



DC3

PhD Enrolment: Politecnico di Milano, Italy

Duration: 36 Months

Specific Deliverable: SD4.2, SD5.3

Time Input: [WP4 (55%), WP5 (45%)]

Secondments:

DC3S1: Host: RamDk, Tobias Friis, (M13-M18) 6 months on sensor fusion and optimal placement industrial needs;

DC3S2: Host: UTH, Costas Papadimitriou,, (M31-M33), on sensor fusion and optimal placement

Decentralized Cumulative Damage for Novel Smart Bridges

Context

Estimating the weight of vehicles in transit, known as Weigh In Motion (WIM), is not just important for freight but also for estimating features from these responses to be related to bridge structural health monitoring (SHM) and similar infrastructure. Several challenges exist in road infrastructure SHM and using vehicular passage to estimate their health, including uncertainty bounds and variabilities from sensors/detection tools. The variabilities adversely impact historically calibrated results or degradation scenarios

Objectives (Ob):

Ob1: Evaluate the extent to which long term cumulative damage can be predicted for road bridges and related infrastructure (e.g. culverts, retaining walls) utilizing vehicular excitation through smart-edge devices and embedded sensors (e.g. accelerometer, strain gauge, optical fibre),

Ob2: Establish local processing units enabling sensor fusion and edge-AI.

Ob3: Trained neural networks on edge cameras for vehicle detection (type, number) with minimized errors and long term monitoring fused with other measurements to automatically

correlate and rapidly statistically validate weight estimates, and link to load restriction compliance and freight monitoring in an indirect way to assess structural health.

Ob4: Testing protocols for accountability, explainability, repeatability, human intervention and other aspects for responsible AI will be established, forming a first pathway towards future guidance.

Expected Results (R):

Overall: Developing an automated edge-AI solution framework for simultaneous estimation of vehicular axle weights and structural health of bridges and related infrastructure.

R1: Developing a low-power, inexpensive edge-sensor network with rapid installation capabilities assimilated with at-location AI-driven sensor fusion.

R2: Algorithms and lab validation for reliable vehicular axle weight estimates to advance weigh-in-motion technology via decentralized computing.

R3: Develop SHM solutions using developed technology and inverse estimates of system parameters with lab validation.

R4: Implementation and demonstration of reliability, accuracy and real-time capability of developed technology via full scale implementation leading to an authoritative open benchmark.

Contributions for Recruited Researchers over 36 months

Living Allowance: €137575.08

Mobility Allowance: €25560

Family Allowance: (where relevant) €17820

This position and related financial contributions is subject to the commencement of the project and agreement signed.