



Promoted and Organized by:



SUSTAINABLE COMPLETE STREETS - INTEGRATION BETWEEN URBAN DESIGN AND UNDERGROUND INFRASTRUCTURE - INFRAVIA SYSTEM

*Aloisio Pereira da Silva, Dr.* Santa Catarina State Secretariat of Planning – SUDERF / UFSC *Carlos Loch, Dr.* Federal University of Santa Catarina - UFSC

#### MOTIVATION OF THE PROPOSAL PROBLEMS IN THE CURRENT INFRASTRUCTURE SYSTEM



SAFETY ASPECTS



INTEGRATED MANAGEMENT OF INFRASTRUCTURE FACILITIES AND URBAN PLANNING



PLANNING AND URBAN CADASTRE



AESTHETICAL ASPECTS



SUSTAINABILITY IN THE RESOURCE USE, RECYCLED MATERIALS, AND SOCIAL PROJECTS.



COMPLETE STREETS MULTIMODAL TRANSPORT / ACCESSIBILITY



SMART ENERGY GRID DISTRIBUTED GENERATION -RENEWABLE SOURCES



COSTS REDUCTION OF SYSTEM CONSTRUCTION, OPERATION AND MAINTENANCE

Utility Streetworks maintenance and upgrade operations costs estimated at **£1.5 billion** per year in the UK (of which  $\sim £150$  million is associated with third party damages). Indirect costs (including social and environmental impacts) have been estimated at **£5.5 billion** per year (McMahon et al., 2005).



# **STATE OF ART - SHARED INFRASTRUCTURE -** EU / U.S.



Advantage Joint Trenching		<ul> <li>Reduces installation and maintenance costs</li> <li>Accommodates multiple utilities</li> <li>Positively impacts safety and construction</li> <li>Requires less ROW</li> <li>Requires shorter construction times</li> <li>Requires less time to perform inspections</li> <li>Enhances long-term identification and tracking of utilities within ROW</li> <li>Minimizes impact on the environment</li> <li>Provides benefits in areas where the type of soil involves expensive excavation costs</li> </ul>
	Disadvantages	<ul> <li>Is uncommon in underground facilities</li> <li>Needs detailed coordination between utilities for successful completion</li> <li>Complicates agreements for design parameters and shared costs</li> <li>Requires one utility to take a leadership role in design and construction</li> </ul>
		ALL PSE'S CUSTOMER CONSTRUCTION SERVICES AT 1-888-321-7779 OR VISIT PSE CONVCUSTOMERCONSTRUCTION FOR MORE INFORMATION.
	Т	Spical mainline joint trench dimensions and facility placement
	Ρ	SE (2017)

#### HUD (1983)

Electric Utility Common Trenching of Electric, Telephone, Natural Innovations Gas, and Cable Television Lines Common Trenching Practices Used by Electrical Utility Companies Surveyed				
Electric Utility	Utilities in Common Trench*	Reported Cost Savings		
<ul> <li>Houston Lighting and Power Houston, Texas (713) 228-9211</li> </ul>	E+T	30% of Labor Costs	9 N. M. K.	
<ul> <li>Florida Power &amp; Light Co. Miami, Florida (305) 552-3552</li> </ul>	E * T	Less Than 40% of Trench	ing Costs	
<ul> <li>Sacramento Municipal Utilities District</li> <li>Sacramento, California (916) 452-3211</li> </ul>	E + T + G	Cost Shared Equally Betw Utility Companies	Legend E - Electric T - Telephone	
<ul> <li>City of Seattle, Washington City Lighting Department (206) 625-3000</li> </ul>	E + T + CATV	40 to 60%	G - Natural Gas CATV - Cable Television	

## **STATE OF ART - SHARED INFRASTRUCTURE - BRAZIL**

	Ganhos	Possíveis formas de contribuições	
AES Eletropaulo	<ul> <li>Redução de custos com manutenção corretiva;</li> <li>Redução dos custos com podas;</li> <li>Redução de perdas técnicas e comerciais;</li> <li>Incremento na tarifa;</li> <li>Melhoria da imagem junto ao cliente.</li> </ul>	- Parceria para divisão dos custos de obras civis com outras utilities.	
Município	- Ganhos com ISS da obra; - Valorização imobiliária (IPTU); - Melhoria do ambiente urbano.	- Isenção de ISS sobre serviços relacionados ao enterramento; - Coparticipação na obra física (pavimentação).	
Estado	<ul> <li>Recolhimento de ICMS sobre a obra;</li> <li>Recolhimento de ICMS sobre o aumento da tarifa.</li> </ul>	<ul> <li>- Isenção de ICMS sobre equipamentos;</li> <li>- Criação de um fundo de enterramento de redes de forma a compensar o aumento de arrecadação de ICMS advindo do aumento da tarifa.</li> </ul>	
Governo Federal	Recolhimento de impostos incidentes na obra (IPI, PIS/PASEP e COFINS); Recolhimento de impostos na tarifa (IR, CSSL, PIS e COFINS).	<ul> <li>Assegurar a incorporação de 100% dos investimentos no projeto, incluindo custos operacionais diretamente ligados ao projeto.</li> </ul>	
Telecoms	<ul> <li>Melhora da imagem junto aos clientes;</li> <li>Diminuição do custo de mantutenção;</li> <li>Ampliação da infra estrutura estimulando a competição.</li> </ul>	- Parceria para divisão dos custos de dutos e pavimentação.	
Fornecedor	- Aumento na venda de equipamentos.	- Alinhamento de custos por ganho em escala.	

#### **ELETROPAULO (2013)**



 Custo médio de uma Rede de Distribuição Subterrânea varia de 12 à 18 vezes o custo de uma Redes de Distribuição Aérea.

#### **ELETROPAULO (2016)**



#### PROJETO DE LEI N.º 5.858, DE 2013 (Do Senado Federal)

PLS n° 119/2011 Ofício n° 1.519/2013 - SF

Altera as Leis nº 6.768, de 19 de dezembro de 1979, que dispõe sobre o parcelamento do solo urbano, e nº 10.257, de 10 de julho de 2001 (Estatuto da Cidade), para dispor sobre a implantação de redes subterrâneas de infraestrutura básica previamente às obras de pavimentação e condicionar a concessão de financiamento federal para obras municipais ao cumprimento dessa disposição.

#### DESPACHO: AS COMISSÕES DE:

AS COMISSOES DE: VIAÇÃO E TRANSPORTES; DESENVOLVIMENTO URBANO; FINANÇAS E TRIBUTAÇÃO (MÉRITO E ART. 54, RICD) E CONSTITUIÇÃO E JUSTIÇA E DE CIDADANIA (ART. 54 RICD) APENSE-SE A ESTE O PL 4931/2013.

APRECIAÇÃO:

Proposição Sujeita à Apreciação Conclusiva pelas Comissões - Art. 24 II



## **PROPOSED MODEL - INFRAVIA SYSTEM**











### **INFRAVIA SYSTEM – CROSS SECTION**



**In the sidewalk (F): (A)** Natural Gas, **(B)** Telecommunications, Cable TV, Data, **(C)** Potable Water/ fire-fighter system (concept with Standpipe), **(D)** Electric lines (low), **(E)** Electric lines (medium) / Public Illumination, **(Q)** Basis and drainage structure system – made with recycled gravel from bricks and concrete construction waste, **(R)** sand cover, **(S)** Recycled Plastic Walls – INFRAVIAS structure.

**In the Bike Lane (H): (I)** Natural Gas main, **(G)** Sewer, **(T)** Recycled water pipeline.

**Storm water drainage (J)**: (eco drainage system) -(O) Concrete curb, (N) Vegetation (Specific plant species to assist in the filtration of rain water), (L) Eco Filter – To filter the rain water and – made with recycled gravel from bricks and concrete construction waste, (M) Drainage pipe – to collect the rain water, (J) Aperture for rainwater entrance

**Street (P)**: without underground facilities, there are improvements in urban mobility and the traffic and increases the life of the pavement due to lower interference in maintenance these.



## **INFRAVIA SYSTEM - DETAIL**



#### FLOWCHART OF THE BASE PRODUCTION AND DRAINAGE SYSTEM WITH RECYCLED AGGREGATE ARISING FROM CONSTRUCTION WASTE



ILLEGAL DEPOSIT FROM CONSTRUCTION WASTE



WASTE CONSTRUCTION IS DIRECTED TO RECYCLING UNIT, MECHANICALLY SEPARATED AND SENT TO THE CENTRAL CRUSHING



IN THE CENTRAL CRUSHING, THE WASTE IS PROCESSED AND SIEVED



EQUIPMENT FOR THE CONSTRUCTION WASTE CRUSHING AND SEPARATION OF PARTICLE SIZE THROUGH SIEVES TO PRODUCE RECYCLED GRAVEL AND SAND



RECYCLED SAND FROM THE CONSTRUCTION WASTE CRUSHING.



RECYCLED GRAVEL FROM THE CONSTRUCTION WASTE CRUSHING.



GRAVEL (DRAINAGE LAYER) AND SAND (BASE STRUCTURE ) - SIDEWALK BASE



(BIKE LANE BASE)

EACH METER OF THE O INFRAVIA SYSTEM (SIDEWALK) CONSUME NEARLY 1,500 CIVIL CONSTRUCTION WASTE KILOS.

EACH METER OF THE O INFRAVIA SYSTEM (BIKE LANE) CONSUME NEARLY 2.000 CIVIL CONSTRUCTION WASTE KILOS.

EACH METER OF THE O INFRAVIA SYSTEM (ECO DRAINAGE SYSTEM) CONSUME NEARLY 1500 CIVIL CONSTRUCTION WASTE KILOS.

A TOTAL OF THE 5.000 WASTE CONSTRUCTION KILOS EACH METER OF THE O INFRAVIAS SYSTEM.

JUST IN ONE BLOCK (200X50 METERS), 2.500 TON OF WASTE CONSTRUCTION IS REMOVED FROM THE NATURE

BULK DENSITY: RECYCLED SAND: 1.300 Kg/m<sup>3</sup> RECYCLED GRAVEL:1.200 Kg/m<sup>3</sup>



# FLOWCHART OF THE RECYCLED PLASTIC PANELS PRODUCTION IN THE INFRAVIA® SYSTEM, DERIVED FROM URBAN AND INDUSTRIAL WASTE



THE RECYCLED PLASTIC IS SEPARATE FROM THE URBAN WASTE BY RECYCLING COOPERATIVE AND SENT TO FACTORY IN STATE PRISON.



THROUGH THE SOCIAL PROJECT INSIDE THE STATE PRISON, THE WASTE (PLASTIC) IS TRANSFORMED IN RAW MATERIAL FOR RECYCLED PLASTIC PRODUCTION



THE RECYCLED PLASTIC IS TRANSFORMED ON PLATES, RAW MATERIAL TO THE INFRAVIA SYSTEM



INSIDE THE FACTORY, THESE PLATES ARE PROCESSED IN PANELS FOR INSTALLATION TO THE INFRAVIA SYSTEM



INFRAVIA SYSTEM PROTOTYPE IN REAL SCALE MOUNTED AND TESTED.



QUALITY CONTROL AND SHIPMENT BATCH TO ASSEMBLY.





#### **INFRAVIA SYSTEM – ASSEMBLY**





## PILOT PROJECT SAPIENS PARQUE









#### **INFRAVIA SYSTEM – ASSEMBLY - PLASTIC PANEL**











#### **IMPLEMENTATION OF THE FACILITIES INFRASTRUCTURE**











## **CONNECTION BOXES SYSTEM**











#### **NATURAL GAS VALVE IMPLANTATION - MAINLINE**











### **CONSUMER AND MAINLINE VALVE - NATURAL GAS**



## **COVER WITH SAND - FACILITIES PROTECTION**











#### **BIKE LANE AND DRAINAGE SYSTEM**













# **CORNER DETAIL**









# **ASSEMBLED SYSTEM**





# **SYSTEM ADVANTAGES**



- QUICK REMOVAL OF PAVEMENT.
- WITHOUT DESTRUCTION OF STREET PAVEMENT.
- WITHOUT DEMOLITION OR GARBAGE.
- ONLY 2 WORKERS IN 10 MINUTES.
- WITHOUT TRANSIT INTERRUPTING.
- EXCAVATION WITH VACUUM SYSTEM.
- 100% SAFE, CLEAN AND VERY QUICK.
- ONLY 1 WORKER IN 20 MINUTES.
- TOTAL REUSE OF MATERIAL.
- COST REDUCTIONS OF IMPLEMENTATION OF THE ORDER OF 30%.
- REDUCTION OF 70% IN IMPLANTATION A NEW DERIVATION (NATURAL GAS CONSUMER)



# SYSTEM ADVANTAGES



- EXCAVATION DEPTH BELOW 1.25 M NO NEED SHORING.
- UNNECESSARY THE USE OF EXCAVATION EQUIPMENT AND THE CUTTING TOOL.
- POSSIBILITY OF USING SUCTION EQUIPMENT TO REMOVE MATERIAL FROM THE TRENCH.
- EXCLUDING THE POSSIBILITY OF ACCIDENTAL CONTACT.
- FACILITIES IN DEFINED POSITIONS.
- PRECISE KNOWLEDGE OF THE LOCATION OF EACH UTILITY.
- DERIVATIONS AND INTERCONNECTIONS WITH DEFINED PARAMETERS.





INFRAVIA | Sustainable Complete Streets https://www.youtube.com/watch?v=oz58lvM2PgY&t=6s





# **Obrigado / Thank you**

# Aloisio Pereira da Silva. *Civil Engineer, Dr.*

# FOLLOW THE INFRAVIAS PROJECT

#### www.infravias.com facebook.com/infravia twitter.com/infravias flickr.com/infravias apengenharia@gmail.com



