

An experience for the future:  
Innovation and design for the resilience of  
tunnels and infrastructure of the Liguria region

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***We but mirror the world. If we could change ourselves, the tendencies in the world would also change. As a man changes his own nature, so does the attitude of the world change towards him. This is the divine mystery supreme.***

—  
Mahatma Gandhi

**Infrastructure is a social value  
Maintenance is a strategic need**

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# Inspection and survey of infrastructures: a new challenge (2018-2019)

## Goals:

≈ 12 km of tunnels to be inspected (working line)

Non-compliances related to cracks

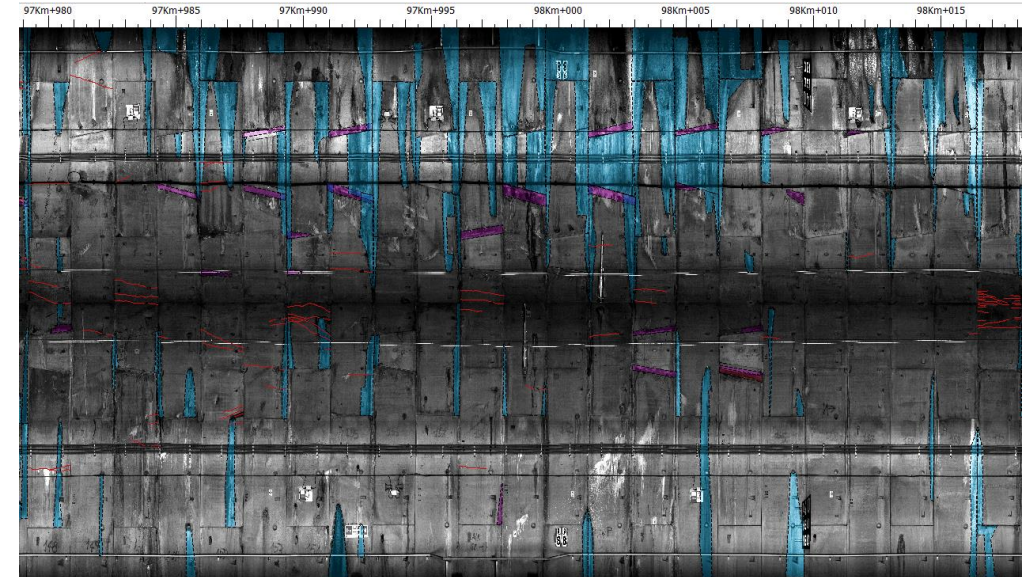
Speed-up the technical-management table

## Solutions:

ARCHITA

Tunneling engineering

A new environment for the data





# Inspection and survey: the Industrialization (2017-2019)



**ETS** 

Engineering Company  
for infrastructure maintenance

 **MICOS**  
IMPRESA DI COSTRUZIONI

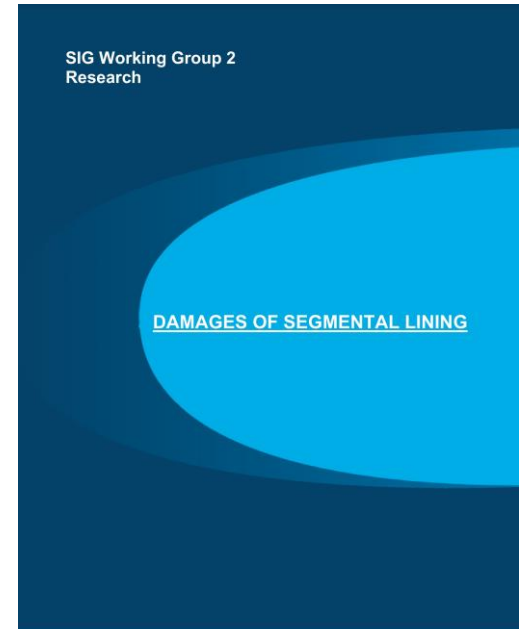
General Contractor  
for infrastructure maintenance



# Inspection and survey: the know-how gap (2016-2019)



WTC2019 - ITA WG2



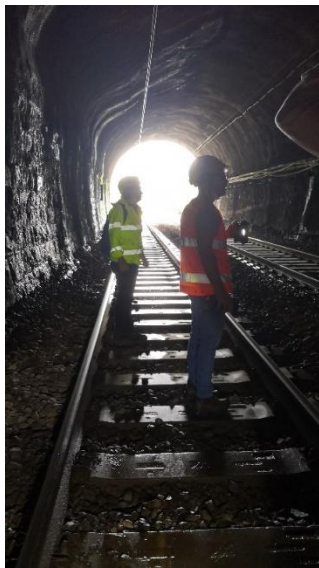
WTC2019 - SIG WG2  
(2016-2019)



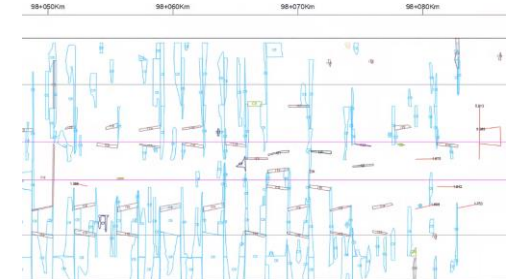
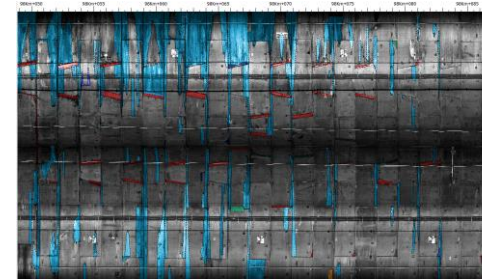
# Inspection and management: the new Engineering (2019)



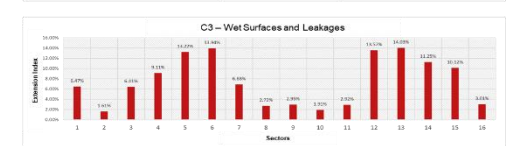
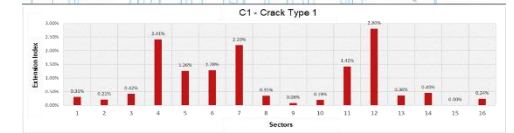
## State-of-the-art



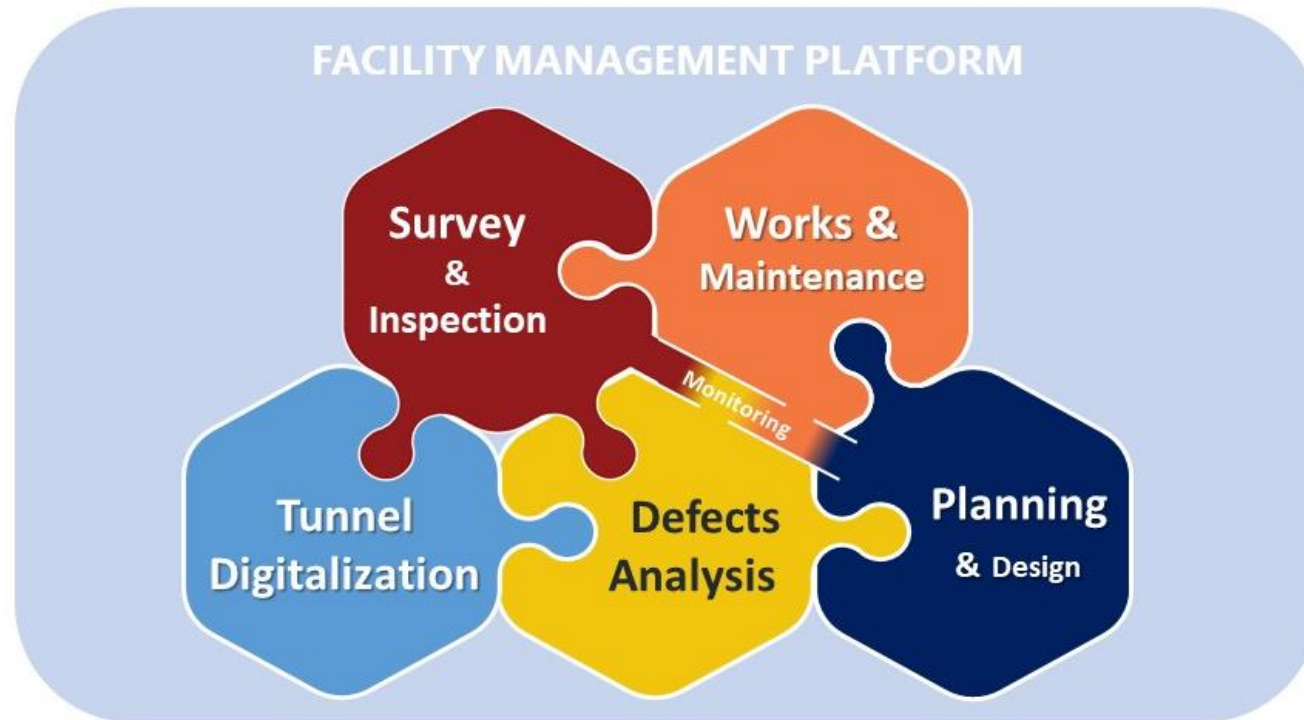
## Engineering in New Projects/Inspections



Water Defect					
<b>C6</b>	<b>Leakage trough the joints</b>				
	<p><b>Definition:</b> infiltration of water through the joints (longitudinal, transverse, mortar injection holes, segment connectors). Presence of humidity or water in the concrete following infiltration. The phenomenon occurs in the presence of imperfect or absent, waterproofing at the construction joints.</p>				
Unit of measure: m <sup>2</sup>					
Intensity Index	0.25	Surface stains deposited by salts and chlorides	Extension index	0.25	% [Total area/Sector Area]
	0.5	Deep deposit stains of salts and chlorides		0.5	% [Total area/Sector Area]
	0.75	Wet surface	0.75	% [Total area/Sector Area]	
	1	Dripping surface	1	% [Total area/Sector Area]	



# A new approach is born! (2019-2020)





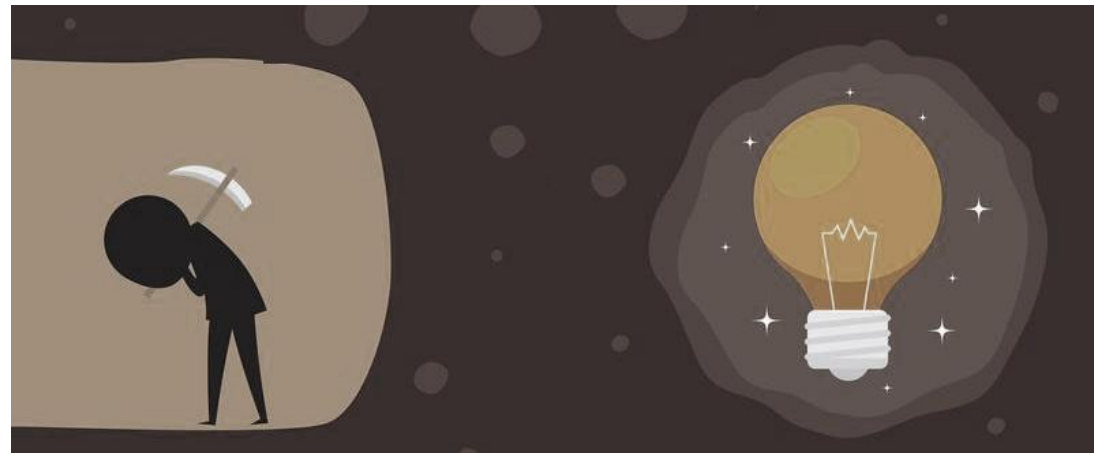
# Crossroads in 2020

## *COVID-19*

SHORTAGE OF CONSTRUCTION SITES  
DIFFICULTIES OF SUPPLIERS  
CHALLENGES IN COMPANY AND R&D PLANNING

## *INSPECTION BOOM IN ITALY*

ESPECIALLY HIGHWAY  
OLD-SCHOOL INSPECTION AND SCARCITY OF INNOVATION





# The Ground Engineering Awards (2020)



# New innovations in projects! (2020-2022)

## The Alassio Experience

SPATIAL IT ENVIRONMENT

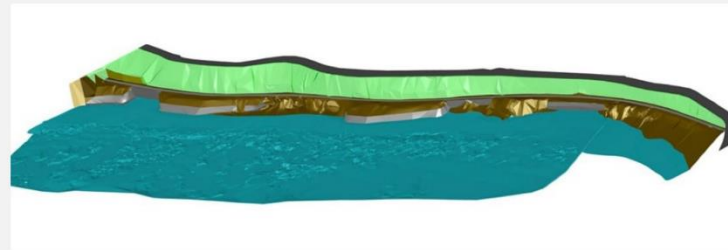
### MAPPING

with priority index values distribution

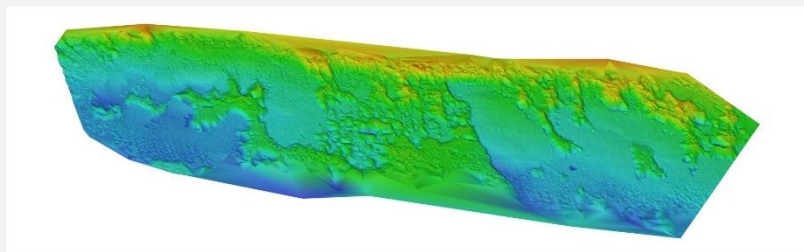


### TOPOGRAPHIC AND BATHYMETRIC

3D model after the landslide



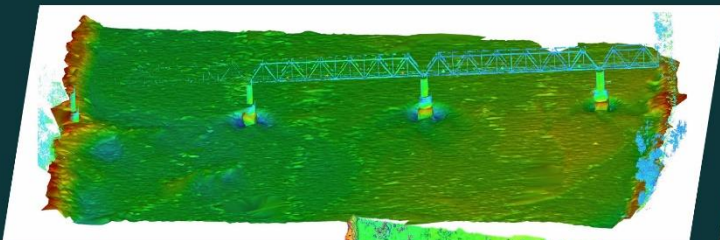
### BATHYMETRIC survey



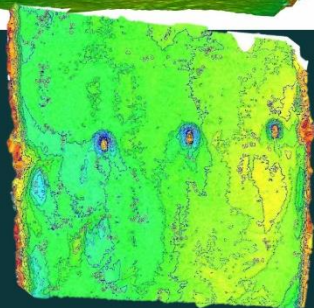
# New innovations in projects! (2020-2022)



## DIGITALIZATION AND CHARACTERIZATION OF RIVER-SEA BEDS



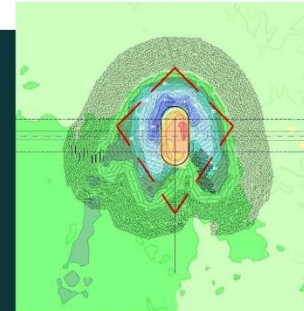
Advanced equipment (USV) and implemented algorithm allowed 3D bathymetry with a precision/accuracy of the centimeter.



## INTEGRATION WITH DESIGN ANALYSIS AND QUANTITY TAKE OFF



The riverbed geometries-characterization is integrated directly in the software for the hydraulic analysis of the erosion and the slope stability of the levees. The configuration of intervention is detailed in the early stage, calculating the exact quantity take-off.

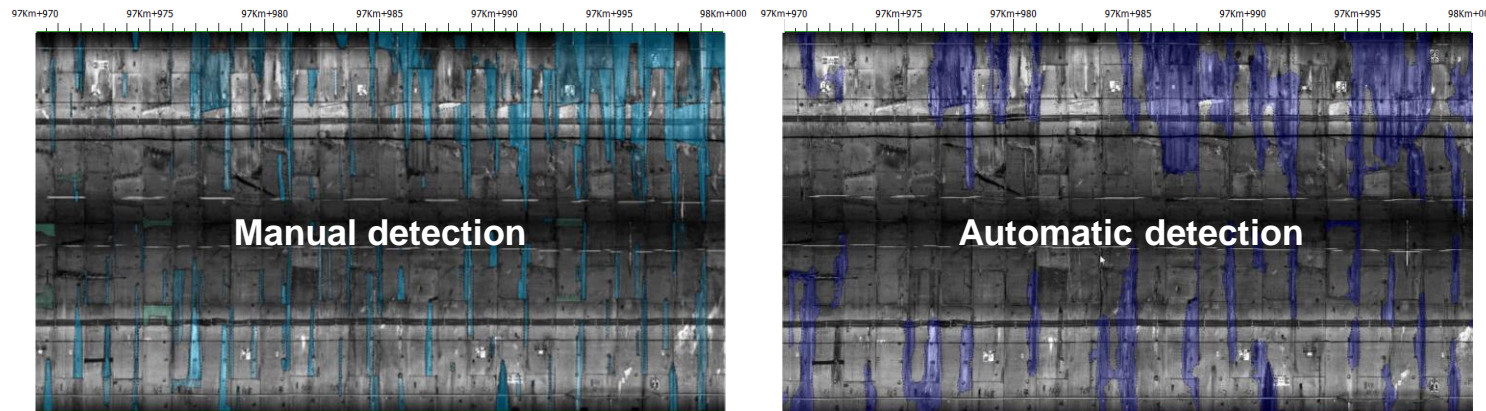




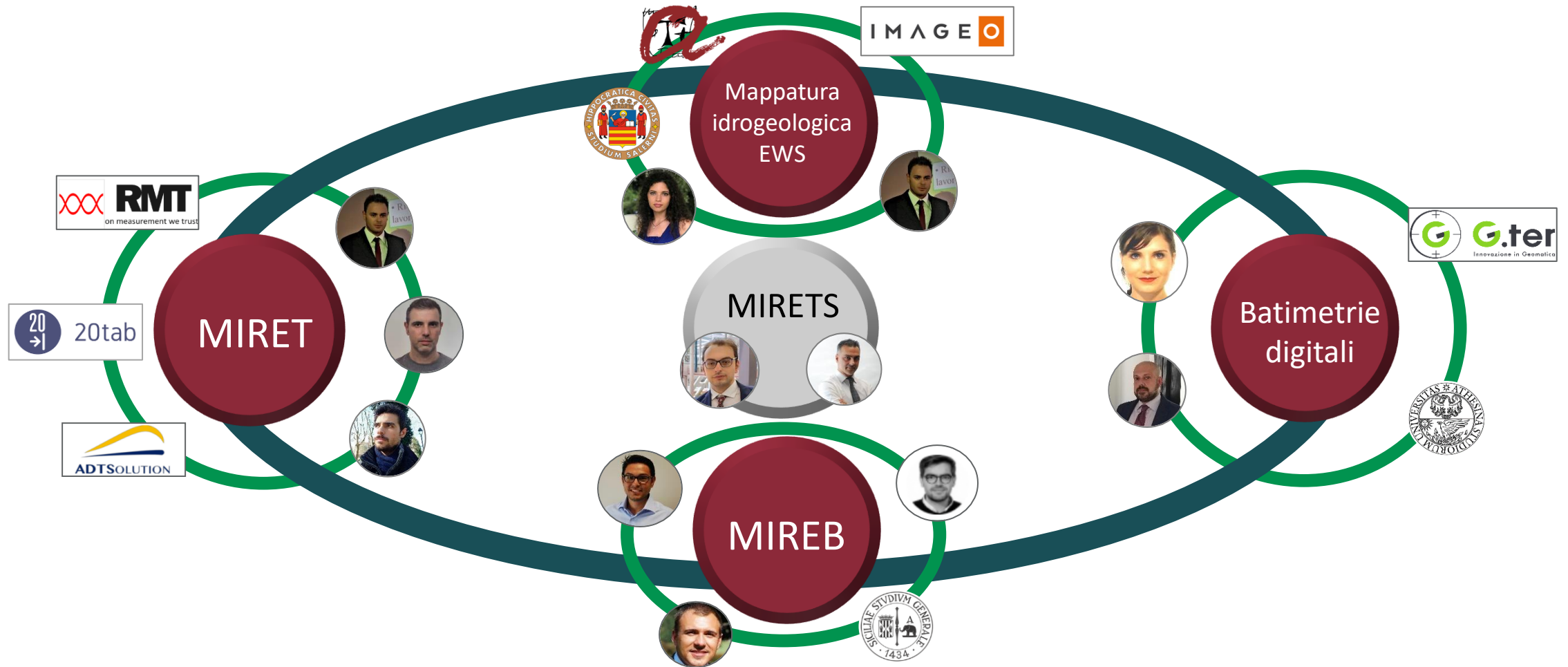
# New innovations in projects! (2020-2022)



## Artificial intelligence and image processing in the MIRET approach for the water detection and integrated geotechnical management of existing mechanized tunnels: methodology, algorithm and case study

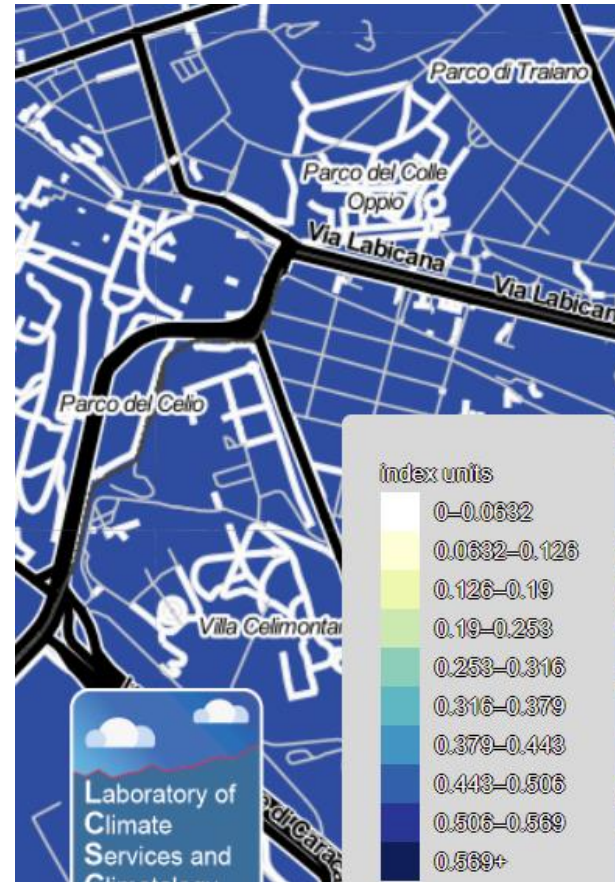


# ...the R&D Department is officially born! (2021)





# We have just started (>2022)



First co-created **CLIMATE CHANGE** risk analysis for infrastructures

Integration of innovation and design in **SUSTAINABILITY** protocols



# Team and collaboration... the real force!



Thank you for your attention

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