



Ajuntament
de Barcelona

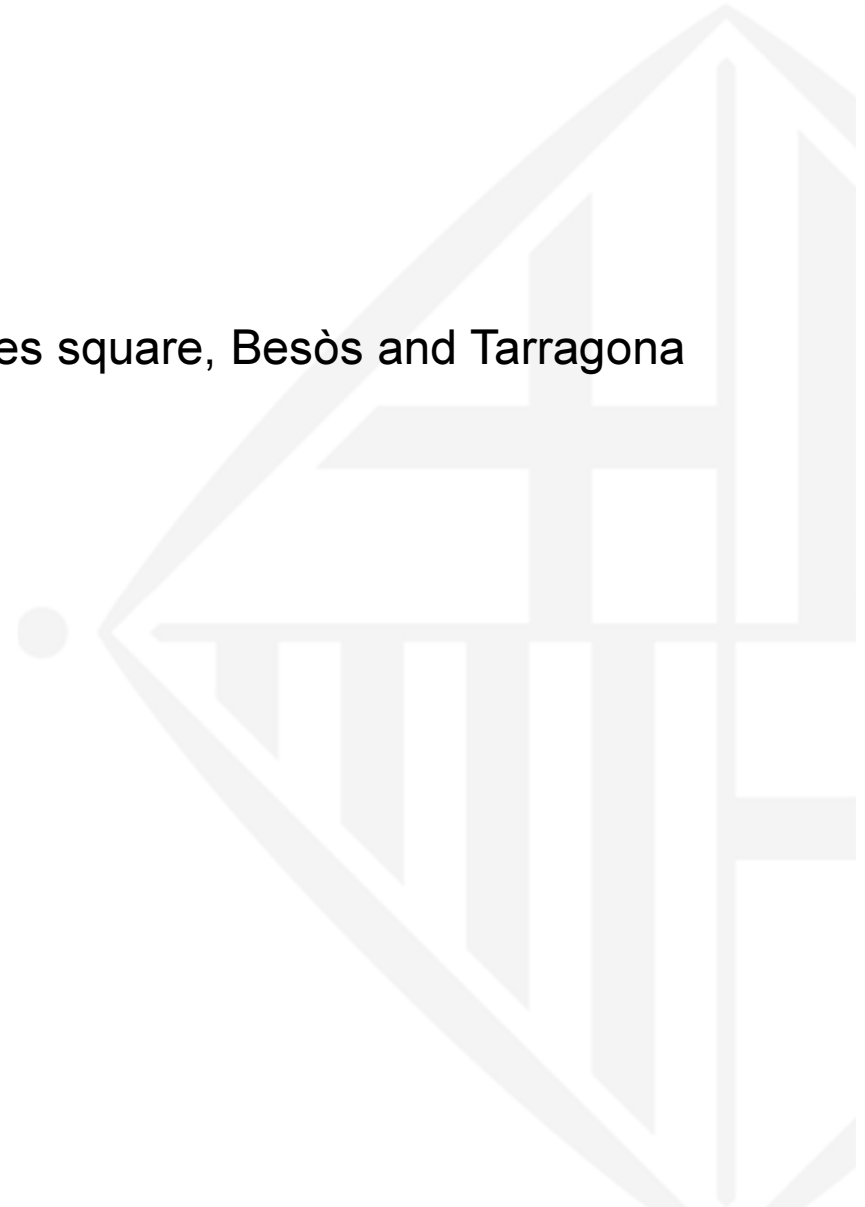
MULTI UTILITY TUNNELS IN BARCELONA

MANAGEMENT MODEL OF RONDA'S UTILITY TUNNELS

December, 3rd 2019

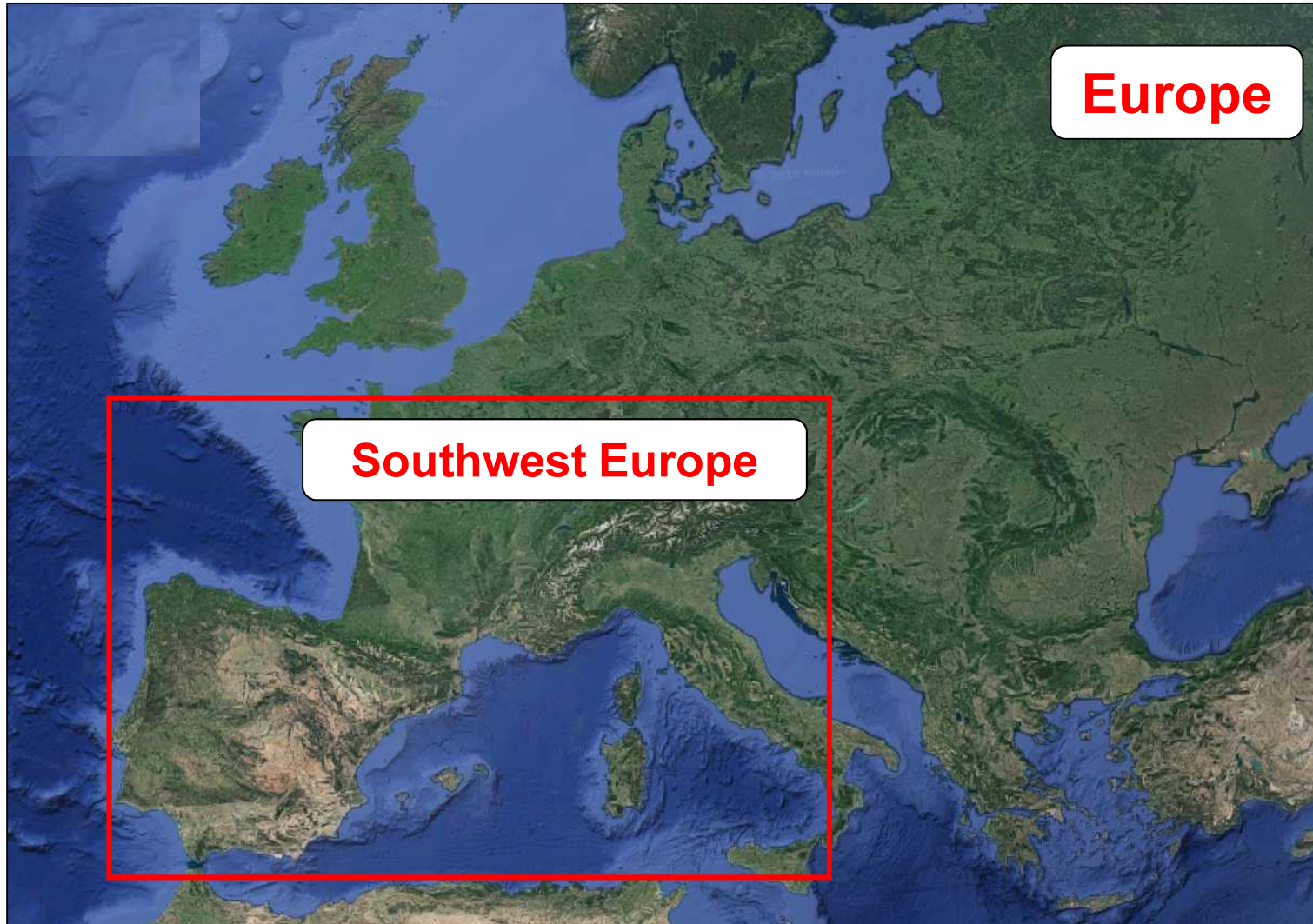
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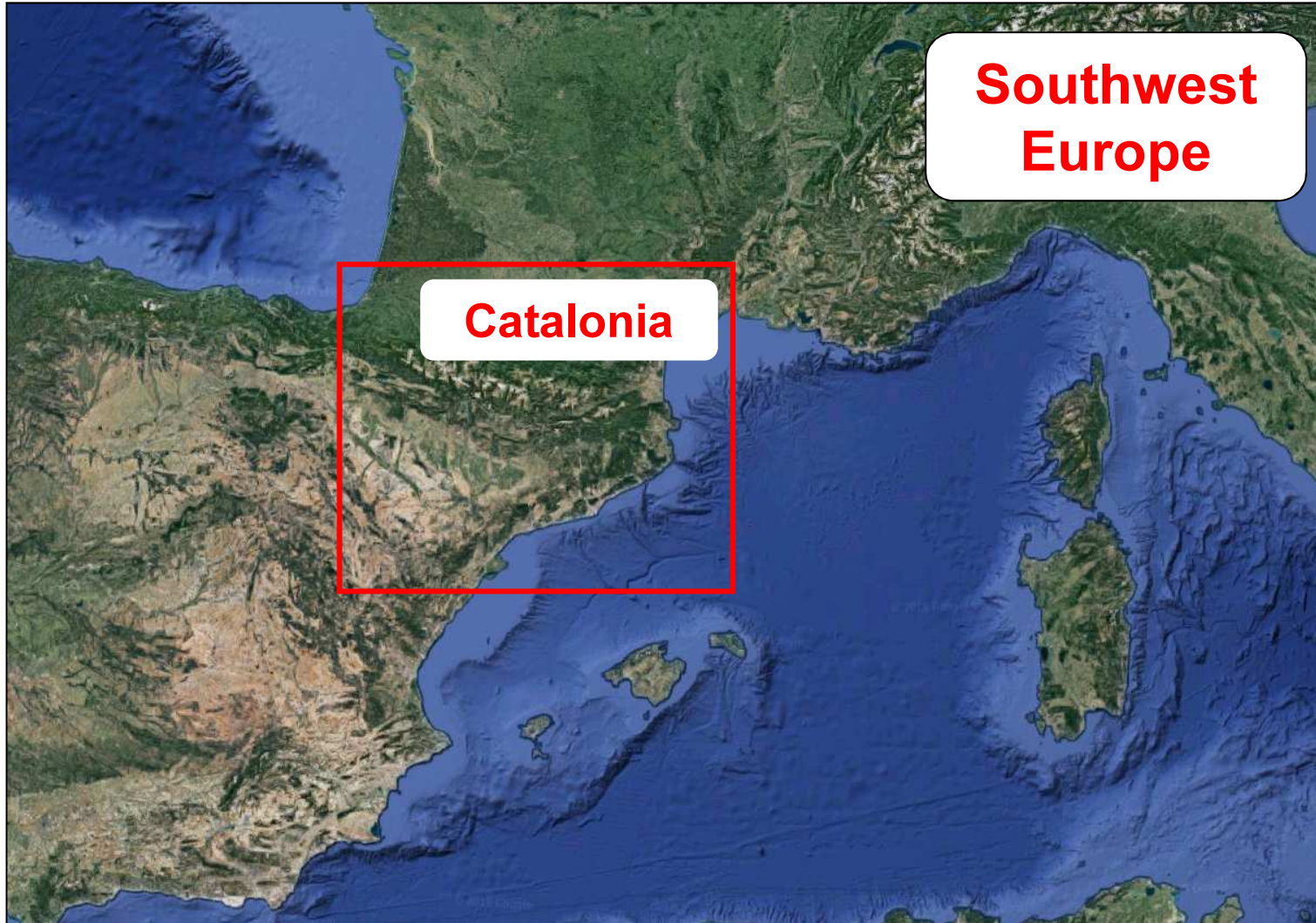


01. LOCATION



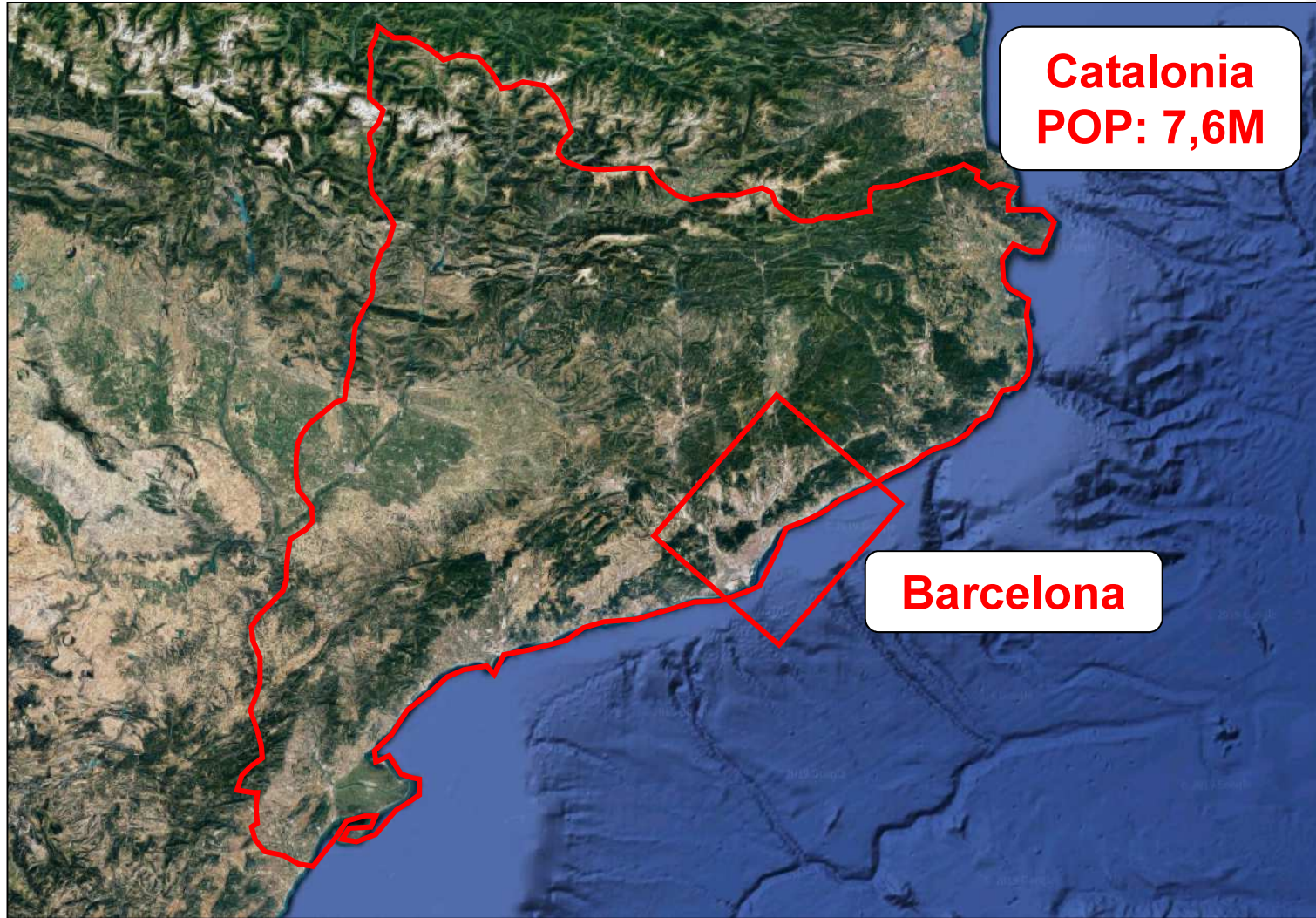


01. LOCATION





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02. EXISTING UTILITY TUNNELS



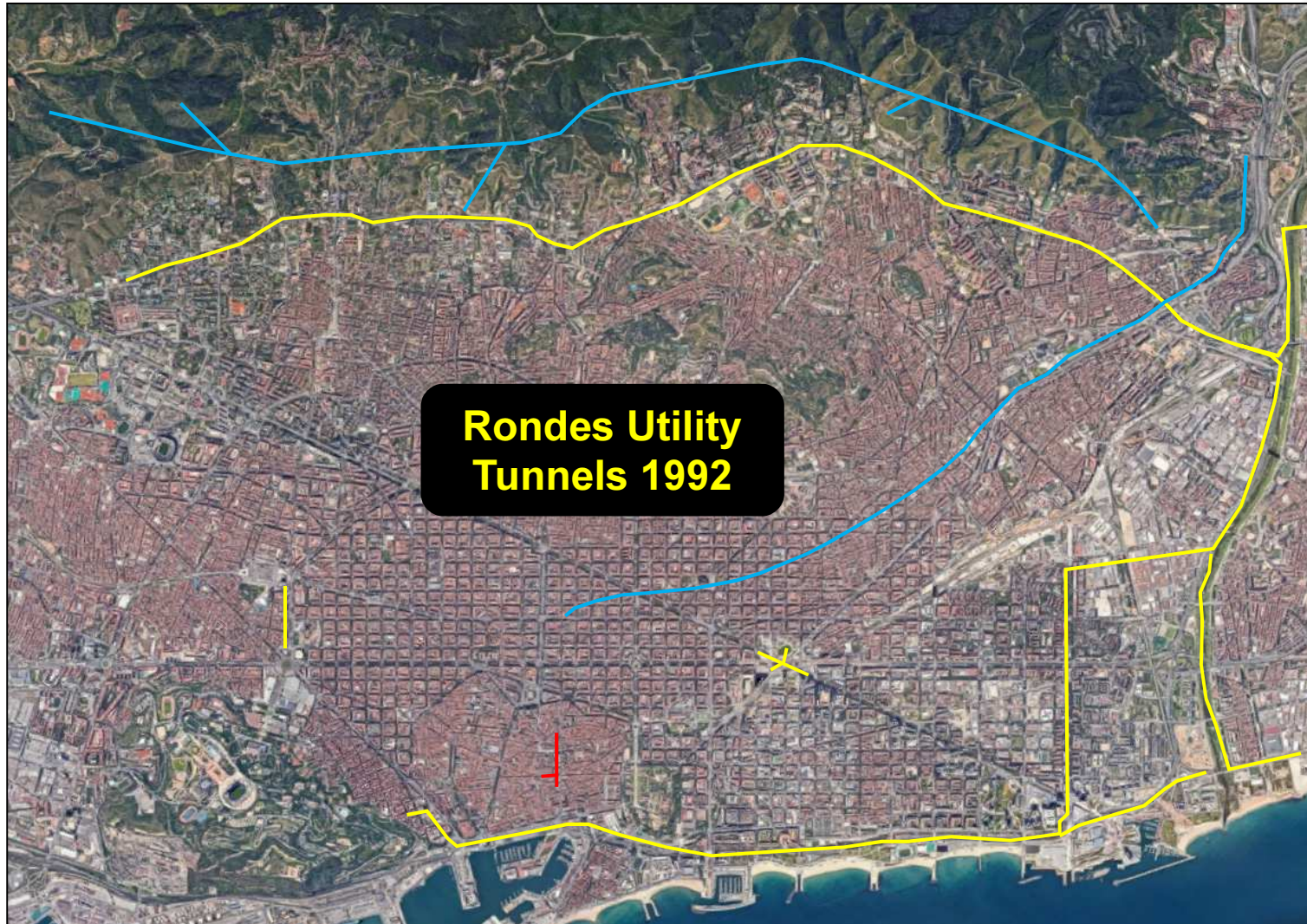


02. EXISTING UTILITY TUNNELS





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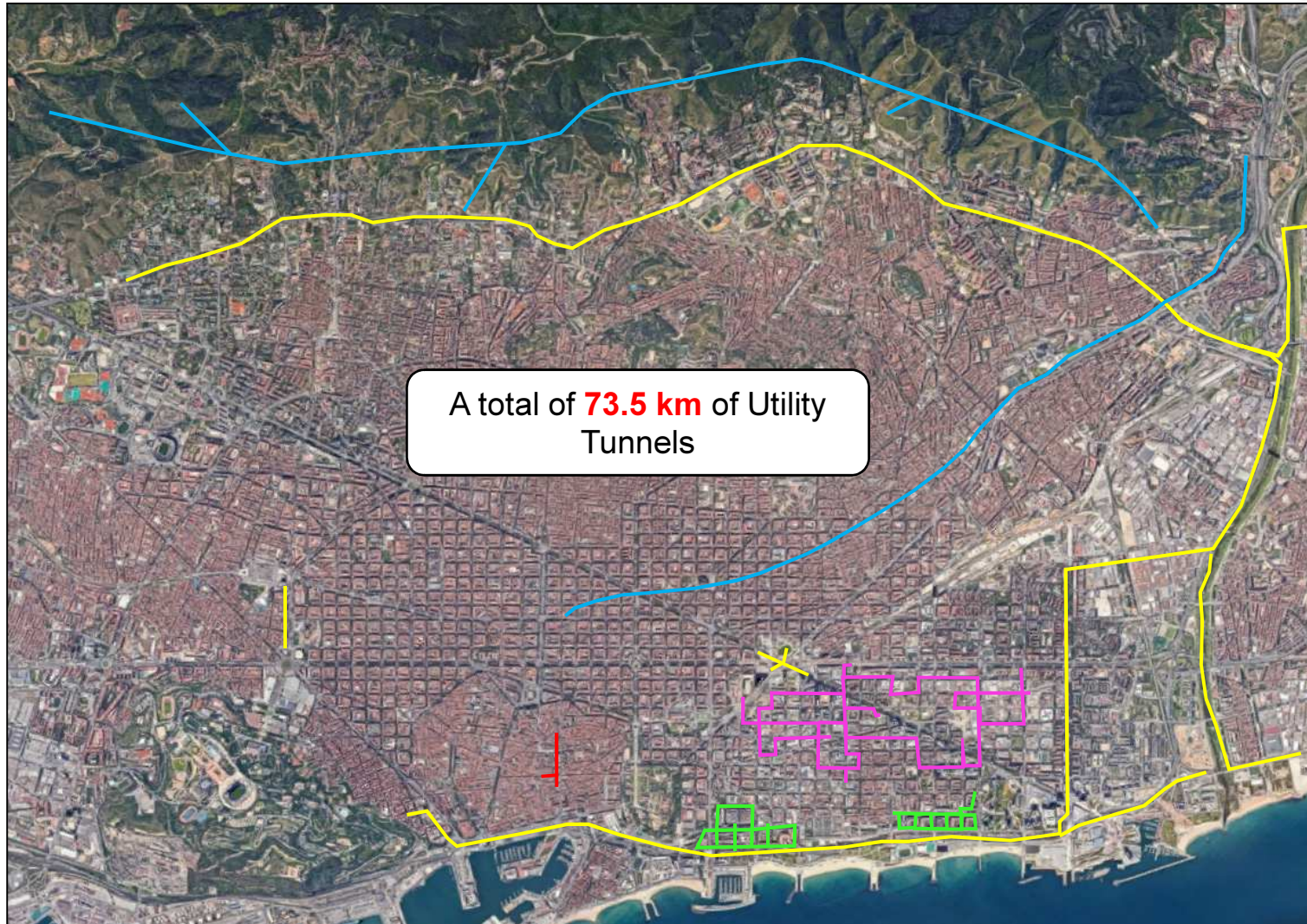


02. EXISTING UTILITY TUNNELS



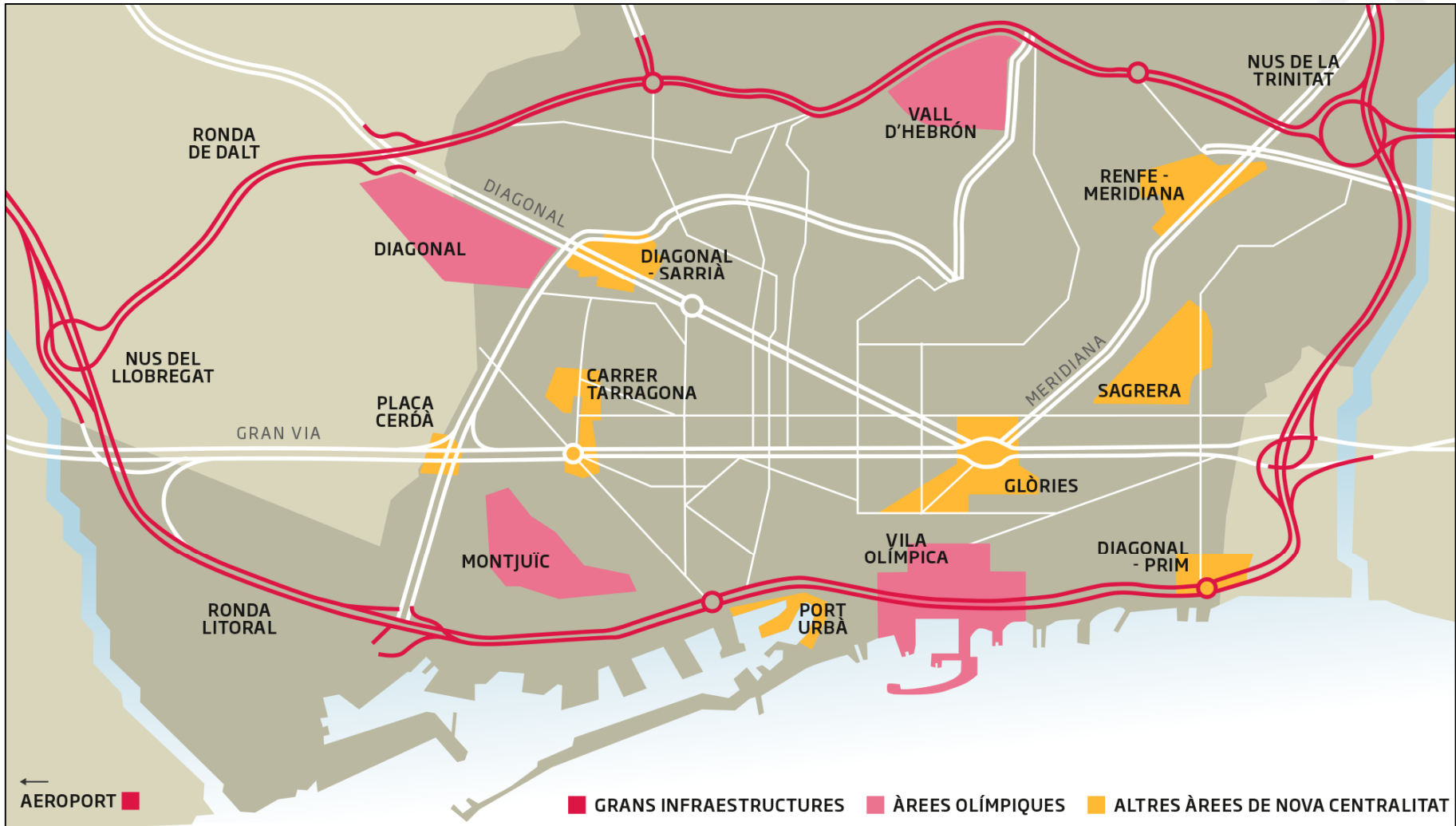


02. EXISTING UTILITY TUNNELS





03. MULTI UTILITY TUNNELS OF RONDES, GLÒRIES SQ., BESÒS AND TARRAGONA STREET CASE





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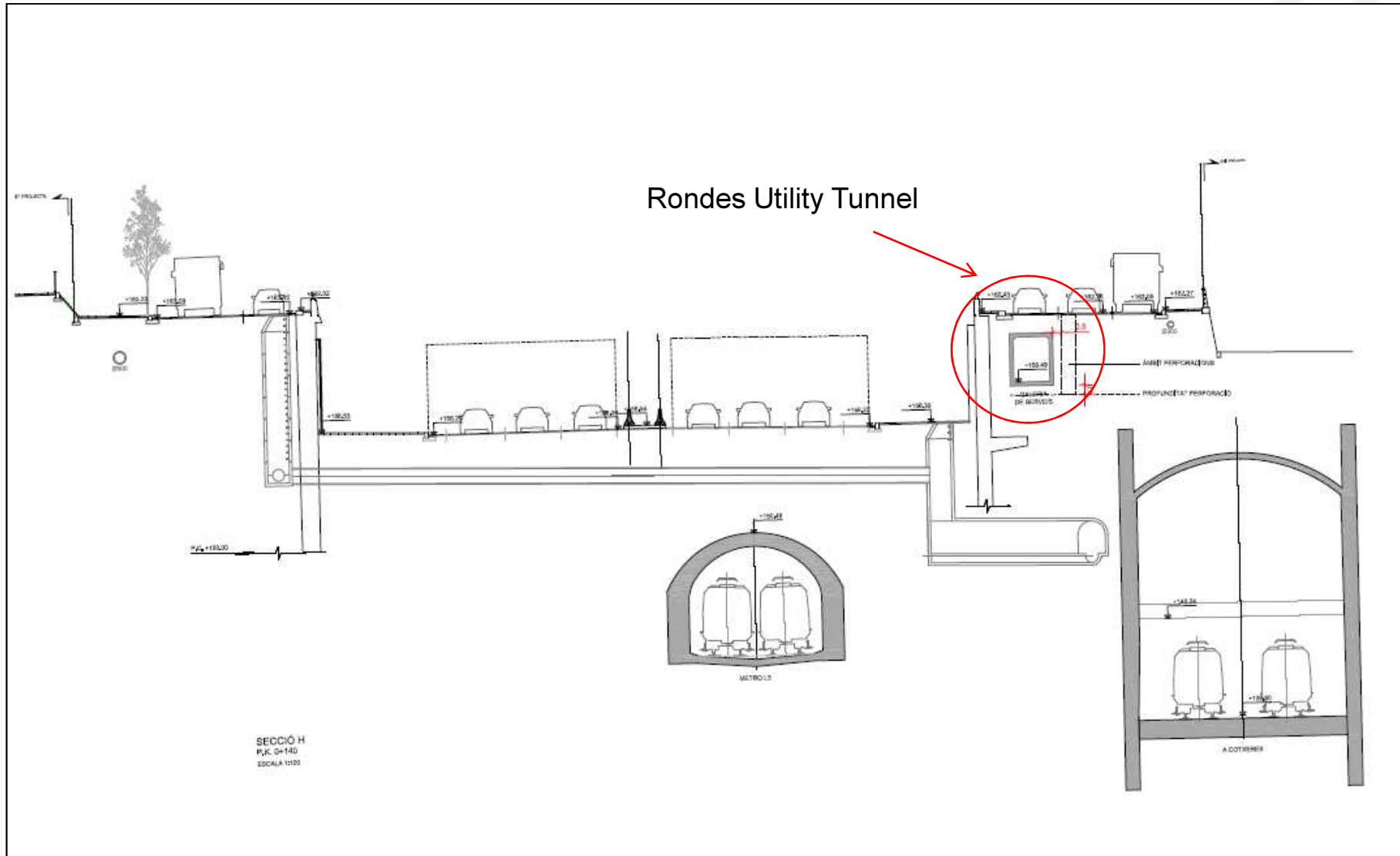


03. MULTI UTILITY TUNNELS OF RONDES, GLÒRIES SQ., BESÒS AND TARRAGONA STREET CASE



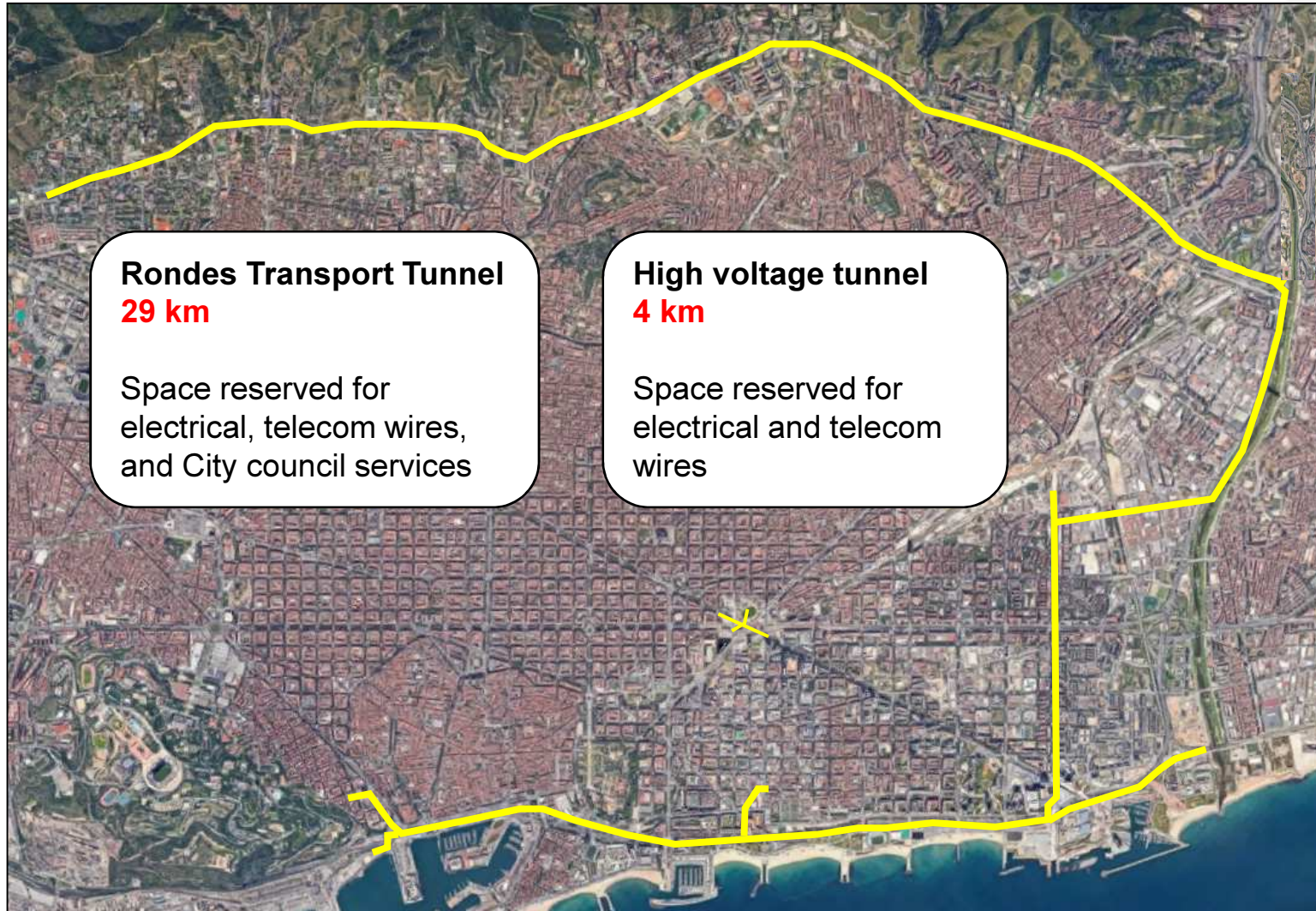


03. MULTI UTILITY TUNNELS OF RONDES, PL. GLÒRIES, BESÒS AND TARRAGONA STREET CASE





04. SPECIFICATIONS. RONDES TRANSPORT TUNNELS AND HIGH VOLTAGE TUNNELS





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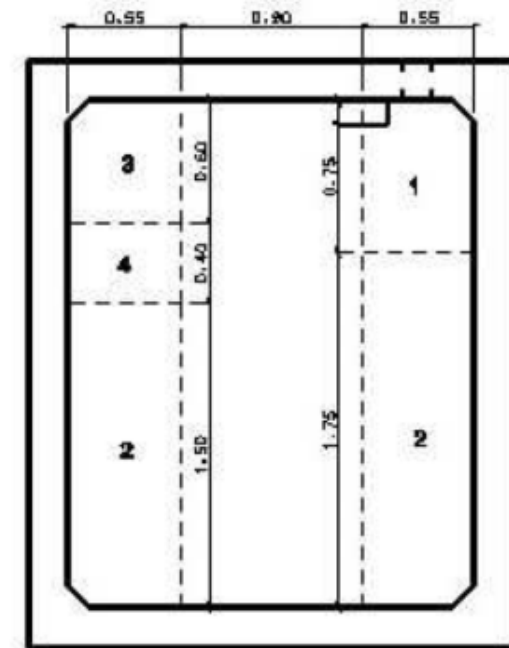
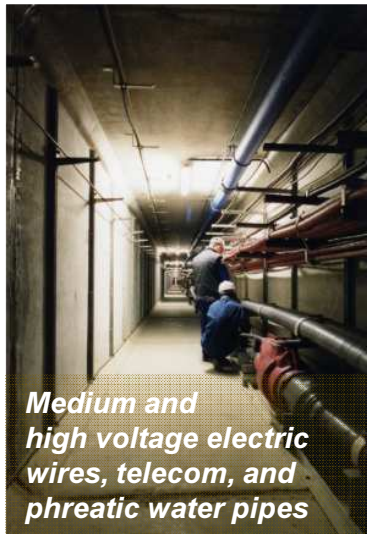
Rectangular Transport Tunnel

Runs longitudinally under the main roads (Rondes, Rbla. Prim and Santander St.).

Rectangular section 2x2,5m, made of 24 tons reinforced concrete prefabricated pieces, 20 cm thickness.

Four brackets per module for the installation of corbels and transport's facilities.

Space reserved for electrical, telecom wires, and City council



- 1 – Barcelona City Council
- 2 – Endesa / Red Eléctrica
- 3 – Telefónica de España
- 4 – Security space



04. SPECIFICATIONS. RONDES TRANSPORT TUNNELS

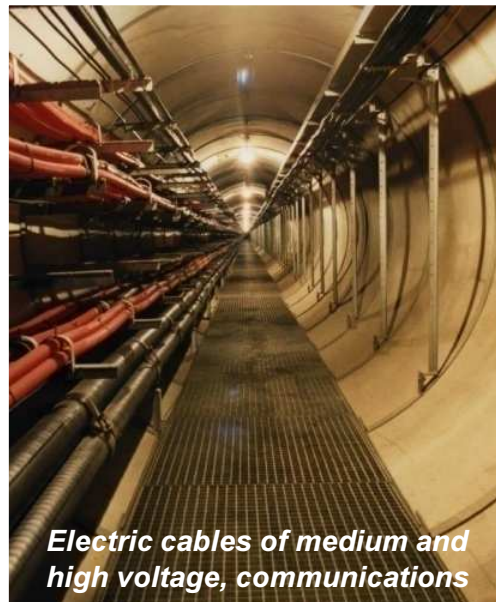
Circular Transport Tunnel

Runs longitudinally under Ronda Litoral, at Vila Olímpica.

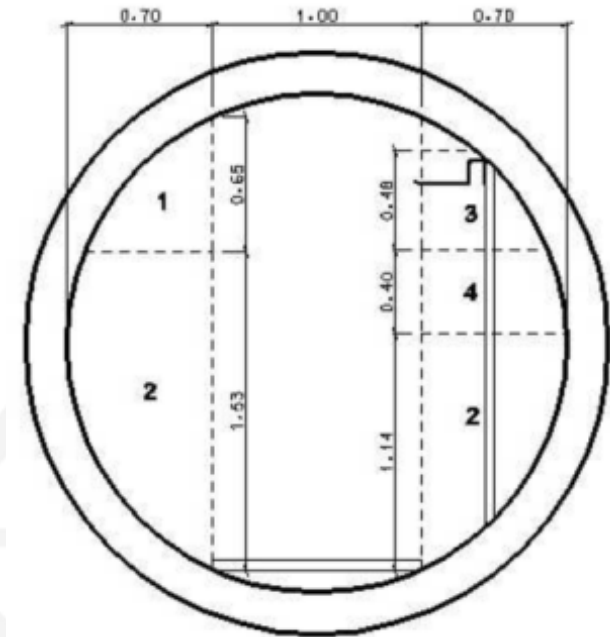
Circular section of 2,4m diameter, made of 24 tons reinforced concrete prefabricated pieces, 20 cm thickness.

Four brackets per module for the installation of corbels and transport's facilities.

Space reserved for electrical, telecom wires, and City council services.



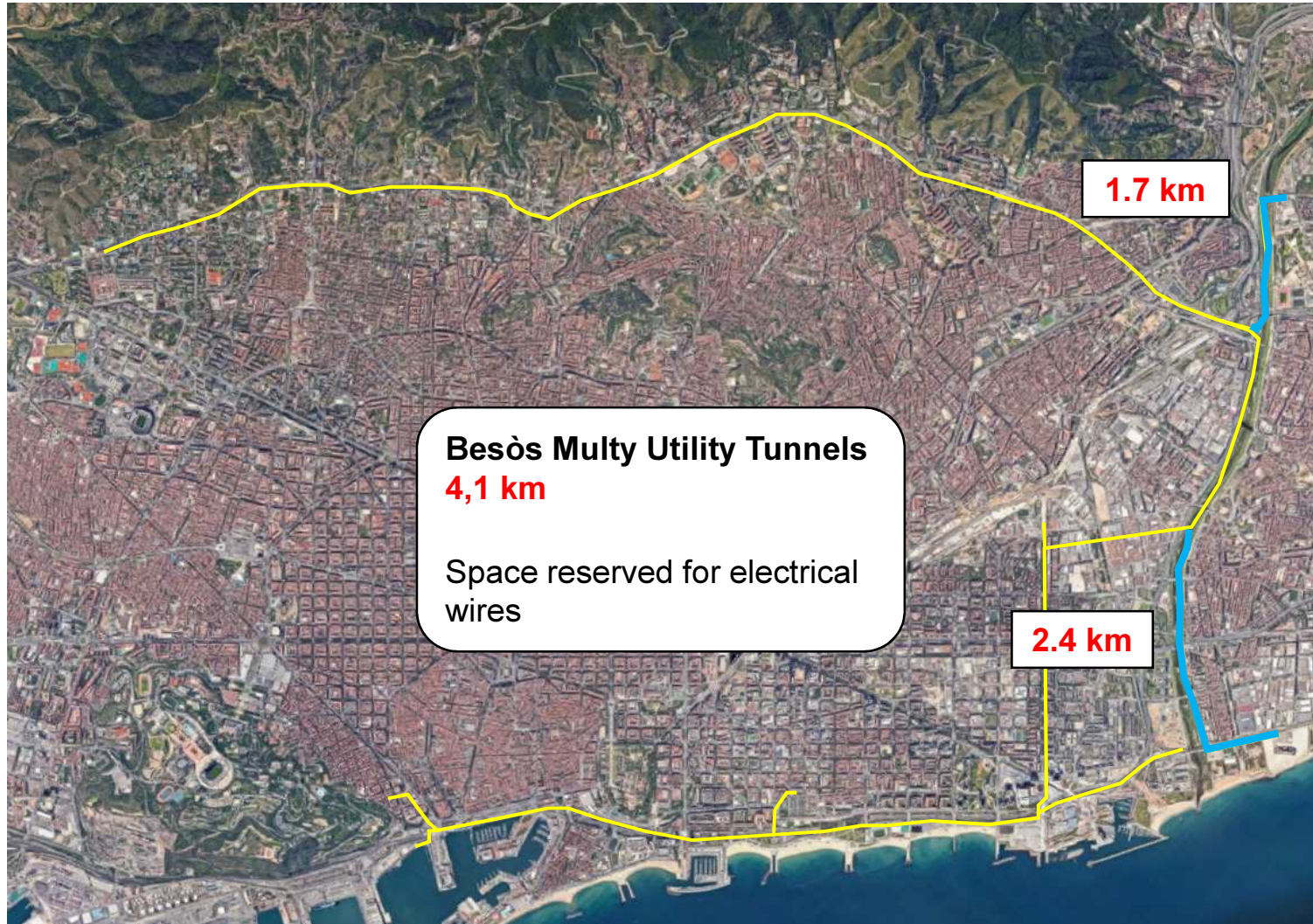
Electric cables of medium and high voltage, communications



- 1 – Barcelona City Council
- 2 – Endesa / Red Eléctrica
- 3 – Telefónica de España
- 4 – Security space



04. SPECIFICATIONS. BESÒS TUNNELS





04. SPECIFICATIONS. BESÒS TUNNELS

Rectangular section, made with reinforced concrete.

Dimensions: 2.00 m width, 2.50 m high and 30 cm thickness.

It has brackets for the installation of corbels and transport's facilities.

Space reserved for electrical wires.





04. SPECIFICATIONS. CROSSING TUNNELS





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Perpendicular to Rondes and, in some cases, to railway lines.

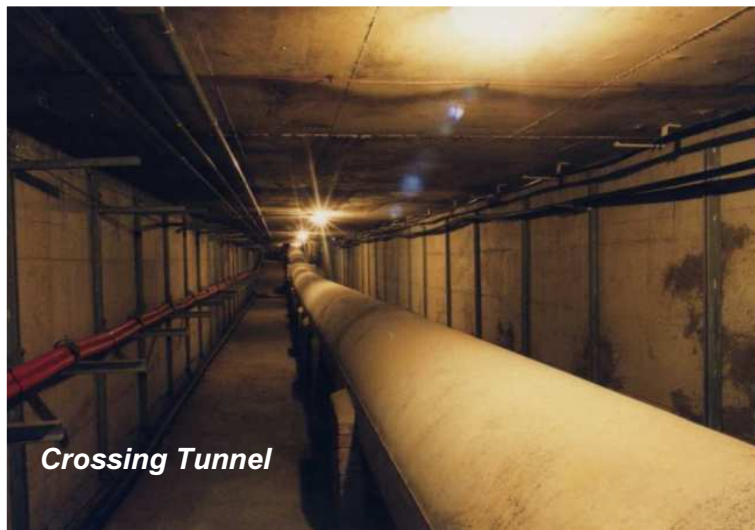
Rectangular section, made with reinforced concrete.

Dimensions: 3.5 m width, 2.2 m high, 20 cm thick.

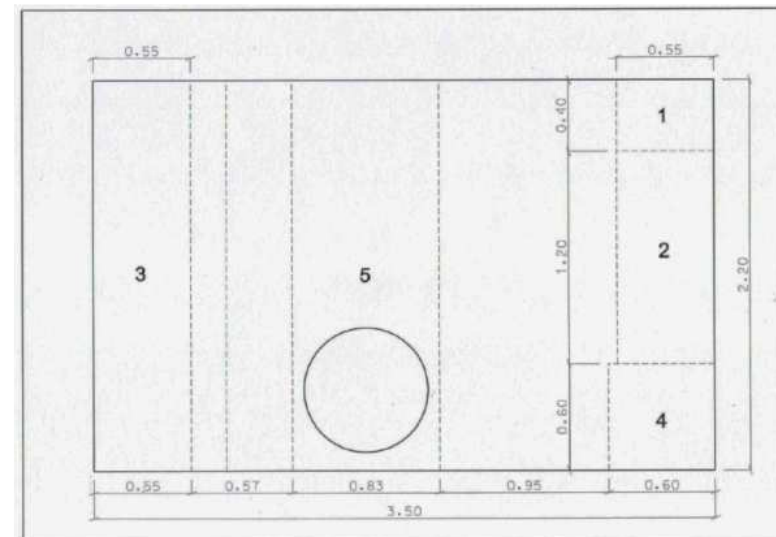
It has brackets for the installation of corbels and transport's facilities.

Space reserved for electrical, telecom wires, water and gas pipes and City council services.

- 1 – Barcelona City Council
- 2 – Endesa
- 3 – Telefónica de España
- 4 – Nedgia
- 5 – Aigües de Barcelona



Crossing Tunnel





04. SPECIFICATIONS. TARRAGONA STREET TUNNEL





04. SPECIFICATIONS. TARRAGONA STREET TUNNEL

Runs longitudinally under Tarragona St., from Mallorca St. to Consell de Cent St.

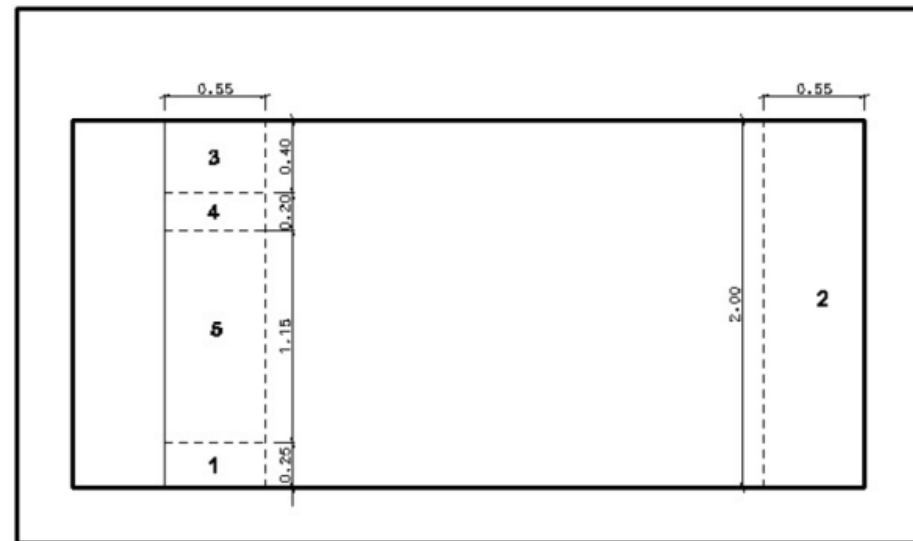
Rectangular section, made with reinforced concrete.

Dimensions: 4.65 m width, 2 m high and 70 cm thick.

It has brackets for the installation of corbels and transport's facilities.

Space reserved for electrical, telecom wires, and City council services.

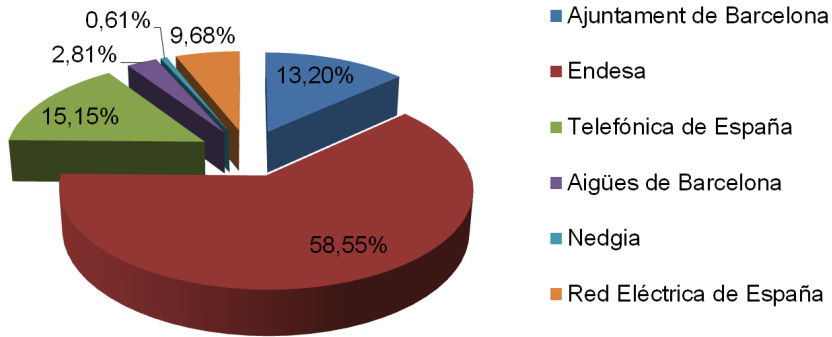
- 1 – Barcelona City Council
- 2 – Endesa
- 3 – Telefónica de España
- 4 – Vodafone Ono
- 5 – Space reserved



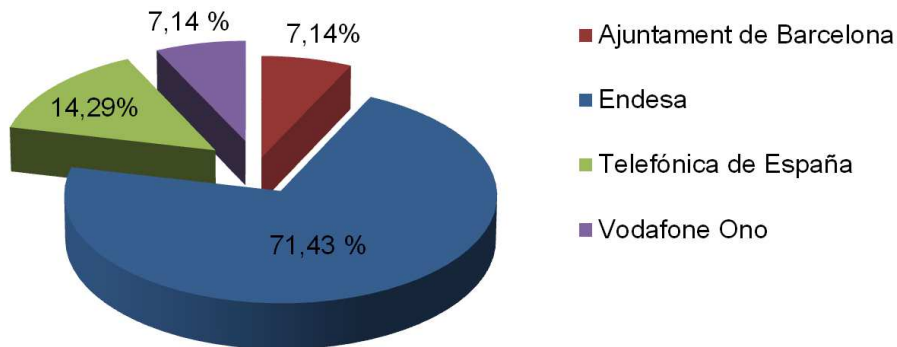


04. SPECIFICATIONS. SPACE DISTRIBUTION BY USERS

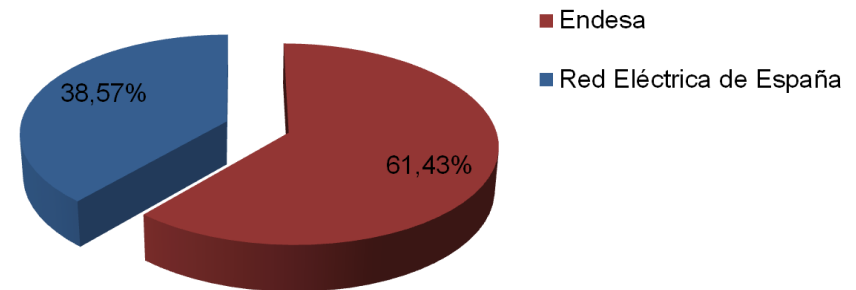
Rondes Tunnels



Tarragona St. Tunnel



Besòs Tunnels





04. SPECIFICATIONS. SINGULAR ELEMENTS

Accesses

Tunnel connections

- Octagons :**
- Located at the junction of three or more tunnels.
 - Big and complex constructions.



Access



Tunnel connections



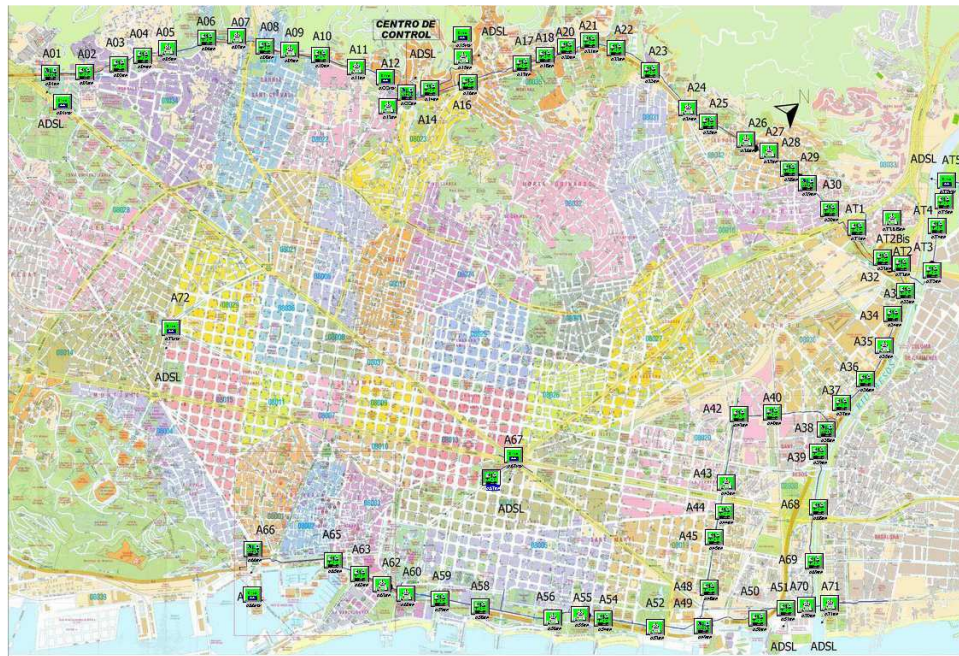
Octagon



05. CONTROL SYSTEM: COMMUNICATIONS

Control Center 24 h/day with non stop information through automated devices connected by an optical fiber network.

- 68 Switches.
- 9 DSL lines closing the communication ring.
- 9 Routers.
- Intercom network



Control Center



05. CONTROL SYSTEM: ENTRIES DETECTION AND ALARM CONTROL

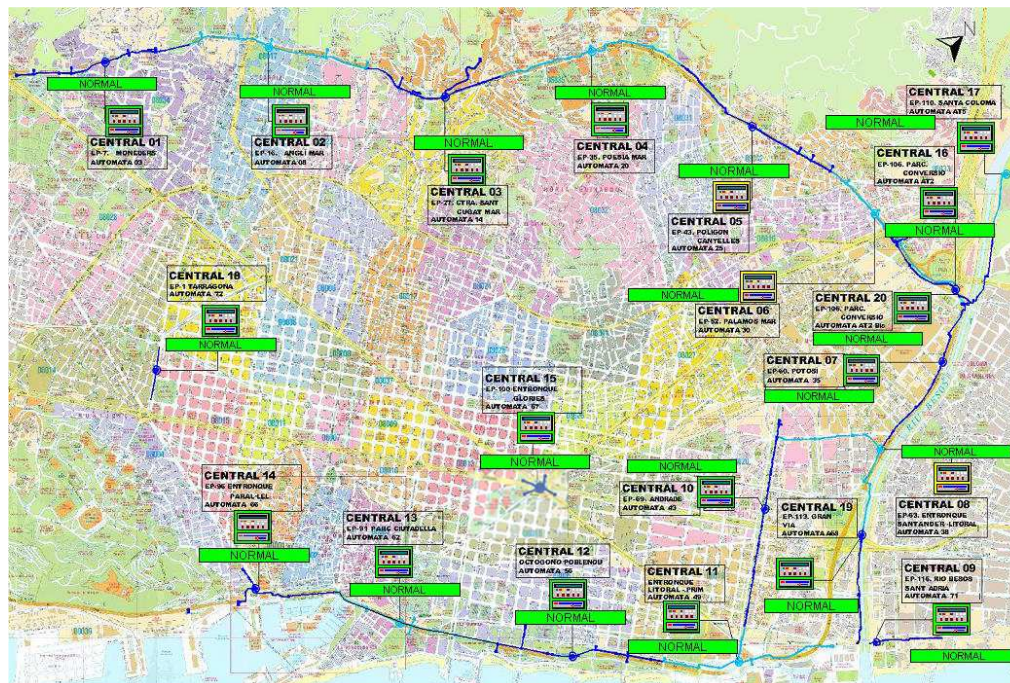
- 113 Personnel entries.
- 28 Emergency exits.
- 87 Temperature detectors.
- 3300 Luminaires.
- 58 Electric meters.
- 68 PLC (Programmable logic controller).
- 87 Extractors renewing the air 5 times/h.
- 77 Automatic water pumps and flooding detectors.
- 850 Emergency luminaires.
- 380 Intercom connections.





05. CONTROL SYSTEM: FIRE AND GAS DETECTION

- **Fire** detection with smoke detectors releasing entrance doors and activating acoustic alarms and other actions.
- **Gas** detection disconnecting the electric systems, blocks entrance doors and activating acoustic alarms.
- **Temperature** control activating the ventilation system, depending on temperature level.
- **Flooding** control with water pumps.



- 18** Fire centrals
- 77** Fire sectors
- 85** Fire doors
- 1920** Smoke detectors
- 139** Gas detectors
- 234** Extintors de CO2.



06. FACILITIES

The facilities provide to the utility tunnel **optimal conditions** for installation, maintenance and repair of services.



- General and emergency lights.
- Sectorization with firewalls
- Signaling
- Power circuit.
- Water pumps.
- Extinguishers.
- Air Extractors.
- Grounding of metallic structures.





06. FACILITIES

PERSONAL ENTRANCES AND VENTILATION PIPES





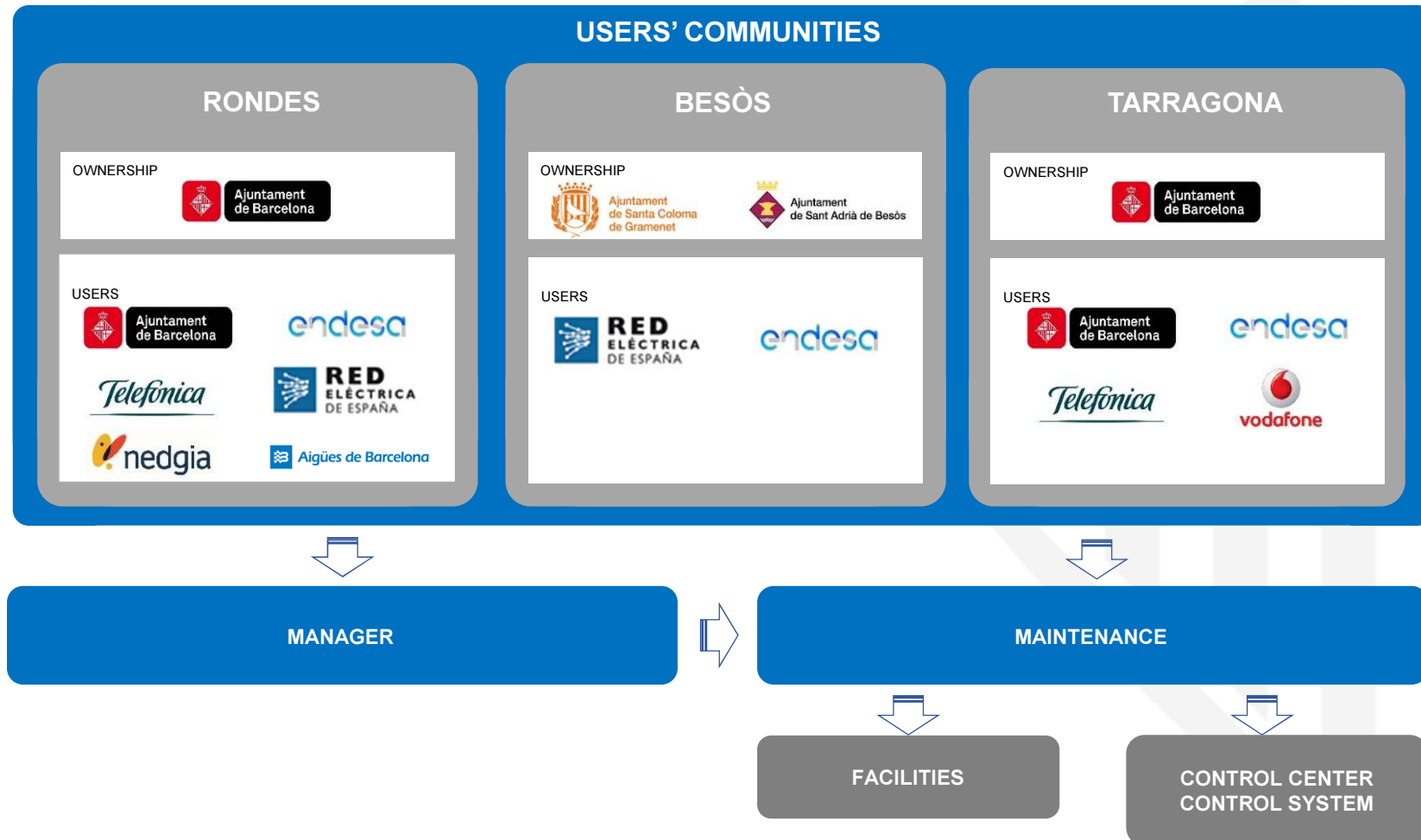
06. FACILITIES

PROTECTION CABINET AND JOINTS



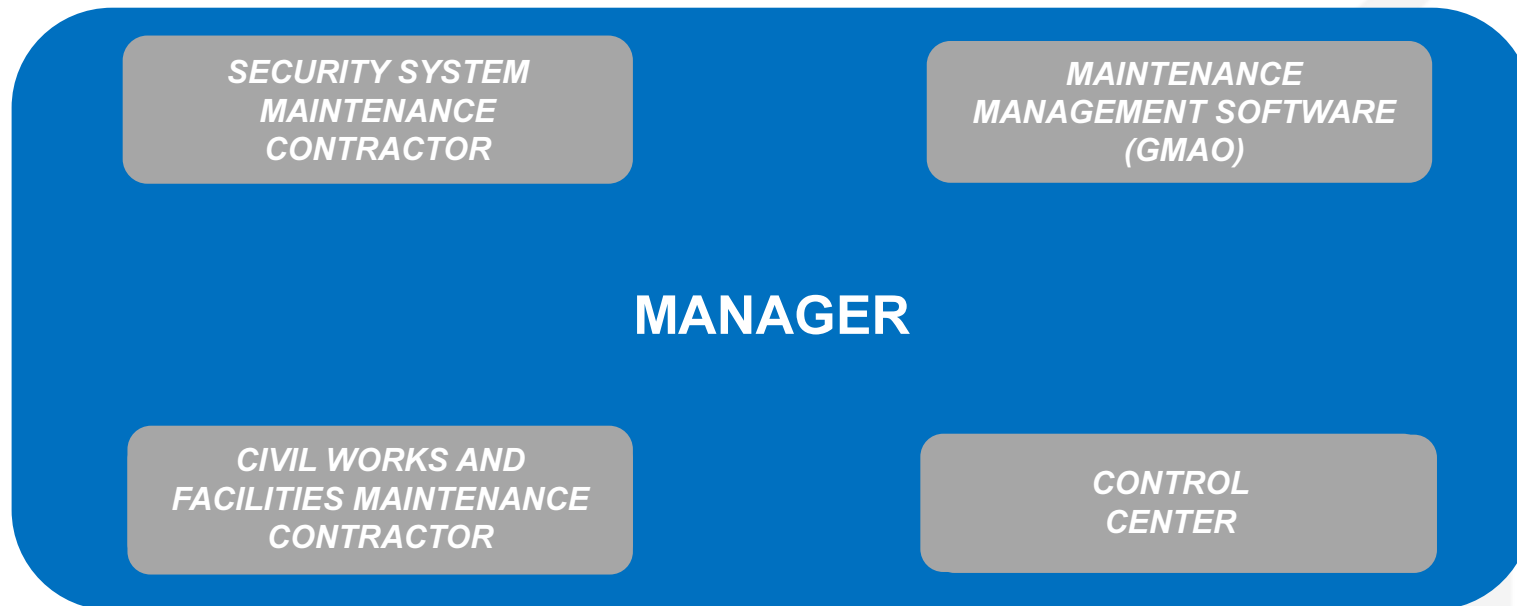


07. MANAGEMENT MODEL





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07. MANAGEMENT MODEL. REFERENCE DOCUMENTS

COLLABORATION AGREEMENT

Within City council and facilities companies
Signed previously to tunnels execution
Define management model

OWNERS COMMUNITY STATUTES

Legal document for management model

MAINTENANCE PLAN

Maintenance elements inventory
Preventive maintenance rounds
Corrective maintenance actions
Emergency actions

OPERATION AND USE RULES

Technical document for management model
Rights and obligations of users
Implantation conditions
Management conditions
Maintenance plans definition

INSURANCE POLICY

SECURITY PLAN

Detection and evaluation of risks
Actions to prevent and control risks
Actions in case of emergency

EUROPEAN REGULATIONS

Define maintenance plans



08. COSTS

BUILDING CONSTRUCCION

Oportunity of execution with essential infrastructures in the city

Transport Tunnels cost: 1.700€/m aprox.

Crossing tunnels cost: 4.650€/m aprox.

ANNUAL MAINTENANCE COST (aprox.)

ITEM	ANNUAL COST
MANAGEMENT COST	160.000€
SECURITY SYSTEM AND FACILITIES MAINTENANCE COST	360.000€
INSURANCE POLICY+SUPPLIES+SOFTWARE	130.000€
OTHERS	40.000€
INFRASTRUCTURE IMPROVEMENT	160.000€
TOTAL	850.000€



09. INCIDENTS

FIRE SITUATION: 23/11/2004





09. INCIDENTS

FIRE SITUATION: 20/06/2005





10. CONCLUSIONS

PROS

1. EASY MAINTENANCE ROUTINES: WIRES AND PIPES ARE ACCESSIBLES.
2. EASY NEW LAYING OF WIRES.
3. SAFETY AND PROTECTION OF WIRES FROM EXTERNAL AGENTS.
4. REDUCTION OF PUBLIC WORKS THAT AFECT STREETS.

CONS

1. COMPLICATED MANAGEMENT MODEL: PUBLIC AND PRIVATE OBJECTIVES ARE DIFFERENTS, AND EACH COMPANY HAS ITS OWN CONDITIONS AND NEEDS.
2. IN CASE OF INCIDENT, ALL THE SERVICES ARE AFECTED.
3. HIGH BUILDING AND MAINTENANCE COSTS.

THOUGHTS

1. UTILITY TUNNELS HAVE SOME PROBLEMS, BUT SOLVE NEEDS OF FACILITIES COMPANIES AND CITY COUNCIL.
2. COST IS AN IMPORTANT POINT TO CONSIDER.
3. GOOD OPTION IN CASE OF NEW DEVELOPMENTS.
4. TRENCH IS BEST OPTION IF ONLY WIRES NEEDED.
5. NEED OF DEVELOPMENT OF MICROTUNNELING TECHNOLOGY (0,2-0,3m diametre)

Thank you for your attention

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