RENOLITH
ROAD OF THE FUTURE

Save Time
Save Money
Save Environment
Save The Earth

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

The Renolith Flexibility System (FS)

Conventional road

fig.1

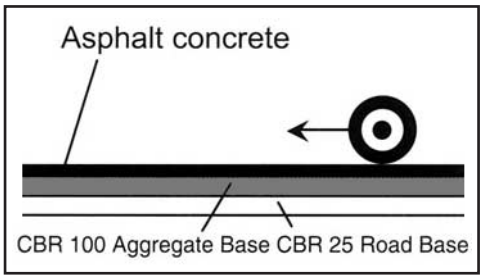


fig.1.1

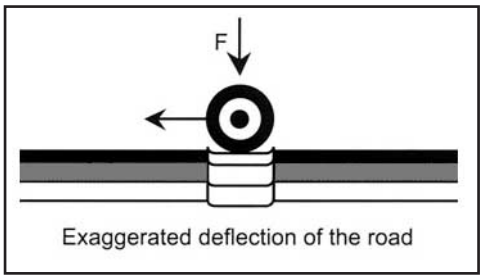
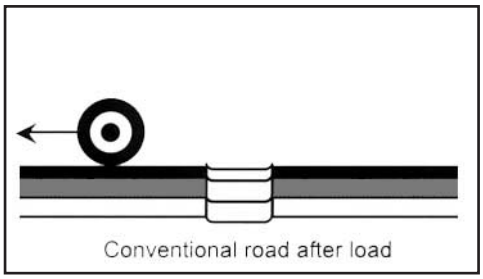


fig.1.2



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 pavement 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 values for the modulus of elasticity means, that the force 'F' has also to be higher to deflect the material. In turns,the elasticity limit of the pavement then is raised.

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.

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

Renolith flexibility system

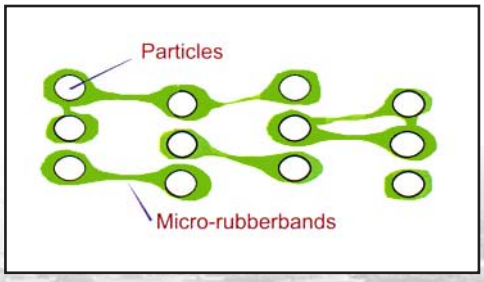


fig.2

Between the particles, Renolith adds kind of "micro-rubber-bands", (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 of 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.

How does it help the road construction?

Renolith road

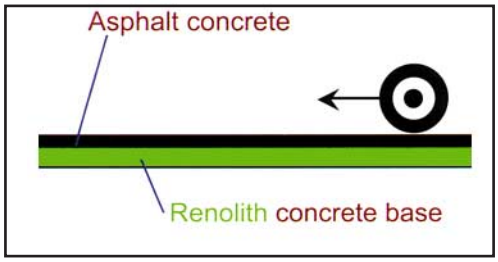


fig.3.1

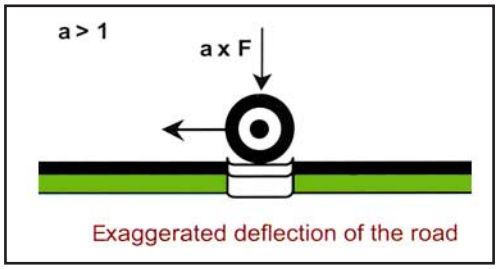


fig.3.2

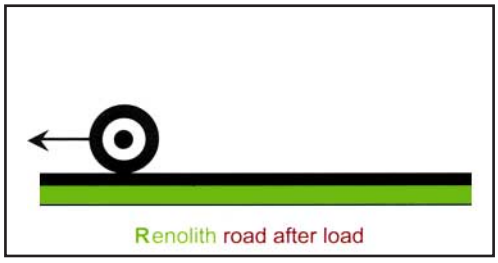


fig.3.3

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's look again on Renolith segment, which is loaded by a force F (figure 3.2) The factor "a" is a 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.

Renolith Water Penetration Protection System (WPPS)

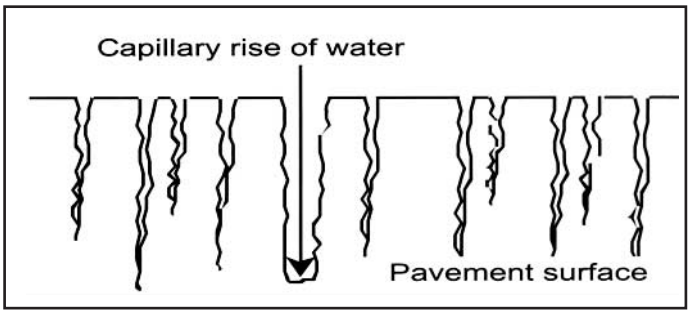


fig.4 Water penetration of cement treated base.

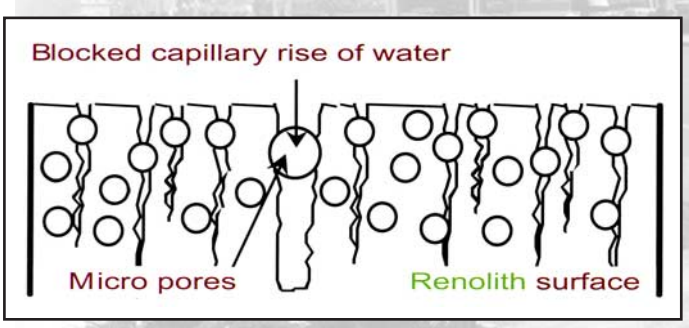


fig.5 Water penetration of Renolith concrete base.

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.

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.

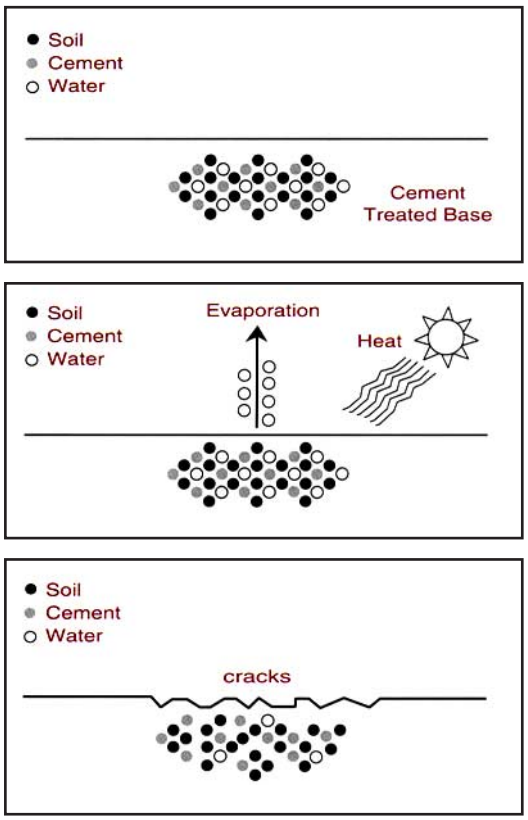
These micro-pores settled in, or in the near of the capillaries, building small "caverns". These caverns break the physical attribute of the capillaries to raise water. That means, water is able to rise up to the level of the first micro-pore (see figure 5).

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)

fig.6 **"Die of thirst"** Cement treated base.



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.

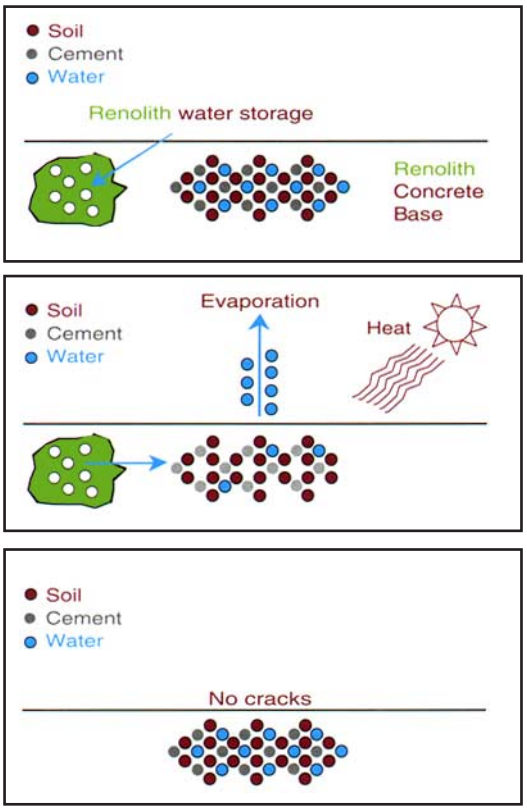
A well-defined amount of water is needed to allow the cement to react with the soil during curing process.

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.

The Magic Solution to this problem is Renolith WSS,which is able to supply water whenever and where it is needed.

fig.7 No **"Die of thirst"** Renolith Concrete base.



Within Renolith WSS, additional water is stored (see figure7) 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.

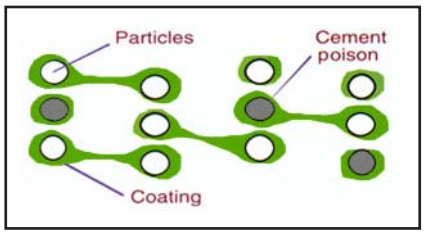
With the feature, the binding process of the cement can be completed properly without having any clusters. That means, no cracks and no potholes will occur. The renolith water storage will control the humidity of the road base and keep it at its optimum. This minimises the shrinkage of the road base.

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.

fig.8



Renolith cement poison protection system

Can the in-situ materials be used?

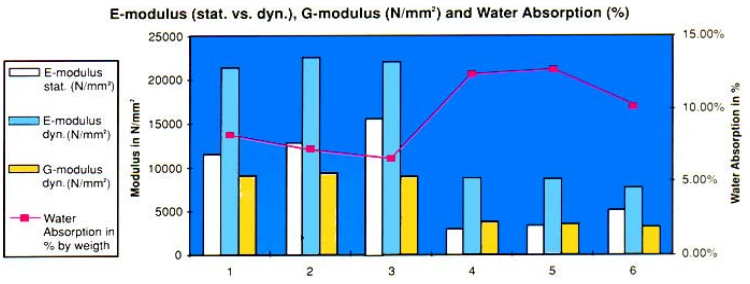
Unfortunately, soils normally contain a lot of so-called cement poisons such as salt. These cement poisons disable the binding process and make the whole concrete treated base fail

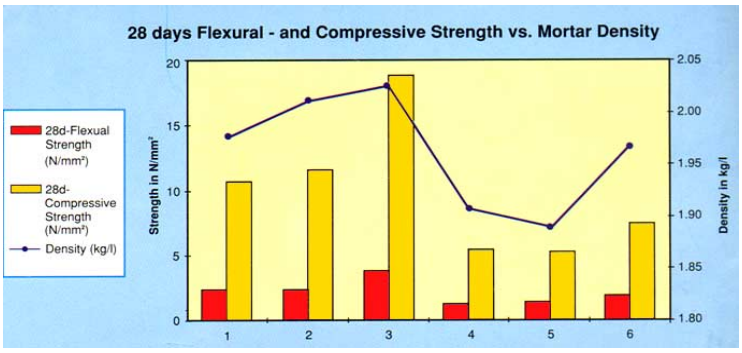
Renolith's CPPS has the way to protect the cement treated base against cement poisons.

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.





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 D4767
ASTM D1632-96
ASTM D1633-96
ASTM D1883-94

Packaging

In : 25 litre pail
GW. : 26.54 Kilogram
NW. : 25..4 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 drums

WHAT?

Renolith modifies normal soil stabilisied 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.

HOW?

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

Summary

Now you have seen how Renolith is sloving the main issues such as durability,maintenance and high costs. Road construction is now easy and efficient. Now be confident to a give a good presentation to your customers

Material Safety Data Sheet

Renolith is classified as a completely environmentally friendly and save products as per approval by:

Switzerland	: UBA NO.4596002
Germany	: BAG T NO.98136
	: DIN 4102, Part 1,B 1.

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

If you have a further questions regarding Renolith, do not hesitate to contact us

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Advanced Technology

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