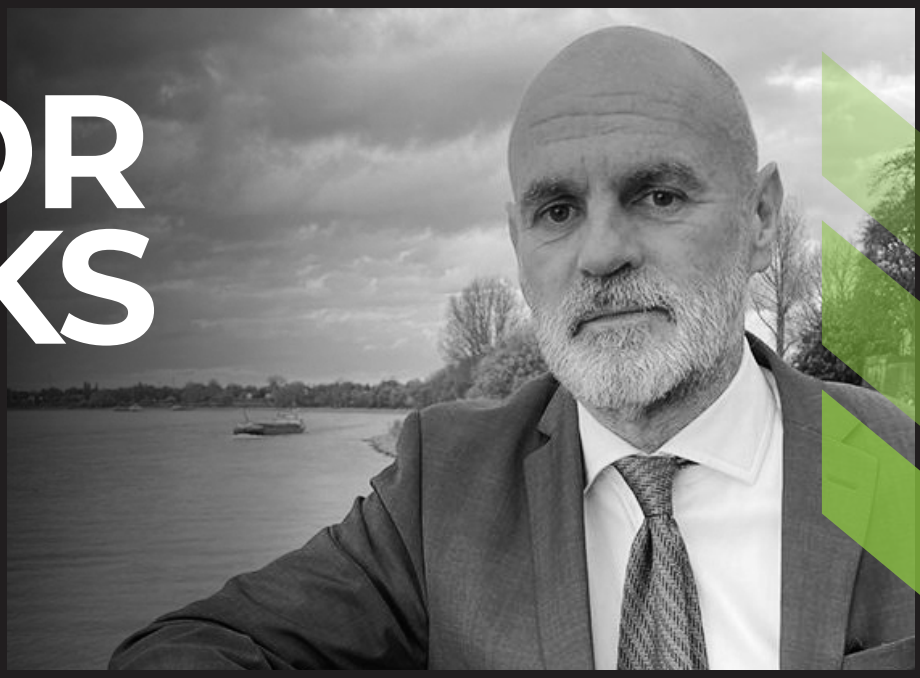
TITAN

Q&A DOCUMENT

SUSTAINABILITY & CLIMATE CHANGE

Trends in Infrastructure Construction

TREVOR SPARKS



Global Vice President, Tailings, Water and Environmental Management, Mining and Metallurgy, SNC-Lavalin

TOPIC

The Impact of Raw Materials: What the mining industry is doing to make critical raw materials more sustainable?

What roles do different levels of government bodies play in shaping pro-environmental attitudes?

Much of the leadership on environmental custodianship within the mining and minerals sector is shaped by the investment community, in parallel to government bodies.

- To focus for a moment on Tailings Management – "...[the] Church of England Pensions Board and the Council on Ethics of the Swedish National Pension Funds have written to over 350 mining companies on behalf of investors with $21 trillion in assets under management (AUM), asking them to confirm on their company websites their support for the Standard and to set out a timeline for their intended compliance with it. Take-up at the company level of the Standard beyond the largest mining companies will be key to its success." Partnership to Support the Global Tailings Standard | The Church of England

Organizations such as the Mining Association of Canada with the Towards Sustainable Mining (TSM) standard and the ICMM are a key part of the agenda and provide fantastic frameworks and educational resources.

- ICMM - Our Story
- Towards Sustainable Mining - The Mining Association of Canada

Regarding Government bodies, they play their crucial role in standards and enforcement tailored to their locations, climate, and communities.

Different levels of government bodies can play important roles in shaping pro-environmental attitudes by providing leadership, enacting policies, and regulations, supporting research and development, and engaging with communities and stakeholders to promote sustainable practices and protect the environment.

As a geotechnical engineer, what are some key areas key decarbonization areas of a mining operation we can focus on?

This is a topic that warrants a very long discussion, but a few points that we did not touch upon during the roundtable:

- Finding a purpose for any mine waste or tailings. If Iron tailings have the right properties to be used as aggregate in construction or roads then their use will eliminate the GHG emissions (at least Scope 1 and 2) from any aggregates that would otherwise be used.
- Catherine touched on this during the roundtable, but sequestering GHG with tailings, exploiting any useful geochemical properties is another route.

In general, though, as the need for metals and critical minerals will remain for decades and the resource grades are reducing then the focus needs to be on:

- Minimizing the quantity of material to be moved.
    - The mining technique – open pit or underground.
    - (mineral processors are starting to pre-sort rock prior to crushing)
- Building in adaptability to new technologies
    - For example, planning for electrification of haulage and allocating space, even if it will not happen for a few years
- Taking advantage of topography
    - For example, a downward slope could be a recharging leg of any journey.
    - Can an open pit be used for pumped water power storage and hydropower?
- Designing efficient and effective mine layouts
    - Geotechnical engineers can help design mine layouts that minimize the amount of material that needs to be excavated, which reduces the energy required for mining and therefore the carbon emissions associated with the process.
- Implementing best practices for resource utilization
    - Geotechnical engineers can help develop and implement best practices for resource utilization, such as minimizing the amount of water and energy used in mining operations. They can also help design systems for the reuse and recycling of water and other resources.

CATHERINE MULLIGAN

Director, Institute of Water,
Energy & Sustainable Systems,
Concordia University

TOPIC

Mitigating Climate Change: Why engineers are adopting Envision as a leading sustainability framework

Is Envision a multicriteria decision making tool to rate any project option?

Yes, Envision is a multicriteria decision-making tool that can be used to rate the sustainability of a wide range of infrastructure projects. Envision is designed to evaluate the sustainability of infrastructure projects across a range of criteria, including environmental, social, and economic factors.

The Envision rating system is based on a set of credits and prerequisites that cover a range of sustainability issues, such as project design, land use, water management, materials, and energy use. Each credit and prerequisite is assigned a point value based on its importance to sustainability, and the project is awarded an overall rating based on the total number of points earned.

Envision can be used by a variety of stakeholders, including engineers, designers, project managers, and sustainability professionals, to evaluate the sustainability of infrastructure projects and to identify areas where improvements can be made. By using Envision, project teams can make informed decisions about the design, construction, and operation of infrastructure projects, and can communicate the benefits of sustainable infrastructure to stakeholders and the public.

What are your thoughts regarding the role of innovative geosynthetics solutions to facilitate sustainability in the infrastructure, especially resisting the extreme temperatures/freeze thaw cycles relevant to Canadian climates. I think more field research studies need to be conducted in this regard. Would love to hear your thoughts!

For sure more research is needed, particularly in regards to the extreme temperature swings we are now experiencing. Geosynthetics can be used for road construction and for other stabilization requirements and for winter roads.

How do we ensure our designs are economical and void of serviceability failure as we adopt sustainability and climate change into our designs?

Various analyses will need to be performed to ensure economic options and uncertainty will need to be incorporated in light of climate change. Cost benefit analyses can be conducted and so can life cycle assessments for various options.

What are the best questions to ask to a product supplier when evaluating a new product for carbon and GHG emissions?

Some questions can include what the composition of the product is, what materials were needed for the production of the produce, where is it manufactured and what are the transportation requirements.

Other than CEPA and EPA, what other resources (codes and standards) can an engineer reference during a project?

This depends on the project of course. Some standards are from ASTM and the US Army Corps of Engineers. There are also many ISO standards for LCA, carbon footprint of products, integrating environmental aspects into product des design and development, reporting of greenhouse gas emission, social responsibility and use of environmental management systems. GRI Guidelines include reporting on sustainability goals.

RYAN DOBSON

Geotechnical Engineer,
KGS Group

TOPIC

Adapting to Changing Climates: How engineers are re-thinking Canadian winter roads

How is rerouting possible when a community is on the other side of a lake or body of water?

There is always a land route that will lead to the communities. The routing would simply go around the lakes. So, in sense when we consider our current winter road routes which traverse directly through the lakes to minimize the overall distance of the road and required no grading requirements (flat roads are always best), these routes would be re-positioned to go around lakes and follow higher ground to be more climate resilient. See the photo of a winter road that cuts right through the lake. In the future we go around it.

Do you ever generate permafrost when you build a road? I thought you always cause permafrost degradation.

This depends on several factors and permafrost degradation is true in most cases when you replace the existing natural subgrade with a road. Having sunlight beat down on a road surface in the summer typically contributes to more ground warming in comparison to having a surface that is cleared of snow all winter and is exposed to the winter elements. But there are more factors than that, did we remove the peat (insulator)? If not, how much did we compress it and how much did that change it's thermal properties? Do we have standing water in our ditches (heat sink)?. Did we place a bunch of material in a "fill" section and trap frost in the ground (which would effect the system short term)? It really comes down to the overall net energy that is contributed to the subgrade. As you are likely aware, specific techniques are used to promote more cooling on road systems that are subject to permafrost thaw (ie: thermosyphons, air convection embankments, painting the road white.. etc.) But at the end of the day the question is, how are we changing it by building the road or other infrastructure.. not just roads here. In some cases you could potentially generate permafrost or atleast there is a seasonal case where a harsh winter promotes less energy into the ground. The key is that we need long term modelling on all infrastructure to not only predict and quantify the risk and impact of melting permafrost, but to understand the system as a whole. So, in a sense know your system and how it will behave in the future.

You mentioned geosynthetic reinforced winter roads. What products have you seen success with and how are geosynthetics used within the build? What specifically are the sustainability benefits of these products for this application?

Titan offers the exact solution with their Swamp Grid product. This is a combination of a geosynthetic and geotextile. Think of a snow fence stapled to a fabric. This product is laid down on the surface first and becomes the underside of your road while fill materials will be placed on it. It spreads out the weight and provides more strength for the weak peat subgrades. The main intention is to reduce the amount of fill material required to "float the road" over the organics. Fill material make up the majority of the costing to build a road. Furthermore, reducing the amount of fill reduces costing, greenhouse emissions during construction, reduction in borrow sourcing and ground disturbance, etc. So, this technique must be used through stretches of organic terrain in order to provide a feasible solution. The Swamp grid does not break down over time and remains buried much like a historical corduroy road which uses closely spaced logs as the underlying foundation for the roads. Now we have more applicable solutions to "floating roads" that are designed for the exact intent.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