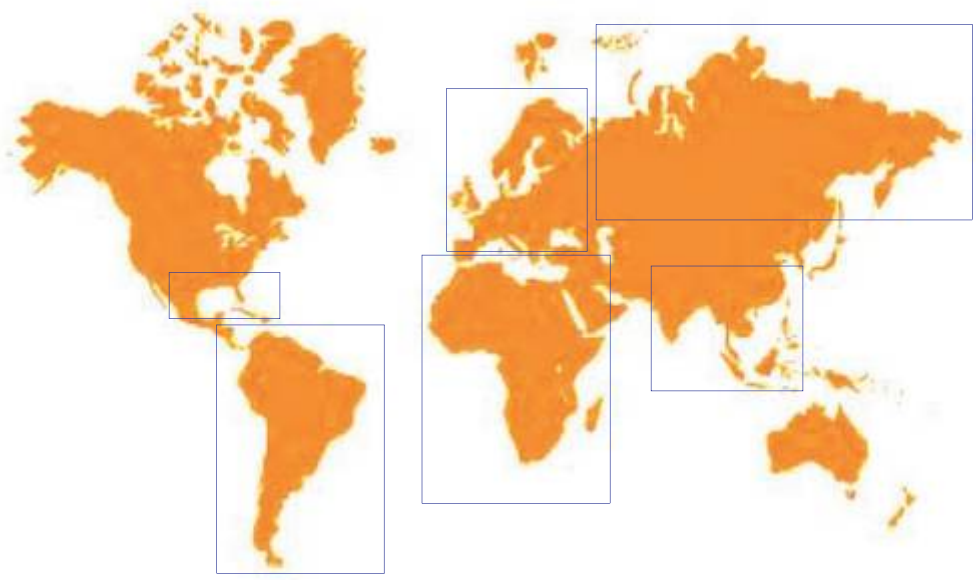
ROCAMIX

Stabilization and Waterproofing

any type soil in the Word

MANUAL OF THE APPLICATION OF THE ROCAMIX® TECHNOLOGY

Version-Oct. 2018



SCHEME OF THE APPLICATION OF ROCAMIX TECHNOLOGY

TECHNICAL INFORMATIONS

WORKS ON CONSTRUCTION

Soil classification and dosages calculated by a laboratory ←-----**RECALL**

1

SOIL CLASSIFICATION AASHTO and SUCS methods

RECOMMENDED DOSES

Classification												
AASHTO	A-1		A-2				A-3	A-4	A-5	A-6	A-7	
	A-1a	A-1b	A-2-4	A-2-5	A-2-6	A-2-7					A-7-5	A-7-6
SUCS	GW	GC	SM	SM	SC	SC	SP	ML	MH	CL	CH	CH
Option 1												
Soils conforming to Rocamix Theorem 10 + 10 + 20.												
	no	*no*	yes*	yes*	yes	yes	*no*	yes*	yes	yes**	yes**	yes**
Rocamix liter/m3			0,50	0,50	0,50	0,50		0,50	0,60	0,60	0,60	0,60
Cement& kg/m3			7 to 15	7 to 15	7 to 15	7 to 15		15 to 20	15 to 20	15 to 20	20 to 25	20 to 25
Option 2		IT IS ADVISABLE TO ADD TO										
Non compliant soils because the IP (Plasticity Index) <to (8-10) or Methylene Blue result <2.5												
Change the composition of the soil by adding 3% to 10% of previously liquefied clay												
Rocamix liter/m3	0,40	0,40	0,50	0,50			0,50	0,50				
Cement& kg/m3	7	7	7 à 15	7 à 15			10 à 15	15 to 20				
Option 3		IT IS ADVISABLE TO ADD TO										
Soils that contain a sieve 200 (0.075 mm) sieve greater than 85%												
Change the composition of the soil by adding 3% to 10% of crushed stone (8/10 mm)												
Rocamix liter/m3										0,60	0,60	0,60
Rocamix liter/m3										0,60	0,60	0,60
Cement& kg/m3										15 à 20	20 à 25	20 à 25

yes* Soils can have an IP (Plasticity Index) = o, or than less < 10, in this case add a % of liquefied clay

yes** these soils can have a passage sieve 200 (0.075mm) of **more than 85%** and in this case it is advisable to improve the composition with a% of crushed stones. If necessary to increase the CBR

Cement& The dosage starts at the lowest and depending on the results the choice is frozen.
Sometimes for certain soils A5, A6, A7 it is better to mix cement + lime

WARNING!

ROCAMIX has carried out hundreds of laboratory tests with all types of soils. And the application rates of the ROCAMIX System displayed are based on the results of these tests and remain indicative.

THIS CHART OF ASSAYS SHOULD ACT AS A GUIDE BUT **CAN NOT BE CONSIDERED AS PETRIFIED FOR** THE DOSES POSTED.

Only laboratory tests will be able to fix and certify exact doses to be applied

2

Proctor calculation basis transmitted by the laboratory ←----- **RECALL**

FOR THE BEST POSSIBLE COMPACTION IT IS NECESSARILY NECESSARY USE PROCTOR DATA

CALCULATION OF THE PROCTOR modified

The Proctor is the calculation of the optimum soil moisture to get the best compaction.
Its measurement is expressed in % of the volume of water on the volume of the soil

Si nous utilisons les valeurs (γ_d vs ω) nous obtenons Figura 1.

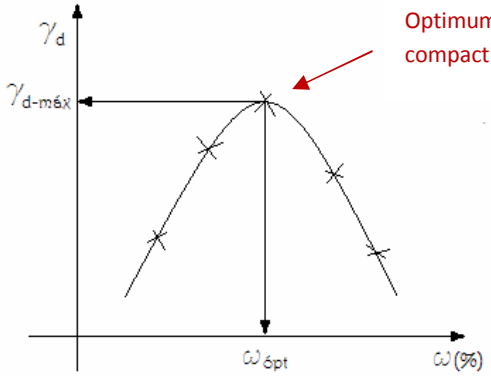
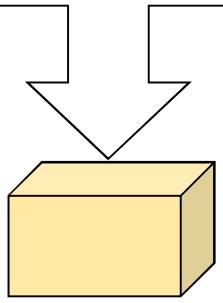
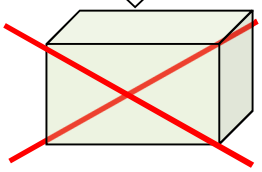


Figure 1 : Courbe de compactation Proctor

→ **Once these parameters are established, the amount of water to add to the soil is known.**

This amount of water to be added (very variable) by M3 soil, can now be mixed with the dose of ROCAMIX diluted ready to use (see page 5).

Warning!

	NORMAL CASES	**SOILS SATURATED WITH WATER**
	ROCAMIX *Diluted (see page 5)* **MORE** The possible amount of water needed to obtain **Conditions of PROCTOR *modified*** (Laboratory study)	ROCAMIX **CAN NOT** Apply before the soil moisture content allows to add the mixture ROCAMIX ***Diluted*** + WATER of PROCTOR planned
		
Measures calculated by	1 M3	1 M3

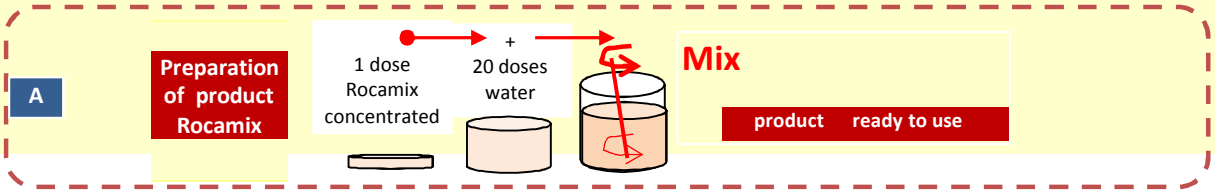
3 THE FORMULA FOR THE PREPARATION OF ROCAMIX

EXPLANATIONS ABOUT THE MIXTURE OF ROCAMIX + WATER = READY-TO-USE PRODUCT

With the aim of distributing the Rocamix liquid all over the surface with the greatest efficiency so as to reach all the particles of the soil, it is obligatory that Rocamix be diluted with a dose of WATER allowing this.
After many field trials and the finding that all particles were affected, a rule was granted = ROCAMIX should be diluted in a minimum of 20 liters of water. Either with a minimum thickness of 0,15 m and a minimum dosage of 0,40 liter / m3 **->** 0,40 l / m3 Rocamix x 20 doses of water = 8 liters liquid by m3 = 8 liters x 0,15 m thickness = a minimum of **1.20 liters of ready-to-use Rocamix per m2**. *Proven effective by experience on Ciudad de México field (September 2006) Mexico*

THE FORMULA FOR THE PREPARATION OF ROCAMIX

Preparation of ROCAMIX diluted = **1 dose of ROCAMIX *concentrated*** for **20 doses WATER**



CASE OF ADDITIONAL WATER ADJUSTMENT (possible) TO MATCH PROCTOR'S RESULTS

The diluted ROCAMIX product ready for use in the soil may also be mixed with any additional water the amount of which is determined by the parameters of the modified PROCTOR.
For example: with a soil that has a classification that imposes a dose per M3 are 0.50 Liter of concentrated Rocamix + 20 kg of cement) and which would require an additive (difference of% humidity between the soil of the place to be compacted and the PROCTOR data) **of 30 liters of WATER** according to the PROCTOR parameters, the calculation is: -> 0.50 liter of concentrated ROCAMIX + WATER necessary to create diluted ready-to-use ROCAMIX, i.e. 1 dose of concentrated ROCAMIX + 20 doses of WATER = 0.50 l by m3 X 20 = 10 Liters WATER to create the Rocamix *ready-to-use*. And, as the parameters of the PROCTOR require to add 30 liters of WATER, it is necessary to subtract from the 30 liters (PROCTOR parameters) the 10 liters of the transformation of ROCAMIX concentrate into ROCAMIX *diluted ready-to-use* **= 20 liters of water in addition. Thus, when the site is realized**, and when the treatment is carried out on a thickness of 15 cm, the minimum of water + ROCAMIX *diluted ready to use* will be at least ((20 + 10) = 30 liters x 1m2 x 0.15m) = **4.5 liters per M2,** allowing enough watering for the product to reach all the particles of the soil.
In the case of soils saturated with water, it is therefore not possible to add an overdose of WATER, since this would no longer correspond to the PROCTOR parameters previously established by the laboratory tests and it is necessary:

- that the sun and the air dry the soil in a natural way.
- or create artificial conditions (for example, absorbing moisture from the soil by lime treatment) to reduce this moisture.

- RECALL When soils require more WATER to meet the parameters of the modified PROCTOR, this essential amount of WATER is added to the mandatory minimum

But this dose supplementary, not affect the ROCAMIX effect which is calculated on the amount of ROCAMIX concentrated by M3 soil.



NOTE **Pour mélanger Rocamix *concentré* avec l'eau, il est conseillé de procéder de la manière suivante :**
To mix Rocamix concentrate with water, it is advisable to proceed as follows:
First pour the amount of water expected in the tank
Second, pour the amount of Rocamix calculated according to the amount of water
To mix Rocamix with water, usually with the tank truck or the tractor + tank, a very short and fast return (jolting) allows an efficient mix of concentrated Rocamix and water.

NOTE Rocamix is a product that makes emulsions (bubble soap type) when it mixes with water.
when the product is accidentally thrown on the body**. No danger**. Always wash with large amounts of water

4 ROCAMIX MIXES WITH THE SOIL OF THE PLACE FOLLOWING THIS METHOD

Depending on the type of machine and equipment available, many other machines and equipment may be used for the Rocamix application.

Follow the lists of equipment and machines that can be used.

5

SOILS THAT HAVE FULFILLED THE CONDITIONS OF THE ROCAMIX THEOREM 10 + 10 + 20
Classification AASHTO A2-6, A2-7, A4, A5, A6, A7 SUCK SM, SC, ML, MH, CL, CH
Typical application as described on page 6, and using the machines or equipment described on pages 7 and 8

1 - SCARIFICATION

WITH A GRADER TRUCK+ GRAVES /DISCK



The purpose of the scarification is to transform the soil of the place into a soil free of any lumps and totally crumbled. For this the motor-grader must have the rear teeth (rippers)
In the most difficult cases, with too stony ground (more than 50 mm)
it is advisable to carry out the first scarification with a machine
"Crushing"----------→

1 - DISTRIBUTION OF ROCAMIX LIQUID

TRANKER OR TRACTOR +TANK + DISTRIBUTION BAR



Ready-to-use Rocamix liquid dispensing can be realized with any type of towed tank or truck. The most important is the regularity of the watering of the soil and to make sure to have the quantity of product recommended per m3, which are on the ground the m2.

The most important to obtain a great regularity in the distribution of the liquid is to use a bar-vending machine (automatic or not), regulating the output flow of the tank.

It is important to calculate the dosage of Rocamix ready for use + possible addition for Proctor = total volume of liquid to be sprayed on the ground.

The equation of calculation is simple but must be calculated before work

Example: a path 1000 m long, 5 m wide and a treatment of 0.20 m thick
1000 ml x 5 ml = 5000 m2 and a volume to be treated of 5000 m2 x 0.20 thickness = 1000 m3
The laboratory has calculated that this soil requires 0.50-liter Rocamix per m3, i.e. a volume of 1000 m3 x 0.50 l / m3 = 500 liters of concentrated Rocamix which, to be Rocamix *ready for use* requires a volume of 500 l / m3 x 20 times volume of water = 10,000 liters of liquid to distribute on these 5000 m2.
The option of adding water to obtain the optimum moisture content of the soil to be compacted, recommended by the results of Proctor is either
- A) Add directly in addition to diluted Rocamix *ready to use*
- B) Add the water after a first pass of the motor-grader once profile Rocamix *ready to use* + cements, to roughly outline the path.
To simplify the calculation example, we select option B).
So, a liquid volume of 10,000 liters of liquid to distribute on 5000 m2 = 10,000 liters / 5000 m2 = **2 liters / m2**
The calculation if we had selected option A) is the same because only the volume to be distributed would change.

3 - DISTRIBUTION OF CEMENT (sometimes lime or mixture of 2)

TRUCK OR A SKID STEER LOADER




Many ways exist to distribute the cement on the soil to be treated. The little cement used makes it possible to use simple means to distribute it with ease and speed. The most important remaining is to obtain a regular volume distribution.

Example: a path 1000 m long, 5 m wide and a treatment of 0.20 m thick

1000 ml x 5 ml = 5000 m2 and a volume to be treated of 5000 m2 x 0.20 thickness = 1000 m3

The laboratory has calculated that this soil requires 15 kg per m3 of cement, i.e. a volume of 1000 m3 x 15 kg / m3 = 15,000 kg of cement to be distributed over these 5000 m2.

So, a volume 15.000 kg of cement to distribute on 5000 m2 = 15.000 kg / 5000 m2 = **3 kg per m2**

4 – MIXING ROCAMIX LIQUID AND SOLID (cement / lime or both)

WITH A GRANDER TRUCK+ GRAVES /DISCK



Many machines can do the work of mixing the additives with the soil of the place. The motor-grader with fast and numerous backs and forth in one direction and the other is a safe option. But the tractor to which is attached a disc type equipment also achieves a very good regular mix.

It is obvious that this phase is very important and for that will be rigorously monitored to ensure that the liquid + cement mix perfectly with the soil to be treated.

5 – SOIL PROFILING AND COMPACTION

WITH A GRADER


Classic profiling and finishing with motor-grader.

Vibrator-compactor roller minimum 7.5 tons.

Compaction is a very important phase for Rocamix Technology.

Respecting the rules of optimum moisture data (PROCTOR) before compacting is a golden rule that is forbidden to transgress. It is a very simple act of measuring the soil moisture to be compacted because today many inexpensive devices allow an immediate and reliable measurement. **And with Proctor's results in hand to compare, it is obvious that not respecting this rule can be considered malpractice.**

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6

SOILS THAT DO NOT ENTER THE CONDITIONS OF THE THEOREM ROCAMIX 10 + 10 + 20

AASHTO classification A1, A3, *and sometimes* A2-4 and A2-5 - SUCS SP, and sometimes SM

Typical application as described on page 6, but with an obligatory addition of clay according to the dose described by the laboratory (from 5% to 10%)

It is obvious that the AASHTO type sols A1, A-24 and A2-5, A3-SUCS SP, or SM which in general have a high support capacity (i.e. CBR greater than 50%) are therefore considered as support floors for excellent basis.

But sometimes for reasons of permeability it will be necessary to treat them with Rocamix + a clay addition that will be added in this way.

Treatment Rocamix + Cement → Add plastic limit clay → Mix All

Scarified soil

Soil + Rocamix + cement

Soil + clay (plastic limit)

It is very important that the clay is perfectly crumbled and at the limit plastic stage close to the liquid limit. An example of a machine for spreading on the soil

Mix the soil using the machines described below

How to distribute clay plastic format on the soil?

The laboratory gave a % of clay to mix in the soil. If one calculates this% with respect to the thickness of the soil, one can conclude that for a thickness of treatment of for example 20 cm and an addition of 10% of clay the computation will be 20 cm x 10% = 2 cm of thickness of clay to add to this soil.

AFTER, **MIX** with a TRACTOR + **Crusher or crushing Rotavator**

TO COMPLETE THE WORK

Reprofiling and compacting are identical to the definition on page 8

7

SOILS THAT COME IN THE CONDITIONS OF THE THEOREM ROCAMIX 10 + 10 + 20
But who need to undergo CBR
AASHTO classification A6, A7, and sometimes A5 - SUCS CL, CH and sometimes MH
Typical application as described on page 6, but with an addition of crushed stones (8/12 mm) according to the dose described by the laboratory (from 5% to 10%)

Soils of AASHTO type A6, A7, *and sometimes* A5 - SUCS CL, CH *and sometimes* MH which have a % of grain pass through the sieve 200 (0.075 mm) between 75 and 95% often have a support capacity (CBR less than 5%) very weak.
Adding crushed pebbles (8/12 mm) can raise the CBR.
As mandatory at ROCAMIX, the laboratory will have to determine the effect of this addition and indicate the% necessary to add to the existing soil.

Treatment Rocamix + Cement → Add crushed stones → Mix All

Scarified soil

Soil + Rocamix + cement

Soil + crushed stones
An example of a machine for spreading on the soil

Mix the soil using the machines described below

How to distribute crushed stones on the soil?
The laboratory gave a percentage of crushed pebbles to mix in the soil. If one calculates this % with respect to the thickness of the soil one can conclude that for a thickness of treatment of for example 20 cm and an addition of 5% of crushed pebbles the computation will be 20 cm x 5% = 1 cm of thickness crushed pebbles to add to this soil.

AFTER, **MIX** with a TRACTOR + **Crusher or crushing Rotavator**

TO COMPLETE THE WORK
Reprofiling and compacting are identical to the definition on pag

8

WHEN THE TREATED SOILS ARE VERY CLAY, THE ROLLING SURFACE MAY BE VERY SLIPPERY AFTER RAIN.

2 solutions

- Add on the ground a minimal dose (1/2 kg m2) of "filer" - crushed stones (3/5 mm)

- Make an asphalt emulsion reinforced by a projection of crushed stones 2/4 kg m2

1st solution: add spinning on the ground "nail the soil"

Treatment Cement → Profiler and achieve 75% compaction → Add the crushers stones → 

Soil + Rocamix + cement | **Compaction 75 %** | **Soil + crushers stones** An example of a machine for distributing crushers stones | **Compaction finale**

Asphalt distribution tanker truck

Tool to adjust and calibrate the volume of distribution

2nd solution: projected asphalt emulsion + crushed stones

Asphaltic emulsion projection

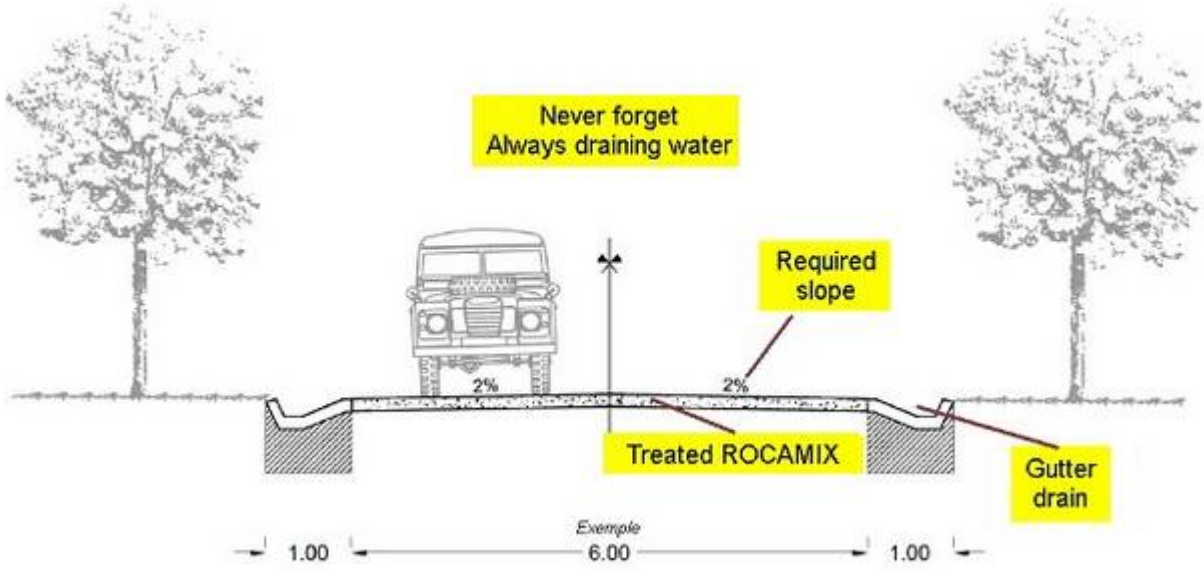
Distribution crusher stone

Final compaction

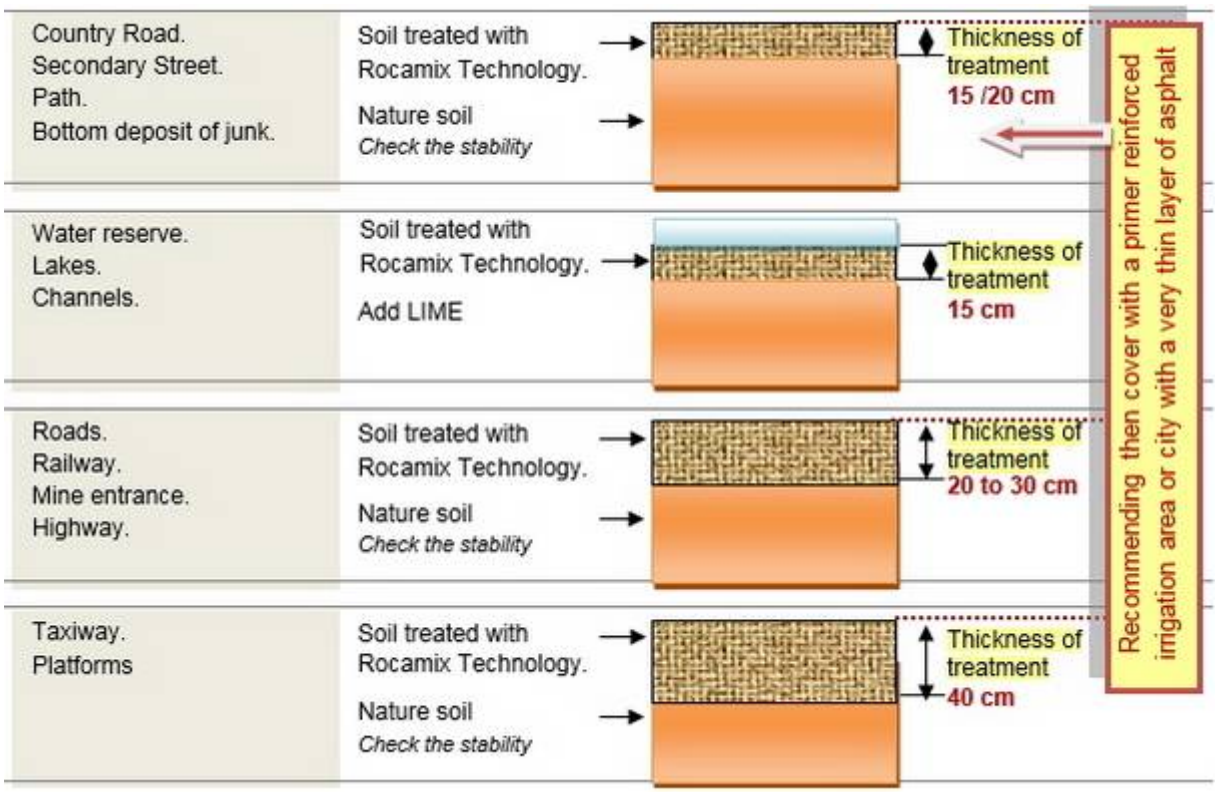
A soil treated with the Rocamix System + 1 asphalt emulsion and crushers stone is guaranteed for several years of useful life.

DO NOT FORGET THE RULES FOR THE CONSTRUCTION OF ROADS, PATHS, PLATFORMS

CONSTRUCTION DIAGRAM



Example **THIKNESS TO BE TREATED** (always indicated by study or laboratory)



ESTIMATE OF THE AVERAGE TIME OF APPLICATION ON-SITE OF THE ROCAMIX SYSTEM

The workforce must be skilled and used to working on creating or maintaining roads or paths. In addition, all phases and applications of the site must be guided and controlled by a Civil Engineer familiar with the Rocamix System.

The prices of labor and machine rentals for the application of the Rocamix® System can vary considerably from country to country and for this we cannot quantify them

But, years of experience and observation of construction work, throughout the world, allow us to indicate for **the specific application of Rocamix®** an average time of use.

			example work	
			length ml	width ml
			2.000	4,00
			Surface m2	
TIME Hand work by M2			8.000	
SOIL SCARIFICATION	Time / m2		**M2**	total hours
	0,00065		8.000	5,20
DISTRIBUTION OF ROCAMIX *ready for employment*				
	0,00060		8.000	4,80
CEMENT DISTRIBUTION				
	0,00060		8.000	4,80
MIXTURE				
	0,00060		8.000	4,80
PERFILE				
	0,00020		8.000	1,60
COMPACT				
	0,00095		8.000	7,60
TIME USED MACHINES with driver BY m2				total hours
SOIL SCARIFICATION	Time / m2			
	0,00065		8.000	5,20
DISTRIBUTION OF ROCAMIX *ready for employment*				
	0,00060		8.000	4,80
CEMENT DISTRIBUTION				
	0,00060		8.000	4,80
MIXTURE				
	0,00060		8.000	4,80
PERFILE				
	0,00020		8.000	1,60
COMPACT				
	0,00095		8.000	7,60
Total time for m2 (% de hour)	**0,00360**		8.000	28,80
the calculation is about the machine time		time 1 day working		8,00
		Number of days of work		**3,60**