

Initiation of and challenges associated to full-scale concrete bridge testing and related monitoring

*Technical University of Denmark
Department of Civil Engineering*

*Post doc Philip Halding
at CASMat Symposium, Risø.
Oct 5, 2016.*

Presentation outline

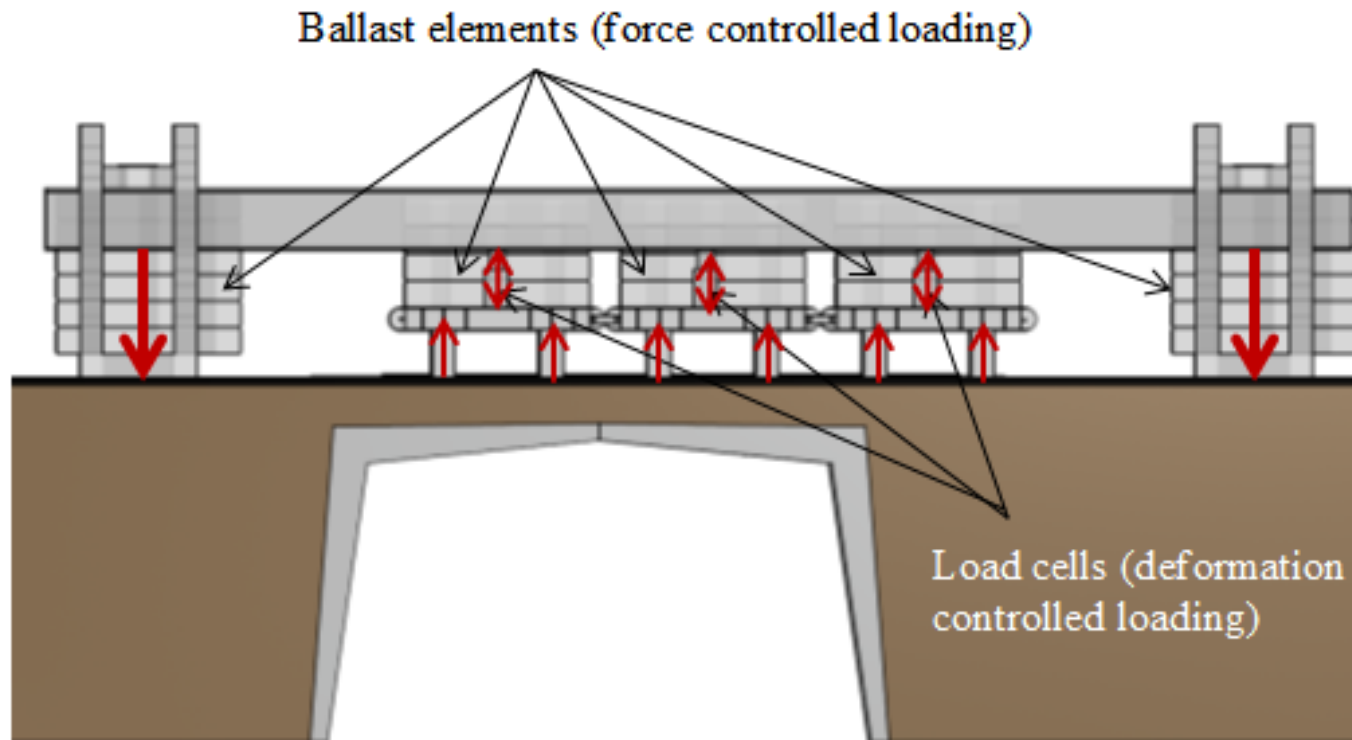
- Introduction to the project
- Test method: Loading procedure
- Test method: Monitoring bridge responses
- Initial test results from the Foldagervej test
- Conclusion

Introduction

- Project with DTU, COWI and the Danish Road Directorate.
- Project started in June 2016.
- The overall project scope is to: “develop test methods and related state-of-the-art monitoring which can be used in a standardized way to test the capacity of existing (one span) full-scale concrete bridges”.
- First four bridges were tested this September.
- Basic idea: Load an existing bridge and monitor the structural response to predict a load capacity or bridge class.

Test method

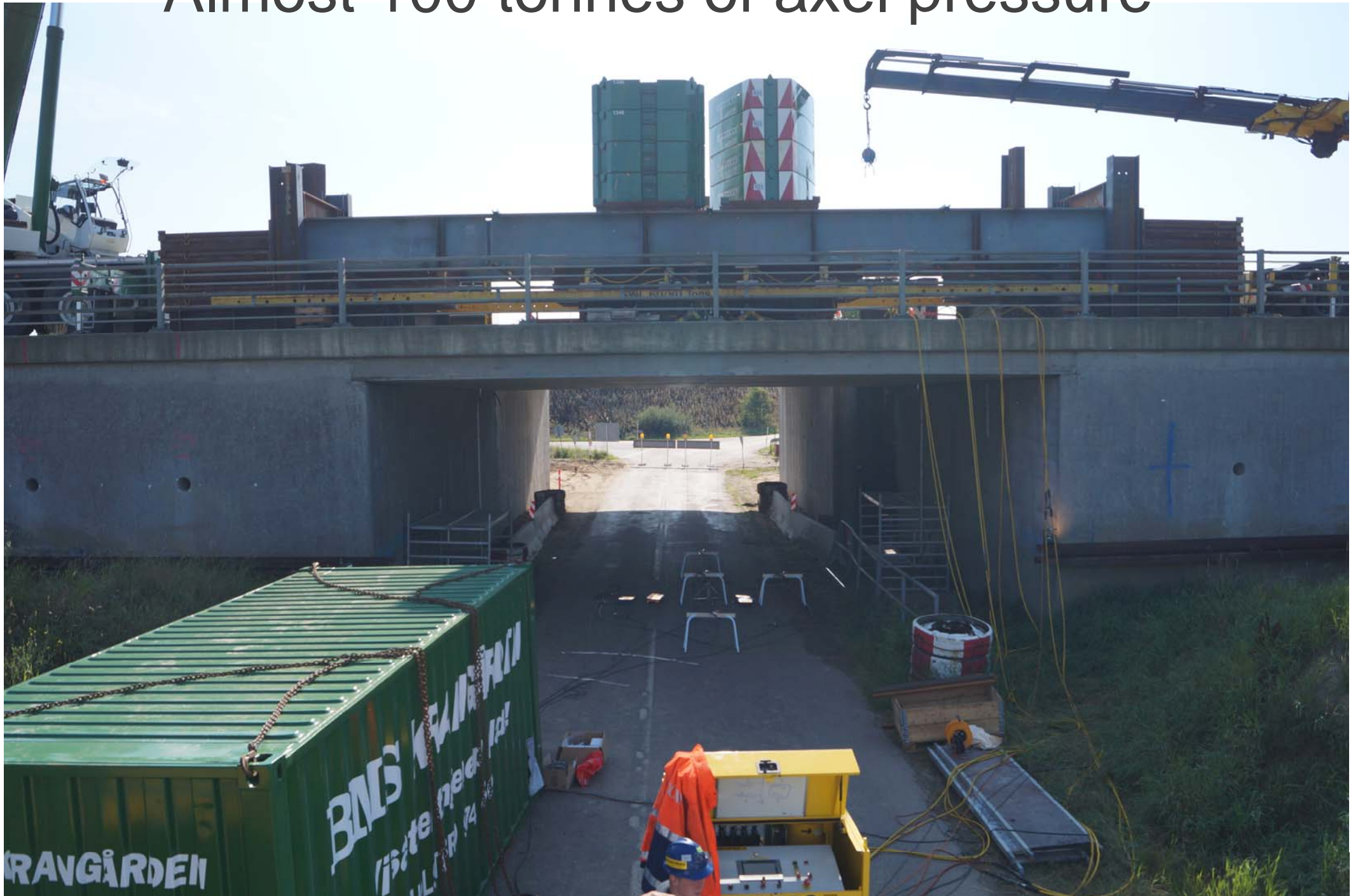
- Applying load:
 - Force controlled and (semi) deformation controlled loading.
 - First bridges tested were spanning up to 11 m.



Foldagervej (11 m span)



Almost 100 tonnes of axel pressure



Test method

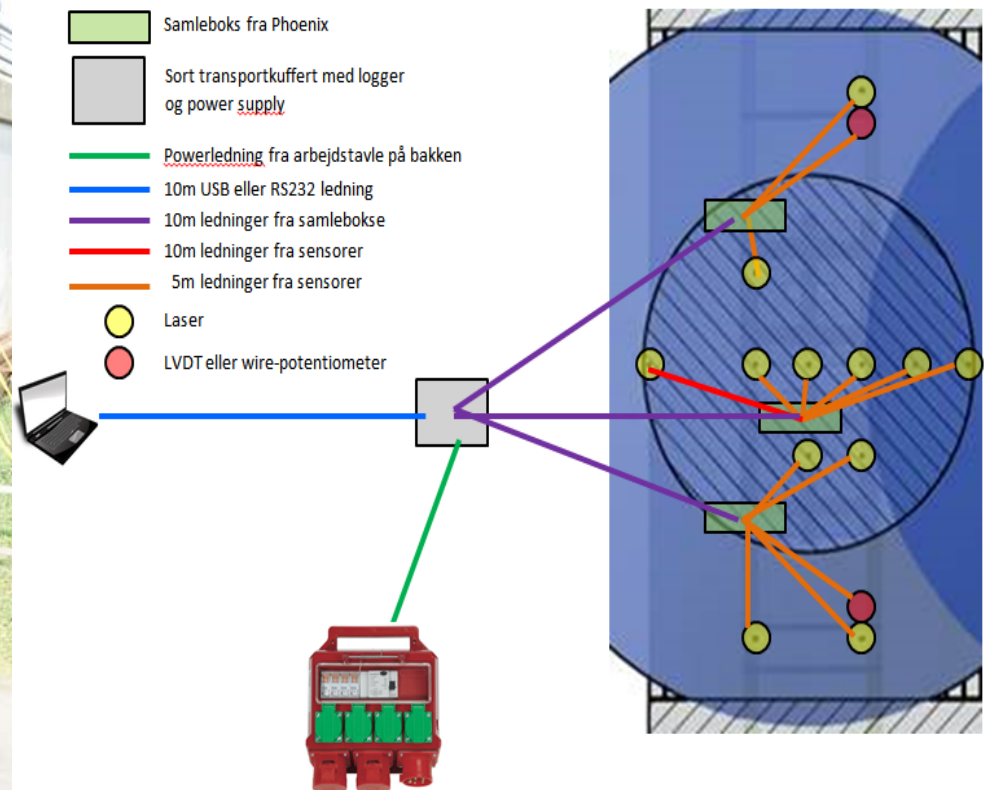
- Monitoring the response of the bridge:
 - The full monitoring method has not yet been established. So far the following equipment was used for testing:
 - 12 laser distance meters
 - 4 LVDT (Linear Variable Differential Transformer)
 - 1 camera (wide angle) for DIC software ARAMIS
 - Surveyor equipment
 - Force and deflection output from the hydraulic jacks.
 - Possible necessary future bridge monitoring equipment:
 - 2D or 3D laser
 - FBG's optical fibres
 - Imetrum DIC-system
 - Etc.

Test method

- Monitoring the response of the bridge: Example at Foldagervej



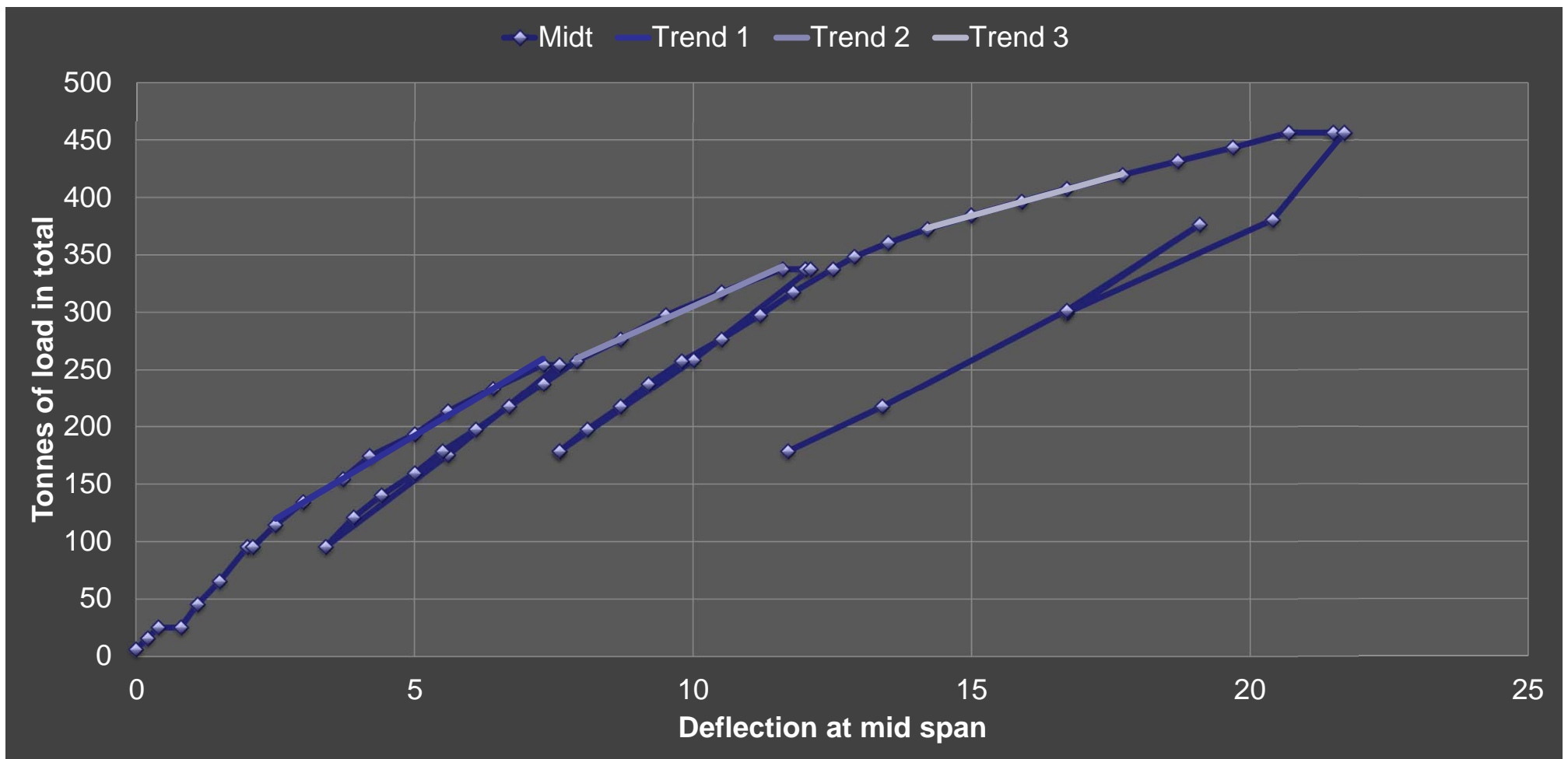
Placeringstegning over sensorer og andet udstyr



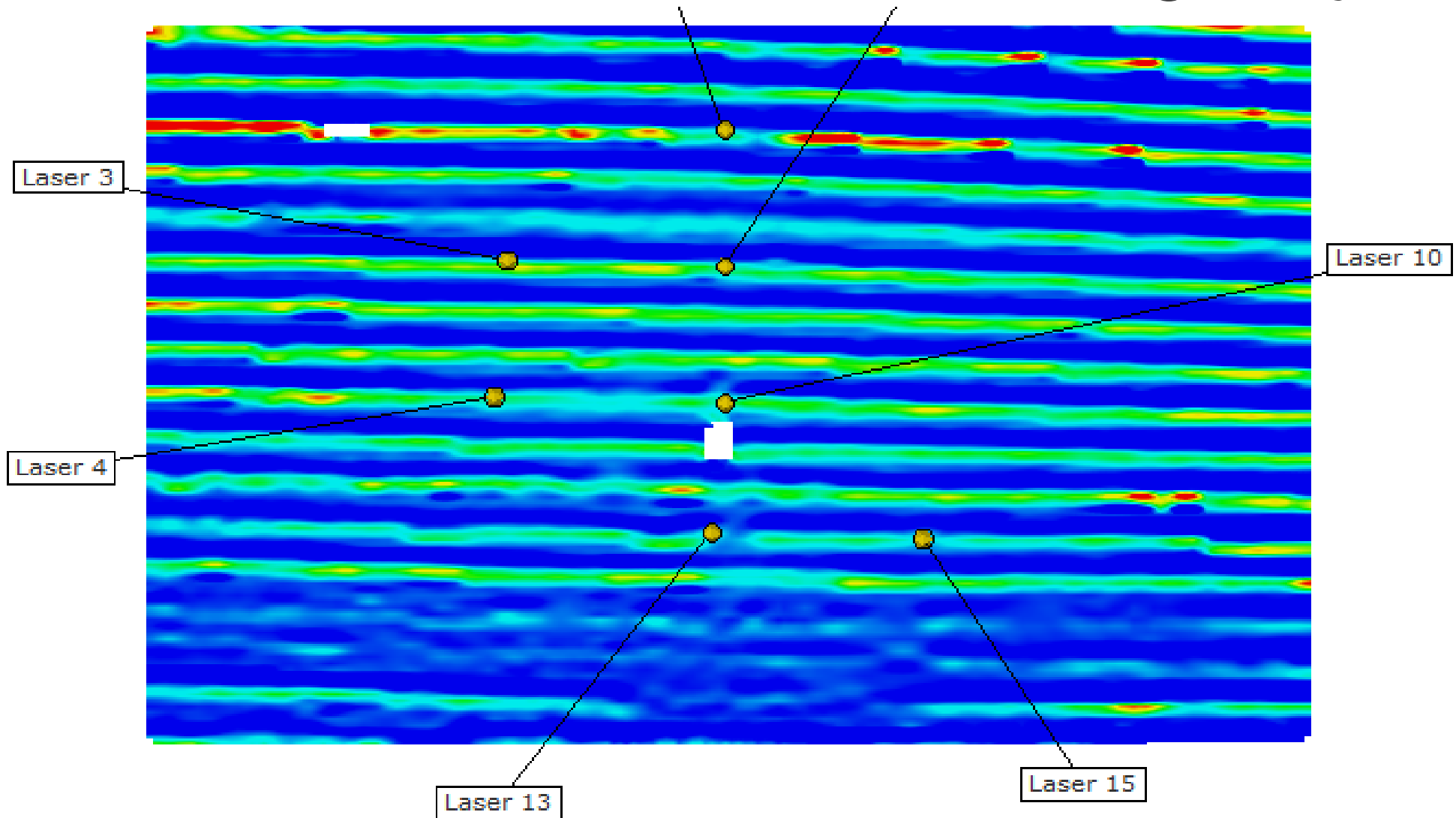
Test method

- One of main project scopes for future tests:
 - Real time monitoring (the test results can be directly viewed and analyzed)
 - Extensive data collection and handling
 - Shared interface for external experts to follow tests live
 - Remote access monitoring (minimal personnel interference after calibration of equipment)
- Examples already implemented from Foldagervej test:
 - Photos from DIC camera were taken from and transferred directly to smartphone via WIFI.
 - Laser deflection meters could after calibration be positioned within an hour and removed instantly.
 - No personnel assess underneath the bridge was necessary during testing at all.

Initial test results from Foldagervej



Initial test results from Foldagervej



Conclusion

- The method for applying load was successfully tested on four bridges in September 2016.
- Despite of the project having run for only few month the first equipment for monitoring of bridge responses were purchased, calibrated and used in the Foldagervej test.
 - DIC software ARAMIS was used via WIFI in combination with wide angle camera and was able to cover a large surface.
 - Laser distance meters were used to find deflections of the bridge in several location, and compared well with LVDT's and land surveyor results.
- Future goals of the project include: Real time data processing and remote access monitoring.

Thank you!

You can contact me for further details:
phsh@byg.dtu.dk or +45 3020 4125