

## M30 MADRID MOTORWAY - SPAIN

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The Madrid M30 motorway, the inner ring road of the city, is at the centre of a major urban renewal project. At the current time (2004) the M30 is a 'barrier' to movement in the urban areas it runs through. Despite its necessity as part of the road infrastructure of Madrid it causes much pollution to the air and also the Manzanares River which it runs close to.

The Madrid Calle 30 project will refurbish the road (which is badly in need of structural work) and reroute major sections of it through tunnels under the city areas with which it is associated. This will allow the surface areas that used to be asphalt paved to be redeveloped into green park areas, footpaths, cycle paths and new housing.

While the Madrid City Council is trying to extol the virtues of the environmental benefits of the project, many environmental activists point out that although large sections of the M30 will be routed underground the amount of traffic using it will increase and therefore pollution problems are not just going to go away. The council has countered this by releasing figures of the projected reduction in emissions from 2007 (35,000t reduction) to 2037 (64,800t reduction).



## OBJECTIVES

The objectives of the project include an increase in the capacity of the M30, recovery of the environmental areas surrounding the old sections of the M30, and regeneration and clean-up of the Manzanares River. There will also be an improvement to the radial connections with surrounding secondary roads in Madrid that will reduce intra-city travel times significantly.

The new sections of road construction will total 99km, 56km of which will be in tunnels. Construction started in September 2004 and should be finished by the second quarter of 2007 (although these dates may be over ambitious as the project is already behind schedule). The total project budget is estimated at €3.7 billion.

## M30 CONSTRUCTION PROJECTS

The motorway reconstruction is to take place in sections and has been divided into 15 separate projects and four regions - north, south, east and west.

### M30 EAST PROJECTS

- **Nudo de la Paloma:** overall length 5,508m (1,546m of cut and cover tunnel, 175m of conventional tunnel), term of contract 24 months, estimated cost €56 million
- **Nudo de Costa Rica:** overall length 2,078m (892m of cut and cover tunnel, 175m of conventional tunnel), term of contract 15 months, estimated cost €27 million
- **Nudo de la A-2:** overall length 4,460m (510m of cut and cover tunnel, 140m of viaduct), term of contract 16 months, estimated cost €25 million
- **Nudo de O'Donnell:** overall length 6,800m (150m of cut and cover tunnel, 150m of viaduct), term of contract 18 months, estimated cost €18 million
- **Nudo de la A-3:** overall length 4,800m (1,400m of cut and cover tunnel, 430m of conventional tunnel), term of contract 24 months, estimated cost €187 million
- **Conexiones between los Nudos de Manoteras y Sur:** overall length 12,000m, estimated cost €30 million

### M30 SOUTH PROJECTS

- **By-pass Sur:** overall length 8,344m (7,212m of conventional tunnel, 632m of cut and cover tunnel), term of contract 30 months, total estimated cost €792 million (north tunnel €340 million, south tunnel €429 million)
- **Conexión Embajadores con M-40:** overall length 5,800m (2,460m of cut and cover tunnel), term of contract 18 months, total estimated cost €74 million

### M30 WEST PROJECTS

- **Excavation av. de Portugal Hasta Gta. San Vicente:** overall length 2,983m (2,674m of cut and cover tunnel), term of contract 36 months, estimated cost €159 million
- **Excavation M-30 between paseo Marqués de Monistrol and puente de San Isidro:** overall length 12,759m (12,719m of cut and cover tunnel, 40m of traditional tunnel), term of contract 36 months, estimated cost €618 million
- **Excavation between the bridge of San Isidro and the bridge of the Princess:** overall length 12,212m (11,852m of cut and cover tunnel, 360m of traditional tunnel), term of contract 26 months, estimated cost €450 million

## M30 NORTH PROJECTS

- **Vía de Servicio M-30 Zona Noroeste:** overall length 3,426m, term of contract 24 months, estimated cost €32 million
- **By-pass Norte:** overall length 10,525m (4,817m of cut and cover tunnel, 4,187m of conventional tunnel), term of contract 30 months, estimated cost €722 million (west tunnel €293 million, east tunnel €429 million)
- **Acceso av. de la Ilustración M-607:** overall length 1,650m (482m of viaduct), term of contract 18 months, estimated cost €25 million
- **Conexión by-pass Norte con A-I:** overall length 5,479m (4,463m of conventional tunnel), term of contract 30 months, estimated cost €474 million

## CONTRACTORS AND PROJECTS AWARDED

Municipal agency Madrid Calle 30 has awarded Necso and Ferrovial Agroman the construction contract for the north tunnel on the south bypass for €340 million. The south tunnel on the south bypass will be constructed by a joint venture between FCC and ACS Dragados for €429 million. The south bypass is an 8,344m, three-lane infrastructure divided into two tunnels, of which 7,212 m is to be built by 15m-diameter TBMs and 632m by cut-and-cover tunnel method. Sinking of the shafts for the TBMs started in August 2004 and construction will last 30 months. Both tunnels, one in each direction, will allow drivers to avoid the A-4 intersection.

Sacyr Vallehermoso is to improve the connection to the A-3, at a cost of €187 million, in 24 months. This is a 4.8km section where 1.4km will be in cut-and-cover tunnel and 430m in conventional tunnel.

Corsan-Corviam is to improve the La Paloma Interchange for €56 million. The 5,508m section will require a 1,546m section to be excavated and constructed in cut-and-cover and 175m using conventional means.

A joint venture set up by Construcciones Sando and Ploder will construct the connections to Costa Rica and Jose Maria Soler in 14 months at a cost of €27 million. This section is 2,078m in length and includes 892m of cut-and-cover tunnel.

Aldesa Construcciones has been selected to refurbish and strengthen the connection with Avenida de América in 14.5 months for €23 million.

Two underpasses are needed to link up the N-II with the M-30 south and the M-30 north with the N-II.

## TUNNELLING MACHINES

In September 2004 MHI-Duro Felguera SA, a joint venture between Mitsubishi Heavy Industries Ltd (MHI) and Duro Felguera SA, received an order to supply the world's largest Earth Pressure Balanced (EPB) Tunnel Boring Machine (TBM), with a diameter of 15m (4,000t, 160m long) and an advance rate of 0.665m/min, to Dragados-FCC UTE of Spain. Design work on the equipment is to be performed by MHI and manufacturing will be carried out by Felguera Construcciones Mecánicas SA. The machine fabrication is scheduled to be completed in July 2005.

The EPB tunnelling machine will be used for construction of the south tunnel of the south bypass on Madrid's M30. This is of course only one of the seven machines expected to be required to carry out the tunnelling excavation for the 15 projects of Madrid Calle 30. Six more

machines are on order with various different requirements. Most will be 15m cutting diameter, but at least one will be configured to cut a dual-lane tunnel 12m in diameter. All of the machines will use an earth pressure balance shield system, since most of the excavation will be in soft ground (little hard rock). The segment erectors will be configured to line tunnels with 70cm-thick segments of concrete although some sections may be double lined with a second segmental ring to act as a safeguard against fire - this would require a second segment erector on the TBM.



**Specifications - M30 Madrid Calle 30 Project, Madrid, Spain**

**Key Data**

<b>Order year</b>	2003
<b>Project type</b>	Major road reconstruction and tunnelling
<b>Location</b>	Madrid, Spain
<b>Construction started</b>	Mid 2004
<b>TBM characteristics</b>	15m-diameter TBM with EPB, 4,000t, 160m long, 30,000t of thrust, advance rate of 0.665m/min
<b>Estimated investment</b>	€3.7 billion
<b>Completion</b>	2007