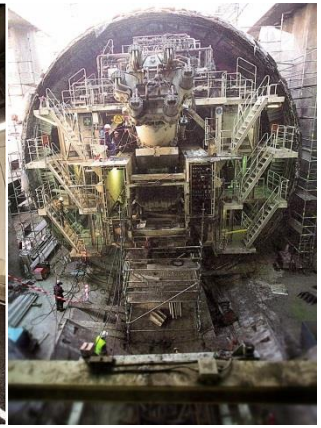
Madrid M-30 M-RÍO



LOCATION:

Madrid, Spain

SUBMITTING FIRM:

Acciona Ingenería, S.A,GINPROSA Ingeniería, S.L.,TÉCNICA Y PROYECTOS, S.A. (TYPSA) & INTECSA-INARSA, S.A

FIDIC MEMBER:

Tecniberia

EXHIBIT A

Madrid M-30 M-RIO - The Regeneration of an Urban Space

INTRODUCTION

In February 2004, the Spanish Government authorized an agreement to be signed between the Ministry of Public Works and the City of Madrid to transfer ownership of the M-30 ring road, and other state-controlled urban road sections, to the City. This enabled the City to start work on the M-30 M-RIO Project, also known as Madrid Calle 30 (Figure 1).

By redirecting the M-30 underground, the surface areas previously occupied by the urban highway on the banks of the Manzanares River could be recovered and landscaped, achieving several objectives including the elimination of noise pollution suffered by local inhabitants.

The project included different works planned for the entire length of the M- 30, but the tunnels under the banks of the Manzanares River and the construction of the south bypass where the two largest TBMs in the world were used, were particularly significant.

The projects were completed and opened at different stages throughout 2007. Upon completion of construction, the project to landscape the surface made available by tunnels in the west sector parallel to the Manzanares River (M Rio Project) began, and works were completed in various stages between 2010 and 2011.

Figure 1. Madrid M-30 M-RIO. Arganzuela Park

Source: Martinez-Deaño (coord.), 2011, *Madrid M-30. Un proyecto de transformación urbana*

Madrid M-30 M-RIO is a comprehensive and innovative regeneration project developed by Madrid City Council. It has two main components:

- The M-30 Ring Road Improvements Project (**M-30**) which includes 43 km of new urban tunnels (Figure 2)
- The **M-RIO**, a major Architectural Project to landscape the reclaimed banks and the new urban areas along the Manzanares River (Figures 1 & 3)

This nomination is submitted by the Lead Design Engineering Firms which are members of TECNIBERIA: ACCIONA Ingeniería (formerly AEPO), GINPROSA, INTECSA-INARSA and TYPSA

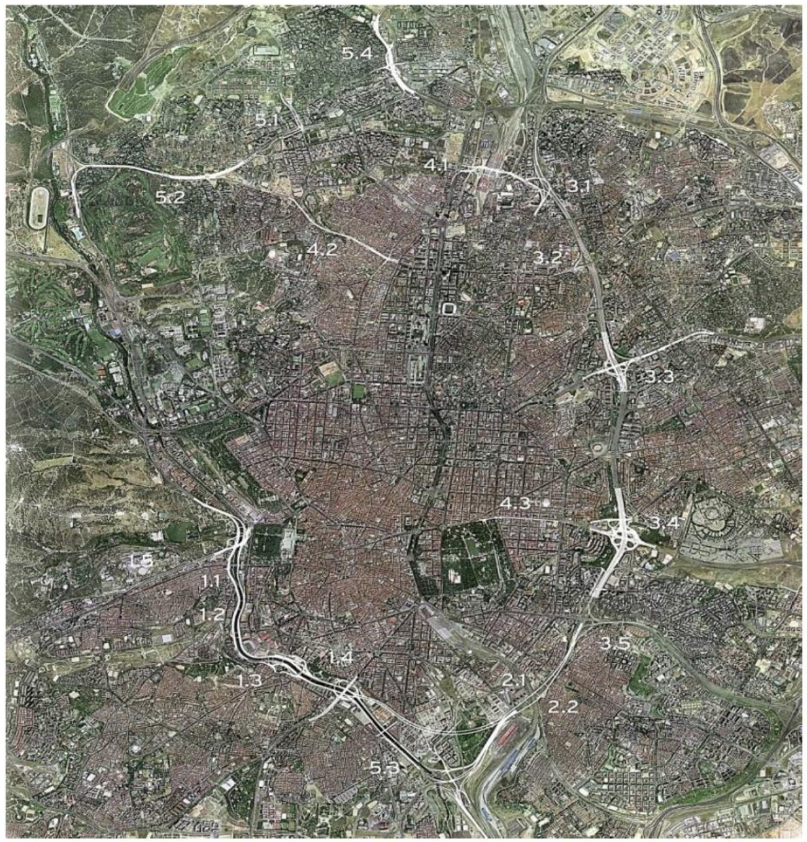


Figure 2. Madrid M-30 M RIO Project. Areas of performance.

PROJECT 1: WEST ARCH (Lead Designer: AEPO.ACCIONA & GINPROSA)
1.1 M-30 tunnels between Paseo de Monistrol and Puente de Segovia
1.2 M-30 tunnels between Puente de Segovia and Puente de San Isidro
1.3 M-30 tunnels between Puente de San Isidro and Puente de Praga
1.4 M-30 tunnels between Puente de Praga and the Nudo Sur (South Junction)
1.5 Avenida de Portugal tunnel
PROJECT 2: BYPASS SUR (Lead Designer: TYPSA)
2.1 North tunnel
2.2 South tunnel
PROJECT 3: EAST ARCH (Lead Designer: PROSER)
3.1 Nudo de la Paloma (La Paloma Junction)
3.2 Costa Rica /M-30 Interchange
3.3 A-2 /M-30 Interchange
3.4 Nudo de O'Donnell (O'Donell Junction)
3.5 A-3 /M-30 Interchange
3.6 Remodeling of the east section of the M-30
PROJECT 4: CLOSING THE CIRCLE TO THE EAST AND TO THE WEST (Madrid City Council)
4.1 New Pío XII Axis
4.2 New Sor Ángela de la Cruz Axis
4.3 New O'Donnell Axis
PROJECT 5: CONNECTIONS WITH M-40 AND OTHER AXIS (Lead Designer: INTECSA-INARSA)
5.1 Avenida de la Ilustración - Avenida del Ventisquero de la Condesa Connection
5.2 Northwest connection, three lane widening
5.3 Embajadores Axis - M-40 Connection
5.4 Avenida de la Ilustración – Colmenar Road (M -607) Connection
MANZANARES RIVER RESTORATION (Lead Designer: GINPROSA)

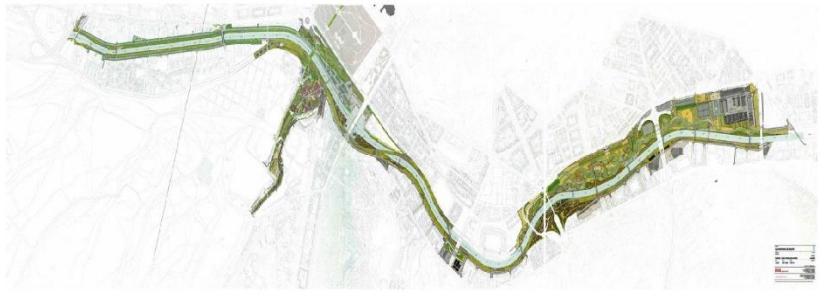


Figure 3. Madrid M-30 M-RIO Project.
Source: Martinez-Deaño (coord.), 2011, *Madrid M-30. Un proyecto de transformación urbana*
Architectural/Landscape Design by West-8 and MRio Arquitectos Asociados (Burgos & Garrido, De Porras-Isla & La Casta, Rubio & Álvarez-Sala)

Innovation, quality, and professional excellence

The critical path of the overall M-30 project schedule was undoubtedly conditioned by the performance of the work along the river. In this area the tunnels were constructed by cut and cover method, i.e. with screens and a top slab. A TBM could not be used because it has to be at a certain distance from the surface for safety reasons, leaving at least one diameter and a half of terrain above the tunnel crown. At this depth, however, the TBM did not allow egress to the surface in the numerous accesses to the area. Therefore screens had to be designed on the whole stretch. But this created a serious problem as the number of screens needed exceeded Spain's building capacity. Almost one million square meters of screens had to be built, which had never been done in our country before. In total, with all the other works on the M-30, 1.7 million sq m of screen were needed, which meant that for an average depth of 20 m, over 88 km of screen walls were built, of which nearly 49 km were in the river area.

Figure 4. Madrid M-30 M-RIO. Aerial view of the works (Puente de Praga)

The machines that build the screens occupy a lot of space on the surface; they dig the thin wall with the excavator bucket, fill the floor void with special dense sludge called bentonite which in turn requires large storage pumping and filtering facilities. Then the reinforcement cage is inserted - a huge steel grid 1 m high by 2.50 m wide and 20m deep - and another crane is needed to lift and insert it. In addition, considerable surface space is required for mounting and storing the frames. It is not difficult to imagine the implications of building the 49 km of screen wall with this equipment and with the continuous and dense traffic on the M-30 (Figure 4).

At peak times, during the months of September 2005 and April 2006, ninety units of screen machines were working simultaneously on the M-30, each one with its auxiliary crane. There has never been a similar concentration of resources for one structure in the whole of Europe and the works were developed smoothly. The volume of concrete required was also extraordinary. A concrete mixer truck carries 6 m³, so 330,000 trucks were needed for this area of work, which certainly contributed to the discomfort of M-30 users.

Figure 5. Madrid M-30 M-RIO. Works along the river.
Source: "Madrid M-30. Un proyecto de transformación urbana"

The quality of the reinforcing steel was also remarkable; more than 100 kg per m3 of concrete, due to the enormous depths and spans of the built structures that at some points of the San Vicente connection have up to three levels of overlapping tunnels. A huge volume of tunnel was bored in this area, reaching over six million m³. This volume, measured on the bank, expands once it is dug up and is poured into the truck, so that the six million became nine on the truck. If an average truck has a load of 10 m3 (a higher load prevents the truck from climbing the ramps) this means that about 900,000 large truck trips were required.

Once the screens were finished, the road slab was laid enabling digging to continue beneath it. Traffic could then circulate on the slab while digging the tunnel and building the segmental lining.

But perhaps the most difficult and unrewarding work, in a city like Madrid (Figure 5), is the work that has to be done prior to the tunnel boring or the construction of the screens - the diversion of the huge network of public utilities such as electricity, water, gas and telephone lines. In a city as old as Madrid, there are many lines and services of which even the utility companies are not aware. Many of the services reflected in the drawings – location drawings defining their exact position – no longer exist, have never existed, have been lost or are very inaccurate. The amount of telephone, electricity, water and gas service disruption that often occurred at this stage was therefore enormous, in spite of the care taken in the work.

Moreover, in addition to the tunnels in this area, dozens of control rooms and emergency exits had to be built. Each technical or control room is a huge and complex underground structure with numerous entrances, slabs at different levels, electromechanical equipment rooms and sophisticated control facilities for the ventilation, lighting, fire protection and power systems, among others.

The dimensions of this construction were phenomenal. There had been nothing like it in Spain before. However, with the work methods applied it was possible to embark on such an endeavour in Madrid.

In the first few months of work, the new team studied the construction methods that would be needed to implement the construction program. Construction processes used in comparable projects in the world were studied, but there was really only one truly similar one - the Big Dig in Boston. Construction processes used in Madrid by the same team for the extensions of the Metro network and the one hundred metro stations built in the last decade were reviewed and improved, as the geotechnical characteristics of the terrain and other local factors are extremely important in choosing the right construction processes. The methods used for the M-30 project - already used in the Metro extensions - were defined based on these initial studies.

The teams for the project planning and construction were among the bests available in Europe, as demonstrated in the Metro extensions where they achieved what no other country had been able to achieve before. They also had the best possible political support, enabling the works to be carried out in the capital of Spain. In addition, absolute priority was given to safety: security had to be one hundred per cent, which was transmitted to all the teams involved in the project.

The design and planning of the projects, traffic flow, safety, links to the M-30 and its adaptation to the 21st century, were

developed with the support and advice of the best professors, consultant engineers and experts from Spain. Professors from the Transport Department of the Madrid School of Civil Engineering (Escuela Técnica Superior de Ingenieros de Caminos, Universidad Politécnica de Madrid) took part, such as Sandro Rocci, Miguel Ángel del Val, Alberto Camarero and many others.

As in the case of the Madrid Metro Extension Project, the design of the M-30 would only succeed if the critical and dangerous activities were successfully concluded. In this case, the south bypass tunnels (Figure 6). These large diameter tunnels constituted one of the most difficult works of civil engineering since they are urban tunnels, in a densely populated city more than five hundred years old, with many services under the pavement and, above all, with soft soil and soft rock. The work is not comparable to the construction of tunnels in the rock of a mountain, with just pines, oaks or firs above.

Figure 6. Madrid M-30 M-RIO. Tunnel of the south bypass.

To successfully build the bypass tunnels clear priorities and criteria had to be set, such as:

• Innovative construction procedures that would ensure maximum safety for the workers in the tunnel.

• Maximum safety for buildings and other urban structures located on or in the vicinity of the tunnels.

• Geotechnical safety. In small connection tunnels and in other works such as Embajadores, Ventisquero de la Condesa and Sor Ángela de la Cruz the minimum surface of exposed floor front had to be lower than that used in urban tunnels.

• No consideration would be given to cost or term factors versus safety factors, especially in the underground works.

Consequently, open-face methods were banned. They had also been banned in the 1995 Metro extension projects. Specifically, the new method (NATM), mechanical pre-cutting (or Premill) and similar methods that were known to have caused very serious collapses such as El Carmel in Barcelona, were banned in the Madrid tunnels. This prohibition, which caused outrage and bewilderment among many foreign and Spanish technicians in 1995, is now applied to other projects.

Designers and builders were selected with the utmost care, taking into account experience in tunnels in soft soils of the engineers and technicians proposed by each bidder. The criteria for evaluation of bids should give more weight to technical aspects than to the economic factor.

An underground work control system had to be developed capable of detailed, high precision tracking of the impact of digging on buildings and other surface structures. This system had to be able to detect possible incidents and offer solutions in time. Any additional structures needed for the complete safety of the work could thus be built after reaching an agreement with contractors on cost, and after approval of the corresponding design variations or additions needed to immediately implement the chosen solutions. Problems had to be detected in time before they became impossible to deal with, which is what has happened in other major projects around the world. The system had already been developed and implemented in the extension of the Madrid Metro in 1995 and is still in use, enabling more than 50,000 control points to be tracked throughout the city on the M-30 project, contributing to the prevention of tunnel collapses that fortunately have not occurred.

The works were managed by the City of Madrid's highly competent technical department, including civil engineers Manuel Arnaiz, as director-general of infrastructure, Juan Antonio de las Heras, assistant director of unique infrastructure, Ricardo Dominguez construction manager of Madrid Calle30, and other brilliant engineers such as Jorge Presa, Javier Najera, Luis Caneda or Mercedes Jack. These engineers were responsible for the management and preparation of civil engineering and services designs, as well as commissioning of complete sections.

Geotechnical and soil mechanics were a decisive factor in the design of the M-30. If the geotechnical problems were solved, the project would succeed. It was therefore decided to continue with what was started in 1995 for the extension of Madrid Metro, and the best Spanish experts in this discipline became full-time advisers to the works manager. The professors and civil engineers José María Rodríguez Ortiz (Professor of Foundations at the School of Architecture of Madrid) and Carlos Oteo Deck (Professor of Soil Mechanics at the Civil Engineering School of A Coruña), both with over forty years of experience in tunnels in soft soil, made a decisive contribution to the success of the project. The development of the numerical model of the behaviour of the big EPB TBM (Earth Pressure Balance) used and the analysis and interpretation of all results of monitoring measures were developed by the civil engineer Luis Medina Rodríguez, professor at the A Coruña School of Civil Engineering, who also collaborated in the development and adjustment of other analytical models, semi-empirical and numerical, of soil-tunnel-structure interaction and the prediction of subsidence. Civil engineers Juan Alcaide and Pedro Romo, the best experts in Spain, were responsible for monitoring and measurement and for technical support.

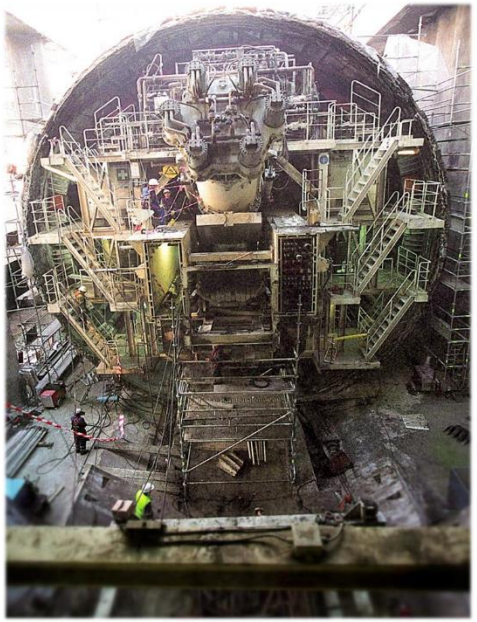


Figure 7. Madrid M-30 M-RIO. Disassembly of "Tizona" TBM.
Source: Martínez-Deaño (coord.), 2011, *Madrid M-30. Un proyecto de transformación urbana*

As already mentioned, the cut and cover method was the chosen construction method for the river area and earth pressure balance (EPB) was the construction method for the south bypass. The TBM was the largest ever built and used in the world (Figure 7) and therefore its specification was very important. This specification was prepared by Manuel Melis directly from the City's General Infrastructure Coordination department, together with the machinery team of the successful contractors and the manufacturers of the TBMs. The two EPB TBMs, had a 15.2 m diameter, and were the largest and most powerful in the world. The maximum thrust of the hydraulic jack was increased from the recommended 20,000 t to 30,000 t. The torque of the cutting head was increased from the recommended 9,000 mt to 12,000 mt. This, among other factors, was key to the success of the excavation of the tunnels.

The principles of transparency and integrity

Madrid City Council undertook the urban transformation of the M-30 ring road between 2003 and 2007 through a complex legal and administrative process that enabled the City to manage, approve and tender the different projects involved in this transformation and to design and implement the organization that funds and manages public service for the remodelling, operation, upkeep and maintenance of the M-30.

The local government's decision to transform the M-30 was based on the legal reality that the road was urban and should therefore be transferred to the City of Madrid and integrated into the local public road system. The transfer of the M-30 from the Ministry of Public Works to the City became a reality on March 4, 2004. The State Council ratified its condition as an urban road and the legal framework on April 29, 2004. Since then, other similar legal decisions have ratified the urban nature of the M-30.

The urban transformation of the M-30 was aligned with the overall, explicit aims and objectives to be achieved along the whole length of the road, within the framework of a municipal strategy on citizen mobility. The different parts of the ring road were all subject to the same objectives and purposes although there was often no physical continuity between each section. Each might have a different problem which could only be solved by a specific intervention, fully functional by itself, and independent of any other, but always aligned with the overall design as described, as required for any public work. These actions might be articulated at a different time in a different way, due to technical, urban, legal or economic factors.

The City Council developed a technical project for each of the actions of the transformation program. Projects were processed independently, although due to reasons of economy and procedural efficiency, submission to public information and approval and publication were pooled, resulting in three approval acts - covering all the projects - which were performed by the competent municipal bodies on June 3 and November 4, 2004 and January 17, 2005

Local law does not require public information to approve municipal work projects, in this case the transformation of the M-30. However, the City Council ordered the that all projects be submitted to a public inquiry, for the statutory period of twenty working days, during which time the projects were discussed at the headquarters of the Department of Planning, Housing and Infrastructure and arguments were presented. The whole content of the projects was made available to citizens, which included, among others, the specifications and annexes for mapping and surveying, traffic, geology and geotechnics, study of the geometric layout, climatology and hydrology, environmental condition, landscaping and plantings.

Taking advantage of the opportunity to establish other forms of participation through legally recognized organizations and associations, four informative sessions with neighbourhood associations were held at the beginning of the public information period for the first projects, coordinated by the regional federation of neighbourhood associations, whose representatives in municipal bodies had been showing active interest in the projects and making suggestions about them from the beginning, often supported by many residents from specific areas.

The result of these public participation processes was the submission of 2,385 claims and suggestions made by private citizens, political, union and corporate organizations, environmentalists and defenders of sustainable mobility organizations, citizen forums and thirty neighbourhood associations in Madrid. All proposals were analyzed and answered individually by each bidder, incorporating changes arising from this participation process in the projects.

The approval of the final designs by the City of Madrid also required permits or mandatory reports as stipulated by the different sectoral laws for this type of action.

Briefly, it should be noted that the projects were subjected to fifteen resolutions of the Directorate-General of Cultural Heritage of the Madrid Regional Government, by which the projects were authorized or given favourable reports, as appropriate in each case, in accordance with the law of Historical Heritage of Madrid. These rulings were accompanied by specific controls during the execution of works, issuing additional resolutions where required.

The actions affecting green spaces or protected urban elements were subjected to the Institutional Commission for the Protection of Historical, Artistic and Natural Heritage of Madrid, which ruled favourably.

Projects in the river area were the subject of a report issued by the Ministry of the Environment and Spatial Planning, which imposed twenty-eight environmental conditions on the works, nine applying to the stage prior to the works and nineteen applying to the implementation phase. In addition, they were controlled by the Tagus River Basin Authority, under the Ministry of the Environment, which authorized actions and performance conditions through four resolutions that imposed more than forty prescriptions for the preservation and improvement of the hydraulic and hydrological environment.

Despite the intense debate on the transformation of the M -30, the litigation generated was quite low. Urban planning and environmental control were the two main issues of contention.

Arguments based on urban planning maintained that the projects had not received approval for construction because they did not have previous approval through a planning instrument or through a modification of the current General Urban Plan of 1997. The City argued that, according to law, they could remodel the M-30 without any previous planning instrument to legitimize the works, based on a municipality's right to exercise its capacity to maintain and operate the local roads. The sentences handed down to date have confirmed the opinion of the City Council, dismissing the legal actions presented.

The second relevant legal question was whether the required environmental impact assessment should be undertaken for

municipal projects, prior to approval. The City submitted the Manzanares River area refurbishment project to the Madrid Regional Government, as the competent environmental agency, since only the projects to be developed close to the river were considered to fall within the scope of the environmental assessment procedure. In order to dispel any doubt, the Madrid Regional Government requested the opinion of the Council of State, this being the top advisory body to which Regional Governments can appeal. The Council of State concluded in its statement of 29 April 2004 mentioned above that the M-30 is an urban road and therefore remodelling is not subject to environmental assessment under the applicable regulations.

All the competent conservation authorities in Madrid have analyzed the projects and authorized them.

Sustainability and respect for the environment

The M -30 works in the area of the river gave rise to the largest operation affecting the ecological balance in the recent history of the city of Madrid. Where thousands of cars once circulated there is now a large linear park, a green corridor that extends from El Pardo to Getafe, linking forests, green spaces, historic gardens and urban parks, which were scattered and unconnected, giving Madrid a unique environmental infrastructure among all great cities. This operation has enabled the city to look south and west, making the Casa de Campo public park part of the town centre and finally retrieving and integrating the river in the urban structure, making the Manzanares River the new backbone of the city.

The aim of the M Rio project was to reconcile the city with its river, by running 6 km of the M-30 underground, and by improving the water quality and upgrading the sewage network. As Ginés Garrido, the eminent member of the winning architectural team of the "M Rio" design competition, said this plan was a "chance" that , in his opinion, "must correct the debt that the city has with its landscape, both north and south", with three main goals: "Develop a relationship between Campo del Moro and Casa de Campo, recover the river area as a place for the enjoyment of citizens and create a green identity through the construction of a wooded path on the right bank of the river".

This was an old dream. The idea of transforming the river banks into a linear park starting with the first phase of the Manzanares linear park, had already been reflected in the 1985 and 1997: urban development plans, and was behind the mayor Alberto Ruiz-Gallardón's announcement to redirect part of the ring road underground along the river.

M Rio is a space that is open to all, structured around nine areas of reference: the woodland promenade, called Salón de Pinos which is the backbone of the park; six garden areas spread from north to south (Aniceto Marinas gardens, Virgen del Puerto, Segovia bridge, Toledo bridge, Matadero and Arganzuela park), the boulevard of Portugal Avenue, that extends the park to the west, and Huerta de la Partida, which is the link with the Casa de Campo.

M Rio has 30 km of cycle paths; 33 sports facilities for skating, skateboarding, climbing, football, paddle tennis, tennis, basketball and BMX biking; 17 playgrounds with 65 elements; 3 fitness circuits with 22 elements; 7 petanque courts; 12 game tables; three platforms for cultural events in Puente del Rey and Matadero and the Manzanares River performance centre, to which the Madrid Matadero Cultural Complex has to be added. Furthermore, for a more pleasant park experience 5,506 new benches, 63 drinking fountains, 637 bicycle parking and 84 bicycle parking forks and 8,528 lights have been installed.

There are 33 river crossings to facilitate access between the districts situated on both banks of the river, among them the newly created bridges whose singular features make them new urban icons, such as Arganzuela monumental bridge, the twin Invernadero and Matadero bridges, the Principality of Andorra bridge, or the so-called oblique bridge, which was built on the old M-30 roads. The new bridges are in addition to the historic bridges of Segovia and Toledo, Puente del Rey, among others. Water is one of the main features of the park. There are 13 ornamental fountains, and an urban beach with three water enclosures located in Arganzuela park, which is the result of a request made by the children who participated in the Madrid Río competition. Furthermore, this new green lung provides a privileged position from which to enjoy the city from five viewpoints: San Vicente square, Huerta de la Partida, Segovia bridge, Arganzuela bridge and pedestrian and cyclist bridge of the south interchange.

GREEN AREAS AND CULTURAL ISLANDS

The proposed underground project repaired one of the harmful impacts of the 1969 M-30 construction which had radically changed the way in which the citizens of Madrid lived with the river. From that moment, a "wall" of asphalt moved the Manzanares neighbourhood away from its traditional link to the watercourse, as is the case of Carabanchel district or the Paseo de Extremadura road, and interrupted the relationship with another iconic ecosystem of Madrid, Casa de Campo - a forest of oaks, pines, elms, chestnut, ash and black cottonwood in the inner city. This relationship was re-established after the remodelling proposed in the Madrid Rio project. But it has not been the only benefit. There were green areas, West Park and Casa de

Campo, on the banks of the Manzanares River between the M -30 south interchange and Los Franceses bridge next to historic bridges and old infrastructure and the old slaughterhouse that now houses new cultural developments, such as the headquarters of the ARCO collection. This space has been recovered for citizenship and the environment, as vehicles now travel along the river 6 km underground. Added to this is the double tunnel of the south interchange, a 4.2 km tunnel with a twin in running east-west, used every day by 80,000 of the 260,000 vehicles that use the M -30 South. The south bypass shortens travel by 1.5 km, which also results in an estimated 53% reduction in accidents, fuel consumption and therefore pollution.

BIODIVERSITY

The Tagus River Basin water authority, responsible for the public water supply, imposed fifty environmental conditions. The debate as to whether the area was a natural or humanized ecosystem was intense, but the fact was that the stretch of the Manzanares River that runs along the M-30 had long since ceased to be a "natural ecosystem" to become a "channel" and subsequent channelling in the sixties and seventies put an end to the "islands" that existed in the river and much of the biodiversity within them.

One goal of the project was the recovery of this biodiversity, but we must not forget that this is a largely urban stretch of river and very altered by the hand of man. However the area could be very suitable for some species as a continuation of the Casa de Campo park. It will also help to reduce noise and polluting emissions and, of course, provide park access to the river for the diverse wildlife.

FISH

Fish fauna were badly affected by the deterioration of the waters along this stretch of the river, and in the Matadero area significant discharges were remedied by the Integral Drainage Plan, which was an important step that has been enhanced by the new construction. Other infrastructure includes new and bigger drains and several "storm tanks" to improve the quality of the water of the Manzanares river.

The remodelling of the M-30 has served, as the Mayor said, to "reduce air and noise pollution, create a linear park from the Monte de El Pardo to the Southeast Regional Park, providing the city with 110 new ha of parkland and recover, thanks to the construction of 34 km of sewers and 27 storm tanks, the quality of the water in the Manzanares River".

BETTER AIR QUALITY

It is estimated that every day between 600,000 and 1,000,000 vehicles enter Madrid. It became "a priority" to reconcile sustainable mobility with the preservation of the urban environment. In this context, the remodelling of the M-30 and the recovery of the whole Manzanares River environment claim that "vehicles leave Madrid faster" and that transport in the historical district has been reduced in favour of the pedestrian.

CULTURAL DIVERSITY

Not all biodiversity is natural. The works have also tried to recover the river for the public, by making the watercourse accessible with the removal of barriers that surrounded and isolated it. About 500,000 m^2 have been obtained for public use in the vicinity of the river, the equivalent of fifty football stadiums. Noise has also been reduced and historical heritage improved, particularly the bridges. Among them, Los Franceses bridge which owes its name to the nationality of the engineers who worked on its construction; the modernist Reina Victoria bridge, El Rey bridge, built during the reign of Fernando VII; Segovia bridge by Juan de Herrera, and Toledo bridge, the oldest in Madrid and declared a national monument in I956. Now cars will continue to flow under their arches, but underground. Furthermore, the archaeo-paleontological activities associated with the refurbishment of the M-30 contemplate a plan for disseminating the more than three hundred findings that have been detected during the works, among which is the skull of bos prim/genius, a large quaternary bovid known as a primitive bull, and a Epipaleolithic site, unique in Spain.

LANDSCAPE

The improvement of the landscape, sometimes an intangible value, is also one of the environmental benefits of the project since the underground section of the M-30 that runs parallel to the Manzanares River has led to the removal of more than 13 km of overhead lines and three high voltage substations, which will also run underground (Figure 1).