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INFLUENCE OF THE PRECAST CONCRETE UNIT NAMED PAVER IN THE DEVELOPMENT OF THE DIRECTOR PLAN OF A COLOMBIAN CITY, MEDELLÍN

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Note: The following is the notation used in this paper: (.) for decimals and ( ) for thousands. Currencies are expressed as CO$ for Colombian Pesos and US$ for US Dollars. Approximate exchange rate (2009-08) = 2 030 CO$ / 1.0 US$.

1. BACKGROUND

1.1 Acceptance of prefabricated concrete in Colombia

Prefabrication of concrete in Colombia initiated of the 20th century with the creation of small size companies that grew slowly with time.

Small-size prefabrication has been of greatest acceptance and development, mainly during the last decade, with products such as blocks, pavers, curbs and tubes. Medium-sized prefabrication has been present in minor volumes in products such as poles, prefabricated slabs, ribs, piles, retaining walls, beams and small columns.

Large-size prefabrication does not exist as an industry. Projects are built with plants designed specifically for each project, as it was the case of the Medellín Metro for whose viaduct they produced beams in its own plant, same as the sleepers for rails. The most buildings are cast-on-site reinforced concrete structures. Prestressed systems have not had much industrial impulse. There use is mostly in bridges.

In short, there is prefabricating industry but in a minor scale, which consumes 5% of the domestic production of cement.

The presence of burnt clay products in large cities is greater, in size and market, than the one of concrete. Bogotá, Colombia's capital city, produce some 200 000 t of clay in a month; concrete products instead, are only 15 000 t of small units. Furthermore, Colombia exports clay tiles, bricks, tablets and other products, to Central and North America and to the Caribbean. This is possible due to the abundance of suitable soils, the existence of large plants in five Departments and by the ease for the informal production of clay items in *chircales* (craft factories) along 50% of the country.

All above applies very well to masonry but not for pavers. In Medellín and Barranquilla, there are almost no clay pavers. In Bogotá, Cali and other intermediate cities the competition is 1 to 1.

1.2 The introduction of pavers to Antioquia

Although paves were known from the old-world history, in Colombia there were no manufacturers before 1974. That year, the Colombian Institute of Cement Producers (*ICPC*), headquartered in Medellín (capital of the Department of Antioquia), decided to investigate the issue and knew that in Nicaragua there were several plants owned by President Anastasio Somoza, and organized a trip with people of the precasting Industry and the banks. There they found a blooming industry, with an intense participation of handwork, and several road projects under development. Over there, they knew the techniques used at that time, which served to propose the first projects in the country.

ICPC (created by the Colombian Cement Industry to promote the use of cement and its applications) found in pavers a new opportunity for the promotion of cement. During years 1970s and 1980s, there were campaigns to promote pavers in small Municipalities for their parks and main streets, generating a lot of labor in production and installation. Many towns in Antioquia have concrete block paved streets. For this purpose, ICPC edited an Installation Manual, which served to train and guide the staffs in villages and cities.

Another task that is worth highlighting and that very well played the ICPC was the standardization of pavers, through the work of its engineer, German G. Madrid, who decided to investigate the issue and proposed to the Colombian Institute of Technical Standards (*ICONTEC*), a standard for concrete pavers, adopted in 1983 under the designation NTC 2017. This standard defined the dimensional and strength requirements the concrete pavers must have, through a flexural strength test. In further revision, absorption and abrasion parameters were included.

1.3 Early works and market penetration

The promotion of pavers had two parallel fronts: ICPC focused in the Mayors of municipalities, mainly in the Department of Antioquia and some capital cities; the block producers, in the case of Medellín they were *Indural* and *Roca Industries*, devoted themselves to promote paves with designers and contractors. The first important project in the city was the outdoor terrace of the Exhibitions Palace in 1975, with an area of 2 000 m^2. Then private designers and builders accepted pavers and built several parking lots, pedestrian areas and vehicular circulation in housing subdivisions. Furthermore, industries understood the benefits of pavers and used them for their yards and displacement areas. All this happened in spite of a difficult competition with asphalt mainly due to its lower cost and faster construction speed.

The public sector was the last to accept paver as a paving material. The first important example was the Saint Antony Park, built in 1994, with rectangular pavers (200 mm x 100 mm x 60 mm) in four colors (see Figures 1 and 2).

Figure 1. Saint Antony Park, Medellín.

Figure 2. Saint Antony Park, Medellín.

1.4 Importance of public space; standardization and national consciousness

Some political changes have had important consequences in the development of Colombian cities. In years 1990s, government management improved mainly thanks to the new tools of democratization and decentralization and the fact that mayors are now elected by direct vote.

Bogotá´s mayors who most contributed to this change were: Jaime Castro (1992-1994) who acted in the financial and administrative fields; Antanas Mockus (1995-1997 and 2001-2003) who developed a speech on the urban culture and Enrique Peñalosa (1998-2000) who carried out substantial and comprehensive works of recovery of public spaces.

The first Plan of Territorial Organization (POT) in Bogotá was developed in 1997, and approved by the Council of Territorial Planning (CTP). At that time, the city faced many problems with its public urban transport. The buses were mostly obsolete and inadequate for a city of seven million inhabitants. Mayor Peñalosa rescued the public space, empowered a network of libraries, and created and developed the Massive Transport System (*Transmilenio*) in this city. This system has a new operating system, based on a public planning, organization, collection, control and building infrastructure and the operation given in concession to private companies (see Figures 3 and 4).

Figure 3. Jiménez Avenue, Bogotá.

Figure 4. Jiménez Avenue, Bogotá.

With this Bogotá modified his physiognomy with the recovery of pedestrian public space (sidewalks and parks) and the construction road infrastructure including bike routes, with an investment of more than US$ 46 million.

2. STANDARDIZATION

After the beginning of the transformation of Bogotá, the City Council approved the Sidewalks Handbook (*Cartilla de Andenes*) in 2000, through the District Decree 1003. It regulates the design and construction of sidewalks and public spaces, opened the scene for the other cities of the country, starting with Medellín.

In 1999, ICPC invited the Laboratory of Architecture and Urbanism (LAUR) of the School of Architecture and Urbanism of the Pontifical Bolivarian University (UPB) of Medellín, to develop a document to help for standardizing the constructive units for the public space public. This document meant to be consistent with the Colombian Technical Standards (NTC) produced by ICONTEC and with the legislation on public space, including accessibility concepts and the mobility for physical and visual impaired people and good design practices and construction. This

document should make possible the reparability and low-cost maintenance of such spaces and the possibility to have readily available replacement pieces along time, produce by the industries.

This work gave life to the Handbook for the Design and Construction of the Components of Public Space (*Manual de Diseño y Construcción de los Componenetes del Easpacio Público*) (MEP). A technical and functional tool eases the development, construction, and review of projects of public space, without attempting to replace the role of the Designer and his conceptual and formal autonomy in each project. This document serves as a guide to all the actors involved, from the owner to the architectural designer contractor and quality controllers, to ensure the quality, durability, and the environmental and spatial balance.

The MEP also introduced in Colombia, the British alphabet of tactile pieces for floors, for the guidance of visually disabled (blind and people with visual limitations), and dimensioned and standardized the items associated with mobility for all citizens (ramps, pedestrian continuity, height of the curbs, etc.) in accordance with Law 361 of 1997 on mobility.

The Mayor approved the MEP by Decree and made it mandatory for the municipality of Medellín in 2003. Nowadays it is under a process of review and approval in the complete Metropolitan Area of the *Aburrá* Valley (composed of 10 municipalities including Medellín). However, many of these municipalities already use it. They have been able to count with the standardization in their projects.

3. TRANSFORMING PROJECTS

The transformation of a city is possible only through substantial changes in its society, i.e. with the modification of the civic culture. Previous governments of Bogotá and Medellín have gone this way through administrative transparency, reflected in a higher investment in city projects.

"The Government's commitment is fundamental, since without political will it is impossible to run a project of such a scale". An example of this is the figures for the development of this plan proposed for Medellín by Mayor Sergio Fajardo during his 2004- 2007 term. According to his report, the programmed budget was CO$ 6 trillion (US$ 2 400 million) but the final collection was CO$ 8 billion (US$ 3 200 million), 37 % over the planned amount; 81% of it was devoted to social investment projects or went to meet priority needs under his development program.

With the proposal of transformation and the MEP, the architects took up the challenge of designing public spaces with segmented pieces (pavers), colors and different textures for each place, looking for creating citizen recreation areas that are durable, reparable and new life to the city. In this process, the precasting industry actively participate with the design offices and in the supporting of initiatives to make them possible by the standard units based on the MEP and the standards; and so each site of the city of Medellin acquired its own identity.

3.1 Infrastructure master plan for libraries, schools, hospitals, etc.

3.1.1 Park Libraries

The citizen culture becomes possible with education and inclusion, converting spaces in large meeting, education and fund areas. In Medellín, this infrastructure was located in different sites preferably in the areas most depressed, and in those places that make possible the holistic development of people, making them to be part of the heritage that never before had access to. Those spaces even allowing that their ideas about enterprise generation become a reality, no matter social class to which they belong, emphasizing the interventions in sites where nobody ever thought to intervene (see Table 1 and Figure 5).

Table 1. Works for the Library-Parks.

LIBRARY-PARK	LOCATION	INVESTMENT (US$)	AREA (m^2)		
			Land	Built	Public Space in pavers
Pbro. José l. ARROYAVE	Saint Javier	7 000 000	15 500	4 000	1 400
Tomas Carrasquilla	The Quintana	4 280 000	12 700	2 805	1 000
León de Greiff	The Ladera	5 120 000	10 384	4 000	700
Spain	S. Domingo Savio	5 880 000	13 942	2 960	3 000
Bethlehem	Bethlehem Quart.	5 120 000	13 864	2.800	2 000
Total Investment		**27 400 000**	**66 390**	**16 565**	**8 100**

3.1.2 Schools

The Medellin's Public Services Company (EPM) donated the municipality US$ 64 million to build 10 "quality" schools, located in low educational-coverage areas. A bonus value of this project was in that schools, in addition to its role as educators, turned into relating urban community centers for the communal congregation and the improvement of life quality of the benefitted communities (see Table 2 and Figures 6 and 7).

Table 2. Works for the Schools.

SCHOOL	DESIGNER	INVESTMENT (US$)	ÁREA (m^2)	
			Built	Public Space
Héctor Abad	Rafael García Gaviria, Luis Roberto Duran and others	1 400 000	3 197	266
The Independence	Juan Felipe Uribe of Bedout	3 800 000	7 322	38 262
Llanadas	Oscar Mesa Rodríguez	3 600 000	3 596	11 778
Francisco Miranda	Laureano Forero Ochoa	3 200 000	2 770	3 088
Plaza de Ferias	Carlos Julio Calle Jaramillo	3 200 000	4 680	6 164
S. Domingo Savio & Ant. Derka	Carlos Pardo Botero	3 200 000	7 103	8 071
AltaVista	Juan Fernando Forero Soto	3 200 000	5 326	20 147
S. Antonio de Prado	Gabriel Arango Villegas	3 400 000	3 523	7 703
S. Javier	Horacio Navarro Mesa	3 600 000	3 678	5 370
The Mercedes	Juan Manuel Peláez Freydel	3 600 000	7 233	6 172
Total Investment		**32 200 000**	**48 429**	**107 021**

Figure 5. Location of Park-Libraries, Medellín.

Figure 6. Location of Schools, Medellín.

In addition, 128 existing little schools were renewed, totaling 38 005 m^2, expanding their physical plants, number of classrooms, multi-sport fields, school restaurants to expand the service and to improve their conditions.

Figure 7. Francisco Miranda School, Medellín.

3.1.3 Hospitals

Regarding health, the Political Colombian Constitution enshrines the right to social security. There are two administrative regimes: "contributory", accessible through a contractual labor relationship and the "subsidized" named *Sisben*, for those without any capacity to pay for it. To improve the subsidized service, attended with resources of the State, investments were made by US$ 40 000 000 in the public health network of the city and by US$ 33 600 000 in improvements and reconstruction of several units of *Metrosalud* (state social health system).

3.2 Parks

3.2.1 Explora Park

This is the greatest project of dissemination and promotion of science and technology in Medellín. It is an interactive park, for the enjoyment, ant the appropriation science, with more than 300 interactive experiences and the largest sweet water aquarium in South America with 2 200 m^2 (see Figure 8).

3.2.2 Juanes Peace Park

This is the first "multi-sensorial" public park of the city, dedicated to the rehabilitation and reintegration of persons with physical limitations. It matches the goals of the Foundation "My Blood" run by *Juanes* (a Colombian pop singer), to help victims of anti-personal mines (See Figure 9).

3.2.3 North Park

With almost 40 years of existence, it has a privileged place in the heart of the inhabitants of Medellín. It has spaces and completely renovated attractions, and fun in an area of 160,000 m^2.

3.2.4 *Nutibara* Hill

It is one of the mentor and emblematic hills of the city. The program renovated it with more than 1 000 m^2 of new gardens for the city.

3.2.5 Botanical Garden

It is a park for the dissemination and conservation of regional flora. The intervention included architectural work, the enlargement of the live collections and green areas, the construction of public space and the recovery of the lagoon and creek (see Table 3).

Table 3. Works for the Theme Parks.

THEME PARKS	INVESTMENT (US$)	AREA (m^2)	
		Lot and Construction	Public Space
Explora Park	28 000	27 500	5 500
Juanes Peace Park	4 252 000	70 000	14 550
North Park	6 400 000	160 000	160 000
Nutibara Hill	800 000		6 200
Botanical Garden	10 400 000		7 000
Total Investment	**21 880 000**	**257 500**	**193 250**

Figure 8. Explora Park, Medellín.

Figure 9. Juanes Peace Park, Medellín.

3.3 Interventions in roads, walks, emblematic streets and linear parks

Medellín sought to retrieve the urban quality of the streets, sidewalks, walks and linear parks; "the city for the people". Simultaneously, the projects incorporate public space, mobility, with priority in public transport and urban culture; with the participation of the citizens (see Figure 10 and 11).

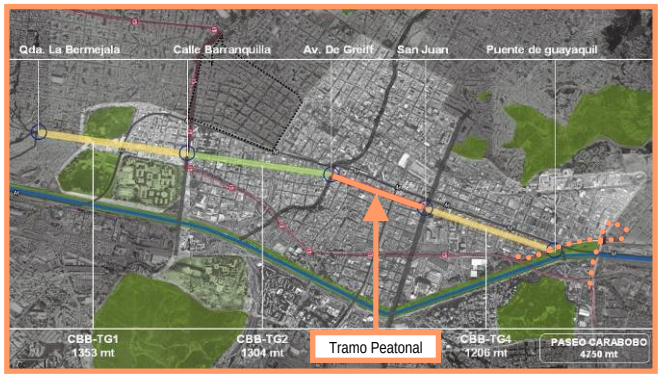

Figure 10. Revitalization of Downtown, Medellín.

Figure 11. Carabobo Walk, Medellín.

3.3.1 Special plan of the downtown area

By agreement 03 of 2004 by the Council of Medellín, they adopted the "Development plan 2004-2007 / Medellín commitment of all citizens". In its strategic line No. 3 "Medellín a space for meeting of citizens", defined one of the strategic projects of the City: "Downtown lives" (see Table 4).

Table 4. Works for the Downtown Plan.

DOWNTOWN PROJECTS	INVESTMENT (US$)	PUBLIC SPACE (m^2)
Carabobo Pedestrian Walkway	3 273 600	35 000
Eastern Avenue	10 760 000	11 000
Saint Juan Avenue	1 880 000	4 750
Plaza Mayor - Palace of Exhibitions	800 000	6 200
Total Investment	**16 713 600**	**56 950**

3.3.2 *Carabobo* pedestrian walk

It is a journey through the most characteristic areas of Medellín at early and middle 20th century, in which the old city extends its urban transformation 30 blocks. The *Carabobo* Avenue has been vital in the history of Medellín, and has several heritage and architectural and artistic value buildings.

3.3.3 Eastern Avenue

This important artery in the heart of Medellín has been the subject of a visible urban intervention, which resulted in a friendlier environment for citizens (see Figure 12).

3.3.4 Integration of the International Convention Center (CIC) - Exhibitions Palace

The International Convention and Exhibition Center "*Plaza Mayor*" has become the new integration space and place for fairs, conventions and congresses to high level (see Figure 13).

Figure 12. Eastern Avenue, Medellín.

Figure 13. Convention Center, Medellín.

3.3.5 Special plan for *El Poblado*

The *El Poblado* quarter is an important area of high socio-economic level of the city. However, its great vehicle density displaced the pedestrian with the use of sidewalks for parking, breaking the continuity of pedestrian public space and deteriorating the urban quality.

In order to generate an important pedestrian zone that benefit to the passer-by pedestrians, the administration made the following interventions (see Table 5).

Table 5. Works for the *El Poblado* Plan.

EL POBLADO PLAN PROJECTS	INVESTMENT (US$)	PUBLIC SPACE (m^2)
El Poblado Avenue Urban Boulevard	2 800 000	18 100
Recovery of 10th Street	2 029 600	9 478
La Presidenta Creek Linear Park	763 773	20 000
Los Balsos Double Road	11 167 600	29 700
Total Investment	**16 760 973**	**77 278**

3.3.6 The *El Poblado* Avenue

A street that crosses the city. When it passes through the *El Poblado* Quarter, it gathers the most expensive properties in town and it is the most important shopping and business zone of the city (see Figure 14).

3.3.7 Linear Park of the *La Presidenta* Creek

It links the creek to the city, with bridges and pedestrian trails in pavers, guaranteeing the connection between both sides of the Park and invite citizens to enjoy the furniture and the country atmosphere (see Figure 15).

3.3.8 Urban recovery of 10th Street

This street is the axis of a commercial area of gastronomic and enjoyment offer. The remodeling retrieved public spaces where it was precarious some two years ago.

3.3.9 *Los Balsos* Hill Street

As well as there are deficiencies in pedestrian public space, the problems of vehicular mobility are significant throughout the *El Poblado* area. To overcome them, inside a "road system" concept, two more tracks of the *Los Balsos* Hill Street were proposed, adding wide sidewalks and other associated projects that connect to the city primary road network.

Figure 14. El Poblado Avenue, Medellín.

Figure 15. The President Lady Park, Medellín.

3.4 Integration to the METRO Massive Transport System

3.4.1 Metrocables

Medellín´s Metro (the only one in Colombia), was promoted since its conception through a culture of respect and identity. The enlargement of this service is the *Metrocables* system (cables with

mobile cabins for 10 people), going to sites with difficult topography and highly populated villages. Two cables (lines J and K) area built, and there is a third one under construction and two more in design (see Table 6 and Figure 16).

Table 6. Works for the Metrocables.

METROCABLES WORKS	INVESTMENT (US$)	PUBLIC SPACE (m^2)
Andalucía Urban Walk (107th St.) - Line K	39 200 000	37 100
El Mirador Park		
Saint Javier - Line J		
Total Investment	**39 200 000**	**37 100**

The contribution of the city to the Metrocables was 74%, and the one by the Metro was the rest. These works generated a great impact on the quality of life of persons who, for the first time, have an agile and secure transport; and contributed to the cultural change of the zone and to the employment generation since they became tourist and commercial areas.

3.4.2 *Metroplús*

A transport system similar to the *Trasmilenio* of Bogotá, with articulated buses that seeks to extend the mass, efficient and ordered transport coverage integrated to the Metro. Its construction began three years ago, the intervened zones have expanded, and recovered public space, mobility and security of pedestrians, following the parameters of the MEP (see Table 7 and Figure 17).

Table 7. Works for the *Metroplús*.

METROPLÚS WORKS	INVESTMENT (US$)	PUBLIC SPACE (m^2)
Bethlehem, 30th Street	19 105 296	32 000
Railroad Avenue	19 882 623	34 000
Fatelares - Palos Verdes	19 669 623	37 000
Manrique	9 384 074	10,000
Aranjuez	10 222 642	11 000
Current Investment	**78 264 258**	**124 000**

Figure 16. Metrocable Mirador Park, Med.

Figure 17. Metroplus, Medellín.

During these years, Medellín changed completely and pavers were a fundamental part of this change, investments continue in public space and this material has steal the heart of the city by allows versatility in designs, colors and textures (see Table 8).

Table 8. Recent investment in concrete pavers in Medellín.

PUBLIC SPACE (YEARS 2004-2008)	AMOUNT (m^2)	INVESTMENT (US $)
Pavers: 200 mm x 100 mm and 200 mm x 200 mm Flags: 400 mm x 400 mm	140 000	3 586 770

4. PARTICIPATION OF THE PRIVATE SECTOR

The growth of the city also influenced in the private sector, which decided to construct projects with major interventions of public space (see Table 8 and Figures 18 and 19).

Table 8. Representative Private Works.

WORKS PRIVATE	INVESTMENT (US$)	PUBLIC space (m^2)
Bancolombia	253.736	13,000
River City	117.959	14,000
Pier 30	48.216	3.556
Suramericana Clinic	23.899	1.719
EAFIT University	214.602	14.387
Mayorca Shopping centre	103.876	8.114
Total Private Investment	**762.288**	**54.776**

Figure 18. Eafit University, Medellín.

Figure 19. Bancolombia´s building, Medellín.

With passion and enormous pride, the paver-producing industry feels protagonist of this story. The paver is a rigid concrete piece with sharp edges, pastel colors (mostly gray) influenced the public space of the cities of Colombia, and especially in Medellín, to make it more attractive, practical and economic. It had a social impact such that it became an icon of Medellín. The industry went for vanguard, innovation and the believing in the dreams of designers and developers, to make them possible. Our secret is ¡BELIEVING IT IS POSSIBLE!.

"In recent years Medellín past of fear to tranquility, and from tranquility to hope, said former Mayor Sergio Fajardo. Medellín has gone from small public spaces to wide spaces with harmony and color and with a great prospect of future".

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