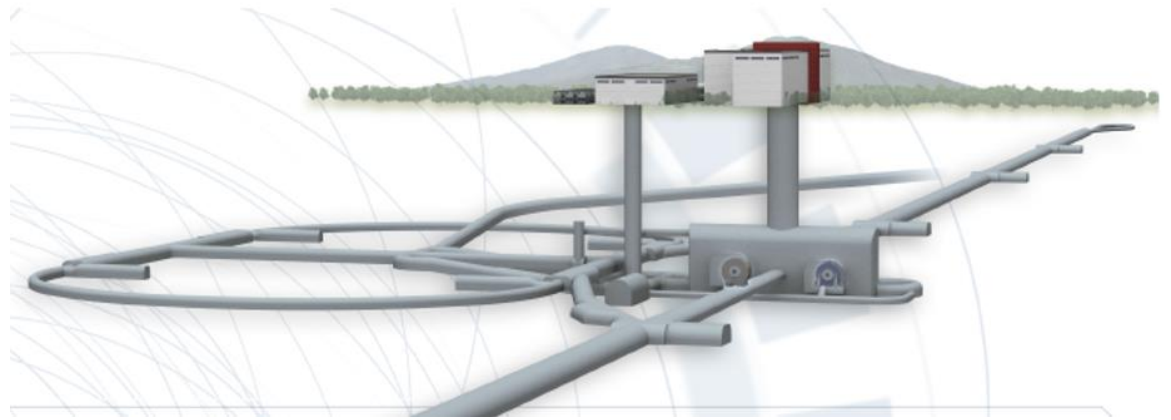


Tour Guide

Inspection: **Kannagawa UPS**



Highlights: Large Cavern Construction:



Tour Guide

Inspection of Large Cavern : **Kannagawa UPS**

- Date: 29 Sep, 2017
- Destination: Ueno-mura in Gunma Pref.
- Time required: approxi. a half day



Chartering Bus:
大栄観光バス: 029-851-5599
DAIEI KANKO

	Schedule	Note
Outward	<p>KEK (Main Gate) ===== Tsukuba Center ===== Tsukuba-IC ===== <i>Expressway</i> 6:40 Dep. 7:00 Dep. 7:10 <rest> 下仁田 上野村 ===== Takasaka-SA ===== Shimonita-IC ===== Ueno-mura 8:15-8:25 10:00 Arr.</p>	上野村産業情報センター: 0274-20-7070
	<p>神流川発電所 上野ダム ● Kannagawa-UPS & Uneno-Dam == ◎Restaurant/琴平 <i>Lunch</i> Kotohira 10:00-12:00 12:15-13:15</p>	R:琴平 0274-59-2665
Return	<p>上野村 Ueno-mura (Restaurant) == (Excursion) == Shimonita-IC ===== 13:15 Dep. <15:00> <i>Expressway</i> <rest> ===== Shoubu-PA ===== Tusukuba-IC ===== KEK 16:50-17:00 18:00 arr. 18:20arr.</p>	

Underground Cavern Inspection Tour

Date: 29 Sep, 2017
Dep: 6:40am <from KEK-main gate>
7:00am <from Tsukuba Station>
Destination: Kannagawa UPS /TEPCO
Place: Ueno-mura in Gunma Pref.
Traffic: Chartered Bus

Kannagawa UPS Cavern



TEPCO / Tour Station



Purpose of the Tour:

By inspecting the underground large cavern similar to ILC-DH, we gain knowledge about construction methods and problems after construction.

Based on this, we will study the reduction of DH construction costs.

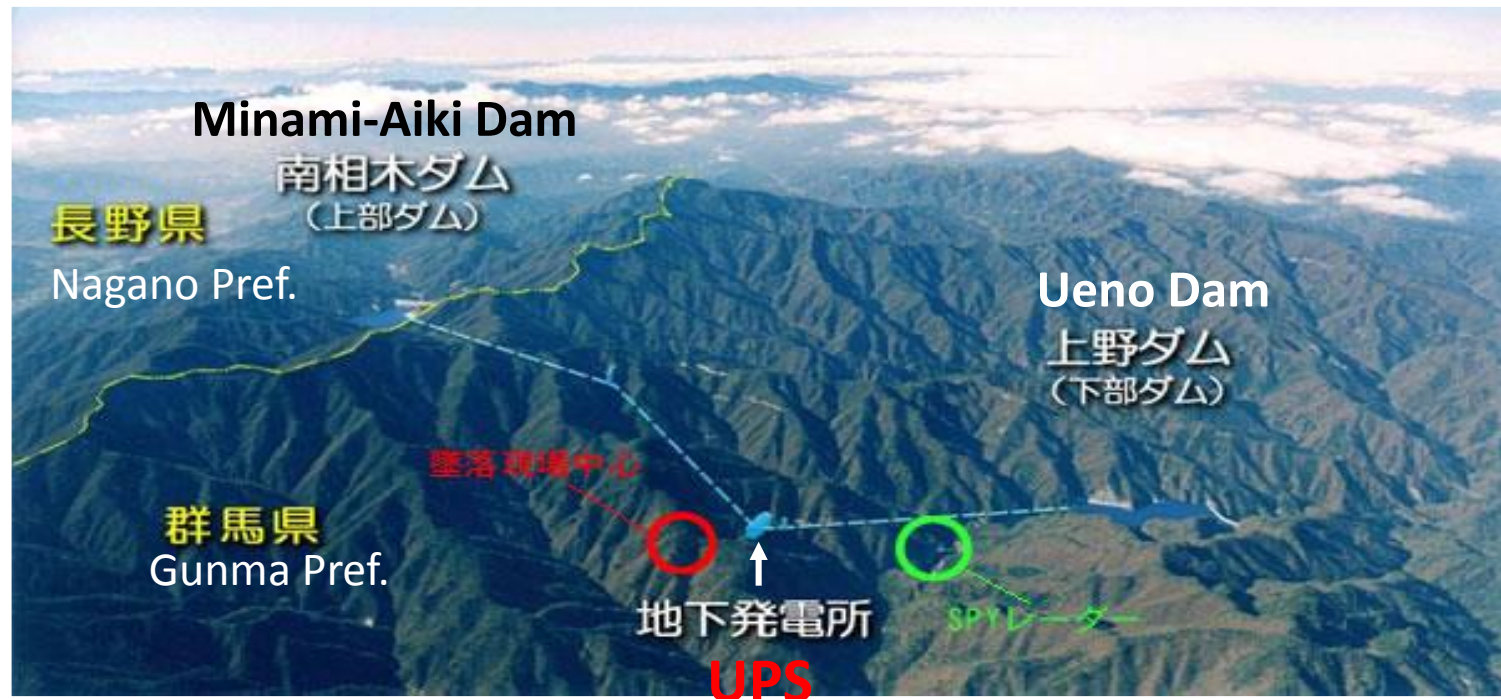
Introduction

Overview of the Kannagawa UPS

■ Outline of the Construction

Kannagawa-UPS is a pure **pumping-up power station** of total output 2,800 MW (Largest in the world)

Currently, 4 generators are operating (finally 6 generators)

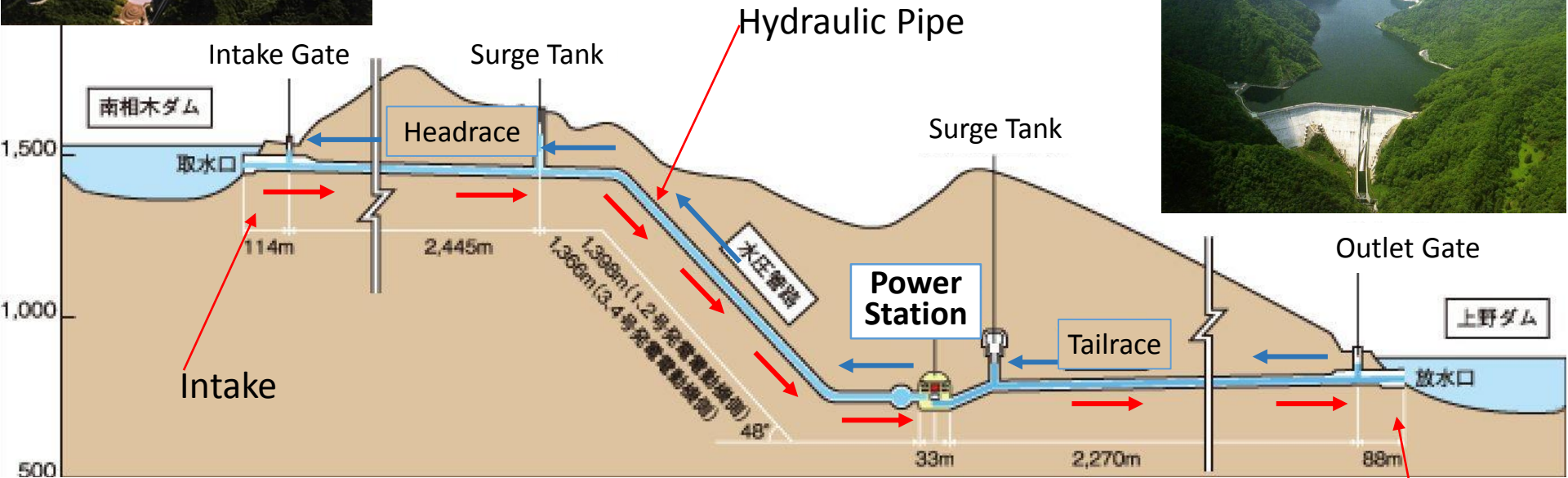


Waterway Structure

Upper Dam
Minami-Aiki Dam



Lower Dam
Ueno Dam



- ← Peak off in night
- Peak time in daytime



Outlet

Overview of the Kannagawa UPS

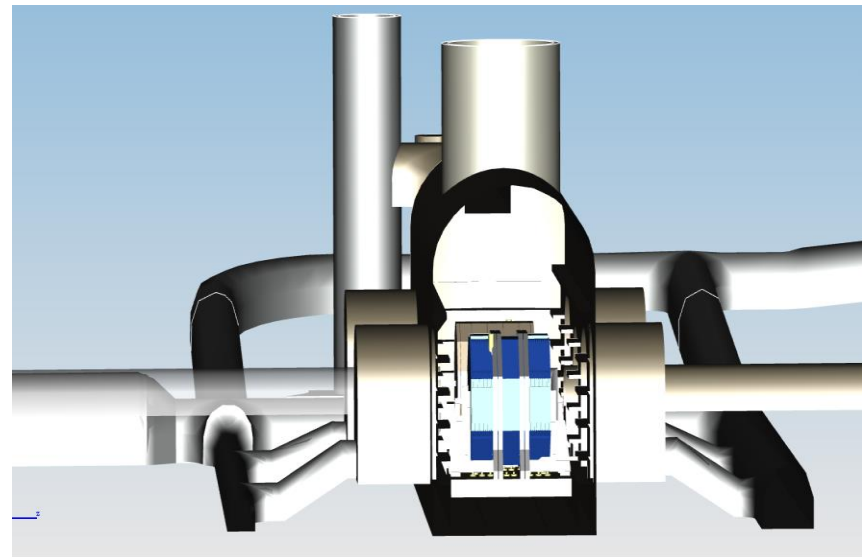
■ Construction of first stage:

- Construction Term: 8 years (Mar,1997 ~ June, 2005)
- Contractor: Kajima-co.-JV
- Contract Amount: 35,000 My (Whole Project: 500,000 My)
- Geology: **Mixed rocks/** Sandstone, Chart, Basalt, Limestone gravel on the bedrock based on Mudstone

Kannagawa UPS Cavern



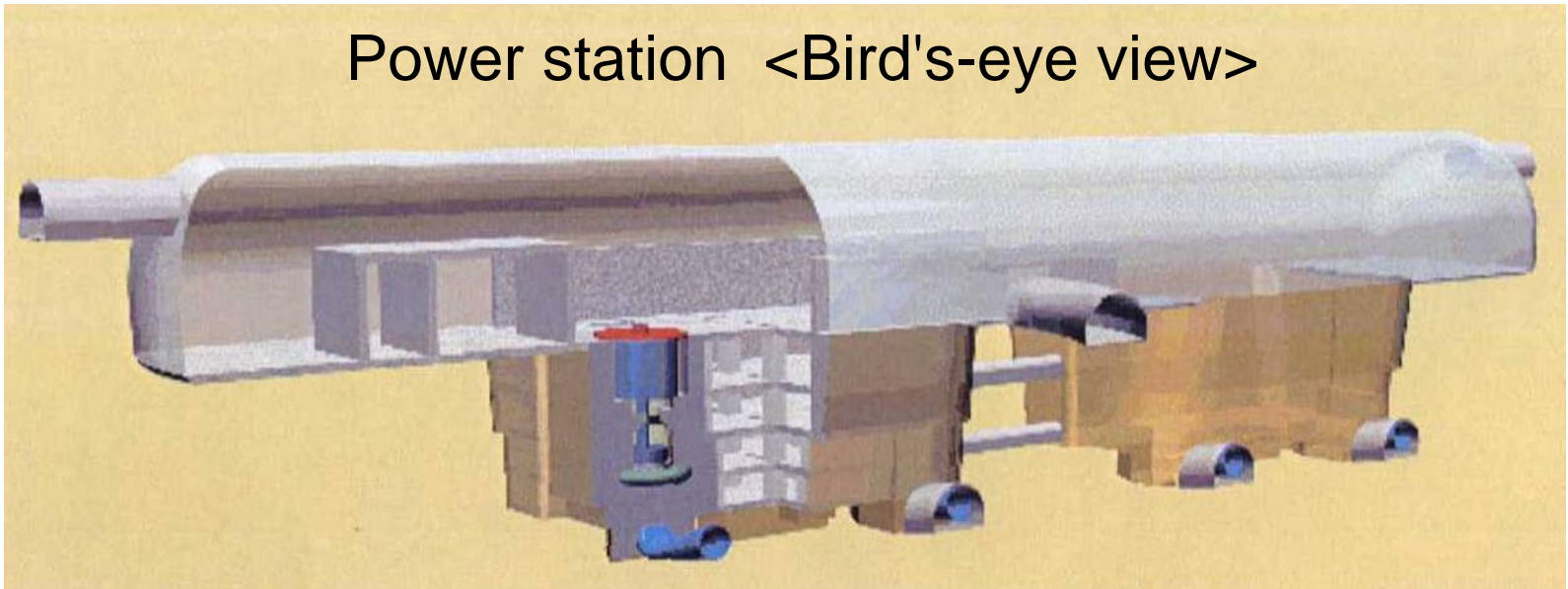
ILC DH Cavern



Construction Quantity of the UPS Cavern

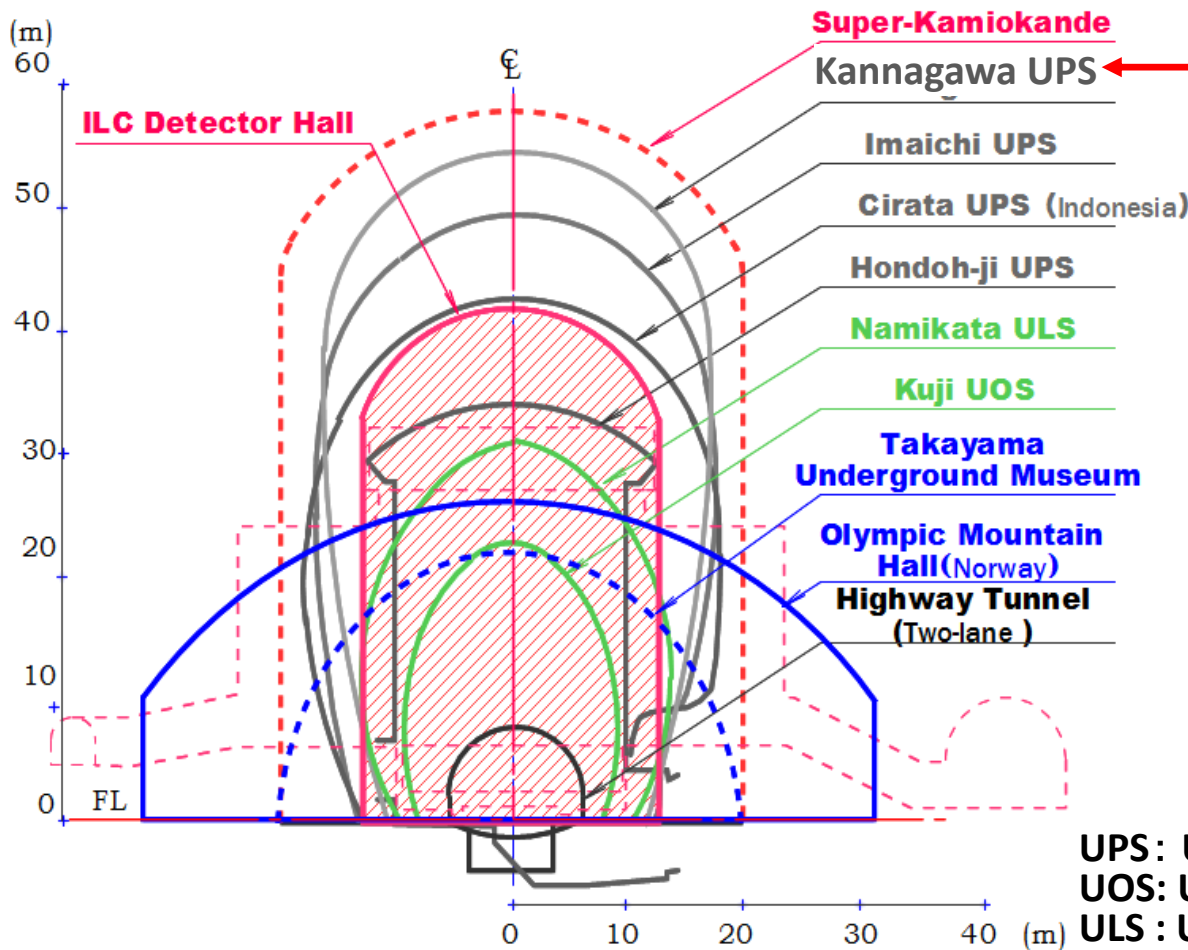
Subject	Dimension	Excavation Volume
UPS Cavern	Height: 52.1 m Width: 33.0 m Length 215.9 m	250,000 m ³
Service Tunnel	Cross-section: 24~50m ² Total Length: 5,700 m	220,000 m ³

Power station <Bird's-eye view>

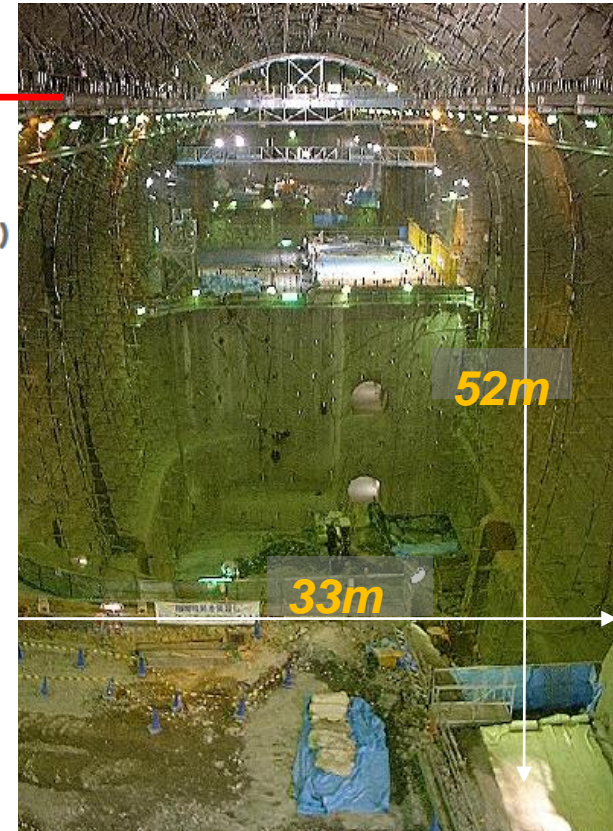


Construction Quantity of the UPS Cavern

Large Cavern in the world



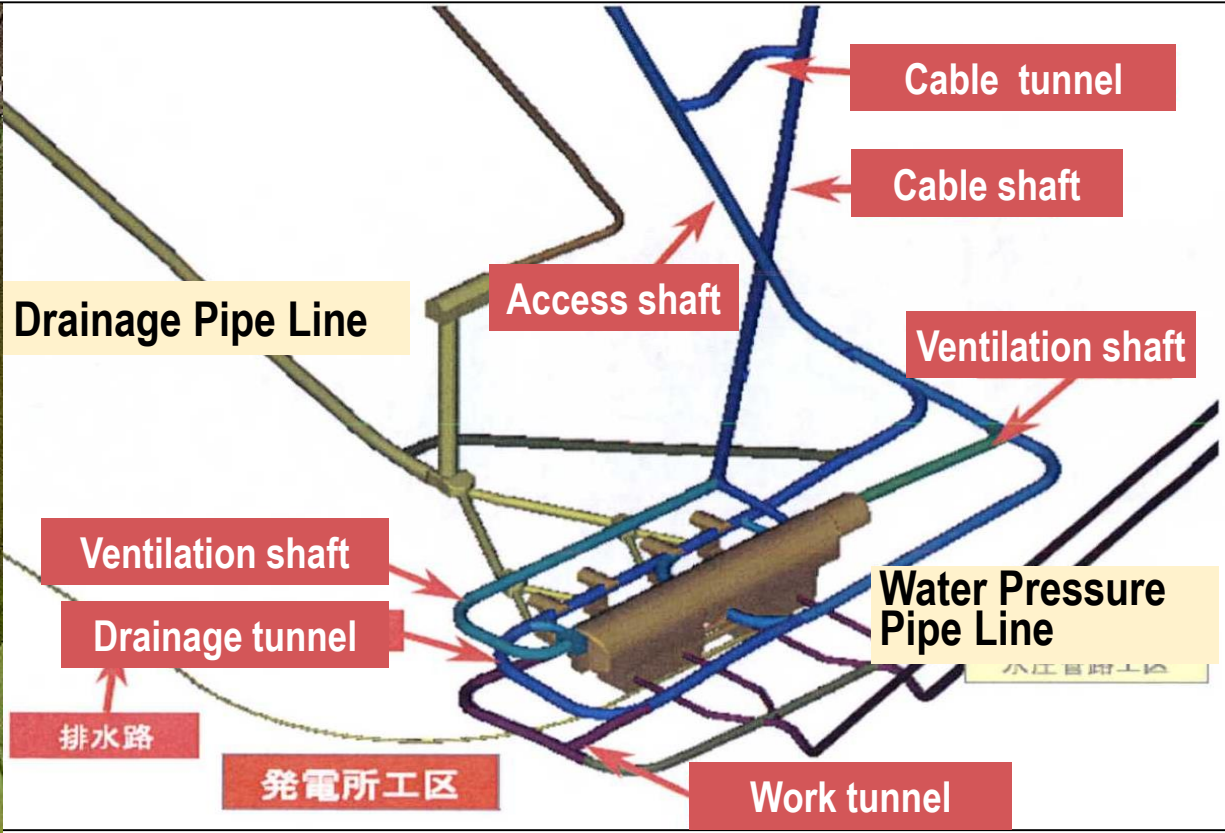
Kannagawa UPS



UPS : Underground Power Station
 UOS : Underground Oil Station
 ULS : Underground LPG Station

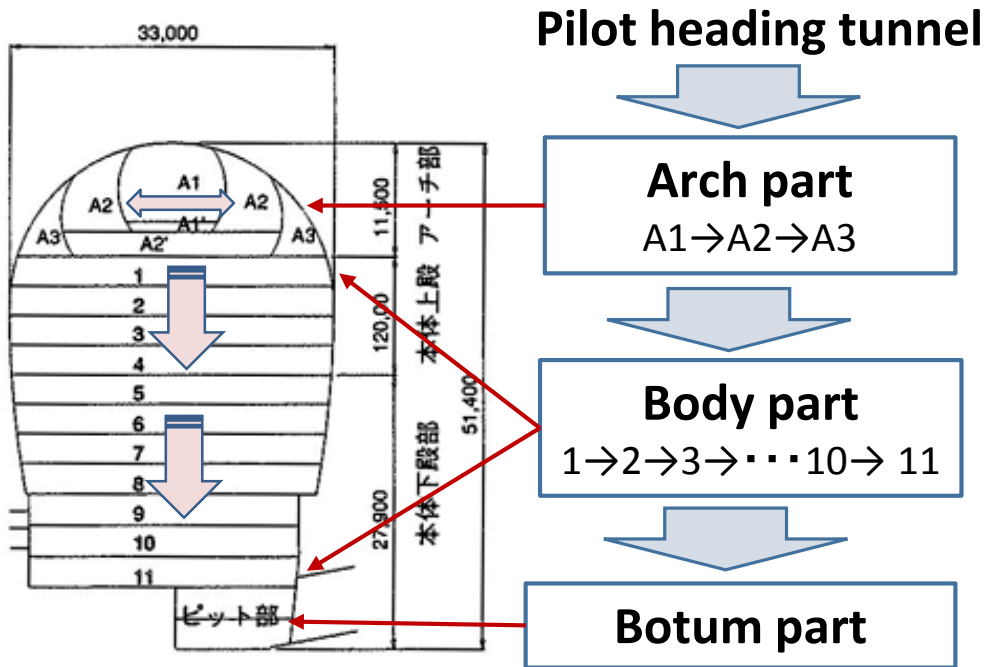
Service Facilities around the UPS Cavern

UPS Construction Area



Excavation procedure (Bench program)

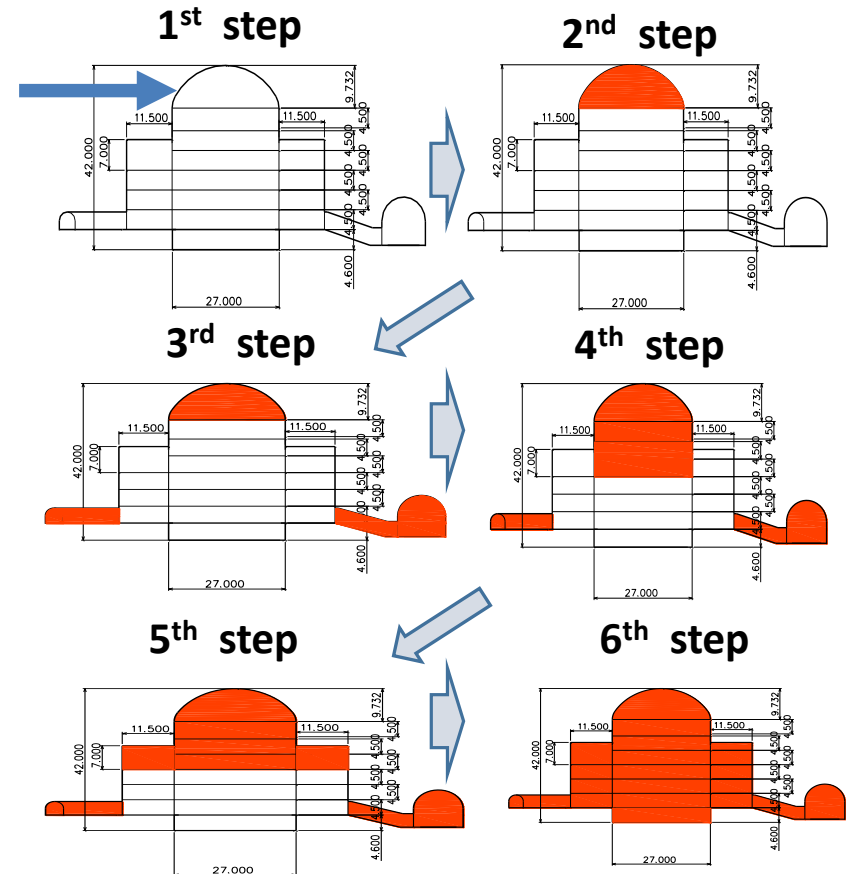
Kanngawa-UPS Cavern



◆ Both facilities are almost the same procedure for cavern excavation.

Bench Cut Method

ILC-Detector Hall





Excavation Arch(A2) 1999.02



Excavation Arch(A3)



Bench Cut (1) 1999.8



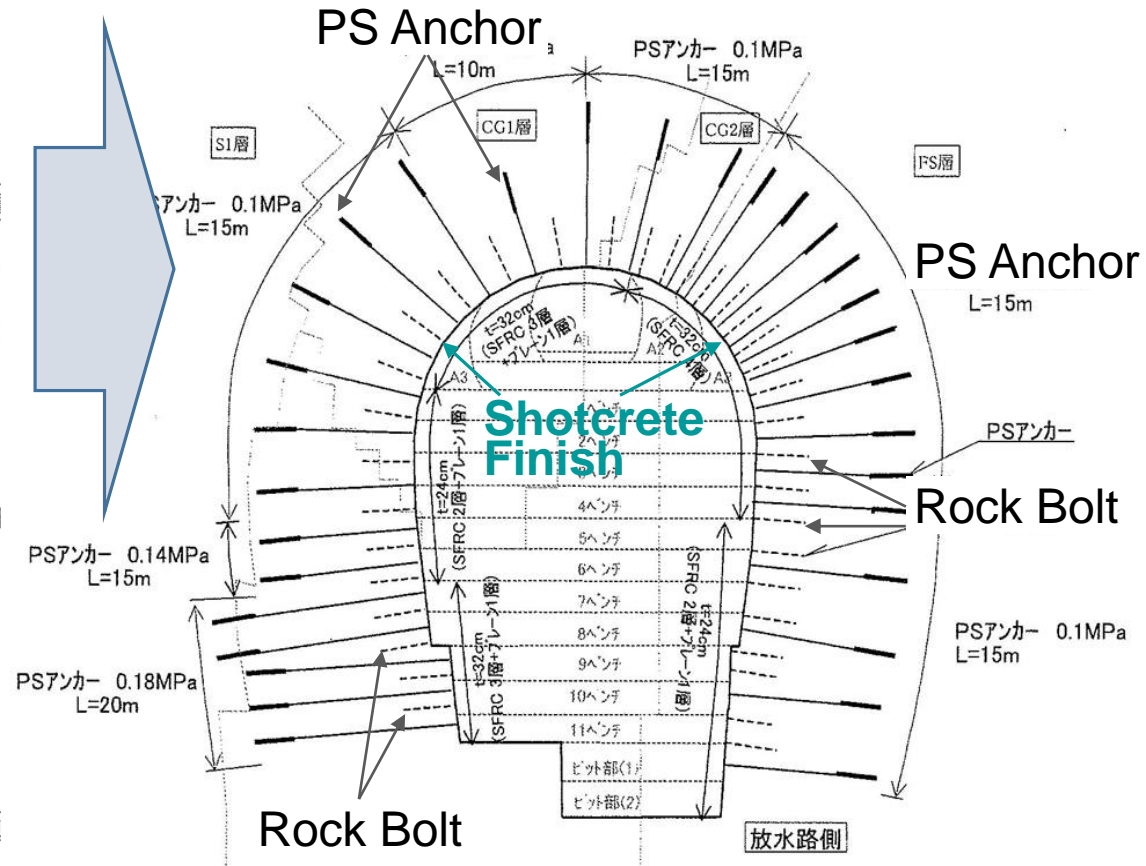
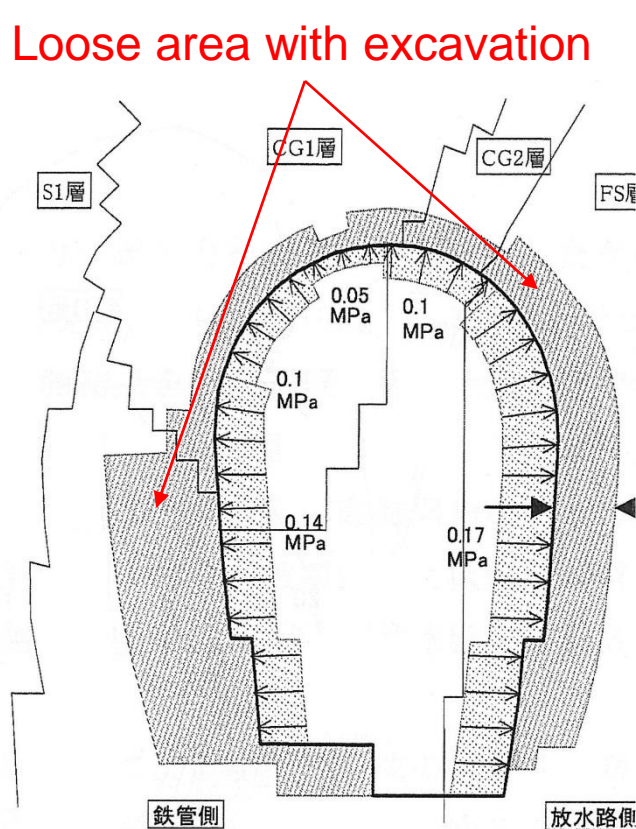
Bench Cut (4) 1999.12

Earth Anchor & Rock Bolt

FEM analysis about bedrock looseness with excavation

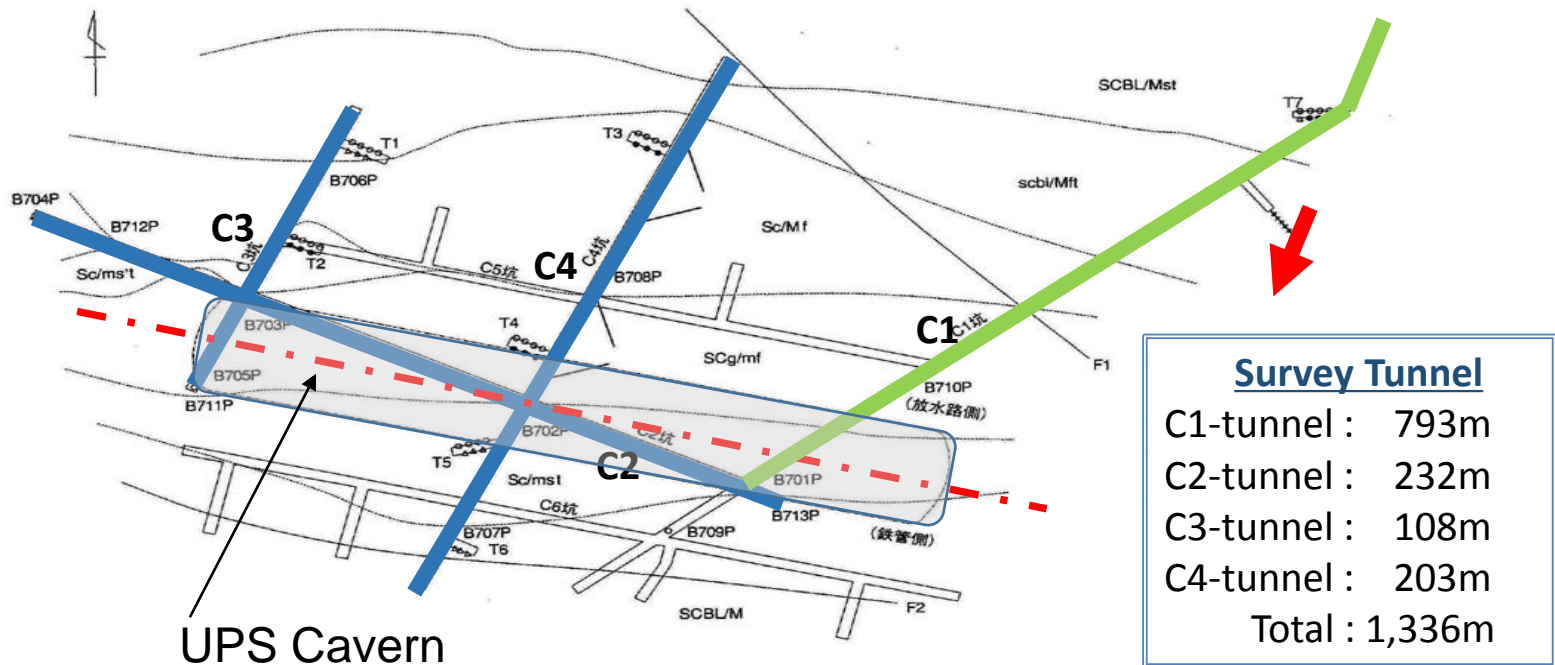
Timbering by PS Anchor & Rock Bolt

Loose area with excavation



Survey Tunnel Construction for the UPS Cavern Position Determination

Item	Quantity	Contents
Surface Boring Survey	5 Holes (Total length=2,800m)	<ul style="list-style-type: none"> Water Permeability P/S wave Velocity
Side Tunnel Survey	6 holes (Total length=1,500m)	<ul style="list-style-type: none"> Wall geological observation
Tunnel Boring Survey	13 holes (Total length=1,400m)	<ul style="list-style-type: none"> Borehole observation Boring-Core Observation



Investigation for Cavern Design

In the pre-design phase

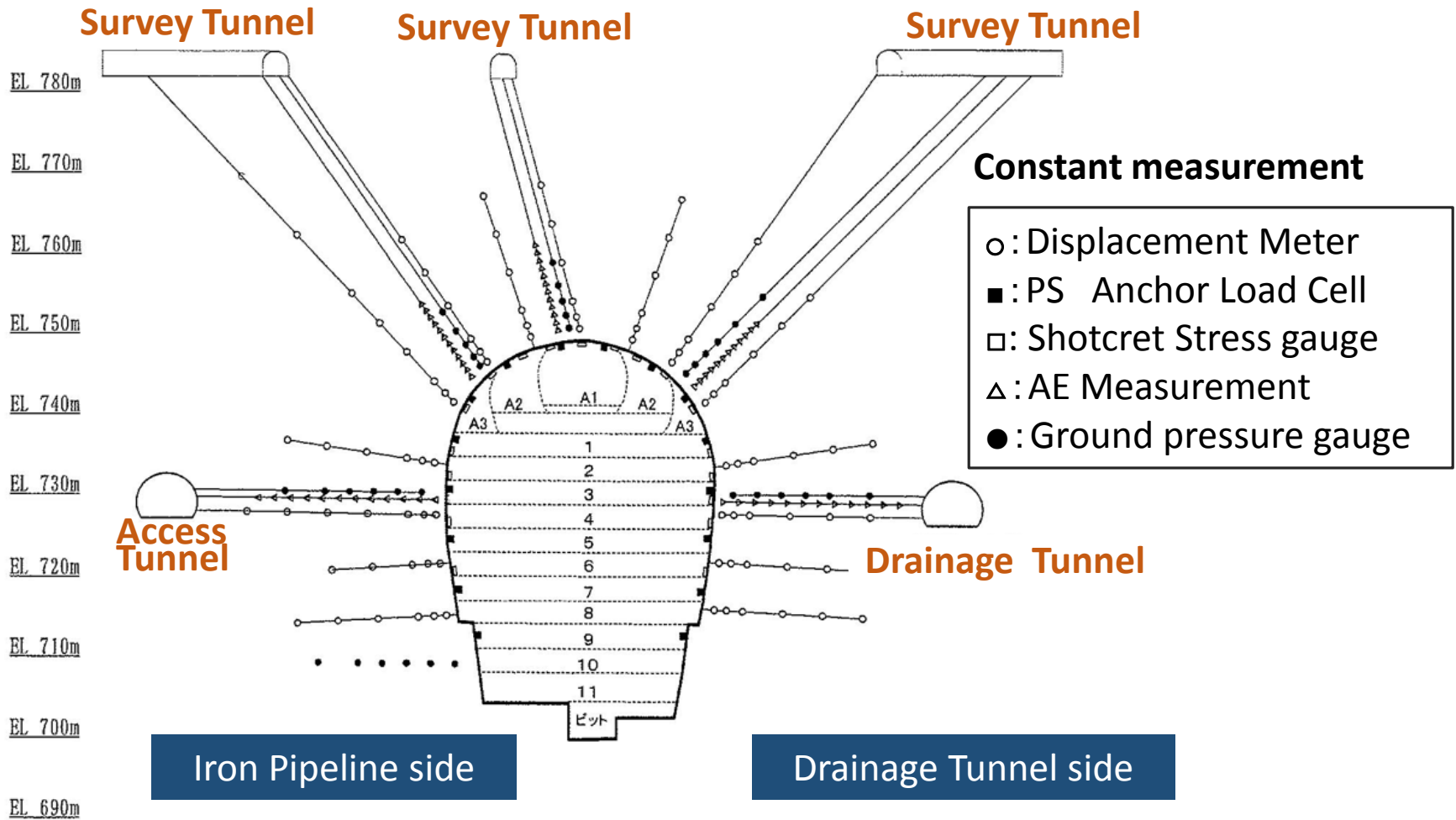
Investigation on surface

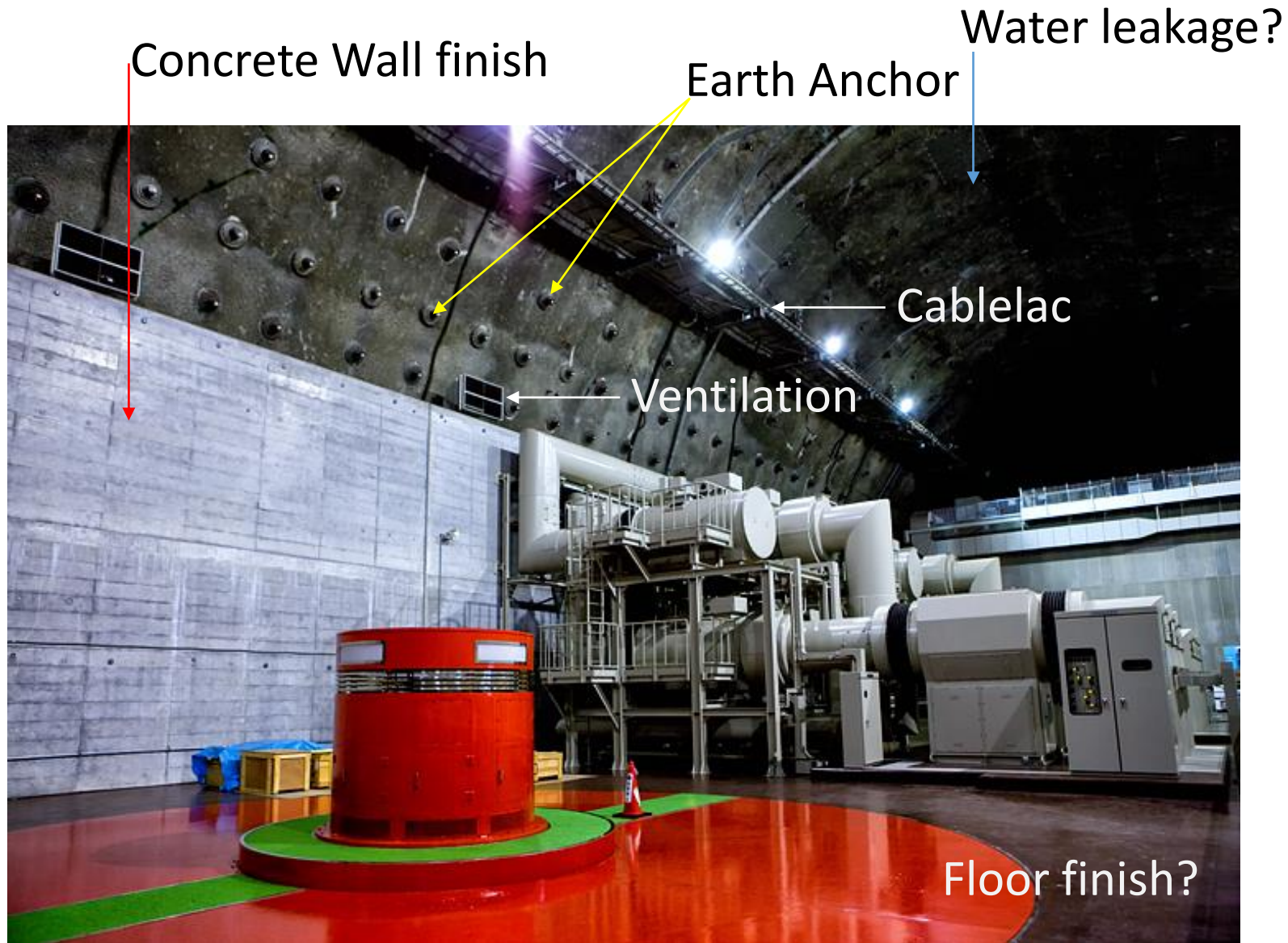
- Surface Exploration, Geological Survey
- Boring Survey / Ground water
- Bedrock Test
- Seismic Prospecting

Investigation in Pilot tunnel

- Geological Investigation / Ground water
- Boring Survey
- In situ Rock Test

Measurement system Diagram





Concrete Wall finish

Earth Anchor

Water leakage?

Cablelac

Ventilation

Floor finish?



Excavation Completed

End

Local weather forecast for 29 Sep (Fri)

- Sunny all day (rainy percent: 0)
- Temperature : Max:24 °C, Min: 11 °C