

CESTiCC

Sustainable Construction in Remote Cold Regions

Robert A. Perkins, P.E., PhD, and
F. Lawrence Bennett, P.E., PhD

Project Progress Update

16 June 2015

- “Sustainable Construction in Remote Cold Regions: Methods and Knowledge Transfer”
- Introduction
- Work to date
- Work in Progress
- Input needed

“Sustainable”

- Current buzz word
 - Many definitions
 - 211,000,000 Google hits
 - All revolve around the importance of creating and maintaining conditions under which human and natural needs can be met both in the present and in the future.
- “A sustainable society is one that can persist over generations, one that is far-seeing enough, flexible enough, and wise enough not to undermine either its physical or its social systems of support” (Meadows et al, 1992).
- “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission on Environment and Development, quoted in Burrow et al, 2013).

Three Dimensions

- Three dimensions : the economy, the environment and society.
- ASCE Strategic priority (<http://www.asce.org/sustainability/>)
- Sustainability is achieved only when there is a balance among those three aspects, implying the need, often, for tradeoffs and compromise among the three. Burrow (2013)
- Typically, the term is used to refer to a project life-cycle as a whole

Sustainable Construction

- A sustainable construction project would be one for which there is a balance among present and future needs.
- For this project we confine our consideration to environmental sustainability while recognizing the importance of the other two aspects, since they become more important later in the projects life-cycle.
- Sustainable construction involves “creating construction items using best-practice clean and resource-efficient techniques from the extraction of the raw materials to the demolition and disposal of its components.” (Yates, 2014)
- Here we focus on environmentally responsible methods for conducting field construction and maintenance operations in remote cold regions.

- Sustainable, or “green,” construction has been an essential part of the building (vertical) construction process for many decades. The contemporary interest in such practices arose in the 1970’s when rapid increases in world oil prices instigated improvements in building energy efficiency. Furthermore, the environmental movement that began in the 1960’s and 70’s spurred the development of environmentally friendly and energy efficient buildings and other structures (EPA 2014).

Research Realities

- A review of the literature of sustainable construction reveals two important realities about the work accomplished to date (see, for example Clemente 2007, U.S. Green Building Council 2014, Santos et al 2007, Institute for Sustainable Infrastructure 2014).
- First, “sustainable construction” embraces all phases of the project life cycle, from early planning to operations, maintenance and even decommissioning, but the greatest emphasis has been on the design and material specification aspects of the project development process.
- Second, the emphasis to date has been on buildings and other such structures (“vertical” construction), with much less consideration of such practices in heavy construction (“horizontal” construction), such as roadways, pipelines, boardwalks, and airfields.

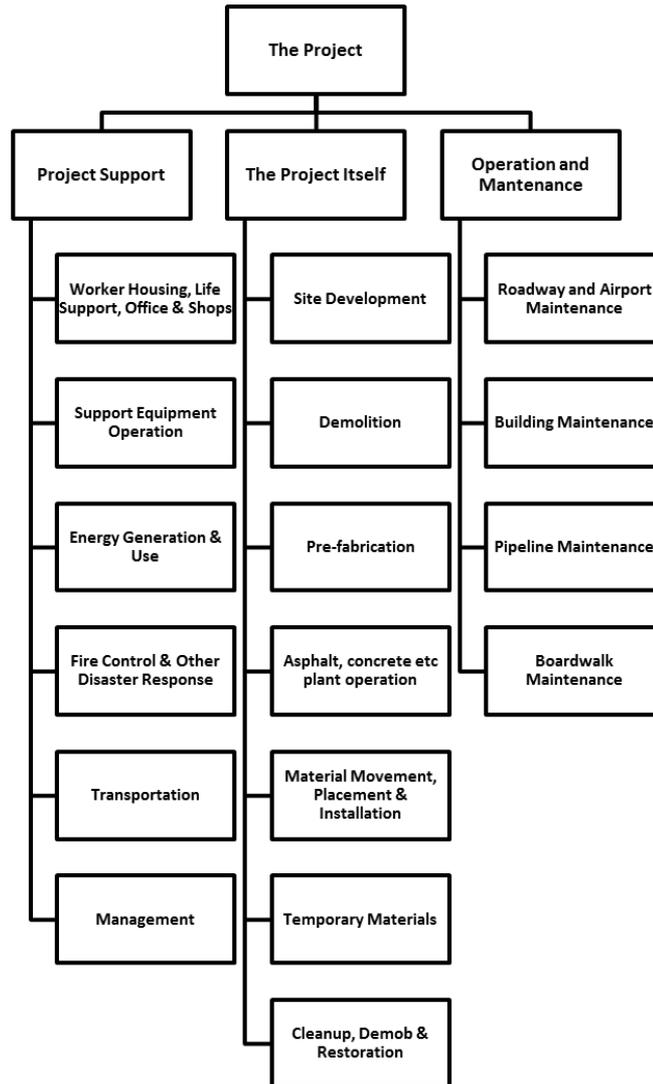
Cold Regions

- There is a need, especially in remote cold regions such as rural Alaska, for a compilation of guidelines to assist construction contractors in conducting their operations in environmentally responsible ways. Since a large proportion of construction efforts in such areas develop horizontal projects, it is for this kind of work that such guidelines will be most helpful. Our purpose is:
- Identify and codify practical environmentally sustainable construction practices for use by contractors operating in remote cold regions, and
- Convey the findings in useful form to those who can use them.

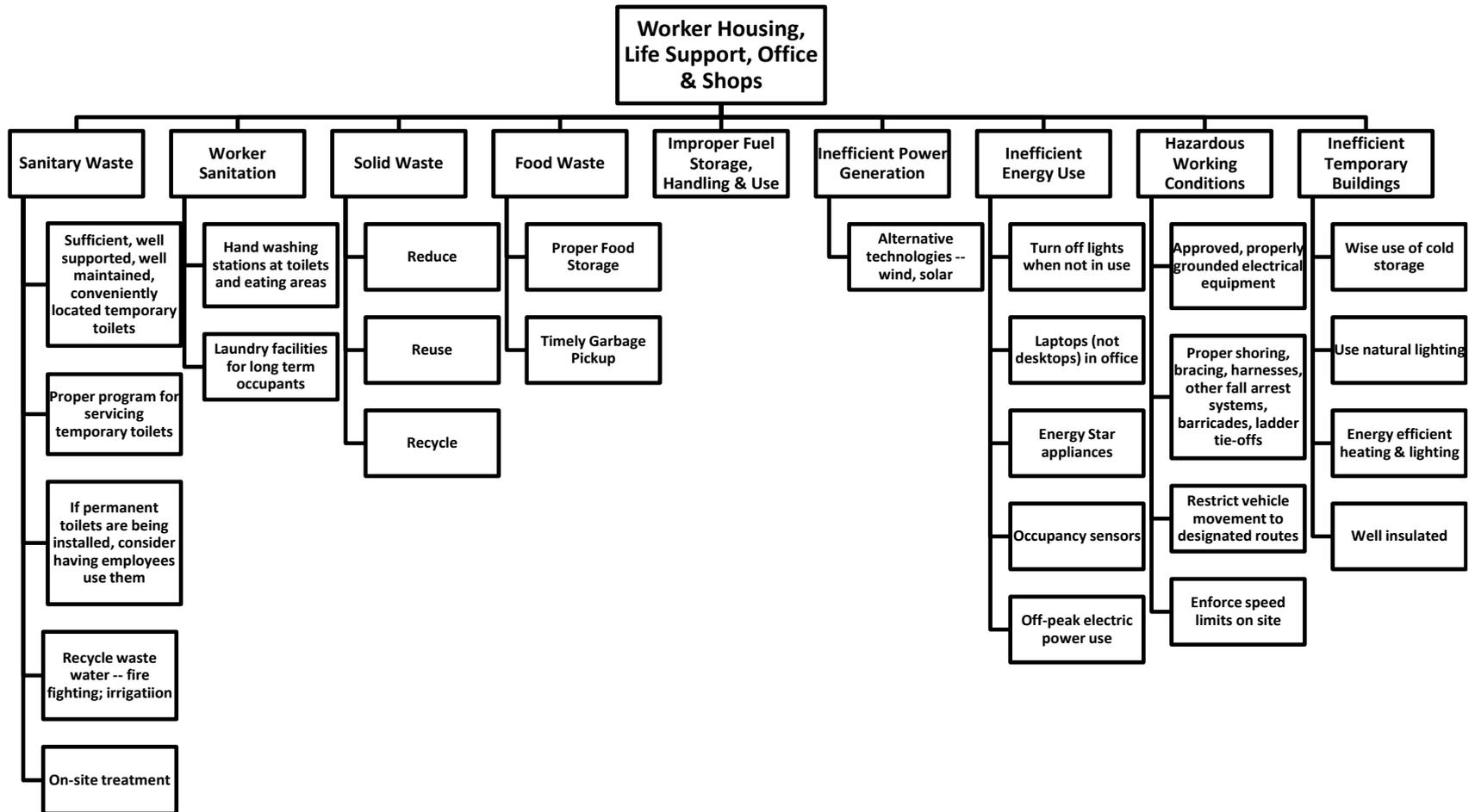
Outline and Status

- Literature search
 - Complete
 - Identified likely issues
- Taxonomy
 - Sorted myriad of issues into logical categories
 - Keyed to construction activities
 - Example, environmental impacts
 - Sources of impact
 - Methods to mitigate impact
- CESTiCC conference paper
- Now we have handle on issues
 - Based on literature

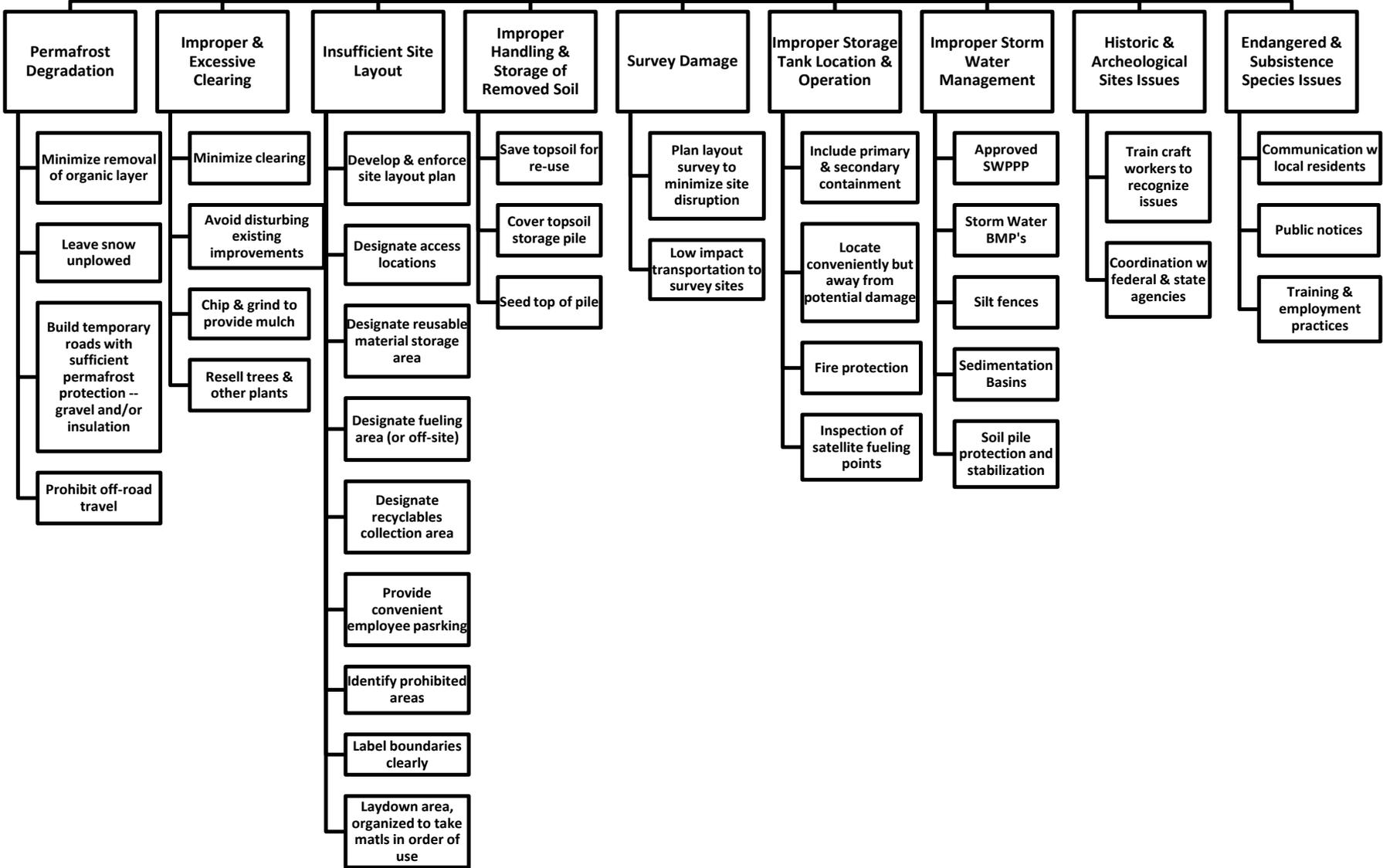
Examples of main rubrics:



Impacts and Mitigation – Examples from Taxonomy



Site Development



Expert Interviews

- Completed 22 interviews
 - Fairbanks, Anchorage,
 - Contractors, agency, environmental consultants
- Summarized by interview
- Topic
 - E.g. Solid waste, or air pollution
- Refined with respect to taxonomy

Example Interview Summary for Clearing

Clearing

Smyth

- Minimize cleared area, especially in permafrost area
- Might use organics from cleared area to protect disturbed areas.

Ganley

- Unless this is done when ground is frozen, this is a permit issue. This is a “ground disturbing activity” and must be done by hand with no wheeled vehicles unless frozen. A seasonality consideration.
- Might leave cut trees and brush in place – minimize erosion; quicker regrowth.
- Chipping and using for mulch is a re-use example.
- Over a certain size (4” maybe 6”—not practical to chip) – their spec requires decking. Can then be made available locally.

Peterson/Packee

- No permit required if you don’t disturb existing root mass.
- Try to use existing pad rather than more clearing.

Vezey

- Better done in winter; and/or phased construction.
- If you chip clearing debris, in some cases you might bury it in deep fill. Then cover it. In some cases, the result is sufficiently structurally stable.

Buteyn

- Ref: Tok project by State Forestry
 - Cleared dead trees from wildfire
 - Made available to locals for firewood
 - Good PR

May/Dobberpuhl

- Avoid too much working in woods
- Mow and mulch
 - Use as a cover material
 - Permafrost protector
- Example: Eielson AFB project
 - All unsalable timber was chipped and used as insulation
 - 3’ thick; enzymes cause temperature rise. > 32 °F when air is very cold

Trivette

- Often dictated by specs
- Salvage trees greater than 6-8"; yard them up and make them available locally
- Hydro-ax the smaller stuff.
- Don't disturb until ready to start work.
- This is another seasonality issue – work on frozen ground if possible.

Mears

- Minimize footprint

Travis

- Use debris as mulch
- Make firewood available to community

Alyeska Manual

- Select the appropriate time of year for the project. By conducting work in winter, for example, the ground surface and vegetation can be more easily protected in its frozen condition.
- The appropriate type of equipment must be used so that impacts are minimized. Smaller equipment that can be better maneuvered or equipment that uses low impact wheels or tracks can significantly reduce impacts.
- Hand tools, rather than heavy equipment, should be used as much as possible when working in sensitive areas. Sensitive areas include wetlands, stream banks, alpine or arctic tundra, areas underlain by permafrost, or other areas of high ecological value that are slow to recover or difficult to rehabilitate.
- Use of tundra mats, Duramats, or snow/ice roads to protect the ground surface can reduce the expense of building temporary or permanent gravel access roads while allowing for quicker restoration of underlying vegetation.
- Use snow machines, tuckers, and other low-impact vehicles only after the ground surface is sufficiently frozen and covered with enough deep snow.
- Preplanning of equipment access points, traffic flow in the work area, and incorporation of site-specific features into work plans can minimize the footprint of a project.
- Use of trails, winter roads, or other existing access routes can significantly reduce impacts.
- Careful selection of staging areas, areas for dewatering basins, and work areas can minimize vegetation impacts.

Review

1. Reviewed the available literature to determine likely issues/impacts and mitigation
2. Little about cold regions, although authors added some from their experience
3. Used the info from above to plan interviews with experts
4. Derived from experts some new ideas and specifics on our original thoughts

Now What?

- Refine and disseminate
- Develop guidelines
- Transfer methods to those who conduct construction operations in the north
- Examine practicality of such techniques for use in remote and harsh environments by rural residents.

For Whom?

- Contractors
- Owners and designers
 - Specifications
 - Issues
- Practicality
 - Cost
 - Schedule

Special Issues

- Transportation
- Seasonality
- Logistics
- Labor
- Rural Residents
 - Community relations
 - Local hire

Venues for Guidelines

- Pamphlets
- Presentations
- [Your input]

Presenting Results

- Current Status
 - Raw data
 - Could benefit from input from users
- Organize by Impact Topics
 - Air pollution, etc.?
 - [input from audience]

Example Guideline Presentation – Permafrost Protection

- Minimize clearing to maintain shade
 - Design and specification issue
 - Contractor's camps and laydown areas
- Well engineered temporary roads and pads
 - Sufficient thickness, insulation maybe
 - Demobilization
 - Leave it?
 - Seasonality
- Snow removal and handling

Cogitation

- In progress
- Good start on organization, but some topics and mitigations overlap
- Need more comments and inputs to finalize

Guidelines

- What do you believe will be effective dissemination tools?
- Booklet, pdf
 - Basic document surely needed.
 - [Ask audience]
- Task 7 of contract:
 - Design an outreach course for use with rural Alaskan construction personnel that sets forth suggested practical sustainable construction methodologies perhaps a manual or teaching

Venues?

- Ideas?
- Seminar?
 - Length
 - Location

Possible Seminar Sponsors

- AGC
- DOT PF
- Soldotna
- DEC
- Others??

Arrangements

- Expenses?
- Venue
- Attendees
 - Video Conference
 - A, F, J, Rural?
- Publicity and Advertising

Tentative Agenda

- [for your comments]
- Introduction
- Need
 - Just because others are doing?
 - Benefits for Alaska
 - Don't know, so we find out
- Overview of Project
- Contractor case studies
- Tentative Guidelines

- Invited speakers to guidelines and audience Critiques
 - On topics
 - Wildlife
 - Dust
 - Solid waste
 - Permafrost

Board Comments

- List of CESTiCC emailing list.
- Newsletter
- List from L & B of people's names for email list
- Work with local organizing committee
 - Construction session – panel
- Webinar, restarts September
 - 1 hour
- Vs. One day workshop
- Tribal Assistance one day in fall?
- eNews Letter, research spotlight