EUROPEAN COMMISSION

SEVENTH FRAMEWORK PROGRAMME

Community research
Research DG
H2 Surface Transport

SMART RAIL

SMARTRAIL – WP 2: Assessment and Modelling

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Roughan and O'Donovan Innovative Solutions (RODIS)

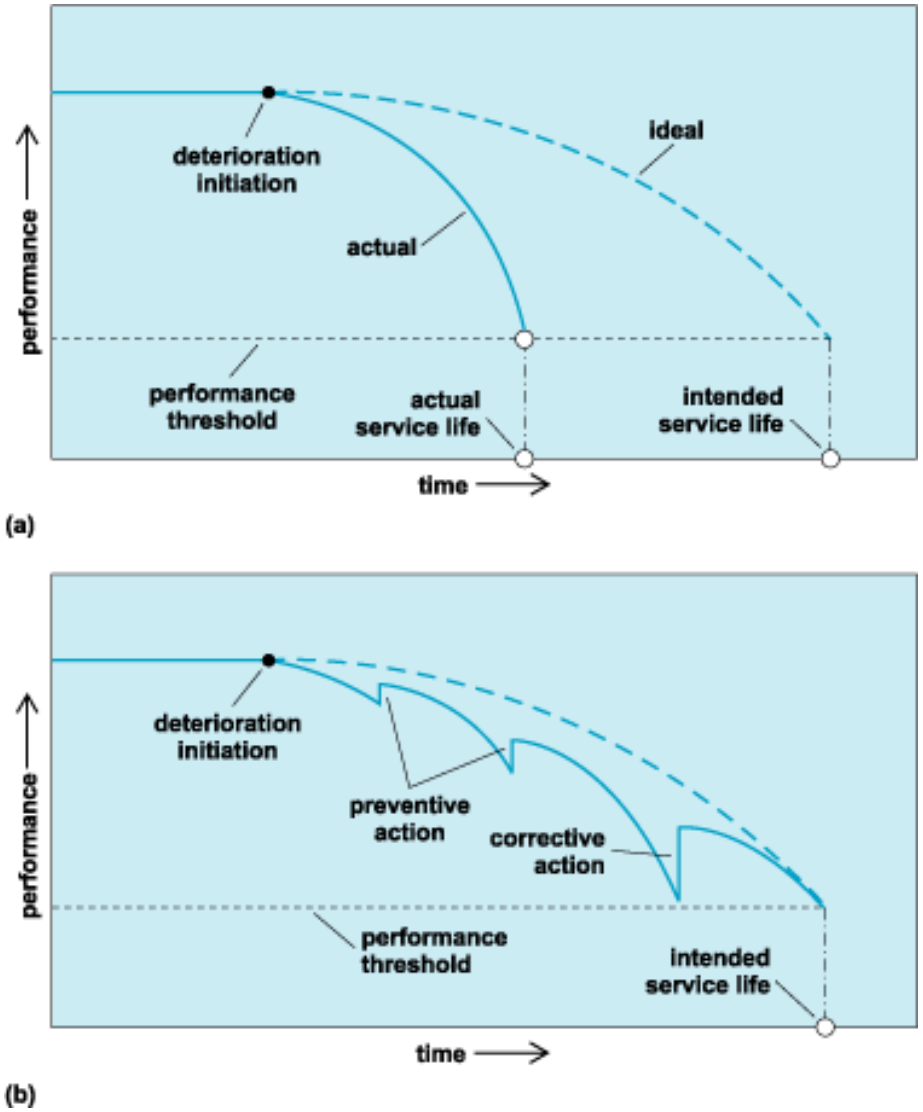
RODIS INNOVATIVE SOLUTIONS

Introduction

- **Current assessment methods**
  - Rely on visual inspections and
  - Deterministic Approaches

- **Work Package 2**
  - Goal to “Extend the life and optimise rehabilitation/renewal”
  - Develop a safety evaluation framework (evaluation of p_f?)
  - Incorporate information from SHM in safety computation
  - Analysing slope stability
  - Facilitate optimisation of planned interventions to extend working life

WP 2 – Assessment & Modelling



Work Package 2 Tasks

Task 2.1 – Develop a General Rail Transport Infrastructure Safety Framework (RODIS, FEHRL)

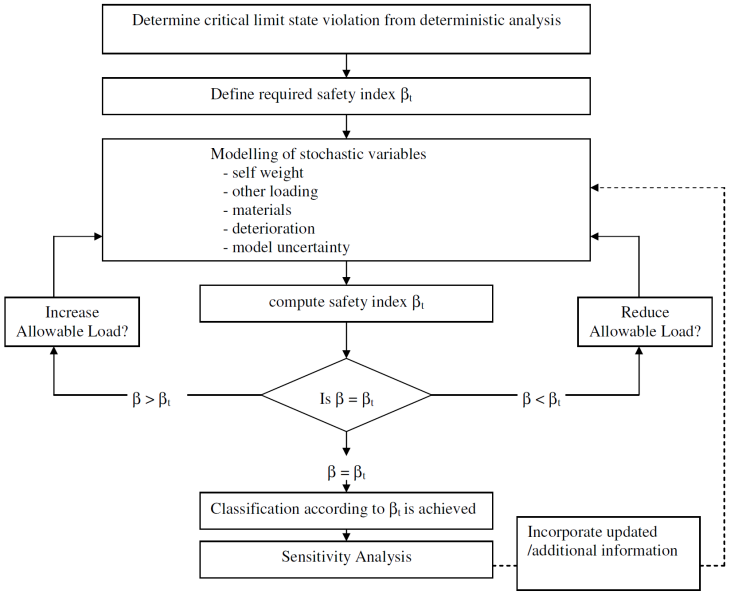
Task 2.2 – Incorporate Sensor, Inspection and NDT Data into Structural Safety Models (RODIS)

Task 2.3 – Slope Stability (UCD, RODIS)

Task 2.4 – Track Settlement and Stiffness (UON, TUM, IGH)

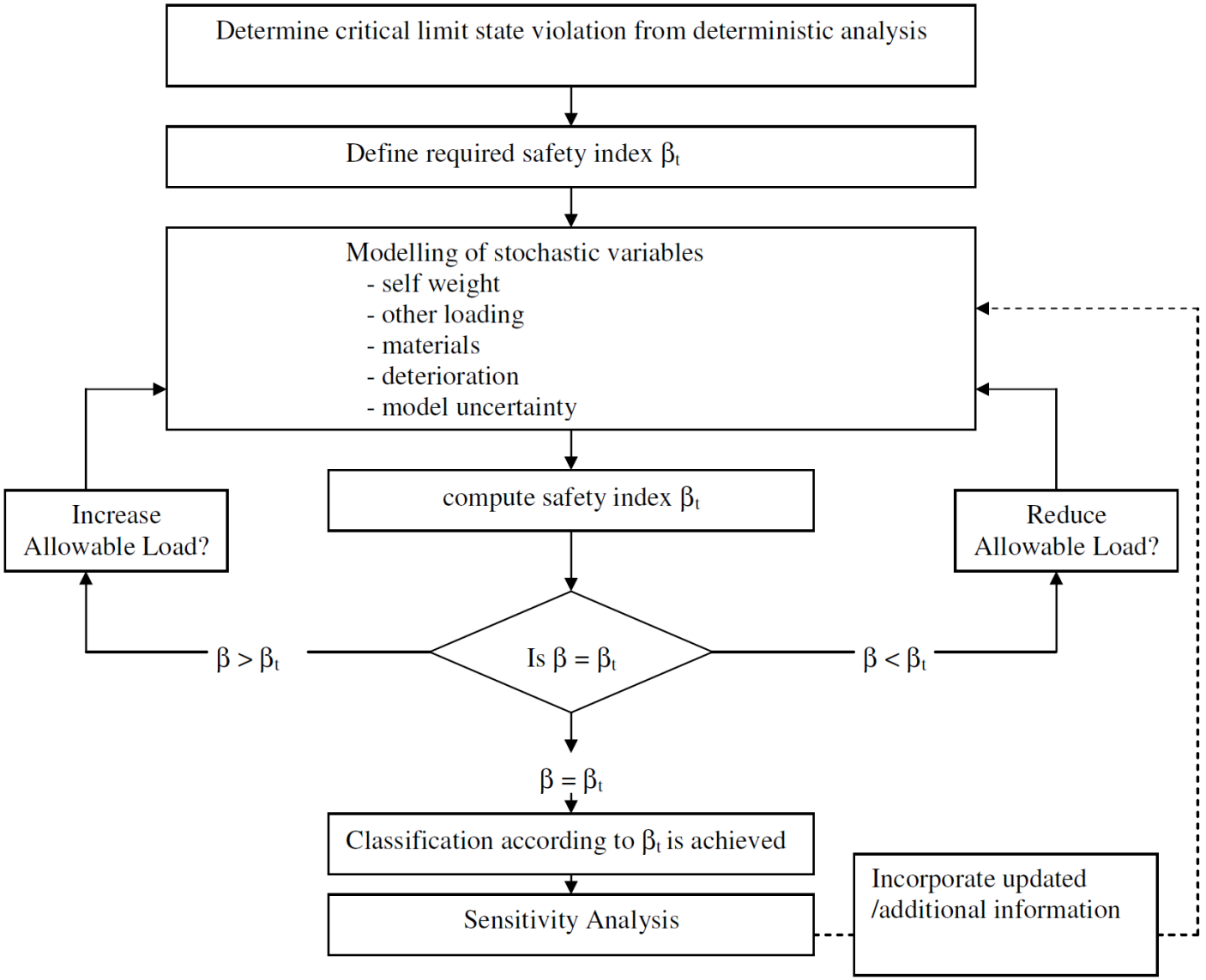
Task 2.1 – General Rail Transport Infrastructure Safety Framework

- **Probability based framework for optimised whole life management of infrastructure elements**



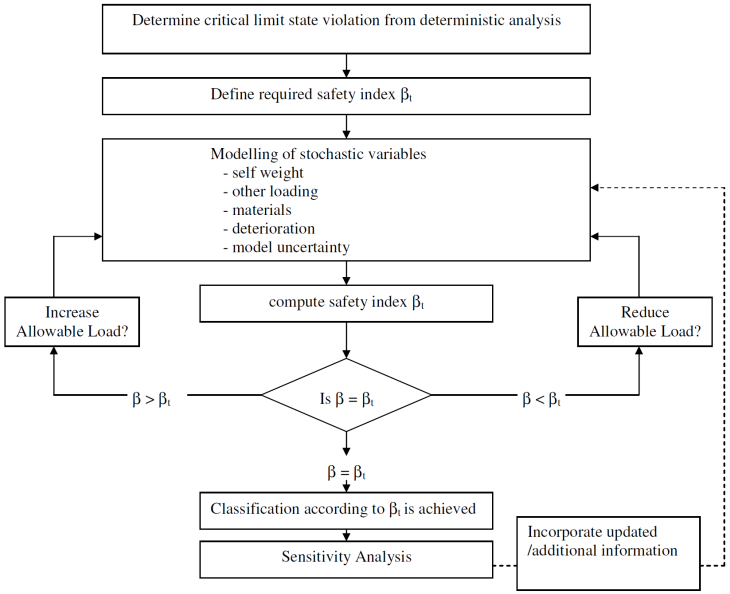
- **Simplified approach**

  Calibrate simplified approaches (e.g. partial factor approaches) based upon advanced approaches.


Determine critical limit state violation from deterministic analysis
Define required safety index β_t
Modelling of stochastic variables
- self weight
- other loading
- materials
- deterioration
- model uncertainty
compute safety index β_t
Increase Allowable Load?
Reduce Allowable Load?
$\beta > \beta_t$
Is $\beta = \beta_t$
$\beta < \beta_t$
$\beta = \beta_t$
Classification according to β_t is achieved
Sensitivity Analysis
Incorporate updated /additional information

Task 2.1 – General Rail Transport Infrastructure Safety Framework

- **Probability based framework for optimised whole life management of infrastructure elements**

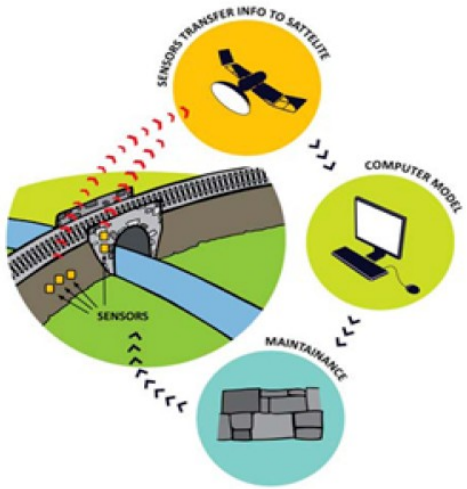


- **Simplified approach**

  Calibrate simplified approaches (e.g. partial factor approaches) based upon advanced approaches.

Task 2.2 – Incorporate Sensor, Inspection and NDT Data into Structural Safety Model

- **Real-time data**
- Condition of structure?
  - Data is currently an indicator rather than a true measure of structure condition
  - Data from sensors (e.g. instrumented Dublin-Wx Railway line) incorporated into structural safety model
    - determine level of safety
    - appropriate actions
      maintenance/replacement?



Task 2.3 Slope Stability

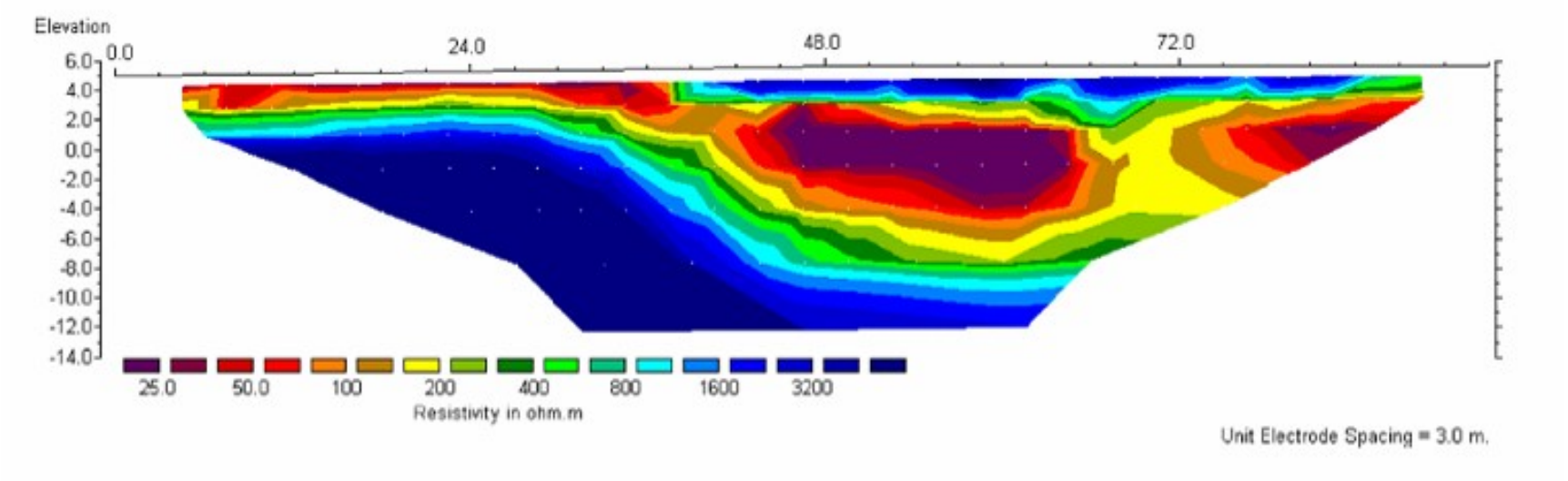
Rainfall induced slope failure outside Wicklow station (2009)

Slope failure near Castlebar Co. Mayo (2007)

Task 2.3 Slope Stability

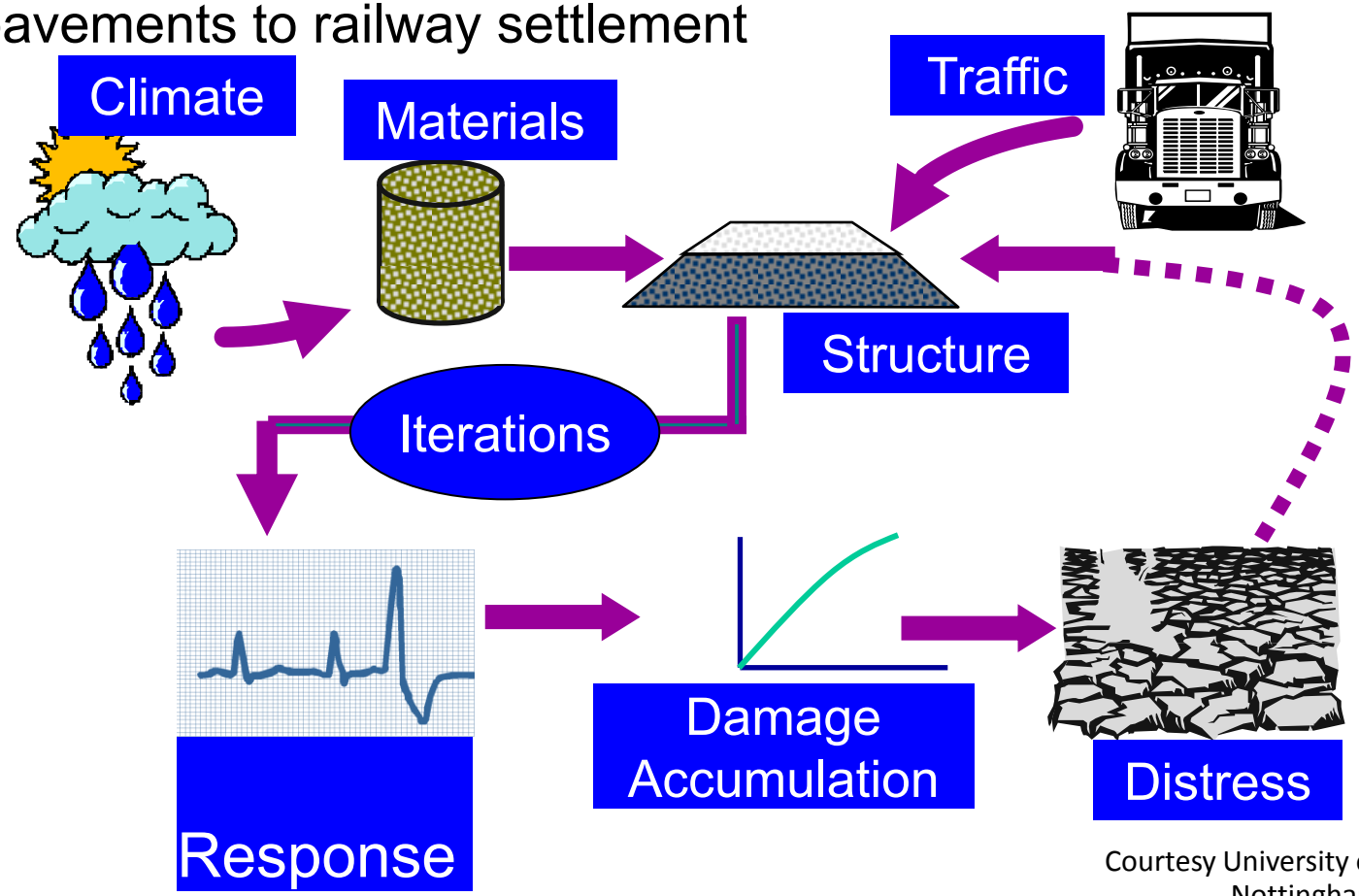
Aims:

- Develop new models of rainfall ingress and movement through slope and resulting risk of failure
- Incorporate NDT information/data into models (instrumented test slopes)



Task 2.4 Track Settlement and Stiffness

Adapt existing mechanistic/empirical models developed for road pavements to railway settlement



Courtesy University of Nottingham

Task 2.4 Track Settlement and Stiffness

Aims:

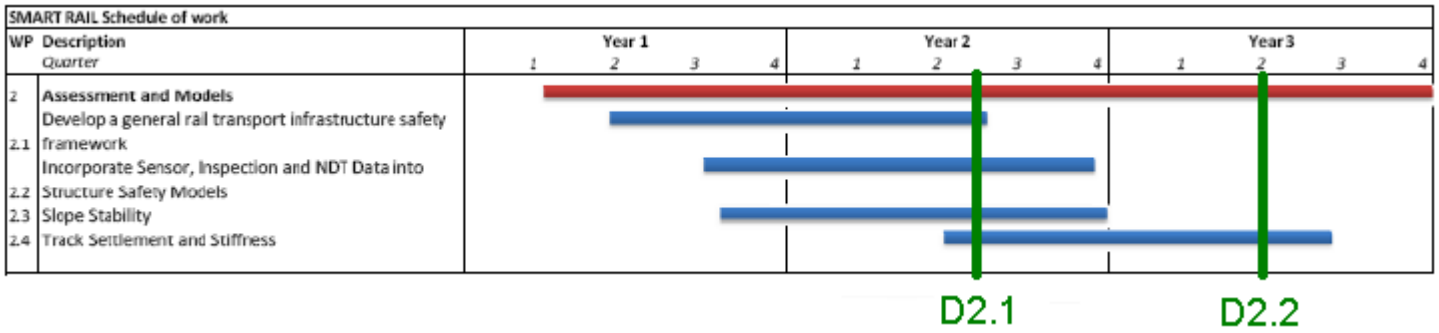
(i) Model the response (notably settlement) of an individual sleeper to repeated load, depending on ballast properties and subgrade stiffness.

(ii) Model the response of a length of track to the passage of trains, depending on axle load, speed, suspension stiffness, initial track quality (evenness), rail and sleeper details.

Deliverables

D.2.1 – Specification for non-intrusive test methods for assessing railway infrastructure *Month 20*

D.2.2 – Statistical methods to allow rail infrastructure management companies perform real-time analyses of monitored structures *Month 30*



Work Package 2 Summary

Work package number	WP2			Start date or starting event:			M3
Work package title		Assessment and Models					
Activity Type		RTD					
Participant number	1	2	4	8	12	9	11
Participant short name	UCD	MAV	FEHRL	**RODIS**	UoN	Adaptronica	IK
Person-months per participant:	9	10	10	15	10	3	5
							Total
							72

Discussion

Questions?