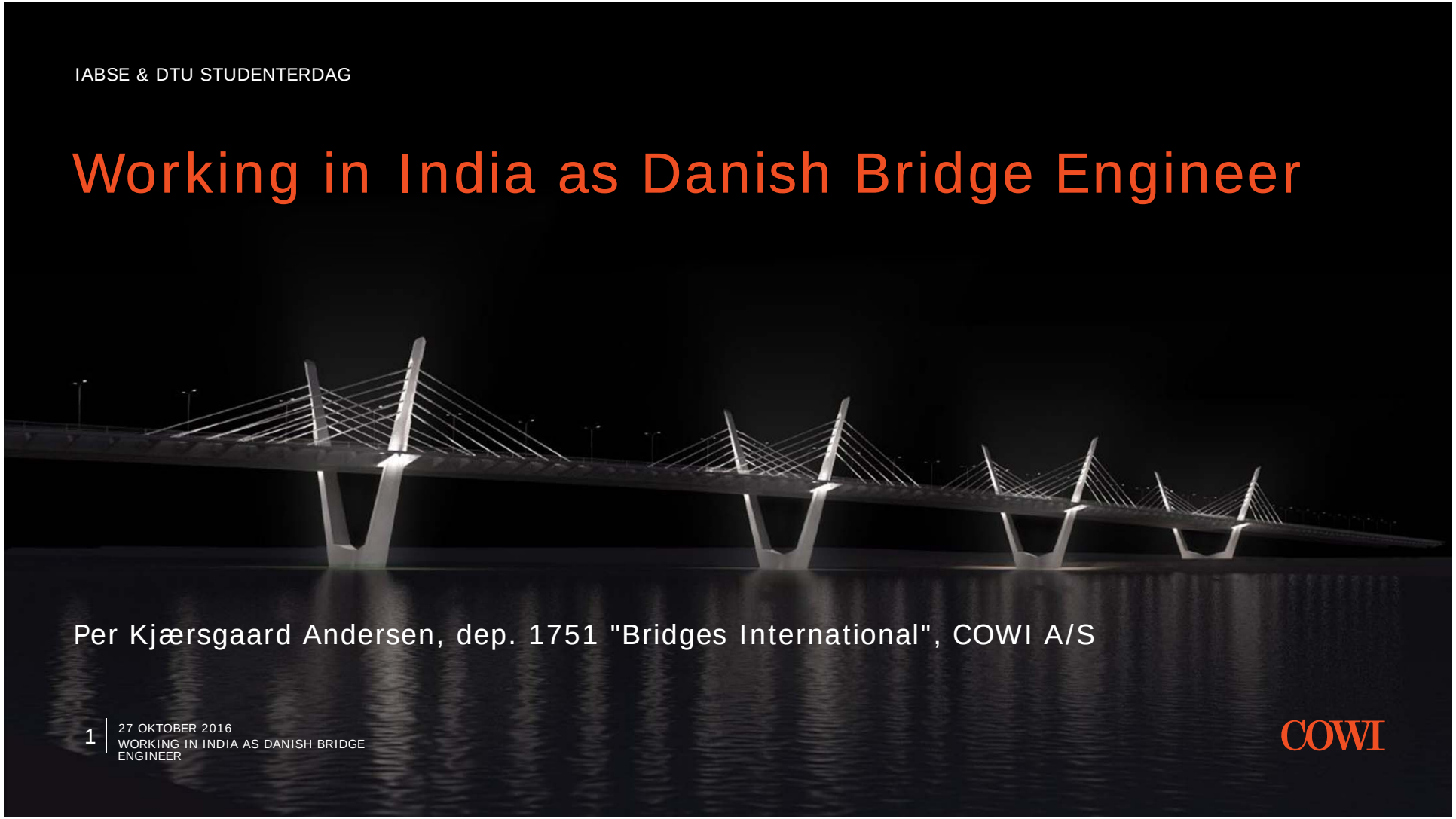
IABSE & DTU STUDENTERDAG

Working in India as Danish Bridge Engineer



Per Kjærsgaard Andersen, dep. 1751 "Bridges International", COWI A/S

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Agenda

- Who am I?
- Introduction to the SIGS project and my role
- Off we went to India…
- Technical focus 1 : Extradosed bridges in general
- Technical focus 2 : The analysis matrix
- Technical focus 3 : The articulation – pros and cons
- A glimpse of the FE-model of the bridge
- Cultural differences working as a Dane in India
- Life as a tourist in India

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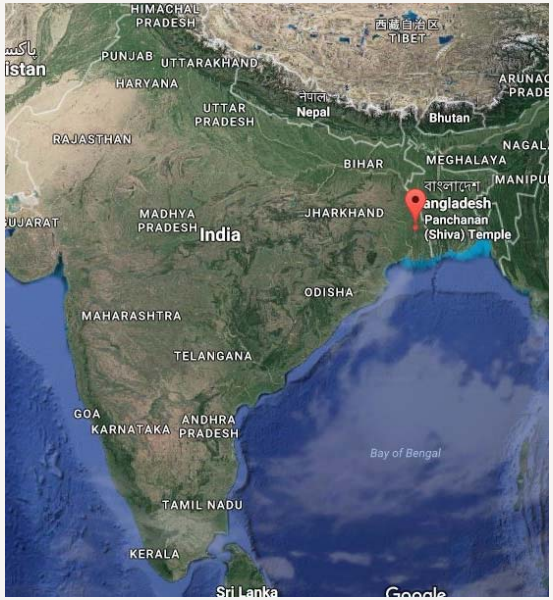
Who am I?

- Per Kjærsgaard Andersen
- M.Sc. in Structural Engineering from AAU, 2008
- Started in COWI's department of Major Bridges right after graduation and have been there ever since
- Main interest in the "macro physical" behaviour of structures
- Primary job function is analytical modelling of mainly cable supported bridges
- Specialist in COWI's in-house software IBDAS (Integrated Bridge Design and Analysis System)

Iswar Gupta Setu Kalyani



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Second Iswar Gupta Setu Kalyani (SIGS)

- 3 + 3 lane road bridge & 2 walkways
- 10m spacing between the old and the new bridge
- Same span configuration as old bridge
- Iconic architectural land mark
- 100 years design life
- Precast segmental
- Costwise small part of large West Bengal infrastructure project
- Indian consultancy RITES on everything else than main bridge
- Danish bridge architects Dissing & Weitling
- My role : Main responsible for the global analysis model

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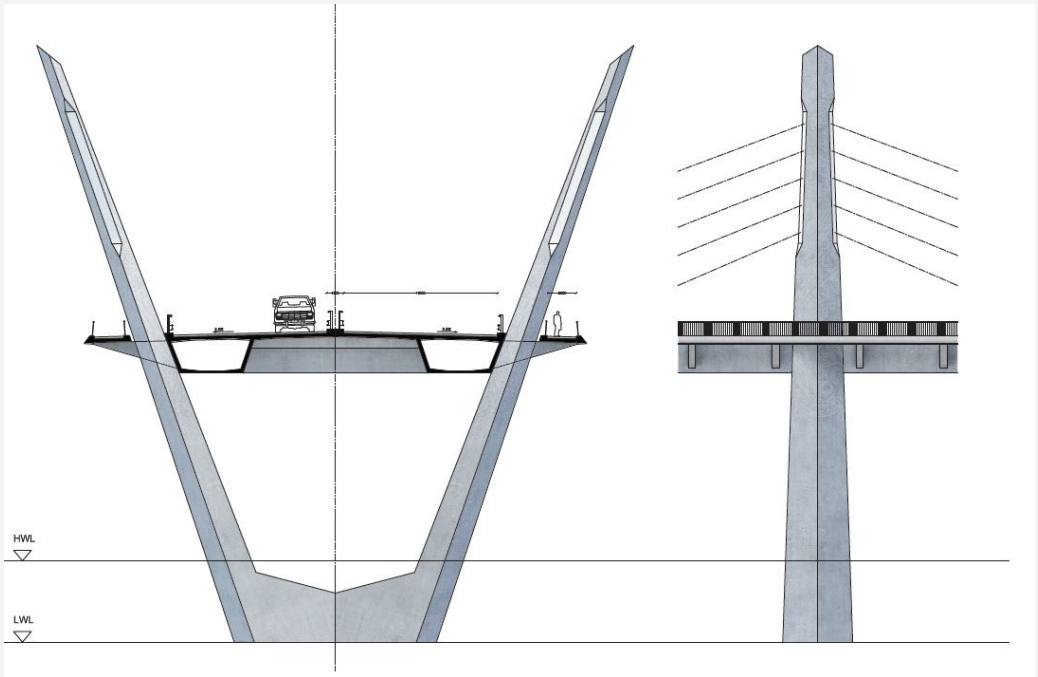
SIGS PICS...



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SIGS PICS...

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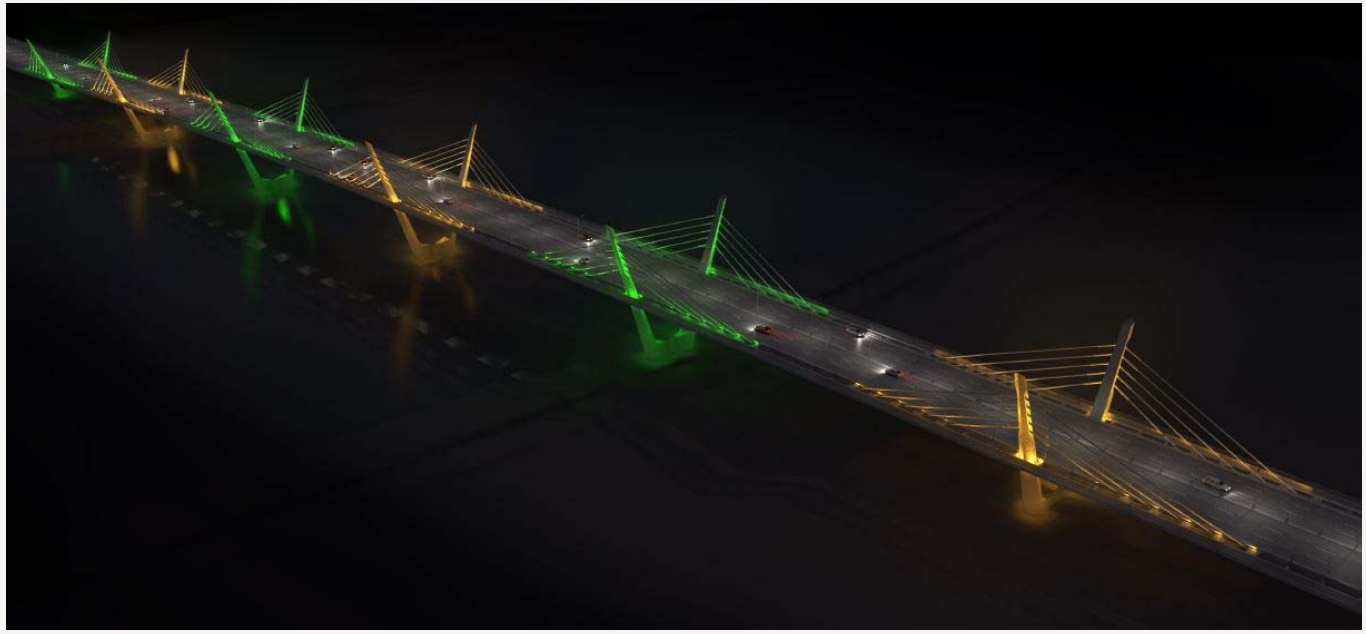
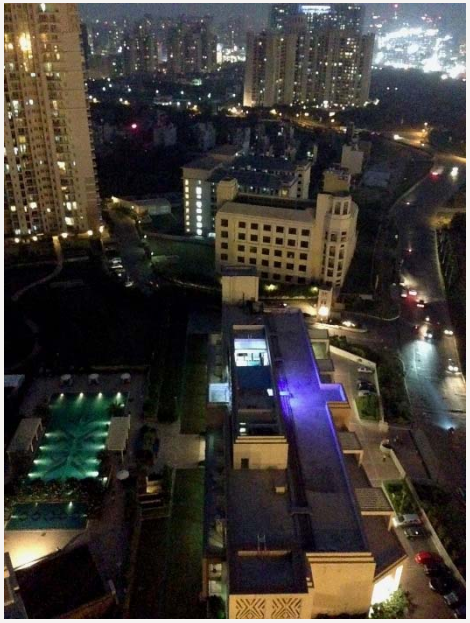


Off we went to India



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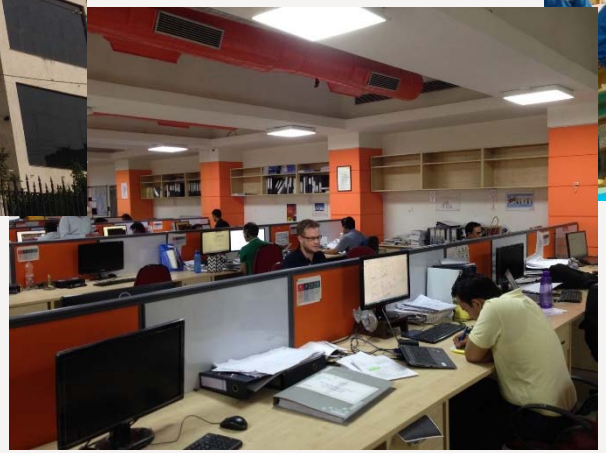
Off we went to India



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Extradosed Bridges in general

- French word Extradosé ("not so inclined")
- Statically a hybrid between a beam bridge and a Cable Stayed Bridge
- Low inclination of stay cables compared to Cable Stayed Bridge
- Stays acting as external post tensioning in addition to support points
- Good fatigue resistance in stays due to low live load induced stress range
- Typically highly monolithic structure (i.e. few bearings etc.)
- Suitable for span lengths around 100-250m

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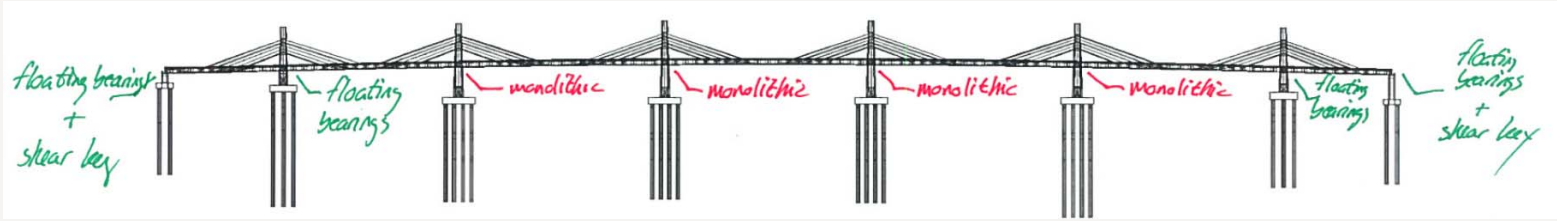
The analysis matrix on SIGS

- 0 + 100 year situation
  - 50% of t_∞ creep and shrinkage taken place at 2 years after opening
  - bearings slightly more loaded at 100 year situation
  - girder de-compression criterion to be checked at both situations
- Scour or no scour
  - Piles : Scour most adverse
  - Superstucture : No scour most adverse
- Uncracked or cracked sectional properties
  - SLS+ULS : Uncracked
  - Seismic : Cracked

Articulation – pros & cons

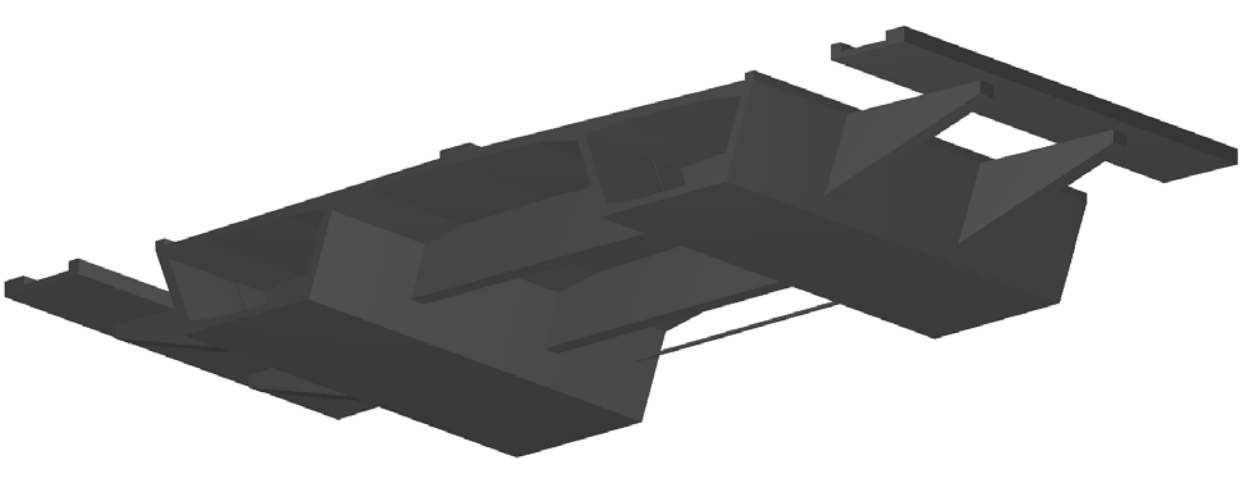


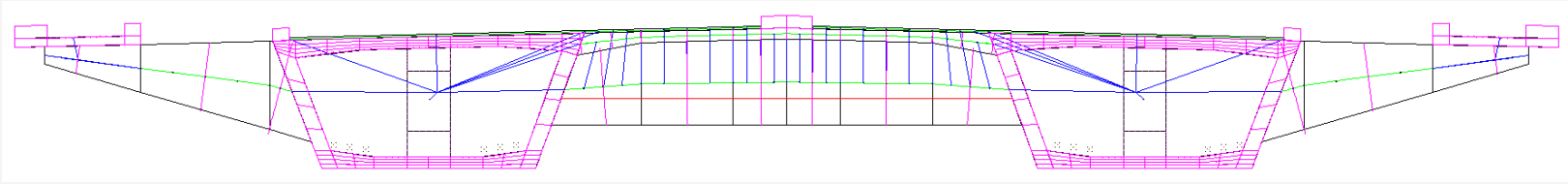
- Few bearings = lower maintenance costs
- Monolithic connections & short pylons causing significant restraint forces from creep and shrinkage, temperature
- Two cable planes, box girders and stiff transverse system is very suitable for taking up excentric loads
- Large mass of girder along with frame system (transverse & longitudinal) attracts large seismic forces (elastic design not feasible -> plastic hinges)

IBDAS model

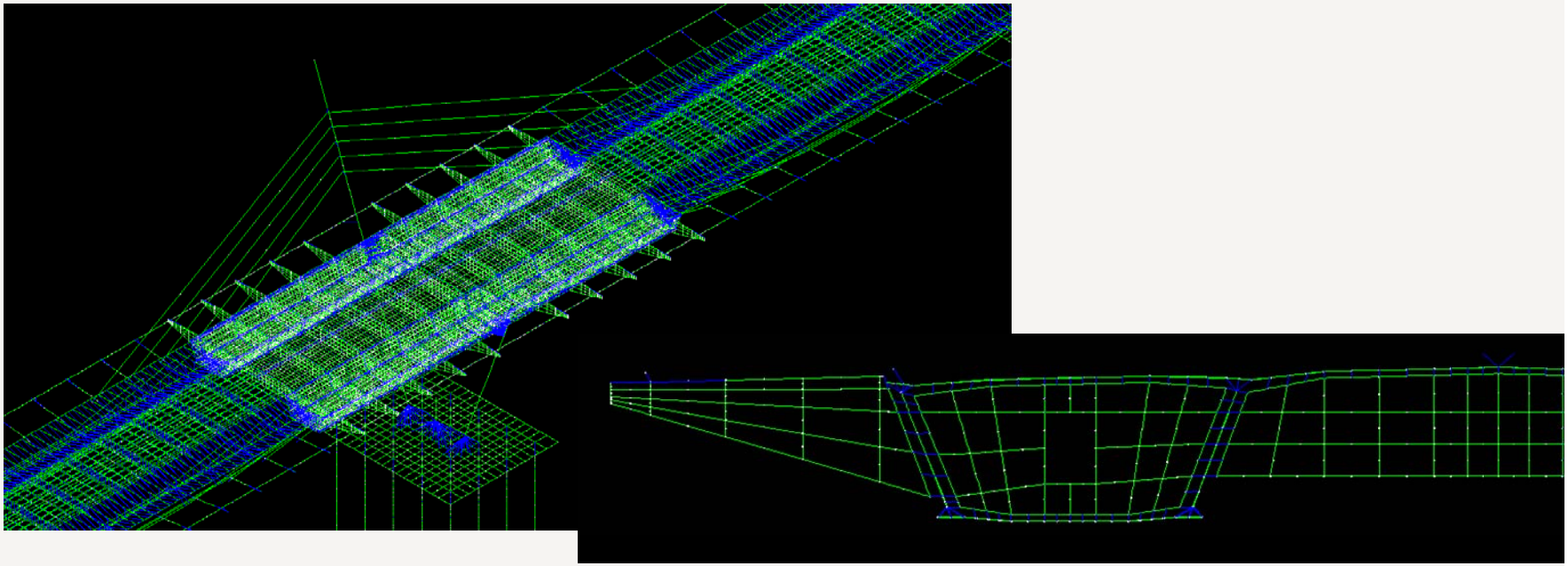
- IBDAS = "Integrated Bridge Design and Analysis System"
- Developed in-house COWI since the 1980's by two full-time engineers
- Parametric modelling with many tailor made bridge features
  - live load optimization
  - construction stage modelling
  - automatic handling of time dependent effects in concrete etc. etc.

IBDAS model of superstructure





IBDAS model – shell model embedded in global model



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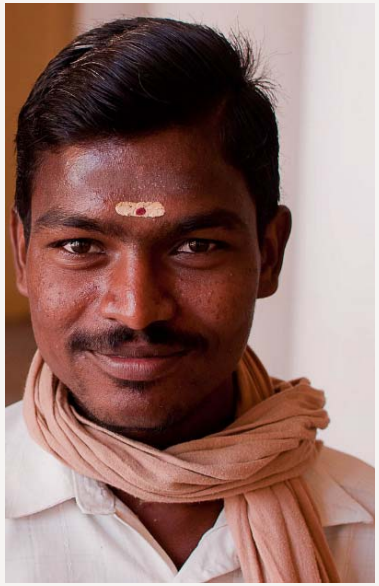
Cultural Differences

- Very friendly and easy-going in general
- Danish and Indian humor "compatible"
- Indians are much more aware of hierarchy
- Do not leave the office before your boss…
- Highly skilled technical, but not very proactive compared to Western engineers
- Do not dare to question results from a more experienced colleague
- Senior engineers tend to take on a coordinator rather than technical role



Life as an expat tourist

- You are paid to stay very close to some of the most beautiful and exotic places on earth – GO ENJOY IT !!!
- And so we did – in average every 6-7 weeks ☺

Andaman islands

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Kerala

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The southern Himmalayas

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