TECHNICAL KNOWLEDGE EXCHANGE ON

SUMMARY REPORT

THE WORLD BANK
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GFDRR
Global Facility for Disaster Reduction and Recovery

Resilient Transport
Community of practice

TECHNICAL KNOWLEDGE EXCHANGE (TKX)

ON RESILIENT TRANSPORT

Summary Report

MAY 8 – 12 2017

This Technical Knowledge Exchange (TKX) was organized by the World Bank Disaster Risk Management Hub, Tokyo, in collaboration with the World Bank's Resilient Transport Community of Practice (CoP) in partnership with the government of Japan (Ministry of Finance(MoF); Ministry of Land, Infrastructure, Transport and Tourism(MLIT)). The TKX also benefited greatly from contributions by the following: the Global Facility for Disaster Reduction and Recovery(GFDRR), Japan International Cooperation Agency (JICA), Iwate Reconstruction Bureau, Hyogo Prefecture, Kyoto University, Nippon Expressway Company (NEXCO), Japan Bosai Platform, and World Road Association (PIARC).

CONCEPT: The Technical Knowledge Exchange (TKX)

Technical Knowledge Exchange (TKX) integrates workshops, site visits, peer-to-peer knowledge sharing, and action planning to support World Bank clients on specific topics. TKX both facilitates knowledge sharing and provides ongoing support to connect clients with technical experts and best practices in close collaboration with the World Bank's Communities of Practice (CoPs).

The TKXs have four core elements:

1. Objective-focused structure: Demand-driven and problem-solving orientation, with possible technical assistance, including consultation and expert visits to client nations through the World Bank's City Resilience Program and other programs.

2. Knowledge exchange to foster operations: Knowledge exchange, just-in-time assistance, and potential technical assistance for clients and World Bank task teams.

3. Structured learning: Delivery of structured learning for clients and partners such as e-learning courses and a package of selected knowledge exchange instruments before, during, and after the Technical Knowledge Exchange in Japan.

4. Application to knowledge networks: Contribution of relevant inputs to CoPs to support development of their knowledge assets (such as case studies and best-practice lessons) and to disseminate them to the broader community.

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University of Auckland

We thank the participating officials and project task teams for their presentations, active involvement, and knowledge sharing.

TABLE OF FIGURES

ABBREVIATIONS

DRM	Disaster Risk Management
GRM	Geohazard Risk Management (Handbook)
IT	Information Technology
JICA	Japan International Cooperation Agency
LMICs	low- and middle-income countries
NGO	nongovernmental organization
TEC-FORCE	Technical Emergency Control Force (Japan)
TKX	Technical Knowledge Exchange

EXECUTIVE SUMMARY

Technical Knowledge Exchange on Resilient Transport

TRANSPORTATION infrastructure represents a significant public and private investment that is fundamental to the functioning and development of economies and societies. As such, transport investments have been integral to the World Bank's partnerships with client countries. Since 2002, more than 260,000 kilometers of road were constructed or rehabilitated through World Bank-supported projects. However, these investments are increasingly exposed to disaster and climate hazards, including landslides, flooding, and earthquakes. To manage and reduce the risks these hazards may pose, low- and middle-income countries are seeking new approaches to plan, design, construct, operate, and maintain their transportation systems.

On May 8–12, 2017, the World Bank Disaster Risk Management (DRM) Hub in Tokyo and the Resilient Transport Community of Practice (CoP) hosted a week-long Technical Knowledge Exchange (TKX) in Tokyo that convened clients and World Bank task team leaders (TTLs) from 16 countries to share concepts and practices on resilient transport, including systems planning, engineering and design, asset management, and contingency programming. The exchange drew upon Japanese and international experts to showcase innovative approaches and practical advice for facing the challenges when addressing risk management planning for the transport sector. Country representatives and World Bank teams learned from one another and from Japan's challenges and successes with large-scale disasters. One key lesson was that continuously reviewing and enhancing domestic practices and regulations will ultimately increase the resilience of transport networks.

The Resilient Transport TKX also served as a platform for the launch of the new Road *Geohazard Risk Management Handbook* developed under the Hub's Knowledge Program. The tool was presented alongside case studies of its application across federal, state, and municipal levels in Brazil and Serbia. The *Handbook* itself urges a shift away from traditional and reactive approaches towards a multidimensional geohazard risk management approach that incorporates people, the environment, hydrology, and geology as well as transportation infrastructure so that such proactive methodology can result in 60–70 percent life-cycle cost savings. Going forward, the Resilient Transport CoP will continue to connect current and future World Bank transport investments with the information, tools, and technical expertise that exist in Japan and in many countries in the area of resilient transport.

Participant Profile and Challenges Faced

THE TKX brought together World Bank staff working in five regions; experts from Japan and New Zealand; and client delegations from Afghanistan, Argentina, Brazil, Cambodia, Colombia, Georgia, India, the Kyrgyz Republic, the Lao People's Democratic Republic, Mozambique, Myanmar, the Philippines, Serbia, Sri Lanka, Tajikistan, and Vietnam. **FIGURE 1** 60 percent of the attendees represented the transport sector, while the other 40 percent comprised individuals working in the infrastructure and public works and disaster risk management (DRM) fields. Country representatives shared their unique challenges, practices, and lessons learned with over 70 people who participated in the exchange. Each country presented a lightning talk on the disaster risks affecting their own transport sectors **FIGURE 2** and the methods they employ to make them more resilient. This ultimately informed each country as they developed action plans.

AFGHANISTAN	▪ AF: Afghanistan Rural Access Project (P125961) ▪ Trans-Hindukush Road Connectivty Project (P145347)
ARGENTINA	▪ Northwestern Road Corridor (P163115)
BRAZIL	▪ São Paulo Sustainable Transport Project (P127723)
CAMBODIA	▪ KH - Road Asset Management Project II (P150572)
COLOMBIA	▪ CO Support Nat'l Urban Transit Program (P117947)
GEORGIA	▪ GE: Climate Resilience of Road Network (P161222)
INDIA	▪ IN: PMGSY Rural Roads Project (P124639) ▪ BRRP (P155522)
KYRGYZ REPUBLIC	▪ Central Asia Regional Links - Phase 3 (P159220)
LAO PDR	▪ Lao Road Sector Project 2 (P158504) ▪ Lao PDR Southeast Asia DRM Project (P160930)
MOZAMBIQUE	▪ MZ-APL2 Roads & Bridges (P083325) ▪ Feeder Road Project (P158231)
MYANMAR	▪ Flood and Landslide Emergency Recovery C (P158194)
PHILIPPINES	▪ Technical assistance on Local Roads Management (P162622)
SERBIA	▪ Corridor X Highway AF (P158413) ▪ Implementing Open Data Plan for Serbia (P162777)
SOUTH ASIA	▪ Nepal-India Reg Trade & Transport Prj (P144335)
SRI LANKA	▪ Transport Sector Project (P132833)
TAJIKISTAN	▪ RSIP (P159707)
VIETNAM	▪ Vietnam Road Asset Management Project (P123961) ▪ Local Road Asset Management Program (P155086)

▪ Together, these projects represent more than US$5 billion in government-led investment, supported by the World Bank.

FIGURE 1
TKX Client Countries and Supported Projects
Source: Tokyo DRM Hub

LANDSLIDE SLOPE GEOHAZARD	RIVER FLOOD	CYCLONE TYPHOON HURRICANE	EARTHQUAKE	COASTAL FLOOD
Afghanistan	Afghanistan	Cambodia	Afghanistan	Colombia
Argentina	Argentina	India	Kyrgyz Republic	Myanmar
Brazil	Brazil	Lao PDR	Tajikistan	Vietnam
Colombia	Cambodia	Mozambique		
Georgia	Colombia	Myanmar		
India	Georgia	Philippines		
Kyrgyz Republic	Kyrgyz Republic	Sri Lanka		
Lao PDR	Lao PDR			
Philippines	Mozambique			
Serbia	Myanmar			
Sri Lanka	Philippines			
Tajikistan	Serbia			
Vietnam	Tajikistan			
	Vietnam			

FIGURE 2
A Profile of the Risks Participating Countries Identified
Source: Tokyo DRM Hub

Structure of the TKX

THE WEEK-LONG innovative learning exchange is structured around key practical themes: FIGURE 3

1. Understanding disaster (that is, geohazard) risks faced by the transport sector and system planning-based approaches to manage these risks
2. Showcasing Japan and global good practices on asset management technologies and institutional and financial mechanisms
3. Exploring innovative materials and structures to reduce vulnerability
4. Learning from Japan's emergency management response and contingency planning efforts
5. Examining how transport infrastructure can be used as protection against hydrometeorological events

The TKX included six main sessions (including 14 lectures) on the principles of resilient transport, about which the experts from Japan offered relevant experience; two keynote addresses; two field visits; and two workshops.

FIGURE 3
Key Themes of the TKX
Source: Resilient Transport CoP

Key Takeaways

- Investments in accurate data collection, archiving, analyzing, and sharing systems are crucial. A comprehensive system should be developed that focuses on the entire value chain, from data collection and analysis to efficient service delivery. Long-term planning, institutional aspects, and data systems are key for sustainability of investments.
- Capacity building of the stakeholders, through training and site visits, promotes well-coordinated, long-lasting, and effective resilient transport planning. Participants were specifically interested in developing asset management tools; implementing comprehensive geohazard management systems; and sharing technical guidance notes, case studies, and terms of reference.
- Incorporating climate and DRM in the transport sector life cycle is essential, and effective resilient transport management systems are built on legal and regulatory frameworks that define clear responsibilities and roles of different stakeholders, such as governments, municipalities, media, and the private sector.
- Upstream planning of transport systems can reduce the hazard exposure of the infrastructure that results in greater disaster risk. To utilize the life-cycle approach effectively, institutional and regulatory challenges, which are cross-cutting in nature, need to be mitigated. The life-cycle approach FIGURE 4 was applied to highlight how climate and disaster risk management can be integrated in the different phases of infrastructure life-span:
  - ***Systems planning:*** Shifting deployment of long-lived infrastructure away from disaster-prone areas to avoid development lock-in; consideration of integration and redundancy on critical infrastructure to offer alternatives.
  - ***Engineering and design:*** Using transport infrastructure both for connectivity and for DRM purposes, particularly from hydrometeorological-related hazards; use of innovative materials and design specifications that enhance robustness and flexibility of infrastructure.
  - ***Asset management:*** Inventory and mapping of transport infrastructure using open and interoperable technologies and improving institutional and financial arrangements for infrastructure maintenance; integration of climate and disaster risk considerations in the prioritization of investments in new infrastructure, rehabilitation, and restoration.
  - ***Contingency programming:*** Developing policy and institutional frameworks, communication protocols, and investments in emergency preparedness and response; alignment of transport systems and flows with local and regional evacuation, response, and recovery needs.

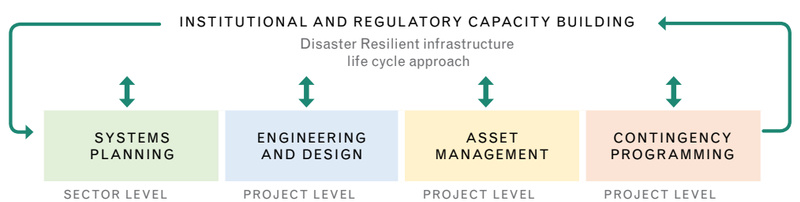


FIGURE 4
Disaster-Resilient Infrastructure: Life-Cycle Approach
Source: Resilient Transport CoP

Background on the Resilient Transport CoP

TRANSPORT damages and losses often make up a significant proportion of the economic impacts of disasters, frequently surpassing destruction to housing and agriculture in value terms. Damage is sustained not only by road surfaces or structures, but also by bridges, culverts, and other drainage works, while losses occur when breaks in transport links lead to reduced economic activity. Transport systems that are built well the first time—upholding structural and schematic standards and planning for safe failure—and that are well maintained are less likely to collapse when under pressure. With networks incurring damage less often, costs of rebuilding the same structures are reduced, and time and funding are made available for investment in more capable, adapted systems. If disaster strikes, a still-functioning transport system can also enhance the protection and revitalization of other sectors. Finally, planning and programming for contingencies ensures that when failures do occur, they can be addressed in a way that limits negative impacts.

With a growing transport and DRM agenda across the WB, the Resilient Transport CoP brings together members of the Climate Change Cross-Cutting Solutions Area (CCSA), GFDRR, Social Urban Rural & Resilience Global Practice (GPSURR), and Transport and ICT GP (T&I GP), with the objective of creating a knowledge-sharing environment for DRM and transport sector specialists. This COP has principally developed since September 2016, with the aim at establishing professional sharing practices among multidisciplinary staff that provides Task Teams with a suite of cross regional best practices and grant funding for technical assistance. By tackling DRM and transport in tandem—integrating the priorities and needs of both sectors—robust resilient transport systems can be established to reduce the risk of lost returns on investments and make strides toward long-term poverty reduction.

Japan's Experience in Transport DRM

THE government of Japan has a wealth of knowledge and experience in identifying and managing hazards that may adversely affect transport. In Japan, the challenges and lessons learned from large-scale disasters have been the driving force for continuously reviewing and enhancing the regulations, institutional frameworks, financing, staff capacity, and technology to advance resilience in transport. The TKX tapped into this experience by inviting speakers from Japan's public sector, private sector, academia, and civil society to share their lessons learned in relation to each of the life-cycle phases.

Specifically, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) provided the overall institutional DRM framework for roads in Japan and introduced the Technical Emergency Control Force (TEC-FORCE) mechanism whereby the national government coordinates across regions to quickly deploy technical capacity for post-disaster recovery. In addition, Nippon Expressway Company Limited (NEXCO) presented an advanced and unique model for how private highway companies can manage and operate resilient roads, as well as the technology and capacities put in place to respond to disasters.

OPENING AND WELCOME

MARIA Cordeiro and Marc Forni from the World Bank welcomed the participants on behalf of the Bank's Resilient Transport Community of Practice. The interest received for this event and the coming together of global practice units and client countries from around the world was a testament to the importance of and need to enhance the resilience of transport systems to the impacts of natural disasters and climate change.

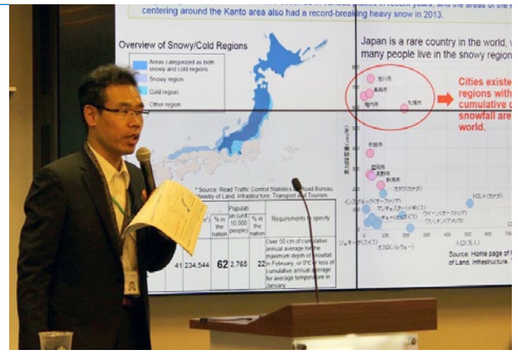
Incorporating climate and disaster risk management into infrastructure investments is an important part of meeting the World Bank Group's commitments to address climate change. Given this context, the Technical Knowledge Exchange (TKX) set the following key objectives:

- Raise awareness of the importance of climate and natural-disaster-resilient transport systems by exposing World Bank clients and teams to resilient transport concepts and best practices
- Foster learning, knowledge sharing, and collaboration among client countries on the topic of resilient transport
- Start documenting best practices being deployed by client countries, with the support of the World Bank, to facilitate replication and scaling-up of solutions
- Improve understanding of challenges faced by client countries to inform World Bank products and services in order to best serve and support client countries.

SESSION SUMMARIES

KEYNOTE 1:
Disaster Risk Management of Roads in Japan

HITOSHI FUKUMOTO, senior deputy director, Road Bureau, Japan Ministry of Land, Infrastructure, Transport and Tourism



JAPAN has developed its institutional and regulatory framework to define roles and responsibilities of governmental organizations for disaster risk management (DRM) as one of the world's most disaster-prone countries. FIGURE 5 Fukumoto provided a comprehensive explanation of how Japan has established a centralized DRM system by having strong coordination and communication at the national, prefectural, and municipal levels to ensure the consistency of DRM plans and its implementation approach. As a result, Japan has been able to mobilize people and resources effectively during any phase of the disaster management cycle (mitigation, preparedness, response, and recovery). His presentation emphasized the importance of continuously improving the technical capacity of those who engage in disaster response and recovery work through practical trainings. For example, Japan's Technical Emergency Control Force (TEC-FORCE) is a group of trained experts who provide immediate support when local municipalities cannot manage the situation in the event of disaster.

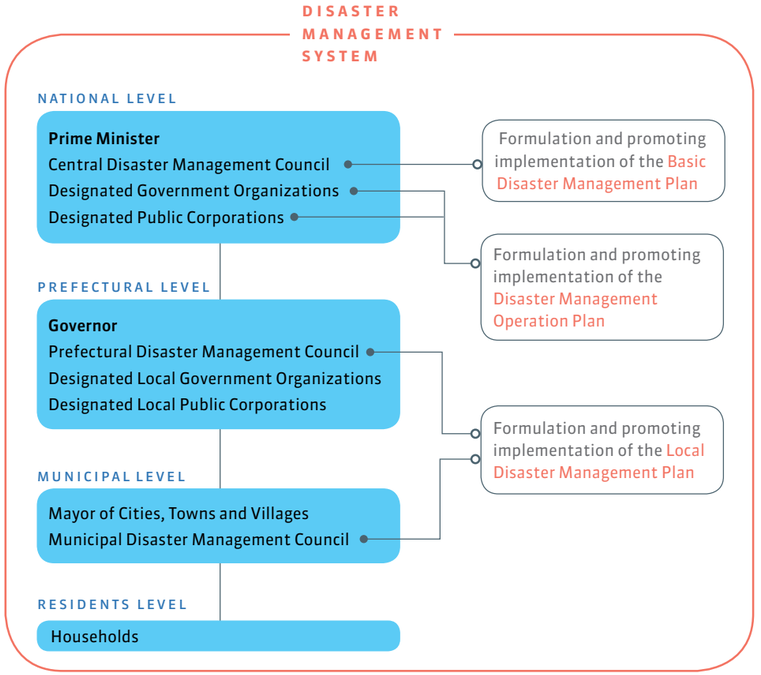


FIGURE 5
Japan's Institutional Framework for Disaster Management System.
Source: Adapted from Hitoshi Fukumoto's presentation.

SESSION 1:
Introduction to Road Geohazard Risk Management

YUKA MAKINO, senior natural resources management and disaster risk management specialist, World Bank

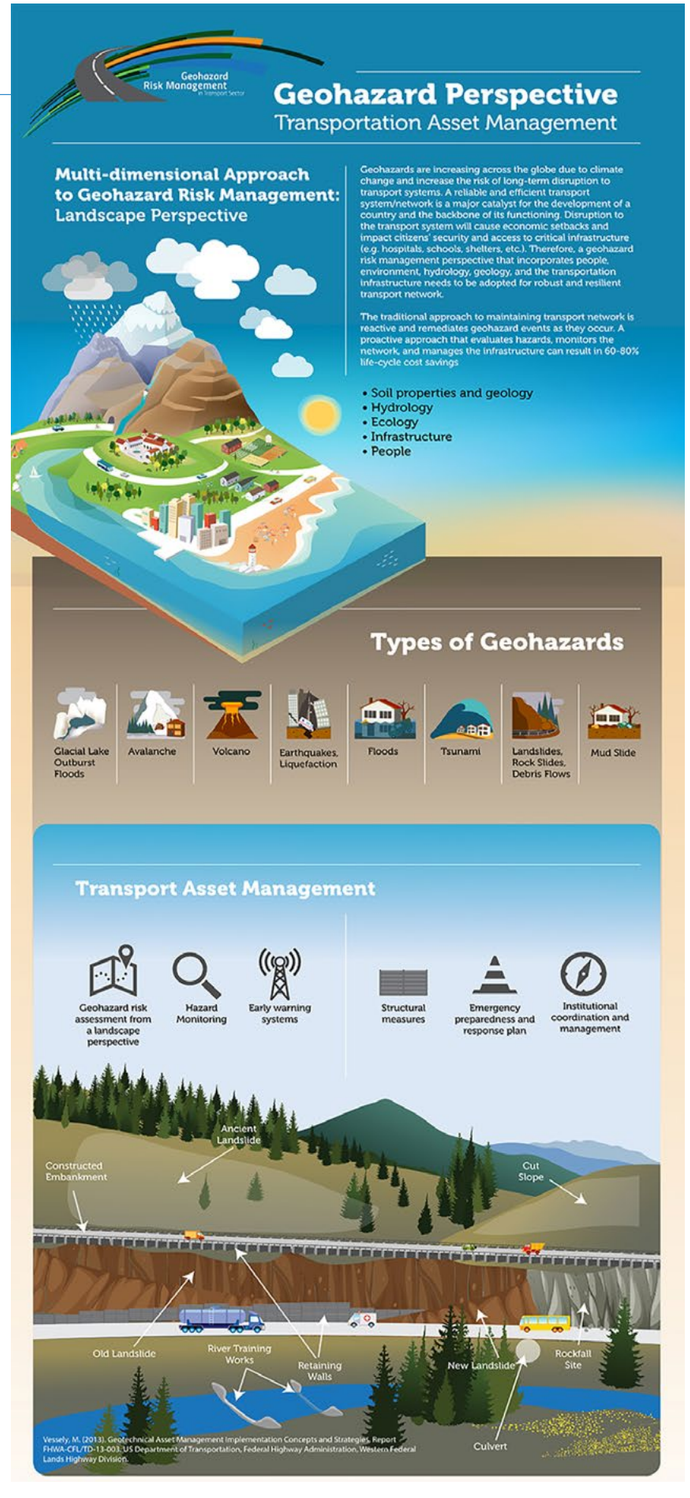
THE *World Bank's Road Geohazard Risk Management (GRM) Handbook* urges traditional reactive approaches to improving transport network resilience to move toward a multidimensional geohazard risk management approach **FIGURE 6,** which incorporates people, the environment, hydrology, and geology as well as transportation infrastructure. This proactive methodology is threefold—working through the steps of evaluating hazards, monitoring networks, and managing infrastructure accordingly—and can result in 60–70 percent life-cycle cost savings.

Effective transport asset management must include the following elements: (a) geohazard risk evaluation from a landscape perspective; (b) hazard monitoring, early warning systems, structural measures, and emergency preparedness and response planning; and (c) institutional coordination and management.

[It is] easy to get money when disaster happens but difficult to get funding for preventive actions. —Yuka Makino

Currently the *GRM Handbook* is being tested through technical assistance programs and the first release of the executive summary was distributed to Technical Knowledge Exchange (TXK) participants. The unabridged version of the document contains sample terms of reference, operations manuals, and guidance for cost-benefit analysis.

FIGURE 6
Holistic Approach for Geohazard Management
Source: Road Geohazard Risk Management Handbook.



FREDERICO FERREIRA PEDROSO, DRM specialist , World Bank

ALTHOUGH Brazil faces significantly fewer natural hazards than many of the countries represented at the TKX, its transport infrastructure is extremely critical and highly vulnerable to disaster shocks. Approximately 25 percent of the Brazilian economy relies on the functioning of a pair of highways between the São Paulo metropolitan area and the Port of Santos, the busiest container port in the Latin American region. Therefore, any obstruction on that road can have a sizable impact on the entire country's economy. Unfortunately, the country faces significant institutional challenges in mobilizing disaster resilience. The GRM Handbook encourages countries to establish standard operating procedures and recognize that DRM is not only the responsibility of federal or central governments, but also of state, local, and all other administrative bodies. The World Bank

team is working in Brazil across federal, state, and municipal levels and is currently focused on addressing issues of poor communication to promote better sharing of data across government sectors.

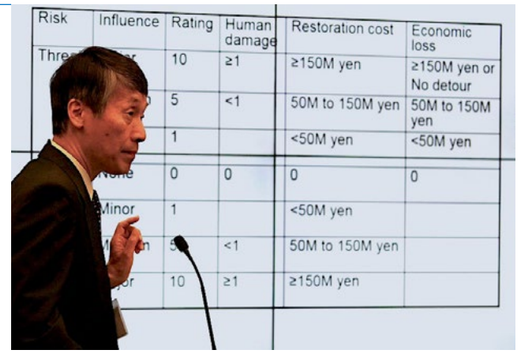
YOGANATH ADIKARI, DRM consultant, World Bank

IN MAY 2014, an unprecedented rainfall resulted in massive flash flooding and landslides in Serbia. The transport sector took an enormous hit as bridges failed, roads were eroded, and throughways were flooded by river water. The government realizes that it needs to streamline DRM but doesn't know where to start. Therefore, the World Bank team is applying the GRM Handbook to address the government's unanswered questions. This effort includes making the case for increasing capacity, upgrading maintenance plans, and filling the data gap to improve the country's 5- and 10-year DRM implementation plans.

SESSION 2:
Understanding Risk and System Planning

Keiichi Tamura, chair, Technical Committee on Risk Management, World Road Association (PIARC)

KEIICHI TAMURA, chair, Technical Committee on Risk Management, World Road Association (PIARC)



RISKS are defined and evaluated quantitatively and qualitatively. Based on the shared understanding of risks, Tamura suggested evaluating road geohazard risks more systematically by using a standardized risk index and rating. By using the example of risk assessment on the national highway (a 110-kilometer section) running through the Pacific coast area of Japan, Tamura emphasized the importance of quantifying road geohazard risks by using a risk index to identify treatment areas and specify risk mitigation methods. The proposed method of road DRM is to evaluate the risk of road facilities systematically and demonstrate the efficiency of the proposed method through a case study. The process involves the identification of natural disasters (hazards), damage assessment of road facilities, evaluation of direct and indirect damages, evaluation of consequences, evaluation of risks, and examination of the disaster prevention measures. FIGURE 7

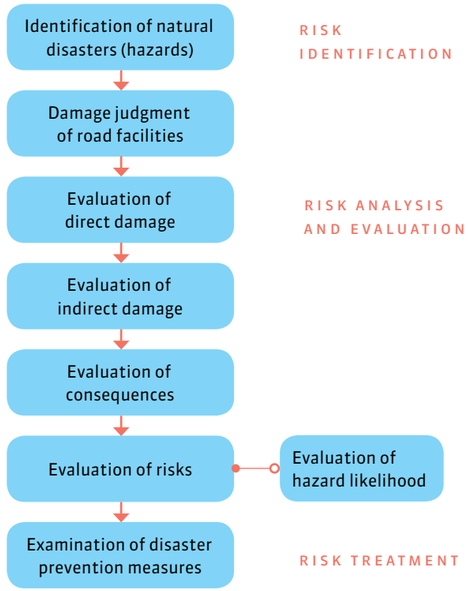


FIGURE 7
Proposed Risk Management Process
Source: Adapted from Keiichi Tamura's presentation.

JULIE ROZENBERG, economist, World Bank

DECISION MAKERS often have to make decisions that will have an impact for many years to come, without having access to full information or certainty. Rozenberg presented a road network model designed to help decision makers overcome this burden in two ways:

- Identify critical links in a transport network by using a new technology (available as a free phone app) called RoadLabPro to collect up-to-date data about the network and then systematically simulate disruptions to highlight the road disruptions that will lead to the highest increase in costs and time
- Prioritize robust interventions to improve the resilience of the transport network given that risks and their consequences are uncertain

Experience shows that relying too much on the past can be sometimes dangerous for future plans. —Julie Rozenberg

The tool urges decision makers to move from a "predict, then act" system to one that allows for iteration—that is, moving through phases of learning, acting, learning, revising, and then acting again based on new information. **FIGURE 8** This model was applied to Mozambique and Peru, and findings from a series of scenario studies show that increasing maintenance always yields higher economic benefits, though they do not protect against the worst-case scenarios. The World Bank team recommends that the best option is to build redundancy only in the routes that draw the highest traffic and that it is always beneficial to invest in resilience.

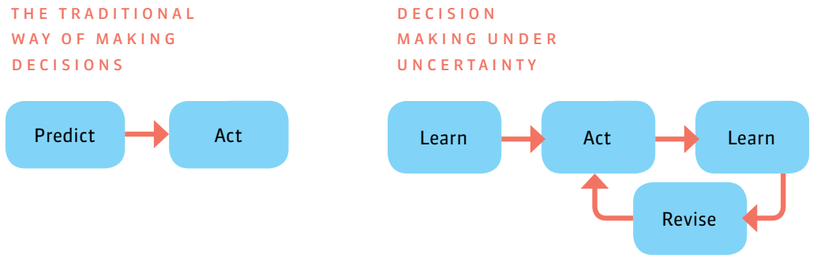
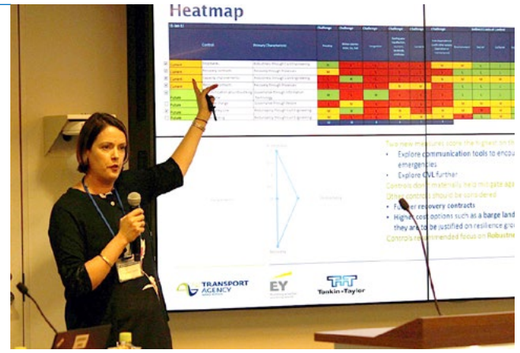


FIGURE 8
Proposed Decision Making Process
Source: Adapted from Julie Rozenberg's presentation.

MONIQUE CORNISH, New Zealand Climate Adaptation Platform, University of Auckland, and Tonkin & Taylor

RECENT RESEARCH commissioned by the New Zealand Transport Agency (NZTA) defines resilience as "the ability of systems (including infrastructure, government, business, and communities) to proactively resist, absorb, recover from, or adapt to disruption within a timeframe which is tolerable from a social, economic, cultural, and environmental perspective." This definition is not restricted to natural hazards but takes a wide view of challenges to the system.

The tool developed for NZTA supports decision makers in the consideration of the consequences of unavailability of an asset in the context of social, cultural, environment, and economic impacts, as well as community tolerance to outage and willingness to pay. **FIGURE 9** Monique emphasized the importance of taking a wide view of resilience as it relates



to a variety of stresses and shocks; of focusing on social, cultural, and environmental as well as economic value at stake; of allowing for a range of stakeholder perspectives in decision making, and of prioritizing outcomes and systems rather than assets.

It's very important to place communities and their tolerance of risk at the heart of our decision making. —Monique Cornish

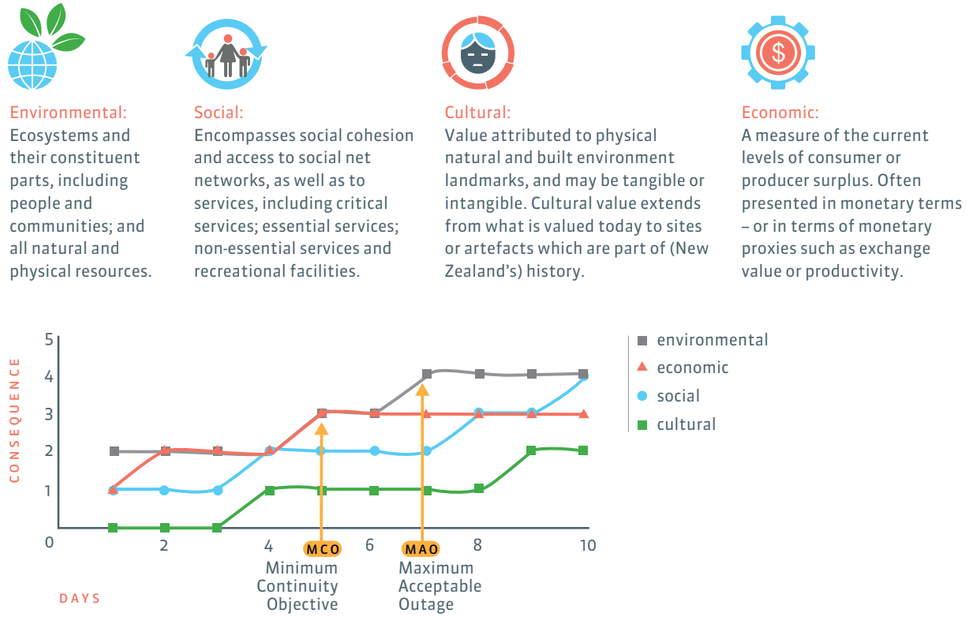


FIGURE 9
Suggested New Approach to Consequence
Source: Adapted from Monique Cornish's presentation

Keynote 2: Road Asset Management for Disaster Resilience

KIYOSHI KOBAYASHI, professor, Graduate School of Management, Kyoto University

INFRASTRUCTURE is a driving force for development and is an invaluable asset in megacities, especially in low- and middle-income countries (LMICs). Kobayashi first defined the objective of road asset management as "to enhance the optimal allocation of the limited budget between the new arrangement of infrastructure and rehabilitation/maintenance of the existing infrastructure to maximize the value of the stock of infrastructure and to realize the maximum outcomes for the citizens." Considering the challenges of asset management in LMICs—due to their poor quality of infrastructure, growing and diverse needs for infrastructure services, and vulnerabilities to disasters—Kobayashi reiterated the need for proper road inspections and asset data collection and management to prioritize road investment in a strategic manner.

Infrastructure is a driving force for development and is an invaluable asset in megacities.
—Kiyoshi Kobayashi

His presentation focused on the collaboration of Kyoto University with Vietnam to improve the road asset management system over the past 12 years. By conducting a training course with Vietnamese universities and others to enhance the skills of the civil engineers, Kyoto University and the Japan International Cooperation Agency (JICA) helped Vietnam build its technical capacity to apply the "Kyoto Model" invented by Kyoto University. The Kyoto Model is a performance-based road asset management system that supports the decision making of PMS (pavement management systems) based on an actual investigation inspection, repair data, and performance to reduce the life-cycle cost of road pavement at the project level or network levels. Unlike previous models—including the Highway Design and Maintenance Standards Model (HDM) developed by the World Bank—the Kyoto Model requires minimal data and provides a standard platform corresponding to an international standard as well as a PMS that supports overall pavement asset management. **FIGURES 10 A–B**

Finally, Kobayashi again emphasized the importance of maximizing the value of infrastructure for citizens by having optimal allocation of resources between investment for new construction and spending for the maintenance costs of existing facilities through a step-by-step evolution of the asset management system.

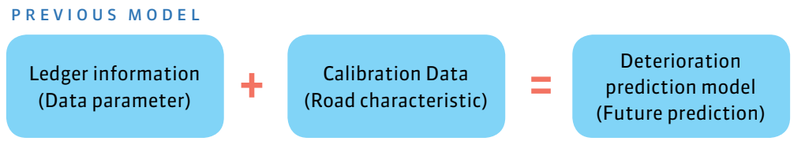


FIGURE 10A
The Kyoto Model of Road Asset Management vs. Previous Models
Source: Adapted from Kiyoshi Kobayashi's presentation.

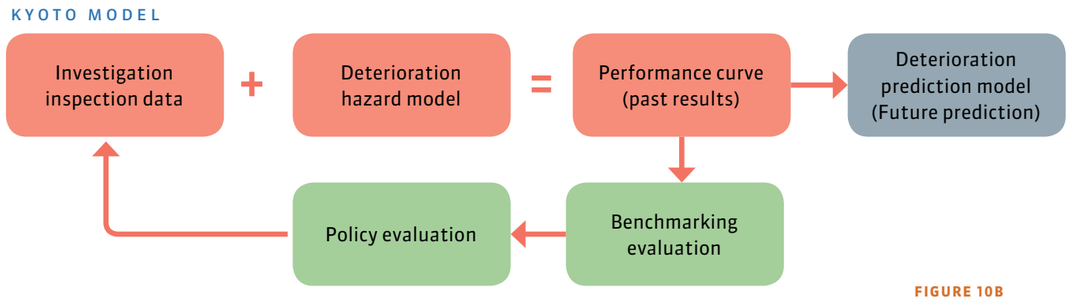


FIGURE 10B
The Kyoto Model of Road Asset Management vs. Previous Models
Source: Adapted from Kiyoshi Kobayashi's presentation.

SESSION 3:
Road Asset Management and Mapping for Resilience

TAKEAKI SHONO, civil engineer, Land Development Department, Land Planning Division, Hyogo Prefecture

MOST of Hyogo Prefecture's infrastructure was built after the 1960s, and thus maintenance and renewal costs are expected to increase in coming years. To repair and renew aging infrastructure efficiently, maintenance plans based on a wide range of data and information are necessary. Hyogo prefecture is using infrastructure data management systems to maintain infrastructure efficiently. Hyogo Prefecture manages a comprehensive infrastructure data platform by centralizing six key information systems: a facility ledger system, an asset management system, a geographic information management system, a requests-and-complaints management system, a photograph storage system, and a mobile system. FIGURE 11 This infrastructure data platform allows users to access data from anywhere (such as office and construction or inspection sites) remotely via internet. The photograph storage system, which enables users to share geographical location and photographs of disasters, can enhance the quick recovery of affected sites.

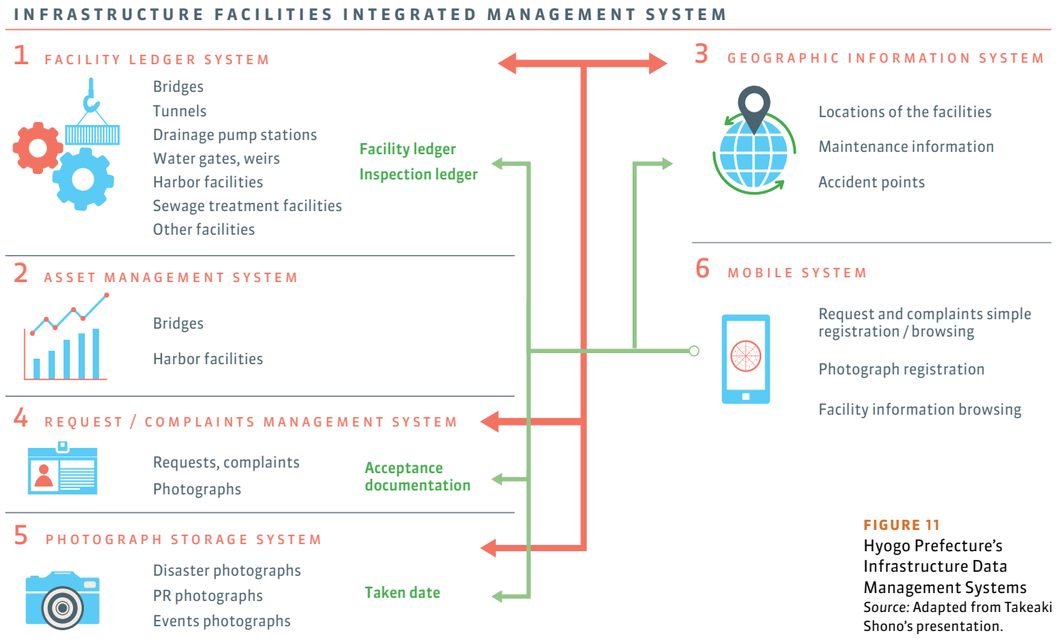


FIGURE 11
Hyogo Prefecture's Infrastructure Data Management Systems
Source: Adapted from Takeaki Shono's presentation.

ROGER FAIRCLOUGH, New Zealand Climate Adaptation Platform, University of Auckland, and managing director, Neo Leaf Global

THE NEW Zealand government has a policy, upheld across all sectors, that urges a focus on resilience planning, emergency response, and integration with business continuity planning. Resilience planning involves the mapping of hazard exposure—understanding road networks not only as linear systems of state highways and local roads but also about what they connect and enable.

Fairclough shared the Modeling the Economics of Resilient Infrastructure Tool (MERIT) that the New Zealand government is developing to understand the types of businesses that can be affected by different hazards and how those impacts can take shape. FIGURE 12 MERIT is an economic evaluation tool and may be used to assess the economic impacts associated with major infrastructure outages such as the GDP impacts. MERIT is a dynamic, multi-regional and multi-sectoral economic model that contains all of the core features of a computable general equilibrium (CGE) model. Finally, he recalled that adaptability is key; plans need to be easy to understand and easily readjusted.

We are guilty of plans that run into hundreds of pages. We need realistic implementation.
—Roger Fairclough

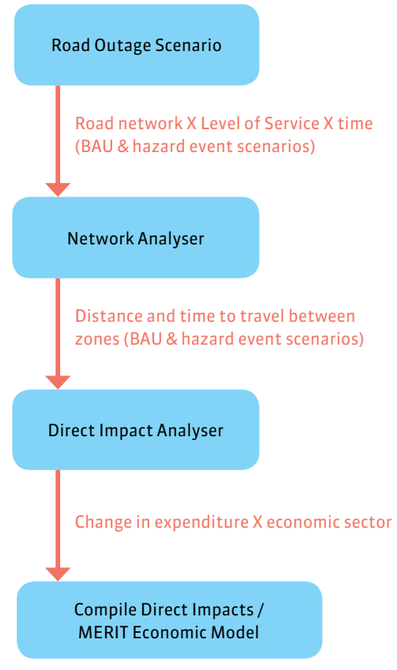


FIGURE 12
Modeling the Economics of Resilient Infrastructure Tool (MERIT)
Source: Adapted from Roger Fairclough's presentation.

SESSION 4:
Innovative Materials and Structures for Vulnerability Reduction

KENSUKE ICHIKAWA, manager, Disaster and Water Resources Management Division, Kokusai Kogyo Co. Ltd.

ETHIOPIA'S National Road Route 3 crosses through the Abay Gorge to connect the district towns of Dejen and Gohatsion. The winding 42-kilometer stretch of road drops and then climbs 1.2 kilometers along cliffs and steep slopes, presenting difficult geohazard conditions and demanding engineering challenges for road construction and maintenance. In fact, engineers found four critical landslides in the project area. From 2010 to 2012, JICA-supported work identified options to address these issues.* Focusing on surface drainage, earth removal, soil nailing, erosion prevention, and anchoring, the project showed the value of sharing and adapting techniques with local engineers and the need to continue

to innovate and adapt economic selection of materials and more labor-intensive—rather than capital-intensive—approaches. **FIGURE 13**

*Japan International Cooperation Agency (JICA), "The Project for Developing Countermeasures against Landslides in the Abay River Gorge." Final Report: http://open_jicareport.jica.go.jp/pdf/12044756_01.pdf.

INTRODUCING OF JAPANECE TECHNIQUES AND ITS APPLICATION

COUNTERMEASURES APPLICABLE IN ETHIOPIA

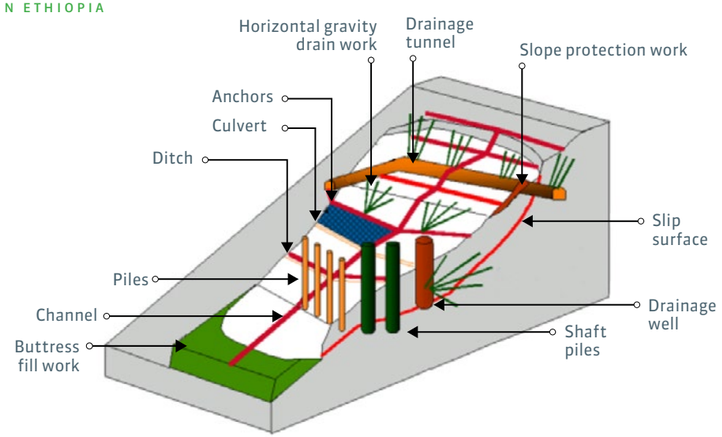
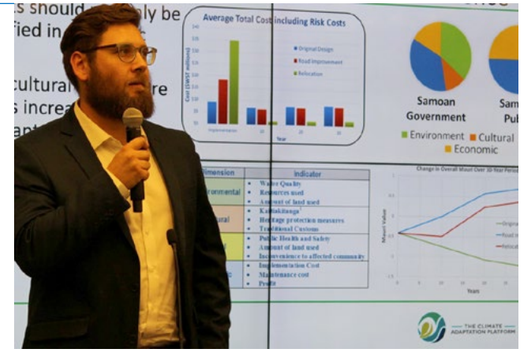


FIGURE 13
Landslide Countermeasures
Source: Adapted from Kensuke Ichikawa's presentation

STEFAN HUSZAK, geotechnical engineer, New Zealand Climate Adaptation Platform, University of Auckland

HUSZAK SHARED the research conducted at the University of Auckland concerning the better understanding of the role that water ingress has to play on road asset failures. Water related failures is an issue that is being exacerbated through climate change, population increase, and urbanization. Conducted research includes deepening the understanding of water related failures, as well as exploring options to increase road asset resilience. In many cases, water is needed to build roads, but as soon as building is completed, water is seen as the enemy. Water can enter the system through infiltration through the surface (including being forced through by traffic), capillary rise (water rising from water table), and from the shoulder. Research aimed at understanding waterproofness of thin chipseals (sprayed seals), and moisture susceptibility of pavement materials. This research will provide better



information from which to improve and optimize design processes of road assets. Options to increase resilience of roads include the use of positive drainage techniques, permeable pavements, Epoxy modified open graded porous asphalt (EMOGPA), and waterproof solutions for thin chipseals (sprayed seals). The challenge still exists of integrating this knowledge into widely used decision making processes to select options that increase resilience and reduce risk. **FIGURE 14**

WITHOUT WATERPROOFING

WATERPROOF ROAD SOLUTIONS

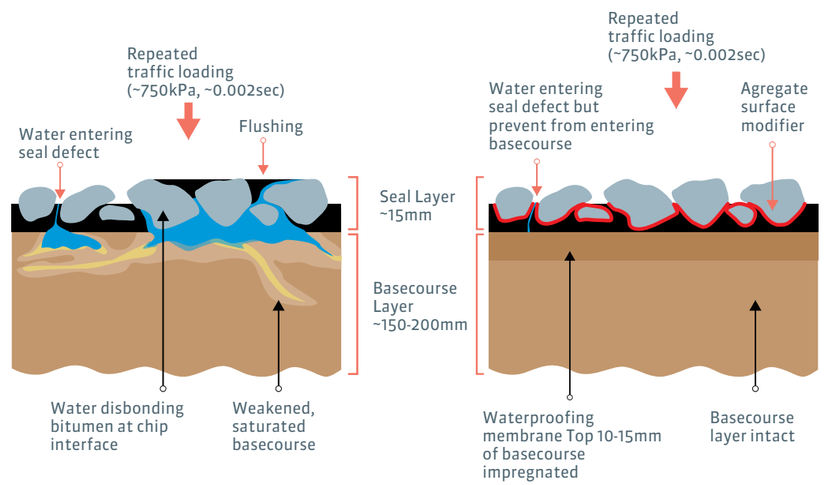
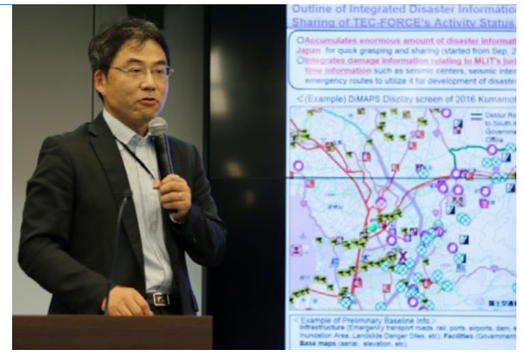


FIGURE 14
Surface and Pavement Waterproofness
Source: Adapted from Stefan Huszak's presentation.

SESSION 5:
Emergency Management Response and Contingency Planning

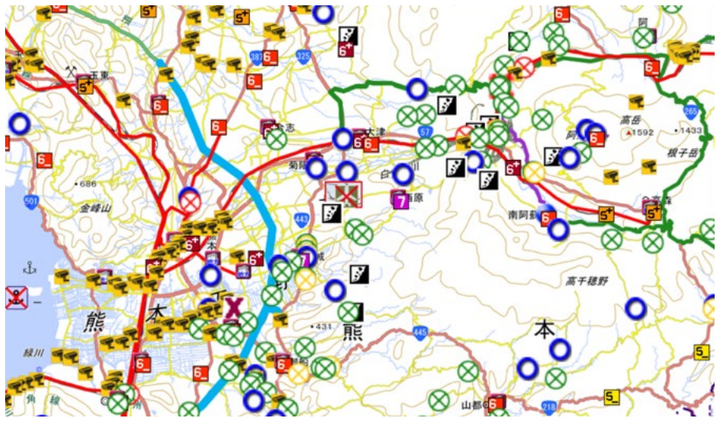
KATSUNAO TANAKA, director, Disaster Risk Management Division, Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transportation and Tourism



According to MLIT's DRM protocol, when large-scale natural disasters occur, MLIT's senior officials gather immediately at the Disaster Control Center to

- Collect disaster-related data and information;
- Assess damage situations;
- Share critical disaster-related information with the prime minister's office and other ministries (such as the Cabinet Office, which plays a general coordination role and provides disaster information to the public and mass media); and
- Determine contingency plans.

MLIT's Technical Emergency Control Force (TEC-FORCE) is a group of trained technical experts dedicated to providing special support in case of emergency. Since its establishment in April 2008, more than 8,000 people from each organization of MLIT have been assigned to TEC-FORCE and have supported 69 disaster-affected areas. TEC-FORCE's activity location and investigation results are shared through the Integrated Disaster Mapping System (DiMAPS), which integrates damage information such as roads, rivers, seismic intensity, and emergency routes. FIGURE 15 Finally, Tanaka shared MLIT's efforts to prepare for a future Nankai Trough megathrust earthquake, which is expected to occur around the time of the 2020 Tokyo Olympics, and emphasized the importance of investing in preparedness.



Infrastructure (Emergency transport roads, rail, ports, airports, dam, etc); Hazard Map (Expected Inundation Area, Landslide Sites, etc); Facilities (Government, evacuation sites, hospitals, etc); Base maps (aerial, elevation, etc)

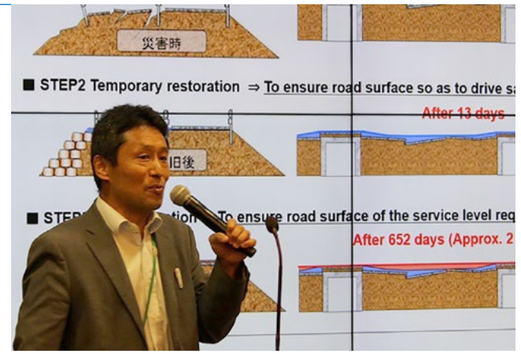
FIGURE 15
DiMAPS showing the damage of 2016 Kumamoto Earthquake
Source: Adapted from Katsunao Tanaka 's presentation

OSAMU UEMURA, manager, disaster and risk management team, Nippon Expressway Company (NEXCO)

UEMURA gave an overview of the duties of Japan's Nippon Expressway Company (NEXCO), which include toll management, road maintenance and repairs, and inspection. The regional head office and traffic control center collect private data from weather forecasting information services, meteorological agencies, and traffic patrol monitors to assess road and weather conditions. For NEXCO, information and institutional arrangements are the essential foundation of a well-operated expressway.

> *In our roles, who and when needs to do what is very well prescribed.—Osamu Uemura*

In the event of a disaster, NEXCO prioritizes road clearance to restore the network within 20 hours for emergency vehicle passage. General use is permitted within 13 days after



temporary restorations have been made, while full restorations are expected to take up to two years after an event. To conclude, Uemura shared strategies, such as NEXCO's comb-like road-opening process and eight-directions strategy, which aims to reestablish the accessibility to Tokyo from eight directions within 48 hours after the earthquake by maintaining at least one route in each direction. FIGURE 16 These strategies facilitate the rapid response and recovery of transport systems and enable NEXCO to fulfill its mission of protecting society and responding to disaster-hit areas.

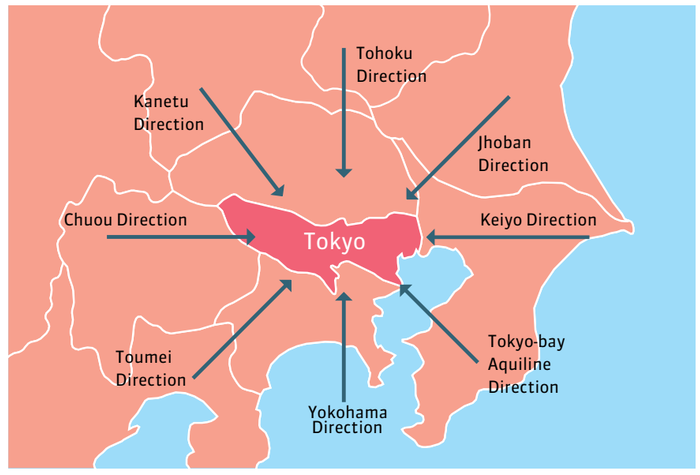


FIGURE 16
NEXCO's Eight-directions Strategy
Source: Adapted from Osamu Uemura 's presentation

SESSION 6:
Transport Infrastructure as Protection against Hydromet Events

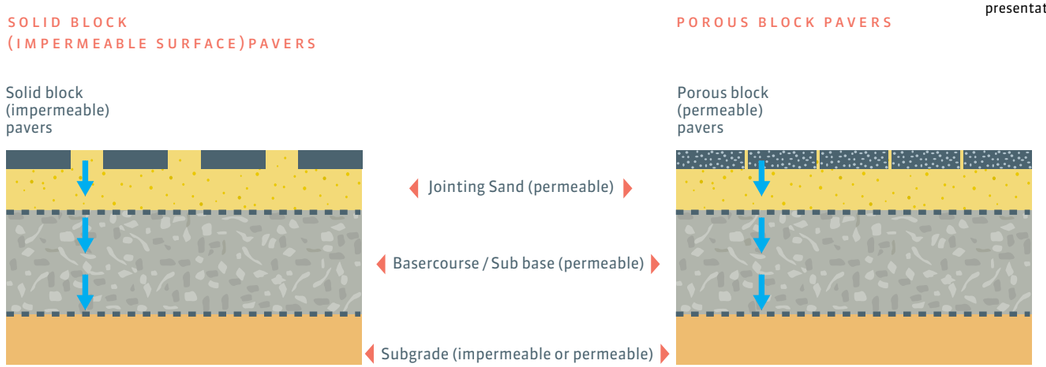
STEFAN HUSZAK, geotechnical engineer, New Zealand Climate Adaptation Platform, University of Auckland

URBANIZATION removes a number of natural means to reduce flooding, and paved surfaces also cover significant urban areas that could be used to recharge the groundwater and reduce pressure on storm water. Although pavements traditionally are designed to keep water out, permeable pavements do the opposite and, as a result, they can effectively disseminate water to ground and avoid flooding. A trial of permeable pavement technology was constructed on Auckland's North Shore (New Zealand); which was a success in its function, but a more expensive option when not including the value of other benefits such as environmental and flood risk reduction benefits. These benefits of DRM intervention need to be properly quantified and considered for a true value of the technology. Huszak highlighted that although various pavement and surface design options exist around the world, it is critical to consider the hydro-related hazards holistically

as well as long-term infrastructure performance for the needs in specific locations. FIGURE 17 In addition, he reiterated that the benefits of resilience measures should not only be quantified in economic terms but should also include their environmental, social, and cultural aspects. The Mauri model* was presented as a tool to quantify and account these benefits, and successfully shown to be of use on a case study of a road project in Samoa (funded by the World Bank).

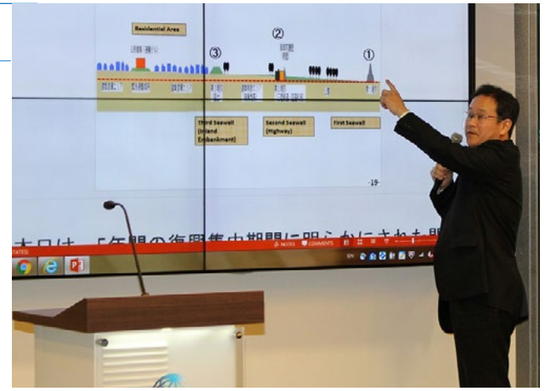
* «https://urldefense.proofpoint.com/v2/url?u=http-3A__www.mauriometer.com_&d=DwMGaQ&c=AgHBXVkk0bblyDQ8JQu5Fw&r=80g0sfvBFQvJaA2ZreaV2rb6zXpzEFLoWKUTF-edovg&m=0wlvAre3qSh4uya-qu1mrHztJbEmg9D9CnjGhiESwZ4&s=_M34j98Es956YmNwpkqc9D6PS6tbqyfnq1cqXifwicQ&e=" http://www.mauriometer.com/»

FIGURE 17
Permeable Pavement Technology
Source: Adapted from Stefan Huszak's presentation.



KAZUSHIGE ENDO, deputy director general, Iwate Reconstruction Bureau, Reconstruction Agency

AFTER THE GREAT East Japan earthquake in 2011, the government established a Reconstruction Agency in 2012 to coordinate reconstruction policies and implement government assistance by promoting clear communication between the central government and local governments and other line ministries and agencies. Under Japan's Cabinet Office, the Reconstruction Agency was positioned and ranked higher than other ministries and agencies. FIGURE 18 Within this institutional framework, the minister of the Reconstruction Agency is authorized to provide any support across different ministries and agencies and thus can comprehensively manage and expedite the reconstruction process.
The budget for reconstruction measures and activities for the planned 10-year period (FY 2011 to FY 2020) was set at approximately US$320 billion, and the progress of recovery of key infrastructure such as transportation, schools, and hospitals was almost complete (as of November 2016).



Endo shared examples of the seawalls constructed in Rikuzentakata city in Iwate Prefecture and how the design of the seawalls is harmonized with the natural environment and recreational space such as parks and provides not only safety for the residents but also beautiful scenery. He also noted that roads can serve as seawalls in case of emergency by explaining how the East Sendai Expressway in Miyagi protected 230 people who evacuated to the roadway (height of embankment is 7–10 meters) during the 2011 Tōhoku earthquakes by blocking the tsunami and debris from the Pacific Ocean.

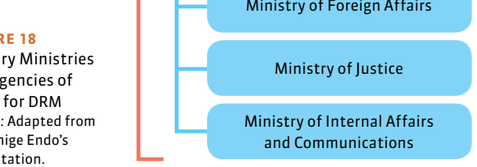


FIGURE 18
Primary Ministries and Agencies of Japan for DRM
Source: Adapted from Kazushige Endo's presentation.

SITE VISITS

Watarase Retarding Basin, Saitama Prefecture

THE Watarase Retarding Basin (WRB) is a flood control basin that stores water for daily use and retains the river overflow temporarily to prevent flooding. The objective of the visit was to allow participants to understand both normal and extraordinary operations at river management offices, particularly before, during, and after expected major flood events. The site visit included a tour of the facilities and levee, which serve key functions in mitigating flood impacts to downstream metropolitan Tokyo. Participants also visited the roadside station, which was constructed on the super levee to provide amenities for road users and to serve as an evacuation center with storage for emergency goods.

The WRB was constructed as a flood control measure after the flood caused by Typhoon Catherine in 1947, which inflicted large damages to many areas of the flood-prone Kantō Plain. The Fujihatake area super levee was constructed from 1998 to 2000 on the western bank of the Yata River (a tributary of the largest tributary of the Tone River, called Watarase), where the vulnerability to extreme hydromet events is relatively high. In addition to its functions as a WRB levee, the Fujihatake area super levee also forms part of the levee road of Prefectural Road Nº 9. **FIGURE 19**

Participants drew key lessons on the integration of disaster risk management (DRM) into road transport infrastructure from the observation of super levees (much wider than ordinary levees and designed against floods and seismic events); roads in retarding basins; levee roads; and overflow levees, which are applicable for river crossing (as a road river-crossing structure) as a non-all weather service concept for low-volume roads.

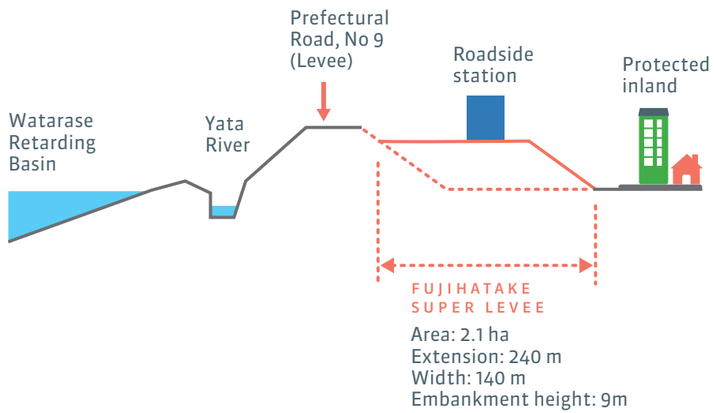
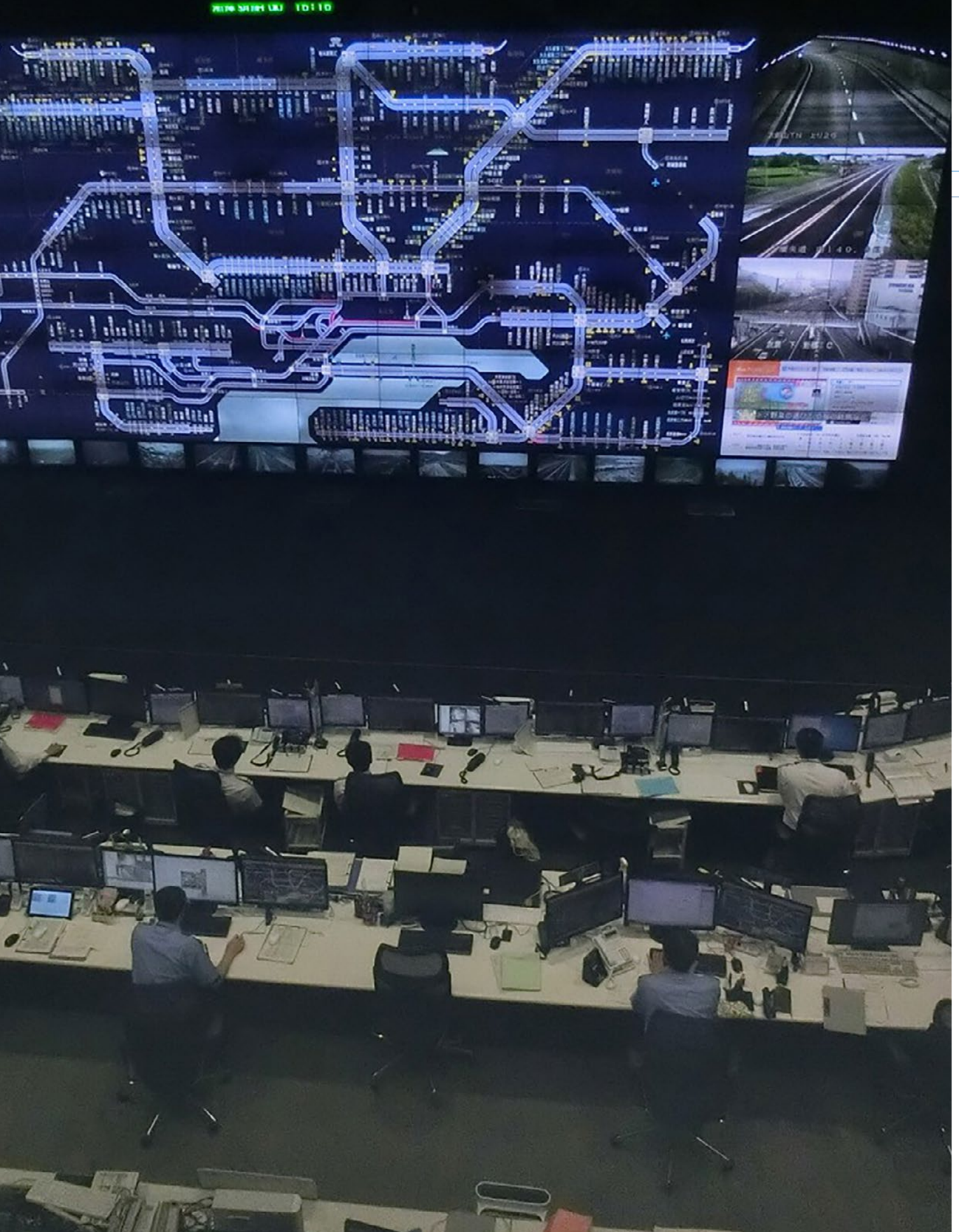


FIGURE 19
A Levee Road (Prefectural Road Nº 9)
Source: Tone River Upper Reach Office



NEXCO Traffic Control Center, Saitama City

EAST Nippon Expressway Company Limited (NEXCO East) is one of the three Nippon Expressway Companies owned by the government of Japan. NEXCO East is responsible for the construction and operation and maintenance of 3,870 kilometers of expressways with a daily traffic volume of 2.8 million vehicles; operation of terminals for trucks; and roadside business including parking lots and rest areas. The main disaster types on the expressway are mountainside slope failures, embankment collapses, flooding, and damage to bridges. The objective of the visit was to allow participants to understand the advanced intelligent traffic control (ITC) technology used for traffic control, including road disaster emergency management.

To prepare and respond to disasters, NEXCO's Iwatsuki Traffic Control Center integrates observed hydrometeorological and seismic data and information as well as early warnings from the Japan Meteorological Agency. This information helps NEXCO organize an emergency task force and response measures at the affected segments of highways that it manages. The Control Center was upgraded in February 2016 with backup arrangements from other control centers to avoid disruption of services in the event of natural disasters. The participants learned about the Control Center's disaster identification and response procedures, as follows:

- *Monitoring and emergency response:* The traffic control room monitors and integrates information about abnormal events (including natural disasters, objects on the road, disabled cars, and accidents); road conditions (such as traffic jams and road closures); and weather conditions to provide emergency information to traffic users in coordination with the Regional Police Bureau's Expressway Management Office, fire departments, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and local governments. At the time of an abnormal event, the traffic control room provides instructions to the NEXCO's Traffic Management Patrol Squad on-site to implement appropriate emergency response measures. The patrol squad sends video feeds to the traffic control room for further instructions.
- *Asset management:* The facility control room collects and analyzes the data and information about tunnels and bridges to develop and implement a maintenance and rehabilitation plan. It also monitors and controls the operations of various facilities on roads and tunnels using remote supervision control facilities that are available 24 hours a day. In case of fire in the long tunnels, control room personnel swiftly guide the road users for evacuation and operate emergency facilities in the tunnels.

SUMMARY OF ACTION PLANNING DISCUSSIONS

PARTICIPATING countries engaged in peer-to-peer learning and formulated takeaways from the Technical Knowledge Exchange (TKX) for potential application to their country contexts. In the action planning discussions summarized below, by country, the participants discussed the range of challenges they face—institutional, legal, financial, technological, communication, structural, and nonstructural.

Afghanistan

Overall transport and disaster risk management (DRM) institutional mapping: The Ministry of Transportation designs, constructs, maintains, and prepares geohazard mapping. The Ministry of Economy acts as a DRM coordinator through the working committee.

Client-identified challenges: Key challenges include the move toward preparedness from the current status of focusing mainly on post disaster response, lack of financial resources, technical capacity, and effective institutional arrangement.

Implementation plan: (1) Conduct capacity building exercise; (2) conduct comprehensive functional analysis of existing systems; and (3) map geohazard risks of a network of selected routes.

Argentina

Overall transport and DRM institutional mapping: The Ministry of Transport is a specialized agency on national roads and national railways. The Ministry of Security provides post disaster response.

Client-identified challenges: Geohazard risks and their impacts are not analyzed on a systematic basis. Owing to the lack of institutional and functional links between transport and DRM, Argentina has no institutionalized risk assessment process.

Implementation plan: (1) Review locally applicable design and construction standards; (2) develop vulnerability assessment guide and database; (3) draft a prioritized plan of locations to be measured on the sample network and a quantified assessment of net benefits; and (4) draft recommendations on design and maintenance protocols with additional climactic data.

Brazil

Overall transport and DRM institutional mapping: Civil defense under the Ministry of Integration has the mandate to provide emergency assistances to people and assets affected by natural disasters. However, it is not linked to the Ministry of Transport and National Road Department for risk identification and assessment.

Client-identified challenges: In the past five years, four major disaster events cost a total of US$7.5 billion, US$5.5 billion of which were direct damages while the other US$2 billion were related losses. In addition to the lack of clarity in responsibility of each institution related to DRM, there is need to enhance DRM data integration and establish risk evaluation methodology.

Implementation plan: (1) Establish the missions, targets, and responsibilities of all related institutions on all phases of DRM in the short and long term; (2) define the approach for the assessment of vulnerability and risk; and

(3) identify how to incorporate DRM data and assessment into road planning and development.

Cambodia

Overall transport and DRM institutional mapping: The National Committee for Disaster Management, the country's lead government authority for disaster management and response, has been established. Responsible institutions are designated for transport and DRM at the national and rural levels.

Client identified challenges: Flooding has been the biggest problem with over the past 50 years, with destructive flooding occurring approximately every five years. There are also flash floods. Most roads are unpaved and vulnerable to disaster risks, particularly with limited maintenance. While hazard maps have been created based on simple and limited hydrometeorological data, upgrading disaster risk identification and assessment is needed.

Implementation plan: (1) Learn more about the matrix system risk identification and measurement; (2) initiate dialogue with the competent bodies around DRM, including community participation; and (3) increase human capabilities and financial resources to implement road asset management with proper design for disaster risks.

Colombia

Overall transport and DRM institutional mapping: The presidential office; sectoral ministries; operational organizations (army, police, firefighters, Red Cross); and regional institutes (states and municipalities) are designated for DRM for transport. National and local committees are established for knowledge management, risk reduction, and emergency response.

Client-identified challenges: Considering avalanches, earthquakes, and coastal flooding, the Colombian government has prepared a "Climate Change Adaptation Plan for the Transport Sector" that aims to strengthen the country's technical and institutional frameworks as well as to raise awareness about the risks that transport infrastructure faces. For a successful implementation of the plan, strong internal capacities in sectoral entities is necessary.

Implementation plan: (1) Consider long-term scenarios for geohazard analysis on specific roads; (2) incorporate road adaptation or measures for programs and projects for local roads; and (3) propose measures or innovative solutions, including nature-based solutions and slope intervention.

Georgia

Overall transport and DRM institutional mapping: Transport and DRM are under different agencies and ministries.

Client-identified challenges: Landslides and rockfalls are the most common and frequent threats. While Georgia implements an identification and assessment process applying multicriteria analysis for vulnerability determination, preparation of strategic action plans and inclusion of geohazard intervention in current asset management systems is required.

Implementation plan: (1) Finalize geohazard vulnerability assessment; (2) prepare a prioritized work program; (3) update the road asset management process and design standards; and (4) prepare clear guidelines for emergency response.

India

Overall transport and DRM institutional mapping: A National Disaster Management Act and Policy, as well as national, state, and district disaster management plans are prepared. State governments lead the process of risk identification by developing satellite imagery and advanced forecasting systems.

Client-identified challenges: India has been focusing on how to integrate disaster and climate resilience through the life cycle of infrastructure by improving knowledge and awareness through modern information technology (IT)-based tools, optimizing network designs and increasing green cover, and improving asset management programs.

Implementation plan: (1) Prepare climate resilience strategy for rural roads; (2) conduct vulnerability mapping of core transport networks; and (3) seek climatically optimized roads and bridges.

Kyrgyz Republic

Overall transport and DRM institutional mapping: The Ministry of Transportation designs, constructs, maintains, and prepares geohazard mapping. The Ministry of Economy acts as a DRM coordinator through the working committee.

Client-identified challenges: Although avalanches occur yearly and the Ministry of Transportation allocates a budget for repairs and response every year, the funds are not sufficient. It is necessary to strengthen preparedness by setting up financial resources, develop technical capacity with dedicated technical units based on effective institutional arrangement, and create sustainable early warning systems.

Implementation plan: (1) Conduct functional analysis of existing systems; (2) map geohazard risk of a selected network of routes; and (3) prepare clear guidelines for emergency response.

Lao People's Democratic Republic

Overall transport and DRM institutional mapping: Transport and DRM management activities are under the responsibility of different agencies at both central and provincial levels. Sector strategy, design standards, specification and budget allocation, risk identification, and implementation of national road are under responsibility of Ministry of Public Works, while provincial level is responsible for risk identification, planning, and implementation of local roads.

Client-identified challenges: Key challenges include the need for a long-term strategic plan integrating land use planning, coordination between sectors to implement a National Green Growth Strategy, and incorporation of the road disaster management into sector development plans and operationalization of resilient road asset management.

Implementation plan: (1) Improve climate resilient road asset management, road design standards and specifications, and technical guidelines to enhance the road network; (2) improve quality of and access to hazard inventory and hydrometeorology data for road design, planning and monitoring; and (3) mainstream National Green Growth Strategy into five-year sector plan and sector strategy.

Mozambique

Overall transport and DRM institutional mapping: Institutions responsible for both transport and DRM are the Ministry of Public Works, Housing and Water Resources; the Ministry of Transport and Communications; the Ministry of Local Government; and the Ministry of Economy and Finance. Engineering and design for the road are managed by the National Road Administration (ANE) and Road Fund (RF). Asset management or risk management are conducted by the ANE, RF, local governments, and municipalities.

Client-identified challenges: Although the Ministry of Transport developed climate risk screening with efforts to revise design standards through a consultative process with industries, academics, and the public sector, successful implementation will require strong institutional and sectorial coordination.

Implementation plan: (1) Implement pilot projects throughout the country; (2) mainstream climate resilience issues into the country strategies; (3) set up a tool for country

preparedness; and (4) improve and strengthen institutional and sectoral coordination.

Myanmar

Overall transport and DRM institutional mapping: In post disaster response, institutional coordination is standard practice between the road sector, the National Disaster Management Committee (NDMC), and national ministries. In the predisaster stage, there is no coordination yet between the national DRM agency and the transport agency.

Client-identified challenges: Myanmar faces cyclone, flooding, and landslide challenges that have damaged roads throughout the country. At present, projects are geared toward improving technical specifications for design and repair of these assets. Risk evaluation methods are not systematic, and hazard maps are not available.

Implementation plan: (1) Improve road inventory and asset management by moving to a digitized system including hazard maps, photos, a geographic information system (GIS), complaint management, and a mobile system; (2) strengthen road maintenance for disasters through guideline updates, training, and community awareness and participation; and (3) develop a contingency or DRM plan for the road sector.

Philippines

Overall transport and DRM institutional mapping: The Department of the Interior and Local Government is the agency that supervises local government units (LGUs). The Department of Public Works and Highways provides design standards and criteria. The Department of Transportation ensures the protection of transport infrastructure. The National Economic and Development Authority supports LGUs regarding transport planning and recovery.

Client-identified challenges: Local roads are mostly unpaved and exhibit low resilience to hazard impacts, becoming unusable during a hazard event. Although institutions are in place to monitor, deliver early warnings, and implement asset management, these tasks are not integrated and considered as a system.

Implementation plan: (1) Establishment of a web-based local roads and bridges inventory system; (2) Mainstream the use of local road network as part of resilience efforts through the establishment of an Information-Driven Local Disaster Risk Governance Program; and (3) Assess the vulnerability of local infrastructure by conducting a rapid assessment of all vital/ core local roads and bridges (The infrastructure assessment tool for roads and bridges has been developed in partnership with the World Bank since 2011. This is the tool that is currently being provided for the LGUs in the conduct of their infrastructure audit).

Serbia

Overall transport and DRM institutional mapping: Institutions responsible for the transport functions are the Ministry of Transport and the Public Enterprise Roads of Serbia (PERS). The institution responsible for DRM is the Sector for Emergency Situations (Ministry of Interior), whereas the recovery and reconstruction is managed by the Public Investment Management Office.

Client-identified challenges: Extreme rainfall in May 2014 affected 1.6 million people (22 percent of the total population) and created a strain on the mining and energy, housing, agriculture, and trade sectors. Key challenges are mainstreaming of climate resilience into road transport management; understanding of transport risk and vulnerabilities; and improving the resilience of infrastructure.

Implementation plan: (1) Create national vulnerability assessment and emergency response plan; (2) formulate a flood risk assessment methodology for vulnerability assessment of roads; and (3) establish a data exchange platform and a construction code considering climate change effects.

Sri Lanka

Overall transport and DRM institutional mapping: The road management authorities include ministries and road development authorities (at the national and provincial levels) and municipalities (for local roads). The Ministry of Irrigation is included for road-related water management issues. Institutions responsible for DRM are the Ministry of Disaster Management, which has overall responsibility and coordination of ministries; the Road Development Authority; and the National Building Research Organization for landslide monitoring.

Client-identified challenges: Since risk assessment is not included in the central asset management system, particularly for pavement and bridges, DRM data need to be integrated at the strategic asset planning level. Although some DRM systems are in place (especially in coastal areas), it is hard to sustain some initiatives owing to lack of financial and technical capacities.

Implementation plan: (1) Improve the existing emergency response system; (2) integrate climate resilience and DRM in the master plan; and (3) integrate climate and disaster risks in the asset management process for pavement and bridges.

Tajikistan

Overall transport and DRM institutional mapping: The Ministry of Transportation and its departments are responsible for policy-making in transport sector, asset management, preservation and maintenance of roads. MoT's Design Institute is preparing designs. Government's Committee on Emergency Situations is responsible for emergency situations. To coordinate DRM efforts, the government has appointed the Ministry of Economy acts as a DRM coordinator of the Working Committee.

Client-identified challenges: Tajikistan faces a series of institutional challenges, including insufficient funding for both preventive and rescue-and-recovery operations; general trend of focusing on post-disaster rather than preparedness; absence of a natural disaster risk assessment, mapping and database; lack of early warning systems.

Implementation plan: (1) Conduct knowledge workshop and capacity building exercise; (2) assess functional analysis of existing systems in relation to DRM and resilience of transport infrastructure; and (3) conduct geohazard risk mapping for a network of selected routes for shorter term and climate change vulnerability assessment for longer term.

Vietnam

Overall transport and DRM institutional mapping: The institutions responsible for transport are the Ministry of Transportation (MoT) and its agencies. DRM responsibilities lie with a National Committee on Preparedness and Response to Natural Hazards (NCPRNH), chaired by the prime minister. MoT is a member of NCPRNH, under the assignment of the premier. The MoT has responsibility for preparing and responding to natural hazards in the transport sector.

Client-identified challenges: Sea level is rising along Vietnam's coasts at an approximate rate of 2.8 millimeters per year, while average annual temperatures have increased by about 0.62 Celsius degree (between 1958 – 2014). The number of strong storms tends to increase and heavy rainfall has been intensified in the Central South - West, South – West and North – West regions. Technical support is needed for partitioning an online database and establishing a system to monitor landslide risks along the national roads in the mountainous Northern provinces.

Implementation plan: (1) Enhance geospatial road asset management, landslide mapping, and monitoring system for the road network; (2) establish natural hazard monitoring; (3) create forecasting and early warning systems; and (4) establish task forces and management systems to respond to disasters.

Summary of Community of Practice (CoP) Work Plan Development

The TKX showed how the Resilient Transport CoP encouraged the creation of partnerships at the country level and emphasized that people are at the center of the World Bank Group's Resilient Transport efforts moving forward. One of tangible engagements emerged through this TKX is the launch of a regional approach, "high mountainous countries initiative," proposed by three countries in Central Asia – Afghanistan, Kyrgyzstan, and Tajikistan –aiming at the creation of resilient transport system based on their numerous similarities in the geography, topography, type and occurrence of disasters, and economic situation. This initiative was agreed among three delegations during the TKX and then idea was presented by the Minister of Transport and Roads of the Kyrgyz Republic, Mr. Kalilov. While countries have diverse starting points, values, and approaches, the CoP reiterated the importance of developing a flexible suite of engagements that can be applied in a modular way.

This Resilient Transport CoP continues to consolidate and scale-up efforts to build climate and disaster resilient transport systems. The program grounds future, relevant World Bank Group projects to the appropriate sectors by establishing a base set of tools, solutions, and priorities on which to build. The CoP will host follow-up events, publish blog posts, create knowledge products, and hold meetings. Ultimately the CoP's goal is to help task team leaders support country officials who make key decisions on transport and encourage them to build more resilient countries.

VULNERABILITY AND RISK ASSESSMENT	CLIMATE RESILIENCE STRATEGY	DRM AND SYSTEMS PLANNING	ENGINEERING & DESIGN STANDARDS	ROAD ASSESSMENT MANAGEMENT	EMERGENCY MANAGEMENT & RESPONSE	CAPACITY BUILDING, INSTITUTIONAL COORDINATION
Serbia	India	Myanmar	Georgia	Lao PDR	India	Philippines
India		LAD PDR	Kyrgyz Republic	Sri Lanka	Vietnam	Colombia
Myanmar		Mozambique	Colombia	Georgia		Argentina
Georgia				Mozambique		Afghanistan
Kyrgyz Republic				Cambodia		
Colombia						

FIGURE 20
Knowledge Sharing Offered to Other Countries
Source: Resilient Transport CoP

CONCLUSION

THE World Bank recognizes infrastructure as a driving force for development and an invaluable asset for cities. Incorporating elements of resilience into infrastructure investments in an informed way is an important part of meeting the World Bank Group's commitments to climate action. Moving forward, the Resilient Transport CoP will continue to leverage the information, tools, and technical expertise that exist in Japan and in many other countries to inform current and future World Bank transport investments by ensuring that the wealth of knowledge and experience within each country or institution can be shared widely to benefit as many countries and people as possible.

ANNEX 1: AGENDA OF TKX

DAY 1. MONDAY, MAY 8	
OBJECTIVES OF DAY 1	
Set out the objectives, concept, definition, and framework of resilient transportation Introduce client profiles and development challenges and set out what we are trying to achieve Launch the Road Geohazard Risk Management Handbook Deepen understanding of risk and system planning Introduce and explore road asset management and resilience mapping	
8:30 am – 9 am	Registration and Breakfast
9 am	**Welcome and Opening Remarks (10 minutes)** **Mr. Marc Forni, lead DRM specialist, World Bank** **Ms. Maria Cordeiro, senior transport specialist, World Bank** **Learning Objectives and Client Profiles (10 minutes)** **Mr. James (Jay) Newman, DRM specialist, DRM Hub, Tokyo (GFDRR)** **Ms. Naho Shibuya, DRM specialist, DRM Hub, Tokyo (GFDRR)** **Ms. Shoko Takemoto, DRM specialist, DRM Hub, Tokyo (GFDRR)** **Keynote Presentation: Disaster Risk Management of Roads in Japan (15 minutes)** **Mr. Hitoshi Fukumoto, senior deputy director, Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism** **Q&A (10 minutes)**
9:45 am SESSION 1	**Session 1: Opening and Launch of Road Geohazard Risk Management Handbook** **Introduction of Road Geohazard Risk Management Handbook (45 minutes)** **Introduction to Road Geohazard Risk Management (10 minutes)** **Dr. Yuka Makino, senior natural resources management and DRM specialist** **Case Study: Brazil (7 minutes)** **Mr. Frederico Ferreira Fonseca Pedroso, DRM specialist, and Fernando De Melo E Silva, transport consultant (via VC)** **Case Study: Serbia (7 minutes)** **Dr. Yoganath ADIKARI, DRM consultant, World Bank** **Q&A (15 minutes)** **Panel, including Mr. Mikihiro Mori, chief specialist, Geosphere Engineering & Disaster Management Office, Nippon Koei**
10:30 am	Coffee Break
10:45 am SESSION 2	**Session 2: Understanding Risk and System Planning** **Understanding Risk and System Planning** Lightning Talks from international experts (45 minutes) **Dr. Keiichi Tamura, chair, Technical Committee on Disaster Management, World Road Association (PIARC): "Quantitative Evaluation of Road Disaster Risks"** **Ms. Monique Cornish, NZ Climate Adaptation Platform and Tonkin & Taylor: "Building the Business Case for Resilience"** **Ms. Julie Rozenberg, economist, World Bank** Q&A (15 minutes)

11:45 am	**Client Country Presentations (20 minutes)** **Mozambique, Brazil, Georgia** **Q&A, exchange of views in small group discussions (10 minutes)** **Participants**
12:15 pm	**Lunch**
1:00 pm **SESSION 3**	**Session 3: Road Asset Management and Mapping for Resilience** **Introduction to Road Asset Management for Disaster Resilience** Keynote presentation (20 minutes) **Director and Professor Kiyoshi Kobayashi, Graduate School of Management, Kyoto University: "An Overview of ISO55000 on Asset Management, Japan's Bottom-Up Approach, and Key Elements for Developing Countries"** Q&A (10 minutes)
1:30 pm	**Case Studies on Technology and Institutional / Financing** Lightning Talks from international experts (30 minutes) **Mr. Takeaki Shono, Hyogo Prefecture, Land Development Department, Land Planning Division** **Mr. Roger Fairclough, NZ Climate Adaptation Platform and Neo Leaf Global: "Road Operators' Approach to Resilience Improvement"** Q&A (10 minutes)
2:10 pm 2:40 pm	**Client Country Presentations (30 minutes)** **India, Kyrgyz Republic, Cambodia, Lao PDR** **Feedback and Comments from Expert Panel** **Prof. Kobayashi, Mr. Fairclough, and World Bank team (10 minutes)**
2:50 pm	Coffee Break
3:10 pm 4:30 pm	**Action Planning (small groups)** **Mr. James (Jay) Newman, DRM specialist, DRM Hub, Tokyo (GFDRR): "Introduction to Action Planning" (15 minutes)** Challenge Questions and Action Planning (WB and client teams) (60 minutes) **Report Back** Small group reporting: representative from each group presents key points (40 minutes) **Feedback and Comments from Expert Panel (15 minutes)** **Prof. Kobayashi, Mr. Fairclough, and World Bank team**
5:25 pm	**Wrap-up** Wrap-up of Day 1 and Overview of Day 2 (5 minutes) **World Bank team**
5:30 pm	**Welcome Reception with Japan Bosai Platform**

DAY 2: TUESDAY, MAY 9TH

OBJECTIVES OF DAY 2

Explore innovative materials and structures for vulnerability reduction
Explore approaches to emergency management response and contingency planning

9:00 am	Recap of Day 1 and Overview of Day 2 (5 minutes)
9:05 am **SESSION 4**	**Session 4: Innovative Materials and Structures for Vulnerability Reduction** **Innovative Materials and Structures for Vulnerability Reduction** Lightning Talks from international experts (45 minutes) **Mr. Kensuke Ichikawa, manager, Disaster and Water Resources Management Division, Kokusai Kogyo Co., Ltd.** **Mr. Stefan Huszak, NZ Climate Adaptation Platform and University of Auckland: "Understanding Resilience of Natural Aggregate Properties; Epoxy Porous Asphalt; Coastal Roads and Rising Seawater Levels"** Q&A (15 minutes)
10:00 am	**Client Country Presentations (30 minutes)** **Colombia, Sri Lanka, India, Vietnam** **Q&A, exchange of views in small group discussions (15 minutes)** **Participants**
11:00 am	Coffee Break
11:30 am **SESSION 5**	**Session 5: Emergency Management Response and Contingency Planning** **Emergency Management Response and Contingency Planning** Lightning Talks from international experts (30 minutes) **Mr. Katsunao Tanaka, Disaster Risk Management Division, Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transportation and Tourism (MLIT), Japan: Presentation on TEC-FORCE** **Mr. Osamu Uemura, Nippon Expressway Company (NEXCO): Presentation on Disaster Management** Q&A (15 minutes)
12:30 pm	**Client Country Presentations (20 minutes)** **Afghanistan, Argentina, Tajikistan** **Q&A, exchange of views in small group discussions (10 minutes)** **Participants**
1:00 pm	Lunch
2:00 pm	**Client Country Presentations (20 minutes)** **Philippines, Myanmar, Serbia** **Q&A, exchange of views in small group discussions (10 minutes)** **Participants**
2:30 pm	**Session 6: Transport Infrastructure as Protection against Hydromet Events** **Transport Infrastructure as Protection against Hydromet Events** Lightning Talks from international experts (15 minutes) **Mr. Stefan Huszak, NZ Climate Adaptation Platform and University of Auckland: "Vulnerability Aspects of Coastal Infrastructure (Erosion and Storm Events), Resilience Options, Coastal Protection, Protection against Storm Events, Infrastructure that Has to Come with Sea Level Rise"** Q&A (10 minutes)
3:00 pm	Coffee Break

3:30 pm	**Engagement and Action Planning** Small group discussion and action planning (30 minutes) Small group reporting: representative from each group presents key points (15 minutes) Interactive session and feedback on learning needs from each country (15 minutes)
5:00 pm	**Wrap-up** Wrap-up of Day 2 and overview of Day 3 (5 minutes) **World Bank team**

DAY 3: WEDNESDAY, MAY 10TH

OBJECTIVES OF DAY 3

Learn about how to utilize transport infrastructure for DRM measures against hydromet events
Expand network of transport sector DRM stakeholders in Japan

9:00 am	**Recap of Day 2 and Overview of Day 3 (5 minutes)**
9:05 am SESSION 6	**Session 6: Transport Infrastructure as Protection against Hydromet Events (contd)** **Transport Infrastructure as Protection against Hydromet Events**
10:00 am	Lightning Talks from international experts (15 minutes) **Mr. Kazushige Endo, Iwate Reconstruction Bureau, Reconstruction Agency** Q&A (10 minutes) Depart from Tokyo to Kazo City, Saitama Prefecture (bus) Lunch in the bus and one break at highway service area
12:30 pm	**Field Visit 1: Watarase Retarding Basin and Levee Roads** **Wetland Information Center** The Watarase Retarding Basin (WRB) is located in the center of Kanto plains and constructed to store water for daily consumption and to temporarily retain the river overflow to prevent flooding in the river basin. The area is highly prone to floods and the facility serves as a key function for mitigating impacts of floods to the downstream metropolitan Tokyo. The levee road (Prefectural Road No.9) surrounds the WRB, and the stability of the road embankment has been enhanced as Super Levee against floods and seismic risk. At the WRB Wetland Information Center, an overview of WRB and the role of Super Levee / Prefecture Road during the past typhoon events will be explained.
1:15 pm	Depart from WRB Wetland Information Center to Fujihatake Area Super Levee
1:35 pm	**Fujihatake Area Super Levee** The Fujihatake Area Super Levee is located on the western bank of Watarase River, the largest tributary of Tone River. The Super Levee is much wider than ordinary levees and designed against floods and seismic events. The Super Levee was constructed from 1998 to 2000, including the Prefectural Road No.9 that runs on top of the Super Levee. In 2004, a Roadside Station and a Sports Leisure Education Center were also opened as part of the Super Levee. These facilities have multiple functions including commercial, leisure, as well as emergency response by serving as storage facilities for emergency goods.
2:20 pm	Depart from Kitakawabe Roadside station to NEXCO's East Kanto Traffic Control Center

3:30 pm 5:00 pm 6:00 pm	**Field Visit 2: Visit to NEXCO's Kanto Traffic Control Center, Saitama City** East Nippon Expressway Company Limited (NEXCO)'s Iwatsuki Traffic Control Center integrates observed hydromet and seismic data and information as well as early warnings from Japan Meteorological Agency to organize an emergency task force and response measures at the affected segments of highways that they manage. The Control Center was upgraded in February 2016 with backup arrangements with other control centers at the time of natural disasters. Depart from Saitama City, Saitama Prefecture to Tokyo Arrive in Tokyo (drop off at hotels)

DAY 4: THURSDAY, MAY 11

OBJECTIVES OF DAY 4

Review and reflect on key lessons learned and explore how to operationalize them into country-specific actions

9:00 am	**Recap of Day 3 and Overview of Day 4 (5 minutes)**
9:05 am	**Stocktaking and Multistakeholder Dialogue (30 minutes)** **Bringing it Home** How to Operationalize Key Takeaways (30 minutes)
10:00 am	**Country-Specific Action Plan Development (60 minutes)** Small group discussions by clients and task team leaders
11:00 am	Coffee Break
11:30 am	**Action Plan Pitch Session 1 (90 minutes)** 5 minute presentation + 5 minute Q&A per client Panelists: **Dr. Mikio Ishiwatari, senior adviser, Japan International Cooperation Agency (JICA)** **Mr. Marc Forni, lead DRM specialist, World Bank** **Ms. Maria Cordeiro, senior transport specialist, World Bank** **Mr. Juan Gaviria, practice manager, Transport for Europe and Central Asia, World Bank** Moderated by DRM Hub
1:00 pm	Lunch
2:00 pm	**Action Plan Pitch Session 2 (90 minutes)** 5 minute presentation + 5 minute Q&A per client Panelists: **Dr. Mikio Ishiwatari, senior adviser, Japan International Cooperation Agency (JICA)** **Dr. Yuka Makino, senior natural resources management and DRM specialist, World Bank** **Ms. Julie Rozenberg, economist, Sustainable Development Group, World Bank** **Ms. Fiona Collin, lead transport specialist, World Bank** Moderated by DRM Hub
3:30 pm	Coffee Break

3:45 pm	**Conclusion and Wrap-up (20min)** **Closing Remarks (10 min)**
5:00 pm	**Farewell Dinner**

DAY 5: FRIDAY, MAY 12	
OBJECTIVES OF DAY 5	
Develop strategy for Resilient Transport Community of Practice (CoP)	
All Day	World Bank teams

ANNEX 2: EXPERT PROFILES

Information is as of the time of the TKX

Marc S. Forni

Lead DRM Specialist | GSURR, World Bank

Marc Forni joined the World Bank in 2003, working for four years in the Latin America and the Caribbean region to help build the disaster risk management practice. He returned to the World Bank in 2011, after a period as an investment banker, to support the expansion of the disaster risk management practice in South Asia, where he leads the World Bank's investments in resilience in Bangladesh and Sri Lanka, as well as housing reconstruction in Nepal following the 2015 earthquake.

Maria Cordeiro

Senior Transport Specialist | Transport and ICT, World Bank

Maria Cordeiro contributes to the Green Transport Community of Practice as a focal point on greenhouse gas accounting and climate risk screening for the transport sector; supporting access to climate finance; and in the preparation of knowledge products on resilient and low-carbon transport.
Maria has 20 years of international work experience in the fields of climate change, air quality, environment management, and sustainable mobility. Prior to joining the World Bank, Maria was a section manager at the Environment Agency, Abu Dhabi, United Arab Emirates. As part of the Policy and Planning team, Maria supported the development of Abu Dhabi's air quality and climate change strategies, Surface Transportation Master Plan, Low Emission Vehicle Strategy, and vehicle fuel economy standards, among other policies. Maria also worked at the Inter-American Development Bank, the World Resources Institute, and other international institutions where she helped shape low-carbon investment portfolios in the transportation sector and contributed to flagship events and publications like Transforming Transportation and United Nations Environment Programme's (UNEP) Global Environment Outlook – West Asia Regional Report. A Portuguese national, Maria holds a Global MBA from IE Business School, a master's degree in integrated environment control from Nottingham Trent University, and a bachelor's degree in energy and environmental technology from the University of Glamorgan, U.K.

James P. Newman (Jay)

DRM Specialist | DRM Hub, Tokyo, GFDRR, World Bank

Jay Newman is a DRM specialist at the World Bank DRM Hub, Tokyo, where he leads the Hub's Knowledge Program, as well as its engagements on resilience. Since joining the World Bank in 2013, Jay has worked at the Global Facility for Disaster Reduction and Recovery (GFDRR), serving as a focal point for urban resilience and regional portfolios in South Asia and East Asia Pacific. He contributed to the development of the CityStrength Diagnostic, and has supported World Bank projects and technical assistance in India, Nepal, South Africa, and Vietnam. Prior to joining the GFDRR, he worked for the City of Baltimore, contributing to the city's 10-Year Financial Plan and CitiStat performance management program, also serving as acting deputy procurement agent. As an adjunct professor at University of Baltimore's Master's in Public Administration, he has taught courses on statistics, urban management, and public policy. Jay holds a master's degree in applied economics and public policy jointly from Georgetown University and Universidad Alberto Hurtado in Santiago, Chile, as well as a bachelor's degree in economics and Spanish from Washington University in St. Louis.

Naho Shibuya

DRM Specialist | DRM Hub, Tokyo, GFDRR, World Bank

Naho Shibuya works on bridging global and Japanese knowledge and expertise with the World Bank's operations to help mainstream DRM in low- and middle-income countries.
She currently implements a knowledge program on resilient infrastructure by leveraging her experience in infrastructure development including public-private partnerships (PPPs) in water supply and sanitation, transport, energy, and urban planning. As a Chartered Water and Environmental Manager and a Chartered Environmentalist, Naho provided advisory service to multilateral and bilateral development banks, commercial lenders, investors, civil contractors, and manufacturers in the Asia Pacific region prior to joining the World Bank. She holds a graduate degree from Arizona State University and a master's degree in sustainability science from the University of Tokyo.

Shoko Takemoto

DRM Specialist | DRM Hub, Tokyo, GFDRR, World Bank

Shoko Takemoto is a DRM specialist based in the DRM Hub, Tokyo. Prior to joining the DRM Hub, she spent more than five years working alongside national governments, communities, and donors in the Pacific and West Africa on climate- and disaster-resilient development through her appointment with the United Nations Development Programme. Her areas of specialization include environmental policy and planning, climate change adaptation, disaster resilient design, and integrated water resource management. She holds a master's degree in city planning from the Massachusetts Institute of Technology.

Hitoshi Fukumoto

Senior Deputy Director | Road Bureau, Ministry of Land, Infrastructure, Transport, and Tourism, Japan

Hitoshi Fukumoto oversees road disaster risk management at the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and leads emergency management and response of roads in face of risks related to natural disasters including earthquakes, hydrometeorological events, and snow. Since joining the former Ministry of Construction in 1996, he has conducted research related to transport and urban planning at the Bureau of City Planning. He has also led initiatives related to railway crossings and streetcars. After his appointment as the head of Kagoshima National Roads Office of the Kyushu Regional Development Bureau, Hitoshi was involved in urban planning, infrastructure development, and DRM at the municipal level in Miyazaki and Shimanto cities.

Yuka Makino

Senior NRM Specialist and DRM Officer | GSURR, World Bank

Yuka Makino has more than 23 years of operational experience in managing and developing programs in geohazard risk management, natural resources management, land management, DRM, and climate change adaptation. She has extensive experience in East Asia, South Asia, and Africa and has held field postings in Bangladesh, Cambodia, Japan, and Nepal. Prior to joining the World Bank in 2001, Yuka was a United Nations Development Programme (UNDP) program officer in Cambodia, and a Japan International Cooperation Agency (JICA) expert on community-based disaster management in Nepal. Yuka has an undergraduate degree from International Christian University in Japan as well as a master's and doctoral degrees in terrestrial ecosystem management from the University of Michigan, Ann Arbor. In addition to her professional experience in South Asia, she spent 14 years of her youth in the Garhwal Himalayas in India and is fluent in Hindi.

Frederico Ferreira P.

DRM Specialist | GSURR, World Bank

Frederico Ferreira Pedroso, a Brazilian national, is currently a DRM specialist at the World Bank working mainly in a vast portfolio of projects in numerous Brazilian States. In Brazil, Fred's engagement includes projects in the transport sector in São Paulo (road resilience) and Rio de Janeiro (climate change impacts on urban transport); the water sector (Espírito Santo and Ceará); the private sector (Rio Grande do Sul); and public management (Paraná and Bahia). Fred has worked as a consultant in the field of transportation in Brasilia and as an assistant professor at the University of Canterbury in New Zealand. He holds a bachelor's degree in civil engineering from the Pontifical University of Goiás, a master's degree in transportation from the University of Brasilia, a doctorate in civil engineering (transport- and DRM-focused) from the University of Canterbury, and a postdoctorate in urban logistics and humanitarian logistics from Kyoto University in Japan.

Yoganath Adhikari

DRM Consultant | GSURR, World Bank

Yoganath Adikari is a Japanese national who has worked for the World Bank as an international consultant since 2016. Yoganath has more than 17 years of experience in the field of disaster reduction and recovery in low- and middle-income, as well as high-income countries while working for the Food and Agriculture Organization of the UN, Nippon Koei, the International Center for Water Hazard and Risk Management (ICHARM), and the Forestry and Forest Products Research Institute of Japan. He also taught as a visiting lecturer at the National Graduate Institute for Policy Studies in Tokyo while working for ICHARM. He has published numerous research papers in international peer-reviewed and local journals and contributed to the Asia-Pacific Water Summit (APWF), World Water Development Reports and its side publications (UNISCO), Global Assessment Reports (UNISDR), and Asian Water Development Outlook 2013 (AWDO2013) for Water Security in Asia (Asian Development Bank). He has a doctorate and postdoctoral research experience in erosion control engineering and forestry at Hokkaido University, Japan. He is fluent in English, Japanese, and Nepali and also speaks Hindi, Tagalog, and some Spanish.

Mikihiro Mori

Chief Specialist | Geosphere Engineering & Disaster Management Office, Nippon Koei Co., Ltd.

Mikihiro Mori specializes in engineering geology and road disaster management. He serves as chief specialist at the Geosphere Engineering & Disaster Management Office, Nippon Koei, and provides technical solutions to the road disasters. Mikihiro's extensive experience includes road and disaster management and technical transfer projects in Armenia, Brazil, Cambodia, Honduras, Indonesia, Jordan, Nepal, Nicaragua, and the Philippines. Before his current position, he conducted projects for the Japan International Cooperation Agency (JICA) in the above countries since 1994. During 2000–03, he was temporarily transferred to the Institute of Road Management Technology in the Road Management Technology Center, Japan, as chief researcher, to develop road disaster management techniques. From 2013 to 2014, he worked as a project manager of slope protection for Sindhuri Road, Nepal. He also served as JICA expert at the technical assistance project on Nepal's Sindhuri Road operation and maintenance from 2012 to 2015. He holds a bachelor's and professional engineering degree in engineering geology, road disaster management, and comprehensive technical management.

Keiichi Tamura

Chair | Technical Committee on Disaster Management, World Road Association (PIARC)

Keiichi Tamura is chair of the Technical Committee on Disaster Management, World Road Association (PIARC), and an adjunct professor at the Graduate School of Management, Kyoto University, specializing in earthquake engineering and infrastructure management. He has more than 30 years of both professional and research experience. Previously, he held multiple management roles including head of the Ground Vibration Division, Research Coordinator for Earthquake Engineering, and director of the Center for Advanced Engineering Structural Assessment and Research at the Public Works Research Institute, where he had developed various specifications, standards, and guidelines in relation to highway bridges, geotechnical structures such as road embankments and retaining walls, risk management, and emergency response. Keiichi also served as a professor at the Graduate School of Management of the Kyoto University for three years from April 2013 while on leave from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). His research interests cover various management techniques of infrastructure such as risk and asset management, and he coauthored two books on infrastructure asset management. He holds a doctoral and bachelor's degrees in civil engineering from the University of Tokyo.

Monique Cornish

Principal Advisor | Sustainability, Risk + Resilience

Monique Cornish specializes in corporate- and programme-level strategy development and implementation; risk and opportunity assessment; and the development of nonfinancial benchmarks and credentials. Monique has worked across the building, infrastructure, and construction sectors in Asia-Pacific, Europe, and the Americas, providing support to corporate, government, and nongovernmental organization (NGO) clients on the risks and opportunities associated with responding to the challenge of creating a sustainable, resilient built environment. Monique specializes in linking sustainability and resilience measures to core business strategy, while measuring the broader costs and benefits of initiatives and outcomes. Most recently Monique led the development of a resilience decision-support tool for the New Zealand Transport Agency (NZTA), which frames the evaluation of resilience measures in the context of broader environmental, social, cultural, and economic costs and benefits, and developed a framework for evaluating environmental, social, and governance risks for the Commonwealth Bank Group.

Julie Rozenberg

Economist | GGSVP CE, World Bank

Julie Rozenberg is an economist with the Office of the Chief Economist of the World Bank's Sustainable Development (SD) Group. Her work includes green growth and climate change mitigation strategies and climate change adaptation and DRM. She coordinates the work of the different SD Global Practices (including Transport & ICT, Water, and Energy & Extractives) on incorporating climate change resilience in projects and strategies. She also works on infrastructure projects, helping World Bank teams and clients take climate change constraints and other long-term uncertainties into account in the feasibility studies and economic analyses of projects. Julie holds a doctorate in economics from Ecole des Hautes Etudes en Sciences Sociales in Paris and an engineering degree from Ecole Nationale Superieure de Techniques Avancees.

Kiyoshi Kobayashi

Professor of Infrastructure Economics / Director | Graduate School of Management and Research Centre of Business Administration, Kyoto University

Kiyoshi Kobayashi is a professor of planning and management theory of the Graduate School of Engineering, Kyoto University. He was dean of the Graduate School of Management for the period of 2010–12. He is a world-renowned researcher in the fields of urban and infrastructure management and economics and a recipient of several awards, including the Distinguished Research Awards by the Japan Society of Civil Engineers, Fellow Awards by RSA International, and Education Awards by the Danish Ministry of Environment as well as by the Vietnamese Minister of Education. He will be the president of the Japan Society of Civil Engineers in 2018, served as the president of the Applied Regional Science Conference and Global Business Society, and currently serves on the editorial boards of international journals including the American Society of Civil Engineers, Annals of Regional Science, the series editor-in-chief of the Journals of Japan Society of Civil Engineers and the Journal of Applied Regional Science. Currently, he is a member of the National Land Development Council of Japan, a committee expert on the Transport Policy Council of Japan, and a coalition member of the Science Council of Japan. He was an adjunct professor of 10 overseas universities and a visiting fellow of international organizations of IIASA, OECD, WHO, and the World Bank, among others. He is the author and coeditor of 70 books and more than 450 academic reviewed papers.

Takeaki Shono

Civil Engineer | Hyogo Prefectural Government, Japan

Takeaki Shono specializes in road development and management since he joined Civil Engineering Office, Hyogo Prefectural Government in 2006. He is currently in charge of the development and operation of an integrated management system of social infrastructure assets and facilities for Hyogo Prefecture.

Roger Fairclough

Managing Director | Neo Leaf Global

Roger Fairclough is a civil engineer and member of the Institution of Professional Engineers New Zealand. His career spans government, state-owned enterprises, and the private sector. This includes national 30-year energy outlooks, managing national petroleum and biofuels policy, and "The Thirty Year New Zealand Infrastructure Plan 2015" with the vision that "New Zealand's Infrastructure will be resilient and coordinated, and contribute to a strong economy and high living standards." The earthquakes in Canterbury, New Zealand, since 2010 and the recovery phase have been an ongoing area of involvement. Roger is currently chair of the New Zealand Lifelines (Utilities) Council and chair of the Built Environment Leadership Steering Committee. His specific areas of interest include asset investment, national resilience, global resources, national infrastructure, emergency management, advanced technologies, and natural hazards.

Kensuke Ichikawa

Manager | International Consulting Department, Kokusai Kogyo Co. Ltd.

Kensuke Ichikawa is a senior geotechnical engineer. He has worked in several low- and middle-income countries as a project manager for international projects funded by the Japan International Cooperation Agency, the World Bank, and the United Nations Development Programme in the areas of water and disaster management. He holds a master's degree in engineering.

Stefan Huszak

Geotechnical Engineer | Opus International Consultants

Stefan Huszak is currently a doctoral candidate studying at the University of Auckland and working at Opus International Consultants as a geotechnical engineer. Stefan has been working at Opus International Consultants since he began his working career as a civil engineering cadet. Stefan has experience in civil droughting, surveying, and stormwater design; however, the main basis of Stefan's background is material testing. Stefan has been involved with both laboratory and field testing for several major projects, both within New Zealand and internationally. Since completing his bachelor's degree in engineering in 2015, Stefan has been working as a geotechnical engineer, widening his capabilities in that area; as well as beginning research toward his doctorate. Stefan's research topic is "Optimising the Waterproofness of Chipseal Surfacings," which predominantly has applications within New Zealand, and other areas that use this type of road seal. The research is part of a larger project, called "Waterproof Roads." The overall aim of the research is to better design chip-seal roads to increase resilience against water infiltration and moisture-related failures. The research project predominantly consists of civil engineering materials research, using laboratory testing that is validated in the field.

Katsunao Tanaka

Director, Disaster Management | Water and Disaster Management Bureau, MLIT

Katsunao Tanaka has specialized in water and disaster management since he joined the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in 1997. After 14 years of experience there, he taught at the Interfaculty Initiative in Information Studies, Graduate School of Interdisciplinary Information Studies, University of Tokyo, as an assistant professor for three years. He was appointed as director of the Kofu River and National Highway Office in Kano Regional Development Bureau from 2014 to 2016. Since 2016, he has been a director for disaster management, Disaster Prevention Office, Water and Disaster Management Bureau.

Osamu Uemura

Manager | Disaster & Risk Management Team, Operational Planning & Coordination Section, Operational Department, East Nippon Expressway Company Ltd. (NEXCO-East)

Osamu Uemura started his career in 1998 at the Construction office of Expressway under the Japan Highway Public Corporation (currently NEXCO-East). He worked at the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in 2010 as a deputy manager for operations and disaster management of expressways and experienced the Great East Japan Earthquake (March 11, 2011). Currently, he is responsible for DRM work, including business continuity planning under the headquarters of NEXCO-East.

Kazushige Endo

Deputy Director General | Iwate Office, Reconstruction Agency of Cabinet Secretariat

Kazushige Endo works on the Great East Japan Earthquake (March 11, 2011) reconstruction projects in the Iwate Office, Reconstruction Agency of Cabinet Secretariat, as deputy director general. After graduating from University of Kyoto with a master's degree in transport engineering in 1990, he joined the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). His career in Japan covers more than 10 engineering positions in the government, at national highway management offices, and with local authorities. He has also worked at the Japan International Cooperation Agency and the World Bank.

Mikio Ishiwatari

Senior Advisor | Japan International Cooperation Agency

Mikio Ishiwatari is a senior advisor in Disaster Management and Water Resources Management at the Japan International Cooperation Agency (JICA) and focuses on DRM and water projects. He led the formulation of Japanese assistance policies for climate change adaptation and community-based disaster management. He worked at the World Bank as a senior DRM specialist and a senior water specialist from 2011 until 2015, and produced "Learning from Megadisaster: Lessons from the Great East Japan Earthquake." He worked at various DRM positions at the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan for 17 years. He formulated and supervised national projects of flood risk management and highways in Iwami District as director of the Hamada River and Road Office, and was responsible for research and technology development as senior deputy director for river technology and information. He also has worked as an urban development specialist at the Asian Development Bank. He holds a master's degree in urban engineering and a doctorate in international studies from the University of Tokyo.

Juan Gaviria

Practice Manager | Transport and ICT, World Bank

Juan Gaviria is a practice manager of transport for Europe at the World Bank and responsible for managing the transport infrastructure practice in 22 active programs in the European Union, Eastern Partnership, Western Balkans, Caucasus, Turkey, and the Russian Federation. He oversees a portfolio of investment projects totaling just under US$5 billion and annual advisory services of about US$5 million, including a diverse portfolio of motorways, railways, waterways, ports, and logistics projects, as well as infrastructure public-private partnerships (PPPs) in a variety of countries. Juan also has broad professional experience in private and public infrastructure development and management, public utility companies and concessions, climate change and infrastructure operations, management of complex assignments, project appraisal, finance, management, and marketing covering Europe, Latin America, Central Asia, South Asia, and Africa. He also has experience as chief operating officer of a medium-size global container shipping line, formulating and implementing new company strategy; carrying out organizational and cultural alignment; and developing regulatory strategy, value creation, integration management, and concluding transactions. He has a doctorate in transport economics from the University of California, Berkeley.

Shanika Hettige

Consultant | GSURR, World Bank

Shanika Hettige joined the World Bank in 2015 and has contributed to the DRM practice by working on the Open Data for Resilience Initiative (OpenDRI), the City Resilience Program (CRP), and the Resilient Transport Community of Practice, among others. Shanika has experience in community mapping and participatory planning, impact modeling, risk communications, open data, and nature-based risk reduction. Shanika works toward the protection of lives, livelihoods, and lifeline infrastructure in the face of disaster and climate risks through process-based design and informed implementation of hard and soft resilience measures. She holds a master's degree in risk and resilience from the Harvard Graduate School of Design, which builds on her prior focus on urban planning at Cornell University.

Jack Campbell

DRM Specialist | GFDRR, World Bank

Jack Campbell was a founding team member in the DRM Hub, Tokyo, where he was based during 2014–15 to set up the program. His operational focus has been on urban and climate resilience projects in South Asia, where he is a task team member of projects in Dhaka and Colombo and manages a regional technical assistance program on hydromet services. For the Global Facility for Disaster Reduction and Recovery (GFDRR), he also focuses on new program development with donors and client countries. Prior to working at the World Bank, Jack was an adviser to the United Kingdom's Department for International Development (DFID) on disaster risk management. He is a British national and holds a degree in geography and Hispanic studies from the University of Birmingham and a master's degree in public administration from the London School of Economics.

Fiona Collins

Lead Transport Specialist | Transport and ICT, World Bank

Fiona Collins joined the World Bank as a senior transport specialist in 2011, initially based in Addis Ababa for three years, and now a further three years in headquarters within the Europe and Central Asia region. Before joining the World Bank, Fiona worked as a civil engineer and project manager, specializing in transport and connectivity. Her 30 years of work experience spans the World Bank and other development partners, road agencies, contractor work, and

consultancies. Geographically, Fiona has worked in Europe, Central Asia, East Africa, East Asia, Australia, and the Pacific Islands. With a significant amount of time spent in tropical latitudes, Fiona has firsthand experience of extreme weather, particularly in relation to cyclones and flooding, and in post disaster recovery and adaptation. This professional and personal exposure brings with it an interest in addressing the impacts of climate change and extreme weather and its effects on road infrastructure; and her professional background as a development practitioner and engineer who has designed, built, and maintained roads provides perspectives on how to deal with it.

Yohannes Yemane Kesete

Disaster Risk Management Specialist | GSURR, World Bank

Yohannes Yemane Kesete is a civil engineer, with specialization in infrastructure and transportation systems engineering. He has more than 10 years of both professional and research experience. He currently works in the Latin America and the Caribbean region on infrastructure improvement projects. He also leads several technical assistance projects that aim to integrate natural disaster risk in infrastructure investment decision making. In the past, he has worked as a risk modeler with AIR-Worldwide and as a structural engineer with the Ministry of Public Works of Eritrea. He holds a doctorate in civil infrastructure systems from Cornell University with a research focus on managing natural disaster risk through insurance.

Vibhu Jain

Consultant | DRM Hub, Tokyo, World Bank

Vibhu Jain is an urban specialist and DRM consultant who supports two teams in Tokyo: one at the Global Infrastructure Facility and one at the DRM Hub. She works on integrated flood risk management, hydrometeorology, geohazard risks, and other related aspects of DRM. Since 2012, she has worked at the World Bank on urban development projects in the New Delhi office and now on DRM and infrastructure public-private partnerships (PPPs) in the Tokyo office. Before joining the World Bank, she worked at PricewaterhouseCoopers Ltd. and Deloitte Touche Tohmatsu. She holds a master's degree in urban regional planning and public policy.

Akiko Toya

Junior Professional Officer | GFDRR, World Bank

Akiko Toya is a junior professional officer who works on GFDRR's technical assistance grant portfolio. She connects leading global and Japanese DRM knowledge and expertise with the World Bank's operational teams, focusing on resilient infrastructure and transport projects. Previously, she worked with the South Asia and Latin America and the Caribbean teams on disaster risk assessment and risk reduction strategies for the transport sector. Prior to joining the World Bank, she worked in enterprise risk management and political risk advisory at private insurance and consulting firms. A Japanese national, Akiko holds a master's degree in public affairs and risk management from Cornell University and a bachelor's degree in environmental economics and sustainable development from the Soka University of America. She has spent a semester abroad at La Universidad San Francisco de Quito in Ecuador.

Haruko Nakamatsu

Program Assistant | DRM Hub, Tokyo, World Bank

Haruko Nakamatsu works at the Global Facility for Disaster Reduction and Recovery's (GFDRR) DRM Hub, Tokyo, as a program assistant. A Japanese national, Haruko provides critical administrative and logistical support and liaises with partners worldwide, the Japanese government, academia, and the private sector. She also works on coordinating events and programs. She has extensive experience in planning, coordinating, and organizing conferences and high-profile events.

Meet the Participants

AFGHANISTAN

Luquan Tian

Senior Transport Specialist | Transport and ICT, World Bank

Luquan Tian specializes in transport infrastructure and planning. Before joining the World Bank in 2009, he worked at the Department of Transport in a province in China, as well as at two engineering consulting firms in the United Kingdom. He has also worked as a project manager on several key national trunk motorway networks in China. Other areas of expertise include road maintenance, traffic engineering, and transport planning in the United Kingdom and the United Arab Emirates. At the World Bank, he works on transport infrastructure and transport planning and policy in Afghanistan and Nepal. Additionally, he works with the DRM team to advise fragile and conflict states. An internationally recognized expert in natural disaster risk management in transport infrastructure, he is a chartered engineer in the United Kingdom and Europe, as well as holds two degrees in civil engineering.

Hamidi Sayed Abdul Manan

Senior Contract Engineer| NRAP, MPW, Kabul, Afghanistan

Hamidi Sayed Abdul Manan joined the Ministry of Public Works' (MPW) Natural Rural Access Program (NRAP) in July 2015. Previously, he worked as a deputy team leader and national technical coordinator at the United Nations Office for Project Services (UNOPS), where he focused on the MPW's Afghanistan Rural Access Project (ARAP). He holds an international master's degree in structural and civil engineering from the University of Manchester Institute of Science and Technology (UMIST) in Manchester, United Kingdom. He has more than 35 years of experience in the field of engineering and has worked with several international and local organizations in Afghanistan and abroad, such as the United Nations Children's Fund (UNICEF), the Afghan Construction and Logistics Unit (ACLU), the Construction Control Services Corporation (CCSC), the United Nations Drug Control Programme/ the United Nations Office on Drugs and Crime (UNDCP/UNODC), the International Rescue Committee (IRC), and International Relief and Development (IRD).

Noori Mohammad Salam

Senior Road Design Engineer | THRCP, MPW, Kabul, Afghanistan

Noori Mohammad Salam works as a road design engineer with the Ministry of Public Works' (MPW) Trans-Hindukush Road Connectivity Project (THRCP). Before joining the MPW, he worked as international road design engineer with the United Nations Office for Project Services (UNOPS). He has also worked for the Sudanese government, where he worked in Khartoum and on a United States Agency for International Development (USAID)-funded project located at the Blue Nile State and in Gulli. He studied civil engineering at Kabul University in Afghanistan. He has more than 15 years of experience in the field of engineering and has worked with several international organizations in Afghanistan and abroad, such as the National Rural Access Program (NRAP), International Relief and Development (IRD), the United National Procurement Division/ National Area-Based Development Programme (UNPD/NABDP), and the Danish Committee for Aid to Afghan Refugees (DACAAR).

ARGENTINA

Veronica Raffo

Senior Infrastructure Specialist | Transport and ICT, World Bank

Veronica Raffo is a senior infrastructure specialist at the World Bank's Transport & Information and Communication Technologies (ICT) global practice. She joined the World Bank in 2006 as a young professional and has worked for the public sector and transport units. She has helped advance the World Bank's work in sustainable transportation and mobility through her management of lending and advisory operations in urban mobility, road safety, rural connectivity, road asset management, logistics, and transport planning in Latin America, Eastern Europe, and Africa. Before joining the World Bank, she worked as a researcher at the Social Science Research Council, a program coordinator at the Program on Global Security and Cooperation, and as an associate attorney in the capital markets and project finance practice at Marval, O'Farrell & Mairal. She has also worked at the European Parliament in Brussels. An author of several peer-reviewed articles and publications, she also teaches post-graduate courses in Buenos Aires. She holds a law degree from the University of Buenos Aires in Argentina and a master's in science degree as a Chevening Scholar from the London School of Economics in the United Kingdom.

Andres Gartner

Chief Advisor | Ministry of Transport

Andres Gartner is a chief advisor at the Ministry of Transport in Argentina. Previously, he worked at the World Bank's Latin America Transport Cluster and in the City of Buenos Aires's Transport Subsecretary's Sustainable Mobility Unit. He has also worked as a transport specialist at think tanks, universities, and other organizations.He holds a bachelor's degree in economics from the University of Buenos Aires in

Argentina, a master's in science degree in urban economics from the Torcuato di Tella University in Argentina, and a master's in science degree in transport from the Imperial College London in the United Kingdom.

Emma Albrieu

General Manager | Vialidad Nacional

Emma Albrieu is a general manager of projects at Vialidad Nacional, the National Roads Council, which is a part of Argentina's Transportation Ministry. She has also worked as an executive director at the Highway Concession Control Body (El Órgano de Control de Concesiones Viales, OCCOVI), an infrastructure coordinator for the Argentina Operations Center (AROC), and at the United Nations Office for Project Services (UNOPS). She holds a degree in civil engineering from the Universidad Católica de Córdoba in Argentina and a master's in science degree in international business from L'École Nationale des Ponts et Chaussées in France.

BRAZIL

Satoshi Ogita

Senior Transport Specialist | Transport and ICT, World Bank

Satoshi Ogita is a transport specialist with more than 18 years of professional experience. He joined the World Bank in 2011 and works on inter-urban transport projects, mainly in Brazil and Mozambique. Previously, he worked as an international development consultant analyzing more than 25 transport projects in Asia, Eastern Europe, and the Middle East for eight years. He holds a master's degree in public administration from the Harvard Kennedy School in the United States and a degree in international studies from the University of Tokyo in Japan.

Livia Maria Tiemi Fujii

Coordinator | Road Transport Programs, Ministry of Transport, Ports, and Civil Aviation

Livia Maria Tiemi Fujii works as a coordinator at the Brazilian Ministry of Transport, Ports, and Civil Aviation (MTPCA). She joined the MTPCA in 2012. She is a civil engineer and holds a master's degree in geotechnics and a master's in business administration degree in public management.

Fabio Pessoa da Silva Nunes

General Coordinator | Maintenance and Road Restoration, National Department of Transport Infrastructure (DNIT), Brazil

Fabio Pessoa da Silva Nunes is a general coordinator of road maintenance and restoration at the Brazilian Department of Transport Infrastructure (DNIT). Previously, he worked in the construction division of DNIT. He holds a master's degree in structures from the University of Brasilia in Brazil.

CAMBODIA

Chanin Manopiniwes

Infrastructure Specialist | Transport and ICT, World Bank

Chanin Manopiniwes has been an infrastructure economist with the World Bank in Thailand since March 2006. He has worked on developing infrastructure strategy, renewable energy and energy efficiency, public-private partnerships, urban transport policy, road safety, public finance & decentralization, and rapid assessment of damages and losses occurred from natural disasters. He also works with the World Bank's carbon finance team on energy efficiency projects, in addition to highway management projects in Thailand, infrastructure programs in Laos, and transport sector knowledge programs in Malaysia. He holds a doctorate in applied economics and management from Cornell University, a master's degree in policy economics from the University of Illinois at Urbana-Champaign, and a bachelor's degree in economics from Thammasat University.

Pom Chreay

Director | Department of Rural Health Care, Min. of Rural Development

Pom Chreay is a project director at the Ministry of Rural Development's Department of Rural Health Care and is also a director of the World Bank-funded Cambodia Southeast Asia Disaster Risk Management project. He has been working at the Ministry since 1998. He holds a degree in public administration from the University of Canberra in Australia and a degree in rural development management from the University of Khon Kean in Thailand.

Phirith Kang

Deputy Director | Equipment and Road Construction Department, Min. of Public Works and Transport

Phirith Kan is a deputy director at the Ministry of Public Works and Transport. In 2011, he worked on the World Bank-funded Road Asset Management Project (RAMP), which was co-financed by the World Bank, the Asian Development Bank, and Australian Aid. He has also worked as a deputy project director on the World Bank-funded Road Rehabilitation Project.

COLOMBIA

Mauricio Cuéllar

Senior Transport Specialist | Transport and ICT, World Bank

Mauricio Cuéllar is a senior transport specialist at the World Bank, where he has worked on managing numerous transport projects in Colombia, Venezuela, Mexico, Peru, and Ecuador. Prior to joining the World Bank, he worked as a planning director at the Colombian National Planning Department's Rural Roads National Fund. He has also served as a transport advisor for the mayor of Bogotá. He holds a degree in civil engineering from Los Andes University in Colombia and a master's degree in infrastructure planning from the University of Stuttgart in Germany.

Magda C. Buitrago Ríos

Advisor | Deputy Minister of Transport, Ministry of Transport

Magda Constanza Buitrago Ríos has more than 20 years of experience in the transport sector, with specific expertise in supervising road projects, formulating and evaluating public investment projects, international credit structure, budget planning and execution, strategic planning and results management, disaster risk management, and climate change adaptation. She has also developed a manual on the evaluation of disasters, as well as worked on estimating damages and losses from earthquakes in Ecuador. She holds degrees in civil engineering and administration from the University of Santo Tomas in Colombia.

Norma Castellanos

Environmental Infrastructure Advisor | National Planning Department (NPD)

Norma Castellanos is an advisor at the National Planning Department's Infrastructure and Sustainable Energy Unit. She works on structuring, monitoring, and evaluating public policies related to the transport sector, such as mitigation and adaptation to climate change. She holds a degree in civil engineering from the Nueva Granada Military University in Colombia.

GEORGIA

Robert Mutyaba

Transport Specialist | Transport and ICT, World Bank

Robert Mutyaba is a transport specialist at the World Bank country office in Georgia, working on roads and logistics projects in Georgia, Armenia, Azerbaijani, and Kazakhstan. Prior to joining the World Bank, he worked in various positions at the Uganda Road Authority and as a consultant at Mott McDonald and Ernst & Young in the United Kingdom (UK). He holds a bachelor's degree in civil engineering from Makerere University in Uganda and a master's degree in road management and engineering from the University of Birmingham in the U.K.

Gia Sopadze

Head | Environmental Department, Road Department, Georgia

Gia Sopadze has been head of the Environmental Department at the Road Department of Georgia since 2009. Between 1994 and 2004, he was an advisor to the President of Georgia on environmental issues. In 2001, he established ECOVISION, a union of nongovernmental organizations involved in sustainable development projects in Georgia. He has also authored about 25 scientific and educational publications. He holds a doctorate in geographical sciences from Tbilisi State University in Georgia.

INDIA

Ashok Kumar

Senior Highway Engineer | Transport and ICT, World Bank

Ashok Kumar works as a senior highway engineer at the World Bank county office in India, where he focuses on integrating and adapting climate change to rural projects. He has 35 years of experience working on rural roads and highway projects, with international assignments in Afghanistan, China, Mongolia, Indonesia, Nepal, the Philippines, and Sri Lanka. He also has experience in asset management and maintenance, road sector policies and reforms, modernization of road agencies, capacity building, knowledge sharing, contract management, and working on challenging assignments in low capacity regions. Previously, he worked at the Central Road Research Institute in India for 22 years, where he conducted research on rural roads.

Rajesh Bhushan

Joint Secretary | Ministry of Rural Development, Government of India

Rajesh Bhushan is joint secretary and director general at the Indian Ministry of Rural Development's National Rural Roads Development Agency. He manages the rural connectivity sector for the Pradhan Mantri Gramin Sadak Yojana (PMGSY), a flagship government program which aims to improve livelihoods and reduce poverty in rural areas by building safe roads and bridges. The annual program budget of $3 billion dollars is administered through the State Rural Roads Development Agencies. More than one million residents have benefited from the five million kilometers of roads built by the PMGSY program.

Vinay Kumar Kumar

Secretary | Rural Works Department, State Government of Bihar

Vinay Kumar Kumar is a secretary at the State Government of Bihar's Rural Works Department. Previously, he has served as a director at the Bihar State Beverages Corporation, a chairman at the Bihar Rural Livelihoods Project, and a secretary at the Animal Husbandry & Fish Resources. He holds a master's degree in physics.

Rajeev Nayan Prasad Singh

Project Director / Superintending Engineer | Bihar Rural Roads Project, State Government of Bihar

Rajeev Nayan Prasad Singh is a project director on the Bihar Rural Roads Project at the Bihar Rural Roads Development Agency. He has 30 years of experience in planning, executing, and monitoring Rural Roads Projects. Previously, he worked in the Advance Planning section at the Road Construction Department. He has participated in numerous training programs at the IIT Khargpur (innovative technology), ASCI Hyderabad (project management & procurement), Asian Institute of Transport & Development, New Delhi, NITHE (Noida), and AIMA (Ahmedabad).

KYRGYZ REPUBLIC

Cordula Rastogi

Senior Transport Economist | Trade & Competitiveness Global Practice, World Bank

Cordula Rastogi, a senior transport economist, is a global solutions lead on connectivity at the World Bank's Trade & Competitiveness Global Practice. She has more than 15 years of project management experience, with strong analytical skills to deliver policy-relevant solutions to clients and advise them on strategic investments and policy changes in the area of connectivity, transportation, and logistics. She leads World Bank-supported lending and non-lending transport and logistics projects in East Asia and the Pacific, South Asia, and Europe and Central Asia. Most recently in the Central Asia region, her work has resulted in renewed engagement with Central Asian governments (Tajikistan, Uzbekistan and Turkmenistan) and the preparation of four new investments, including a regional connectivity program addressing connectivity challenges. She has authored publications on logistics and connectivity, as well as has recently published the book, "The Eurasian Connection: Supply Chain Efficiency along the Modern Silk Route through Central Asia." She holds a doctorate degree.

Zhamshitbek Kalilov

Minister | Ministry of Transport and Roads, Kyrgyz Republic

Zhamshitbek Kalilov has significant experience in the construction and rehabilitation of roads in the Kyrgyz Republic, trans-border roads with China, and other neighboring countries. He has 33 years of experience and is a member of the International Transport Academy. An award-winning, widely recognized transport expert, he holds a post graduate degree in transport.

Ruslanbek Satybaldiev

Program Coordinator | Ministry of Transport and Roads, Kyrgyz Republic

Ruslanbek Satybaldiev has 22 years of engineering experience in road construction and rehabilitation. His portfolio includes managerial experience and engineering expertise in road rehabilitation projects within the Kyrgyz Republic and neighboring countries.

LAO PDR

Sombath Southivong

Senior Infrastructure Specialist | Transport and ICT, World Bank

Sombath Southivong has more than 25 years of professional experience in institutional strengthening and capacity building for transport sector development, disaster risk management, and hydropower and mining sector development. He also has extensive experience in road construction and maintenance, as well as road asset management in Laos and the region. He holds degrees in civil engineering and public policy.

Lamphoun Khounphakdy

Deputy Director | Road Maintenance Division, Ministry of Public Works and Trade

Lamphoun Khounphakdy has more than 15 years of field experience in road network maintenance planning, road construction management, urban traffic planning, and disaster risk management. He also has extensive experience in surveying road and bridge conditions throughout Laos. He joined the Ministry of Public Works and Trade's Department of Roads as a road assets management engineer in 2000. He holds degrees in civil engineering and urban transport engineering.

Litta Khattiya

Deputy Director General | Department of Road, Ministry of Public Works and Trade

Litta Khattiya is a deputy director general at the Ministry of Public Works and Trade's Department of Roads. He has 19 years of professional experience working in the field of road transport infrastructure development and management, with a special focus on road asset management. He also has experience working with development partners such as the World Bank, the Asian Development Bank, KfW German Development Bank, Japan International Cooperation Agency, and the Nordic Development Fund to support road infrastructure development in the Lao PDR. He holds degrees in civil engineering and development planning.

MOZAMBIQUE

Kulwinder Rao

Senior Highway Engineer | Transport and ICT, World Bank

Kulwinder Rao is a senior highway engineer and the global lead for Fragile and Conflict Affected Countries at the World Bank's Transport and Information Communication Technologies Global Practice. He manages the World Bank's transport portfolios in Liberia and Mozambique. He is a professional engineer with more than 31 years of post-graduate experience in highway policy planning, engineering, project management, including performance-based contracting methods such as Output- and Performance-Based Road Contracts (OPRC). Previously, he held senior-level management positions in the Indian government and the private sector.

Francisco Manual Jose Danca

Senior Highway Engineer | Road Fund

Francisco Manuel Jose Danca is a civil engineer, specializing in roads and bridges. He is currently acting as a provincial delegate for the Roads Fund in the Sofala Province. He has worked for several years as a road construction and maintenance supervisor in the Manica and Nampula provinces.

Emilia Tembe Boene

Environmental Specialist | National Administration of Roads

Emilia Tembe Boene is the head of the National Roads Administration's Monitoring Department. She has 17 years of experience in coordinating environment and resettlement issues. She is responsible for coordinating road monitoring and cross-cutting issues, as well as mainstreaming environmental and social considerations into all stages of a road project's life cycle. She is also tasked with creating strategies to increase women's participation in road projects. She holds a master's degree in environmental resource management.

Francisco Álvaro

Technician (International Relations) | Road Fund

Francisco Álvaro works as a technician of external affairs at the Directorate of External Relations' Road Fund. He is responsible for liaising with development partners such as the World Bank, as well as monitoring and evaluating the Integrated Road Sector Program. He holds a degree in international relations and diplomacy.

Jorge Tomás Muonima

Civil Engineer | National Roads Administration

Jorge Tomás Muonima is a division head at the National Roads Administration, where he oversees local government projects. One project involves building climate resilience in roads located in the Gaza province's Limpopo basin. He has 27 years of experience as a civil engineer specializing in road construction, rehabilitation, and maintenance.

MYANMAR

Henrike Brecht

Senior Infrastructure Specialist | GSURR, World Bank

Henrike Brecht is a senior infrastructure specialist at the World Bank. Based in Vientiane, Lao PDR, she is the task team leader of disaster risk management projects in Cambodia, Lao PDR, and Myanmar. Previously, she worked at the Global Facility for Disaster Reduction and Recovery (GFDRR), the Louisiana Hurricane Center after Hurricane Katrina, and the United Nations High Commissioner for Refugees in Switzerland and Kenya. She holds a master's degree in environmental science and a doctorate in disaster risk management.

Tin Moe Myint

Director | Road & Bridge Division, Department of Rural Development

Tin Moe Myint is a director at the Department of Rural Development's Road and Bridge Division. Previously, she worked at the Ministry of Home Affairs, the Ministry of Border Affairs, National Races and Development Affairs, and the Ministry of Livestock, Fishery and Rural Development. She also works on grants and other projects supported by the World Bank, the KfW German Development Bank, the Asian Development Bank, Japanese Infrastructure Partner, and the Japanese International Cooperation Agency.

Kyaw Myo Htut

Director | Department of Highway

Kyaw Myo Htut manages road and bridge construction and maintenance projects located in Myanmar's Chin State. He also liaises with Indian counterparts on grant projects and manages the Japanese International Cooperation Agency's overseas development assistance loans. He joined the Ministry of Construction in 1997 as a junior engineer. He holds a degree in civil engineering from the Rangoon Institute of Technology in Myanmar.

PHILIPPINES

Victor Dato

Senior Infrastructure Specialist | Transport and ICT, World Bank

Victor Dato is a senior infrastructure specialist at the World Bank country office in the Philippines. He specializes in roads and

transport projects for the Philippine government's transport department. Recently, the transport team has started to work on local provincial road development programs. He was part of the World Bank-led Post Disaster Needs Assessment team in the aftermath of Typhoon Ketsana and Parma in 2009.

Maria Teresa H. Concepcion

Local Government Operations Officer V | Department of the Interior

Maria Teresa H. Concepcion focuses on the project development and management of local roads and bridges information systems. She is also involved in disaster risk reduction and management, specifically disaster risk financing, local risk assessments, and vulnerability assessment of local infrastructures. In her 30 years with the Philippine Republic's Department of the Interior and Local Government (DILG) as a local government operations officer, her work has mostly revolved around the various phases of project development and management – from inception to feasibility study preparations, to results-based monitoring.

Paul Irineo P. Montano

Local Government Operations Officer V | Department of the Interior

Paul Irineo P. Montano works on project development, policy research and formulation, with a special focus on strengthening disaster risk governance at the sub-national levels. This includes risk information management and analysis, vulnerability assessment of local infrastructures, and risk financing windows.

SERBIA

Darko Milutin

Disaster Risk Management Specialist | GSURR, World Bank

Prior to joining the Eastern Europe and Central Asia urban and disaster risk management (DRM) unit as a DRM Specialist in 2016, Darko Milutin worked as a project manager for the DRM team in the Serbia country management unit, where he was responsible for implementing Serbia's DRM program. He has previously worked as a consultant and as a donor representative for Luxembourg's bilateral development cooperation projects in Serbia and Montenegro. A Serbian and Dutch national, he holds a doctorate degree in environmental sciences from Wageningen University in the Netherlands and a bachelor's degree in hydrology and water resources management engineering.

Petar Krasic

Department for Road Transport, Roads and Road Safety | Ministry of Construction, Transport and Infrastructure

Petar Krasic has been working at the Ministry for more than four years on various road safety and road intelligent transport systems projects. He specializes in the development of strategic frameworks, studies, legislation, and other technical documents. He also works on international cooperation initiatives that involve European Union integration processes in the transport field. In 2009, he was awarded a third place prize for a road safety project by the European Transport Safety Council. He holds a master's and bachelor's degree in traffic engineering from the University of Novi Sad in Serbia.

Slobodan Basuric

Head | Belgrade Department for Road Maintenance and Preservation

Slobodan Basuric has been actively involved in Belgrade's road maintenance projects and road sector economic planning for the past five years. He is also the project manager for performance-based maintenance of category I and II state roads. In the area of disaster risk management, he works on assessing damages and economic losses in the roads sector. Previously, he was a supervisor specializing in landslide repairs and rehabilitation, as well as road reconstruction. He holds a degree in civil engineering from the Civil University of Belgrade in Serbia.

SRI LANKA

Amali Rajapaksa

Senior Infrastructure Specialist | Transport and ICT, World Bank

Amali Rajapaksa leads the dialogue on public private partnerships (PPPs) and manages the transport portfolio. She joined the World Bank in 2003 as an infrastructure specialist managing the World Bank's portfolio on transport, energy, and water in Sri Lanka. She has contributed greatly to the growth of the transport sector within the World Bank's portfolio in Sri Lanka and has been instrumental in bringing the first public-private partnership (PPP) to the road sector. She has also been involved in the World Bank's energy projects in India and Pakistan. Previously, she worked at the Government of Sri Lanka's Bureau of Infrastructure Investments. She is a fellow of the United Kingdom Chartered Institute of Management Accountants and holds a master's degree in business finance from Brunel University in the United Kingdom.

Nimal Chandrasiri

Additional Director General (Construction Design) | Road Development Authority

Nimal Chandraisiri has more than 37 years of experience in highway and bridge design, as well as road construction and management in both Sri Lanka and abroad. He was instrumental in introducing computer aided design and global position systems (GPS), as well as raised project management standards at the Road Development Authority. He served as a project director when Sri Lanka built the Southern Expressway, which opened to traffic in 2011. He holds a master's degree in structural engineering from the University of Moratuwa in Sri Lanka and a diploma in project planning and development management from the Asian Institute of Manila in the Philippines.

Shyamalee Karunasekera

Deputy Director (Planning) | Highway Information and Development Management System, Road Development Authority

Shyamalee Karunasekera leads and manages a wide range of activities, including collecting, processing, and analysing road pavement data. She is also responsible for road rehabilitation, reconstruction, and maintenance programs. Additionally, she works on conceptualizing, formulating, and developing the Road Asset Management System. She joined the Road Development Authority in 1995 as a civil engineer and has worked in several areas such as research and development, highway designs, and construction and maintenance of road projects on national highways and expressways. She is a chartered civil engineer, with a post graduate diploma in highway and traffic engineering from the University of Moratuwa in Sri Lanka.

TAJIKISTAN

Aidai Bayalieva

Transport Specialist | Transport and ICT , World Bank

Aidai Bayalieva works on transport programs in the Kyrgyz Republic and the Republic of Tajikistan, both highly mountainous and the most climate change vulnerable countries in the Central Asian region. She also works on the preparation of climate resilient components in regional programs. She has more than 10 years of experience working on infrastructure-related projects. She holds a master's of science degree from Hiroshima University in Japan.

Olim Yatimov

Head | Foreign Investments Cooperation, Department of Ministry of Transport, Republic of Tajikistan

Olim Yatimov is a deputy director of the Project Implementation Group at the Ministry of Transport and directly supervises regional World Bank transport programs. He has more than 10 years of extensive experience in the transport sector and cooperating with various international financial institutions in preparing and implementing priority road rehabilitation and construction projects. Under his direct supervision, his teams implemented and successfully completed numerous projects.

VIETNAM

Phuong Thi Minh Tran

Senior Transport Specialist | Transport and ICT, World Bank

Phuong Thi Minh Tran is a senior transport specialist with over 17 years of experience in project development and management. She is currently the Task Team Leader (TTL) for the Vietnam Road Asset Management Project and the P4R Local Road Asset Management Operation. She is also a co-TTL for the Central Highland Connectivity Improvement Project. Additionally, she manages various trust funds that support project lending and supervision, as well as analytical and advisory assistance. She holds a master's degree in public policy from the National University of Singapore, a bachelor's degree in agronomy from Hanoi Agricultural University, and a bachelor's degree in English from Hanoi Teachers' Training University.

To Nam Toan

Director | Science Technology, Environment and International Cooperation, Department of the Directorate for Roads, Vietnam

To Nam Toan is a director at the Department of the Directorate for Road's Science Technology, Environment, and International Cooperation Department. His responsibilities include drafting road standards for the department and the Ministry of Transport, as well as applying new technologies. He holds bachelor's and master's degrees in road engineering from the University of Transport in Vietnam and a doctorate degree in construction management from the University of Tokyo in Japan.

Tran Anh Duong

Director General | Department of Environment, Ministry of Transport, Vietnam

Tran Anh Duong is responsible for overseeing state management duties in the areas of environmental protection, energy efficiency, and climate change response for the transport sector. He has been working on the environment portfolio at the Ministry of Transport since 2003. He has a degree in mechanical marine engineering from the Vietnam Maritime University and a master's degree in maritime safety and environmental protection from the World Maritime University in Sweden.

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The World Bank Disaster Risk Management Hub, Tokyo supports developing countries to mainstream DRM in national development planning and investment programs. As part of the Global Facility for Disaster Reduction and Recovery and in coordination with the World Bank Tokyo Office, the DRM Hub provides technical assistance grants and connects Japanese and global DRM expertise and solutions with World Bank teams and government officials. Over 47 countries have benefited from the Hub's technical assistance, knowledge, and capacity building activities. The DRM Hub was established in 2014 through the Japan-World Bank Program for Mainstreaming DRM in Developing Countries – a partnership between Japan's Ministry of Finance and the World Bank.