CONCRETE SLAB FOUNDATION SYSTEM

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PRESENTS

THE SCIENTIFIC PAVEMENT WORLD SYSTEMS

SPWS
Scientific Pavement World Systems

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SCIENTIFIC PAVEMENT

Scientific Pavement World Systems

GREAT SAVINGS

IN CONSTRUCTION COSTS

FASTER

EASIER

CHEAPER

BETTER

ENVIRONMENT FRIENDLY SOLUTION

30% LESS ENERGY USED WHEN COMPARED TO ASPHALT SOLUTIONS

FULLY RECYCLABLE AT THE END OF ITS LIFE

LESS POLLUTION THAN ASPHALT AND LESS GLOBAL WARMING

THE CONCRETE SLAB-FOUNDATION SYSTEM ADVANTAGES

The slab-foundation system definitely solves all problems associated with the instability of natural soils, as well as slab cracking, either due to shrinkage or to natural foundation movements.

This patented technology adds several technical advantages over all other systems, such as:

- load reduction on the natural ground from 1800 to 30 kg/m3, by replacing and avoiding embankment material;
- reduction of ground movements – organic soil stripping (topsoil removal) is the only necessary step to establish the construction base;
- joint formation without mechanical intervention whatsoever;
- effective seepage (watertight joint), avoiding pumping phenomena;
- effective load transmission to all contiguous slabs;
- shortened construction deadlines – reduced ground movements and no need for a compacted base;
- allows the use of light machinery for the pavement construction - crucial in remote areas;
- no need to seal the joints;
- no need for reinforced concrete or any fibbers or any other additives;
- environment friendly: 30% less energy used when compared to asphalt solution.

30% cheaper works and 40% quicker works.

Better construction decreasing expenses.

More ecological and less pollution construction.

High resilient concrete without any reinforcement or any fibbers whatsoever.

Use of light equipments is possible.

Turn useless the need of piles.

Flat and levelled pavements with no more than 1 mm dissemblance.

THE WORLD'S BEST TECHNOLOGY FOR CONCRETE PAVEMENTS

All these technical advantages lead to enormous costs decreasing.

40 YEARS WITHOUT REPAIRS AND MINIMUM MAINTENANCE

CONCRETE SLAB-FOUNDATION SYSTEM

DESCRIPTION

The pavement is composed of a base of E.P.S. blocks, placed directly on the ground, overlaid by high resilient concrete slabs. E.P.S. means High Density Expanded Polystyrene.

The E.P.S. base replaces the embankment and the usual compressed base. Because

it keeps all its features over time, EPS ensures a durable base throughout the lifespan of the pavement. Simultaneously, the reduced friction with the concrete slab ensures that movements due to expansion, contraction or shrinkage do not create any undesirable stresses in the slab.

EPS base shall have the height arising out from the dimensioning of the pavement and from its mathematical calculations, normally varying from 5 cm to 30 cm.

However at some construction areas, where sand is available at a very low price (transportation included), the base may be made with compacted sand, which constitutes a very reliable and hard base. Compacted sand must nevertheless be involved with a textile tissue in order to ensure it does not displace the pavement base.

Before concreting, load transmission steel plates are placed under the joint location between slabs, anchored alternately on either side of the joint, forming a rigid support.

A watertight joint inductor (seepage) is placed on the steel plates to ensure the joint opening in its exact location.

High strength concrete, designed by our technicians, is poured and finished with lightweight equipment.

THIS IS NOT AN EXPERIMENTAL TECHNOLOGY

The key invention is the steel plate load transfer was recognized by the **State of France** (Annales - Institut Technique du Batiment et dês Travaux Publics, 1984) and **State of Belgium** (Centre de Recherches Routiéres, at Bruxelles, 1985) and latter on extraordinarily developed by us.

The steel load transfer plates, consists of steel plates that are alternately anchored

to the base of the slabs on alternate sides of the joint, and allow the transmission of tensions between contiguous slabs, ensuring the structural continuity of the pavement. The slabs can slide on the EPS base perpendicularly to the joint, without any stresses due to expansion and / or contraction. The rotation movement allowed by the steel plates ensures continuity of the pavement in case of natural movements of the soil. The Plastic Film allows concrete to retract freely without danger of any anchorage.

The joint inductor, made from galvanized steel sheet, is placed on the steel plates to ensure the exact location of the joint, and simultaneously prevent all and any infiltration of liquids to and from the base, directing all liquids coming from the surface to the pavement's drainage system. The "pumping" phenomenon is thus eliminated, and the EPS base is protected against the infiltration of contaminants.

THIS TECHNOLOGY IS EXTREMELY FLEXIBLE
ALL MATERIALS TO BE USED ARE PRODUCED AND MADE IN THE CONCERNED COUNTRY, NONE IS TO BE IMPORTED.

CONCRETE SLAB-FOUNDATION SYSTEM – USES

- AIRPORTS
- PORTS
- RAILWAYS
- ROADS AND HIGHWAYS
- FACTORIES, INDUSTRIAL AREAS AND COMMERCIAL AREAS
- WAREHOUSES AND FOOD REFRIGERATED WAREHOUSES
- PARKING PLACES.

TRADITIONAL TECHNIQUES AND OUR CONCRETE SLAB FOUNDATION TECHNOLOGY

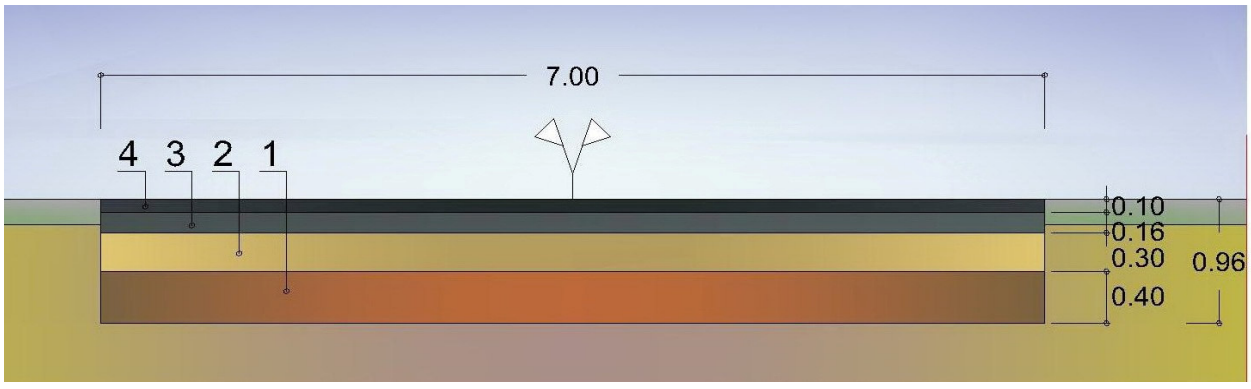
ADVANTAGES & COMPARISON

Any pavement construction is based on a foundation, once soils are not inert material, on the contrary, being live material.
It increases volume when it rains and decreases volume when it dries.

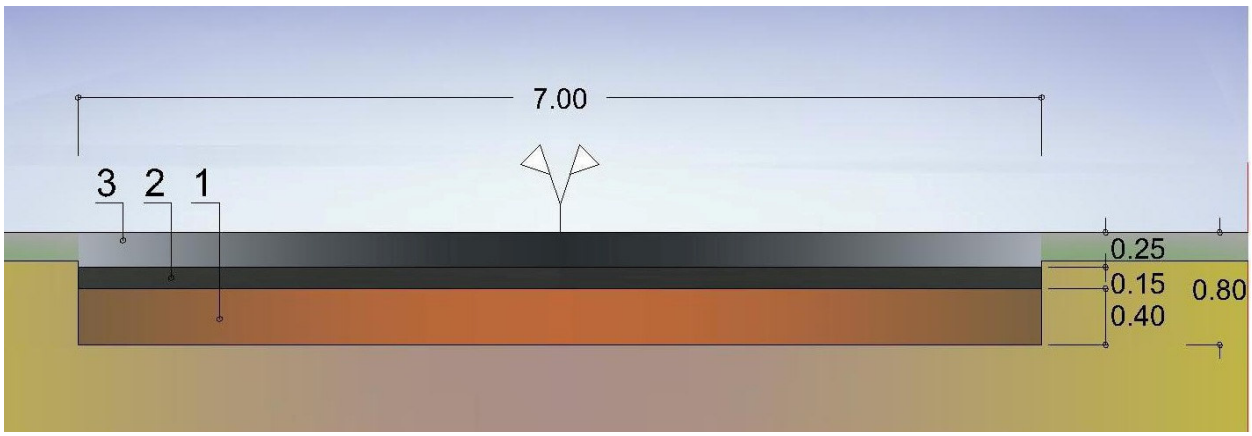
The first action in any construction is to remove the topsoil, which is unfit for construction, in order to create a pavement' box where the foundation is to be constructed.
The base construction is made usually (when using traditional techniques) with compressed selected soils – Crusher Run – topped with a layer of gravel, sand, and irrigation with tar (to provide some consistency to these loose materials).

Once this done (again when using traditional techniques) the two final layers are made (i) for flexible pavements with two layers of asphalt (bitumen), and (ii) for concrete pavements with a layer of lean concrete layer (lean concrete) (100kg of cement) and a layer of concrete, this latter after concrete retraction shall form the concrete slabs.

ASPHALT LAYERS



CONVENTIONAL CONCRETE PAVEMENT LAYERS



For a century traditional techniques have poorly and badly tested and for almost a century concrete pavements made with load transfer bars always break the slabs once they are not fit to admit differential settlements or soil distortions.

In some countries, where near the worksite sand can be provided at a low price, we can use instead of EPS compressed sand as a base, or other low cost inert material, provided that the sand is involved with a geotextil tissue to ensure it does not displace the pavement base.

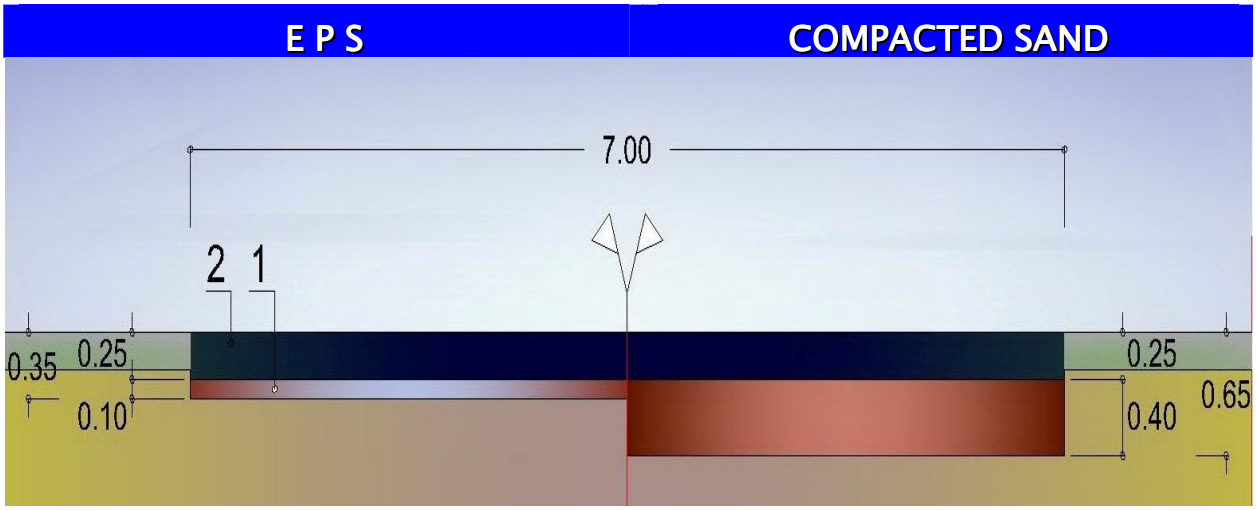
Our technology of monolithic foundation system replaces the classical foundation, made with inert materials, for:

a) a layer of EPS (5 cm to 30 cm) (also an inert material), or
b) a layer of compacted sand (also an inert material);

both allowing immediately the construction of the pavement on top of it.

THE ULTIMATE SOLUTION

SCIENTIFIC PAVEMENT CONCRETE SLAB FOUNDATION SYSTEM LAYERS

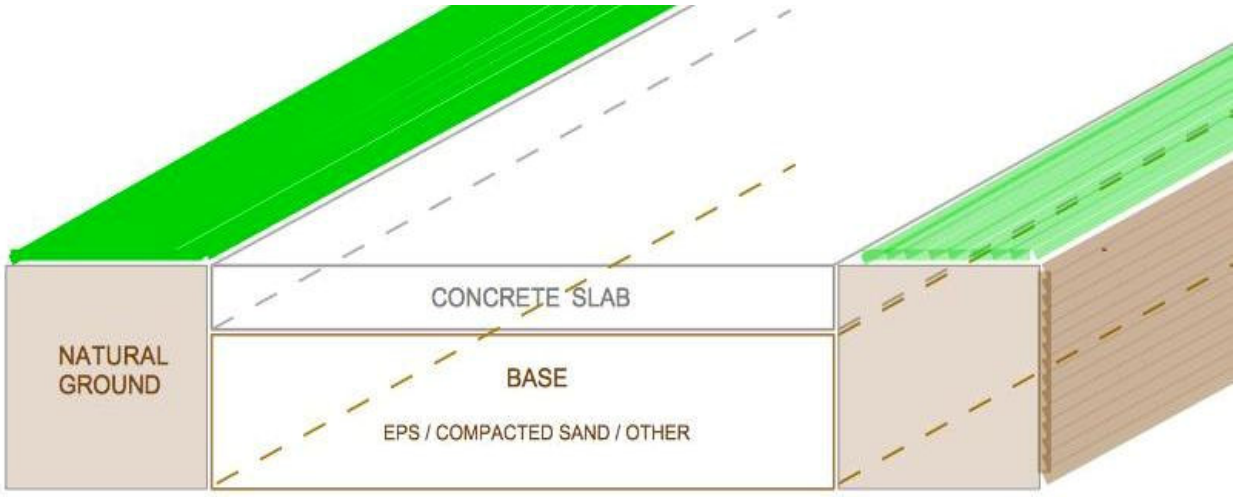


EPS placed directly over the soil substitutes quite efficiently the stabilization layers of inert laid under the traditional techniques, once EPS maintain a neutral and lasting action, without any relevant changes on of its mechanical action, being easy to handle and fast to place.

Our technology removes the layer of lean concrete layer (lean concrete), the steel load transfer bars (and the stresses that such bars causes on the concrete) and the need of construction of the traditional foundation with all its layers of inert materials, as it places under the concrete our steel load transfer plates, which transfer effectively the loads to all contiguous slabs.

Therefore the pavement can be <u>construed continuously with two layers only</u> – EPS or compressed sand (as a base) and the concrete poured immediately over it.

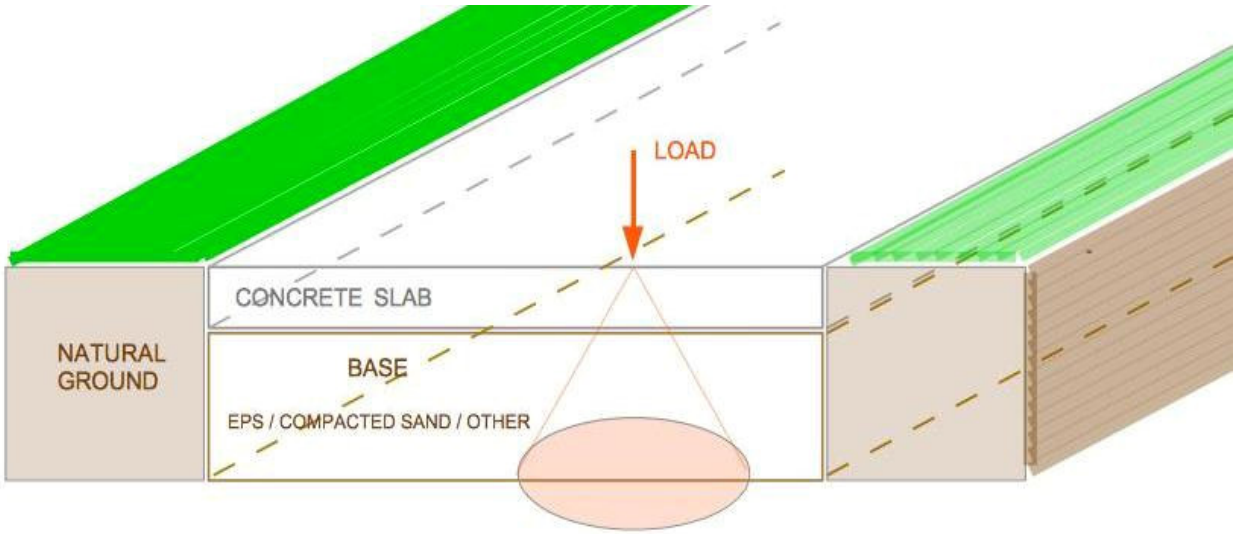
TWO LAYERS ONLY



<u>THE QUICKNESS OF EXECUTION IS EXTRAORDINARY.</u>

SCIENTIFIC MATHEMATICAL CALCULATIONS

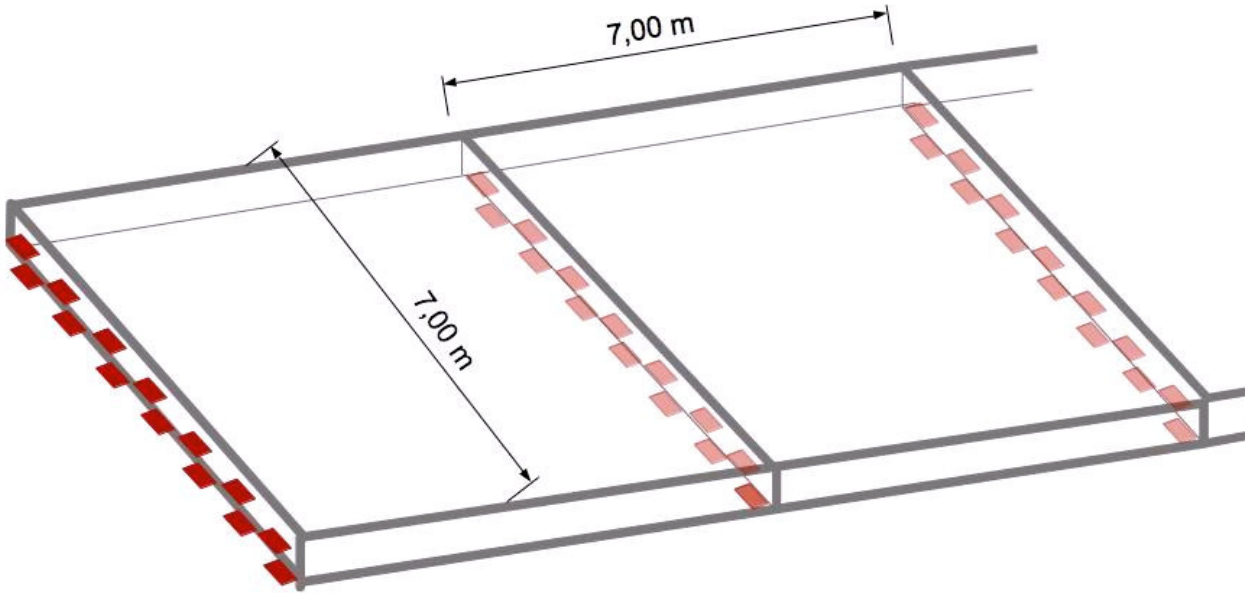
LOADS DEGRADE THEMSELVES WITHIN THE SLAB AND THE BASE ARRIVING AT THE SOIL FOR AN INFERIOR VALUE THAN ITS C.B.R.



The slabs can slide on the EPS base (or compressed sand involved with a geotextil tissue in order the base does not displace) perpendicularly to the joint, without any stresses due to expansion and or contraction.

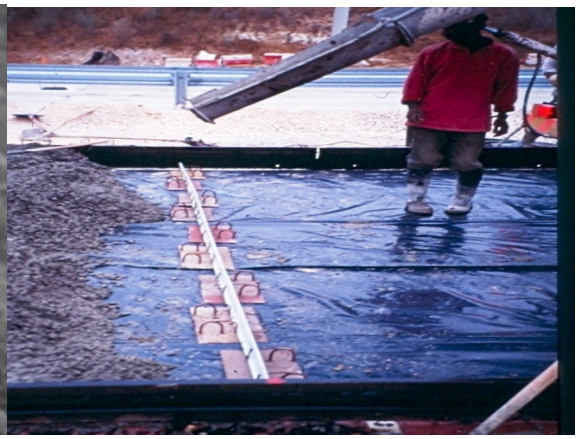
The rotation movement allowed by these steel load transfer plates ensures perfect continuity of the pavement in case of natural movements of the soil, allowing differential settlements of the ground up to more than 25 mm without damaging the concrete slabs.

OUR UNIQUE LOAD TRANSFER STEEL PLATES ENSURES VERTICAL AND HORIZONTAL ROTATION OF THE SLABS



High resilient concrete is used under IS.COM formulas, therefore steel reinforcement of concrete is never used and no fibbers whatsoever are included in the concrete formulas, reflecting a significant economy.

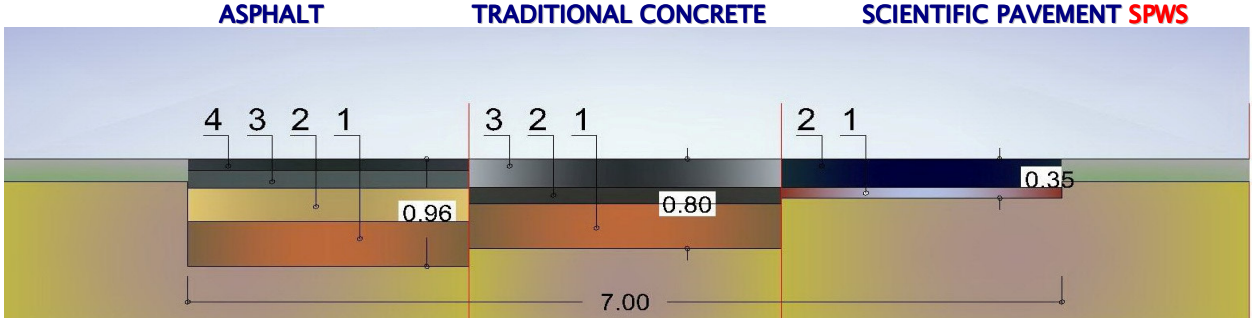
Our steel load transfer plates do include a joint inductor that insure the opening of the joints without any mechanical action exactly at that location, at the middle of the steel plates and simultaneously prevent any liquid infiltration to and from the base, therefore any pumping phenomenon is thus eliminated.



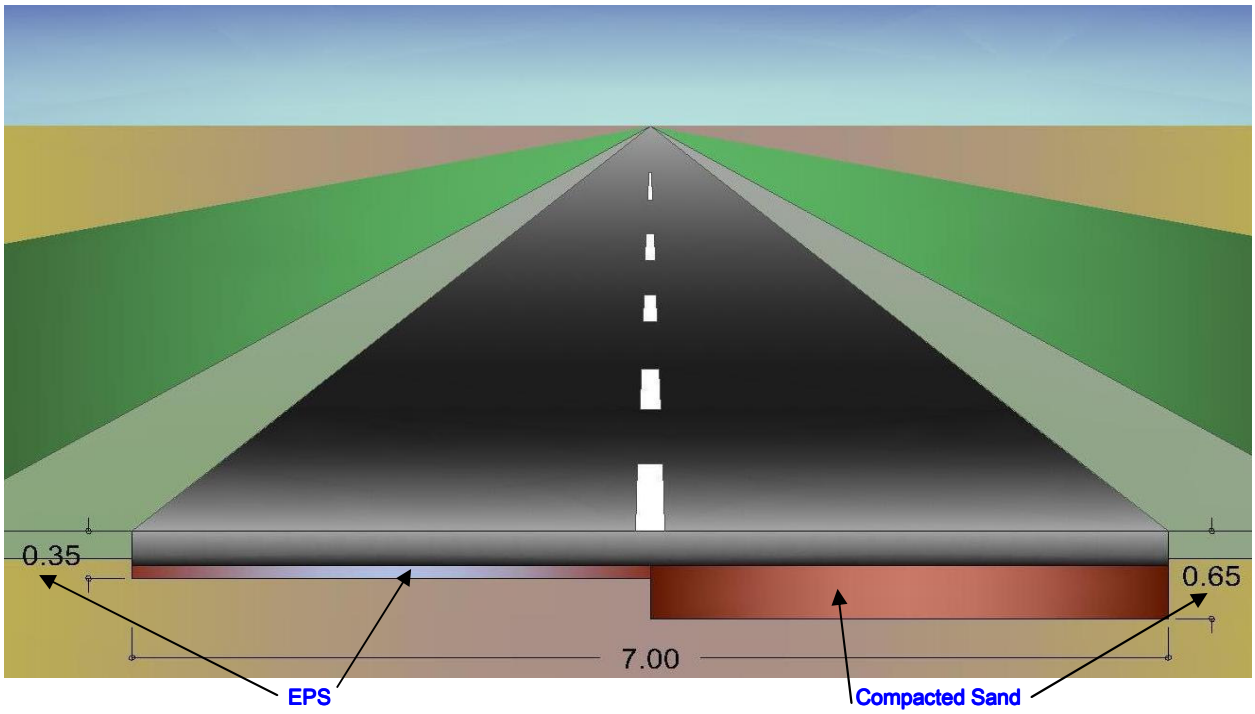
COMPARATIVE

AS PER EUROPEAN STANDARD

ASPHALT TRADITIONAL CONCRETE SCIENTIFIC PAVEMENT SPWS



A BASE OF 10 CM EPS OR A COMPACTED SAND BASE OF 40 CM AND A SCIENTIFIC CONCRETE SLAB ON TOP OF IT



TRANSPORTATION AND MATERIALS - for 1 km of pavement, 7m wide

= 20ton = 10 m³ = EPS machine on truck

Asphalt	Concrete	SPWS Sand	SPWS EPS
225	225	225	1
180	105	175	175
135	175		
90			
630 Total 100%	505 Total - 20%	400 Total - 37%	176 Total - 72%

or

SLAB-FOUNDATION FOUDATION SYSTEM- SPWS

R A I L W A Y S

The line of behaviour results from a complex interaction of the various components of the system, due to the demands imposed by railway composition in various environmental conditions. In order to fulfil the required demands, it is essential that each element performs its function, so that the system is stable, resilient and avoids either permanent deformations or wear of the components. The railway line solutions are characterized as follows:

Ballasted line;
Mixed support line;
Not ballasted line

The ballasted line is the oldest and is still today, structural solution. Its composition appears to have evolved very little over two hundred years, however, from the last forty years has been discussed the efficiency of its use for several reasons.

Alternative solutions to the ballasted line have emerged with the aim to reduce the problems in this type of structure. The non-ballasted track has been implemented in various countries such as Germany and Japan. Currently, this solution contained a large variety of structural designs,

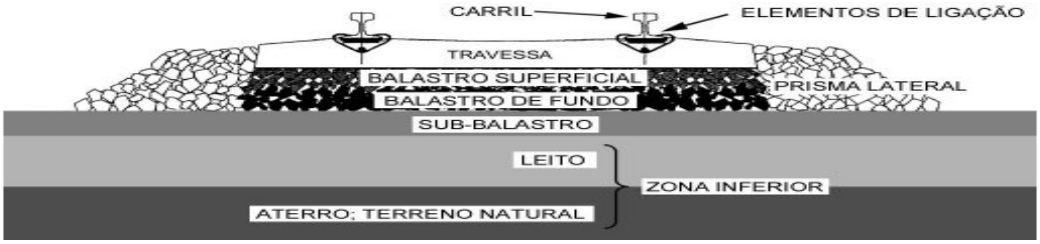
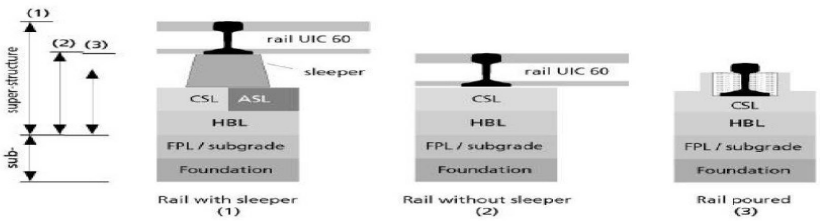


Figure 1. : Schematic cross section of ballasted track

Another solution is mixed support line that usually used is a layer of bituminous mix in place of granular material in the sub-ballast layer. The mixed support line solutions have been developed in several countries, and best solution and widespread and successful application in Italy, with the high-speed lines.

In non-ballasted track, the ballast layer in the ballasted track is usually replaced by a layer of reinforced concrete slab or a layer of bituminous mixture (Figure 2.). The first group of solution which consists of rails, supported by sleepers laid or embedded in a concrete slab, being typically called line slab. For the second group, these solutions consist of sleepers made of reinforced concrete, supported directly on a bituminous layer, which replaces the ballast.



CSL - laje de betão (*Concrete Supportive Layer*); *ASL* – camada de mistura betuminosa (*Asphalt Supportive Layer*); *HBL* - agregados tratados com ligante hidráulico (*Hydraulically-Bonded Layer*); *FPL* - Camada de protecção contra o gelo (*Frost protection layer*); subgrade – leito de via.

Figure 2: Different solutions for non-ballasted line

There are currently two types of concrete sleepers in particular the bi block sleepers (reinforced concrete) and monoblock sleepers (prestressed concrete) (Figure 3.).

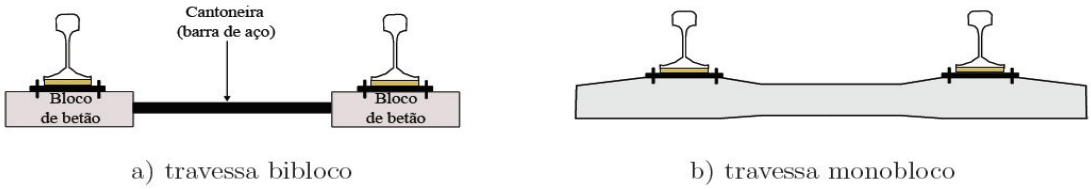


Figure 3: concrete sleepers

The line slab solution, presents a wide range of structural designs. This variety results from different disposal possibilities and integration of the elements face the constraints imposed on the line. For example, in figure 4. are presented six different types of line design

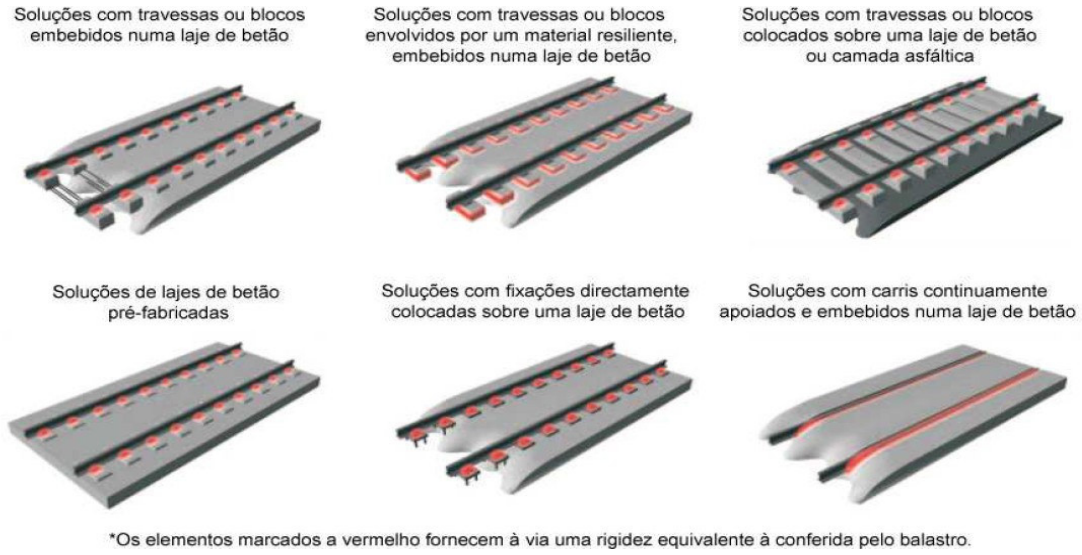


Figure 4. : Several concepts for line slab solution

When compared to the solution ballasted line, the line not ballasted is defined with three new layers

1 - Top layer in concrete slab (CSL - concrete supportive layer) or bituminous mixture (ASL - asphalt supportive layer) - this layer receives the reinforcement of the slab and distributes the loads transmitted by the carriages to the lower layers, respecting demanding durability requirements.
If reinforced concrete slabs are used it should assure a controlled cracking standard and ensure frost resistance and defreezing resistance.
In the case of bitumen support layers, conditions similar to the motorways/highways construction must be considered, however obeying more stringent criteria.

2 - Aggregates layer treated with hydraulic binder (HBL - Hydraulically Bonded Layer- - This layer lies between the CLS (or SLA) and lower granular layer, degrading the loads to the lower layers. It is composed of inert materials and specific glanulometry, treated with a hydraulic binder.

The line In tunnels, bridges or more economic solutions is usual to eliminate this layer, provided that the thickness of the upper concrete slab is increased or improvement measures of the layers located immediately below are carried out;

3 - Layer of granular material, with properties similar to the sub-ballast (FPL - Frost protection layer): supports the layer treated with hydraulic binder and distributes the loads into the foundation layers. It must have a certain resistance to freezing and defreezing when and where it is relevant, as well as provide an acceptable drainage to the line.

The use of non-ballasted line as a solution for new railway lines enables a reduction in maintenance costs and increased stability of the line, allowing greater safety regarding the movement of carriages with increasingly higher speeds.
Regarding the foundation platform, it is necessary that this present deformations reduced to minimize the differential settlements throughout the project life.
Nowadays several solutions with high quality levels for lines not ballasted are available, thanks to the work developed in recent decades. Most of these solutions present life project for approximately 60 years, almost without requiring maintenance works.

Given the problems caused by granular sub-ballast, in some high-speed lines it arise the need to seek solutions for these matters. For such purposes soils were improved with cement to achieve acceptable CBR values. In addition to these solutions, in the first existing high-speed lines, bituminous mixtures were applied as sub-ballast in some countries.
Figure 5. shows the typical structure adopted by some countries.

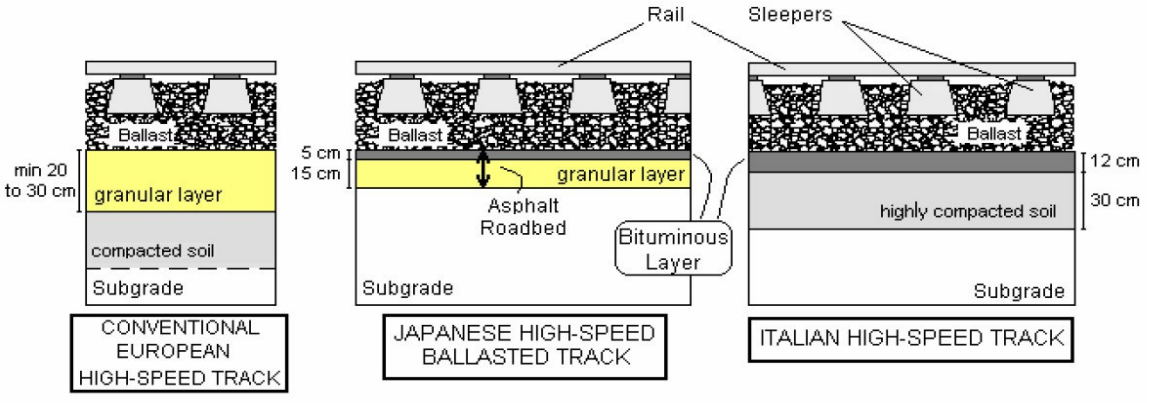


Figure 5. : Typical section of high-speed lines

THE SOLUTION

THE SYSTEM SLAB-FOUNDATION !!!!

The base being formed by E.P.S. blocks (High density polystyrene at 30/kg / m3 at least) placed directly over the natural ground.
Over it a plastic film of 0.02 cm, which function is only to allow the concrete to retract freely without anchoring and preventing it to crack while concrete retracts, High strength resilient concrete is immediately poured over supported by our unique steel load transfer plates.

Our unique steel load transfer plates, which are anchored alternately on one side and the other of the concrete slabs, do allow transmission of the stresses caused by loads to all the adjacent slabs and accept differential settlements of the ground up to 25mm, but always ensuring the perfect continuity of the pavement..

The joint inductors, manufactured in plastic or galvanized steel, are placed over the steel load transfer plates to ensure the precise location of the joint opening, that simultaneously prevent the infiltration of all liquids to and from the base, forwarding them to the floor drain.

The end of the rails should never coincide with the joints.

The price of the base in E.P.S. should be around € 5.00

TWO LAYERS ONLY. THE SLEEPERS MAY HAVE A FIXING SOLUTION

ECONOMY

THE FINAL CONSTRUCTION PRICE IS ALWAYS LOWER AND INCLUDES THE FOLLOWING ECONOMIES:

- reduction of deadlines in 40% of term at least;
- savings on maintenance of the construction yard, on equipments, on transportation and on manpower – global economy of 1/3.
- transport of crusher Run; spreading and compacting of crusher Run;
- transport of gravel, spreading and compacting the gravel;
- transport of sands; spreading and compacting the sand
- final irrigation with asphalt;

Concrete roads	Bitumen roads
Lean concrete layer (lean concrete)	A layer of asphalt
No sealing of joints and sawing in fresh	

- concrete unreinforced and fibbers free;
- less earthmoving.

PLEASE NOTE WHAT WE DO

IS.COM IS NOT A GENERAL CONTRACTOR AND DOES NOT CARRY ON WORKS ITSELF.

IS.COM is a technological company therefore we offer the dimensioning project of the pavement, all mathematical calculations, indicates the appropriated mix and composition of concretes, supervises the making of the steel load transfer plates and it's dimensions and shapes, sizes and endurance according to our specifications, indicates shapes and sizes and the materials to produce the joint inductors and supervises it's endurance, supervises and advise the construction works at the work site, guide the exact location of the steel transfer load plates as well the joint inductors along with other know how.

IS.COM WORKS ALONG WITH ANY GENERAL CONTRACTOR.

THE PATENTED FOUNDATION SYSTEM ALLOWANCE

- Significant load reduction on natural ground.
- To predict the long term base behaviour and to sizing the slabs accordingly.
- Allows constructing the concrete slabs directly over the EPS base.
- Effective load transmission to the contiguous slabs.
- Achieve a continuous pavement in case of natural movements of the soil.
- Allow to increase the length of the slabs and to reduce the width of the joints.
- Avoid liquid infiltration trough the joints to the soil and avoid the "pumping" phenomena.
- Excellent results in the speeding of works versus traditional techniques.
- Reduces all tensions throughout the retraction phase of concrete.
- Decrease construction costs and reduces maintenance costs.

SPWS SUMMARY OF TECHNOLOGY

a) cheaper works – less 30% and faster works – 40%
b) 40 years with no repairs and minimum maintenance.
c) better construction
d) more ecological and less pollutant
e) use of high resilient concretes without reinforcement or fibbers
f) flat pavements with an unevenness not exceeding 1 mm
g) use of light equipments for construction works
h) turn useless the use of piles over grounds with a low CBR or K
i) the best world technology for pavements

SPWS OTHER TECHNICAL ADVANTAGES:

1 – reduces the loads arising out from the pavement' base on the natural ground from 1800 kg/m3 to 30 kg/m3.
2 – creates the joints without mechanical intervention.
3 – speeds the construction works once the land displacement is quite reduced, there is no need of a compressed base nor for any lean concrete layer (lean concrete) sub base.
4 – turns possible the use of light equipment for construction.
5 – reduction of deadlines and all associated costs of construction, maintenance and repair.

SPWS OTHER ENVIRONMENT ADVANTAGES:

- The Slab Foundation System is less pollutant than any conventional technique once concrete accumulates less heat and generates less global warming and vehicles have an inferior consumption of fuel.
- Also at the end of its life all materials are fully recyclable.
- Concrete is not pollutant, but bitumen is throughout its entire life pollutant and causes infiltration in the soil of hydrocarbons.

JOINT FORMATION WITHOUT ANY MECHANICAL INTERVENTION

JOINTS MAY BE SAWED IN FRESH

NO SEALING IS REQUIRED ONCE JOINTS ARE SEEPAGE (WATERTIGHT)

THE JOINT'S WIDTH IS THEREFORE VERY THIN.

CONCRETE SLAB-FOUNDATION SYSTEM – HISTORY

Soil stabilization has been the main problem in road construction throughout the ages. Asphalt roads tend to follow soil settlement or swelling. Concrete roads tend to break upon soil distortions. Developments in geotechnical engineering and in geotechny, especially in the improvement of foundation soils, have benefited the techniques of road construction. But in many cases it is economically impossible to ensure soil stabilization. In such cases, asphalt is not an option. Many techniques have been used to ensure pavement's continuity, such as load transfer bars and reinforced concrete. None of them proved to be a durable and maintenance-free solution. Reinforced concrete cracks, steel reinforcements corrode and the concrete surface delaminates. Load transfer bars are almost impossible to align, and do not allow any vertical movement between slabs. Any soil distortion will break the slab's joint. Such technology is not watertight, therefore infiltrations will eventually erode the base and pumping problems will emerge. Since the early 1980s, IS.COM's technicians have been working on a solution to all these problems:

1 - The joint's vertical mobility has to be ensured while maintaining the load transfer ability.

2 – The base movements have to be predicted, controlled and limited.

3 – The friction between the slab and the base has to be reduced.

4 – The joint must open without mechanical intervention but with precision and sawed while the concrete is still fresh.

5 – The joint has to be watertight (seepage).

After many studies and tests, IS.COM has patented the new SPWS CONCRETE SLAB-FOUNDATION SYSTEM TECHNOLOGY, THE ULTIMATE SOLUTION to all ground pavements' problems.

SOME CONSTRUCTION WORKS

• WAREHOUSE FOR JOHNSON & JOHNSON, AT LISBON, QUELUZ, PORTUGAL
PUNCTUAL LOADS OF 8.000 KG / M2
SLABS OF 12 X 12 M COM 12 CM THICKNESS

• PARKING FOR MATERIALS AND WAREHOUSES OF NATO'S AIRPORT, AT MONTE REAL, PORTUGAL
PUNCTUAL LOADS OF 20.000 KG / M2
SLABS OF 8 X 8 M WITH 20 CM THICKNESS

• ROAD AT VALENÇA, PORTUGAL
FOR TRUCKS WITH 13.000 KG PER AXLE
SLABS OF 8 X 4 M WITH 16 CM THICKNESS

• ROADS AT DE VILA NOVA DE CERVEIRA, PORTUGAL
FOR TRUCKS WITH 13.000 KG PER AXLE
SLABS OF 8 X 4 M WITH 16 CM THICKNESS

• WAREHOUSE OF NESTLÉ, AT AVANCA, PORTUGAL
PUNCTUAL LOADS OF 4.000 KG
SLABS OF 12 X 12 M WITH 12 CM THICKNESS

• TREATMENT OF SOLID RESIDUALS (TRASH) AT VALE DO AVE, PORTUGAL
FOR TRUCKS WITH 13.000 KG PER AXLE
SLABS OF 8 X 4 M WITH 16 CM THICKNESS

• INSTITUTE FOR DEVELOPMENT AND TECHNOLOGICAL INNOVATION (IDIT) AT SANTA MARIA DA FEIRA, PORTUGAL
SLABS OF 8 X 8 M WITH 13 CM THICKNESS

• EXPONOR (PAVILHÃO TOPO NORTE) AT OPORTO, PORTUGAL
PUNCTUAL LOADS OF 13.000 KG / M2
SLABS OF 8 X 8 M WITH 16 CM THICKNESS

• ACCESS ROAD TO CIMPOR CEMENT FACTORY AT S. MIGUEL, AZORES
FOR TRUCKS WITH 13.000 KG PER AXLE
SLABS OF 8 X 4 M WITH 16 CM THICKNESS

• MOTORWAY A8 – REPAIR – PAVEMENT REPLACEMENT AT TORRES VEDRAS TOLL
FOR TRUCKS WITH 13.000 KG PER AXLE
SLABS OF 5 X 6 M WITH 20 CM THICKNESS

• PORT AT VITÓRIA, ESPÍRITO SANTO STATE, BRAZIL ,FOR PRYSMIAN (PIRELLI MARITIME CABLES) JUNE 2011
LOADS OF 25 TON/PUNCTUAL
SLABS OF 5 X 5 M WITH 25 CM THICKNESS

• A NUMBER OF WAREHOUSES AND FACTORIES IN ESPÍRITO SANTO, BRAZIL, 2012

• BIANCOGRES FACTORY AT VITÓRIA, ESPÍRITO SANTO STATE, BRAZIL, JANUARY 2013
LOADS OF 25 TON/M2
SLABS OF 5 X 5 M WITH 14 CM THICKNESS

• JURONG PORT AT ARACRUZ (A SINGAPORE COMPANY), ESPÍRITO SANTO, BRAZIL – 2014

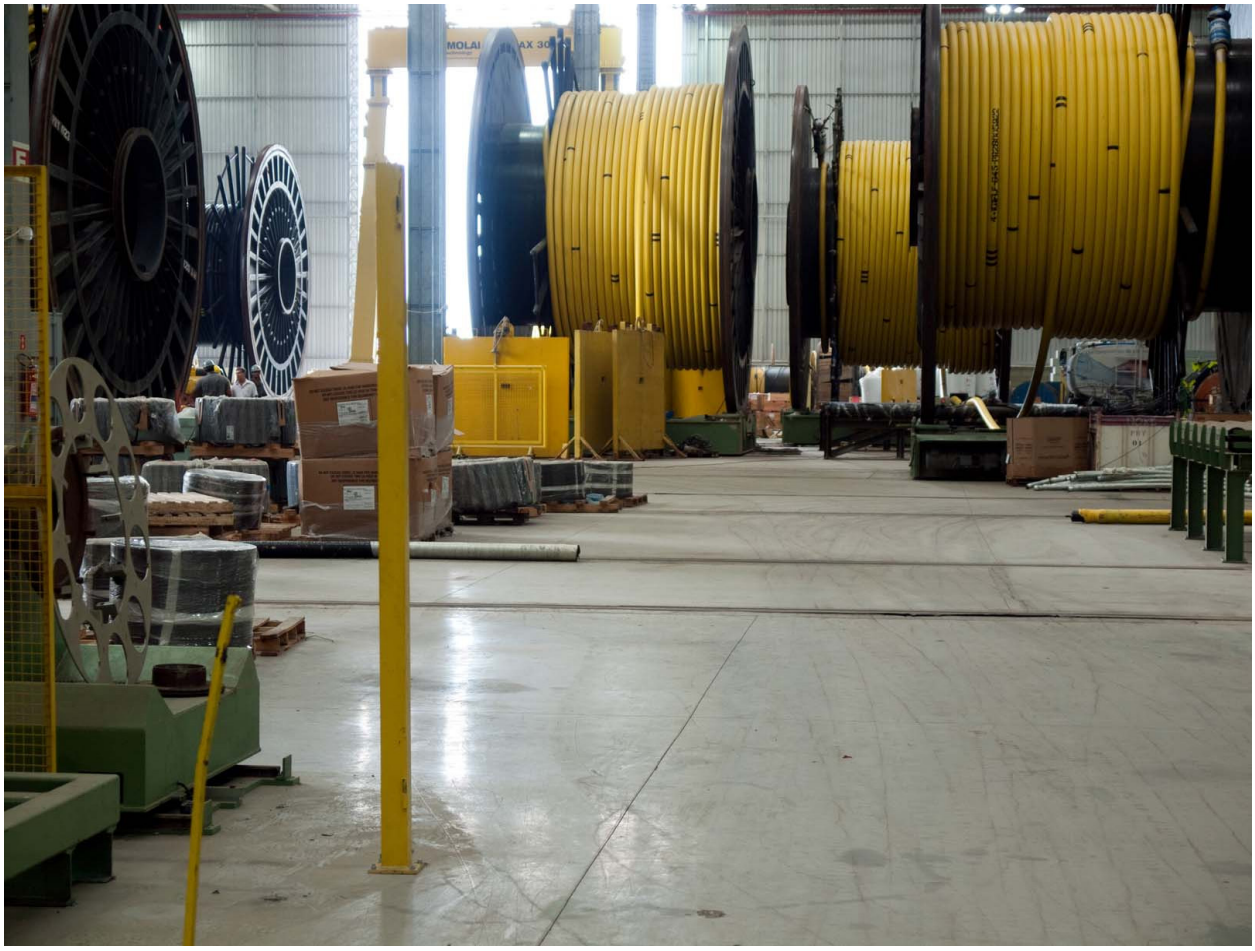
PORT

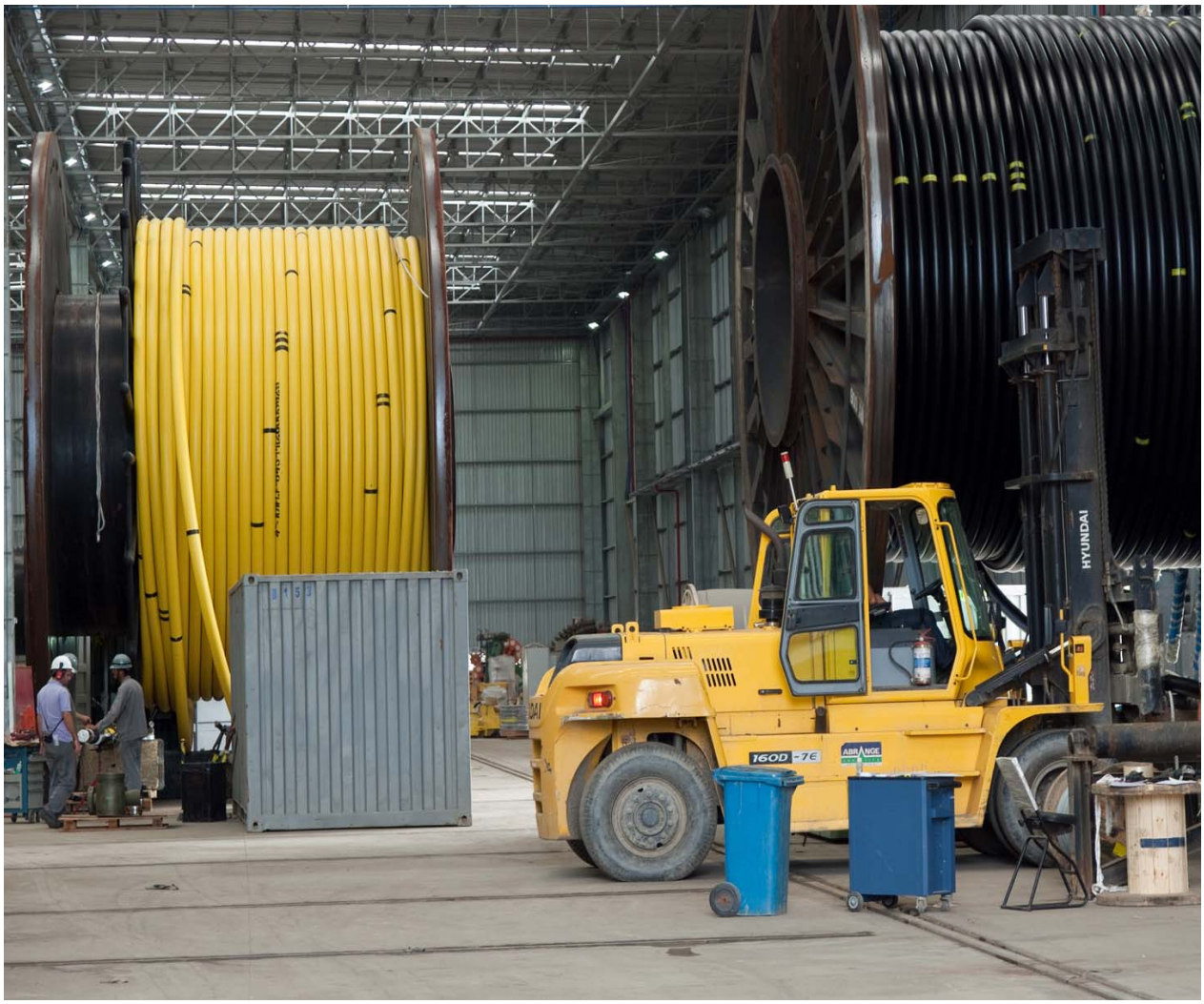
VITÓRIA, ESPÍRITO SANTO STATE, BRAZIL

PRYSMIAN (PIRELLI MARITIME CABLES) JUNE 2011

GENERAL CONTRACTOR – HOCHTIEF (BRAZIL)

THIS PAVEMENT WAS ORDERED FOR 25 TON AND LATER ON LOADS UNTIL 225 TON WHERE PACED ON THE PAVEMENT WITHOUT CAUSING ANY DAMAGES TO IT.




HYUNDAI
160D-7E

Apoio em faca/em forma de caril

Carga maxima aleatoria do cliente: 225 ton/com apoio em faca

Recalque diferencial da fundação após 10 meses

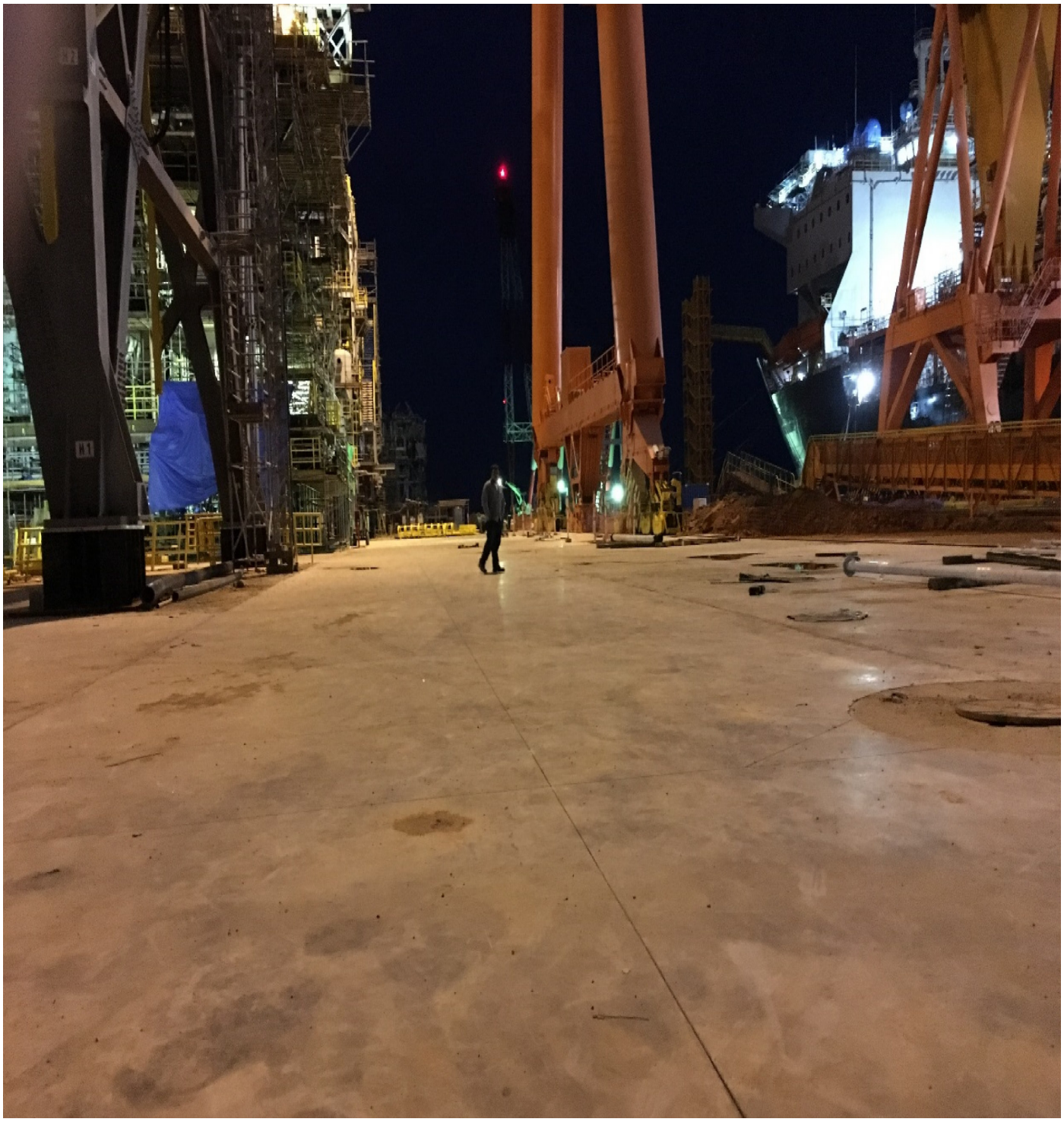
MOTORWAY - PORTUGAL

FACTORY - BRAZIL

JURONG PORT IN BRAZIL

ARACRUZ, ESPÍRITO SANTO

820,000.00M2



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SPWS IS MANAGED WIDE WORLD BY IS.COM

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