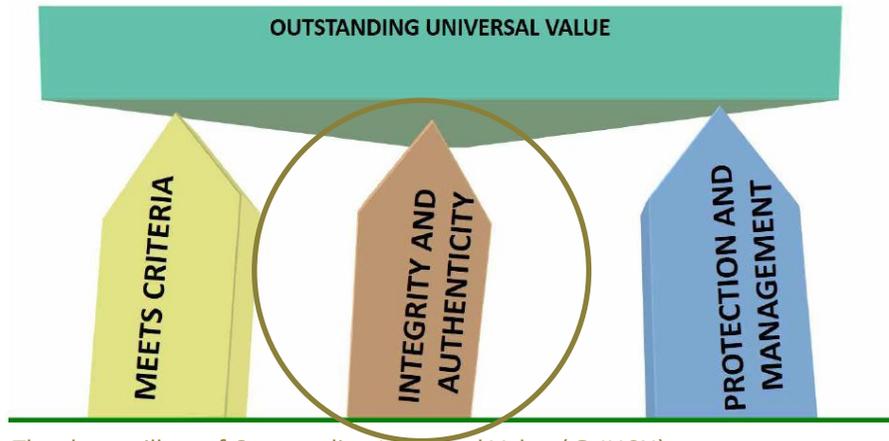




**DRAFT**

# Heritage Impact Assessment of the planned Bybanen Light-Rail Extension on the World Heritage Property Bryggen / Bergen

25 September 2021



The three pillars of Outstanding Universal Value (@ IUCN)

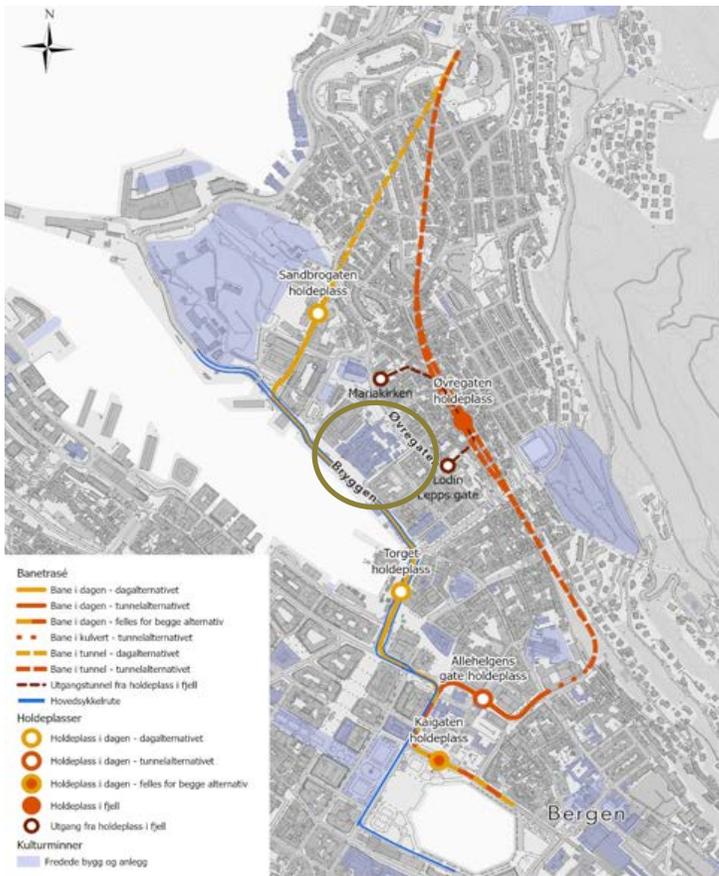
Operational Guidelines, §49:

„Outstanding Universal Value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole. The Committee defines the criteria for the inscription of properties on the World Heritage List.“

## MAIN ISSUE

Assessment of impacts and risks of Day option and Tunnel option on functional, visual and structural integrity of World Heritage Property Bryggen

# Starting Point of HIA: World Heritage Values



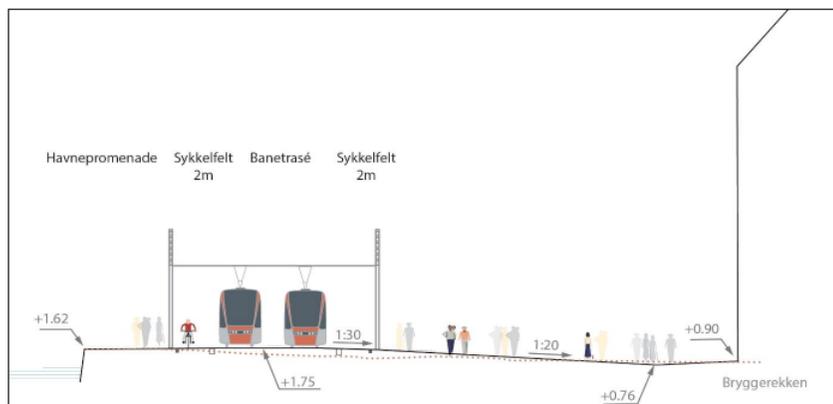
Routing of planned day option (yellow) and tunnel option (red) (@Mijløftet)

## MAIN ISSUE:

COMPARISON of positive and negative impacts and potential risks on the OUV of WH Property Bryggen due to planned alternative day- / tunnel option

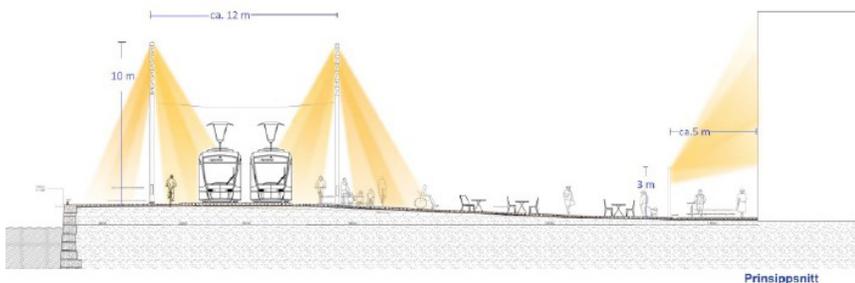
# Background

- HIA PRELIMINARY REPORT 1 (submitted in October 2020) provided a first assessment of the impact of the **proposed day option** of the light-rail network (Bybanen) on the Outstanding Universal Value (OUV) of the World Heritage property Bryggen from an independent point of view.
- Recommendation 1: to **modify proposed day option** so as to mitigate negative impacts.
- Recommendation 2: to **develop an alternative tunnel-option** and to **compare impacts and risks with the day option**.
- It is the objective of HIA PRELIMINARY REPORT 2 to
  - assess both potential **positive and negative impacts and risks** of the two planned Bybanen Light-Rail alternatives on the Outstanding Universal Value (OUV) of the UNESCO World Heritage property Bryggen.
  - to **recommend future steps to mitigate potential negative impacts** and to enhance positive impacts respectively regarding the World Heritage Property's OUV so as to avoid, reduce, or compensate for negative impacts and to possibly amplify positive impacts.



Figur 2-6 Snitt C-C' med høydeangivelse og fallforhold. Lavbrekk foran Bryggerekken er plassert med utgangspunkt i oppdatert plan fra "Mot Vågen". Rød stipling angir eksisterende terreng.

Mastplassering integreres med dekket og møblering som ivaretar tverrgående akser og tillater fri ferdsel. Nøyaktig plassering avhenger av sonemåling og annen møblering. Dette alternativet gir et mer åpent rom og bidrar trolig til mindre barrierewirkning i kort utsikt.



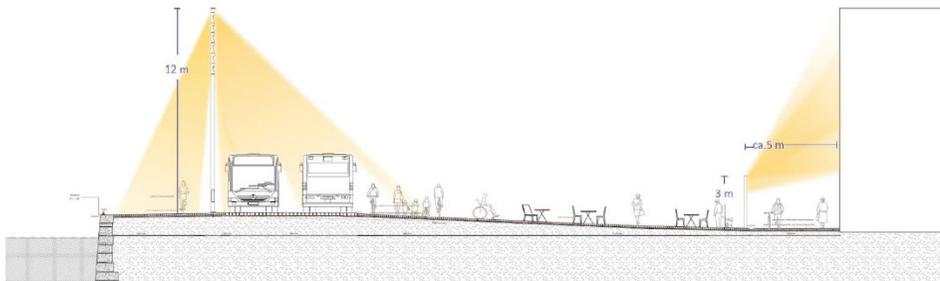
Day option: Systematic section shows high-voltage line and lighting (@Mijøløftet)

- **Routing:** The day option goes over Torget and Bryggen quay and continues in a tunnel at Sandbrogaten. It has two light rail stops in this section, on Torget and Sandbrogaten.
- **Traffic:** In case of the day option Bryggen Quay will be cleared from bus traffic. On both sides of the Bybanen track there will be located a cycle path.
- The day option has been assessed in HIA Preliminary 1. Recommendations in HIA Phase 1 have resulted in following adjustments:
  - **Lowered height of tracks:** Tracks the cycle lanes in front of Bryggen have been lowered to 1.75 meter above sea level. By Dreggekaien and Finnegården the level is raised to 1.90 m contributing to a lower risk for flooding.
  - **Revised quay surface design:** new coherent levels and a cobble stone paving.
  - **Improvements at Finnegården/Hanseatic Museum:** Situation between the light rail track and bicycle zone at has been improved by widening the curve of Bybanen.
  - **High-voltage line along Bybanen:** This system remains, a new design combines masts with lighting on both sides of the track and bicycle path. The possibility of Bybanen without high-voltage overhead system after 2050 has been investigated.
  - **Construction works:** It is planned to renew and relocate existing infrastructure on Bryggen Quay. The functional integration of the Bryggen area with the city centre and the (redirection of traffic, replacing infrastructure, track building, tunnel from Sandbrogaten) are expected to take up to three years in the Bryggen area.

## Planned Bybanen Light-Rail-Extension\_Modified Day option

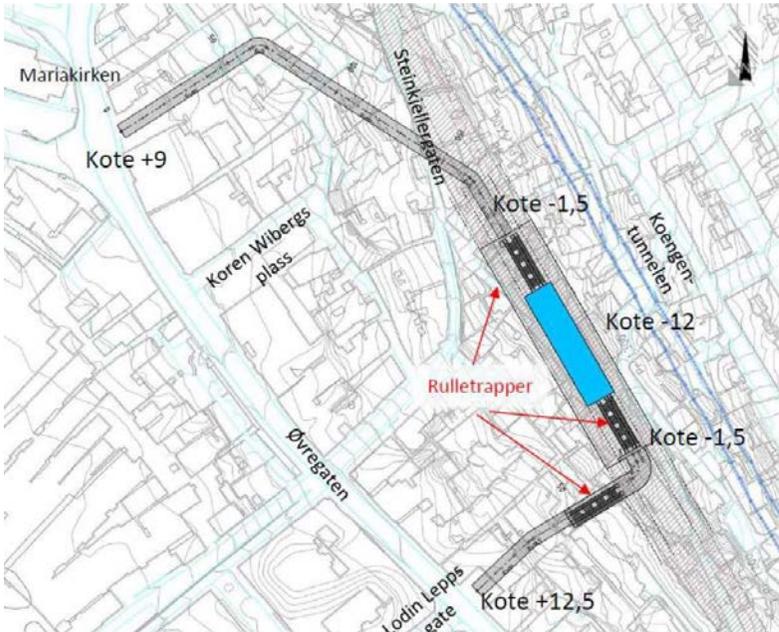


- The **tunnel option** goes in tunnel from Heggebakken in the centre to Sandviken. It has a tunnel station with two exits at Øvregaten, one at Lodin Lepps gate (Øvregaten 9/11) and one near Mariakirke (Øvregaten 43/43a).
- **Traffic:** In case of the tunnel option Bryggen Quay will carry bus traffic. On both sides of the bus track there will be located a cycle path. Øvregaten will be cleared from bus traffic.
- **Exits:** The proposed exits will likely require demolition or replacement of several existing buildings in the potential World Heritage buffer zone.
- **Construction works:** Time span to build the new entrances at Øvregaten is estimated for 3 years.



*Tunnel option: Systematic section shows concepts for lighting of planned bus track and cycle path (@Mijøløftet)*

## Planned Bybanen Light-Rail-Extension\_Tunnel Option



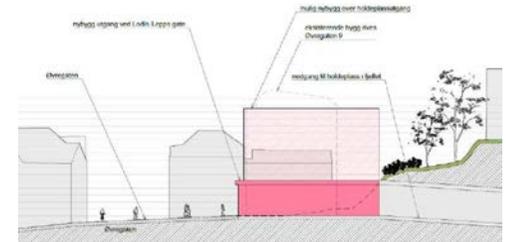
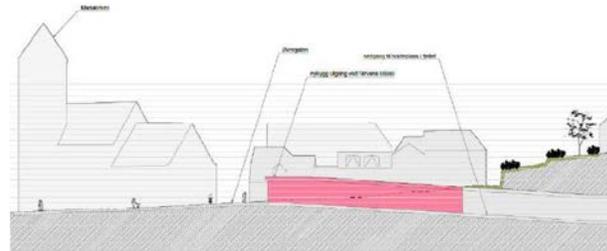
Tunnel option: Planned tunnel entrances (@Mijølføtet)



Tunnel option: Planned tunnel entrance at Mariakirke (Øvregaten 43/43a) (@Mijølføtet)



Tunnel option: Planned tunnel entrance at Øvregaten 9/11 (@Mijølføtet)



## Tunnel option: Planned entrances



HIA 2021 – day option



HIA 2021 – tunnel option

Issue

Day Alternative

Tunnel Option

**Functional Impact**

Buses at Øvregatan  
 Cycle lane on Bryggen Quay  
 Planned stops at Torget / Sandbrogaten  
 Planned situation at Finnegården/Hanseatic Museum

Buses on Bryggen Quay  
 Cycle lane on Bryggen Quay  
 Planned stop with entrances Mariakirken / Øvregatan

**Visual Impact**

Transformation of Bryggen

Transformation of Bryggen Quay

**Structural Impact**

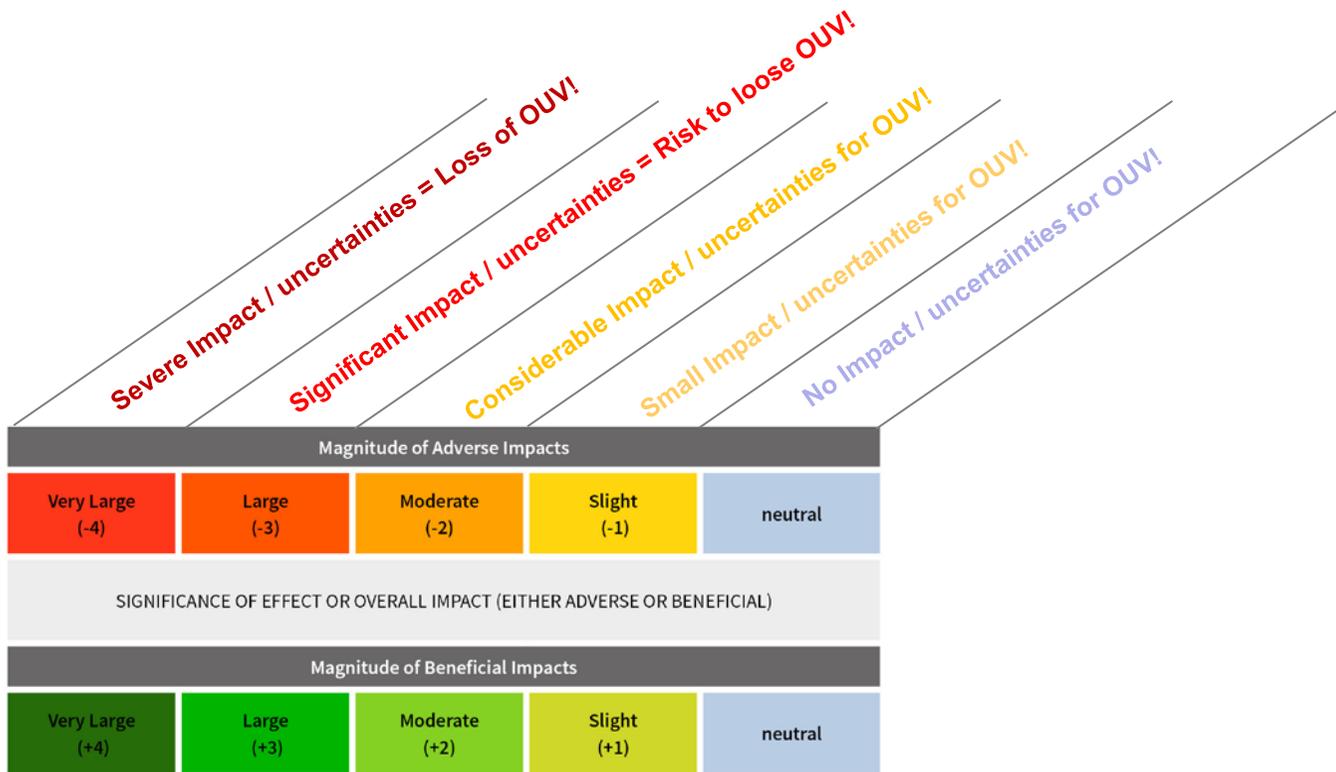
Planned tunnel and foundations of light-rail track at Sandbrogaten (Archaeology)  
 Planned relocation of infrastructure and placement of piling wall on Bryggen Quay  
 Construction works at Bryggesporden - Sandbrogaten

Planned tunnel Heggebakken - Øvregatan (Archaeology / Hydrology)  
 Planned Entrances Mariakirken / Øvregatan (Built heritage)  
 Construction works at Øvregatan

Impact Assessment

Risk Assessment

# Summary: Issues to be assessed\_comparison of day / tunnel option



(© ICOMOS / mkphc)

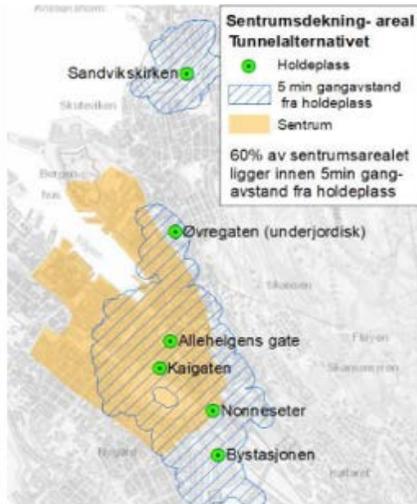
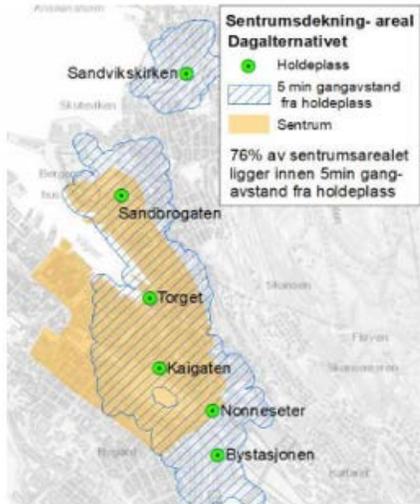
### MAIN ISSUE

Are there **very large / large** impacts or risks concerning functional and visual integrity of World Heritage property Bryggen which might endanger the OUV?

## Methodology – Assessment / Magnitude of Impact



Figur 4-8: Byromanalyse Øvre regaten med to utganger fra underjordisk holdeplass



**Accessibility – Day option:**

- Planned light-rail-stop at Sandbrogaten potentially improves the accessibility of Bryggen Quay and Mariakirke

**Accessibility – Tunnel option:**

- Planned light-rail-stops at Øvre regaten potentially improve the accessibility of Bryggen World Heritage property.

**Accessibility Vågen Area and Torget (City Centre)**

- There are differences concerning the coverage of Vågen Area and the city centre. Mainly due to the planned stop at Torget and Sandbrogaten the day alternative provides a better accessibility of these central areas.

Day option

Tunnel option

(@Mijøløftet)

# Traffic: Walkability and accessibility



## MAIN ISSUE

Potential large functional conflicts between light-rail-cars and entrance of Hanseatic Museum

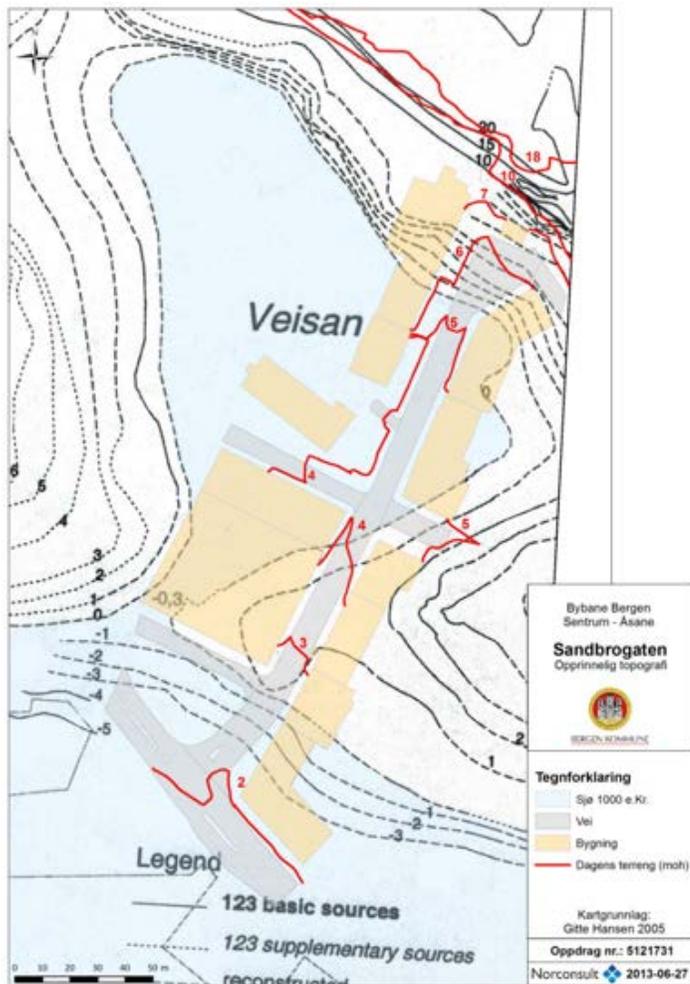
# Viewpoint 2\_Bryggesporden: Assessment day option



## MAIN ISSUE

Potential large barrier effect of cycle path, light-rail-cars and masts for lighting and high-voltage-line

# Viewpoint 6b\_Dreggekaien: Assessment day option



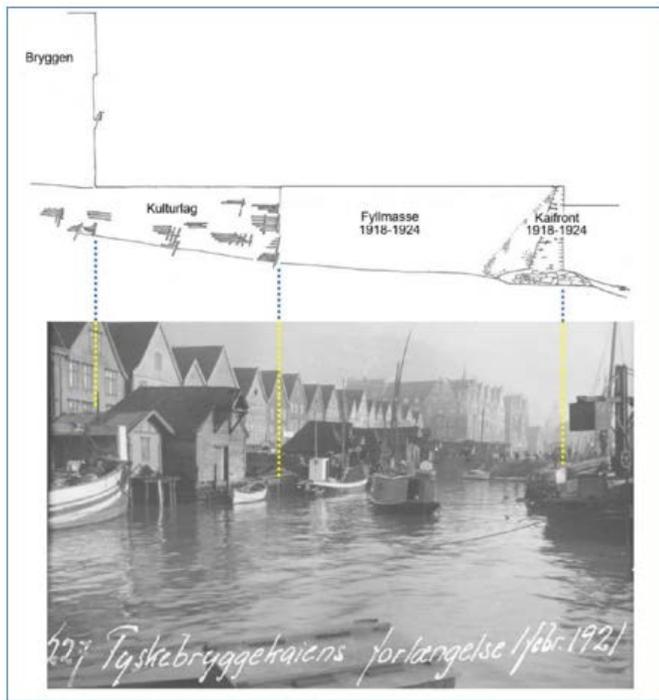
### Sandbrogaten:

The area where today's Sandbrogaten is was reclaimed during the medieval period.

- According to Riksantikvaren the site holds the oldest and most important archaeological deposits in Bergen.
- Medieval finds are **from 1.32 m below surface and deeper**.
- The day alternative light rail track penetrates 1 meter below surface. The replacement of the infrastructure will go 3 meters below surface

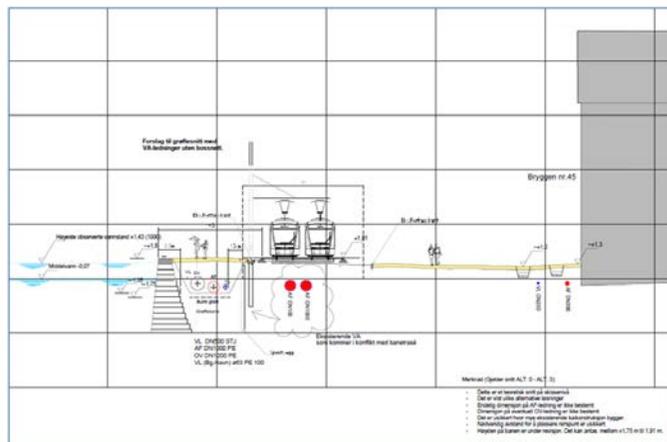
Archaeological layers at Sandbrogaten (@ source Norconsult / asplan viag)

## Day option: Risks for impacts on archaeology at Sandbrogaten



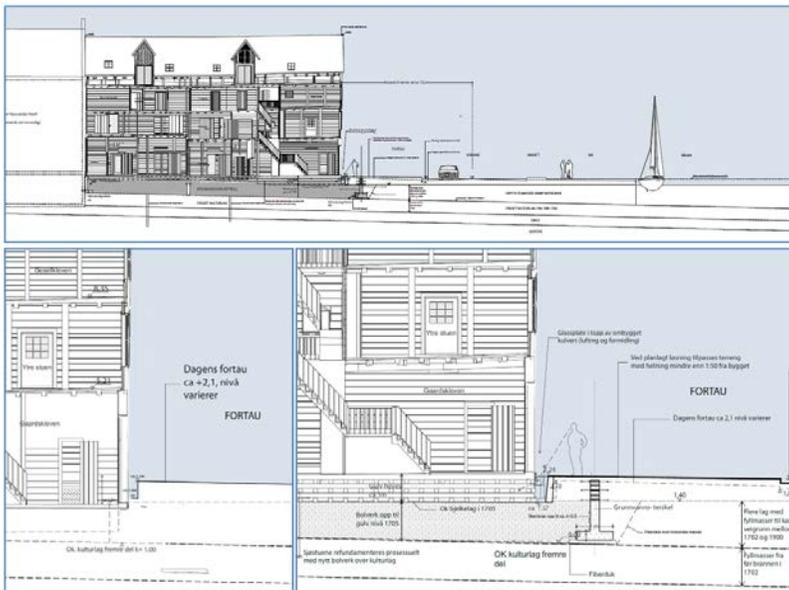
## Bryggen (Quay)

- The works include replacing the existing infrastructure.
- The introduction of the piling wall in the fillings outside Bryggen is expected to function as a water threshold securing the groundwater in zone C. Zone C is characterized by thick archaeological deposits in an excellent state of preservation.
- Risk preparedness for sea water rise and flooding has been improved by the pile wall and higher quay level at Bryggen Quay. The lower level of the quay is estimated to be within the operational levels.
- Risks from vibrations from the construction activities at Bryggen quay and at Finnegården.
- During construction time disturbances from noise and vibrations and limited access to the existing buildings.



Archaeological layers at Bryggen quay (@ source Norconsult / asplan viag)

# Day option: Potential structural impacts on archaeology at Bryggen



## Finnegården

- The building is under restoration.
- A basin is being constructed around the foundations as prevention from eventual changes in groundwater level.

## Target

- However valuable, the archaeological deposits here are younger and not quite as significant as along the Bryggen or Sandbrogaten area.



Archaeological layers at Finnegården / Bryggen Quay (@ source Norconsult / asplan viag)

# Day option: Low risk for potential structural impacts at Finnegården



### Tunnel option / General remarks

- The tunnel alternative does not pass directly under archaeological deposits, but behind them, although deep on the mountainside.
- The present proposal is not adequately developed for an in-depth risk assessment. The main potential impacts are the overall hydrogeological risks especially during construction works and the impacts on the medieval built heritage at Mariakirken and Øvregaten .
- ***It is important to keep the groundwater at the same level in the mountain area behind Bryggen.***

### Øvregaten

- At the location of the planned light rail station tunnel entrances at Øvregaten 9 archaeological deposits are observed, around 1,4 meters deep.
- At the station from Øvregatan 41 archaeological deposits are highly probable. Neighboring area has thick layers dating back to 12th century.

### Mariakirken

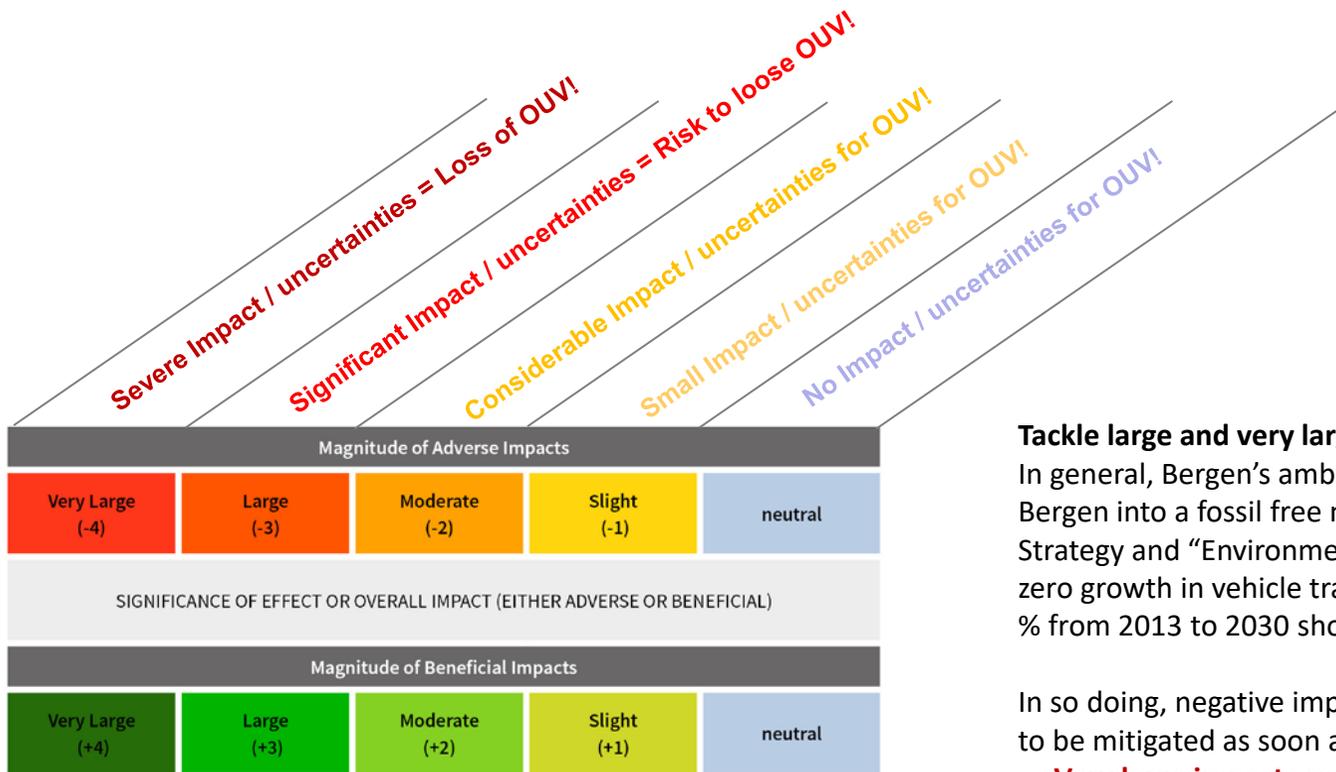
- The entrance at Mariakirken entails the demolition of medieval buildings.
- Construction works in the area of Mariakirken are likely to cause undue damage to the cultural layers and building foundations
- The construction works for the entrance at Lodin Lepps gate contains risks to existing buildings

### @Byantikvaren



Planned location for tunnel entrances at Øvregatan 9 / Mariakirke (@ source Norconsult / asplan viag)

# Tunnel option: Potential structural impacts



### Tackle large and very large negative impacts

In general, Bergen's ambitious strategy to use Bybanen to develop Bergen into a fossil free municipality according to Bergen's Green Strategy and "Environmental Pledge -Miljøløftet" and promoting zero growth in vehicle traffic and decrease of traffic by at least 20 % from 2013 to 2030 should be followed up.

In so doing, negative impacts graded with **very large** or **large** have to be mitigated as soon as possible.

- **Very large impacts** cause need for *reconsideration of plans or details of plans*.
- **Large impacts** are considered to be solvable by *application / adaption of consequent measures and plans*.

### KEY MESSAGE

Both options have potential **positive** and **negative** impacts!

Strengthen positive and mitigate negative impacts to a maximum extent!

## General findings / steps to take

## Negative

### *Functional Impact:*

Potential **large barrier effect** of cycle path on **Bryggen Quay**:

Potential **large functional** conflict at entrance area of **Finnegården**:



### *Functional Impact:*

▶ DEVELOP a detailed concept for planned cycle path on **Bryggen Quay**. This plan should show in detail how the potential barrier effect is avoided!

▶ DEVELOP detailed concept for secure handling of larger groups at **Finnegården**.

### *Visual Impact:*

Potential **large visual impact** on **Bryggen Quay**.

Visual impacts have been slightly improved, but will only be solvable to a limited extent due size of light-rail-cars and high-voltage line.



### *Visual Impact:*

▶ PROVIDE visualisations showing the design state of **Bryggen Quay** without high-voltage line!

Include detailed information of planned cycle path as well daylight and night views so as to show clearly how lighting concept will work.

### *Structural Impact:*

**Large risks** concerning archaeological deposits at **Sandbrogaten**:

**Large risks** for changes for structural damage to built heritage during the construction period on **Bryggen Quay**.



### *Structural Impact:*

▶ DEVELOP precise plan with a clear view concerning risks during construction activities at **Sandbrogaten**. Communicate this plan especially with experts from Riksantikvaren!

▶ DEVELOP precise plan to mitigate risks during constructions!

## ISSUES

## RECOMMENDATIONS

# Issues & Recommendations for day option

## Negative

*Several very large / large issues concerning structural Impact:*

1. Potential **very large structural impact** on archaeological deposits at *Mariakirke*:
2. Potential **large risks for structural impact** due to changes of groundwater level at Bryggen World Heritage property and its potential buffer zone.
3. Potential **large risks** for demolition of listed buildings at medieval Øvregaten.
4. Potential **large risks** during construction activities for entrances at Øvregaten.

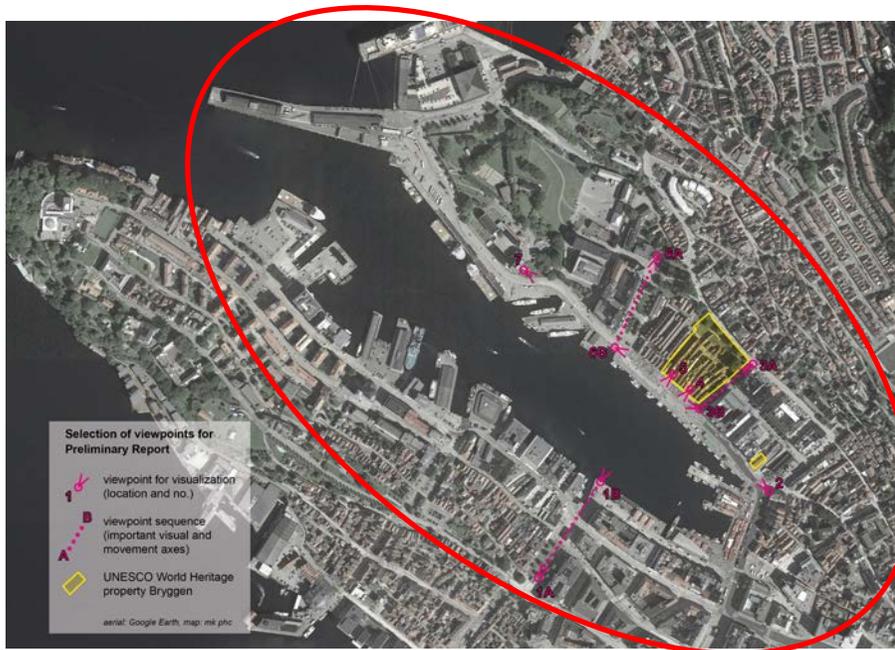


- ▶ DEVELOP a **new plan** for a light-rail-stop at Øvregaten without planned entrance at Mariakirken.
- ▶ DEVELOP a **detailed plan** how to seal planned tunnel in order to avoid potential large uncertainties for World Heritage property Bryggen.
- ▶ DEVELOP a **detailed plan** how to avoid or at least mitigate these risks.
- ▶ DEVELOP a **detailed plan** how to avoid or at least mitigate risks due to construction activities.
- ▶ **Active risk management** and identification of further risk-reducing measures.

## ISSUES

## RECOMMENDATIONS

# Issues & Recommendations for tunnel option



*Recommendation:* COMBINE knowledge of **cultural environment management, urban planning and transport planning:**

IDENTIFY risks and potentials in the **entire Vågen area.**

DEVELOP a **Plan for Sustainable Management of Tourist Traffic**

DEVELOP a concept for a **World Heritage buffer zone** on this basis.

## KEY ISSUE

Think about potential buffer zone which needs to cover entire Vågen area!

# General recommendation for Day option and Tunnel option

©  
michael kloos planning and heritage consultancy  
Aachen, 25 September 2021