

Natural stone paving technique for roads : Injection process

أسلوب تعبيد الطرق بالحجارة الطبيعية أسلوب الحقن

Stone pavement that does not break under the traffic of heavyweight vehicles

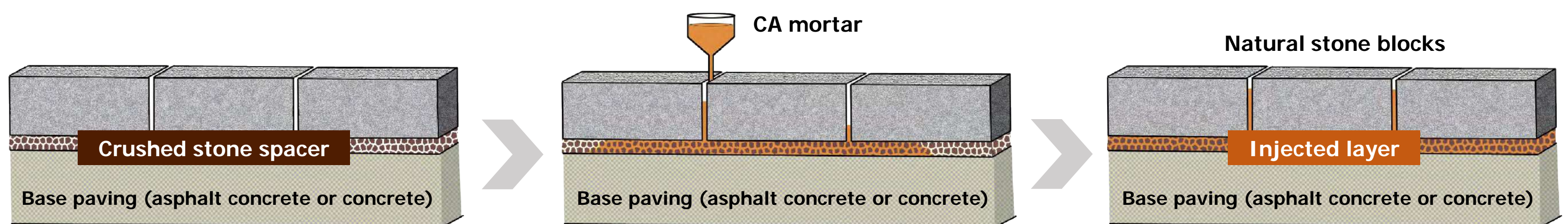
Cement asphalt mortar (CA mortar), a material with good fluidity that also provides superb post-curing impact absorption, is injected into the joints between stone blocks in the pavement, some of it reaching and filling the crushed stone spacer layer underneath the blocks as well as the joints on the four sides of the stone block and thus having five sides of each stone block bound with mortar. This makes a highly durable stone block pavement that is flexible and impact-absorptive under the harsh loading of vehicle traffic.

Advantages

- ◆ Long-term durability that dependably supports large-vehicle's running.
- ◆ Caters to a variety of paving needs from large-scale new pavement to existing road repairs.
- ◆ Can be installed over an asphalt paving base.

Installation steps

1. Position stone blocks over the crushed stone spacer layer and inject CA mortar into the joint areas between stone blocks.
2. Inject enough mortar until the voids between crushed stones are fully filled and the top of the injected layer comes up to above the mid-point of the stone block height.
3. Apply the finishing mortar up to slightly below the top of the stone blocks.



- ◆ To assure stone positioning accuracy, the injection layer thickness should be 3 cm.
- ◆ No expansion joints need to be installed as the joint mortar has sufficient elastic properties.
- ◆ In some situations, the finishing mortar may be applied after the pavement is opened to traffic.

Installation examples



Bus stop zone
Oita Prefecture



LRT strip
Toyama Prefecture



Tourist area
Kyoto Prefecture



Shopping street
Kanagawa Prefecture



Highly durable, stress-reducing asphalt paving product: Relax-Phalt HT

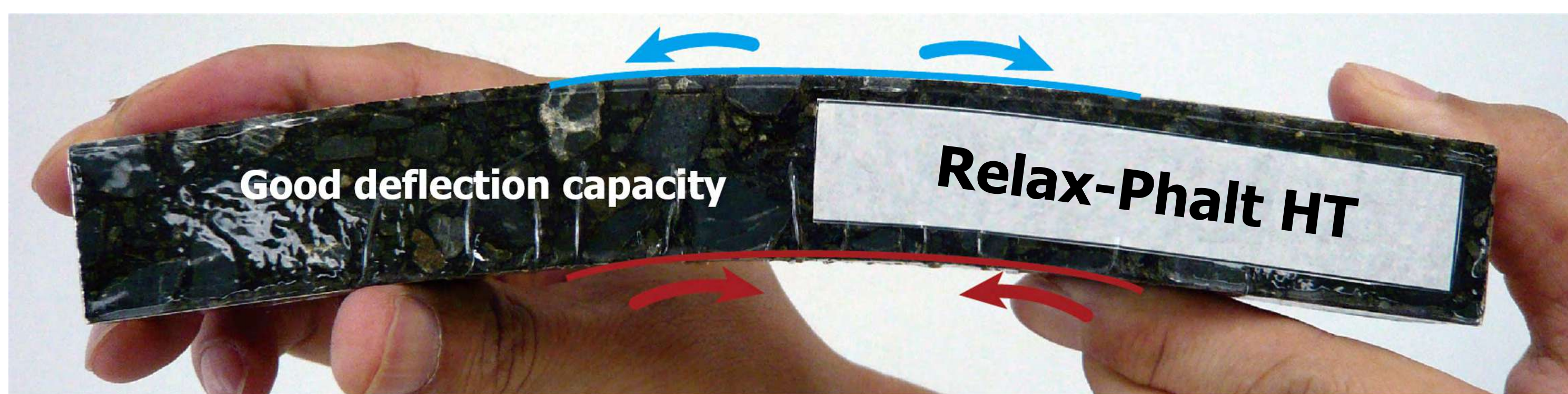
تعبيد الطرق بالأسفلت عالي المتانة يخفف الإجهاد
تعبيد الطرق بالأسفلت HT يخفف الإجهاد

Long life pavement with cracking and rutting resistance

“Relax-Phalt HT” is an improved special asphalt paving product that offers good displacement conformability (flexibility) and stress relaxation at low temperatures as well as resistance to plastic deformation at high temperatures.

Relax-Phalt HT-based asphalt composites are highly resistant to cracking and fluid rutting, providing an ideal solution to create a long-life pavement for heavy traffic roads.

Advantages



◆ Reduction of reflection cracking

Overlaying fresh asphalt composites over a concrete pavement or cracked asphalt pavement involves reflection cracking concerns. The excellent physical properties of the Relax-Phalt HT-based composite help reduce reflection cracking in the pavement.

◆ Low temperature cracking reduction in asphalt pavement

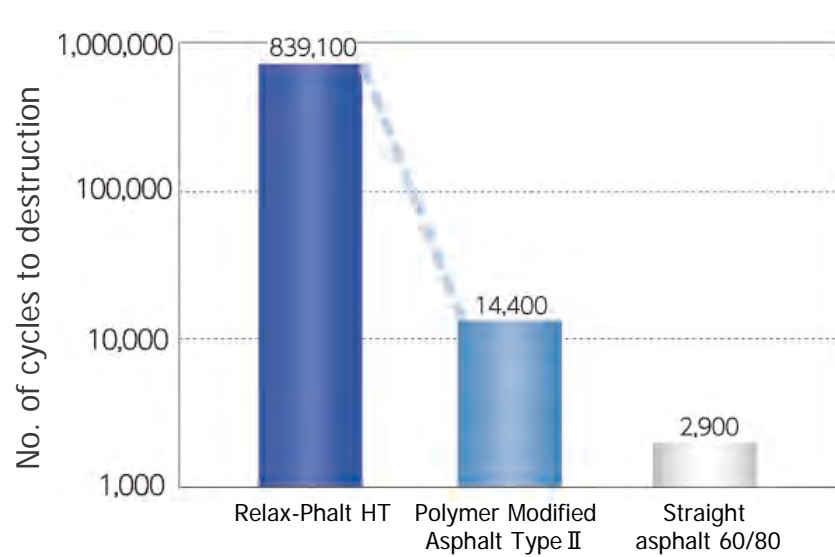
Asphalt pavement in cold climate locations has low temperature cracking risks due to contraction of the pavement. Relax-Phalt HT is effective in reducing low-temperature cracking in asphalt pavement.

Composite properties

Examples of application to granular asphalt composite

Cracking resistance

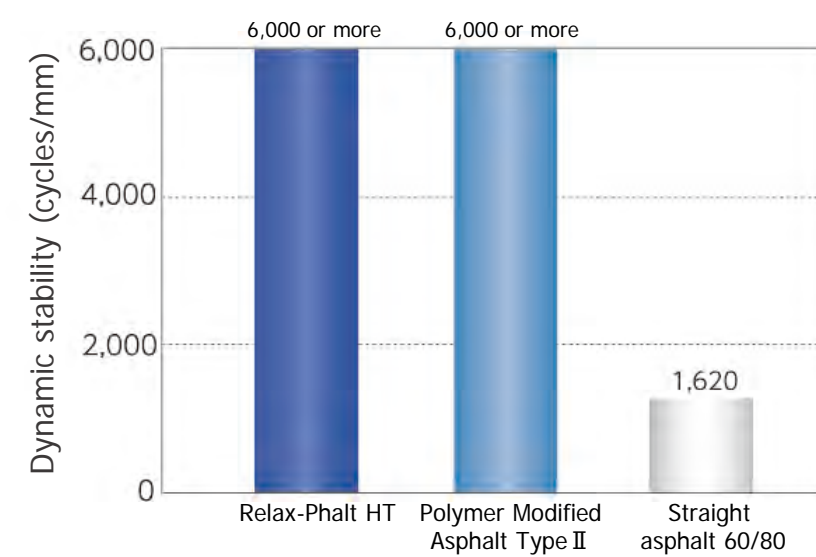
Offers 50 times as much resistance as that of Polymer Modified Asphalt Type II



Repetitive bending test result

Fluid rutting resistance

Offers an equivalent fluidity resistance as that of Polymer Modified Asphalt Type II

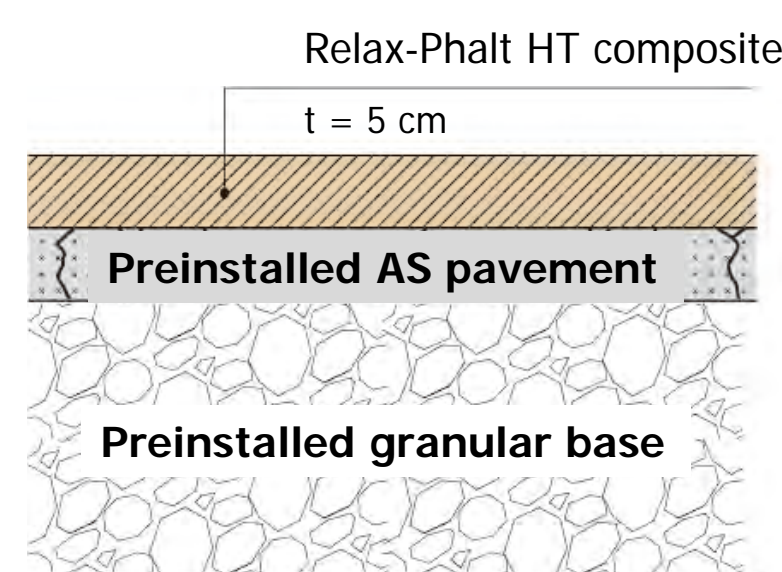


Wheel tracking test result

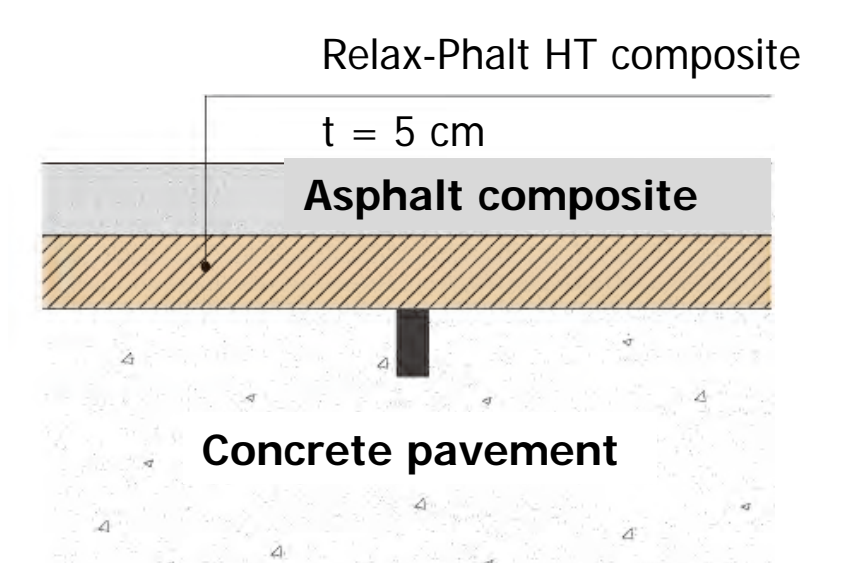
Loading method	Two-point loading with both ends supported
Specimen dimensions	40×40×400 mm (300 mm span)
Test temperature	5°C
Loading condition	Distortion-controlled 5Hz frequency
Distortion	400 μ

Pavement cross sections

Asphalt pavement repair



Overlay on top of a Concrete pavement



Installation examples

Common national highway (heavy traffic)



Pavement in a private facility (heavyweight vehicle traffic)



Water-retaining paving technology Ceracool Block Pavement

الرصف بمواد تتمتع بخاصية الاحتفاظ بالماء
رصف سيراكول

An environmentally improved paving technology with high-performance interlocking blocks alleviates the urban heat island effect.

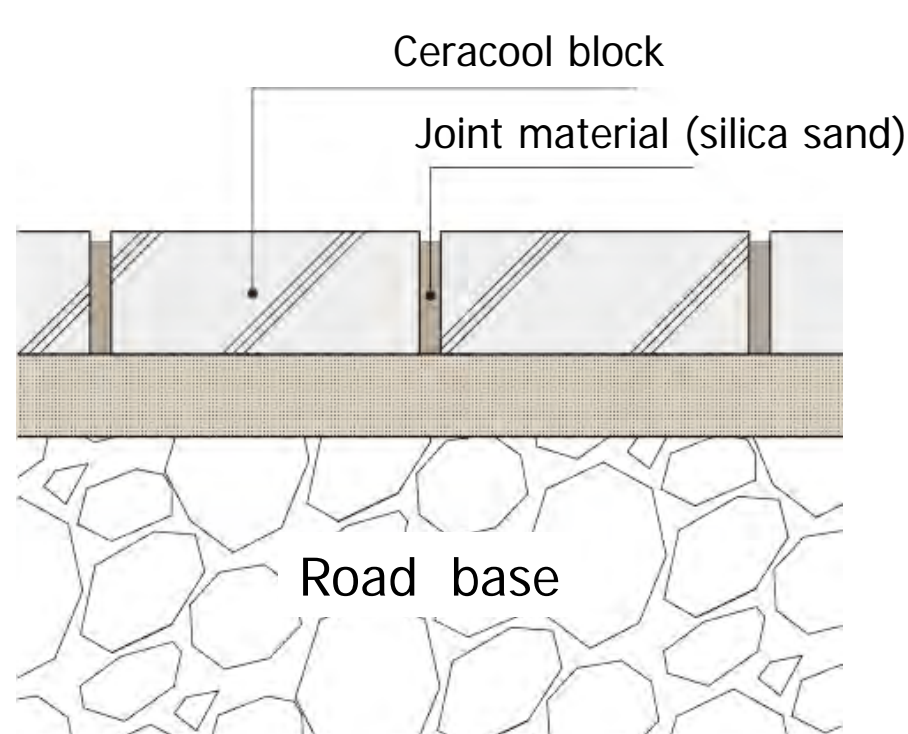
“Ceracool” is a water-retaining and aesthetically pleasing paving technology using ceramic blocks, with strong water retention properties to reduce road surface heating.

Advantages

- ◆ Offers excellent water retention.
- ◆ Evaporation of retained water in the blocks helps reduce road surface heating.
- ◆ Blends in well with natural scenery in the parks or along promenades to create a relaxing, refreshing atmosphere.
- ◆ Exhibits an equivalent strength to that of common ceramic pedestrian paving blocks.
- ◆ Water supply pipes can be installed under the blocks to provide a constant water retention.

Paving structure

Standard cross section

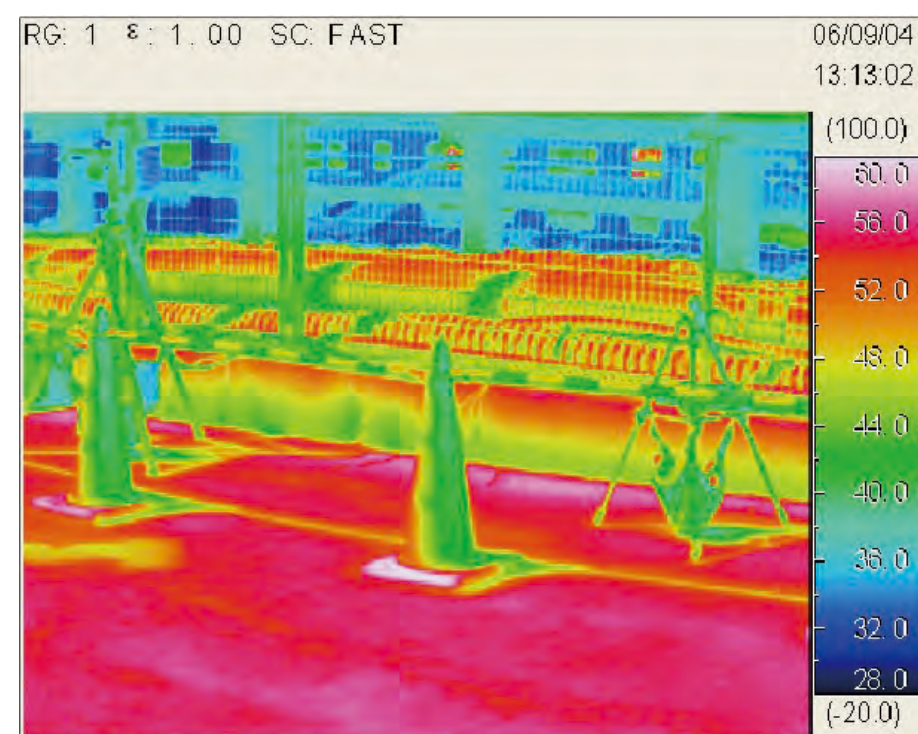


Block surface

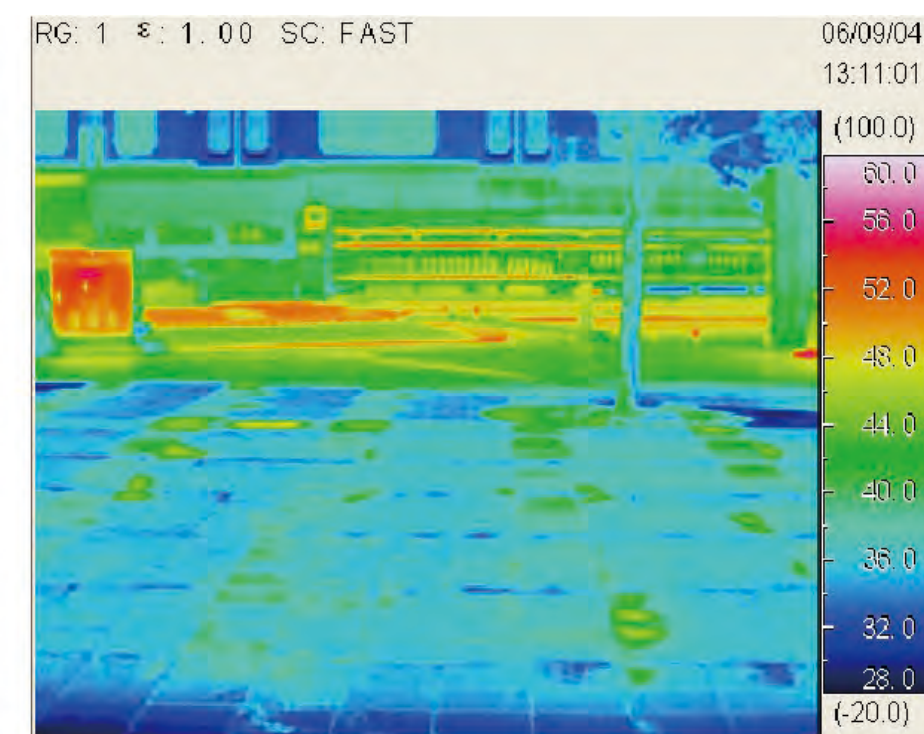


※ Standard color options include three shades of gray and two shades of beige.

Comparison of road surface temperatures by thermographs



Asphalt pavement surface



Ceracool block pavement surface

Installation examples

Promenade of a shopping mall



Public square in front of a train station



Underground storage of seepage water using water-retaining plastics

Underground water retention

أسلوب تخزين (إنقاذ) المياه الجوفية باستخدام مواد بلاستيكية لحفظ المياه
أسلوب تخزين المياه الجوفية

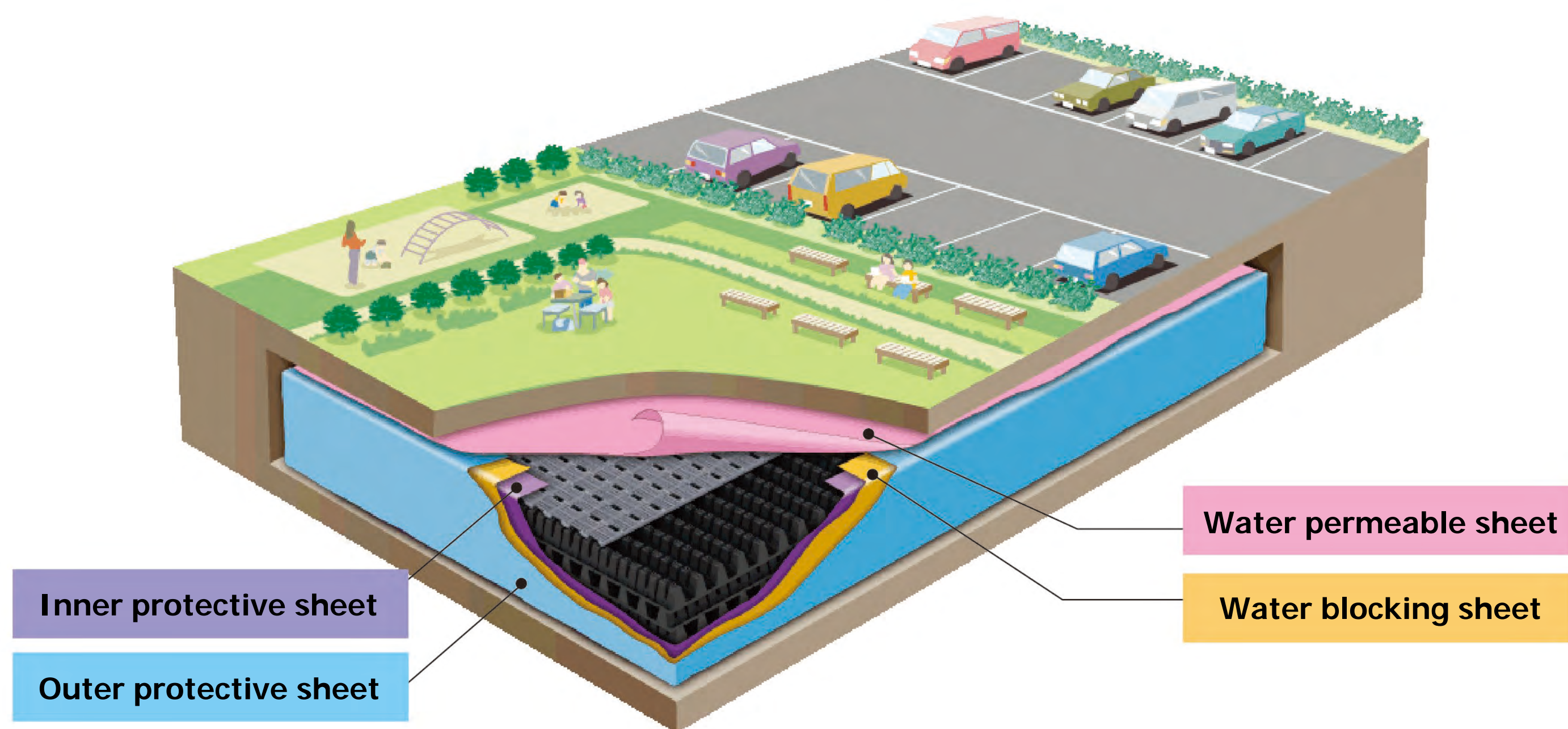
Water retention facilities can be created using plastic water-retaining components and protective sheets.

Underground rainwater retention facilities can be efficiently created under public squares, school athletic fields and car parks to provide an effective solution against flooding or hazardous rainwater outflow during sudden, intense rainstorms.

Advantages

- ◆ Plastic water-retaining components can be assembled (layered or stacked) to create a water storage space.
- ◆ The greater void ratio than graded crushed stones enables larger water retention per unit volume.
- ◆ The high void ratio allows water retention facilities to be created in a compact space, involving lesser earth digging.
- ◆ The lightweight material can be installed by human workers and reduced jointing needs between components contribute to low installation error risks.
- ◆ Factory-fabricated components provide consistent strength, durability and earthquake resistance.
- ◆ The recycled polypropylene material entails least environmental impact and does not detrimentally affect water quality.

Conceptual drawing



Installation examples

The land above can be used for other purposes.



Land used as a public square

