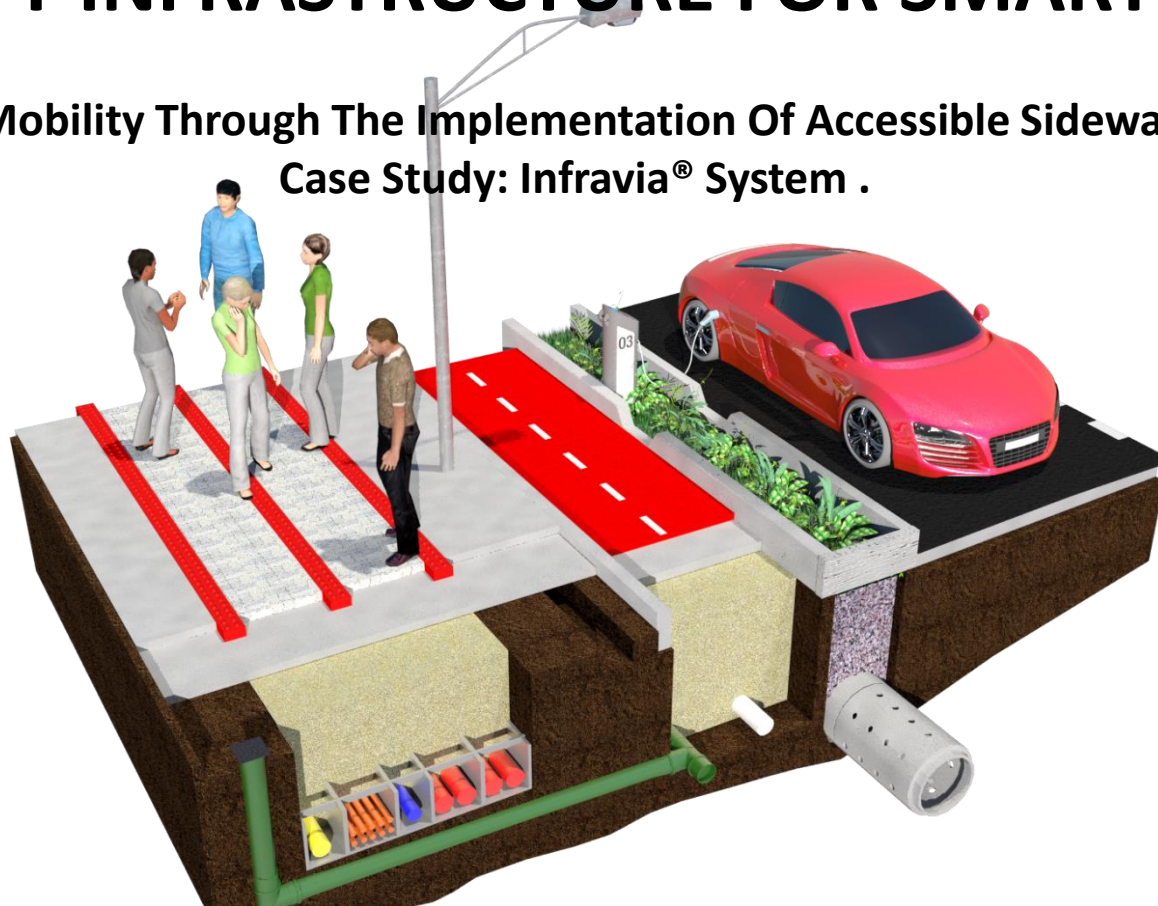


SMART CITY INFRASTRUCTURE FOR SMART MOBILITY

Promoting Active Mobility Through The Implementation Of Accessible Sidewalks And Bike Lanes
Case Study: Infravia® System .



“Simplicity is the ultimate sophistication”.

Dr. Aloisio Pereira Da Silva
Civil Engineer

Leonardo da Vinci



PRESENTED CONDITIONS

- Disorderly growth of cities
- Prioritization by individual transport
- Inability to expand road infrastructure

PROPOSED SOLUTIONS

Solutions that contemplate a mix, involving public and individual transportation

(**FOCUS ON TECHNOLOGY**)

Importance of public transport development as a policy for sustainable cities.



Space to transport 60 people

MOTORIZED INDIVIDUAL TRANSPORTATION

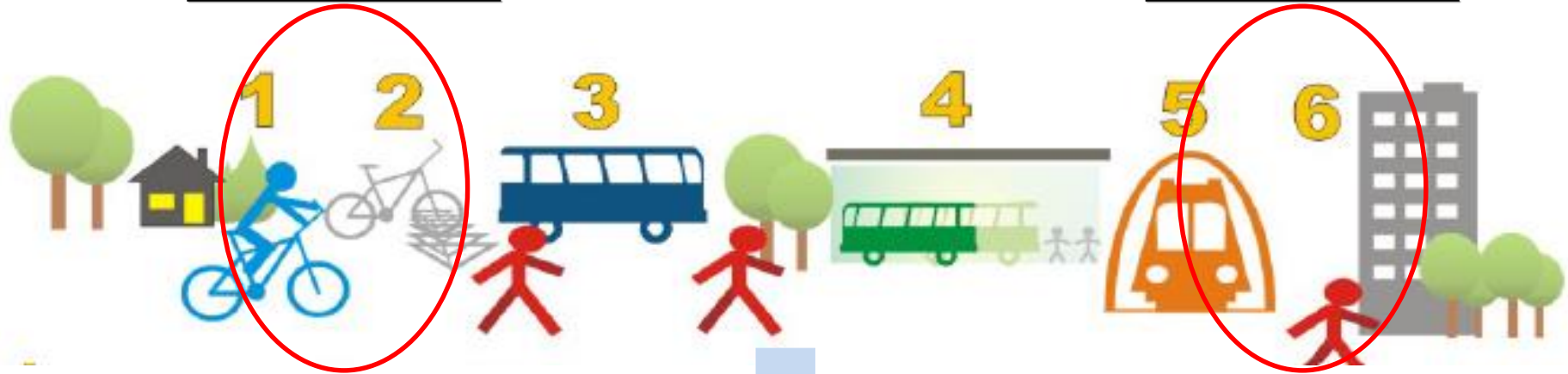


... Replace only the type of fuel is not the solution.

PUBLIC TRANSPORT SYSTEM

SIDEWALK AND BIKE LANES

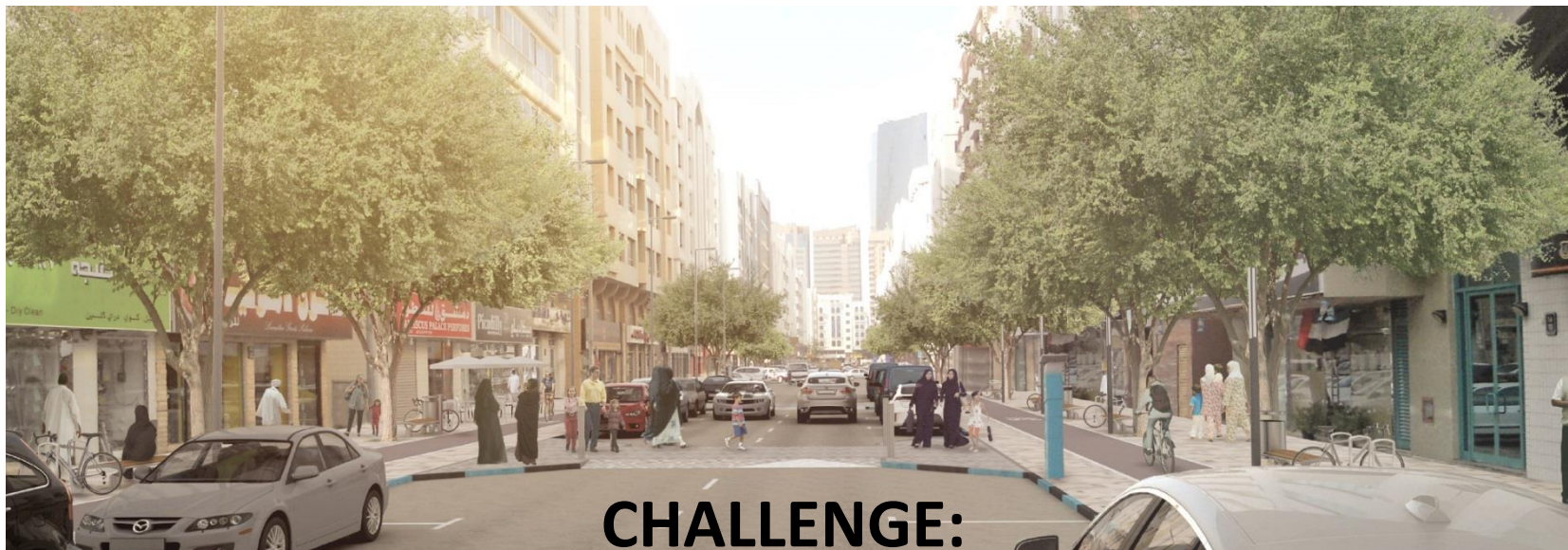
SIDEWALK AND BIKE LANES



REQUIREMENT OF ACCESSIBLE **SIDEWALK AND BIKE LANES** FOR THE COMPLETE AND EFFICIENT OPERATION OF THE PUBLIC TRANSPORT SYSTEM

URBAN MOBILITY CHAIN

ACCESSIBLE SIDEWALK AND BIKE LANES



**CONSTRUCTION OF ACCESSIBLE SIDEWALK AND BIKE LANES
IN HARMONY WITH UNDERGROUND UTILITIES.**



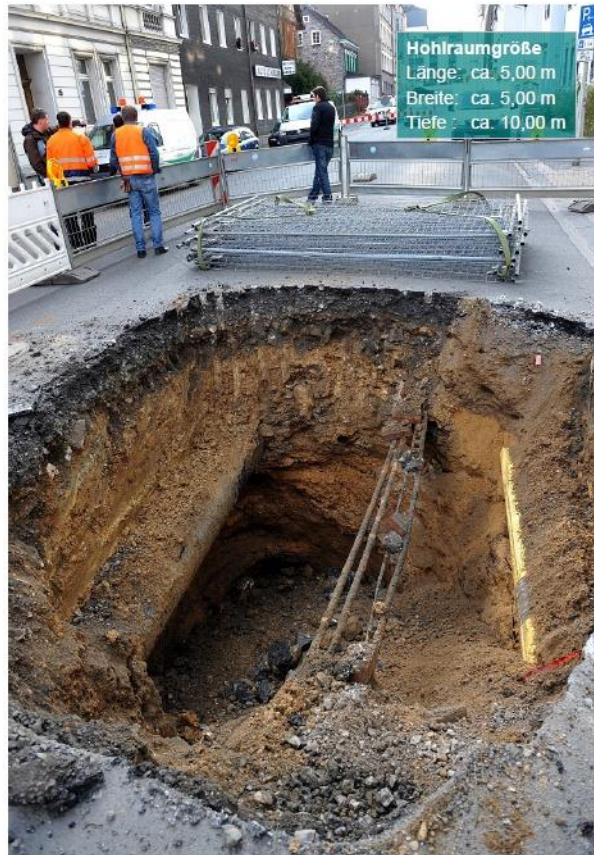


Bild 56: Freigelegter Hohlraum in der Gasstraße
[Foto: Technische Betriebe Solingen]



Utility streetworks and associated costs

- Streetworks operations (utility placement, renewal and maintenance) cost money, damage the environment and disrupt society.
- They also damage adjacent services, and the overlying road structure.
- More than 4 million holes in the UK's roads each year
- Utility streetworks cost the UK economy ~£7bn per annum

~£1.5bn direct construction costs

~£5.5bn indirect costs (social and environmental impacts)

(after McMahon et al., 2005)

- NO COORDINATION OF THE NETWORK'S CONSTRUCTION WITH THE URBAN DESIGN
- NO ACCURATE KNOWLEDGE OF UNDERGROUND NETWORKS
- NO COORDINATION OF THE CONSTRUCTION AND MAINTENANCE BETWEEN UTILITY CONCESSIONAIRES
- UNKNOWN AND UNSAFE UNDERGROUND
- INSTALLATIONS LOCATED MAINLY UNDER THE STREET, CAUSING PROBLEMS RELATED TO SUCCESSIVE WORKS OF PAVING AND MOBILITY.

ECONOMIC IMPACT OF INFRASTRUCTURE NETWORKS

Underground Assets in the European Union



> 2.4 trillion €

~ 10,000 km undergr. transport systems ^[1] ⇒ 142 bn € ^[1]

2,500,000 km sewers ^[1], ⇒ 1.371 bn € ^[1]

3,495,000 km water pipes ^[1] ⇒ 535 bn € ^[1]

2,030,000 km gas pipes ^[2] ⇒ 305 bn € ^[1]

200,000 km district heating pipes ^[3] ⇒ 66 bn € ^[1]

+ pipelines, cables, pneumatic post, waste air, goods

^[1] IKT estimate 2016 (EU-28) ^[2] European Commission 2011 (EU-28) ^[3] Euroheat&Power, 2011 for EU-27 (not includ. Croatia)

THE SOLUTION IS INNOVATION !

INFRAVIA® SYSTEM

***Next Generation Infrastructure and
Sustainable Mobility for Smart Cities***

Smart Infrastructure for Smart Cities

System developed based on Brazilian standard ABNT NBR 16584-2007/16584-2007

INFRAVIA 2.0

System that organizes and shares the networks of natural gas, telecommunications, water, electricity, street lighting, sewage and urban drainage under sidewalks and bike lanes as an innovative solution for smart cities.



Natural gas pipeline = 1

Telecommunications,
Cable TV and data = 2

Drinking water network | Hydrant = 3

Electrical network (low - < 220 V) = 4

Electrical network (medium - < 13.800 V)
street public lighting = 5

Sand cover = 6

Recycled plastic walls = 7

Interlocking blocks
network signaling = 8

Bike lane = 9

High-pressure pipeline = 10

Sewer = 11

Recycled water network
and rainwater
drainage = 12

Eco-drainage
system = 13

Drain pipe to collect
rainwater = 14

Street without
underground facilities = 15

Recycled water network = 16

Electric Car Charging = 17

Network Monitoring System = 18

Anti-Root System = 19

BENEFITS:

01

Accessibility: Standardization of sidewalks and bike lanes along the urban roads.

02

Security: Paved signaling, indicating the exact position of networks that are protected by the structure of the system and are monitored in real time, from the web, in an exclusive security system.

03

Sustainability: The whole system has the concept of "zero waste" in its construction and operation, using urban waste as raw material in the production of the system and not generating rubble in its operation and maintenance.

04

Economy: Reduction in the costs of the order of 30% in the construction and of up to 70% in the operation and maintenance of the systems, when compared to the individual implantation of the infrastructure networks.

05

Aesthetics: Change in the landscape of cities, today overloaded with exposed wires and networks.



Pilot project technology Park "Sapiens Parque" - Florianópolis - SC

GLOBAL PARTNERS



<http://www.fapescc.sc.gov.br/projeto-infravias-tem-destaque-internacional/>

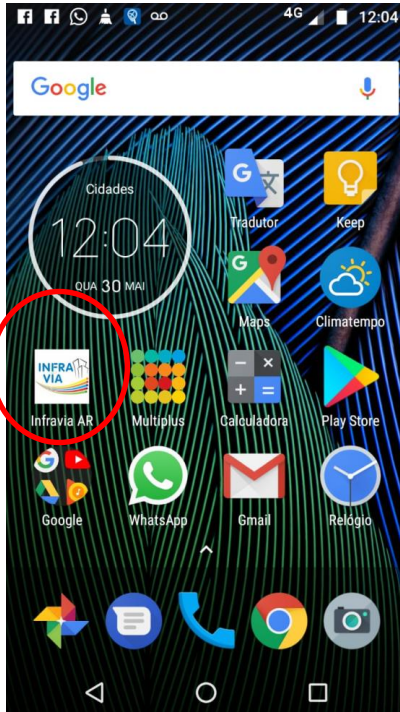
SIGNATURE OF MEMORANDUM OF UNDERSTANDING (MoU) FOR DEVELOPMENT OF THE INFRAVIA SYSTEM IN GERMANY - 2017

BRAZILIAN STANDARD ABOUT THE THEME

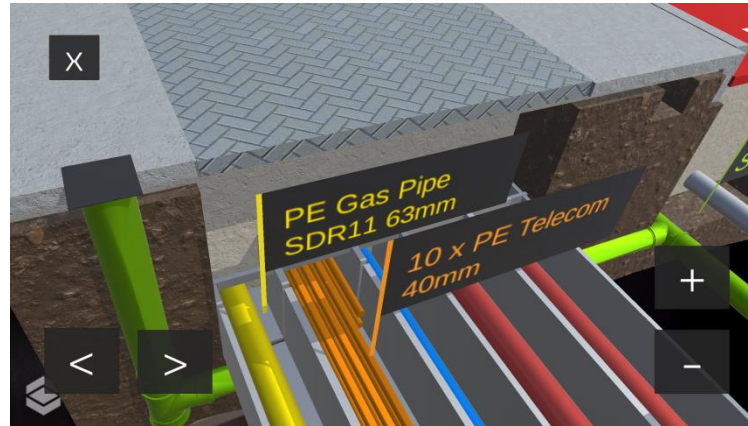


PARTICIPATION IN THE COMMITTEE FOR CREATION OF THE BRAZILIAN STANDARD ABNT NBR 16584/2017

INFRAVIA SAFETY MONITORING SYSTEM AND ASSET MANAGEMENT



INFRAVIA AR app

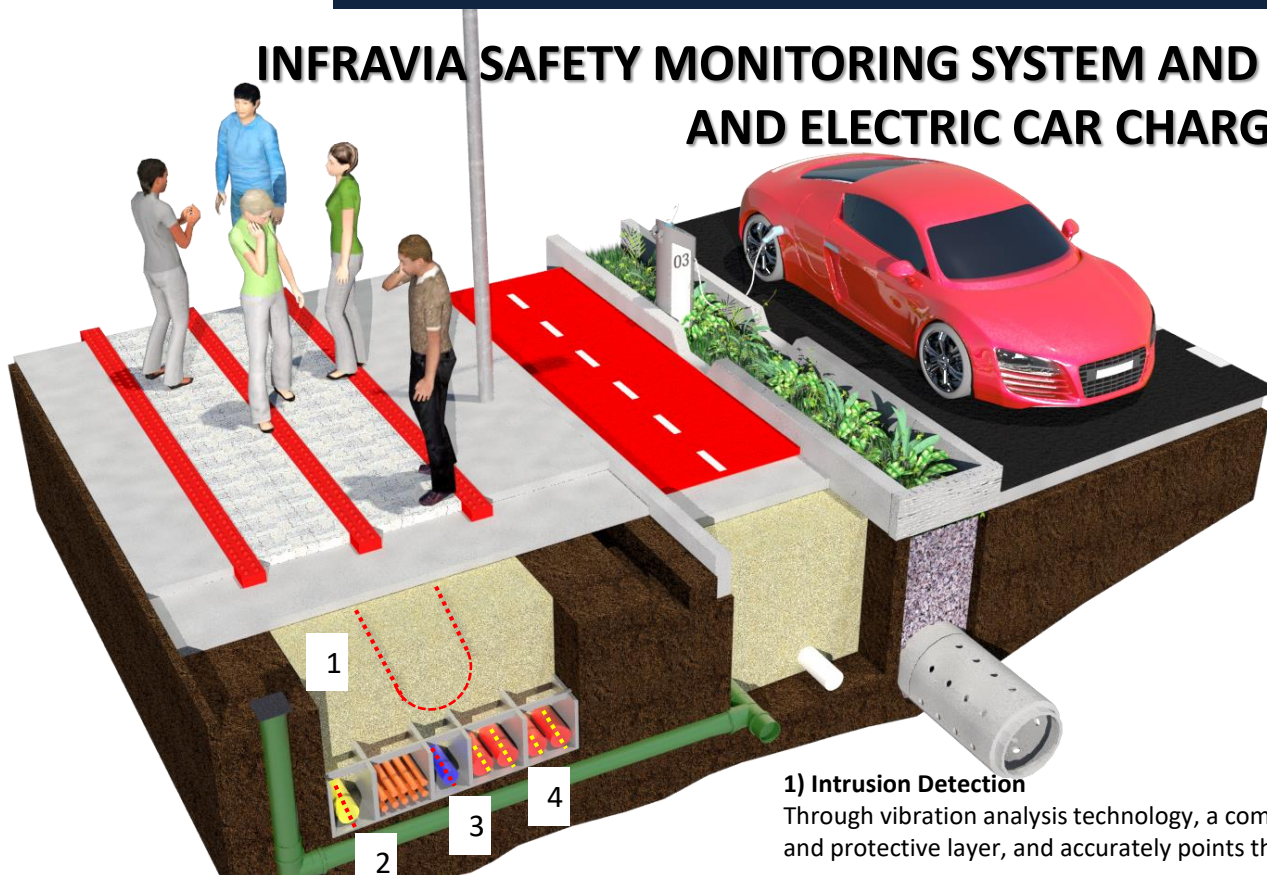


INFRAVIA AR app in use - Test

Augmented reality application developed exclusively for the INFRAVIA system by the Innovation Center of the National Industrial Learning Service - SENAI, the INFRAVIA AR, already in tests, for safety monitoring and asset management

Projects developed in Building Information Model - BIM in partnership with Bentley.

INFRAVIA SAFETY MONITORING SYSTEM AND ASSET MANAGEMENT AND ELECTRIC CAR CHARGER



**Intrusion detection tests –
Sapiens Parque -2017**

1) Intrusion Detection

Through vibration analysis technology, a common fiber optic cable detects movement in the sidewalk pavement and protective layer, and accurately points the location to the occurrence at a remote monitoring center.

2) Detection of Leak (Gas)

Through DTS technology, a common fiber optic cable is transformed into a thermometer that allows to detect and locate temperature variations, allowing to identify gas and liquid leaks in real time, as well as its precise location.

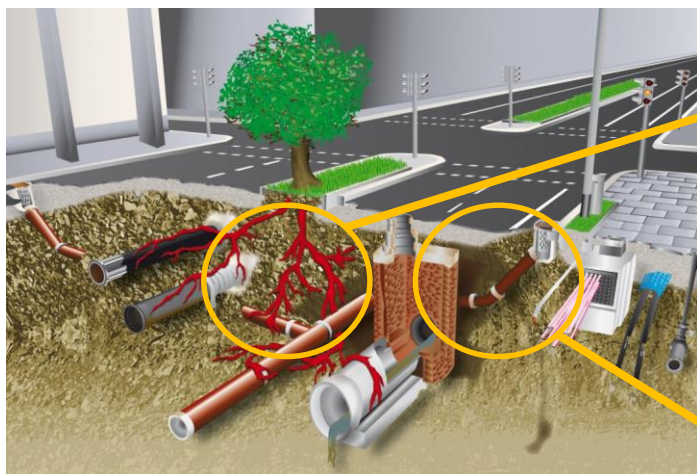
3) Detection of Leak (Liquid)

Through DTS technology, a common fiber optic cable is transformed into a thermometer that allows to detect and locate temperature variations, allowing to identify gas and liquid leaks in real time, as well as its precise location.

4) Hot Spot Monitoring and Arc Failures / Isolation

By combining temperature and vibration technologies, it is possible to identify insulation or arc faults and monitor hot spots along low, medium and high voltage lines as well as monitor the temperature of transformers and junctions, generating automatic alerts to the maintenance team before a serious occurrence.

INFRAVIA DRAINAGE SYSTEM AND ROOT BARRIER



CURRENT CONDITION

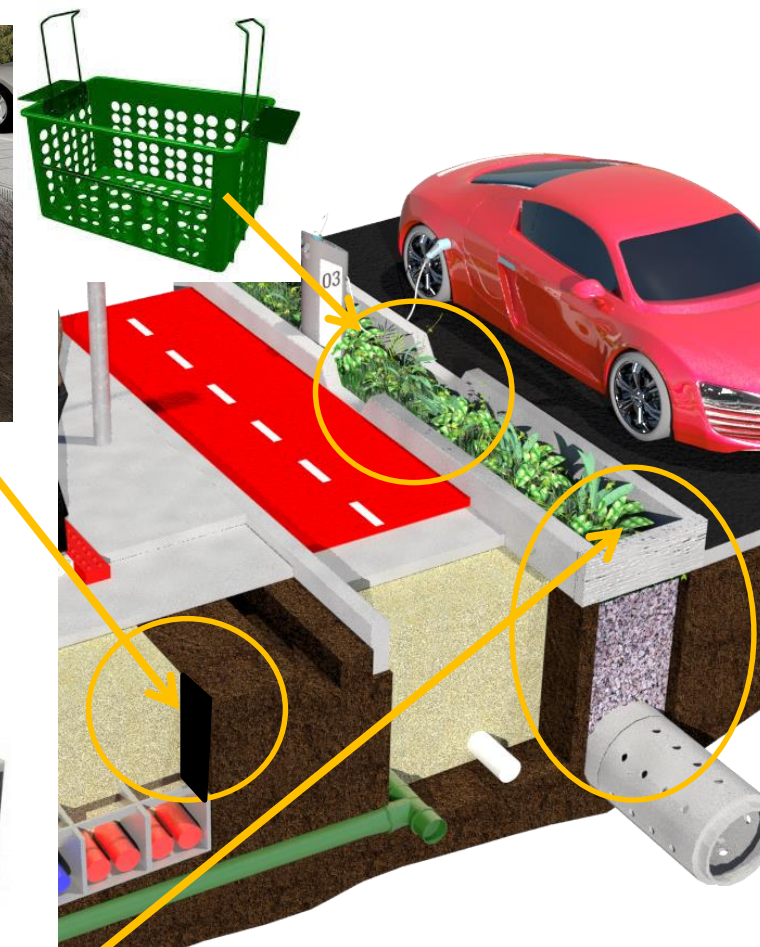


ROOT BARRIER



DRAINAGE SYSTEM

New filter



UTILIZATION OF URBAN WASTE AS RAW MATERIAL FOR PRODUCTION OF THE INFRAVIA SYSTEM



Signature of the MoU between INFRAVIA and CS BIOENERGIA for the production of the plastic panels of the system through urban waste.



CS BIOENERGIA's plant for energy production through the generation of biogas from sewage and urban waste - (Construction 2016)



CS BIOENERGIA's plant for energy production through the generation of biogas from sewage and urban waste - (In operation 2018)



Plastic removed during the urban waste processing.
Estimated production - 120 tons/day of recycled plastic



Raw material for the INFRAVIA System.
100% mechanized and automated process.

Comparing INFRAVIA® System with individual system and utility tunnel (construction).

SYSTEM ADVANTAGES

SAFETY ASPECTS

- 1) Excavation Depth Below 1.25 m - No Need Shoring
- 2) Unnecessary The Use Of Excavation Equipment And The Cutting Tool.
- 3) Possibility Of Using Suction Equipment To Remove Material From The Trench - Approx. 150 Liters Per Interconnection
- 4) Excluding The Possibility Of Accidental Contact

PLANNING AND URBAN CADASTRE

- 1) Facilities in defined positions.
- 2) Precise knowledge of the location of each utility.
- 3) Derivations and interconnections with defined parameters.

COMPLETE STREETS

- 1) The stripe of interlocking blocks located over the trench may be flagged for both urban accessibility statement (tactile floor indication blocks), as well as information from the utilities, stating that the area contains facilities;
- 2) Signalized, it becomes clear to the community that the site is A "cradle" of facilities that should be protected from excavations.
- 3) Its position in the sidewalk does not disturb the car traffic in the streets and reduced the use of trucks and other equipment.

SMART ENERGY GRID

- 1) Concept of joint trench system with smart energy grid -" INFRAVIA System ""
- 2) Use the joint trench model for transmission of "energy" - natural gas and electricity.
- 3) All systems in the trench can be monitored and operated by telemetry methods: integration of the systems, safety and economy.
- 4) Using the joint trench as power transmission element.
- 3) concept generation of district - gain in reliability and stability of systems;
- 5) Energy management with integration of the systems; production of "energy" through renewable sources. Storage of 'energy' through natural gas storage.
- 6) The clients that now only consume natural gas and electricity, can generate electricity at the end of the system through cogeneration systems using natural gas.

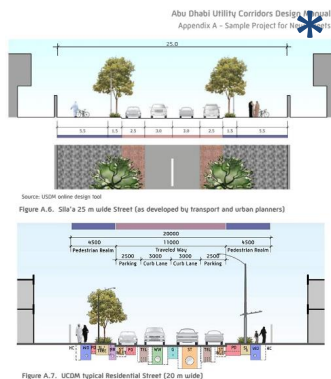
SUSTAINABILITY IN THE RESOURCE USE

RAINWATER REUSE, RECYCLED MATERIALS, AND SOCIAL PROJECTS "WASTE ZERO" IN THE CONSTRUCTION AND USE.

- 1) Each meter of the INFRAVIAS System (sidewalk/ bike lane/ eco drainage system) consume nearly 5.000 kilos of civil construction waste.
- 2) Each meter of the INFRAVIAS System (sidewalk) consume nearly 100 kilos of the urban waste.
- 3) cost reductions of implementation of the order of 32% for non-destructive method and destructive method of 26% to the natural gas pipeline and the similar value in the other facilities (30 % cost reductions in average) and presenting a reduction of 70,30% in implantation a new derivation (natural gas consumer)



X

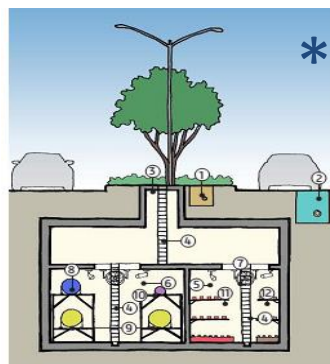


U\$ 1,15 M /Km

U\$ 2,65 M /Km



X

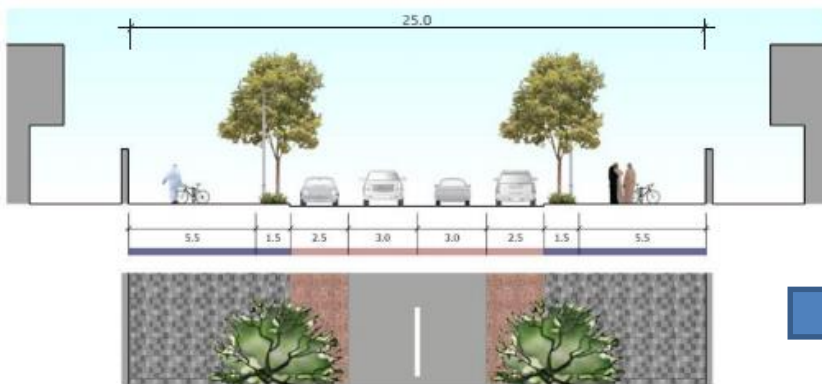


U\$ 1,15 M /Km

U\$ 9,50 M /Km

Comparing INFRAVIA® System with individual system and utility tunnel (construction).

Abu Dhabi Utility Corridors Design Manual
Appendix A - Sample Project for New Streets



Source: USDM online design tool

Figure A.6. Sila'a 25 m wide Street (as developed by transport and urban planners)

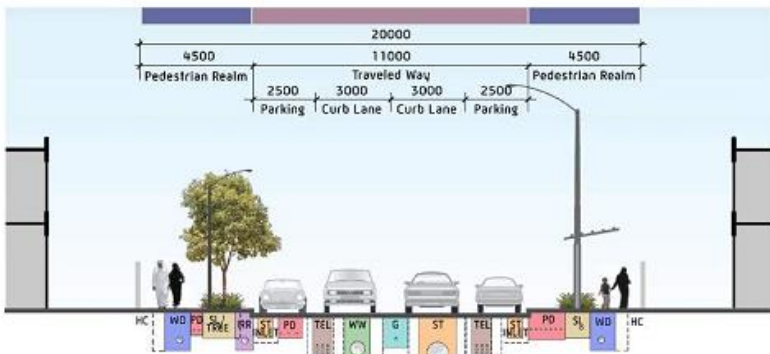
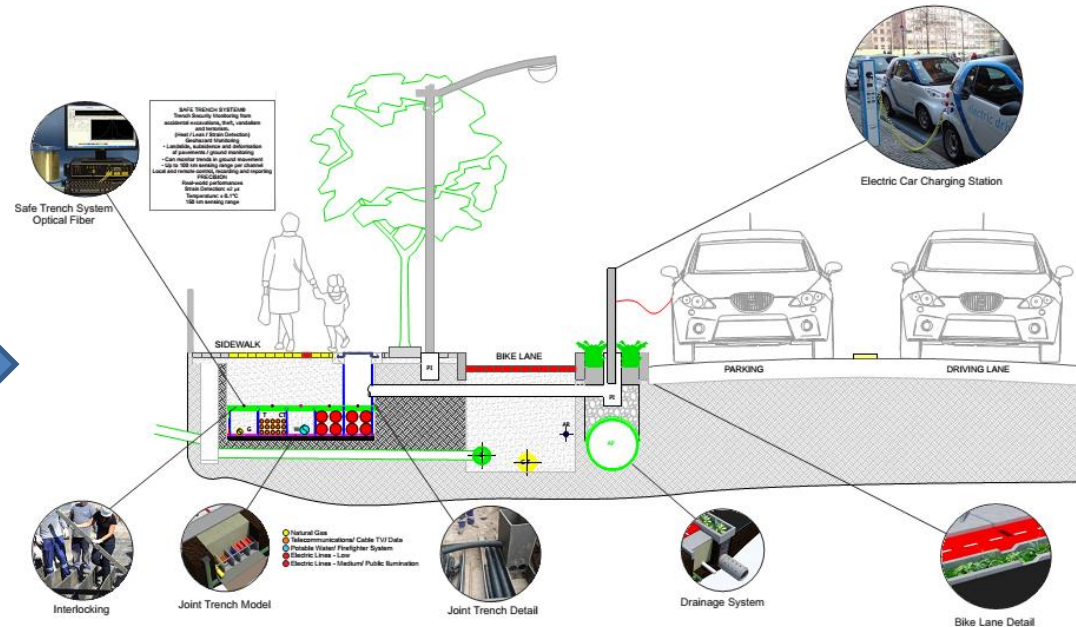


Figure A.7. UCDM typical Residential Street (20 m wide)



INVESTMENTS EXPECTED FOR 1 KM OF UNDERGROUND INFRASTRUCTURE *	
Method	Construction costs (Million US\$)
UTILITY TUNNELS	9,50
INDIVIDUALIZED SYSTEM	2,65
INFRAVIA SYSTEM	1,00

* Estimated costs for installation of underground networks: electric (8x4") (no cable), telecommunication (15x40mm), natural gas (63mm), water (100mm), Public Lighting (1x4") (Excluding pavement repair and sidewalk construction services.)

The management model is modular and scalable and consists of the creation of a specific entity for the centralized management of infrastructure networks, composed of private partners and government, through Public-Private Partnership (PPP) or Specific Purpose Entity (SPE), and may have the participation of the concessionaires.



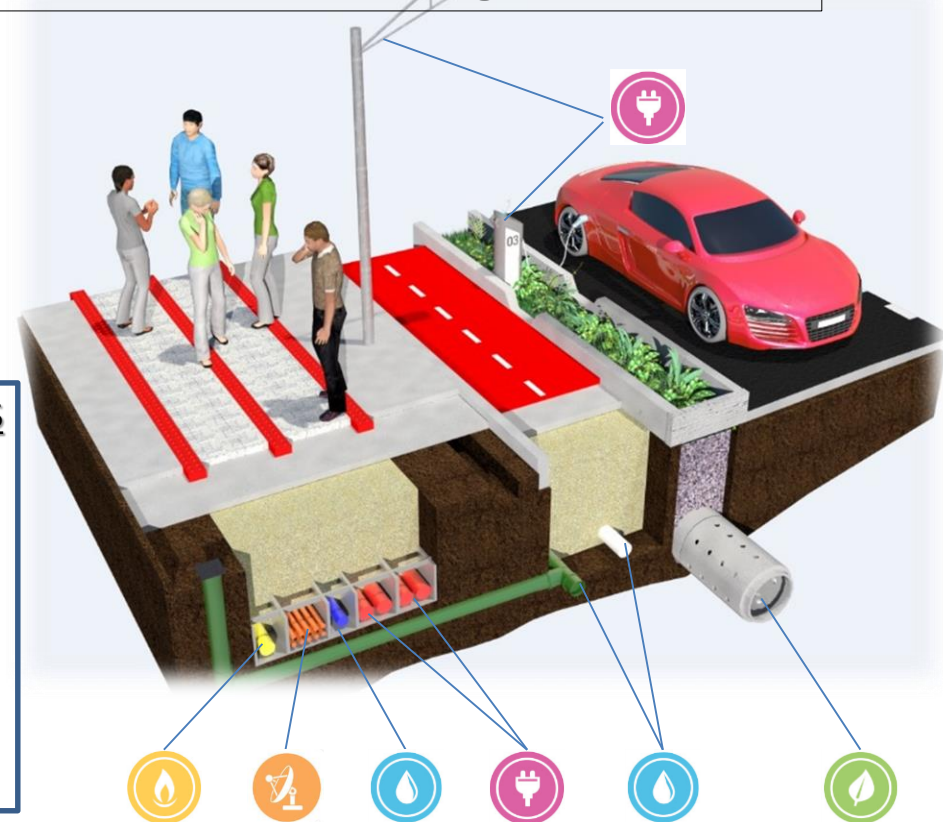
Area of operation of the new concessionaire

This new "concessionaire" has the role of construction, operation, and maintenance of this underground system, where the current infrastructure concessionaires will locate the spaces related to their networks and will operate them, being the manager, excavation, and maintenance services thus reducing costs and improving services to users.

CONCESSIONAIRES

-  Natural gas
-  Telecom
-  Sanitation / water - sewer
-  Electricity - Street lighting
-  Drainage -

Governance and management model



Current models of city design do not contemplate a complete solution with the concept of "Zero Waste"

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DHUHR 12:28PM
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ENVIRONMENT

Pledge against plastic: It's time we fight back

Gulf News campaign: Dubai Municipality rolling out initiatives to reduce and recycle plastic waste

Sajila Saseendran, Senior Reporter
20:00 April 8, 2018

1 million
TONNES OF PLASTIC WASTE
GENERATED IN DUBAI IN 2017

3.6 million
PIECES OF PLASTIC BAGS USED IN DUBAI
IN 2017, A 25% SPIKE FROM 2013

Of the 3.6 million tonnes of domestic waste generated by Dubai in 2017, 30 per cent was plastic waste.

In other words, Dubai produced one million tonnes of plastic waste in 2017.

RELATED LINKS

How aware are UAE residents of plastic menace

The annual usage of plastic bags in Dubai in 2017 was estimated to be around 3.6 million pieces, a 25 per cent increase from the 2.9 million figure Dubai Municipality released in 2013.

Will the residents of Dubai help bring down that number for 2018?

"The city of Dubai is producing almost 9,300 tonnes of domestic waste per day. Thirty per cent of it unfortunately is plastic," said **Abdul Majeed Abdul Aziz Al Saifaie** (right), director of the Waste Management Department, Dubai Municipality.

Dubai Municipality's war on waste, especially plastic waste, has gathered momentum as it strives to achieve the strategic goal of diverting 75 per cent of waste from landfills by 2021.

The civic body is adding up various efforts apart from partnering with private companies for recycling waste.

The Waste Management Department of the civic body has adopted various projects and campaigns specifically to reduce the volume of plastic waste going to landfills.

"All our campaigns target segregating waste at source and promoting recycling and reuse," said Al Saifaie.

With the usage of plastic continuing to grow, officials are urging the residents to limit the use of plastic bags and other plastic products.

The department has also been promoting segregation of plastic waste at source.

"We have set up 13 Smart Sustainable Oasis Centres, where people can easily deposit as many as 18 types of recyclable items including plastic.

In the second phase of the project, we are expecting shopping centres and malls to come forward for setting up these collection centres for recyclables," said Al Saifaie.

9,300 tonnes
of domestic waste Dubai
residents produce per day, of
which 30% is plastic. Think
about it and make a difference.

PROJECT IN THE CITY OF FOZ DO IGUAÇU-BRAZIL, IN PARTNER WITH THE INTERNATIONAL CENTER FOR RENEWABLE ENERGIES - CIBIOGÁS AND ITAIPU TECHNOLOGICAL PARK.



On January 2019, Was Signed MoU For Sustainable Development Project In City.



ITAIPU TODAY IS THE LARGEST GENERATOR OF CLEAN AND RENEWABLE ENERGY IN THE WORLD.



IGUAÇU FALLS - ONE OF THE SEVEN NATURAL WONDERS OF THE WORLD.

PROJECT IN THE CITY OF FOZ DO IGUAÇU-BRAZIL

Focus on Active Mobility and Micro mobility

INFRAVIA BUS STOP

- INTEGRATION BETWEEN PUBLIC TRANSPORT, SIDEWALK AND BIKE LANE.
- “LAST MILE” CONCEPT
- UNIVERSAL ACCESSIBILITY
- CONNECTIVITY – WI-FI
- MOBILE DEVICE CHARGING SYSTEM
- CAMERAS MONITORING SYSTEM
- MULTIMEDIA INFORMATION SYSTEM
- SPACE FOR BICYCLES AND SHARED SCOOTERS
- SOLAR PANEL SYSTEM



EVERYONE WINS!

Municipality:

- Reduced costs - No holes in the streets
- Use of urban waste as raw material - Revenue
- Percentage of revenue from the integrated system

Dealers / Concessionaries:

- Reduction in construction and operation costs
- Focus on business and consumers
- No more initial investments.

Investors:

- New Business and Opportunities
- Modular and scalable business
- Circular Economy
- INFRAVIA® System can be used in ANY CITY in the world. (standard)

Society:

- Transparency in resource management
- Accessible sidewalks and bike lanes
- Sustainability



WHY IS NOT INFRAVIA® SYSTEM EVERYWHERE?

- **Fear of innovation.**
- **Lack of planning culture.**
- **Lack of transparency in information.**
- **Lack of communication between government and concessionaires.**

So, let's start to innovate with responsibility?

We can help!

Thank you

ALOISIO PEREIRA DA SILVA
CEO

Civil engineer, Dr.

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