Case History-1

Restoration and Reconstruction of Kyu-Kitakami River

Mr. Hiroho Takada

Ministry of Land, Infrastructure, Transport and Tourism
Tohoku Regional Bureau, Kitakamigawa-Karyu River Office

The estuary area of Kyu-Kitakami River was significantly damaged due to the earthquake and tsunami in the Great East Japan Earthquake in 2011. Picture 1 was taken from the Hiyoriyama Mountain in Ishinomaki City in Miyagi Prefecture, one month after the disaster. This Hiyoriyama Mountain is famous for the cherry blossoms and is usually very crowded with the visitors. However, in 2011, it was very quiet spring with few visitors. The city was destroyed by tsunami, and the disposal of the disaster wastes and the search for the missing continued, with the support from inside and outside of Japan. On the other hand, the cherry blossoms were blooming beautifully and the poem monument was standing still saying 'May peace prevail on earth'.

Picture 1

In the estuary of Kyu-Kitakami River, there is a city called Ishinomaki City, Miyagi Prefecture. The city lies along the river. The river and the lives of people in this city are closely connected with each other. In addition, there are ports and factories near the river estuary, with industries such as papermaking and wood processing, taking advantage of the plentiness of water from Kyu-Kitakami River.

In the Great East Japan Earthquake, tsunami went upstream through the river, destroying buildings and houses. When the tsunami hit this district, there was a staff working in 'Ishinomaki Comic Book Hall', and some residents nearby escaped into the hall. The water level of the tsunami rose up just beneath the window of the Hall, but the Hall survived. The staff is still working in the Hall now, and is devoted to the restoration and reconstruction of Ishinomaki.

The basic concept of the restoration plan for the central district of Ishinomaki is shown in Figure 1. The first defence is the coastal levee and the river levee, to protect the city from the tsunami with relatively high frequency of occurrence. The second defence is the multi-defense structure, such as the levees with high road banks and disaster-prevention green parks, to minimize the damage. The district between the first and the second defence will be designated as the uninhabitable area.

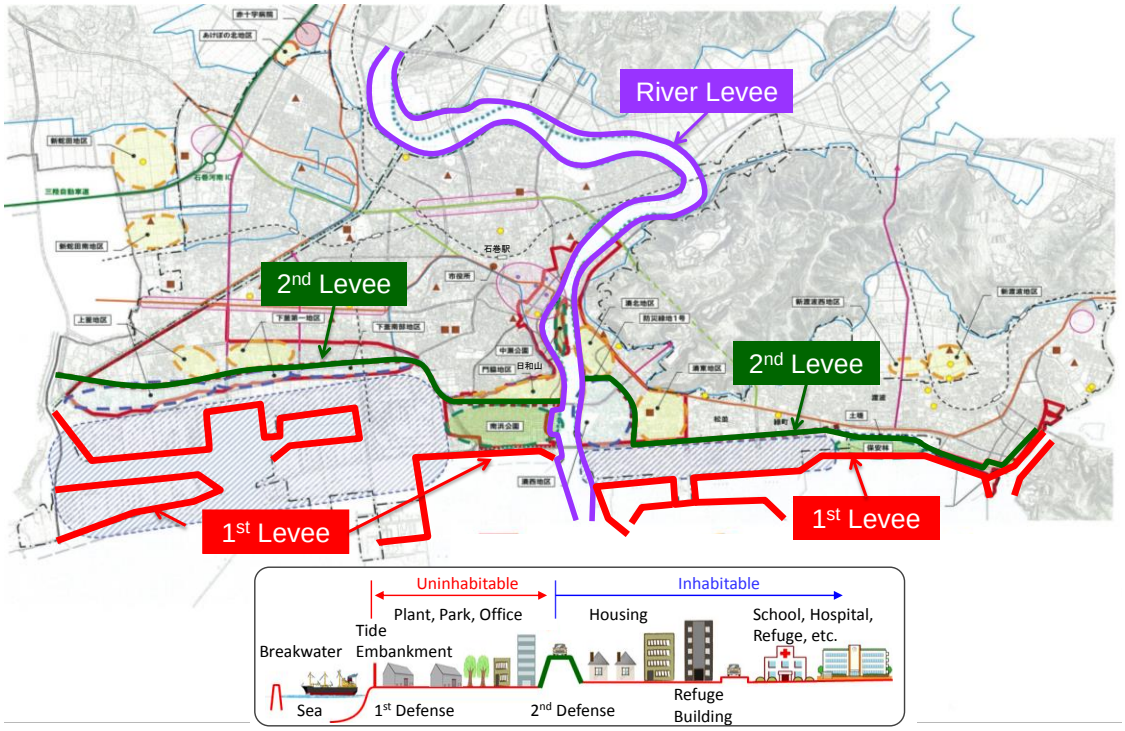

Figure 1

The height of the river levee in the estuary should harmonize with the height of the coastal levee, and cover the required height for flood, high tide and tsunami. The height of the levee in the estuary is determined by the high tide and will be T.P. 7.2m up to 1.6km from the estuary. Then it will then be decreased to T.P. 4.5m up to 1.9km from the estuary, and be fixed at T.P. 4.5m. The revetment will be constructed to prevent the ground subsidence and the succeeding inundation. The river levee will be constructed behind the revetment. Between the revetment and the river levee will be designated as the inspection passage where the citizens can enjoy walking.

The river side was significantly eroded by tsunami. Because of this erosion, only small room was left between the river and the houses. As this area is also influenced by the tide, an immediate action was required to prevent the erosion. The noise and vibration due to the construction process should be as small as possible, taking into consideration the lives of the residents. In addition, the space for the construction was limited, as shown in Picture 2.

Picture 2

The first example is the construction at the right bank in Kadowaki district. 450 SPU-2W type sheet piles and 170 SPU-4W type sheet piles were used in this revetment. As there were a lot of stones on the river bed, Hard Ground Press-in Method was adopted.

The second example is the construction in Kadowaki and Chuo district at the right bank, as shown in Picture 3. 600 tubular piles with the diameter of 800mm and 1000mm were used in this revetment. As the ground condition was very hard, Gyropress Method was adopted. The number of teeth on the pile base was varied depending on the hardness of the ground.

Picture 3

The third example is the construction in Sumiyoshi district at the right bank, as shown in Picture 4. 100 SPU-2W type sheet piles and 850 SPU-4W type sheet piles were used in this revetment. As there was little space for supplying the sheet piles to the piling machine, GRB Non-staging System was adopted. Sheet piles were transported on top of the installed piles from the upstream side of the site.

The final example of the revetment construction, as shown in Picture 5. This is the construction at the left bank in Hachiman and Fudocho district. 370 SPU-3W type sheet piles and 200 SPU-4W type sheet piles were used in this revetment. Here, the existing revetment was adjacent to the planned line for the sheet pile installation. In addition, there was rubble near the existing revetment. To cope with these difficulties, Hard Ground Press-in Method was adopted.

Picture 4

Picture 5