Flood Mitigation by Adaptive Use of Urban Infrastructure

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Climate Change and Urban Flooding

Climate Change and Heavier Rainfalls
Source: NASA, 2013

Urban Growth and Hydrologic Effects of Urban Development
Source: USGS, 2003

Beijing, China in Jul. 2012
Atlanta, U.S. in Sept. 2009
Ayutthaya Province, Thailand, Oct. 2011
Climate Change and Urban Flooding

No Exception in Korea

More precipitation by fewer more intense events!

Losses due to Natural Hazards in Korea

89% damages originated from storm (61.3%) and flood (28.0%) within the recent 10 years (1998~2007)
How about Busan, Korea?

Korea’s second largest city after Seoul (3.5 million)
Located on the southeastern tip of the Korean peninsula
Situated between the two rivers (Nakdong and Suyeong)
Districts separated and surrounded by mountains

Flooding Problem? Change from Safer to Vulnerable City

4 people killed by flooding near Oncheon urban stream on Aug. 2014
Total Urban Flooding Mitigation Strategy

“Not only urban drainage infrastructure but also every integral part of the city is to make contribution”

“How about roads?”
“What Below or Above the roads?”
Road Networks in Busan

Well developed north-south road networks
Insufficient west-east networks → fourth one being constructed
Road Networks in Busan

New network passing under the vulnerable area near Oncheon urban stream

“Any chance to mitigate the flooding problem?”
Adaptive Use of the Network

Hydrological Characteristics of Oncheon Watershed

Oncheon Urban Stream
- Branch of the Suyeong River
- Total Length: 14.85 km
- Watershed Area: 56.28 km²
- Gradient
  Origin to Jangjeon Bridge: 1/100
  Jangjeon Bridge to Sebyung Bridge: 1/300
  Sebyung Bridge to Suyeong River: 1/1,400
Adaptive Use of the Network

Scheme for Flooding Mitigation (J. Biddle et al., 2008)

Slow it down
Spread it out
Soak it in

How to Secure the Land and Money?

http://greenhouse.ca/greenroofs/features.php
http://www.doremihouse.com/bbs/b_humor/196557
Adaptive Use of the Network

Let’s Use the Space above the Network!

- Location: Near the Jangjeon Bridge
- Dimension: L=450m, W=20m, H=5m
- Storage Volume: approx. 40,000 ton
- Cost: 5 million US dollar (addition to the underpass construction costs)
Benefits

Flood Risk Mitigation

Best Location to be!
- The lowest point above the Sebyung Bridge Sub-watershed

Rainwater Harvest and Reuse

Rainwater Harvesting during ordinary times
- Harvest ground water from the tunnels and rainwater and reuse it for maintaining the stream
- annually 0.5 million US dollar saving expected

Construction Cost Saving

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<th>Location</th>
<th>Volume (ton)</th>
<th>Cost (million U.S. Dollar)</th>
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