Asia-Pacific
Economic Cooperation

2018/SOM3/EPWG/014
Agenda Item: 8.1

APEC Casebook of Infrastructure Build Back Better from Natural Disasters - Enhancing Rural Disaster Resilience Through Effective Infrastructure Investment

Purpose: Information
Submitted by: Japan

APEC 2018
PAPUA NEW
GUINEA

14th Emergency Preparedness Working Group Meeting
Port Moresby, Papua New Guinea
10–11 August 2018

APEC Casebook of Infrastructure Build Back Better from Natural Disasters

Enhancing Rural Disaster Resilience through Effective Infrastructure Investment

APEC Emergency Preparedness Working Group, March 2018

Executive Summary

I Concept: APEC region needs to be well-prepared for recovery through BBB approaches

Quality infrastructure investment towards upgrading connectivity

Many APEC economies in the midst of economic growth face an increasing demand for infrastructure investment. In order to foster regional and sub-regional connectivity, APEC leaders have reaffirmed the Da Nang Declaration, Nov. 2017, which codified the commitment to build a seamless and comprehensively connected and integrated APEC region by 2025 by reiterating the importance of quality infrastructure. More intensified policy efforts should be made to facilitate accelerating infrastructure investment, in particular, in rural areas and outside metropolitan areas facing progressive urbanization. It is imperative to accelerate upgrading connectivity so that regions outside metropolitan areas can become better integrated in economic and social development, as well. This includes efforts to develop safe, secure, resilient, efficient, affordable and sustainable transportation systems by encouraging infrastructure investment.

Recovery from natural disasters as an opportunity for investment

APEC economies, located on the Pacific Ring of Fire, saw more than 40 natural disasters resulting in the loss of close to two thousand lives, or more, throughout the 20th century, and already 10 such instances in the 21st century. Critical infrastructure resiliency is one of the key areas in the APEC Disaster Risk Reduction (DRR) Framework adopted by APEC leaders in 2015. The government authorities in the affected regions have, however, little opportunity to discuss and plan recovery and Build Back Better (BBB) strategies during "peacetime". Rather, it is in the aftermath of disasters that DRR authorities have attempted to find feasible and affordable solutions for restoration, reconstruction and BBB. Recovery and reconstruction from natural disasters could, in fact, be a key opportunity for infrastructure investment.

This casebook is the output of the APEC project "Enhancing Rural Disaster Resilience through Effective Infrastructure Investment (EPWG 01 2016), and is intended to help guide economies in need of planning infrastructure recovery and BBB approaches. Focus is placed on non-metropolitan and rural areas facing growing demands for infrastructure investments in the coming decades. The casebook compiles knowledge mainly from the case studies of six APEC economies, including Chinese Taipei, Indonesia, Japan, Philippines, USA and Viet Nam, and the APEC workshop discussion on 17th September 2017 back to back with the Senior Disaster Management Officials Forum, SDMOF in Vinh City, Viet Nam.

Table1: Diverse types of Infrastructure BBB discussed at the APEC workshop

BBB Types	Cases
0. Immediate recovery	
1. Instauration of disaster-resistant infrastructure / enhancing capacity of the existing structure	• Earthquake-resistant, water-resistant , anti -tsunami structures • Instauration of emergency power supply • Introduction of structures to facilitate smooth recovery • Increasing redundancy by installing alternative facilities
2. Upgrading the function	• Use of cutting-edge technology vs. technology more adapted to the diverse conditions, less costly structures for maintenance • Realizing further links with local industrial clusters
3. Redefining and diversifying the function	• More environmentally friendly structures, "plant back better" • Infrastructure serves also as tourist destination • Improving scenic beauty
4. Planning & designing of recovery	• Relocation of infrastructure to the areas with less danger • Wider scope of planning and vision making for building new urbanised areas
5. Governance and finance or BBB	• Special fund facilitating immediate recovery • Effective organisation for smooth BBB • Collaboration with the Private sector
7. More effective and safer implementation of BBB works	• Use of construction technologies satisfying diverse demands for recovery
6. Installing facilities to support evacuation as an alternative/second best solution	• Installation of evacuation route, tsunami tower, and so on
8. Others	• Training of relevant human resources

Source: material from the APEC workshop in Vinh City, Viet Nam, September 2017

The casebook highlights:

- Effects of infrastructure recovery on local industry and economy: how reconstructed infrastructure has facilitated bringing rural products to regional and international markets by enhancing connectivity for the supply chain and global value chain.
- DRR and development nexus: Infrastructure development projects could be financed not just by recovery budgets but also through various sources provided for development policies.
- Locally based or environmentally friendly technologies as well as high technologies contributing to BBB.

The full report is made available from APEC website: www.apec.org

For further questions: Asian Disaster Reduction Center, ADRC
TEL: +81 (78) 262-5540 FAX: +81 (78) 262-5546 E-mail: rep@adrc.asia Website: www.adrc.asia

II Cases of Infrastructure BBB and lessons learnt

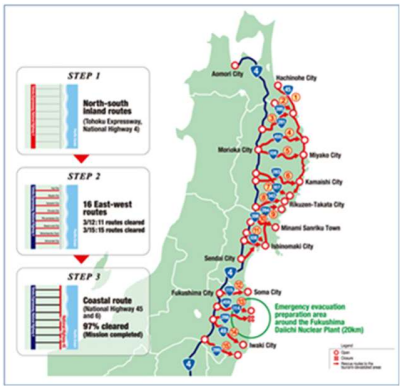
Almost 30 cases of infrastructure BBB, have been provided from APEC economies (See Table 2), including transport infrastructure at both communal and wide regional levels aimed at upgrading connectivity, recovery of ports and other transport infrastructure, sea dike and water resources development infrastructure, and village relocation.

2-1: Immediate recovery of road transport

Immediate recovery of key infrastructure, especially that of roads used for rescue operations, is a precondition for the whole recovery process.

- Shihwei Bridge, an important road destroyed by the 921 Earthquake that struck **Chinese Taipei** in 1999 (Case 1-1-2), was successfully restored in eight months through close collaboration with contractors who applied cutting-edge construction technologies.
- Due to Typhoon Morakot in 2009, which affected wide areas of southern Chinese Taipei, bridges of the No. 20 provincial road collapsed (Case 1-1-1). Quick decision-making by the government to devote significant resources into the road and bridges' restoration facilitated a smooth recovery as well as redevelopment of the local tourism industry.

Photo left:
Reconstruction of the new Lidao bridge affected by Typhoon Morakot,
Photo right:
Reconstructed Shihwei Bridge, affected by the 921 Earthquake



- In **Japan**, the immediate clearing and securing of the trunk road-networks in the heavily affected areas, begun on the very day after the Great East Japan Earthquake, greatly contributed to accelerate rescue operations and the overall recovery process (Case 1-1-4).
- In **the USA**, the initiative of the State of Vermont enabled the immediate recovery of highways in three months, after Hurricane Irene in 2011, by considering the effect on the local economy (Case 1-1-3).

The cases demonstrate that quick recovery was supported by close communication among the relevant authorities, enabling urgent decision-making and consensus building among the authorities and communities, immediate allocation of funding, and application of the appropriate technologies to accelerate recovery work.

2-2 Recovery as an opportunity for upgrading connectivity

Post-disaster recovery has been planned by aiming not just at recovery of infrastructure but also BBB of the local economy. Recovery projects need to be integrated into the development plan, which can be used as a tool for facilitating coordination among relevant stakeholders.

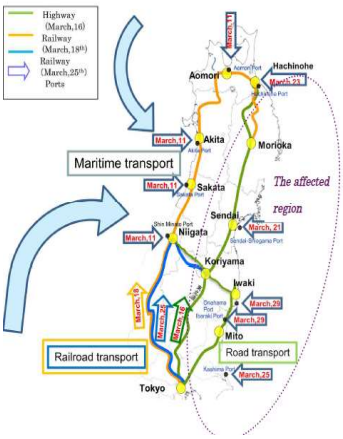
- **Philippines:** Road improvements and alternative highways construction (Case 1-2-1)

The Mt. Pinatubo eruption brought about widespread destruction of the major roads and bridges; the authorities were thus forced to design new, alternative roads and bridges more resistant to lahars, which ensured the accessibility of rural provinces. The Subic–Clark–Tarlac Expressway (SCTEX), for example, is one of the highways that connects the affected provinces with other provinces of Central Luzon. The SCTEX provided more efficient transport among growth corridors in Cenral Luzon through the integration of economic activities in the Subic Bay Freeport, the Clark Freeport Zone, and the Central Techno Park in Tarlac. It fostered development of the municipalities served and connected major infrastructures such as the Seaport in Subic and the International Airport in Clark. The existence of redundant routes ensures that rural areas will not be isolated, even during future disasters.

- **Indonesia**: The 2010 tsunami and earthquake and Trans-Mentawai road networks (Case 1-2-2).

Photo 1. Trans-Mentawai Road on Siberut Island
Photo 2. The new bridge to Monga village, next to the old bridge

The Trans-Mentawai road networks development project, after the Mentawai Archipelago Earthquake in 2010, has successfully connected rural areas by improving road networks. Before the disaster, the absence of inter-district land transportation had slowed the region's economic growth. The Trans-Mentawai highway was thus planned to connect the areas to potential markets for their agricultural products, which encouraged the rural inhabitants to build houses and farms near the roadsides. The road recovery construction work directly benefited the affected areas by creating temporary job opportunities, which accelerated recovery. The authorities effectively collaborated with private companies which provided land alongside existing roads for the improved roads, leading to a win-win solution.



- In **Japan**, the immediate road networks clearance operation after the Great East Japan Earthquake (Case 1-1-4) has reminded authorities of the importance of alternative roads. The concept of redundancy and the idea of doubling road networks was clearly defined in the "National Spatial Strategy", revised in 2015, stressing the importance of dual road networks for upgrading spatial resilience. Other regions have then integrated similar ideas of doubling road networks in individual regional development plans.

2-3 Community-based infrastructure BBB as "small is smart" solution

Infrastructure BBB can be achieved not just by applying cutting-edge and huge-scale infrastructure. Infrastructure tailored for the local situation could benefit by involving the local community in maintaining and improving the infrastructure in their daily life. A community-based infrastructure management model could provide sustainable solutions if sufficient opportunities are made available for local authorities to choose the best solutions adapted to local conditions. In the process of recovery, cultural aspects can also be integrated as an important value-added.

- Many cases are reported from Viet Nam by using low-cost and environmentally friendly technologies well-adapted to the affected rural areas: In the case of Ca Mau province, recently affected by landslides damaging the long coastal lines (Case 2-1), local authorities applied low-cost technologies, including a "soft" embankment of rocks and concrete, to reduce the impacts of sea waves and protect mangroves. The use of such technologies contributed to reduce the construction cost, while for the case of Thanh Mai stream embankment (Case 2-2), low-cost biological technology was applied.

Photo (right) Low cost and "soft" technology applied for sea dike embankment (Source: PMUARDW, 2017) (Case 2-1),
Photo (left) Biological dike after three months, (Source: MARD-PMU, 2016) (Case 2-2)

- In Indonesia, a small-scale infrastructure, as reported in the case of smoldering peat fires and canal blocking in Meranti (Case1-2-3), has been successfully undertaken through community involvement.

Photo. One of the canal blocking projects in Sungaitohor Village, Meranti Islands District Source: Directorate of Forest and Land Fire Control. 2015

- The Dabang elementary school building complex, damaged by Typhoon Morakot in Chinese Taipei (Case 4-1), was reconstructed by integrating indigenous culture with modern building design as a symbol of the local industry and culture, which has ultimately contributed to preserving traditional culture and local identity.

Photo. Reconstruction of Dabang elementary school(Source: MTPRC, 2013)

2-4 Village relocation as an alternative for BBB

Many economies have attempted whole village relocation projects to disaster-resilient locations as an alternative, despite the complicated coordination and consensus-building process required. Relocation provides an important opportunity for building new villages equipped with a full set of updated community infrastructure.

- After Typhoon Morakot struck the southern part of Chinese Taipei in 2009, several villages of Pingtung county were classified as unsafe areas (Case 3.1). The central and local governments negotiated with the residents and selected South Bank Farm as a permanent housing area renamed as "the new Laiyi tribe". A site of 24 ha was developed to settle 223 families. The reconstruction council placed importance on local industries and job opportunities for villagers and implemented projects to promote agricultural development and tourism. The government also established a production and marketing center featured indigenous handicraft industries so that the refugees could develop their traditional culture and handicraft skills.

- The 2007-2008 Kickapoo River floods affected the Village of Gays Mills in Crawford County, Wisconsin, USA (Case 4.2), home to a population of almost 525, and damaged 60 homes and devastated local businesses in the downtown area. Previous planning efforts that had not yet been implemented before the floods jump-started a conversation that would lead to Gays Mills, in effect, being relocated a mile north of the original downtown area. In 2008, the Gays Mills Long-Term Community Recovery Team led an intensive three-month long planning process in consultation with local, state, and federal officials, resulting in a Long-Term Community Recovery Plan characterized by the basic objectives of reducing consumption of non-renewable resources, waste minimization, and creation of healthy, productive environments. The recovery of Gays Mills illustrates a good practice of leveraging multiple funding streams to enact a potentially decades-long relocation project for a relatively microscopic portion of the population.

In Australia, after the Queensland flooding in 2010-2011 resulted in 35 deaths, the community relocation project "Strengthening Grantham" was established to provide vital community infrastructure, including water supply, sewerage and roads, at a new residential development on higher ground better protected from flooding.

Source: Cabinet Office/MLIT, Japan (Provisional translation by ADRC)

In Japan, a scheme facilitating collective relocation from disaster-struck and vulnerable areas has been made available since 1972. In the tsunami-affected areas after the Great East Japan Earthquake, more than 300 collective relocation projects from coastal areas to hilly areas have been underway.

3. Challenges and ways forward

Achieving infrastructure BBB requires overcoming many challenges, including administrative, organizational, financial, and technical challenges.

Examples of infrastructure BBB challenges
Need for immediate recovery vs. BBB that will require good planning from long-term perspectives.
Natural constraints: Reconstruction work should be completed before the next typhoon or flood season starts.
Financial constraints including budgeting process, timing as well as insufficient resources. - Absence of pre-allocated budget for recovery - Principles of building back to the pre-disaster status and not BBB
Immediate availability of information on technological solutions adapted to the damages, on funds available, and possibilities to collaborate with the private sector.
Addressing inequality and achieving balance: Infrastructure BBB may generate inequality of access to newly developed infrastructure among the affected, or between the affected and the non-affected.
Governance challenges for BBB: Organizational arrangements for recovery are not always well institutionalized, due partly to the sporadic and rushed nature of recovery.

Natural disaster as a driver for long-term planning

In spite of the challenges, the cases demonstrate that *post-disaster situations could be a key moment of important investment, if the relevant authorities and stakeholders are prepared for it.* Furthermore, post-disaster infrastructure investment could improve connectivity and trigger further growth of the local economy, as demonstrated in the cases of the Philippines and Indonesia. Strengthening the nexus of DRR policy and regional development policy is a key for effective post-disaster investment in critical infrastructure. Important infrastructure BBB plans are more likely to be effective when the groundwork has been laid before disaster strikes. The strategy of territorial redundancy had been defined in "the national development plan of 1998, in Japan, for example. After that, the resiliency of road networks had been gradually improved, eventually enabling the successful "Teeth of a Comb" operation after the Great East Japan Earthquake in 2011.

Small is smart: advantages of locally based infrastructure

Highly developed and intensively networked transport infrastructure can actually suffer more significant damage than small scale, locally manageable infrastructure. Rural areas have an advantage to build small and smart infrastructure, locally manageable and more resilient, as demonstrated in the "small is innovative" cases of community-based infrastructure from Viet Nam and Indonesia.

Towards creative recovery

For many government DRR authorities, working for recovery from a mega-disaster would be the first such experience in their careers. It would thus be useful to share APEC-wide experiences of recovery to prepare for an effective BBB strategy, since the APEC region has historically endured many large-scale disasters.

Table 2. Major good practices of infrastructure BBB studied in the casebook

Economy	Natural Disasters	Infrastrucrtue
Immediate recovery of road transport		
CT	Typhoon Morakot	No. 20 Chinese Taipei Provincial Road
CT	921 Earthquake	Shihwei Bridge
USA	Hurricane Irene	Federal highway in the State of Vermont
Japan	Great East Japan Earthquake	Road networks
Upgrading connectivity — wide area road networks		
Philippines	Mt. Pinatubo eruption	Highways
Philippines	Mt. Pinatubo eruption	Olongapo-San Fernando-Gapan road & highway
Philippines	Mt. Pinatubo eruption	Subic–Tipo Expressway road & highway
Philippines	Mt. Pinatubo eruption	Subic–Clark–Tarlac Expressway (SCTEx)
Indonesia	Mentawai Earthquake	Trans-Mentawai road networks
Indonesia	Meranti peatland fires	Canal Blocking in Meranti
Viet Nam	2015 floods	Tan Lap Communal roads
Ports, airports and other transport infrastructure		
Indonesia	The Indian Ocean earthquake and tsunami	Deep-water ports in the Nias Islands
Philippines	7.2 Earthquake	Tubigon Port
USA	Hurricane Katrina	Gulfport, Mississippi port facilities
Japan	Great Hanshin Awaji Earthquake	Port of Kobe
Philippines	Super typhoon Haiyan/Yolanda	Tacloban Airport
Japan	Chuetsu Earthquake	*Shinkansen* "bullet train"
Water and waste management infrastructure		
Viet Nam	2007 landslides	Sea dike system in western Ca Mau province
Viet Nam	Landslides casued by floods	Thanh Mai stream embankment
Viet Nam	2013 acute erosion	Sea dike in Hai Duong area
Japan	1982 Nagasaki Flood	Bridge
CT	921 Earthquake	Shihgang Dam in Taichung County
Indonesia	Indian Ocean Tsunami	Waste management infrastructure
Philippines	Typhoon Uring	Slit dams
Village relocation		
CT	Typhoon Morakot	Laiyi township relocation
USA	Kickapoo River Floods, 2007–2008	Village of Gays Mills community relocation
Australia	Queensland flooding 2010–2011	Village relocation
Japan	Great Hanshin-Awaji Earthquake	Urban redevelopment of (HAT Kobe)
Lessons for infrastructure from reconstruction of houses and buildings		
CT	Typhoon Morakot	Dabang elementary school in Alishan township
Viet Nam	Central region floods	Flood resilient housing in the Central regions