# SAN ANTONIO PARK IN MEDELLIN: FIRST LARGE-SCALE PROJECT IN COLORED CONCRETE PAVING BLOCKS IN COLOMBIA

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This paper presents the historical, architectural and physical characteristics of San Antonio Park in Medellín, and the process followed by the designers and contractors of the concrete block pavement built in the hard areas of the park. The most remarkable facts of the development of a project of this magnitude (33 000 $m^2$) are highlighted. Special reference is made to the use of colored concrete paving blocks, following an intricate and detailed pattern, since it totally changes the physical and technical assumptions about the detailing, the development of the project and the programming of the construction. Some considerations are made about the design parameters, the role played by concrete paving blocks to satisfy them and how those parameters play an important role in the development of the city and the creation of a better environment for its inhabitants.

**Genesis of the San Antonio Park**

San Antonio Church and the Convent begun to be built in 1874, in a well-to-do neighborhood, five blocks from The Berrio's Park, Medellín's main square. 25 years later there was already a great influence of the nearby Guayaquil Market Plaza and the Amagá and Antioquia Railroad Stations, pushing for new uses for the land (bus terminals, bars, small hotels). This process became so evident that in 1963 the City Council decided to undertake an urban renovation program and built a new City Center, three blocks south-west from San Antonio.

EDUVA (the Urban Development Corporation of the Valley of the Aburrá River), created during the 1970's, bought most of the properties between 44 (San Juan) and 49 (Pichincha) Streets and 49 (Junín) and 46 (Oriental) Avenues, demolished them and made a redevelopment plan that never was built. Once EDUVA was closed, this lot passed to the BCH (Central Mortgage Bank) and stayed undeveloped until Mayor Juan Gómez (1989) declared this land should be a park. In 1992, during the administration of Mayor Luis A. Ramos, the City bought the 33 000 $m^2$ of land for US $ 1,05 million (left after a portion was sold to Almacenes Éxito, a large supermarket chain, to build a store). On December 17, 1992, the Colombian Architects Society (SCA) opened a competition for the design of the Park. 42 projects were presented and the winner was the joint design by AIA and CONVEL, two local architecture and construction companies.

The City Council authorized the Mayor (on December 3, 1993) to set up a "company" to build the Park, as a part of the Downtown Intervention Plan, managed by Eng. Sergio Betancur, with the support of the United Nations Development Plan (PNUD). The City contributed with the land and the commercial space built within the Park, when sold, generated near US $ 6 million, almost the cost of the construction. The first phase of the Park, the Plaza, was inaugurated on December 14, 1994, one year after the start of the "company".

**Description**

*Location of the Park*

The Park is made by two large city blocks in downtown Medellín, surrounded by three main streets (Avenida Oriental, San Juan and Junín). It is expected to be a development focus for this area since it is near to the interchange (San Antonio) station of the Metro's A and B lines, the new building of the EPM (Municipal Public Enterprises), a 140 000 $m^2$ structure, the renovation of two very old landmark buildings (Carré and Vásquez), the foretold Almacenes Éxito, and a large concentration of educational institutions.

*Components of the Winning Project*

The winning project conceives the Park as a motor for the renovation of the downtown area, keeping intact the Church and the Convent, but with a totally new design concept compared to the traditional parks in the city (Medellín does not have large green areas, only neighborhood squares or plazas designed in the French tradition of gardens). The open space was assigned with new functions (commerce, culture, parking lots), complementary to the dominant activities of the area (shopping, transportation, government, and a lot of pedestrians).

The Park is divided in two large zones by Amador Street; the Plaza (north) and the Garden (south). The Plaza, a 7 800 $m^2$ open space, designed for massive events, is surrounded by two Galleries (east and west sides, totaling 10 000 $m^2$), with a series of commercial buildings unified by a curved roof, and passing over Amador Street to end in the last building already in the Garden. The shops which will be responsible for the cleaning, maintenance and security of the Park through a common administration.

The Plaza is open toward the Garden and closed at the opposite side (north), with a two-floor commercial building with an Amphitheater for 1 000 people. The steps of the Amphitheater work as a fountain when not in service. Under the Plaza there is a Parking Lot for 354 cars, with 10 182 $m^2$ in two levels. There is a total of 78 commercial spaces in the Park.

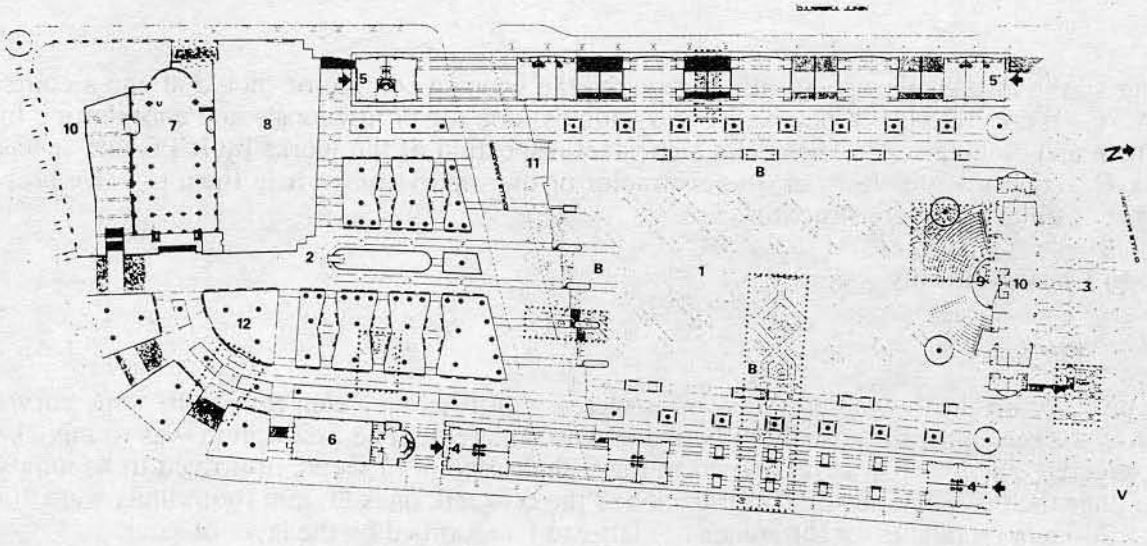
South of Amador Street there is the 9 000 $m^2$ Garden, designed in the traditional way (green areas crossed by walking paths with benches and fountains). The Garden is surrounded by the Church, the Convent, the ends of the Galleries and the building of the Alliance Francaise. Since the terrain descends toward the south-west, it was necessary to build some structures to stabilize the Church. The rest of the buildings was demolished to highlight the Church and the Convent. An institutional building is planned to complete the cloister of the Convent.

*Vegetation*

The historical difficulties for the City to maintain green areas generated the concept of controlled, organized and durable vegetation, for the hard urban conditions it will have to withstand in the Park. For this reason 252 trees were planted, very small. Three rows of them run parallel to the Galleries' buildings to extend its shadow to a wider area. The 4 100 $m^2$ Small Plaza has 58 palm trees and two huge trees will compete, one at each side, with the umbrella-like roof of the Amphitheater. The Garden have several types of trees, most of them with flowers of different colors.

*Furniture and Sculptures*

The furniture is all made in concrete, with the designs made for the Metro by the School of Design of the Pontifical Bolivarian University (UPB). There are 200 benches to seat more than 800 people and bollards to stop vehicular traffic from entering the Park. There are three sculptures by Fernando Botero in the Plaza (Male Torso, Laying Venus and Birdie) and one by Ronny Vayda (Door to San Antonio) in the eastern corner of Maturín Street.



1. PLAZA
2. GARDEN
3. LITTLE PLAZA
4-4'. W. GALLERY
5-5'. E. GALLERY
6. CULTURAL BUILDING
7. S. ANTONIO CHURCH
8. CONVENT
9. AMPHITHEATER
10. COMMERCIAL SPACES
11. PARKING ENTRANCE
12. GREEN AREAS
B. SCULPTURES BY BOTERO
V. SCULPTURE BY VAYDA
— BENCHES
• TREES
... TYPICAL DESIGN AREAS

Fig. 1. Layout of San Antonio Park. Medellín, 1994-1996.



Fig. 2. Downtown Medellín ant the Park at right top corner of the Metro station.

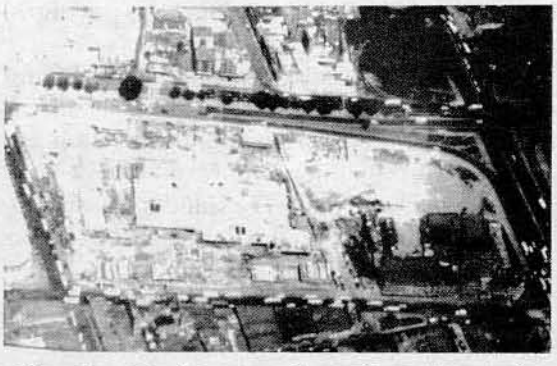


Fig. 3. Underground parking lot under construction (mid. 1994).

**ICPC's Role as a Promotion Institution**

ICPC had a special interest in the project, even before the competition, for the following reasons:

- A project with large areas of pavements, no matter the winning design (potential use of concrete paving blocks).
- Availability of, at least, one precaster capable of producing two-layer concrete paving blocks, making them more attractive and competitive (project with high architectural and landscaping parameters).
- Speed at which the Park would have to be built, specially the pavements (concrete block pavers would allow versatility, speed and on-time provision of materials)

There was a presentation for the winning team of designers to explain them the technical characteristics of the material and its architectural and landscaping possibilities. A few days before the presentation of the final drawings, ICPC was asked about the technical parameters to be included; so with the cooperation of the designers a set of specifications was prepared both for production of the paving blocks (shape, dimensions, colors) and for the construction of the pavements.

Going a little further, the specifications required the winning contractor should attend a course by ICPC on concrete block paving, in two editions: one for professionals and another one for foremen and block layers. There was a constant inspection of the works by ICPC and special visits, by request of the designer, the contractor or the supervisor, to help them to solve problems appearing during construction.

**Design Considerations**

*Preliminaries*

The designer originally wanted the floors covered with fired-clay elements, with some curved lines, in a clear color, supposedly to be made with concrete. The first option was to mix clay and concrete pavers. It was feasible form the technical point of view but proved to be impossible since the clay units were 50 mm thick and the concrete ones 60 mm (both units were 100 mm x 200 mm rectangles), a difference too large to be absorbed by the layer of sand.

It is important to realize that up to date there is no standard for clay flooring products in Colombia; but there is standard NTC 2 017 for Concrete Block Pavers, making more difficult the cost comparisons between equivalent alternatives in durability and strength.

The designer changed the design to concrete due to:

- The possibility to have concrete paving blocks in colors different from traditional concrete gray and the terra-cotta fired clay.
- Two layer pavers were available, reducing the cost of colored ones and keeping quality and appearance.
- The guarantee of a constant provision according with the construction schedule, in 60 mm and 80 mm thickness.
- The existence of a NTC standard assuring quality and durability of concrete paving blocks.
- Superior dimensional tolerances of the concrete units to guarantee the execution of the intricate design to the detail.

*The Pavers and the Formal Design of the Pavement*

The design is based on a stretcher bond pattern for 100 mm x 200 mm units, parallel to the longitudinal axis of the Park, with a dominant terra-cotta color over which there is a fabric of 2 m wide gray lines, aligned 45 ° with respect to the axis in the Plaza, and generating a row of hexagons on this axis. When the Plaza abandon the slab of the parking lot and appears the first line of trees, the fabric becomes aligned with the Galleries and the squares turn to rectangles, defining the place for trees and furniture.

This fabric turn to squares in the Small Plaza, with a palm three in each intersection. In the corner of the Oriental Avenue and Maturín Street the design was altered with a yellow diagonal passing under the Door to San Antonio sculpture. The scheme of the Plaza changes after the stairs descending to Amador, turning into lines and entering the Garden, where the scheme changes according to the pattern of the walking paths.

This design in concrete paving blocks has the same dominant terra-cotta color as the one proposed with clay units, but is accentuated with two yellow lines in the middle of the gray fabric and a line of green pavers in the middle of the terra-cotta squares. It makes the design to look like a tartan fabric. The colors were chosen according to the catalogs of Bayferrox with a 6 % content in terms of cement. White cement was used for the surface layer in the terra-cotta, yellow and gray units, with a 15 mm minimum thickness and a 7 mm maximum vertical and horizontal projections of the chamfer.



Fig. 4. General view of the Park, Almacenes Éxito and City Center.



Fig. 5. Plaza, Galleries, northern building and The Door to San Antonio sculpture.



Fig. 6. South west view of the Plaza, the church, the Convent and Torso sculpture.



Fig. 7. Western Gallery and Birdie sculpture.



Fig. 8. Northern building with the Amphitheater, furniture and young trees.



Fig. 9. Little Plaza behind the northern building (Maturín street).



Fig. 10. Partial view of the Garden under construction, the Church and Convent.

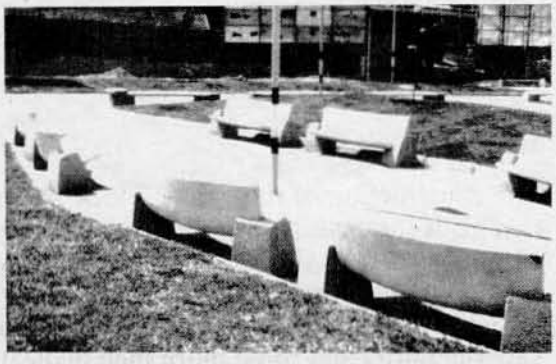


Fig. 11. Concrete furniture in the Garden made of three precast pieces.

*The Structure and the Drainage of the Pavement*

Most of the pavements are for pedestrian traffic. Over the slab of underground parking building there is a 3 mm impermeable film and a thick impermeable paper to avoid the bedding sand to break the film. The two layers are bounded with tar. Over these layers there is a 50 mm sand layer and 60 mm paving blocks. Outside the slab, there are 200 mm of subbase material over a 95 % sub-grade, and a 150 mm base course, the sand and the pavers.

The pavement on Amador Street and the access to the parking lot was built over the existing asphalt pavement, good enough to be the base. Since the architectural design asked for the level of this street to rise three times to the rim of the sidewalk (to allow the crossing of handicapped people), the profile was modified with a variable thickness overlay made with poor concrete, perforated each 500 mm in both directions to create sand-filled vertical drains, in order to avoid the accumulation of water in the sand layer.

The Plaza was designed with a 1 % slope, much flatter than the recommended 2,5 % to avoid flooding of the surface. A longitudinal drainage channel was designed for the boundaries of the parking structure, 300 mm wide x 300 mm deep. The contractor was asked to make 18 mm perforations in the walls of the channel every 200 mm, protected with a patch of non-woven geotextile, to allow the water entering the sand layer to evacuate. At the southern extreme, against the steps toward Amador Street and in the bottom of the waves generated with the poor concrete in this street, a micro-filter was created with a 25 mm perforated PVC pipe, covered with the same geotextile.

*The Confining Structures*

A special care was dedicated to the design of the confining structures with a thickens of 100 mm for less important applications and 150 mm for gardens and street sides. A 24 MPa concrete was specified, with a rectangular profile and a 20 mm chamfer for inner applications and a barrier profile when kerb-automobile interaction was expected. It was required that all confining structures be built before the paving block layer reaches them (the standard practice).

**The Bidding Process**

The construction schedule for the Park was conditioned by the existence of the buildings surrounding the Church and the Convent, that had to be demolished. CONCONCRETO was awarded the construction of the structures in the Park on January 15, 1994, except the southern extremes of the Galleries. On June 15 the same company was awarded the construction of the block pavements, with the intention to inaugurate the Park before the end of year (the end of Mayor Ramos' administration). On December 14 the Plaza and Amador Street was inaugurated and open to the public.

**The Construction of the Park**

*The Human Resources*

The construction of the paving block pavement was assigned to an engineer, a construction architect, a foreman and a tool keeper. It was necessary to have two drafting technicians dedicated to enlarge the original design drawings to provide each block layer with a detailed scheme (magnifying lens) of the zone he was supposed to lay. Those two technicians worked also as inspectors to verify if the design was followed in detail. It was necessary to have three saw operators and three more men dedicated to the transportation of the blocks since the saws were located in a fixed place. There was also a furnace operator and an auxiliary deliverer to bring the dry sand wherever it was necessary.

Since most of the construction activities were developed simultaneously, the construction of the pavements was difficult, taking advantage of each peace of land ready to be covered; having to move the block storing areas and demanding a long manual transportation of the blocks.

As usual, the labor for laying the pavers was sub-contract, as well as the additional labor to clean the pavement after it was finished, since a lot of sand was left over the surface to allow it to better accommodate into the joints and to protect the surface from the construction traffic.

*The Draining and Confining Structures*

The overlapping of contracts showed to be inconvenient for topics like: Respect for levels and slopes of the pavements; construction of the confinements previously to the layer of pavers (specially due to the existence of a large number of service boxes and manholes) and the accomplishment of a good quality for non-structural concrete like in the draining channel.

The very shallow slope, plus the irregularities of the final surface of the top slab of the parking garage (non intended to receive a finish without an overlay), generated local deformations the sand layer was not prepared to even. Those disturbances have been corrected as long as they have appeared. This conflict with levels and the bad construction of the channels reflect, at least, the poverty of the local design and construction specifications, contrasting with the strict dimensional tolerances for the production of the blocks and the excellent uniformity of the laying of the block. The perforations of the channels were not made when casting the concrete so the contractor decided to leave vertical incisions protected with a geotextile. It is advisable to have more strict specifications for structures like this, with the possibility to be precast and placed with simple technology, in order to improve the general quality

*The Block Surface*

The system used for the construction of the block course was the standard hand method used for concrete paving units.

**The Sand Layer.** A 50 mm sand layer was placed using aluminum and wood rails. Special care was dedicated to protect, from wind and rain, the already placed sand and the newly laid, non compacted blocks, with a plastic film.

**The Concrete Block Layer.** Rectangular 100 mm x 200 mm blocks were specified, 60 mm thick for pedestrian areas and 80 mm thick for Amador Street and the entrance to the underground parking garage. All were made in a Columbia machine, by Indural, a 40 years experienced producer of masonry block and the first producer of paving blocks in Colombia (20 years).

A dimensional evaluation of 10 blocks (60 mm thick) resulted in:

- 100,7 mm average width with a range of 0,8 mm (- 0,1 mm, + 0,7 mm).
- 200,2 mm average length with a range of 0,7 mm (+ 0,3 mm, + 1,0 mm). Both were among the $\pm$ 2 mm specified by standard NTC 2 017.
- 59,9 mm average thickness with a range of 3,2 mm (- 1,8 mm, + 1,4 mm), also among the $\pm$ 3 mm specified by the same standard.

The measurements taken in the middle of the Plaza showed that these good tolerances plus the well-constructed stretcher bond pattern and the fact that the paving blocks do not have spacers (nibs) generated an average joint width of 0,94 mm for the 100 mm sides and 1,04 mm for the 200 mm sides. It gives an average 1 mm joint width (shovel joint), the tool used to even and adjust the block lines. These very tight lines are the result of a good laying procedure and gave an excellent behavior for rainwater penetration (verified during the construction when some blocks were taking out of the pavement after heavy rains and the sand as found totally dry), and the resistance to the washing (just 5 mm) of the joint sand under the rim of the curved roof of the Galleries falling freely on a very narrow line.

The construction specifications asked for the blocks to be say cut; but at the end of the jobs mechanical splitters were used since: the bench circular saws were always in the same place requiring a lot of inner transportation of the blocks and the labor was not prepared to deter-

mine the line where to cut the pieces by (very often they were signaled 4 or 5 mm shorter or with the wrong angle).

It is important to mention that during the construction procedure appeared two tools developed to ease certain activities: a box to mark block pavers in the same place every time (very useful when there is the need for a lot of equal units and the saw benches do not have a good adjustable guide), and a concrete block to fix the treads, with a thickness equal to the one of the sand plus the blocks, a wooden top to nail in and two metallic handles to move it.

**The Joint Sand.** The sand was dried out in an open oven consisting of a metallic plate (2 or 3 unfolded 55 gallon barrels) supported by some concrete masonry blocks. The plate was heated from underside with a fire made with the wooden debris of the construction. This furnace was managed by one man and another one delivered the dry sand wherever it was required. It is a good example about the inventiveness; but from the environmental point of view there could be a lot of restrictions.

A lot of sand was left over the surface. It got pasted inside the joints and it was necessary to use reinforcement rods to remove it and then to brush or broom it. This cleaning activity is often considered inside the current costs of laying blocks, but proved to too costly when considered as a separate activity at the end of the project.

**The Laying Pattern.** Most of the foretold problems are common in block paving projects. But this one had some very particular problems originated in the fact that the drawings for the surface were made on a 100 mm x 200 mm grid generated in a CAD system (the standard or catalog dimensions of Indural), not considering the joint thickness. It made that when the pavement begun to be built, departing form the center of the Plaza, the design began to expand 1 mm per joint (5 mm/m in north-south direction and 10 mm/m in east-west direction).

This expansion is not a problem when one-color surfaces are paved or when the designs do not have to adjust to symmetry axis like the center of the Plaza. The problem in this case was that the lines approaching the buildings of the Galleries had to be coincident with them so the constructor had to adjust several lines to be respectful of those axis. But those adjustments were not possible to be made in the middle since there were lanes marking those imaginary axis, so a lot of adjustments had to be made in the middle of each area of terra-cotta or gray color. This problem made block laying to be out of sequence, having to define and lay a lot of axis first and then proceed to fill the remaining spaces. The 35 $m^2$ average output when laying gray paving blocks, started in just 4 $m^2$ and went to 17 $m^2$ at the end of the project.

The lesson is that an intricate design, like the one in San Antonio Park, must be made taking into account the nominal dimensions (the standard dimension plus the width of a joint), having to determine the theoretical width of the joint in the drawing board, based on the experience and expertise of the contractors.

Another problem, out of the reach of block paving, was the difficulties to keep a tight schedule due to the diversity of contractors working on site and the activities being performed at the same time in the same place, in order to be able to finish for the inauguration date. Another important lesson came from the need for the activities implying the spillage of water or any other substance on the pavement to be performed before laying the blocks since it is almost impossible to protect them and even more difficult to clean them. It happened this way with the wet-grinded mortar socles of all buildings.

**Final Considerations**

This paper described the process followed for the construction of a project with singular characteristics and no parallel in the history of concrete block-paving in Colombia. The final result has been completely satisfactory for the designer, the contractor and the owner, with the special consideration of the fast-track schedule, the overlapping of activities and the physical tightness of the space to work in, making it merits to be even larger.

From the philosophical point of view it is important to recall that this project was possible because the designing team believed in the characteristics and quality of the material (concrete paving block), some of which had never been explored in their environment; the contractor was patient enough to learn, the hard way, a lot of secrets involved in this technology; the precasters were responsible to make a product according to the standards, and their expertise, to push the technology a little further; and the owner did not enter into very detailed cost considerations when the quality of the project was a topic to deal with.

A lot of teachings are left after this project. There is the need for a better physical planning and scheduling of the projects to avoid delays or repetition of activities. For building and landscape architects San Antonio Park is a living example of: the acceptance and appropriation of foreign experiences in order to transmit them to an environment without any, so complex, previous experience (like the design of intricate patterned concrete block pavements), and also of the need to dedicate more effort to think in the technical aspects their designs would imply in projects of such magnitude. It is fundamental to create a working team from the beginning of the design of the project in order to make infrastructures, structures, surfaces and constructive methods work harmoniously for a better global behavior of the project.

**Project Data, San Antonio Park**

- **Client**: The City of Medellín, Colombia.
- **Architectural and Landscape Design**: AIA-CONVEL. Chief Architects: Gabriel J. Arango, Juan J. Escobar. Coordinator: Maria E. Escobar.
- **Structural Design**: León Restrepo, Luis G. Mejía, C.E.
- **Metal Structures**: Impac S.A.
- **General Contractor**: CONCONCRETO S.A. Coordinators: Daniel Uribe, Samuel Wigoda, C.E. Director: Juan C. Londoño, C.E. Concrete Structures: Carlos Giraldo, C.E. Finishes: Dario Morales, Arch. Block Paving: Jesus Lotero, C.E., Miguel A. Porras, Arch. B.P.Contractor: Carlos A. Mesa
- **Supervision**: AEI Engineers. Dora Gómez and Oscar Perez, C.E.
- **Coordination**: Municipal Public Works Secretariat. Francisco Rave, C.E.
- **Paving Blocks**: Indural S.A.
- **Street Furniture**: Cimbrados S.A.
- **Landscape Advisor**: Jorge A. Mesa, F.E. Plants: Municipal Nursery.
- **Total Area**: 33 000 $m^2$.
- **Estimated total cost**: US $ 12,2 million.
- **Concrete Block Paved Area**: 18 000 $m^2$.
- **Average cost of the Concrete Block Pavement / $m^2$**: Approximately US $ 7,45 + the cost of the blocks (US $ 7,3; 8,8; 10,3 and 13,9 for two layaer 60 mm gray, terracotta, yellow and green. US $ 8,2; 10,1; 11,5 and 15,1 respectively for 80 mm units).