

PROJECT

## **ROBO-SPECT**

# **ROBotic System with Intelligent Vision and Control for Tunnel Structural INSPECTion and Evaluation**

**Funding:** European (7th RTD Framework Programme)

**Duration:** Oct 2013 - Sep 2016

**Status:** Complete

**Total project cost:** €4,775,531

**EU contribution:** €3,300,000



**Call for proposal:** FP7-ICT-2013-10

[CORDIS RCN : 110721](#)

### **Background & policy context:**

A large number of underground transportation tunnels have been in operation for more than half a century and are in dire need for inspection, assessment and maintenance. Things are bad to the point that there have been a number of failures resulting in collapses in tunnels in recent years which highlighted the need for better ways to inspect and assess the tunnel stability of in-service tunnels.

ROBO-SPECT adapts and integrates recent research results in robotics, computer vision and non-destructive sensing in an innovative, integrated, robotic system that automatically scans the intrados for potential defects on the surface and detects and measures radial deformation in the cross-section, distance between parallel cracks, cracks and open joints that impact tunnel stability, with mm accuracies. This permits in one pass, both the inspection and structural assessment of tunnels.

### **Objectives:**

The main goal of the project is to develop an autonomous robotic inspection and assessment system for tunnels that will include: (a) a computer vision system that will detect structural defects and colour changes at the concrete lining intrados, (b) a sensor system that will measure the depth of cracks and the depth of opening of joints of interest with an accuracy of 1 mm and the width of these cracks and openings with an accuracy of 0.1 mm and (c) laser equipment able to measure radial deformation with an accuracy of 1 mm, while it will be integrated with software that based on the above measurements will assess the structural condition of the inspected tunnel.

The ROBO-SPECT system will be tested at a research infrastructure of tunnels in Switzerland and at actual tunnels in UK and Greece.

### **Methodology:**

ROBO-SPECT proposes specialised work to adapt, extent and validate recent exploitable research results that will provide the required functionalities and intelligence to an automatic, multi component and multi-degree of freedom robotic system that will credibly, efficiently and inexpensively perform both inspection and assessment of the tunnel in a single pass.

The work includes the following steps:

- Definition of user requirements and system architecture.
- Development of robotic navigation and intelligent positioning controllers.
- Development of the computer vision system for real time defect detection.
- Development of ultrasonic sensors for the measurement of width and depth of cracks and openings.
- Structural assessment based on measurements at the intrados.
- Integration of the whole system.
- Field evaluation and benchmarking of the integrated system at a research infrastructure of tunnels in Switzerland and at actual tunnels in UK and Greece.

**Parent Programmes:**

[FP7-ICT - Information and Communication Technologies](#)

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

**Lead Organisation:****Institute Of Communication And Computer Systems****Address:**

Patission  
10682 Athens  
Greece

**Organisation Website:**

<http://www.iccs.gr>

**EU Contribution:** €565,645

**Partner Organisations:****Egnatia Odos Ae****Address:**

Chlm Thessalonikis-Thermis  
57001 Thessaloniki  
Greece

**Organisation Website:**

<http://www.egnatia.gr/>

**EU Contribution:** €120,000

**Robotnik Automation SII****Address:**

CARRER DE BARCELONA, 3-A. P.I. FUENTE DEL JARRO  
46988 PATERNA  
Spain

**Organisation Website:**

<http://www.robotnik.es>

**EU Contribution:** €313,575

**Risa Sicherheitsanalysen Gmbh****Address:**

Krumme Strasse  
10627 Berlin  
Germany

**Organisation Website:**

<http://www.risa.de>

**EU Contribution:** €254,087

**T.e.c.n.i.c. Tecniche E Consulenzenell'ingegneria Civile-Consulting Engineers-Spa****Address:**

Via Panama

198 Roma  
Italy

**Organisation Website:**

<http://www.tecnic-spa.it>

**EU Contribution:** €184,240

**D. Mpairaktaris Kai Synergates-Grafeion Technikon Meleton Etaireia Periorismenis Efthynis**

**Address:**

PESMATZOGLOU 17  
14561 ATHINA  
Greece

**EU Contribution:** €181,128

**Consiglio Nazionale Delle Ricerche**

**Address:**

Piazzale Aldo Moro  
185 Roma  
Italy

**Organisation Website:**

<http://www.cnr.it>

**EU Contribution:** €259,574

**Cassidian**

**Address:**

BOULEVARD JEAN MOULIN - ZAC DE LA CLEF SAINT PIERRE 1  
78990 ELANCOURT  
France

**Organisation Website:**

<http://www.cassidian.com>

**EU Contribution:** €408,265

**Ecole Nationale Des Ponts Et Chaussées**

**Address:**

6 À 8 Avenue Blaise Pascal- Cité Descartes  
77455 CHAMPS SUR MARNE  
France

**Organisation Website:**

<http://www.enpc.fr>

**EU Contribution:** €376,256

**Vsh Hagerbach Test Gallery Ltd**

**Address:**

Polistrasse, Hagerbach  
8890 Flums  
Switzerland

**Organisation Website:**

<http://www.hagerbach.ch>

**EU Contribution:** €231,900

**Universidad Carlos iii De Madrid****Address:**

Calle Madrid  
28903 Getafe (Madrid)  
Spain

**Organisation Website:**

<http://www.uc3m.es>

**EU Contribution:** €405,330

**Technologies:**

Manufacturing processes  
Manufacturing processes for running gear

**Development phase:** Research/Invention

**STRIA Roadmaps:** Infrastructure

**Transport mode:** Multimodal transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Safety/Security

**Geo-spatial type:** Infrastructure Node