Architecture and Urban Design for Disaster Risk Reduction Database
User's Manual

https://isdm.lab.irides.tohoku.ac.jp/english/archi-drr/

Ver.1.0（2022/10/10）

1. Purpose and Overview of the Architecture and Urban Design for Disaster Risk Reduction Database (Archi-DRR DB)

Regardless of the period, in disaster areas, cities have been regenerated through new initiatives based on the lessons learned from past disasters. In addition, there are characteristic villages that respond to disasters unique to regions all over the world and are deeply related to the climate, such as the traditional village of Okinawa with impressive white plaster and red brick roofs. Archi-DRR DB principally manages examples of Architecture and Urban Design that respond to disasters around the world, and it aims to provide information to domestic and foreign stakeholders, researchers, tourists, school educators, etc. involved in disaster countermeasures.

Each case is systematized from the perspective of disaster science and consists of Location (linked to Google Maps), Construction Era/Year, Triggering Disaster Classification, Targeting Disaster Classification, Purpose in the Systematic Disaster Life Cycle (Mitigation / Preparedness / Response / Recovery / Prediction and Early Warning / Damage Assessment / Information and Communication / Information Sharing and Education / DRR Base Facility not Constructed in a Post-Disaster Recovery Process / Others), Spatial Scale Classification (Architectural Element / Building Unit / Building Cluster / Infrastructure / Landscape / Open Space / District / Monument /Others, including Intangible Assets), Explanation, References. In addition, disasters are classified into Primary Item (Wind-related Disasters / Water-related Disasters / Fire-related Disasters / Earth-related Disasters) and Secondary Item (Storm and Flood / Extreme Climatic Event / Snow, Freezing, and Lightning / Ground Deformation / Earthquakes / Volcanic Disaster / Tsunami / Explosion / Fire / Leakage / Toxicosis / Structural Collapse / Break Down / Traffic Accident / Environmental Pollution / Human Error and Fatal Accident / Others).

By systematically aggregating cases of Architecture and Urban Design that respond to disasters around the world, users can collect information regarding their purpose and by linking the database with Google Maps, people can query information for on-site inspection.

2. Database Composition

(1) Basic Information and Disaster Classification

The database is structured as shown in Table 1.

The location of each case is gradually narrowed down from world regions to district names. As for the construction era/year, cases of Ground motion-resistant structures in the Nara and Heian periods, such as the pillars of the Shosoin of Todaiji Temple, are also covered, Past periods up to the Reiwa period (Japan only) are included with labeled Christian eras. In addition, since there are cases that do not exist already, such as burning down due to disasters and temporary structures during subsequent reconstruction, the presence or absence of them is also included.

“Triggering Disaster Classification” is the disaster that triggered the construction of the case, along with the “Specific Related Disaster”. "Targeting Disaster Classification" indicates the type of disaster for which a space is created.

Disasters are classified into "Primary Item" and "Secondary Item". The incubation of disasters is inseparable from the behavior of substances that cause hazards. Therefore, "Primary Item" classifies disasters into 4 elements that constitute all things: Wind, Water, Fire, and Earth. A more specific disaster classification is "Secondary Item". Including accidents, it is divided into 17 categories here.

Table 1 Database Composition

ID	Title	Keywords
Location: Region / Country / Prefecture/Province/State / Municipality / District		
Construction Era/Year / A.D. / Existing Status		
Triggering Disaster Classification: <Primary Item> Wind-related Disasters / Water-related Disasters / Fire-related Disasters / Earth-related Disasters <Secondary Item> Storm and Flood / Extreme Climatic Event / Snow, Freezing, and Lightning / Ground Deformation / Earthquakes / Volcanic Disaster / Tsunami / Explosion / Fire / Leakage / Toxicosis / Structural Collapse / Break Down/Traffic Accident / Environmental Pollution / Human Error and Fatal Accident / Others		
Targeting Disaster Classification: Same as above		
Related Disaster		
Purpose in the Systematic Disaster Life Cycle: 01. Mitigation: Environmental Mitigation / Structural Mitigation / Landuse Mitigation 02. Preparedness 03. Response: Evacuation / Evacuation (Vertical) / Evacuation (Horizontal) / Open Space / Shelter 04. Recovery: Sheltering Place / Temporary Housing / Temporary Complex / Permanent Housing / Post-disaster Memorial Park / Post-disaster Memorial/Monument / DRR Education Facilities / Disaster Remains / City Hall / Commercial Facilities / Industrial Base / Transportation Facilities / Educational/Cultural Facilities / Community Base / Others 05. Prediction and Early Warning 06. Damage Assessment 07. Information and Communication 08. Information Sharing and Education 09. DRR Base Facility not Constructed in a Post-disaster Recovery Process 10. Others		
Spatial Scale Classification: Architectural Element / Building Unit / Building Cluster / Infrastructure / Landscape / Open Space / District / Monument / Others, including Intangible Assets		
Explanation		
Map/Coordinate		
Photo	Document	Drawing
References		

(2) Disaster Life Cycle

This database covers Architecture and Urban Design that respond to disasters around the world. In the field of disaster management, there is a concept called Disaster Life Cycle. This means that when a certain area is hit by a disaster, after going through the disaster emergency response stage, it reaches the stage of recovery and reconstruction, and then takes 2 disaster prevention measures (damage prevention and advance preparation for damage reduction) in preparation for the next disaster (Figure 1). There are 4 basic phases in this cycle. 1) Mitigation, 2) Preparedness, 3) Response, and 4) Recovery/Reconstruction. This is explained below, starting from the stage of pre-measures to prepare for disasters.

1) Mitigation

In normal times, it is necessary to prepare for the next hazard and take actions to prevent damage with financial and technical feasible extents. This is Mitigation. It is an effort to prevent damage from being caused by external forces, and it is also called "Hard Bosai" because it mainly takes preventive measures on the physical environment.

2) Preparedness

Even if the physical environment is prepared to mitigate the damage, if the external force of a hazard becomes greater than the damage deterrence, a disaster will occur. It is also necessary to prepare in advance so that even if damage is suffered, it should be minimized. This is a preparation task for damage mitigation, also called “Soft Bosai”. It is necessary to implement disaster prevention measures with a well-balanced combination of "Mitigation" and "Preparedness" according to the economic conditions of society and regional characteristics.

3) Response

Damage occurs when the impact of a hazard hits urbanized areas, and the external force exceeds the damage deterrence prepared in advance. This is a disaster. Due to the impact, the ground shape changes, social infrastructure and structures are destroyed, and the impact spreads to human casualties. In the immediate aftermath of a disaster, regardless of the position of the local government or residents, emergency response such as lifesaving and rescue operations and firefighting activities are taken to minimize the damage by making full use of the preparations that have been made in advance. This is the phase of disaster response.

4) Recovery/Reconstruction

After dealing with the immediate disaster outcome, it enters the phase of recovery and reconstruction. In the immediate aftermath of a disaster, damaged systems are restored to ensure a minimum level of social life. After short-term recovery has been achieved and if the damage is devastating, a reconstruction phase begins to create a new urban system. Reconstruction is basically a long-term process that lasts from a few years to a dozen years. During this long process, victims or communities gradually acquire a sense of normality. This is called long-term recovery, or “absolute recovery”. Then, preparation for the next disaster is essential from 2 aspects of disaster prevention: 1) Mitigation and 2) Preparedness.

Accompanying the above 4 basic aspects are 5) Prediction and Early Warning, 6) Damage Assessment, and 7) Information and Communication.

5) Prediction and Early Warning

A disaster is caused by a certain external force. Earthquakes can occur suddenly without warning. However, the movement of typhoons can be predicted based on advance weather information, making it possible to take countermeasures before a typhoon hits an area directly. The necessary elements for this are Prediction and Early Warning. When an earthquake occurs in the ocean floor, a

tsunami may be predicted providing enough time for evacuation. Similarly, when a storm and flood damage occur, early warnings are of great significance. In addition, Earthquake Early Warning system has also been prepared for sudden earthquakes. Research is being conducted on how to reduce the damage to human lives by using the short timeframes, from when the P wave is felt until the S wave arrives, with drills being conducted in various places.

6) Damage Assessment

In the immediate aftermath of a disaster, it is necessary to grasp the overall picture of the damage and the degree of damage in each area as soon as possible to proceed with the emergency correspondence more appropriately. This is Damage Assessment. By roughly estimating the damage, it is possible to estimate the activities to be corresponded to and physical/human resources that can be invested, and to implement appropriate disaster responses.

7) Information and Communication

It is important to have various types of information in the event of a disaster, as well as cooperation with regions that serve as disaster prevention bases. However, disasters, disaster prevention, information and communication also have many aspects. It depends on the position, purpose, and each situation. Information and Communication are positioned as Perimeter (dotted line) in Disaster Life Cycle (Figure 1) because they become important elements in different ways in each phase of disaster responses.

Figure 1 shows how each aspect in Disaster Life Cycle above corresponds to various spaces. In addition to the 7 aspects listed here, the database also includes the following 3 spatial classifications.

8) Information Sharing and Education

It is a facility established for the purpose of sharing lessons and records from the disaster with society after the reconstruction process.

9) DRR Base Facility not Constructed in a Post-disaster Recovery Process

It is a facility established to serve as a base for disaster prevention activities, regardless of the recovery or reconstruction process, in areas that have not been affected by the disaster.

10) Others

Items that do not fall under any of the above categories are classified here.

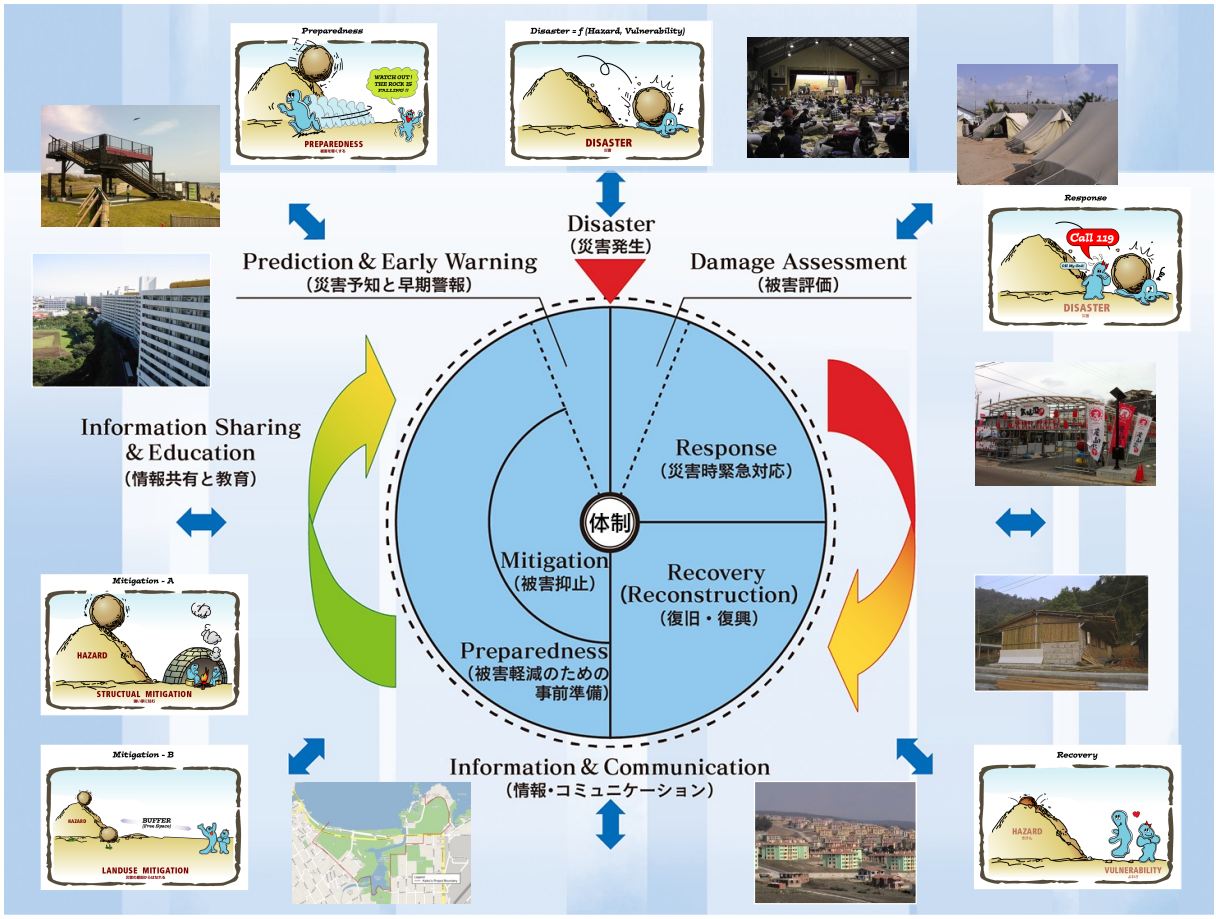


Figure 1 Relationship between Disaster Life Cycle and Architecture/Urban Design

(3) Spatial Scale Classification

Architecture and Urban Design vary in scale from certain functions within buildings suitable for disaster prevention to urban redevelopment for disaster mitigation. In this database, spaces corresponding to each stage of disaster correspondence are defined as "Architecture and Urban Design for Disaster Risk Reduction" and categorized as Architectural Element / Building Unit / Building Cluster (Villages) / Infrastructure / Landscape / Open Space / District / Monument / Others.

【Architectural Element】

A part of a building that has a disaster mitigation function, such as "Udatsu" that prevents the spread of fire to neighboring areas.

【Building Unit】

A space that corresponds to disasters as a single building, like a raised-floor house built to avoid flooding.

【Building Cluster (Villages)】

A space with a defense or disaster prevention function as Building Cluster (Village), such as moated settlement in Yamatokoriyama City, Nara Prefecture, which functioned for defense during the Sengoku period.

【Infrastructure】

Structures other than buildings built for the purpose of land management and conservation, public convenience, and disaster prevention. Dams, embankments, etc.

【Landscape】

There are also spaces created by natural environmental elements, such as windbreak forests, which contrast with buildings as structures. In this way, Landscape is defined as the various elements of urban spaces and landscaped spaces that make up sceneries other than structures. They are related to topography, green space, and waterfront space.

【Open Space】

Open spaces and plazas with no particular purpose as urban voids.

【District】

A place that functions as a whole space with a certain scale.

【Monument】

A statue or other structure monuments created to pass down the situation and lessons of disasters to future generations.

【Others, including Intangible Assets】

Anything not included in the above categories comes here. Examples include things that no longer exist as a physical environment but are recorded as memories or information.

(4) Other Information

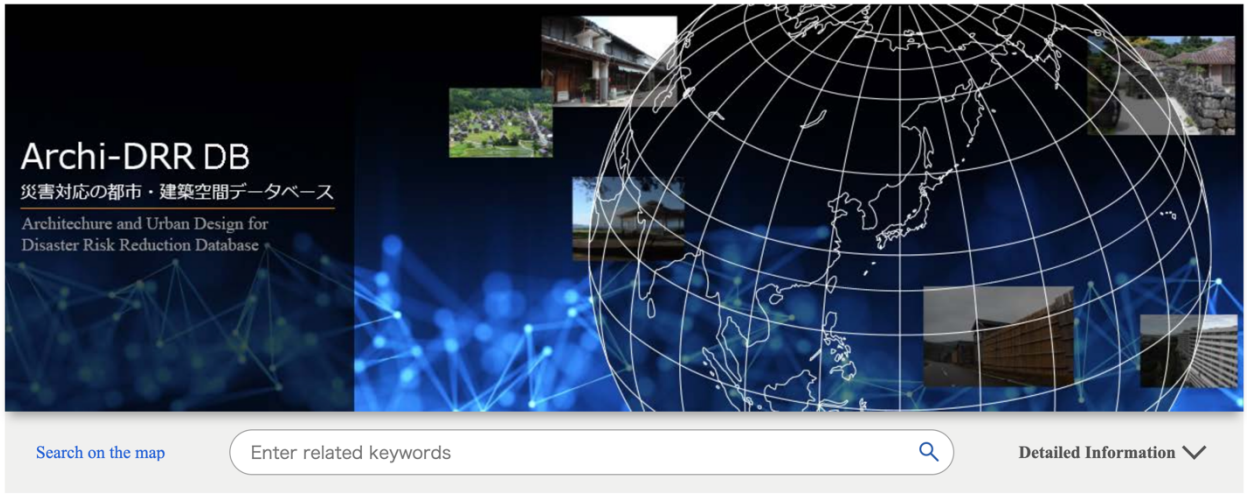
In addition to explanations based on the above basic information, this database also provides location information on Google Maps, as well as images/photographs, documents, and drawings. References are also provided where necessary.

*Reference: Osamu Murao, "Architecture/Space/Disaster" Risk Engineering Series 10, Corona Publishing, 2013

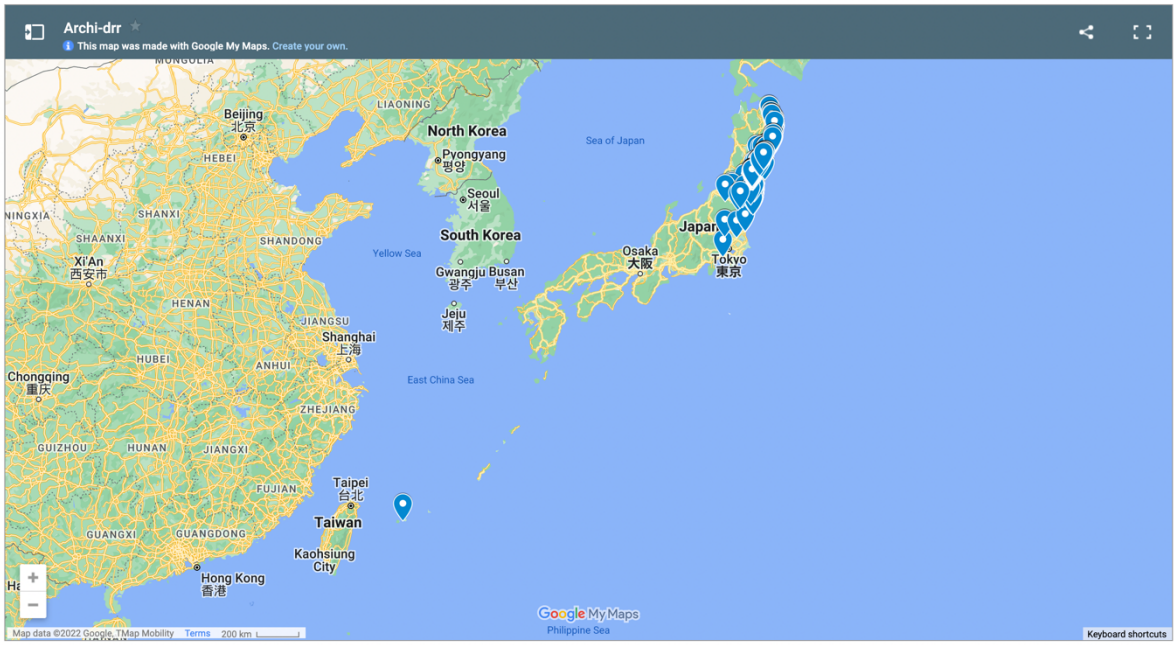
3. How to use Archi-DRR DB

（1） Home page

If you enter a keyword in the search field on the home page, search results will be displayed. In addition, you can 1) Search by detailed information and 2) Search on the map. They are explained below.

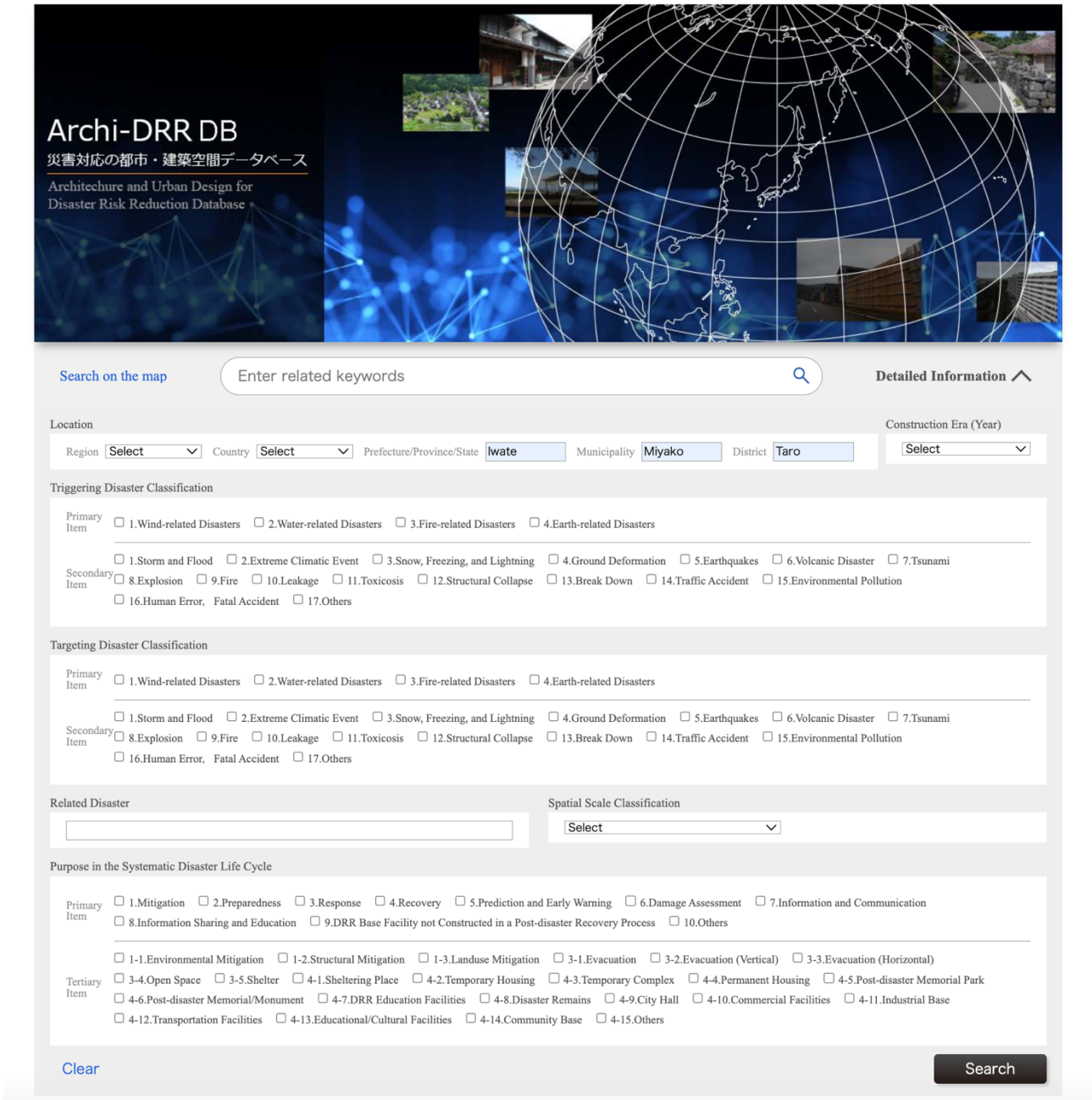


Search on the map



(2) 1) Search by detailed information (When searching by Iwate Prefecture / Miyako City / Taro)

Click “Detailed Information” and the following screen will appear. This screen corresponds to the classification described in 2. Database Composition. Select and enter conditions according to your purpose and search. Here, "Iwate Prefecture / Miyako City / Taro" is entered in the "Location" column.

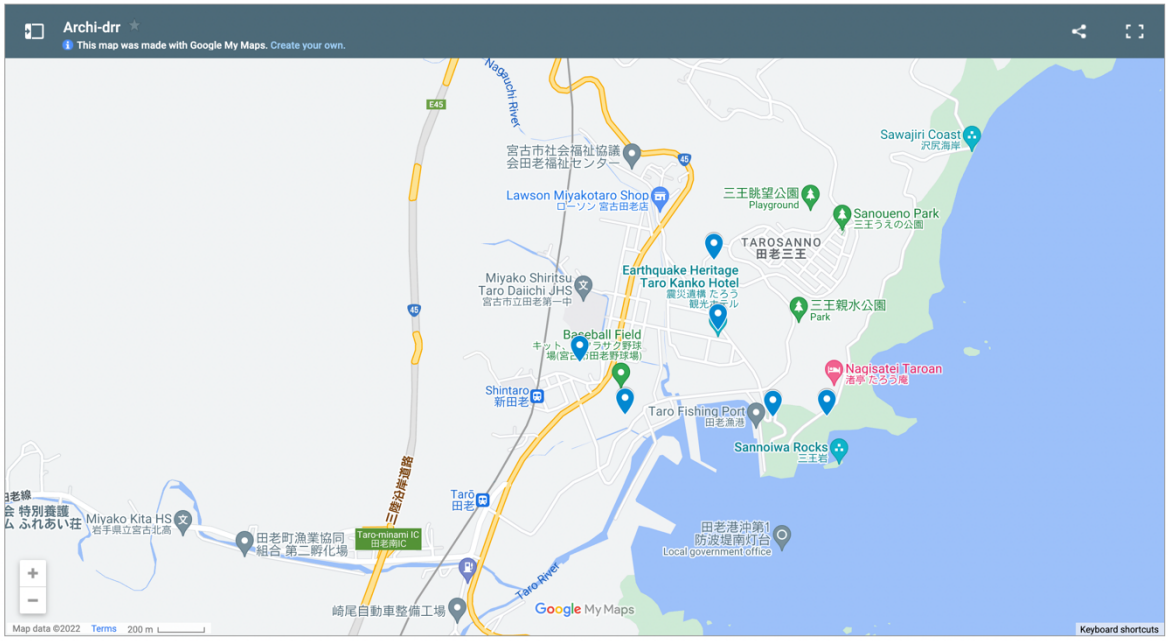


(3) 2) Search on the map (Around Taro district)

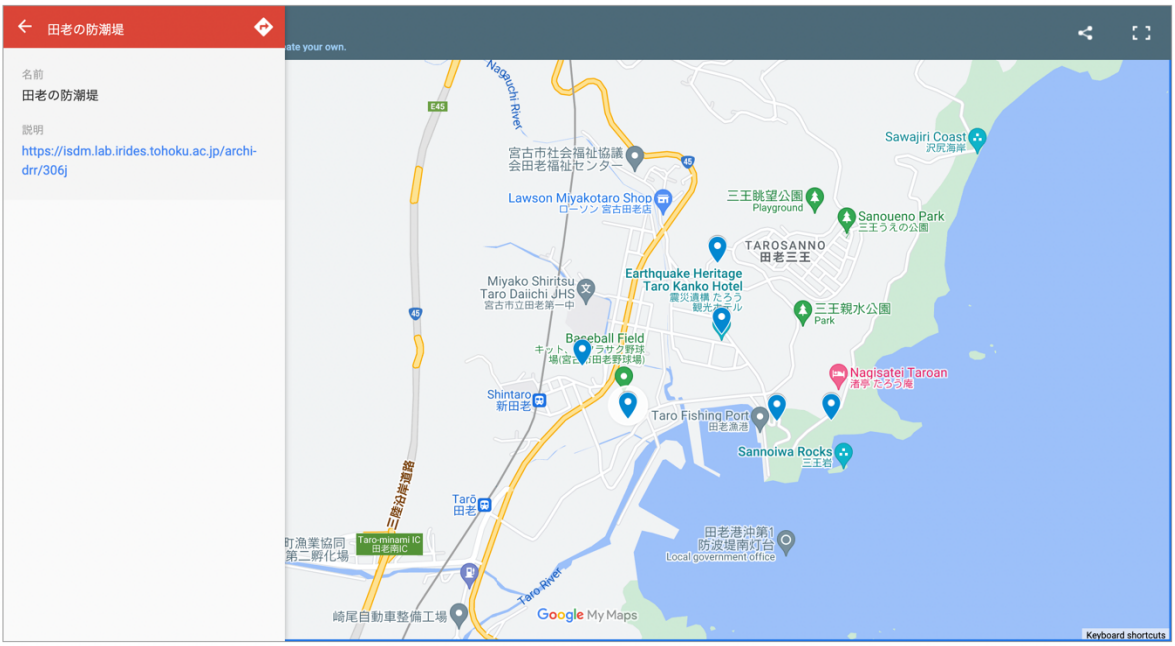
People may visit Taro area for sightseeing. If they have already decided to go to the Taro area, which has been rebuilt from the Great East Japan Earthquake, but there is also the possibility of "They don't know what kind of facility is in what kind of area" situation. In such cases, searching by map is convenient. Since the map uses Google Map, you can see what is around by clicking on the place you want to go and expanding it.

If you find a place of interest, click the pin there, and the name of the point and the URL of the data will be displayed as shown in the images below.

Search on the map

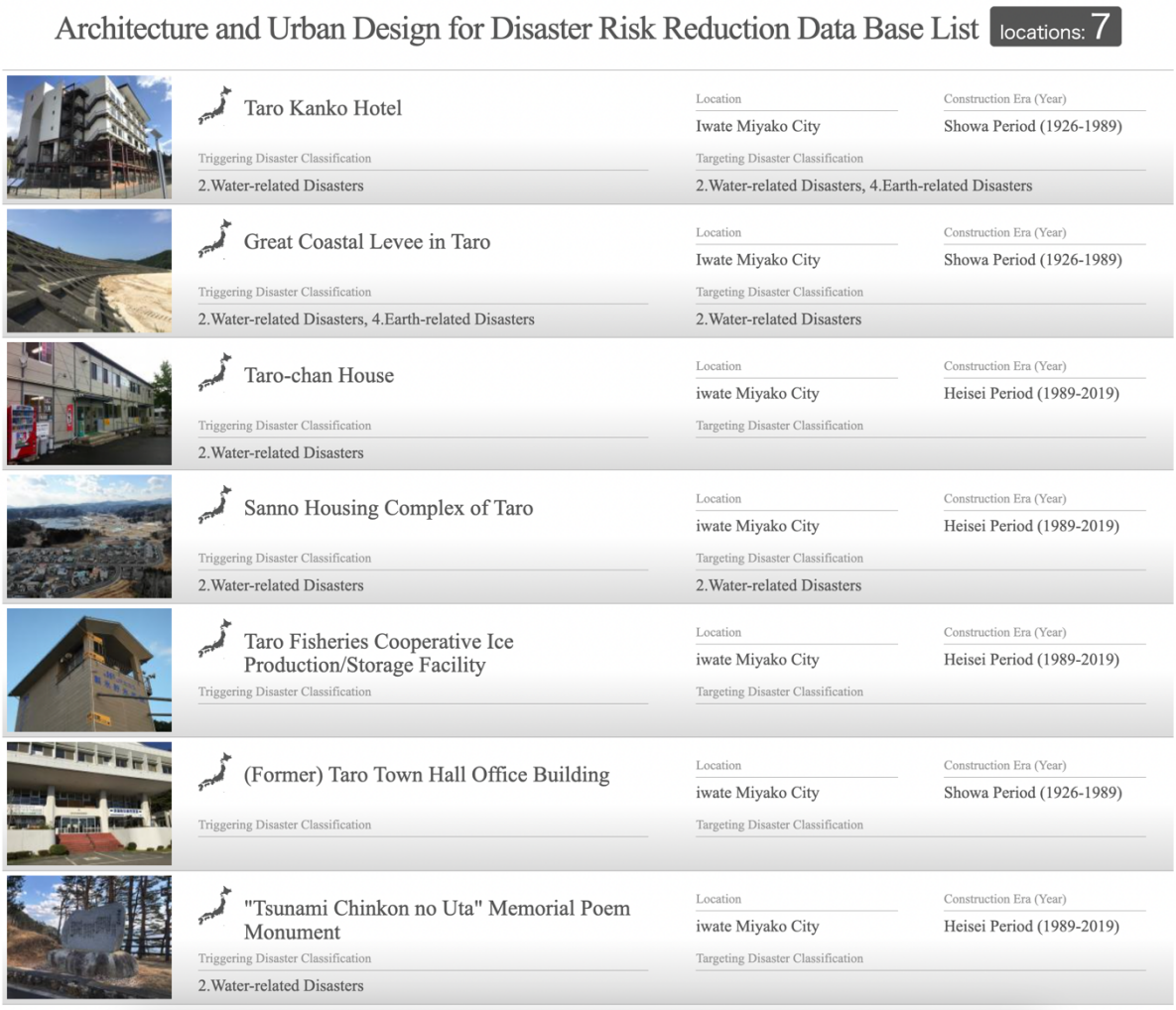


Search on the map



(4) Search Result List

If you perform 1) Search by detailed information or 2) Search on the map, the following search results will be displayed. Look through this list and when you find a target case, click on it. Move to the data screen for each case. Here, let's select "Great Coastal Levee in Taro".



(5) Search results (in the case of "Great Coastal Levee in Taro")
The data for "Great Coastal Levee in Taro" will be displayed as a search result.

Great Coastal Levee in Taro

Location

Eastern Asia　Japan　Iwate　Miyako City　Taro

Construction Era (Year)

Showa Period (1926-1989)1934-1978

Map

Open Map

Triggering Disaster Classification (Primary Item)

2.Water-related Disasters
4.Earth-related Disasters

Triggering Disaster Classification (Secondary Item)

7.Tsunami　5.Earthquakes

Targeting Disaster Classification (Primary Item)

2.Water-related Disasters

Targeting Disaster Classification (Secondary Item)

7.Tsunami

Related Disaster

The 1896 Great Meiji-Sanriku Earthquake
The 1933 Great Showa-Sanriku Earthquake
The 2011 Great East Japan Earthquake

Spatial Scale Classification

Infrastructure

Purpose in the Systematic Disaster Life Cycle (Primary Item)

1.Mitigation

Purpose in the Systematic Disaster Life Cycle (Tertiary Item)

1-2.Structural Mitigation

Explanation

The Taro district of Miyako City (former Taro Village / Taro Town) suffered two catastrophic damages, the 1896 Great Meiji-Sanriku Tsunami and the 1933 Great Showa-Sanriku Tsunami. After the Great Showa Tsunami, many of the disaster-stricken areas were relocated to higher ground, but there was no suitable high ground around Taro Village, and it was difficult to secure a relocation site. Therefore, it was decided to rebuild the site with a plan to protect the village from future tsunamis by constructing levees. Taking over 40 years, an X-shaped large levee with a height of 7.7m and 10m above sea level, and a total length of 2,433m was completed.

The height of the tsunami at the 1960 Chilean tsunami came to Taro was 3.5m, and this levee protected the town. Eventually, this world's number one levee became known as the "Great Wall of China," and researchers visited from all over the world. However, the tsunami on March 11, 2011 overcame this levee and destroyed the town of Taro again. (OM)

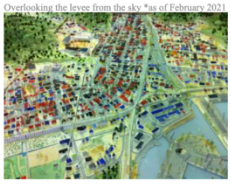
Data

First levee with a height of 7.7m *as of August 2015

Damage to the city caused by the tsunami at the Great East Japan Earthquake *as of April 2011

Overlooking the levee from the sky *as of February 2021

Explanation about the levee



Taro townscape before the Great East Japan Earthquake

Outline figure of disaster recovery projects in the surrounding area

Levee looking from the harbor

Another levee coming in sight from the passage of the levee: its size is clearly seen

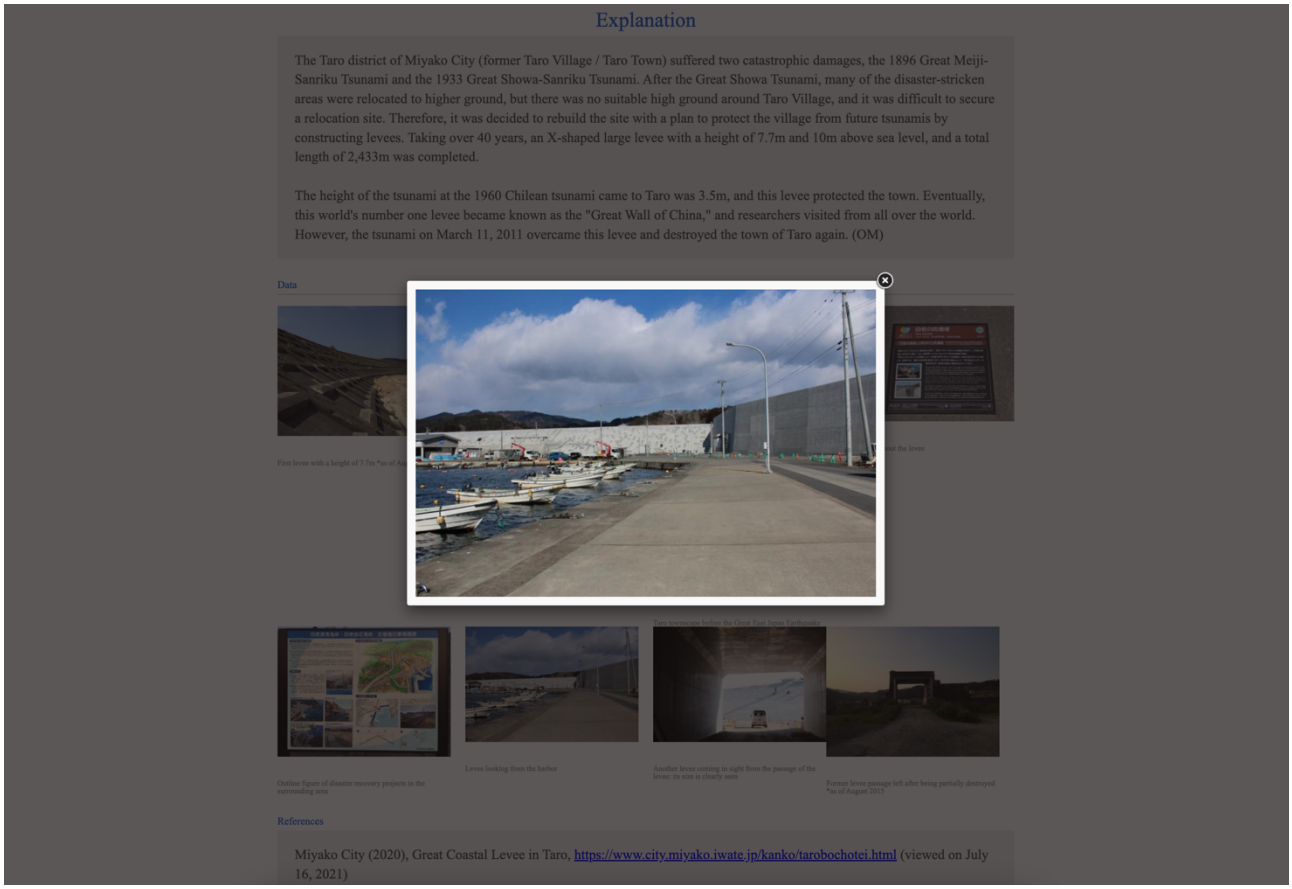
Former levee passage left after being partially destroyed *as of August 2015

References

Miyako City (2020), Great Coastal Levee in Taro, https://www.city.miyako.iwate.jp/kanko/tarobochotei.html (viewed on July 16, 2021)

(6) Enlarged display of the clicked image

Images are also included in the data. Click on the thumbnail image that interests you to enlarge the image as shown below. You can return to previous screen or home page using the buttons on the left and right of the bottom of the screen.



End