

The 8 principles on how to make an smart city

Vicente Guallart, Architect

Institute for Advanced Architecture of Catalonia

Guallart Architects

Barcelona

“ We live in a world of cities ”





Barcelona



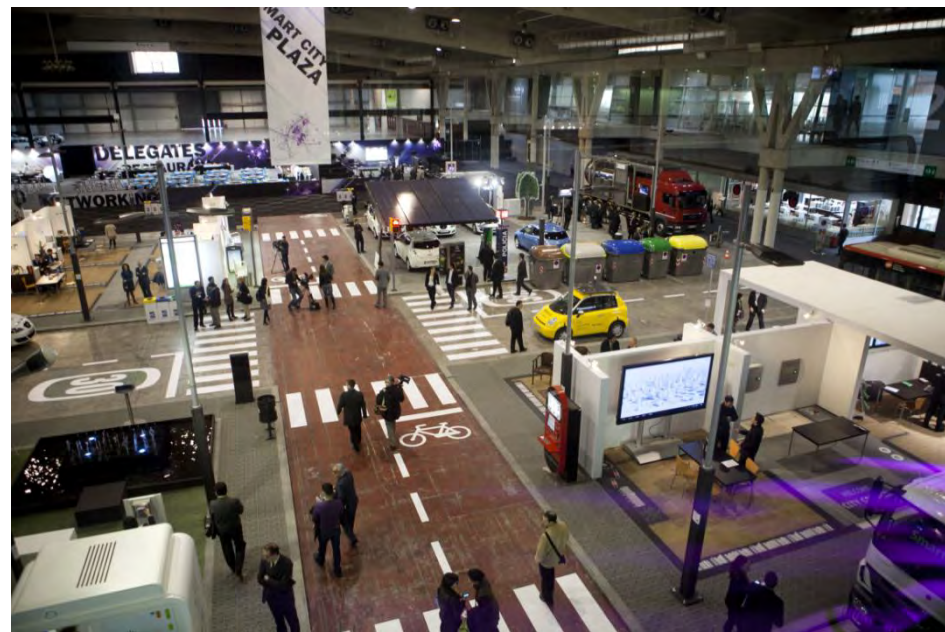






SCHERANO

MONTOLI



Barcelona 1st Smart City in the World

Juniper Report

→ THE MOST

WIRED

CITY

IN THE
WORLD

BARCELONA is a showcase for the “smart” metropolis of the future—in which tech giants like **Cisco**, **Microsoft**, and **IBM** see big profits in helping governments save by tracking data on everything from garbage to traffic to selfies. But not everyone is happy about this new urban reality.

Tourists (seen photographing the Antoni Gaudi Museum in Barcelona) can use Wi-Fi from a lamppost to send selfies. The technology monitors traffic (human and auto), noise, temperature, and much more.

BY VIVIENNE WALT



PHOTOGRAPHS BY
JOAN TOMAS

The 8 principles to make an smart city

1. Define your own city model with “your city mantra”
2. Analyze the structure of your city and define your priorities
3. Rethink your city systems, not just upgrade them.
4. Develop the economy of city services with partners
5. Make your city more resilient and promote long term investment
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8. Make good designs and make projects that break silos

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REGENERAR BARCELONA

El projecte de Xavier Trias per la ciutat





REAFORÇAMENT
del patrimoni natural
de l'Àrea de l'Alt Llobregat

REAFORÇAMENT
del patrimoni natural
de l'Àrea de l'Alt Llobregat
Calçada
del Centre
Municipal
de l'Àrea
de l'Alt
Llobregat
Febrer
2014

REGENERACIÓ

VERVEDA
BARRI MIXTE
PRODUCTIU

ILLES
AUTOSUFICIENTS

NOVA SAGREDA
CONEXIÓ DE BARRIS
CONEXIÓ AMB EL MAR



REGENERACIÓ

VERVEDA
BARRI MIXTE
PRODUCTIU



"ILLES
AUTOSUFICIENTS



NOVA CASERES
COMUNITAT DE BARRIS
COMUNITAT AMB EL NOU



FERRA

NOU
COMUNITAT

RENATURALITZACIÓ

REGENERACIÓ
ENERGÈTICA
DELS PARCS

"TRES TURONS"
PER VIURE-HI

COLSEPOLA
PARC CENTRAL
METROPOLITÀ

PASSEIG DE
LES AIGÜES
PEIXES
MORTS

BOBETA
NATURAL
RONDES



REACTIVACIÓ

ENERGIA
AMB BIOMASSA

MIT "FAB LAB"

CONEXIÓ AMB
BARCELONA



HABITATGE
JÓVE I EQUIPAMENT

TRADE
DESENVOLUPAMENT
ECONÒMIC
DINS BARRIS ORGÀNICS

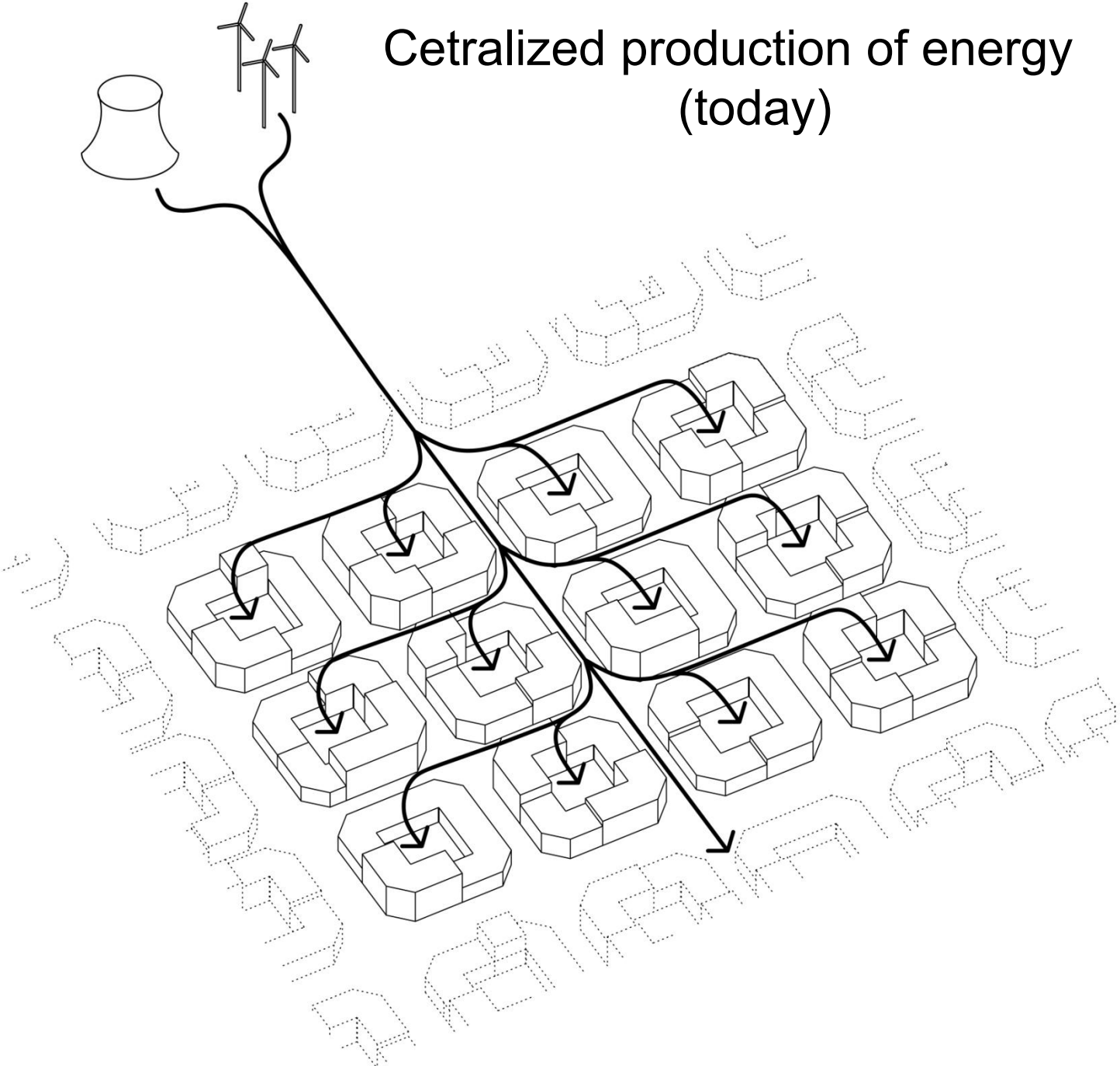
MATURA
ESPORTS
I TECNOLOGIA

“Barcelona will be a
Self-sufficient city
made of
Productive neighborhoods at
human speed,
inside a hiperconnected
metropolis”

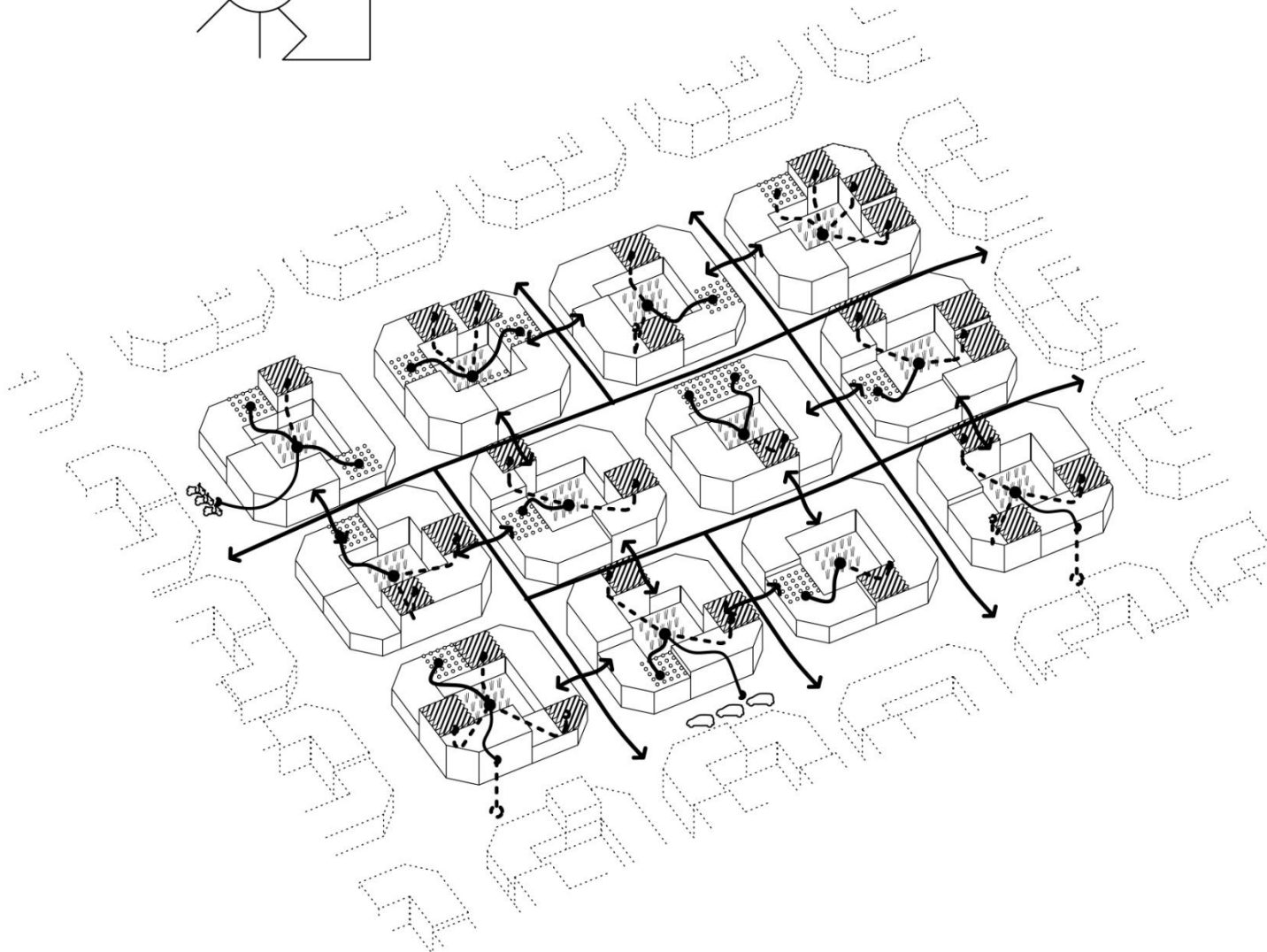
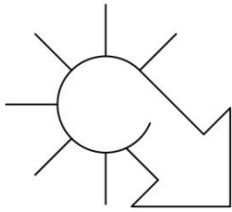


Xavier Trias
Inaugural adress as mayor of Barcelona
07.01.2011

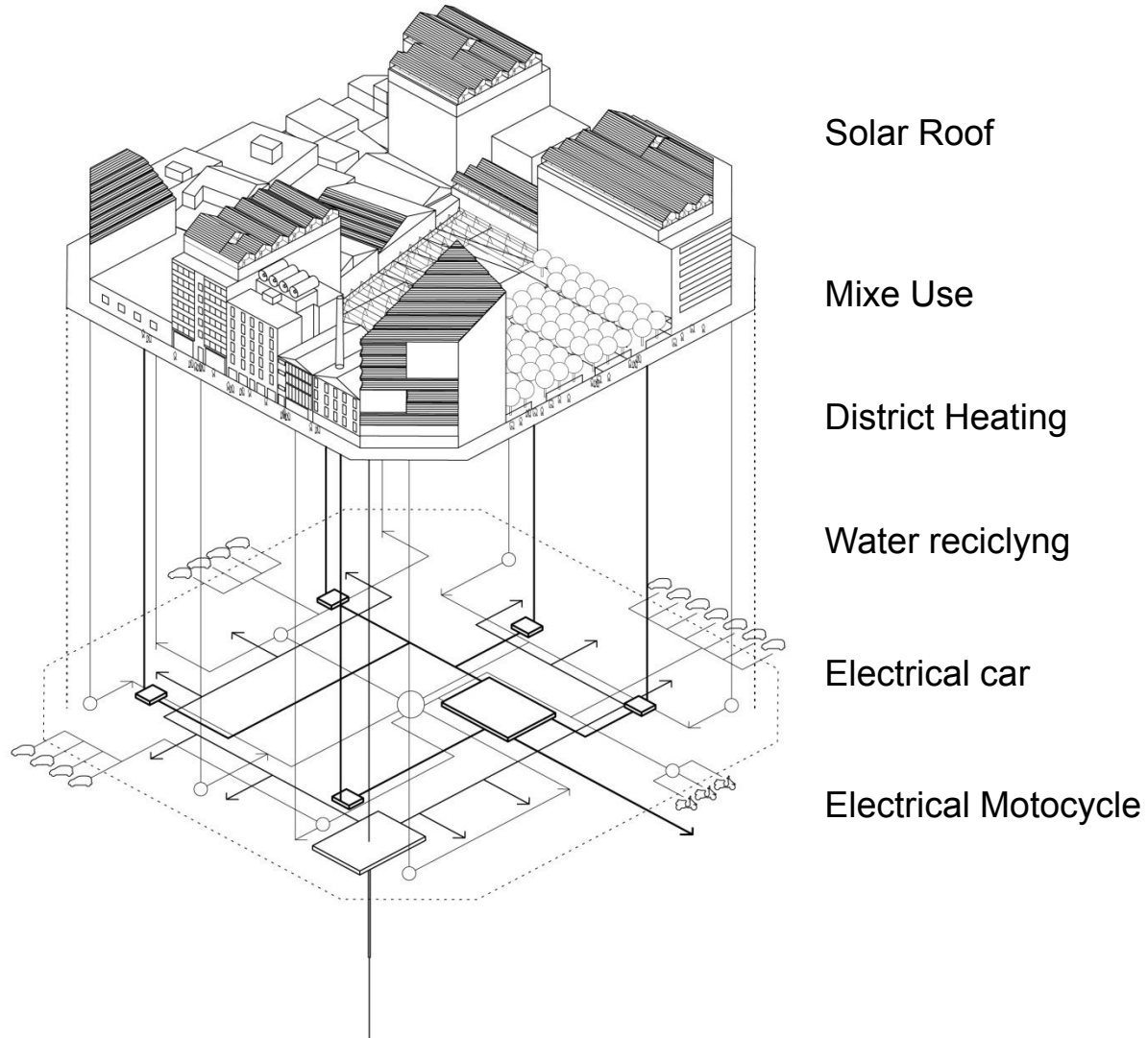
Centralized production of energy (today)



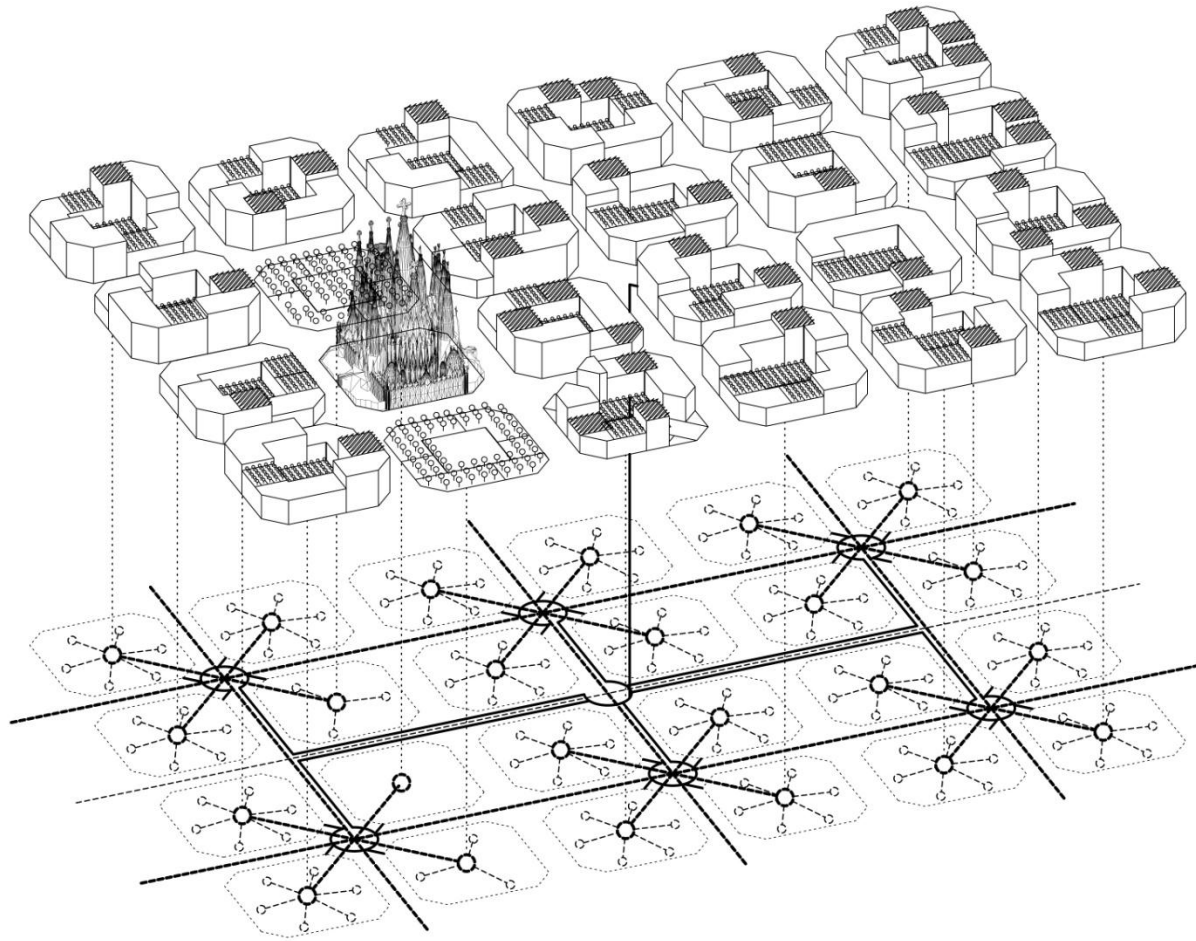
Distributed production of energy (tomorrow)



Self sufficient blocks



Urban retrofitting with networks of self sufficient blocks



BARCELONA

GLOBALMENT CONNECTADA, LOCALMENT AUTOSUFICIENT
GLOBALLY CONNECTED, LOCALLY SELF-SUFFICIENT

39 365 05 59 29

MINUTES / HORAS MINUTE / MINUTES SECONDS / SECONDS

TICAC FABLAB BARCELONA FAB FOUNDATION



Premios Estudiantes
Luis
Student

BARCELONA

GLOBALMENT CONNECTADA, LOCALMENT AUTOSUFICIENT
GLOBALLY CONNECTED, LOCALLY SELF-SUFFICIENT

39 365 05 59 54

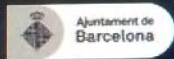
ANYS/YEARS

DIES/DAYS

HORES/HOURS

MINUTS/MINUTES

SEGONS/SECONDS

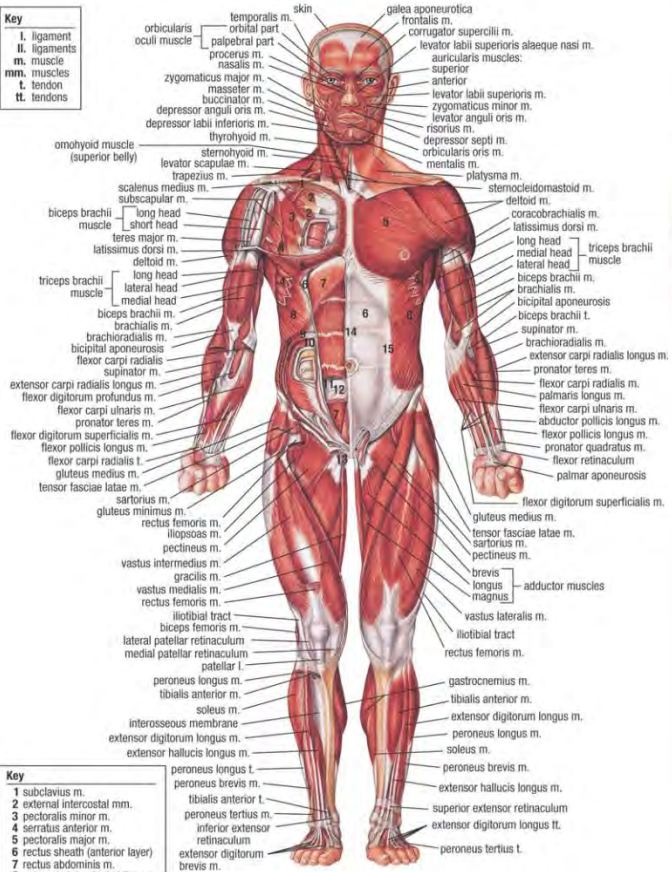


MacBook Pro

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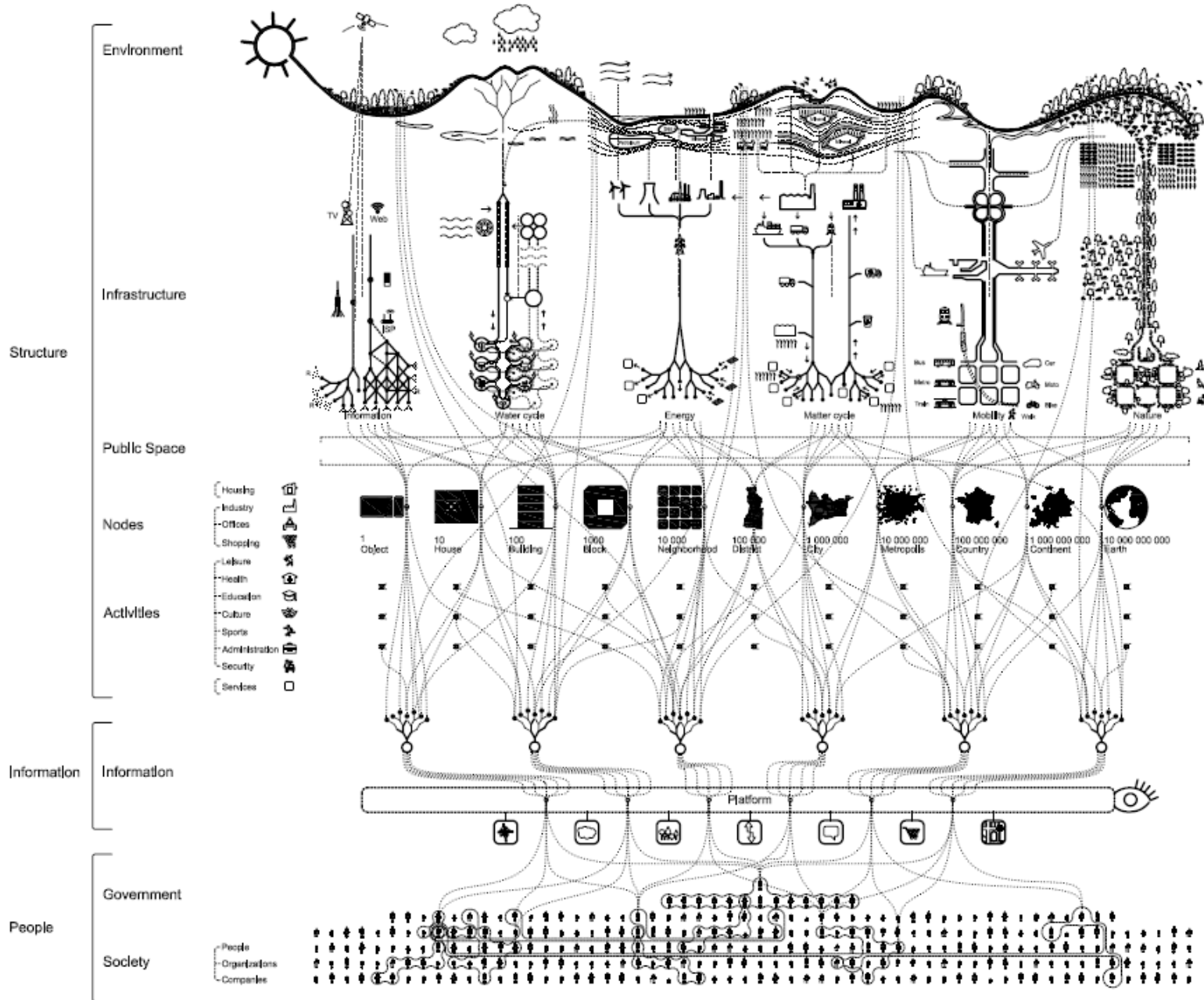
Key
 l. ligament
 ll. ligaments
 m. muscle
 mm. muscles
 t. tendon
 tt. tendons

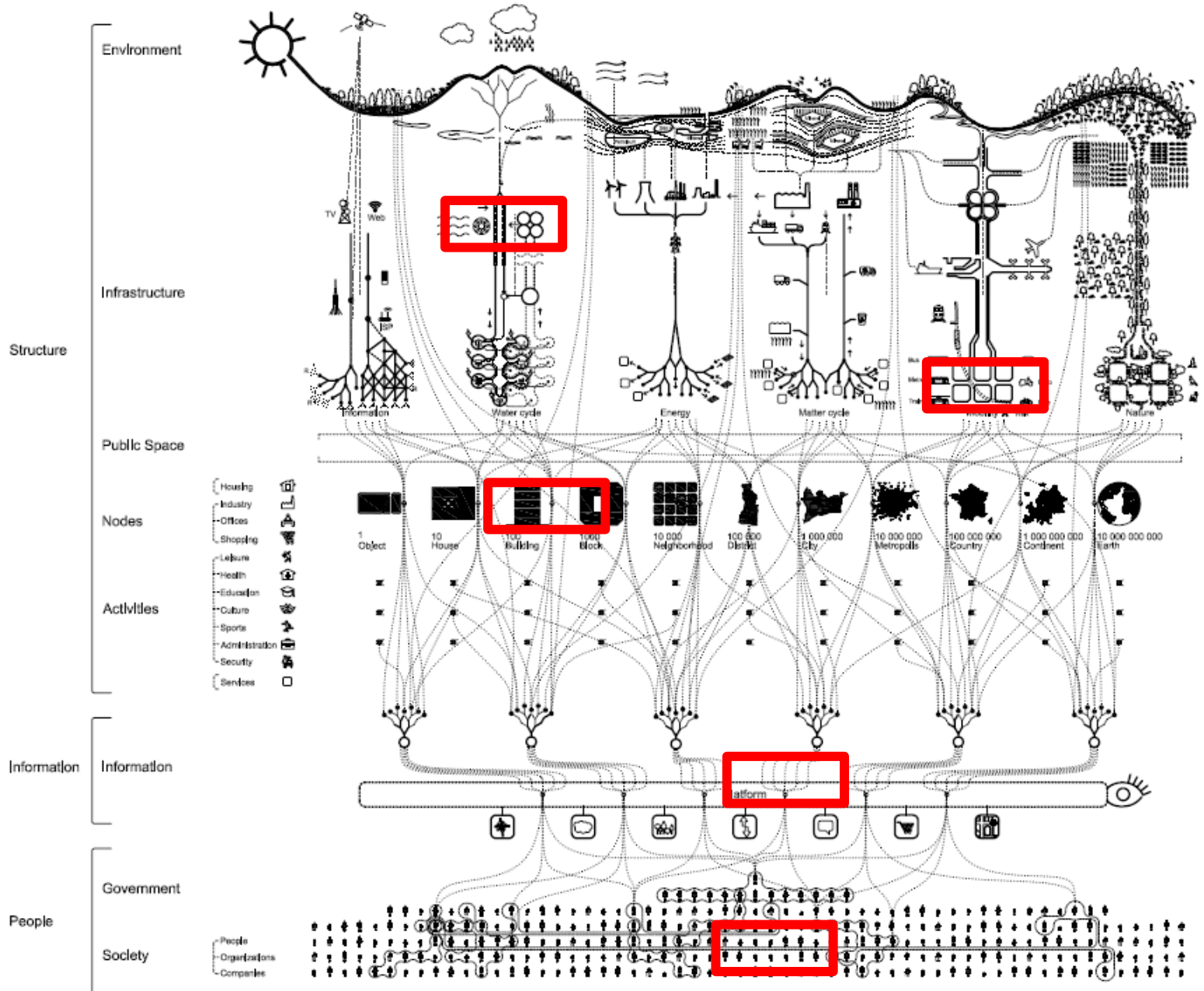


Key
 1 subclavius m.
 2 external intercostal mm.
 3 pectoralis minor m.
 4 serratus anterior m.
 5 pectoralis major m.
 6 rectus sheath (anterior layer)
 7 rectus abdominis m.
 8 external abdominal oblique m.
 9 internal abdominal oblique m.
 10 transversus abdominis m.
 11 rectus sheath (posterior layer)
 12 arcuate line
 13 cremaster m.
 14 linea alba
 15 aponeurosis of external abdominal oblique m.

SKELETAL ANATOMY (ANTERIOR VIEW)







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9 PL. CATALUNYA
PG. Z. FRANCA

3719

B-4483-UM SP



TMB

2



Plànol nova xarxa de bus

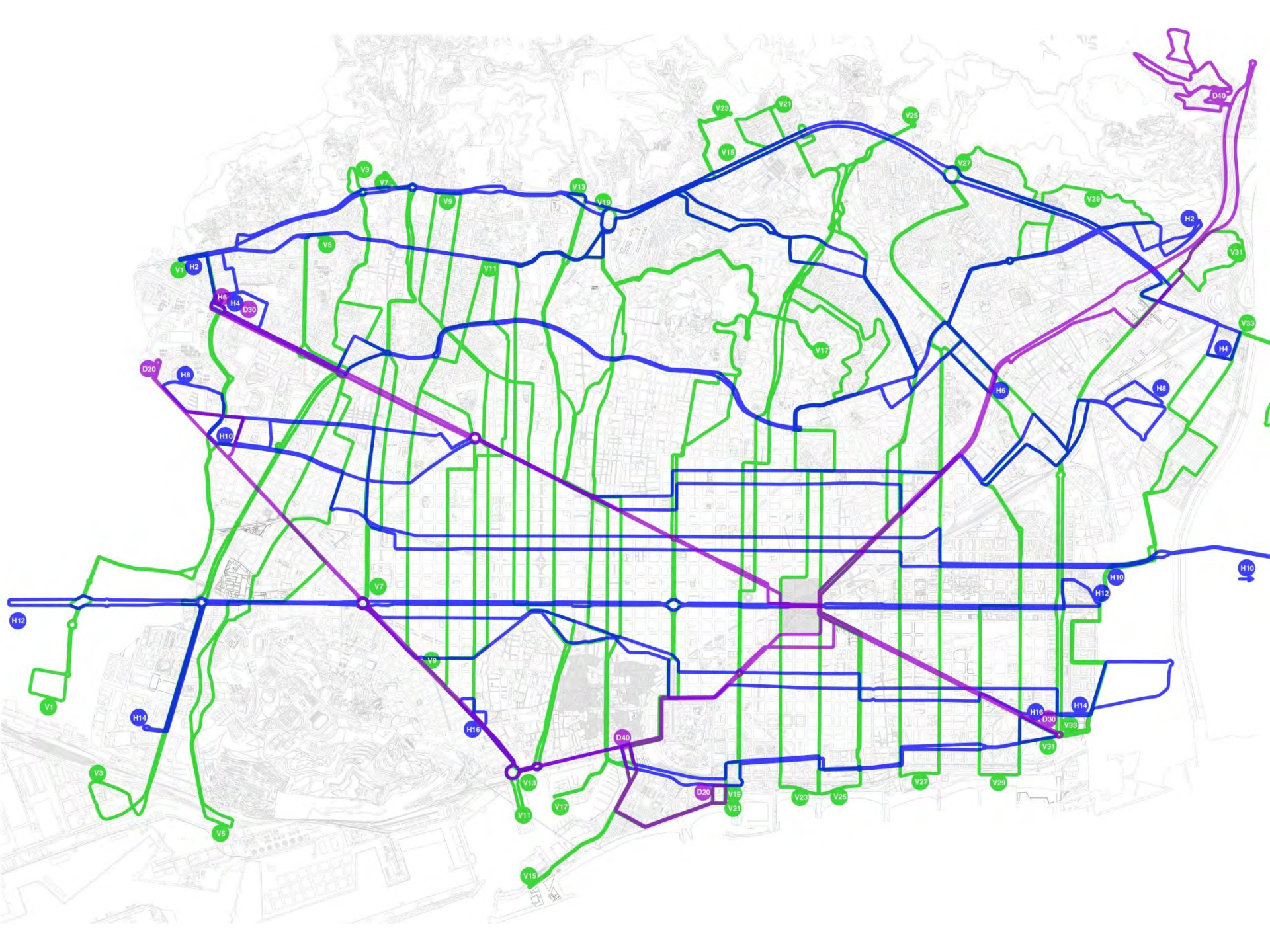


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Totes les dades reservades.



- V3** Zona Franca Can Caralleu
- V7** Pl. Espanya / Sarrià
- V17** Port Vell / Carmel
- V21** Pg. Marítim / Montbau
- H10** Badal Olímpic de Badalona
- H12** Gornal / Besòs/Verneda
- H16** Paral·lel / Fòrum
- D20** Pg. Marítim / Ernest Lluch

- Gran Via** ► Direcció de la línia
- CATEDRAL** Llocs d'interès
- Paral·lel** **H16** Terminal de línia
- Alfons X** Interoanviador
- Funicular de Montjuïc
- Funicular
- Telefèric de Montjuïc





1108



TMB Sostenible Bus Elèctric

100% elèctric
0 emissions

i2e

Irizar i2e
L'autobús del futur
Tecnologia Irizar





Santander

adidas

EV charging station

Yellow and black van

P

Santander

Bershka

P

Bershka

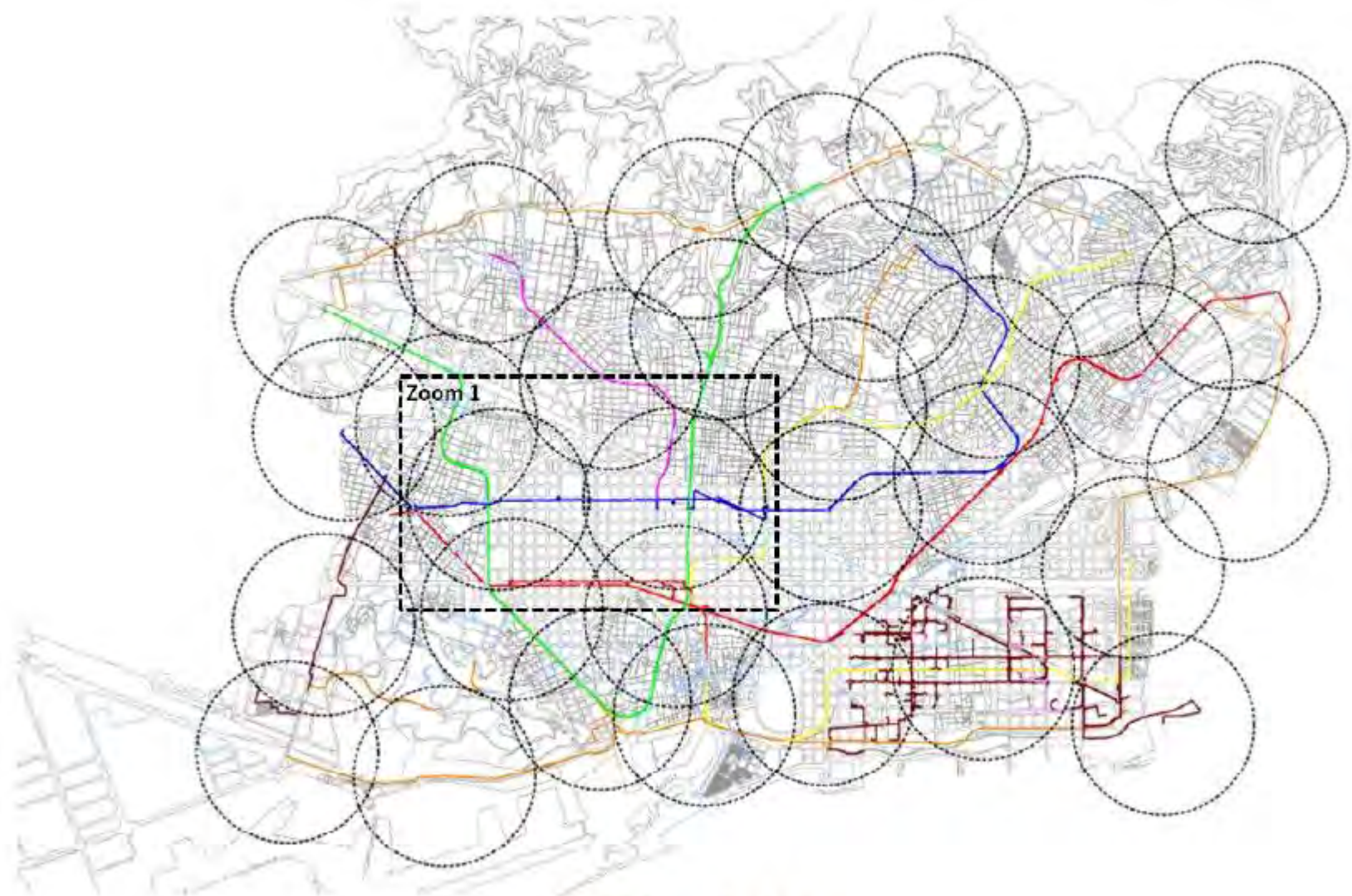




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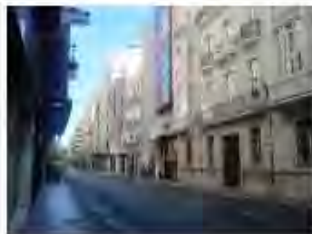
Full coverage of Wi-fi acces in the public space



Font: Elaboració pròpia



1. Avinguda 50m



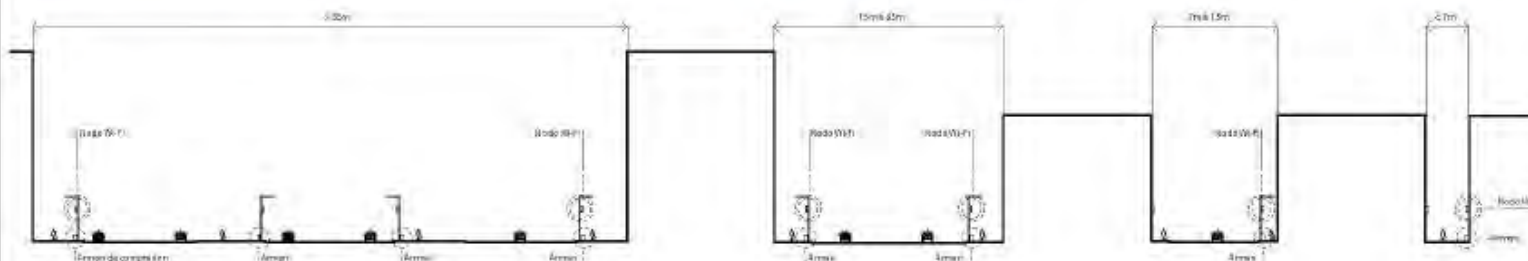
2. Carrer xarxa bàsica



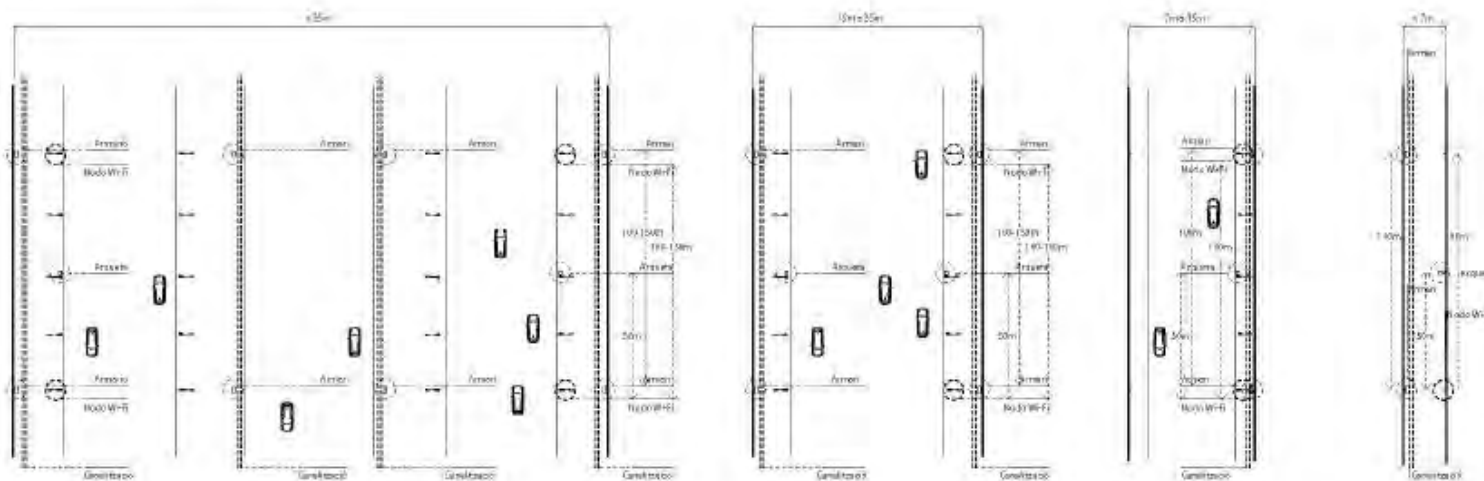
3. Carrer xarxa secundària



4. Carrer xarxa local 7m



Secció



Planta

Quilòmetre 0.0. Zoneta de carrer.
Terrenys i nodes Wi-Fi per a xarxa
0-100. Mòdul cada 150m de carrer.

Quilòmetre 0.1. Zoneta de carrer.
Terrenys i nodes Wi-Fi per a xarxa
0-10. Mòdul cada 15m de carrer.

Quilòmetre 0.2. Zoneta de carrer.
Terrenys i nodes Wi-Fi per a xarxa
0-10. Mòdul cada 15m de carrer.

Quilòmetre 0.3. Zoneta de carrer.
Terrenys i nodes Wi-Fi per a xarxa
0-10. Mòdul cada 15m de carrer.

Es defineixen 4 tipus de carrers a la ciutat de Barcelona.

Avingudes de 50 metres d'ample (A), carrer bàsic de xarxa de 20 metres d'ample (B), carrer secundari de xarxa de 14 metres d'ample (C), carrer de xarxa local 7 metres d'ample (D).

Segons l'ample dels carrers, es defineix si la canalització i els armaris s'implementen en un o en els dos costats del carrer, així com la distància mínima entre armaris i la distància mínima entre nodes Wi-Fi.



Ajuntament de Barcelona

Barcelona d'Infraestructures Municipals

DIRECCIÓ D'INFRAESTRUCTURES
DIRECCIÓ DE PROJECTES D'HABITAT URBÀ

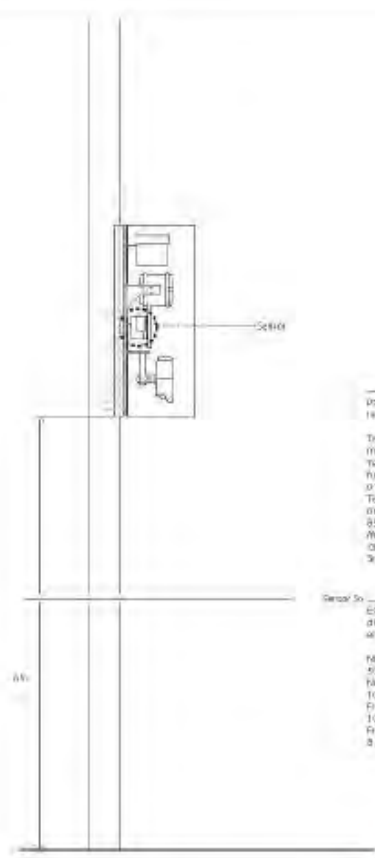
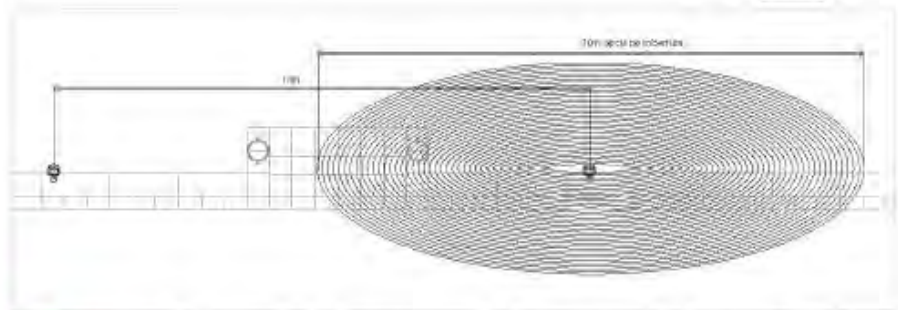
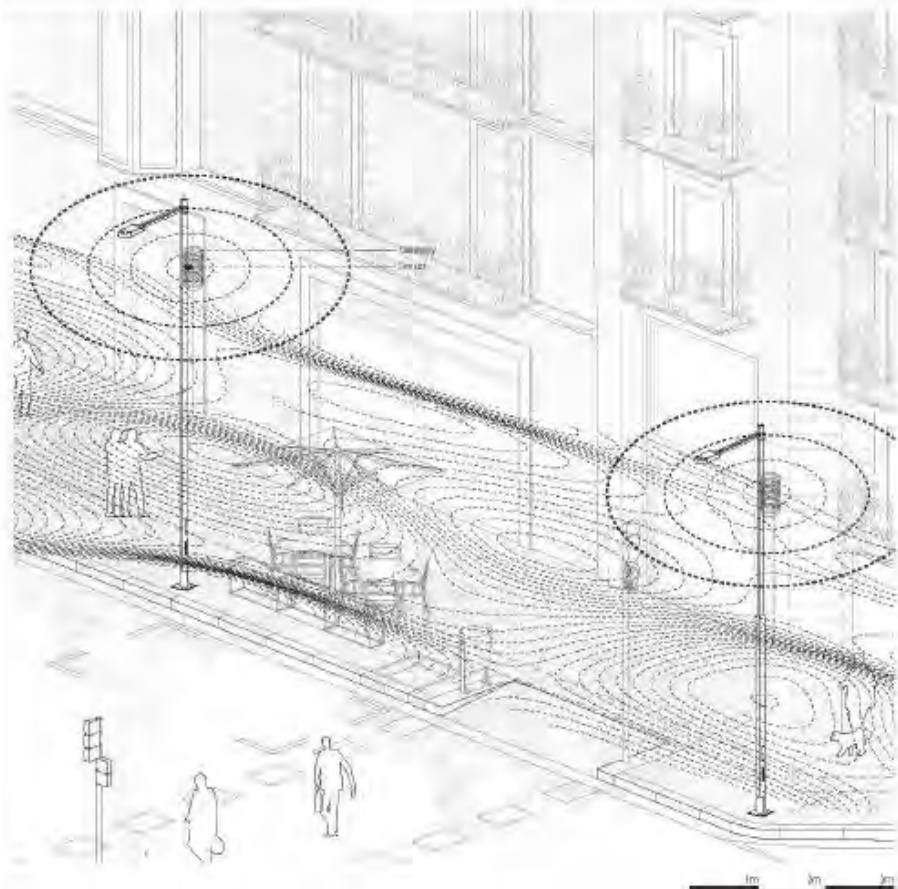
PROJECCIÓ D'INFRAESTRUCTURES
Areti Markopoulou

TÍTOL DEL PROJECTE
Manual d'integració de tecnologies intel·ligents en l'espai públic

MEMÒRIA
Diverses

DESTINACIÓ DEL PROJECTE
Pla d'aplicació als diversos tipus de carrers

PLA D'obra
02



Portador o guiso de 1 hora

- Tensió d'alimentació: 5VDC
- Temperatura mínima de funcionament: 0°C
- Temperatura màxima: 55°C
- Alçada mínima de la columna: 3m



sensor de so

Sensor de

El convertidor a guiso d'aportació amb un sensor acústic

- Mida de l'entorn: 50cm
- Alçada de l'entorn: 100cm
- Freqüència mínima: 100Hz
- Freqüència màxima: 8K



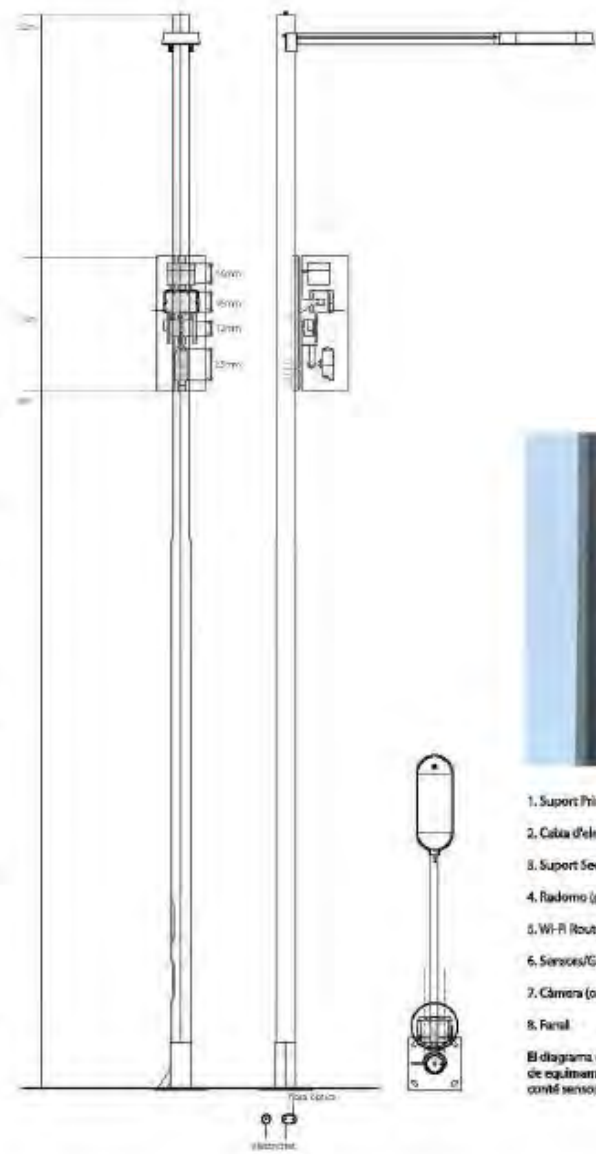
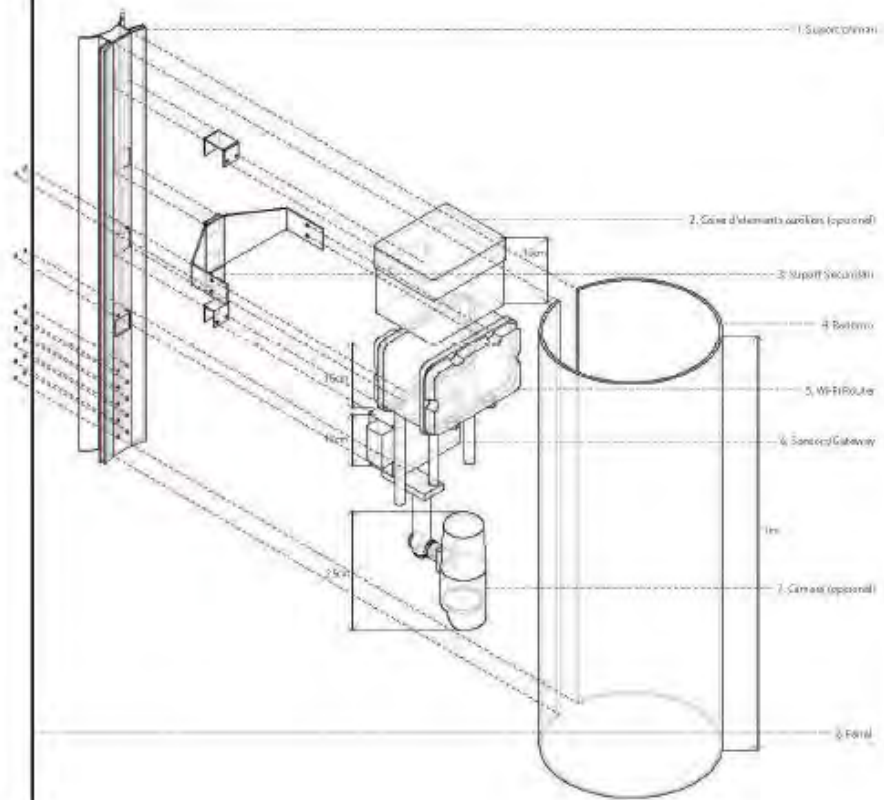
sensor de so



El llibre estàndard de la ciutat compta amb un sensor de pressió i un de so. El llibre té la possibilitat d'afegir més sensors, com ara sensors de vibració.

Possibles Aplicacions:
- Detector patrons de so i de contaminació.

Generació de mapes històrics d'evolució de so i de contaminació a la ciutat.



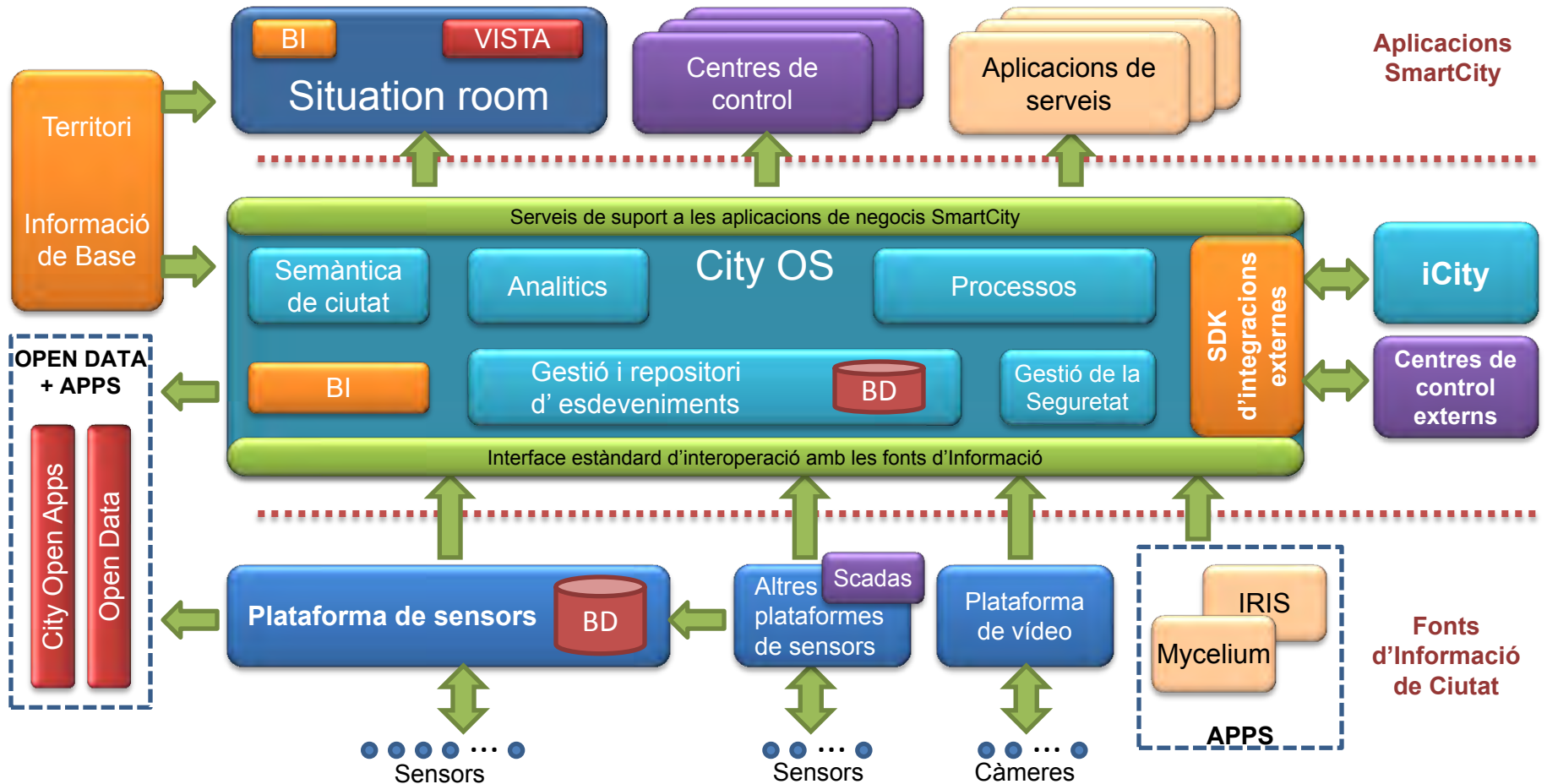
1. Suport Primari
2. Capa d'elements auxiliars (opcional)
3. Suport Secundari
4. Radomo (plàstic policarbonat)
5. Wi-Fi Router
6. Senzors/Gateway
7. Càmera (opcional)
8. Fensal

El diagrama ensenya la situació màxima de equipament. La mínima situació conté sensor o / i gateway i node Wi-Fi





Arquitectura Smart City: Esquema de bloques





Barcelona City Council Barcelona Contactless Tour

Tot el circuit a un click
Todo el circuito a un click
All the tour just one tap away



Barcelona Contactless
#Barcelonainspira



Accede al teu mòbil
 Accede to mobile
 Tap your smartphone



Escanea
 Escanea
 Scan

1 simple tap away on the NFC tag, visitors can access **instantly** the right information at the right Time !



MOBILE WORLD CENTRE



MUSEU D'ART CONTEMPORANI DE BARCELONA

FUNDACIÓ ANTONIÀPIES

Powered by



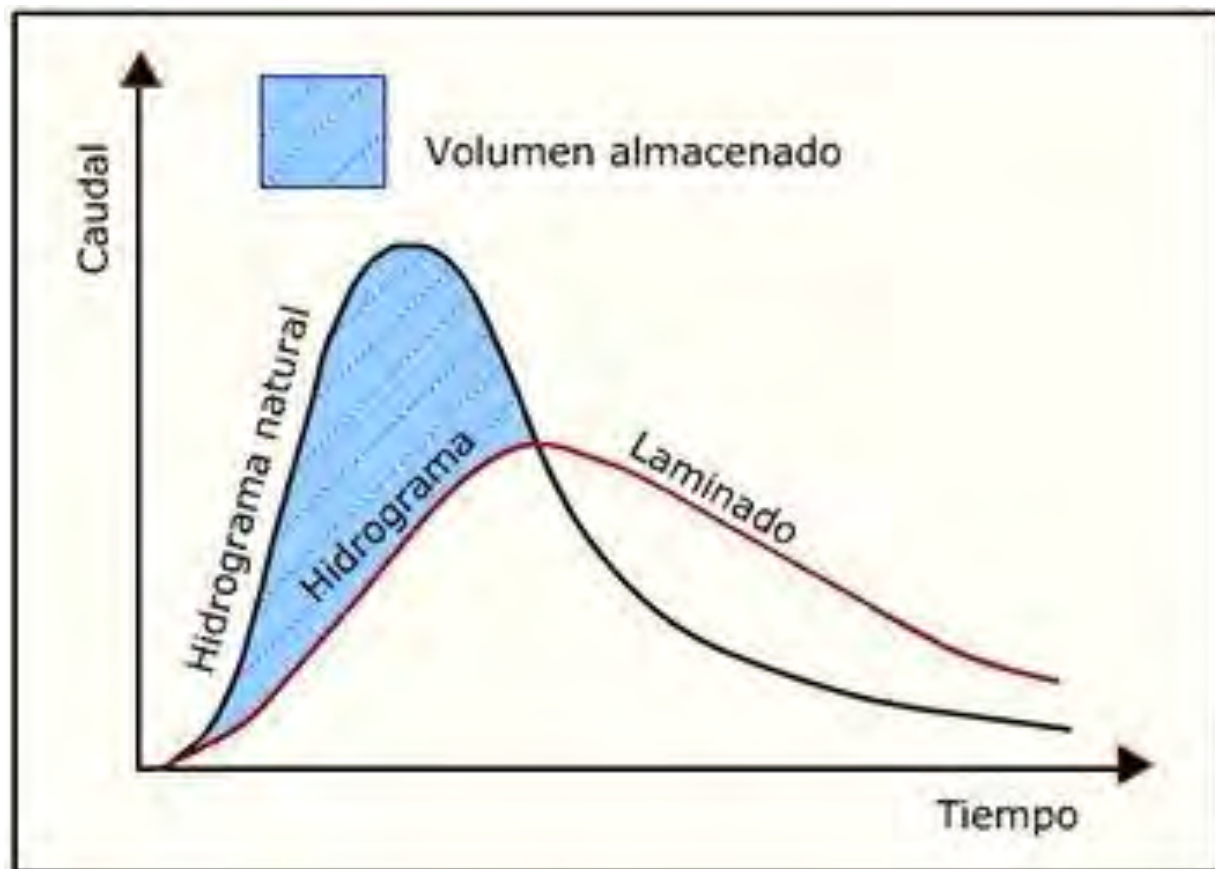
ConnectThings

The 8 principles to make an smart city

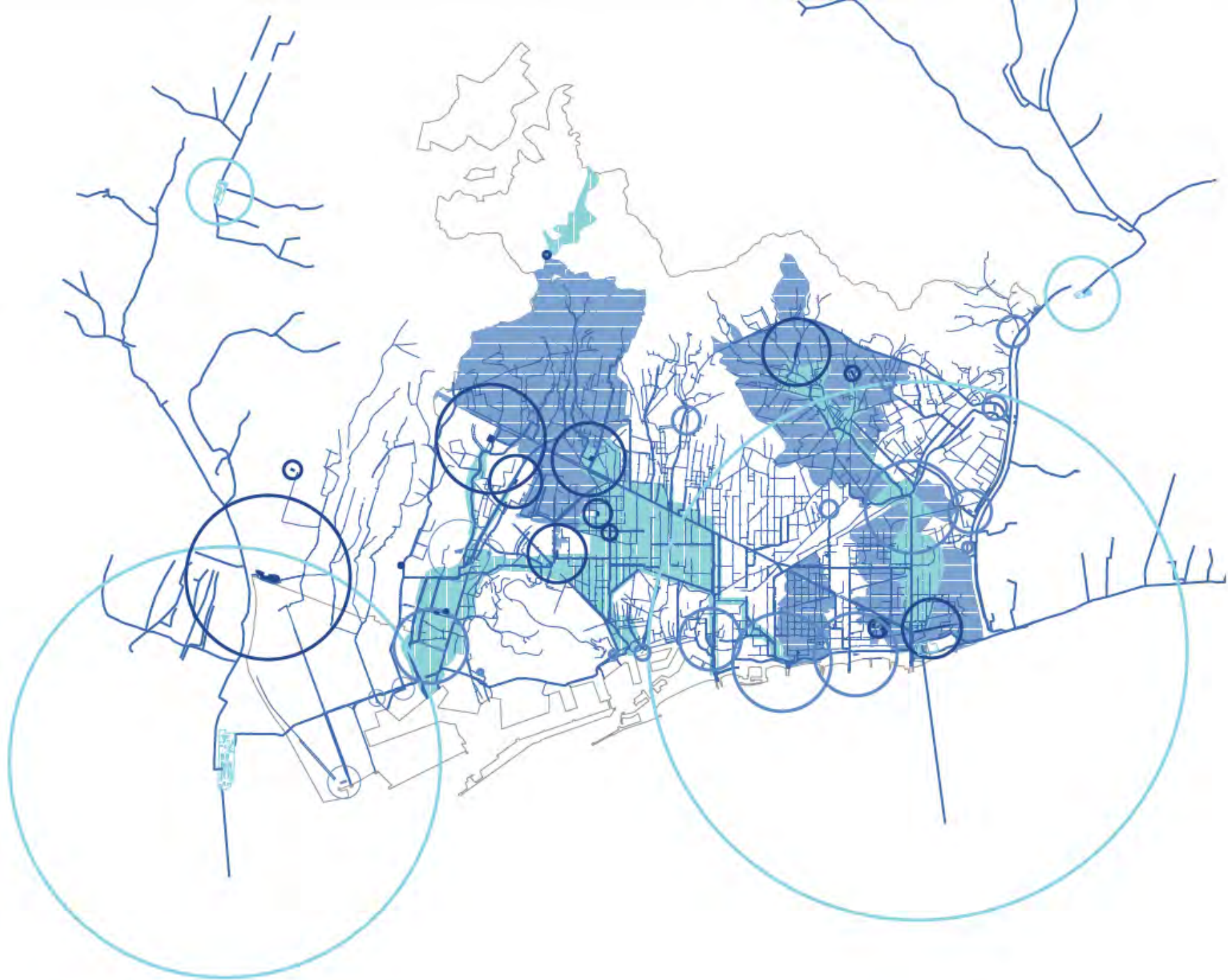
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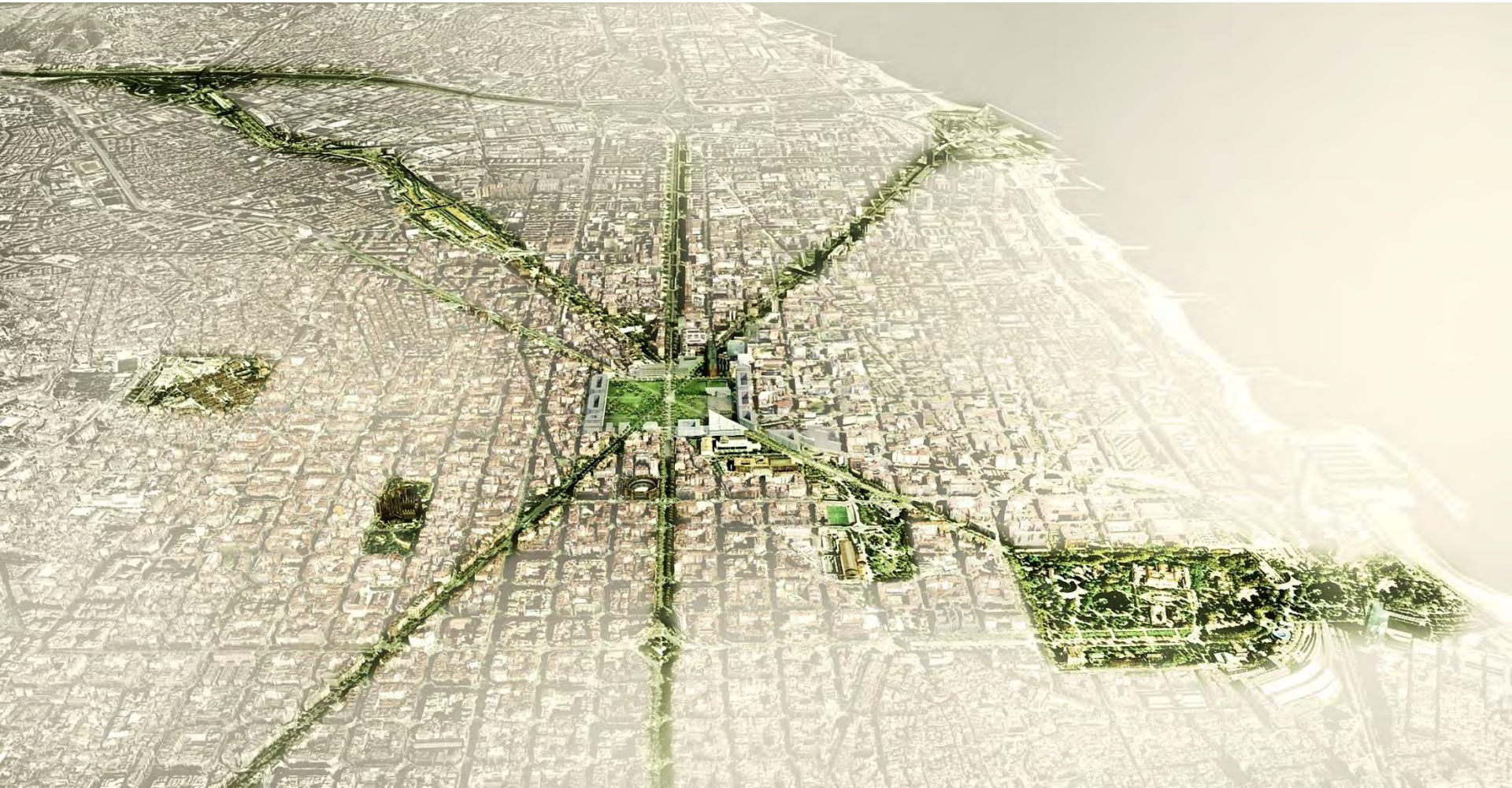
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PLANO
 DE LOS
 BARRIOS DE LA CIUDAD
BARCELONA
 PROYECTO
 DE
 REFORMA Y ENSANCHE



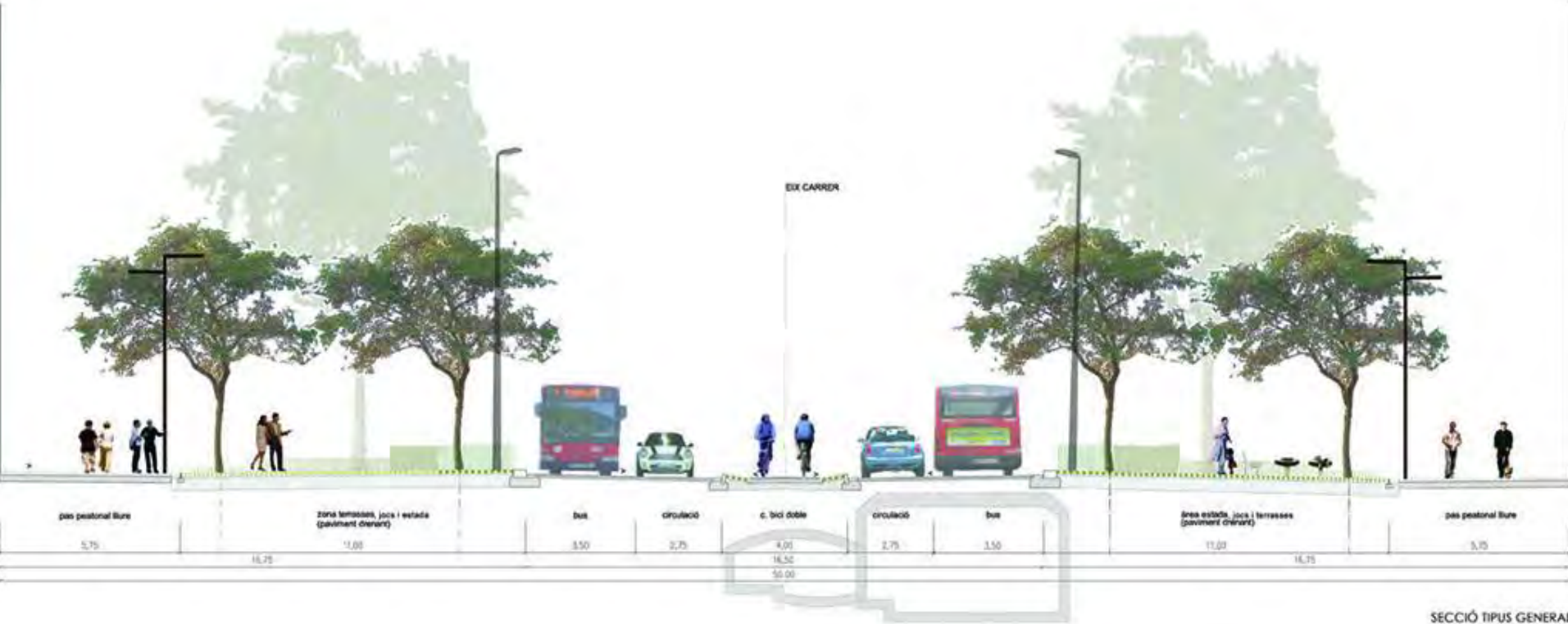












SECCIÓ TIPUS GENERAL











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ATENEU DE
FABRICACIÓ
CIUTAT
MERIDIANA

FUNDACIÓ cim
BARCELONATECH

2000VT

www.kedinamic.com



Fab Lab Kids














 **LES CORTS**
Inclusió


 **SARRA-SANT SERVOI**
Mèdic - Científic


 **Green Fab Lab**
Autosuficiència


 **GRÀCIA**
Moda


 **HORTA-GUINARDÓ**

 **CIUTAT MERIDIANA**
Ocupació


 **CIUTAT VELLA**
Disseny

 **EIXAMPLE**
Cotxeball

 **SANT ANDREU**
Arts Escèniques

 **Forum Nord**
Empreses

 **SANT MARTI**
Fab Lab Barcelona

 **CIUTAT VELLA**
Energies



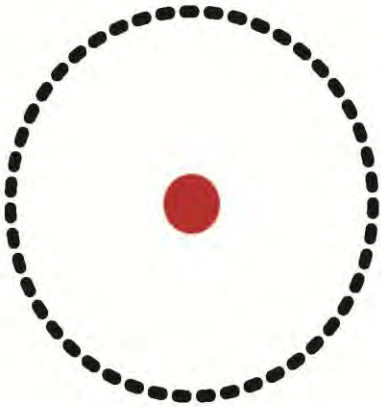
Tele-assistance



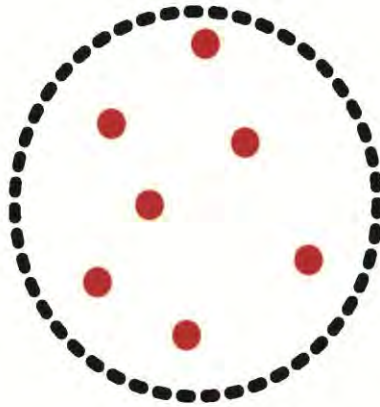
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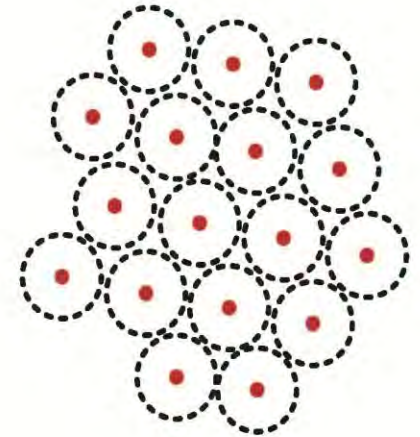
Models of Cities Organization



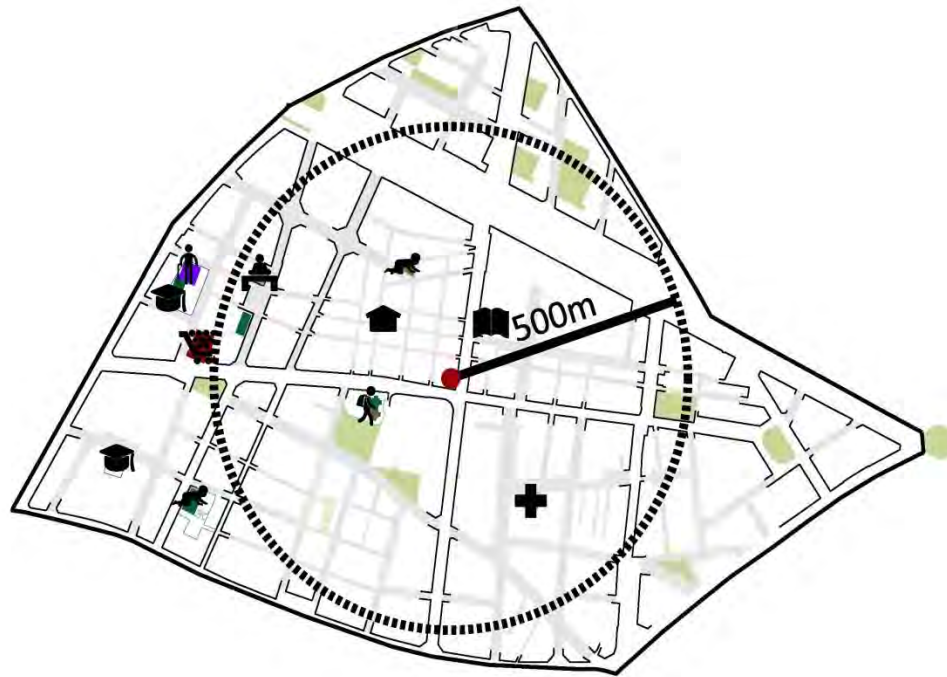
Centralized



Decentralized



Distributed



CATEGORIES

MERCATS MUNICIPALS

ÀREES D'INFLUÈNCIA



ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA
 ÀREA D'INFLUÈNCIA TERCIÀRIA
ESTÀNDARDS MERCATS MUNICIPALS
 Població: 25.000
 Radi d'influència: 500 m
 Superfície tipus: 6000 m2
 (20-30 parades)
 1500 m2 - mercat
 1500 m2 - supermercat
 1500 m2 - logística
 1500 m2 - patis

CENTRE D'ATENCIÓ PRIMÀRIA

ÀREES D'INFLUÈNCIA



ESTÀNDARDS CAPS MUNICIPALS
 Població: 25.000
 Radi d'influència: 350-700 m
 Superfície mínima: 1.440 m2

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

ESCOLES BRESSOL MUNICIPALS

ÀREES D'INFLUÈNCIA



ESTÀNDARDS ESCOLES BRESSOL
 Radi d'influència: 250-500 m

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

CENTRES D'EDUCACIÓ INFANTIL I PRIMÀRIA PÚBLICS

ÀREES D'INFLUÈNCIA



ESTÀNDARDS CEIPS
 Població: 25.000
 Radi d'influència: 700 m

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

CENTRE D'ESPORTS MUNICIPAL



ESTÀNDARDS CENTRES ESPORTIUS MUNICIPALS
 Radi d'influència: 350 - 700 m
 (hauria de ser 300-600) 7,5-15min a peu

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

OFICINES D'ATENCIÓ CIUTADANA

ÀREES D'INFLUÈNCIA



ESTÀNDARDS ADMINISTRACIÓ
 Radi d'influència: 350 - 700 m

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

CASALS DE GENT GRAN

CASALS DE BARRI

ÀREES D'INFLUÈNCIA



ESTÀNDARDS CENTRES CÍVICS*
 Radi d'influència: 350 - 700 m
 (5-10 min a peu)
 Població: 15.000 hab
ESTÀNDARDS CASALS DE BARRI**
 Radi d'influència: 350 - 700 m
 (5-10 min a peu)
 Criteri general: no tenir a prop
 (uns 500m) un centre cívic

ÀREA D'INFLUÈNCIA PRIMÀRIA
 ÀREA D'INFLUÈNCIA SECUNDÀRIA

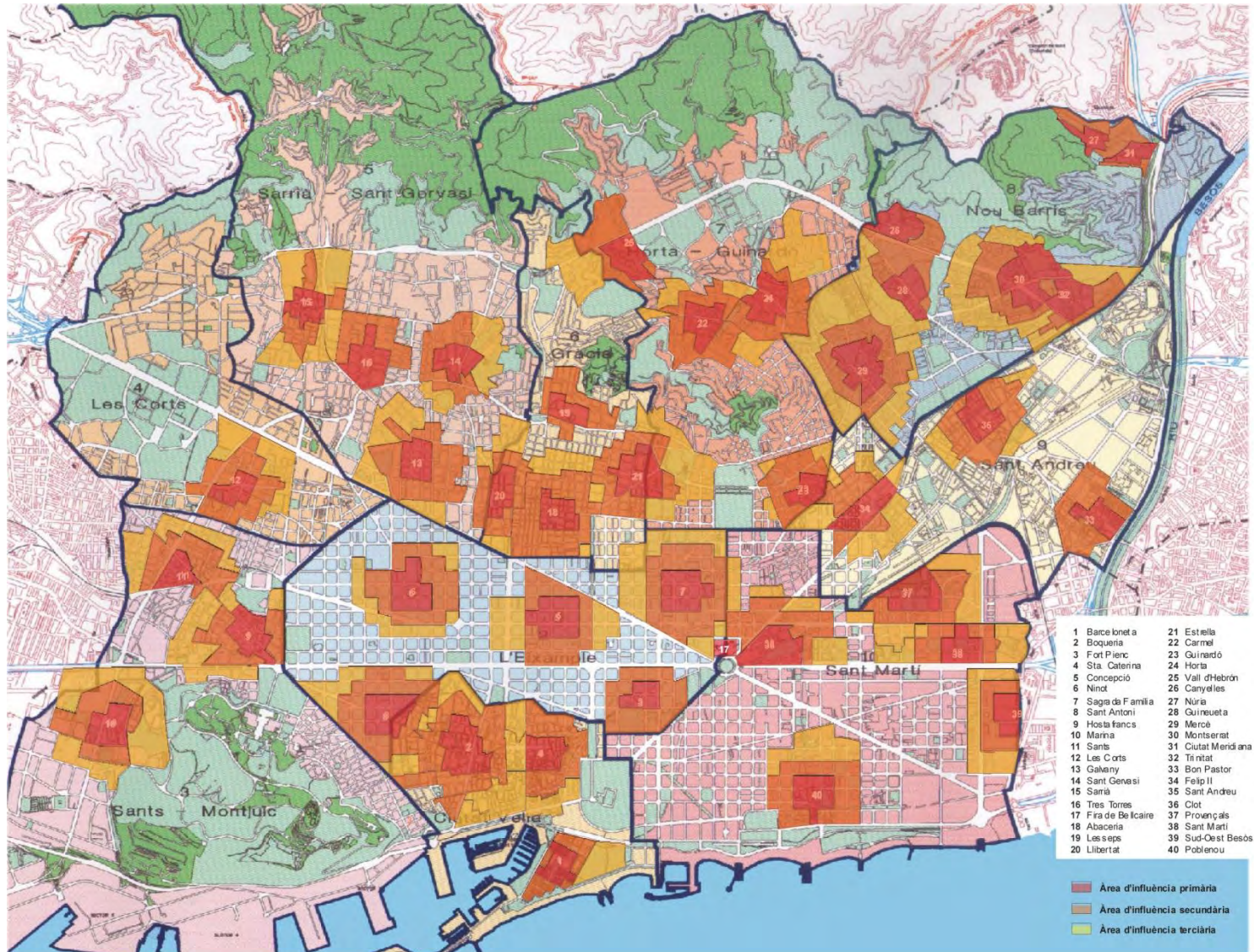
BIBLIOTEQUES MUNICIPALS DE BARRI
ESTÀNDARDS BIBLIOTEQUES MUNICIPALS DE BARRI
 Radi d'influència: 20 min a peu (aprox. 1.300m)
 Població: 10.000-25.000 hab
 Superfície del tipus: 500-650 m2
 Volum: 20.000
 Hores/setmana: 30-40 h

ÀREES D'INFLUÈNCIA



ÀREA D'INFLUÈNCIA PRIMÀRIA (5 minuts a peu)
 ÀREA D'INFLUÈNCIA SECUNDÀRIA (10 minuts a peu)
 ÀREA D'INFLUÈNCIA TERCIÀRIA (20 minuts a peu)

Domini Construït. Mercats. Funcions Urbanes. Àmbit d'influència







MERCAT

SANT JOSEP

LA BOQUERIA

CAFÈ SVITORIA CO

JABUCO GUINQUELO TRETADURIA

www.marcosboqueria886.com

Marcos Boqueria 886



Fruita tropical
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5,00€

3,89€

3,90€

9,90€

CARRETES
14,90€

2,49€

7,99€

5,00€

2,99€

3,99€

5,00€

5,90€

19,90€

12,90€

12,90€

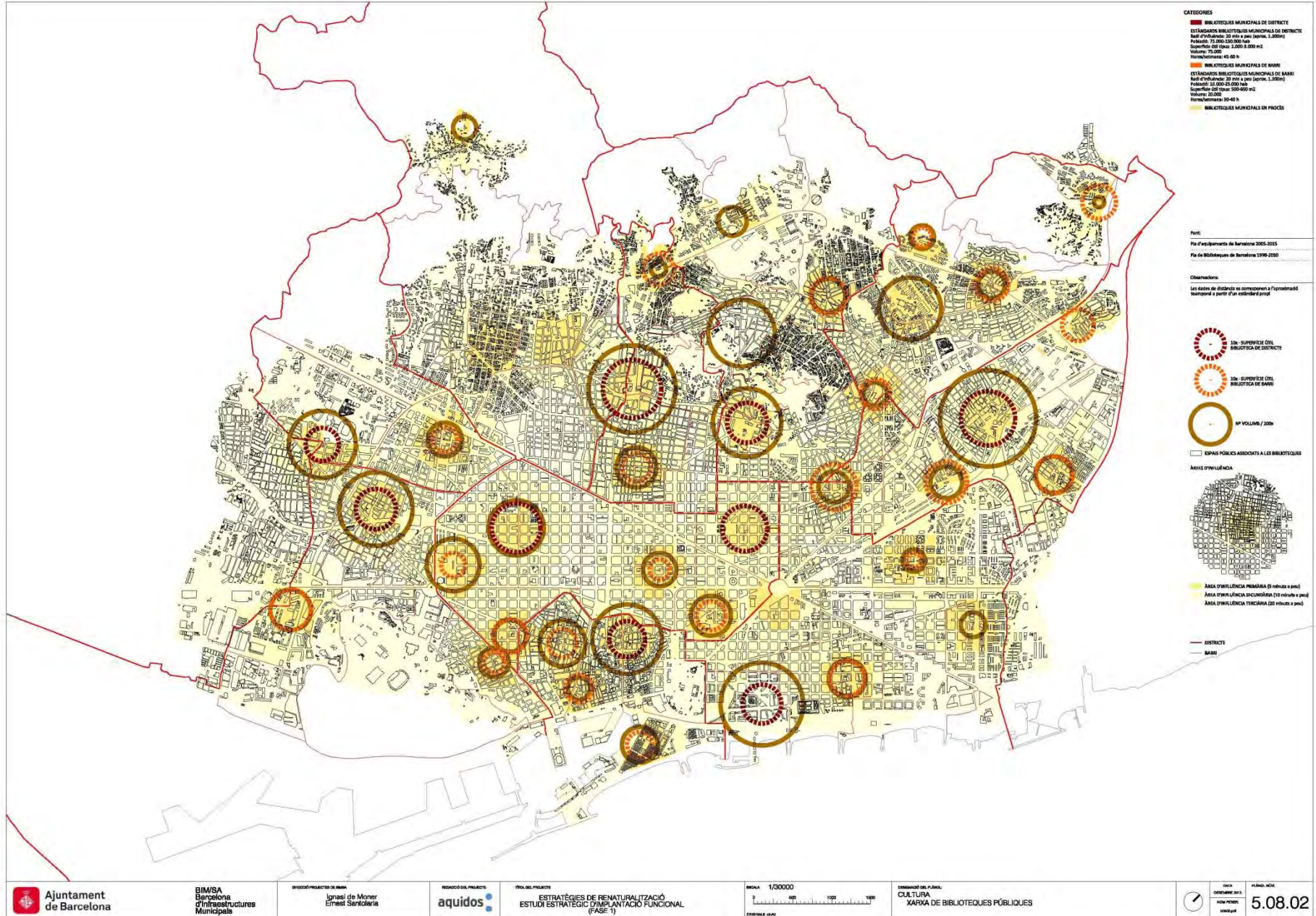
2,50€

3,50€

2,50€

12,00€

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BARCELONA SMART CITY CAMPUS 22@

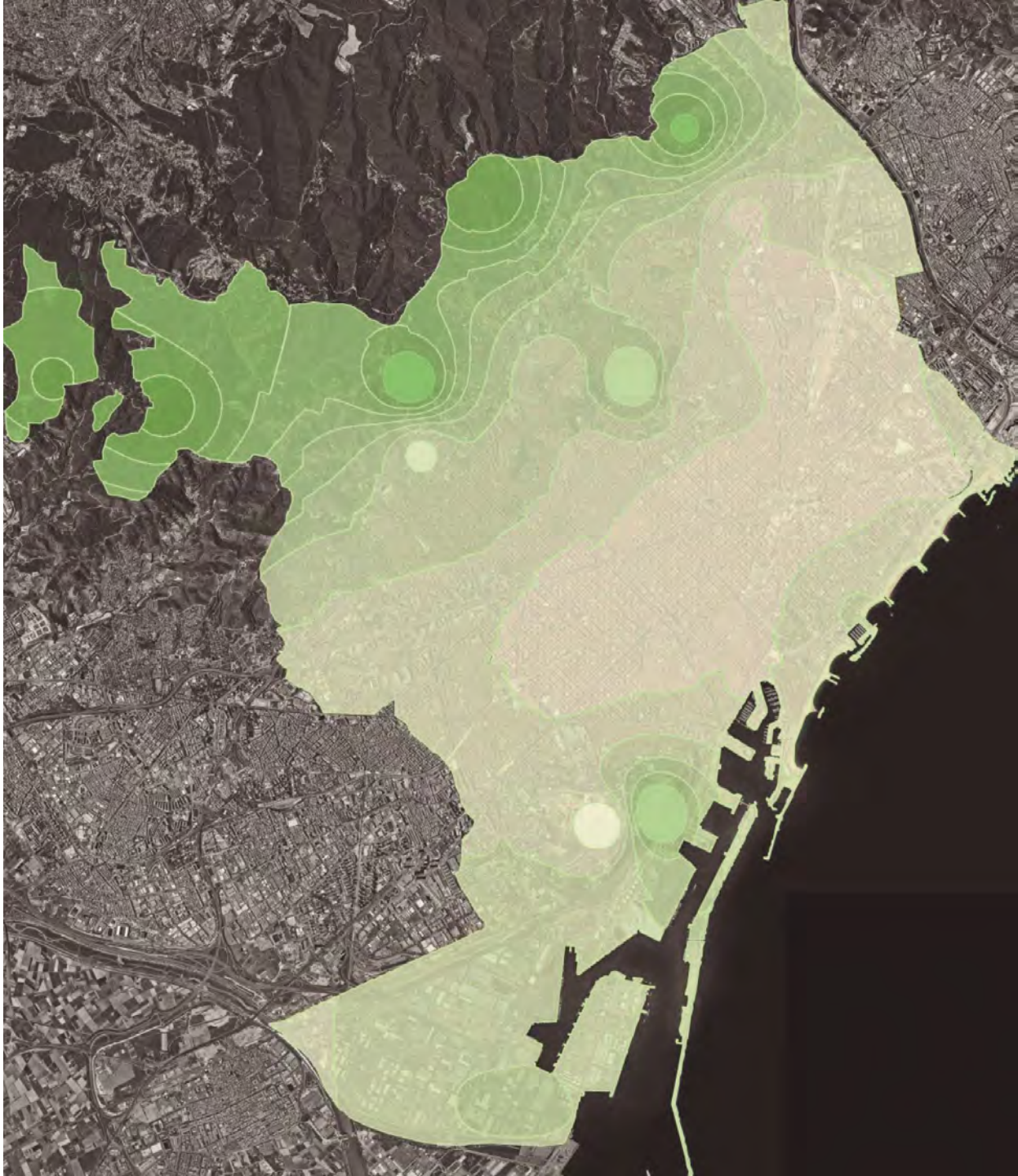




The 8 principles to make an smart city

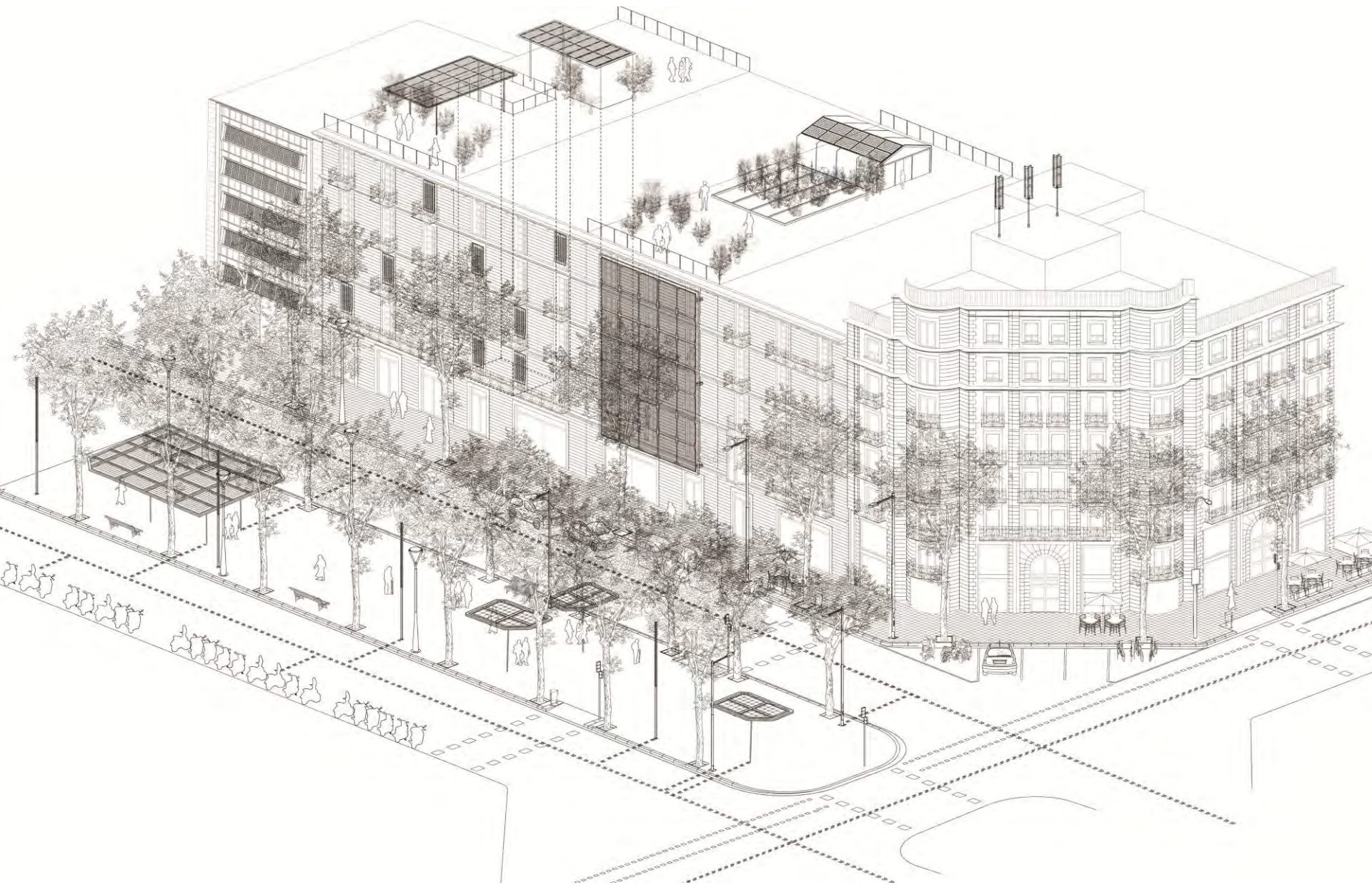
2 conclusions:

1. Make long term plans, start with small projects today











A modern, angular wooden building with solar panels on its facade. The building features a complex, faceted design with large, triangular and quadrilateral panels. The solar panels are integrated into the structure, mounted on various angled surfaces. The building is situated on a paved area, and a small white and blue car is parked in front of it. The sky is clear and blue, and a body of water is visible in the background.

A small white and blue car, likely a Citroën Ami, parked in front of the building. The car has a blue graphic on its side with the text "E-Mobility" and "Citroën".

A person riding a Segway on the left side of the image. They are wearing a helmet and a light-colored shirt.

A person riding a Segway in the center of the image. They are wearing a white shirt and a dark skirt.

A person riding a Segway on the right side of the image. They are wearing a blue shirt and light-colored pants.



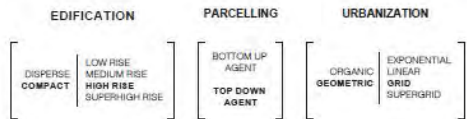
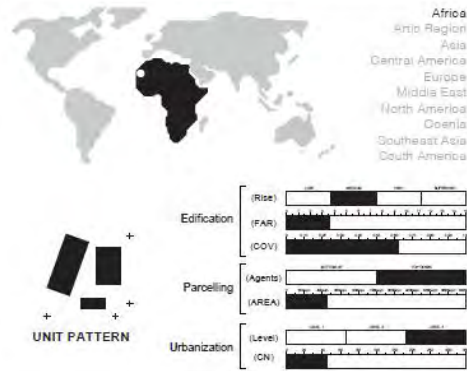


The 8 principles to make an smart city

2 conclusions:

1. Make long term plans, start with small projects today
2. Avoid generations of mistakes by learning from other cities

CITY PROTOCOL



COMPACT GRID high rise top-down



ABU DHABI, UNITED ARAB EMIRATES 24°28'N 54°22'E

Is the capital and the second largest city of the United Arab Emirates in terms of population and the largest of the seven member emirates of the United Arab Emirates. Abu Dhabi lies on a T-shaped island jutting into the Persian Gulf from the central western coast.

FABRIC PARAMETERS main descriptive indicators

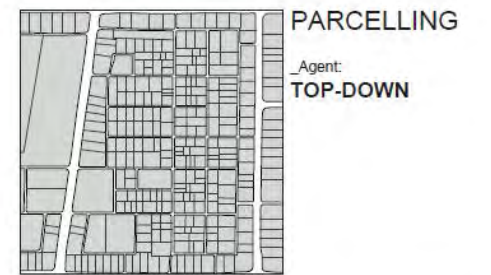
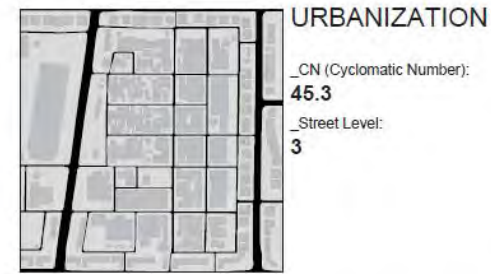
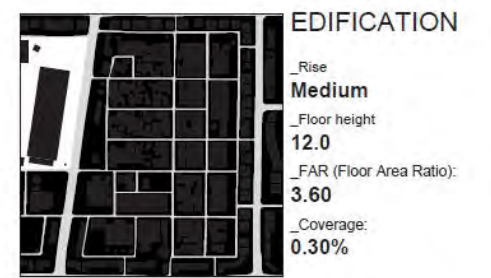
URBAN FABRICS



This level is defined as a cluster of walkable blocks with some local services. Many new developments, especially in the developing world, are of this size. These clusters includes some neighborhood services and open space, but are still mostly self-contained.

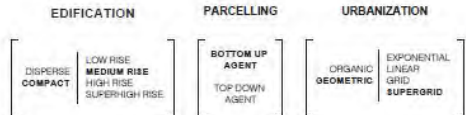
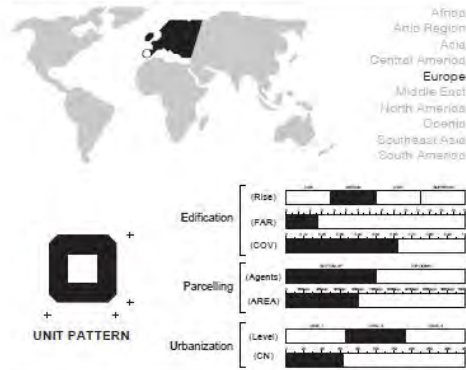
FABRIC SAMPLE km x km satellite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



COMPACT SUPER GRID
medium rise bottom-up



SAGRADA FAMILIA, BARCELONA
41°23'N 2°11'E

The Eixample district covers an area of 748 hectares in central Barcelona. It is part of the notorious expansion project of the city planned by Idelfonso Cerdà in 1859.

FABRIC PARAMETERS main descriptive indicators

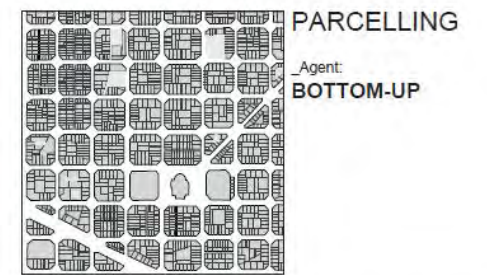
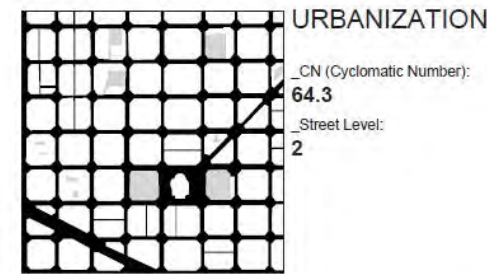
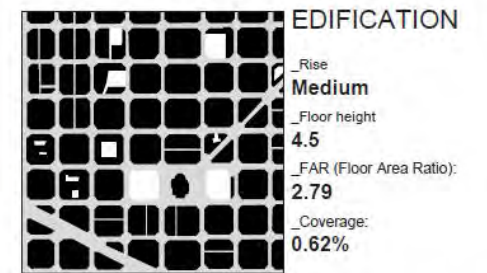
URBAN FABRICS



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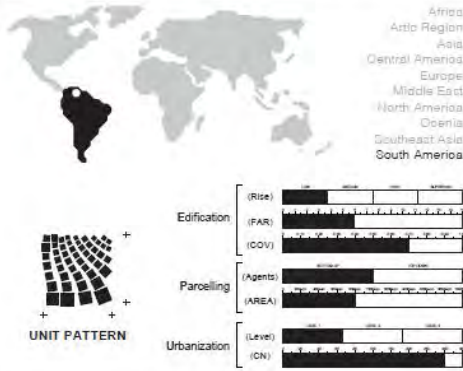
FABRIC SAMPLE km x km satellite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



EDIFICATION		PARCELLING		URBANIZATION	
DISPERSE	LOW RISE	BOTTOM UP	ORGANIC	EXPONENTIAL	
COMPACT	MEDIUM RISE	AGENT	GEOMETRIC	LINEAR	
	HIGH RISE	TOP DOWN		GRID	
	SUPERHIGH RISE	AGENT		SUPERGRID	

COMPACT EXPONENTIAL

low rise bottom-up



CARACAS, VENEZUELA

10°30'N 66°55'W

Officially Santiago de León de Caracas, is the capital and largest city of Venezuela. Caracas is located in the northern part of the country, following the contours of the narrow Caracas Valley on the Venezuelan coastal mountain range (Cordillera de la Costa).

FABRIC PARAMETERS main descriptive indicators

URBAN FABRICS

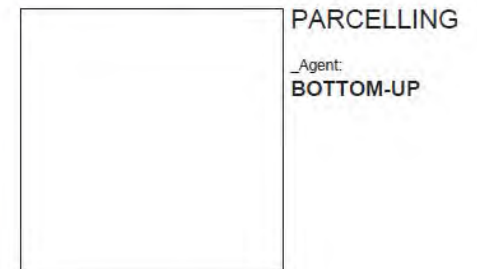
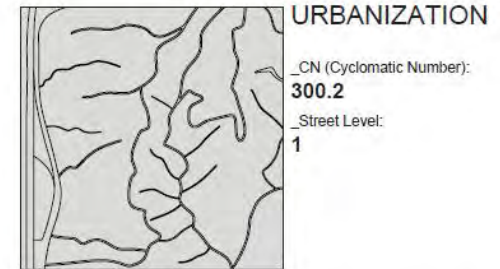
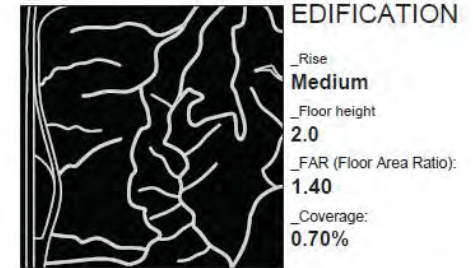


SCALE B

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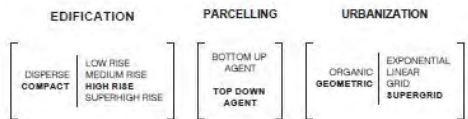
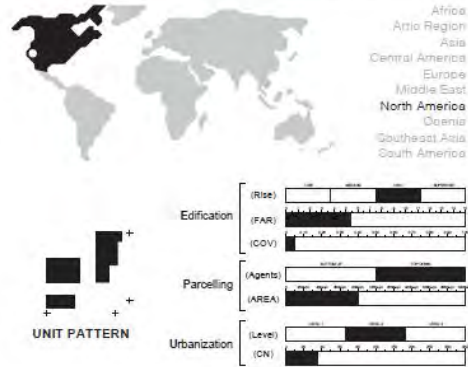
FABRIC SAMPLE km x km satellite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



COMPACT SUPER GRID

high rise top-down



L.A. CALIFORNIA, UNITED STATES

34°03'N 118°15'W

officially the City of Los Angeles, often known by its initials L.A., is the most populous city in the U.S. state of California and the second-most populous in the United States, after New York City, with a population at the 2010 United States Census of 3,792,821.

FABRIC PARAMETERS main descriptive indicators

URBAN FABRICS

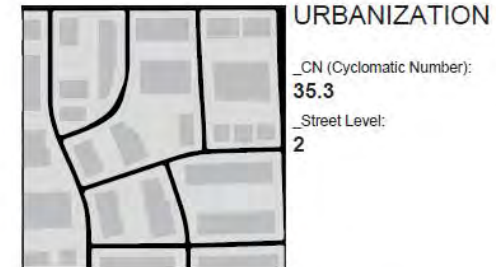
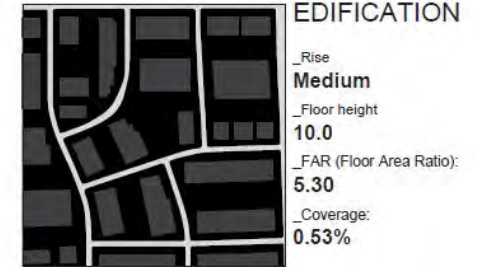


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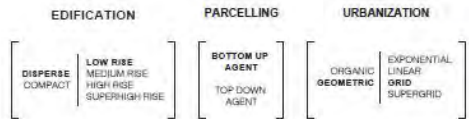
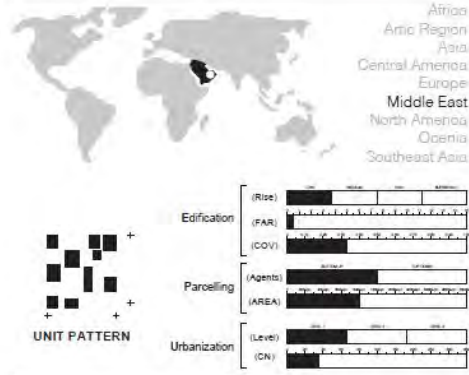
FABRIC SAMPLE km x km satelite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



DISPERSE GRID
 low rise bottom-up

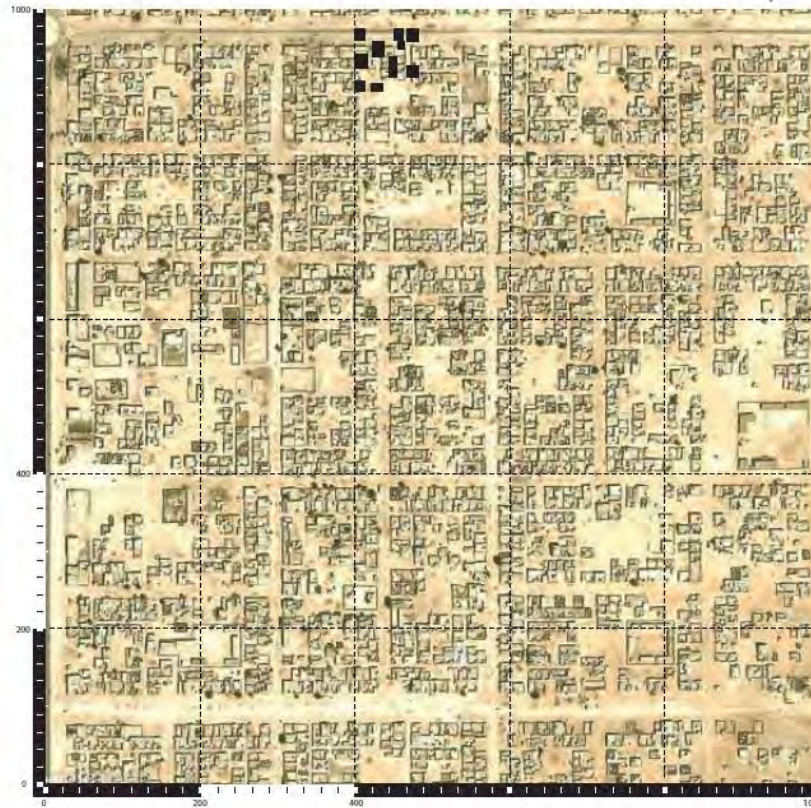


NOUAKCHOTT, MAURITANIA
 18°6 N 15°57 W

Thought to derive from Berber Nawākšūt, "place of the winds" (citation needed) is the capital and by far the largest city of Mauritania. It is one of the largest cities in the Sahara. The city is the administrative and economic centre of Mauritania.

FABRIC PARAMETERS main descriptive indicators

URBAN FABRICS

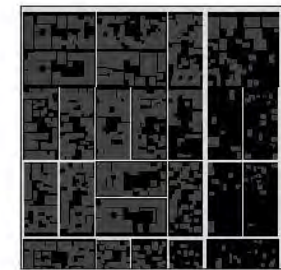


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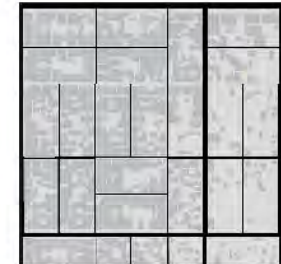
FABRIC SAMPLE km x km satellite picture

EUP



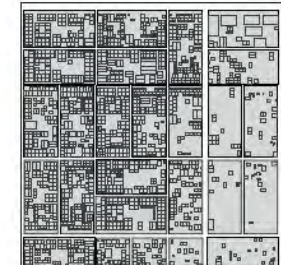
EDIFICATION

_Rise
Medium
 _Floor height
1.5
 _FAR (Floor Area Ratio):
0.50
 _Coverage:
0.33%



URBANIZATION

_CN (Cyclomatic Number):
36.2
 _Street Level:
1

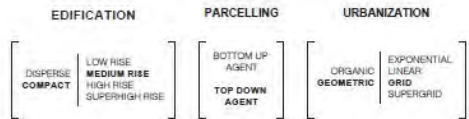
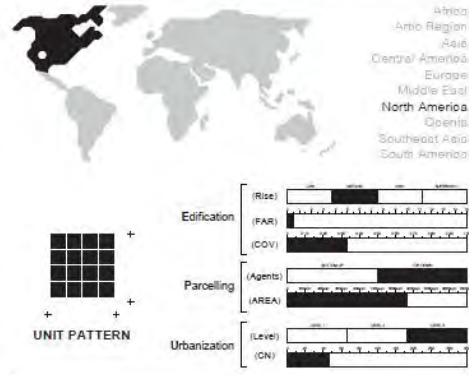


PARCELLING

_Agent:
BOTTOM-UP

FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



COMPACT GRID
medium rise top-down



PHOENIX ARIZONA, UNITED STATES
33°27' N 112°04' W

is the capital, and largest city, of the U.S. state of Arizona, as well as the sixth most populous city nationally, and is also the most populous state capital in the United States. Phoenix is home to 1,446,832 people according to the 2010 U.S. Census Bureau data.

FABRIC PARAMETERS main descriptive indicators

URBAN FABRICS

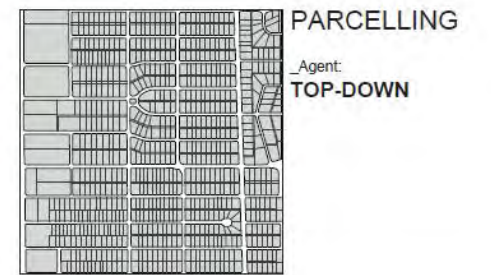
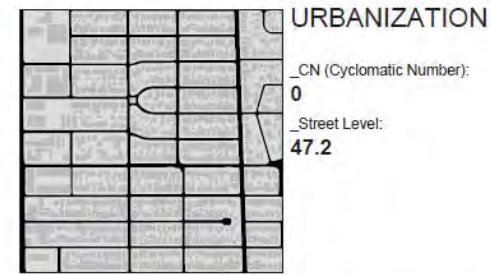
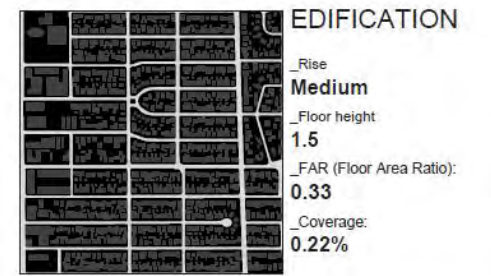


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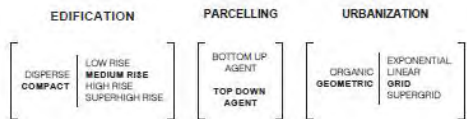
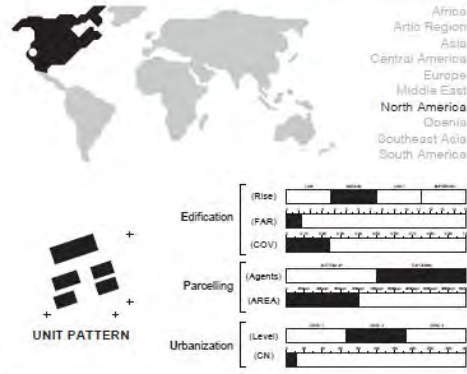
FABRIC SAMPLE km x km satellite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling

CITY PROTOCOL



COMPACT GRID medium rise top-down

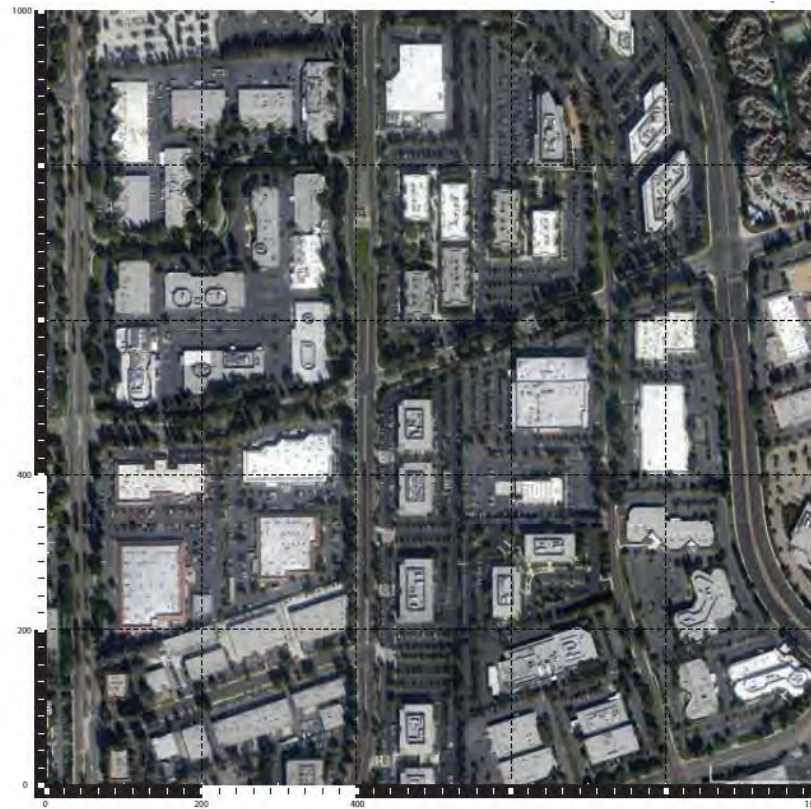


SAN JOSE CALIFORNIA, UNITED STATES 37° 18' N, 121° 52'

Is the third-largest city in California, the tenth-largest in the United States,[4] and the county seat of Santa Clara County. San Jose is the largest city within Silicon Valley, which is a major component of the greater San Francisco Bay Area. It is the largest city in Northern California.

FABRIC PARAMETERS main descriptive indicators

URBAN FABRICS

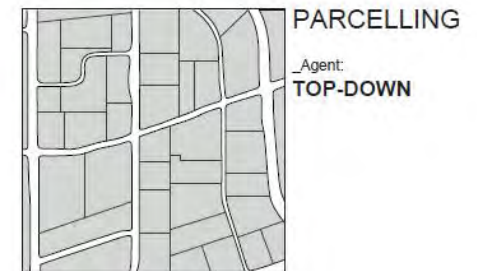
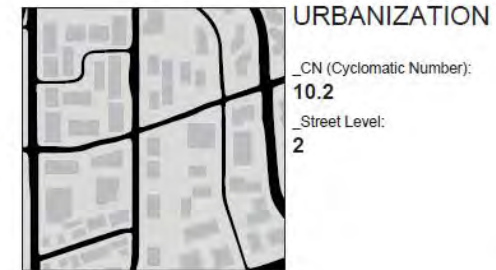
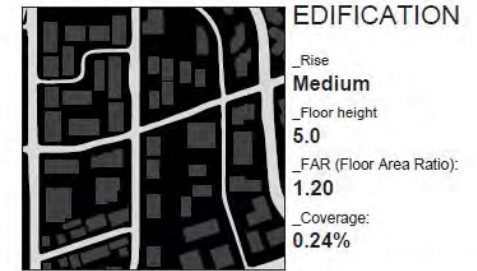


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FABRIC SAMPLE km x km satellite picture

EUP



FABRIC STRUCTURAL LAYERS. Edification, Urbanization, Parcelling



Construcció barri del Besos, 1970











Shri Venkaiah Naidu
Honorable Cabinet Minister
Ministry Of Urban Development,
Gouvernement of India

“I have been in Barcelona.
They follow the principle: Nature, Culture and
Better Future”

Thank You

Vicente Guallart

vicenteguallart@gmail.com