TUNNELS AND UNDERGROUND WORKS

Arroyofresno waste water pipe, Madrid, Spain.

Engineering and technical consulting since 1965

www.intecsa-inarsa.es
GENERAL
PRESENTATION

Intecsa-Inarsa
Intecsa-Inarsa is a Spanish company specialising in consultancy and engineering with private capital, which was founded in 1965 on the basis of a limited number of technicians with wide experience in design and execution of building work. Progressive growth has allowed the company to become one of the leading and most diverse Spanish consultancy and engineering companies with powerful and prestigious international projection.

The constant updating and ongoing innovation make it possible to offer made-to-measure solutions based on latest-generation technology. Our company has been operating for fifty years in the sectors of Engineering for Linear Transport Works, Land Engineering, Underground Works and Structures; Port Engineering, Marine Environment and Coasts; Consultancy and Engineering of Water; Building Engineering and Urban Planning and Project Management.

Intecsa-Inarsa’s technical team, trained and certified in a range of disciplines, is in permanent contact with Universities and Research Centres which puts it on the front line of Technological Development, and offers anything from Feasibility Studies to Detailed Engineering.

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**Countries where there have been projects**

**Permanent offices**
Quality and environmental management

INTECSA-INARSA’S environmental experience in all kinds of building has been recognised for decades and its designs include systems which respect the environment and with high energy efficiency.

INTECSA-INARSA’S experts accompany their customers in such global matters as:

• LEED (Leadership in Energy and Environmental Design)
• High Environmental Quality (HQE, from the French abbreviation)
• BREEAM (BRE Environmental Assessment Method)
• MINERGIE
• PAASIVHAUS.

INTECSA-INARSA contributes unbeatable knowledge to the design and operation of facilities including environmental parameters. Furthermore, it has dealt with numerous projects of considerable energy efficiency and exemplary landscape integration.

The powerful commitment related with sustainable development is put into effect for all kinds of project.
Quality certificates

From the point of view of Quality, in November 1994, INTECSA-INARSA obtained the Certificate of Company Registration No. ER-0244/1/94 from AENOR, the Spanish Association for Standardisation and Certification, accrediting the recognition of the Quality Assurance System applied in the company with the UNE-EN ISO 9001 Regulation.

It likewise obtained the corresponding European Certification, the Quality System Certificate from EQNET (European Network for Quality Assessment and Certification), with the identical accreditation number.

From the environmental point of view, in August 1998, the Certificate of Company Registration No. CGM-98/051 was obtained from AENOR, which accredits that the Environmental Management System applied to Intecsa-Inarsa is adapted to regulation UNE-EN ISO 14001. It likewise obtained the corresponding European Certificate from EQNET with the same accreditation number.

Recent awards

Finalist at The Fleming Awards 2014 by British Geotechnical Association:
- “Barcelona High Speed Railway Tunnel Project – Protecting World Heritage Buildings”. (Barcelona, Spain). Highest budget consultancy contract awarded by ADIF.

Best Civil Public Work 2013 by Madrid College of Civil Engineers:
- “Railway Access to Barajas airport” Project (Madrid, Spain).

Aqueduct of Segovia Award 2011:
- “General System Regeneration and Reuse of Urban Wastewater” (Murcia, Spain)

Prize of the Madrid Civil Engineers Association to the technical office of the “Best Public Work in Madrid. 2012”:
- “Refurbishment of the Serrano street and construction of 3 underground parking lots” (Madrid, Spain)

SNC Lavalin 2013 Awards of excellence:
- “SR99 Alaskan Way Tunnel en Seattle” (Seattle, USA). Øexcavation = 17.50 m (World Record)

Fidic Awards 2014:
- “Burying of M-30 Highway and Madrid-Río”, (Madrid, Spain)
M-30 ring road along the Manzanares river. Madrid – Spain.

ACTIVITY AREAS: TUNNELS

- High speed Railway tunnels.
- Urban tunnels.
- Underwater tunnels.
- Cut and cover tunnels.
- Caverns.
- Analysis of operating safely.
- Tunnel installations.
- Road and highway tunnels.
- Underground stations.
- Settlement Mitigation measures.
ACTIVITY AREAS. GROUND ENGINEERING.

- Geological and geotechnical studies.
- Planning, control and interpretation of geotechnical campaigns (both inland and marine).
- Geotechnical advisors.
- Geotechnical control and monitoring.
- Geological risk assessment.
- Seismic studies.
- Foundations design and site supervision.
TUNNELS AND UNDERGROUND WORKS

SERVICES. (LAST 15 YEARS).

Activity Areas
- High Speed Rail Tunnels.
- Road and motorway tunnels.
- Railway tunnels.
- Underground railway tunnels.
- Geotechnics applied to Works.
- Underground Works: Caverns, Cut and Cover and shafts.
- Site supervision of ongoing Works.

Services / References
- Studies:
  - 228 Studies.
- Projects:
  - 173 Projects.
  - 200 km underground works.
  - Metro: 64 Stations and 88 km.
  - Road Tunnels: 85 km.
  - Urban Tunnels: 150 km.
- Supervision:
  - 68 Supervision.
- Technical assistance:
  - 22 Assistance.
TUNNELS AND UNDERGROUND WORKS

CLIENTS (Nationals)

PUBLICS

- DRAGADOS
- COPISA
- ISOLUX CORPAN
- ORTIZ
- aldea

PRIVATE

- SANDO
- OHL
- ferrovial
- assignia
- aldea
TUNNELS AND UNDERGROUND WORKS

 Clients (Internationals)

Publics

Privates

ASHGAL (Qatar):

Dragados USA:

Dragados - SISK JV.

HNTB.

Dr. Sauer GmbH

Tunnel of Pertus AEIE

IntecsA

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TUNNELS AND UNDERGROUND WORKS

Main References
### MAIN REFERENCES IN METRO TUNNELS

<table>
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<tr>
<th>CITY</th>
<th>LINE</th>
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87.76 km 64 Stations
MAIN REFERENCES IN METRO TUNNELS

- **SPAIN:**
  - Madrid
  - Barcelona
  - Seville
  - Tenerife

- **ABROAD:**
  - Toulouse (France)
  - Buenos Aires (Argentina)
  - New York (USA)
  - Caracas (Venezuela)
  - Andhra Pradesh, Chennai (India)
  - London (England)
LINE 9. BARCELONA METRO, (SPAIN)

Object:
- Detailed Design and Site Supervision.

Relevant Data:
- Length = 4,623 km.
- Øext = 12,06 m. In soft and waterbearing soils.
- EPBS tunnel, precast reinforced segments, \( t_h = 0.4 \) m
- 5 Stations and 1 launching pit.
- 8 Ventilation Shafts, pumping shafts and emergency exits.
- 3 Cross passages.
- Budget of project: 2.3 M€.
- Budget of works: 275.0 M€.
- Date: 2008.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 9. BARCELONA METRO, (SPAIN)

Llefia Station Section.

Plan view and Section of Llefia Station.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 9. BARCELONA METRO, (SPAIN)

Launching pit.
Station under construction.
Final lining in the station shaft.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 9. BARCELONA METRO, (SPAIN)

Lleia station.

Gorg station.
LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

Object:
• New Project after the collapse of the tunnel being constructed and technical assistance during the works.

Relevant Data:
• Length = 2,632 Km (in varying conditions from soft failed rock to unstable and waterbearing soils).
• Ø_ext = 10.4 m.
• N.A.T.M. excavation for main tunnels and German Method for station mined caverns.
• 3 Stations.
• Manoeuvring area and garages.
• Budget of project: 4.5 M€.
• Budget of works: 111 M€.
• Data: 2011.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

Section Tunnel Station Carmel and Ventilation Shaft Station Horta.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

Vall de Hebron Station.
LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

Tunnel portal.

Tunnel portal.

Tunnel excavation.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

- Vall de Hebron Station
- Tunnel portal
- Tunnel excavation
Main References

3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 5. BARCELONA METRO. CARMEL TUNNEL (SPAIN)

Tunnel excavation.

Tunnel.

Vall de Hebrón Station.
LINE 2. BARCELONA METRO, (SPAIN)

Object:
- Detailed Design.

Relevant Data:
- Length = 6.343 Km, Including 1 mined and 5 cut and cover stations.
- Øint = 10.4 m.
- TBM tunnel, precast segments, th= 0.35 m.
- 6 Stations.
- Budget of project: 5,6 M€.
- Budget of works: 380 M€.
- Date: 2009.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 2. BARCELONA METRO, (SPAIN)

Fira 2 Station section.

Foc-Cisell Station section.
**Main References**

3.1 MAIN REFERENCES IN METRO TUNNELS

**LINE 1. SEVILLE METRO. (SPAIN)**

Object:
- Detailed Design and Site Supervision.

Relevant Data:
- Length = 2.3 Km. Soft and weaterbearing soils including crossing under Guadalquivir river.
- Øint = 5.35 m.
- Twin tunnels, EPBS, precast segments, th = 0.25 m.
- 12 Stations (7 news and 5 refurbishment).
- Viaduct over the Highway SE-30 and Guadiana river.
- Traction system in 20 Km.
- Budget of project: 1.9 M€.
- Budget of works: 584.0 M€.
- Date: 2005.

Client:
JOIN VENTURE
SACYR
DRAGADOS
GEA 21
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 1. SEVILLE METRO. (SPAIN)

Building . Garage Station.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 1. SEVILLE METRO. (SPAIN)

San Bernardo Station and Shaft.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 1. SEVILLE METRO. (SPAIN)

1 de Mayo Station.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 11. MADRID METRO. (SPAIN)

Object:
- Detailed Design of two sections to Carabanchel PAU and Fortuna.

Relevant Data:
- Length: EPB: 2.86 + 3.25 Km. Øext = 9.38 m.
- Precast segments, th = 0.32 m.
- Length of the tunnel in mine (Belgian Method) = 1.7 + 0.13 Km.
- Cut and Cover tunnel = 0.8 Km.
- 3 + 1 Stations.
- 7 Shafts (Ventilation, pumping, emergency, launching pit and extraction of tunnelling machine).
- Budget of project: 1.2 + 0.7 M€.
- Date: 2006.

Client:
Madrid Infrastructures of Transport
Main References

3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 11. MADRID METRO. (SPAIN)

Works at the station.

Platforms under construction.
In the tunnel: extinguishing and fire detection facilities, ventilation and heat dissipation facilities for transformation centres and technical rooms, ventilation tunnel facilities and security system, etc. Including stations and platforms facilities.
**Main References in Metro Tunnels**

**Line 10, Madrid Metro, Spain**

**Object:**
- Detailed Design.

**Relevant Data:**
- Length = 6.8 Km.
- $\bar{d}_{\text{ext}} = 9.42$ m.
- EPB tunnel, precast segments, $\text{th} = 0.32$ m.
- 3 Cut and Cover Stations.

**Client:**
- Madrid Infrastructures of Transport
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 10. MADRID METRO. (SPAIN)

Joaquin Vilumbrales Station.

Tunnel interior.
Main References

Main References in Metro Tunnels

Line 4. Madrid Metro, (Spain)

Object:
- Detailed Design.

Relevant Data:
- Length = 4 Km.
- \( \varnothing_{\text{ext}} = 9.38 \) m.
- EPB tunnel, precast segments, \( \text{th} = 0.32 \) m.
- 4 Cut and Cover Stations.
- 2 Launching pits.

Client:
- Madrid Infrastructures of Transport
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 4. MADRID METRO, (SPAIN)

- Parque de Santa María Station.
- Works in Launching pit.
- Mar de Cristal Station.
Main References

3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 12. MADRID METRO (METROSUR).
SECTION 10. (SPAIN)

Object:
• Detailed Design.

Relevant Data:
• Length = 7 Km.
• $\varnothing_{\text{ext}} = 9.38$ m.
• EPB tunnel, precast segments, $\text{th} = 0.32$ m.
• 6 Stations
• 1 Interchange station with the railway station.
• Budget of project: 0.5 M€.
• Budget of works: 176 M€.
• Date: 2003.

Client:
DRAGADOS S.A.
Main References

Main References in Metro Tunnels

Section 10. (Spain)

Auxiliary works. Launching shaft.

Railway interchange station.
Main References

3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 12. MADRID METRO (METROSUR).
SECTION 10. (SPAIN)

Mechanic doors in platforms.

Ventilation systems.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 8. MADRID METRO. (SPAIN)

Object:
- Detailed Design of two Cut and Cover Stations and two launching pit with two TBM.

Relevant Data:
- Length = 5.48 Km.
- $\Omega_{\text{ext}} = 7.20$ m.
- EPB tunnel, precast segments, $th = 0.25$ m.
- 2 Cut and cover station.
- 2 Launching pits with 2 TBM.

Client:
DRAGADOS S.A.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 8. MADRID METRO, (SPAIN)

Colombia Station.

Left lane tunnel. Launching pit.
Main References

MAIN REFERENCES IN METRO TUNNELS

LINE 8. MADRID METRO. (SPAIN)

Nuevos Ministerios Station.
3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 1. TENERIFE METRO. (SPAIN)

Object:
- Detailed Design.

Relevant Data:
- Length of the main tunnel = 5.5 Km.
- TBM tunnel, precast segments, th = 0.40 m.
- $\varnothing_{\text{int}} = 10.80$ m.
- 2 Cut and Cover Stations.
- 2 Launching pit and 1 Extraction shaft.
- 2 Additional Shaft (pumping and ventilation).
- Additional parallel Tunnel to railway tunnel for several services.
- Connection galleries per 500 m.
- Budget of project: 0.65 M€.
- Budget of works: 200 M€.
- Date: 2009-2014.

Client:
Metropolitano de Tenerife

Los Cristianos Interchange Station.
Main References

3.1 MAIN REFERENCES IN METRO TUNNELS

LINE 1. TENERIFE METRO. (SPAIN)

Costa Adeje Interchange Station. Final Design.
Main clients

- Public administrations
  - European Commission
  - GOBIERNO DE ESPAÑA: MINISTERIO DE FOMENTO
  - GOBIERNO DE ESPAÑA: MINISTERIO DE MEDIO AMBIENTE, Y MEDIO RURAL Y MARINO
  - SEGURO SOCIAL
  - RENFE
  - ADIF
  - CSIC
  - SAR

- Construction companies
  - FCC
  - OHL
  - Sacyr
  - Dragados
  - Ferrovial
  - Acciona
  - MECO
  - Ortiz
  - Saudi Aramco
  - ISOLUX CORSÁN
  - DNGO
  - RADCO