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Semi-Continuous Concrete Pavements (Concrete Floors)

ECONOMY AND QUALITY

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Only at a few times are concrete pavements (floors) given their due attention. Usually and as "What's on the ground does not fall", it's placed any sort concrete, in any way and of any thickness, without taking into account the request that it will be used for. If, by chance, it's assigned for a concept of importance, projects of an expensive kind appear, and really not so often effective, that when possible inevitably lead to the choice of the apparently cheaper bituminous. And apparently, as the comparison is not made based on the same assumptions, with the same behavior throughout time.

In concrete floors the situation has worsened with the emergence of a number of companies "specialized" in this work, which, allegedly in possession of advanced technology, dedicated, faithful to the motto "any concrete used provided it has a lot of water," and mercy the results obtained, to tarnish the image of the concrete.

The cases as documented in photographs 1 to 5 multiply, but there were no concern after diagnosis of the cause, prevent similar procedures.



1



2

In photos 1 and 2 it's clear that the failure is the result of concrete composition accompanied by misplacement.



3



4



5

In the photographs 3 and 5 besides the two above indicated factors obviously also project deficiency.

The two works, a road and an industrial area, hereinafter presented both in **Semi-Continuous Concrete** - patented in Portugal since 1982 - clearly prove that the concrete pavements (floors) can be economical and have quality.

The numerous advantages that this technique has come from the device used as the load transfer element - the load transfer plate (photo 6) - which allows bold solutions in comparison with the usual.

Thus:

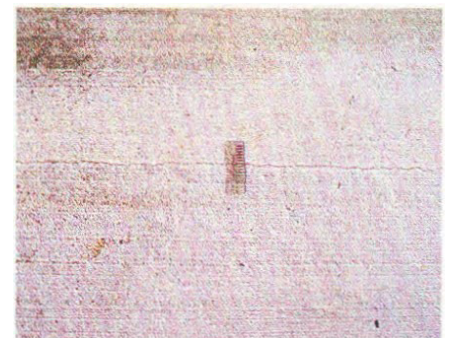


6

Commissioning work of load transfer plates.

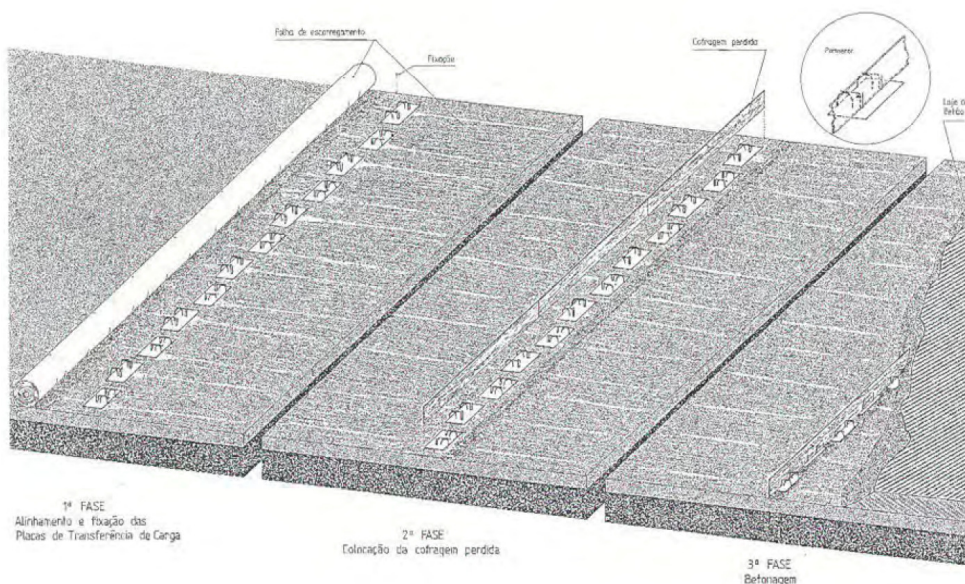
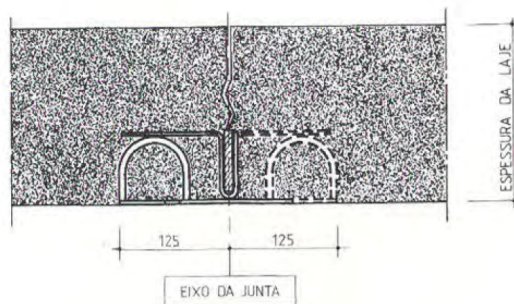
- The non reinforced concrete slabs, laid directly on the natural ground (with interposition only of a plastic film), with no need, as it is usual, of a poor concrete base or solacement.
- In this solution the thickness required is less about 8 to 10 cm in simple concrete and 4 to 6 cm in reinforced concrete, lesser than the required for other load transfer devices.

- The regular spacing of 5m between joints is extended reaching 12 or 15m.
- It's unnecessary to saw the joints, as they open naturally (photo 7).



7

VISTA EM CORTE DA LAJE



It's very well known the inconvenience resulting from the need to saw the joints that if not made in due time causes severe damage to the slabs.

- Achievement of **improved rolling conditions from total absence of differential settlement at the joints.**
- Given the setup location, the **load transfer plate is easy to place (just placed on the floor) without special care as it happens with the transfer bars (dowell bars) serving to also support the casing (picture 8).**



8

ROAD IN THE LAND CONSOLIDATION PERIMETER OF VALENCIA BETWEEN GANFEI AND VERDOEJO

Hydraulic General Directorate and Agricultural Engineering - Project of Alto Minho.

- Directorate - Eng. Carlos Santos - Director (D.G.H.E.A)
- Floor Dimensioning – Seragol
- Concrete composition (mix) - Eng. Ana Maria Proença

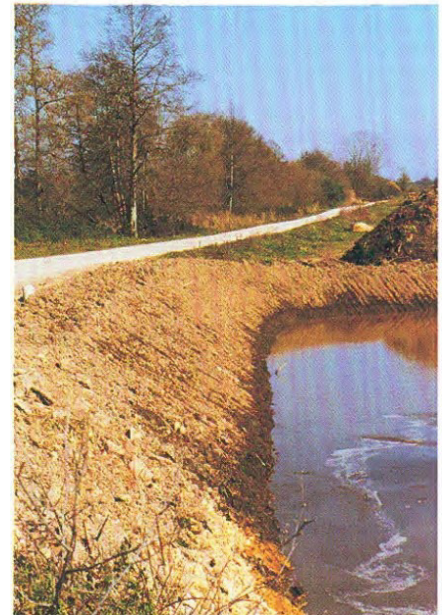
- The concreting is done in continuous webs, without interruption of work.

As important as proper dimensioning project is the proper application of a suitable mix concrete. It is understood by appropriate much more than the mere attainment of strength desired (bending and tensile, not compression). A lot of plastic concretes, even at the expense of flow improvers, rarely give a good flatness; the need to contain the thinner, often results in the appearance of shrinkage cracking, which is avoidable with dry and well vibrated concrete.



9

The road, 6 km long, follows along the left bank of the River Minho, perfectly framed in the environment, following the topography of the land.



10

The nature of the natural ground (photo 10), the adverse weather conditions it was build and it has supported since then, the traffic intensity and type of vehicles (photo 11) that run, allow to us consider it as a test model to full scale.



11

The semi continuous pavement (floor) was dimensioned for loads of 13 t per axel of truck type and is 16 cm thick , with spaced joints of 8m and is based largely on a sludge layer of 26m high.

There are no roadsides or drainage system.

For the concrete of own central production of type B4 (5F) it was used cement of class II (class 32.5), granitic gravel and natural sand; as an adjuvant Sika's Sikament P 1200.

For transportation it was used tipper trucks.



12

The concrete spread was done with a vibrating ruler and by bearing surface roughness achieved at the expense of a broom.

For the concrete curing, it was applied the curing membrane Antisol, also by Sika.

The construction took place in the **summer of 1988**, with temperatures often above 35 degrees C.

Despite having been submerged twice and without any support in large parts due to

these floods, from the thermal amplitudes that has endured, from the loads of extremely aggressive wheel sets (photos 13 and 14), after 5 years, without any kind of repairs, the road does not show any cracks, differential settlements in the joints or even surface wear.



13



14

It's not possible for bituminous (asphalt) to compete in behavior.

TREATMENT STATION FOR COMPOSTING OF URBAN SOLID RESIDUES FROM THE MUNICIPALITIES OF VALE DO AVE

Maturation Area

- Direction of work - Eng. Amandio Fontes - Engil, SA.
- Fiscalization - Eng. Luis Summavielle- Municipal Association of Vale do Ave
- Flooring Dimensioning - Seragol
- Composition (mix) and control of concrete - Eng. Ana Maria Proença



15

The designated "Area of Maturation" (20,000m²) to supplement the compound maturation process, subject to mechanical stress and not inconsiderable chemical attacks, was given special attention by Engil (the general contractor).

The normal operation scheme of the Station will hardly be compatible with repairs, taken that durability is of the highest and of fundamental importance.

Roads

The solution adopted is the result of a thorough and careful analysis of possible projects in concrete and asphalt. **The alternative semi - continuous concrete (dimensioned for a 13 ton load per axle) has allowed the implementation of a pavement (floor) of 16cm thick non-reinforced concrete, having joints each 8m (slabs of 8x8m), resting on the natural ground, only having interposing a plastic film.**

The economy has meant at least 9cm in thickness compared to plain concrete hypothesis and about 6cm for reinforced concrete, both based on the other type of load transfer element (dowel bars).

Regarding the concrete - B4, 5F – it was intended to achieve more than its resiliency (strength), especially its long-term behavior, given the corrosive agents that will face.

In the composition mix of granite gravel and natural sand, type II cement (class 32.5), it was used an adjuvant and adding, respectively, a plasticizer (the BV40) and silica fume (Sikacrete P), both by Sika, and of course water, so as not to exceed a slump of 5cm (photo 16).

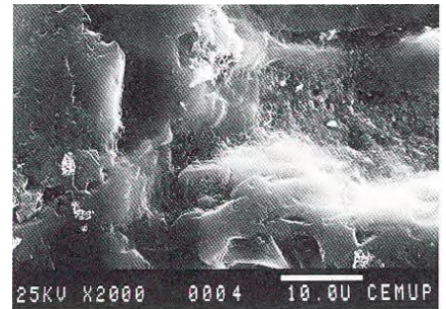


16

As a healing product, it was applied the Antisol by Sika.

While there have been employed only 300 kg of cement per m³ of concrete, 1 l of adjuvant and 7.5 kg of addition, the results of the resistance point of view and behaviour are fairly good.

The high degree of compactness achieved, as can be seen by the picture 17 resulting from the observation taken at S.E.M. (Scanning Electron Microscope) is reflected on the obtained mechanical strength surface texture (Table I), in planimetry (there is no special requirement but was achieved 2 mm in a slit of 3m) (picture 18), in the absence of retraction cracks and in the appearance of joints only 24 m to 24 m.



17

18

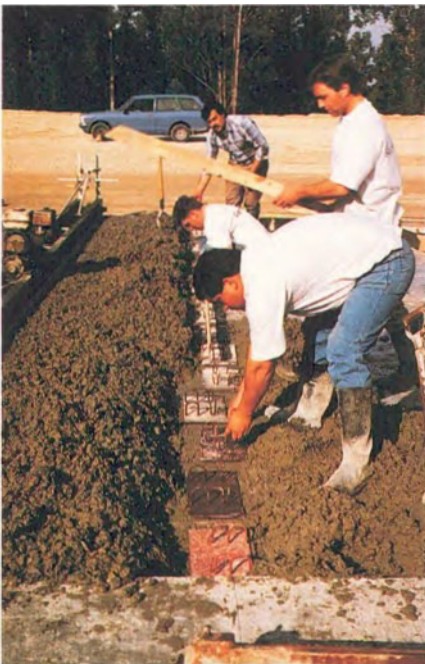


QUADRO 1

| RESISTÊNCIA À TRACÇÃO (POR FLEXÃO) MPa | |
|--|---------|
| 7 dias | 28 dias |
| 5,1 | 6,2 |

| RESISTÊNCIA À COMPRESSÃO MPa | |
|---------------------------------|---------|
| 7 dias | 28 dias |
| 42 | 54 |

In the placing and spreading of the concrete (the responsibility of Famapisos) was used only a vibrating ruler. Pictures 19 to 21 give an idea of the easy execution.



These two works show unequivocally, for different reasons, that the technique of Semi-Continuous Concrete combined with a suitable composition of the concrete (which does not need to have large amounts of cement and expensive adjuvant) is economical and has quality.