



Green Thinking in Infrastructure Project Planning

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As much as 39 percent¹⁾ of all energy-related CO2 emissions worldwide come directly or indirectly from the construction industry.

You can thus divide the building's CO2 emissions into two columns:

Operating energy:

that you use to heat buildings, ventilation, pumps, safety systems and so on. It accounts for 28 percent of the world's energy-related CO2 emissions.

Manufacture of building materials:

The production and transport of building materials such as concrete, metal and others, as well as demolition and waste management from construction. All of this is responsible for 11 percent of the CO2 emissions created by the world's energy production. Often the focus is on the operating energy, however research²⁾ indicates that climate impacts related to the materials were between 50-83 percent, while the operating climate impact was between 17-50 percent.

Do we as responsible citizens and employees in the construction industry have the responsibility to develop, market and support products and technologies that reduce CO2 emissions?

The answer must be a very clear and big YES!

In the infrastructure sector where I come from, concrete plays a major role!

According to the international Energy Agency³⁾, cement production accounts for 7 percent of the total CO2 emissions – equivalent to over half of total global emissions from building materials.

So, there is a need to adopt sustainable thinking when planning for infrastructure projects such as road and rail tunnels.

Examples (from manufacturing):

Reducing concrete consumption:

Think with a 360° view in the planning phase being implemented to optimize construction requirements, newest developments e.g. "higher strength" concrete to reduce volumes required, other mixture e.g. with fly ash instead of cement, recycling of concrete etc.

Reducing metal consumption:

Metal lining of concrete structures either as décor or as part of "passive fire protection". Here, concrete could form its own décor, with colour options being utilized; passive fire protection could be substituted with active fire protection instead.

Operating energy consumption for:

Pumps: Hydrants, drainage & Fire Fighting

Ventilation: Normal & fire operation

Other safety systems: Detection, communication etc.

Examples (operating):

Here pumps & ventilation consumes most of the energy e.g. in a tunnel project. The required pump capacity or number of pumps depending on how many separate systems need to be supported e.g.

- Drainage pumps are a separate system, however by minimizing drainage by installing a Fixed Fire Fighting System with low water density compared to e.g. a sprinkler system, less water needs to be drained, this also potentially allows for space optimization of the tunnel cross section. In addition, allowing smaller water storage tanks to be installed.
- Fire pumps for hydrants are typically also a separate system, however by combining the fire hydrant system with the Fixed Fire Fighting System utilizing the same pumps and water-main, substantial savings could be achieved not only in operating costs for energy and maintenance, but also in initial cost by decreasing the number of pumps and pipes.
- Ventilation is a crucial part of the overall safety system of a tunnel; however, this requires a holistic view of safety to be undertaken. Some examples of modern ventilation technology for example the MoJet® technology reduces surface friction between the discharged jet and the surrounding tunnel surfaces, minimizing the Coanda effect and enhancing in-tunnel aerodynamic thrust with reduced power consumption. By using a Fixed Fire Fighting System to reduce the fire heat release rate in combination with the MoJet®, the required critical velocity in case of a fire can be reduced and the number of jet fans can be cut down by typically 30-50 percent⁴⁾.

Not all the above-mentioned “green” initiatives will produce an immediate pay-back. However, by taking a more holistic long-term or whole-life costing method including environmental perspectives, the benefits become obvious. Not only economically but also from a societal perspective, the reduction of CO₂ emissions can create a cleaner and more sustainable society.

- 1) United Nations Environment Agency - Report 2017.
- 2) Harpa Birgisdóttir, senior researcher at the National Building Research Institute at Aalborg University.
- 3) IEA Report 2019
- 4) VID Fire-Kill - Rize Tunnel Ventilation November 2017