Session 1 - Plenary – How can we foster the Innovative maintenance of Transport Infrastructure?

FIRM15 - Innovative maintenance of Transport Infrastructure: Faster, cheaper, more reliable, safer, greener

Brussels, April 22-23, 2015

INDUSTRIAL PERSPECTIVE ON TRANSPORT INFRASTRUCTURE MAINTENANCE

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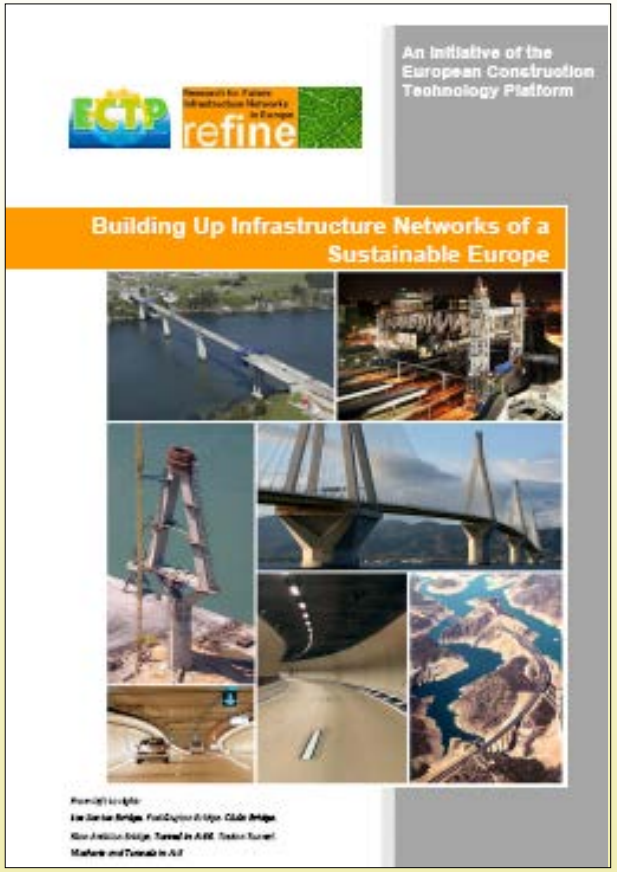
ECTP reFINE Initiative Leader / ENCORD Council member

ENCORD has **21 members with head offices in 11 European countries** and operations worldwide. The member companies are found regularly in the Top 50 European and Global Contractor lists and all together employ over 1.15 Million people and have combined annual revenue of over 205 Billion Euro.

ECTP reFINE initiative

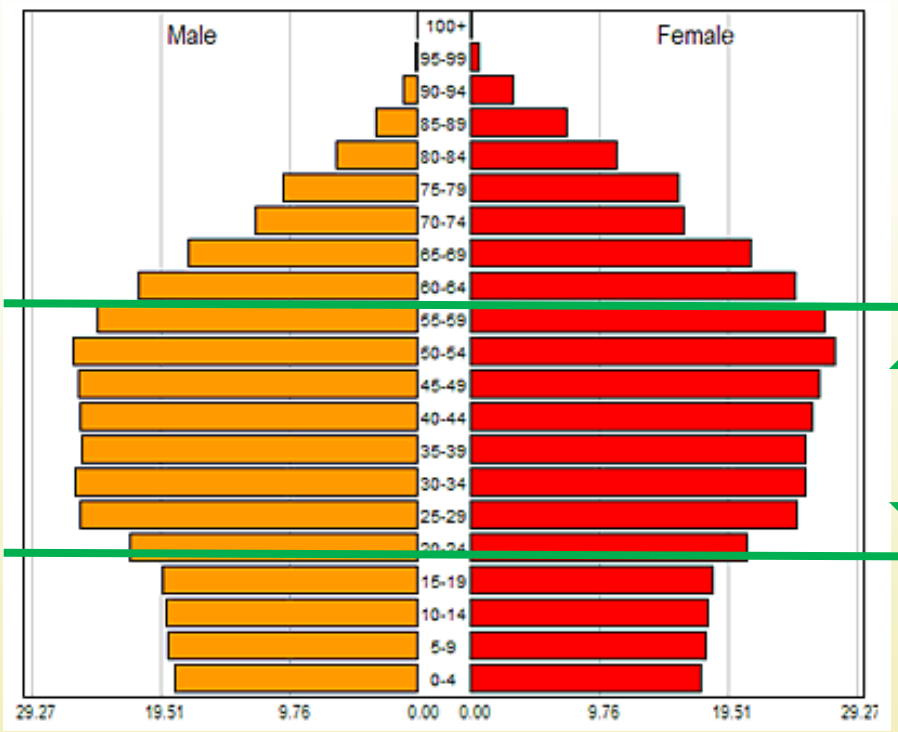
Research for Future Infrastructures in Europe

- ECTP initiative
- Vision Document
- Strategic Research Agenda:
  - ✓*Infrastructure of urban mobility*
  - ✓*Infrastructure of long distance Transport*
  - ✓*Greening infrastructures networks*
  - ✓*Smart and resilient infrastructure networks*
  - ✓*Infrastructure in an inclusive society*
  - ✓*Health and safety*
- Strategic Targets and Impact document.
- Roadmap.

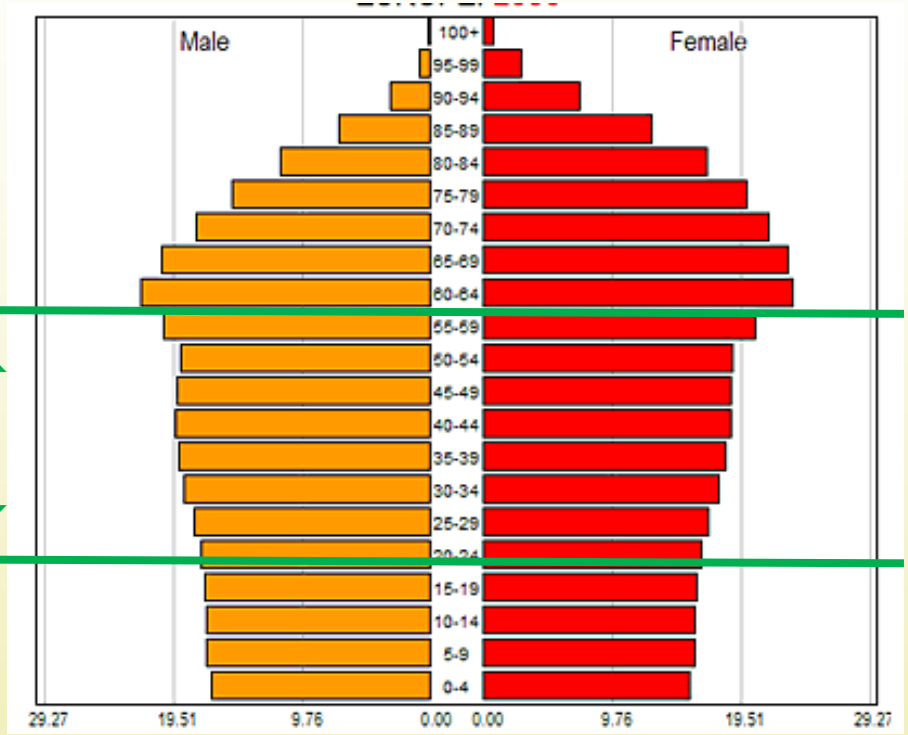


Who is going to pay?

EUROPE 2015



EUROPE 2050



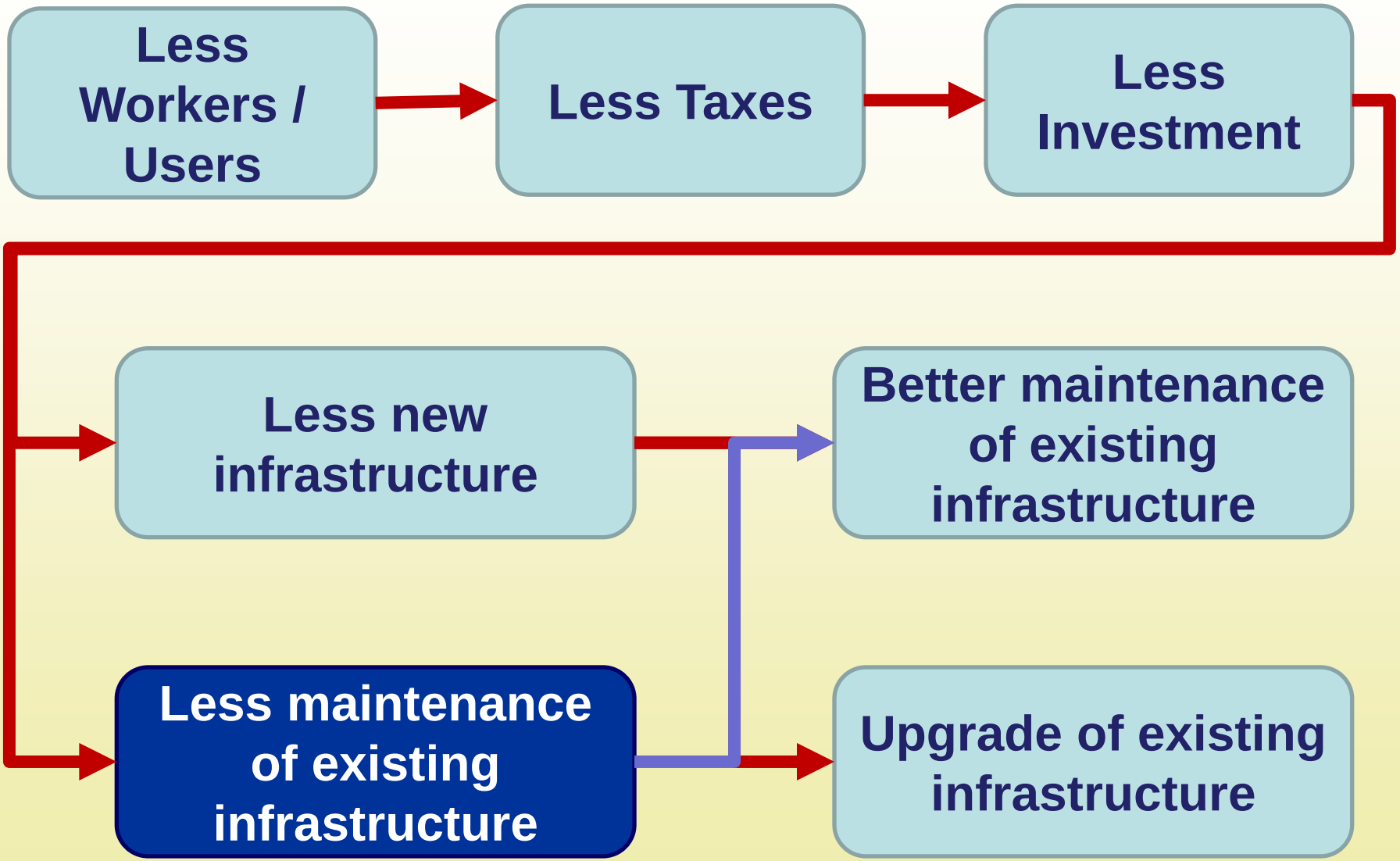
Tax Payers*: 56%
Age Over 60: 23%

Tax Payers*: 45%
Age Over 60: 35%

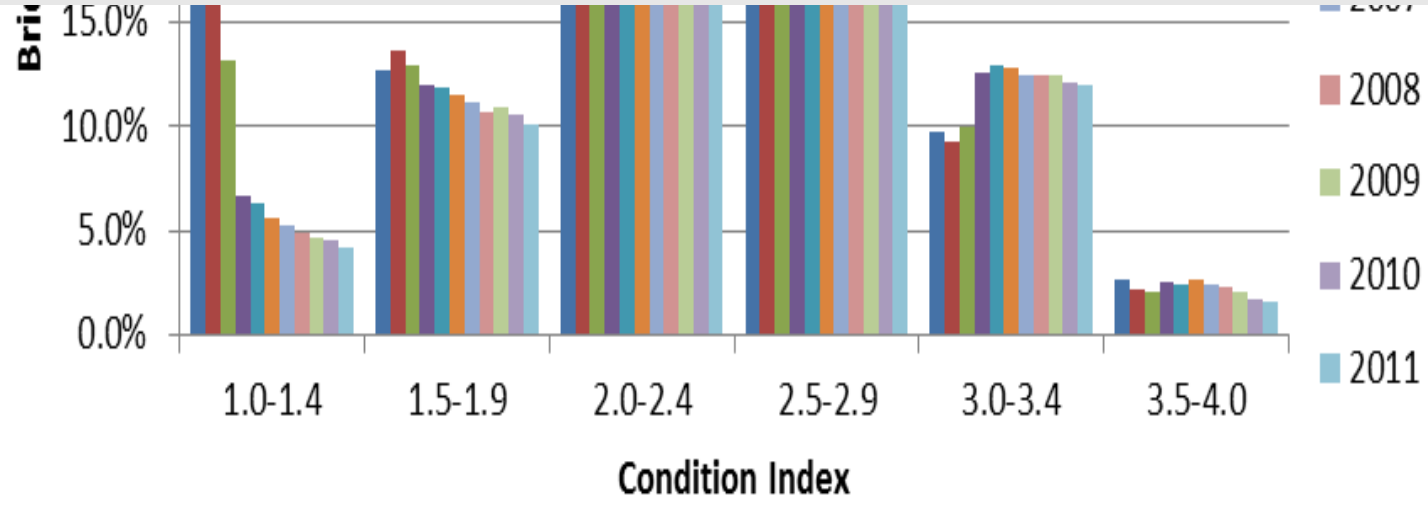
“no policy-change” scenario

*** Not really.**

The “under-optimistic” case


Less Workers / Users
Less Taxes
Less Investment
Less new infrastructure
Better maintenance of existing infrastructure
Less maintenance of existing infrastructure
Upgrade of existing infrastructure

The deterioration of infrastructure is the largest civil engineering challenge facing the developed world



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Inspection and assessment

State of the Art:
The structure will be "discarded" because of the lack of confidence in the inspection procedure.

Evaluation:
Determine remaining capacity of the existing infrastructure (e.g. structural redundancy, load bearing capacity, etc.).

Impact:
Intensive but not extensive actions. Cost and repair time reductions. Availability of the Infrastructure.

Cost of inspection / assessment <<<< Cost of intervention

- The investments are too low for a correct maintenance of the transport infrastructure network.
- The efficiency of such investments is also lowered considering that inspections and interventions are planned/actuated on a time-basis, which could result in extra-costs.
- To handle the ageing infrastructure a different management approach is needed.

Visual inspection can be significantly improved using non-destructive test methods or Structural Health Monitoring (SHM) techniques.

Continuous data allows for a better assessment of a structure's performance and an improved prediction of its durability and remaining life time.

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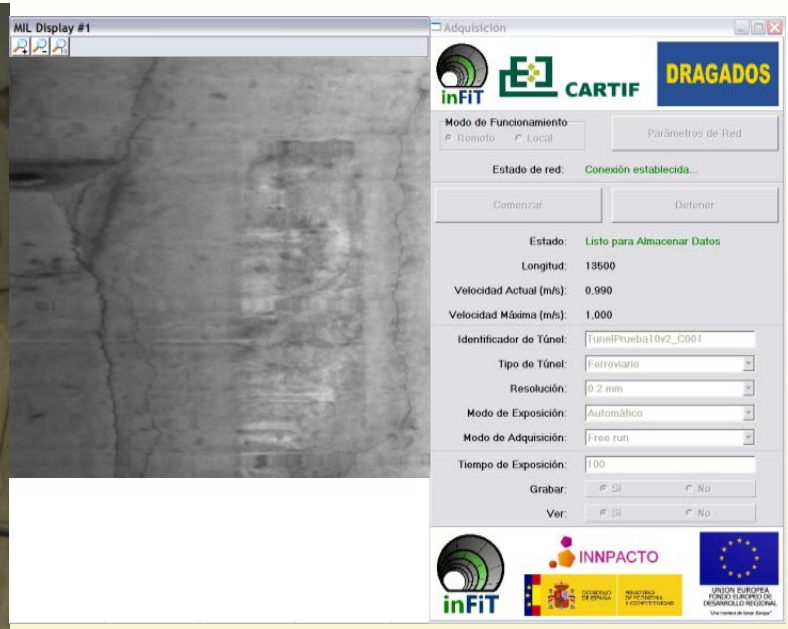

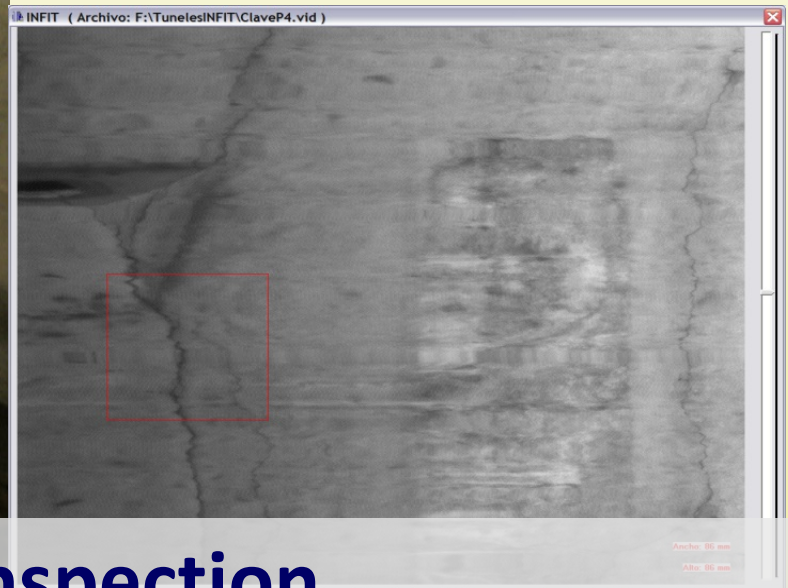

Computer Vision Inspection

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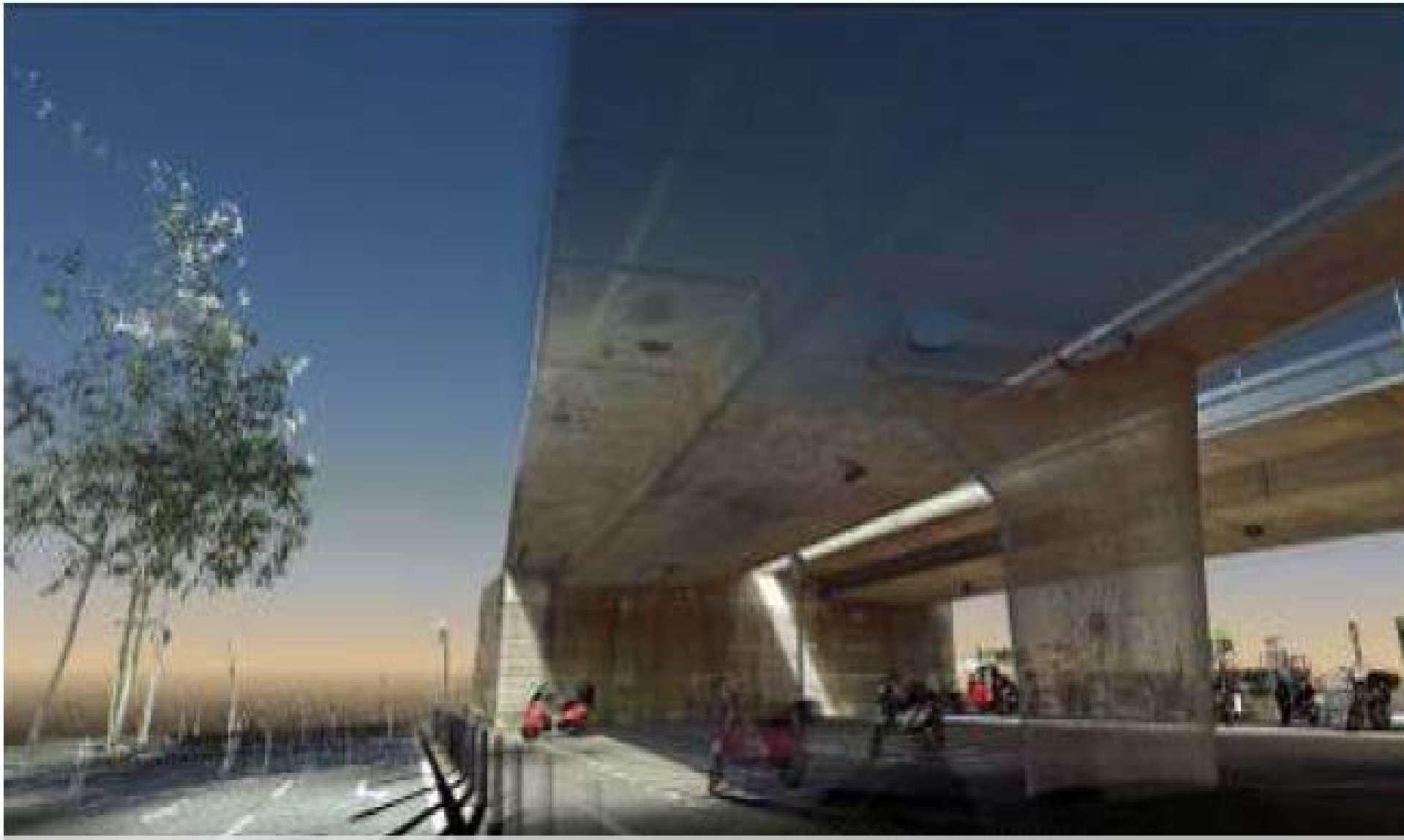

Laser-scanner deck movement monitoring

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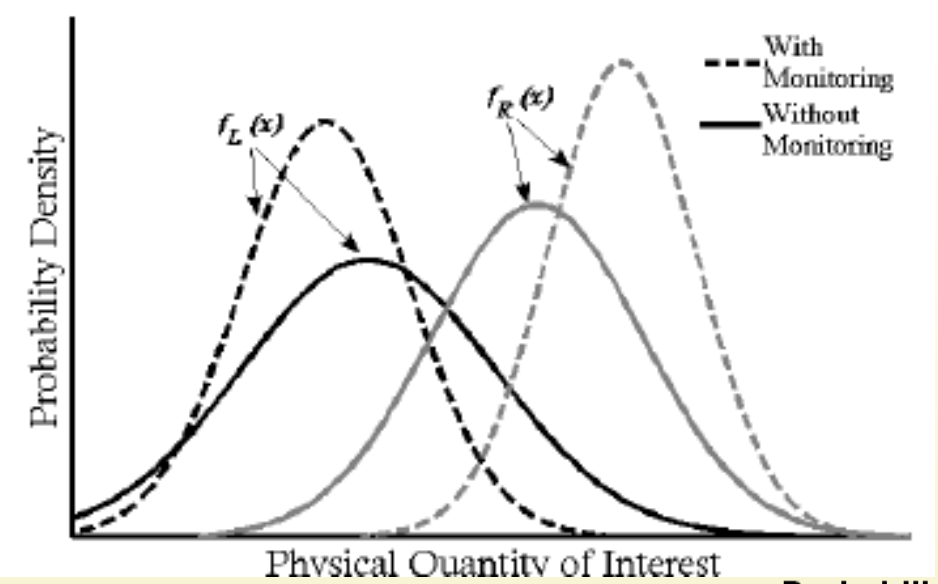
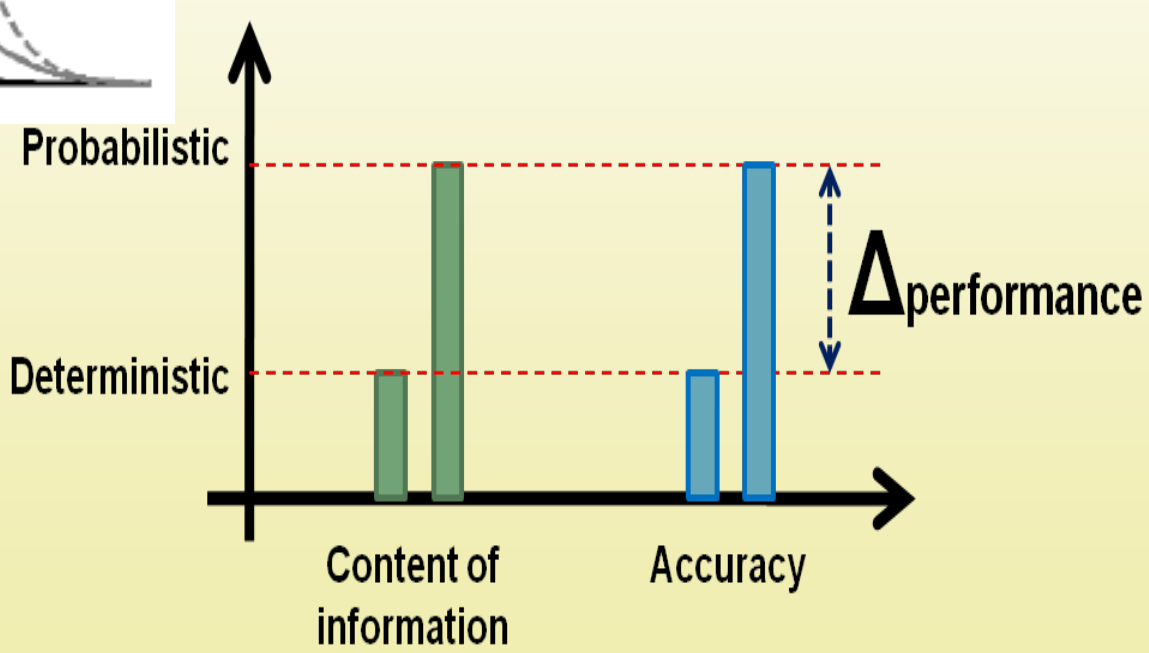
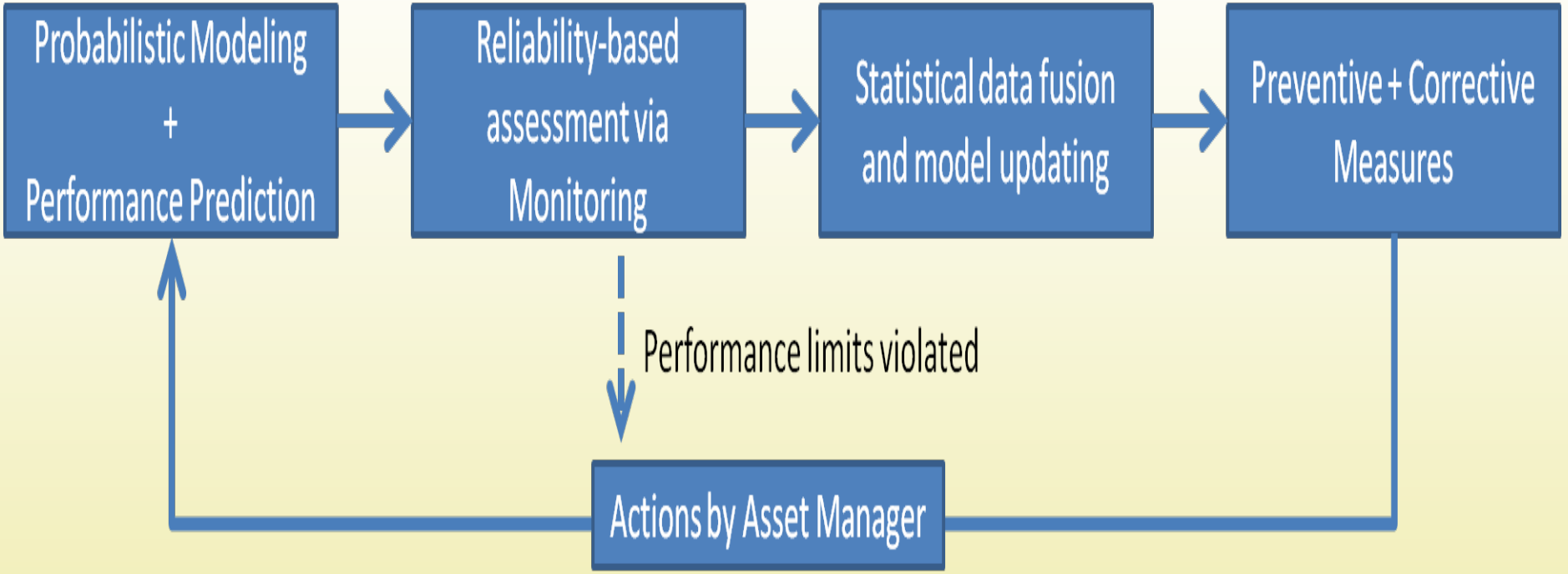
The current time-based approach in Asset Management must be replaced by a performance-based approach that can systematically take into account the dynamic nature of the transport network.

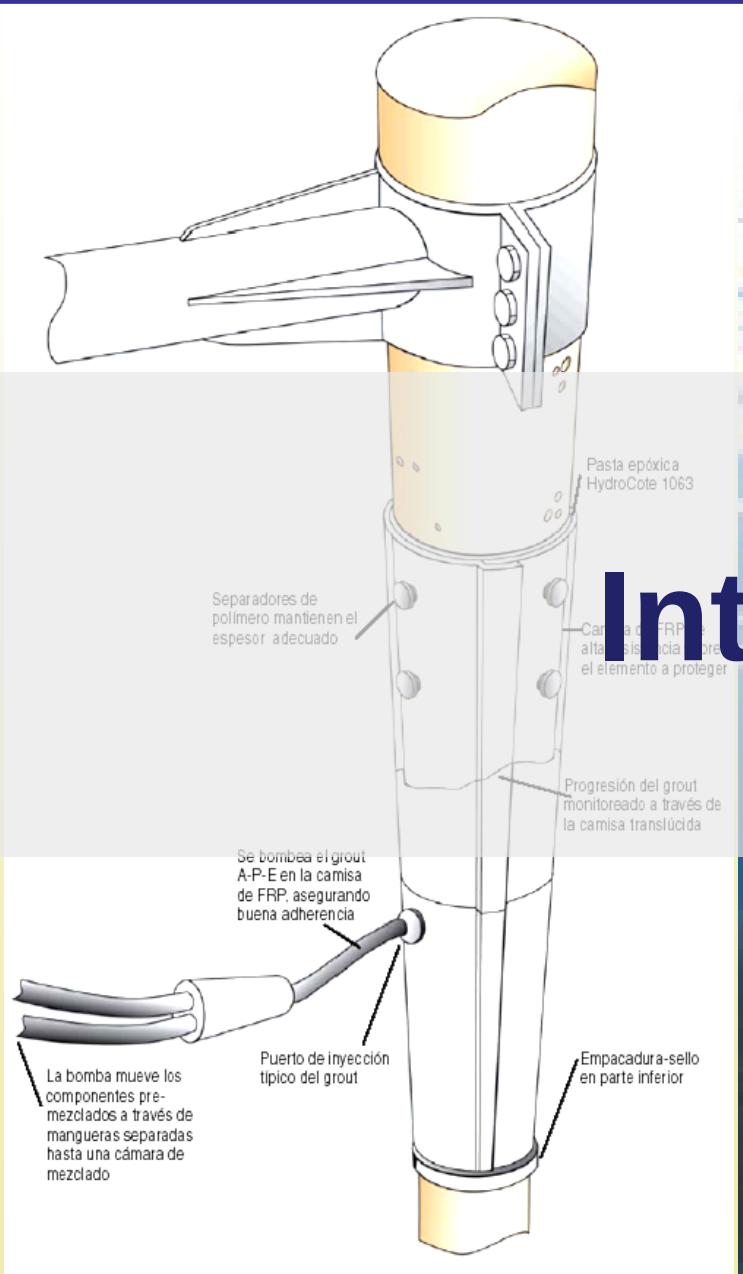




Improved treatment of uncertainty



Impact of the probabilistic approach on actions by the asset manager



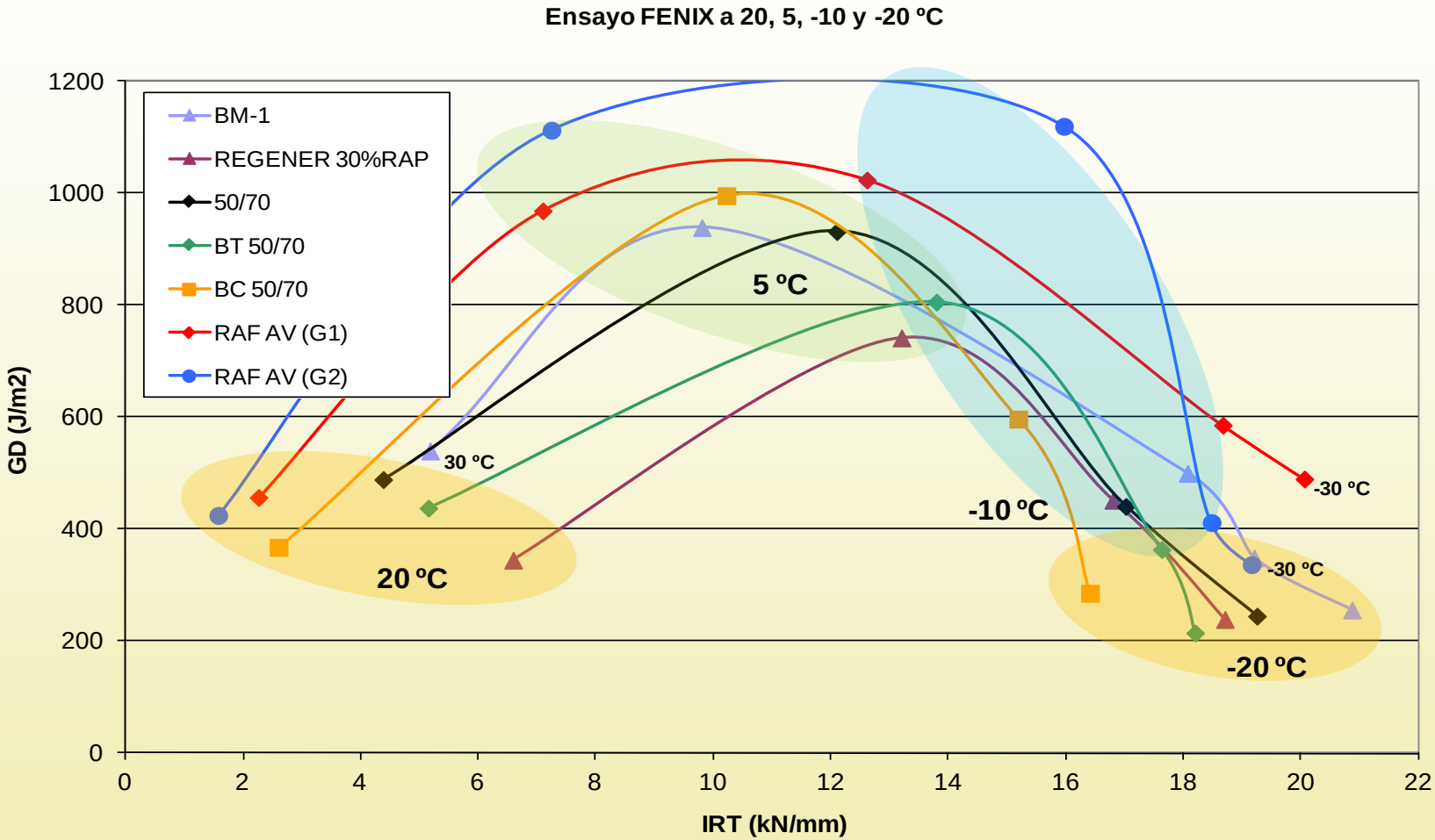
Intervention

Advanced Materials

State of the Art:
Empirical design and renovation methods only considering conventional materials.

Innovation:
Methodology for characterizing and using new products.

Impact:
Infrastructure implementing added-value products at large scale.



Fracture energy vs. tensile stiffness index of studied mixes

Tests adapted to actual working conditions

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Invisible expansion joints in existing bridges

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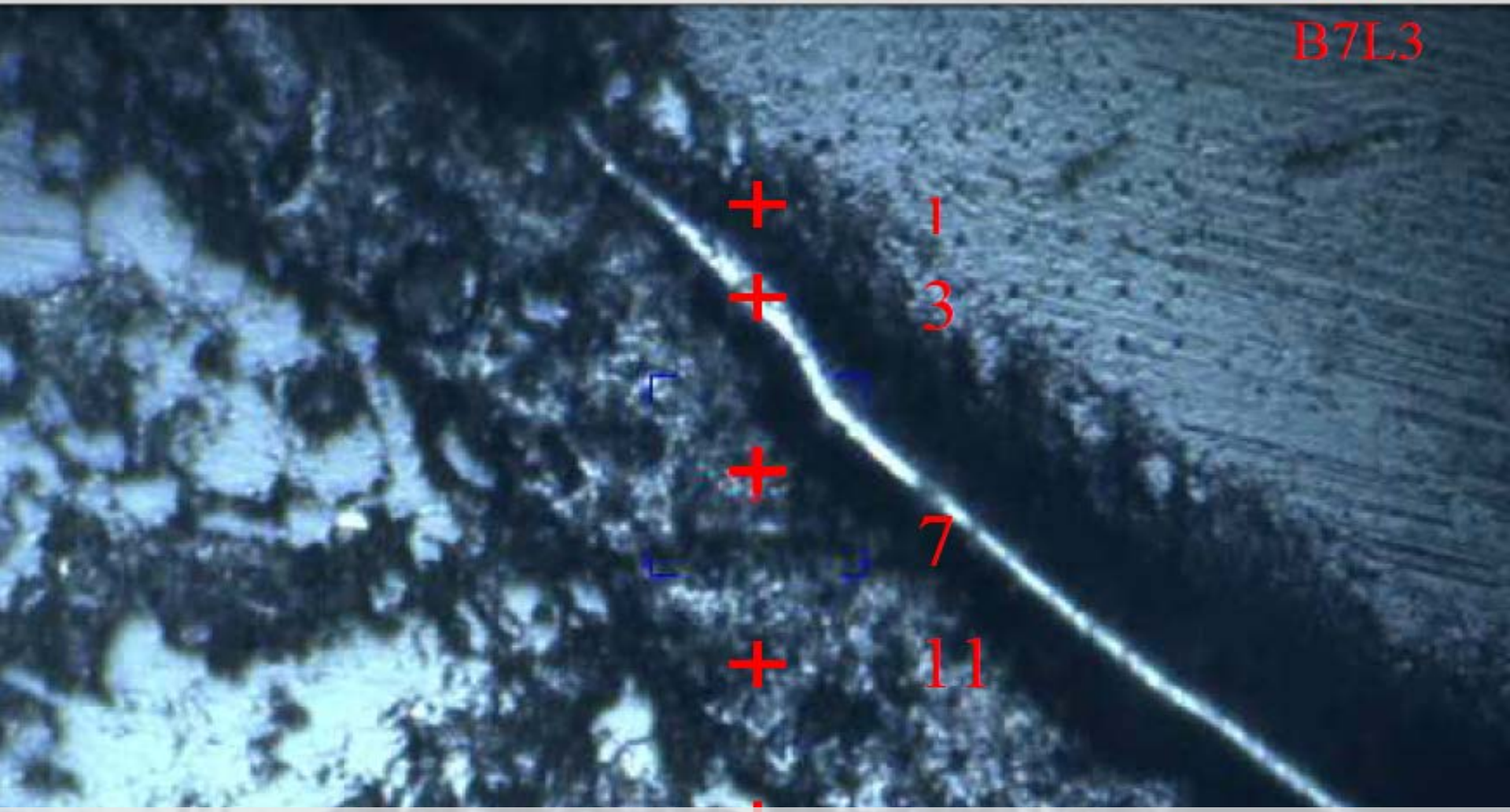


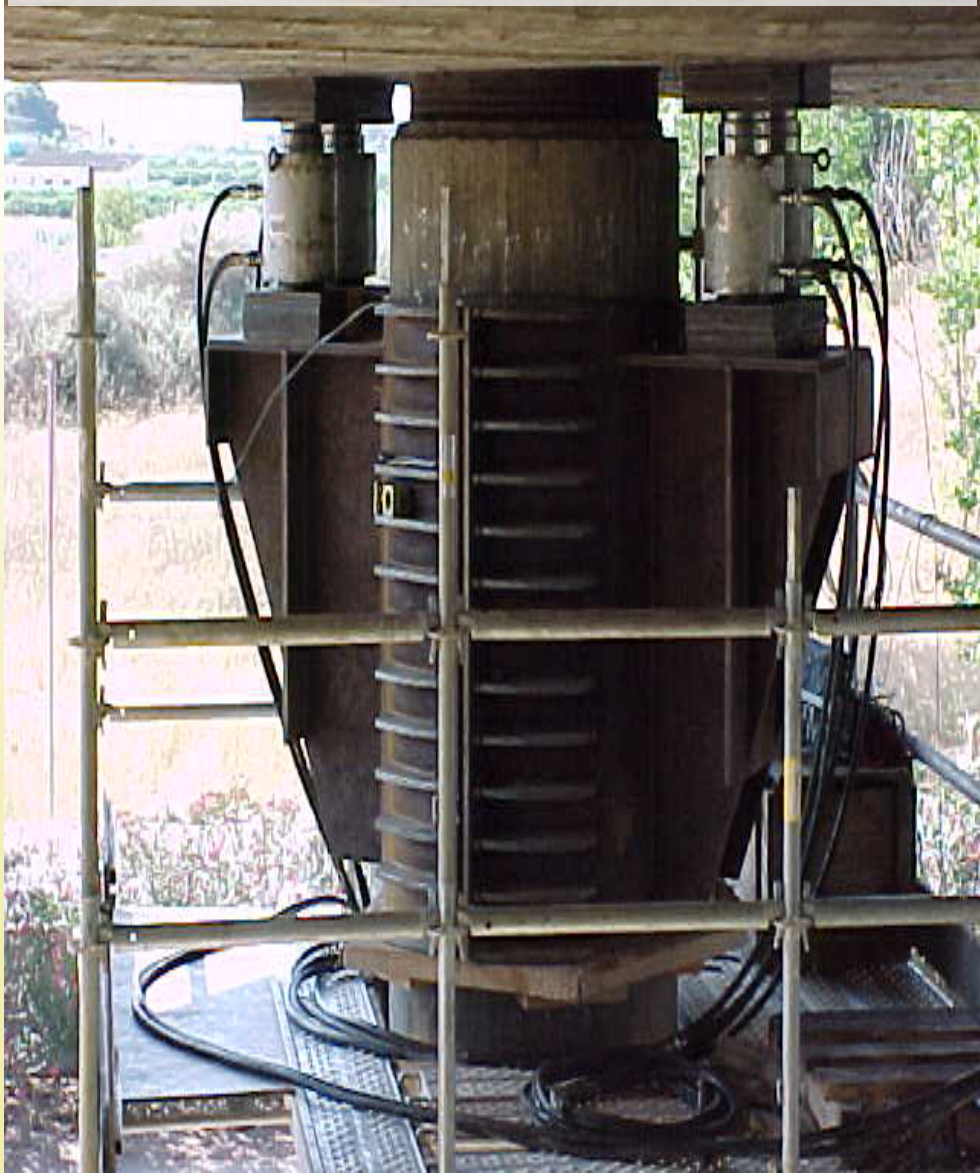
Lifetime prolongation of porous asphalt layers

Construction Processes

State of the Art:
Construction processes limited by inspection quality and materials characterization.

Innovation:
Process improvements on the existing infrastructure (capacity upgrades, traffic disruption, etc.)

Impact:
Improved maintenance and renovation actions regarding, durability, cost and time of repair.



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Adaption / Upgrade of Infrastructure

- **Adapt / Upgrade Infrastructure:**
  - **Improve capacity.**
  - **Upgrade functionality to new service requirements.**
  - **Extend service – life of the infrastructure.**

Move piers: Transfer the load to a new position

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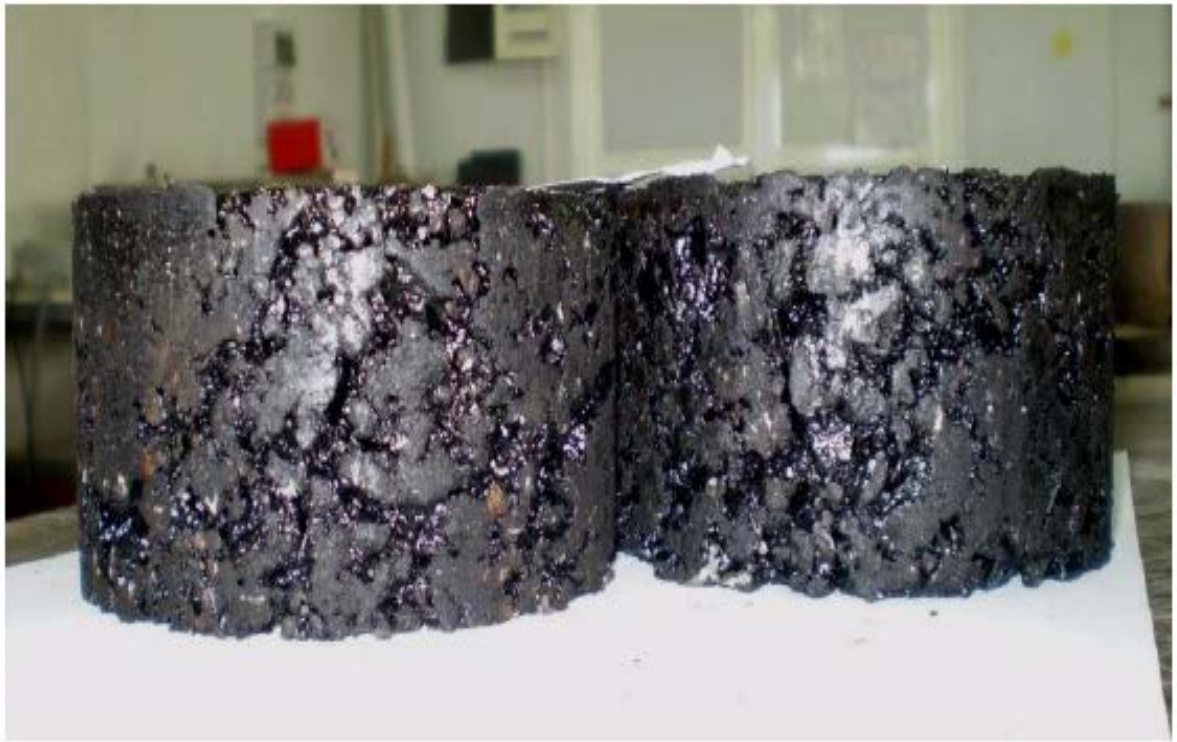
Widen the deck

Avoid /delay reflection cracking – extend lifetime



Increase safety

Change geometry - Jacking of existing access ramp to a new position

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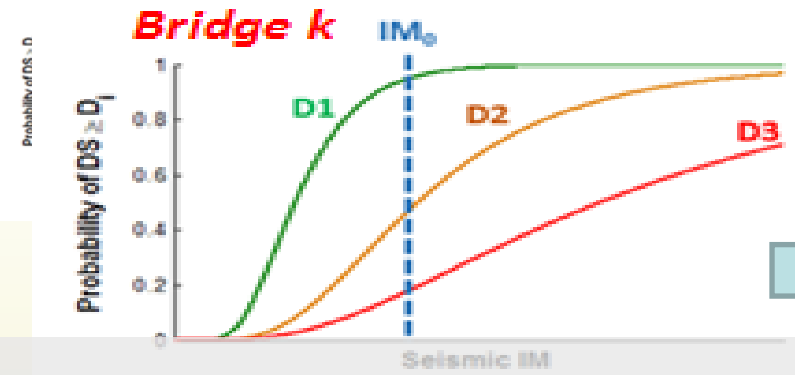
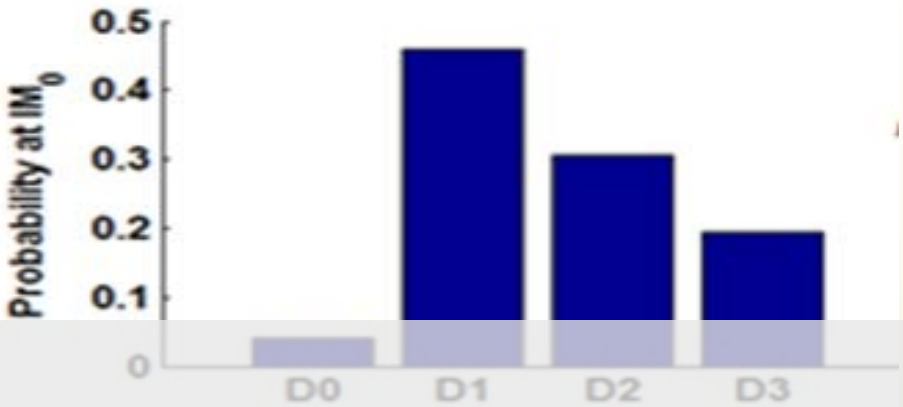
Extreme Events and Climate Change

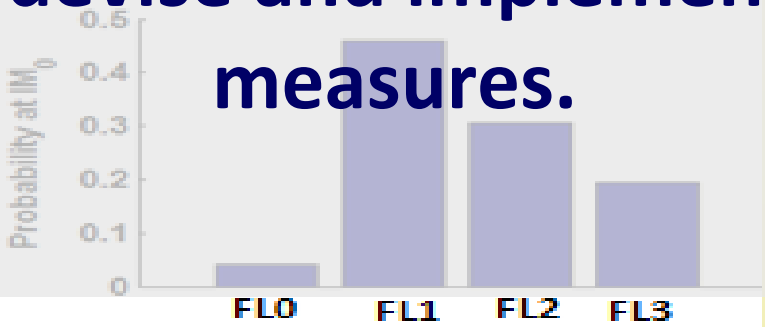


1.- Fragility Curves



2.- Definition of global damage states

…and then devise and implement mitigation measures.



3.- Loss of functionality

How to assess the impact of the events?

In summary:

- **Ensure sustainable funding for the maintenance of the infrastructure.**
- **Apply new technologies for reducing the costs of O&M. Get new continuous knowledge and make informed decisions.**
- **Prioritize interventions.**
- **Extend service life of the asset.**
- **Maximize capacity and throughput.**
- **Enhance climate change and disaster resilience.**

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