

BRIDGE COMPETITION

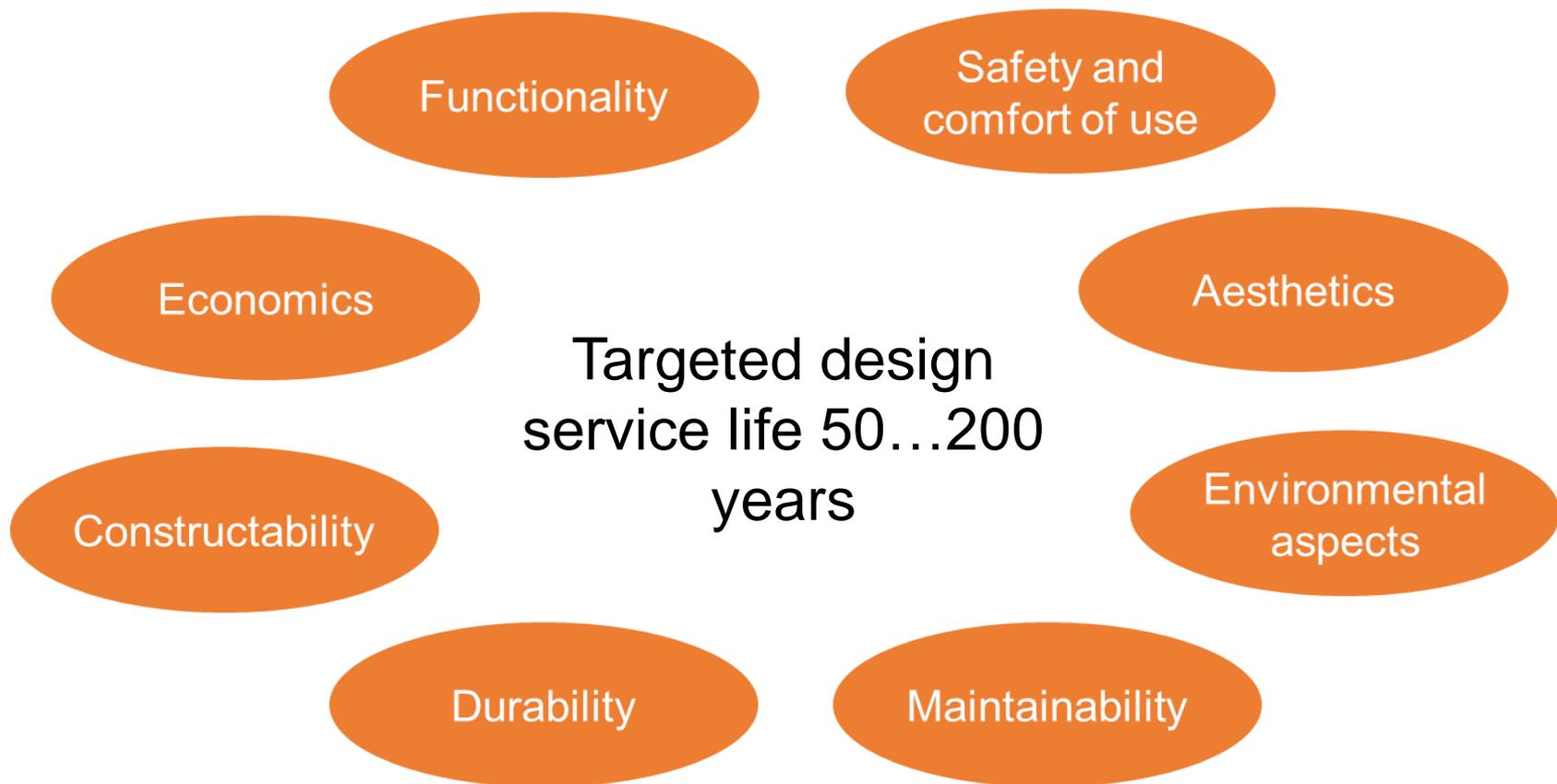
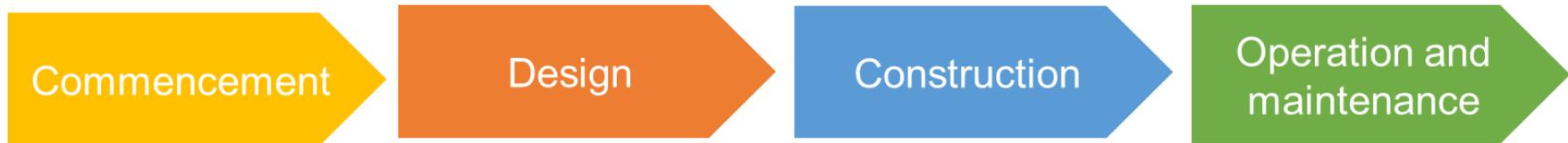
SAVILAHTI, KUOPIO

INFO SEMINAR / 30.11.2018

TECHNICAL REQUIREMENTS

Dr Risto Kiviluoma

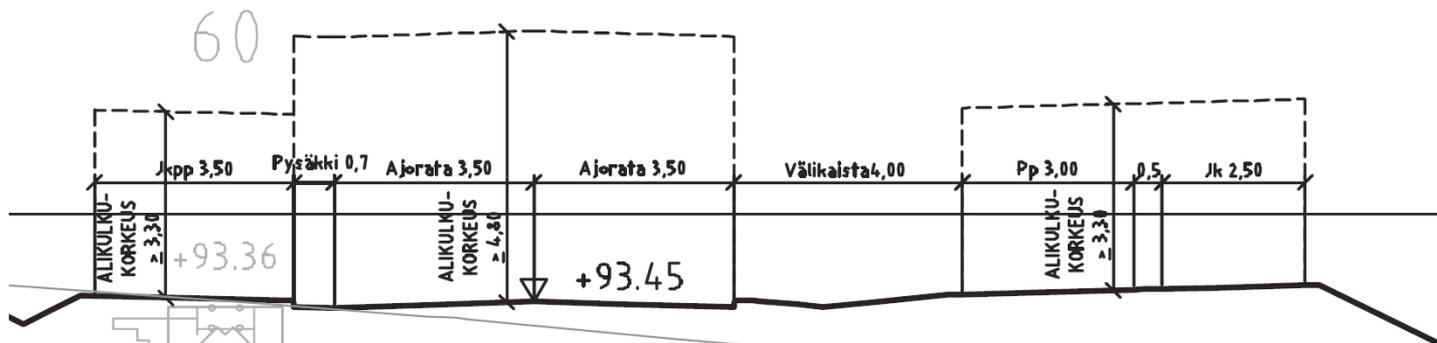
Aalto University, Department of Civil Engineering



Horizontal and vertical clearances

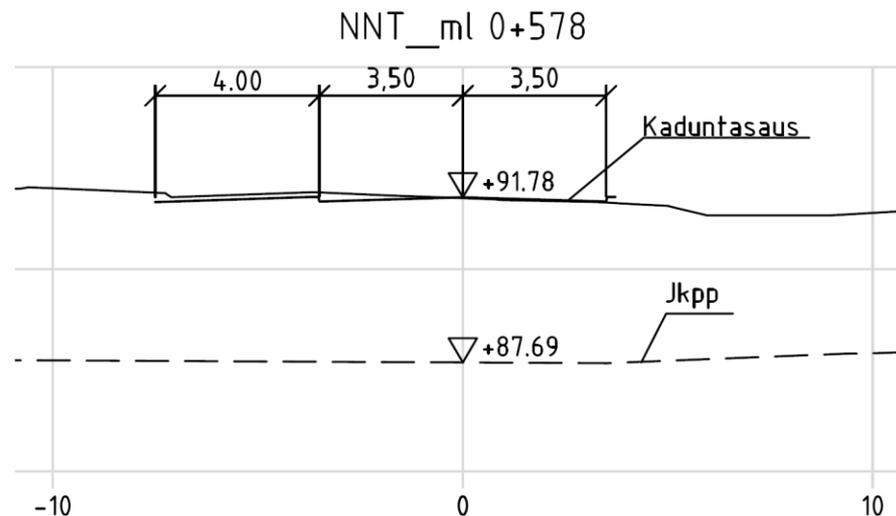
Overpass Bridge

- top of the bridge
 - horizontal clearance ≥ 4.0 m
- below the bridge
 - vertical clearance for the carriageway ≥ 4.8 m
 - vertical clearance for the pedestrian lanes (2 pcs) ≥ 3.3 m
 - horizontal clearances (min) 3.5 m + 7.7 m + $(4.0$ m) + 6.0 m
 - in the case of two span bridge, intermediate support is possible to locate at $(4.0$ m) space “välikaista”



Underpass Bridge

- top of the bridge
 - horizontal clearance for the street ≥ 11.0 m
- below the bridge
 - vertical clearance for the pedestrian lane ≥ 3.3 m
 - horizontal clearance for the pedestrian lane ≥ 5.0 m



Loads for structural analysis

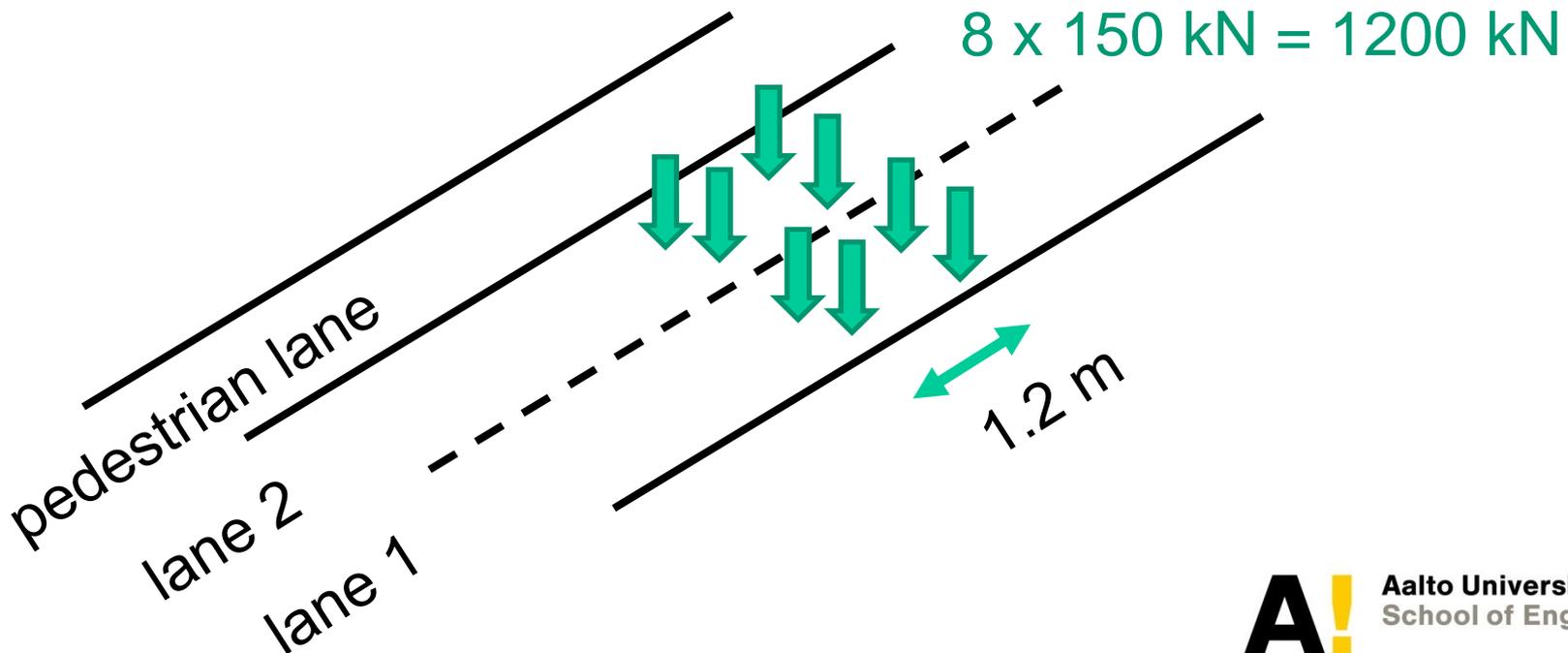
Bridges needs to be technically feasible to fulfil load specifications for bridges on *public roads* in Finland. In the competition, simplified assessment is recommended with loads to consider:

Overpass (pedestrian bridge)

- dead load (from self weight of structures)
- crowd loading 5 kN/m² on the deck (act anywhere on the deck corresponding available horizontal clearance)

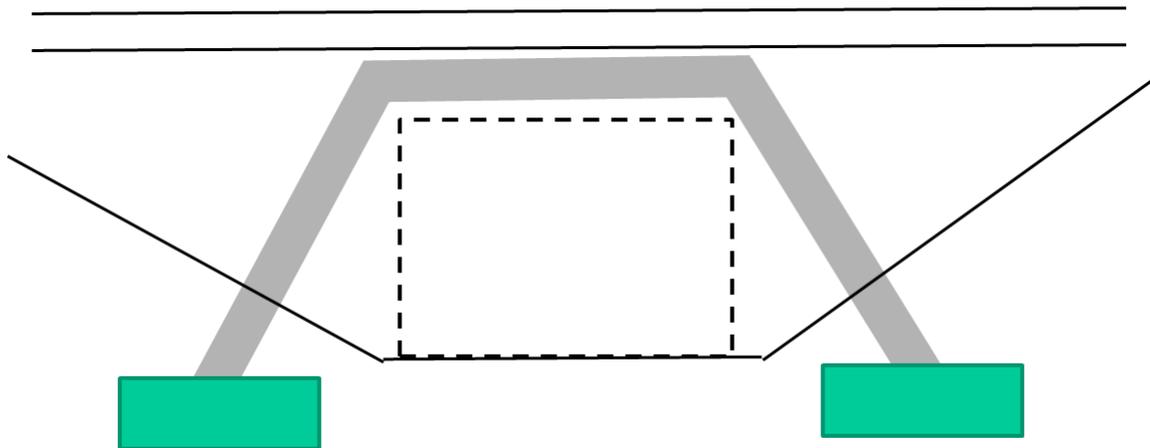
Underpass bridge

- dead load (from self weight of structures)
- axle load pattern 300 kN + 300 kN spacing 1.2 m. Can act on two traffic lanes simultaneously (total load 1200 kN on the bridge). Axle load (300 kN) consist on two tyre loads (150 kN) each



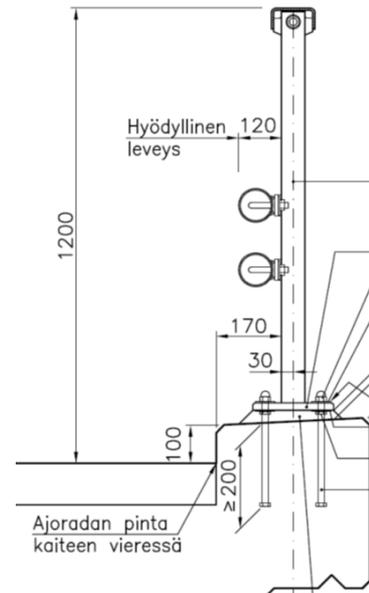
Foundations of the bridges

- Bridge foundation design is not part of the competition
- in the drawings, foundations can be shown as ground supported slabs (with realistic dimensions)



General traffic safety issues

- Bridge parapets are traffic *safety* structures, that for the *underpass bridge* needs to be designed to specific vehicle collision class. Deviations from the standard CE approved parapets (the one mostly used in Finland shown below) will require expensive and time consuming crash test/simulation approval procedure. Free chosen colour painting is possible
- custom parapet design is more feasible for the *overpass* (pedestrian) bridge, but still it has to fulfil the safety aspects



- **vehicle collisions to the bridges are possible (on the abutments, intermediate pier and superstructure). The *overpass bridge* needs to resist notable collision loads specified in the load codes as accidental design situation. They are of order**

800 kN collision load to piers or abutment

400 kN collision load to superstructure (i.e. deck)

- **collision load to superstructure can be assumed reduced or neglected if vertical clearance is made large enough. Load will reduce to zero when vertical clearance change from 5.4 m to 6.4 m**

Reference literature

- **Eurocode application guidelines for Bridge loads and design principles NCCI 1**
https://julkaisut.liikennevirasto.fi/pdf8/lo_2017-24_ncci1_web.pdf
- **Bridge Cost Estimate**
https://julkaisut.liikennevirasto.fi/sillat/julkaisut/kustannusarvio_2008_b.pdf
- **Additional learning material to Aalto students**

CIV-E4020 - Design of Bridges -course lecture slides are available at MyCourses