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Assessment and Maintenance of Long-Life Flexible Pavements

Presented by Mike Nunn

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Assessment and Maintenance of Long-Life Flexible Pavements

Brian Ferne, TRL bferne@trl.co.uk

Mike Nunn, LaneOne mnunn@tiscali.co.uk

Darren Merrill, Shropshire CC darren.merrill@shropshire-cc. gov.uk

HIGHWAYS AGENCY

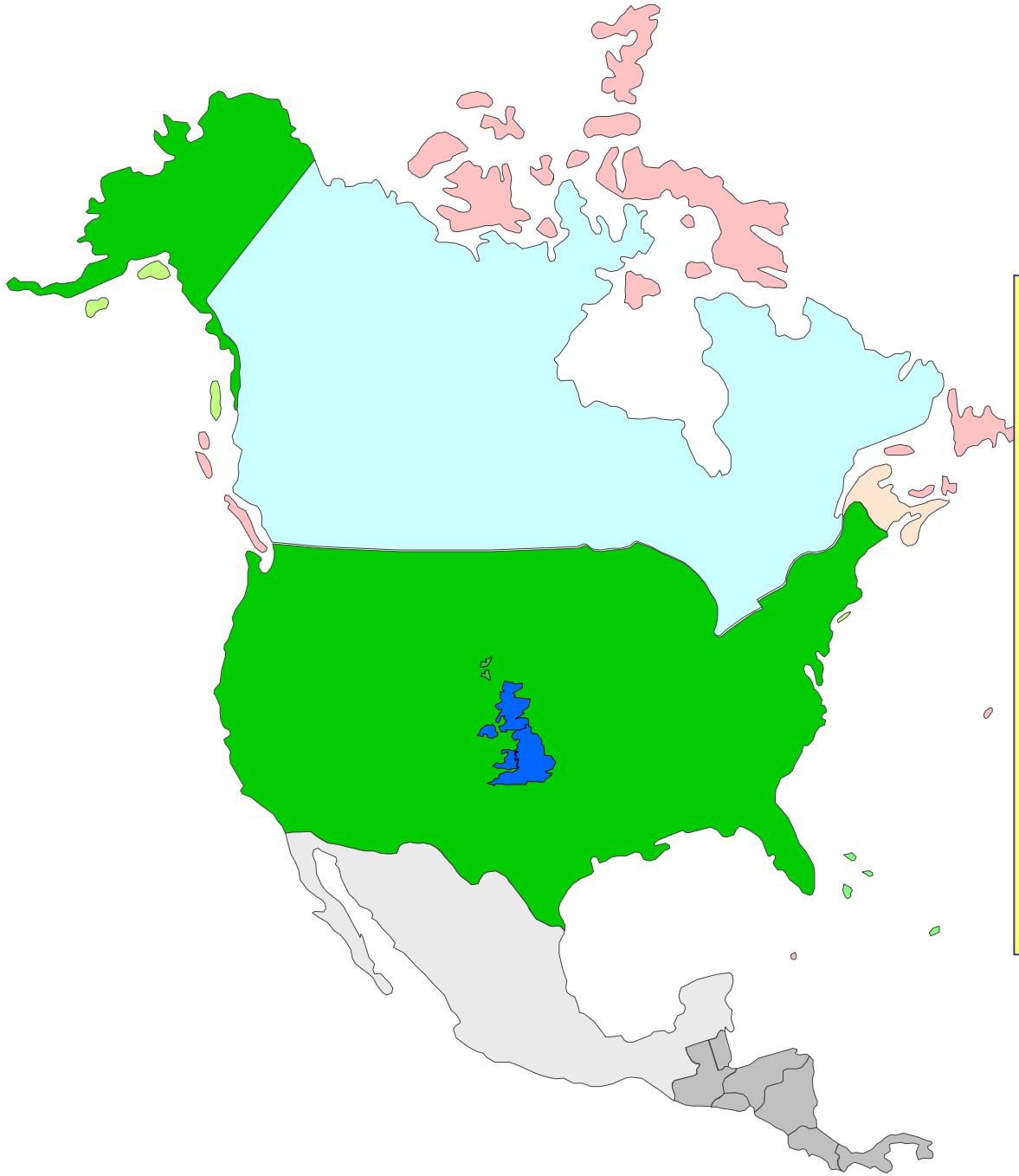
QUARRY PRODUCTS ASSOCIATION

rba THE BEST ROADS ARE ASPHALT

TRL

TOPICS

- Background
- Assessment of the network
- Maintenance and upgrading existing roads
- What else do we need to know?



UK

2.5% area of USA

25% of the population

~ 10 times population density

Trunk Road Network in England

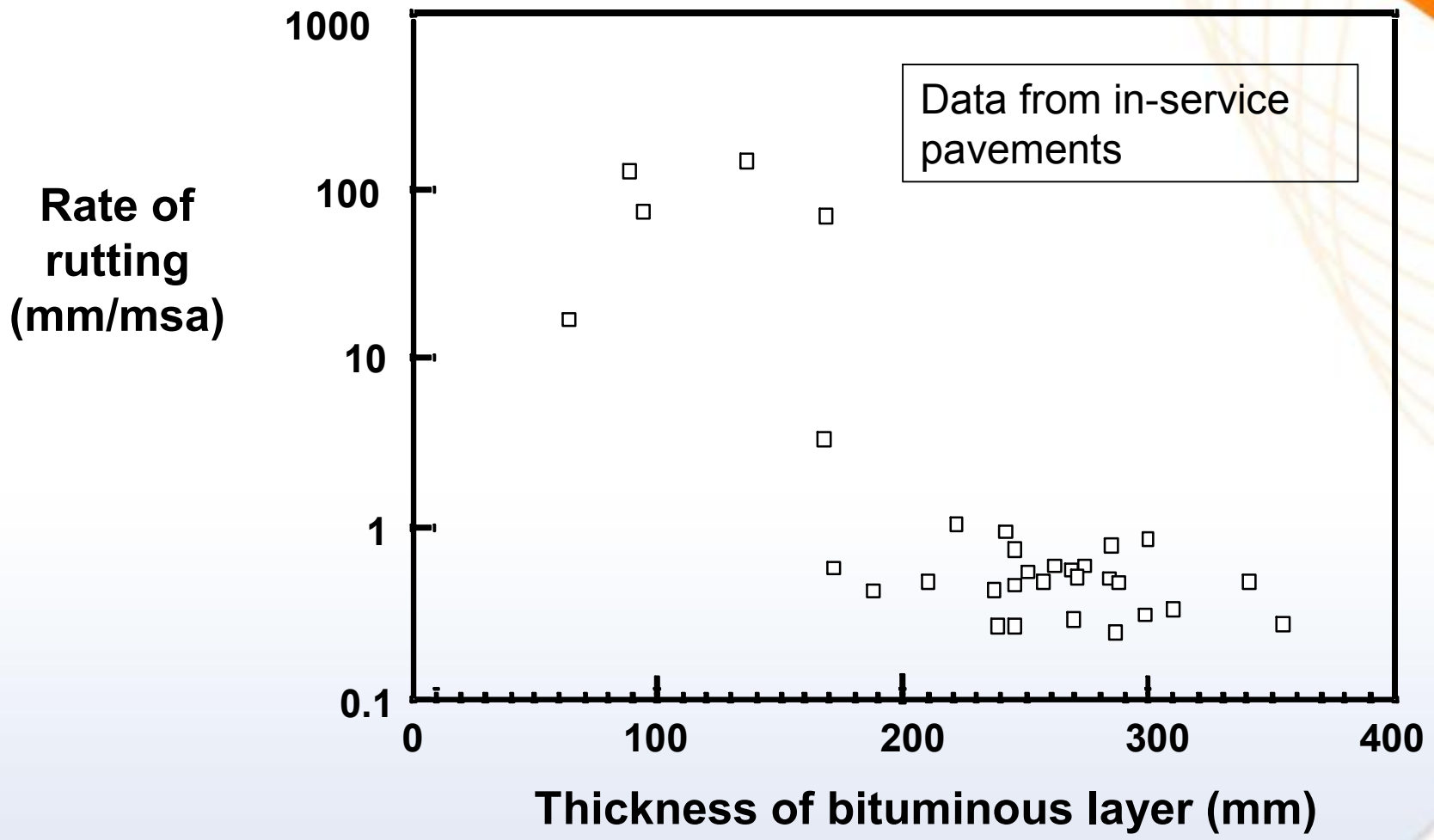

JOSEPH RICE
TRANSPORT
F.SHAIN & SONS


SPILLERS
MILLING
You really
need a Sealy.
Sealy
Pandoro
ILLINGWORTH INGHAM (MCR) LTD

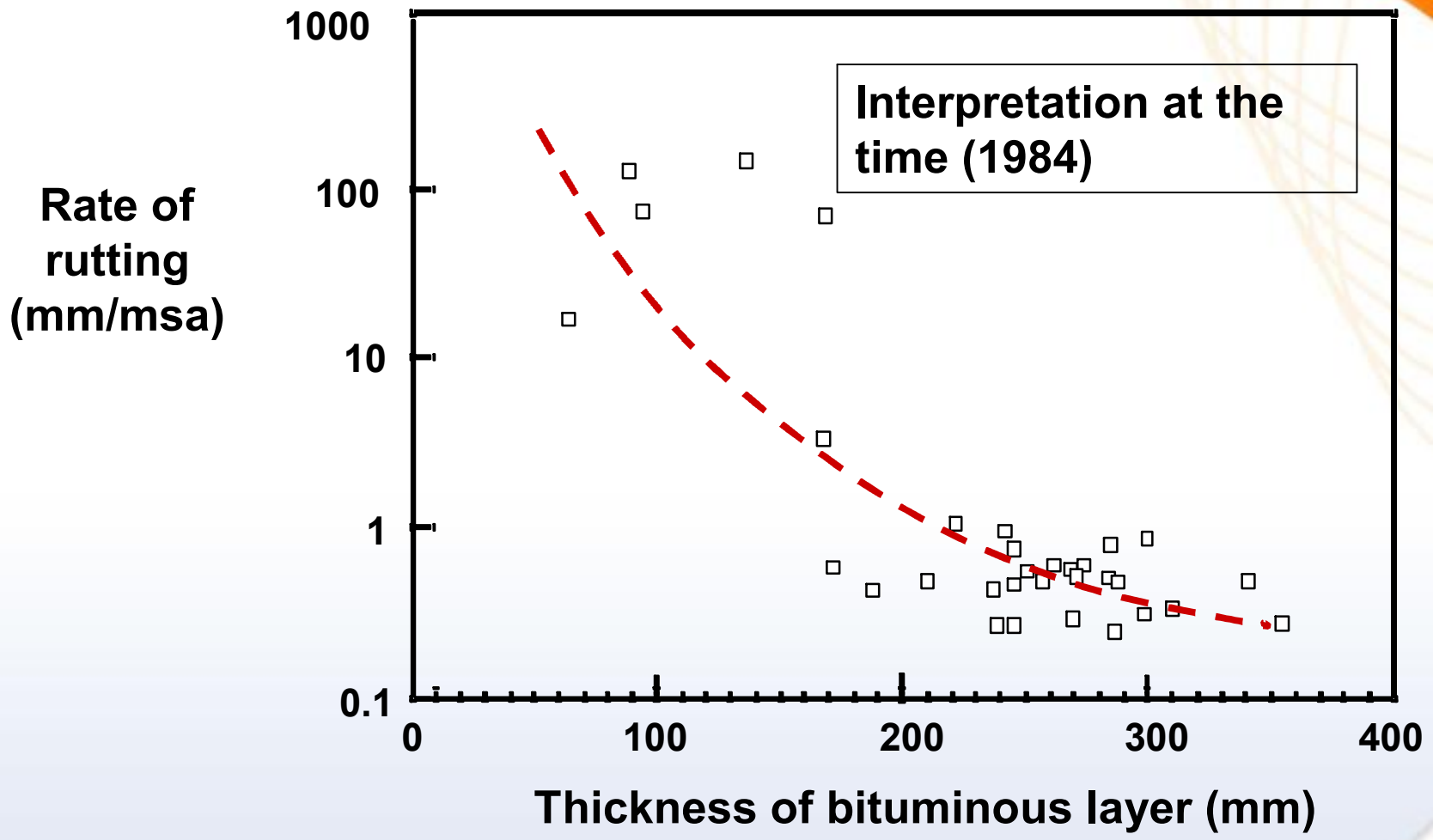
Overview of Current UK M-E Design Method

- 1984: Conventional approach – Limit strains at critical locations
- 1997: Review lead to Long-Life (Perpetual) pavements
- 2005: Adapted to include a greater range of pavements
- 2006+: Design concepts currently being re-examined

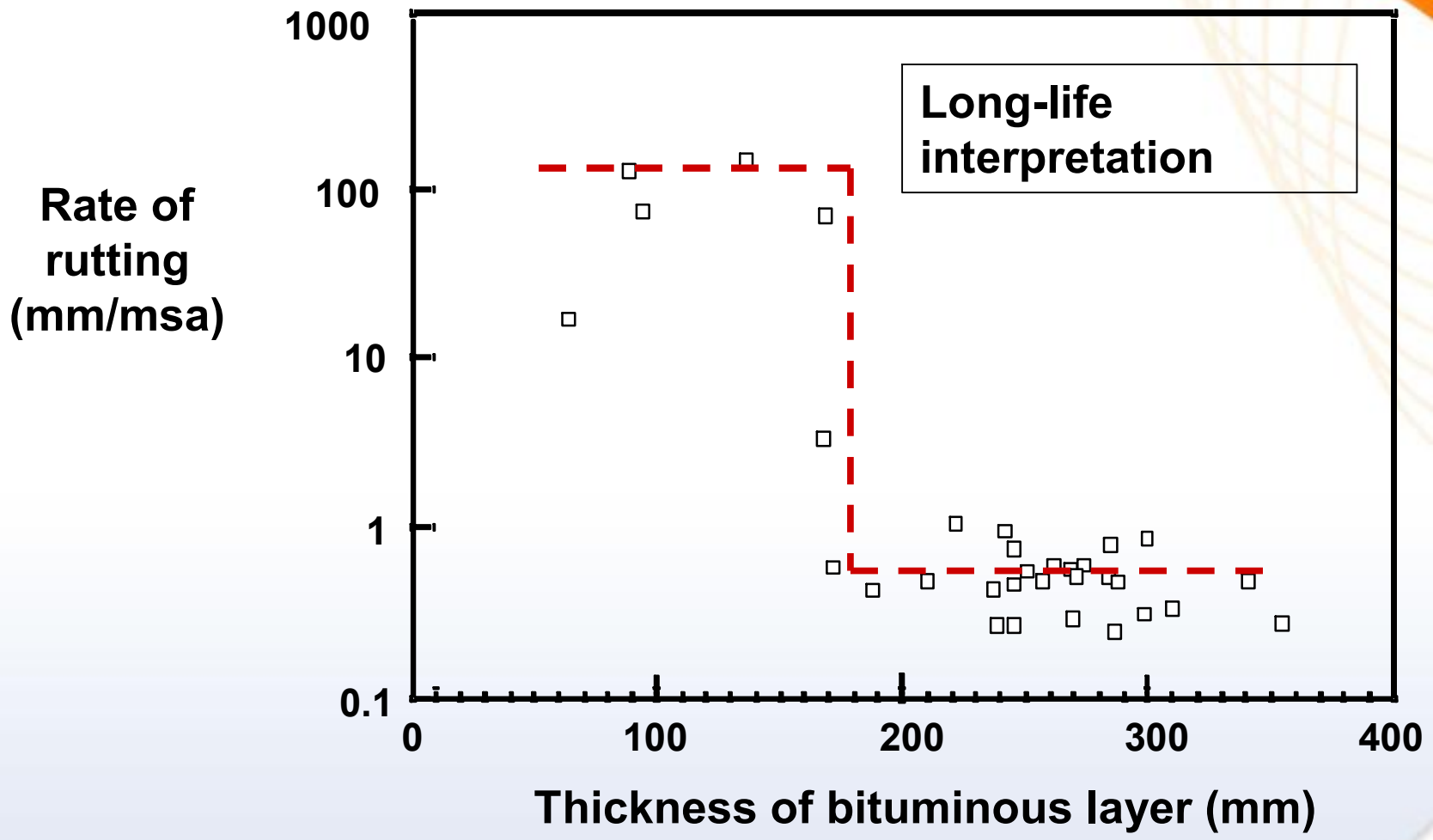
Structural Deformation



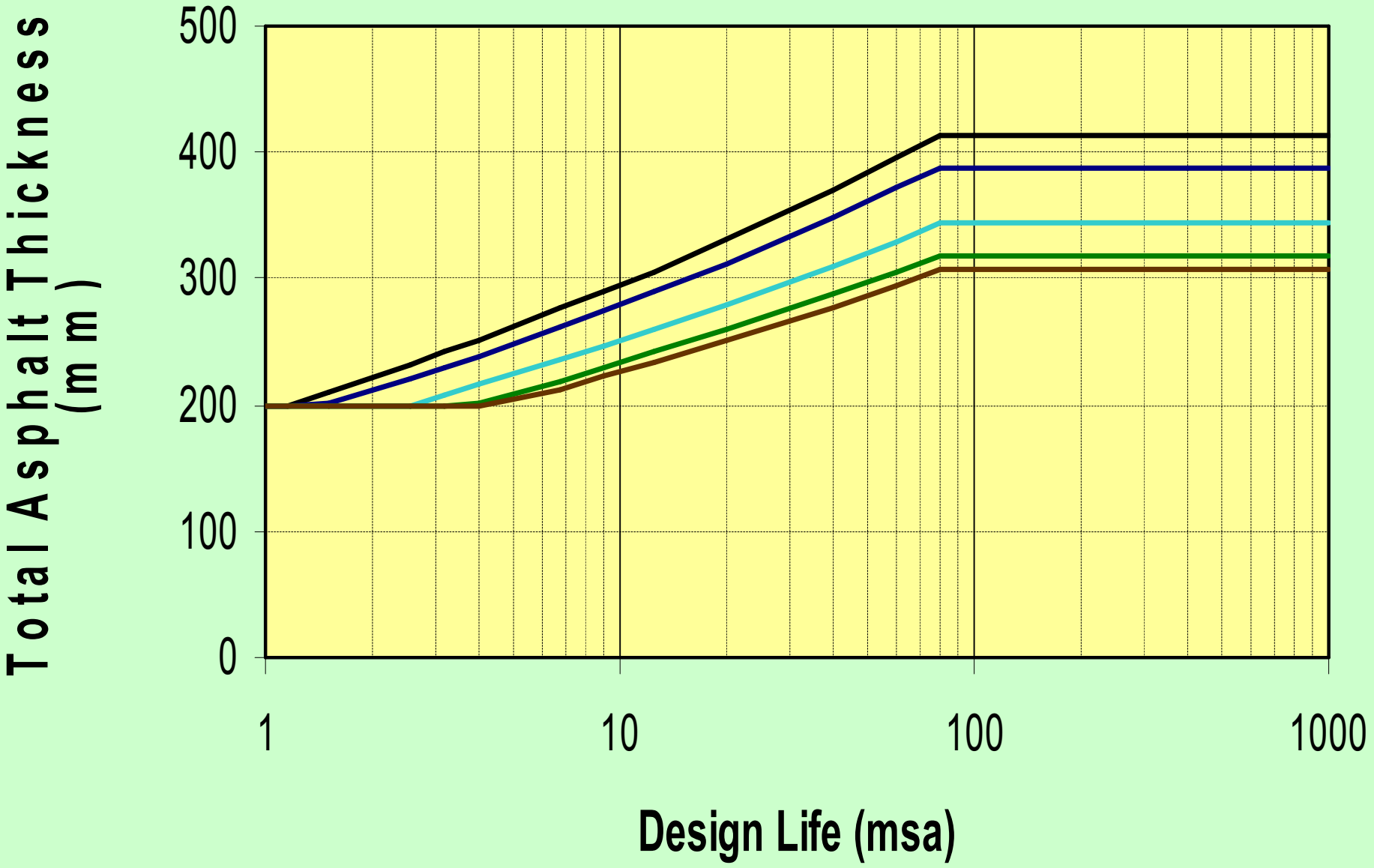
Structural Deformation



Structural Deformation



Design Curves for Roads with Asphalt Roadbase



Long-Life Pavements

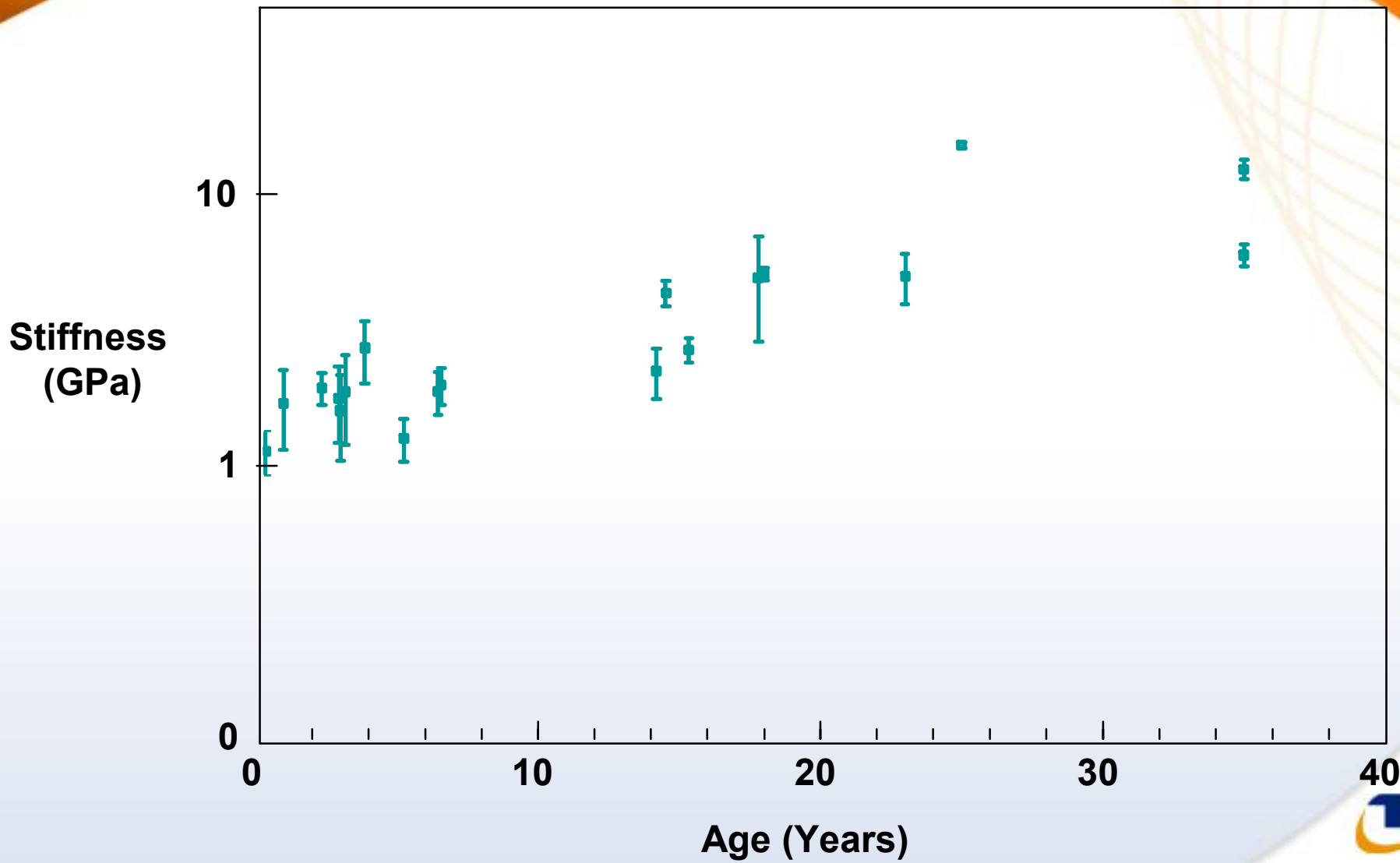
- **“A Long-life Pavement is a type of pavement that can be identified as one lacking any deterioration in either the foundation or the structural pavement layers. Any distresses that might occur are confined to the surfacing layers only.”**

  ELLPAG (European Long-Life Pavement Group) - Phase 1 Report

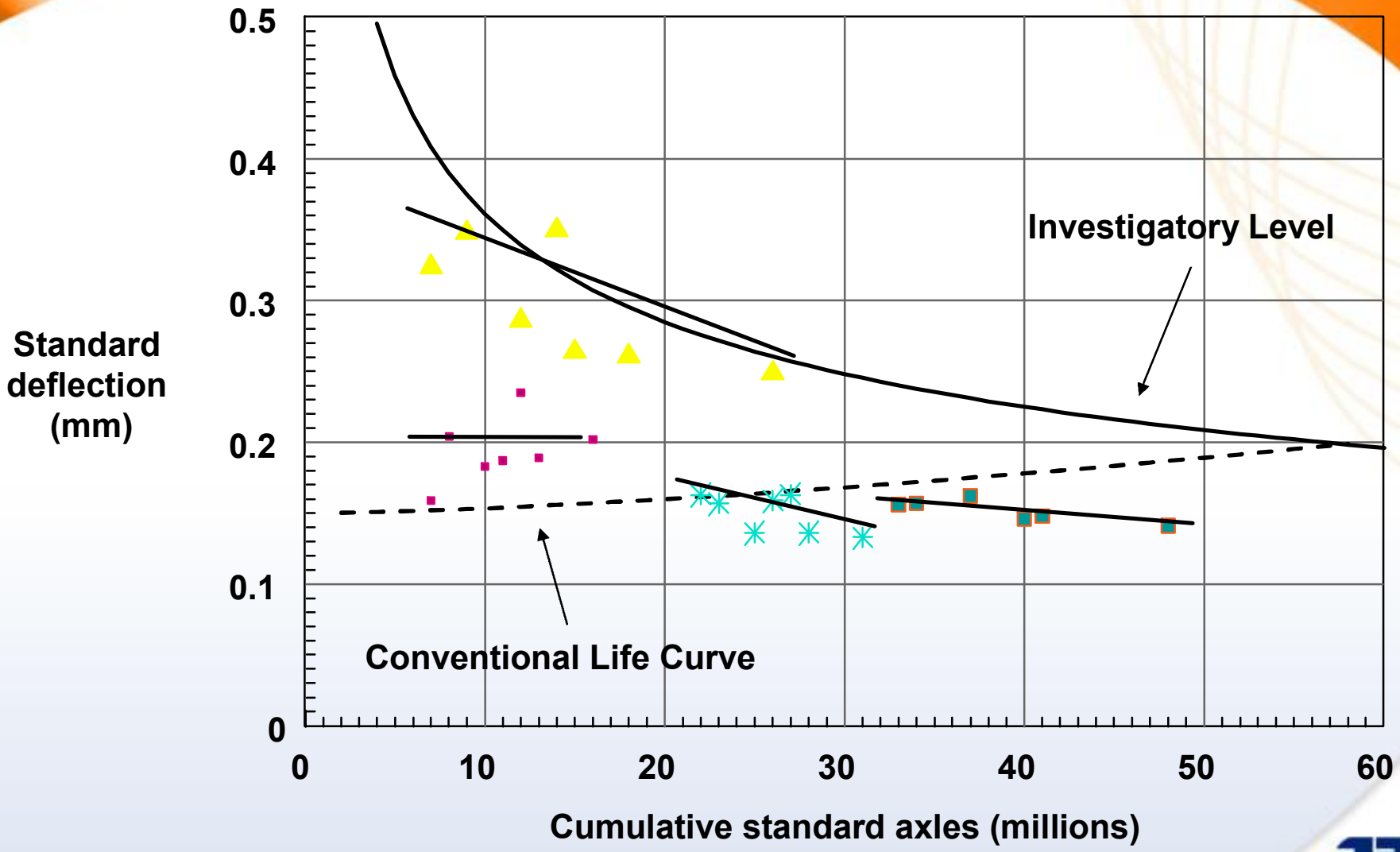

RENEWING
20 YEAR OLD
SURFACE


RENEWING
40 YEAR OLD
SURFACE

CHANGE IN BITUMINOUS STIFFNESS OVER TIME



DEFLECTION HISTORIES OF IN-SERVICE MOTORWAYS (DEFLECTOGRAPH)

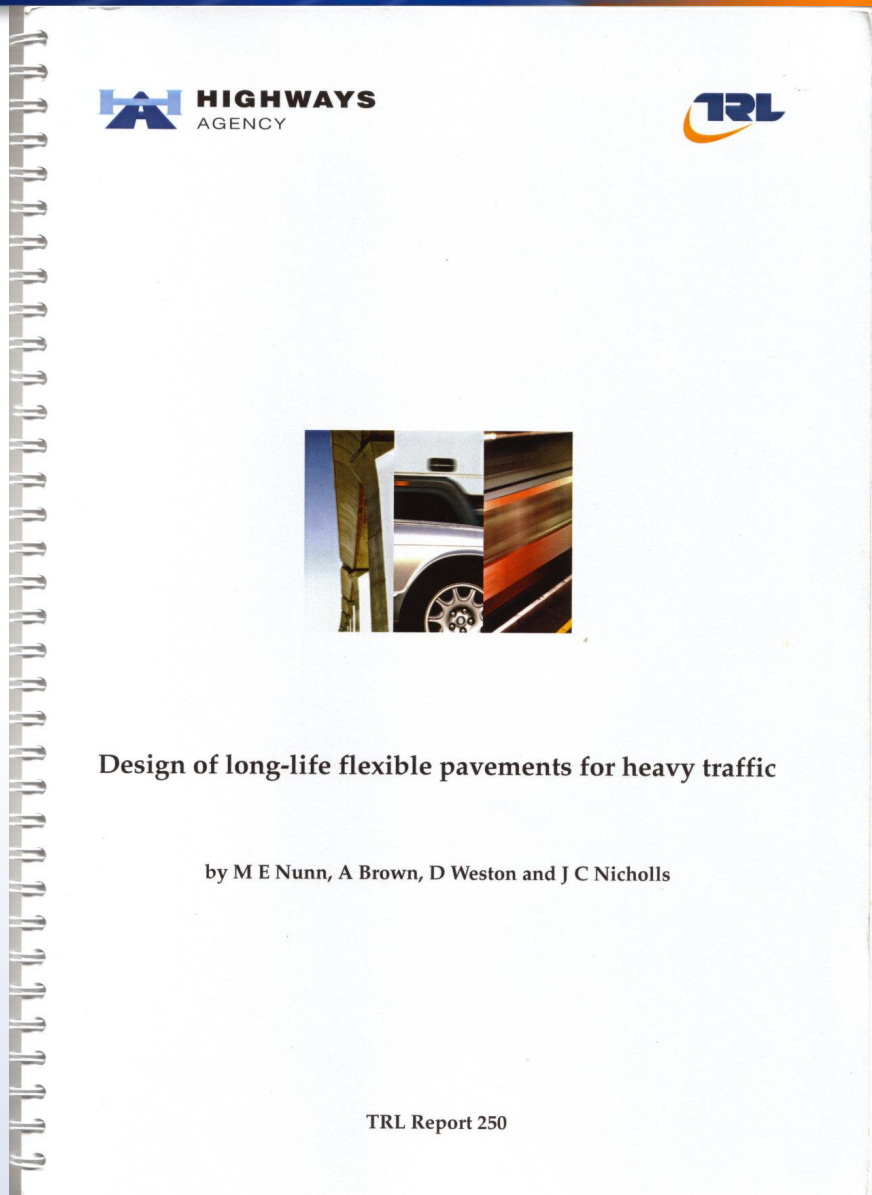


Evolved Long-Life Pavements

- Existing pavements
- Well constructed
- Curing effect of asphalt materials
- Pavement responses reduce, extending the life of the pavement
- Pavement responses below the threshold
- Long-life pavement

Three routes to long-life…..

- Create a long-life pavement → TRL 250
- Build a pavement that eventually becomes a long-life pavement → Assessment
- Perform some structural improvement of an existing pavement → Upgrading

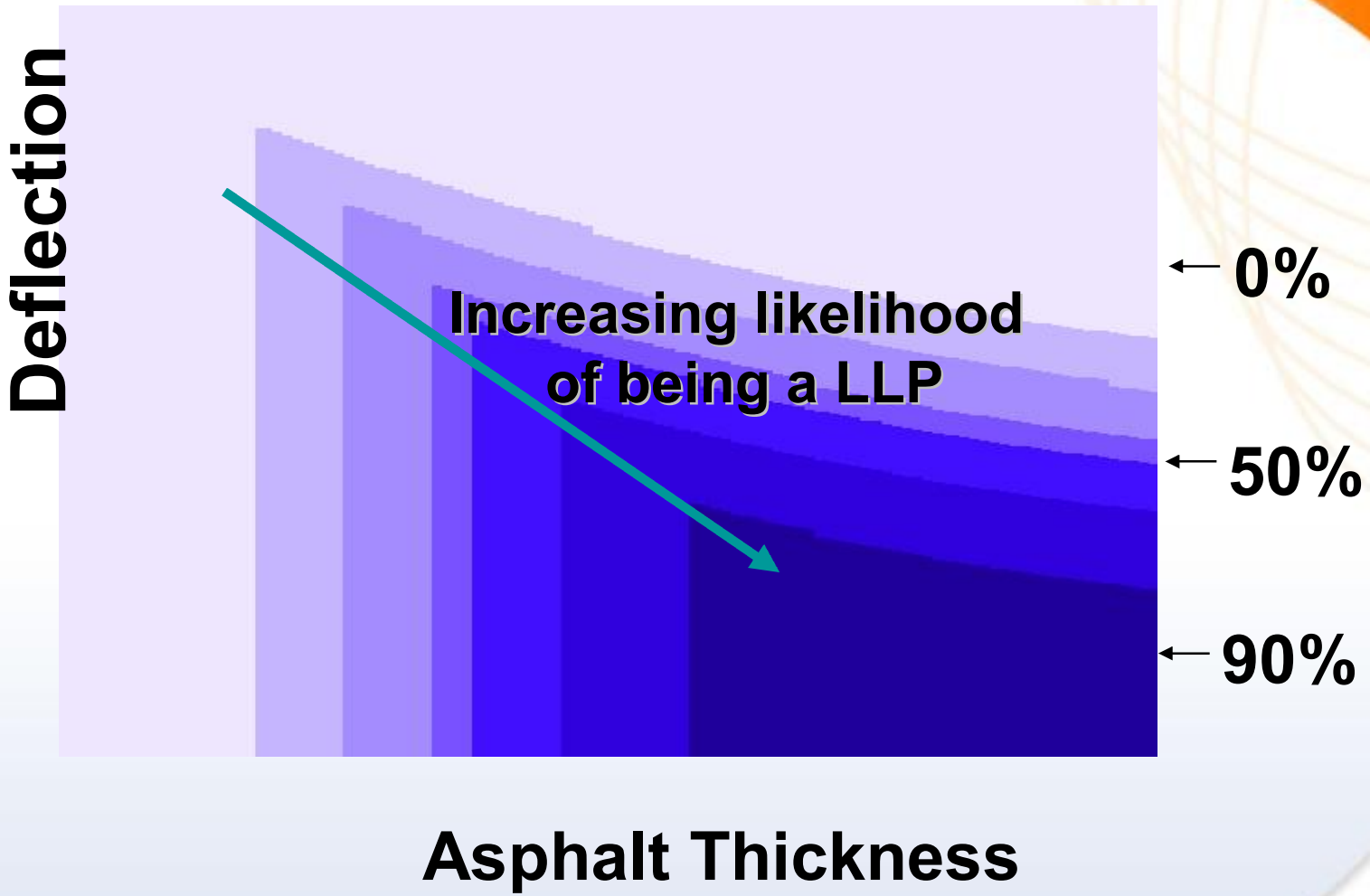


Structural Assessment

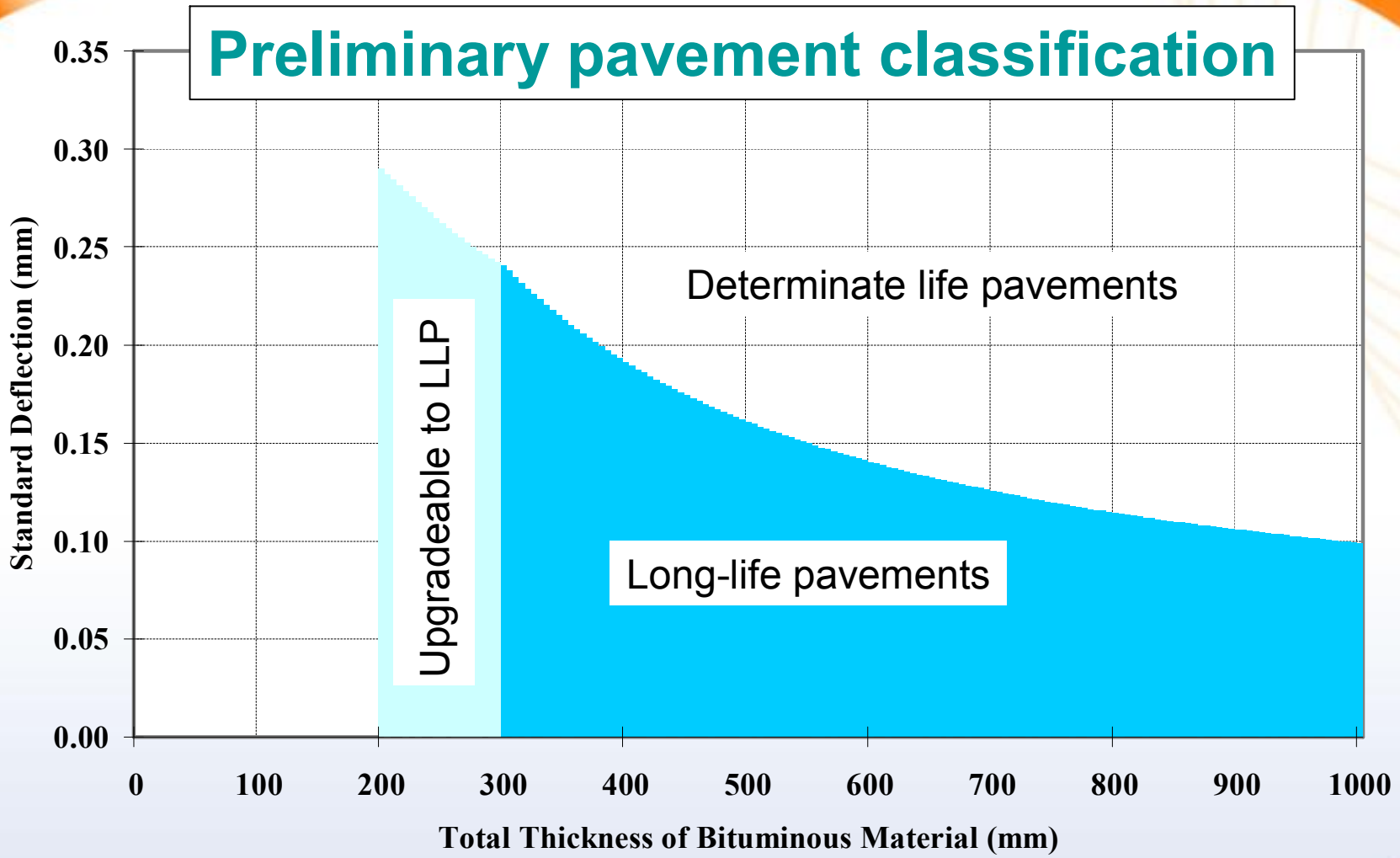
Identifying LLP's on the network

- **Deflection – Thickness approach**
- **Originally network and scheme level**
- **Now Scheme level**
- **Uses Deflectograph**

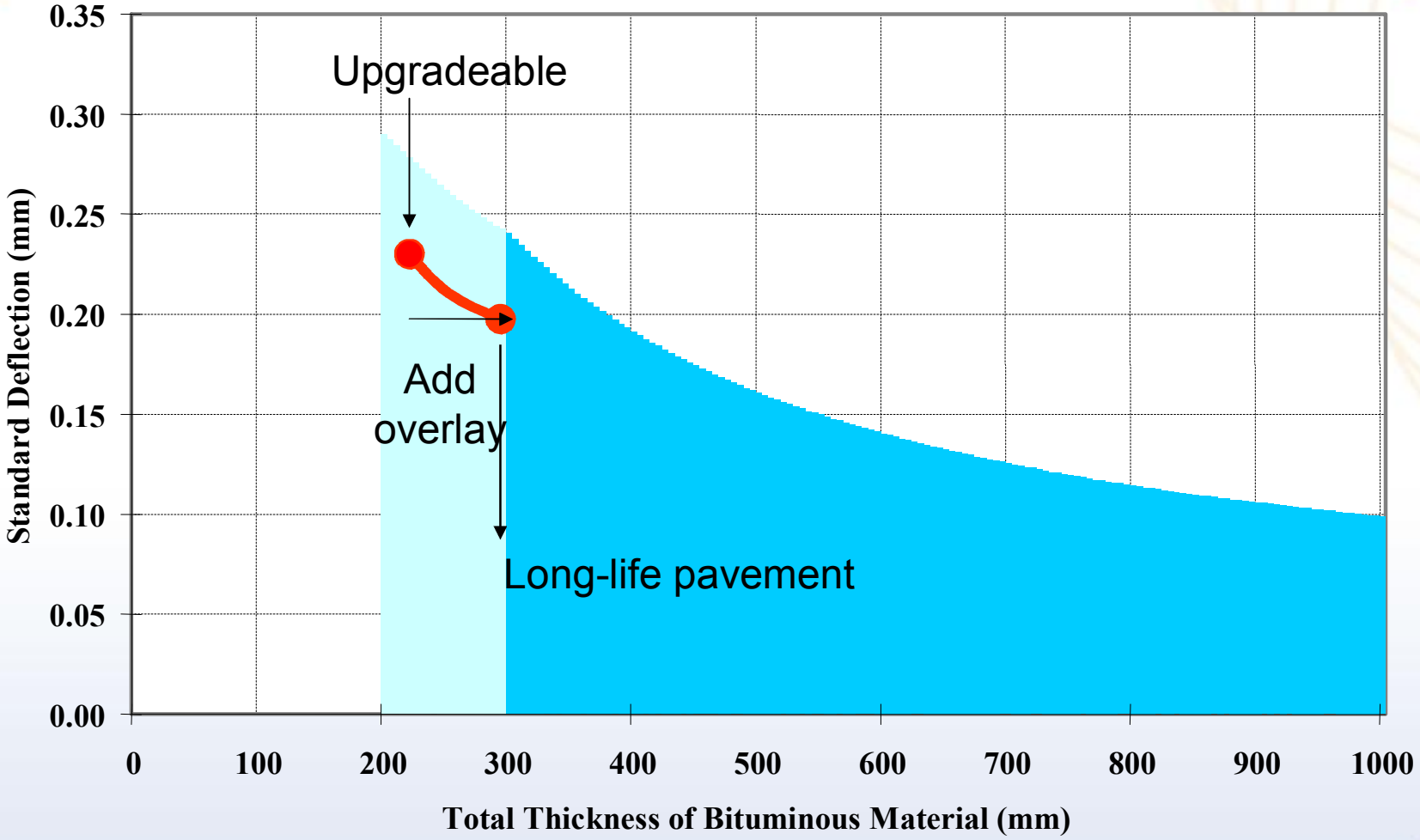
Original deflection-thickness chart



Structural Assessment - DMRB



Current Upgrading



Current Upgrading

- Pavements classified as Upgradeable LLP
- Overlay to bring asphalt thickness to greater than 300mm
- Algorithms built into HAPMS CONFIRM

Other pavement classifications

At present three pavement classifications

- **Long-life pavements**
- **Upgradeable LLP's**
- **Determinate life pavements**

Other pavement classifications

Long-life pavements are particular types of pavements with

- **Low deflections**
- **Strong foundations**
- **Thick asphalt layers**
- **No structural deterioration**

What if asphalt layers not so thick?

What if deflections not so low?

Other evidence in TRL Report 250

- Deformation confined to asphalt layers for pavements greater than 180mm
- Surface cracking confined to 100mm depth for pavements greater than 160mm

Therefore expect well constructed pavements greater than 200mm thick to have long-life characteristics

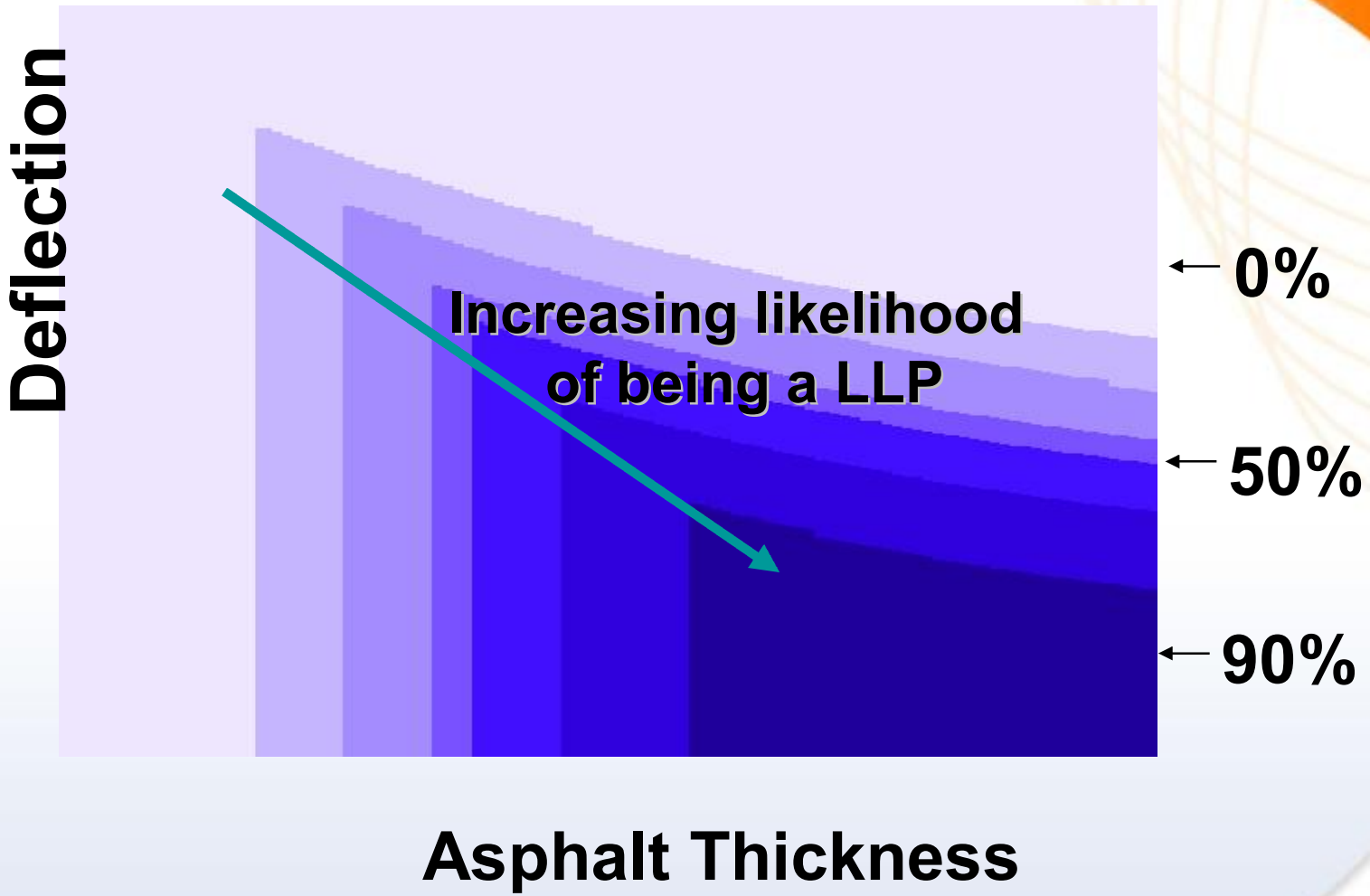
Other pavement classifications

- **Why 300mm threshold for thickness?**
- **Why particular threshold for deflection?**

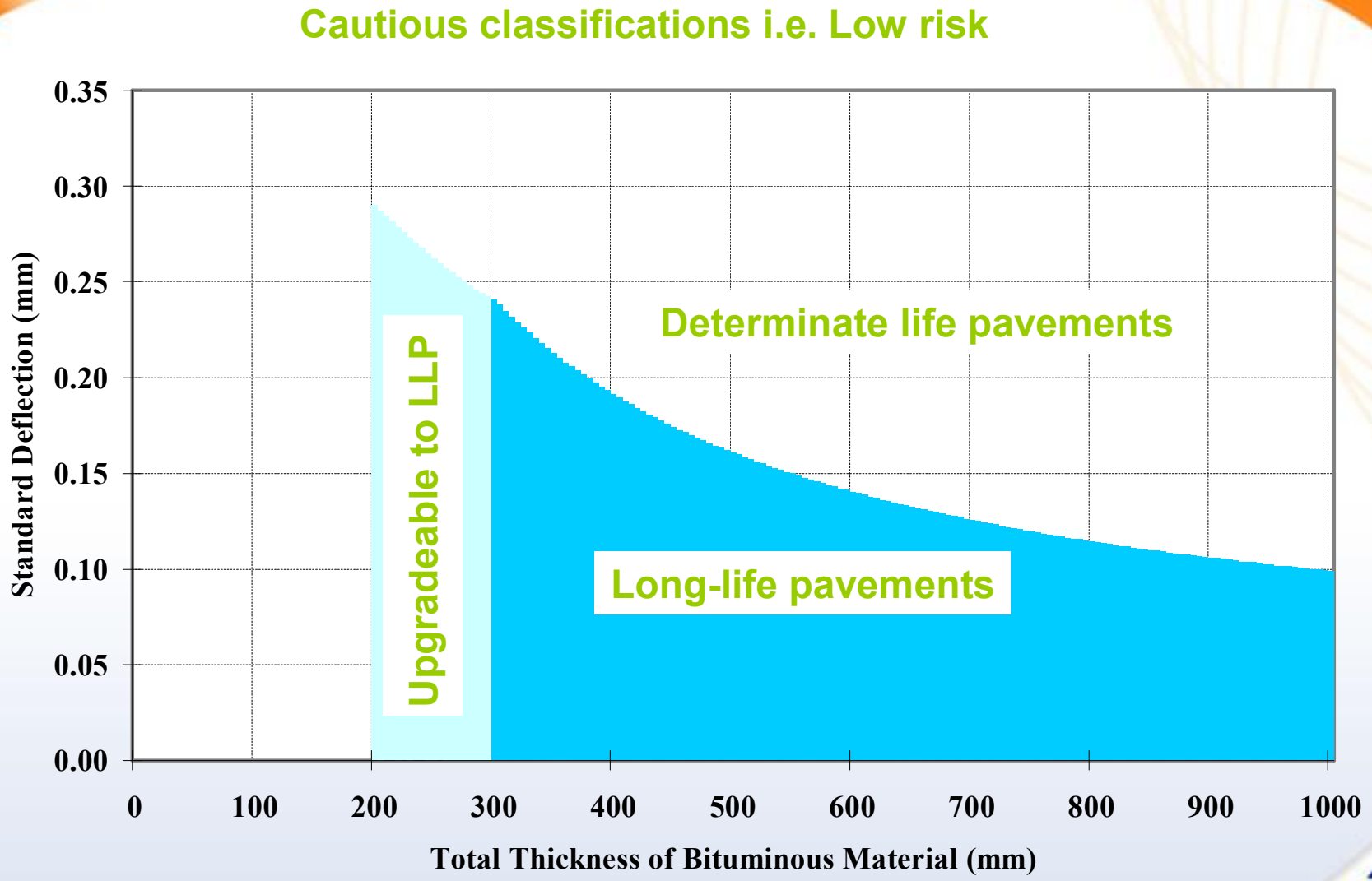
RISK

- **Risk of failure requiring early intervention**
  - For high volume roads : low risk
  - For lower traffic volumes : a greater risk may be justified

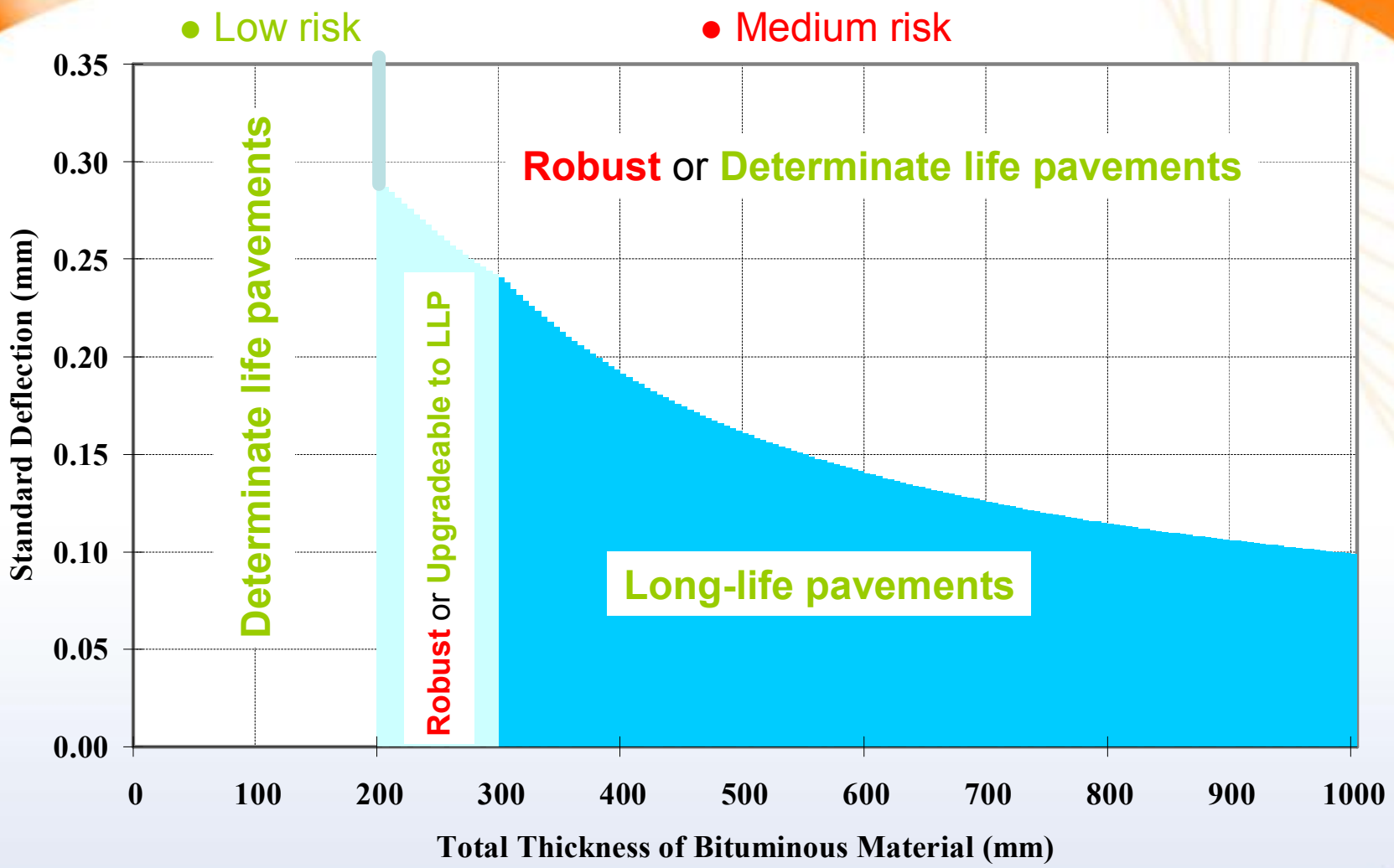
Original deflection-thickness chart



Structural Assessment - DMRB



Introducing Robust Pavements



Robust Pavement Characteristics

A robust flexible pavement :

- **asphalt of at least 200mm**
- **no structural deterioration under current traffic level**
- **good quality foundation**
- **needs regular structural assessment**
- **probably needs maintaining like a long-life pavement**

Identifying Robust Pavements

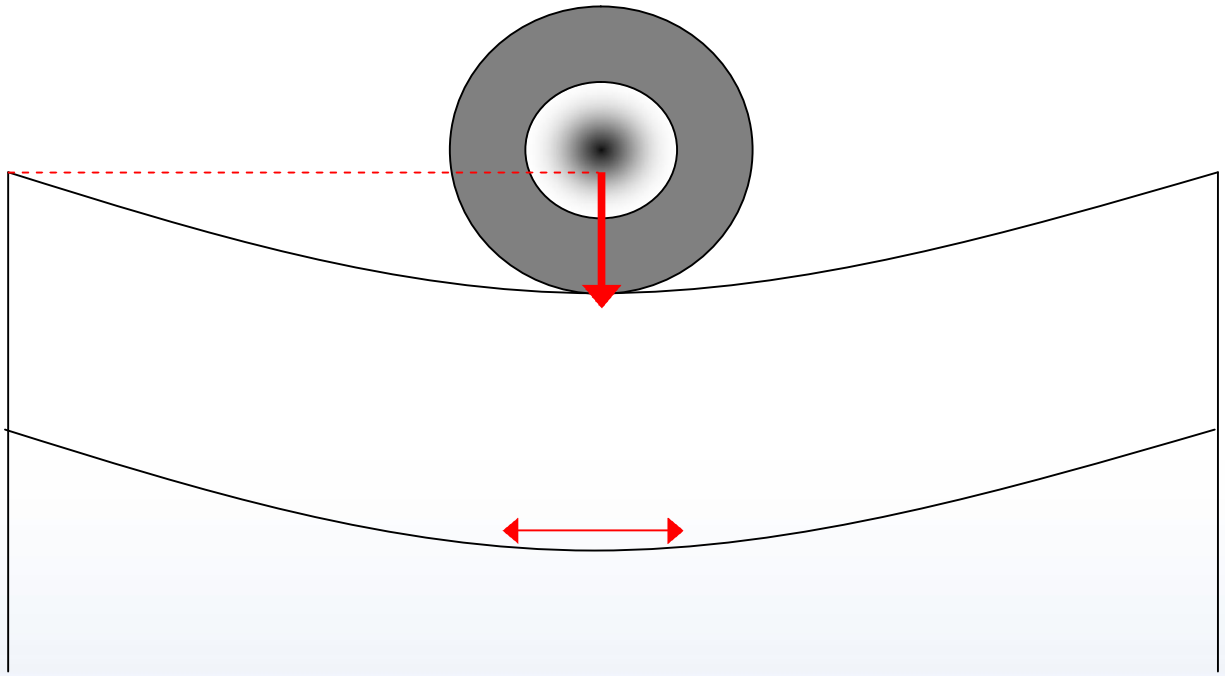
- No structural damage
- Sound asphalt
- Adequate foundation
- Adequate asphalt thickness
- Maintenance history

Identifying Robust Pavements

- **No structural damage**
  - Deflection trends
  - Maintenance history
- **Sound asphalt**
  - Inspection of cores
- **Adequate foundation**
  - Direct and indirect measurement of modulus
- **Adequate asphalt thickness**
  - Cores or ground penetrating radar

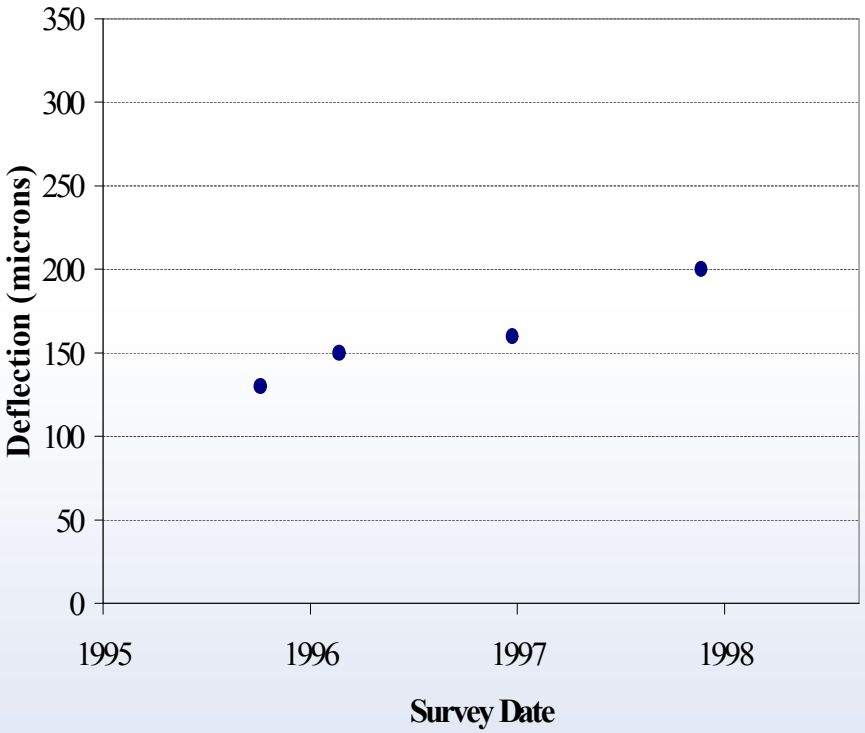
No structural damage?

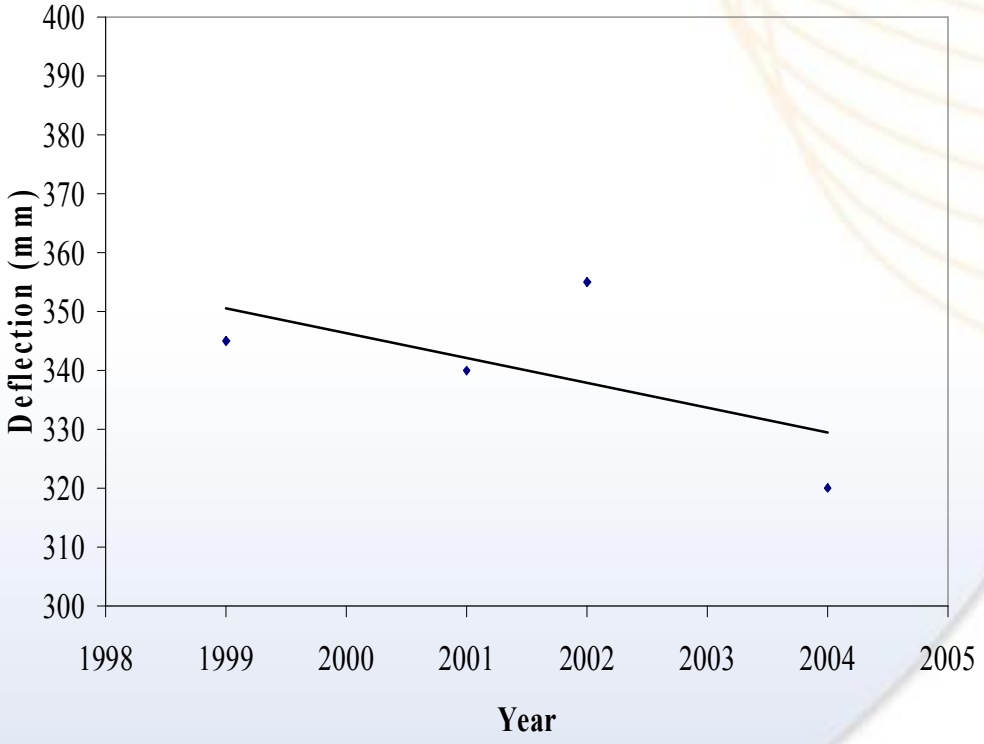
- **Pavement responses**



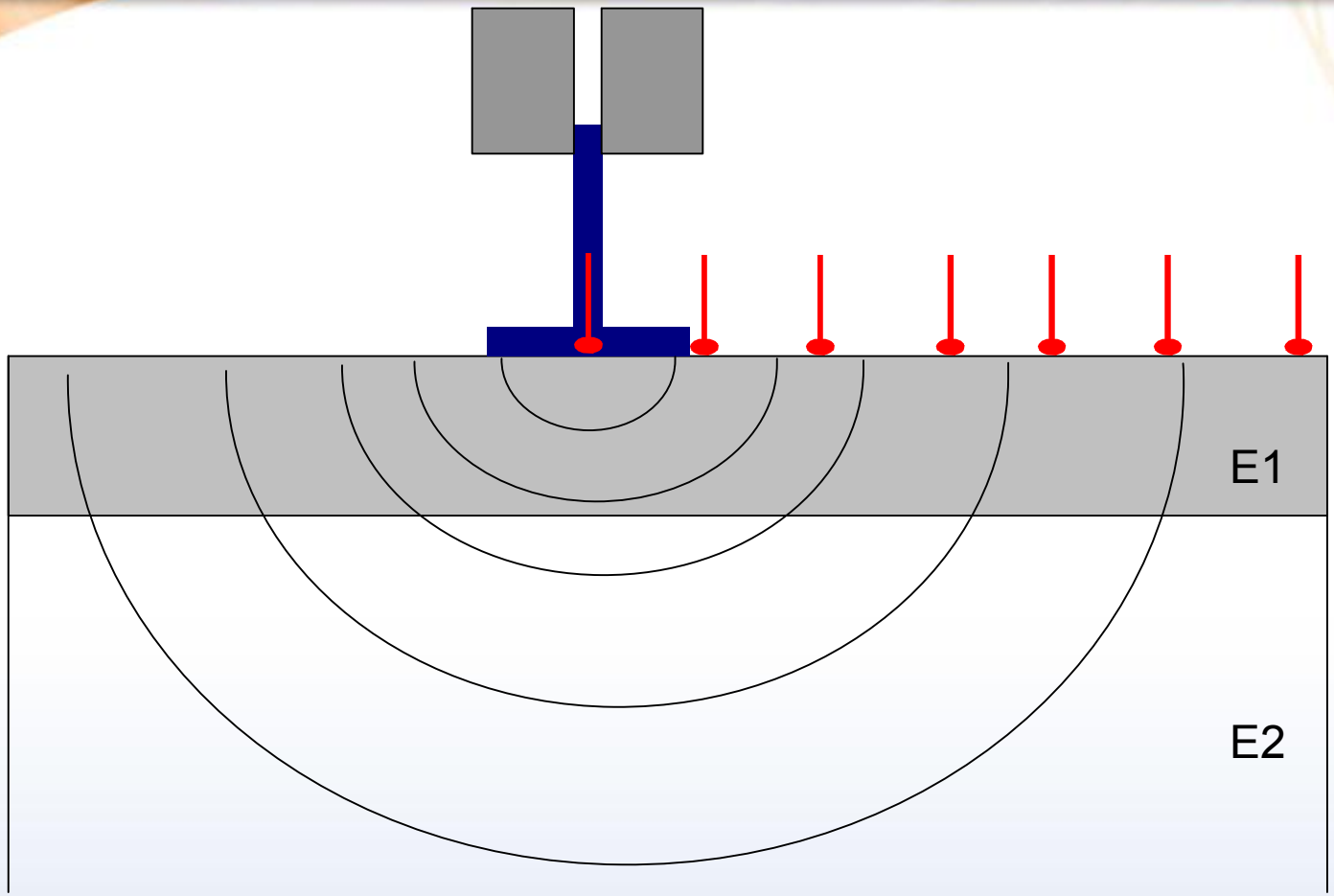
No structural damage

- **Evolution of pavement responses – deflection trends**





Foundation stiffness



Following identification of RP

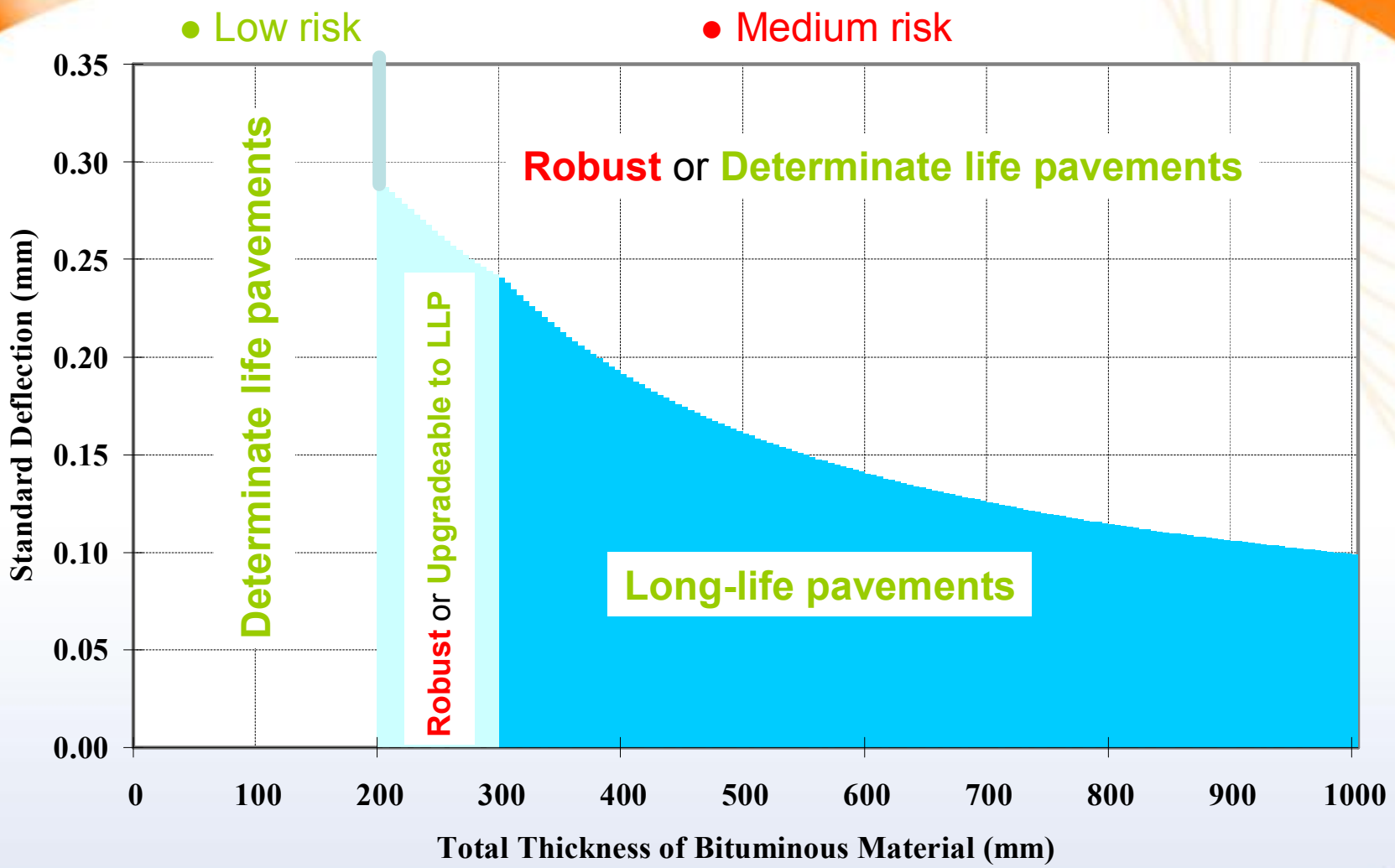
Either:

- **Medium risk strategy**
- **Treat as LLP with more careful structural monitoring**

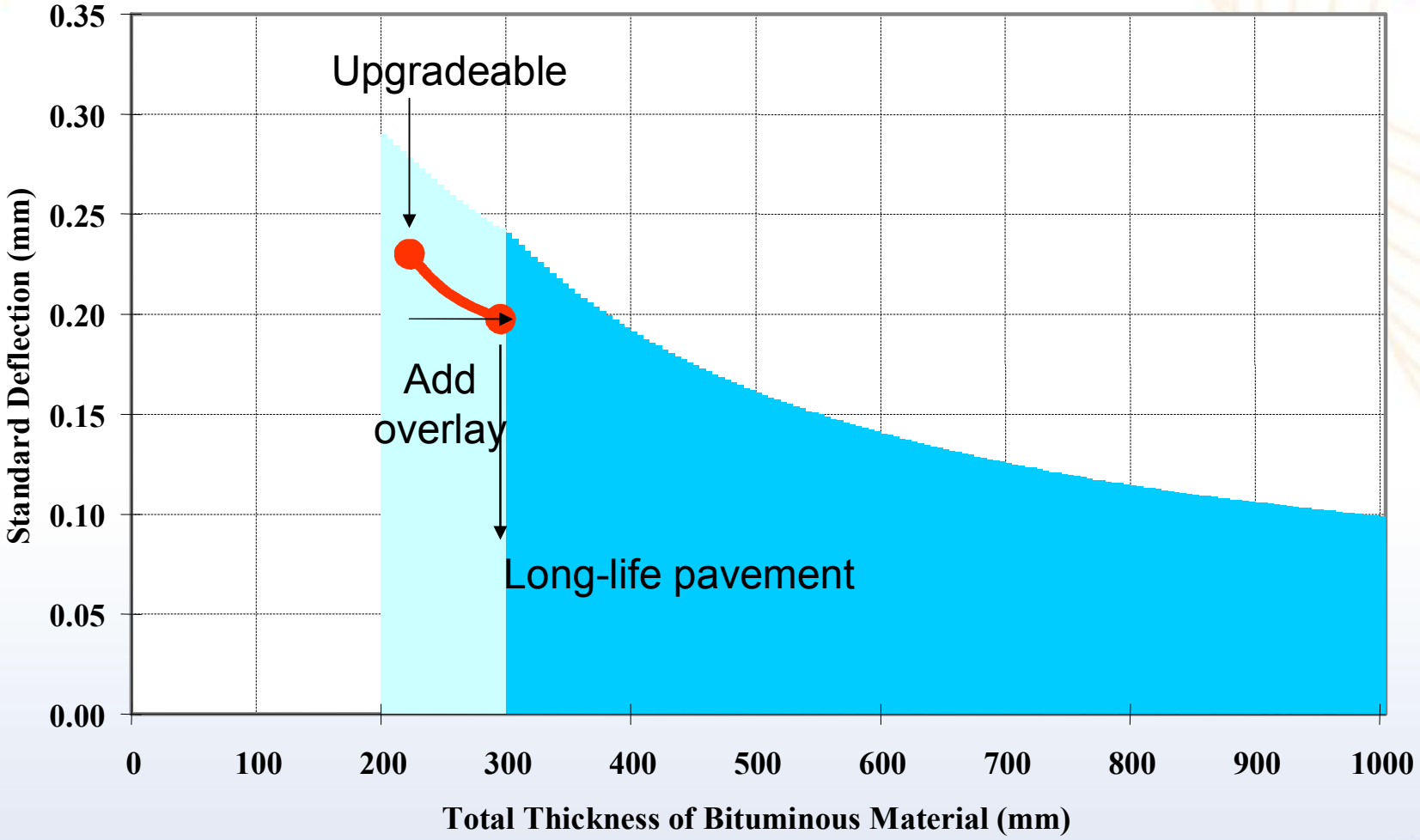
Or

- **Low risk strategy**
- **Upgrade to low risk LLP**

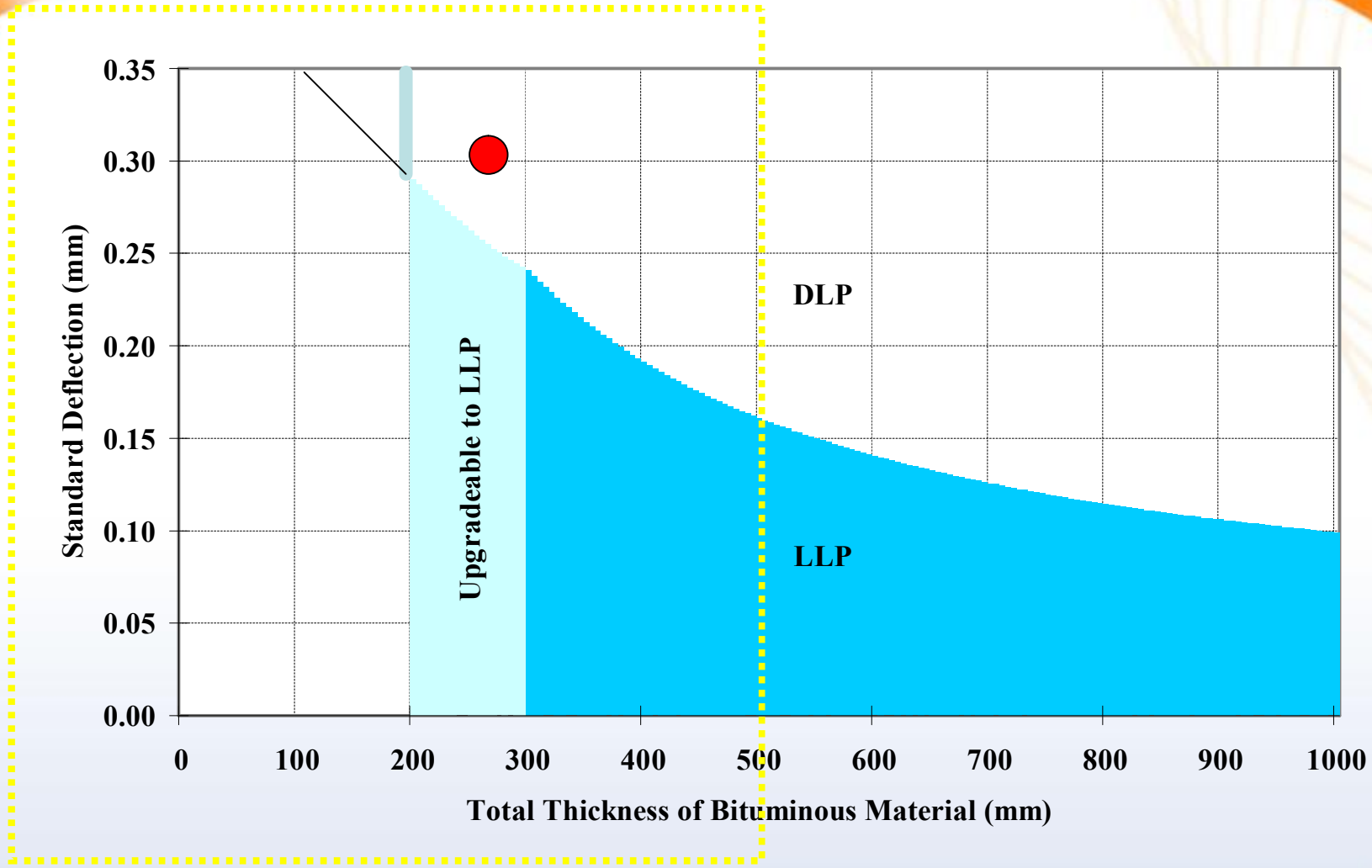
Upgrading of Robust Pavements



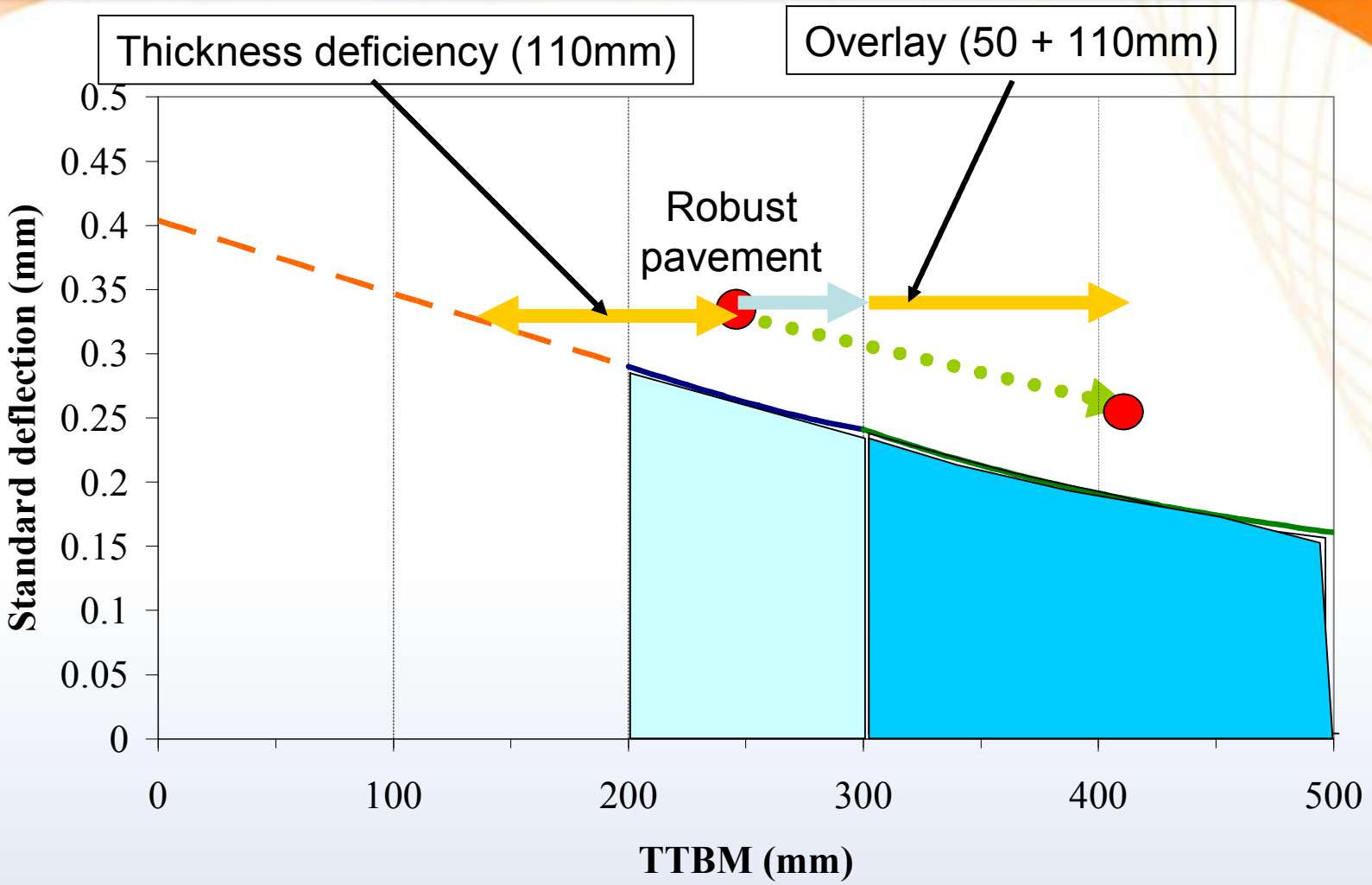
Current Upgrading



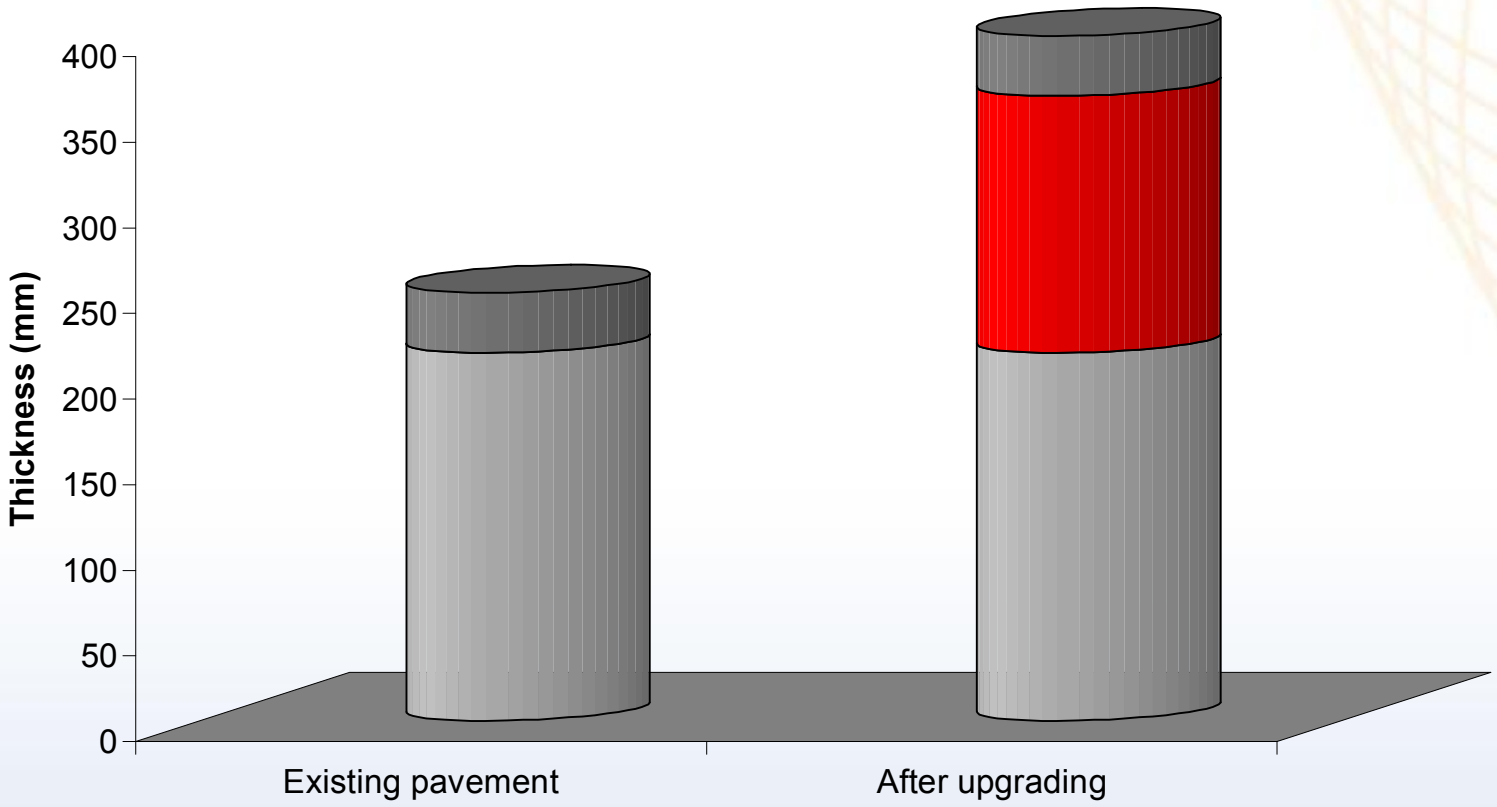
Robust Upgrading



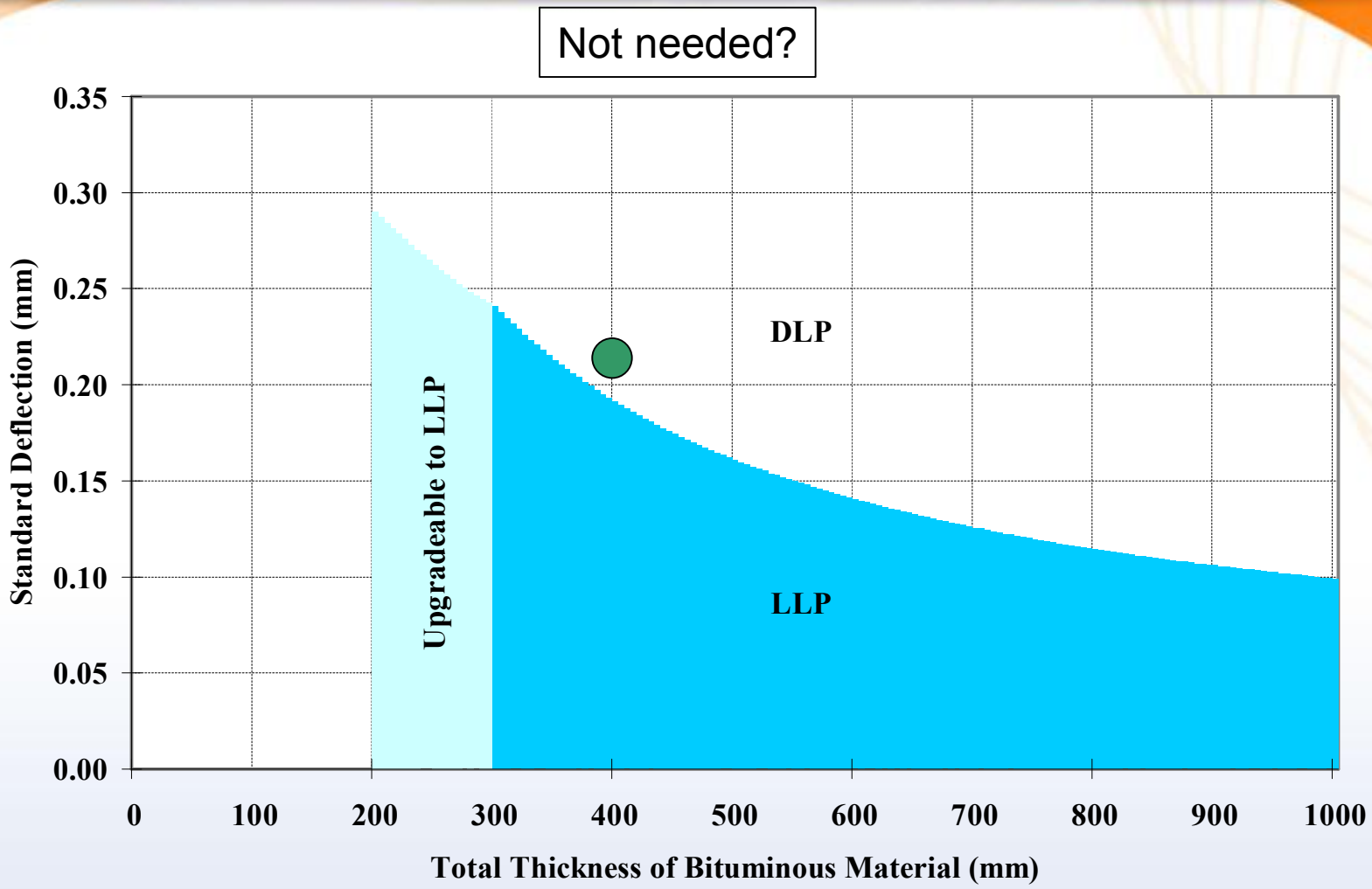
Upgrading robust pavements



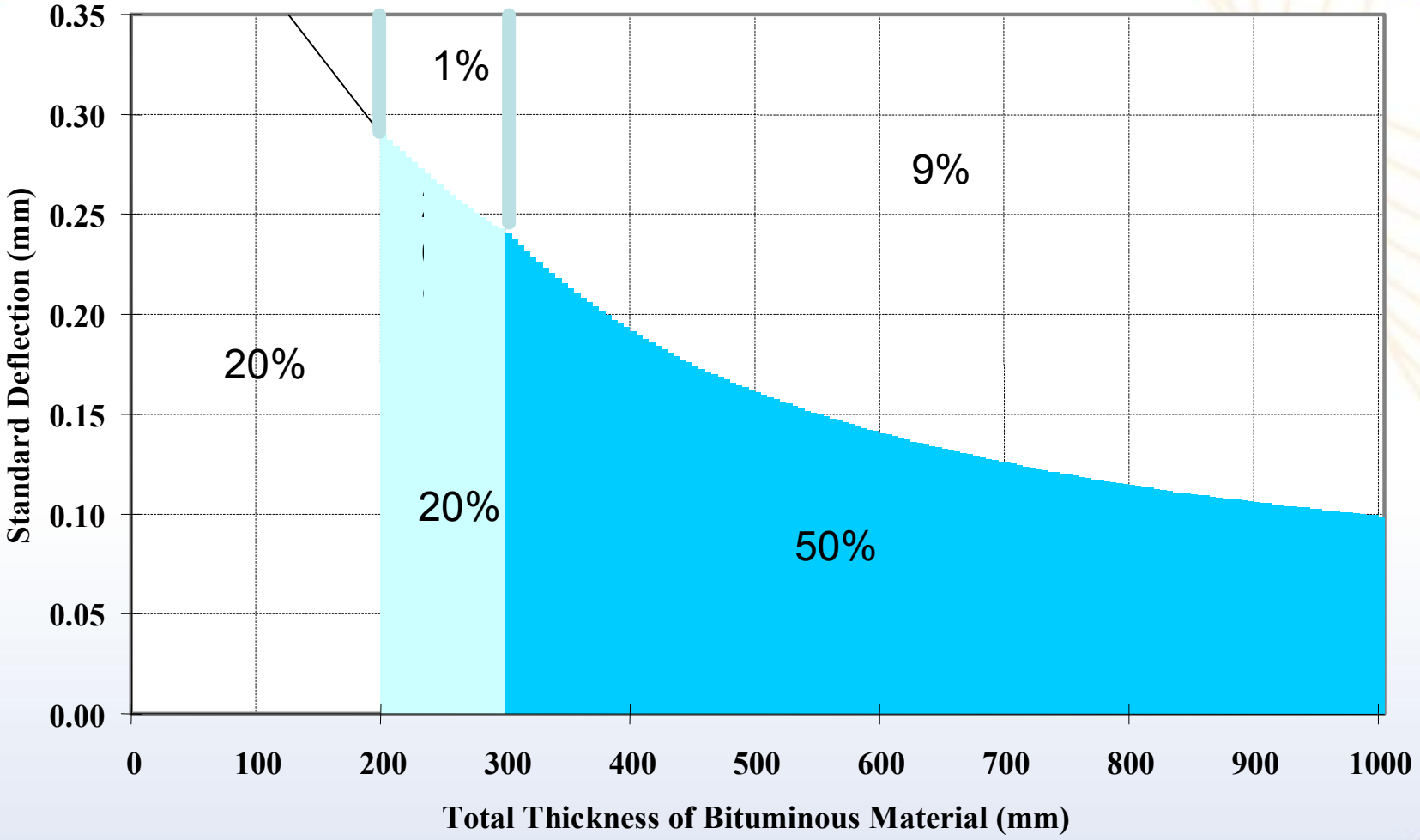
Upgrading robust pavements



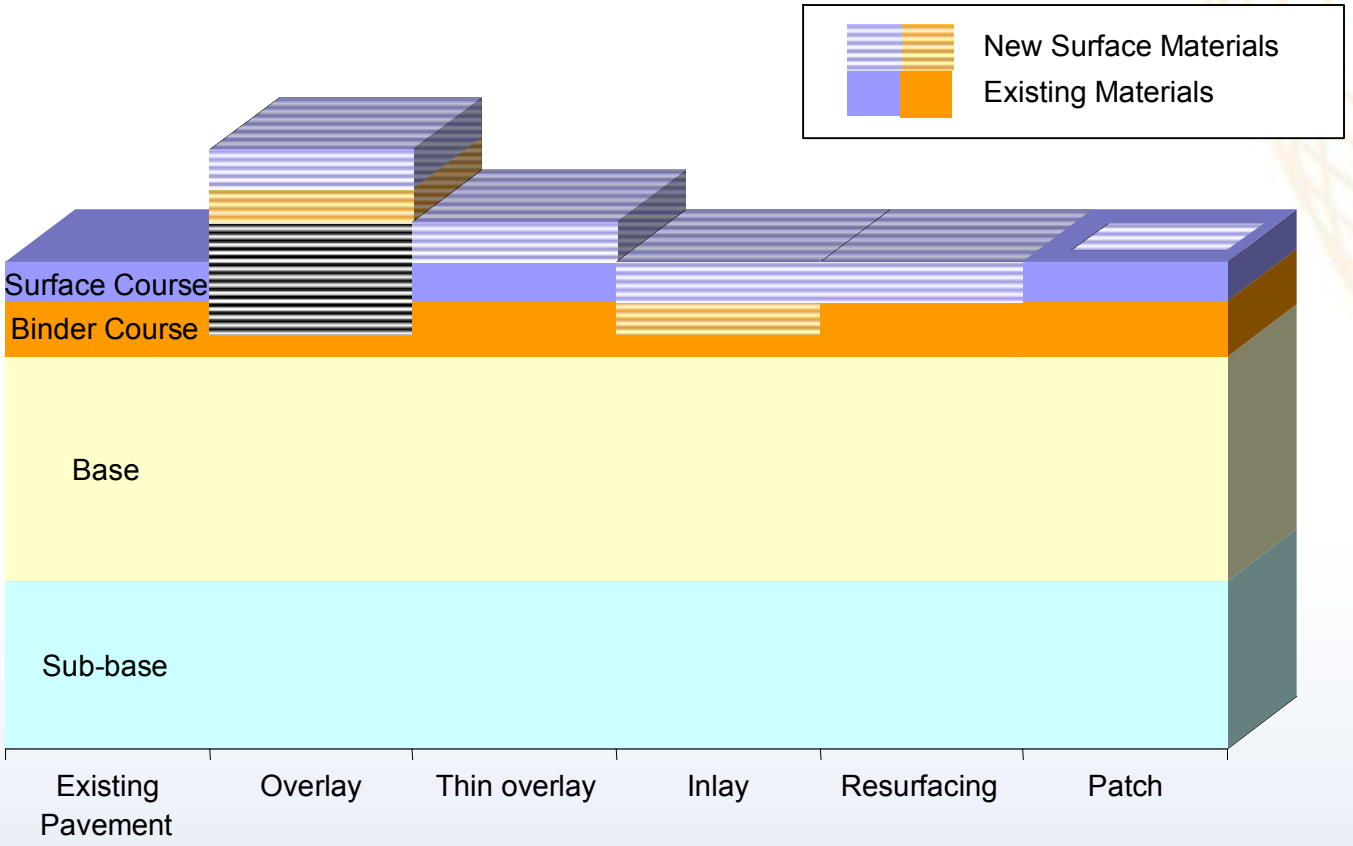
Robust Upgrading ?



Potential impact of RP's on HA network?

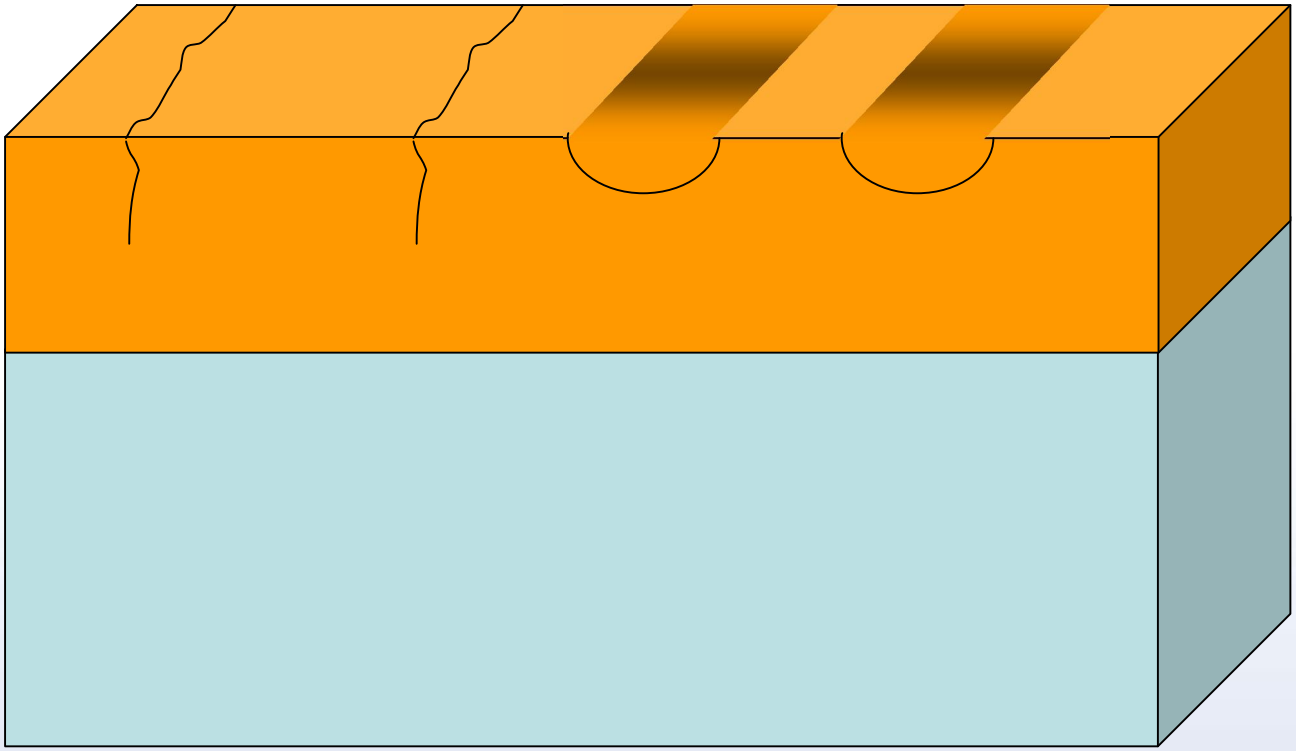


DMRB advice

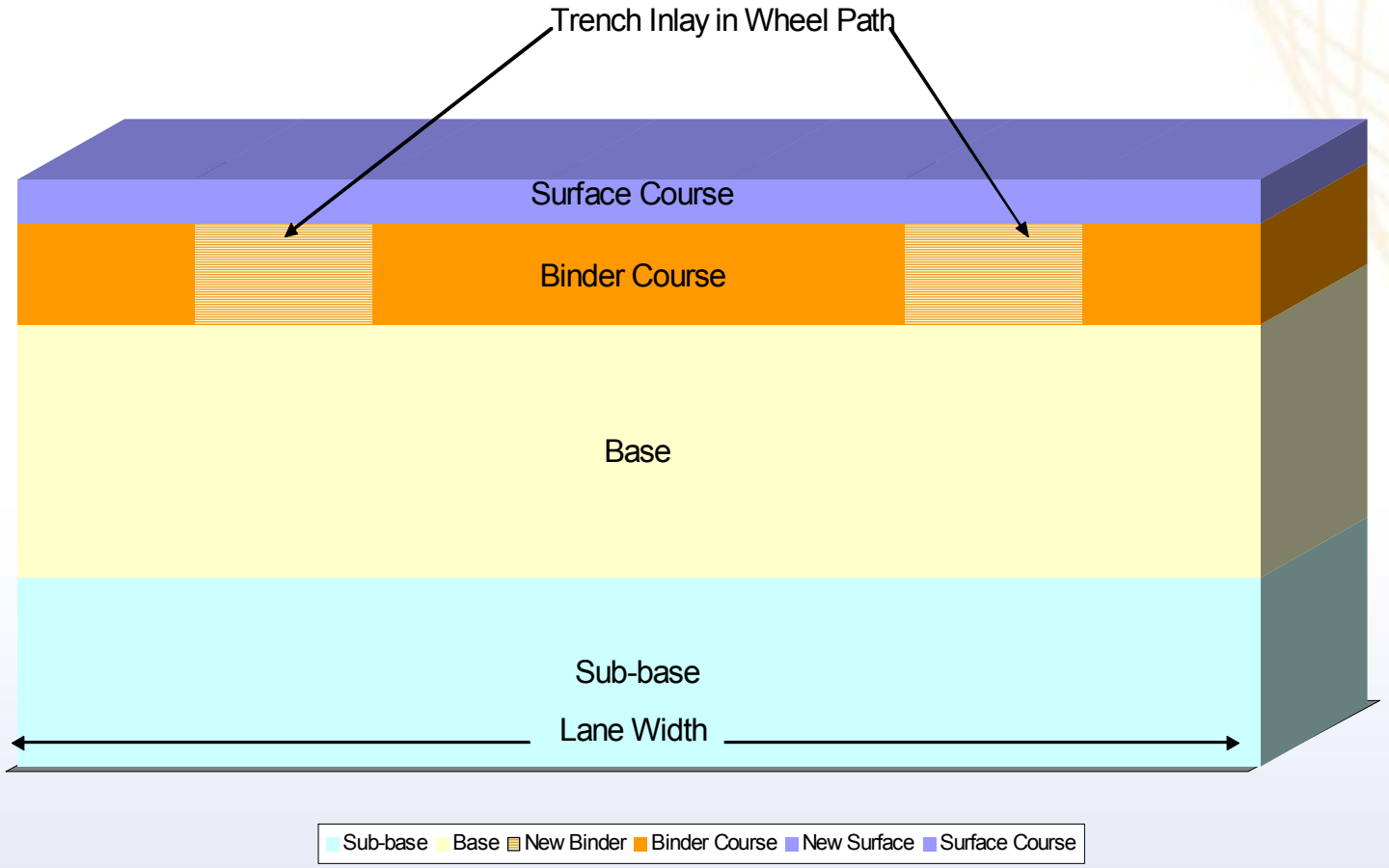

New Surface Materials
Existing Materials
Surface Course
Binder Course
Base
Sub-base
Existing Pavement
Overlay
Thin overlay
Inlay
Resurfacing
Patch

Pavement Deterioration:

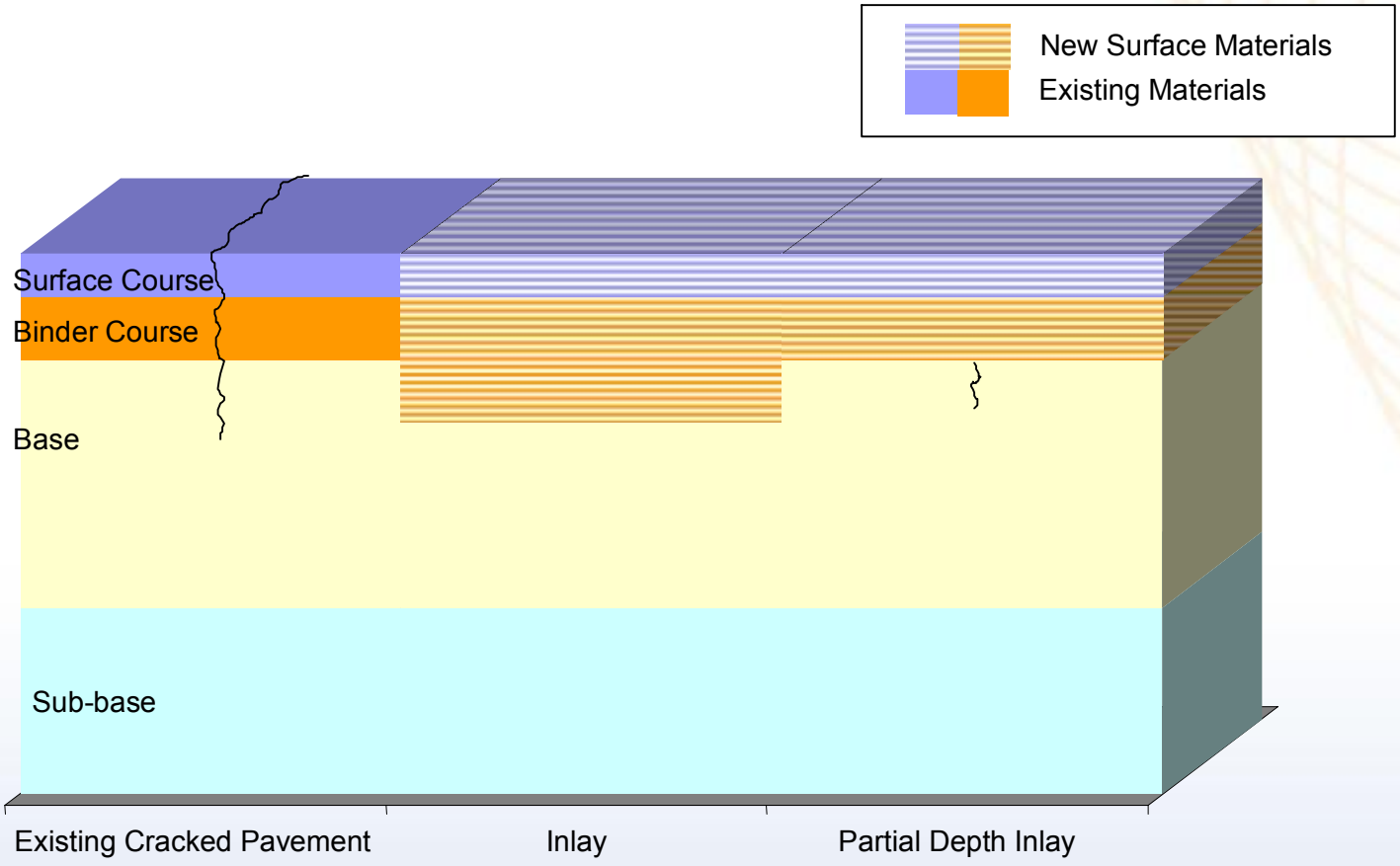
Wheelpath Deterioration



Proposed alternative treatments



Alternative treatments



Benefits of this work

- More of the network identified as potentially long life or robust, particularly on the non-trunk roads
- More options for upgrading

Therefore

- More efficient use of materials
- Better value
- Safer and less disruptive maintenance

Developments

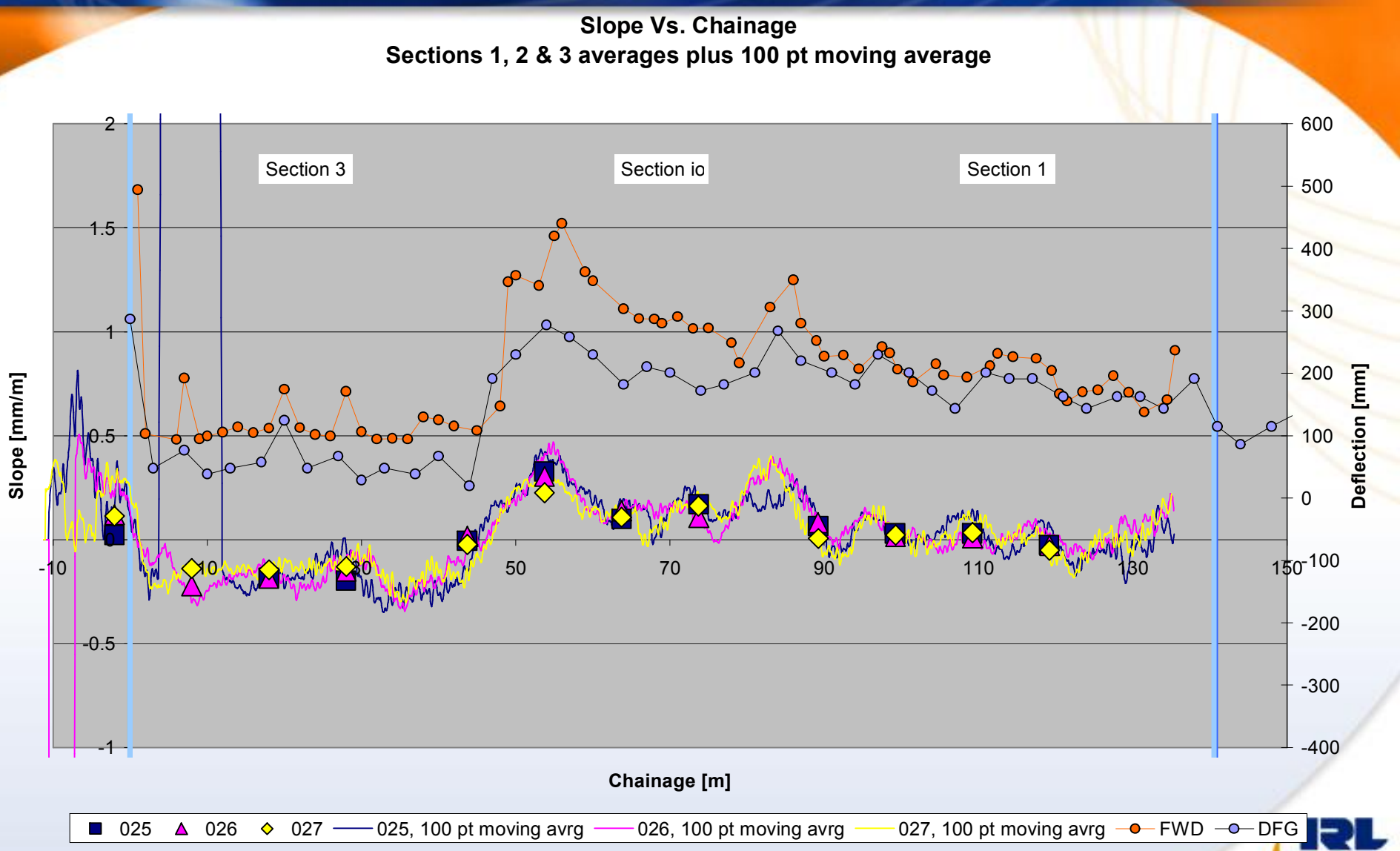
- Dynamic deflections at traffic speed
- Crack detection
- High modulus binder course
- Improved durability
- Re-examine pavement performance and feed-back into design

In the UK we now have……

HA's
Traffic Speed Deflectometer

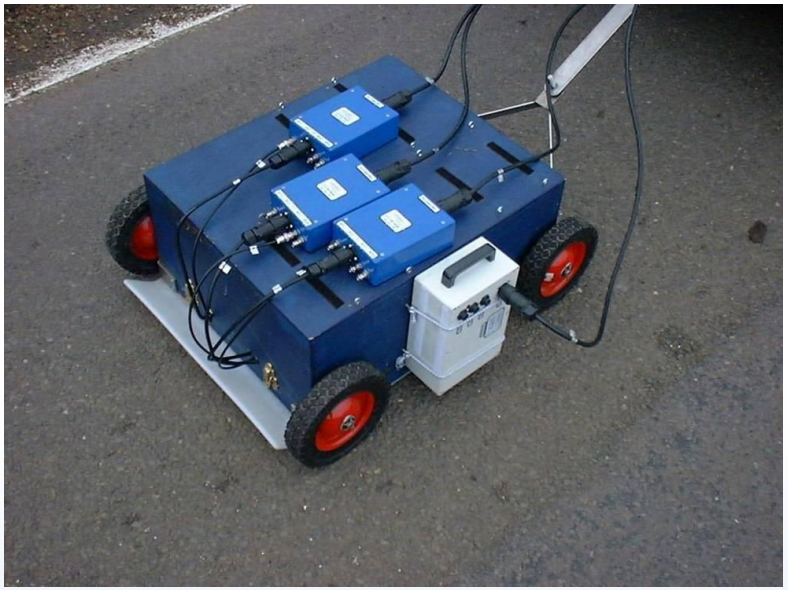
Traffic Speed Deflectometer (TSD)

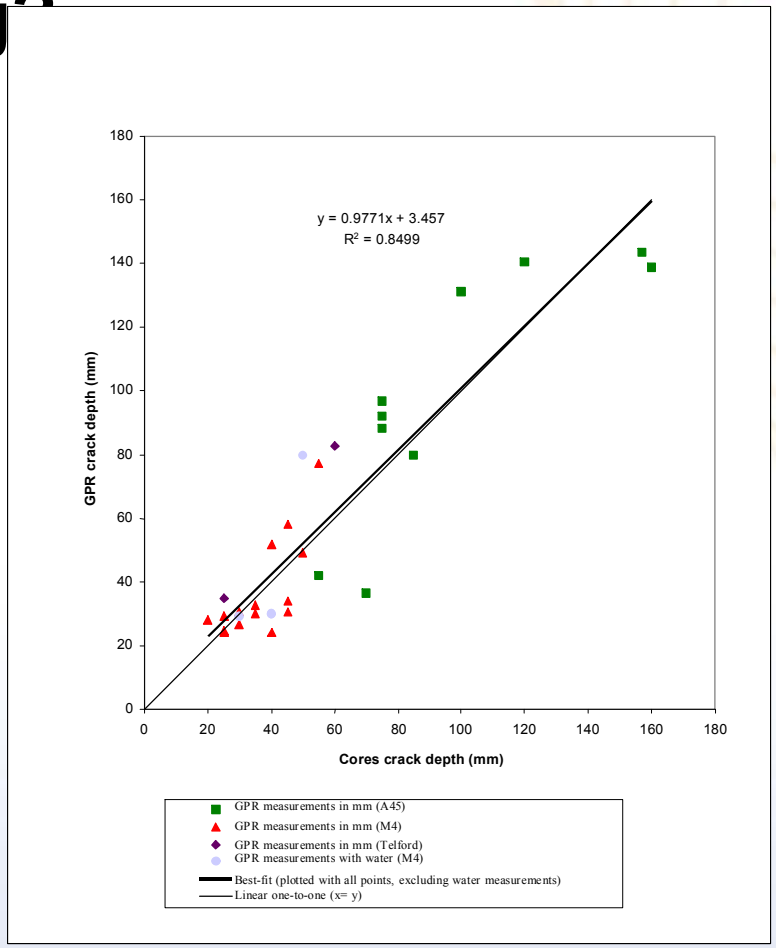
TRL track testing – SRS



How to assess crack depths?

Coring?





Use slow-speed ground penetrating radar

High Modulus Materials

- **Enrobé à Module Elevé (EME)**

  - High binder content/ low air voids

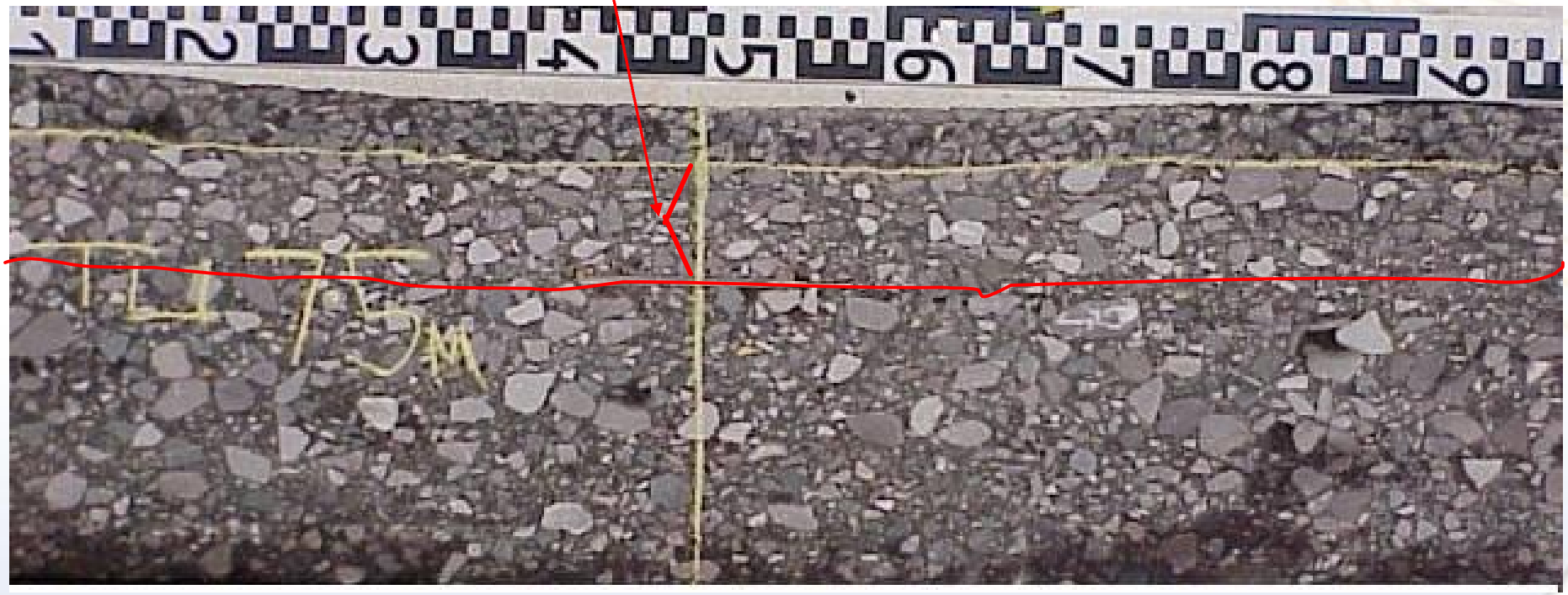
  - Very stiff binder

  - a good track record

  - a laboratory design procedure

EME: resistance to deformation

Minimal deformation in the EME



Re-examine pavement performance and design concepts

- Very complex system
- Understand deterioration phenomenon
- Observe of what is happening
- Re-examine basic concepts

Closing comments

Observations suggest that with a reasonable asphalt thickness, fatigue and structural deformation are not an issue.

What happens in thinner pavements?

Is cracking something waiting to happen as the pavement age hardens?

Benefits of this work

- More efficient use of resources
- Better value
- Safer and less disruptive maintenance

Perpetual or LLPs are durable and ‘resource efficient’


Thank you for
listening

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