1. Basic Attitudes Towards Tsunami Countermeasures

This great earthquake and tsunami that hit Iwate were larger than the 1896 Meiji-Sanriku earthquake and tsunami, the 1933 Sanriku earthquake and tsunami, and the 1960 Valdivia earthquake and tsunami. Existing disaster-prevention facilities, such as coastal levees and bay entrance breakwaters, played a part in the current disaster, i.e. the tsunami arrival time was delayed, the depth of the floodwaters was decreased, and tsunami energy (flow speed) was diminished; however, what became clear was that defense with only “hard” physical countermeasures was insufficient.

On the other hand, the evacuation drills performed in each region on a regular basis, the disaster prevention education provided regionally in elementary and junior public schools, and so on, also contributed a certain degree in terms of evacuating from the great earthquake and tsunami.

Thus, one objective of this Plan is to foster and maintain a culture of disaster prevention and multi-preventative community planning as the basic attitude towards tsunami countermeasures in Iwate so that no more human lives will be lost. Specifically, the goal is to move forward with multi-preventative community planning that appropriately combines coastal protection facilities, community planning, and cultural measures specific to each region through an awareness of the damage conditions, topographical conditions, history, culture, industrial structure, and so on, and ensure safety within a framework of minimizing damage to the best degree possible.

2. Direction of Tsunami Countermeasures

(1) Coastal Protection Facilities

a. Maintenance of Coastal Protection Facilities

In order to achieve the basic attitudes towards tsunami countermeasures described above, the goal should be to maintain coastal protection facilities that can handle the maximum height of tsunamis that have occurred in the past. However, there will be cases in which countermeasures using coastal protection facilities alone are not practical due to terrain conditions, the effects on society and the environment, cost, and so on. In such cases, the target heights for the coastal protection facilities should be determined after verifying the tsunamis that have occurred in each region in the past, and the frequency at which they have occurred there over the past century or so.

The maintenance of coastal protection facilities, including bay entrance breakwaters, coastal levees, river embankments, floodgates, and land locks, must be reviewed together with community planning and the most effective arrangement for each region must be determined.

The mechanism of destruction to the coastal protection facilities as a result of this tsunami
must be studied in detail, and structures must be considered during restoration and maintenance so that it can resist tsunamis that exceed the anticipated strength.

Furthermore, floodgates and land locks must be operable remotely and be multiplexed in terms of communication means and power in order to ensure the safety of the operators.

b. Preservation of Functions through Appropriate Maintenance

The structures of the facilities, topographical conditions, and so on must be fully understood and regular inspections, and timely and accurate repairs of deterioration and damage, and other appropriate maintenance based on a maintenance plan must be performed so that the coastal protection facilities will continue to function for a long time.

(2) Community Planning

a. Maintenance of Safe Living Environment

For damaged residential areas and settlements, coastal protection facilities arrangement plans, locations of urban districts and settlements, and the industrial structure must be taken into consideration and a comprehensive investigation performed while planning for consensus-building with the residents in order to ensure a safe living environment through regrading and relocation to higher altitudes.

b. Plan to Utilize Land while taking Tsunami Disaster Prevention into Consideration

For damaged urban districts, after ensuring a certain degree of safety through coastal protection facilities and so on, residential areas, commercial areas, business districts, industrial areas, and regions in which building restrictions are put in place as necessary must be appropriately arranged, and government buildings, hospitals, schools, welfare facilities, and other public interest facilities put in safe, high locations based on the notion of disaster prevention. In addition, a plan to utilize land while taking tsunami disaster prevention into consideration must be put in place to ensure that evacuation towers and wave-prevention buildings (shelters) that reduce evacuation time, as well as disaster-prevention parks, escape routes, and so on are arranged appropriately.

c. Disaster Prevention Linked to Public Facilities

Escape routes and parks for evacuation sites must be appropriately arranged, and routes of highways, railways, and so on must be reviewed together with grand designs for community planning by public facility managers, private businesses, etc., in addition to the structural reinforcement of buildings like public facilities with added disaster prevention functions through regrading.
(3) Cultural Measures

a. Development of Evacuation Plan and Maintenance of Information Communication Network

Maps showing areas with the potential for flooding from tsunamis that indicate flooding regions and flood depths, as well as tsunami arrival times, must be created based on tsunami simulations, a field survey of evacuation activity from this disaster performed, and an evacuation plan developed that includes the arrangement of evacuation sites and routes, evacuation methods, tsunami prevention procedures, and so on that have taken evacuation distances and times into consideration so that every individual, including the elderly and disabled, is able to evacuate in a timely manner.

A multilayered information communication network must be established so that accurate information can be distributed and provided quickly, even during times of disaster.

b. Fostering and Maintaining a Culture of Disaster Prevention

In order to ensure that the experiences and lessons we learned from this great earthquake and tsunami are passed on to future generations, it is important to foster and maintain a culture of disaster prevention that includes evacuation activities and improvement of disaster prevention awareness so that regions where it is safer and more comfortable to live are built to prevent any more human lives from being lost as a result of tsunamis, and allowing humans to live together with nature while placing importance on the wisdom of our ancestors that has been accumulated through past disaster experiences.

To this end, symbolic facilities such as disaster remains and memorial parks must be maintained and tsunami flood height information displayed on-site, as well as reinforcement of independent disaster prevention organizations and regionally-based tsunami disaster prevention education must be implemented.

3. Grand Designs for Community Planning

Grand designs for community planning are, above all, ensuring that survivors either stay in their region or return home after a temporary relocation, and proactively advancing the rebuilding of lives as related to community planning, while taking the region’s history, culture, topographical and social conditions, and disaster conditions into consideration.

(1) Perspectives on Grand Designs for Community Planning

a. Protecting Lives and Resources

The fundamental way to handle tsunamis under any circumstances is evacuation. On top of that, coastal levees and other such “hard” physical measures have been used to protect lives and resources from tsunamis over the past century or so, and multi-preventative approaches that combine such physical measures and cultural measures have been used for large tsunamis in the
past in order to protect lives.

b. Compact Urban Formation

The functions necessary for the lives of the residents and business activities must be compactly contained in fixed areas, and efficient urban development and improvement planned, as well as the reconstruction motivations of the residents and regions must be raised so that it can become the driving force of community planning.

Getting the streets bustling with activity again is the first step towards reconstruction, so consideration must be given to having residential areas, commercial areas, and business districts either integrated or placed in proximity to one another.

c. Regeneration and Activation of Industries

In addition to regenerating key industries that financially support the region and local industries that are the strengths of the coastal region, such as the fishing industry, maintenance of disaster prevention facilities and urban facilities and appropriate utilization of land must also be planned to form the foundation to foster new industries that will contribute to reconstruction.

In particular, consideration must be given to arranging residential areas and business districts so that efficient production is possible by integrating fishing ports and settlements and by conducting production activities.

d. Living Harmoniously with the Environment

Consideration must be given to living harmoniously with the natural environment, the foundation of industry in the coastal region as well as a tourist resource, by using natural energy and developing and improving urban districts that do not place a burden on the natural environment.
(2) Types of Tsunami Disaster Prevention

Tsunami disaster prevention can be classified into three types, circumvention, dispersion, and suppression, based on the method used to handle the tsunami energy. The multi-preventive community planning will combine these types to accommodate each region’s situation.

Fig. 1: Types of Tsunami Disaster Prevention

<table>
<thead>
<tr>
<th>Type</th>
<th>Circumvention</th>
<th>Dispersion</th>
<th>Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim (in the event of a huge tsunami)</td>
<td>To protect lives and resources</td>
<td>To protect lives and protect many resources</td>
<td>To protect lives and prevent catastrophic damage to resources</td>
</tr>
<tr>
<td>Image</td>
<td>Residential land development Relocation to higher altitudes</td>
<td>Regrading / relocation to higher altitudes</td>
<td>Regrading / relocation to higher altitudes</td>
</tr>
<tr>
<td></td>
<td>Damaged settlements</td>
<td>Damaged urban district Disaster prevention facilities</td>
<td>Damaged urban district Disaster prevention facilities</td>
</tr>
<tr>
<td></td>
<td>Tsunami energy</td>
<td>Tsunami energy</td>
<td>Tsunami energy</td>
</tr>
</tbody>
</table>

Circumvention: Relocate to safe regions that won’t flood in order to avoid the tsunami
Dispersion: Protect the urban district by dispersing the tsunami energy with disaster prevention facilities, etc.
Suppression: In addition to first-line disaster prevention facilities, prevent catastrophic damage by suppressing the tsunami energy by regrading roads, railways, etc.

(3) Multi-preventative Community Planning Tools

Multi-preventative community planning involves coordinating disaster prevention facilities, residential environments, and land use together with public facilities and while taking securing of evacuation routes into consideration, as well as a region’s damage, topographical conditions, history, culture, industrial structure, and so on. Therefore, the tools for multi-preventative planning are split into four groups: framework disaster prevention facilities, disaster prevention and evacuation facilities, buildings, and land use, which indicate the attitudes towards the facilities to be arranged, etc.
### Table 1: Multi-preventative Community Planning Tools

<table>
<thead>
<tr>
<th>Facilities, etc.</th>
<th>Attitudes towards the facilities to be arranged, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bay entrance breakwaters</strong>&lt;br&gt;<strong>Coastal levees</strong>&lt;br&gt;<strong>River embankments</strong></td>
<td>- Bay entrance breakwaters and coastal levees are the first line of disaster prevention facilities to protect the region from the tsunami and tidal waves&lt;br&gt;- River embankments must take coastal levees and surrounding land use into consideration.&lt;br&gt;- Installation of floodgates, dike regrading, etc. evaluated.</td>
</tr>
<tr>
<td><strong>Tidewater control forests</strong></td>
<td>- Plant at constant widths in front of or behind coastal levees&lt;br&gt;- Prevent tsunami and salt damage, as well as provide a place of relaxation for residents</td>
</tr>
<tr>
<td><strong>Sanriku Jūkan Expressway, Sanriku-Kita Road, Hachinohe-Kuji Expressway</strong></td>
<td>- Built in locations that will not be damaged by tsunamis and floods&lt;br&gt;- Provide evacuation routes and emergency supply routes, as well as restoration routes, when there has been a disaster, and also function as links between regions and promote industrial development during normal times&lt;br&gt;- Areas around interchanges are possible sites for urban functions</td>
</tr>
<tr>
<td><strong>National routes, prefectural highways, port roads</strong></td>
<td>- Planned for integration with new urban district. Routes are changed as necessary, and addition of second- and third-line disaster prevention functions through regrading, etc. are also considered.&lt;br&gt;- Provide evacuation routes and emergency supply routes when there has been a disaster, and also function as everyday roads and regional interchanges and promote industrial development during normal times&lt;br&gt;- Regraded roads also function as outlines to prevent further urban expansion</td>
</tr>
<tr>
<td><strong>Railways (JR, Sanriku Railway)</strong></td>
<td>- Planned for integration with new urban district. Routes are hanged as necessary, and addition of second- and third-line disaster prevention functions through regrading, etc. are also considered.&lt;br&gt;- Important means of transportation to link widespread areas and regions together, as well as for tourism, daily life, etc.&lt;br&gt;- Stations function as urban and regional centers. Consider combining with community centers, welfare facilities, etc.</td>
</tr>
<tr>
<td><strong>Evacuation routes</strong></td>
<td>- Routes that will shorten evacuation times to higher-altitude areas when there has been a disaster&lt;br&gt;- Layout of sidewalks, stairs, slopes, etc. must be appropriate. Construction that ensures that both cars and pedestrians can evacuate safely&lt;br&gt;- Take evacuation at night into consideration and arrange lighting that stores electricity</td>
</tr>
<tr>
<td><strong>Memorial (disaster prevention) parks</strong></td>
<td>- Make use of land that is hard to use as a result of subsidence and topographical conditions to establish memorials that will remind future generations about the great earthquake and tsunami&lt;br&gt;- Also function as areas of relaxation and tourist destinations during normal times</td>
</tr>
<tr>
<td><strong>Higher-altitude parks</strong></td>
<td>- Established in safe, high-altitude areas behind residential areas, plants, business districts, etc.&lt;br&gt;- Function as temporary shelters when there has been a disaster&lt;br&gt;- Also function as areas of relaxation for residents during normal times</td>
</tr>
<tr>
<td><strong>Relocation to higher altitudes (tract housing), regrading</strong></td>
<td>- Relocate homes to higher ground and safe, highly regraded locations while keeping community preservation in mind&lt;br&gt;- Comprehensively consider the relationship between landscape and disaster prevention facilities, lifestyle convenience, and economics to select the most effective method&lt;br&gt;- Secure safe residential land that allows for separation of work and home</td>
</tr>
<tr>
<td><strong>Artificial ground</strong></td>
<td>- Install in areas of high-intensity land use, such as around fish markets&lt;br&gt;- Install in areas where other methods, like land regrading, cannot be selected due to the relationship with disaster prevention facilities, etc.</td>
</tr>
</tbody>
</table>
Models of Grand Designs for Community Planning

Grand designs for community planning must effectively incorporate the types of disaster prevention and multi-preventative community planning tools, in light of the perspectives on grand designs for community planning.

In order to ensure that this Plan is used as reference for the reconstruction plans created by cities, towns, and villages for each disaster-stricken region, four types of damage are classified based on the degree of damage and land use. There are three reconstruction patterns according to the damage...
conditions, which are presented as models of grand designs for community planning.

(i) Reconstruction Patterns

Fig. 2: Reconstruction Patterns based on Form and Use of Land Use

*In actuality, there will be regions that fall in between these categorizations, so reconstruction will differ depending on topographical conditions and the intentions of the citizens.
(ii) Models Based on Reconstruction Patterns

Reconstruction Pattern A (Urban Regeneration)

Urban functions have been destroyed, so the basic mindset is to implement urban development based on urban regeneration, forming new urban functions. The damage is widespread, so residential areas and areas where people gather, such as commercial districts, and public interest facility areas, should be arranged in higher-altitude areas and on mountains away from water, and fishing-related facilities placed in coastal regions when necessary, as well as evacuation buildings and evacuation towers are located in walking distances. The fundamental principle here is tsunami energy suppression. Multi-preventative buffer areas used as agricultural zones, large-scale business districts, and
memorial (disaster prevention) parks, and evacuation routes maintained along with evacuation towers, etc. being arranged.

Reconstruction Pattern B (Urban Rebuilding)

-While some urban functions have been lost, industrial areas, commercial districts, business districts, and government offices have not sustained fatal damage, so the basic mindset is to implement urban rebuilding in order to re-establish the urban functions.

-Damaged regions often involve a mixture of commercial areas and business districts with residential areas, so residents must be relocated to higher altitudes and the upper floors of reinforced buildings where the tsunami cannot reach, and tsunami energy suppressed with
disaster prevention facilities, under the assumption that coastal businesses and offices are going to be rebuilt in the same locations.

Areas flooded in the past during large tsunamis must have evacuation routes, wave-prevention buildings, evacuation buildings, and evacuation towers, and higher altitude areas must also have evacuation areas (evacuation parks, etc.).

**Reconstruction Pattern C (Settlement Relocation / Internal Settlement Restructuring)**

-There are many settlements with residents near the water that were completely or partially destroyed, so they must be relocated to higher ground in groups so that the community will not crumble. They can also be relocated to mountains where the tsunami can be avoided, and damaged sites regraded and evacuation routes maintained.
-Ensure an infrastructure that allows for separation of work and home by establishing approach roads that connect new settlements.