

ASSESSING EXISTING STEEL BRIDGES CHALLENGES FOR PRACTICE

PROF. DR. IR. JOHAN MALJAARS

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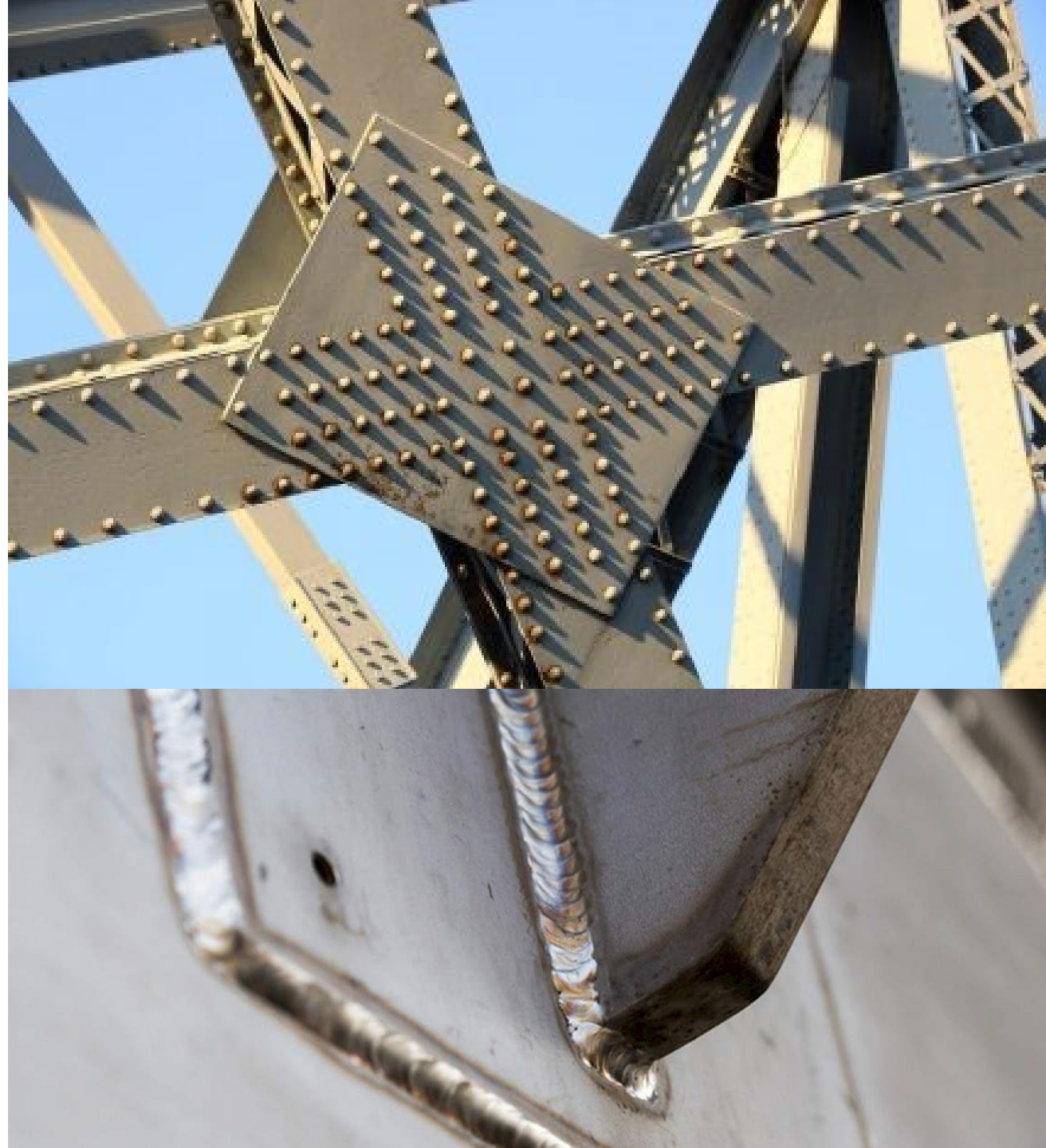
› VARIETY OF STRUCTURES

- › Number of steel bridges in use
 - Rijkswaterstaat: 349 (scheduled for assessment)
 - ProRail: 615 (since 1950)
- › Many built around 1950



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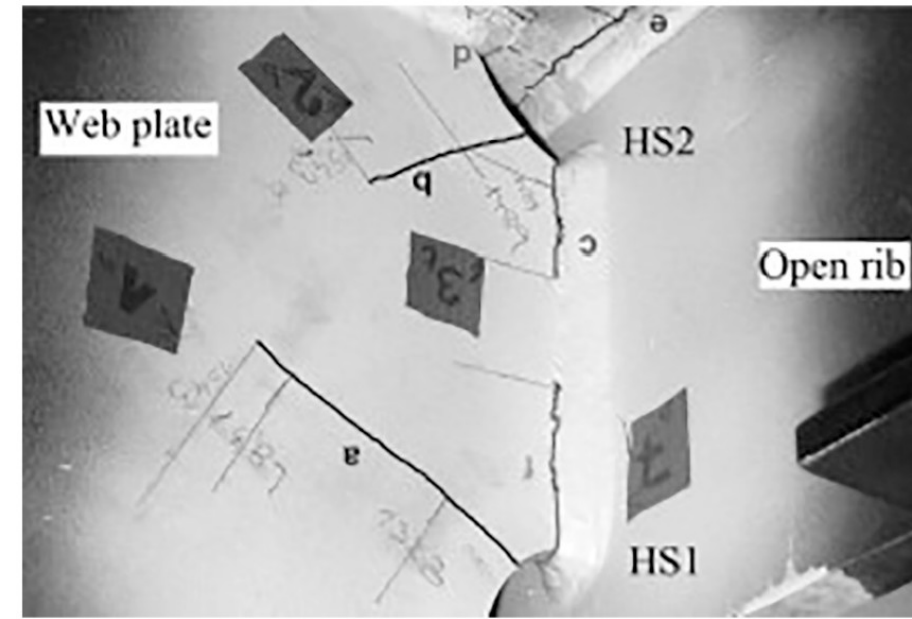
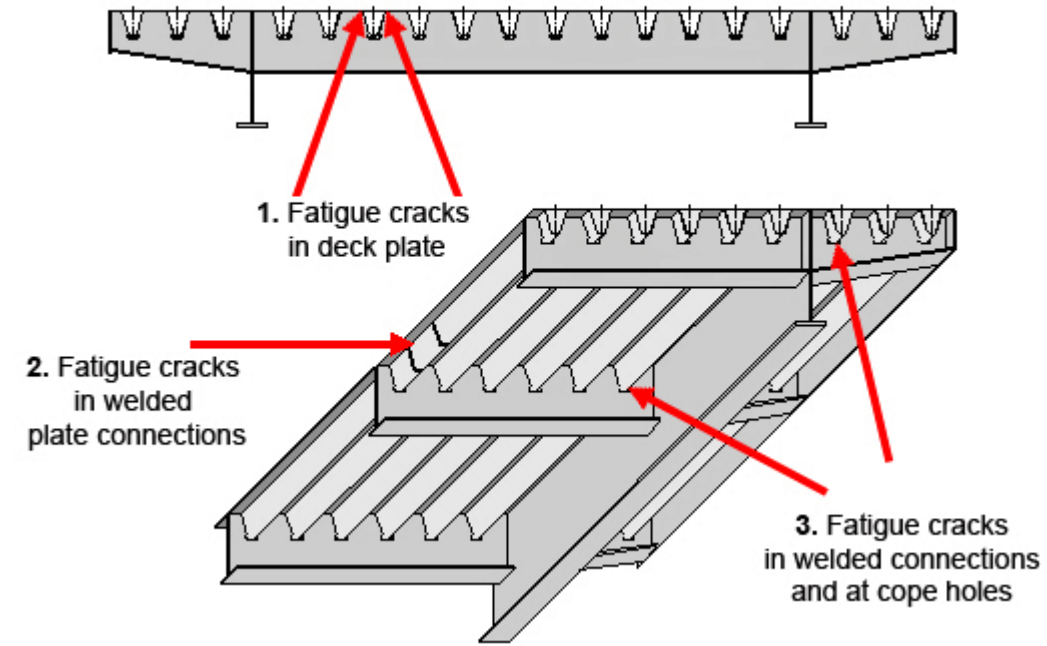
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› Fatigue and fracture

- › To-date: many cracks in orthotropic bridge decks
- › To-date: some cracks in crossbeam-to-main beam connection
- › Expected: cracks in main superstructure
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 - › Buckling
 - › Connection failure (rivets)
 - › (Corrosion)
- › Accidental limit state
 - › Collision
 - › Fire



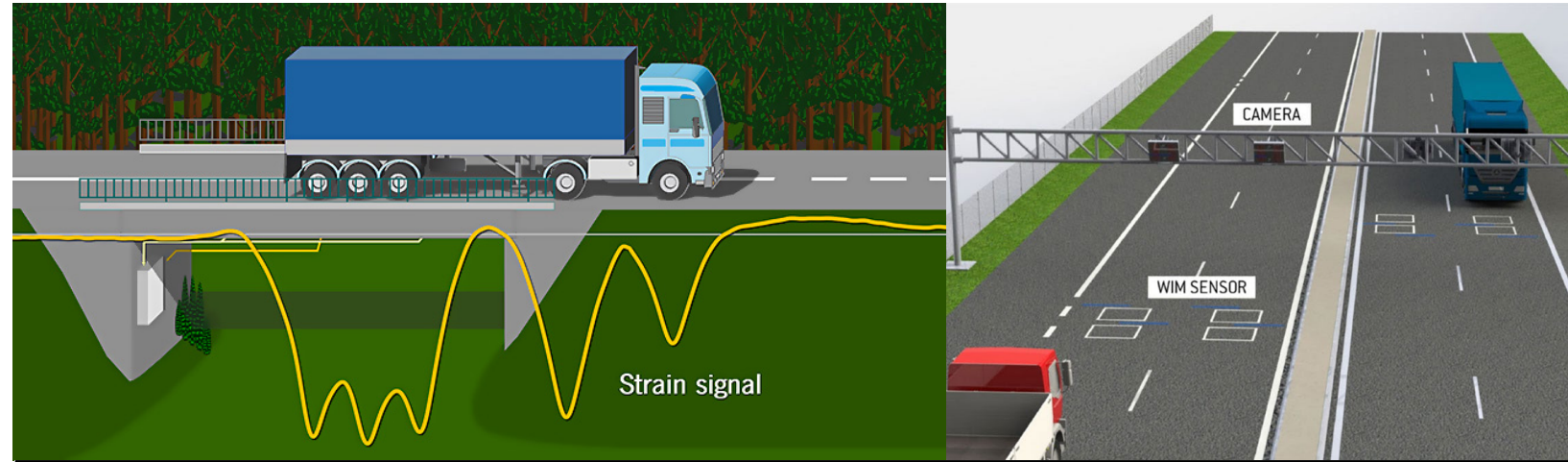
› LOADS AND LOAD EFFECTS

› Loads

- › Measured data for motorways
- › Limited data for local roads
- › Past and future trends?

› Load effects

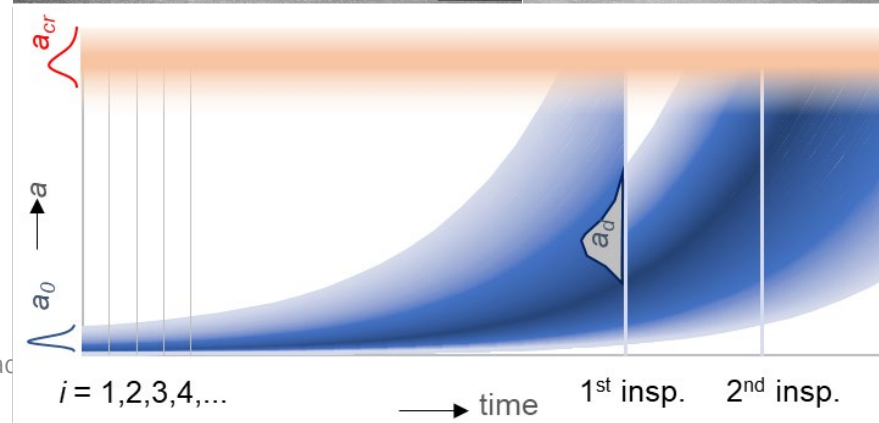
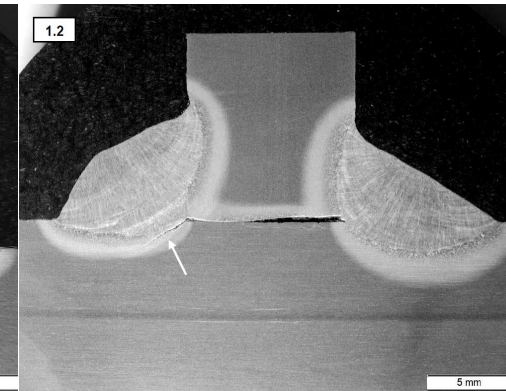
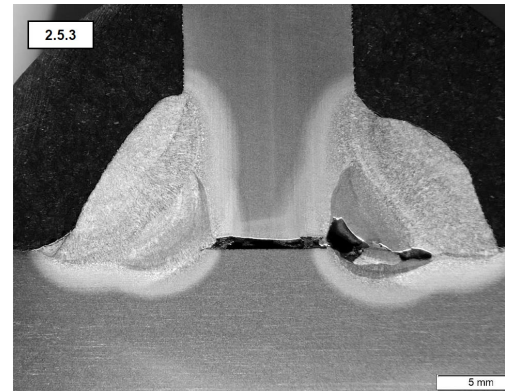
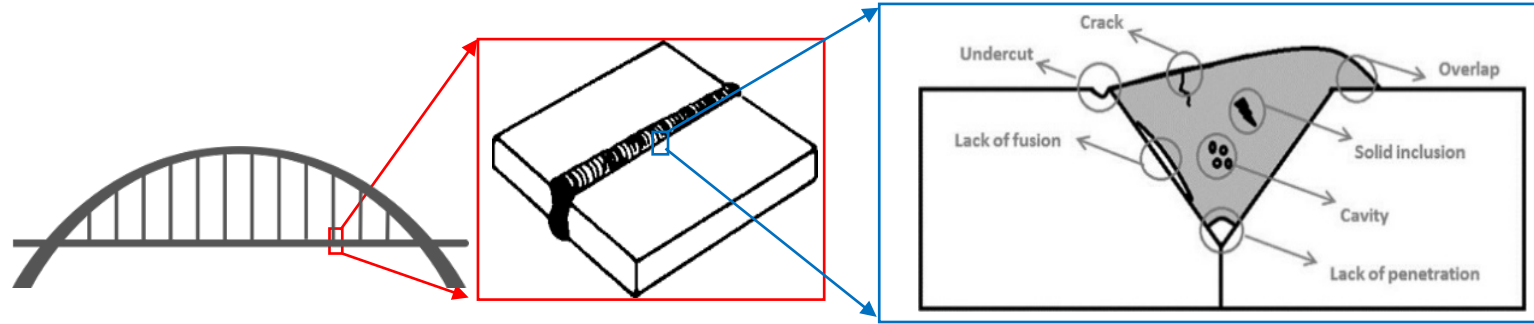
- › Engineering model uncertainty
- › Dynamics



› ON-GOING RESEARCH

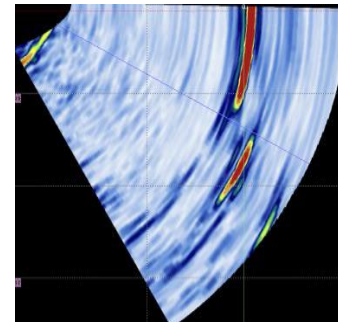
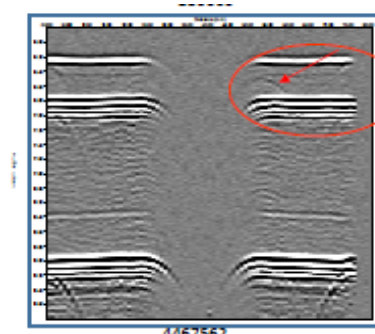
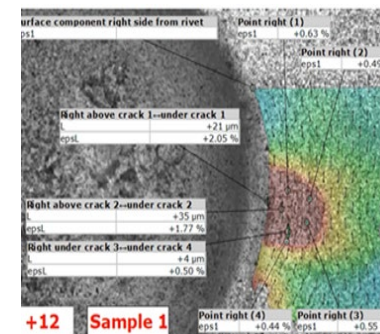
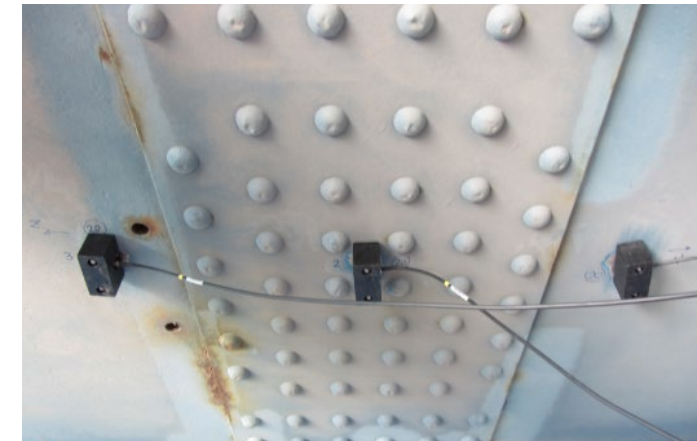
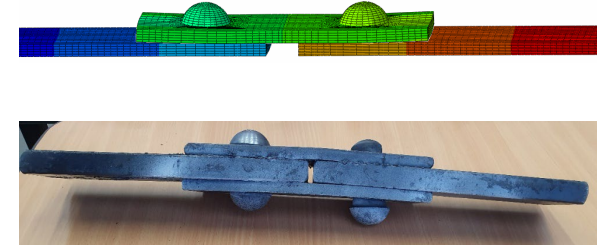
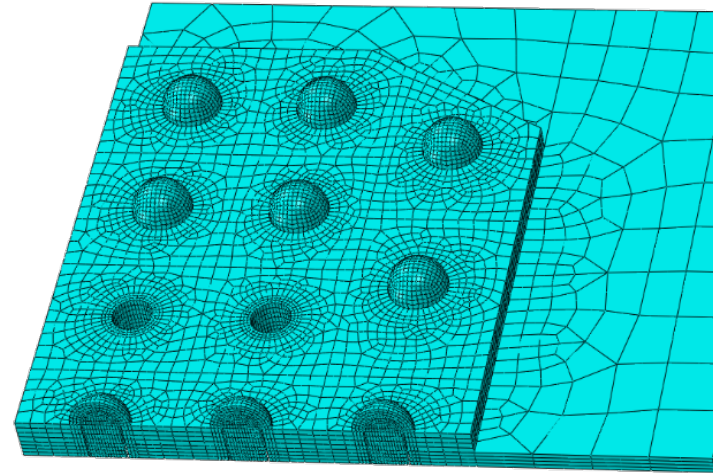
› Fatigue resistance welded joints

- › Life prediction from weld imperfections
- › Remaining life after crack detection
- › Fracture toughness



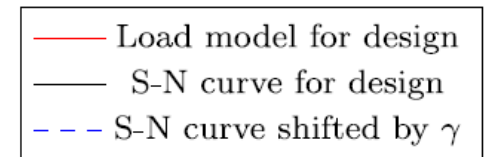
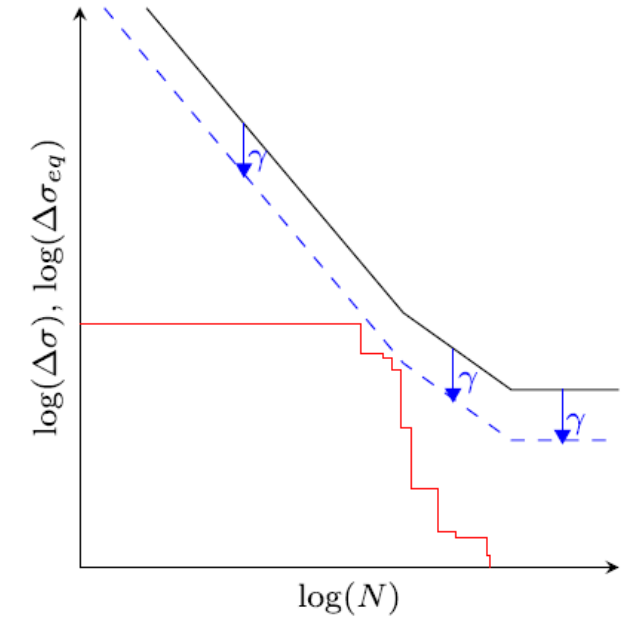
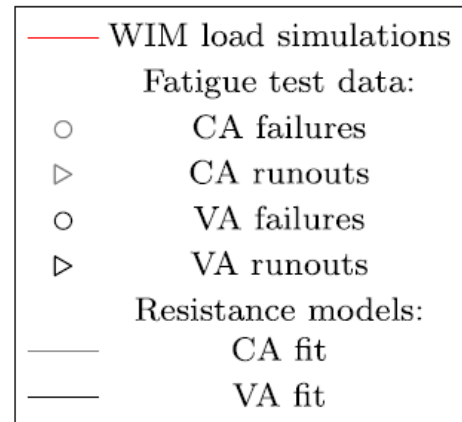
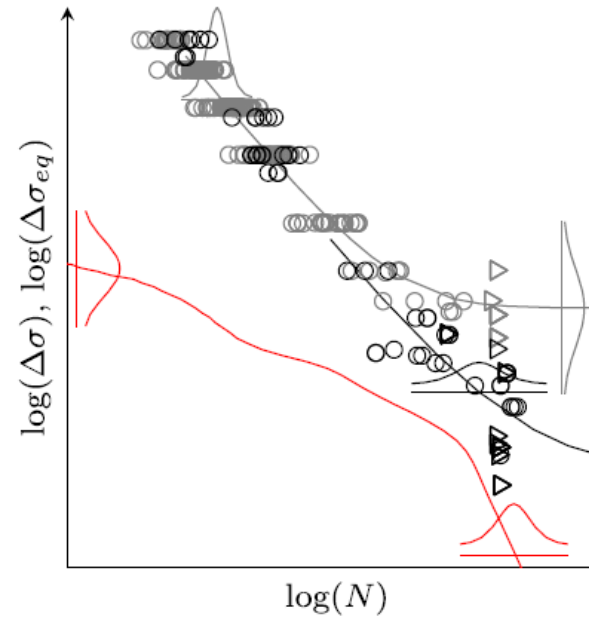
› ON-GOING RESEARCH

- › Fatigue resistance welded joints
 - › Life prediction from weld imperfections
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- › Fatigue resistance riveted joints
 - › Life prediction
 - › Inspection



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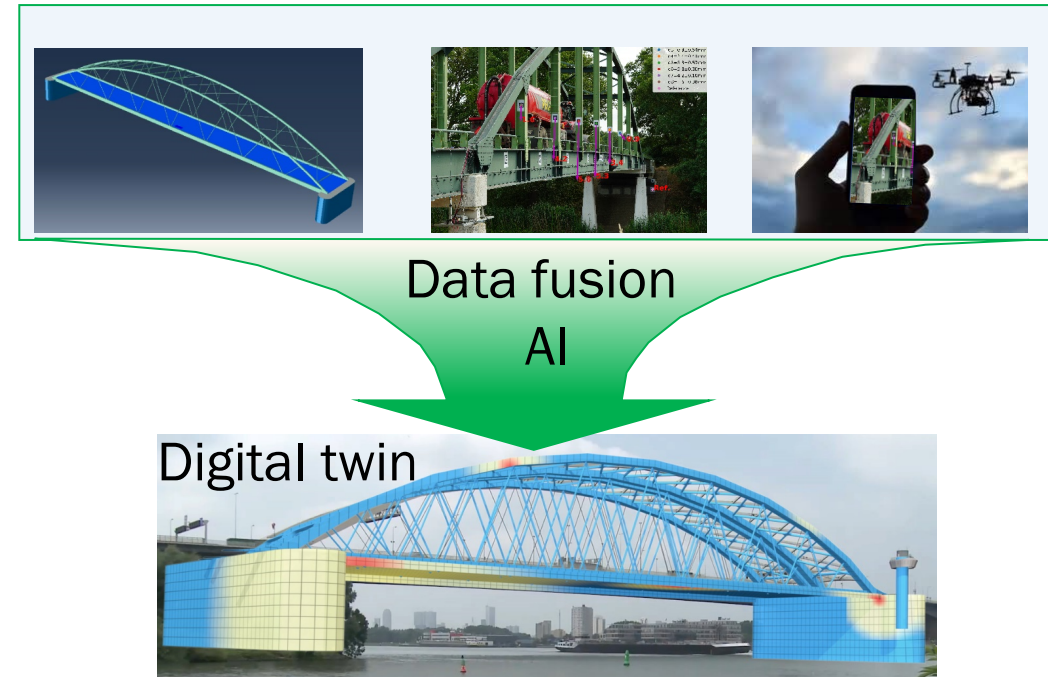
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(c)

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 - › Life prediction
 - › Inspection
- › Safety assessment
- › Digital Twin



› SUMMARY & CONCLUSIONS

- › Many structures to assess
- › Lots of work per assessment
- › Uncertainties load
 - › Local roads
 - › Past and future trends
 - › Dynamics
 - › Engineering model
- › Uncertainties resistance
 - › Probability of detection
 - › Crack growth rate
 - › Fracture toughness
 - › Consequences of local collapse



› **THANK YOU FOR
YOUR TIME**

TNO innovation
for life