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ASSETS4RAIL

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# Project Meeting
## Rome 8 - 9. 1. 2020

# Short presentation of: WP1 Monitoring bridges and tunnels
# Task 1.1, 1,2 and 1.3 objectives, status and main challenges

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# WP 1: Monitoring bridges and tunnels [ Objectives ]

Task 1.1 Subsurface tunnel defect detection

+

Task 1.2 Noise and vibration emission monitoring

+

Task 1.3 Scanning, imaging and structural indicators

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# WP 1: Monitoring bridges and tunnels [ Objectives ]

**Task 1.1 Subsurface tunnel defect detection** +

- Finding the most suitable methods to inspect tunnel wall condition
- Develop best practice guidelines to interpret and analyse measured data

**Task 1.2 Noise and vibration emission monitoring** +

- Devise a noise monitoring system specifically for railway bridges
- Vibration + Noise monitoring
- Generate the least possible interference with regular rail traffic

**Task 1.3 Scanning, imaging and structural indicators**

- Use autonomous drones for infrastructure
- Deffect detection, visual scanning and 3D reconstruction of assets using drones

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# WP 1: Monitoring bridges and tunnels [ Deliverables ]

Task 1.1 Subsurface tunnel defect detection + Task 1.2 Noise and vibration emission monitoring + Task 1.3 Scanning, imaging and structural indicators

Deliverables

| D1.1. Preliminary Report on Subsurface Defects Detection Solution for Railway Tunnels | D1.2. Report on a noise emission monitoring solution for steel railway bridges | D1.3. Preliminary Report on Subsurface Defects Detection Solution for Railway Tunnels |
|---|---|---|
| Submitted ✓ | Submitted ✓ | Submitted ✓ |

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Information provided by: LORAM

# Task 1.1: Subsurface tunnel defect detection [ Status ]

## Current status

- Ran some tunnel survey test in road Tunnel in Finland
- Waiting for access to railway tunnel to start data collection and analysis

## Main results and findings

**GPR**

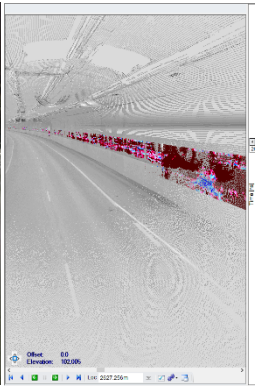
- tunnel lining thickness and anomalies
- subsurface moisture

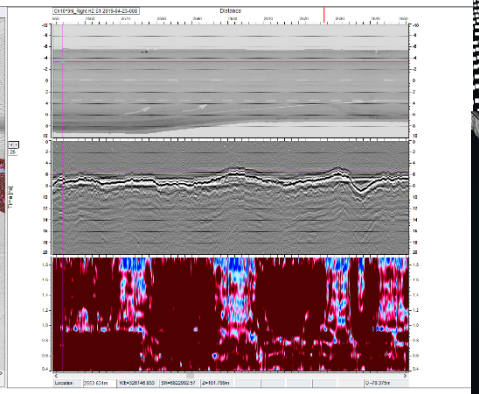
**Thermal camera**

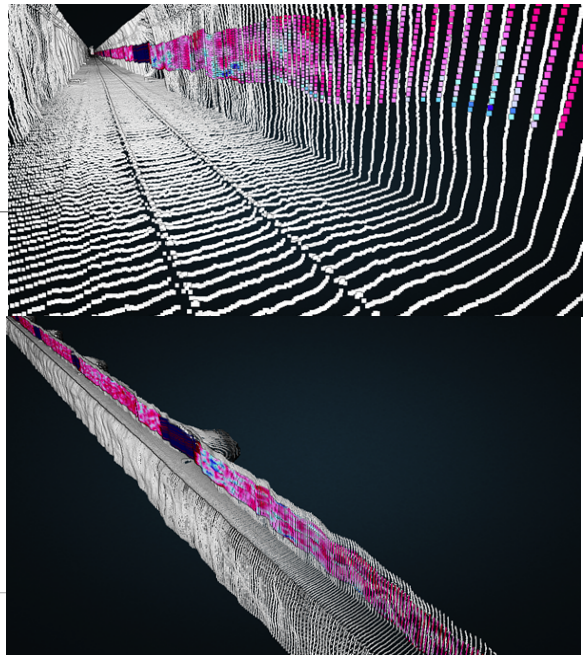
- lining surface and few centimeters in depth moisture

**2D Laser scanner and 3D LIDAR**

- 3D model of tunnel







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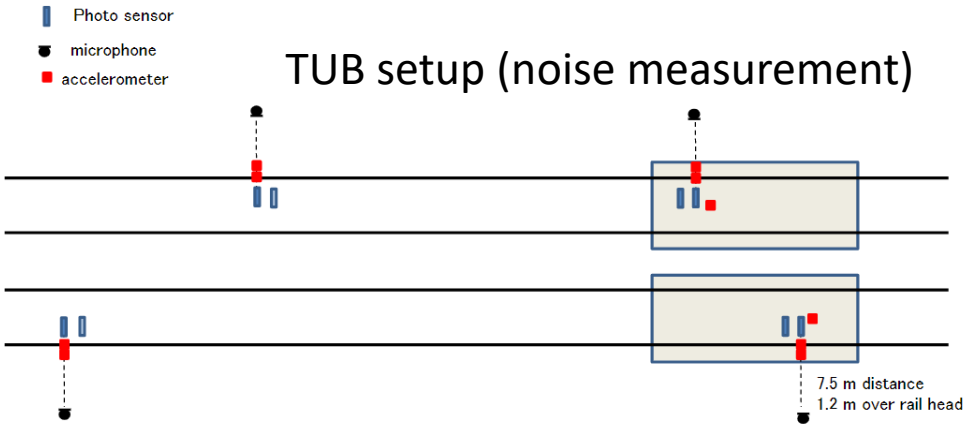
Information provided by: ZAG

# Task 1.2: Noise and vibration emission monitoring [Status]

## Current status

Pressig (DE) (7 - 13. 10. 2019) - data analysis expected end of Jan 2020

Two test bridges on a single convenient location.

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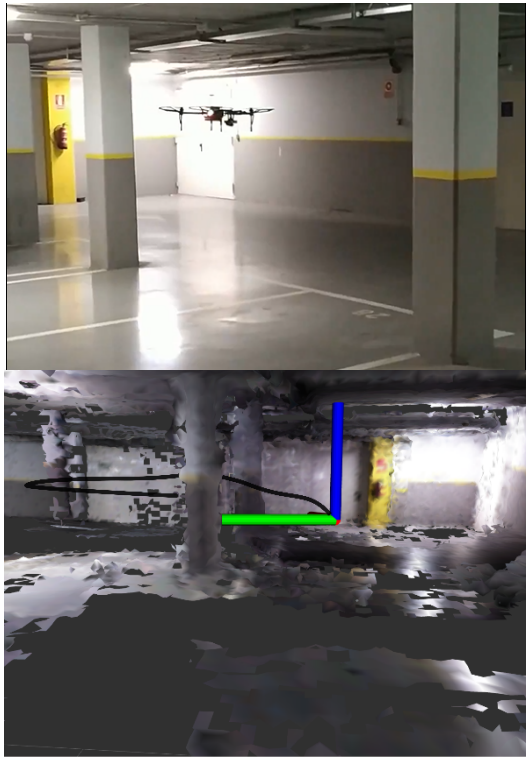
# Task 1.3: Scanning, imaging and structural indicators [ Status ]

## 3D Planning and Mapping



**Mapping**
Orbbec Astra depth camera

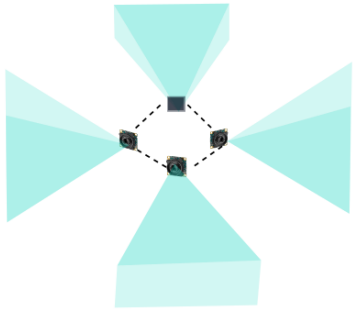
**3D Planning**
Smooth trajectories in complex environments

**Autonomous control**
Obstacle avoidance
Low – light environment

**Next Steps:**
Optimized planner to maximize asset coverage

## Visual Inspection Payload

Requirements:
- Software and hardware trigger
- High update rate
- Low weight
- High resolution
- Good results in low light conditions



**Next Steps:**
Install Multi-camera System
+
Process multiple images

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# TASK 1.2 Challenge: Reduce cost of the system

## Cost reduction and persistent monitoring for Steel Railway Bridges

| Current setup | Challenge setup |
|---|---|
| ***Noise monitoring:*** | ***Noise monitoring:*** |
| Commercial Multi-Channel noise measuring solution<br>Cost: ~20.000 € | ???<br>(4-channel, 40 kHz sample rate, all-weather, off-the-shelf?)<br>Cost: ???<br>Suggested ~400 € per channel |
| ***Vibration monitoring:*** | ***Vibration monitoring:*** |
| Commercial Laser Doppler Vibrometer (LDV)<br>Cost: ~100.000 ~ 150.000 € | ???<br>(Contactless vibration monitoring, near-field microphone solution?)<br>Cost: ??? €, but less then current |

Main advantage to lower cost system would be to allow in practice for longer timeframe or even persistent monitoring!

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# Task 1.3 Challenge: Visual Inspection Payload Design

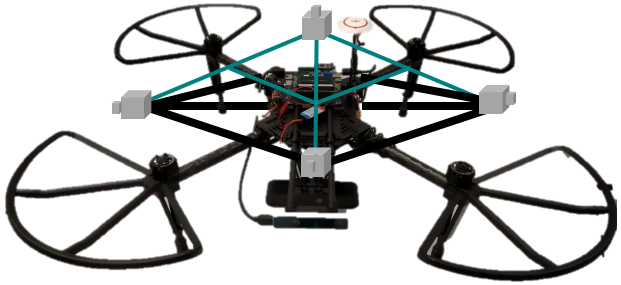
## Requirements

| | vs. |
|---|---|
| Modular for different type of UAVs | Custom design |
| Avoiding occluding images (images occluded by the drone structure) | Maintaining centrum of inertia |
| Low weight | Resistant Structure |
| Maximum coverage | Minimum Nr. of cameras |
| Rigid structure (not flexible with the drone's movement) to avoid blurring images | |

**Assumptions:**

HFOV ~ 90º

VFOV ~ 75º



Example of a custom design for the M100 drone

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# ASSETS4RAIL

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Thank you for your attention!

For further questions please do not hesitate to contact the coordinator:

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