



# Sustainable, thaw-resistant roads with bio-polymer

November 6th 2023



# Norwegian roadtech scaling internationally

## 16 years of experience

Founded in 2007 in Norway

## Norwegian Road Authority recommended

Has used our methods in numerous county roads.  
Recommends it for stabilization



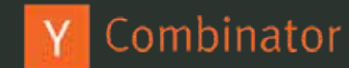
## ~300 roads stabilized

in Norway since we were founded

## 80% + recurring customers

More than 80% of customers in 2018 have used us again.

## US climate investors



## Expanding internationally

USA  
Poland  
Romania  
Lithuania

# 2 unique technologies we combine

## Hardcore Crusher



- Crushes the road to a homogenous mass, 10 in deep
- Can crush through large boulders, asphalt, concrete ++
- Reduced need for additional gravel added to the road

## Bio-Binder



- Flexible use - can work with a large range of materials, incl. native soils
- Reduces thaw damage, provides strength and resistance to permanent deformations
- Sustainable – binds carbon in the road
- Non-toxic, completely safe to use

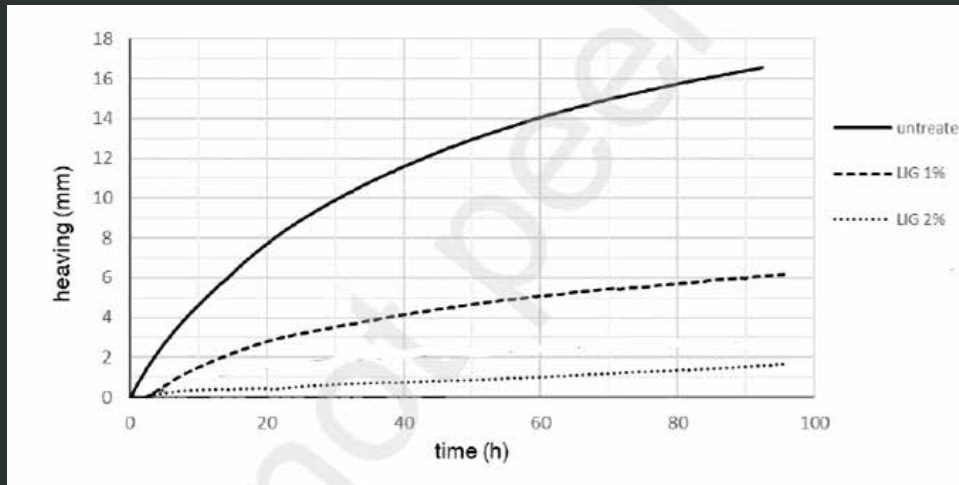


# Our benefits

- **Reduced thaw damage**
- **Increased strength (load bearing) & resistance to deformations (resilient modulus)**
- **Dust binder**
- **Use of local materials**
- **Sustainable**
  - **Carbon negative - 3kg (-6 lbs) CO<sub>2</sub>-equiv. per sq. yard - EPD on cradle-to-grave**
  - **Non-toxic**
- **Cost efficient**
- **Want to partner with local companies**

# Reduction in thaw damage – heaving reduced 60-90%

Gneiss

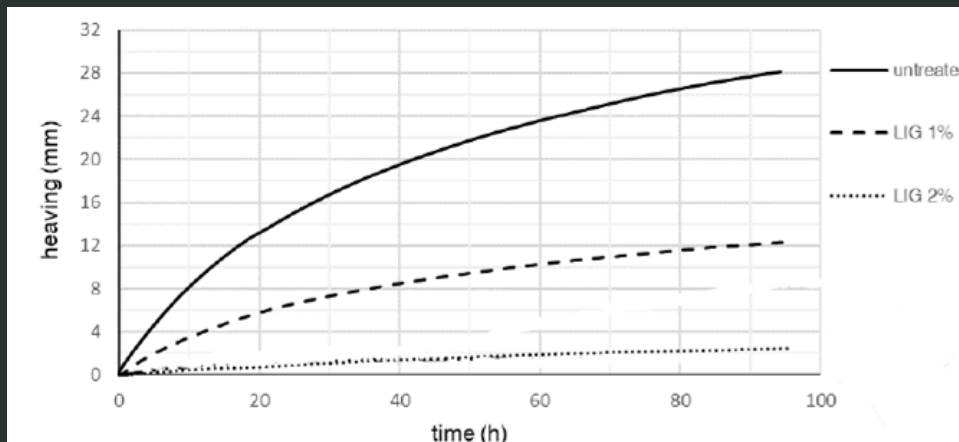


Has been tested on 5 different quarry stones and sandy clay with similar results

Two effects of the bio-binder contribute to reduced heaving:

- Lower hydraulic connectivity
- Lower freezing point

Quartz-diorite



In addition, the bio-binder has properties that increase resistance to permanent damage:

- Higher resilient modulus and resistance to permanent deformation
- Self healing properties

# Reduction in thaw damage – difference seen after 2 years in in-field experiment

ROAD TESTED WITH DIFFERENT TECHNOLOGIES<sup>1</sup>

**Section strengthened with additional asphalt layer**

Visible thaw damage two years later



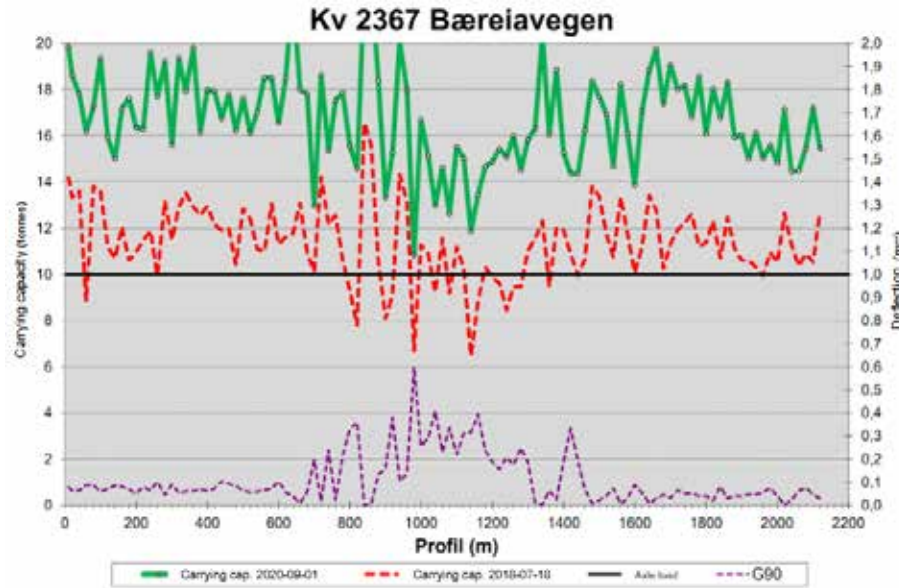
**Section stabilized by Carbon Crusher**

Two years later, Carbon Crusher sections had no visible damage

<sup>1</sup> One stretch additional asphalt layer, two stretches of full replacement of soil, two stretches with Carbon Crusher method  
Sources: [Lindås kommune forsterker veier med "trelim"](#) - Norsk Kommunalteknisk Forening ([kommunalteknikk.no](http://kommunalteknikk.no))

# Durable roads - strength increase 25-300%

Tested in varying geology and harsh climates in Norway and Arizona



Increased carrying capacity of ~5 tons, or 40-70%, as demonstrated here by a recently tested road in Norway



Increased carrying capacity of 25-300%, as demonstrated recently in Arizona

# Happy to discuss more!



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Before refurbishment



We crush asphalt as well as gravel, rocks and dirt roads.

Crushing



Our Crusher creates a homogenous mass of the road materials.

After refurbishment



The result looks like a compact gravel road, harder and more stable.

# Durable roads stabilized in 2007



*“We are very satisfied. It has saved us a lot of money and trouble by using this method”*

- Gudmund Amundsen,  
Engineer, Bø Municipality

# Crushing is included in The Norwegian Public Roads Administration (NPRA) handbook



## B 8 Crushing

### B 8.1 Description of the method

The method consists of crushing materials in the existing road into a more homogeneous material that can function as a new base layer on its own, or new materials or binders can be added to achieve the desired properties. Normal milling depth is 20-30 cm.

The method is particularly well suited where there are many large stones or protruding rocks (rock nodes) in the existing road mass. Normally, large stones (up to 20-30 cm) and smaller protruding rock nodes can be crushed. The method is also particularly well suited where there are long distances and high costs for the transport of new road material. This method is also more environmentally conscious thus can be a good option.[27].