regulatory conflicts in advance in order to minimize conflicts and improve efficiency

2. Because of Project-level Optimization

I. A less expensive approach to the infrastructure is selected, solving the same need, "doing the right project, not the project right".

II. The lifecycle costing of sustainable infrastructure is less because it requires less operational expenses (true only for infrastructure projects that have significant operating expenses).

III. Technology systems can be optimized through a life-cycle approach, so the owner can buy upfront only the capacity the project needs, without over-spending or limiting expansion.

IV. Sustainable infrastructure will include a plan for dismantling and decommissioning avoiding unexpected costs and overruns during the end life of the infrastructure projects.

3. Because of Portfolio/System-level Optimization

I. System level sustainability consumes less, so there is less demand of infrastructure, thus **the cost of installing and operating the infrastructure is lower**

II. creation of systems synergies not just at the project level, but also with other projects located nearby. **Close collaboration with other entities can reduce the cost of the materials used on the site as well as the transportation cost**

III. Owners with several infrastructure assets can **optimize performance** and **reduce/ consolidate** number of operating assets with a system-level approach to sustainable infrastructure

4. Because of External Market Forces

I. SI is also resilient, so it should **require less insurance premiums** and will have less risk to be destroyed and be rebuilt.

II. SI should provide **better risk-adjusted returns** and hence lower cost of capital.

III. SI should **increase access to capital**, with impact-defined capital sources (pension fund or large asset managers)

IV. SI can **provide alternative sources of capital**, eg green bonds, philanthropy, blended approaches.

V. There is a **reduced risk of community opposition**

VI. Sustainability **increases the market value of the company**, because it does the "right thing"

VII. SI often times requires **innovative solutions**, which may provide more efficient outcomes at a lower cost.

5. Because of Broader Societal Benefits

I. Generates innovation, which can create jobs and in general is required for an ongoing concern..

II. Political benefits by helping governments meet the Paris agreement and SDG commitments.

III. Helps reduce or mitigate negative externalities (health care costs and environmental damage) and increase positive externalities.

IV. Promote early on collaboration from all the different stakeholders in a systematic way (conflict reduction).

Part III – Field Research and Case studies

Case studies under development with the active participation of SIAB.

1. **The Mississippi Bridge, Route 84 (HNTB)**
2. **Low Level Road, Vancouver Canada (Stantec)**
3. **AlexRenew. Alexandria, Virginia (CH2M, now Jacobs)**
4. **Sun Valley, Los Angeles (CDM Smith)**
5. Fort Tilden Resiliency Project, New York (Louis Berger)
6. Solar Microgrid Project, Puerto Rico (Louis Berger)
7. Automated Vehicles (HNTB)
8. Columbus Smart City EV Charging Stations (HNTB)
9. Pedestrian Bridge (NYC-DDC)
10. Cross Rail London (Bentley)
11. Pats Plaza (LA Metro)
12. Metro Red/Purple Line Maintenance Yard (Division 20) (LA Metro)
13. Water conservation project (NV5)
14. Waste-to-energy project (Louis Berger)
15. Energy transmission project (Power Engineers)
16. Natural infrastructure project (The Nature Conservancy)

The Mississippi Bridge, Route 84

Project Name:	US 84 Mississippi River Bridge (Natchez-Vidalia Bridge)
Sustainability Savings:	Over $245 million savings Project cost $3.8 million, compared to at least $250 million cost for a new bridge
Project Type:	Bridge repair
Location:	Natchez (MS) & Vidalia (LA)
Area / Length:	527,616 ft^2 / 3,664 ft
Capacity:	2014 average daily traffic = 23,000 Two 12 ft lanes with no shoulder
Owner / Client :	Mississippi Department of Transportation (MDOT) & Louisiana Department of Transportation and Development (LADOTD); MDOT is the lead agency
Project Team:	Contractor: CEC, Inc
	Engineer/Designer: HNTB
	Facility/Project Manager: James Gregg, HNTB
	Consultants: HNTB
Project Lifespan	40-year extension
Current Status:	Complete
Funding model:	Traditional
Delivery Method:	Design–bid–build
Overall investment cost:	$3,562,676 (1940) $3.8 million (2014 rehab)
Design & Construction cost:	$5 million
O&M cost:	$500,000 per year
Source of funding:	Funded by state and federal gas taxes

The Mississippi Bridge, Route 84

- The US 84 Mississippi River Bridge rehabilitation project stands out as an example of how “doing the right project”
- $3.8 million upgrade vs. $250 million new bridge
- Avoided disturbance of the river ecosystem and resources consumption.
- Strong team collaboration during the project (client and consultant)
- Clear risk identification
- correlation between sustainability and useful lifetime.
- The application of Envision® at an early stage would have given the project team a holistic perspective, further improving the sustainable performance of the project

The Mississippi Bridge, Route 84

“The US 84 Mississippi River Bridge project has established a precedent for repairing truss bridges and overturns the prevailing notion that bridges of that type and age should be replaced with new ones, thus saving millions of taxpayers’ dollars”

Low Level Road Project, Port Metro Vancouver by Stantec Consulting Ltd.

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PROJECT OVERVIEW

Case study :	**Low Level Road Project**
Infrastructure type:	Rail, Vehicle & Pedestrian Improvements for safety / congestion reduction / increase port capacity
Location:	Port Metro Vancouver, British Columbia
Sustainability	2015 - ENVISION® (Platinum Award, Score 56%)
Area:	5 km
Capacity:	2.2 km of roadway improvements 1 new overpass 3 at-grade intersections reconfiguration 4m wide pedestrian steel tied-arch bridge 5 km of cyclist lanes over 2 km to the multi-use Spirit Trail new pedestrian connections a 15 m span timber beam bridge with staircases
Owner / Client :	City of North Vancouver & Port Metro Vancouver (lead)
Project Team:	Principal technical design consultant: Stantec Consulting, Ltd. Times and materials (T&M) contractor: B&B Heavy Civil Construction Ltd. Construction manager (CMa): MMM Group
Project duration:	2011 - 2014
Current Status:	Operating
Funding model (CAN):	1. Government of Canada: $49.4 million 2. Port Metro Vancouver: $31.6 million 3. Canadian National Railway: $10 million 4. Translink: $5 million 5. Canadian Pacific Railway: $4.8 million 6. City of North Vancouver:$800,000
Overall	CAN$101.6 million

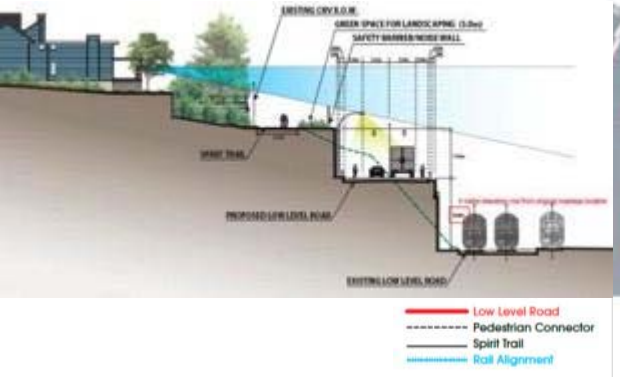
Low Level Road Project, Port Metro Vancouver by Stantec Consulting Ltd.

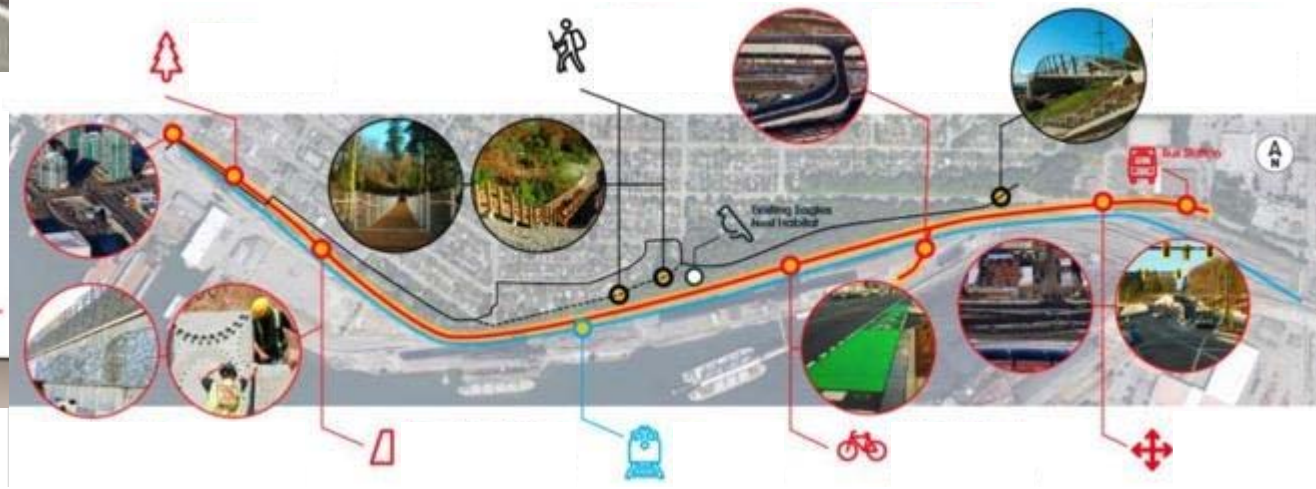
Project Key Characteristics

- **Funding came from 6 sources.**
Main funders: Government of Canada & Port Metro Vancouver

- **Economic benefits:** 224 work-years were created during the design and construction, extra cargo capacity, national forestry, mining, and agriculture sectors will be able to export more products. From 25,996 direct and indirect jobs and CAN$1.68 billion in GDP in 2007, to 30,823 direct and indirect jobs and CAN$2 billion in GDP by 2020.

- 1st design proposal (2008) was rejected by the City Council despite its commercial urgency. **Working with local residents and port terminal operators**, the final design met both the Port's and the City's requirements and was approved (2012).





Nutrient Management Facility, AlexRenew by CH2M

PROJECT OVERVIEW	
Infrastructure type:	Wastewater
Location:	Alexandria, Virginia
Sustainability Rating Tool:	ENVISION® (Platinum Award, Score 56%)
Capacity:	18 million gallons of flow
Owner / Client :	Alex Renew Enterprises
Project Team:	Design/Engineering: CH2M Hill Construction contractor: Clark Civil and Ulliman Schutte Construction (joint venture Clark/US, LLC) Construction manager at Risk (CMAR): Clark/US Owner's representative: Jacobs Engineering
Project duration :	-
Current Status:	Operating
Funding model:	Private, Grant from the Department of Environmental Quality that covered 28.94%
Delivery Method:	CMAR (Construction Manager at Risk)?
Overall investment cost:	-
Design &	-

Sun Valley Watershed, LA County
by MWH Global as general consultant

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PROJECT OVERVIEW

Infrastructure	Inland Waterways - Storm water management
Location:	San Fernando Valley, Los Angeles County, CA USA
Sustainability Rating Tool:	2014 - ENVISION® (Platinum Award, Score 67%)
Area:	2,800 acres
Capacity:	
Owner / Client :	LA County Department of Public Works, LA Flood Control District (lead agency)
Project Team:	General consultant: MWH Global General manager: LA County Department of Public Works Sun Valley Watershed Stakeholder Group (local and federal agencies, government offices, environmental groups, local businesses, conservation agencies and residents of the community)
Project duration :	2004 - today
Current Status:	4 subprojects - operating 2 subprojects - final design 2 subprojects – conceptual design 6 subprojects – concept phase
Funding model:	Public: Flood Control District of the County • U.S. Bureau of Reclamation • California Department of Water Resources • County of Los Angeles Department of Public Works• Metropolitan Water District of California • Water Replenishment District of Southern California
Overall investment	$137 Million (Projected Total Cost)

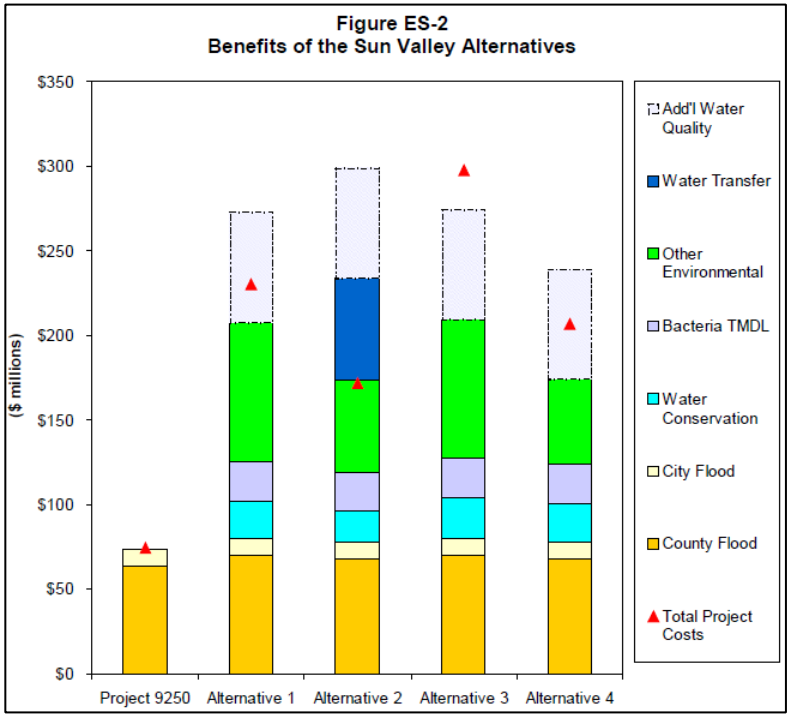
Sun Valley Watershed, LA County
by MWH Global as General Consultant

Project Key Characteristics

Table ES-1
Benefit/Cost Ratio for Each Alternative

	Alternative				
	9250	1	2	3	4
Present Value of All Benefits (in $ million)	$73.44	$270.47	$296.39	$274.93	$239.95
Present Value of Capital and O&M Costs (in $ million)	$74.46	$230.40	$171.58	$297.90	$206.61
Benefit/Cost Ratio	0.99	1.17	1.72	0.92	1.16

Figure ES-2
Benefits of the Sun Valley Alternatives



- **Highly urbanized project area**

- **Group of Stakeholders** that consists of local and federal agencies, government offices, environmental groups, local businesses, conservation agencies and residents of the community.

- **15 pilot projects** (10 planned, 8 awarded, 4 operating)

- Planning process based on the **development and evaluation of alternatives** in order to select a **final set of cost-effective solutions** from the range of potential solutions available.
The final set was **4 feasible sample alternatives.**

- **Extensive input from the community and other stakeholders**

- By preventing flooding in the areas surrounding the basin, the project **eliminates substantial damage repair costs.** More efficient water management and capture techniques also ensures water security for the area and **lowers the cost of water for the community.**

Thank you!