Effect of climate change and resource scarcity on road and railways infrastructure: Norwegian case study

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Norway

- Gulf stream effect on climate
- Mostly seasonal frost (mainland)
- Permafrost (Svalbard and Northern parts)
Temperatures

Increase 2.3°C to 4.6°C by 2100

Precipitations

Increase by 5% to 30% by 2100

permafrost
Norway

- Shortage of traditional aggregate resources (sand, gravel)
- Use of crushed rock material
- Aggregates: 70% of volume of concrete, more than 90% of road and railways structure
- Rigid requirements for pavement layers
Bed rocks in Norway
CASE STUDY 1: SVALBARD
RUNWAY: LONGYEARBYEN
RUNWAY: LONGYEARBYEN

- Permafrost degradation due to warmer climate
- Severe frost heave problems
RUNWAY: LONGYEARBYEN
RUNWAY: LONGYEARBYEN

• Runway was built in 1974 and last repaired in 2014
• Harsh climate: from -40 to +20
• Short summer (July is the best month)
RUNWAY: CHALLENGES

- Length of job site: 2,483 m
- Challenge with aggregates and asphalt production
- Transportation by boat from Tromsø
- Quantity of asphalt: 3,500 tones
- A boat takes up to 2,000 tones
- Trip takes 2.5 days
- Difficulties to keep asphalt warm
Seasonal frost - Alta, Northern Norway

Foto: Lars Andreas Solås
Alta, road FV26
Seasonal frost - Alta, Northern Norway

March 2014

Foto: Lars Andreas Solås
Alta, road FV26
1. Today the pavement design manual sets rigid requirements for pavement layers.
2. The construction of the new E39 highway generates surplus of blasted rock.

Source: Diego M. Barbieri
Need for better solutions than throwing material in the fjord?
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FROST PROTECTION OF ROADS AND RAILWAYS (2015-2019)

Telehiva på fylkesveg 60 gjennom Hornindal er berykta. Det er fare for at dei kjem til å eksistere i mange år framover. (Foto: Hans Holmøyvik)
Field test experiment

Road test section (left) and Railway test section (right), Røros.
CONCLUSIONS

• Climate change brings a lot of challenges on infrastructure built in cold climate
• Building transport infrastructure in Svalbard requires aggregates and asphalt from mainland
• New ways of using of aggregates with non-desirable quality
• How research can help authorities with their challenges
THANK YOU FOR YOUR ATTENTION