THE EVOLUTION OF CONCRETE BLOCK PAVING IN LATIN-AMERICA

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SUMMARY

This paper presents a view of the concrete block paving in several Latin-American countries, making emphasis on the different ways this activity has evolved once the technology was assimilated from foreign countries, and how its flexibility let it offer solutions to a lot of needs and applications.

INTRODUCTION.

Concrete block paving is present in almost every corner of the world. Latin-America is not the exception. Every country from Mexico down to Argentina and Chile have built concrete block pavements in a certain scale, very different if they are compared but with very positive result in most if not all the cases.

Due to the characteristics of the block making procedure and the block pavement construction, there is a huge potential for this type of pavement in the numerous situations where the technical level is not the optimum for other types of pavements or where there is the possibility to obtain a large input in free or cheap labor, a very frequent situation in developing and underdeveloped countries.

But the technology is not necessarily bound to this type of environment in Latin-America. There is a large spectrum of applications in several countries, an the technical level is first rate, with a very complete standardization scenario for almost ail the countries.

Several cases will be presented in the following pages, in order for the reader to get a general view of the state of the art of the concrete block paving technology in Latin-America, around 1990.

1. ARGENTINA.

In the early stages of concrete block paving in Argentina (1958), the use of blocks with keys on their vertical walls played a very important role. This technology was assimilated from Germany and there was an extensive use of hexagonal blocks, sold under the name Blokret, and other shapes known as Trief and Prefar (see Figure 1). Eng. Juan F. Garcia Balado, from the Argentinean Portland Cement Institute - ICPA, developed a pavement design method for this type of blocks (5). Other institutions in Brazil (the Brazilian Concrete Institute - IBRACON, and the Brazilian Portland Cement Association - ABCP, published during the '60s and early 70s, several guides for the design and application of this type of pavement. But this technology makes the blocks more difficult to produce since it is not possible to extrude them, but a set of rings must be used to form the positive and negative keys.

This technology has been used specially in Argentina, Brazil and Bolivia; in Colombia they used it to pave the small port city of Tumaco under an international cooperation program.

Today, there are around 13 paving block industries in the country, producing a full spectrum of block shapes and sizes. Most of them are members of the Asociacibn Argentina del Bloque de Hormigbn (Argentinean Concrete Block Association), one of the few existing in the Latin-American countries.

There are two standards in Argentina dealing with concrete paving blocks. The INEN 11 656 for vertically sided (interlocking) blocks and INEN 11 626 forkeyed (articulated) blocks.

2. BRAZIL.

There is not much information available about the size of the paving block industry in Brazil. This country have a very large tradition in the use of stone blocks in the oldest cities, and they have been traditionally well known fortheir colored floors in front of the shores in Rio de Janeiro. Some o1 those pavements have been made with concrete paving blocks.

Besides the large scale industry, and the early use of keyed paving blocks, there are a lot of small plants, following very similar schemes to those found in Colombia, producing conventional paving blocks and taking advantage of the small and national produced block making equipment; but, contrary to the Colombian technology, basically mechanical, the Brazilian equipment uses hydraulic technology.

The Brazilian Portland Cement Association - ABCP plays a very important role in the promotion of this type of low profile technologies for the use of cement, and block paving is one of the lines they push besides those of concrete pavements, soil-cement and concrete blocks, ferrocement, etc.(1).

3. CHILE.

Chile has one of the oldest and more solid concrete block industries in the continent. Since the late 70s the paving block producers and the Chilean Cement and Concrete Institute (IChCH) produced a guide for the design of concrete block pavements (2), and from then one, a series of documents in order to update the design and construction practice (4). There is an extensive use of concrete paving blocks in the main cities, competing mainly with concrete pavements.

4. COLOMBIA.

The origin of concrete block paving in Colombia has to be traced in Nicaragua, 1974, during the reconstruction of Managua after the earthquake of December 1973. This technology was widely used during the reconstruction and the engineers and architects in charge of the construction of the houses given by Colombia, visualized the social potential of this technology and invited the Colombian Cement Producers Institute - ICPC to know it. As a result the first concrete block pavement was built in Medellin in 1974 and one year later ICPC published the first block paving manual.

Sixteen years later, there is a widespread use of concrete paving blocks in the whole country, specially for private developments (housing, industrial) and for small programs with a special social component like the ones reported in Rome (8). In their field, there are two recent experiences worthy to talk about.

The first one is a program developed by the PNUD (United Nations Development Plan) and the Urban Development Institute - IDU in Bogota. U.N. wanted to generate employment through small production plants and concrete products was the chosen line. Assuming the production of concrete blocks and paving blocks, they coordinated with IDU for them to buy the blocks and to set-up a program to pave several low-income city quarters. The first one was Santa Cecilia in the district of UsaquSn, where the Communal Action committee got the financing from another institution (COREAS) to set-up their own plant (using one of the small nationally produced machines), and produced all the needed blocks. This committee became a contractor for IDU, selling and placing the blocks over the base course provided by IDU. Later on, IDU charged the community with the total cost of the pavement construction but this cost was lower than any other type of pavement, and the committee got an extra income due to the profits of the sale and placing of the blocks (see Figure 2).

This first experience of IDU with concrete paving blocks continued with the paving or 7 km of pedestrian alleys and narrow streets 4.0 to 6.5 m wide, using both commercial and community produced paving blocks, and there is a program now, financed by The World Bank to pave several kilometers of access streets to distant or poorly developed quarters of the city.

The other program is led directly by the Mayor's office in Cartagena, the historic and touristic city on the Caribbean. They organized nearly 20 small production plants, distributed in ttie most undeveloped part of the city, where the streets have no pavement or the pavement structure is missing only a good surface. They will

invest the equivalent to half a million dollars in the first phase of this program, and the first streets are now under construction (see Figure 3).

But the use of concrete block paving in Colombia is not restricted to this type of programs. The promotional activity and the technical documents produced by ICPC (3), (7) have contributed to increase the category and area of the applications (see Figure 4). There is, besides the general street use, the project for the new container terminal by the Flota Mercante Grancolombiana, to be built in Cartagena, using concrete paving blocks, and a proposal to repair extensive areas of the platforms of the Eldorado International Airport in Bogota, originally built with concrete pavement

The block producing industry is growing very fast. Today there are more than 90 commercial producers in the main cities and more than 200 small plants in the secondary or small towns. The registered production is around 1.0 million m^2 , but it might double if the small plants are considered. The potential market is still very big, but this type of pavement has found its place in the market, competing with concrete and asphalt pavements or as the only possible alternative when low costs, simple technology and manpower are necessary.

5. ECUADOR.

Ecuador has a strong tradition in stone paving blocks. Cities like Ibarra are a very good example of the excellent craftsmanship. There is not a good information about the size of the concrete block industry in their country but they have very good examples like the Amazons River Boulevard, in the modern part of Quito, going form the International Airport to the hotel district, built with two type of blocks and in two colors (see Figure 5). In addition they use concrete blocks in shopping centers and there are a lot of small towns paved with concrete a blocks, like TulcLn, near the Colombian border.

6. HAITI.

The situation in Haiti is very singular. Despite their troubled economic and politic situation, the concrete block paving technology has evolved from the first streets, paved following the technology proposed in Central-American countries, to the international standard practice.

They have a very strong block industry with only first rate and large equipment and due to the almost lack of maintenance, it seems block paving will be the technology to be implemented by the Ministry of Public Works from now on in Port-Au-Prince and other cities, starting with the ongoing Urban Development Plan, financed by The World Bank, to pave an important percentage of the streets in the capital city, not only from other point of view of traffic, which is very low in volume and weight, but to prevent deterioration of the existing pavements and erosion migrating into the Drainage Project now under construction (see Figure 6).

The durability of this type of pavement has been much larger than the one of the asphalt alternatives built at the same time, and since paving blocks consume basically national products, do not affect the already weakened trade balance.

7. MEXICO.

Mexico has a large concrete block paving industry grouped by the National Concrete Block Producers Association. There are very well known examples of block pavements in Mexico City in Plaza Garibaldy, the Rosa District and the streets near El Zocalo (see Figure 7).

The Mexican Cement and Concrete Institute - IMCYC has been the one responsible for the technical development of this type of pavement in Mexico, translating and publishing several well known papers (6).

8. URUGUAY.

The concrete paving block industry in Uruguay is not very large compared with the one in Brazil or Colombia, but there are interesting works like the container terminal in the port of Montevideo and several streets. Nowadays they are creating the basic infrastructure for the future development of concrete block paving, starting with

the recent national standard (UNIT 787) and studies for the implementation of small programs following the Colombian model.

9. VENEZUELA.

The Venezuelan experience is very singular, since it is a newcomer but entered with a mayor work: The boulevards over the excavated tunnel for the Caracas Metro, built during the 70s and '80s. In this case the blocks were produced by Viposa, a non-profit company devoted to produce precast houses for low-income programs. After the material was chosen by the project designers, they set-up a plant with a Zenith machine and began producing the concrete paving blocks, not without some problems at the beginning but reaching a very high standard very soon. The first awarded contract was 75 000 m^2 and. after several years, the boulevards continue spreading over the city, not only over the Metro.

One interesting topic, from the marketing point of view, is that since there was only one producer, the blocks were sold as "vipoquines", a word made by Viposa (the name of the producer) and Adoquines, the Spanish Language word for paving blocks.

Since paving blocks were used in the Metro project, a real national pride, and their look is so different from what they had before, many small towns have bought paving blocks in Caracas and have them sent 200 to 300 km inside the country to have the Centra! Plaza paved as in the capital city.

From the technical point of view, this origin, of being placed over the slab forming the roof of the tunnel, made engineers, architects and public works officials to believe that they were good only for architectural purposes, not for heavy industrial applications or even regular street pavements. For this reason, they have started a campaign to show the strength of the pavement and the possible applications, including the proposal for a Venezuelan standard for paving blocks.

The last point to be stressed is that, since the boulevards were paved with blocks, they became the symbol of the boulevard and an indicative of the proximity of a Metro station, so in a campaign for the people to maintain the boulevard as clean as the Metro itself, the backing of the propaganda are paving blocks in full color. Venezuela is one of the few countries exporting paving blocks, in this case to the Island of Curacao.

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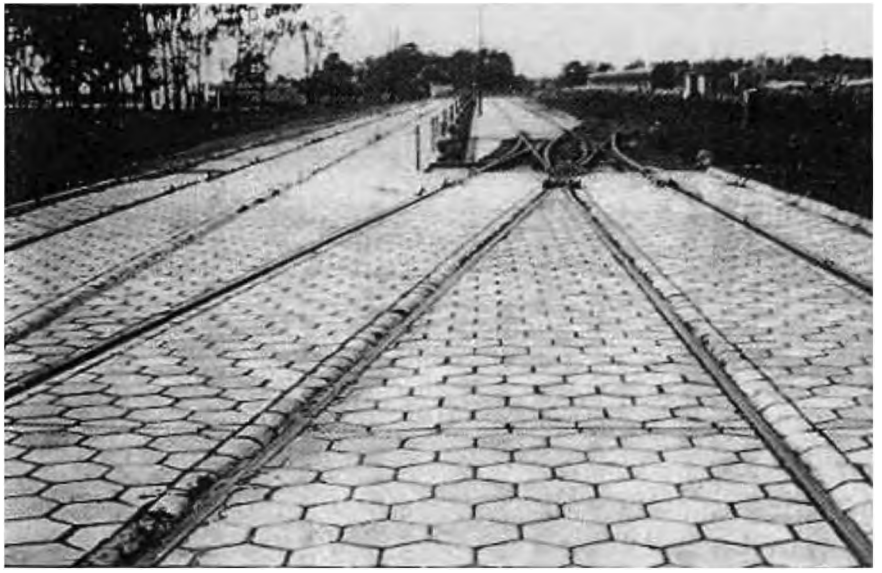


Figure 1. A train station in Argentina.



Figure 2. The production plant and a block paved street in the Santa Lucia project in Bogota, Colombia.



Figure 3. One of the first block paved streets in the block paving project in Cartagena, Colombia.



Figure *4.* Centro Comercial Automotriz, a shopping center in Medellin, Colombia



Figure 5. Amazons River Boulevard in Quito, Ecuador.

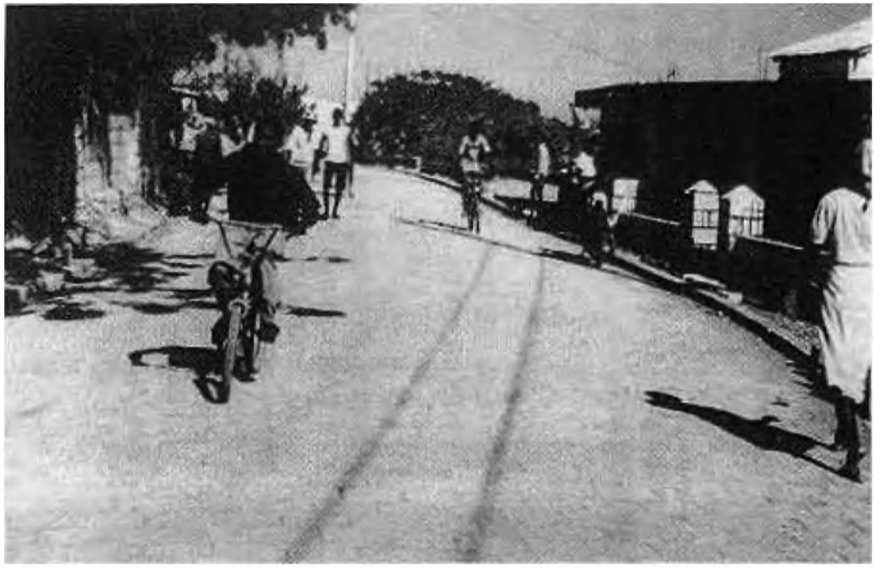


Figure 6. A street built by the Urban Development Project in Port-Au-Prince, Haiti.



Figure 7. A street in the Rosa District in Mexico D.F., Mexico.



Figure 8. A part of the container terminal in Montevideo, Uruguay.



Figure 9. Partial view of one of the Metro stations in Caracas, Venezuela.



Figure 10. A civic campaign to maintain (glean tzie Boulevard de Sabana Granda oyer the Metro in Caracas, Venezuela.