Site-specific Studies for ILC in Tohoku

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LCWS2023
INTERNATIONAL WORKSHOP ON LINEAR COLLIDERS

Outline

1. Improve “Tohoku ILC Civil Engineering Plan”
    1.1. Re-examination of facility layout
    1.2. Updating the construction schedule (& cost)
2. Additional surveys
    2.1. Boring Survey
    2.2. Heavy metals
    2.3. Ground motion near the river
3. Plan for additional surveys during Pre-lab. phase

1

Improve
“Tohoku ILC Civil Engineering Plan”

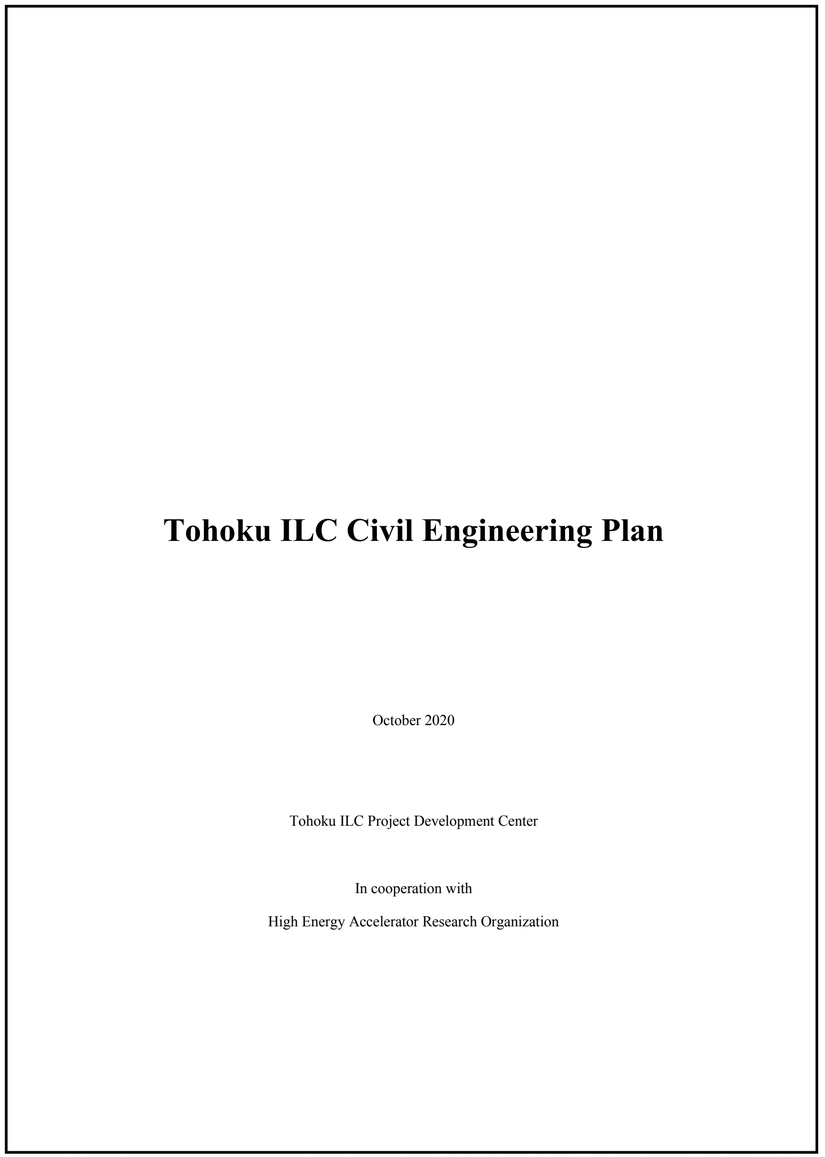
1. Re-examination of facility layout
2. Updating the construction schedule (& cost)

“Tohoku ILC Civil Engineering Plan”
Reviewed by JSCE (2019)

The Tohoku and KEK jointly produced a site-specific design for the ILC that satisfies the international design of the ILC.

An independent review was conducted by the Japan Society of Civil Engineers. (2019)

The Evaluation Subcommittee for ILC Civil Engineering Facility in Tohoku concluded that the "Tohoku ILC Civil Engineering Plan" is technically feasible and that the contents of the plan are appropriate.


Tohoku ILC Civil Engineering Plan

October 2020

Tohoku ILC Project Development Center

In cooperation with

High Energy Accelerator Research Organization

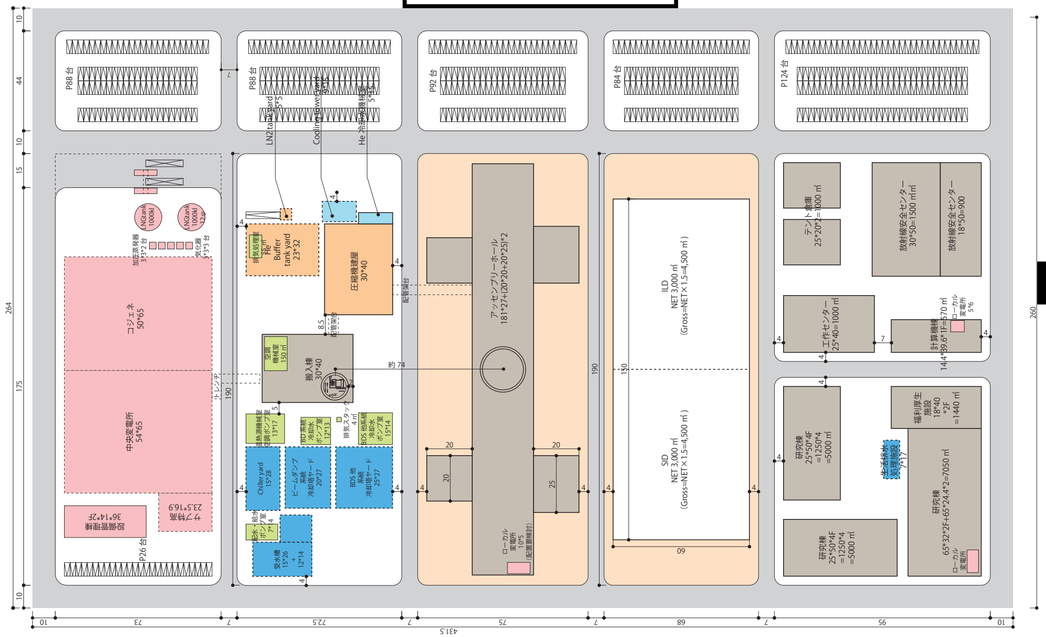
https://tipdc.org/assets/uploads/2021/03/Tohoku_ILC_CEP.pdf

Improve “Tohoku ILC CE Plan”

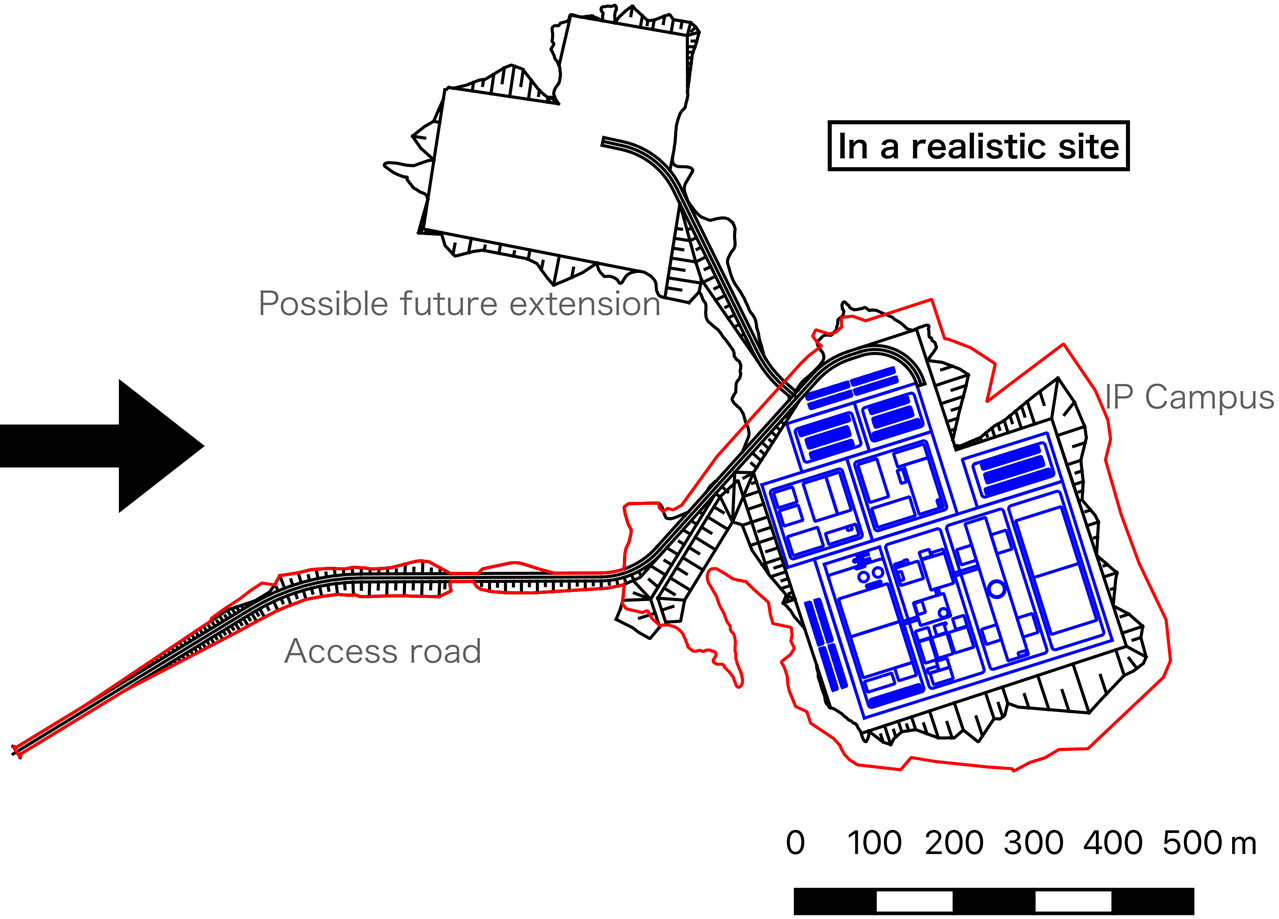
The shape of the site & the layout of the buildings

Example : IP campus ~10ha

In a virtual site



In a realistic site



The shape of the site and the layout of the buildings were modified to fit the topography.

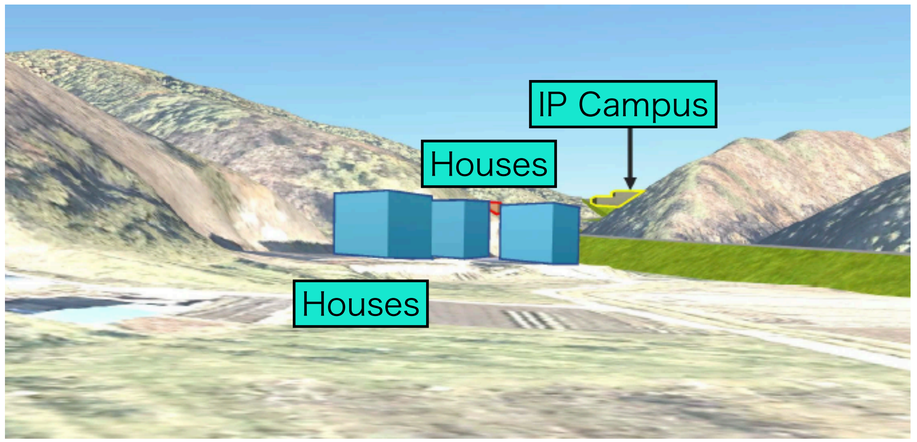
Improve “Tohoku ILC CE Plan”

Impact of our surface facility on the landscape

In a realistic site

Example : IP campus ~10ha

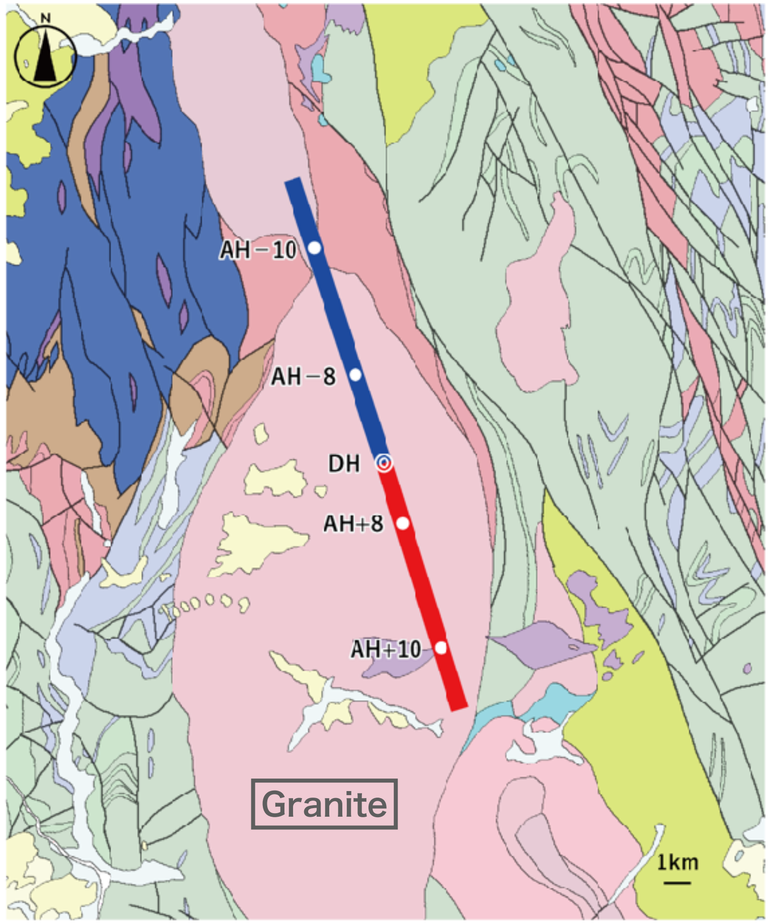
In a virtual site



Landscape simulations were performed to confirm that the impact of our facility on the landscape is small.

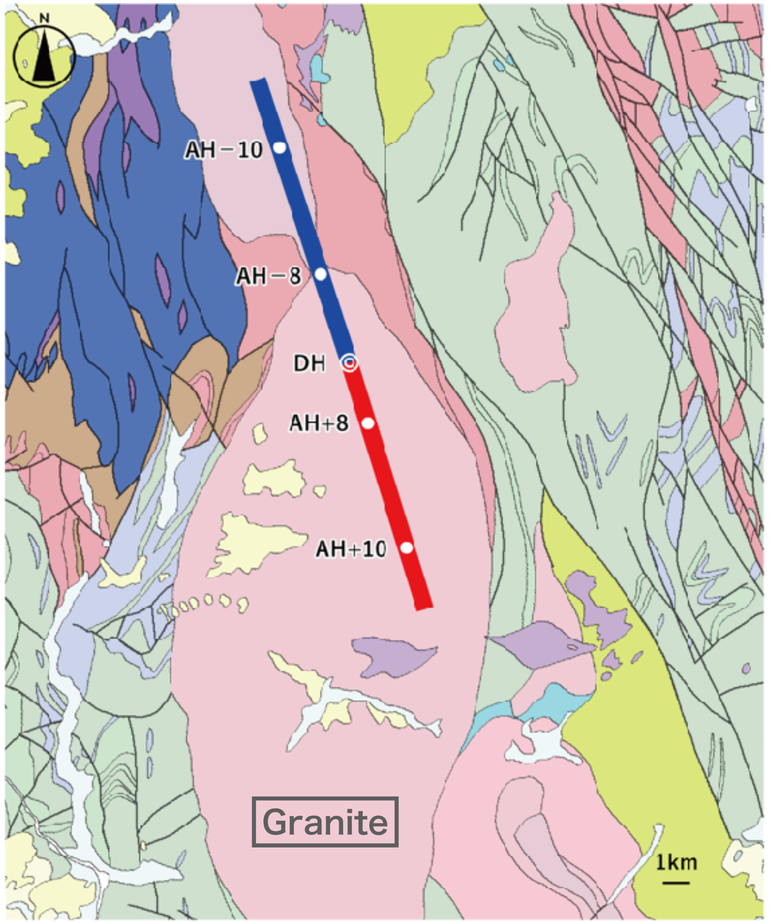
Improve “Tohoku ILC CE Plan”

Re-examination of facility layout



Landscape

Natural environment



“Tohoku ILC Civil Engineering Plan”

The proposed layout of the facility was modified to take into account the landscape and surface environment.

Improve “Tohoku ILC CE Plan”

Updating the construction schedule (& cost)

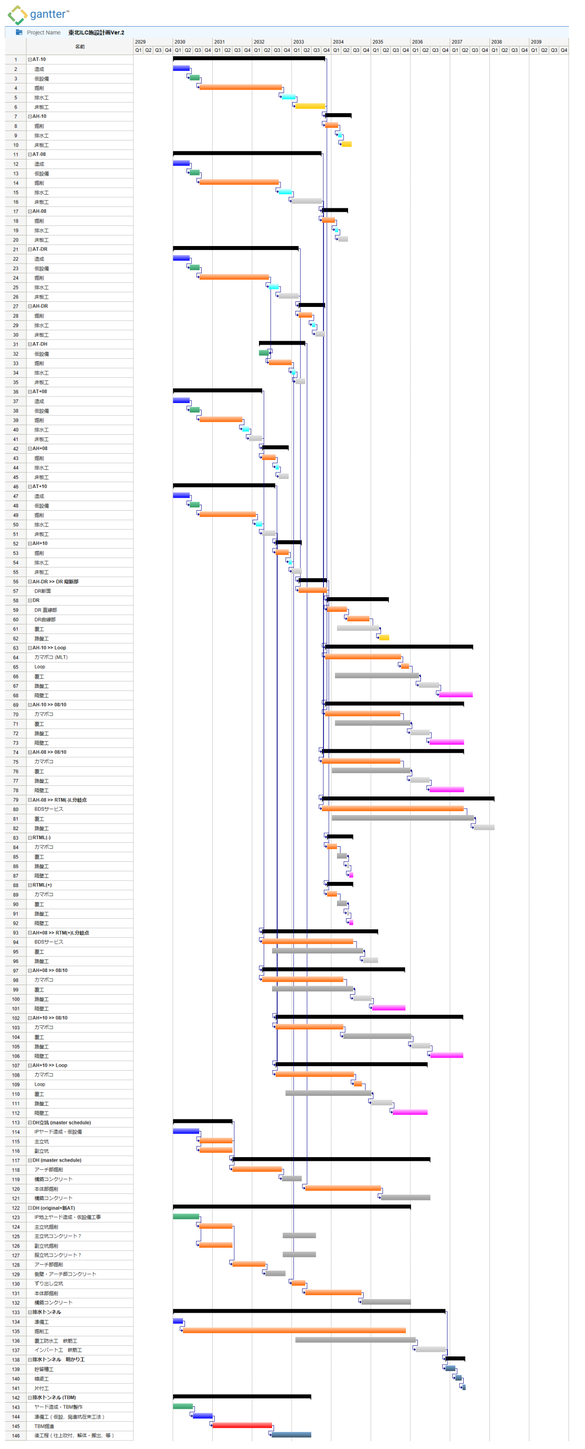
Project Name 東北ILC施設計画Ver.2

	名前
1	⊞AT-10
7	⊞AH-10
11	⊞AT-08
17	⊞AH-08
21	⊞AT-DR
27	⊞AH-DR
31	⊞AT-DH
36	⊞AT+08
42	⊞AH+08
46	⊞AT+10
52	⊞AH+10
56	⊞AH-DR >> DR 縦断部
58	⊞DR
63	⊞AH-10 >> Loop
69	⊞AH-10 >> 08/10
74	⊞AH-08 >> 08/10
79	⊞AH-08 >> RTM(-)L分岐点
83	⊞RTML(-)
88	⊞RTML(+)
93	⊞AH+08 >> RTM(+)L分岐点
97	⊞AH+08 >> 08/10
102	⊞AH+10 >> 08/10
107	⊞AH+10 >> Loop
113	⊞DH立坑 (master schedule)
117	⊞DH (master schedule)
122	⊞DH (original+新AT)
133	⊞排水トンネル
138	⊞排水トンネル　明かり工
142	⊞排水トンネル (TBM)

2029 2030 2031 2032 2033 2034 2035 2036 2037 2038

Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

Still working on it.



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Surveys

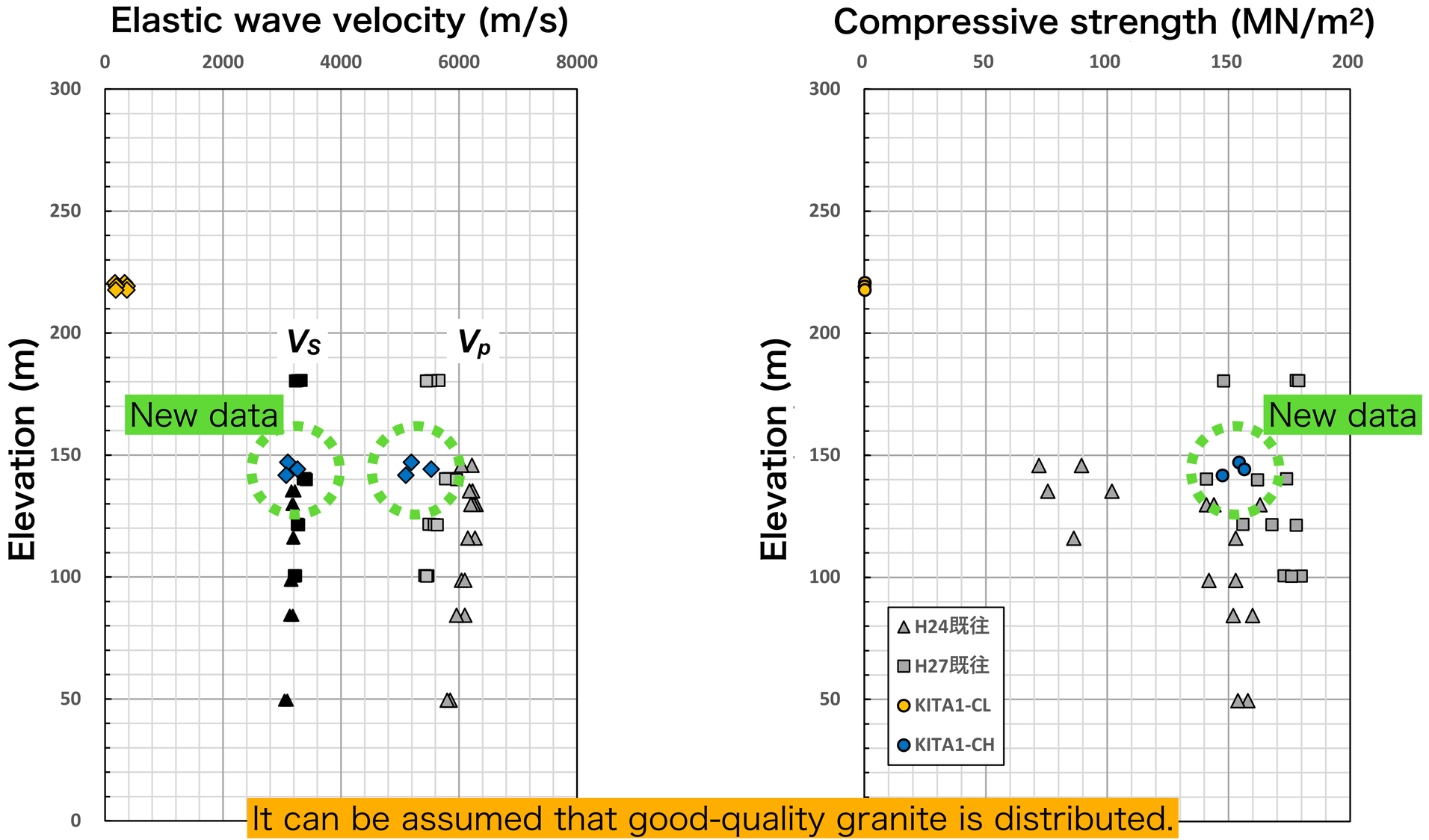
1. Boring Survey
2. Heavy metals
3. Ground motion near the river

Boring survey

Conducted a boring at the “perfect” location to demonstrate a new method of measuring initial rock stress.

IFS 東北大学 流体科学研究所
Institute of Fluid Science. Tohoku University

Mechanical properties of the rock



It can be assumed that good-quality granite is distributed.

Heavy metal content

In the Soil Contamination Countermeasures Act, it is used to determine the designated criteria for risk due to direct ingestion.

Sample-5 and -6 columns: measurements of rock samples collected near the IP.

New data

	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6	environmental standard
Cd [mg/kg]	< 4.5	< 4.5	< 4.5	< 4.5	< 5	< 5	45
Pb [mg/kg]	< 15	< 15	< 15	< 15	< 15	< 15	150
Cr(VI) [mg/kg]	< 25	< 25	< 25	< 25	< 5	< 5	250
As [mg/kg]	< 15	< 15	< 15	< 15	< 5	< 5	150
Hg [mg/kg]	< 1.5	< 1.5	< 1.5	< 1.5	< 0.05	< 0.05	15
Se [mg/kg]	< 15	< 15	< 15	< 15	< 5	< 5	150
F [mg/kg]	< 400	< 400	< 400	< 400	< 50	71	4000
B [mg/kg]	< 400	< 400	< 400	< 400	< 50	< 50	4000

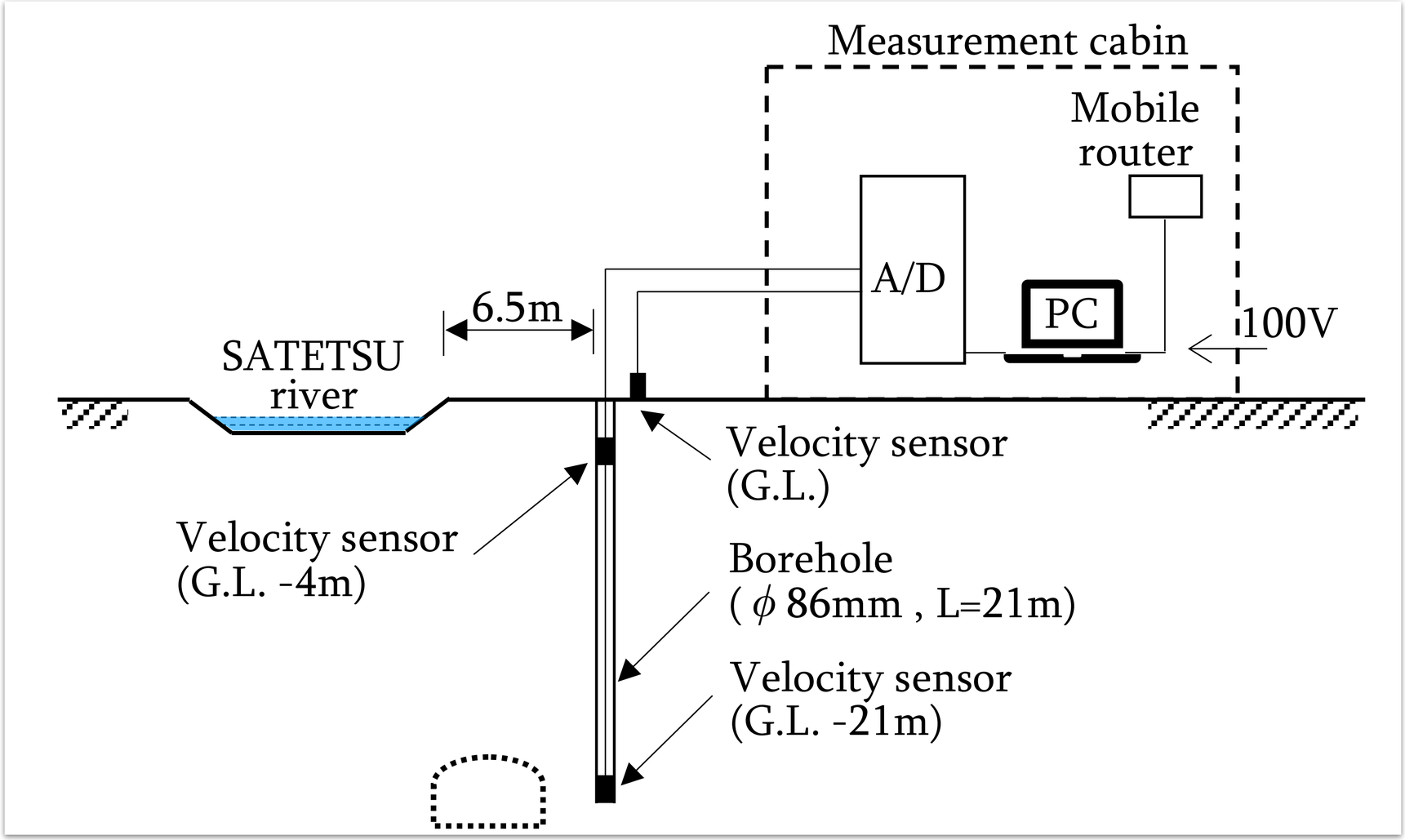
Heavy metal risk can be predicted to be very low.

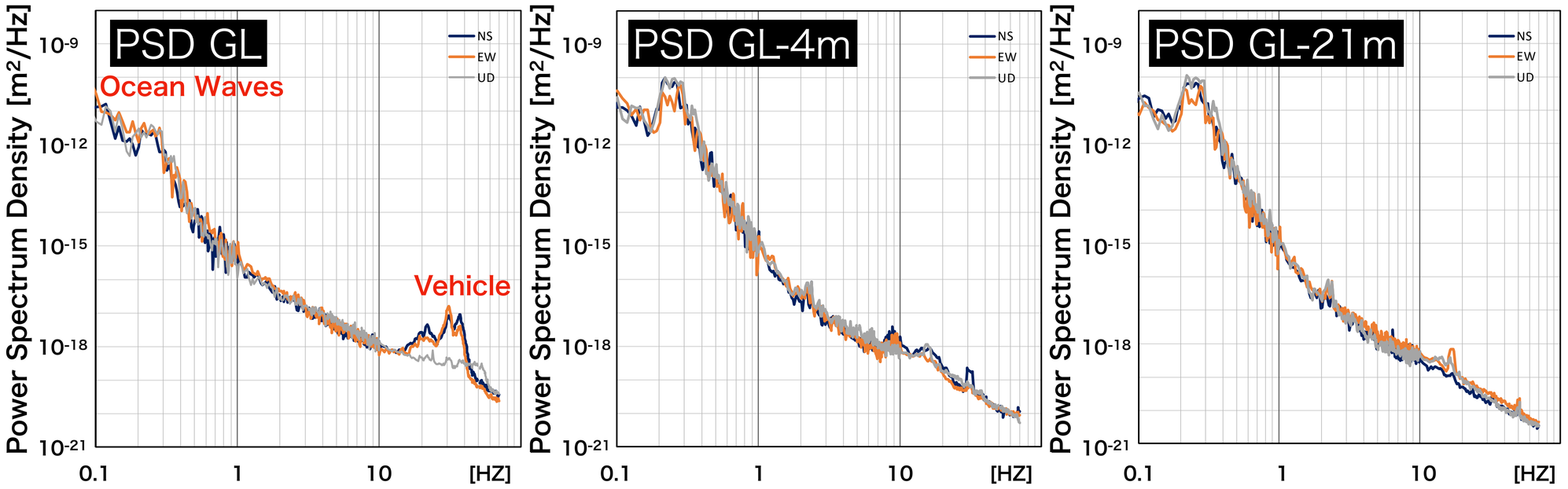
Measurement of ground motion

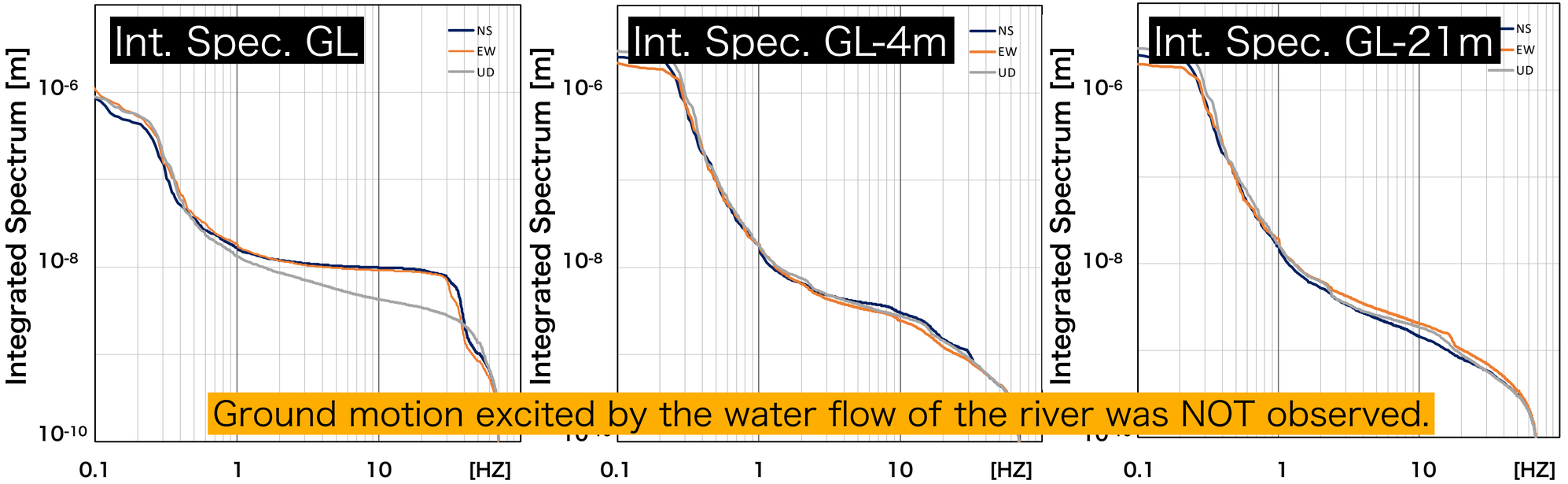
Excited by the river/vehicles

Shallow Earth Covering

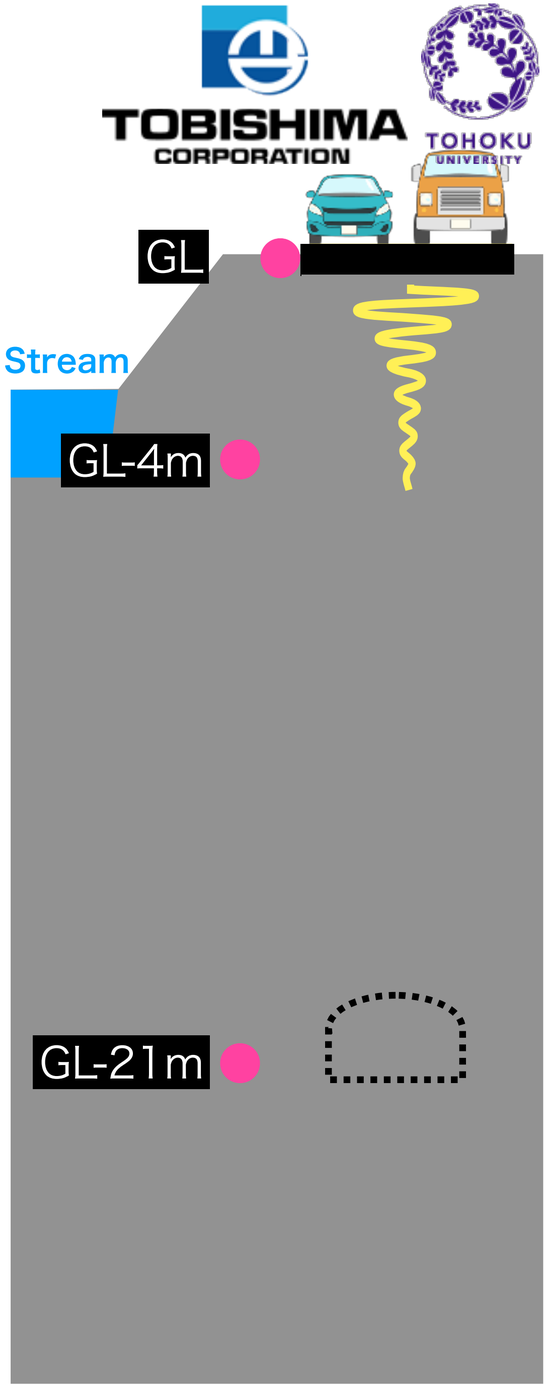
~2 years



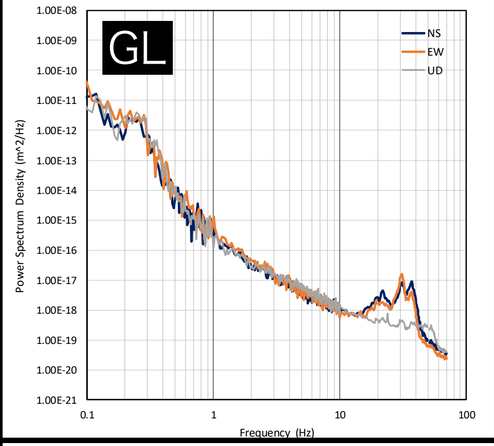


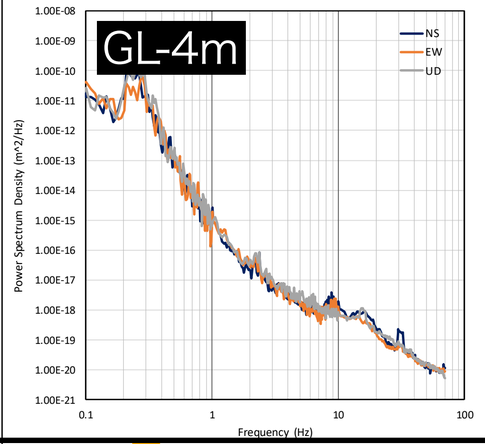


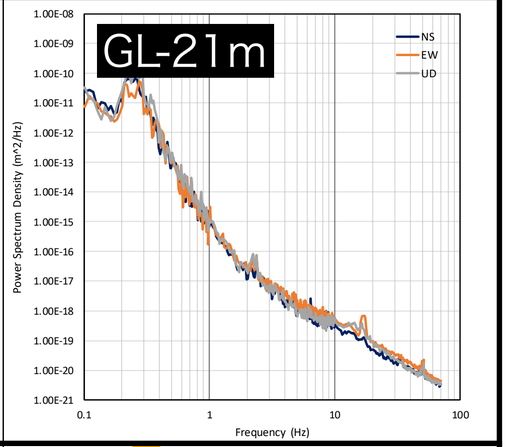
Ground motion excited by the water flow of the river was NOT observed.

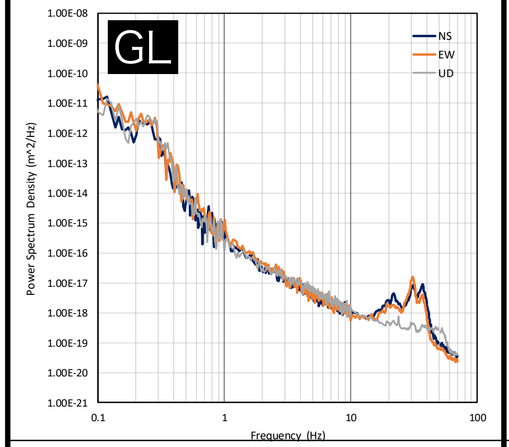


Coherence

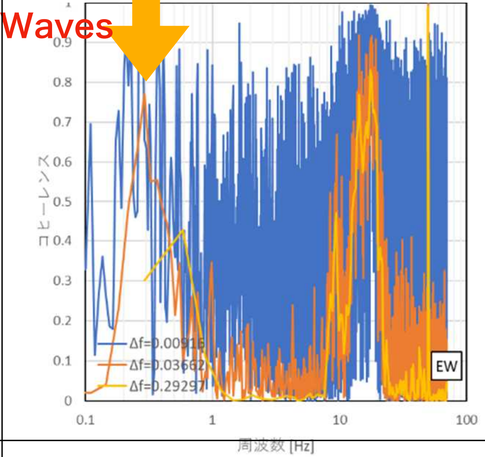


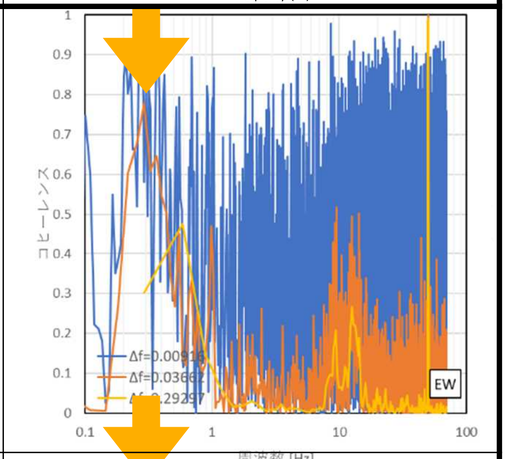


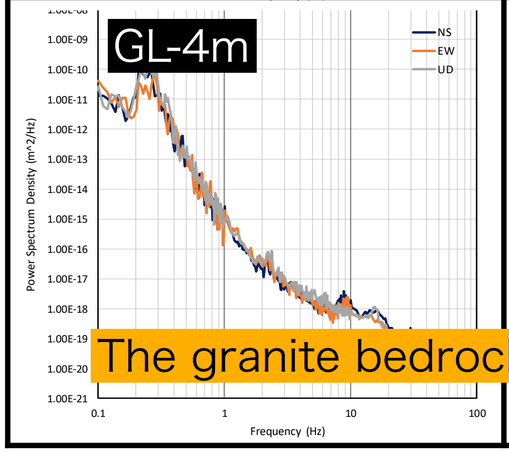


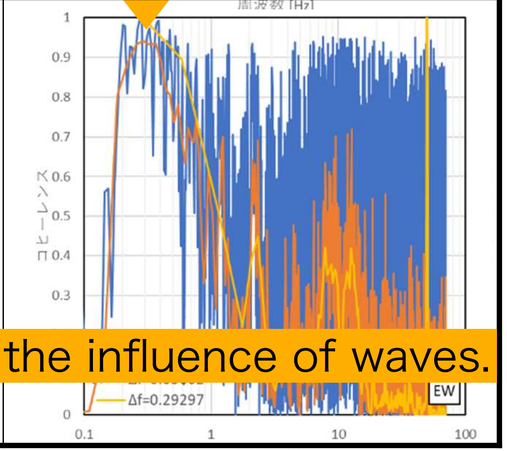


Ocean Waves

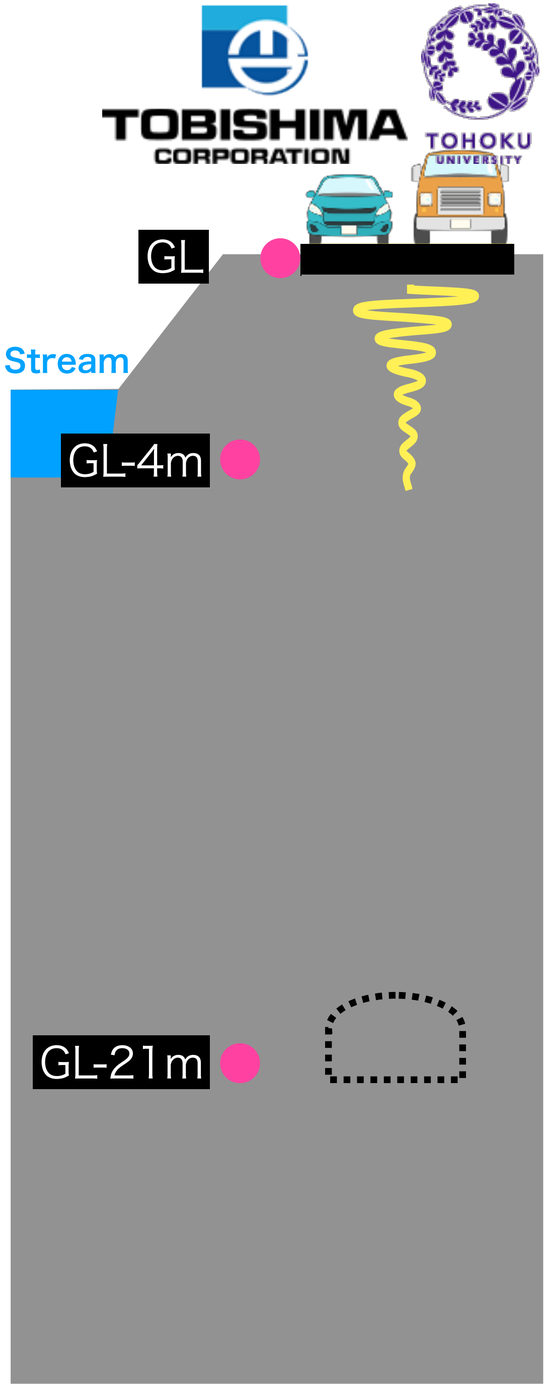








The granite bedrock is moving coherently as a single body under the influence of waves.



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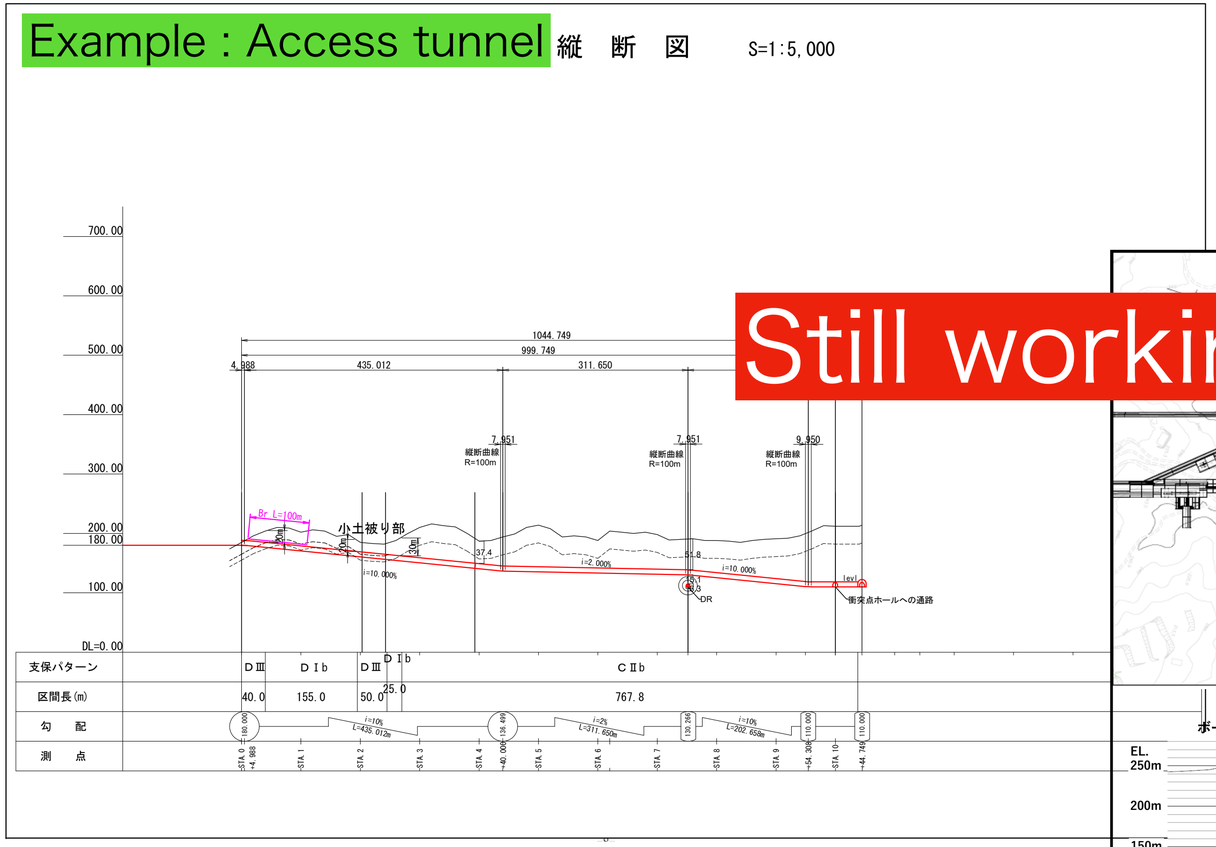
Plans for additional surveys

Plan for additional geological surveys

The realistic CE plan requires additional geological surveys before the construction.

Example : Access tunnel



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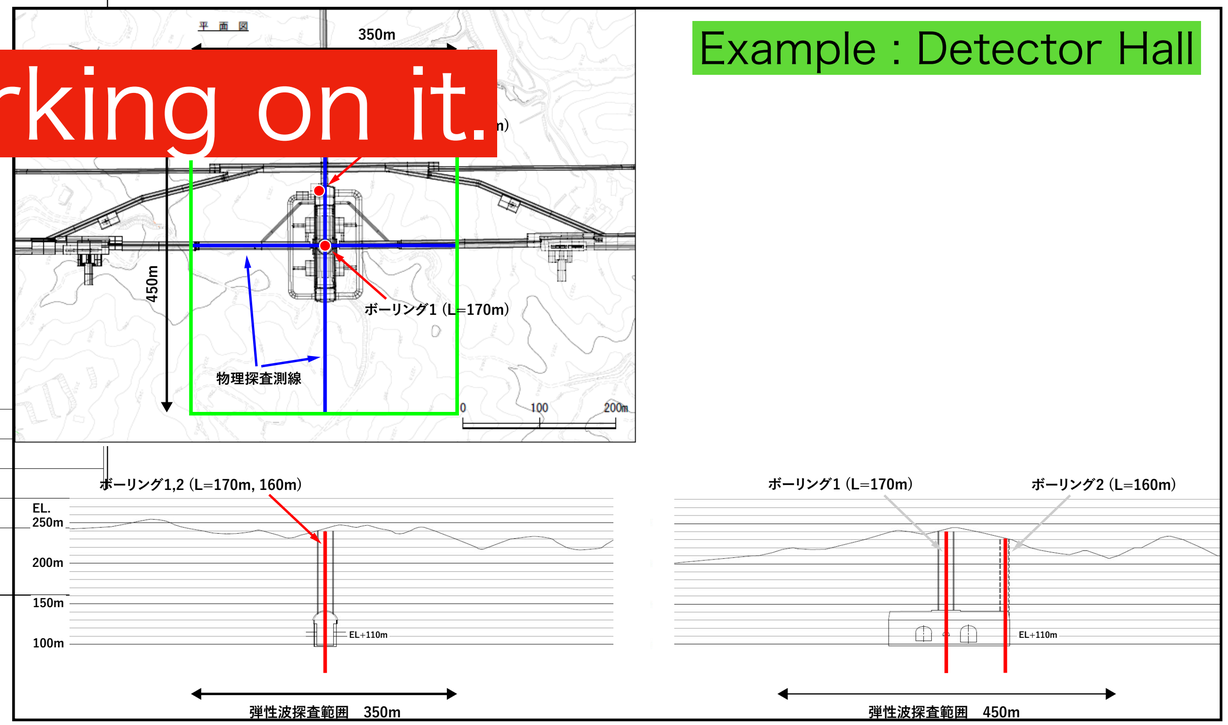

Example : Detector Hall

Summary

- In Tohoku, studies on the facility design and various surveys for the ILC are progressing steadily.

1. Improve “Tohoku ILC Civil Engineering Plan”
2. Additional surveys
3. Plan for additional surveys during Pre-lab. phase