Chembase Treatment System (CTS)

Freezing-condition tolerance to −62 °C: sub-base layers

Research and development

“It costs you nothing to find out how much you can save.”

What freezing does to a road

Water expands as it freezes

Water that seeps into the pavement and freezes expands by about 9%, creating internal pressure and damage.

Cracks grow

Water fills small cracks, freezes and expands, causing larger cracks and further erosion of the road.

Frost heave

On gravel roads, freezing temperatures can make the soil swell upwards.

Freeze-thaw and de-icers

Cold weather, freezing and thawing cycles and many de-icers can be very destructive.

Freezing conditions in numbers

9%

Expansion in volume when water freezes

30–40%

Fall in average arterial road speeds on snowy or slushy pavement

5–40%

Fall in freeway speeds in heavy snow (3% to 13% in light snow)

2–3 years

How often some countries rebuild roads in freezing conditions

Snow and ice reduce pavement friction and vehicle manoeuvrability, which slows traffic, cuts road capacity and raises crash risk.

Figures as quoted in the Chembase R&D brochure. Original sources are not named.

Roads in freezing regions

Constant maintenance

Untreated roads need maintenance that depends on the freezing conditions at the time.

Rebuilt every 2 to 3 years

Some countries have to rebuild their roads every two to three years.

Ice on the surface

Rain, freezing rain or sleet on a road colder than 0 °C (32 °F) forms ice and hazardous driving conditions.

Affected regions include the USA, Canada, Russia, Greenland, Finland, Kazakhstan, Iceland, Estonia, Belarus, Sweden, Latvia, Mongolia and Norway.

Concrete in cold weather

10 °C

Concrete should be kept at around this temperature (50 °F) to cure properly

4 °C

Below about this (40 °F), curing slows sharply and may stop altogether

–4 °C

Fresh concrete can freeze at this temperature (25 °F)

24–48 hrs

Time a well-proportioned mix needs to gain strength at the specified curing temperature

If newly placed concrete freezes, the damage is immediate and permanent. Later curing will not restore its properties.

Celsius values converted from the Fahrenheit figures quoted in the Chembase R&D brochure.

Repairing frost-damaged concrete

Cracks

Resin injection grouts and pourable grouts.

Holes

Thicker-section repair materials.

Exposed rebar

Anti-corrosion and anti-carbonation materials.

Loose aggregate

Remove before carrying out repairs.

One product, supplied in two parts

PART A

Polymer-Stabiliser

+

PART B

Activator

Chembase®
CTS

Five characteristics
combined in one product

A simplified range

- Five different chemistry characteristics are now combined into a single Chembase product.
- The application and treatment methods stay the same.
- The same characteristics, benefits and advantages are retained.

Naming: CTS stands for Chembase Treatment System. Chembase is also known as Chembase International and Chembase International Group.

How CTS works

Binds the soil

Activated by a catalyst, the stabiliser binds soil particles into a solid base with a higher CBR.

Packs it densely

Soil particles move past each other more easily on compaction, packing densely with minimal voids.

Keeps water out

A water-resistant layer under the pavement stops moisture penetrating the road base layers.

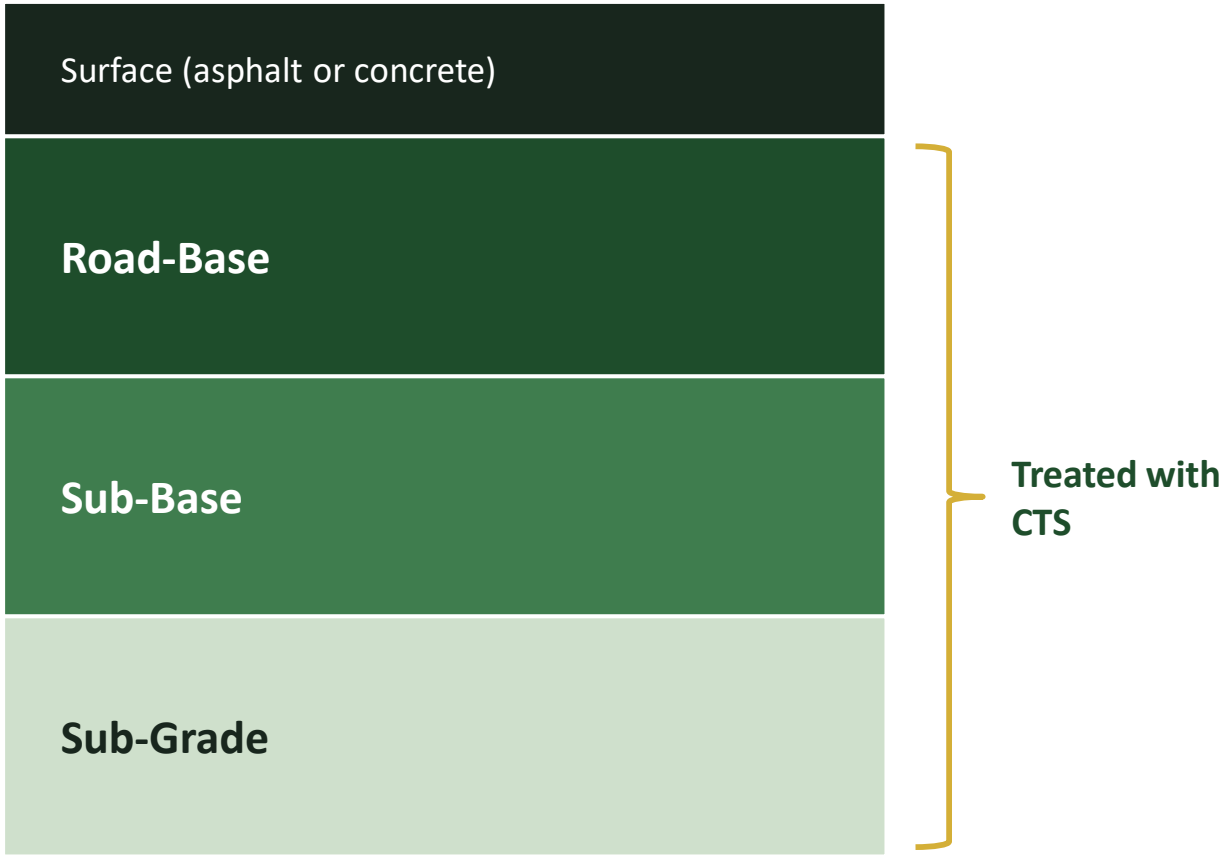
Reduces swell and shrink

Less movement in the soil helps extend pavement life well beyond the design criteria.

Stays active

Chembase is not absorbed by the soil particles and stays active for the life of the pavement.

Where CTS works: beneath the road surface



Indicative cross-section

CTS creates a water-resistant layer under the pavement, protecting the base layers from freezing damage.

- **Greater strength**
- **Higher load-bearing capacity**
- **Resistance to moisture-related issues**

Chembase and conventional road construction work together.

From stabilised layers to lower costs

1. **Stabilised base layers**
   CTS stabilises the road-base, sub-base and sub-grade.

2. **Less water, fewer potholes**
   Water leakage and potholes are reduced in the treated area.

3. **Less maintenance**
   The treated area needs less ongoing repair.

4. **Lower cost, longer life**
   Reduced costs and greater longevity for the treated area.

Performance benefits of treated layers

CBR increase

Raises the California Bearing Ratio (CBR), a standard measure of soil strength.

Water resistance

Treated layers resist water, limiting moisture-related damage.

Liquefaction resistant

Treated soil resists liquefaction, the loss of strength in saturated ground.

Freezing-condition tolerance

Tolerates freezing conditions.

Oil and petroleum barrier

Prevents oil and petroleum penetrating the treated soil.

Longevity

A long service life for the treated area.

Practical and environmental benefits

On site

Workable in any weather
Application is not held up by conditions.

Stable once diluted
The diluted product will not oxidise.

Re-compactable
Treated soil can be re-compacted (20 years).

Savings
Less maintenance and reduced costs.

Safety and sustainability

Safe to use
Product-safe and environmentally safe.

Waste plastic and glass
Shredded plastic or stained glass added to treated soil increases CBR.

Ash waste
Ash added to treated soil increases CBR.

Saltwater
Saltwater can replace fresh water, and increases CBR.

Brick pavements
Can be used in brick pavement manufacturing.

CTS in freezing conditions

–62 °C

Freezing-condition tolerance of treated sub-base layers

Feb 2020

University of Sydney engaged to conduct several extensive tests

36+ years

Without rebuilding the road base, based on Chembase road trials for local and state government in Australia

About 25%

of the cost of some alternative paving and stabilising products and methods

The tests confirmed that Chembase can assist in reducing sub-base deterioration in freezing conditions, at a temperature of minus 62 degrees.

Figures as stated in the Chembase R&D brochure. See the University of Sydney and UNSW tests and reports, 2019–2023.

Further advantages of CTS

Performance

- Reduces absorbed water
- Helps stop surface water entering the road base
- Improves strength by increasing compaction and CBR
- Reduces voids between soil particles
- Eliminates frost heave and break-up
- Strength improvements measured by UCS and CBR
- Very cost-effective

Handling and safety

- Environmentally safe: non-toxic when diluted
- No adverse effects on flora or fauna
- Can be applied at any time of the year
- When diluted, will not oxidise or damage metal
- Liquid form, so very easy to apply
- No special PPE: basic gloves and eye protection
- Packed in 205 kg drums or 1,000 kg IBCs

What changes in a treated pavement

Increases

- Strength
- Density
- Compaction
- California Bearing Ratio (CBR)
- Pavement life

Decreases

- Moisture
- Shrinkage
- Swell and heaving
- Maintenance costs
- Construction costs

Soils CTS works with

CTS works with

- Sandy clay loam
- Medium loam
- Silty clay loam
- Silt
- Clay loam

May need pre-treatment

- Loamy sand
- Sand

A soil that is very high or very low in clay needs pre-treatment. If the liquid limit is above 50, pre-treatment is necessary. Consult Chembase Technical Support.

It costs you nothing to find out how much you can save

Talk to Chembase about protecting your base layers in freezing conditions.

INDEPENDENT UNIVERSITY REPORTS

Reports from The University of Sydney and UNSW (University of New South Wales) are available at www.chembase.com.au

CHEMBASE INTERNATIONAL GROUP

+61 2 8566 3344

info@chembase.com.au

www.chembase.com.au

Chembase International Group Pty Ltd
ABN 98 660 823 316