Appendix to report:

SBJ-33-C5-OON-22-RE-012
STRUCTURAL RESPONSE ANALYSES

Appendix title:

APPENDIX E – CHARACTERISITC AND LIMIT STATE RESPONSE

Contract no:	18/91094
Project number:	5187772/12777
Document number:	SBJ-33-C5-OON-22-RE-012 App. E
Date:	15.08.2019
Revision:	0
Number of pages:	108
Prepared by:	Vegard Kristensen
Controlled by:	Tor Martin Lystad
Approved by:	Kolbjørn Høyland

CONCEPT DEVELOPMENT FLOATING BRIDGE E39 BJØRNAFJORDEN

Norconsult DR. TECHN. OLAV OLSEN

Prodtex IFE Pure Logic HEYERDAHL ARKITEKTER AS H&BB MIKO MARINE AS BUKSÉR OG BERGING FORCE TECHNOLOGY SWERIM

Table of Content

1 INTRODUCTION 3

1.1 Stress points 3

1.2 Coordinate systems 4

CHARACTERISTIC RESPONSE 5

1.3 Permanent loads 5

1.4 Traffic (influence length > 1000 m) 12

1.5 Traffic (influence length = 200 m) 18

1.6 Marine growth 24

1.7 Temperature 30

1.8 Current 36

1.9 Static wind 42

1.10 Coupled analyses 48

2 ULTIMATE LIMIT STATE RESPONSE 54

2.1 ULS 6.10a - 1 year conditions with traffic 54

2.2 ULS 6.10a - 100 year conditions without traffic 60

2.3 ULS 6.10b - 1 year conditions with traffic 66

2.4 ULS 6.10b - 100 year conditions without traffic 72

3 SLS RESPONSE 78

3.1 SLS Characteristic – Traffic load dominating 78

3.2 SLS Characteristic – 1 year conditions with traffic 84

3.3 SLS Characteristic – 100 year conditions 90

3.4 SLS Infrequent 96

3.5 SLS Quasi Permanent 102

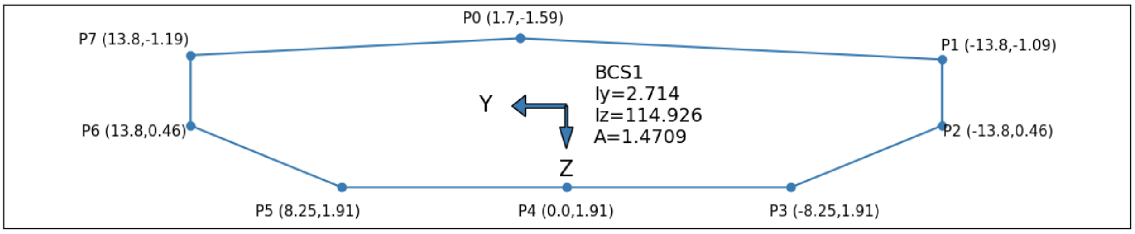
4 REFERENCES 108

1 INTRODUCTION

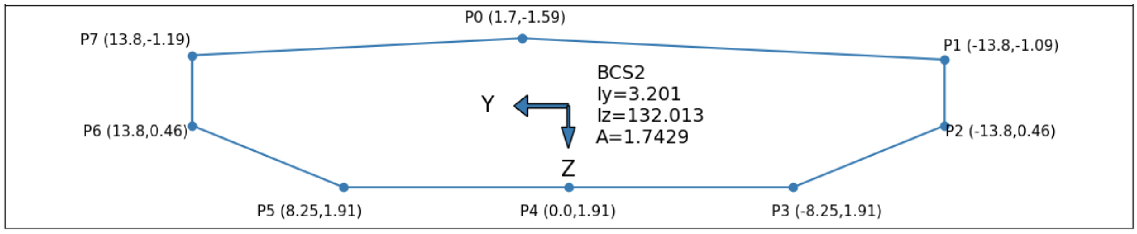
In this report the characteristic and limit state responses of the bridge girder are presented.

1.1 Stress points

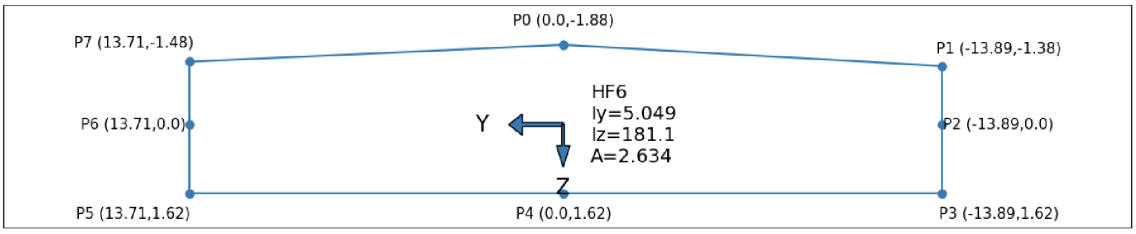
The stresses presented are given for different stress points in the bridge girder cross-section. The distribution of these stress points of the two main cross-sections of the bridge are shown in Figure 1-1, Figure 1-2 and Figure 1-3. For more information on the bridge girder cross-sections, see [1].



> *Figure 1-1 Distribution of stress points and local coordinate system of cross-section BCS1.*



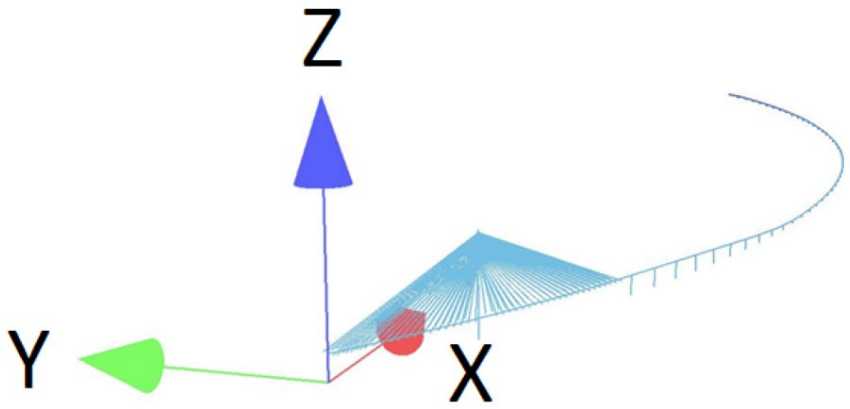
> *Figure 1-2 Distribution of stress points and local coordinate system of cross-section BCS2.*



> *Figure 1-3 Distribution of stress points and local coordinate system of cross-section HF6.*

1.2 Coordinate systems

Displacements are presented according to the global coordinate system given in Figure 1-4.



> *Figure 1-4 Global coordinate system*

Forces and moments are presented according to the local coordinate systems presented in Figure 1-1, Figure 1-2 and Figure 1-3.

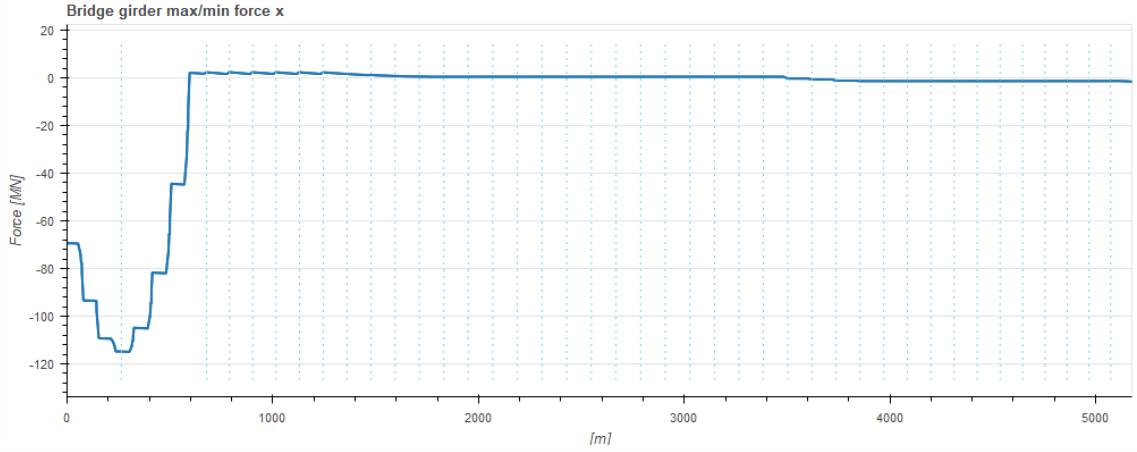
CHARACTERISTIC RESPONSE

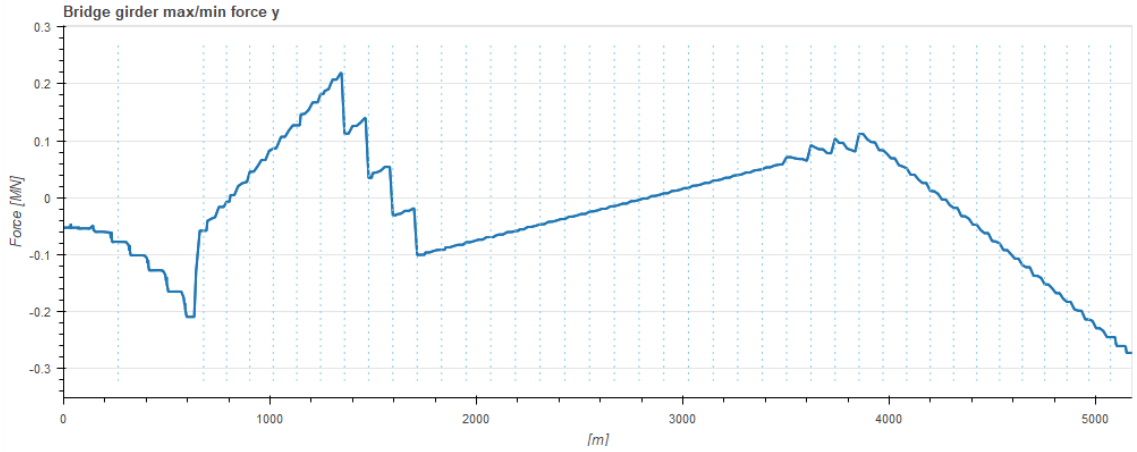
The response can currently be found on the webpage olavolsen.interactive.no [2] for K12 – Model 30 (and Model 27 for traffic characteristic response), in addition to being presented here.

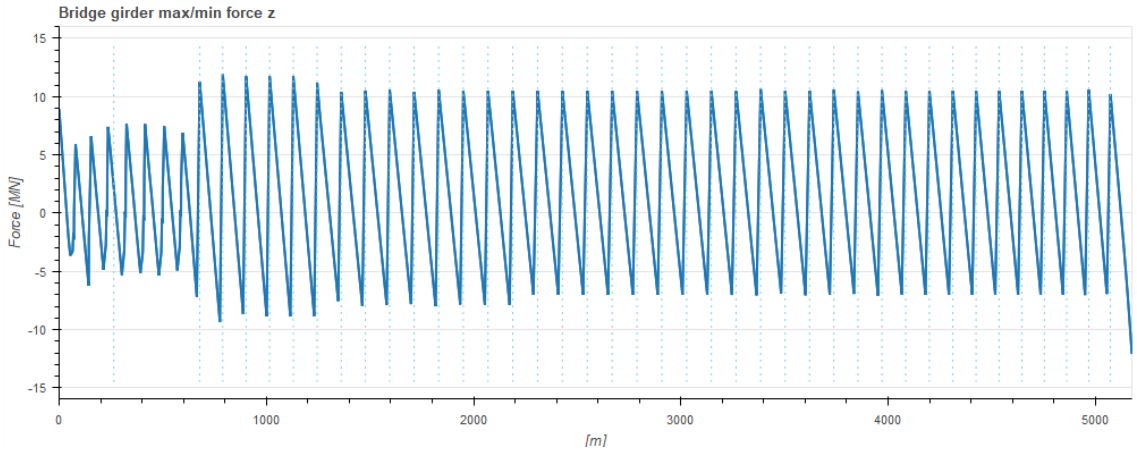
1.3 Permanent loads

The permanent loads are presented in [3], chapter 2.1.1 and correspond to COMB 51 on olavolsen.interactive.no [2].

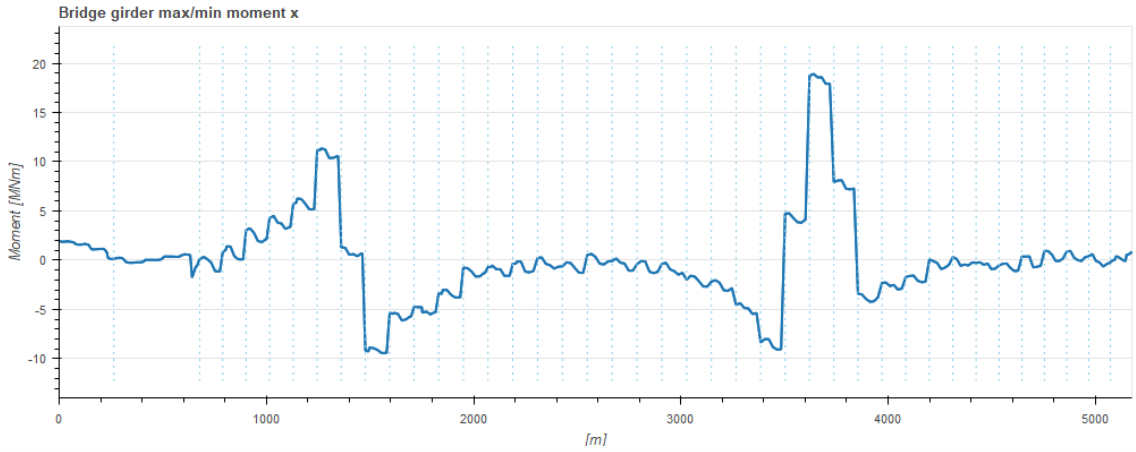
1.3.1 Forces

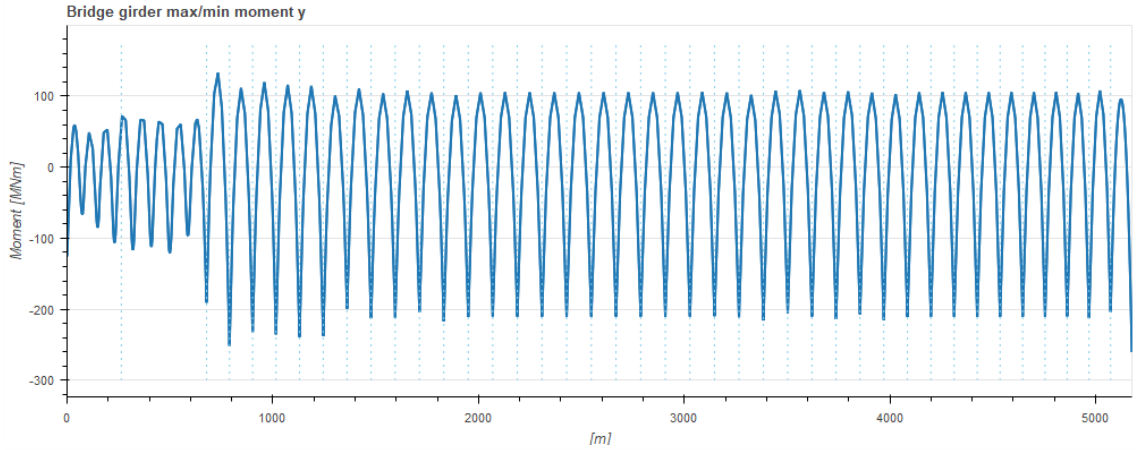

Bridge girder max/min force x
Force [MN]
20
0
-20
-40
-60
-80
-100
-120
0
1000
2000
3000
4000
5000
[m]

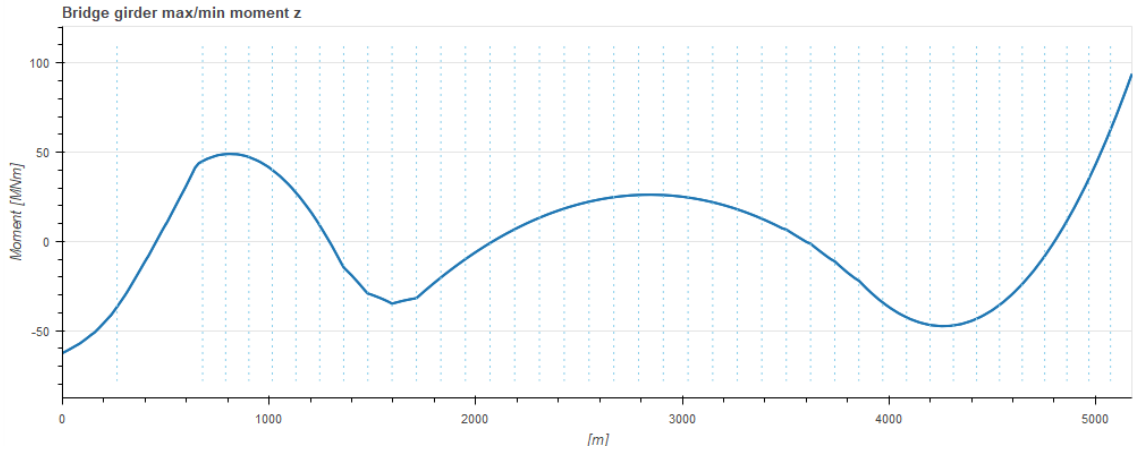

Bridge girder max/min force y
Force [MN]
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min force z
Force [MN]
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
[m]

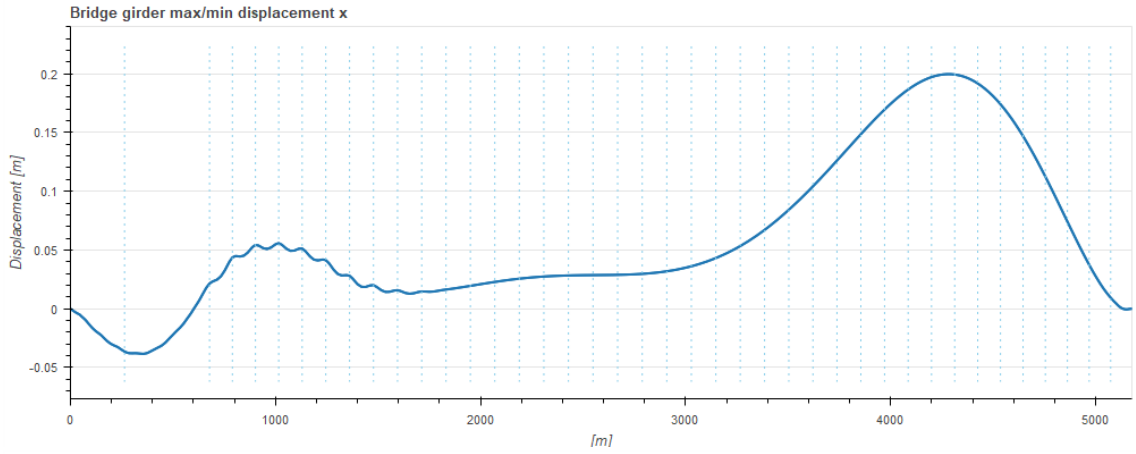
1.3.2 Moments

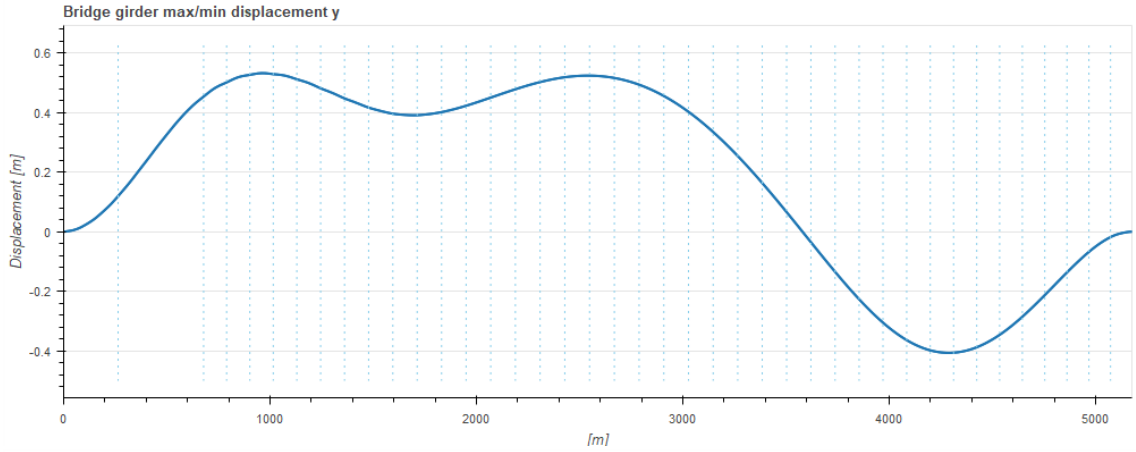

Bridge girder max/min moment x
Moment [MNm]
20
15
10
5
0
-5
-10
0
1000
2000
3000
4000
5000
[m]

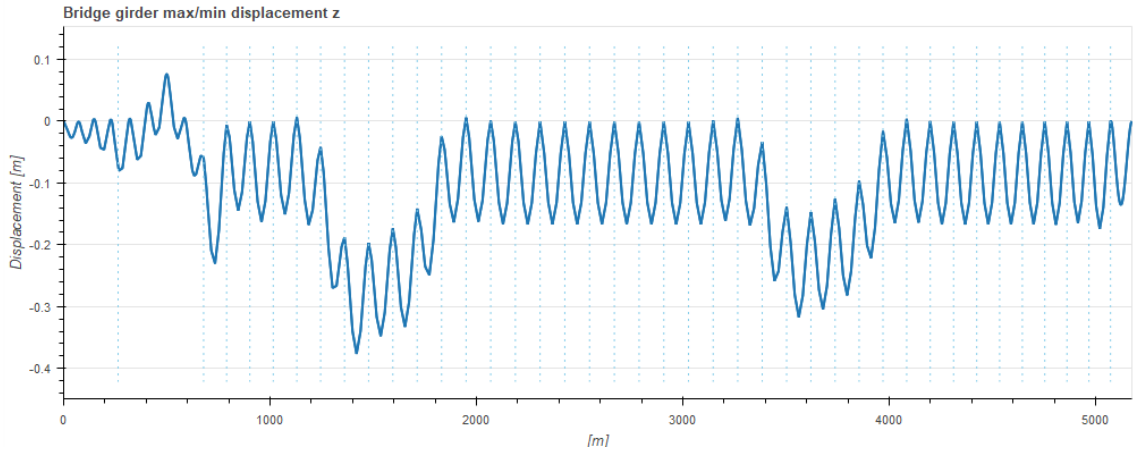

Bridge girder max/min moment y
Moment [MNm]
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
100
50
0
-50
0
1000
2000
3000
4000
5000
[m]

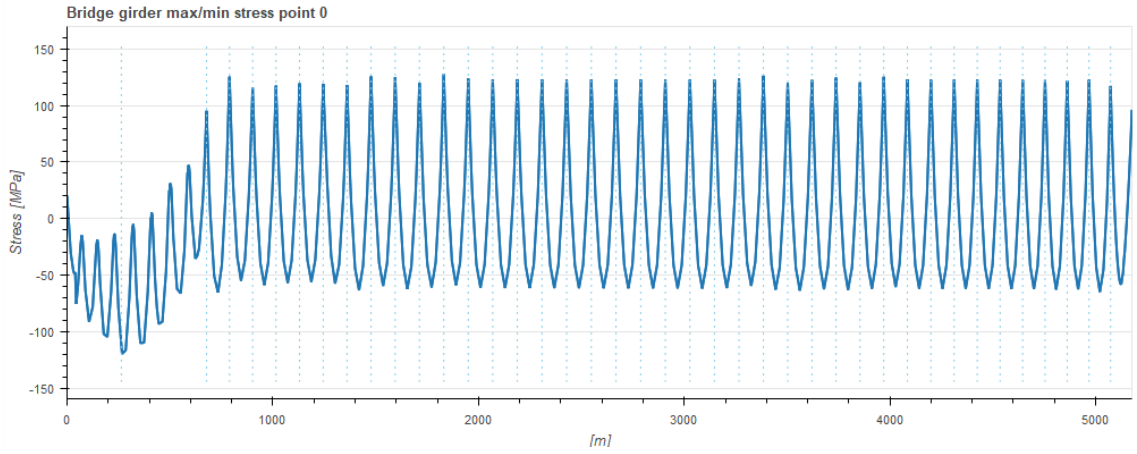
1.3.3 Displacements

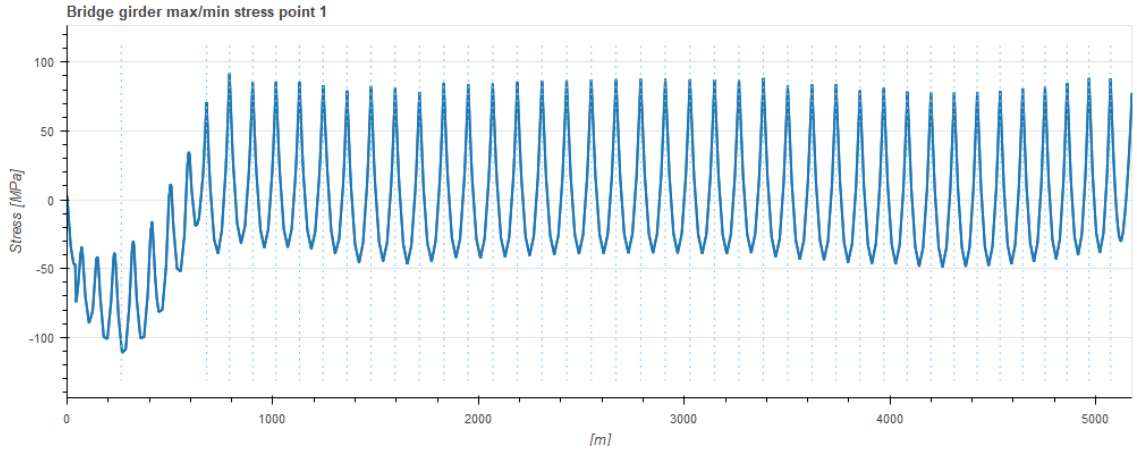


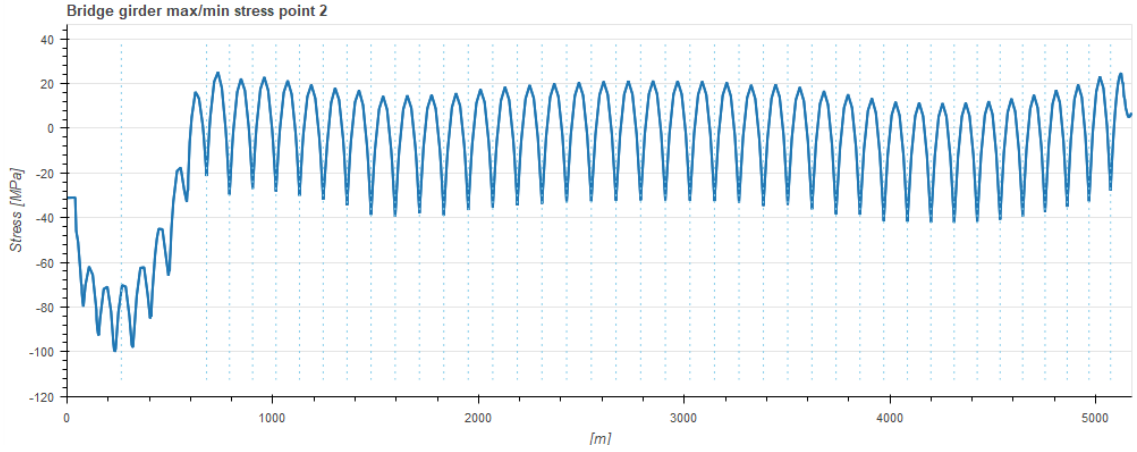


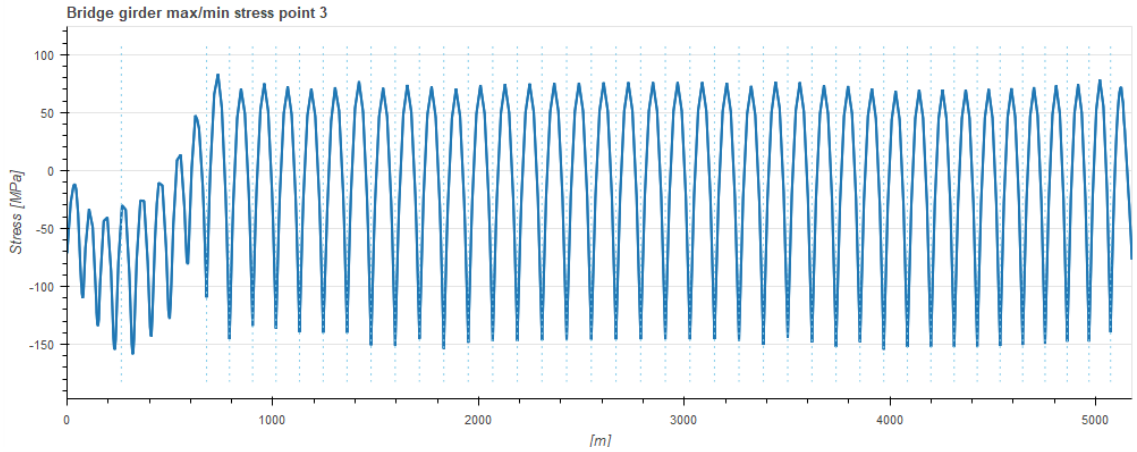


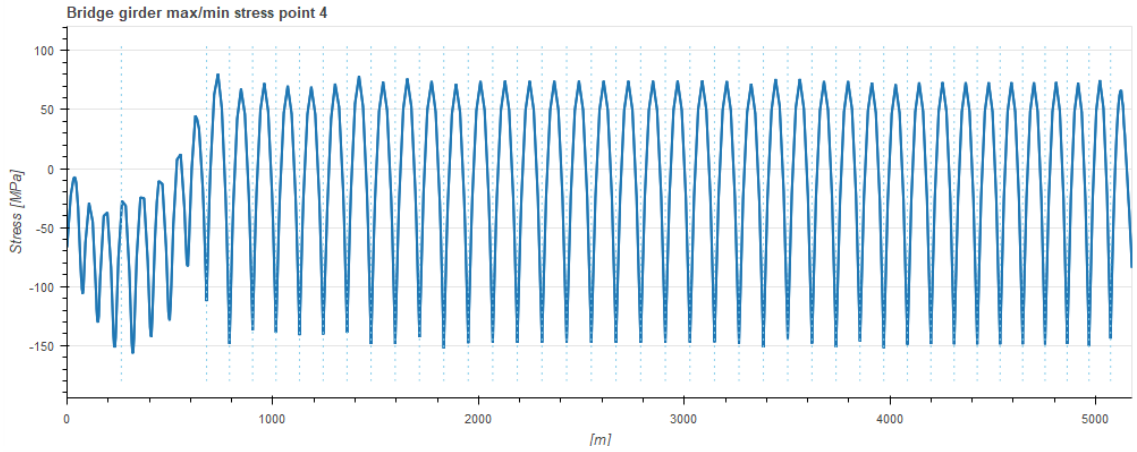
1.3.4 Stresses

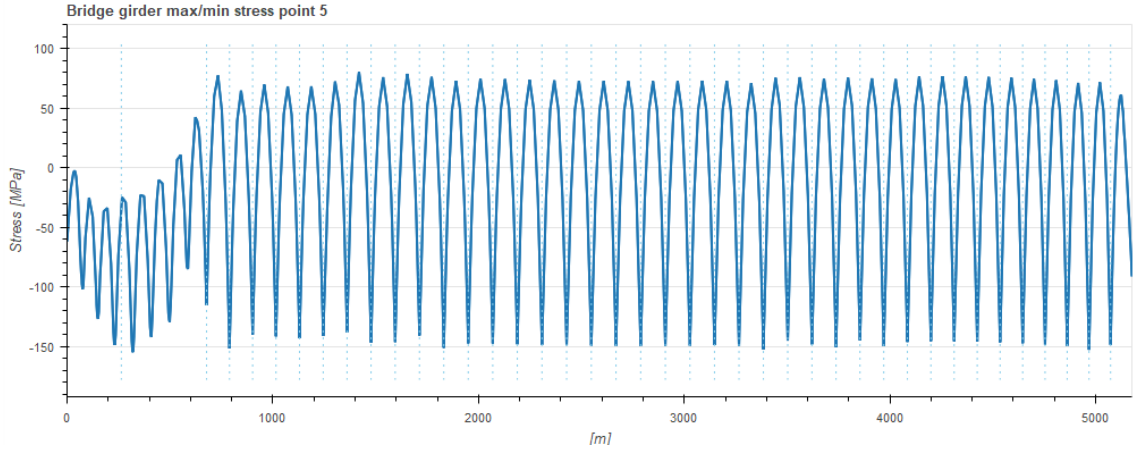


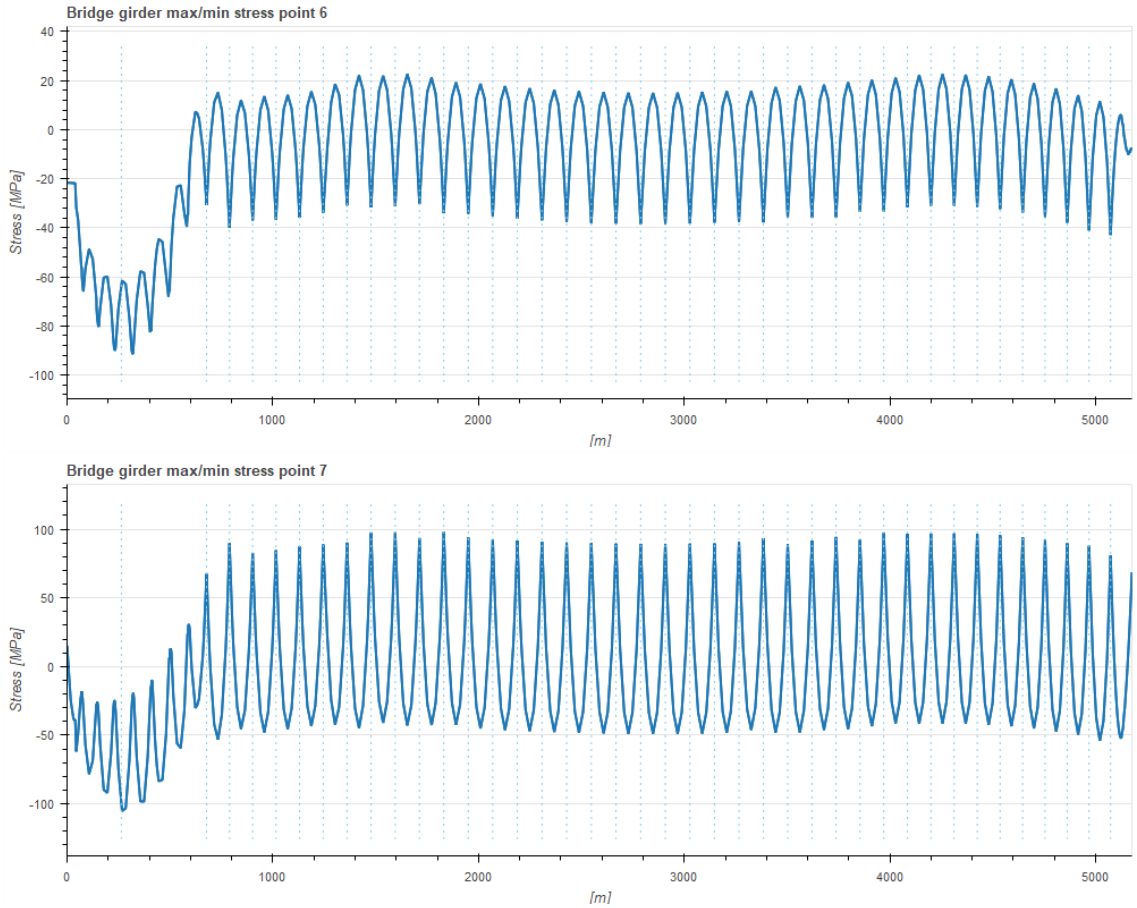





Bridge girder max/min stress point 3
Stress [MPa]
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]

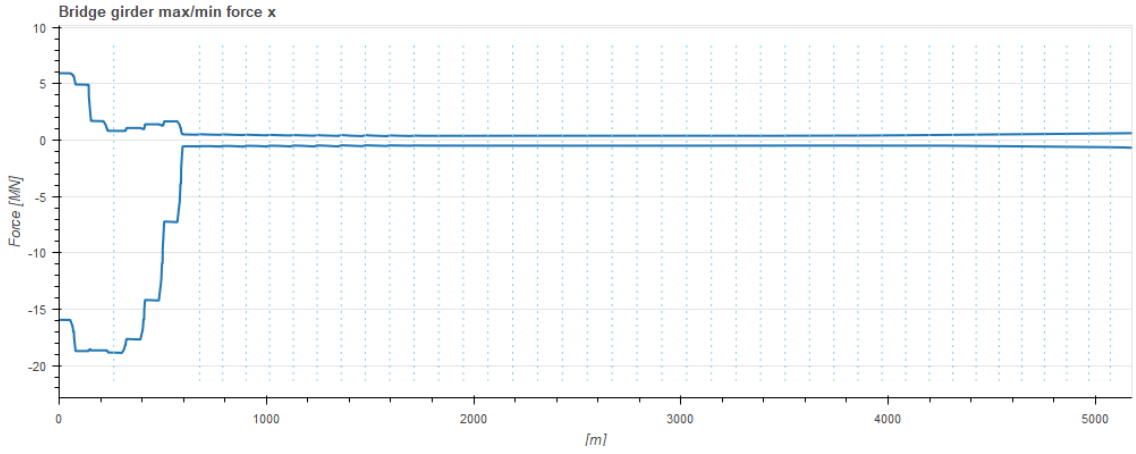

Bridge girder max/min stress point 5
Stress [MPa]
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]

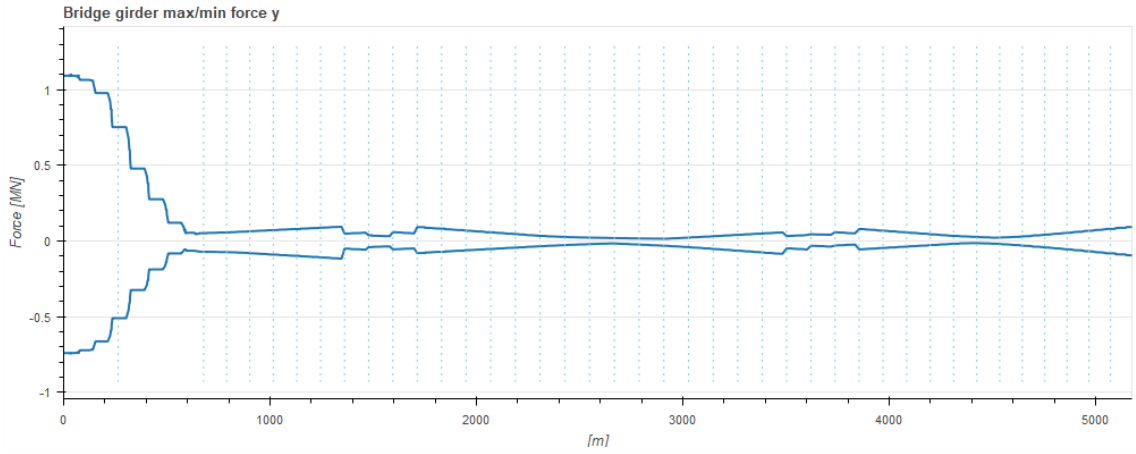

Bridge girder max/min stress point 6
Stress [MPa]
40
20
0
-20
-40
-60
-80
-100
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

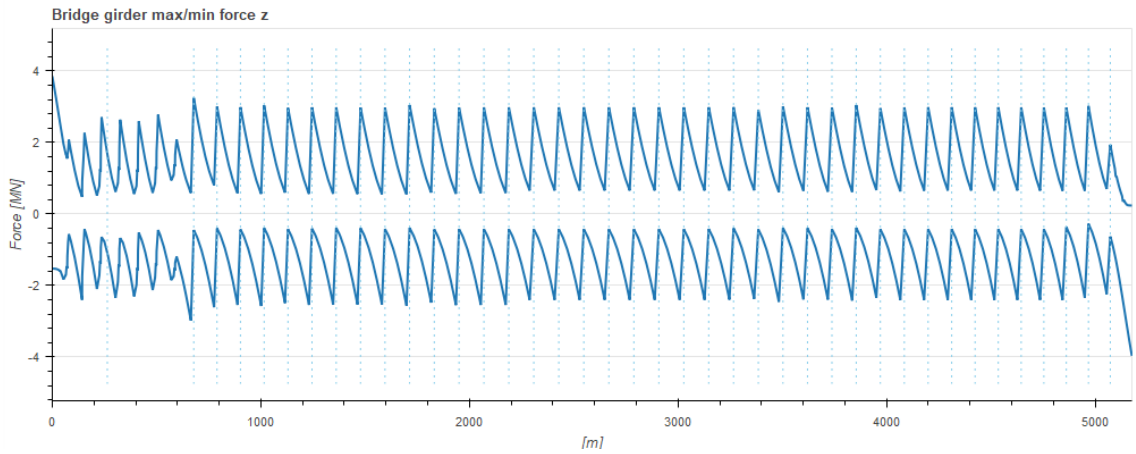
1.4 Traffic (influence length > 1000 m)

The traffic loads are presented in [3], chapter 2.1.2 and correspond to COMB 55 for K12 Model 27 on olavolsen.interactive.no [2]. When using an influence length larger than 1000 m of the distributed loads in the traffic model, reduced correction factors are included according to §6 4) in *Forskrift for trafikklaster på bruer, ferjekaier og andre bærende konstruksjoner i det offentlige vegnettet*, [4].

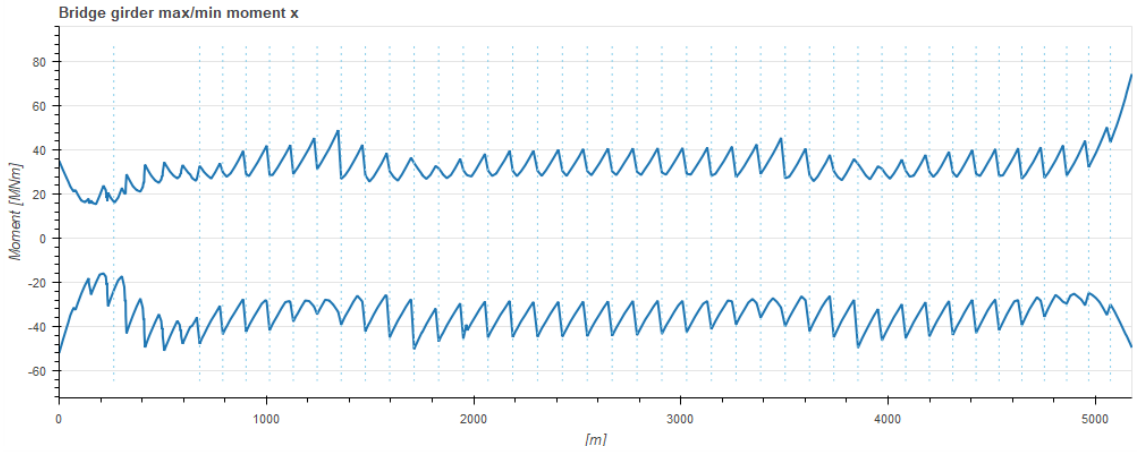
1.4.1 Forces

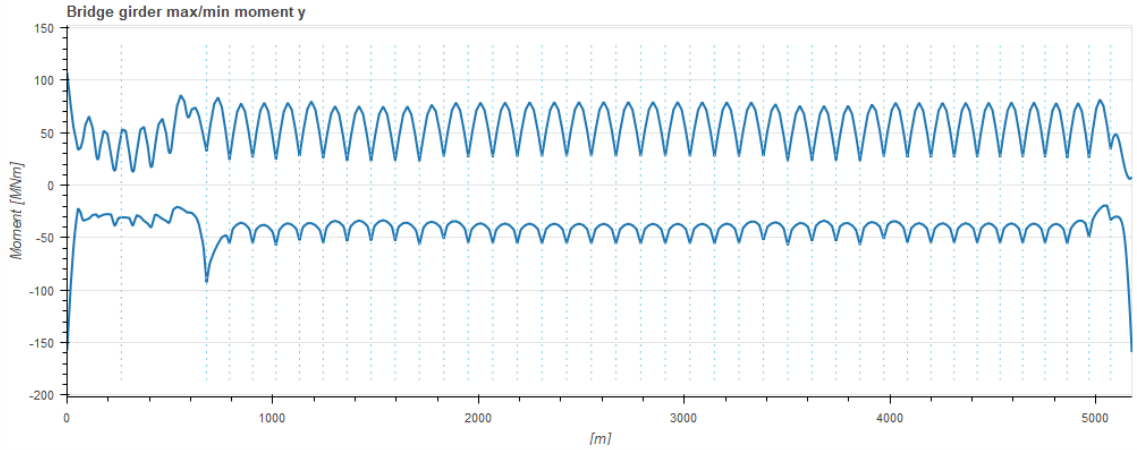


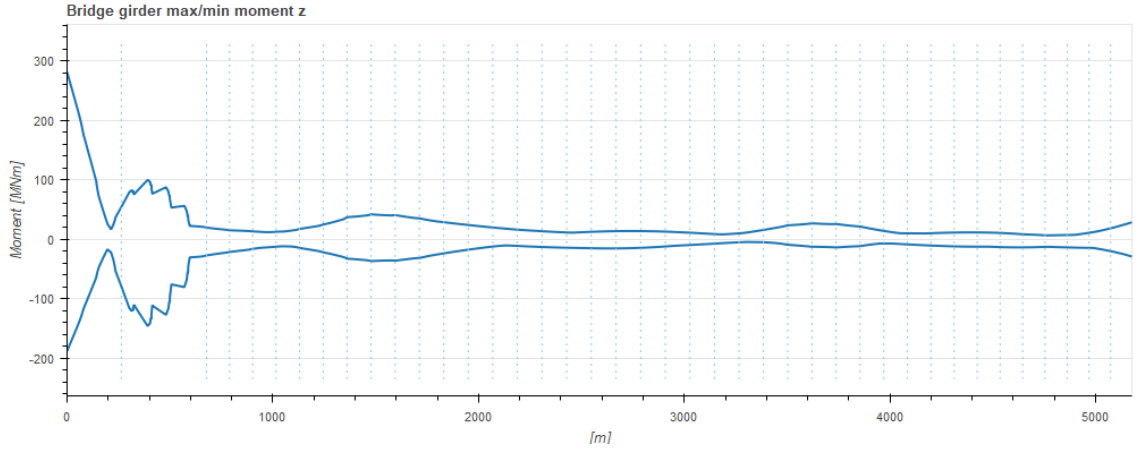




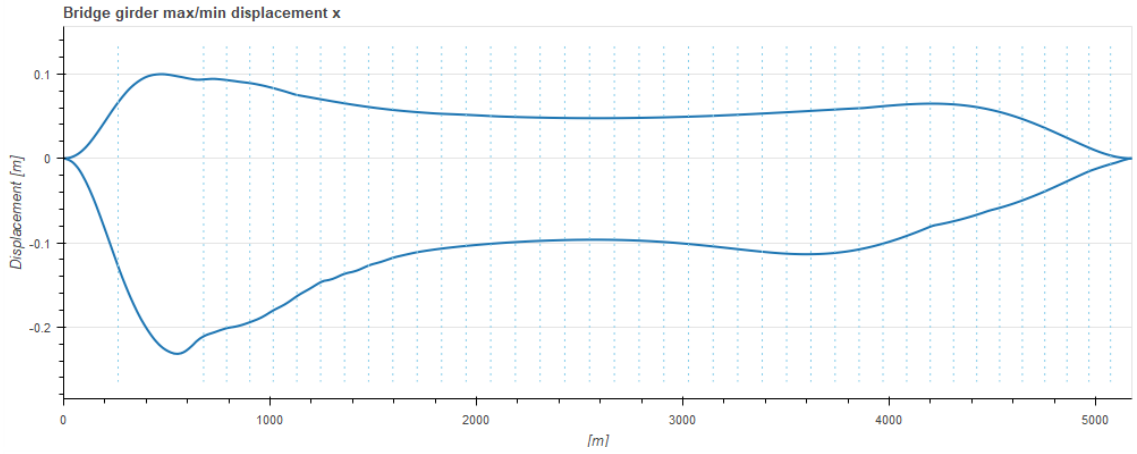
1.4.2 Moments

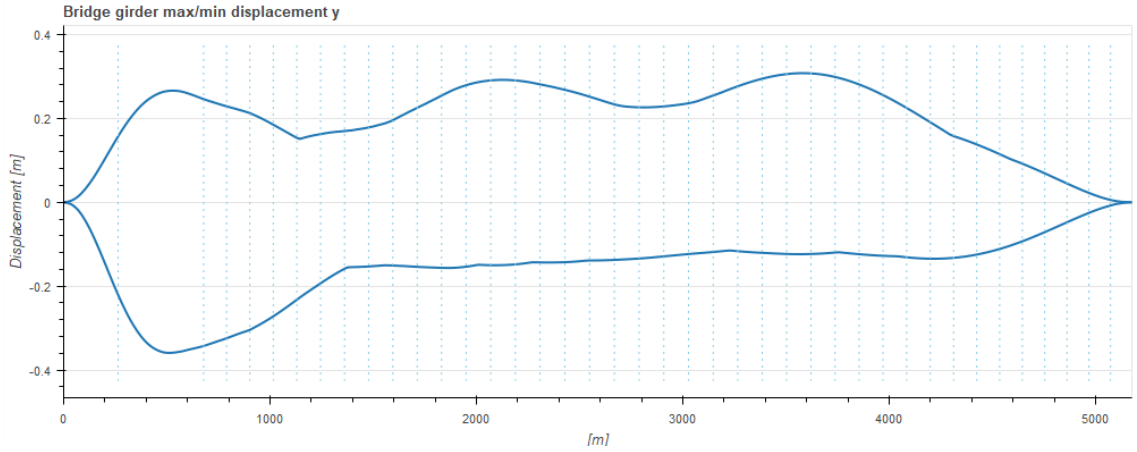

Bridge girder max/min moment x
Moment [MNm]
80
60
40
20
0
-20
-40
-60
0
1000
2000
3000
4000
5000
[m]

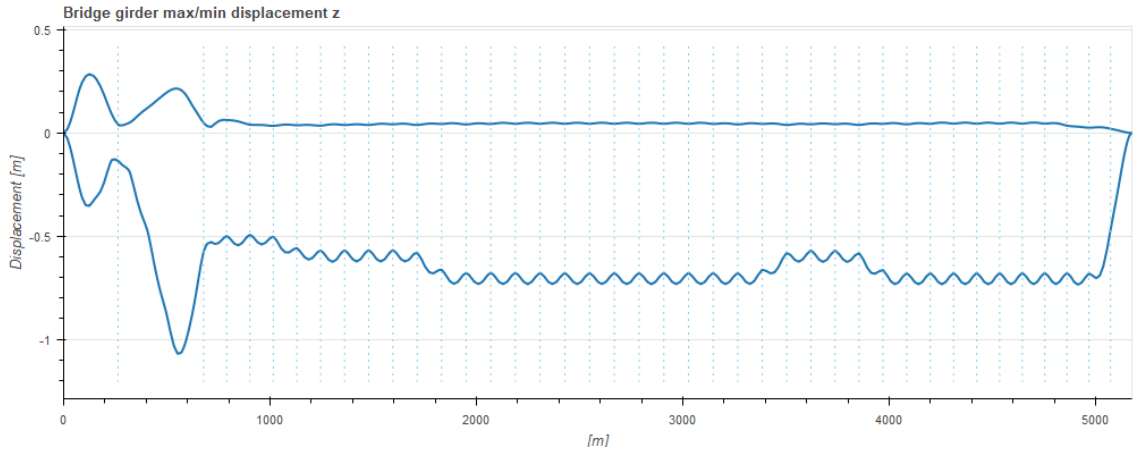

Bridge girder max/min moment y
Moment [MNm]
150
100
50
0
-50
-100
-150
-200
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
300
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

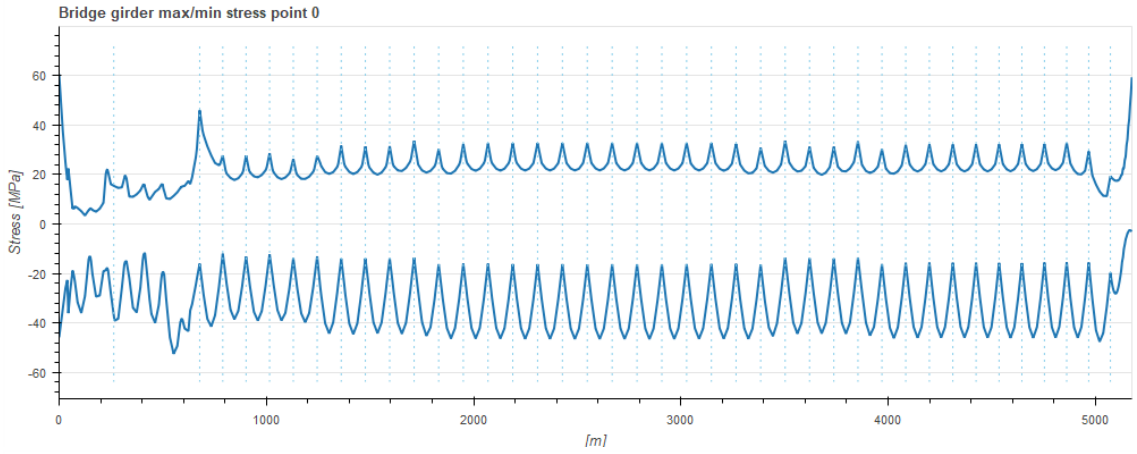
1.4.3 Displacements

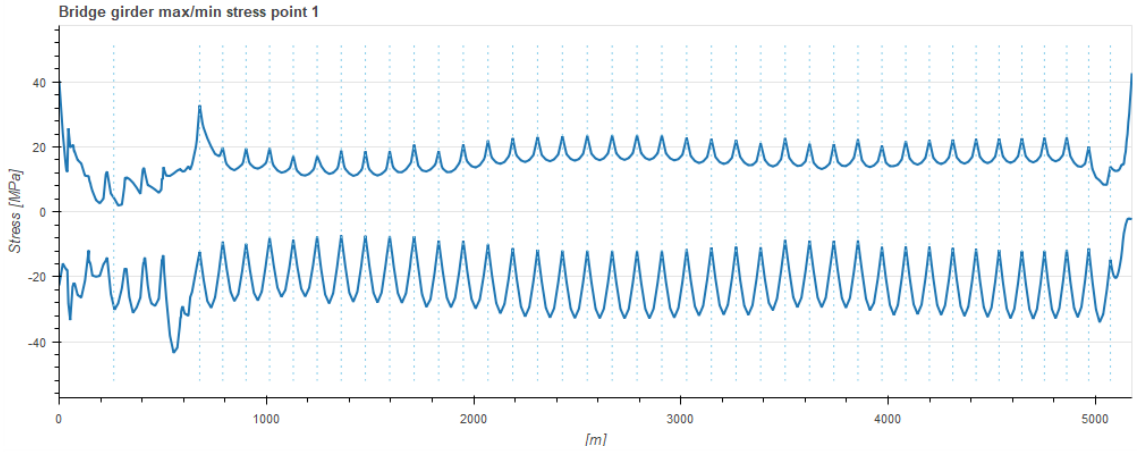


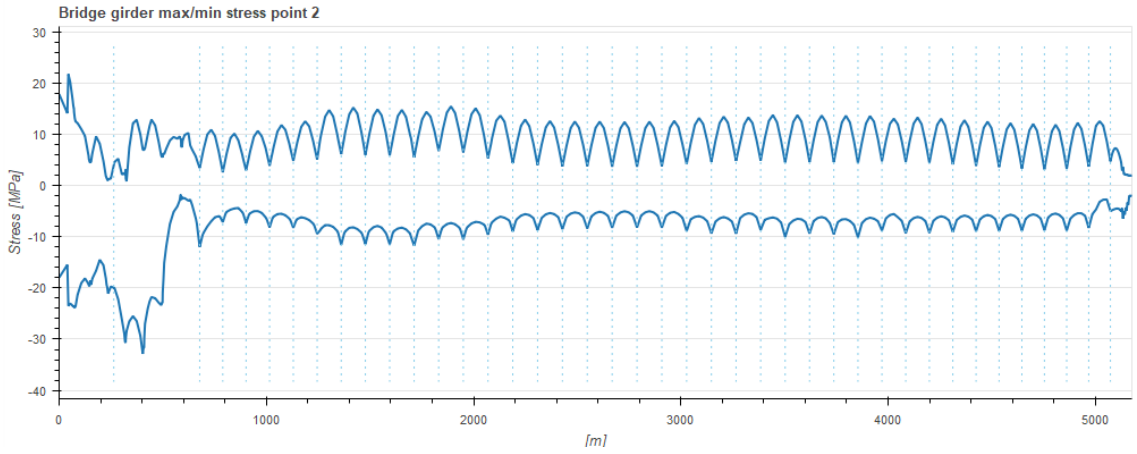


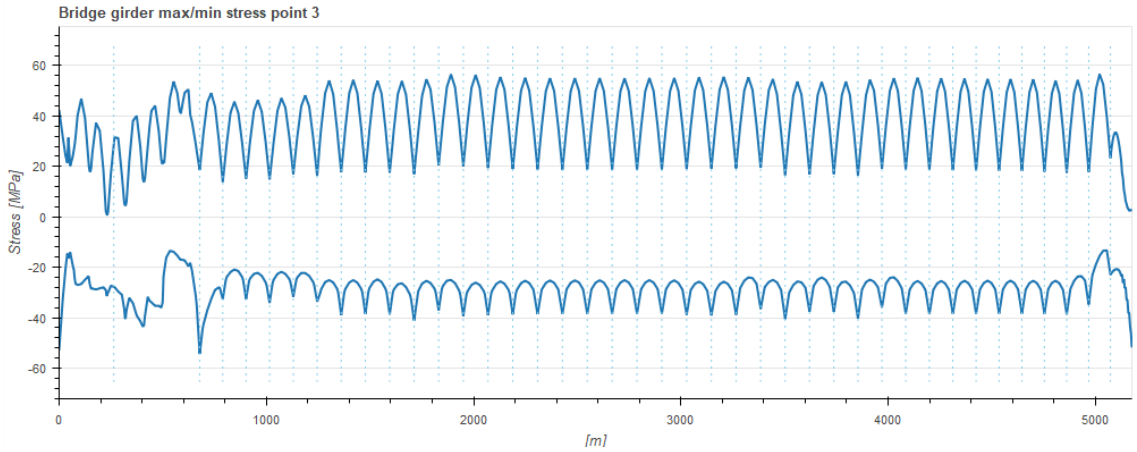


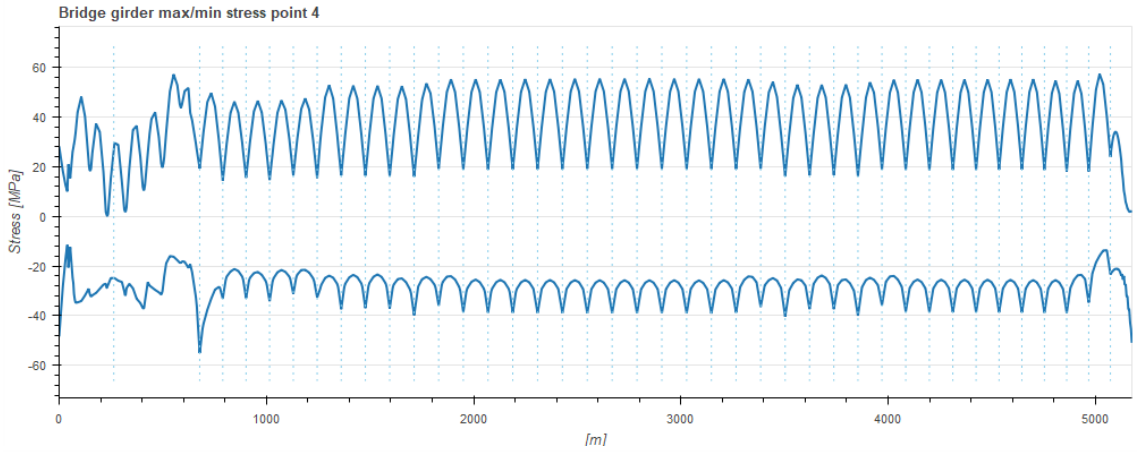
1.4.4 Stresses

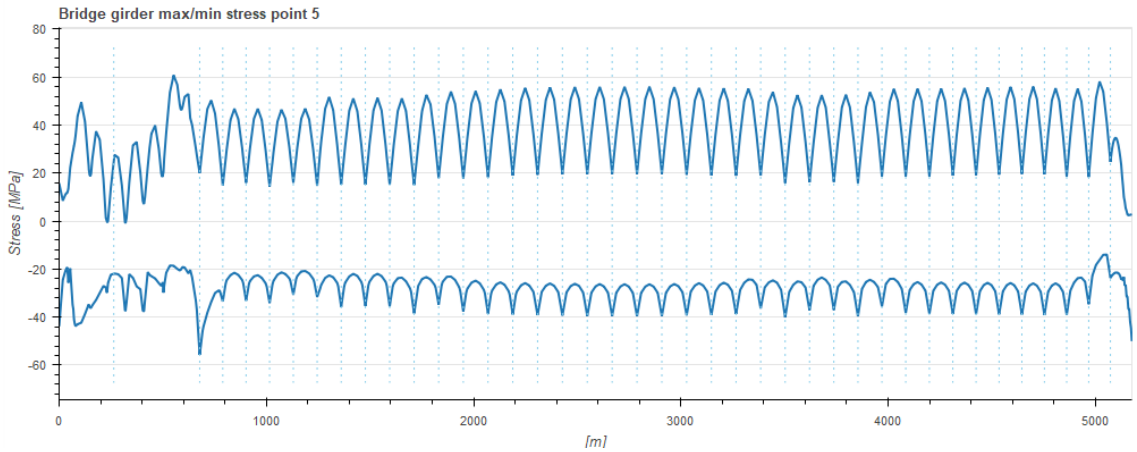


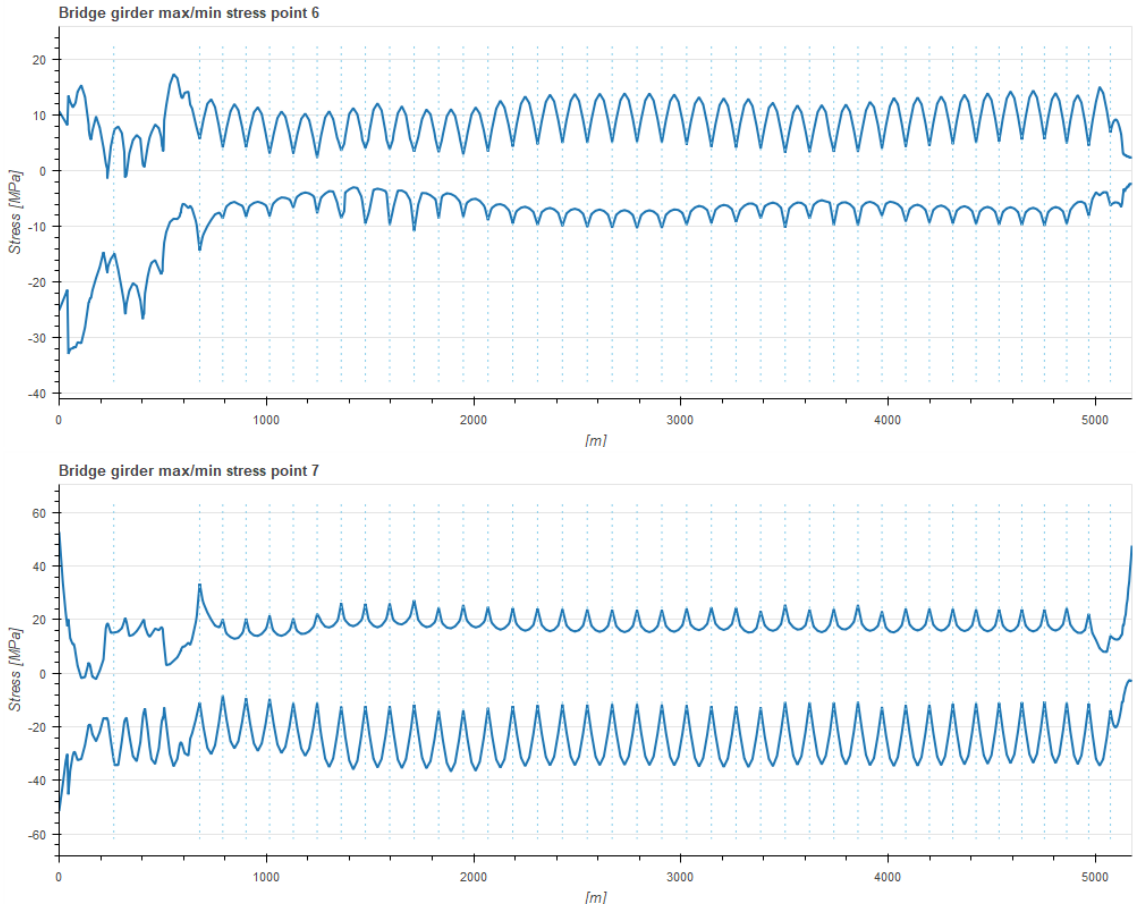





Bridge girder max/min stress point 3
Stress [MPa]
60
40
20
0
-20
-40
-60
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
60
40
20
0
-20
-40
-60
0
1000
2000
3000
4000
5000
[m]

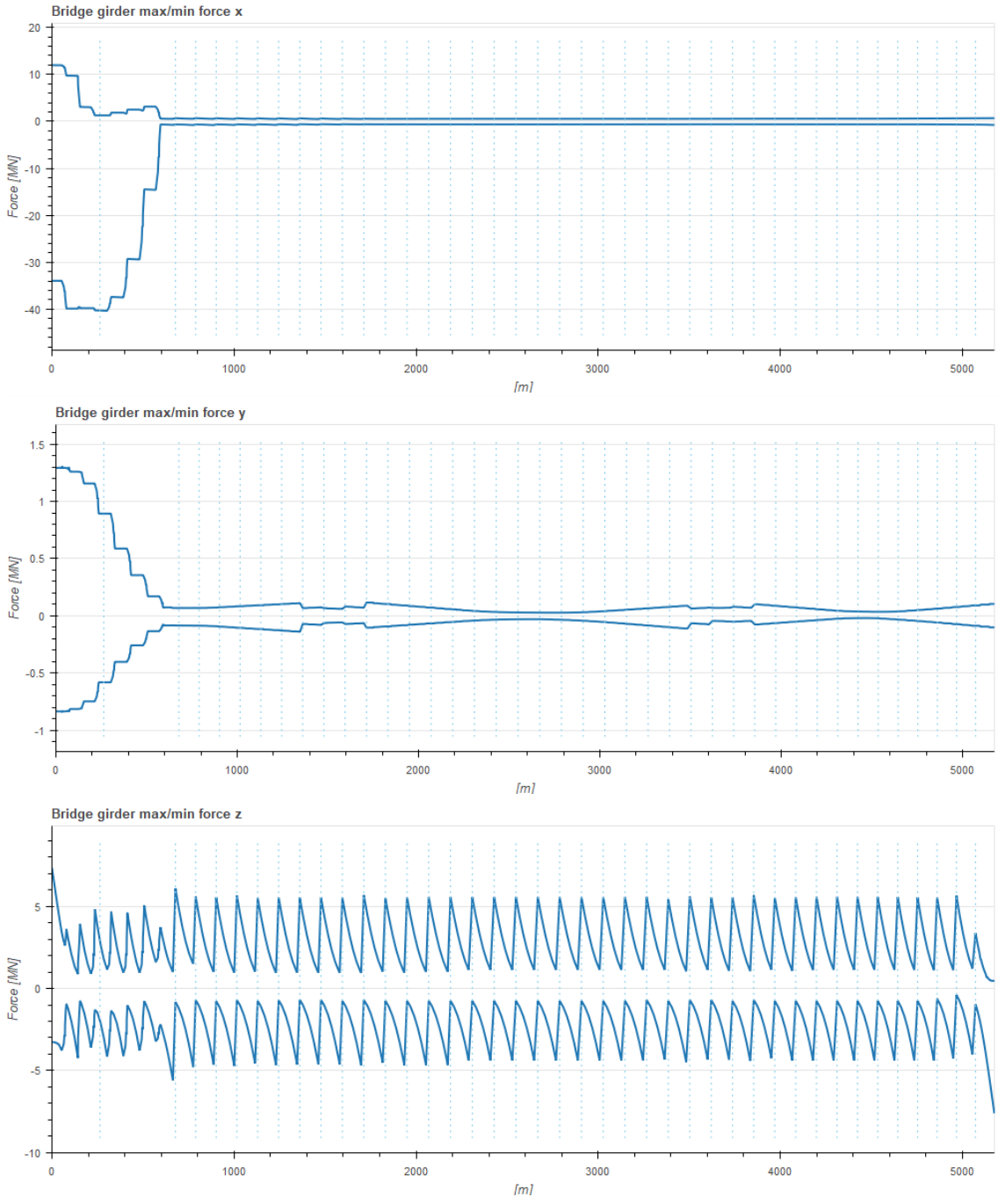

Bridge girder max/min stress point 5
Stress [MPa]
80
60
40
20
0
-20
-40
-60
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 6
Stress [MPa]
20
10
0
-10
-20
-30
-40
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
60
40
20
0
-20
-40
-60
0
1000
2000
3000
4000
5000
[m]

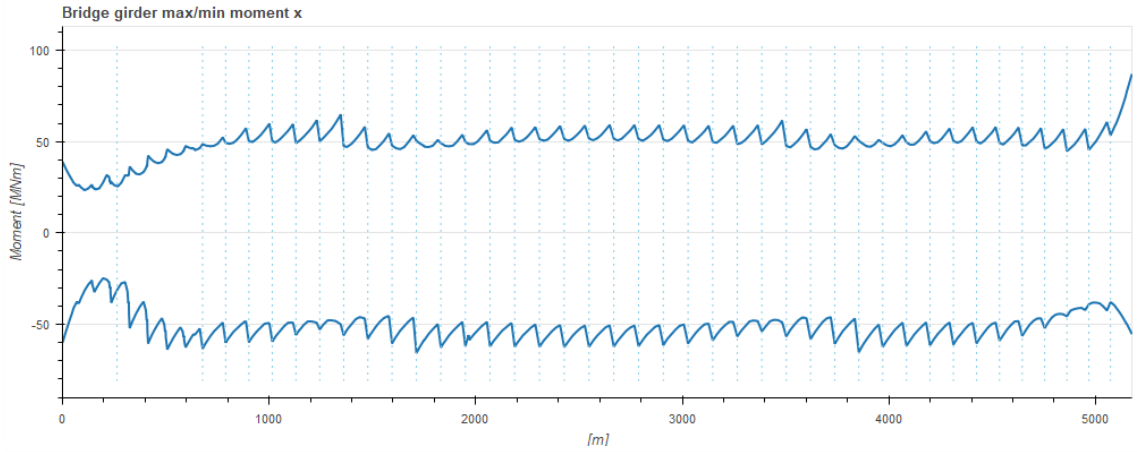
1.5 Traffic (influence length = 200 m)

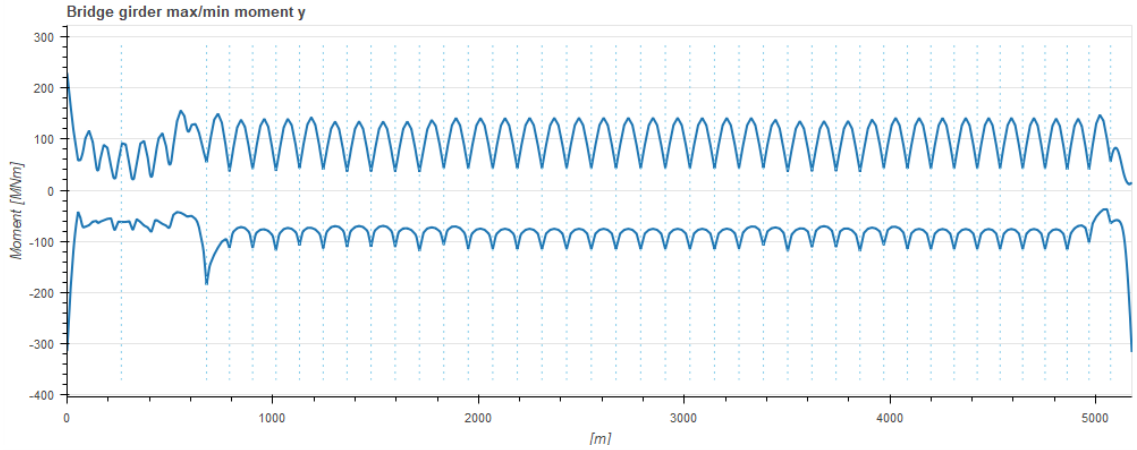
The traffic loads are presented in [3], chapter 2.1.2 and correspond to COMB 55 for K12 Model 30 on olavolsen.interactive.no [2]. A 200 m influence length of the distributed traffic load is applied, with correction factors according to LM1 in NS-EN 1991-2+NA [5].

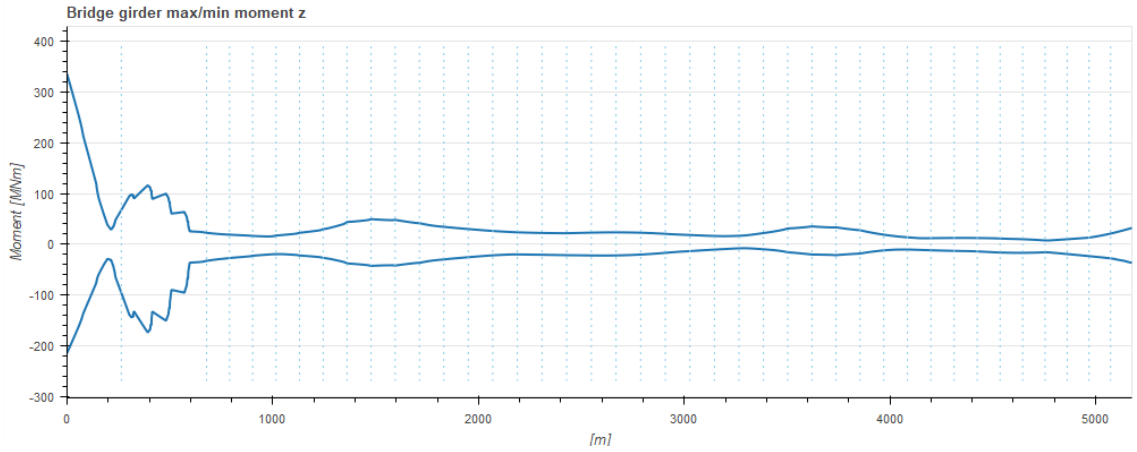
1.5.1 Forces



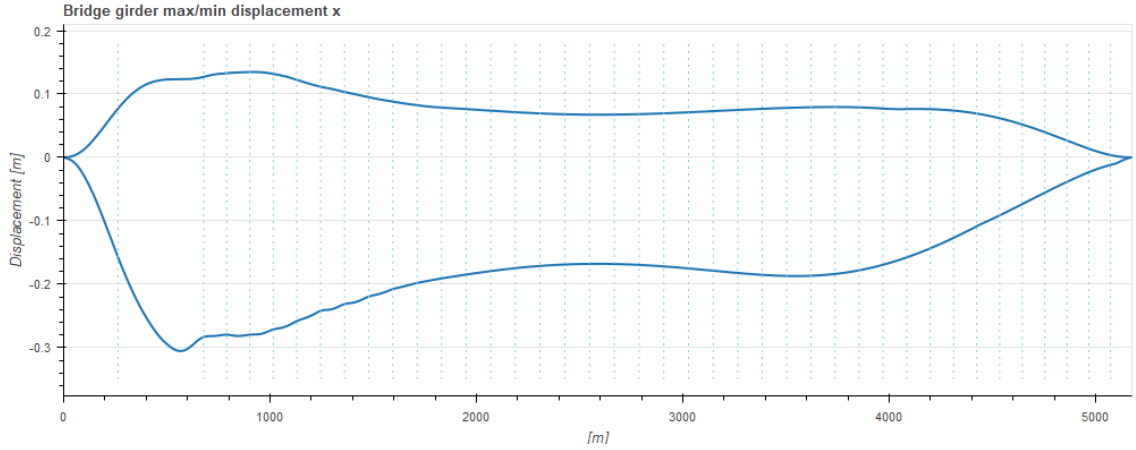
1.5.2 Moments

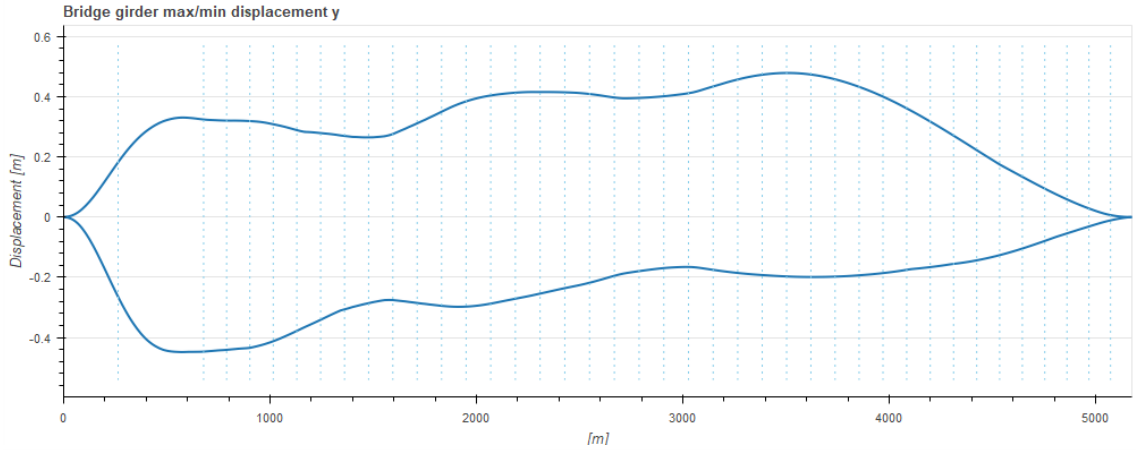

Bridge girder max/min moment x
Moment [MNm]
100
50
0
-50
0
1000
2000
3000
4000
5000
[m]

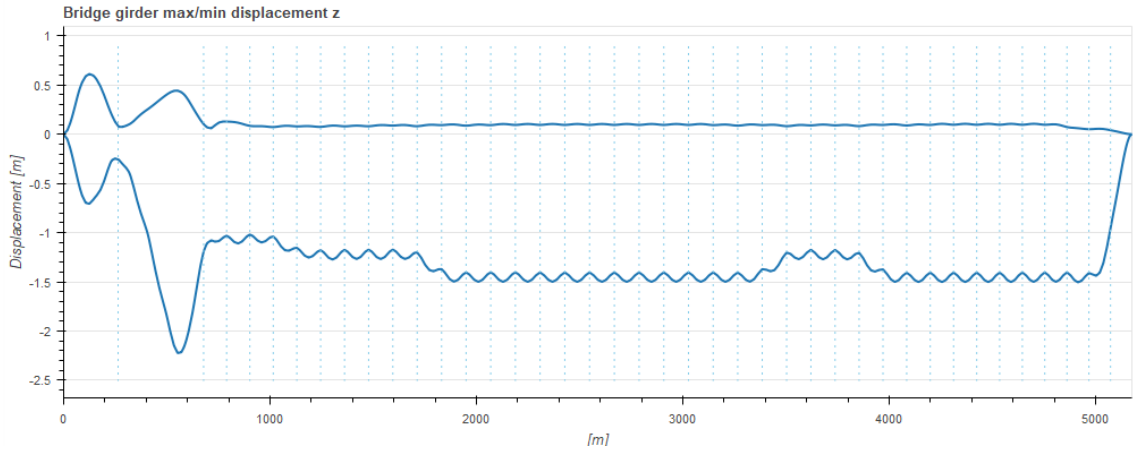

Bridge girder max/min moment y
Moment [MNm]
300
200
100
0
-100
-200
-300
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
400
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

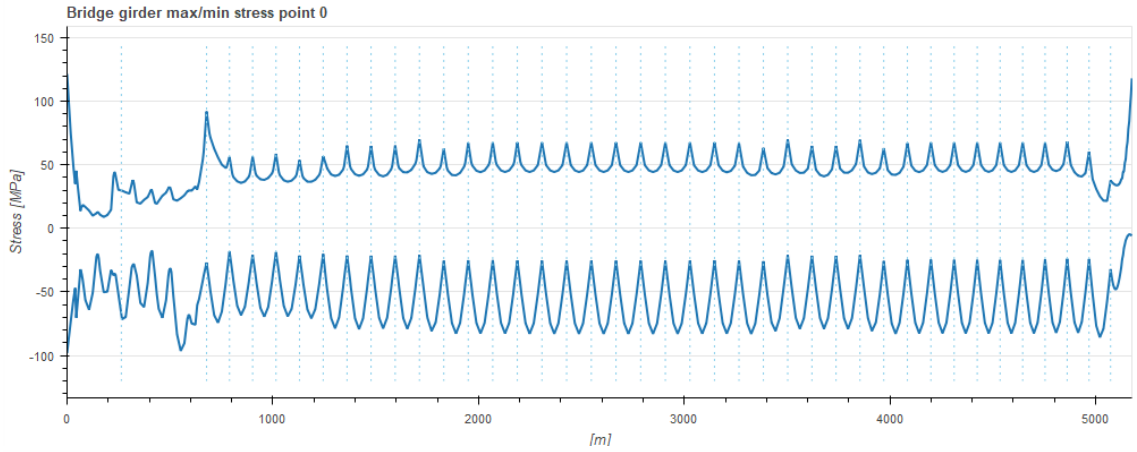
1.5.3 Displacements

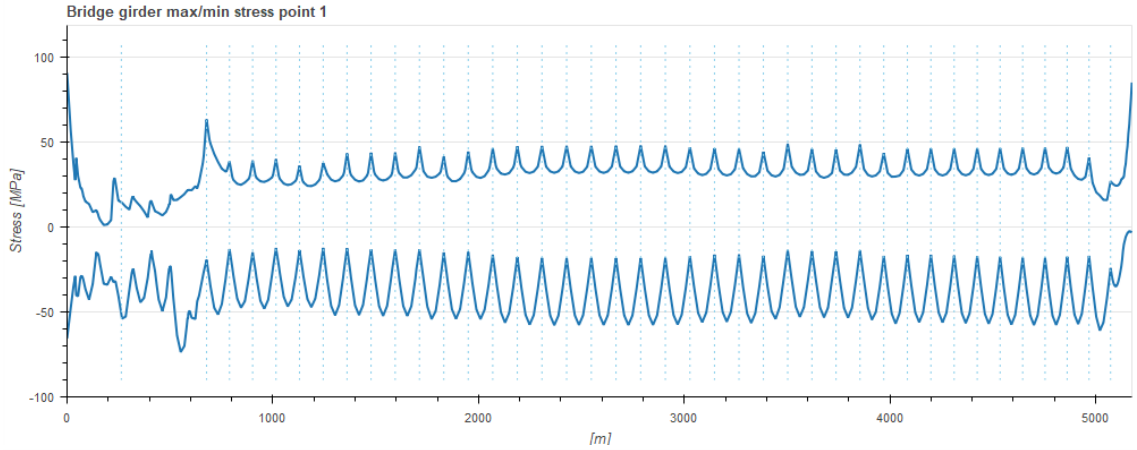


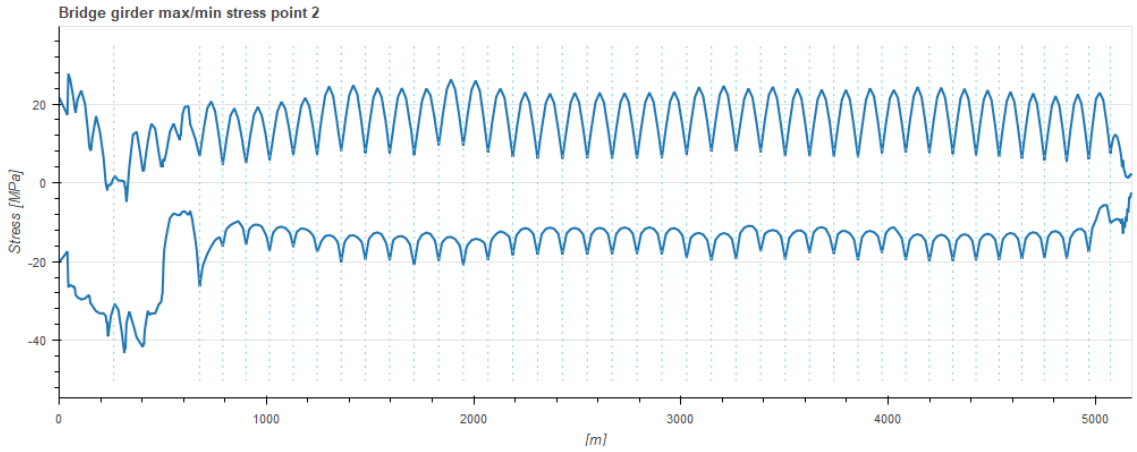


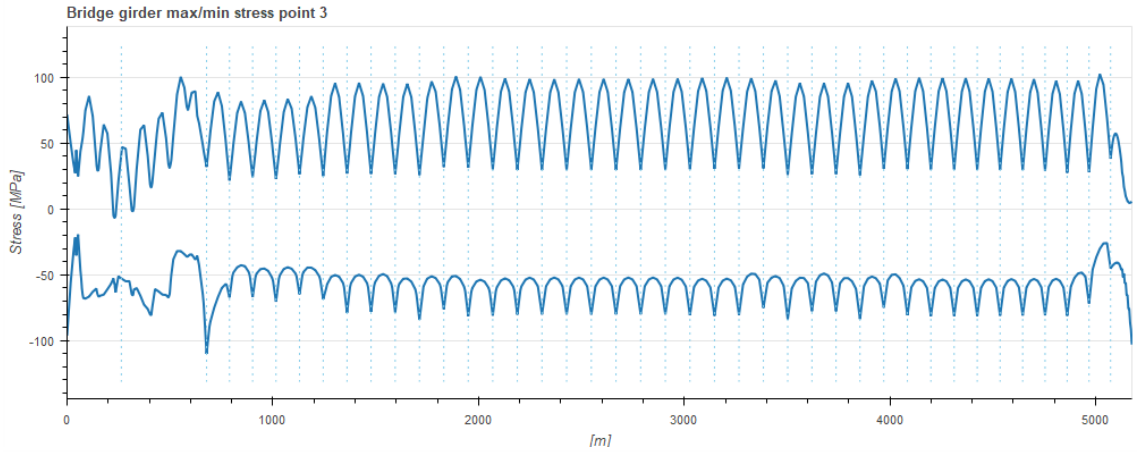


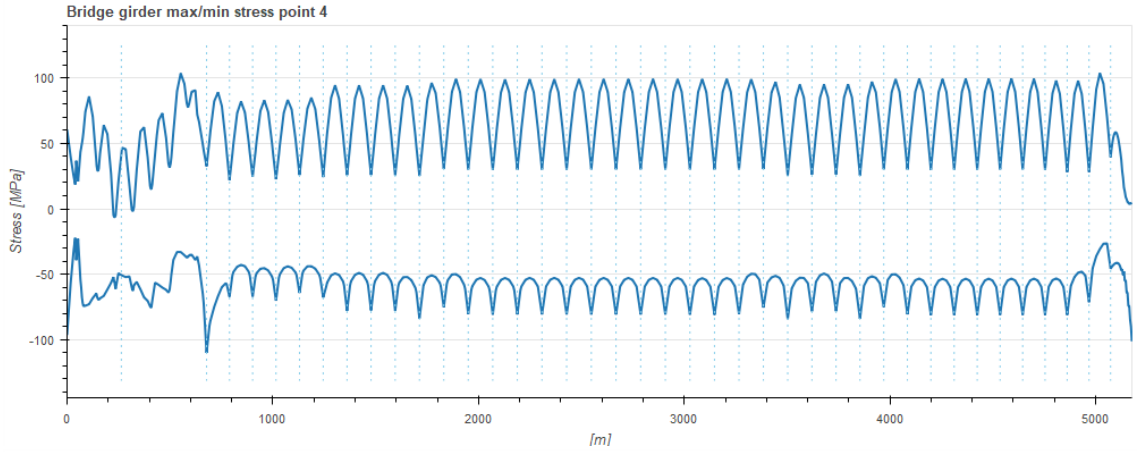
1.5.4 Stresses

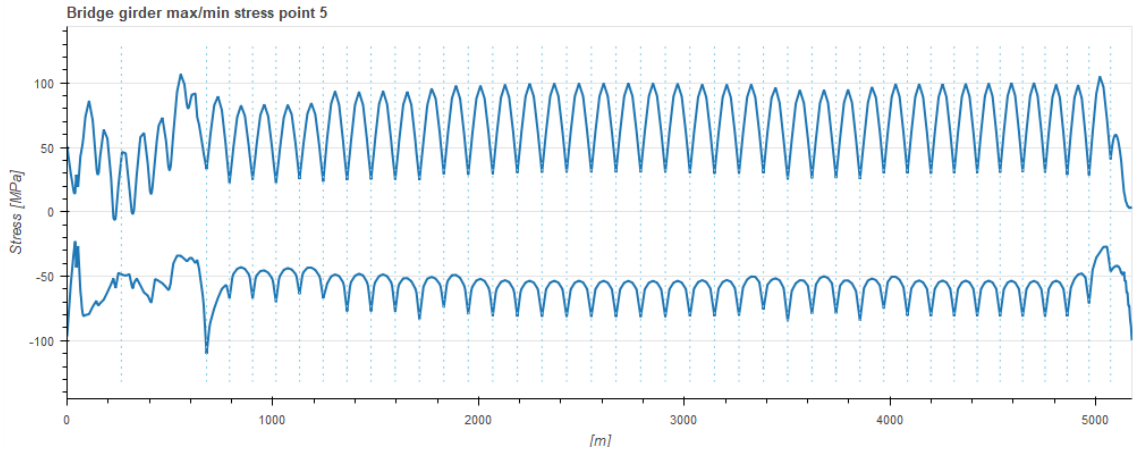


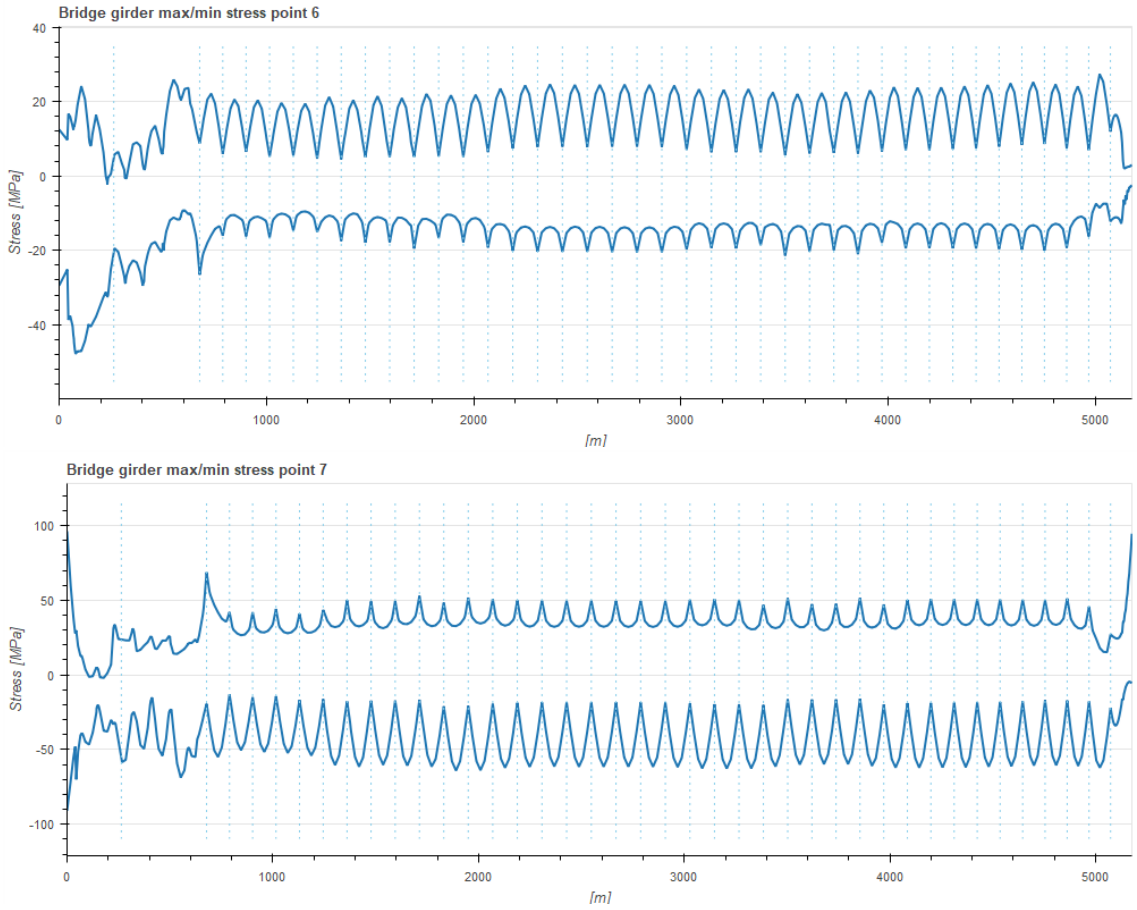





Bridge girder max/min stress point 3
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

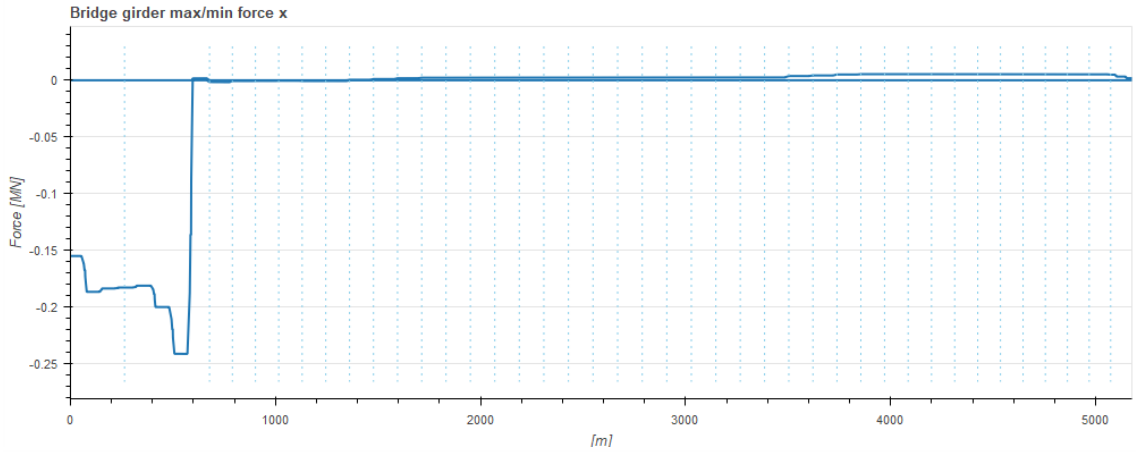

Bridge girder max/min stress point 5
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

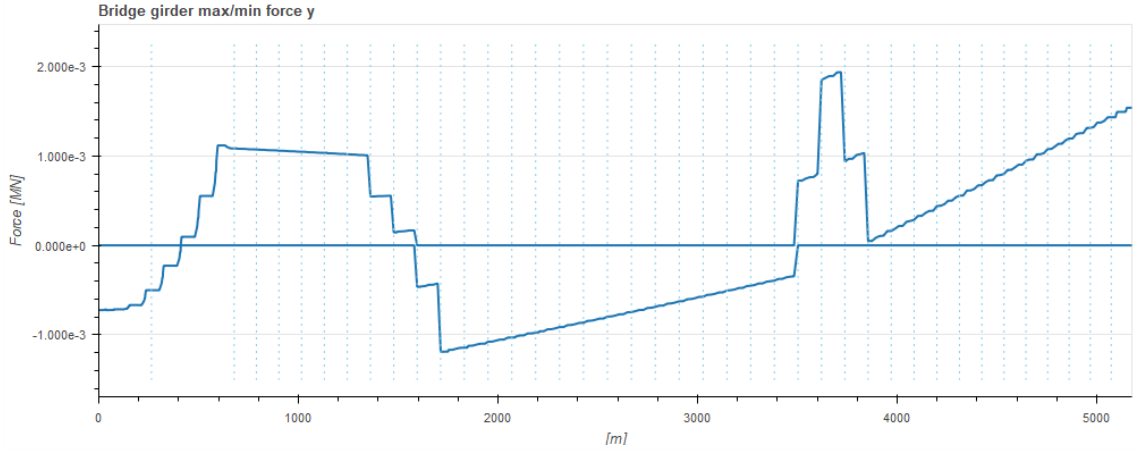

Bridge girder max/min stress point 6
Stress [MPa]
40
20
0
-20
-40
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

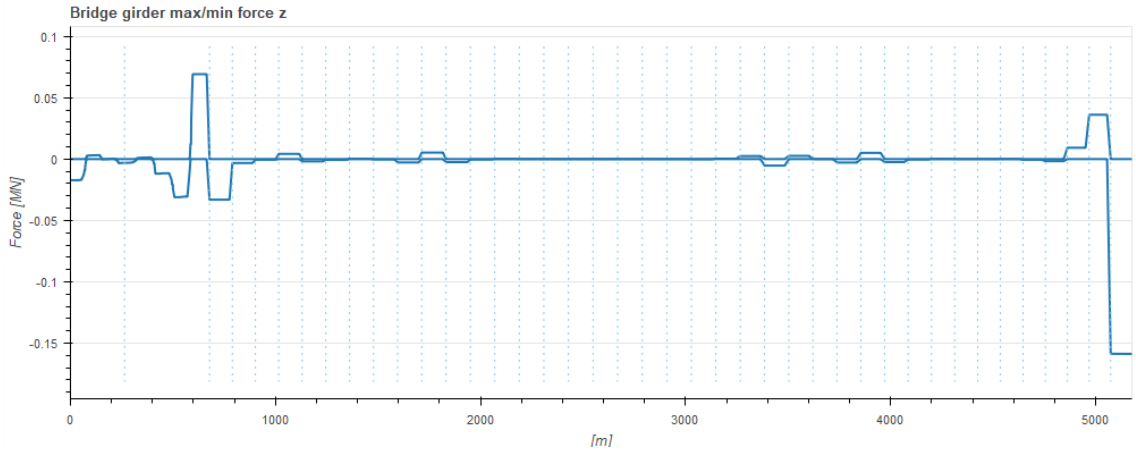
1.6 Marine growth

The loads from marine growth are presented in [3], chapter 2.1.7 and correspond to COMB 52 on olavolsen.interactive.no [2].

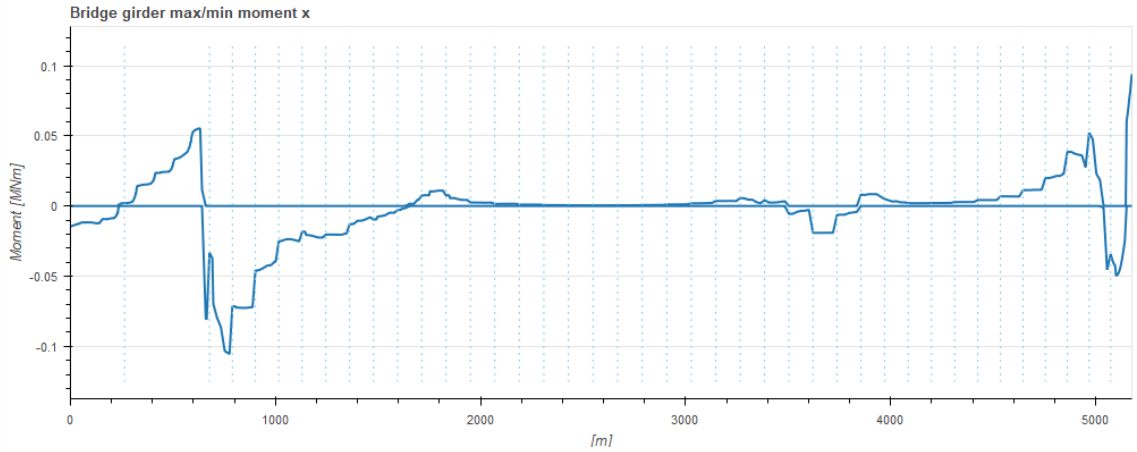
1.6.1 Forces

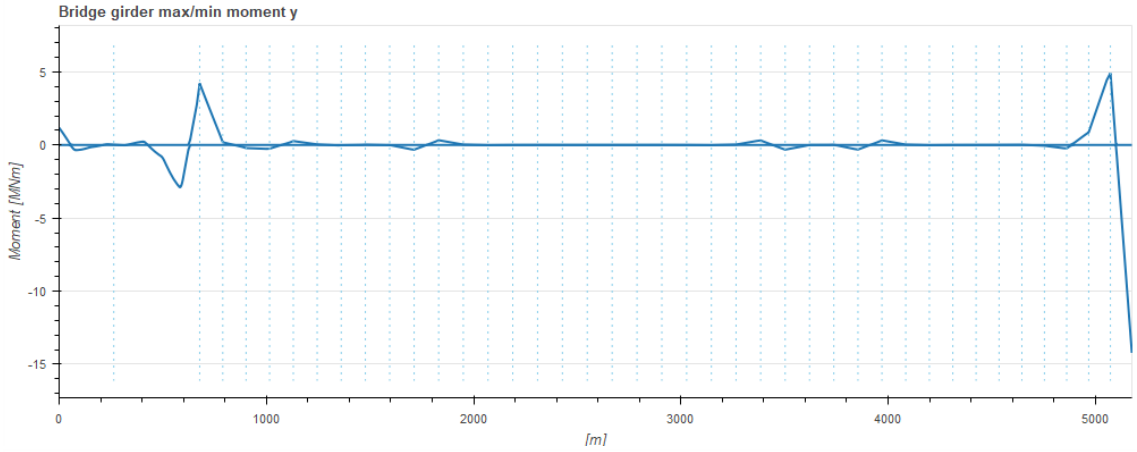


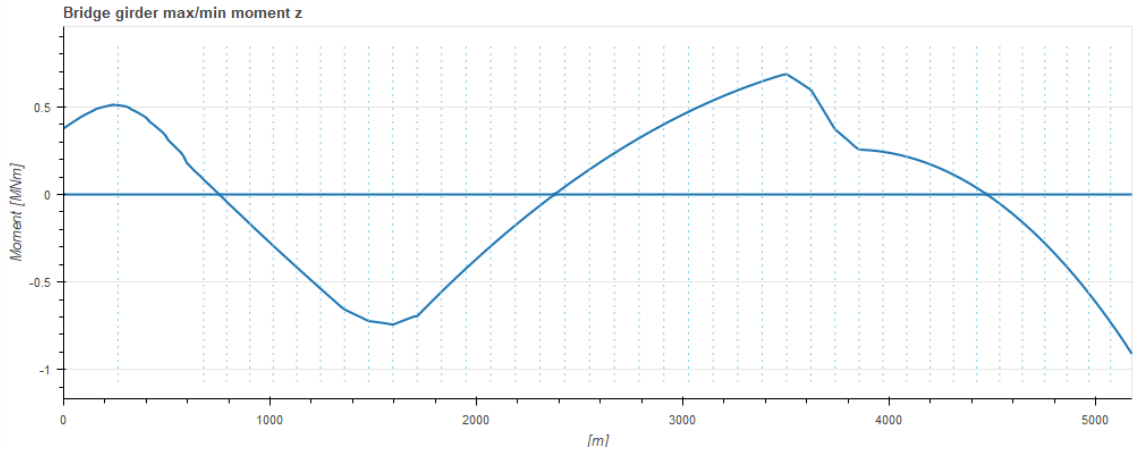




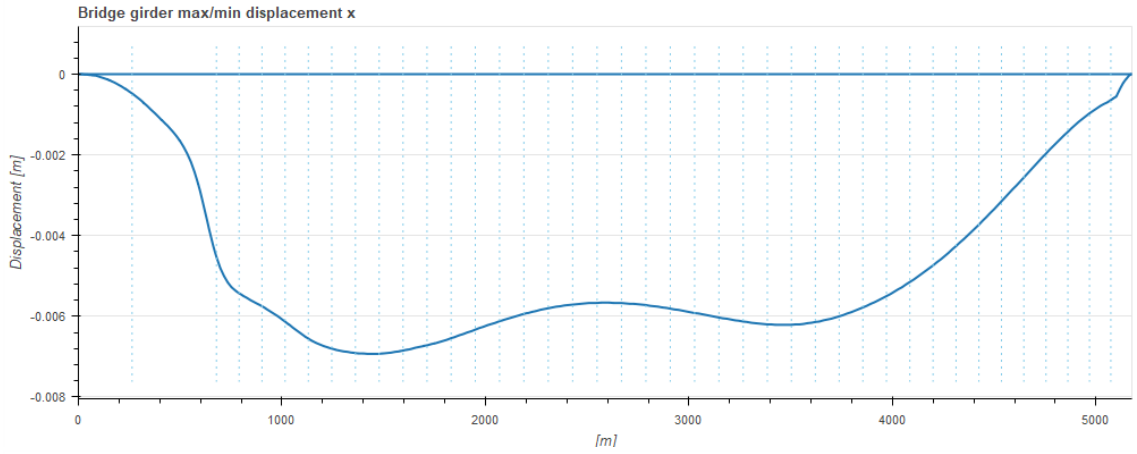
1.6.2 Moments

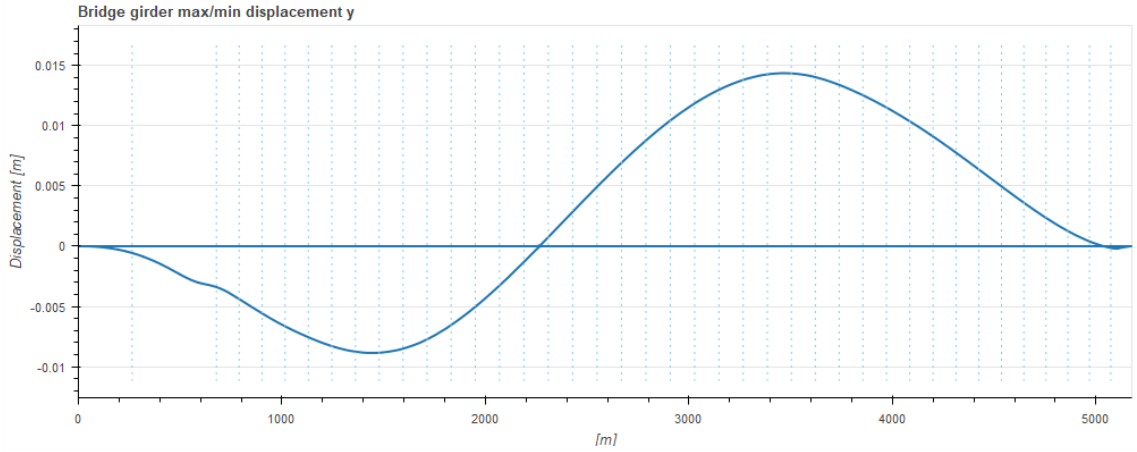

Bridge girder max/min moment x
Moment [MNm]
0.1
0.05
0
-0.05
-0.1
0
1000
2000
3000
4000
5000
[m]

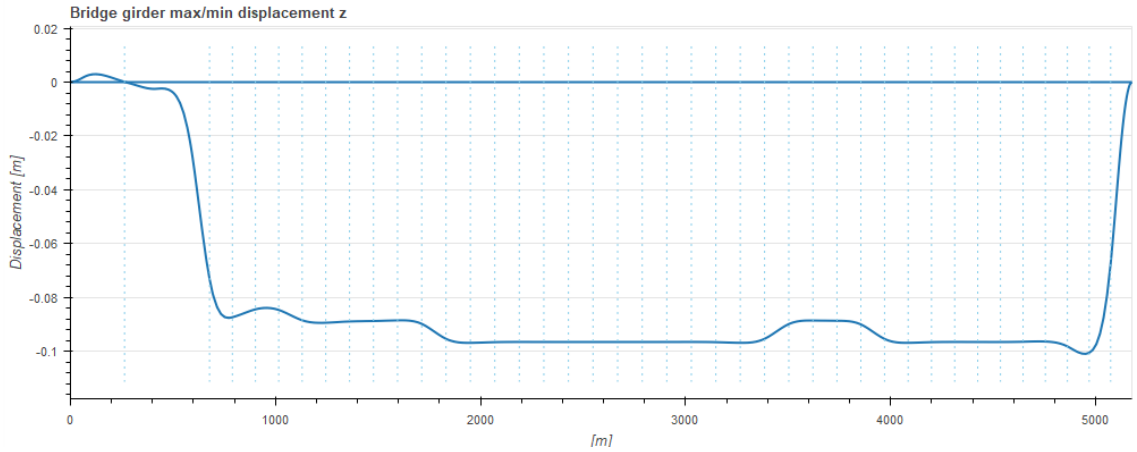

Bridge girder max/min moment y
Moment [MNm]
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
0.5
0
-0.5
-1
0
1000
2000
3000
4000
5000
[m]

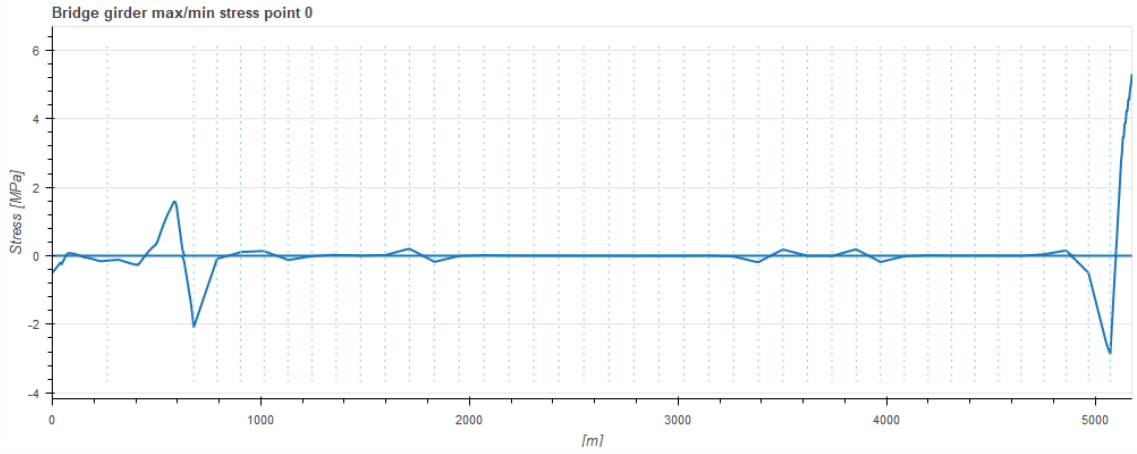
1.6.3 Displacements

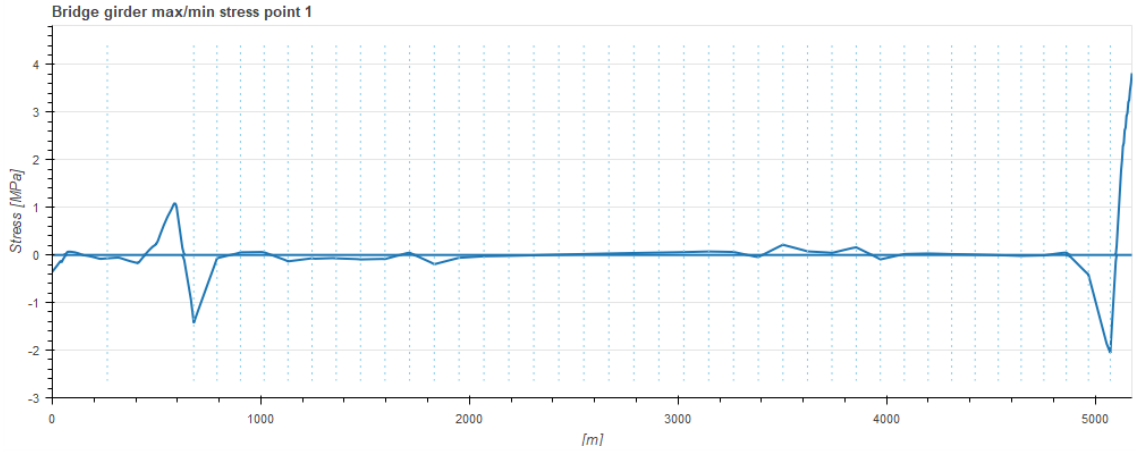


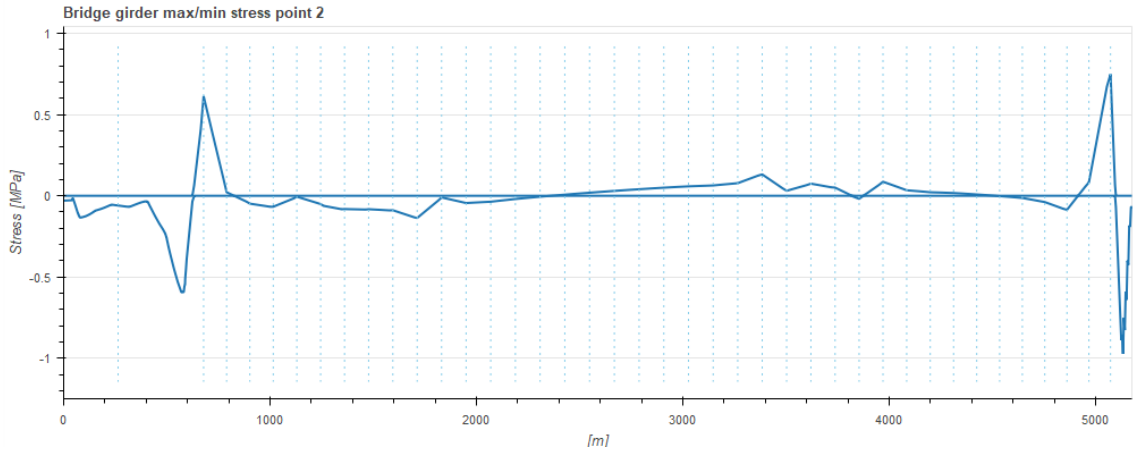


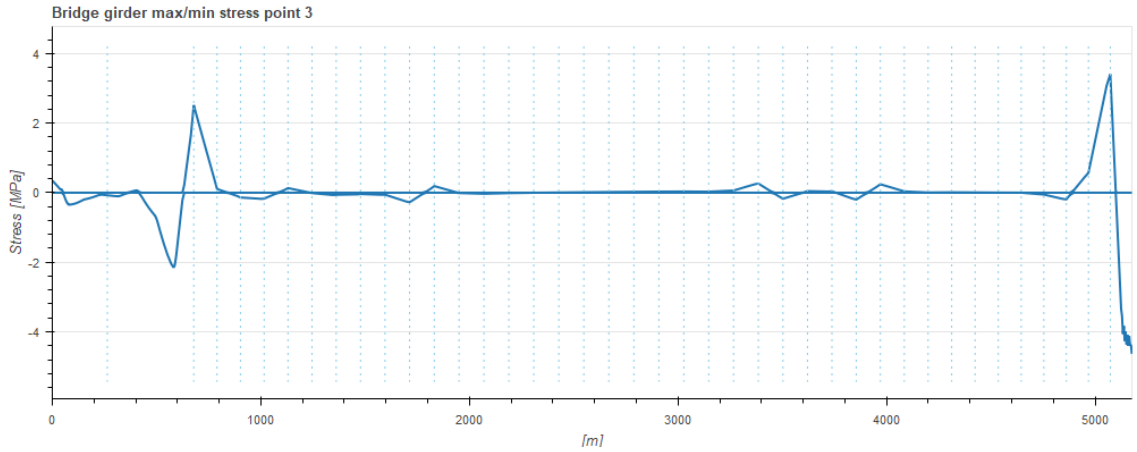


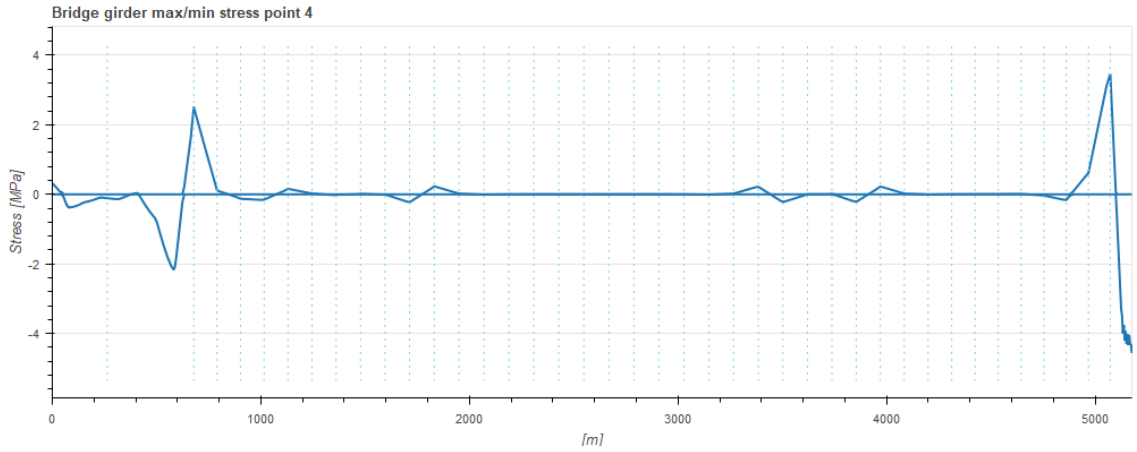
1.6.4 Stresses

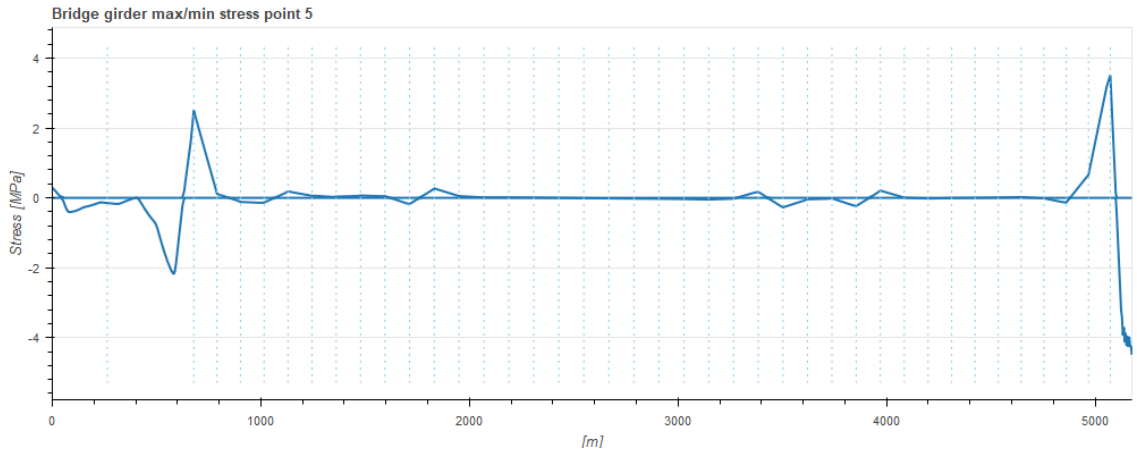


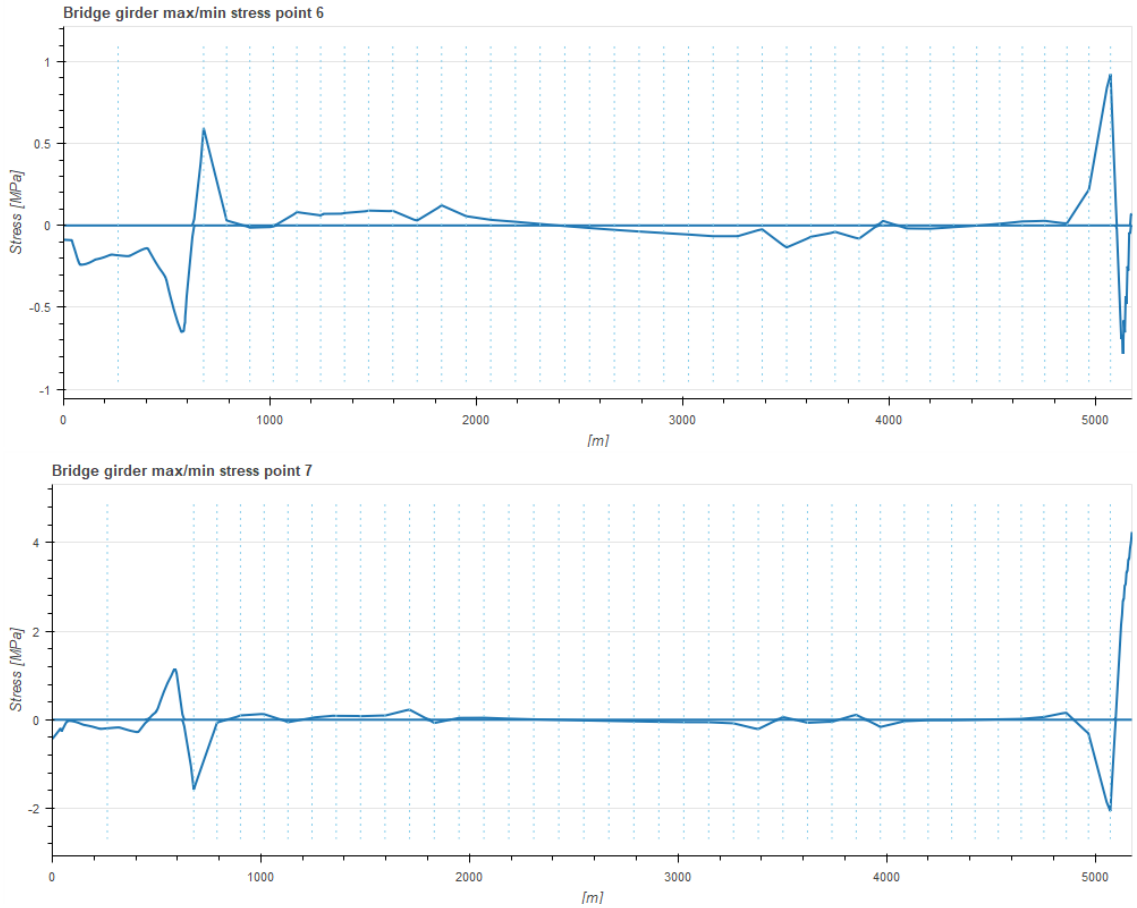





Bridge girder max/min stress point 3
Stress [MPa]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

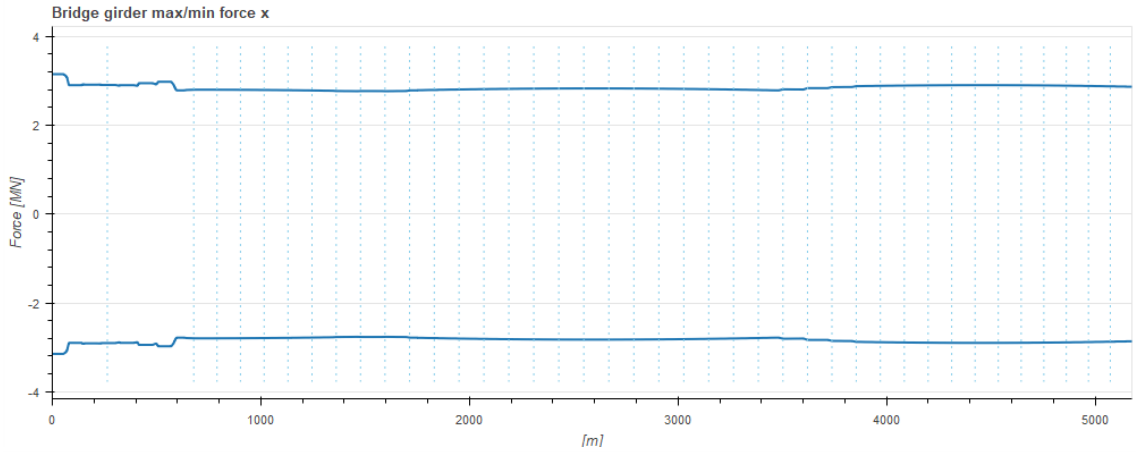

Bridge girder max/min stress point 5
Stress [MPa]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

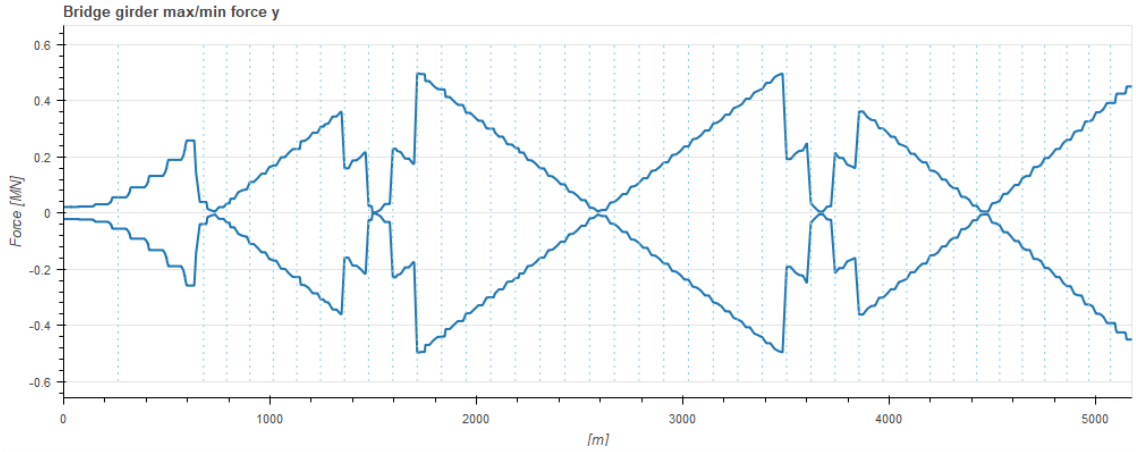

Bridge girder max/min stress point 6
Stress [MPa]
1
0.5
0
-0.5
-1
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
4
2
0
-2
0
1000
2000
3000
4000
5000
[m]

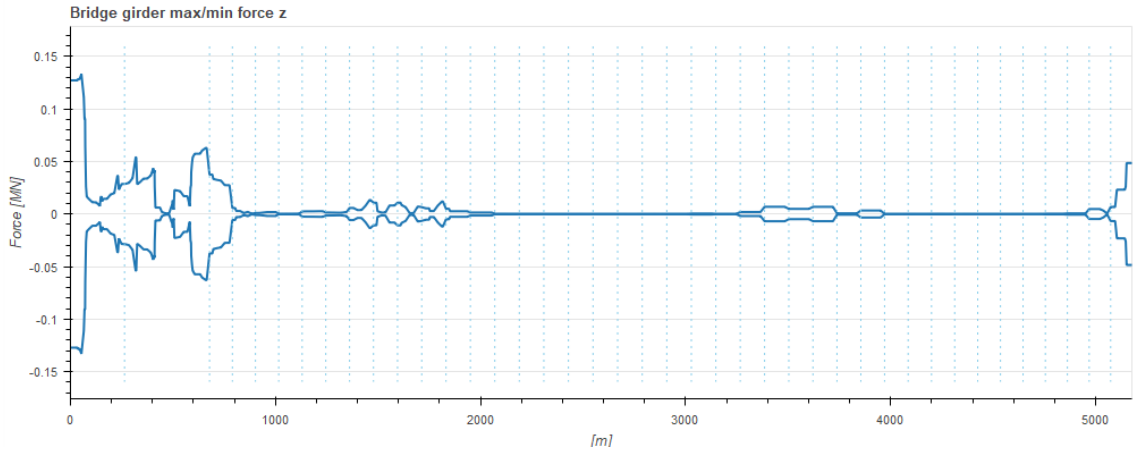
1.7 Temperature

Characteristic response from 100 year temperature is presented here. The loads are presented in [3], chapter 2.1.3 and correspond to COMB 57 on olavolsen.interactive.no [2].

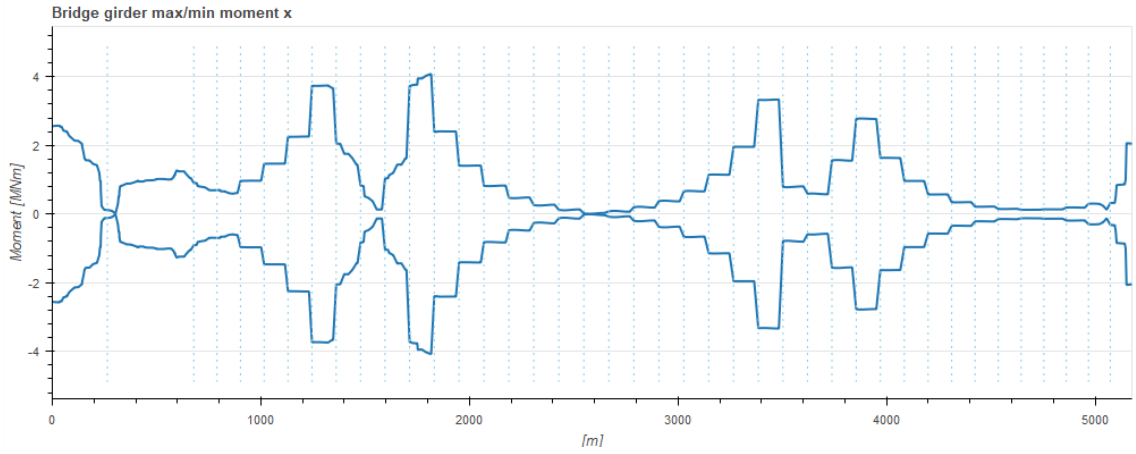
1.7.1 Forces

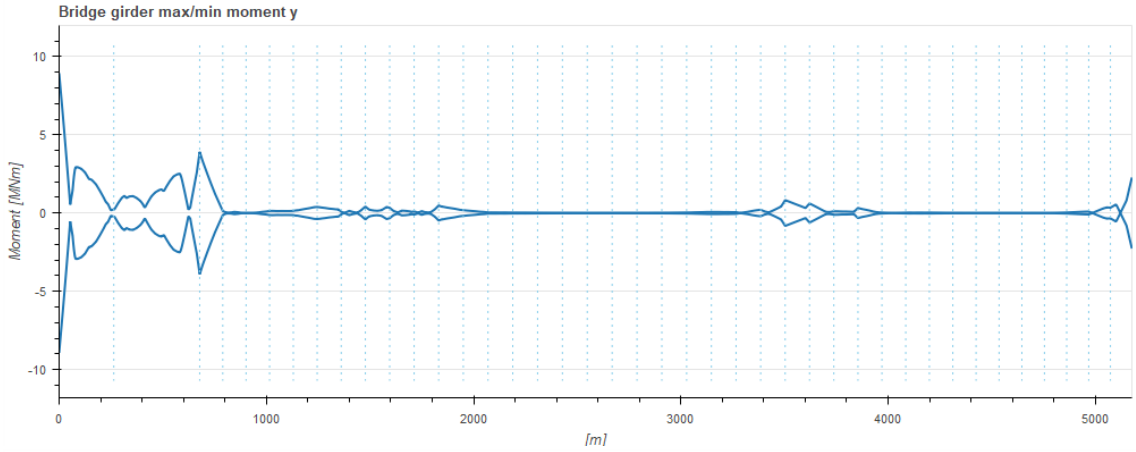


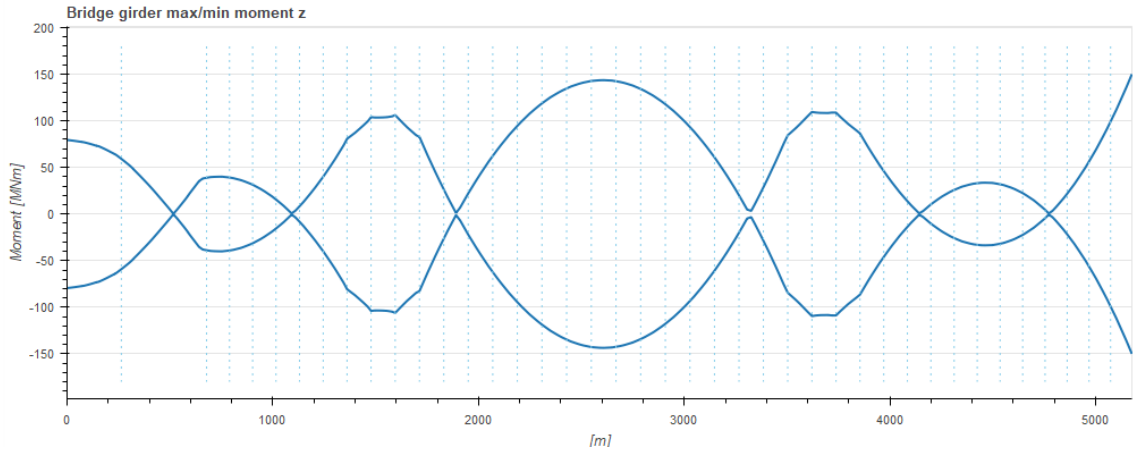




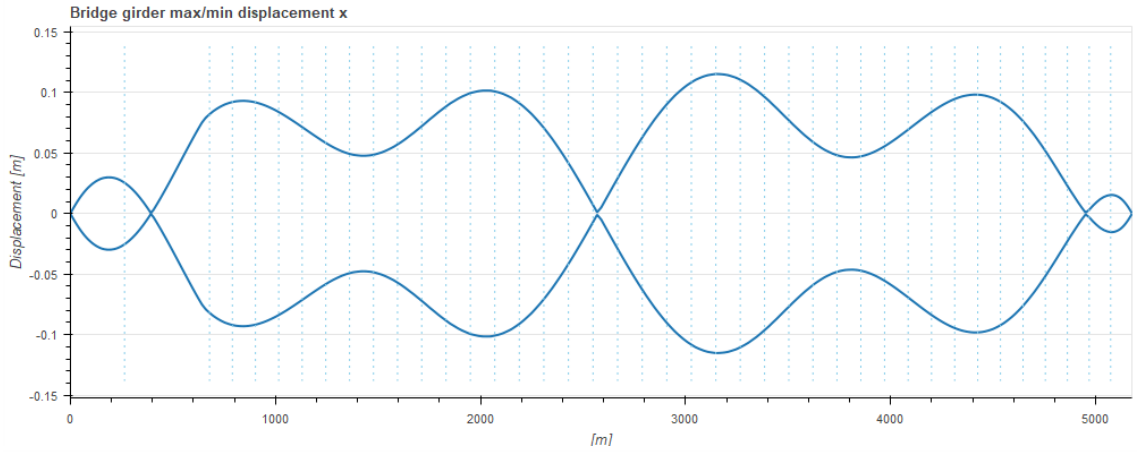
1.7.2 Moments

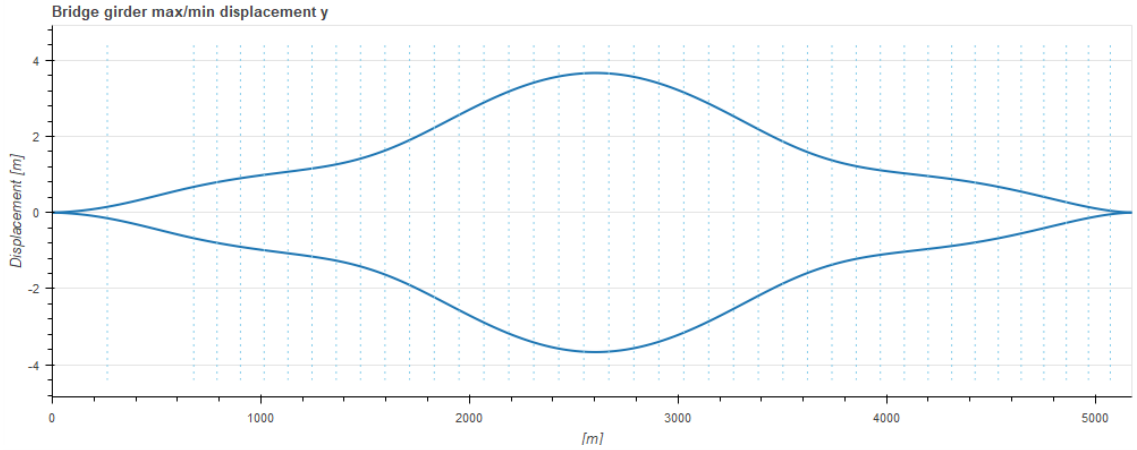

Bridge girder max/min moment x
Moment [MNm]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

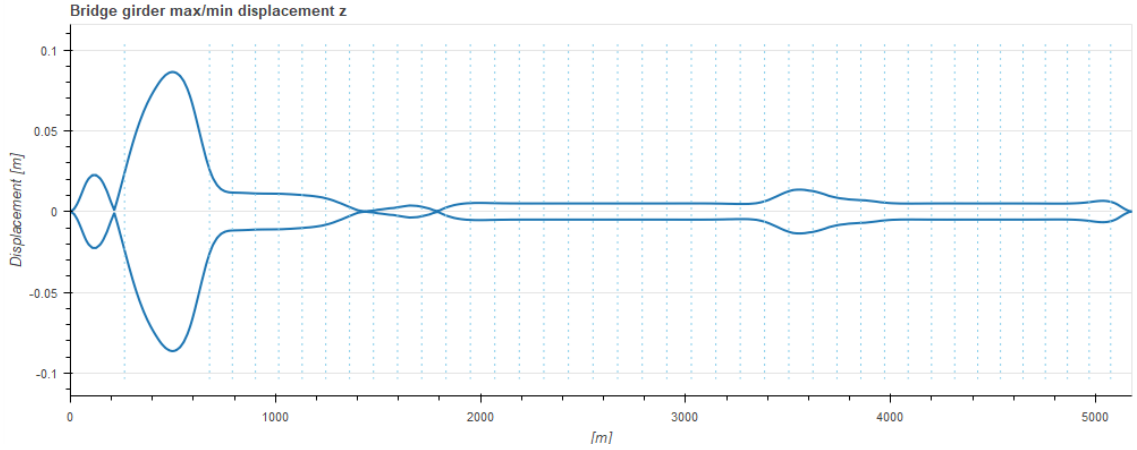

Bridge girder max/min moment y
Moment [MNm]
10
5
0
-5
-10
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
200
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]

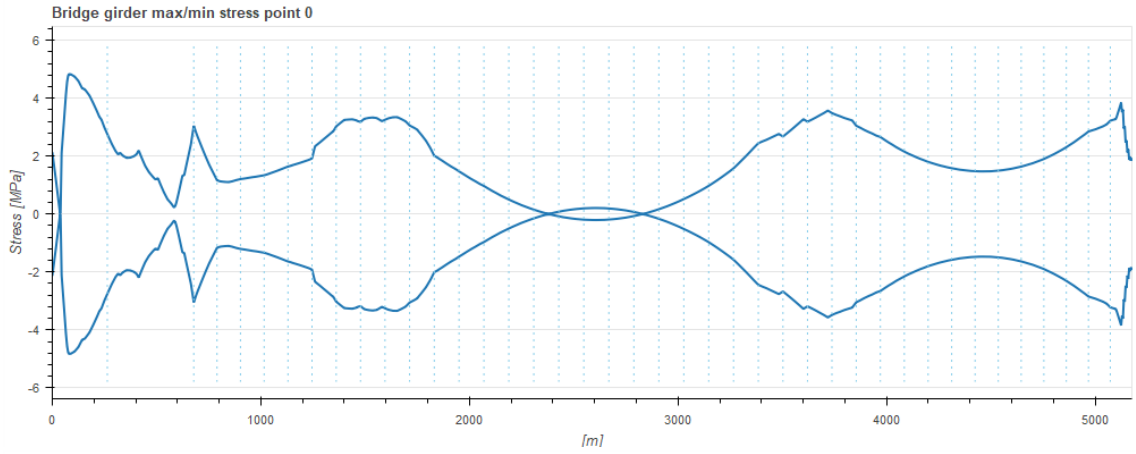
1.7.3 Displacements

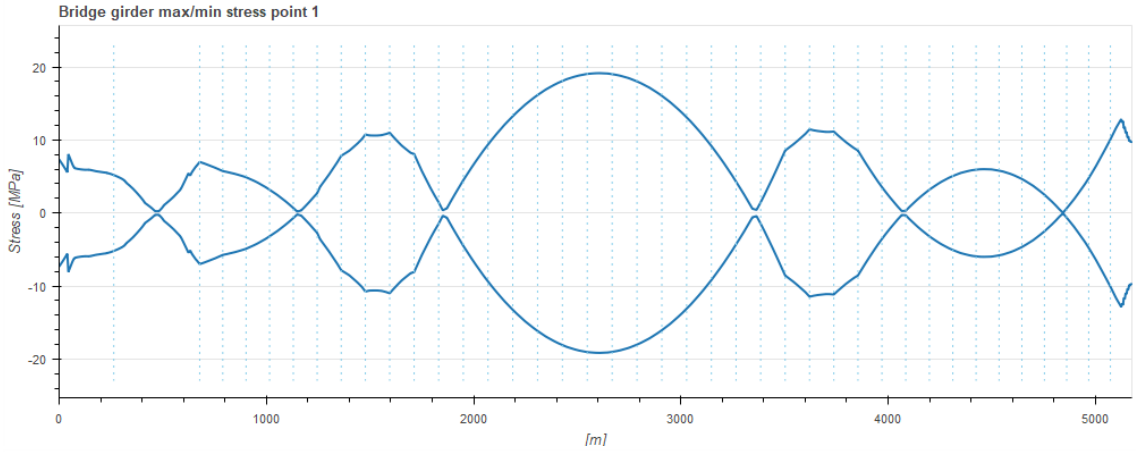


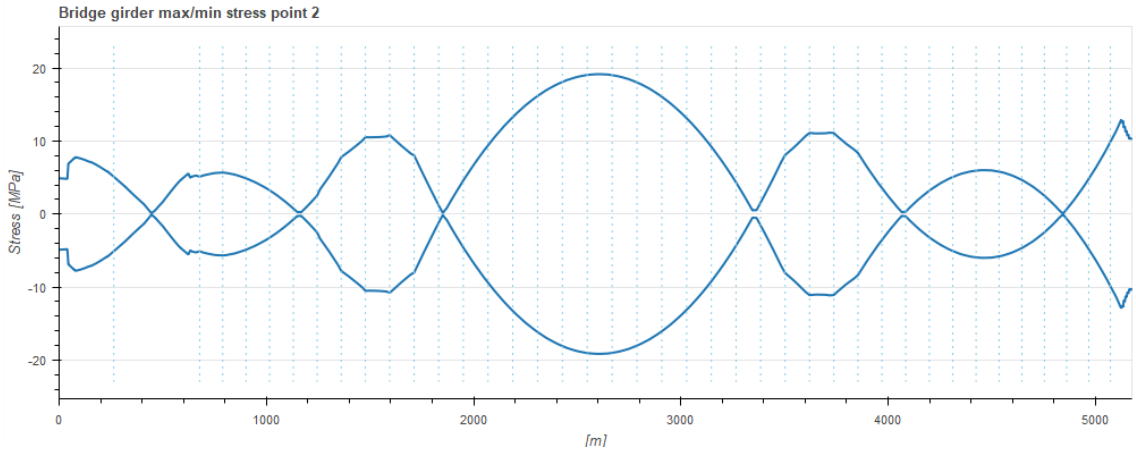


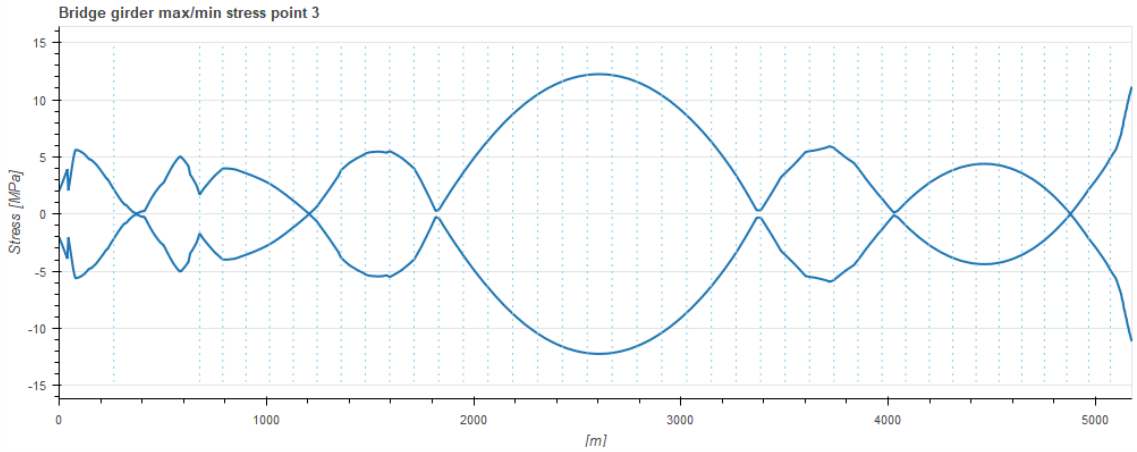


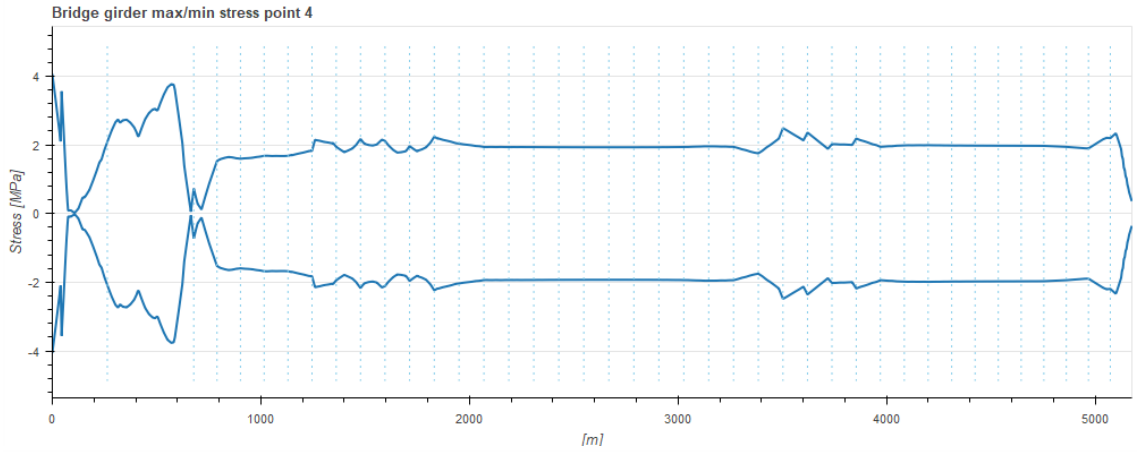
1.7.4 Stresses

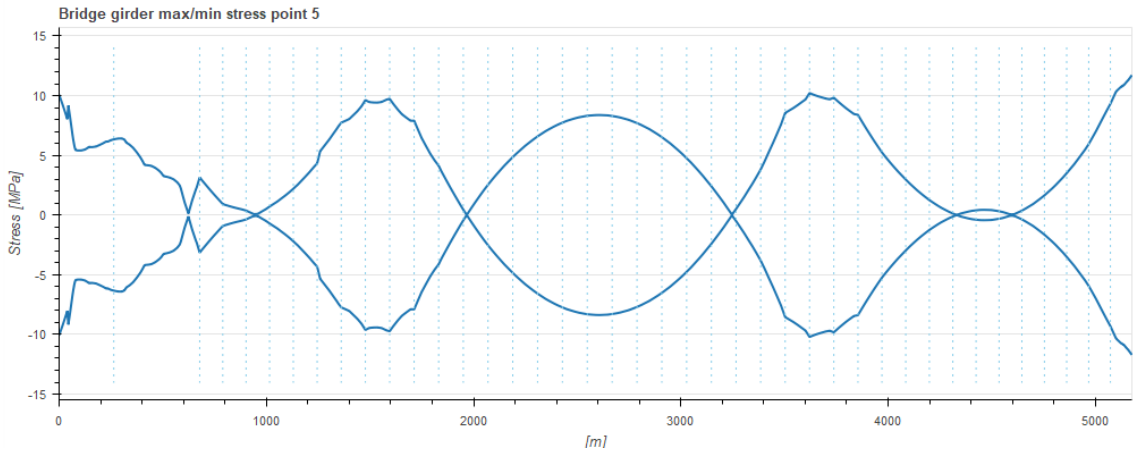


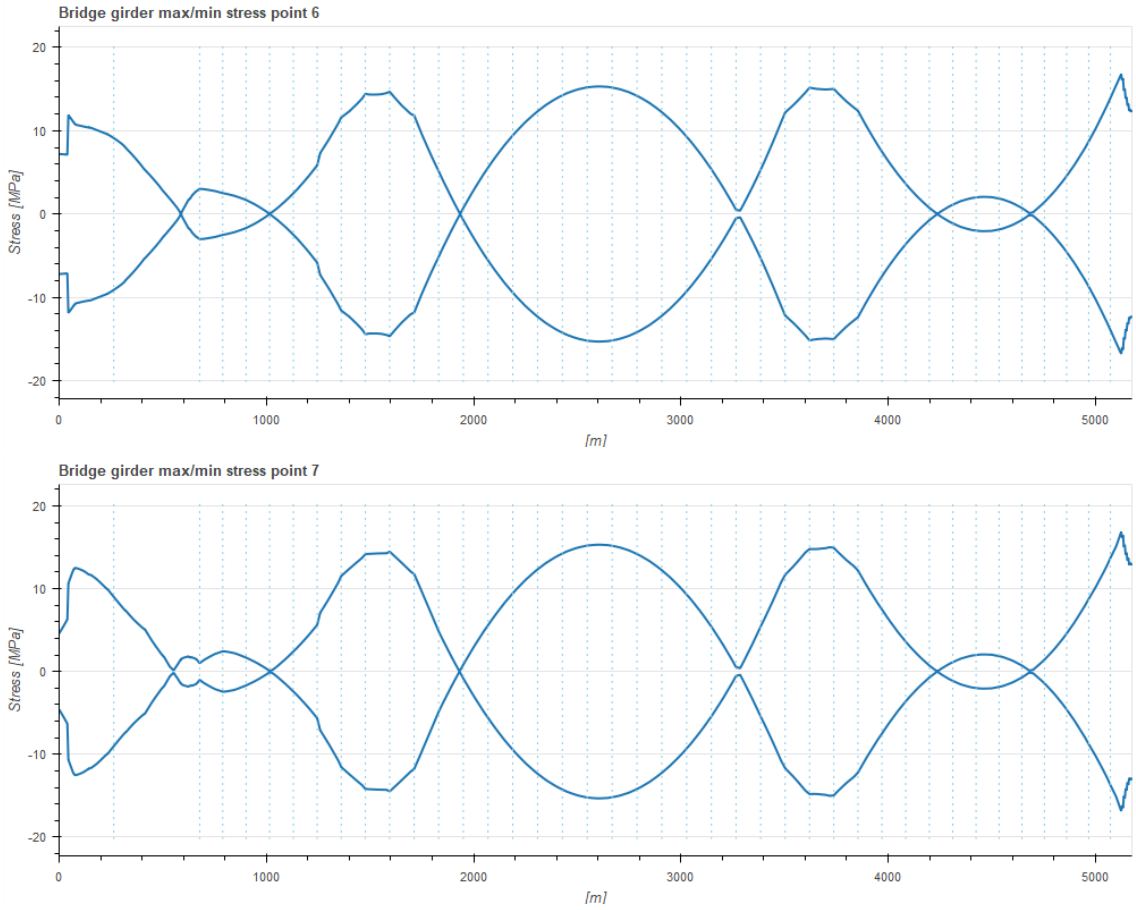





Bridge girder max/min stress point 3
Stress [MPa]
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

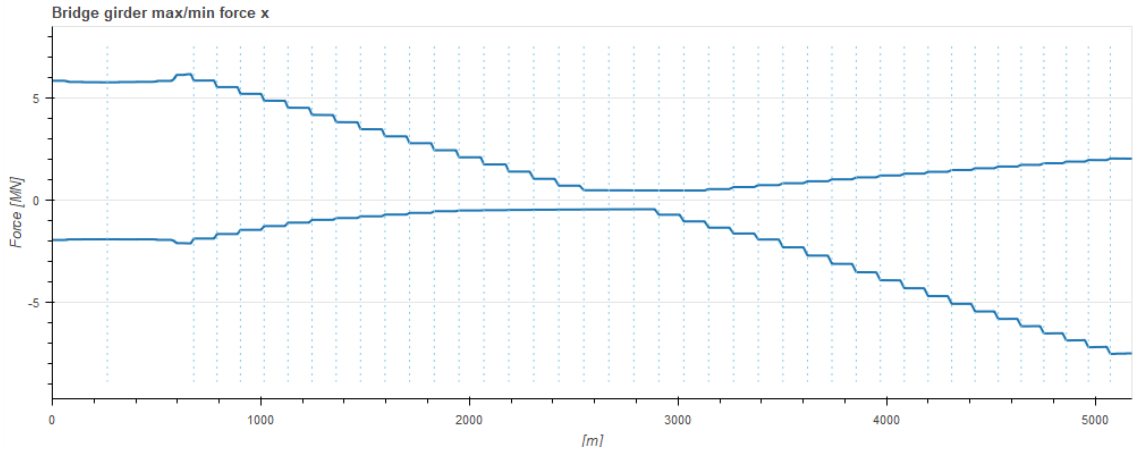

Bridge girder max/min stress point 5
Stress [MPa]
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
[m]

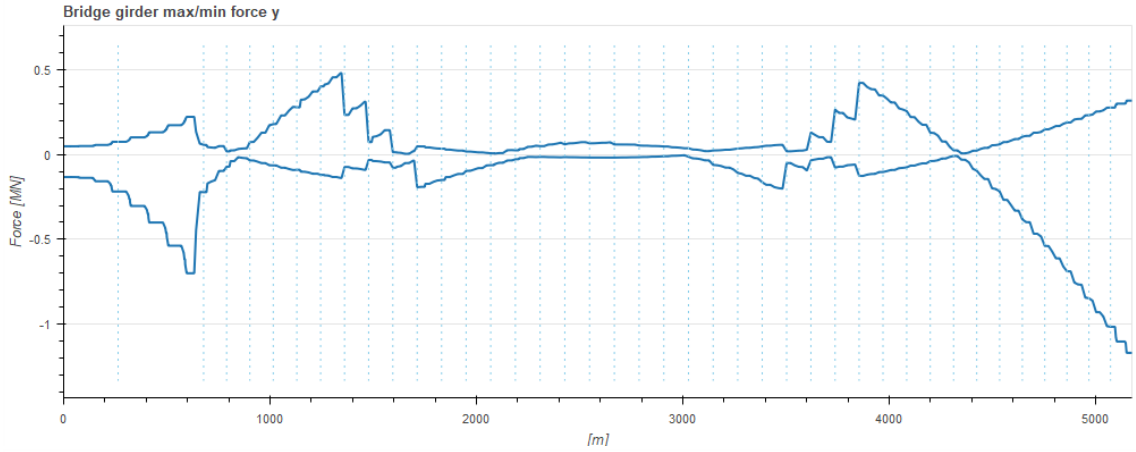

Bridge girder max/min stress point 6
Stress [MPa]
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
[m]

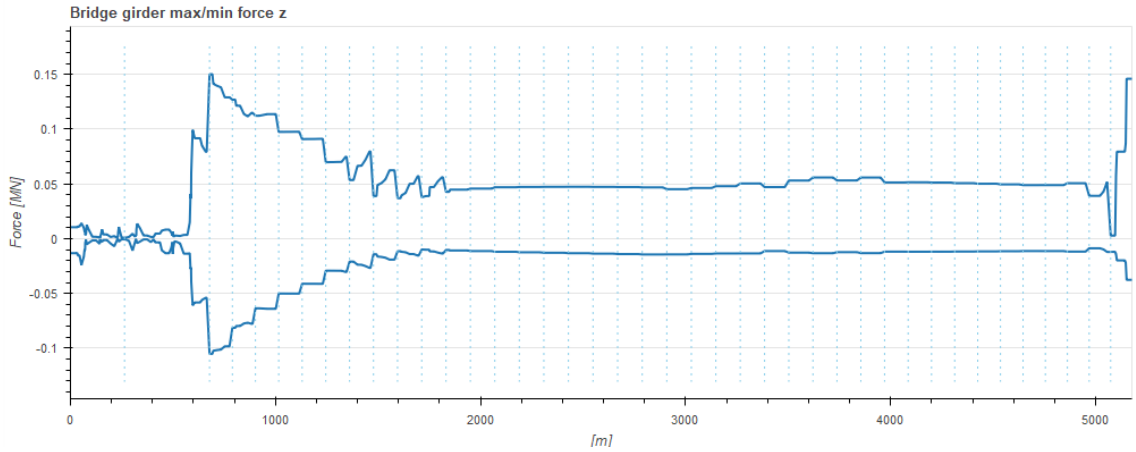
1.8 Current

Characteristic response from 100 year current is presented here. The loads are presented in [3], chapter 2.1.4 and correspond to COMB 54 on olavolsen.interactive.no [2].

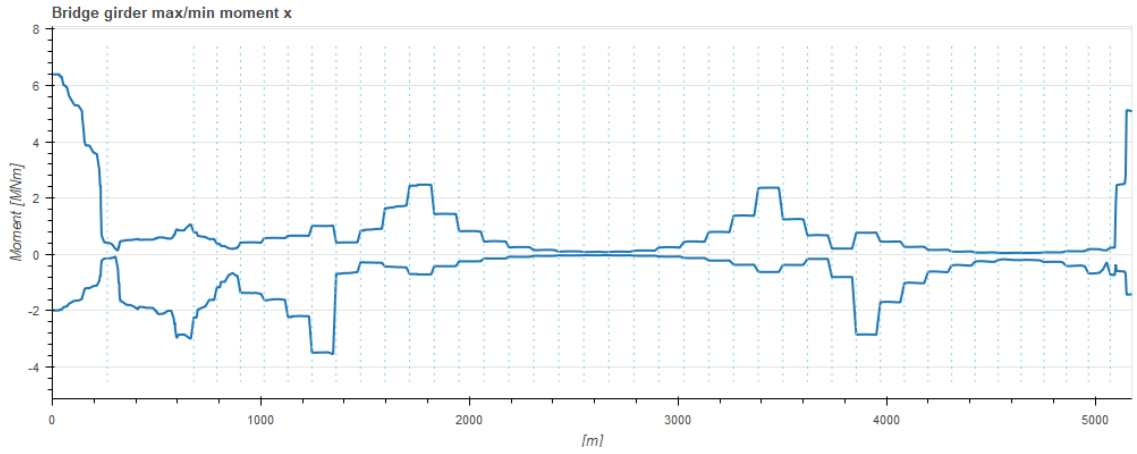
1.8.1 Forces

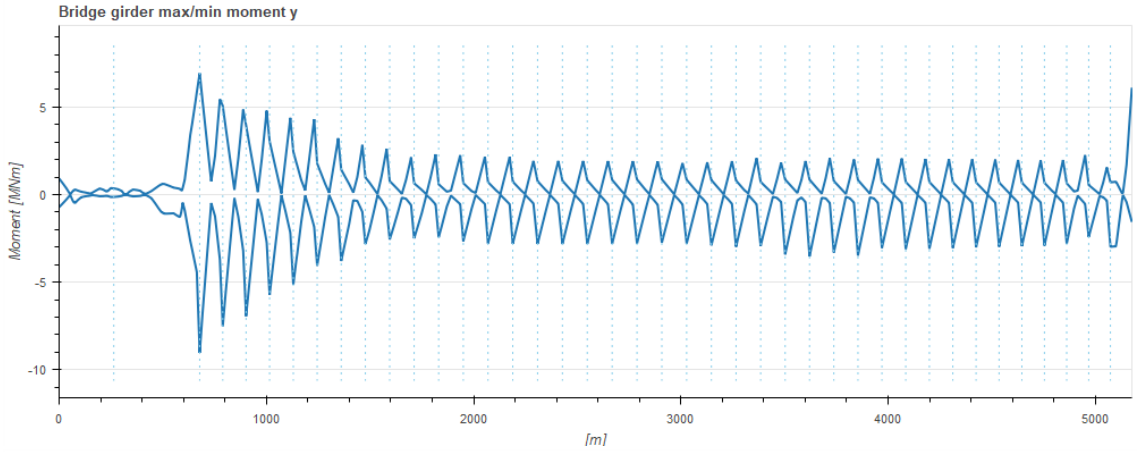


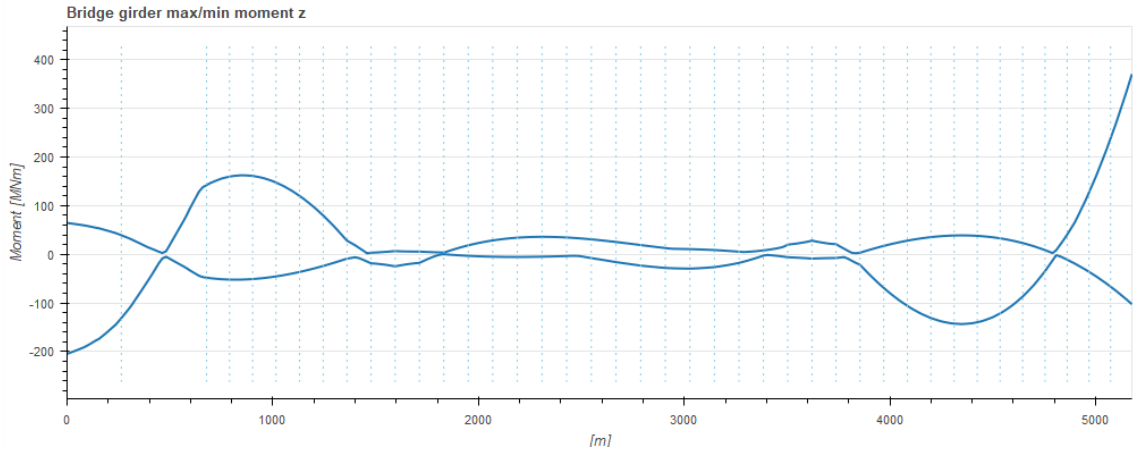




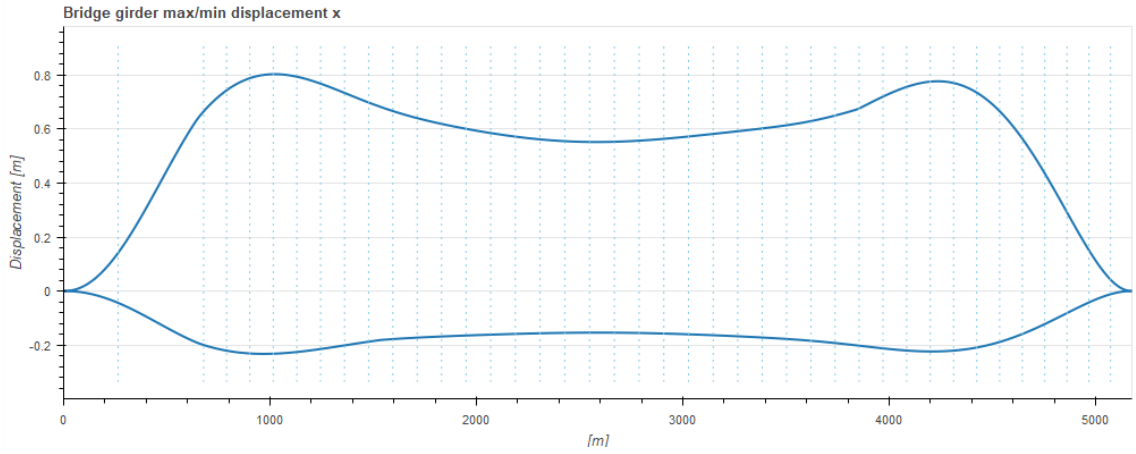
1.8.2 Moments

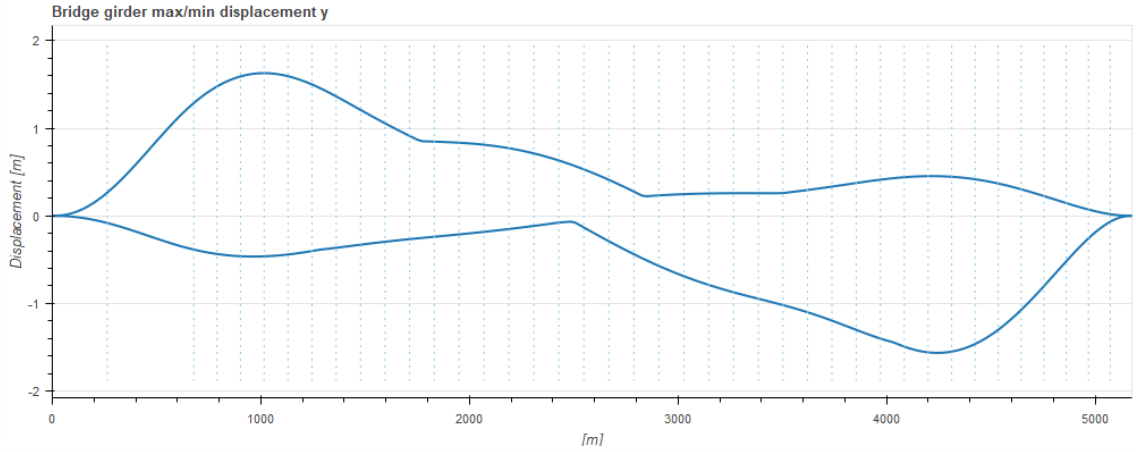

Bridge girder max/min moment x
Moment [MNm]
8
6
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

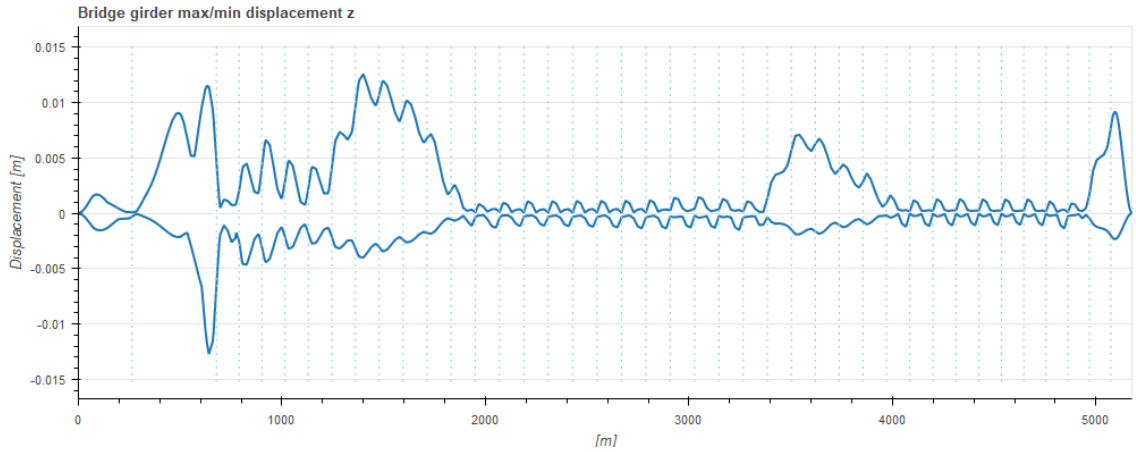

Bridge girder max/min moment y
Moment [MNm]
5
0
-5
-10
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
400
300
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

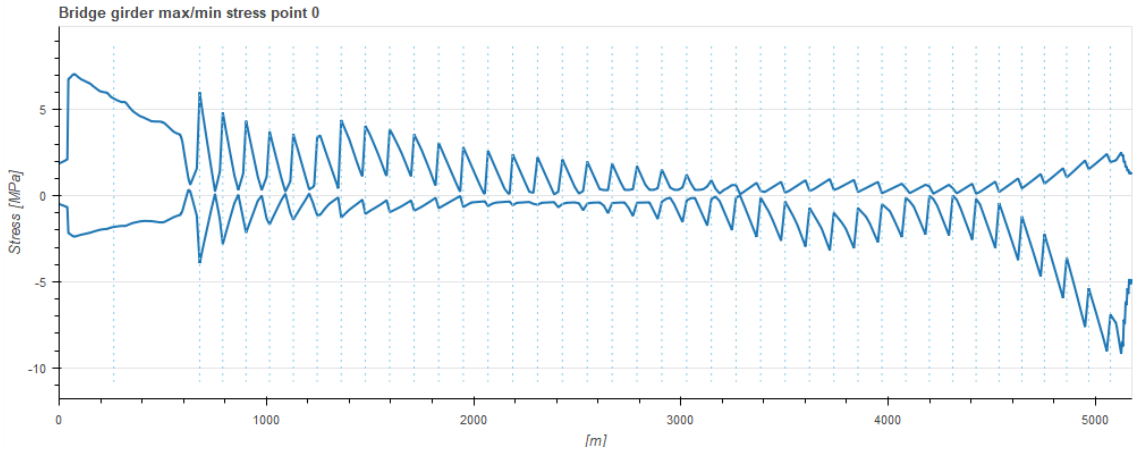
1.8.3 Displacements

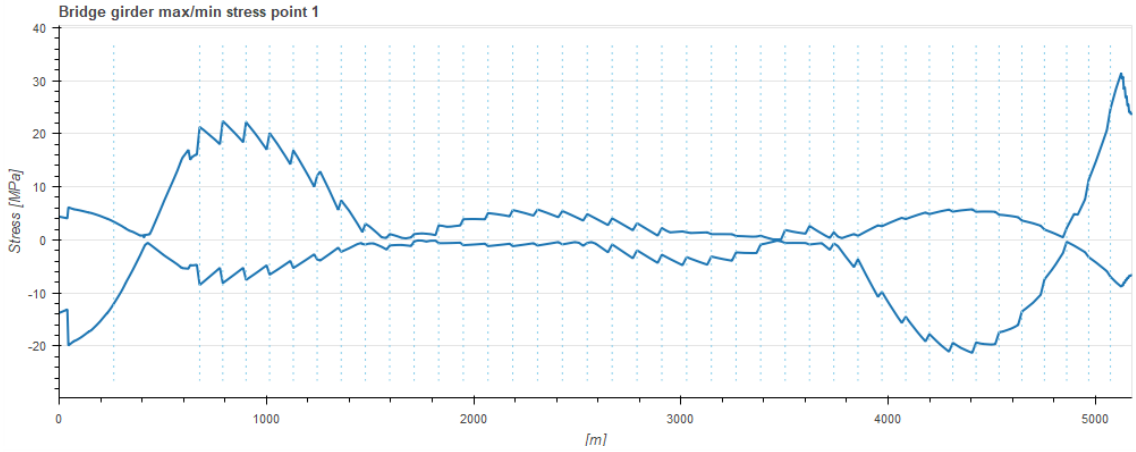


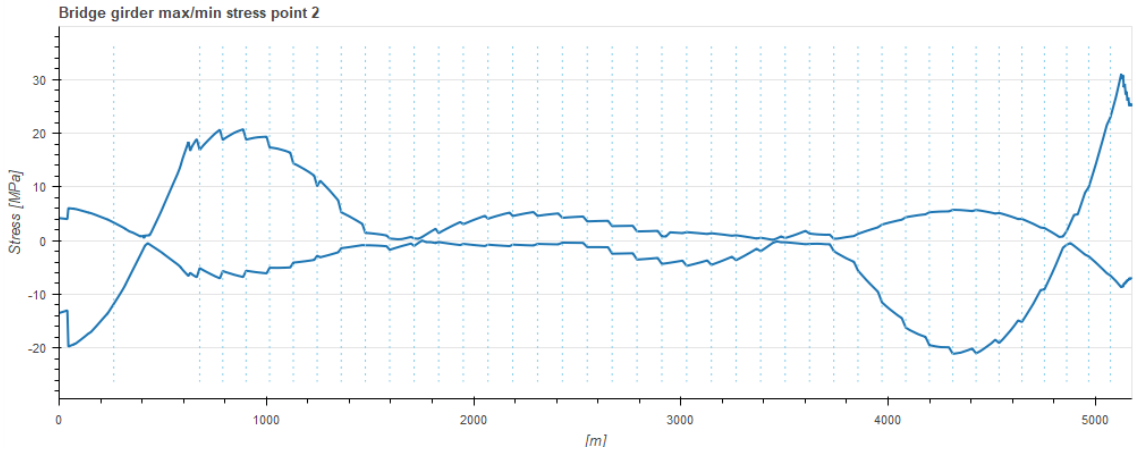


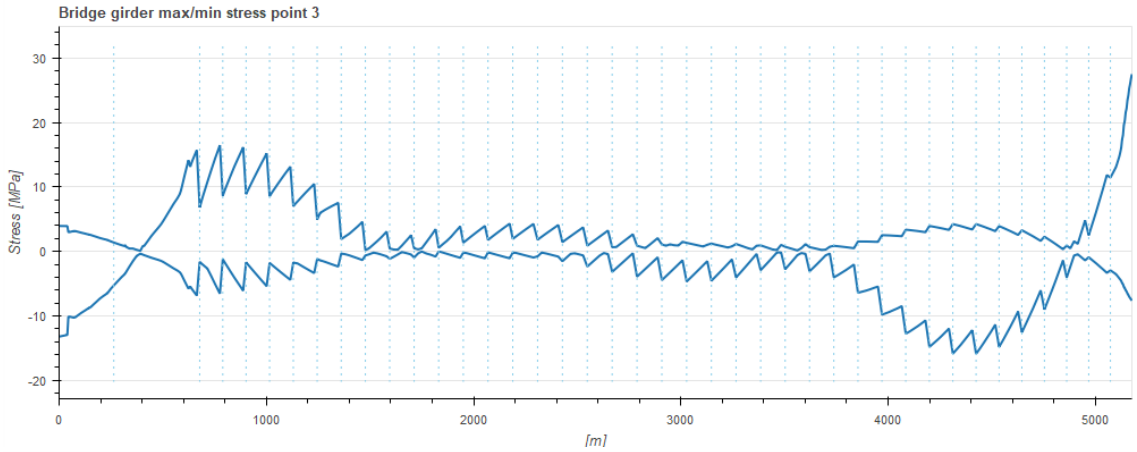


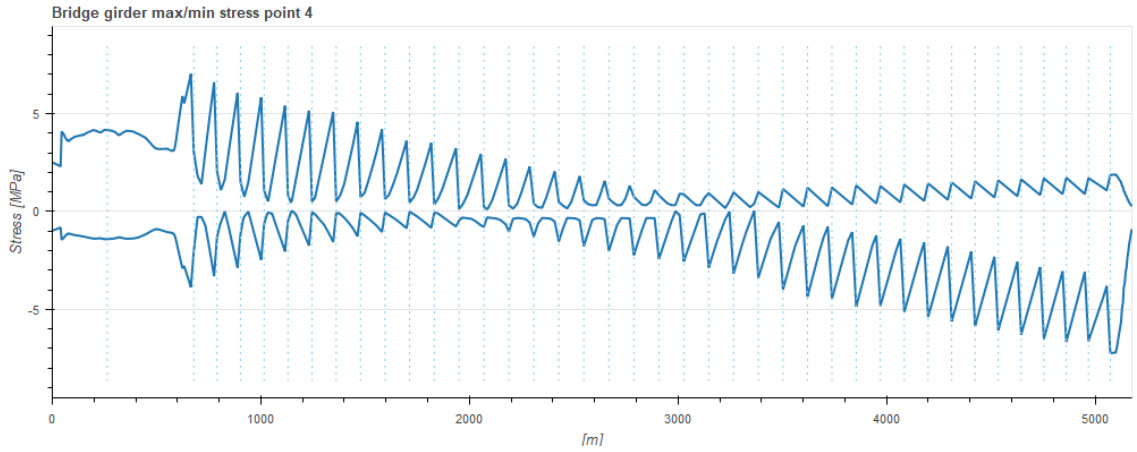
1.8.4 Stresses

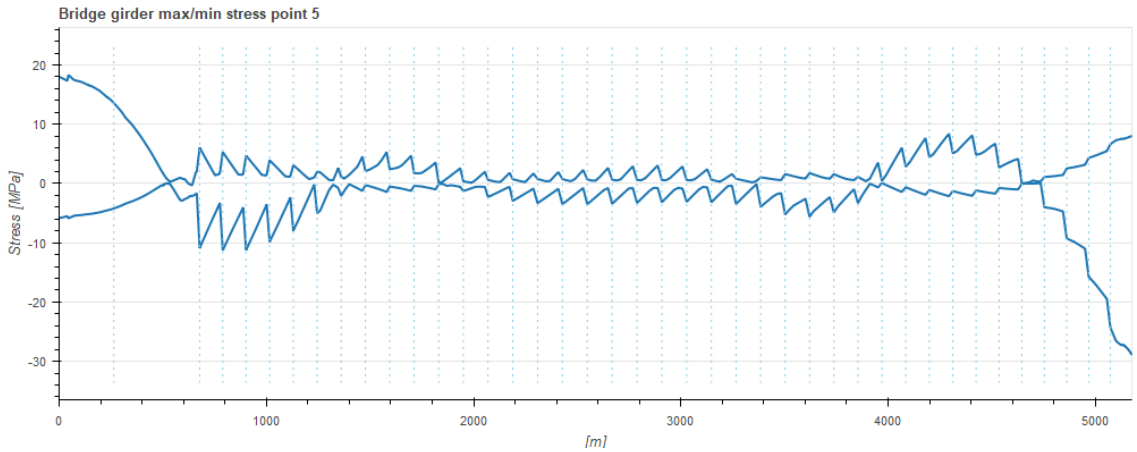


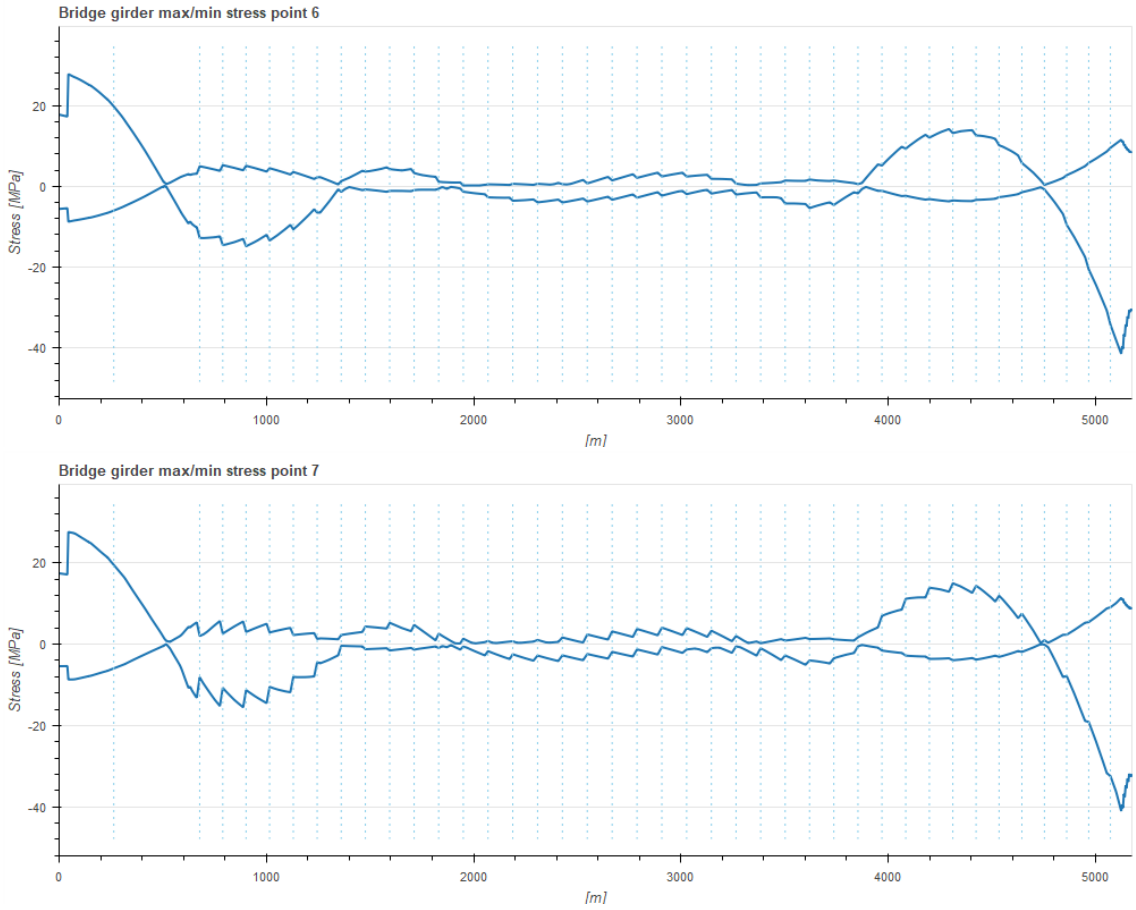





Bridge girder max/min stress point 3
Stress [MPa]
30
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
5
0
-5
0
1000
2000
3000
4000
5000
[m]

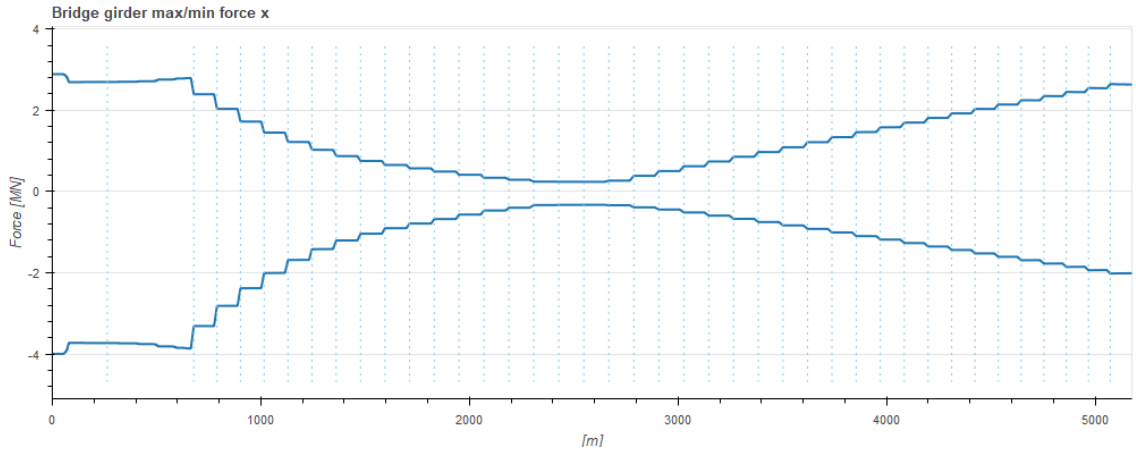

Bridge girder max/min stress point 5
Stress [MPa]
20
10
0
-10
-20
-30
0
1000
2000
3000
4000
5000
[m]

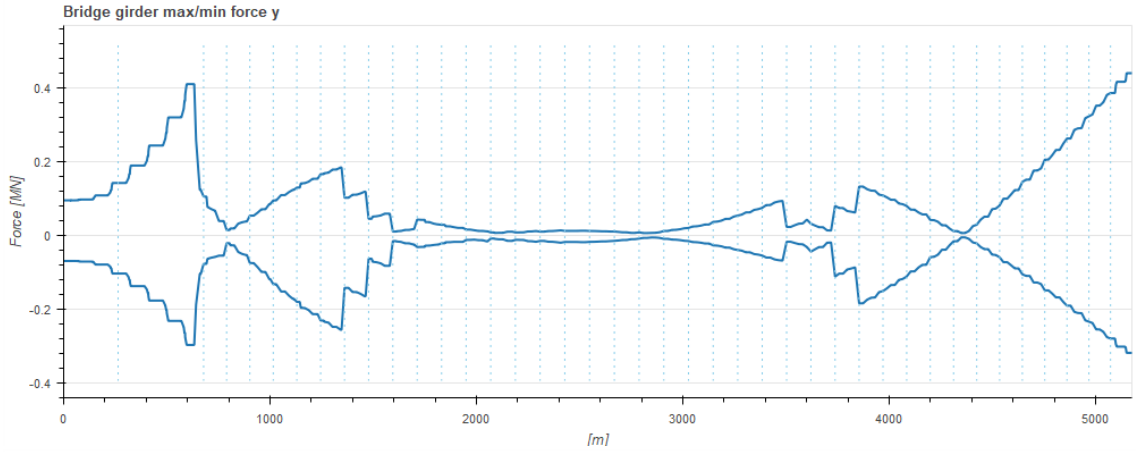

Bridge girder max/min stress point 6
Stress [MPa]
20
0
-20
-40
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
20
0
-20
-40
0
1000
2000
3000
4000
5000
[m]

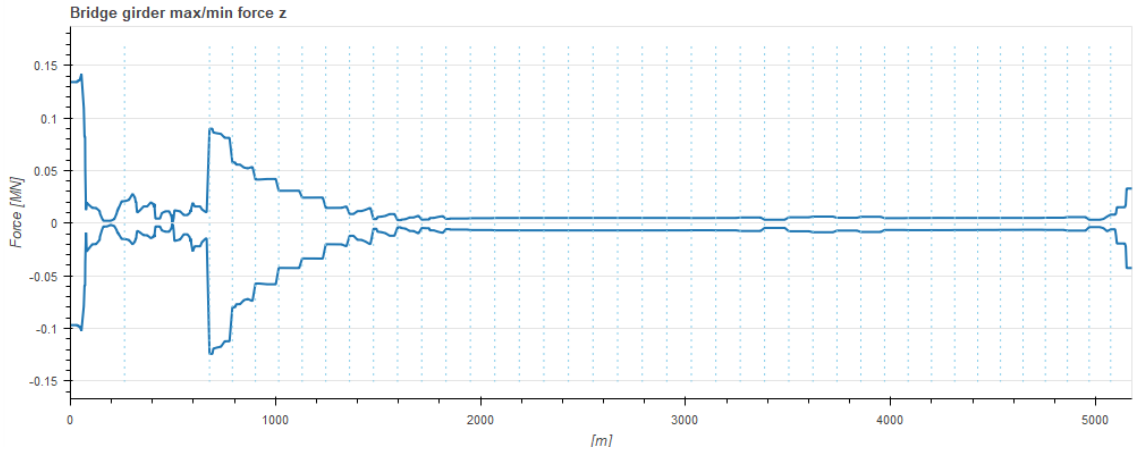
1.9 Static wind

Characteristic response from 100 year static wind is presented here. The loads are presented in [3], chapter 2.1.5 and correspond to COMB 56 on olavolsen.interactive.no [2].

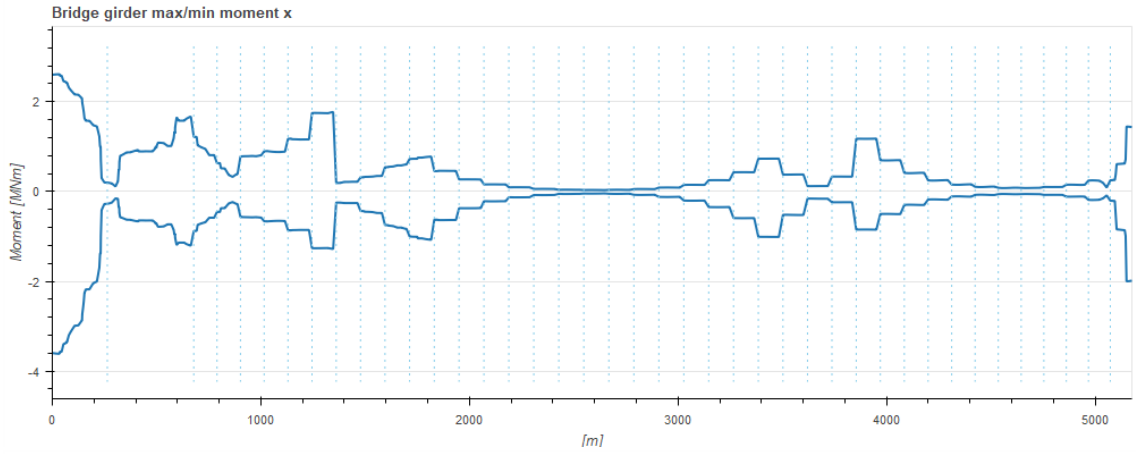
1.9.1 Forces

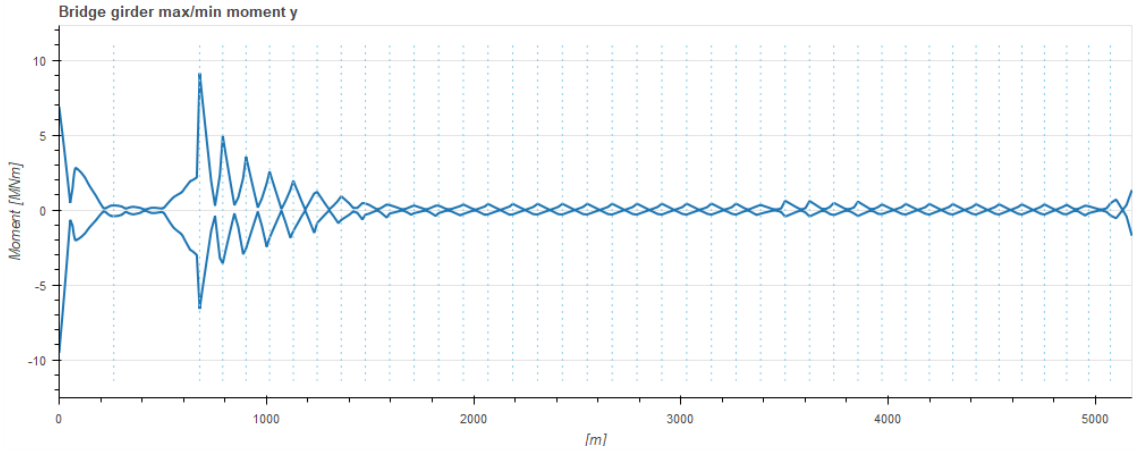


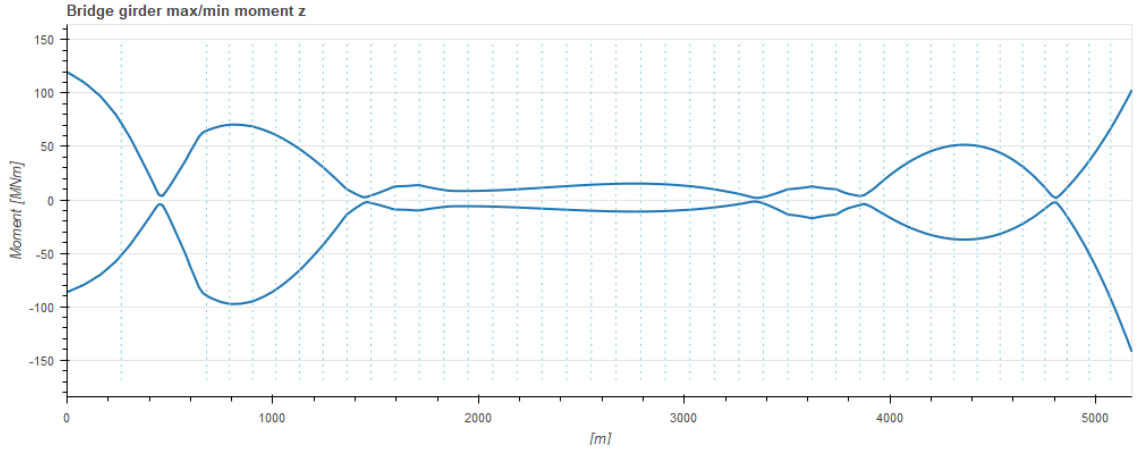




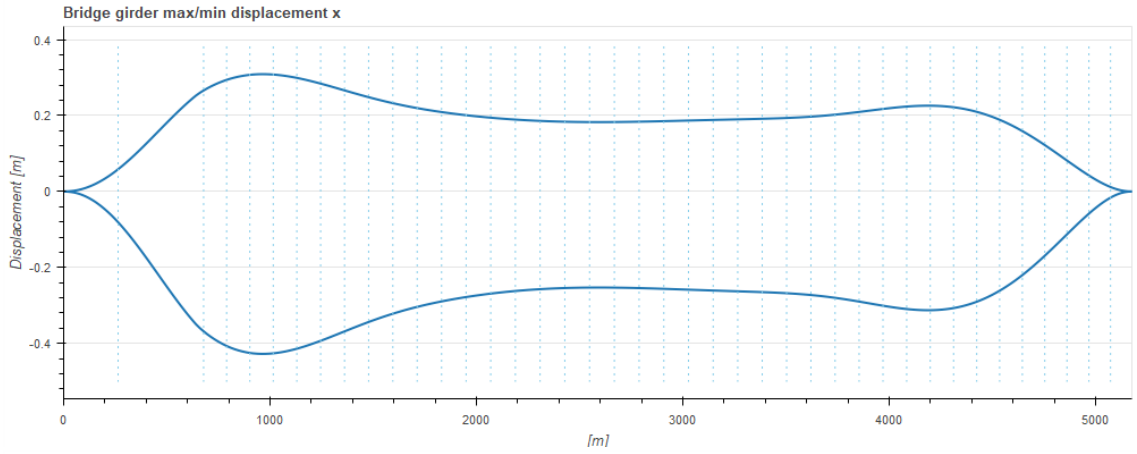
1.9.2 Moments

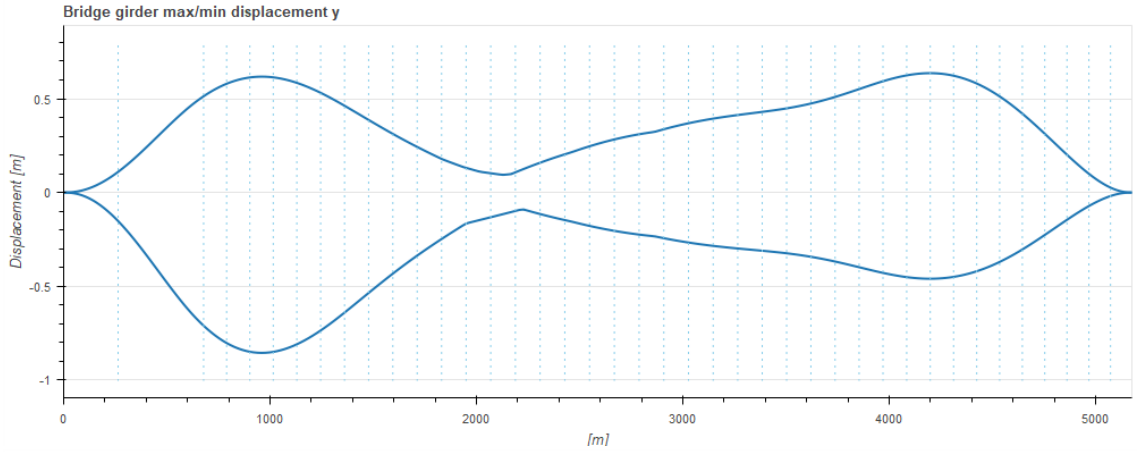

Bridge girder max/min moment x
Moment [MNm]
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

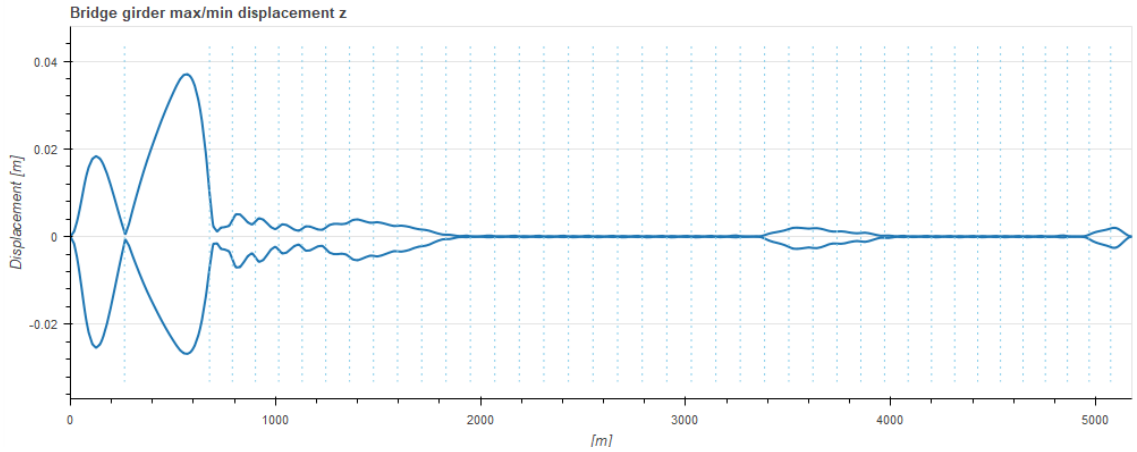

Bridge girder max/min moment y
Moment [MNm]
10
5
0
-5
-10
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]

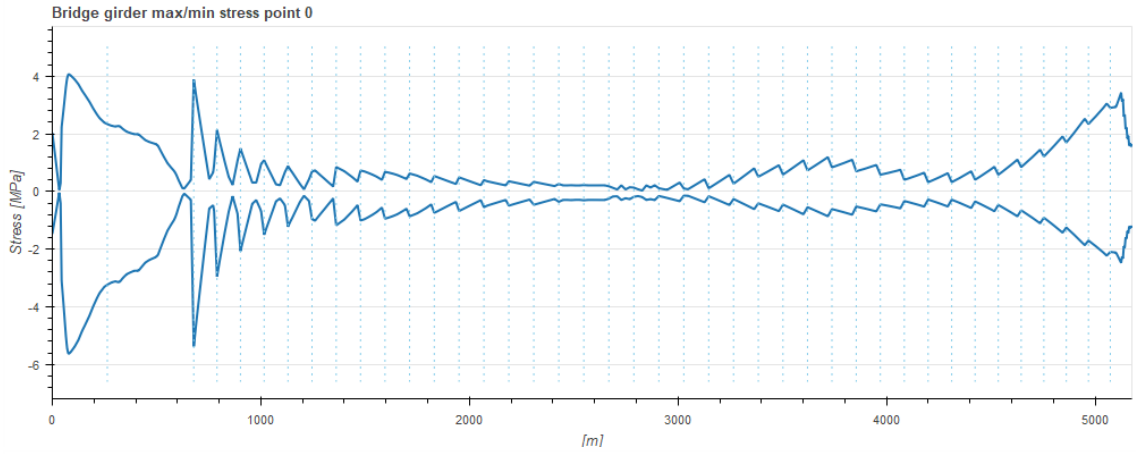
1.9.3 Displacements

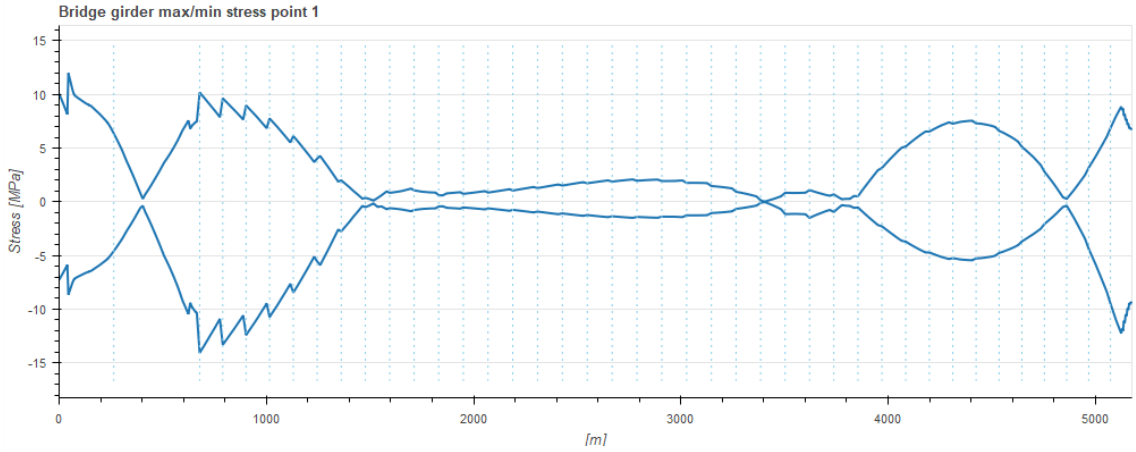


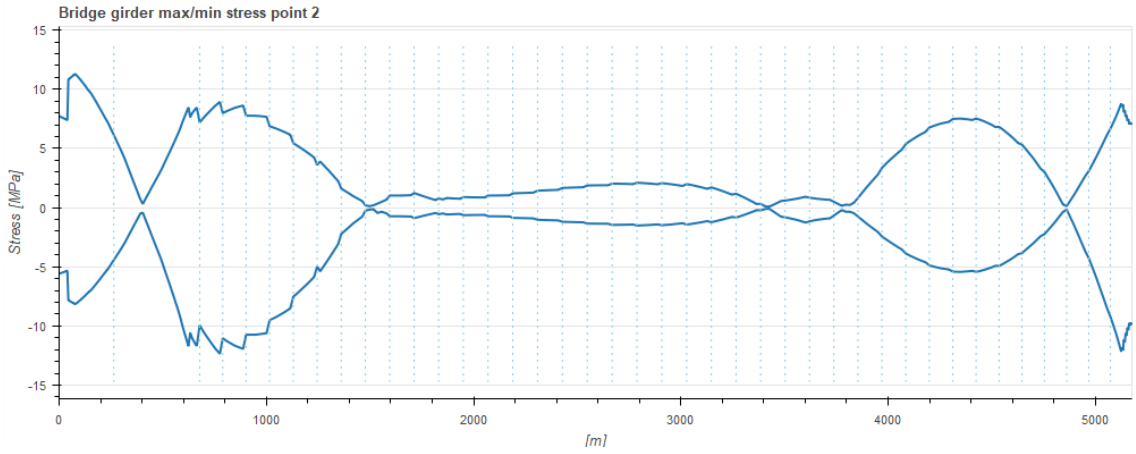


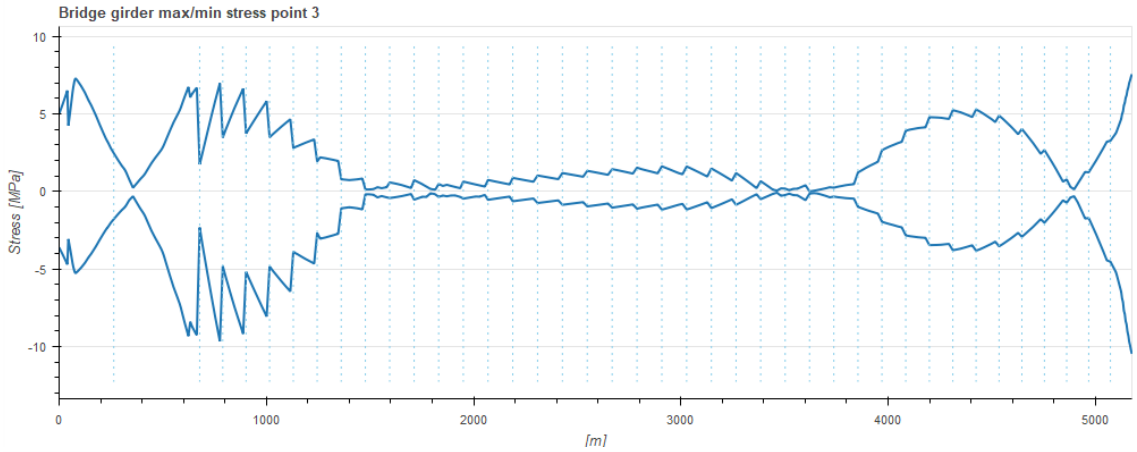


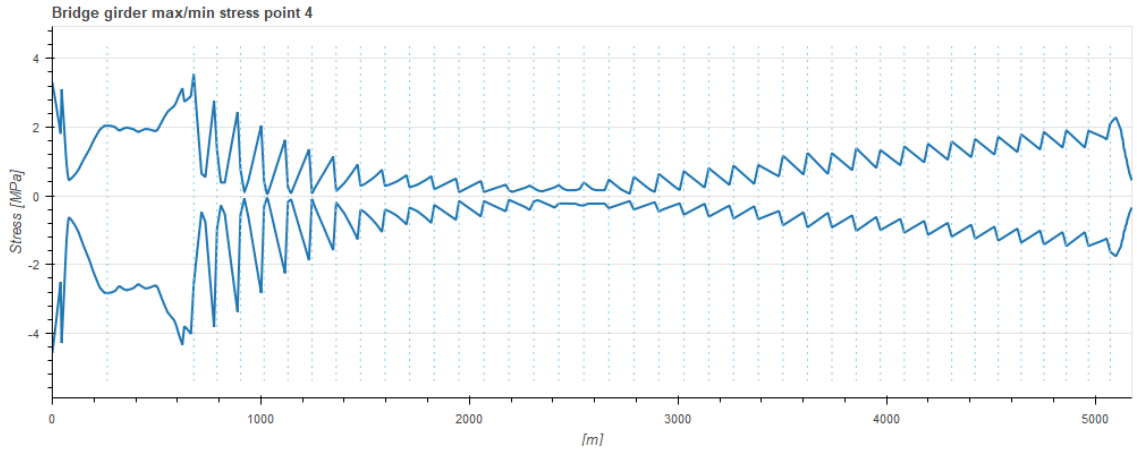
1.9.4 Stresses

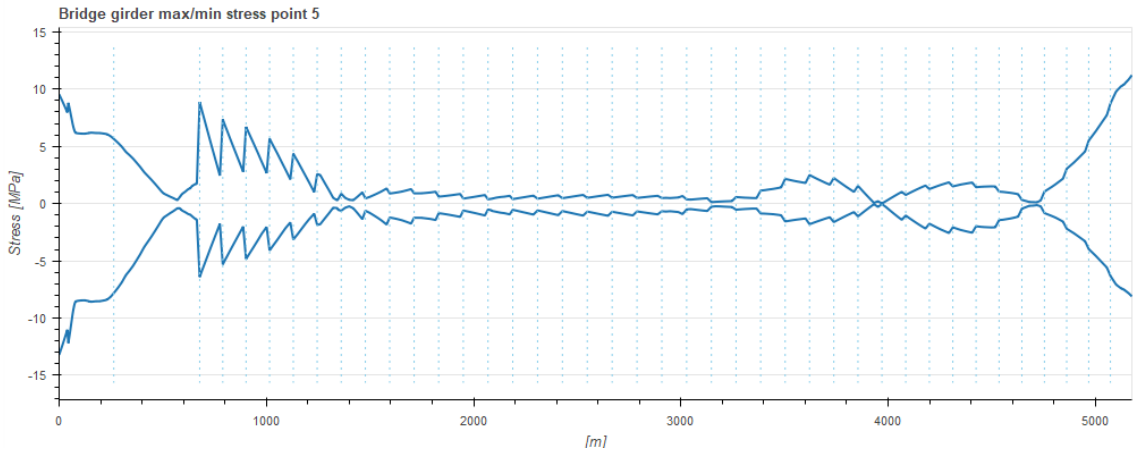


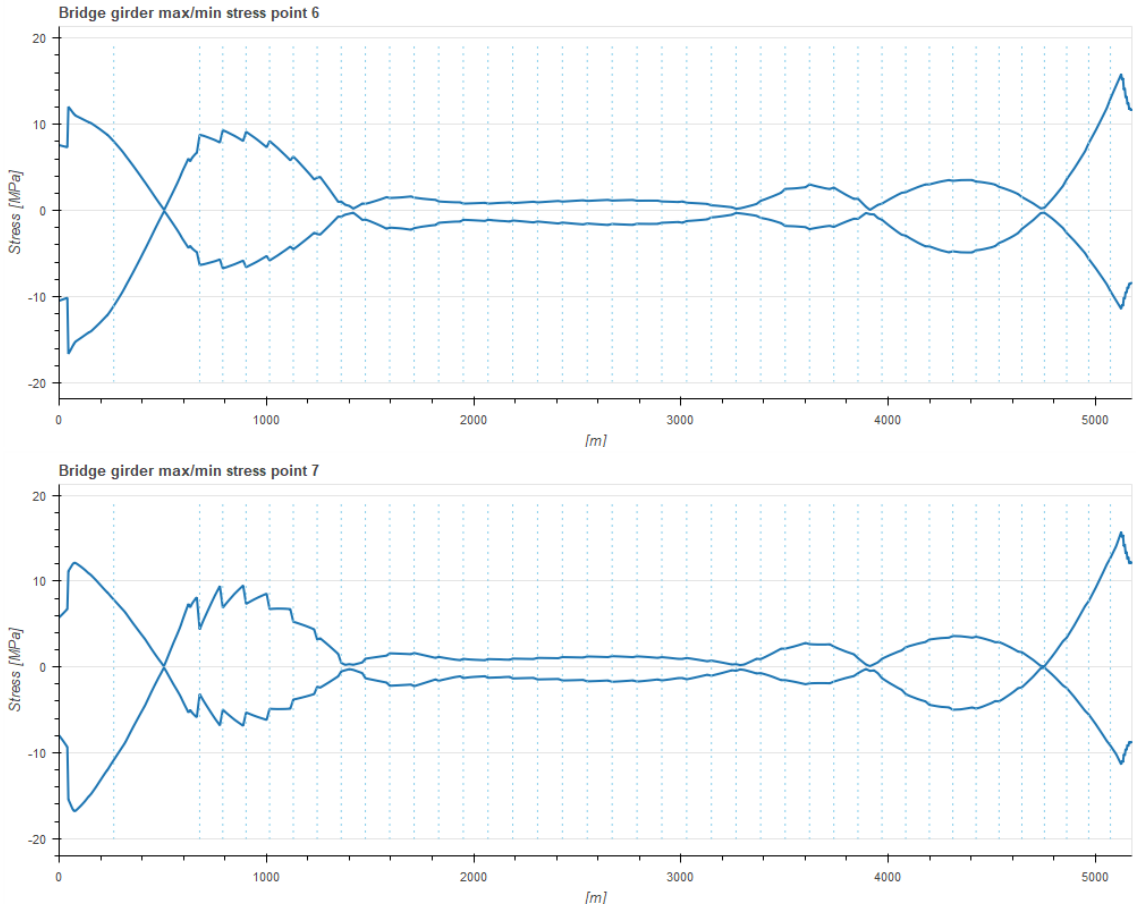





Bridge girder max/min stress point 3
Stress [MPa]
10
5
0
-5
-10
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
4
2
0
-2
-4
0
1000
2000
3000
4000
5000
[m]

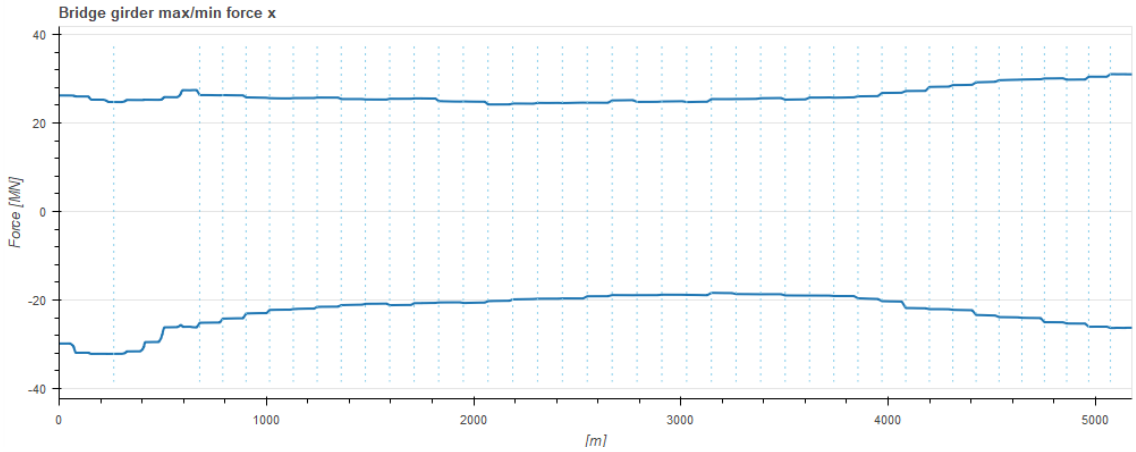

Bridge girder max/min stress point 5
Stress [MPa]
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
[m]

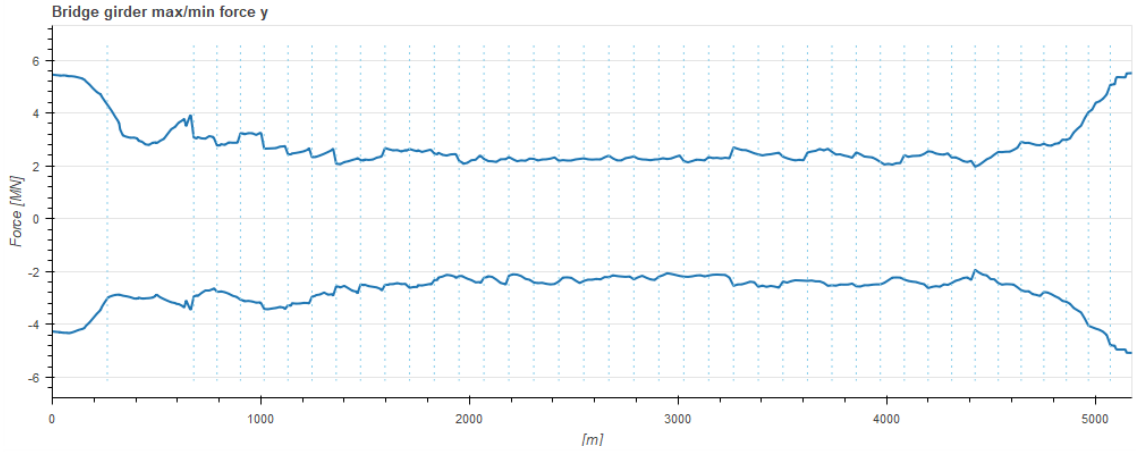

Bridge girder max/min stress point 6
Stress [MPa]
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
[m]

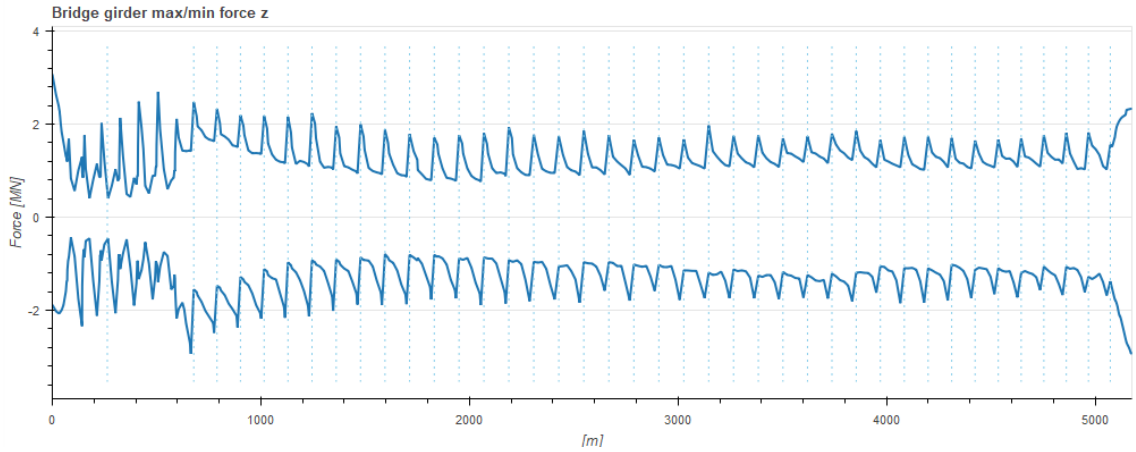
1.10 Coupled analyses

The coupled loads are presented in [3], chapter 2.2 and correspond to COMB 00 on olavolsen.interactive.no [2].

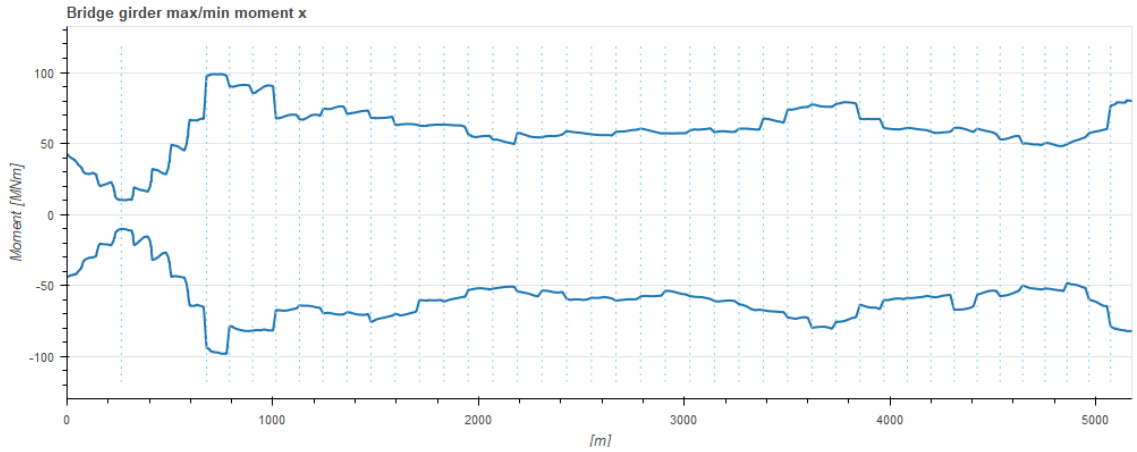
1.10.1 Forces

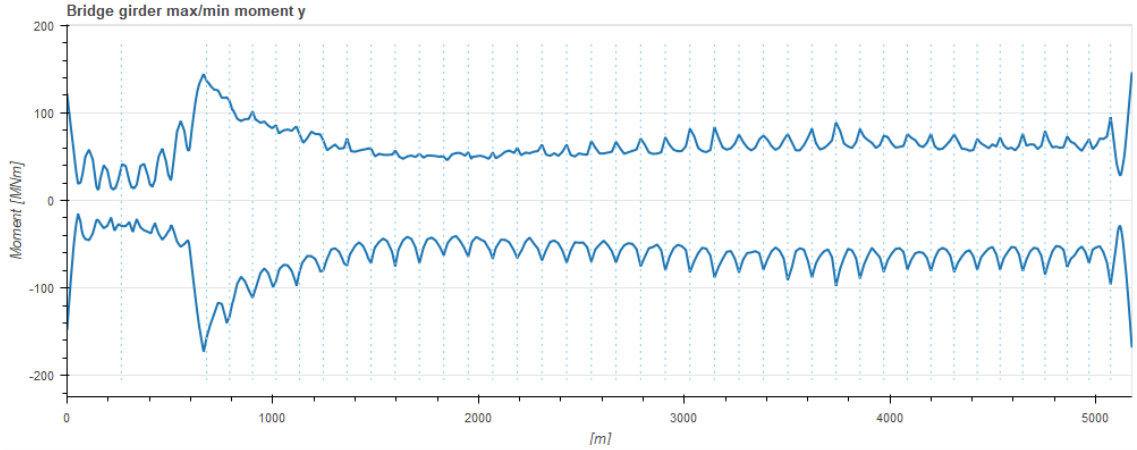


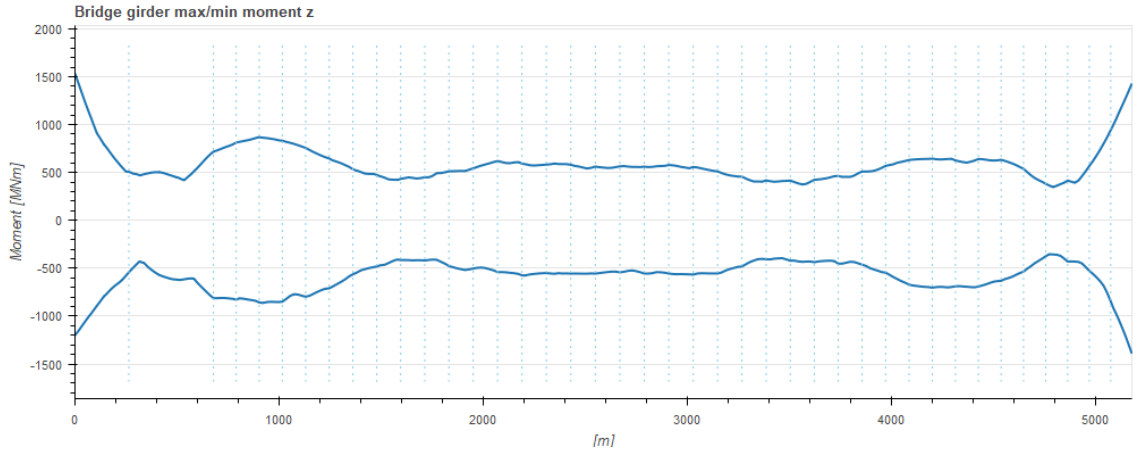




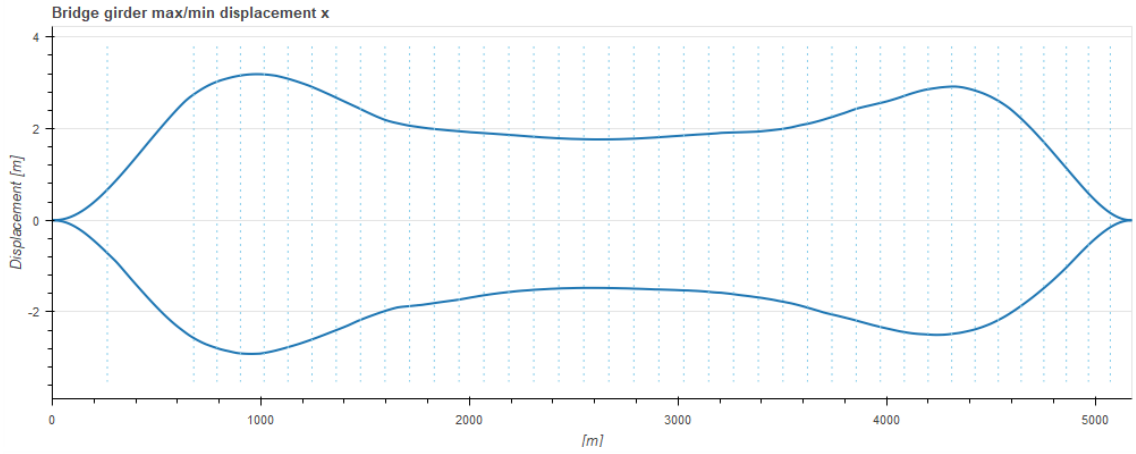
1.10.2 Moments

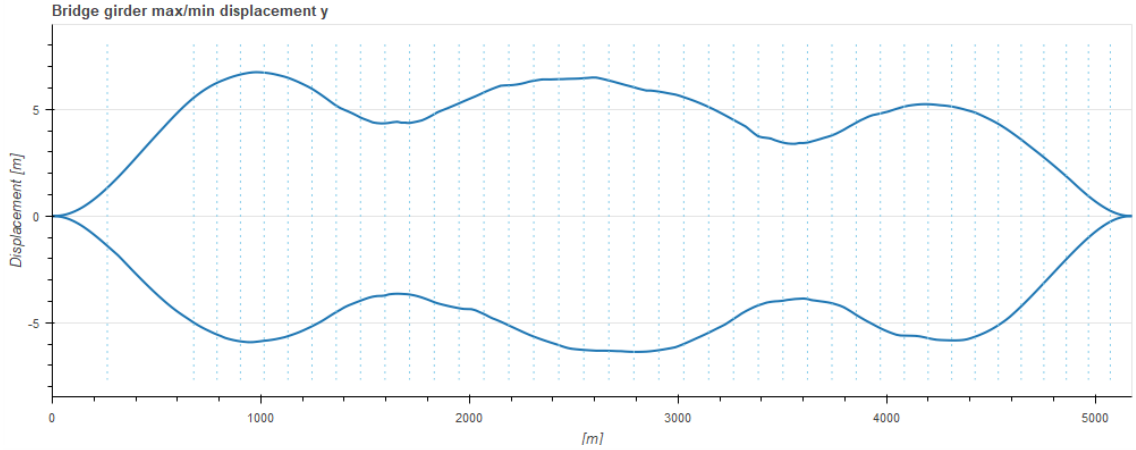


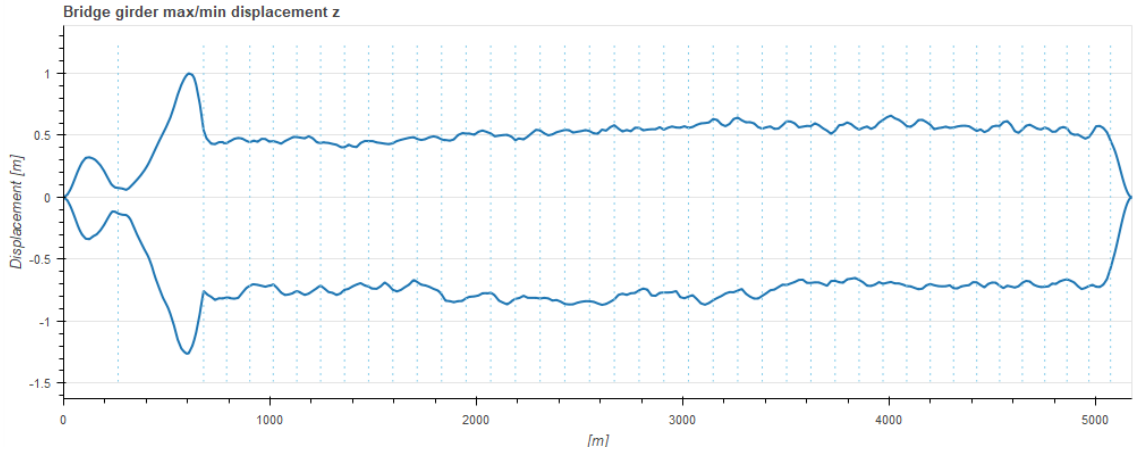




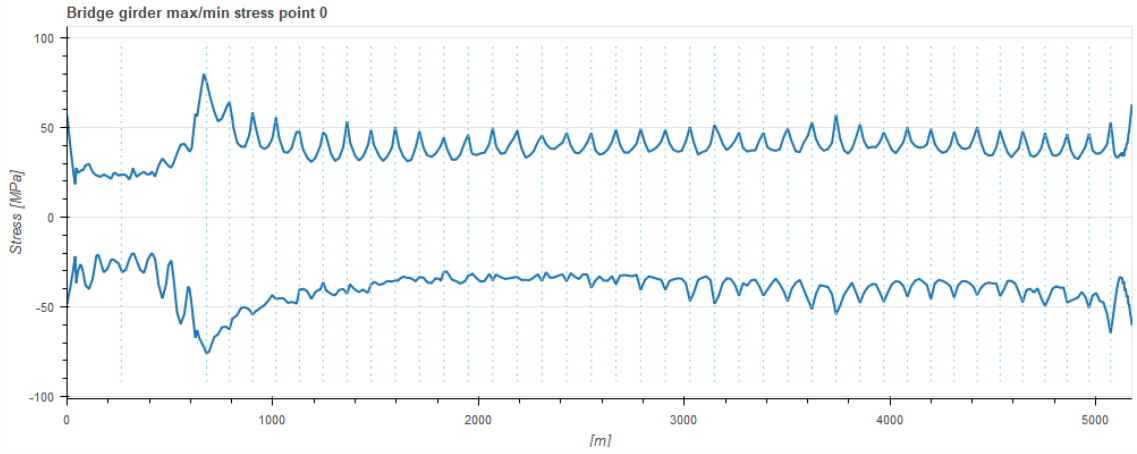
1.10.3 Displacements

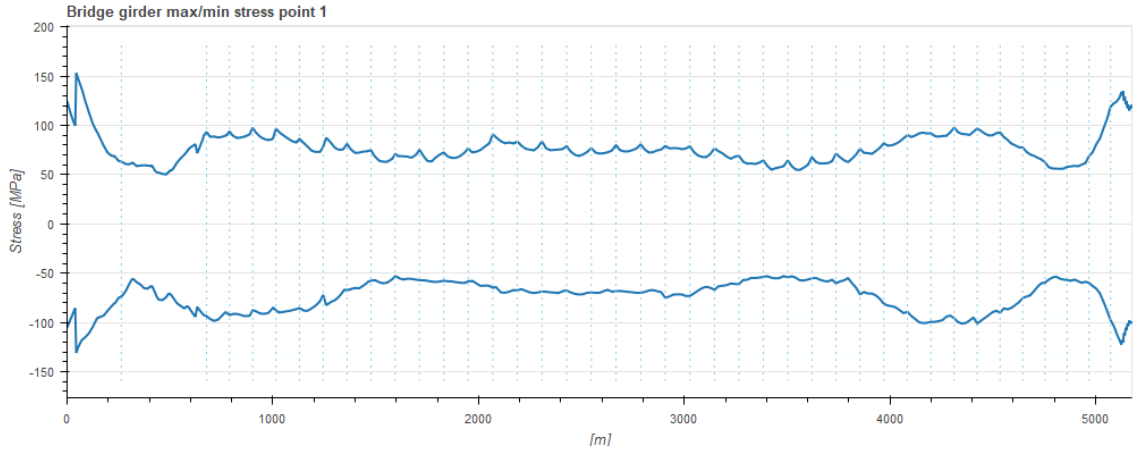


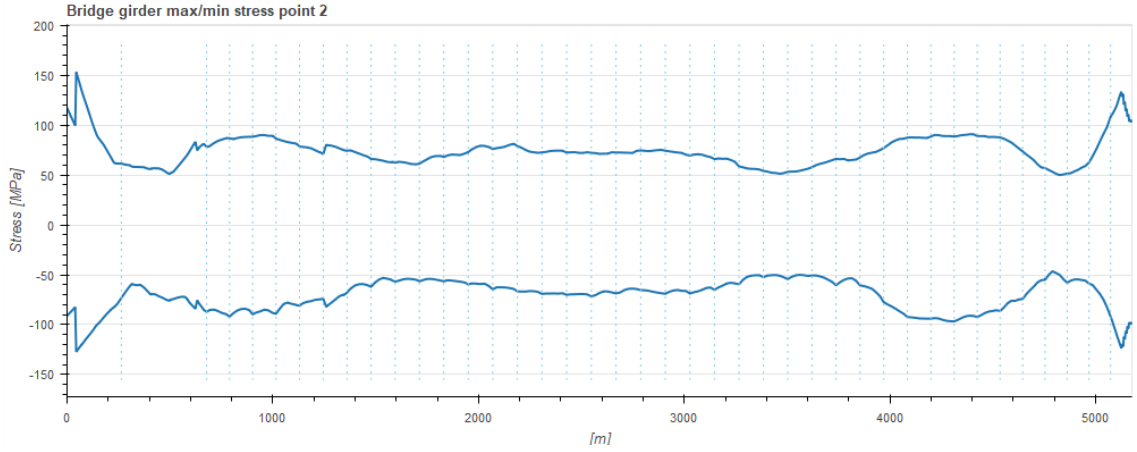


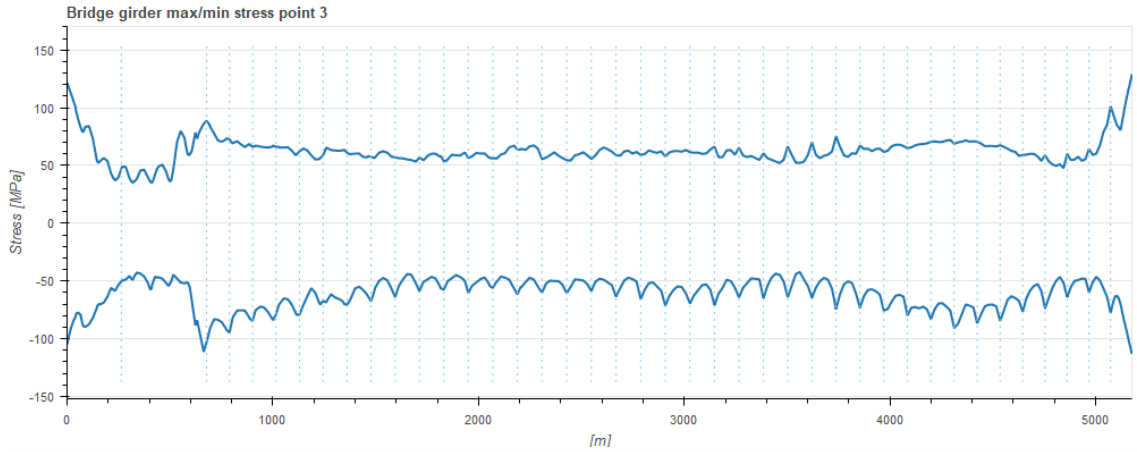


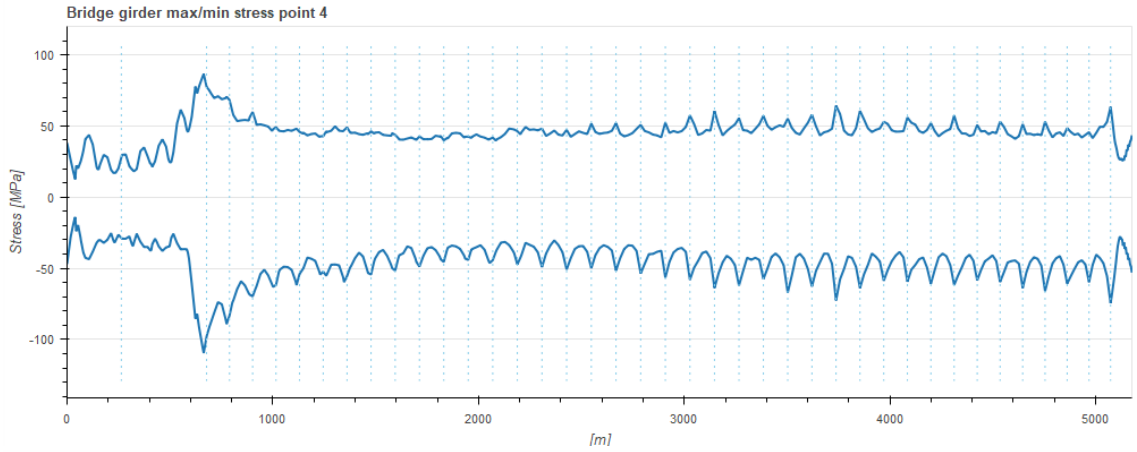
1.10.4 Stresses

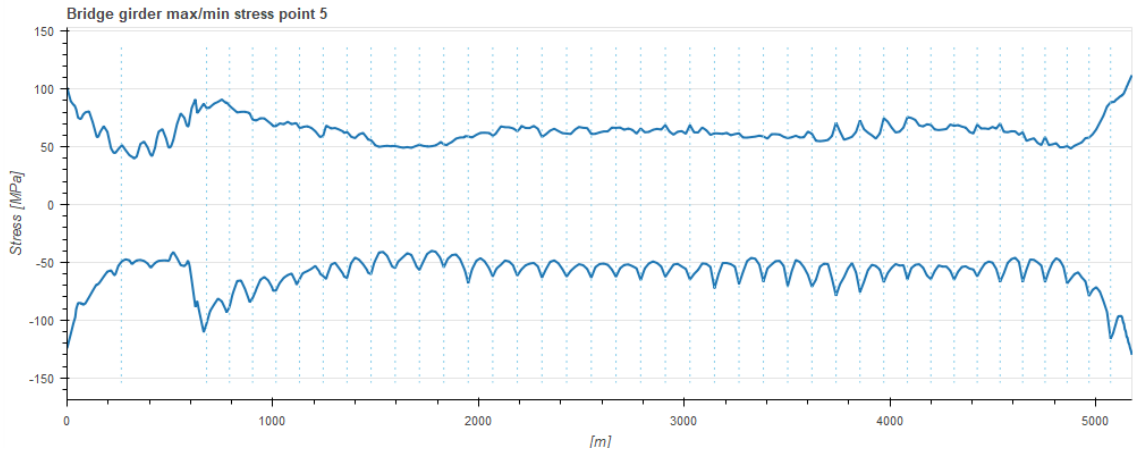


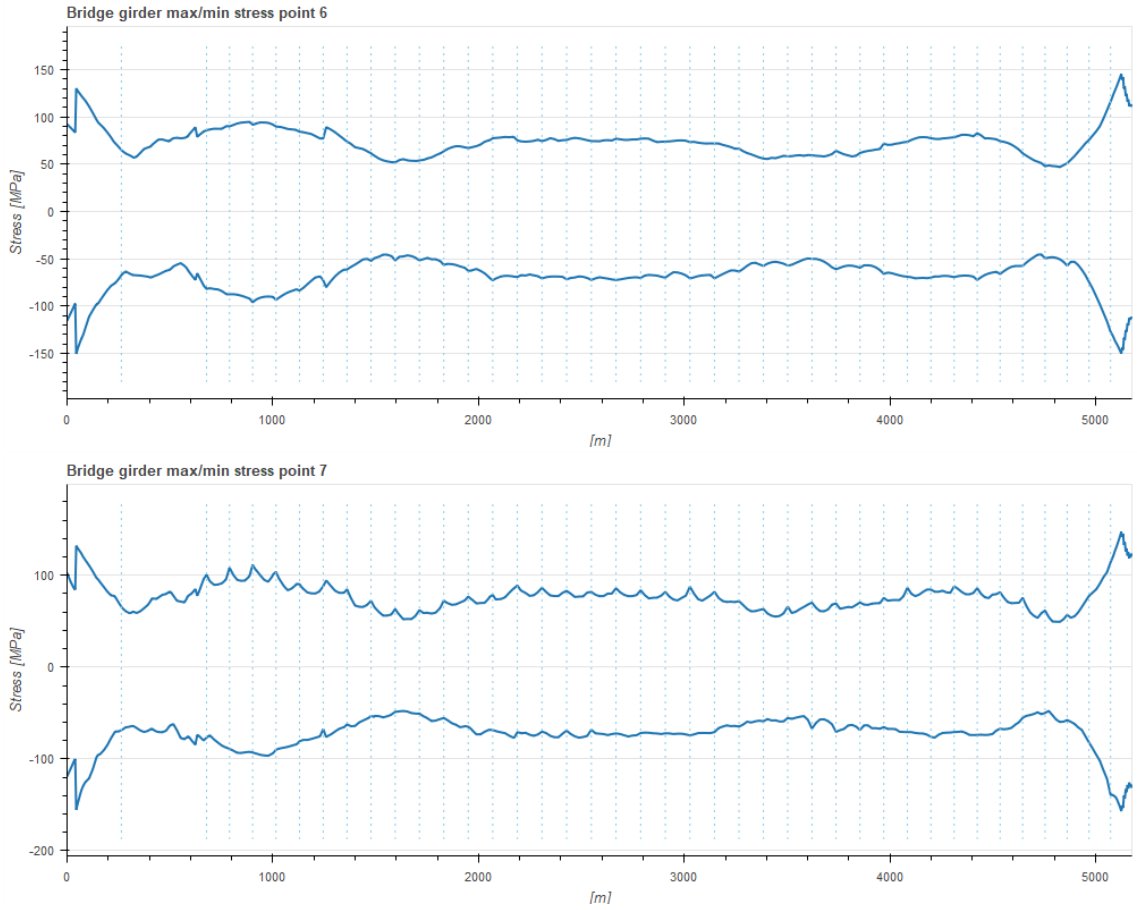





Bridge girder max/min stress point 3
Stress [MPa]
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 5
Stress [MPa]
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 6
Stress [MPa]
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

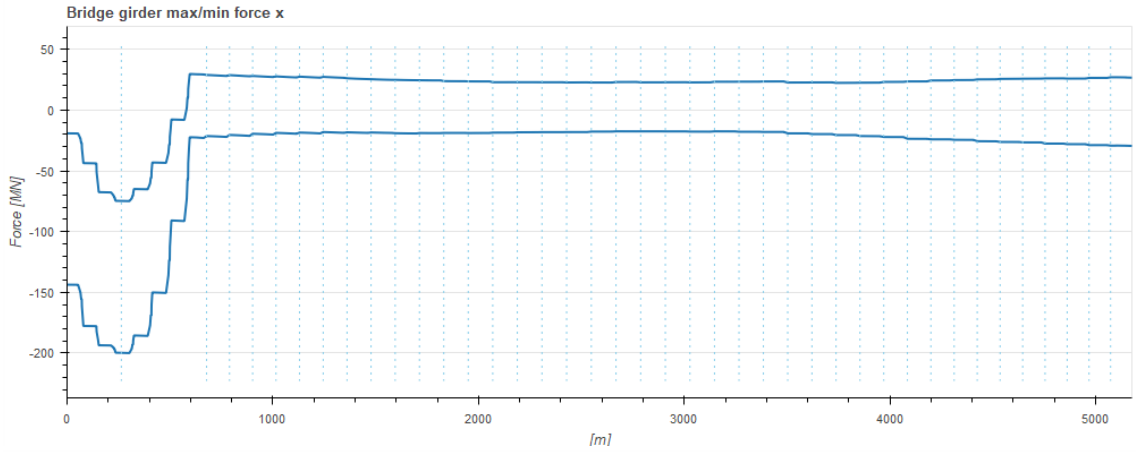
2 ULTIMATE LIMIT STATE RESPONSE

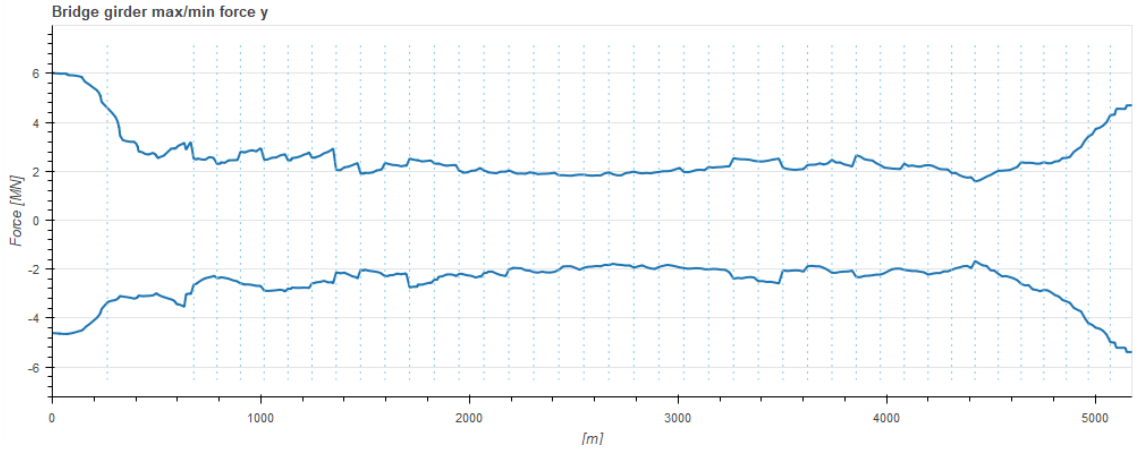
The response can currently be found on the webpage olavolsen.interactive.no [2] for K12 – Model 30. In addition, the most relevant responses are also presented here.

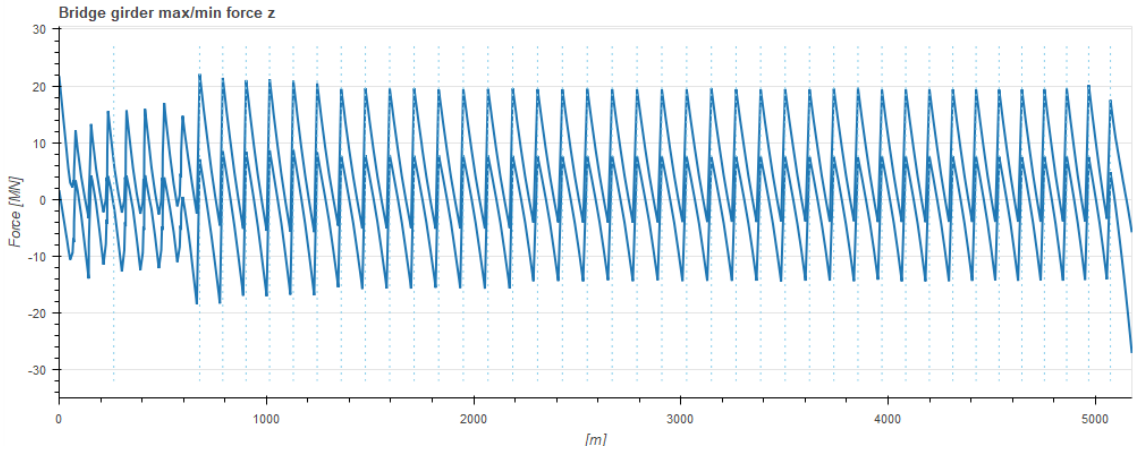
2.1 ULS 6.10a - 1 year conditions with traffic

With respect to olavolsen.interactive.no [2] and [3], ULS 6.10a - 1 year conditions with traffic corresponds to COMB 31.

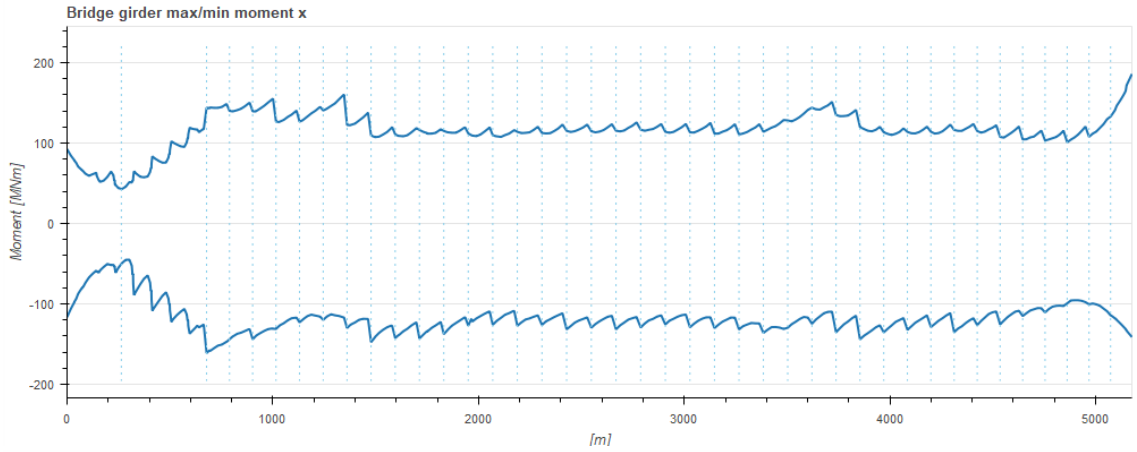
2.1.1 Forces

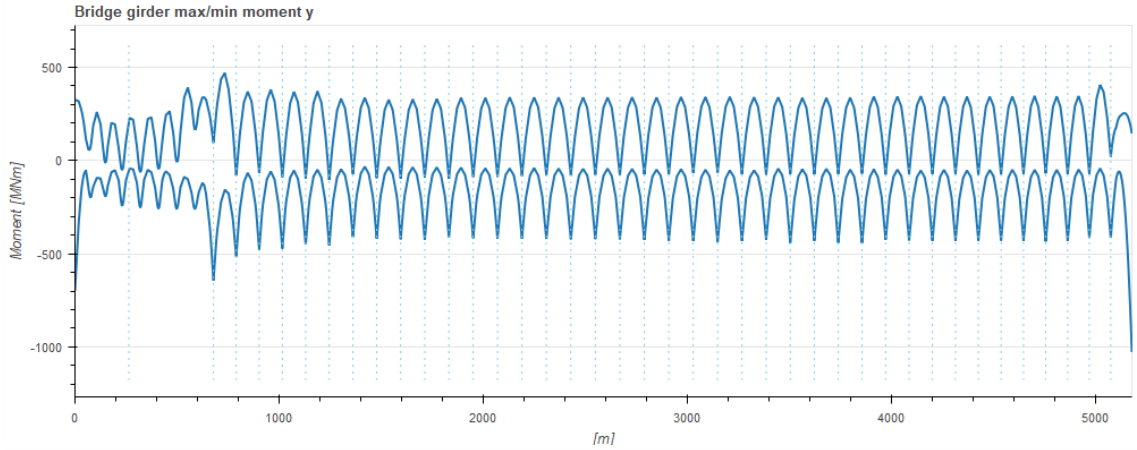


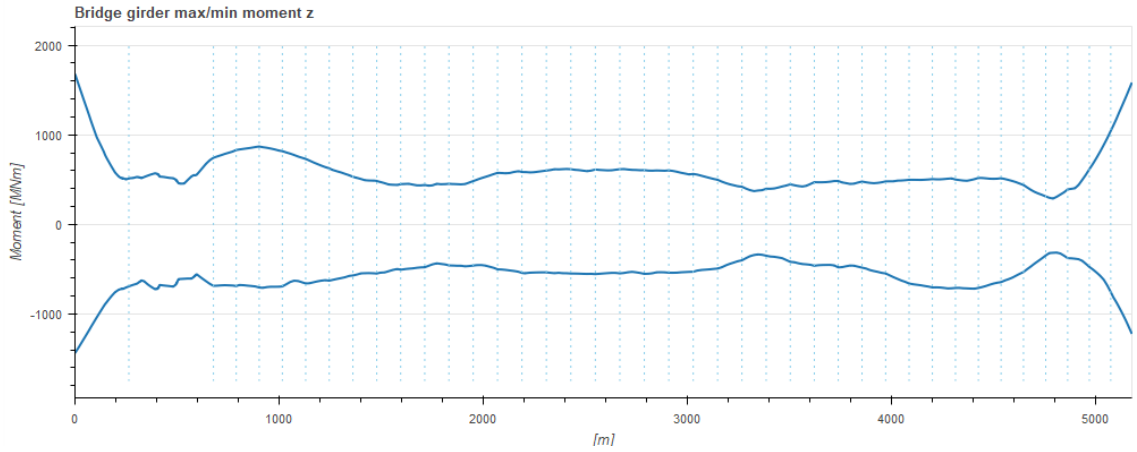




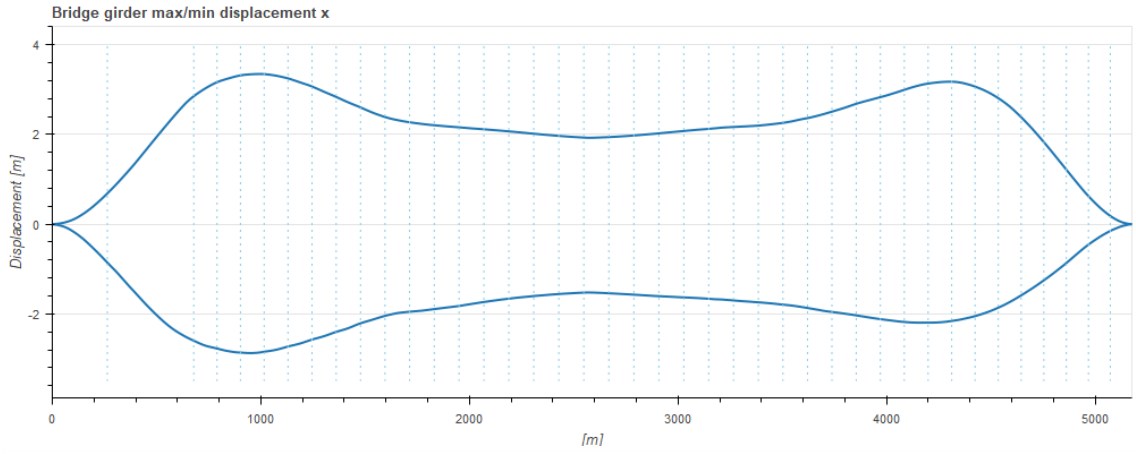
2.1.2 Moments

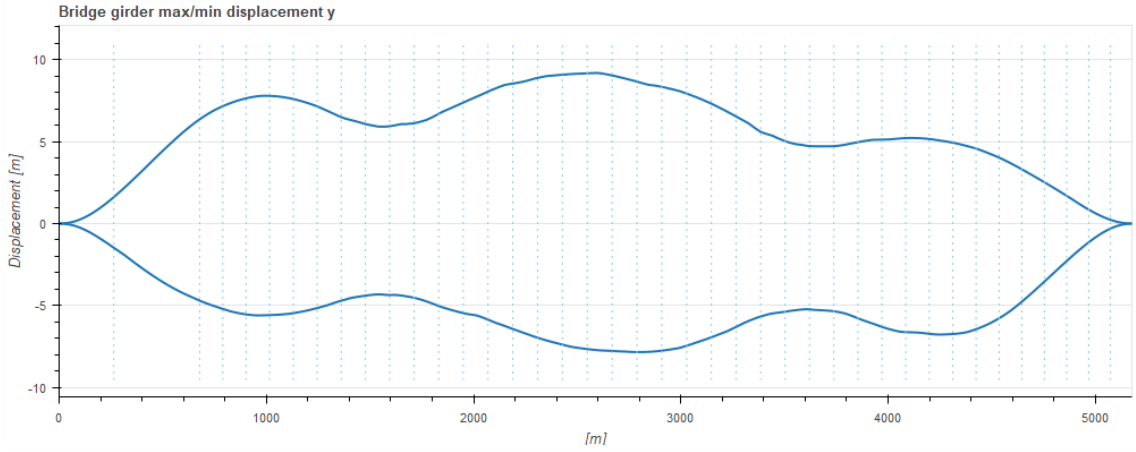

Bridge girder max/min moment x
Moment [MNm]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

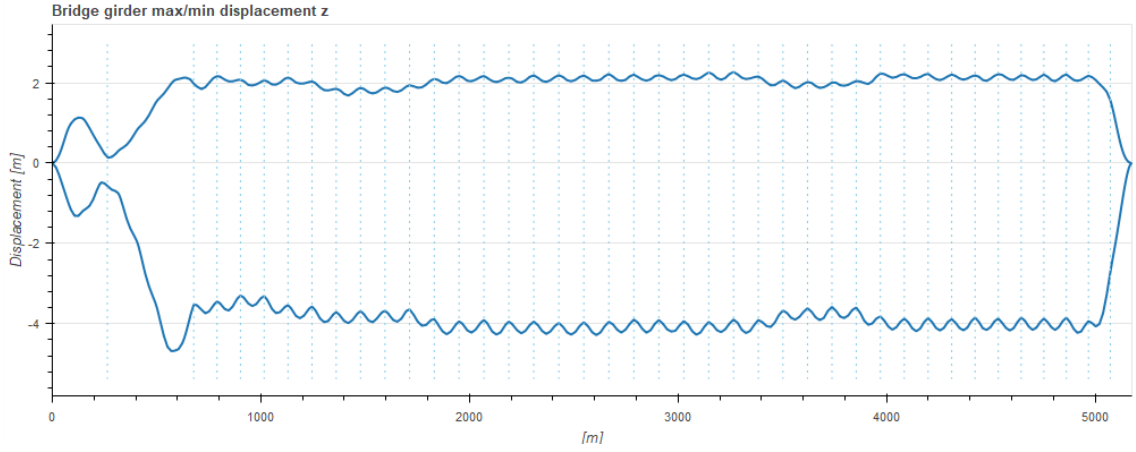

Bridge girder max/min moment y
Moment [MNm]
500
0
-500
-1000
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
2000
1000
0
-1000
0
1000
2000
3000
4000
5000
[m]

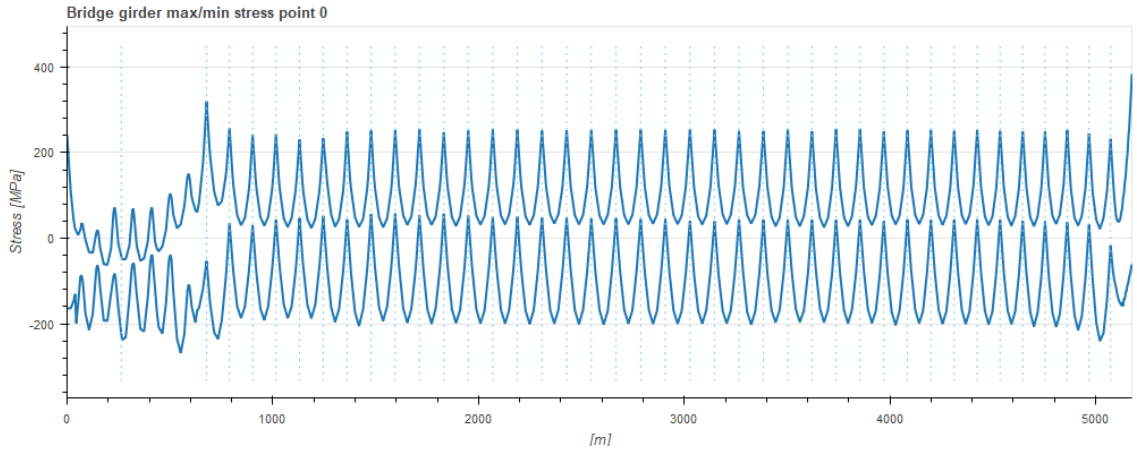
2.1.3 Displacements

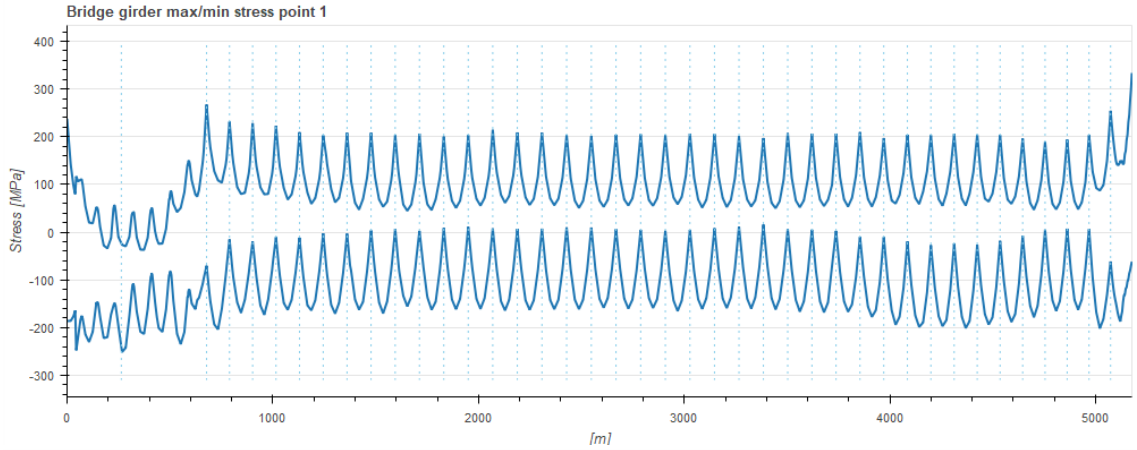


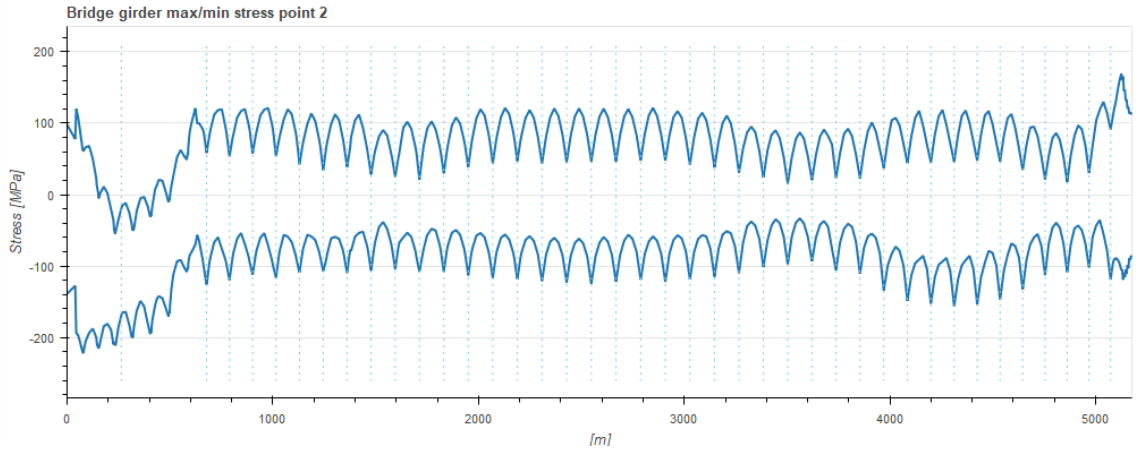


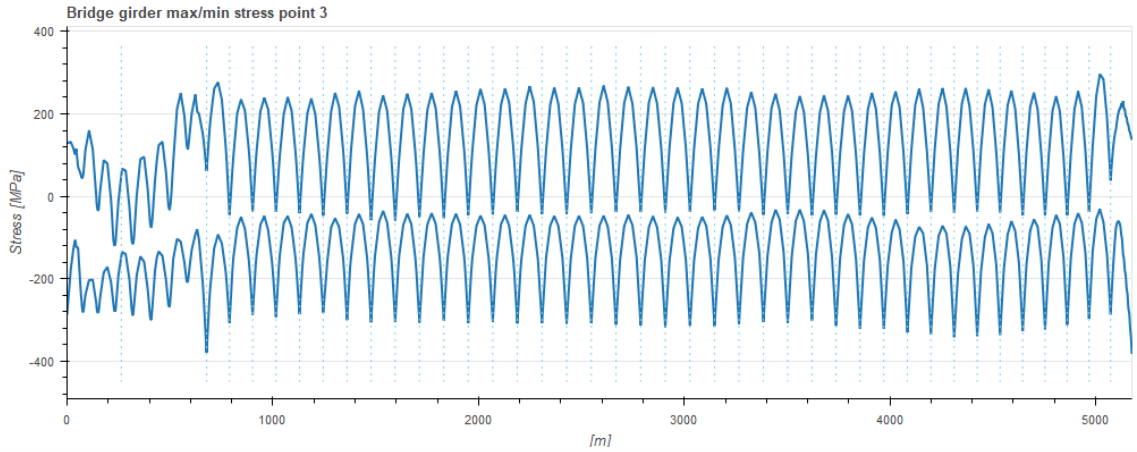


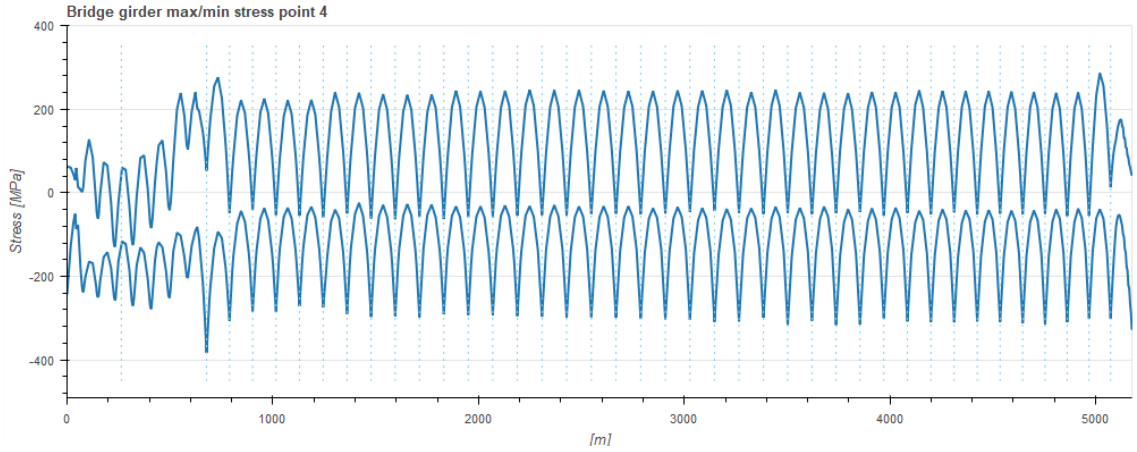
2.1.4 Stresses

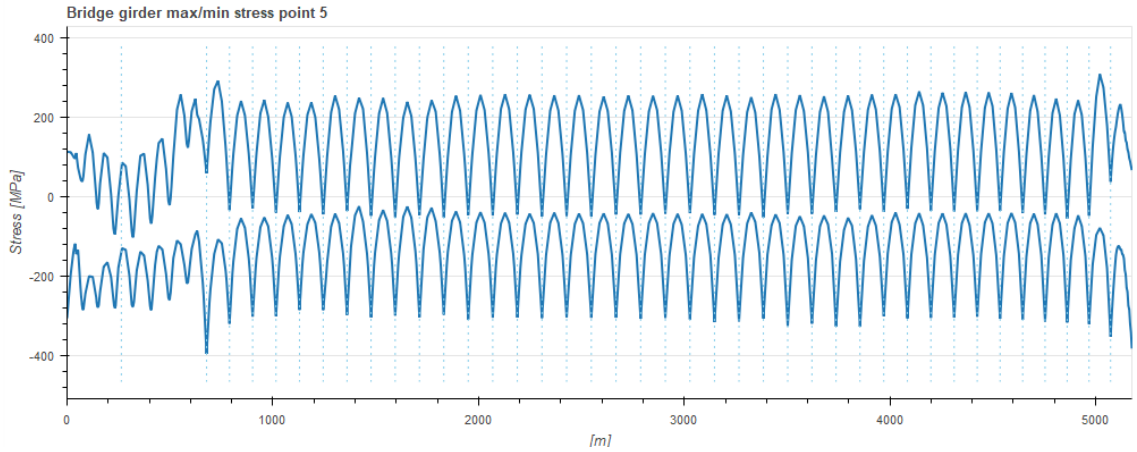


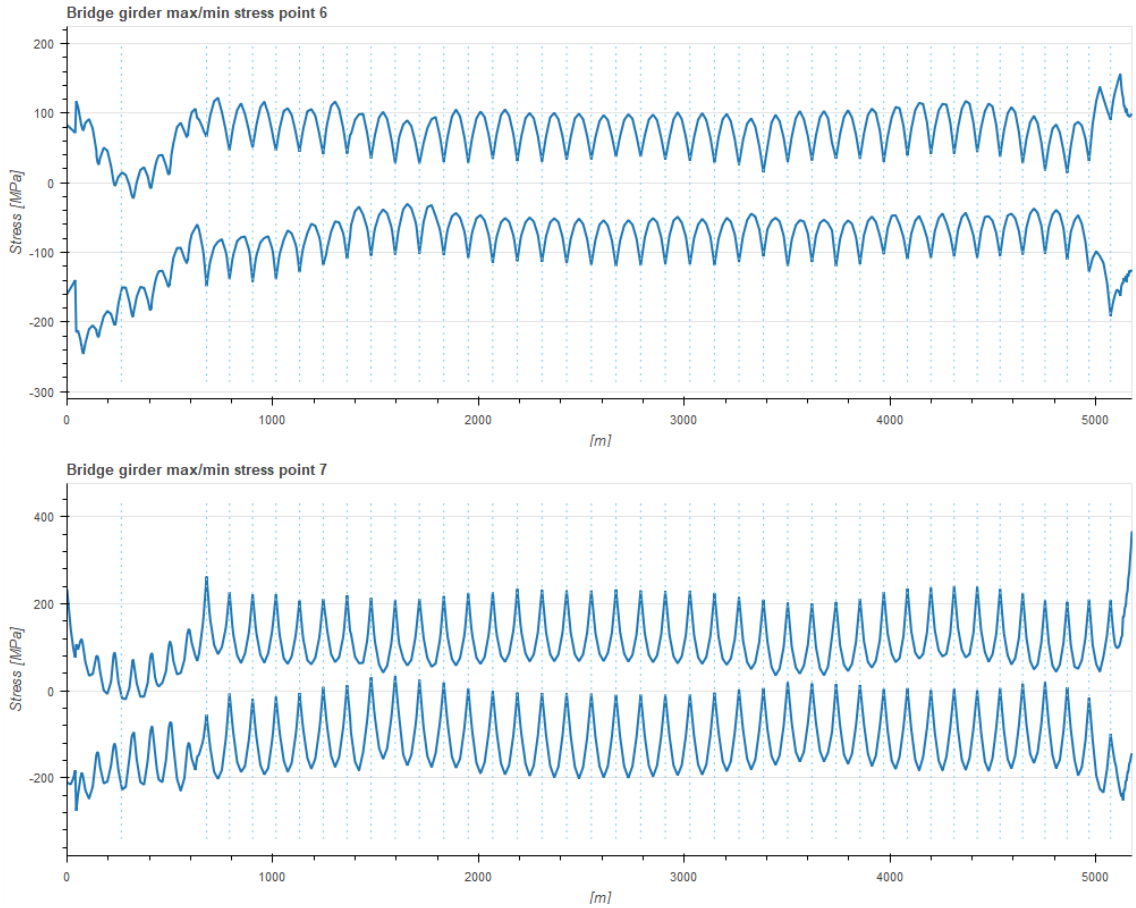





Bridge girder max/min stress point 3
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

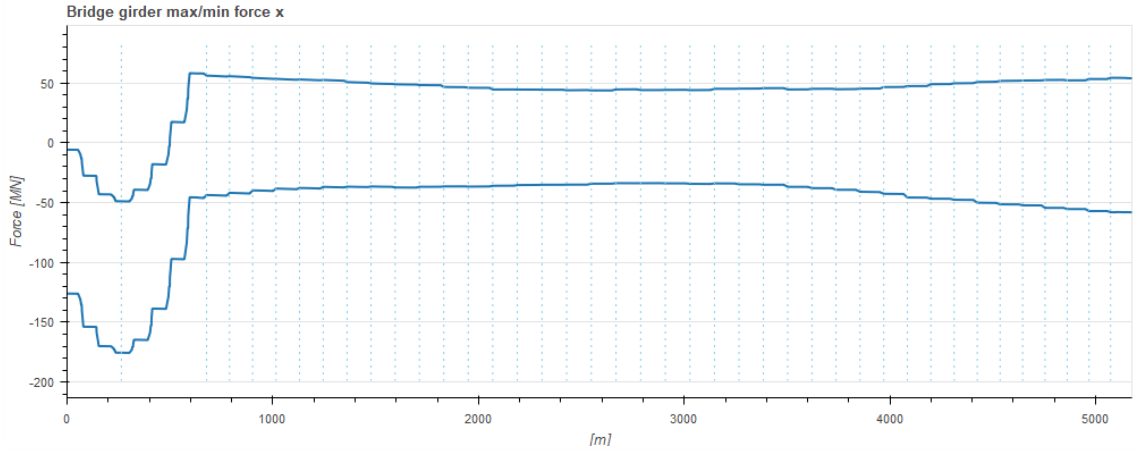

Bridge girder max/min stress point 5
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

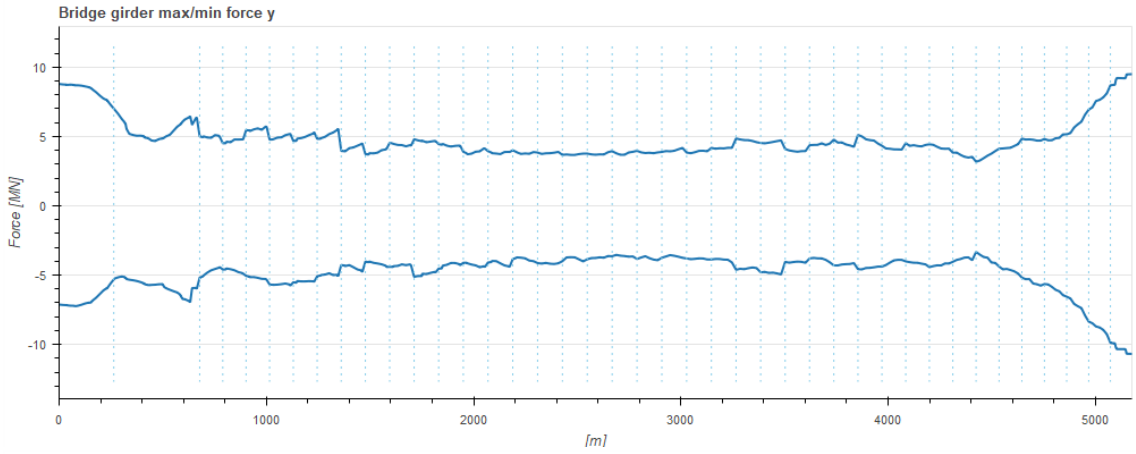

Bridge girder max/min stress point 6
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
400
200
0
-200
0
1000
2000
3000
4000
5000
[m]

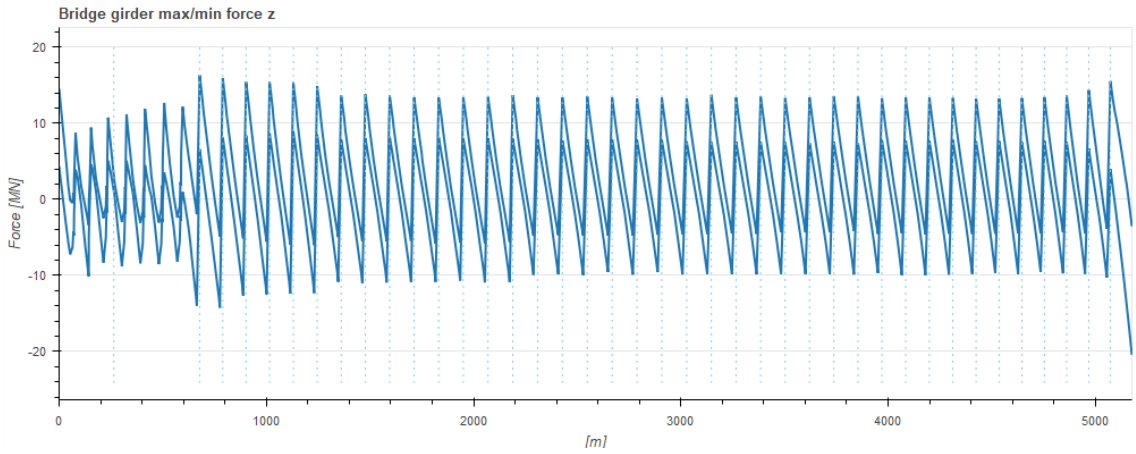
2.2 ULS 6.10a - 100 year conditions without traffic

With respect to olavolsen.interactive.no [2] and [3], ULS 6.10a - 100 year conditions without traffic corresponds to COMB 32.

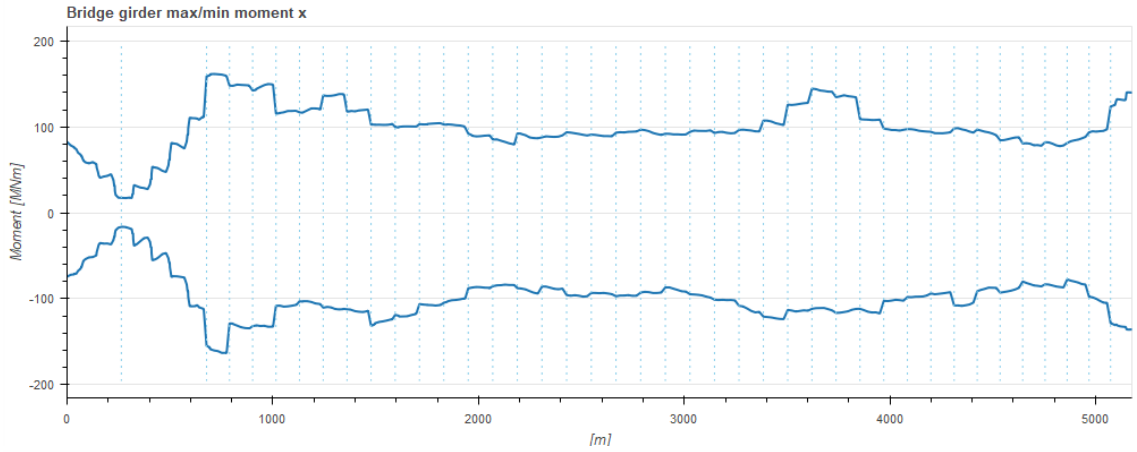
2.2.1 Forces

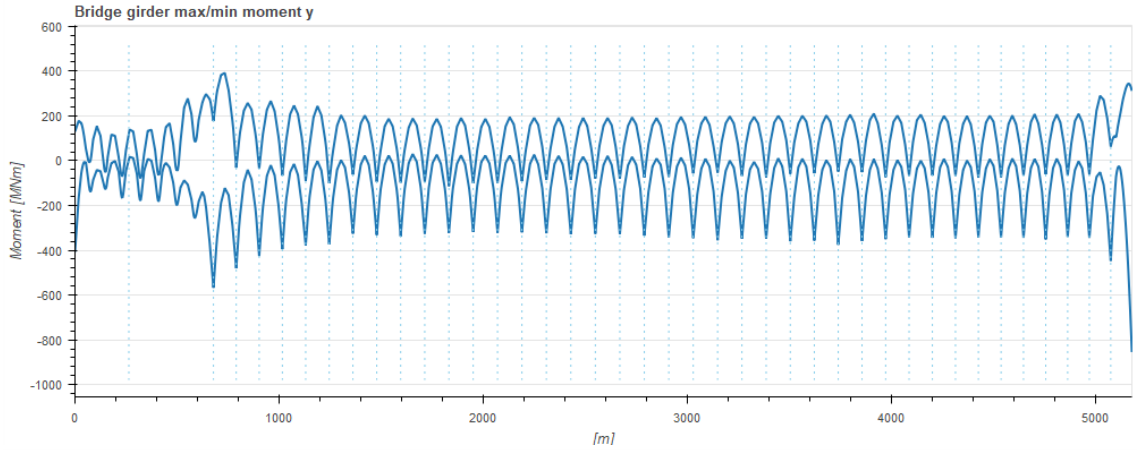


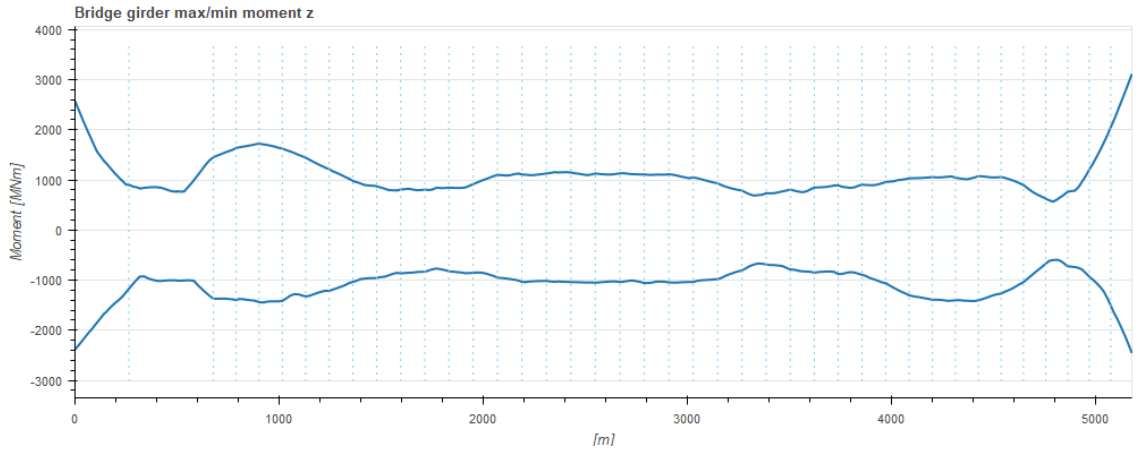




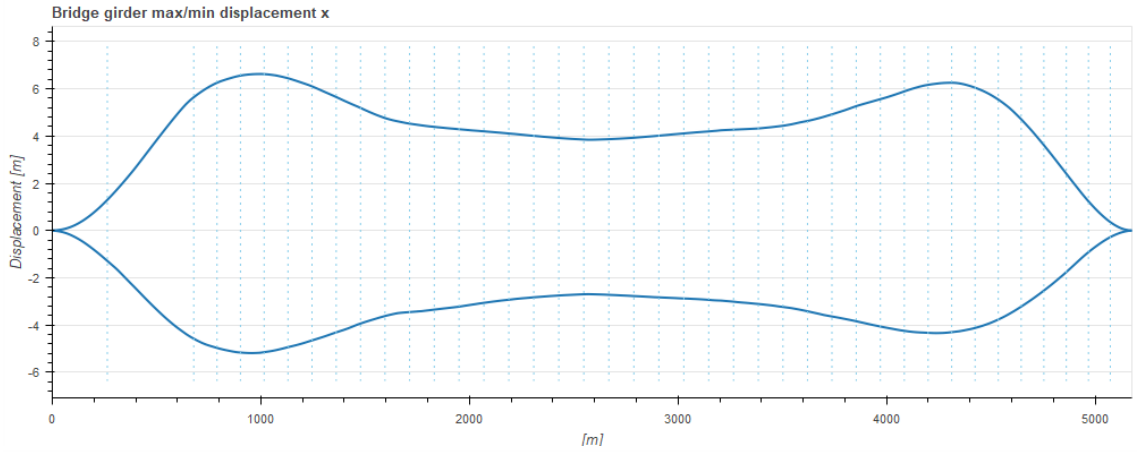
2.2.2 Moments

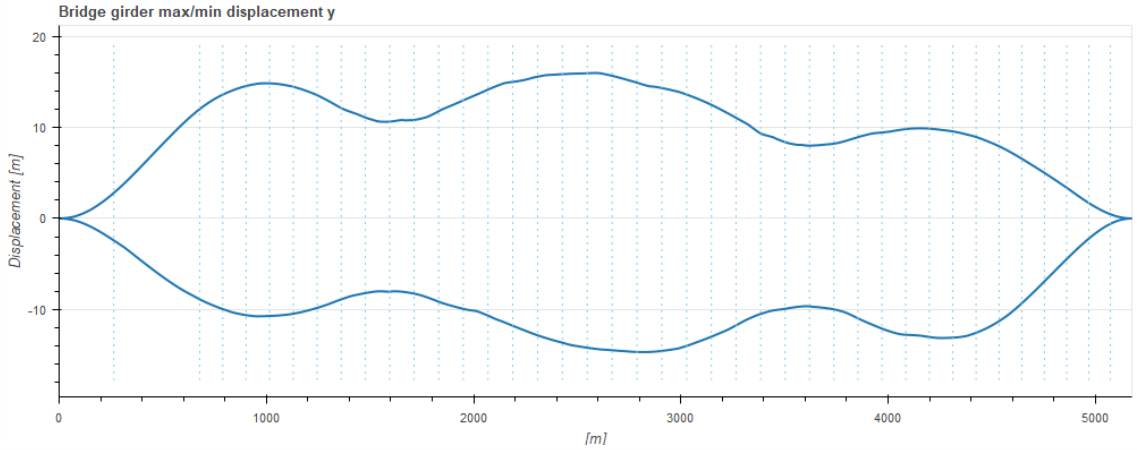

Bridge girder max/min moment x
Moment [MNm]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

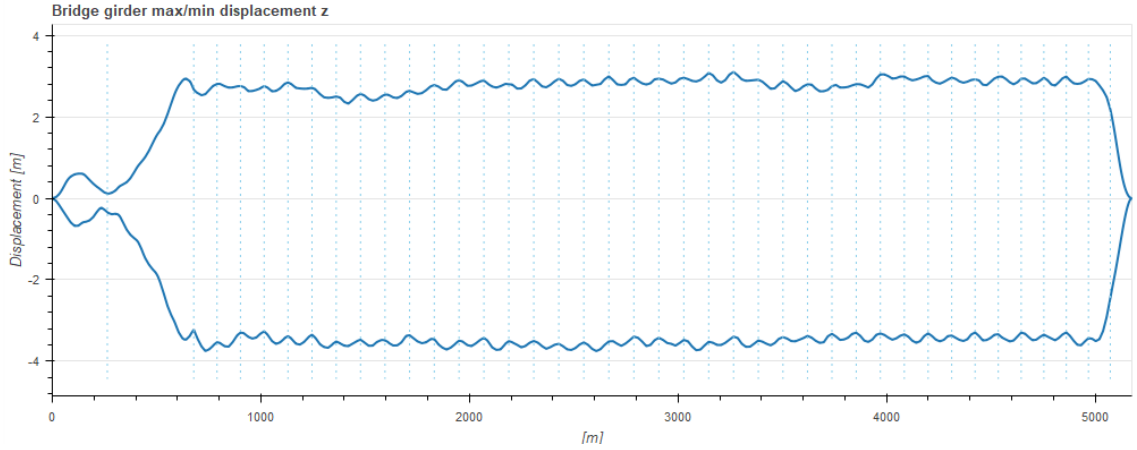

Bridge girder max/min moment y
Moment [MNm]
600
400
200
0
-200
-400
-600
-800
-1000
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
4000
3000
2000
1000
0
-1000
-2000
-3000
0
1000
2000
3000
4000
5000
[m]

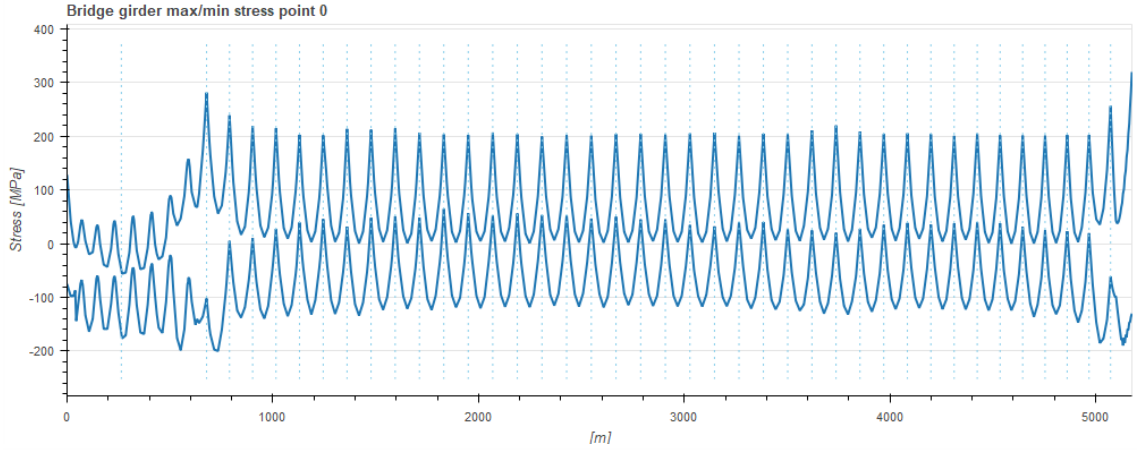
2.2.3 Displacements

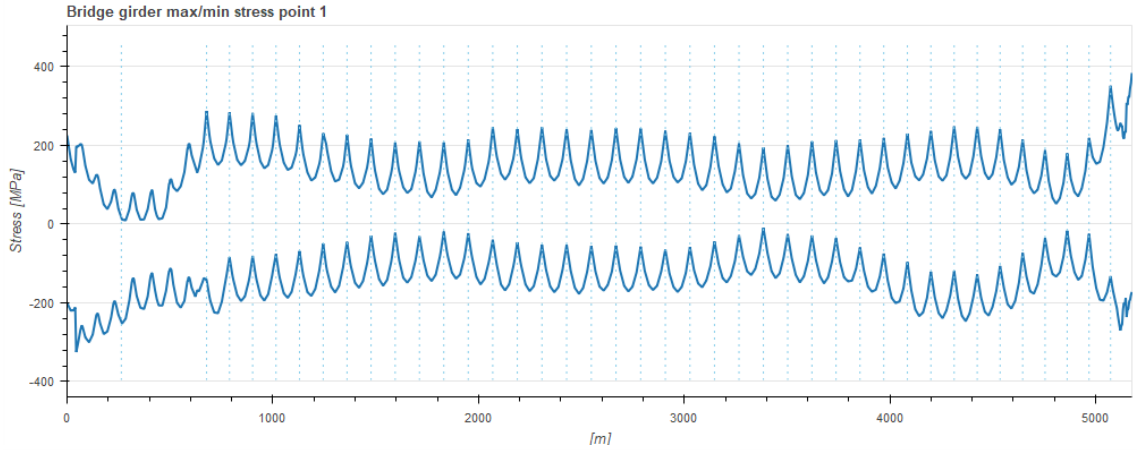


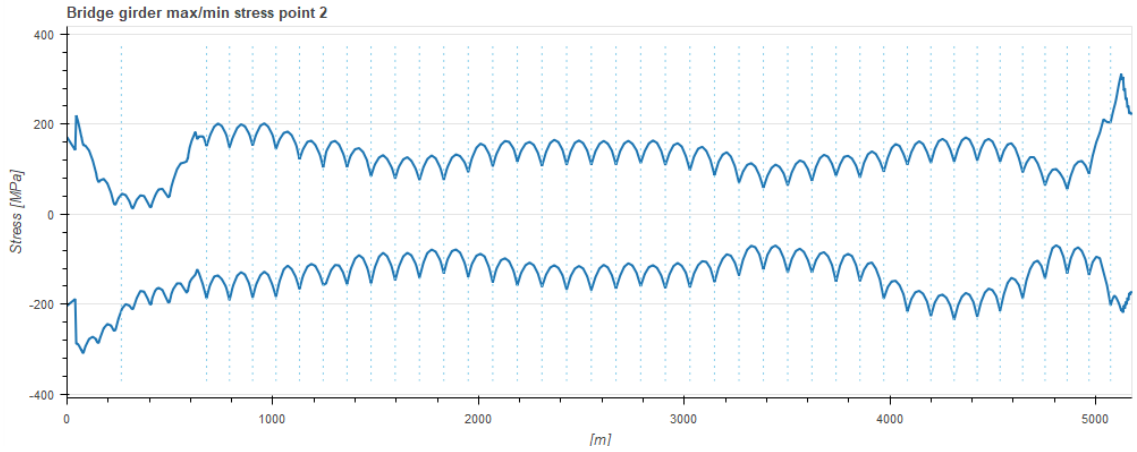


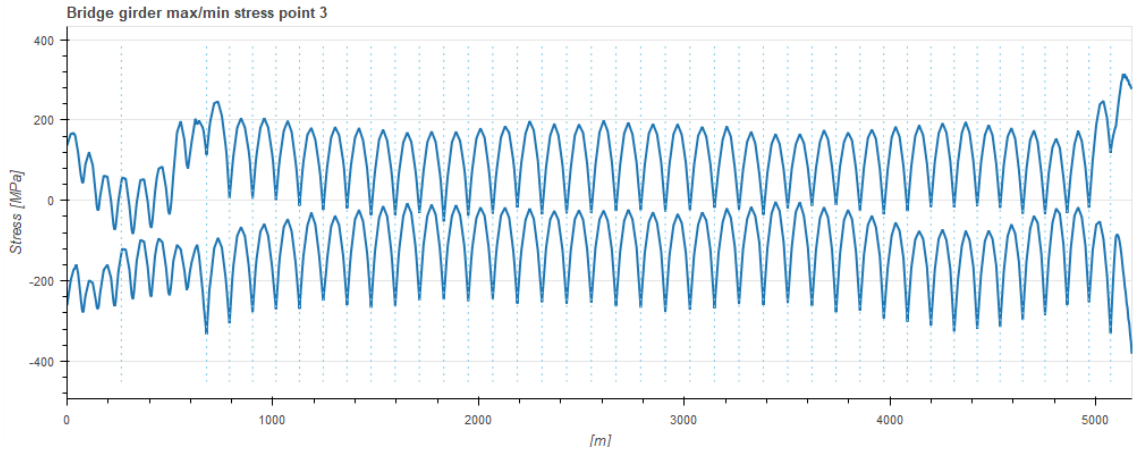


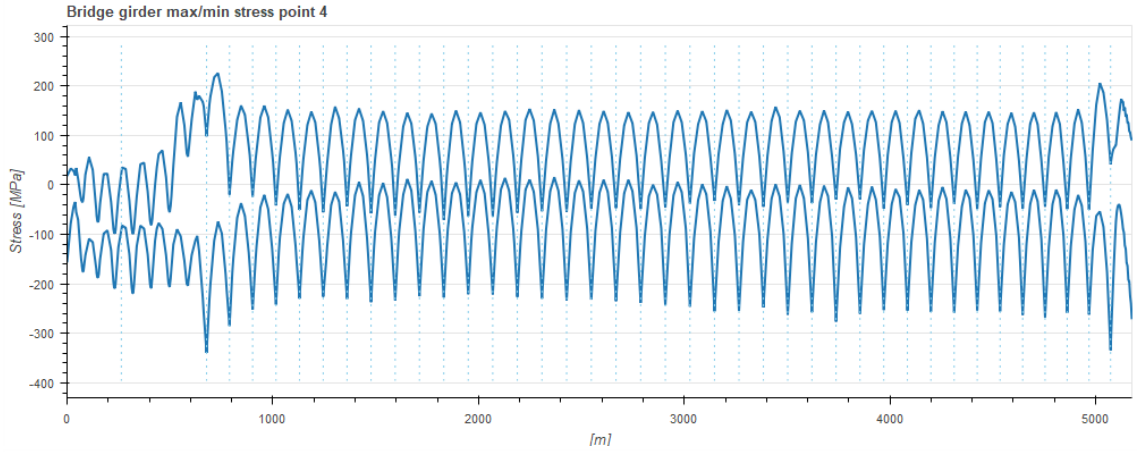
2.2.4 Stresses

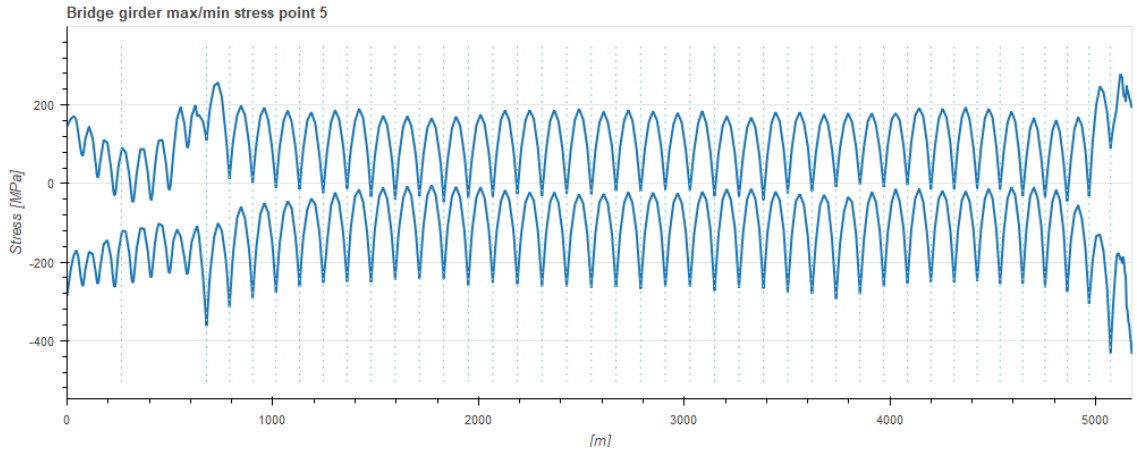


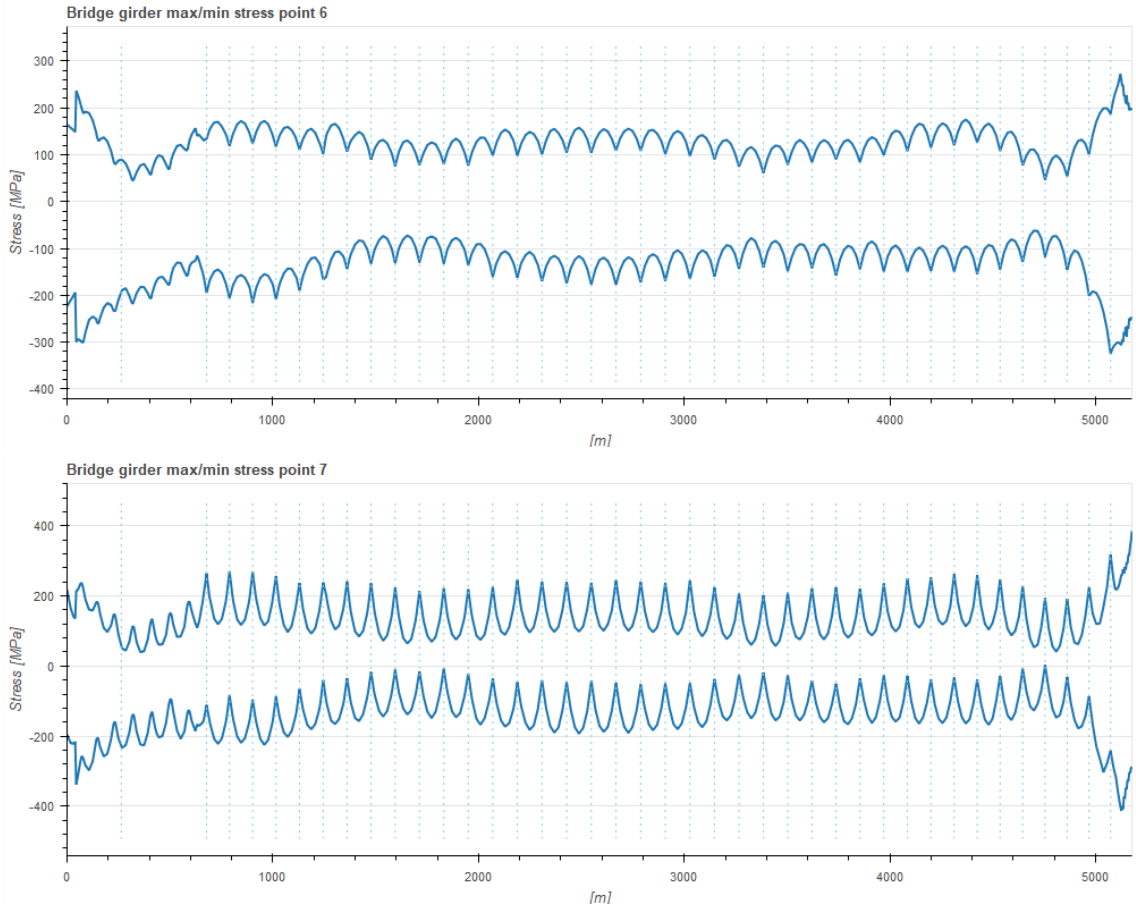





Bridge girder max/min stress point 3
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
300
200
100
0
-100
-200
-300
-400
0
1000
2000
3000
4000
5000
[m]

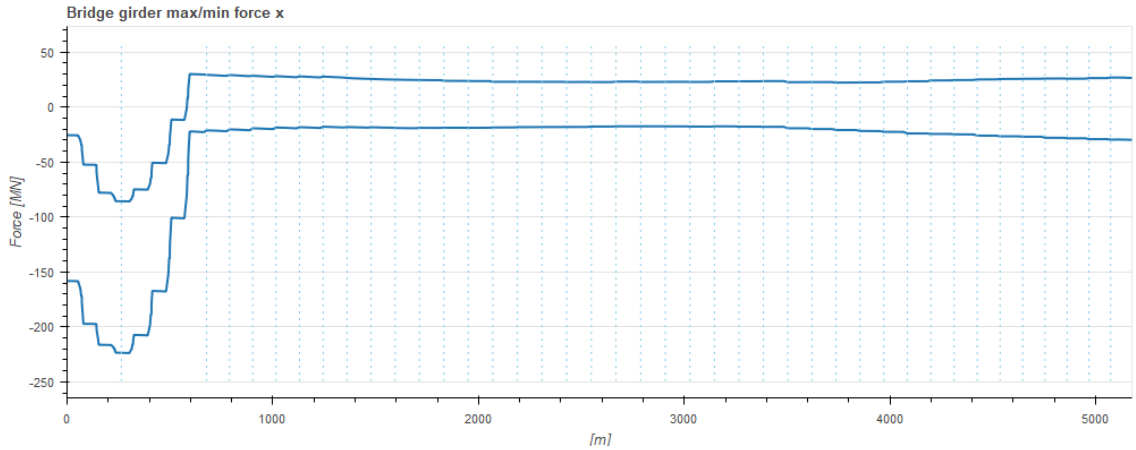

Bridge girder max/min stress point 5
Stress [MPa]
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

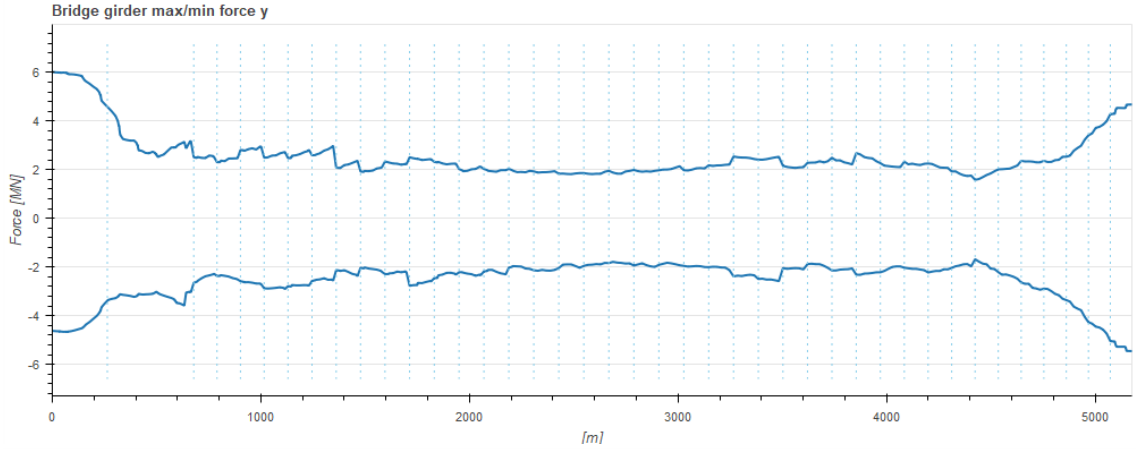

Bridge girder max/min stress point 6
Stress [MPa]
300
200
100
0
-100
-200
-300
-400
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

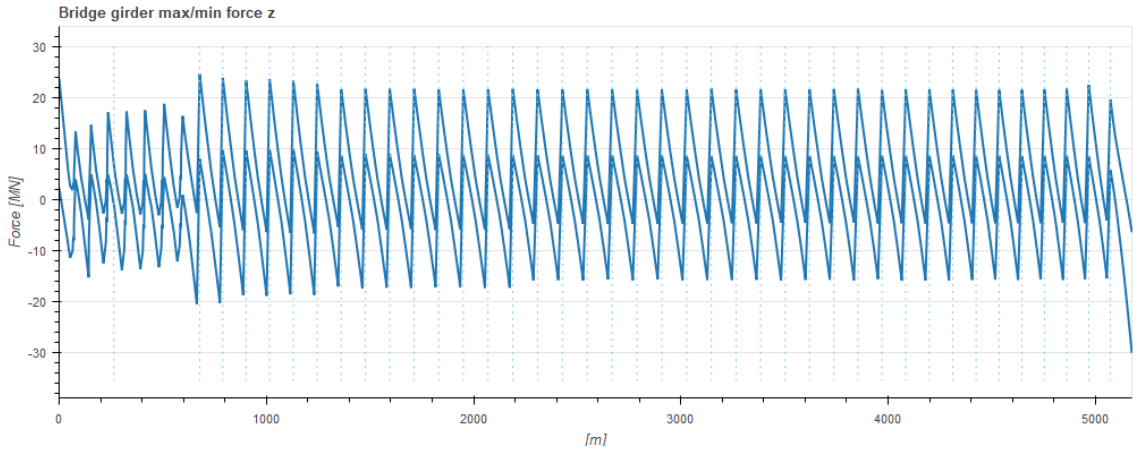
2.3 ULS 6.10b - 1 year conditions with traffic

With respect to olavolsen.interactive.no [2] and [3], ULS 6.10b - 1 year conditions with traffic corresponds to COMB 33.

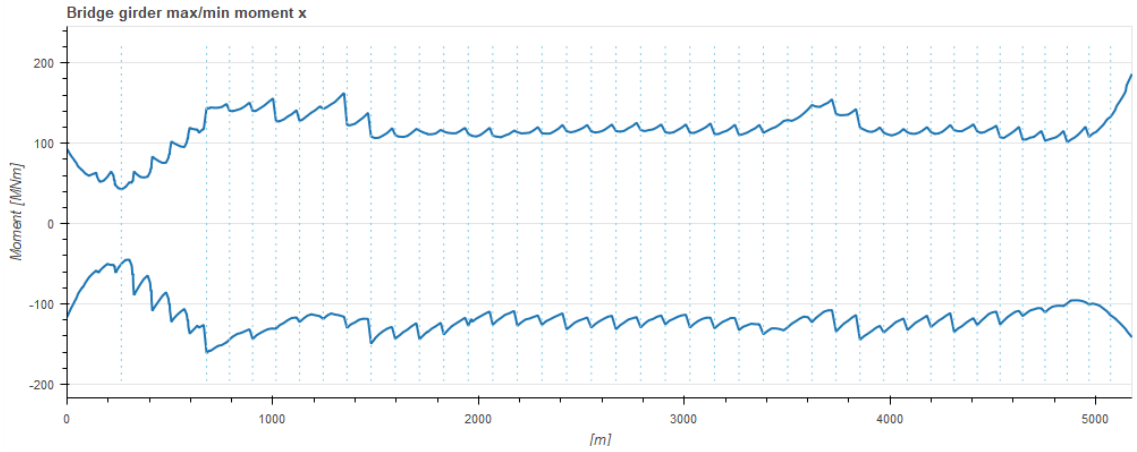
2.3.1 Forces

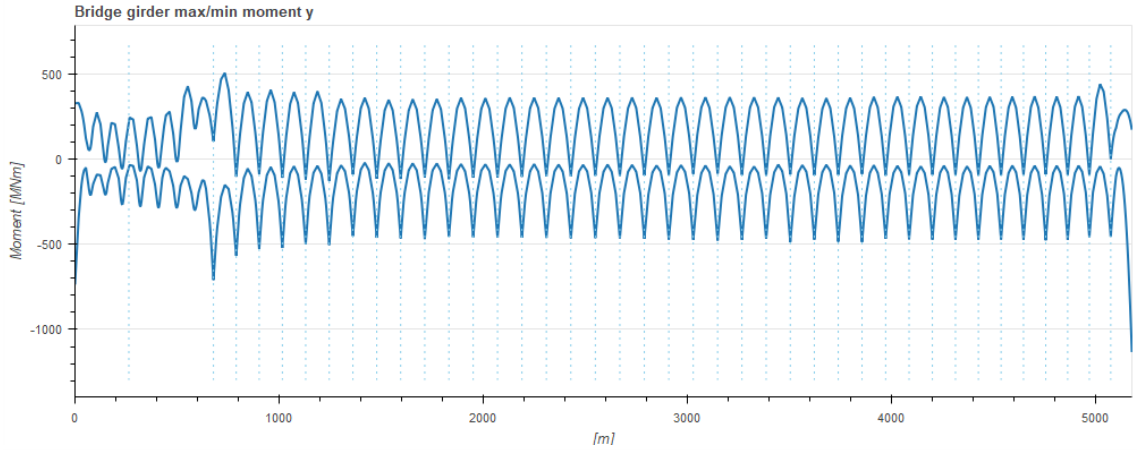


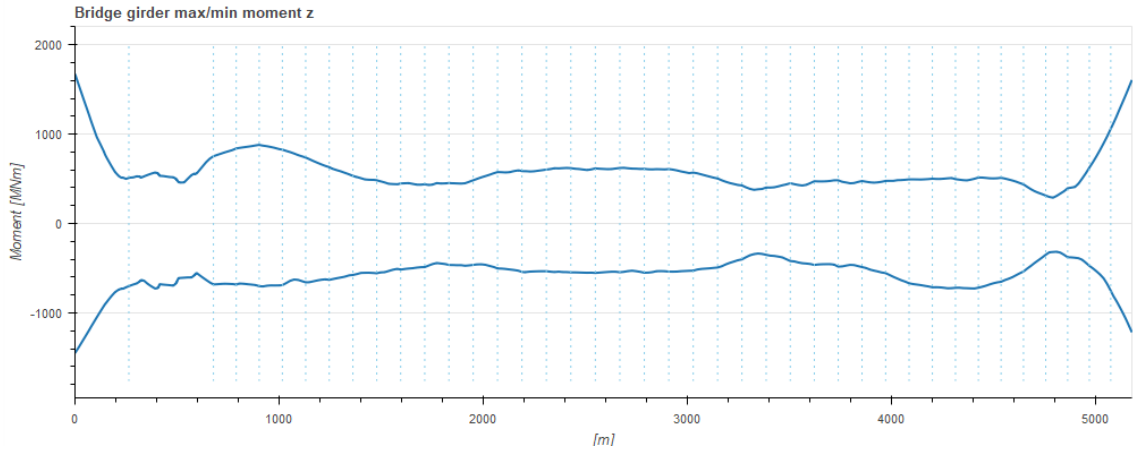




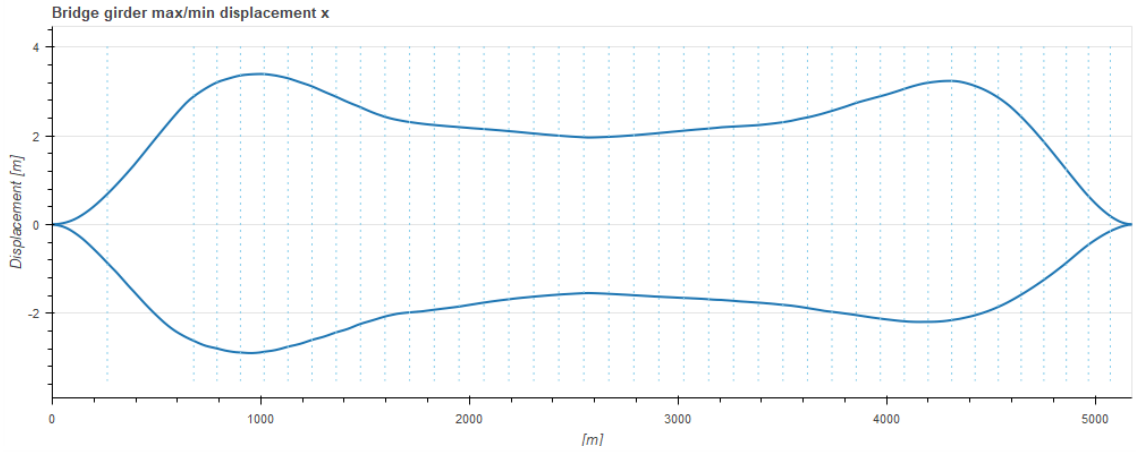
2.3.2 Moments

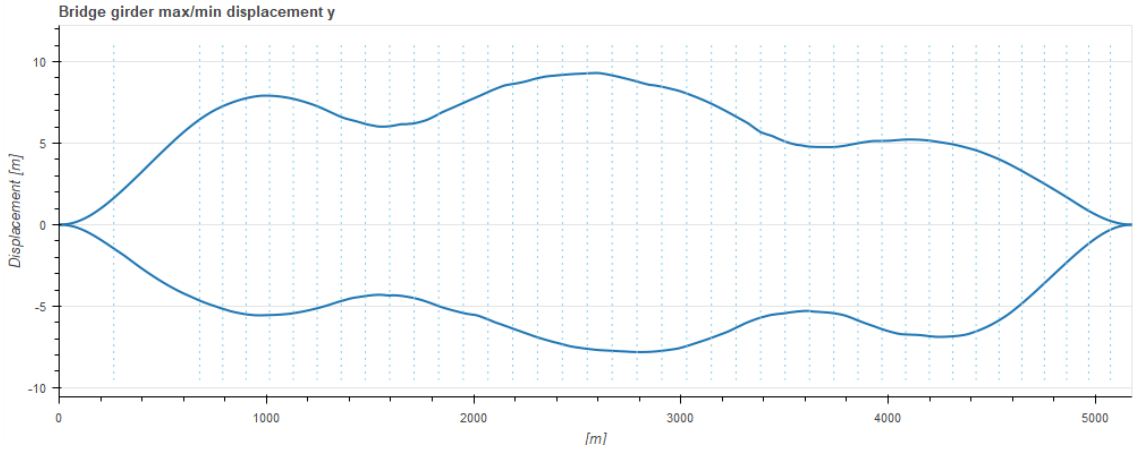

Bridge girder max/min moment x
Moment [MNm]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

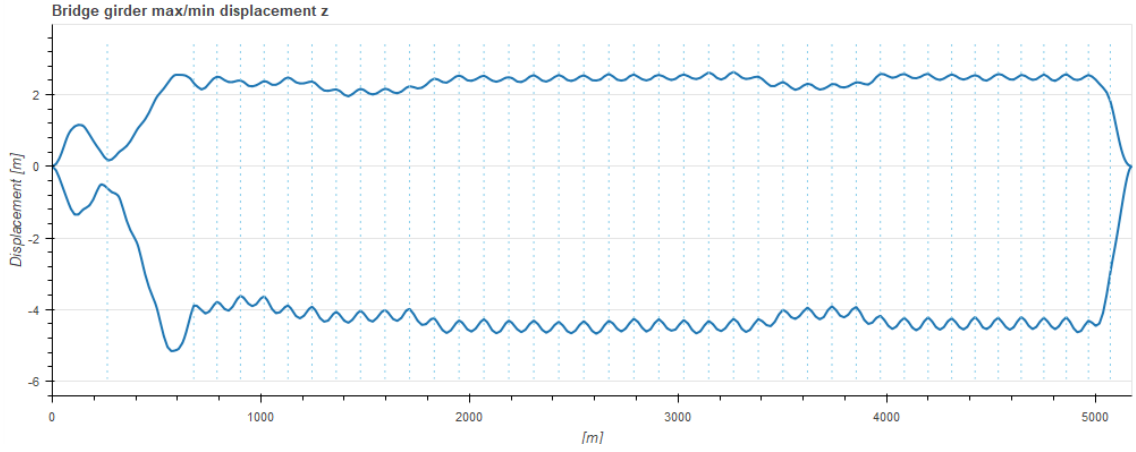

Bridge girder max/min moment y
Moment [MNm]
500
0
-500
-1000
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
2000
1000
0
-1000
0
1000
2000
3000
4000
5000
[m]

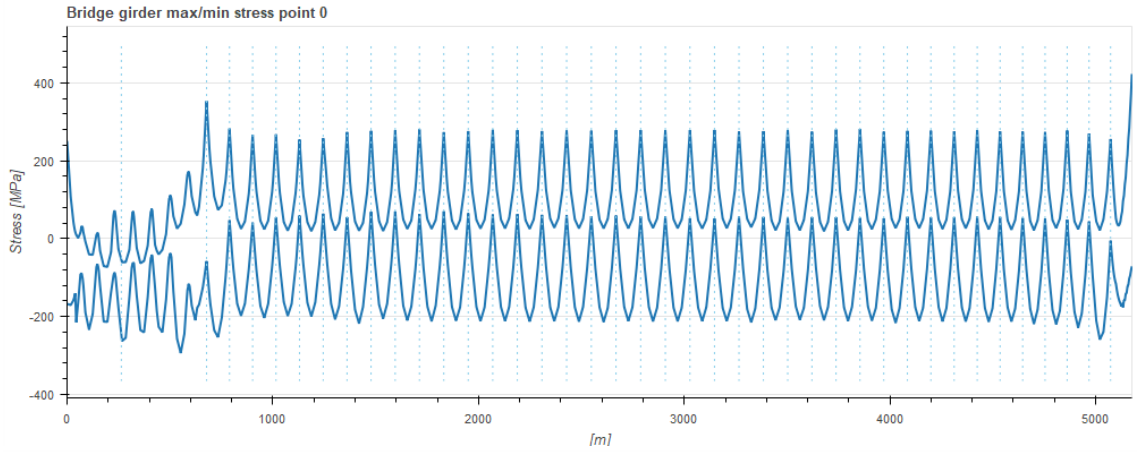
2.3.3 Displacements

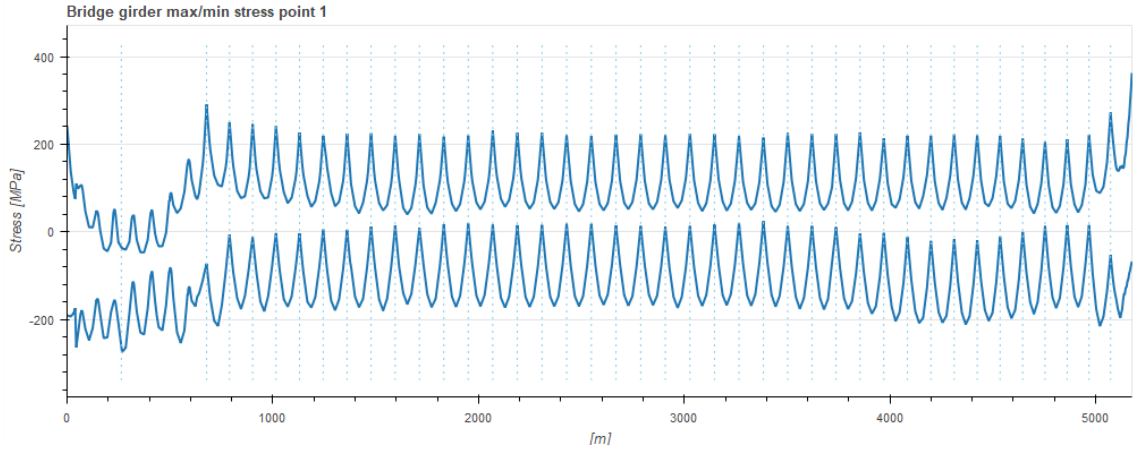


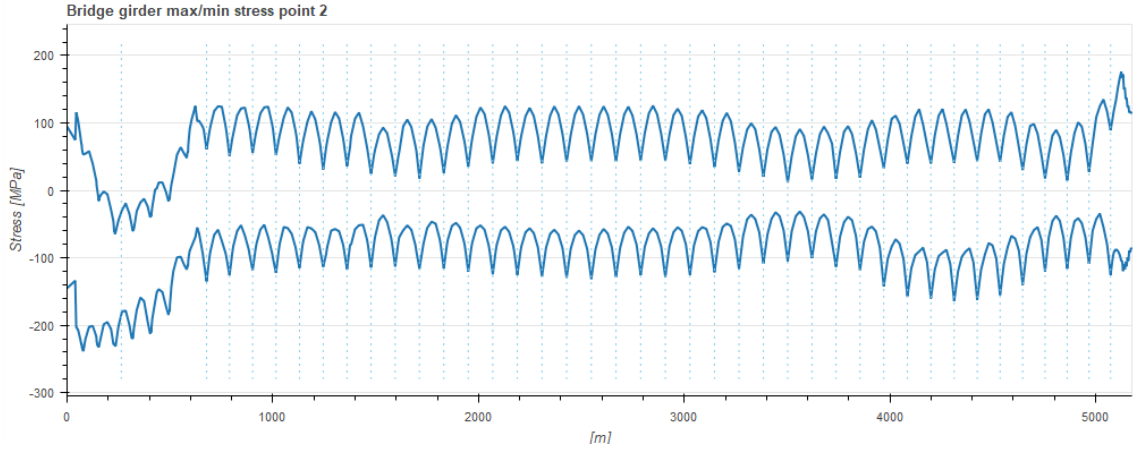


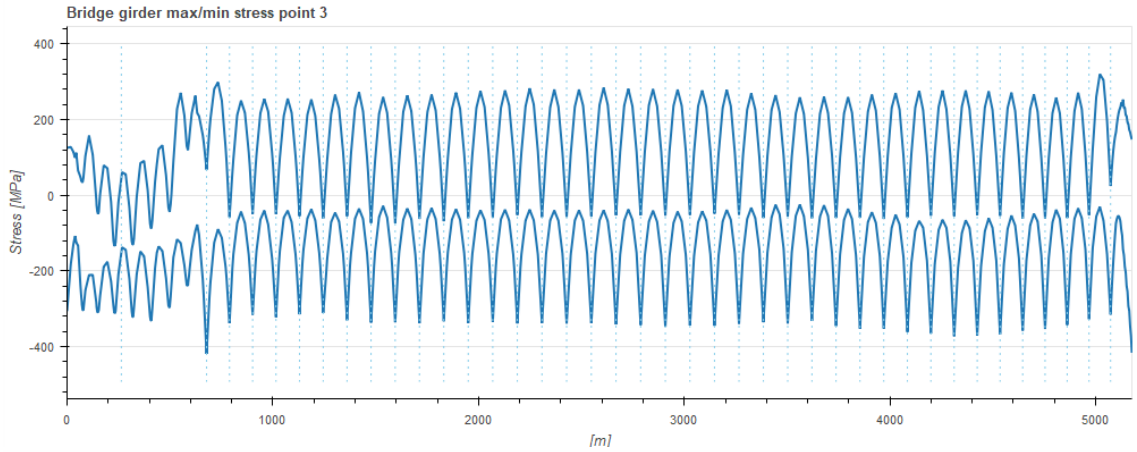


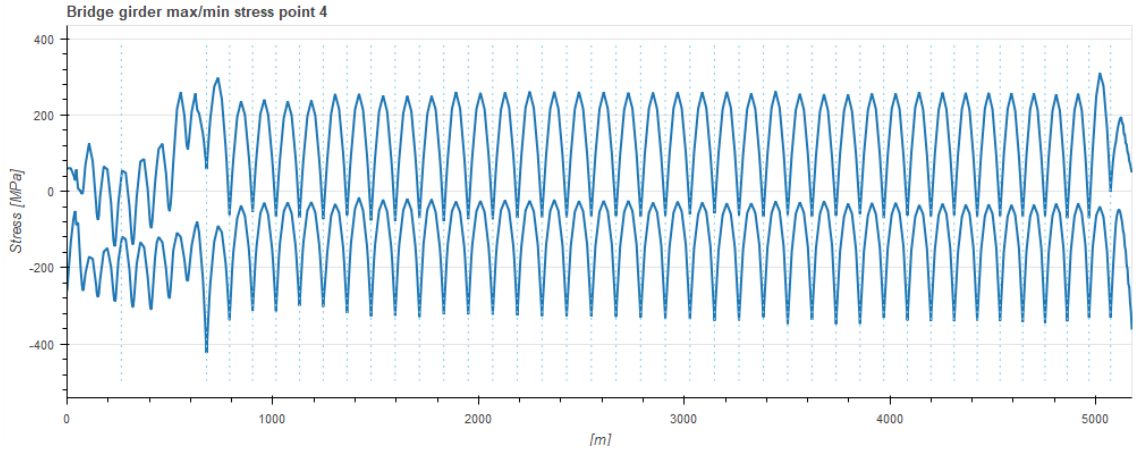
2.3.4 Stresses

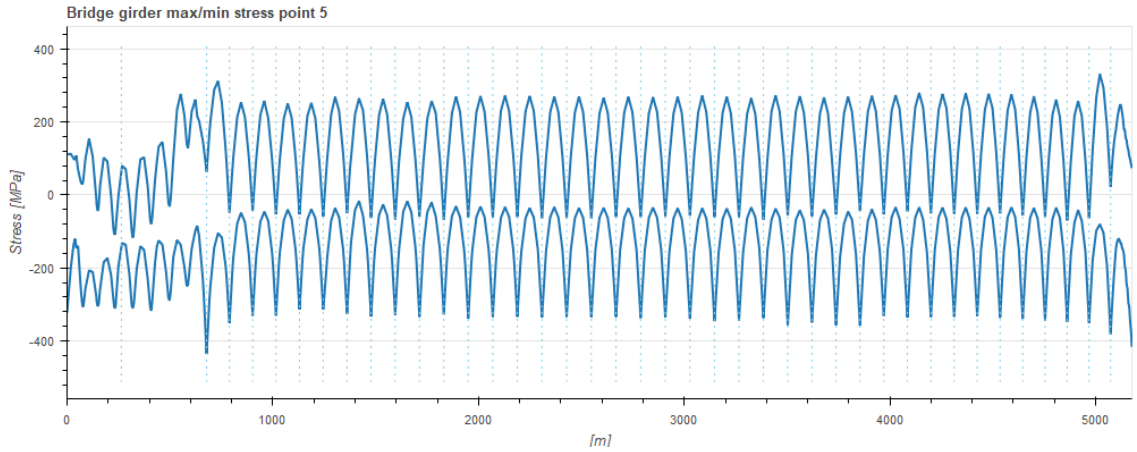


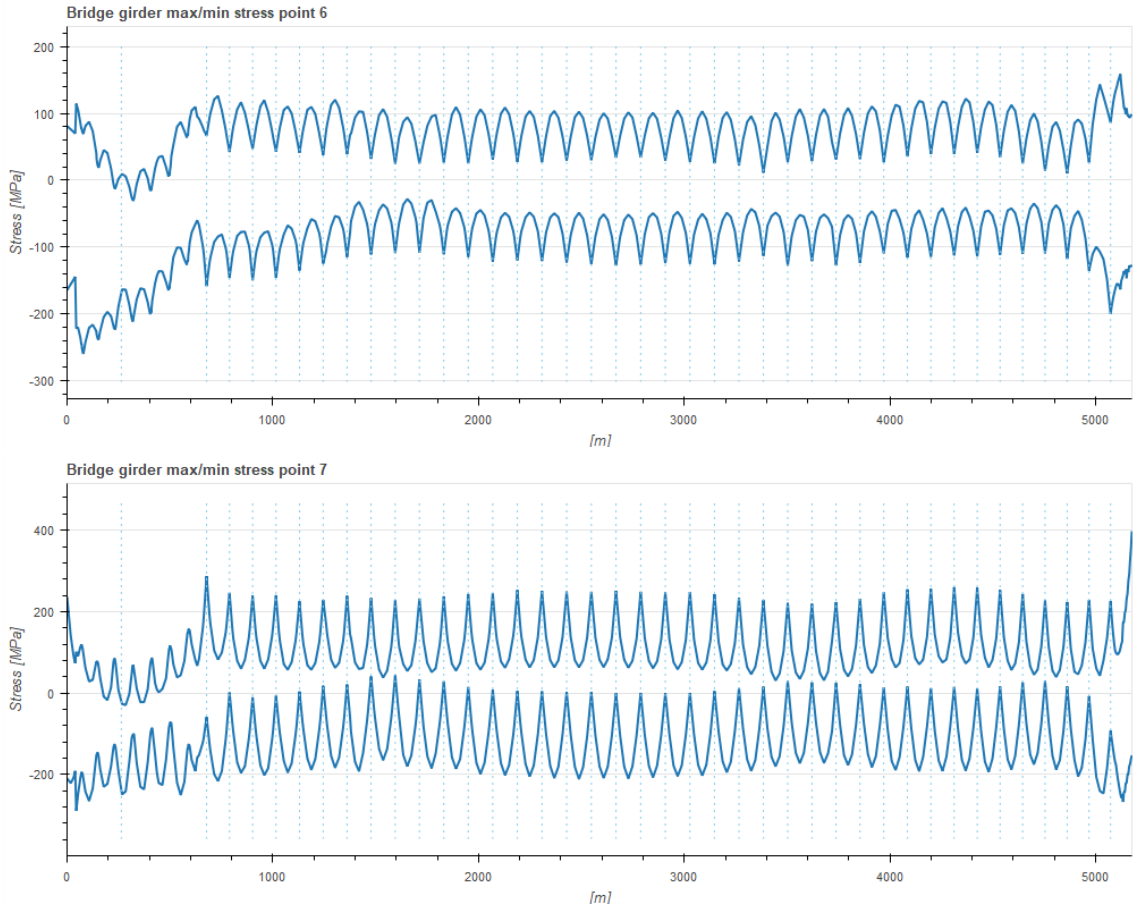





Bridge girder max/min stress point 3
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

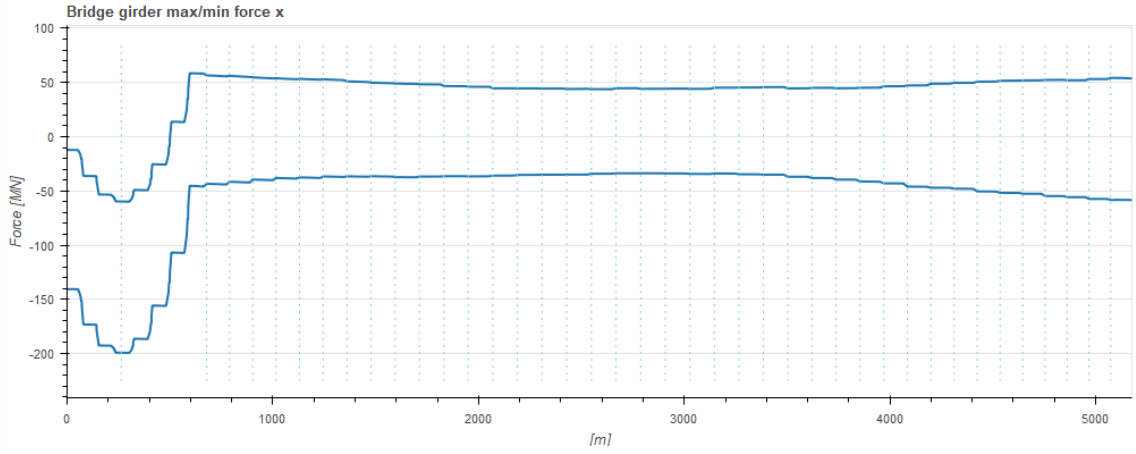

Bridge girder max/min stress point 5
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

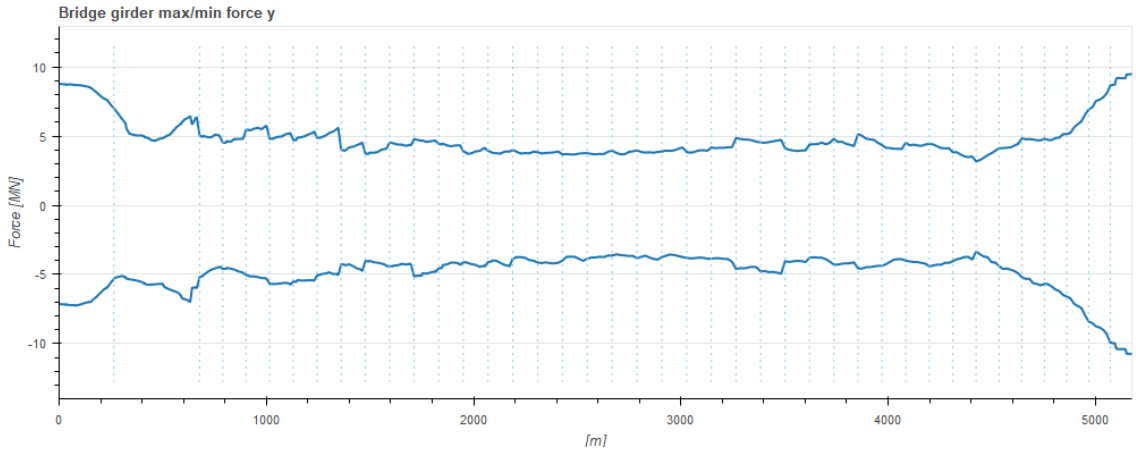

Bridge girder max/min stress point 6
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
400
200
0
-200
0
1000
2000
3000
4000
5000
[m]

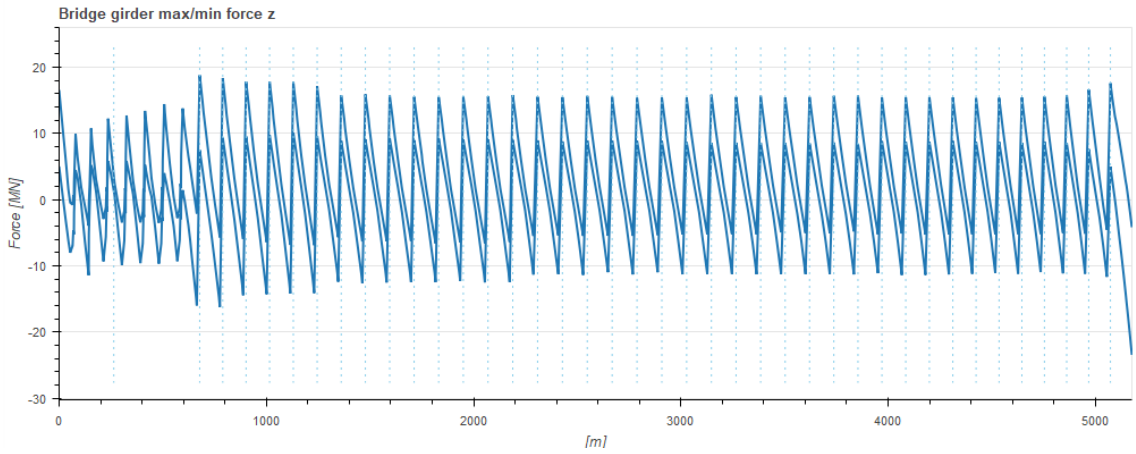
2.4 ULS 6.10b - 100 year conditions without traffic

With respect to olavolsen.interactive.no [2] and [3], ULS 6.10b - 100 year conditions without traffic corresponds to COMB 34.

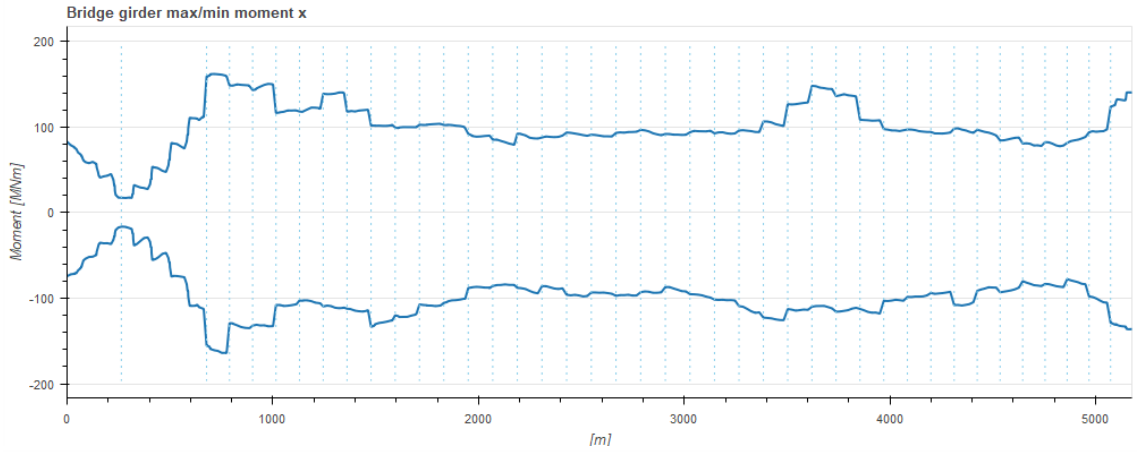
2.4.1 Forces

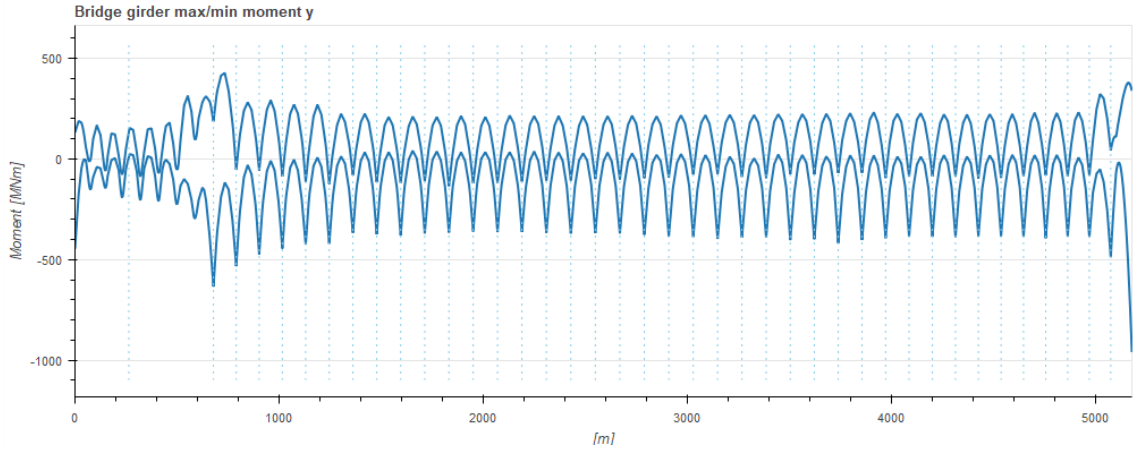


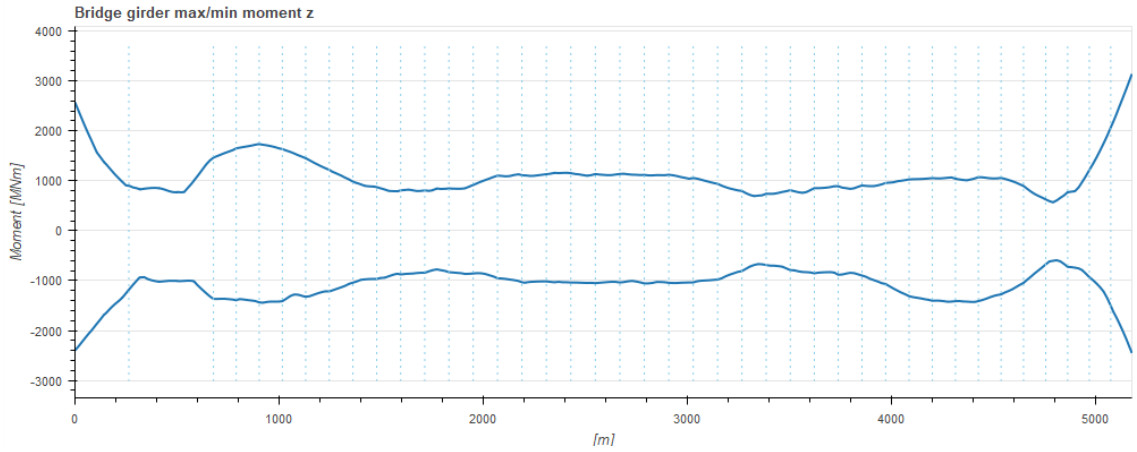




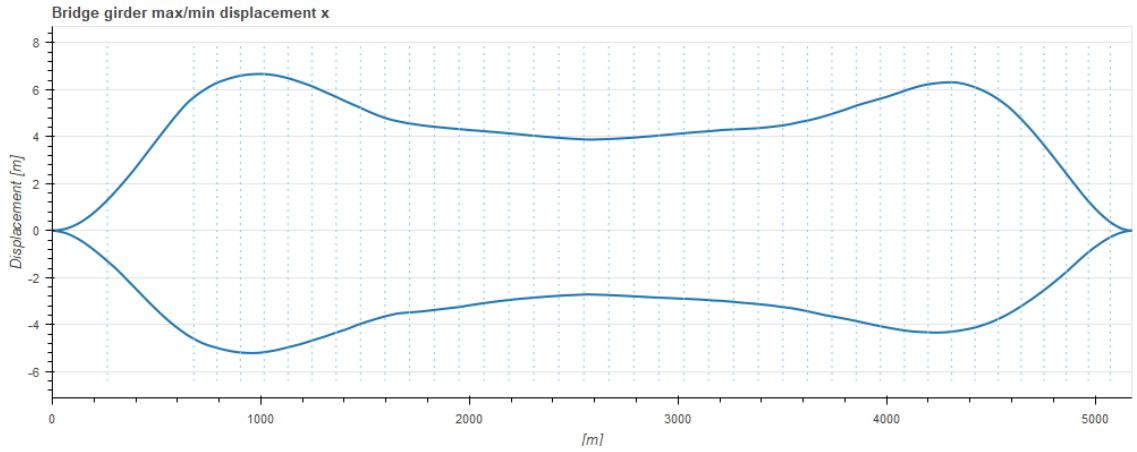
2.4.2 Moments

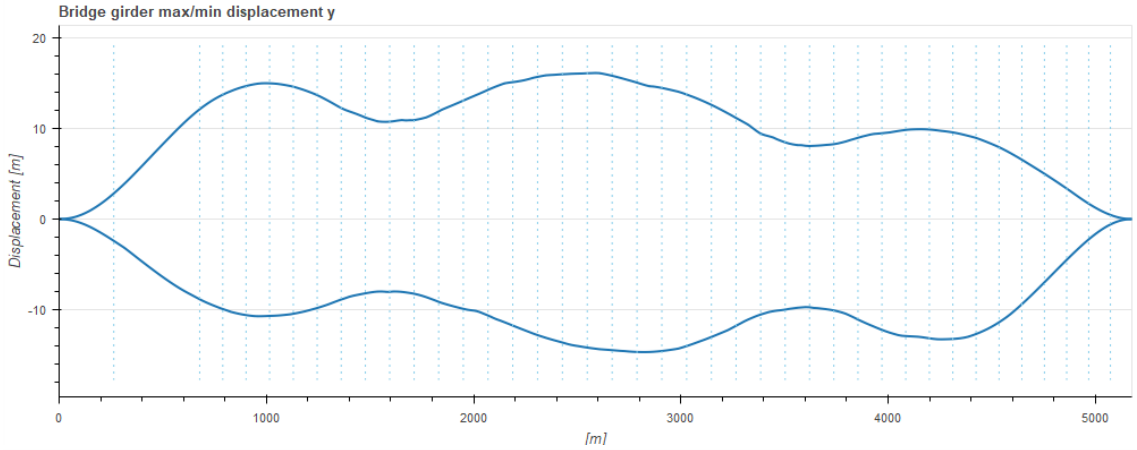

Bridge girder max/min moment x
Moment [MNm]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

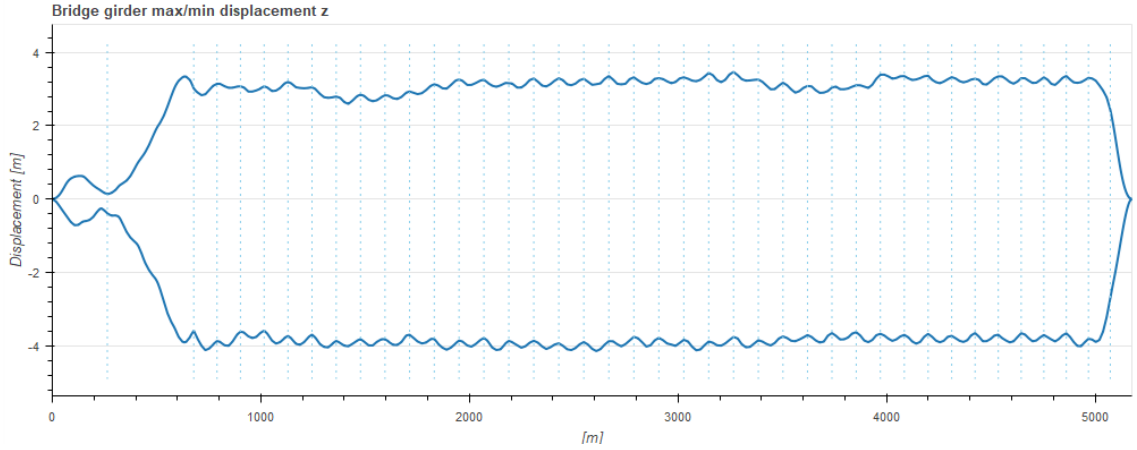

Bridge girder max/min moment y
Moment [MNm]
500
0
-500
-1000
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
4000
3000
2000
1000
0
-1000
-2000
-3000
0
1000
2000
3000
4000
5000
[m]

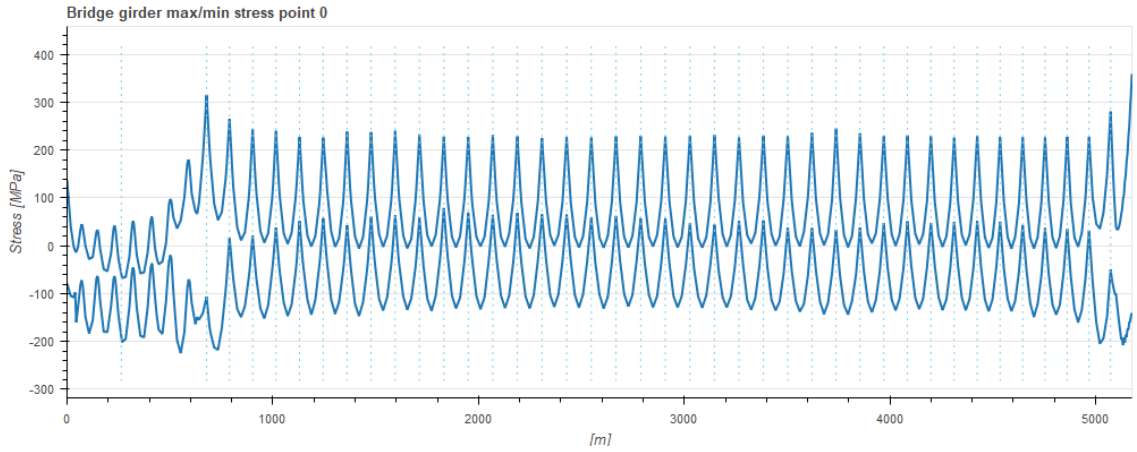
2.4.3 Displacements

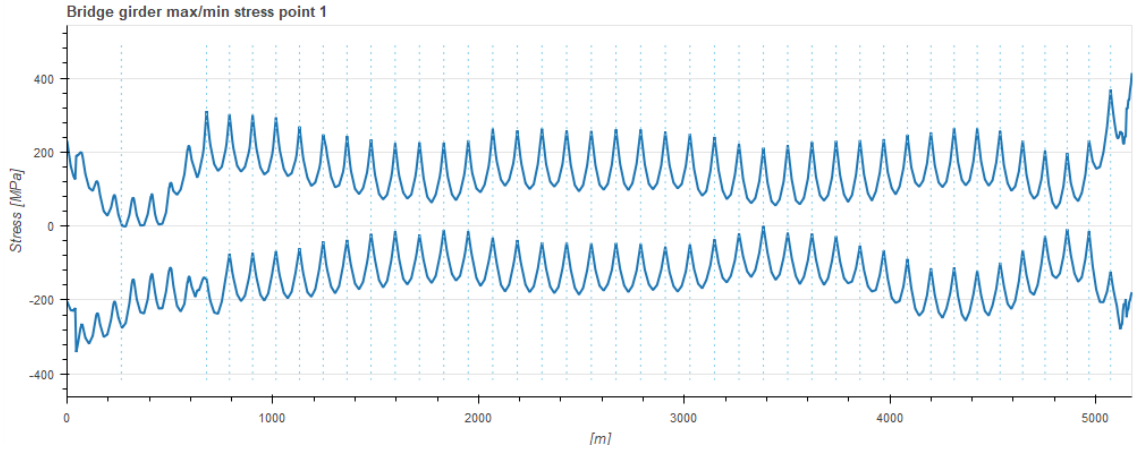


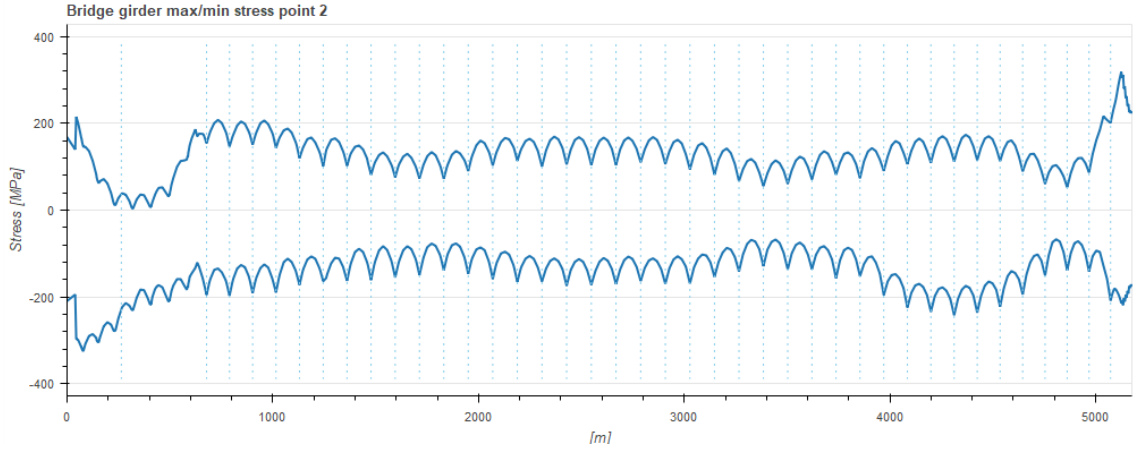


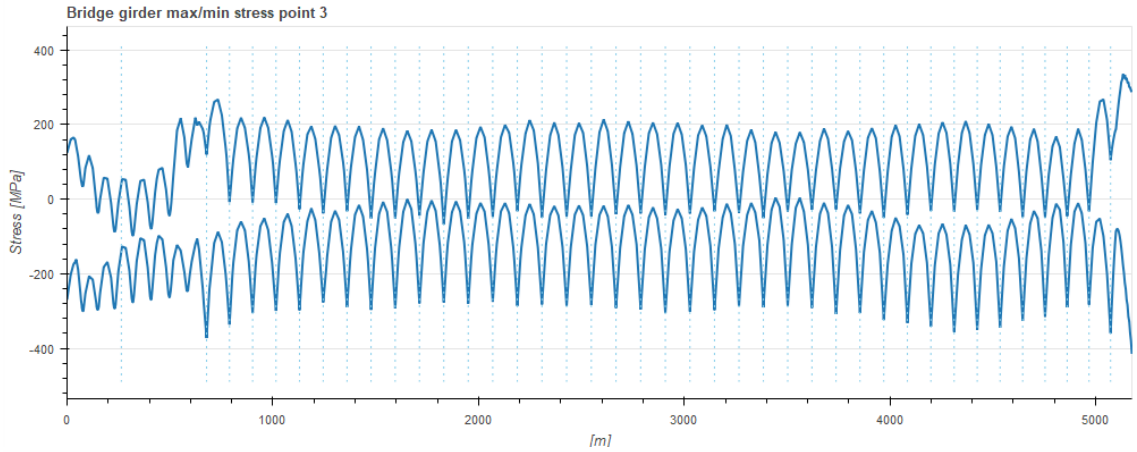


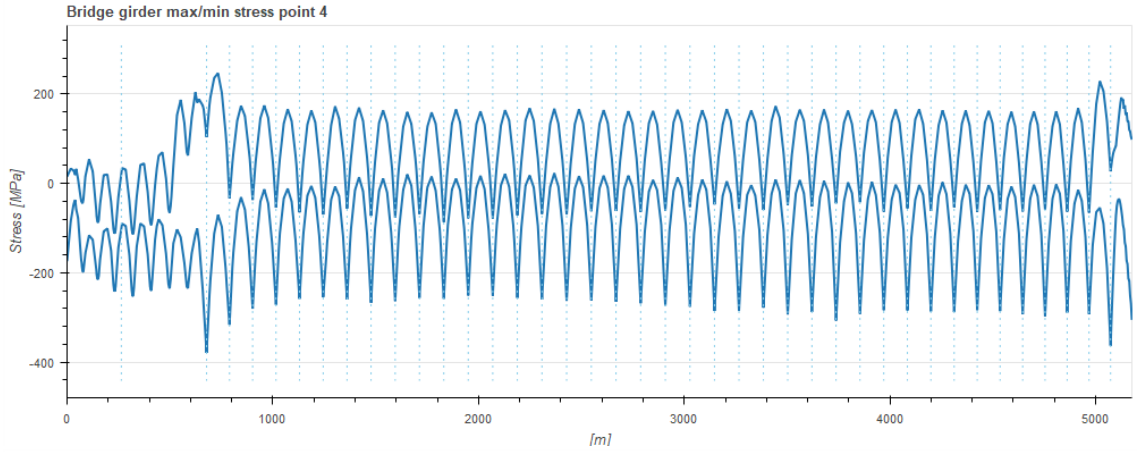
2.4.4 Stresses

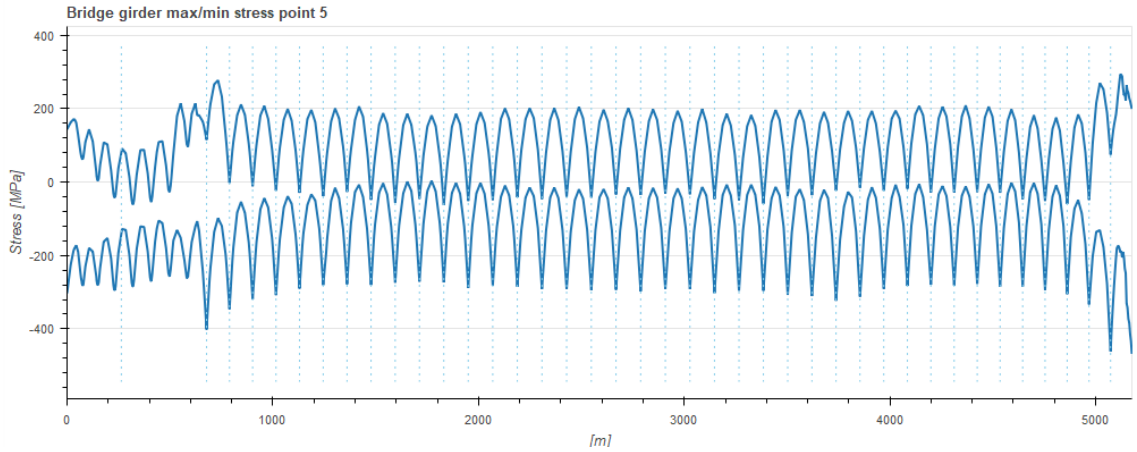


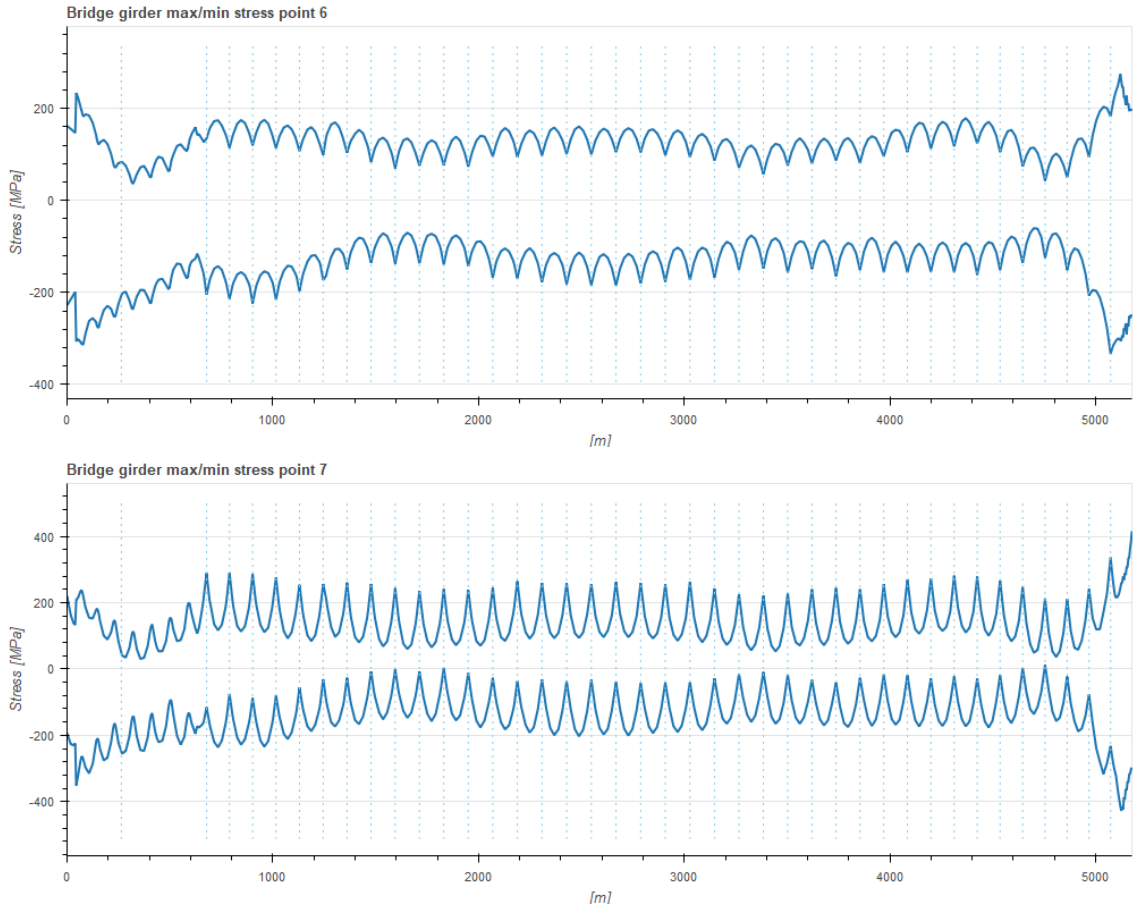





Bridge girder max/min stress point 3
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 5
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 6
Stress [MPa]
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
400
200
0
-200
-400
0
1000
2000
3000
4000
5000
[m]

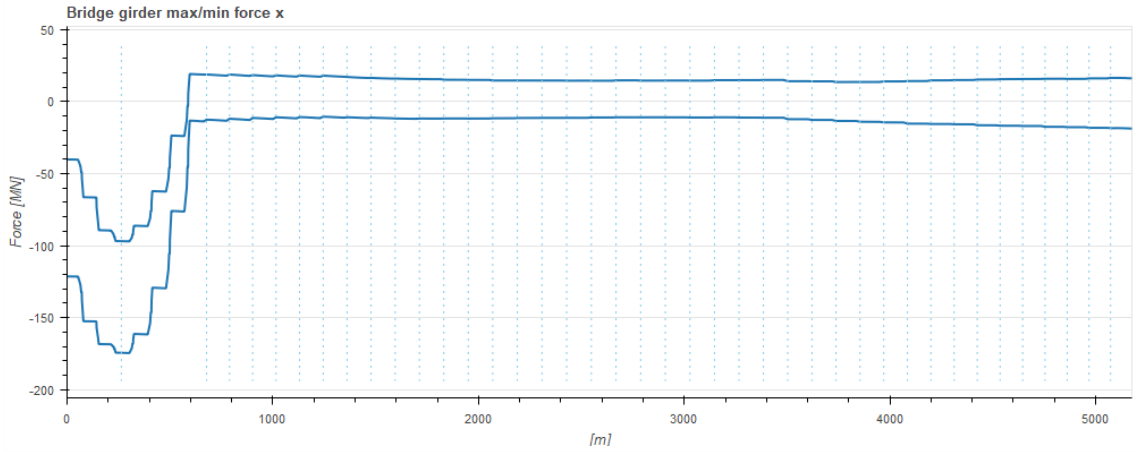
3 SLS RESPONSE

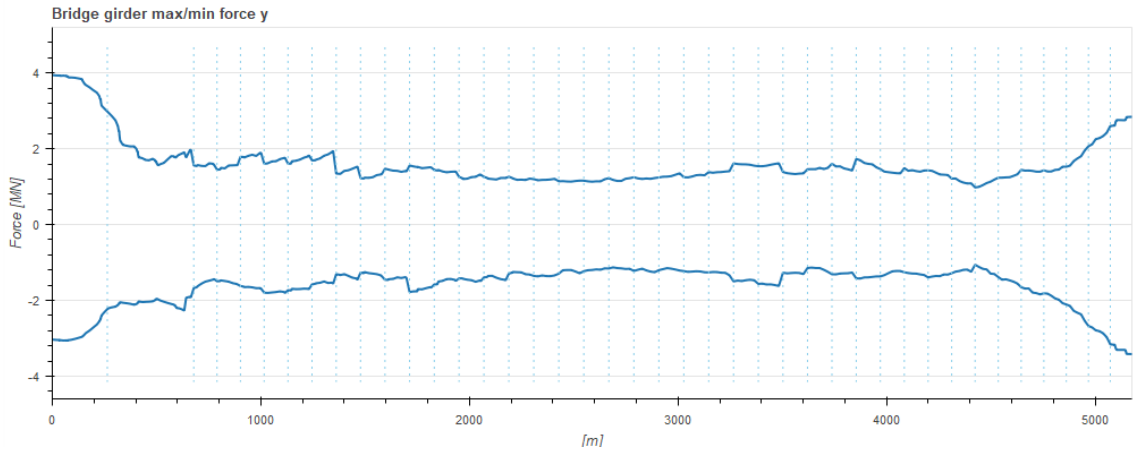
The response can currently be found on the webpage olavolsen.interactive.no [2] for K12 – Model 30. In addition, the most relevant responses are also presented here.

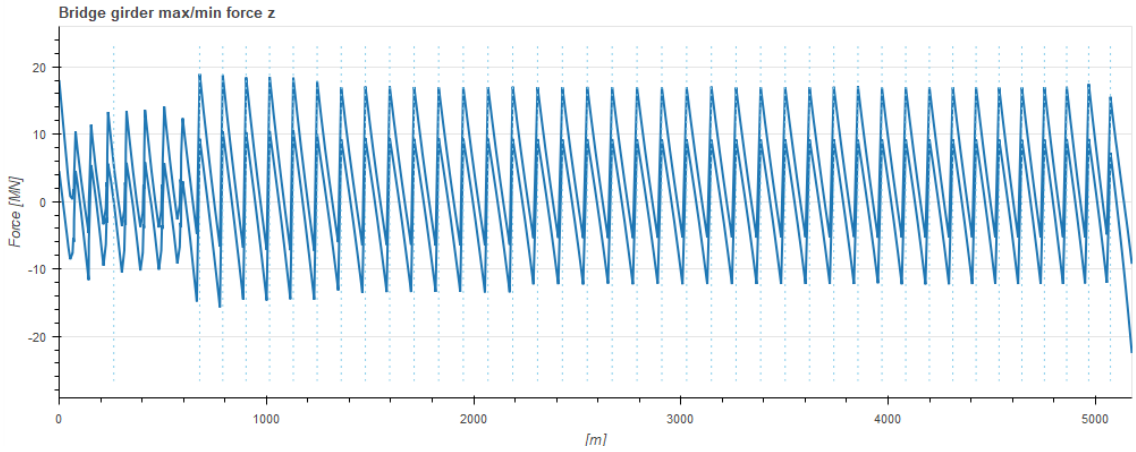
3.1 SLS Characteristic – Traffic load dominating

Response from SLS Characteristic – traffic load dominating is presented here. The loads are presented in [3] and correspond to COMB 21 on olavolsen.interactive.no [2].

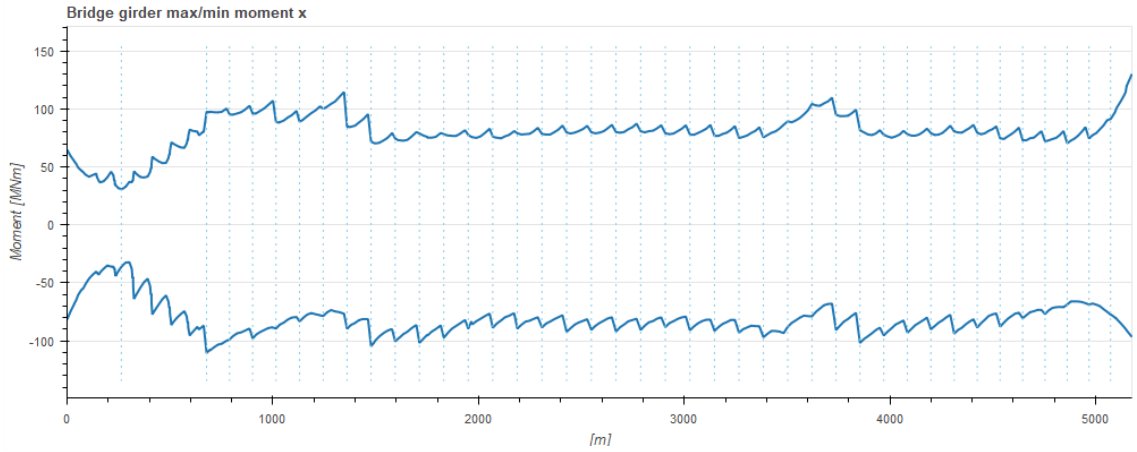
3.1.1 Forces

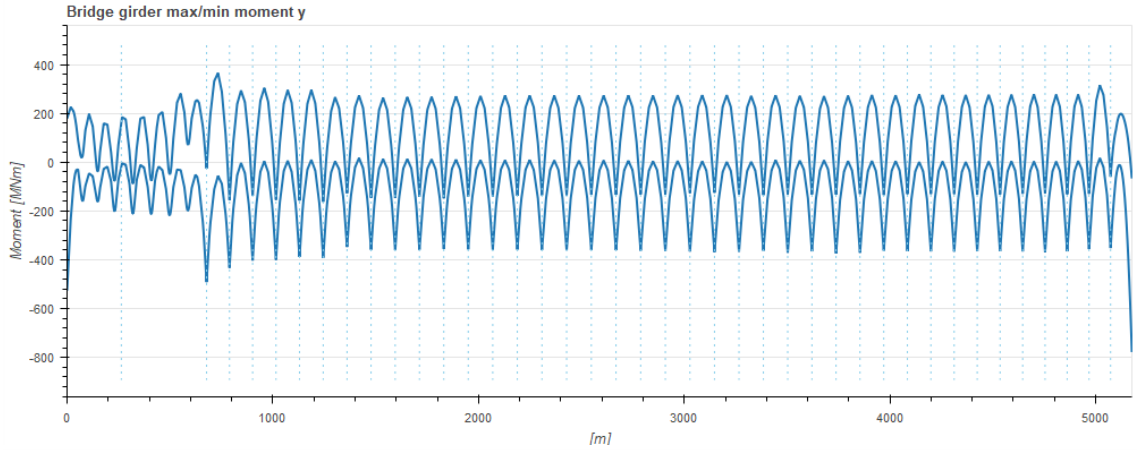


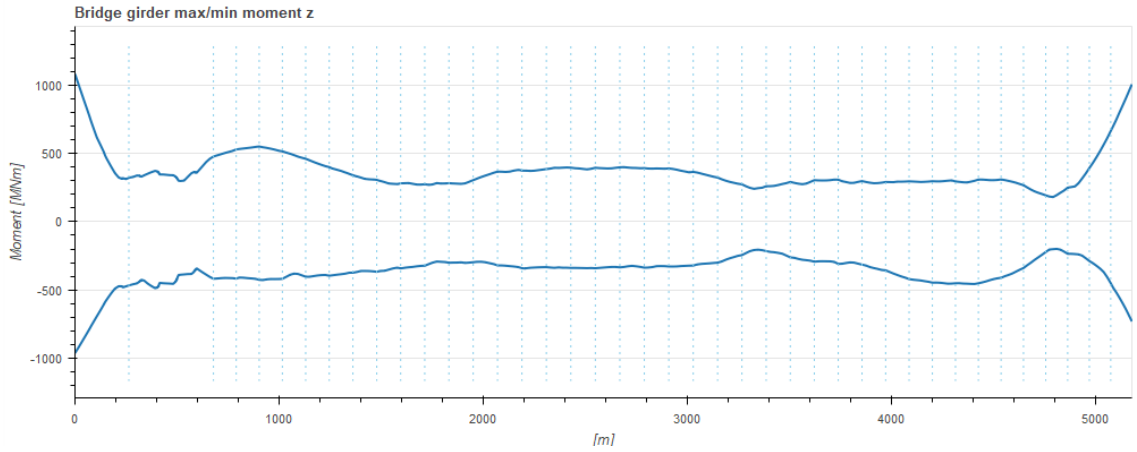




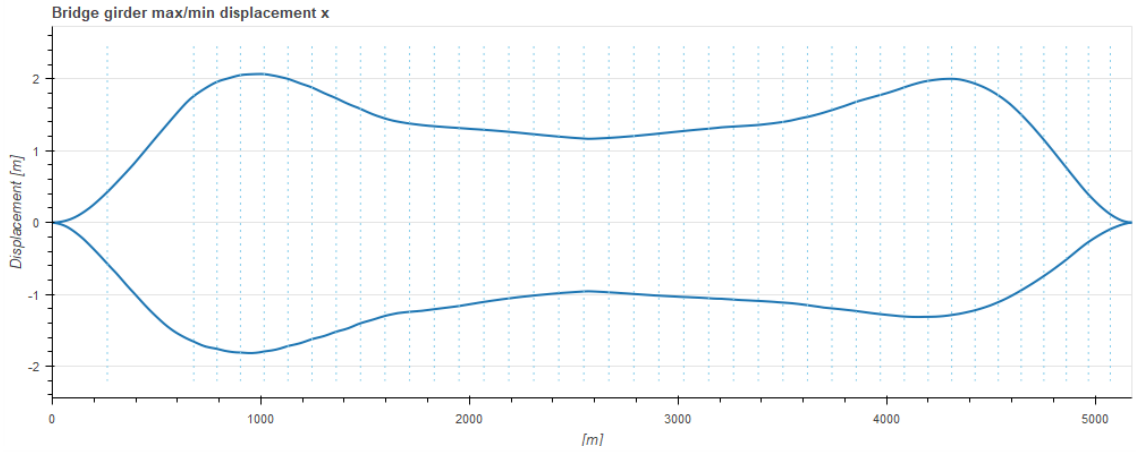
3.1.2 Moments

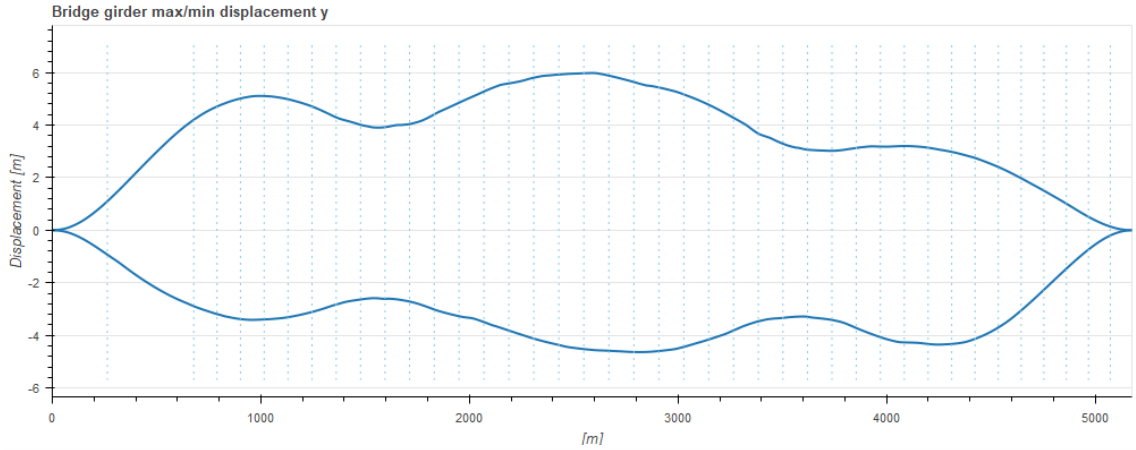

Bridge girder max/min moment x
Moment [MNm]
150
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

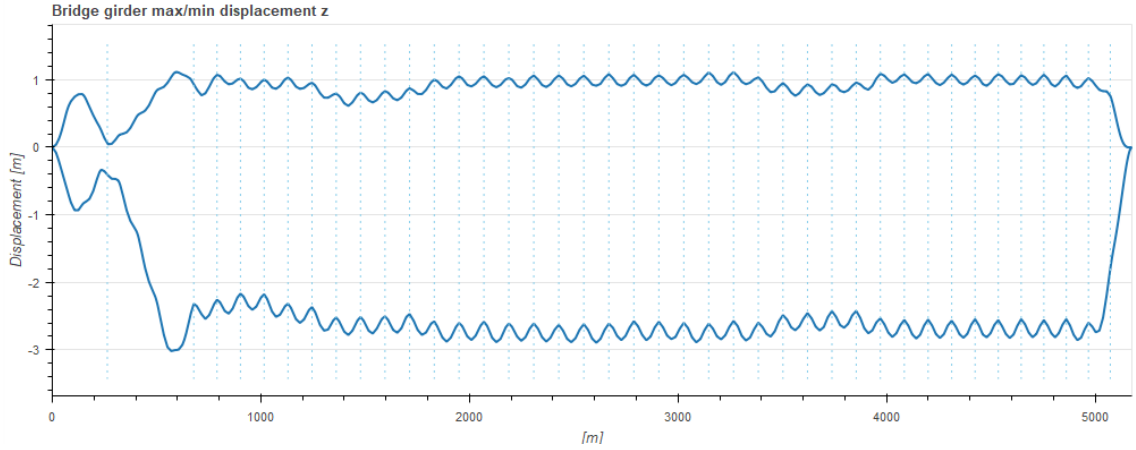

Bridge girder max/min moment y
Moment [MNm]
400
200
0
-200
-400
-600
-800
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
1000
500
0
-500
-1000
0
1000
2000
3000
4000
5000
[m]

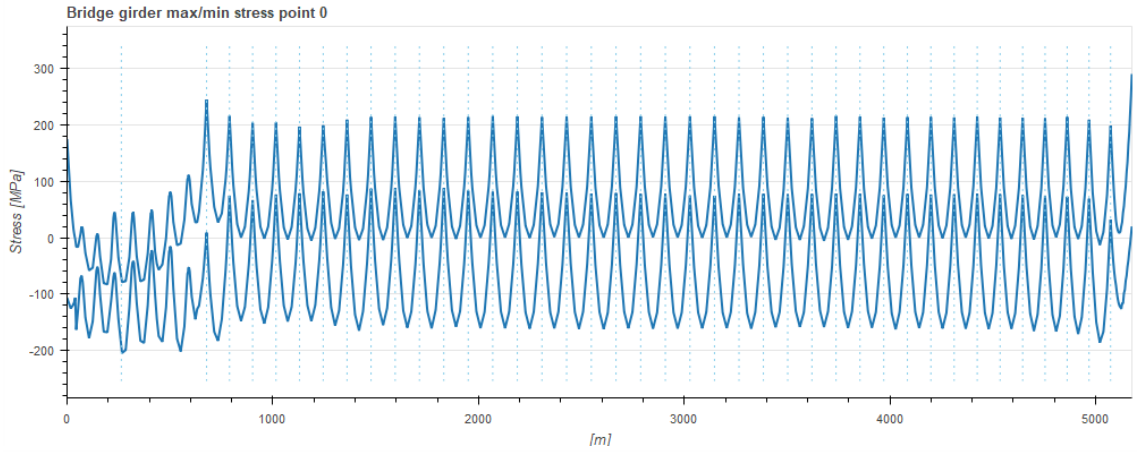
3.1.3 Displacements

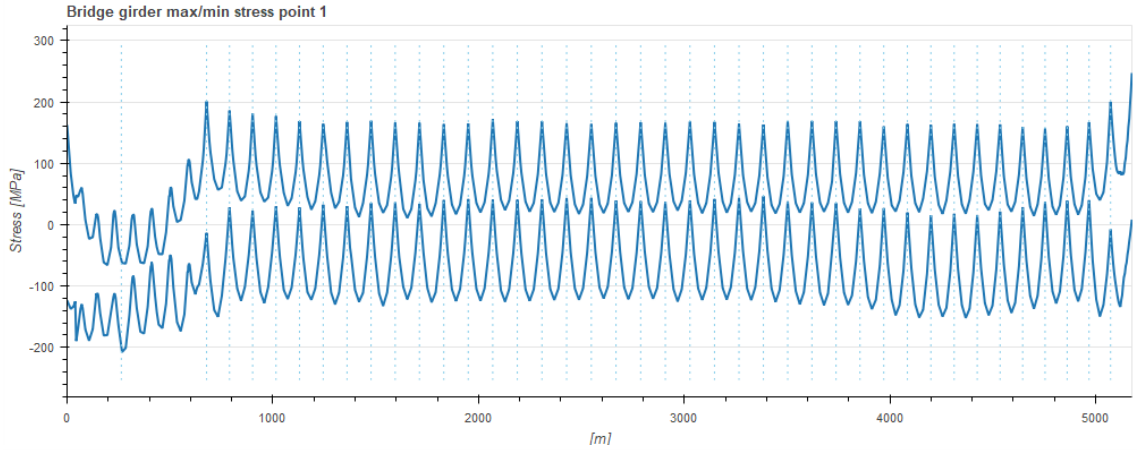


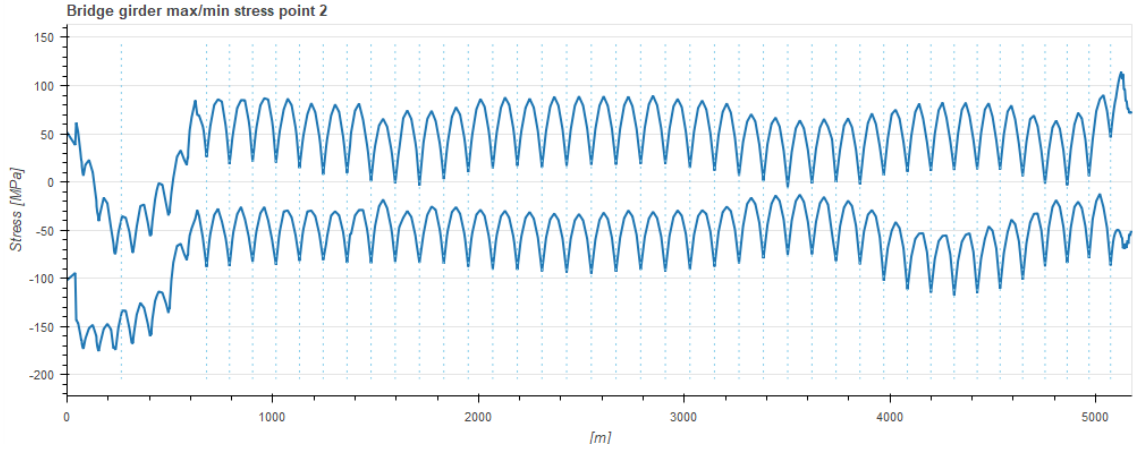


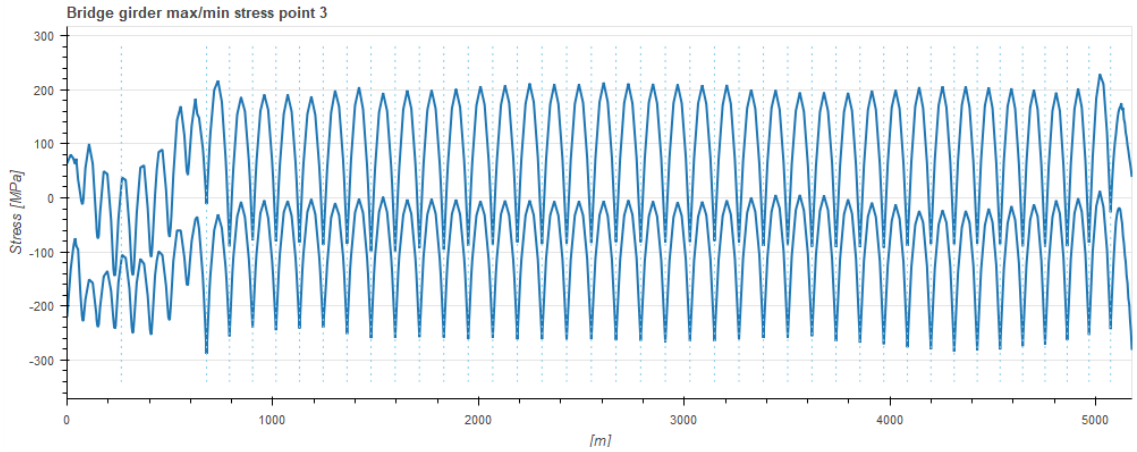


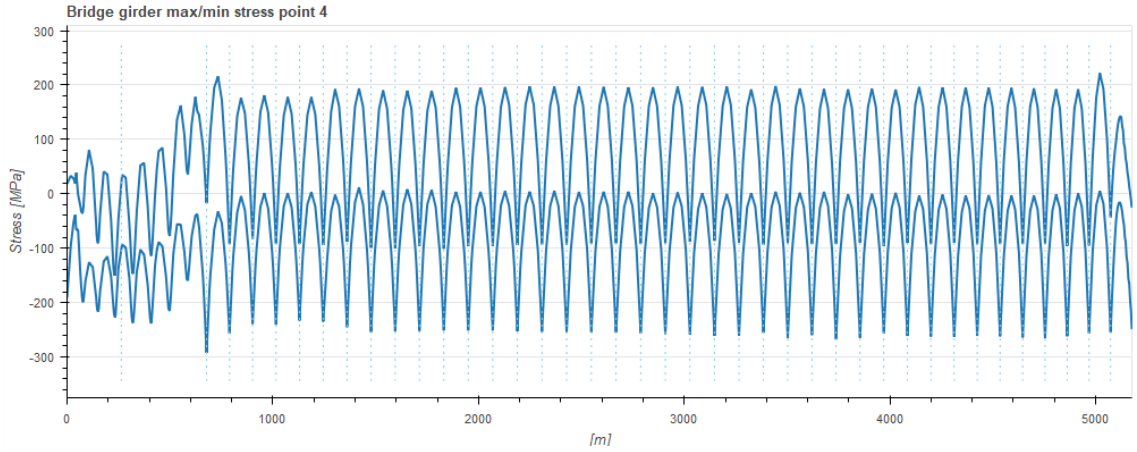
3.1.4 Stresses

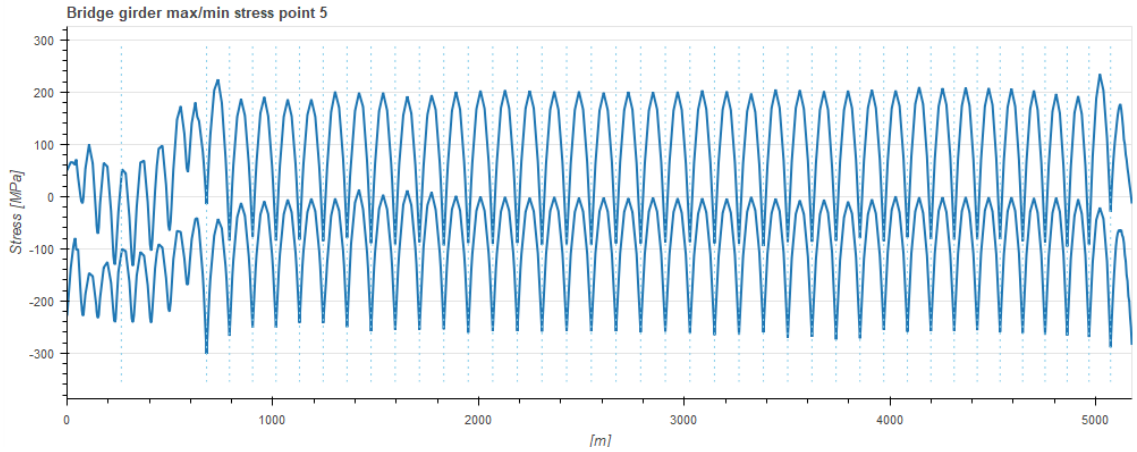


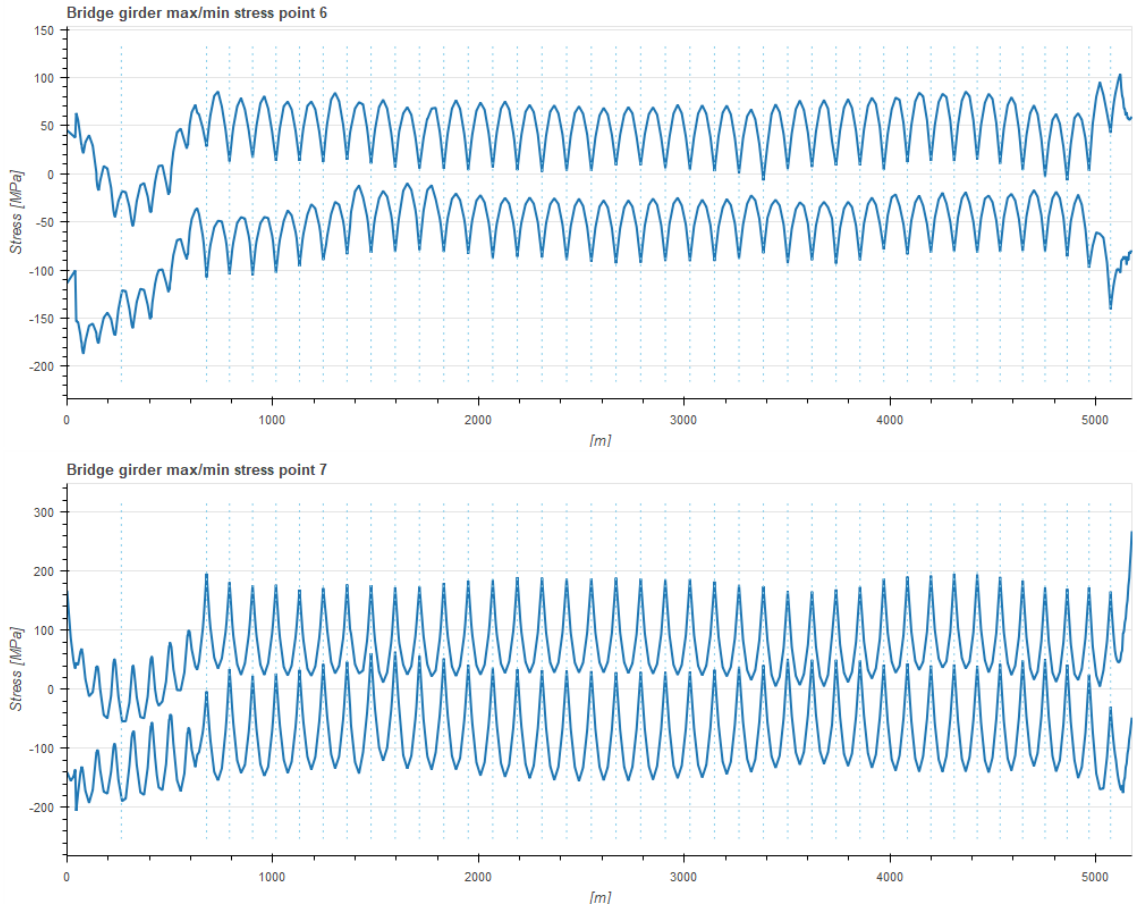





Bridge girder max/min stress point 3
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

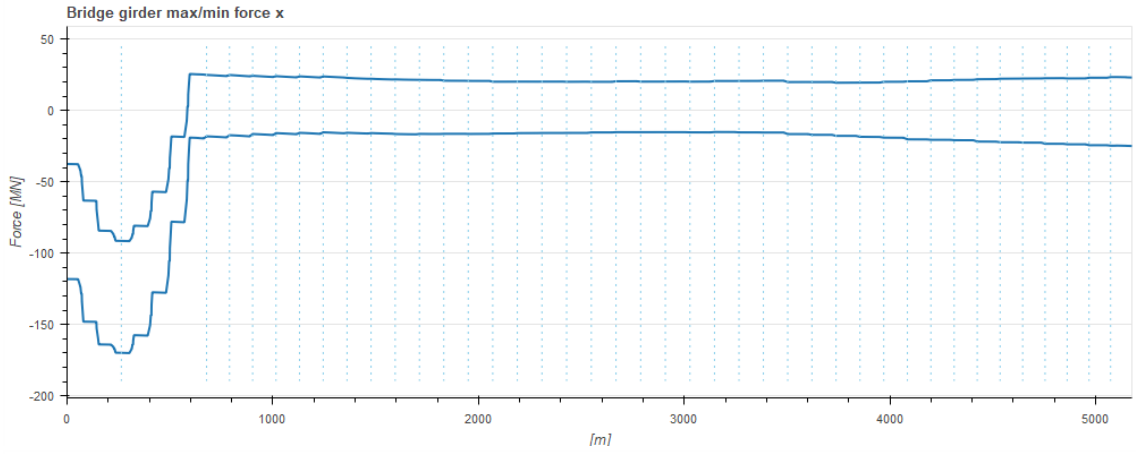

Bridge girder max/min stress point 5
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

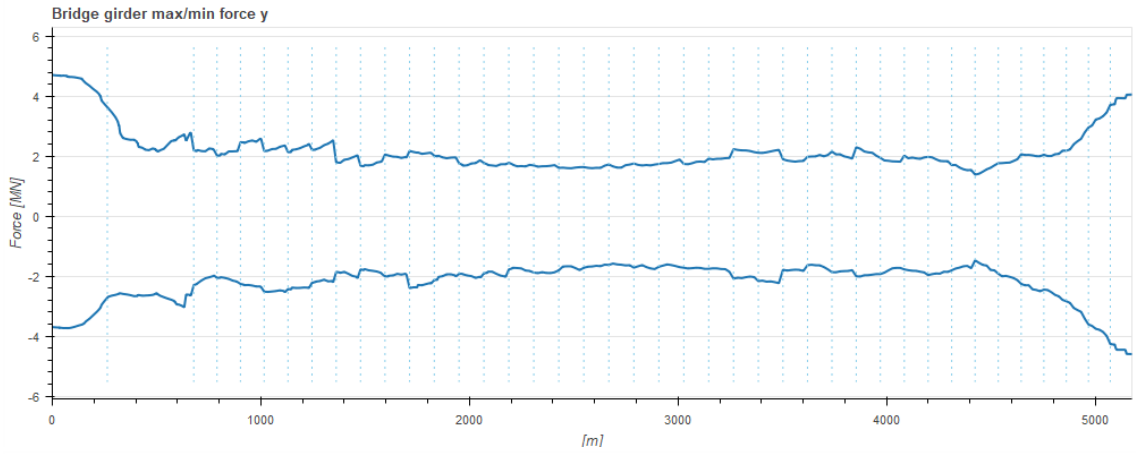

Bridge girder max/min stress point 6
Stress [MPa]
150
100
50
0
-50
-100
-150
-200
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
300
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

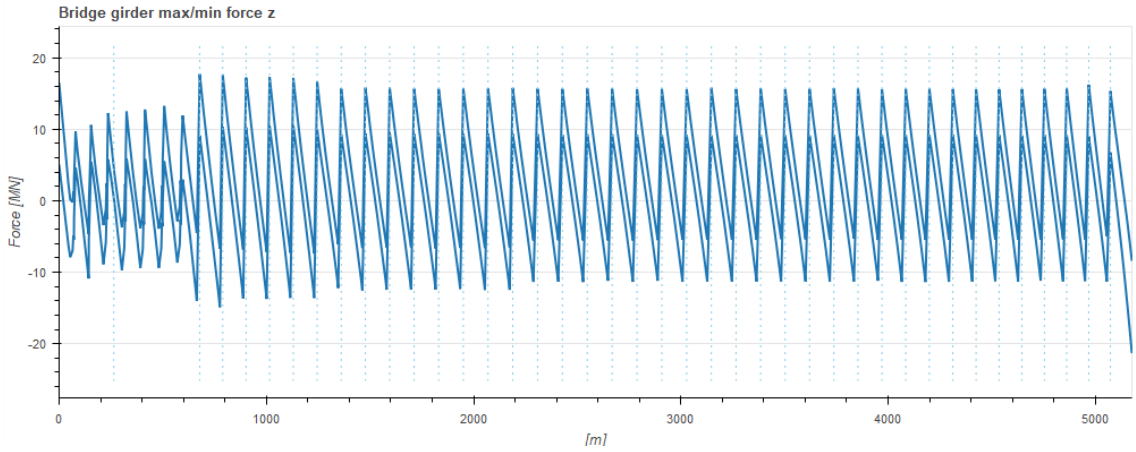
3.2 SLS Characteristic – 1 year conditions with traffic

Response from SLS Characteristic – 1 year conditions with traffic is presented here. The loads are presented in [3] and correspond to COMB 22 on olavolsen.interactive.no [2].

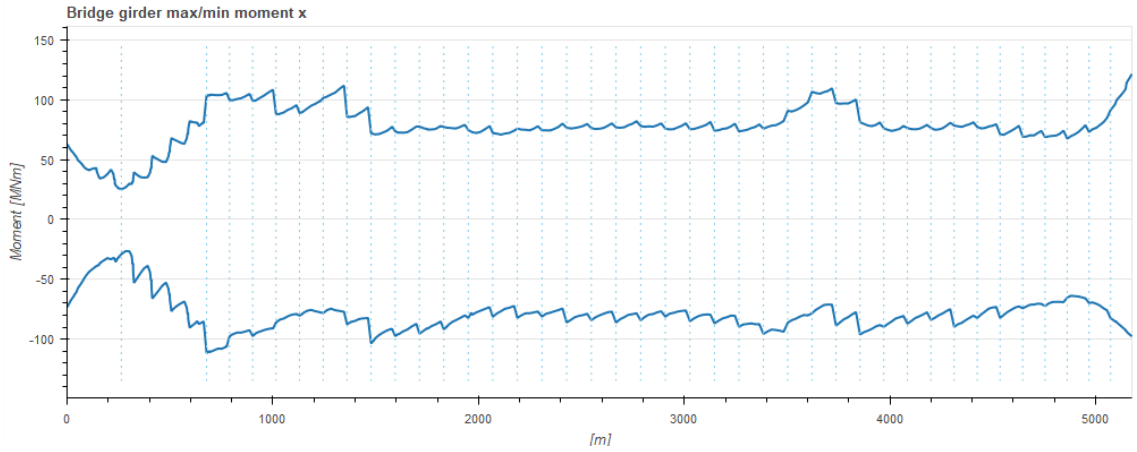
3.2.1 Forces

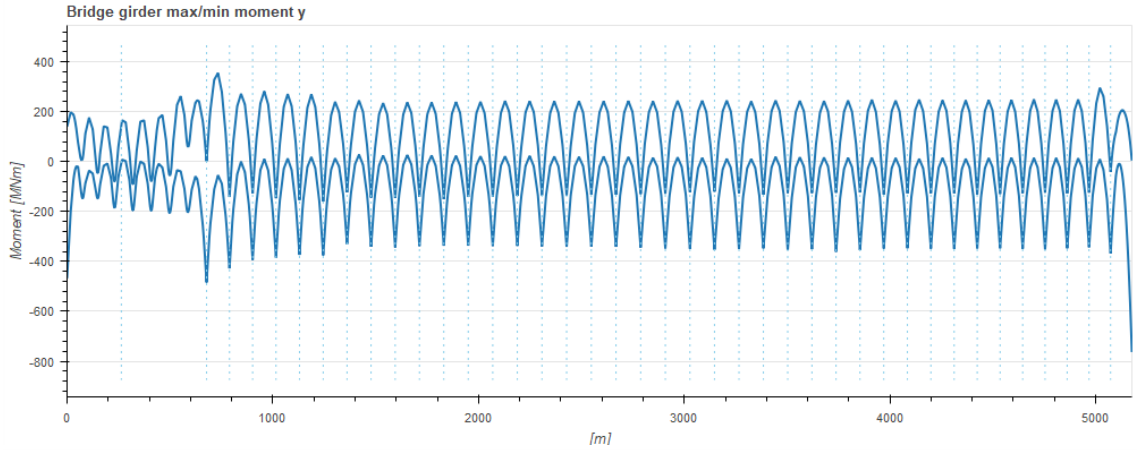


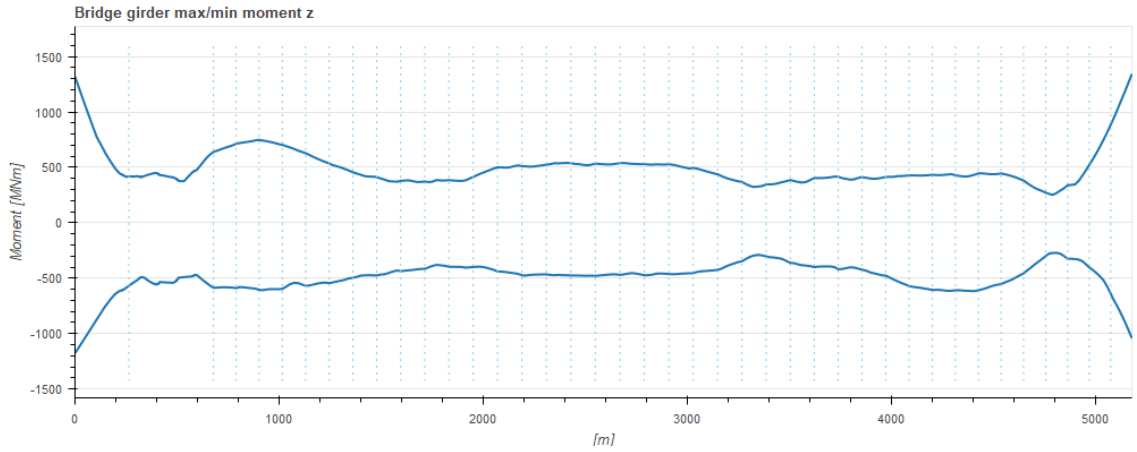




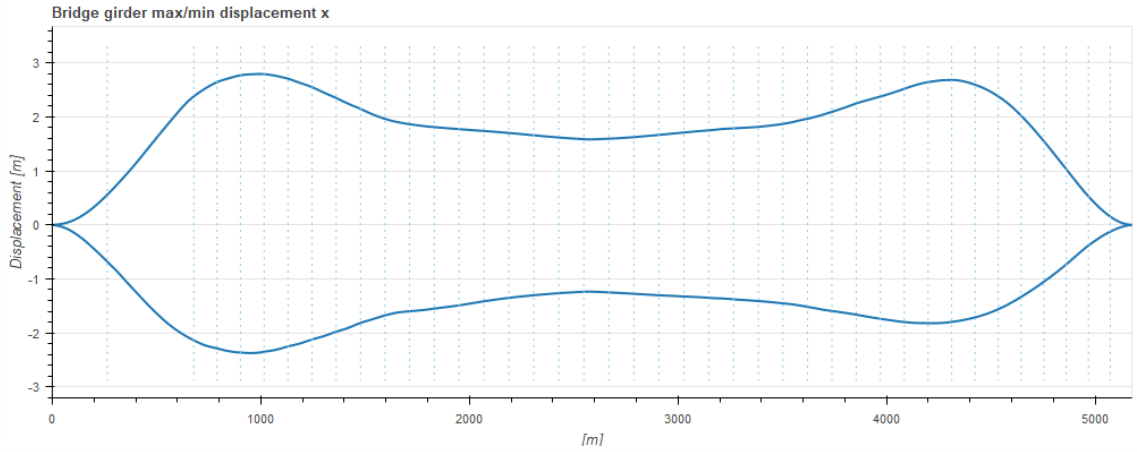
3.2.2 Moments

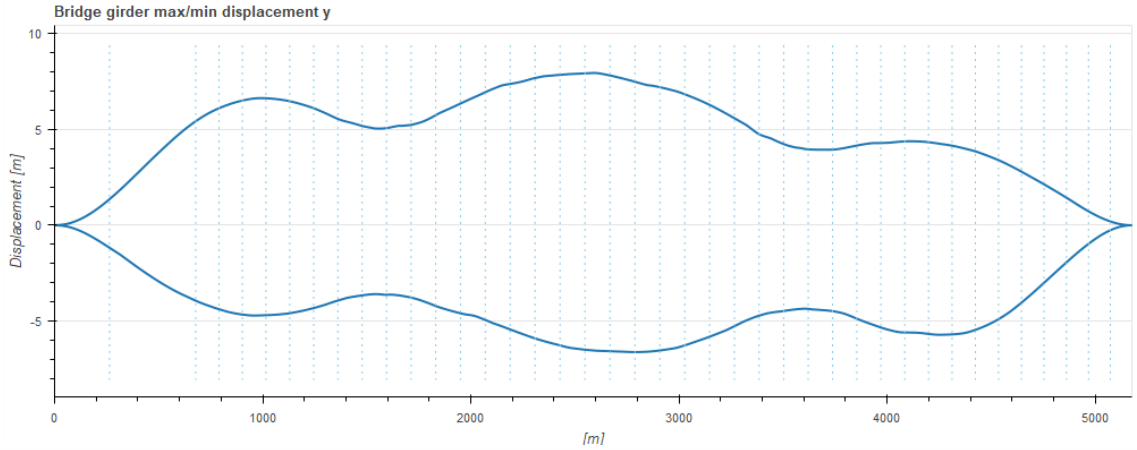

Bridge girder max/min moment x
Moment [MNm]
150
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

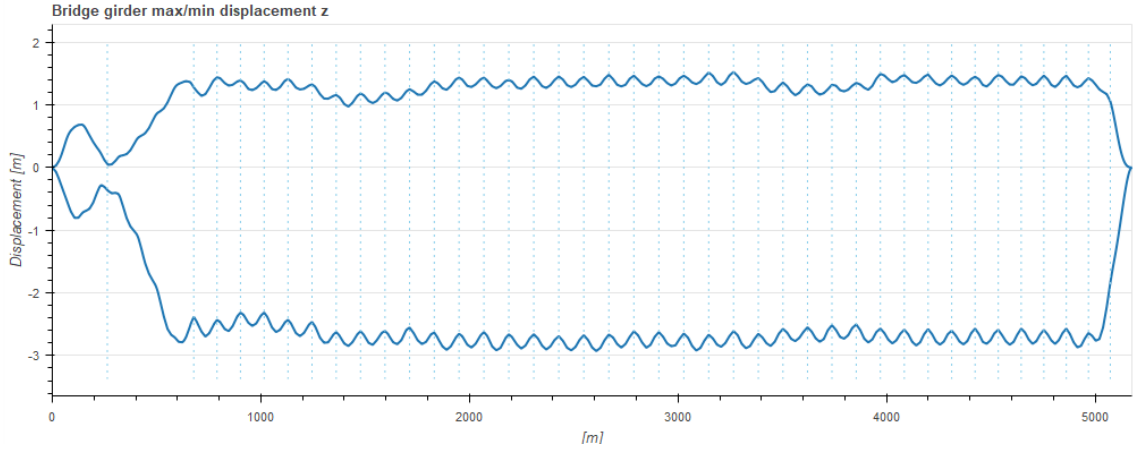

Bridge girder max/min moment y
Moment [MNm]
400
200
0
-200
-400
-600
-800
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
1500
1000
500
0
-500
-1000
-1500
0
1000
2000
3000
4000
5000
[m]

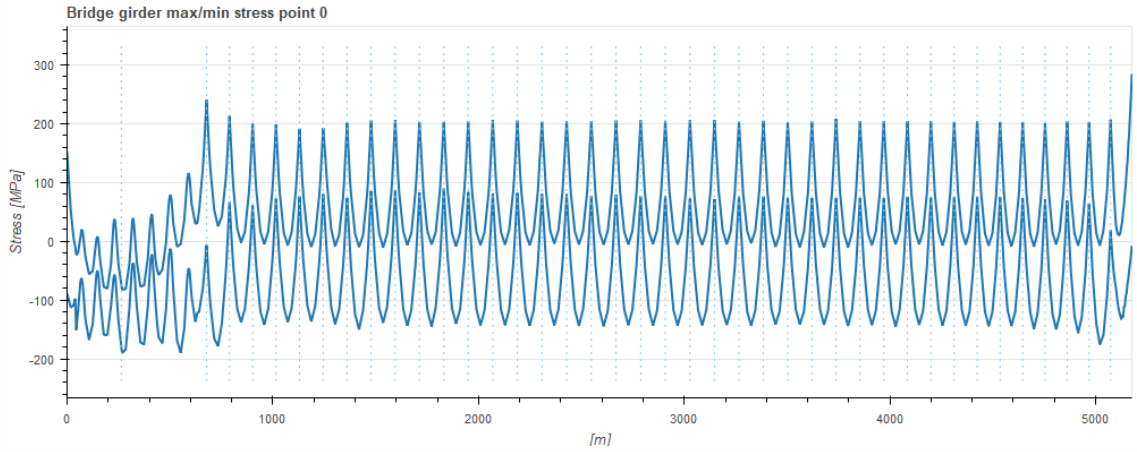
3.2.3 Displacements

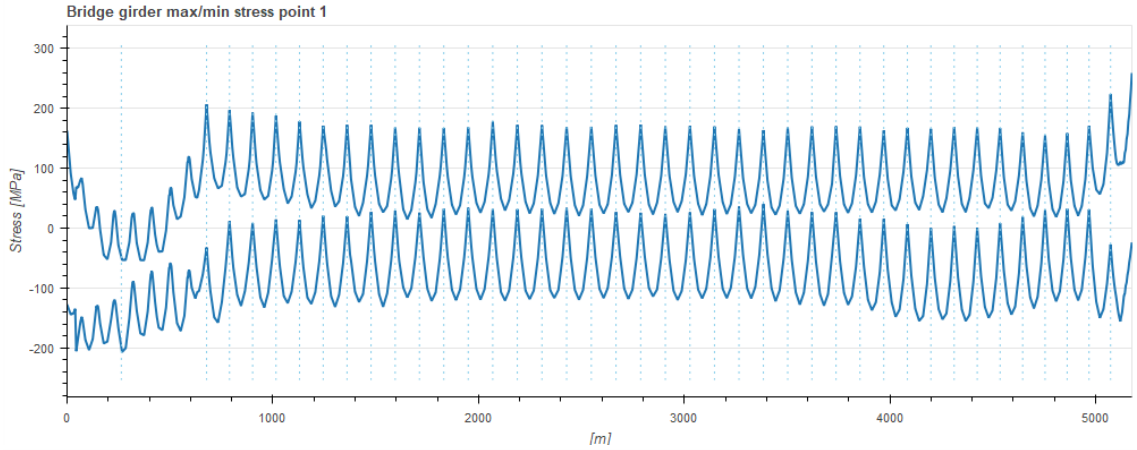


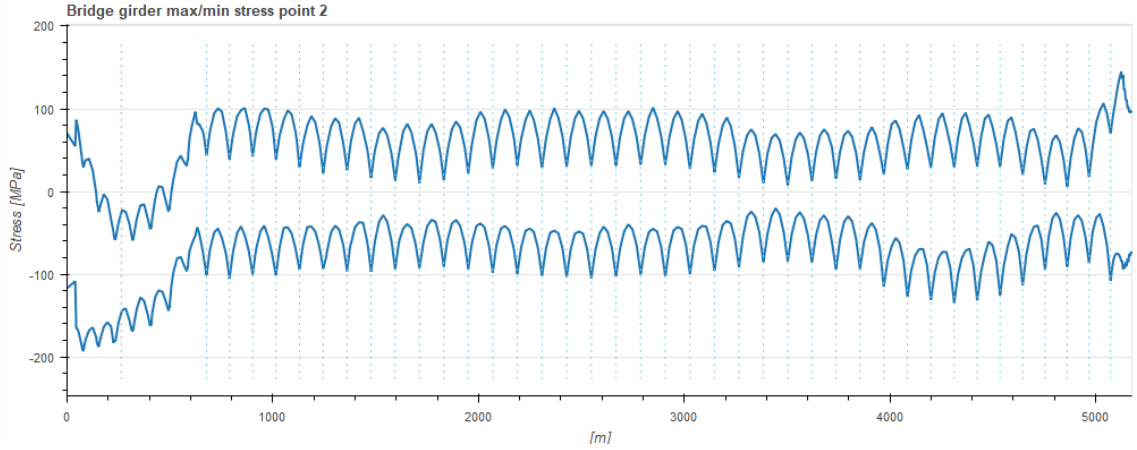


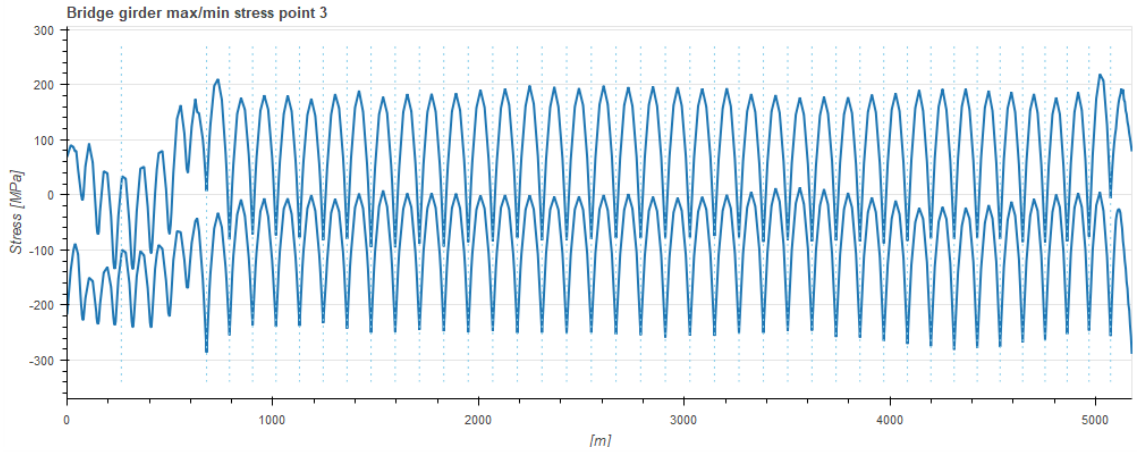


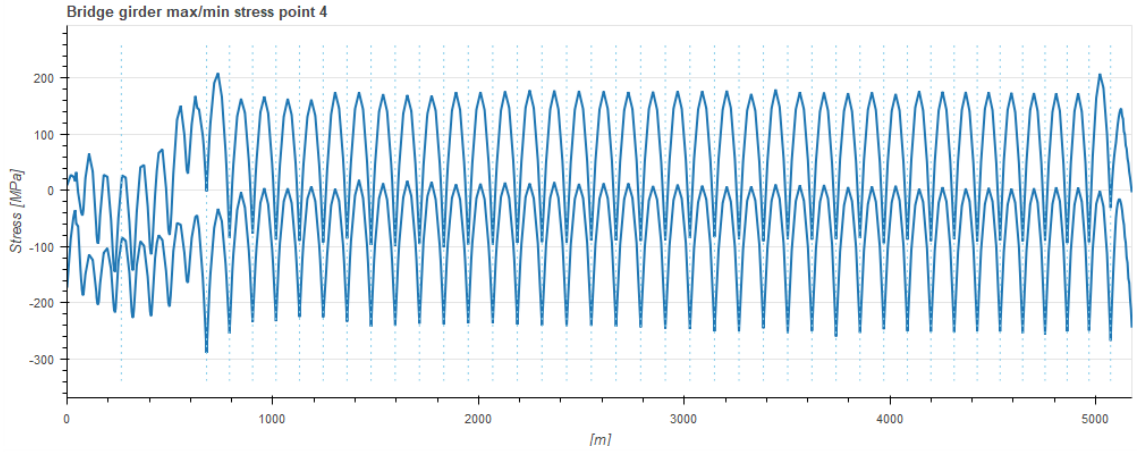
3.2.4 Stresses

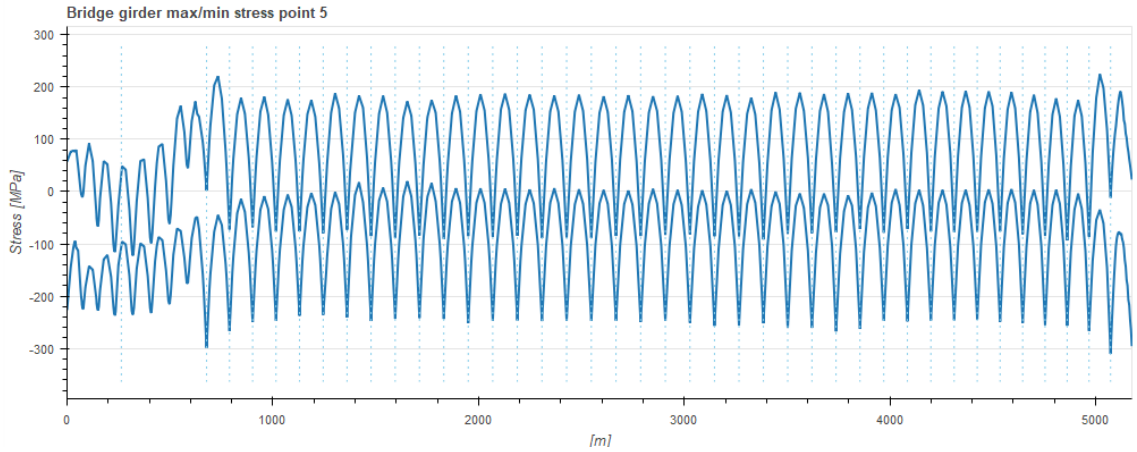


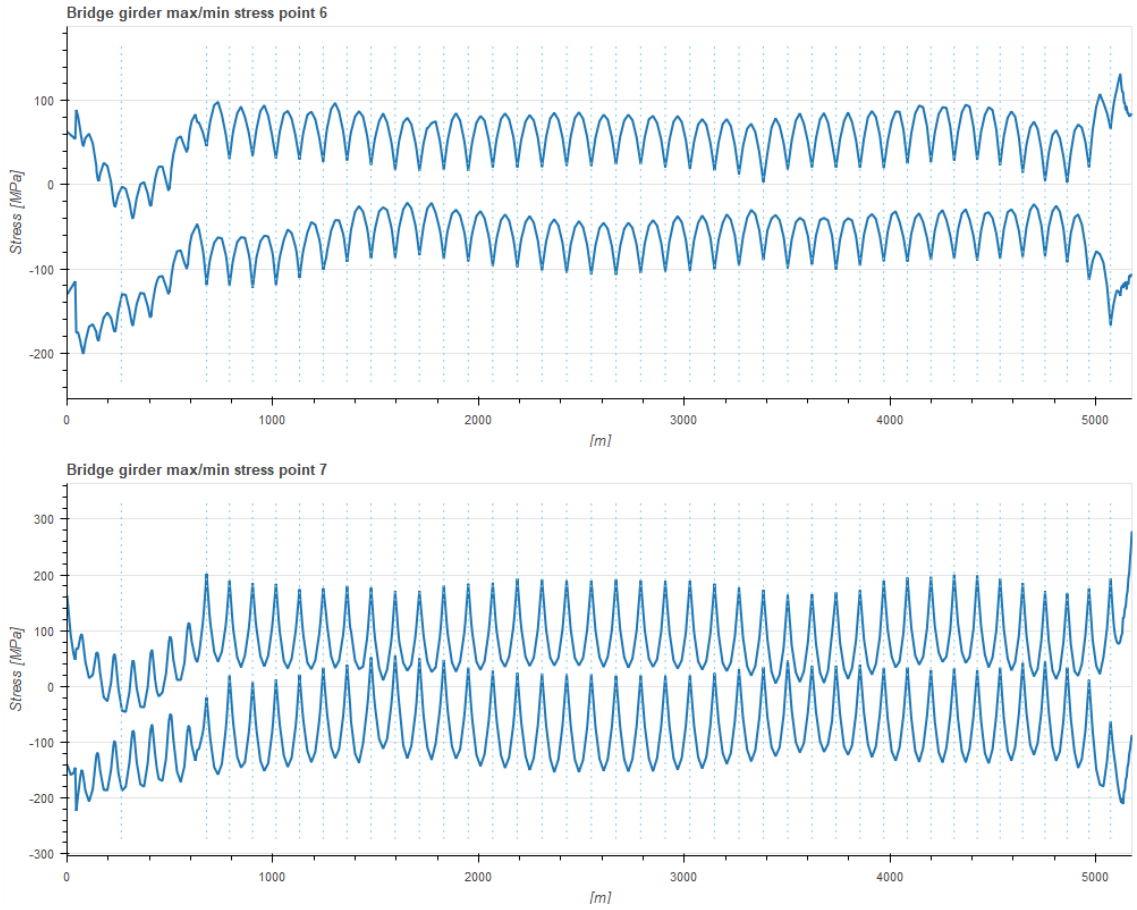





Bridge girder max/min stress point 3
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

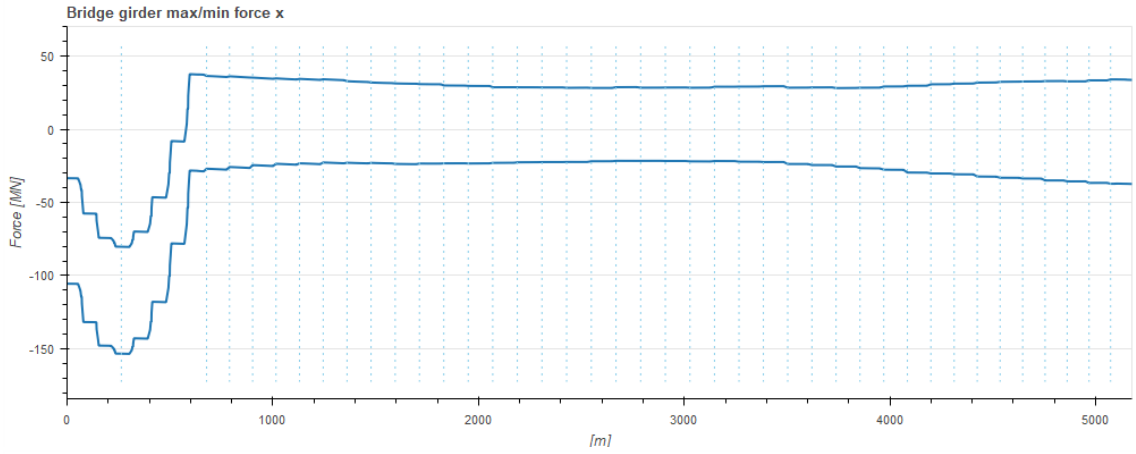

Bridge girder max/min stress point 5
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

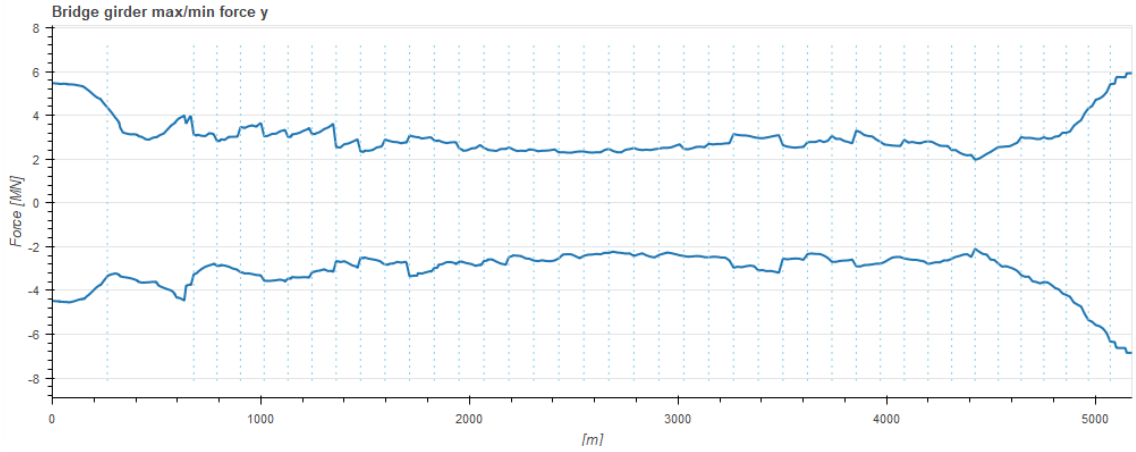

Bridge girder max/min stress point 6
Stress [MPa]
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

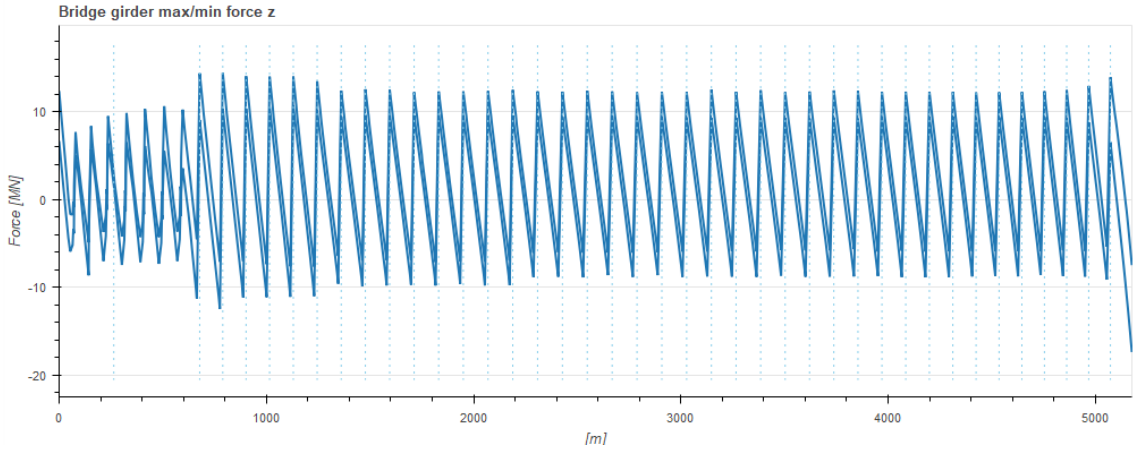
3.3 SLS Characteristic – 100 year conditions

Response from SLS Characteristic – 100 year conditions is presented here. The loads are presented in [3] and correspond to COMB 23 on olavolsen.interactive.no [2].

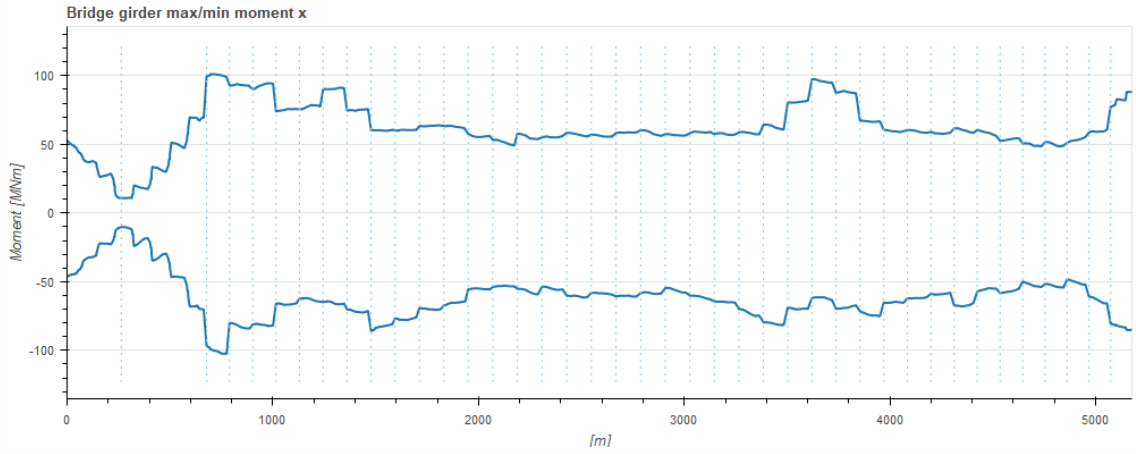
3.3.1 Forces

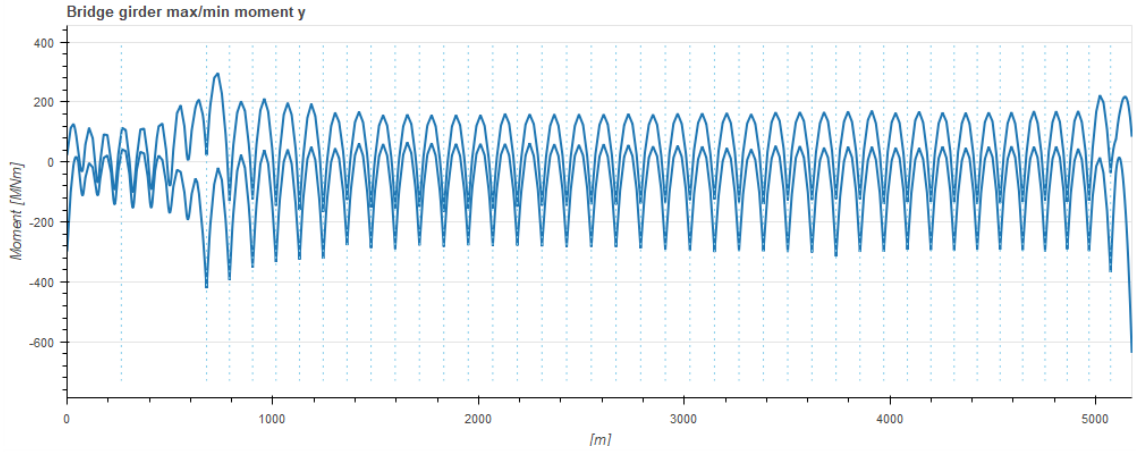


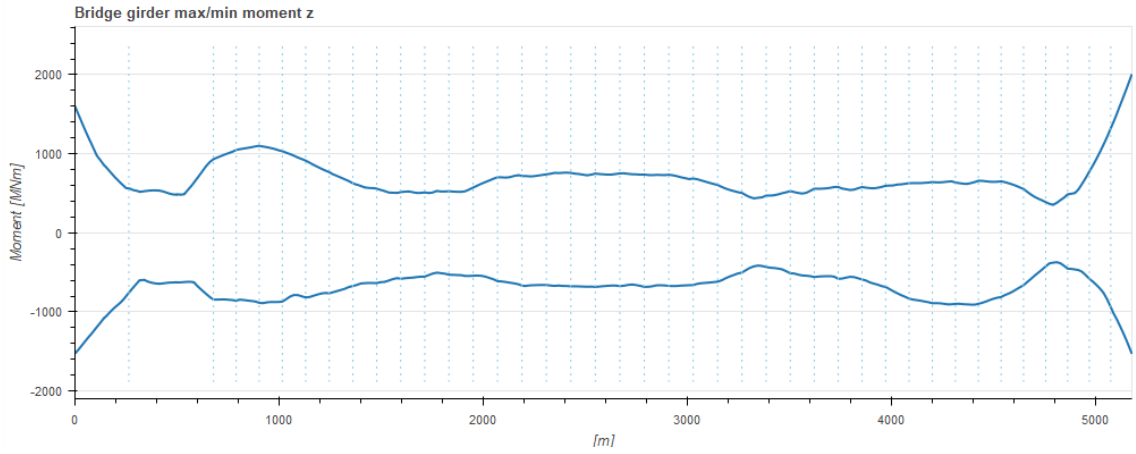




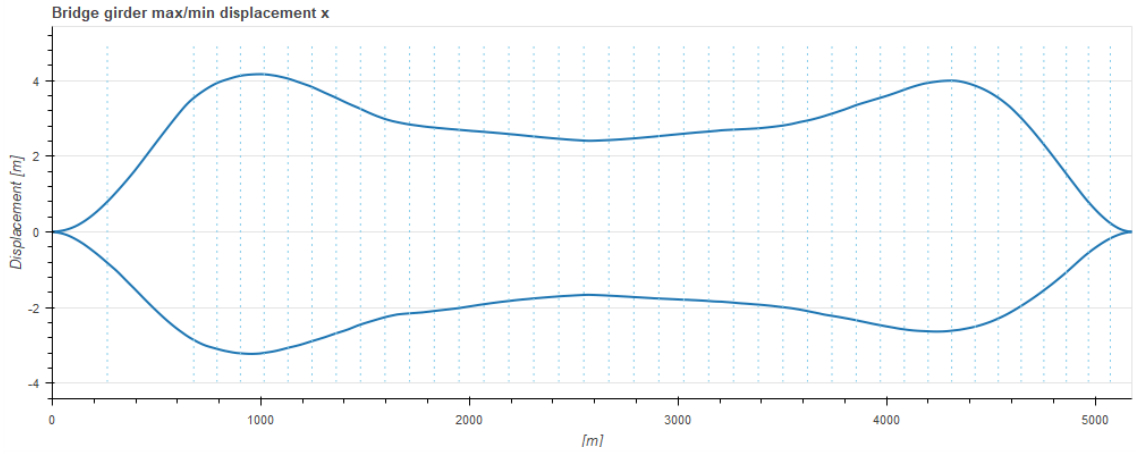
3.3.2 Moments

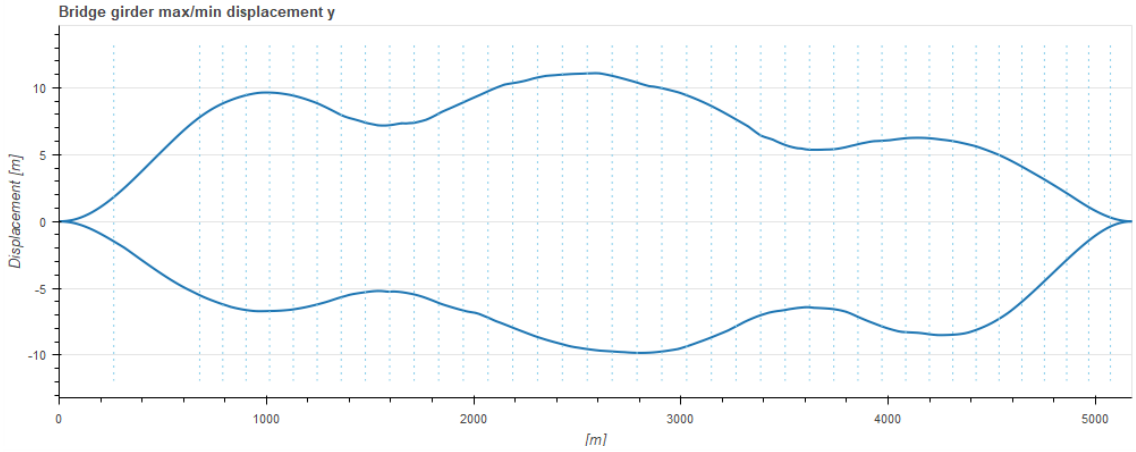

Bridge girder max/min moment x
Moment [MNm]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

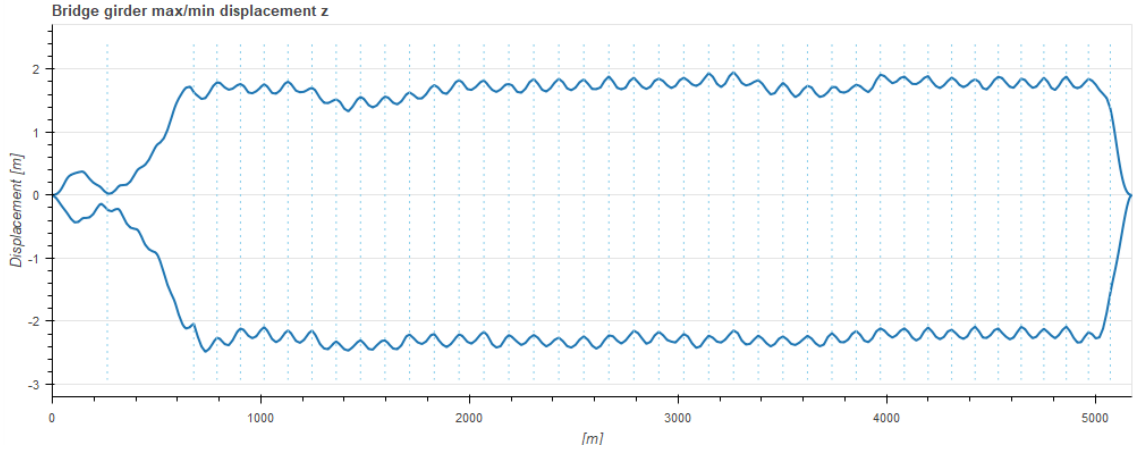

Bridge girder max/min moment y
Moment [MNm]
400
200
0
-200
-400
-600
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
2000
1000
0
-1000
-2000
0
1000
2000
3000
4000
5000
[m]

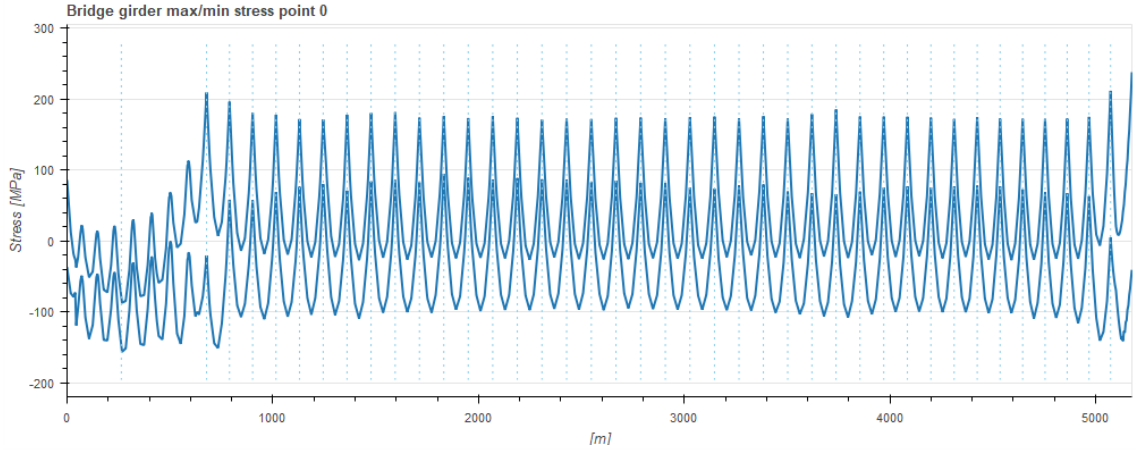
3.3.3 Displacements

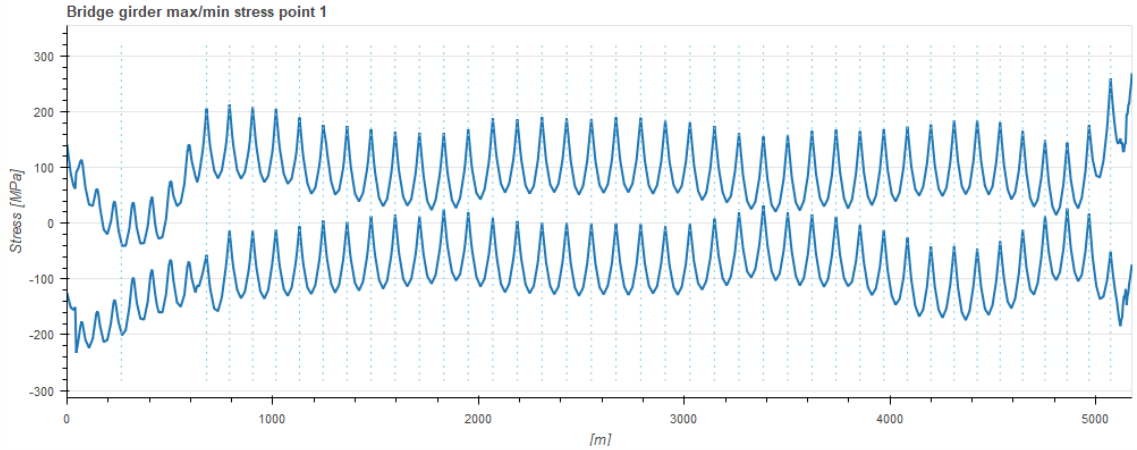


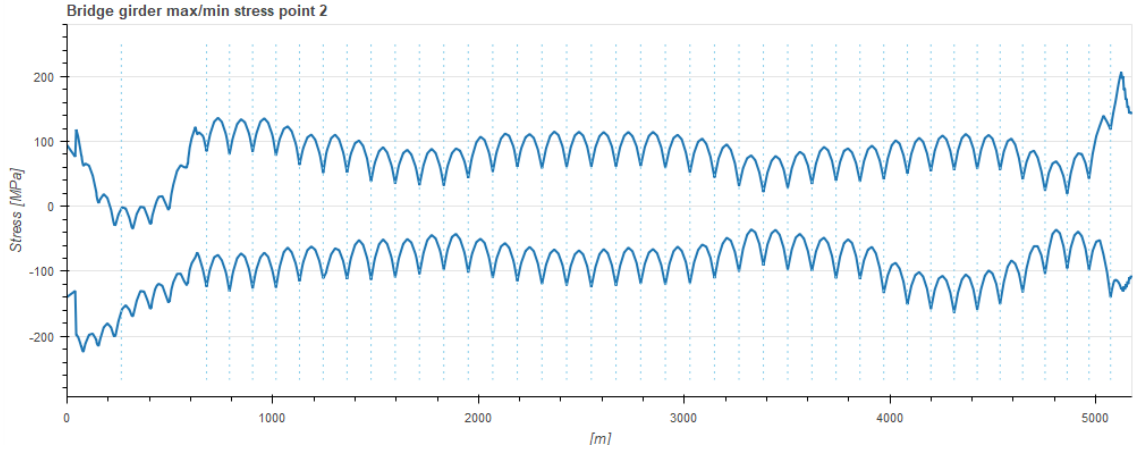


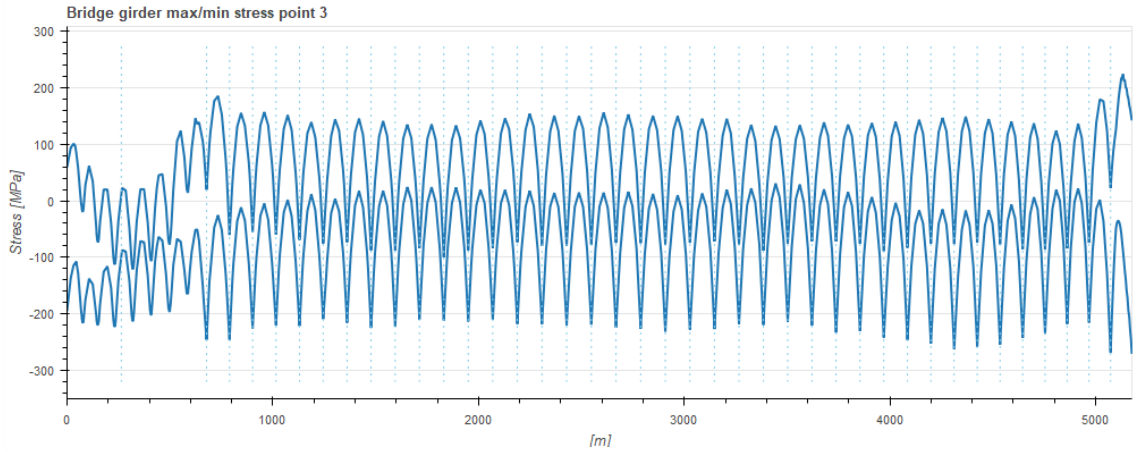


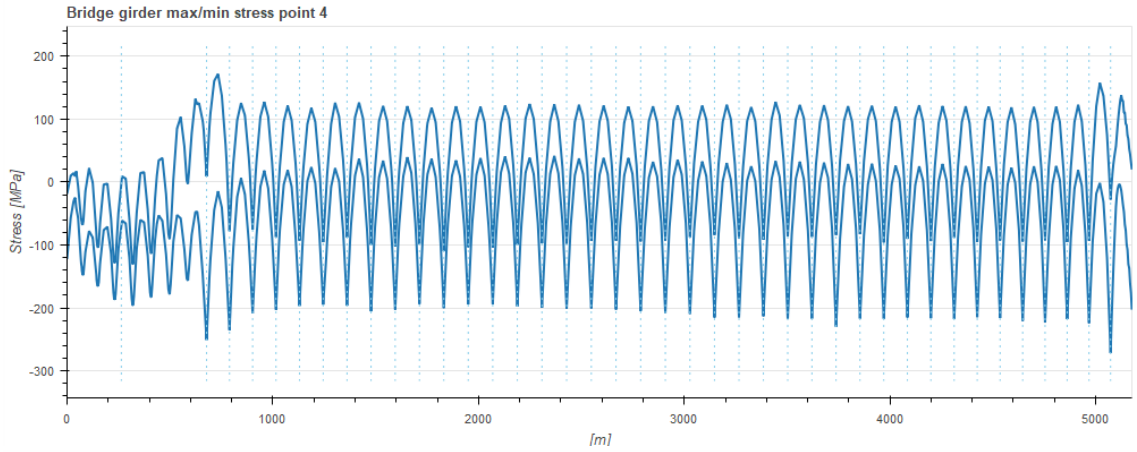
3.3.4 Stresses

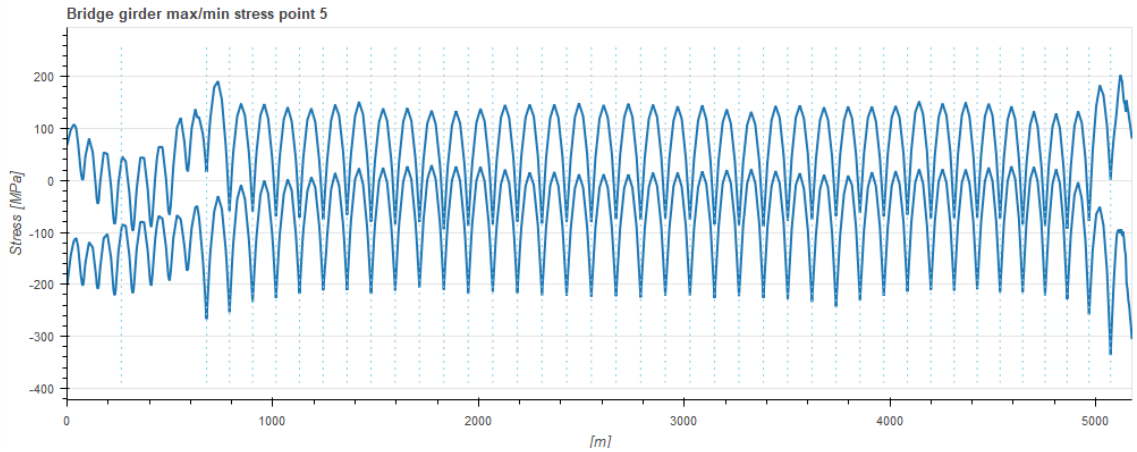


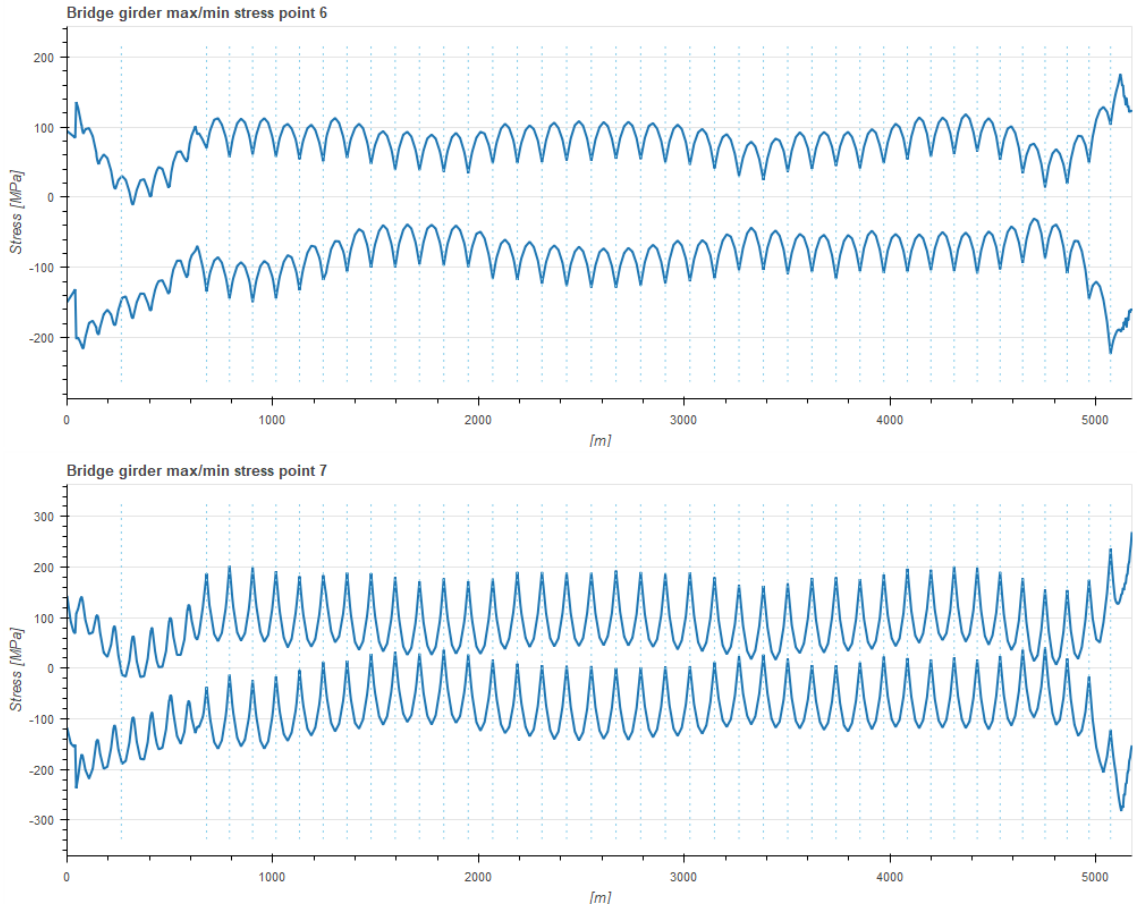





Bridge girder max/min stress point 3
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

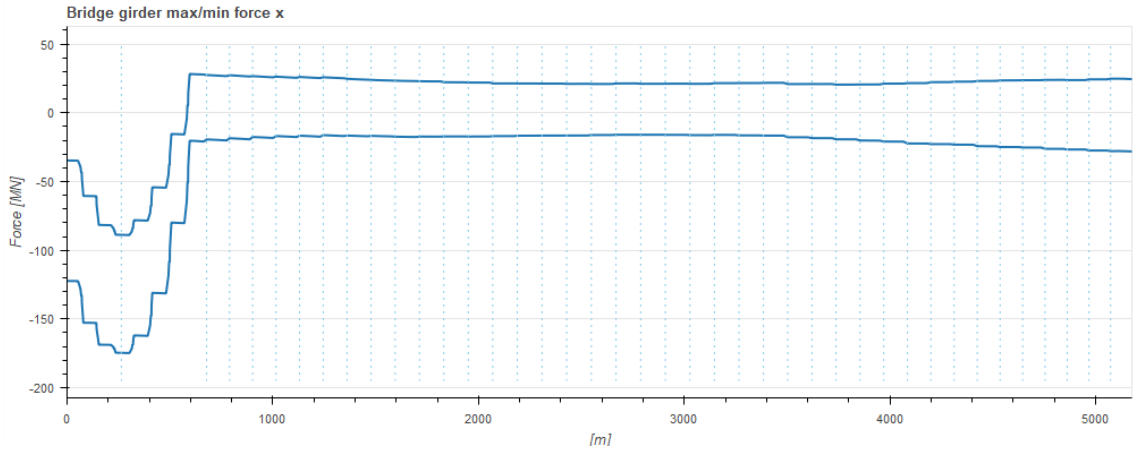

Bridge girder max/min stress point 5
Stress [MPa]
200
100
0
-100
-200
-300
-400
0
1000
2000
3000
4000
5000
[m]

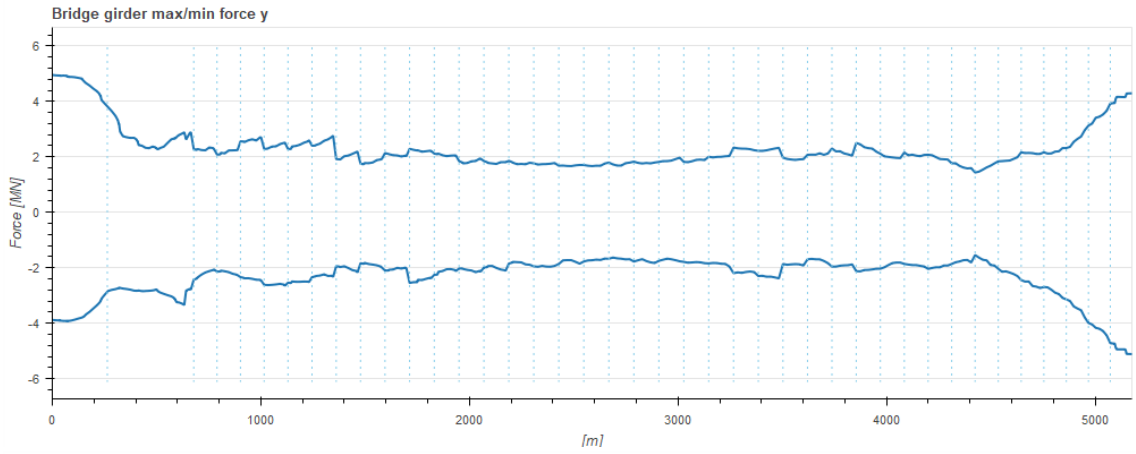

Bridge girder max/min stress point 6
Stress [MPa]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

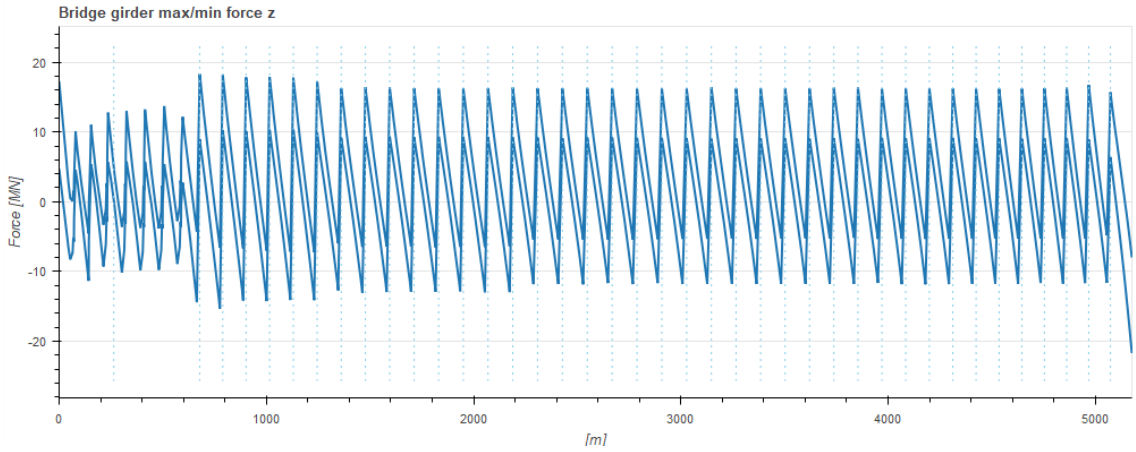
3.4 SLS Infrequent

Response from SLS Infrequent is presented here. The loads are presented in [3] and correspond to COMB 24 on olavolsen.interactive.no [2].

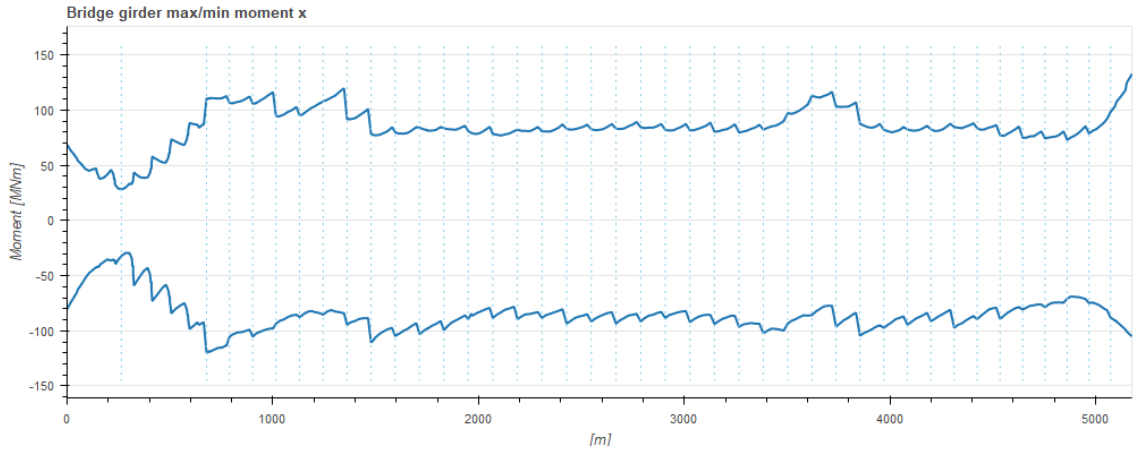
3.4.1 Forces

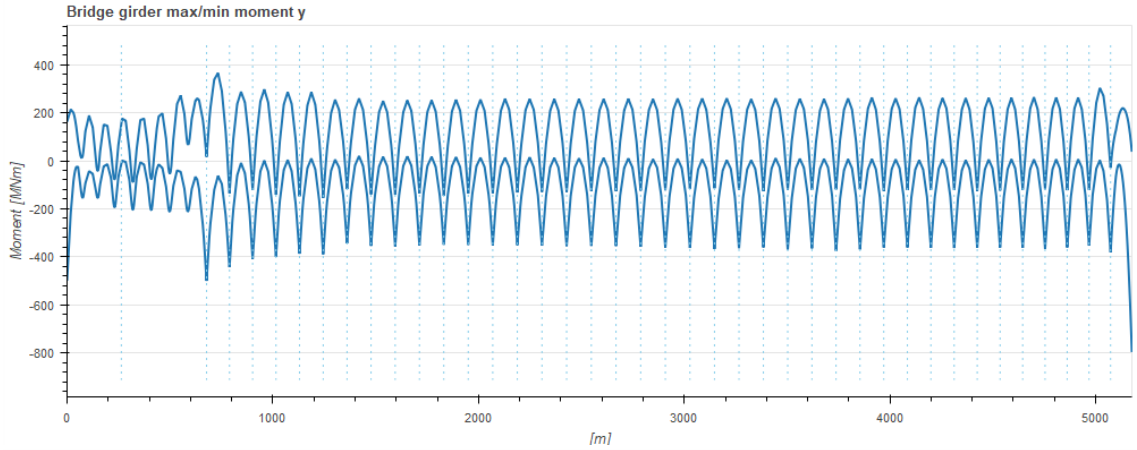


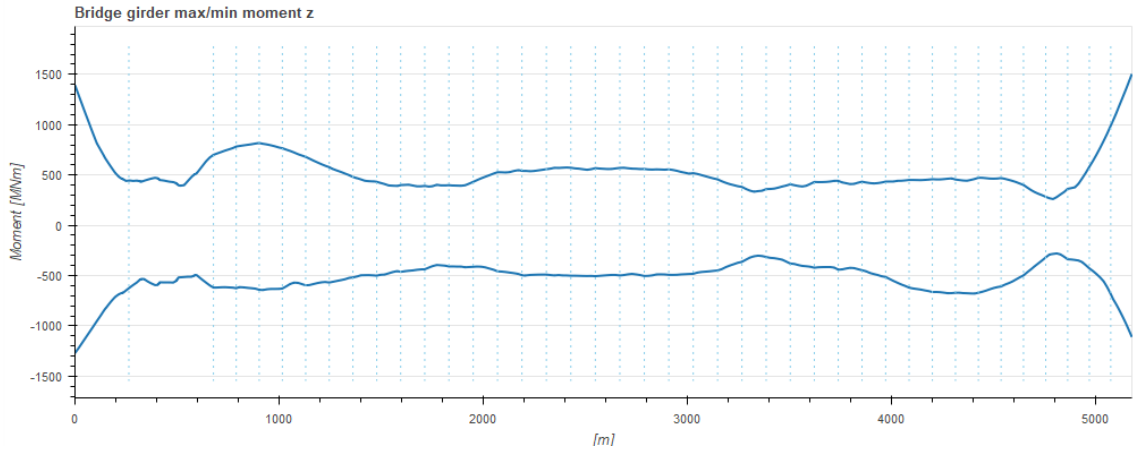




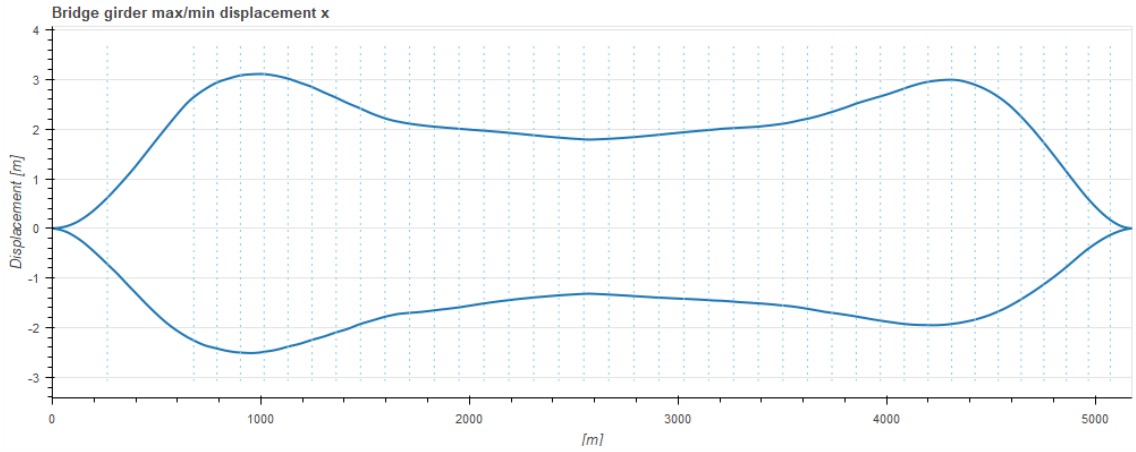
3.4.2 Moments

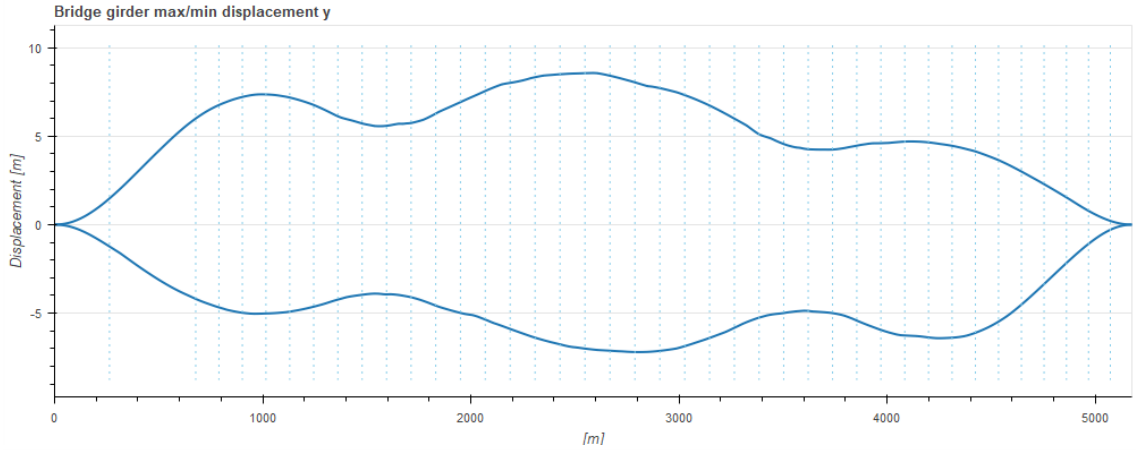

Bridge girder max/min moment x
Moment [MNm]
150
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]

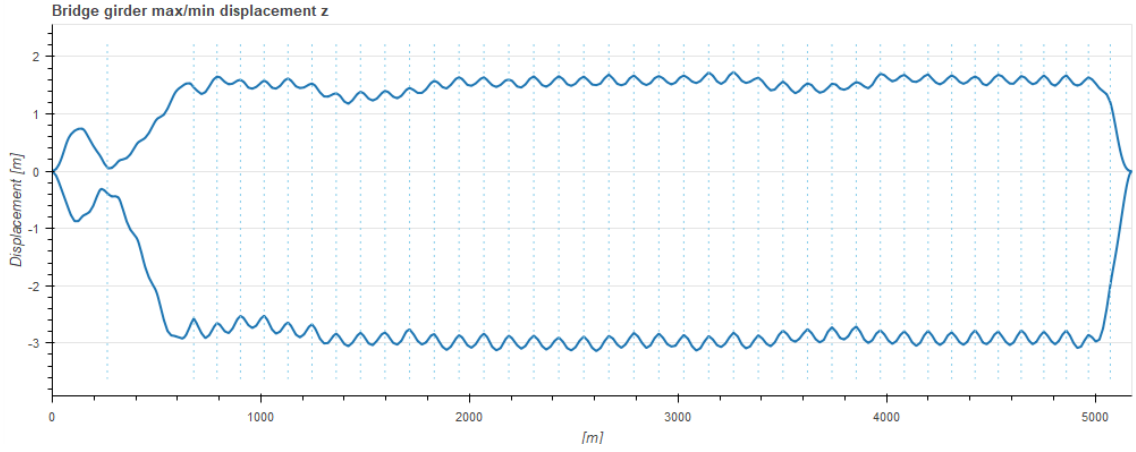

Bridge girder max/min moment y
Moment [MNm]
400
200
0
-200
-400
-600
-800
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
1500
1000
500
0
-500
-1000
-1500
0
1000
2000
3000
4000
5000
[m]

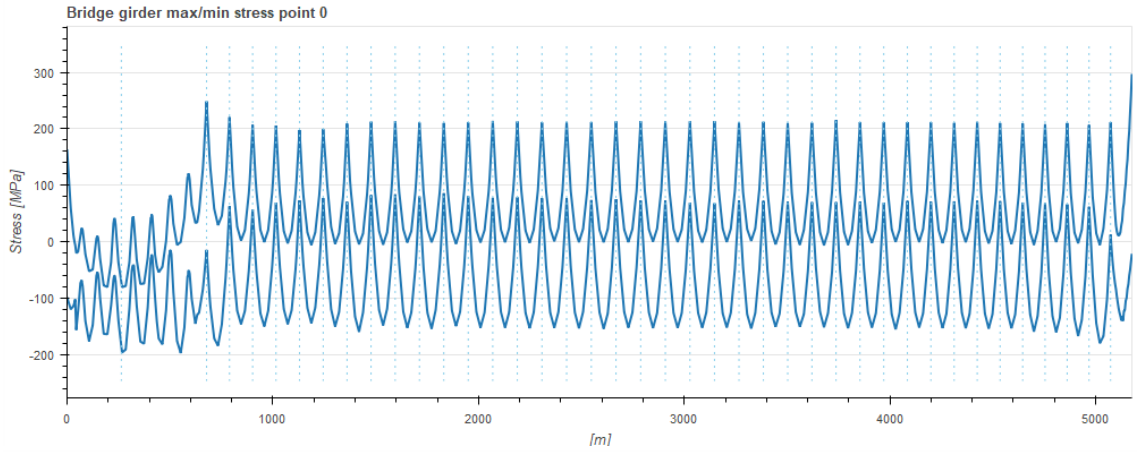
3.4.3 Displacements

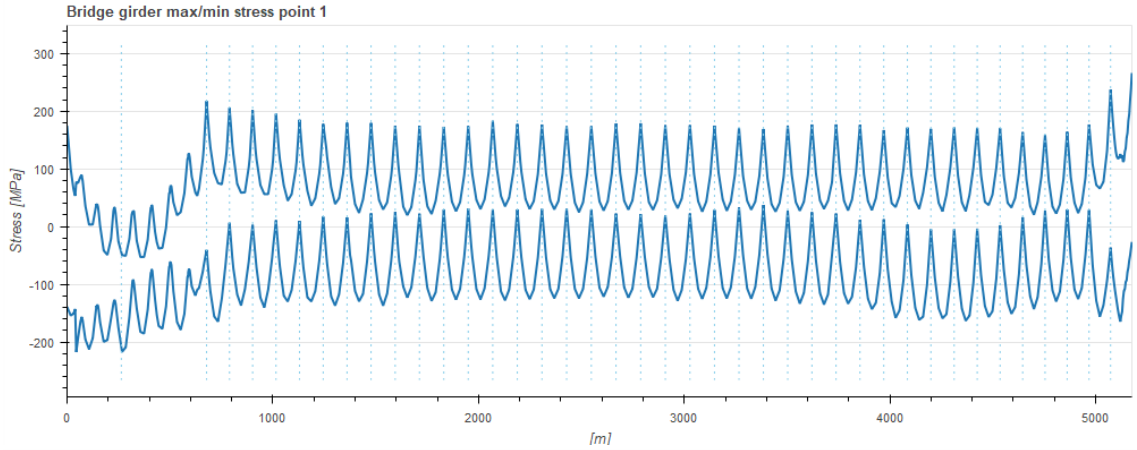


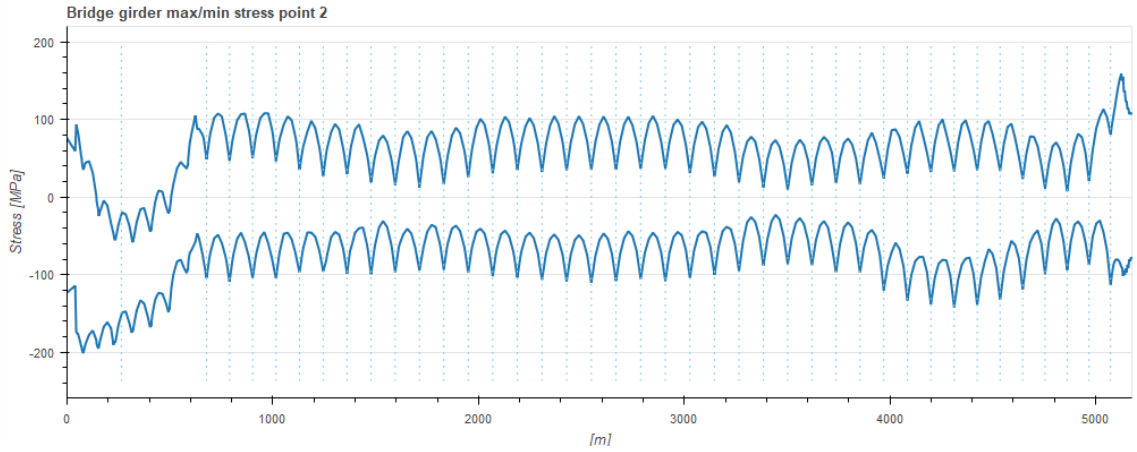


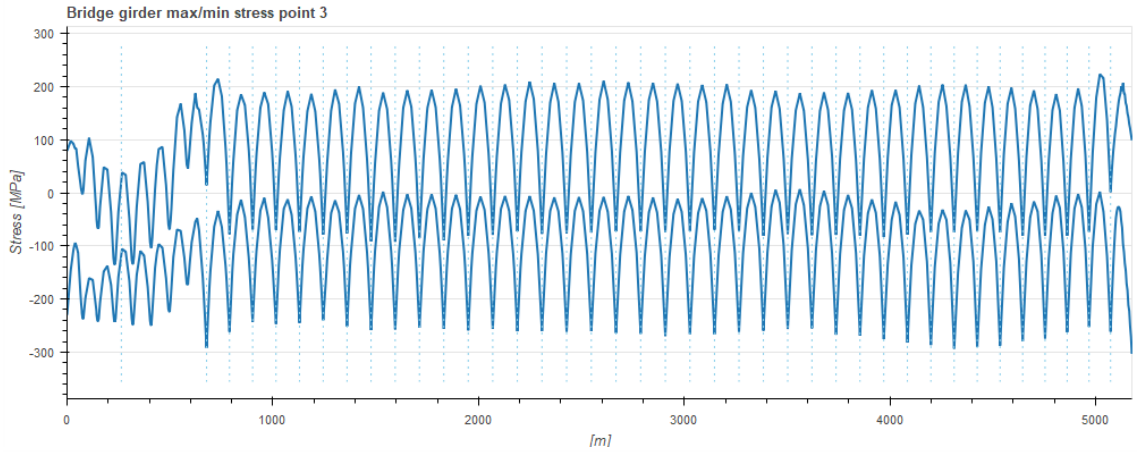


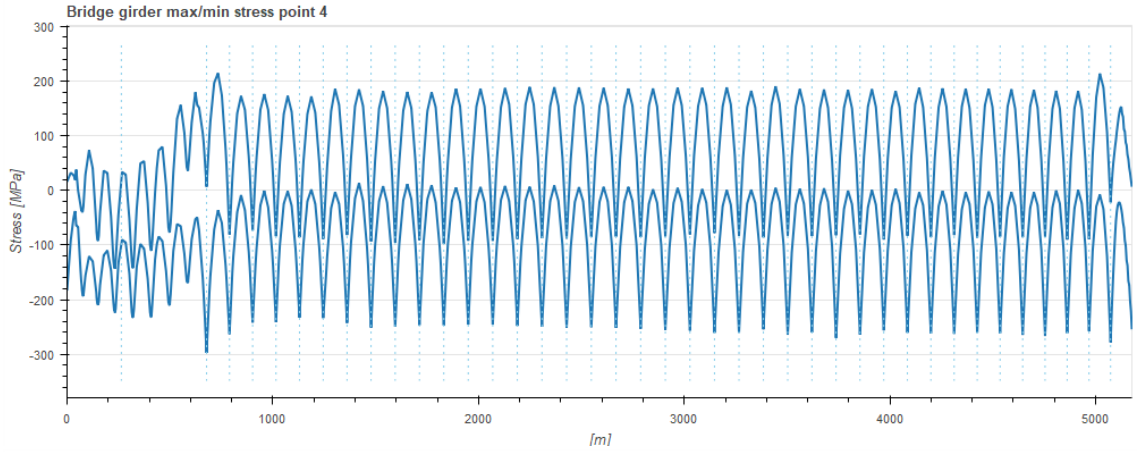
3.4.4 Stresses

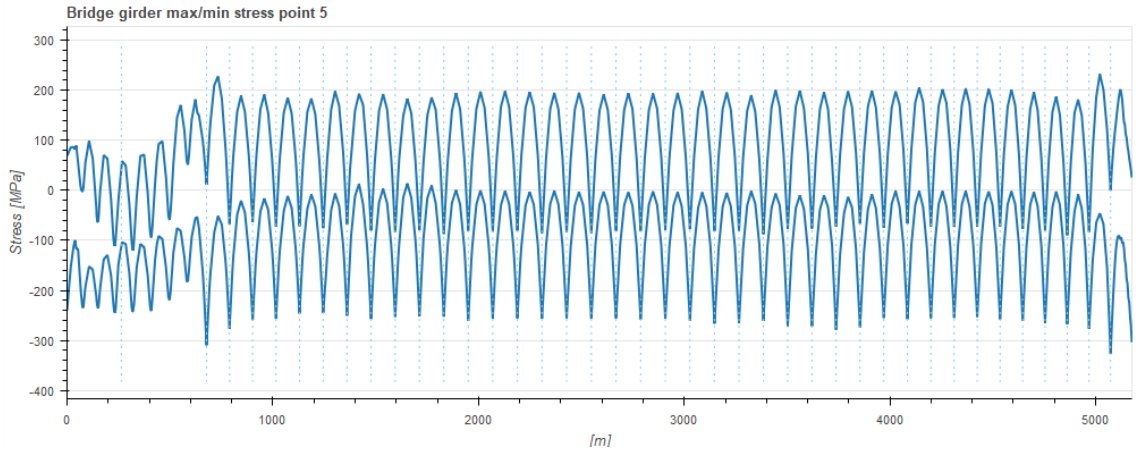


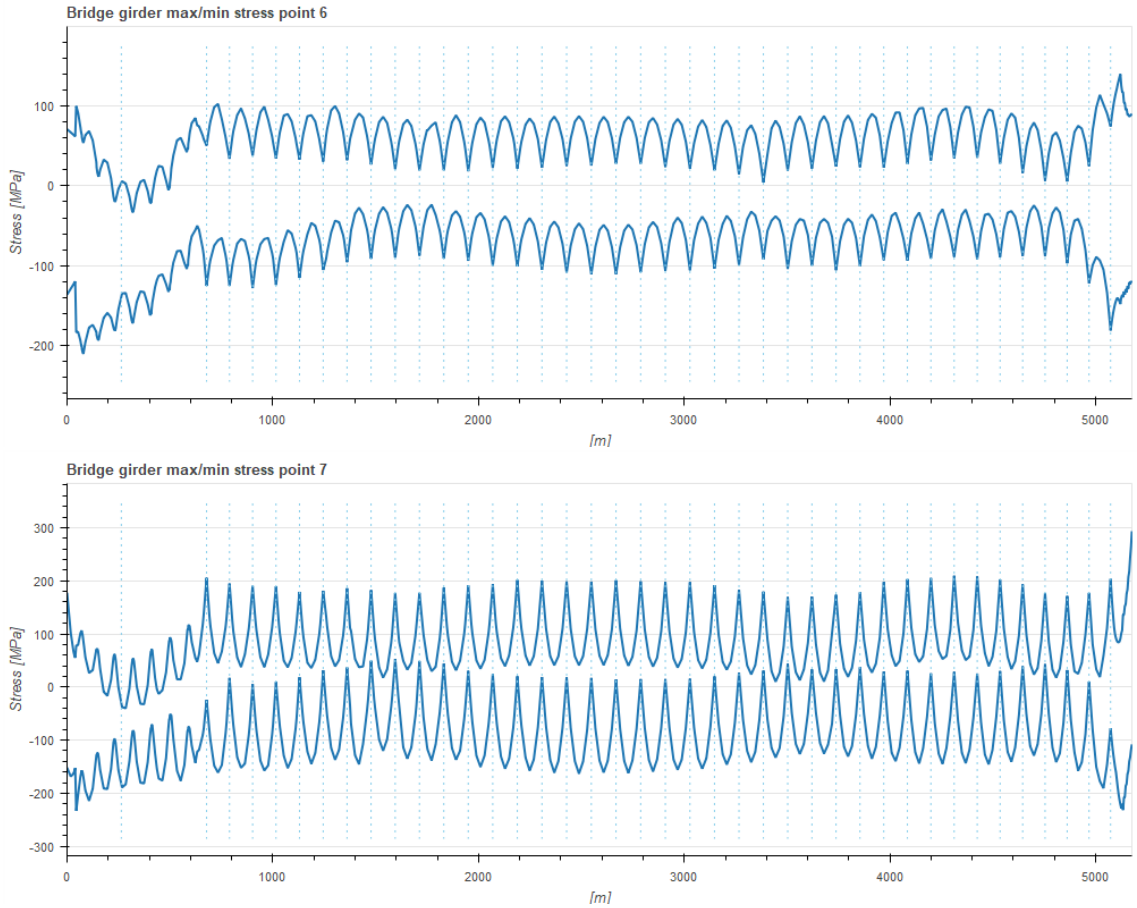





Bridge girder max/min stress point 3
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

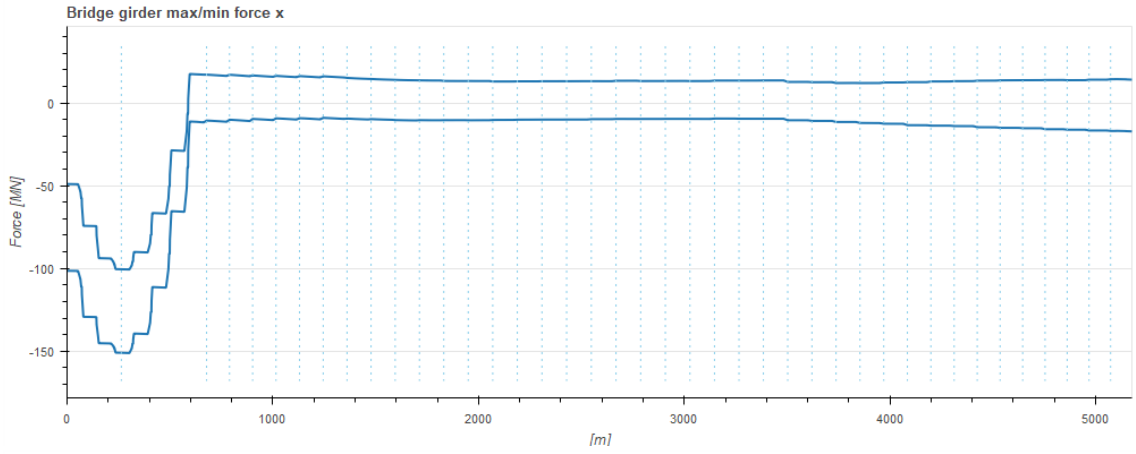

Bridge girder max/min stress point 5
Stress [MPa]
300
200
100
0
-100
-200
-300
-400
0
1000
2000
3000
4000
5000
[m]

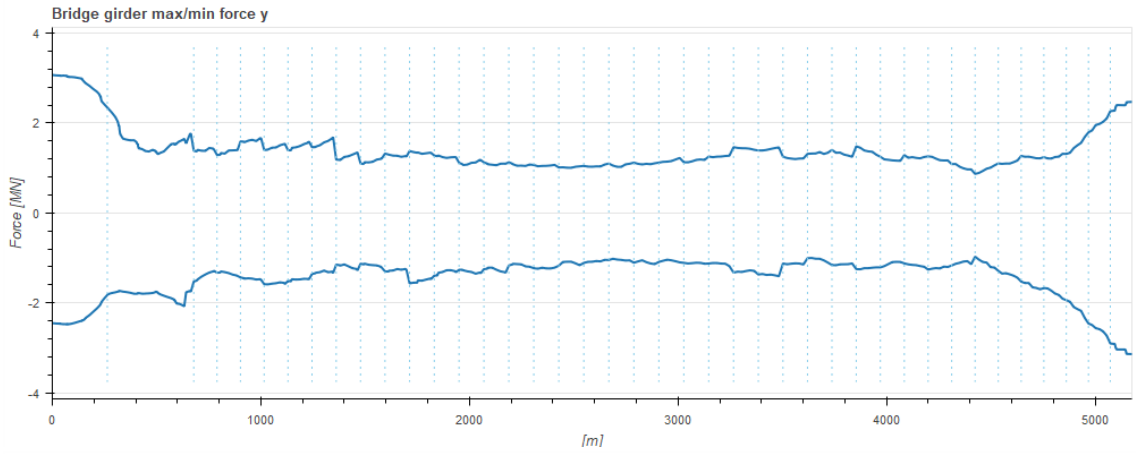

Bridge girder max/min stress point 6
Stress [MPa]
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
300
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]

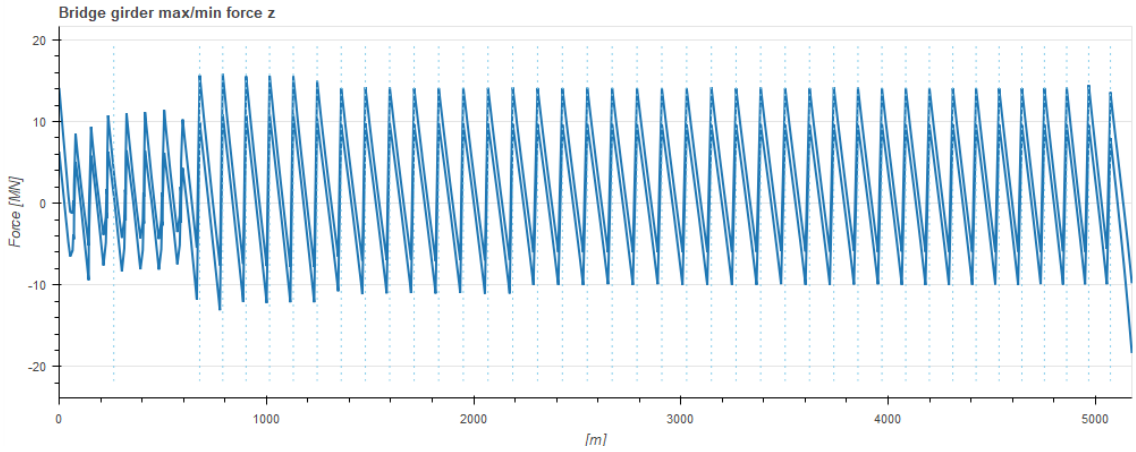
3.5 SLS Quasi Permanent

Response from SLS Quasi Permanent is presented here. The loads are presented in [3] and correspond to COMB 25 on olavolsen.interactive.no [2].

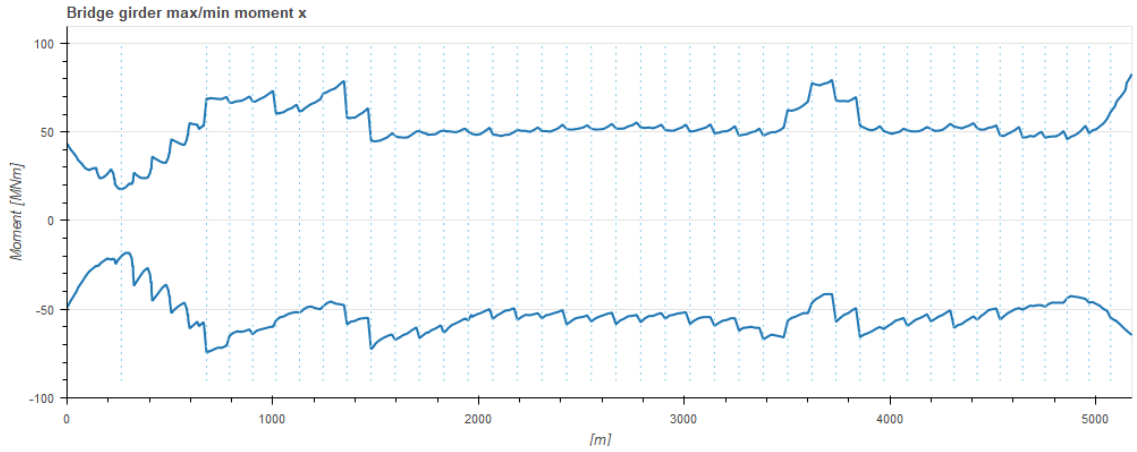
3.5.1 Forces

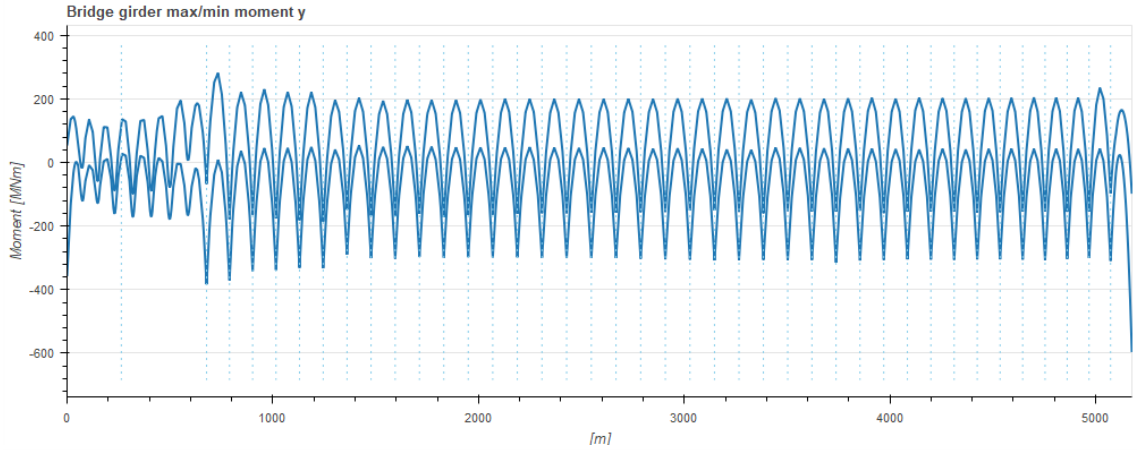


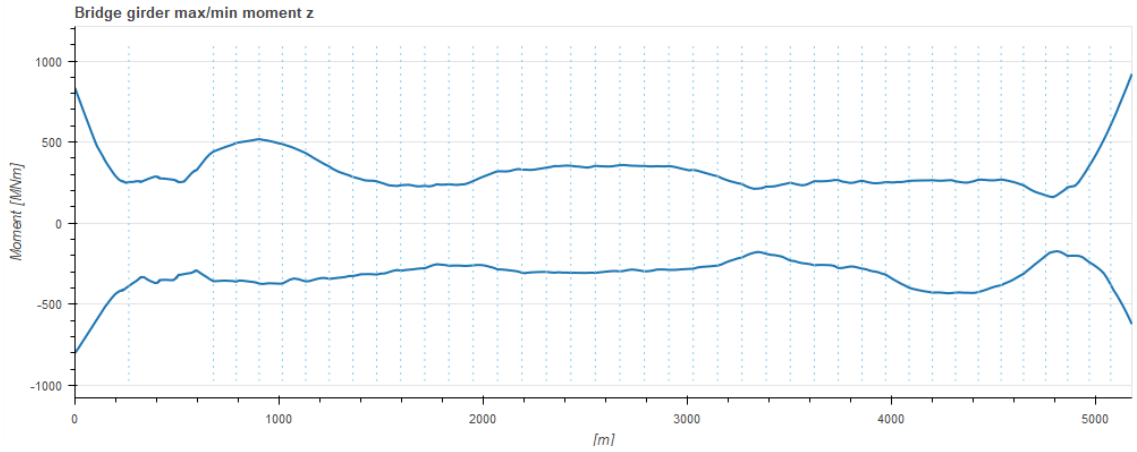




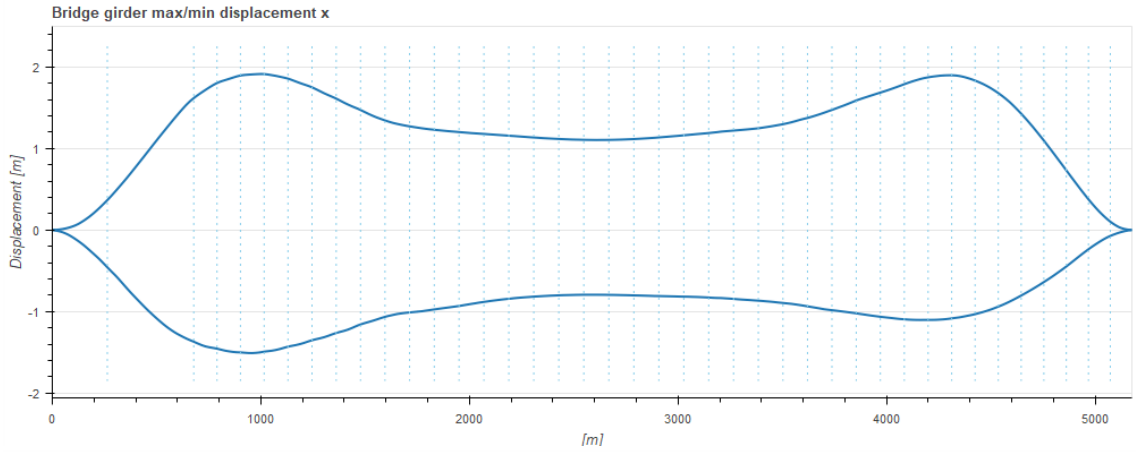
3.5.2 Moments

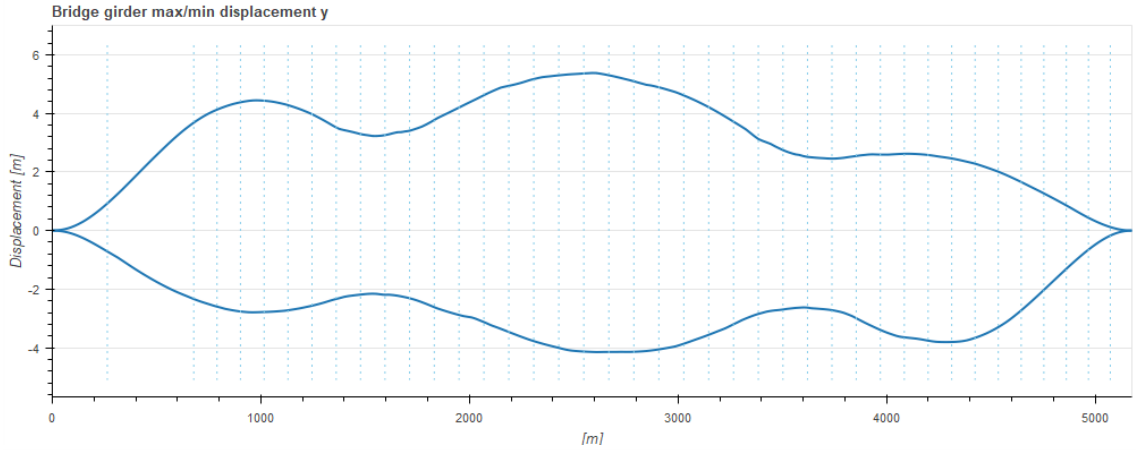

Bridge girder max/min moment x
Moment [MNm]
100
50
0
-50
-100
0
1000
2000
3000
4000
5000
[m]

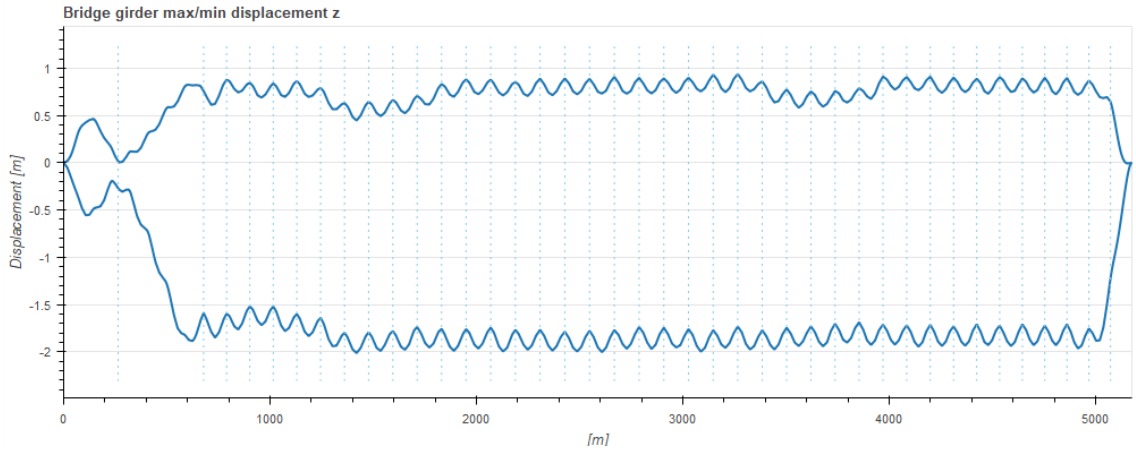

Bridge girder max/min moment y
Moment [MNm]
400
200
0
-200
-400
-600
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min moment z
Moment [MNm]
1000
500
0
-500
-1000
0
1000
2000
3000
4000
5000
[m]

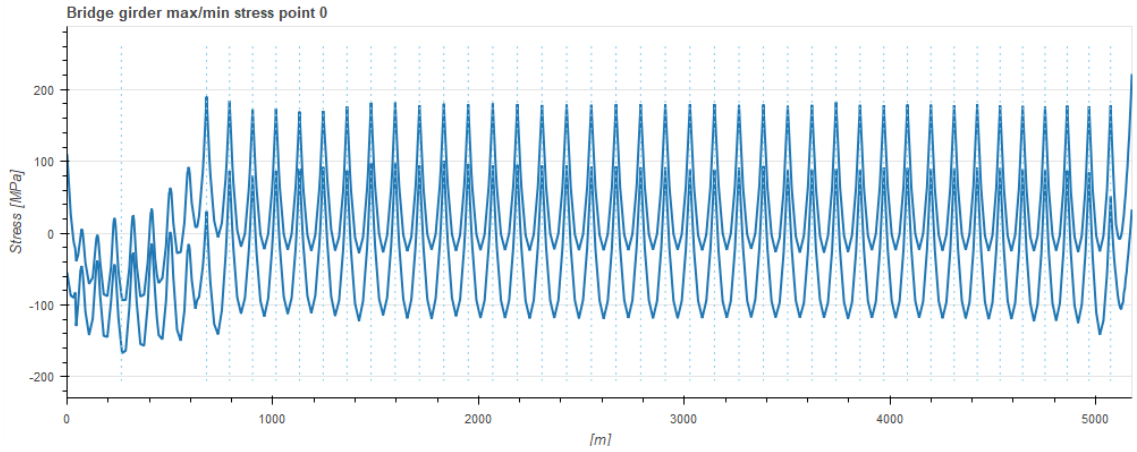
3.5.3 Displacements

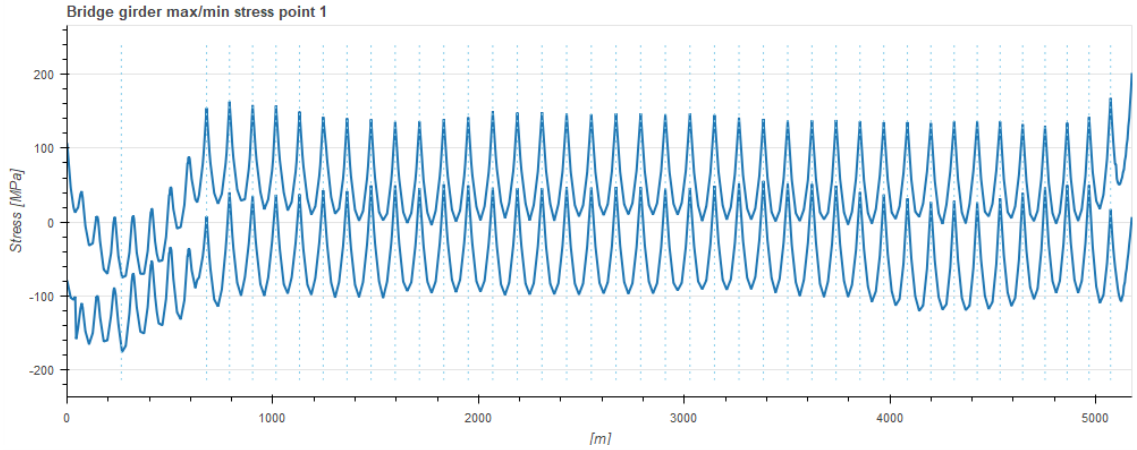


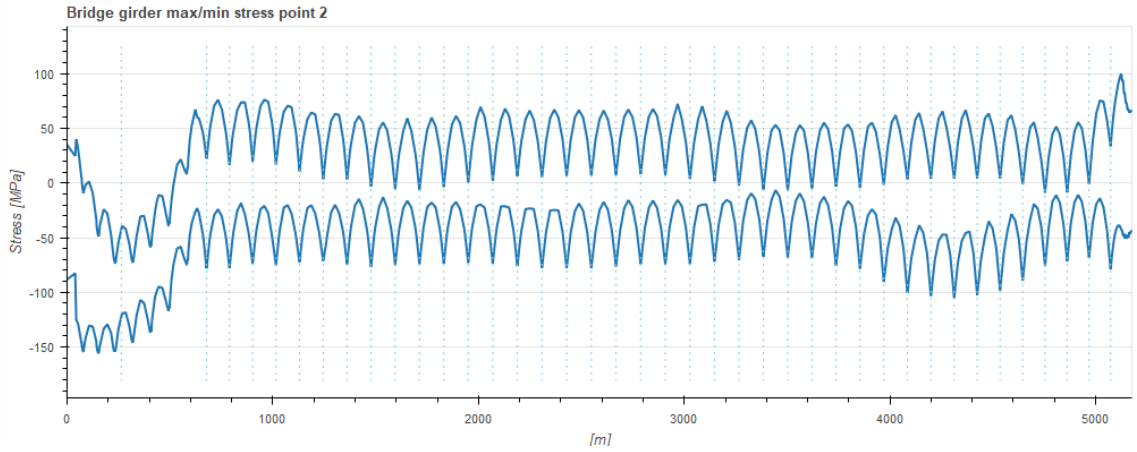


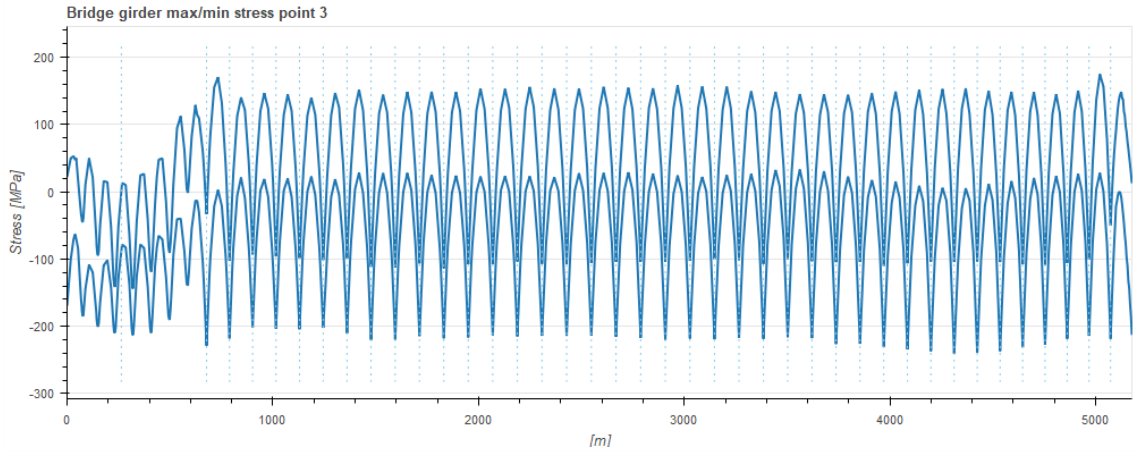


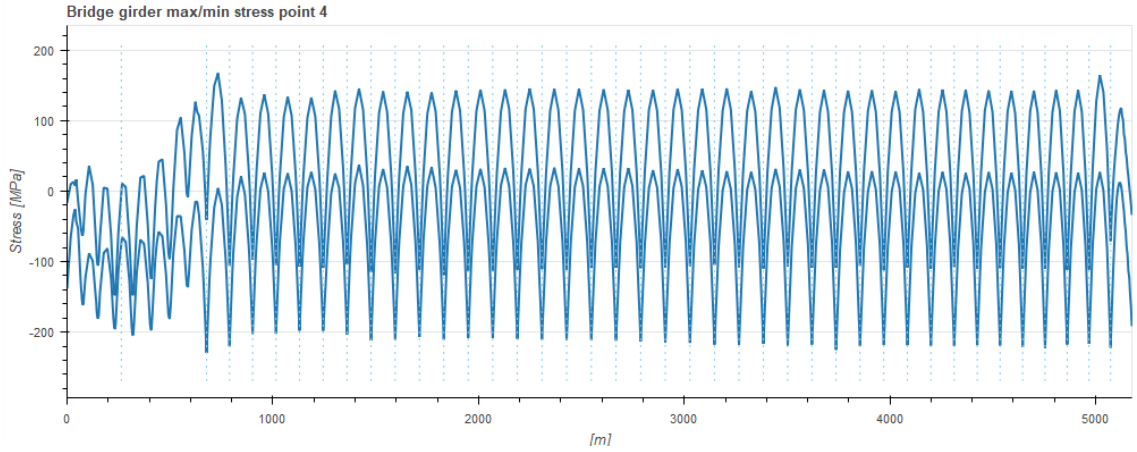
3.5.4 Stresses

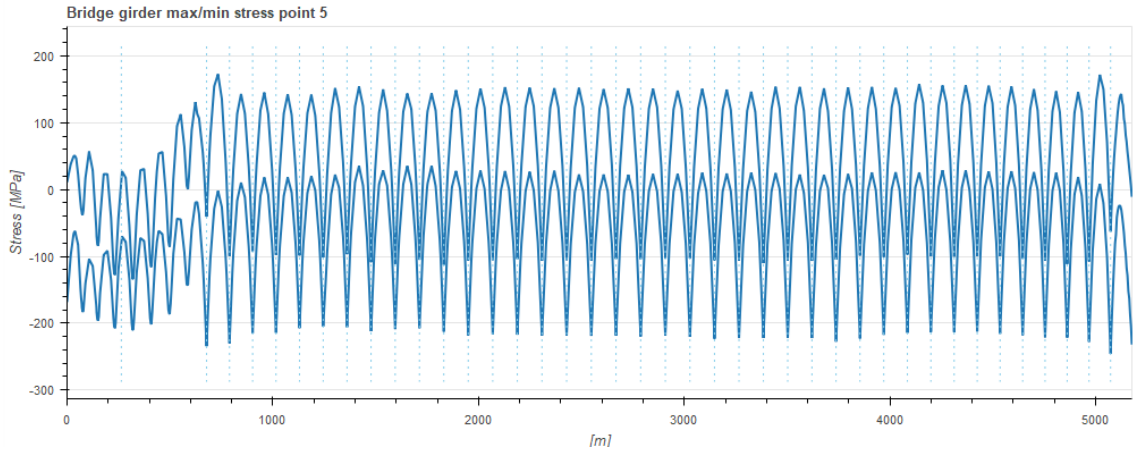


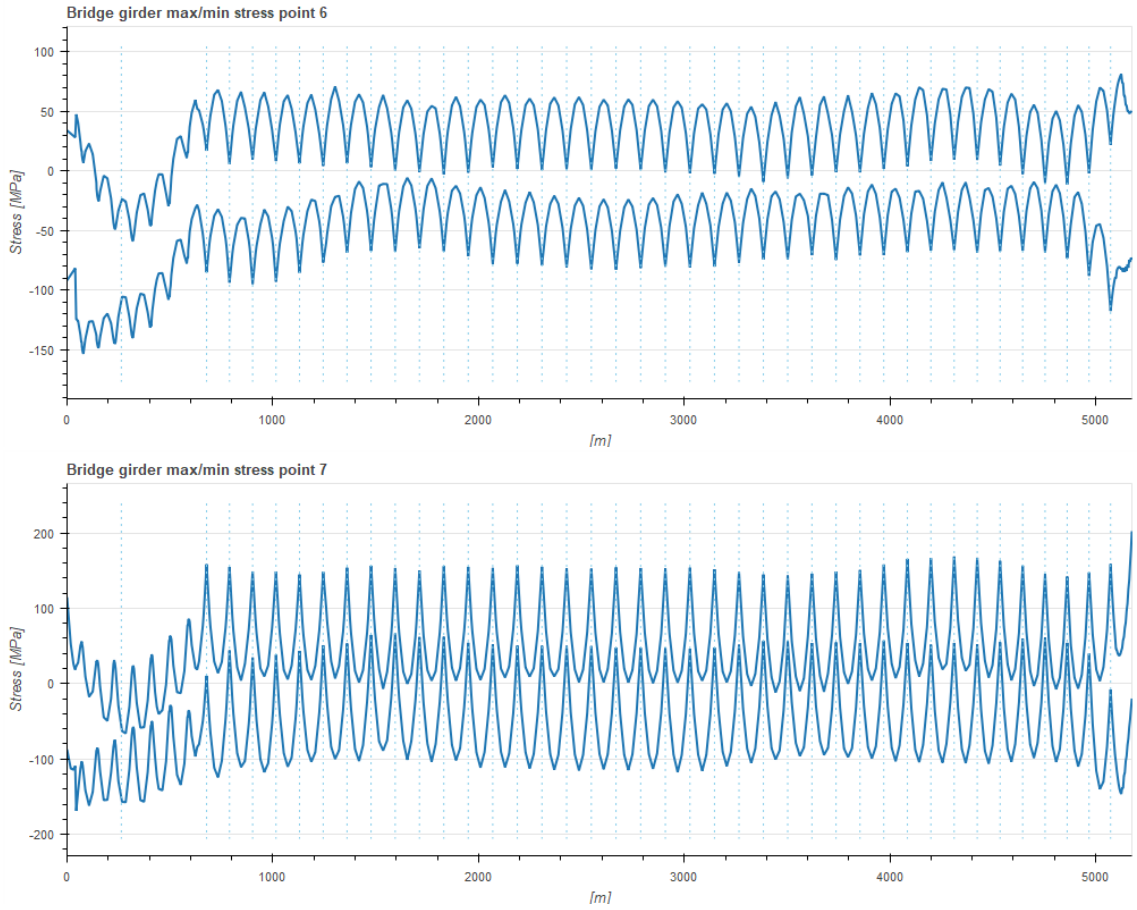





Bridge girder max/min stress point 3
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 4
Stress [MPa]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 5
Stress [MPa]
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
5000
[m]


Bridge girder max/min stress point 6
Stress [MPa]
100
50
0
-50
-100
-150
0
1000
2000
3000
4000
5000
[m]
Bridge girder max/min stress point 7
Stress [MPa]
200
100
0
-100
-200
0
1000
2000
3000
4000
5000
[m]

4 REFERENCES

[1] SBJ-33-C5-OON-22-RE-012 App A K12 Geometry input.

[2] Olav Olsen, Olav Olsen interactive; Project Bjørnafjorden phase 5, Oslo.

[3] SJB-33-C5-OON-22-RE-012 K12 Structural response analyses.

[4] Samferdselsdepartementet, «Forskrift for trafikklast på bruer, ferjekaier og andre bærende konstruksjoner i det offentlige vegnettet (trafikklastforskrift for bruer m.m.),» 2017.

[5] Norsk Standard, «NS-EN 1991-2:2003+NA:2010 - Laster på konstruksjoner - Trafikklast på bruer,» 2010.

[6] Håndbok N400 , «Bruprosjektering,» Statens vegvesen Vegdirektoratet, 2015.

[7] SBJ-32-C4-SVV-90-BA-001, «Design Basis Bjørnafjorden floating bridges,» Statens Vegvesen, 2018.

[8] NS-EN 1993-1-1:2005+A1:2014+NA:2015, «Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings,» Standard Norge, 2005.

[9] SBJ-30-C3-NOR-90-RE-102-4 Appendix 4 - Methods and theory.

[10] SBJ-30-C3-NOR-90-RE-102-2 Appendix 2 - Sensitivity studies.

[11] DNV, WADAM User Manual, 2010.

[12] DNV, DNV-RP-C205 Environmental Conditions and Environmental loads, 2014.

[13] R. B. Lehoucq, D. C. Sorensen og C. Yang, ARPACK USERS GUIDE: Solution of Large Scale Eigenvalue Problems by Implicitly Restarted Arnoldi Methods, SIAM, Philadelphia, PA, 1998.

[14] Sofistik, Sofistik Basics, 2016.