Recovery from Disaster through Design Science

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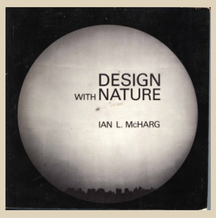
GOOD DESIGN AWARDS 2021 (Category ; District and regional development)

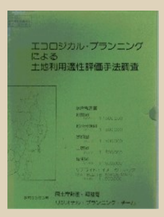
GOOD DESIGN AWARD 2021

It is heartbreaking to see people, who, having unexpectedly lost their homes in 2011 and still wanting to rebuild their lives on the seaside in Tohoku (their hometown), living through their own long disaster as they eke out a living in temporary housing for as long as 10 years. In fact, after these long 10 years nearly 40% of the raised land in the three affected prefectures, created with maintenance costs and a variety of financial adjustments, now remains vacant. Design science, which was put into practiced in this project, is an artistic process of thought that instantaneously integrates and comprehends discrete fields and domains to create a new future through holistic, non-fragmented human perception; it sits in stark contrast to the existing academic framework that continues to subdivide and specialize. Ian McHarg's Design with Nature is exactly the kind of design science that can be applied to urban planning. It is characterized by "doing more with less."

In this project, we conducted the largest number of consultations with residents in the affected areas to relocate housing for victims of the earthquake in Shinchi Town, Fukushima Prefecture. In addition, we digitized and utilized historical book materials from 1980 that were created to apply Ian McHarg's Design with Nature philosophy to land planning in Japan. As a result, housing relocation was achieved in the short period of four years, while taking into account the overlap of complex disaster risks that cannot be represented with a disaster hazard maps based on the latest individual calculations, as well as the wishes of each community for the site of the housing relocation. The construction period was short due to the elimination of large-scale reclamation work to mitigate disaster risks. As a result, four of the seven sites have views of the sea, and the houses were rebuilt in a spacious environment that integrates with the existing nature of the surrounding forest and farmland. This bottom-up, point-by-point approach to relocation was one of the few cases in which a recovery in population was achieved in the disaster-stricken municipalities.

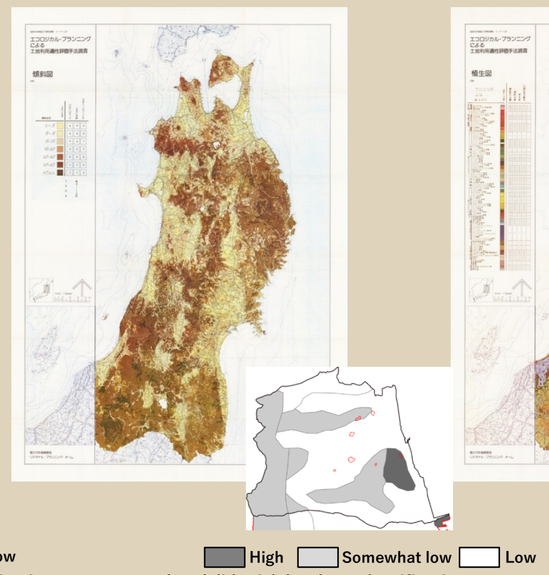
1.The Significance of Using Design Science and National Land Agency Data for Reconstruction

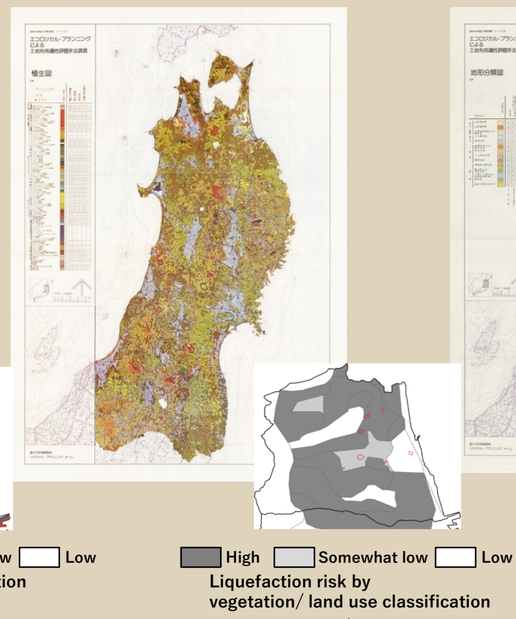




The National Land Agency (Regional Planning Team), which was established with a view to implementing Japan's first multi-disciplinary watershed planning, prepared the " Appropriate Land Use Evaluation Methods by Ecological Planning Study (1980)" to apply the concept of Design with Nature to Japan's Third Comprehensive National Land Development Plan before its home country, the United States.
It involves the process of integrating disaster risks, which are calculated using complex preconditions and specialized parameters subdivided into different areas of expertise, with environmental factors (vegetation, geology, topography, slope classification) so that these risks and factors can be intuitively understood and utilized by residents and government officials.

These historical data unique to Japan, which was the first instance in the world of applying McHarg's theory to national land planning, was very innovative, but due to the depreciation of the yen and appreciation of the dollar caused by the Nixon Shock, it could not be fully reflected in actual planning and was forgotten. This project digitized that data and put them to actual use in the recovery from the Great East Japan Earthquake in 2011.



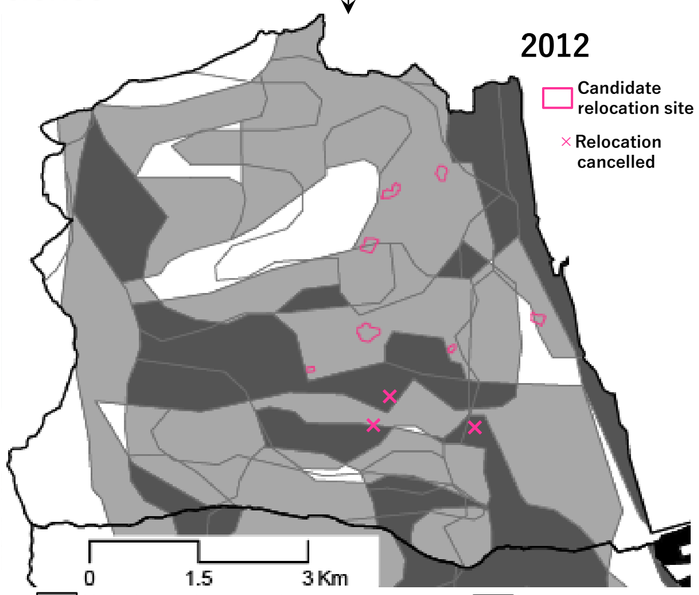


Integrated map (overlay)

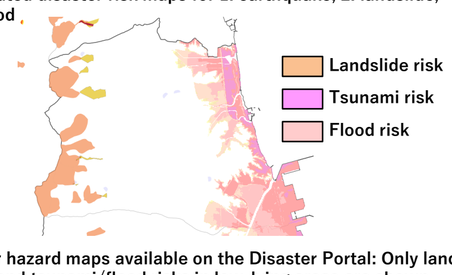
2.The Bottom-up Design Process with Design Science

The town of Shinchi was able to achieve a bottom-up, point-by-point relocation of housing by selecting seven sites from multiple candidate sites in each disaster-stricken community through a combination of risk assessment of multiple disasters based on the theory of design science and consultation with residents. Surprisingly, the National Land Agency's maps created for the 1980 National Land Plan and the relative rankings of disaster risks for each environmental category (top right) are able to show liquefaction and seismic risks that are not shown in the most comprehensive and up-to-date risk maps in Japan published by the Ministry of Land, Infrastructure, Transport and Tourism (bottom right). It also shows the overall risk of the region in relative terms.

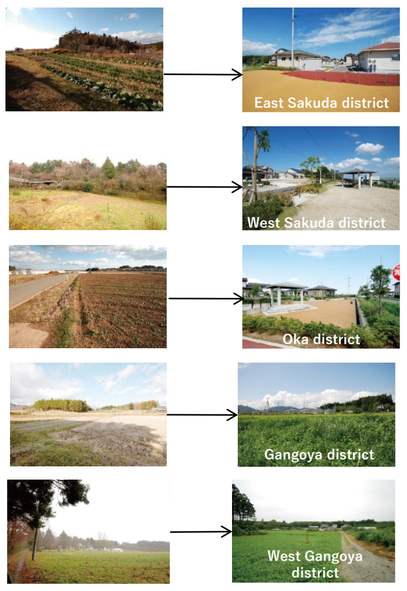
On the other hand, the landslide risk in the latest disaster maps is assessed within a limited environment (Ex. slopes above 30 degrees), so there is a large area that is not assessed within the region. This part of the city appears to be a safe place for citizens and the government.

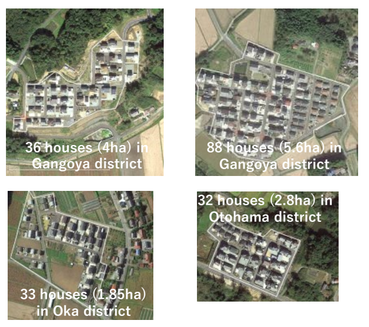


Prepared by the National Land Agency (1980) Map Data Digitization and Risk Assessment Integrated disaster risk maps for 1. earthquake, 2. landslide, liquefaction, and flood



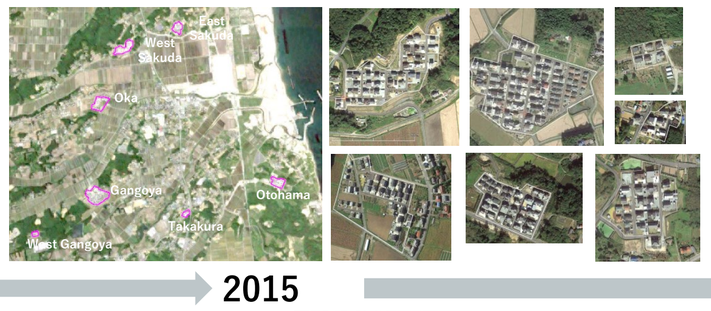
Latest disaster hazard maps available on the Disaster Portal: Only landslides on mountain sides and tsunami/flood risks in low-lying areas are shown.





Shinchi Town: Bottom-up, point-by-point relocation using Design Science

It took two years to select seven sites for relocation, that involved a multi-disaster risk assessment and consultation with local residents to quickly secure sites.



As there was no need for large-scale reconstruction work to reduce the risk of disaster, the construction period was short, and as a result, four out of the seven sites have a view of the sea, and the houses were reconstructed in a relaxed atmosphere that is contiguous with the existing nature of the surrounding forest and farmland.

In 2015, four years after the earthquake, the occupancy rate of the completed reconstruction housing reached 100%, and this bottom-up, point-by-point relocation has led to a population recovery that is rare in disaster-stricken municipalities. Since the development was completed before the increase in the consumption tax rate and the demand for construction work in other disaster-stricken areas as well as the Tokyo Olympics, the public works project was more cost-effective than other projects that suffered delays and high costs.

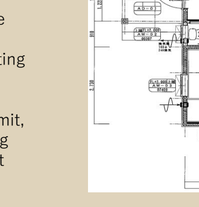
The area that was inundated by the tsunami in Shinchi Town was turned into a green space for disaster prevention and a place of relaxation for the community.

2011

General disaster areas in Tohoku: Top-down relocation through area-based land readjustment (raising and relocation to higher ground)

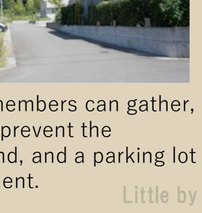
In general reconstruction, relocation sites were sought in larger units that could be grouped together in one place for development that consolidated the affected residents, as in the case of the land readjustment project implemented after the Great Hanshin-Awaji Earthquake. As a result, this method had to include areas with disaster risks such as tsunami flood areas, rice paddies, wetlands, and embankments due to slope development.

2015



Transforming large areas of land that are not suitable for housing, such as tsunami flood zones, will require large-scale land reclamation, terrace building for relocation to higher ground, and negotiations and acquisition of land from more landowners. While this may seem more reasonable than a scattered, point-by-point plan like the one in Shinchi, ultimately it has proven to be a more costly and time-consuming task to create the land for housing.

2021

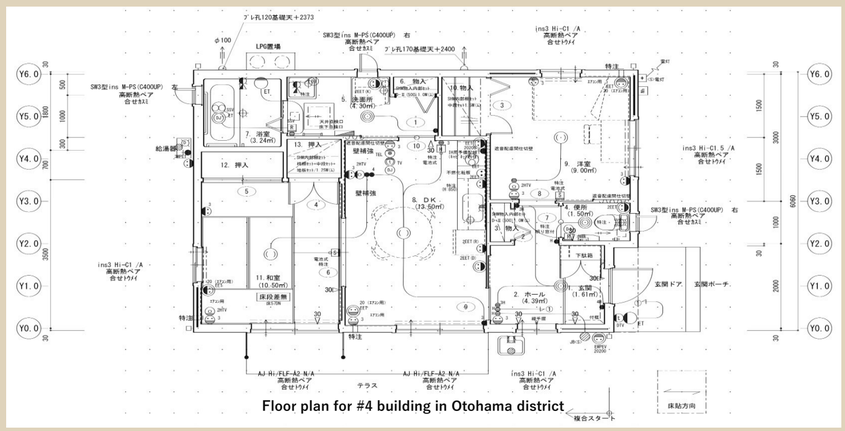


There are many vacant lots in residential areas that have been raised over the past 10 years.

3. Design science achieves a design recovery with diversity and sustainability in less time, while taking more factors into account.

In Fukushima Prefecture, which was hit by a massive earthquake of more than magnitude 9, a massive tsunami, and radioactive contamination from the Fukushima Daiichi Nuclear Power Plant (including reputational damage), we were able to develop housing resistant to a myriad of disaster risks and had spatial diversity in a shorter period of time. While most of the affected municipalities experienced a decline in population, Shinchi Town was able to recover its population by 2015, four years after the disaster. It is also of great significance that this project was made possible through collaboration with participants of different ages and positions (researchers, practitioners, administrators) who have an understanding of McHarg's design science theory. In addition, since the archives digitized and utilized in this project are data for national land planning, they can be applied and deployed to a wide range of local governments. In this sense, the experience of this project will be useful for disaster prevention and recovery from natural disasters, which have become more severe and widespread in recent years.

It was a difficult task to find and negotiate multiple housing sites for each affected community, but we were able to rebuild a diverse town contiguous with the existing natural surroundings. The basic unit of reconstruction housing is up to 100 tsubo (330sqm), but many of the victims were living in housing lots of more than 200 tsubo (660sqm) before the earthquake. In comparison to raising the land and relocating to higher ground, the Shinchi method allows for a more generous allocation of land, and by setting up a system that allows people to purchase land at their own expense if the area exceeds the upper limit, a generous average of 120 tsubo (396sqm) of reconstruction housing was made possible. In the Gangoya district, fishermen who went out early in the morning voluntarily live in together edge of this district.



Shinchi town relocated the houses to an area that is flood and earthquake resistant, so the tsunami stricken area became a disaster prevention green space. It is located on the east side of the station and has playground equipment and a bike path.

Each district has a park where families and community members can gather, walking paths that provide easy access to each house and prevent the shadows of the houses from falling on the adjacent farmland, and a parking lot for visitors that utilizes the leftover land from the development.

Little by Little