Appendix to report:

SBJ-33-C5-OON-22-RE-013-APPE

K12 - SHIP IMPACT, GLOBAL ASSESSMENT

Appendix title:

APPENDIX E – SHIP IMPACT AND TRAFFIC LOADS

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CONCEPT DEVELOPMENT FLOATING BRIDGE E39 BJØRNAFJORDEN

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The combination of ship impact and traffic loads is simplified at this stage and considered globally with an increased girder mass, evenly along the whole bridge length.

Traffic loads are described in section 4.1.2 in "SBJ-32-C5-OON-22-RE-003-A Analysis method" [1], where reduction factors are included. In the ship impact analysis, the traffic loads are simplified to increased mass in the bridge girder. The characteristic line load from traffic is 30.4 kN/m, see table 4-2 in the OONO Analysis methods report [1]. The static effects of the traffic loads are neglected at this stage.

E.1 Increased girder mass from traffic loads

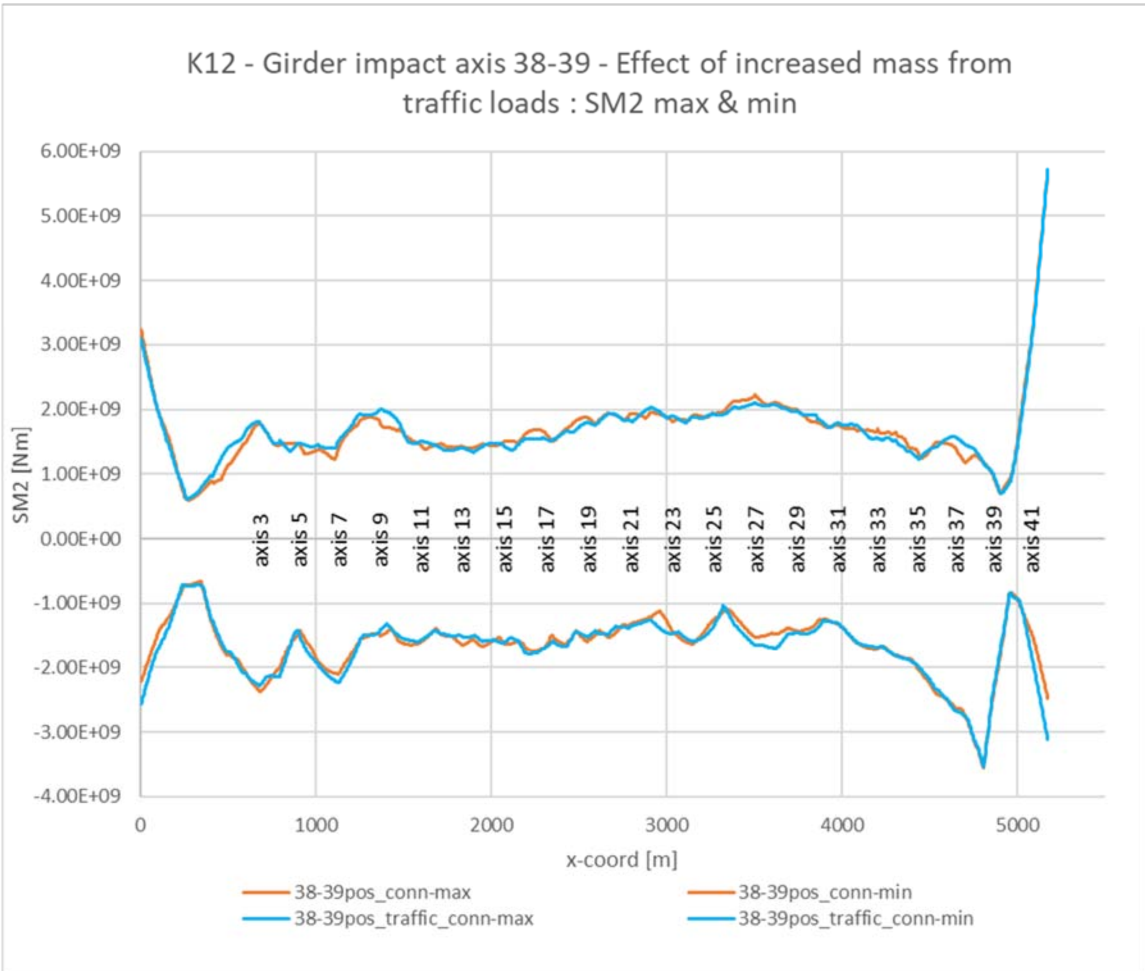
The increased mass in the model is implemented as increased density for the girder profiles, see calculation below:

Increased girder mass from traffic loads		
g [m/s^2]	9.81	
Traffic load [kN/m]	30.4	
Traffic load [kg/m]	3098.88	
	bridgeboxmatBCS1 (cable bridge + low bridge)	bridgeboxmatBCS2 (ramp+high bridge)
Density girder, analysis model [kg/m^3]	12137.17	11468.11
Area girder, analysis model [m^2]	1.47	1.74
Line weight, analysis model [kg/m]	17852.57	19987.76
Line weight girder+traffic [kg/m]	20951.44	23086.64
Modified girder density [kg/m^3]	14243.96	13246.11
Density increase	17 %	16 %

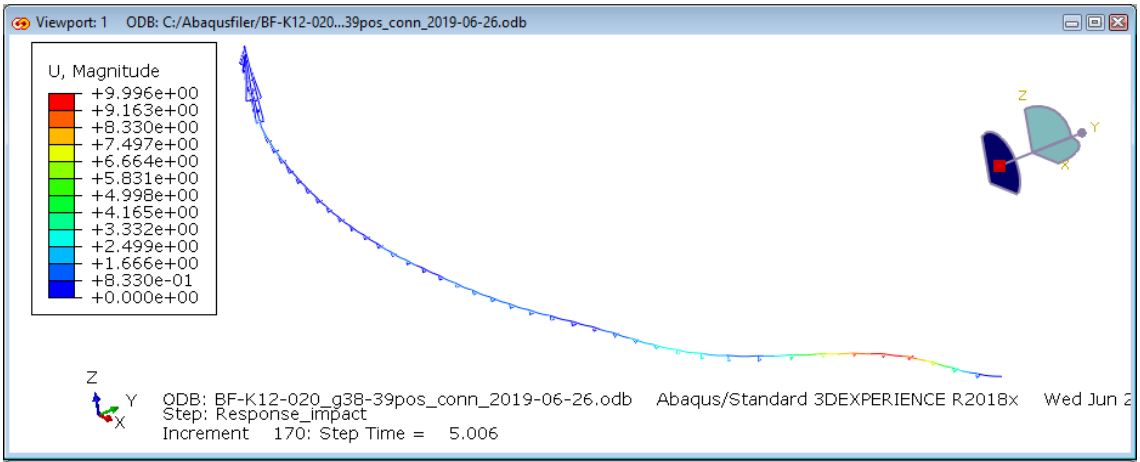
E.2 Strong axis girder moment from analysis

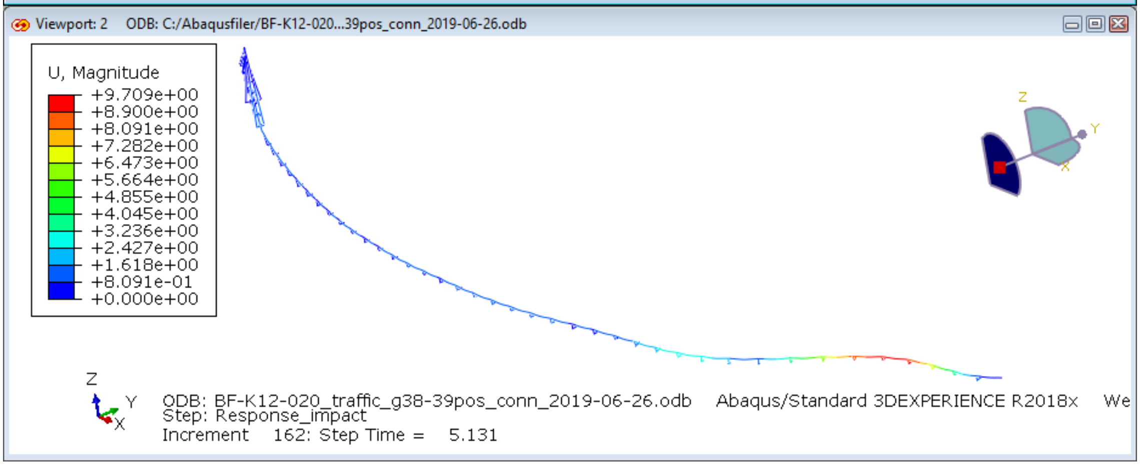
There has been performed two connector analysis, one with the effect of traffic and one without. The impact point is between axis 38 and 39 (the g38-39 impact), as it is the governing load for large parts of the girder, see screening analysis in chapter 5. The analyses are set up with connectors (mass-spring-systems) and the only difference is the density of the girder, which is 16-17 % larger in the traffic load model. The results from the analyses show that the difference is very small.

Maximum and minimum girder strong axis bending moment:

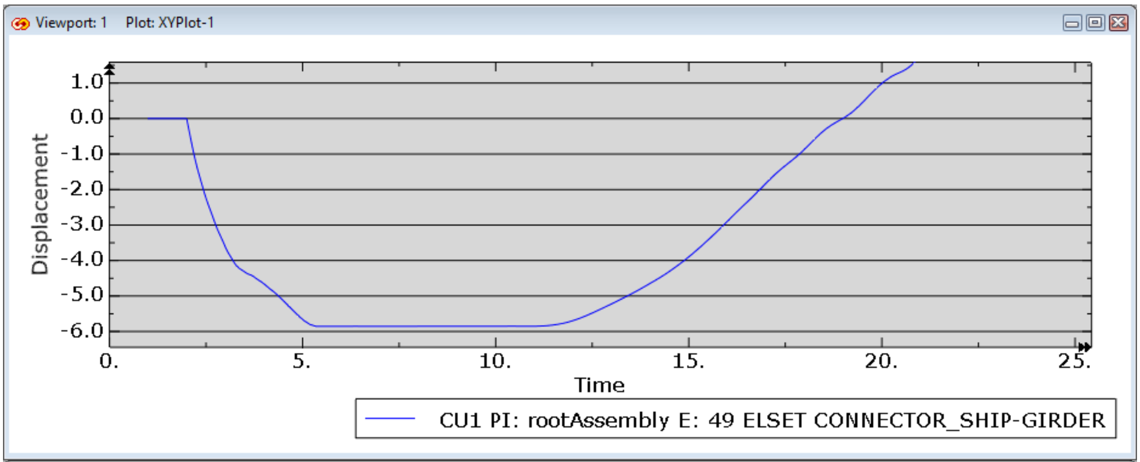


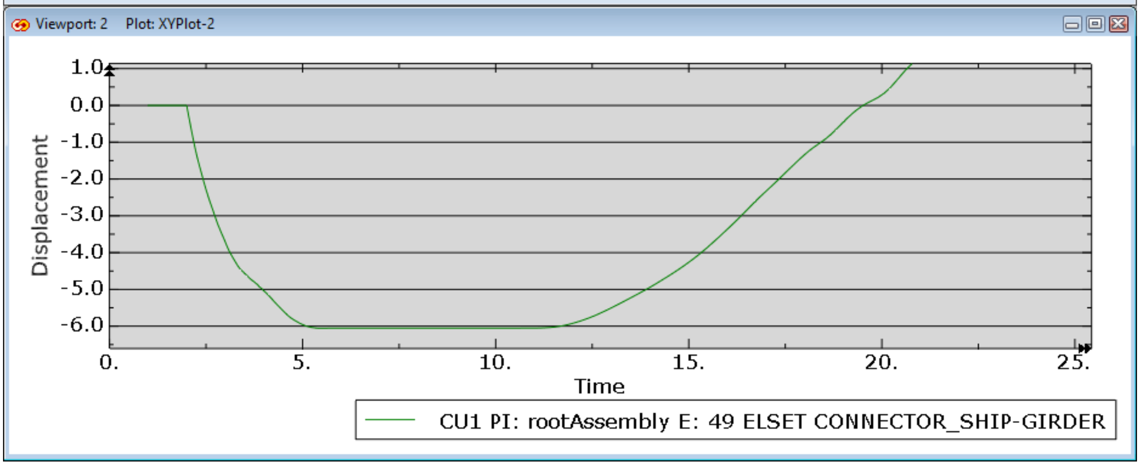
Deformation at maximum impact [m]:





Indentation between ship and girder [m]:





The indentation is slightly larger for the traffic model as the mass here is a bit larger and the system response a bit slower.

1 REFERENCES

[1] SBJ-32-C5-OON-22-RE-003-B, «Analysis method,» 2019.

[2] SBJ-33-C5-OON-22-RE-012-B, «K12 - Structural response analyses,» 2019.

[3] SBJ-33-C5-OON-22-RE-014-B, «K12 - Ship impact, Pontoons and columns,» 2019.

[4] Statens vegvesen, «SBJ-01-C4-SVV-01-BA-001 Design basis MetOcean_rev_1,» 2018.