

RENOLITH



ROAD OF THE FUTURE

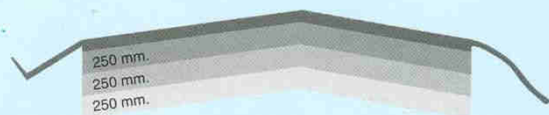
Save Time
Save Money
Save Environment
Save The Earth



ABOUT

CONVENTIONAL

- Asphalt concrete Running Surface
- Concrete 250 mm.
- Base 250 mm.
- Subbase 250 mm.



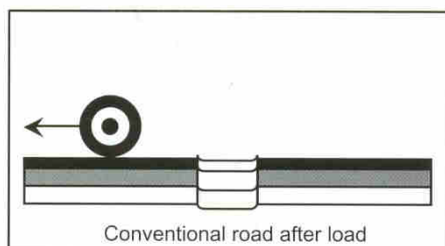
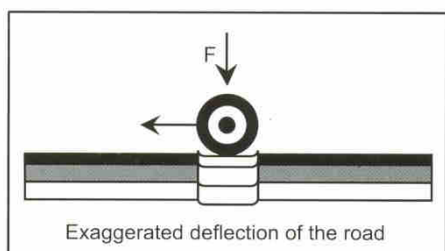
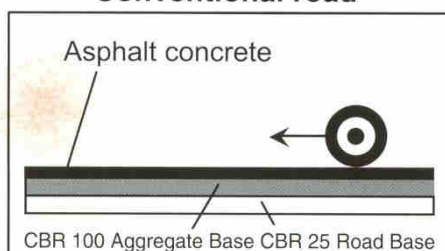
RENOLITH/CEMENT

- Asphalt concrete Running Surface
- Renolith & Cements Treated Natural Soils 300 mm.



Let's see the difference between "Renolith road" and "Conventional road"

Conventional road



High flexibility for the pavement is needed to compensate the deformation (or deflection) after load to avoid things like furrows, which often causes cracks in the asphalt concrete.

The Renolith FlexibilitySystem (FS)

The concept of loads on the construction of roads is contrast to the concept of building construction. Here, the dynamic loads press through the Asphalt concrete to the road base, as shown in figure 1.

Let's take a look at just one segment of the road. When a vehicle moves on the road, that particular segment is deflected by the force 'F'. (i.e. by the vehicle). The logic is when the vehicles are moving from time to time, an alternating stress occur on that segment.

In a long run, the aggregate base is unable to stand this alternating stress. When there is a very high load, the elasticity limit of the pave will be exceeded. And the plastic deformation will stay even after the load has already passed the segment. But in reality, after every load a small amount of deformation will stay. This effect causes a well-known problem called 'furrows'.

Here, **Renolith** has the solution.

Renolith Flexibility System (FS)

can provide ideal concrete base for road construction with:

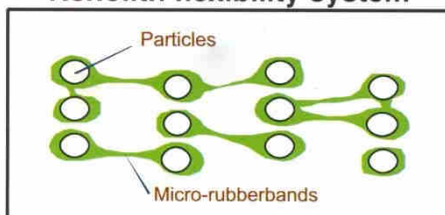
- **High modulus of elasticity.**
- **High flexibility.**

At a first glance, these two points seem to be similar, but they are not.

The **modulus of elasticity** is a value, which determines the amount of force 'F' needed to deflect the material. Therefore, higher to deflect the material. In turns, the elasticity limit of the pavement then is raised.

How can **Renolith** add these two attributes to the road pavement ?

Renolith flexibility system



Between the particles, Renolith adds kinds of "micro-rubberbands", (see figure 2) which are under pressure. These particles are bonded together much stronger than the particles in normal road base. That means, a load has to be much higher to deflect Renolith concrete base. Test results have shown that the average of modulus elasticity is 25% - 50% higher by using Renolith. On the other hand, a deflection is compensated very efficiently, because after a load, the "rubberbands" will push the particles back to their original positions. Our Styrofoam samples proofed the high flexibility of Renolith concrete base.



RE



How does it help the road construction?

Renolith road

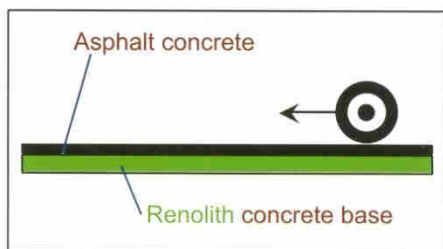


fig. 3.1

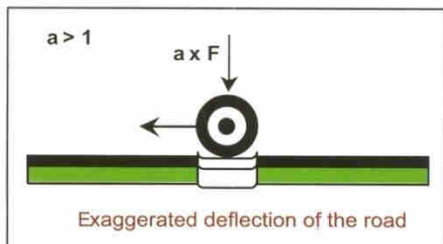


fig. 3.2



fig. 3.3

Take a look at Renolith road (figure 3.1) Obviously, you can see that there is only one road base, which is a mixture of Renolith, cement and in-situ materials. It results in 20% - 50% less cost and time consumed depending on the road design criteria for traffic volume, service period, etc. Let us look again on our segment, which is loaded by a force F (figure 3.2) The factor " a " is higher modulus of elasticity. So a higher load is needed to force the same deflection as in a normal road.

Even after the load has passed the segment, no deformation will stay, because of the high flexibility of the Renolith base. This is essential, because the segment is loaded again and again on the road. Therefore, Renolith concrete base is able to stand this alternation stress for a long period of time without having severe effects.

Now, you can clearly see that a Renolith concrete base has a very high resistant of loads, Furthermore, Renolith road has a long durability and only needs low maintenance, which is again saving time and money.

The Renolith Water Penetration

Water penetration of cement treated base.

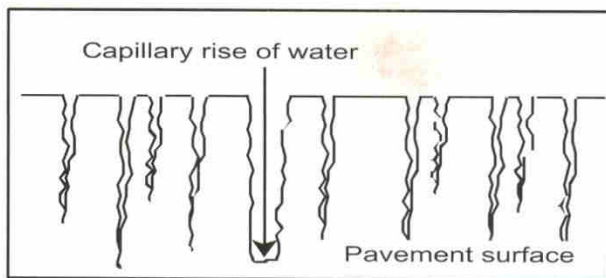


fig. 4

Water penetration is another dangerous effect on pavements with concrete or cement treated base., If water is stored within the pavement, it will be susceptible to hot and low temperatures. Hot temperatures, typically in tropical countries, will cause the formation of water steam within the concrete. On the other hand, low temperatures will cause ice formation. Both are dangerous for the pavement body, because it can "explode" from inside, causing well-known effect like potholes.

To see the clearer picture of WPPS, it is essential to understand the mechanism, which is the main cause of the water penetration.

As cement hydrates during the curing process, very small channels called "capillary" are formed on the surface (see figure 4). Unfortunately, these "capillaries" have the physical attribute to raise water. Therefore, you can speak of the "capillary rise of water". These capillaries can be very deep, so that water can be led also very deep into the pavement.

It is very hard to avoid the formation of capillaries during the curing process; therefore you have to look for a mechanism, which is capable of blocking this physical phenomenon in a different way.

Water Penetration Protection System (WPPS):

Water penetration of **Renolith** concrete base.

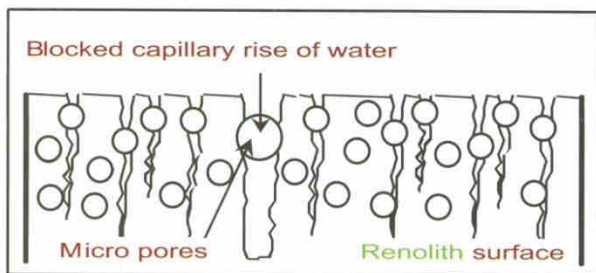


fig. 5

Here again, the answer to the problem is **Renolith** Water Penetration Protection System (WPPS), which provides a mechanism with the ability to block the capillary rise of water.

Renolith adds micro-pores to the pavement with concrete or cement treated base (see figure 5), which are distributed throughout the pavement body randomly.

These micro-pores settled in, or in the near of the capillaries, building small "caverns". These caverns break the physical attribute of the capillaries to raise water. That means, water is able to rise up to the level of the first micro-pore (see figure 5).

Therefore, water is unable to rise as deep as in the pavement with concrete or cement treated base, when Renolith is used.

To summarise, Renolith reduces the water penetration of the road base dramatically with no severe effects, caused by temperatures of the change hereof, like potholes. This is again saving time and money because of the less need of maintenance. On the other hand, Renolith based roads are very versatile in their use: There will be no problems using Renolith based roads in tropical countries or in countries, where they have a perma-freeze ground.

The **Renolith** Water Supply System (WSS) :

Although the problem of water penetration occurs only **after** the curing process, it is very important that **during** the curing process enough water is supplied to the cement for its hydration. Otherwise, a phenomenon called "**Die of thirst**" will occur.

This process is illustrated in figure 6.

"**Die of thirst**" Cement treated base.

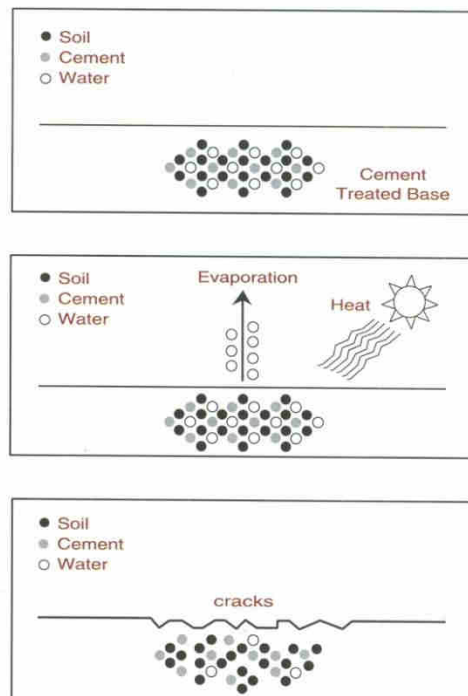
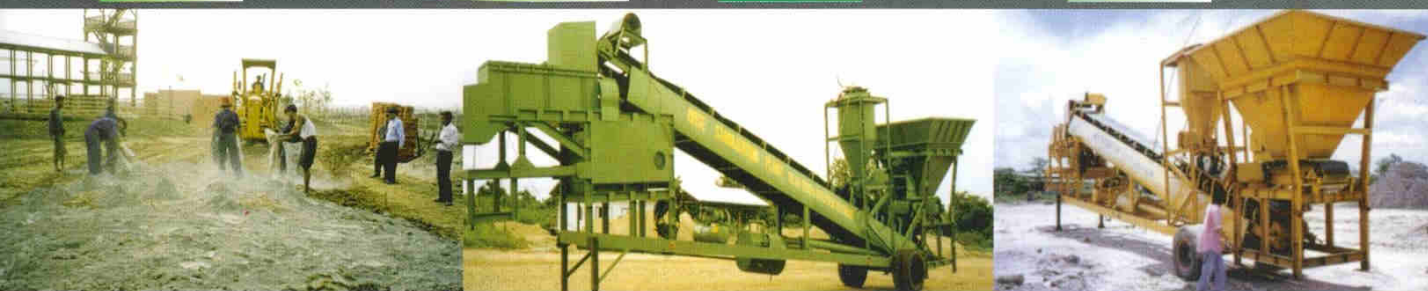
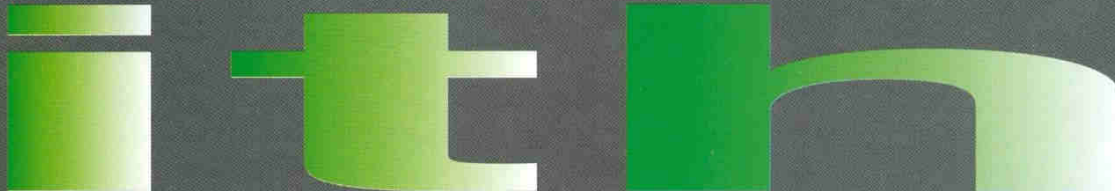


fig. 6

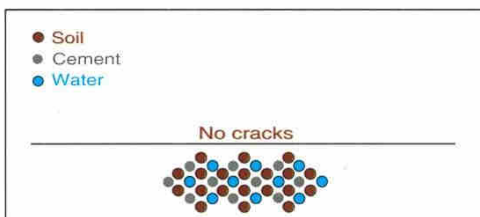
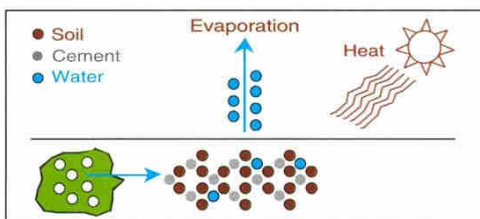
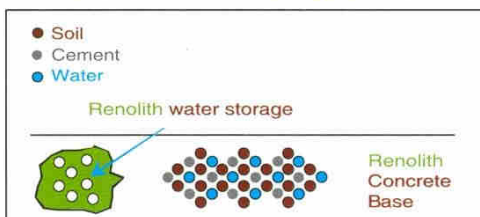
A well-defined amount of water is needed to allow the cement to react with the soil during curing process.

If this amount of water is decimated, through evaporation, the cement will not be able to react properly with the soil.

Big clusters will then be formed in the pavement structure, which weaken the strength of the road structure. Consequently, it causes cracks and potholes in a severe form after loads.



No "Die of thirst" **Renolith** concrete base.



The Magic solution to this problem is **Renolith WSS**, which is able to supply water whenever and wherever it is needed.

Within **Renolith WSS**, additional water is stored (see figure 7) to avoid the "Die of thirst" phenomenon. Because **Renolith** is distributed professionally that the necessary water is available throughout the whole system, to avoid the above mentioned structural weakness.

If necessary water for the binding process is lost because of evaporation or insufficient supply, the additional water will be supplied completely from **Renolith WSS**.

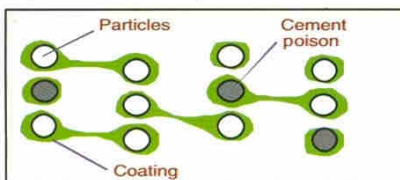
With the feature, the binding process of the cement can be completed properly without having any clusters. That means, no cracks and no potholes will occur. The **renolith water storage** will control the humidity of the road base and keep it at its optimum. This minimises the shrinkage of the road base.

Now you can see that **Renolith** based roads have more resistant against cracks than normal roads and have a lower shrinkage during curing time, which results in a longer durability and again less need of maintenance.

The **Renolith** Cement Poison Protection System (CPPS):

The traditional way of road construction is to dig out the soil for the road base. Then, the expensive washed and sieved sand has to be mixed with cement and water in a plant and has to be transported to the construction site. This method wastes the soil that is dug out from the site, consumes more time, and, more importantly, incurs more cost.

Renolith cement poison protection system



Can the in-situ materials be used?

Unfortunately, soils normally contain a lot of so-called cement poisons such as salt. These cement poisons disable the binding process and make the whole concrete treated base fail

Renolith's CPPS has a way to protect the cement treated base against cement poisons.

Figure 8 is quite similar to figure 2. Indeed it has the same principle. Using **Renolith**, particles and cement poisons are both coated and bonded as in the FS, preventing the cement poisons from reacting with the cement treated base.

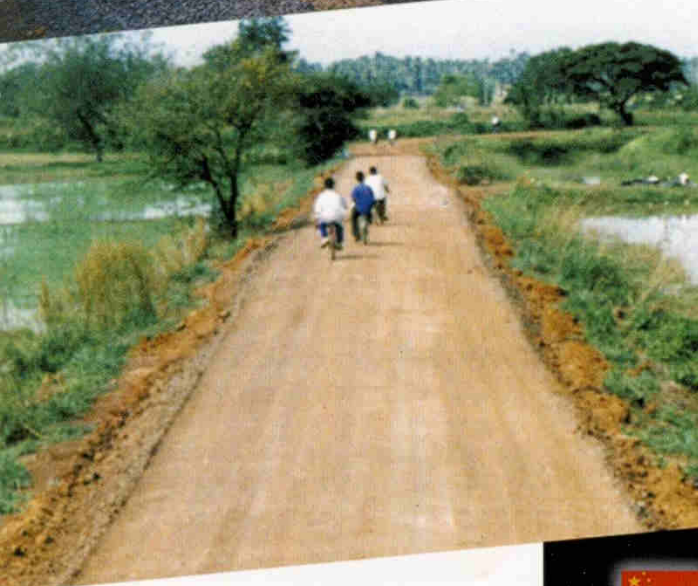
That means, with **Renolith almost every type of in-situ soils** can be used to build a road base.

So, instead of carrying tons of material through the countryside for mixing and disposition, the in-situ material can be conditioned with **Renolith** within the production process direct on the construction site. The necessary machinery used for this conditioning can be varied from high-tech machines to simple agricultural apparatus. The **Renolith CPPS** is the most important part of the whole road construction system, because of its high efficiency and costs saving techniques.

ProjectReferences

Renolith Quality is widely accepted and has been implemented in various applications. Some of our clients are listed as follows :

1. Bangkok Metropolitan Administration (Road Rehabilitation)
2. Department of Highways (Road construction and Road repair)
3. The office of Accelerated Rural Development (Road construction)
4. The Public Works Department (Road construction)
5. Mahasarakham Municipal (Pond lining)
6. Armed Forces Department Command. (Road Construction)
7. Royal Thai Air Force (Road Construction)
8. The Ministry of Public Health (Road Repair)
9. The Royal Gems Golf and Sports Club. (Service Road construction)
10. The Auto City Entertainment Center (Car Parking)



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INDIA



Germany



SINGAPORE



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LAOS



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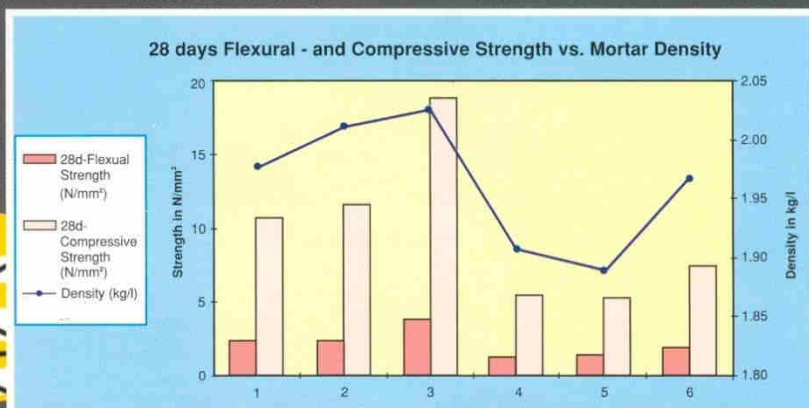
What?

Renolith modifies normal soil stabilised base and cement treated base to perform as a concrete road base where can take much higher load than normal pavement.

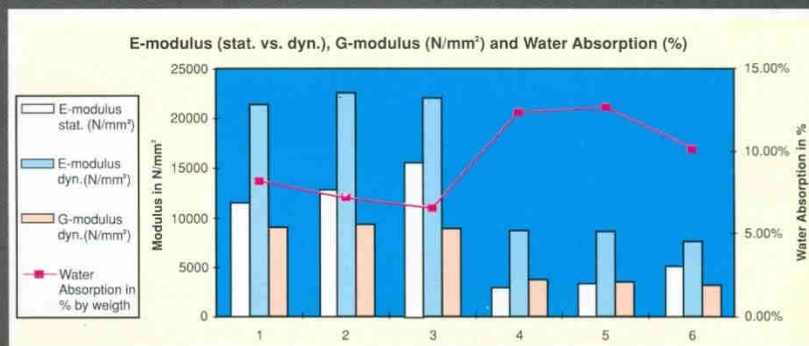
Why...Renolith?

- High flexibility
- More tensile without the decrease of compressive strength.
- High modulus of elasticity
- Usage of any soils
- Low water penetration
- Low shrinkage or expansion
- No'Die of thirst' phenomenon
- Anti-cracking
- Sustainable to Freeze thaw impact.
- Durable road base
- Low maintenance cost

Testing Reports



The **Renolith** Properties have been proven by the reliable laboratory that **Renolith** has improved not only compressive strength, flexural strength, but the modulus of elasticity. Water absorption reduction is also the result of **Renolith** properties.



International Testing Standard

- ASTM D422-63
- ASTM D4318
- ASTM D1632-96
- ASTM D1633-96
- ASTM D4767

How?

- Flexibility System (FS)
- Water Penetration Protection System (WPPS)
- Water Supply System (WSS)
- Cement Poison Protection System (CPPS)

Packaging

In : 25 litre pail
 GW. : 26.54 kilogram
 NW. : 25.34 kilogram
 Size : 45x28x28 cm.
 20' Container : 640 pails



In : 200 litre drum
 GW. : 211.20 kilogram
 NW. : 202.70 kilogram
 Size : 93x58x58 cm.
 20' Container : 80 drum

Material Safety Data Sheet

Renolith is classified as a completely environmentally friendly and safe products as per approval by :
 Switzerland : UBA NO.4596002
 Germany : BAG T NO.98136
 : DIN 4102, Part 1, B 1.
 : Patent no. 195 49 294.3

The Material safety data sheet is as follows :
 UN No. : None allocated (Not required)
 Dangerous Good Class : Not Relevant
 Subsidiary Risk. : Not Relevant
 Hazchem Code. : Not Relevant
 Storage and Transport. : Not defined as Dangerous Goods
 Fire and Explosion Hazard : Not Combustible
 Appearance. : White viscous liquid.
 Packaging : In 200 Litre Drum
 : In 25 Litre Pail

Distributors & Agents



THAILAND



CAMBODIA



GERMANY



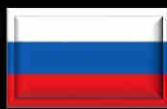
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