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).

TECHNICAL KNOWLEDGE EXCHANGE (TKX)

ON RESILIENT TRANSPORT

Summary Report

MAY 8–12  2017
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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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.

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

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

FIGURES 1 & 2
TKX Client Countries and Supported Projects
Source: Tokyo DRM Hub

AFGHANISTAN
• AF: Afghanistan Rural Access Project (P125961)
• Trans-Hindukush Road Connectivity 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 (P144355)

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.
Structure of the TKX

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.

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.

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 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.
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. Figures 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.

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.

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

FIGURE 6 Holistic Approach for Geohazard Management

Source: Road Geohazard Risk Management Handbook.
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 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.

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.

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.
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.

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.

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

—Kiyoshi Kobayashi
SESSION 3: Road Asset Management and Mapping for Resilience
TAKEAKI SHONO, civil engineer, Land Development Department, Land Planning Division, Hyogo Prefecture

Many 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.

**INFRASTRUCTURE FACILITIES INTEGRATED MANAGEMENT SYSTEM**

1. **Facility Ledger System**
   - Bridges
   - Tunnels
   - Drainage pump stations
   - Water gates, weirs
   - Harbor facilities
   - Sewage treatment facilities
   - Other facilities

2. **Asset Management System**
   - Bridges
   - Harbor facilities

3. **Geographic Information System**
   - Locations of the facilities
   - Maintenance information
   - Accident points

4. **Request / Complaints Management System**
   - Requests, complaints
   - Photographs
   - Acceptance documentation

5. **Photograph Storage System**
   - Disaster photographs
   - PR photographs
   - Events photographs
   - Taken date

6. **Mobile System**
   - Request and complaints simple registration / browsing
   - Photograph registration
   - Facility information browsing

**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.

**FIGURE 12**

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**

**MERIT Economic Model**

- **Road Outage Scenario**
  - Road network X Level of Service X time (BAU & hazard event scenarios)
- **Network Analyser**
  - Distance and time to travel between zones (BAU & hazard event scenarios)
- **Direct Impact Analyser**
- **Change in expenditure X economic sector**
  - Compile Direct Impacts / MERIT Economic Model

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


**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**

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**FIGURE 13**

Landslide Countermeasures

Source: Adapted from Kensuke Ichikawa’s presentation.

**FIGURE 14**

Surface and Pavement Waterproofness

Source: Adapted from Stefan Huszak’s presentation.

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**INTRODUCING OF JAPANESE TECHNIQUES AND ITS APPLICATION**

**COUNTERMEASURES APPLICABLE IN ETHIOPIA**
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.

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

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).

Figure 17 Permeable Pavement Technology Source: Adapted from Stefan Huszak’s presentation.

*A https://urldefense.proofpoint.com/v2/url?u=http-3A__www.mauriometer.com_&d=DwMGaQ&c=AgHBXVkk0bblyDQ8JQu5Fw&r=80g0sfvBFQvJaA2ZreaV2rb6zXpzEFLoWKU7F-moding&m=0wlvAre3qSh4uya-qu1mrHztJbEmg9D9CnjGhiESwZ4&s=_M34j98Es956YmNwpkqc9D6PS6bygfnQxqfFwosQGow7 http://www.mauriometer.com/

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).

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

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 Tohoku earthquakes by blocking the tsunami and debris from the Pacific Ocean.
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.  

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.
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.
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

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

Colombia

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.

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.

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 sectoral 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 (e) 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 short-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 ACTION PLANNING DISCUSSIONS

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.

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.
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. Julie Rozenberg, economist, World Bank

Q&A (15 minutes)
48 ANNEX 1: AGENDA OF TKX

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. Takashiki Shimo, 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  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  Action Planning (small groups)
Mr. James (Jay) Newman, DRM specialist, DRM Hub, Tokyo (GDPRR): “Introduction to Action Planning” (15 minutes)
Challenge Questions and Action Planning (WB and client teams) (60 minutes)

3:30 pm  Report Back
Small group reporting: representative from each group presents key points (40 minutes)

3:50 pm  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

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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, Koksai 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  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
**Annex 1: Agenda for TKX**

**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

**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)
  
**Day 4: Thursday, May 11th**

**Objectives of Day 4**
- Review and reflect on key lessons learned and explore how to operationalize them into country-specific actions

**3:30 pm**
Field Visit 2: Visit to NEXCO’s Kanto Traffic Control Center, Saitama City

**5:00 pm**
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 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

**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)
  
**Day 4: Thursday, May 11th**

**Objectives of Day 4**
- Review and reflect on key lessons learned and explore how to operationalize them into country-specific actions

**3:30 pm**
Field Visit 2: Visit to NEXCO’s Kanto Traffic Control Center, Saitama City

**5:00 pm**
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 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

**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)
  
**Day 4: Thursday, May 11th**

**Objectives of Day 4**
- Review and reflect on key lessons learned and explore how to operationalize them into country-specific actions

**3:30 pm**
Field Visit 2: Visit to NEXCO’s Kanto Traffic Control Center, Saitama City

**5:00 pm**
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 5: FRIDAY, MAY 12

OBJECTIVES OF DAY 5
Develop strategy for Resilient Transport Community of Practice (CoP)

All Day | World Bank teams

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

ANNEX 2: EXPERT PROFILES

Information is as of the time of the TKX

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 agencies 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-resistant 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.

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.

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 agencies 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.

Senor 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 agencies 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.
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. He served as former Minister 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 streetscar.

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 Shimanta cities.

Yuka Makino
Senior NBM Specialist and DRM Officer | GSUR, World Bank

Yuka Makino has more than 23 years of operational experience in management and programming in gohaizard 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 positions in Bangladesh, Indonesia, and Nepal. Prior to joining the World Bank, she was at United Nations Development Programme (UNDP) program officer at the Japan International Cooperation Agency (JICA) office in Tokyo.

Yukan Adhikari
 DRM Consultant | GSUR, World Bank

Yukan Adhikari is a Japanese national who has worked for the World Bank as an international consultant since 2016. Yukan has more than 17 years of experience in the field of disaster reduction and recovery in low, middle-income countries and as an advisor to the Food and Agriculture Organization of the UN, Nippon Koei, the International Center for Water Hazard and Risk Management (ICHRAM), and the Forestry and Forest Products Research Institute of Japan. He also taught as a visiting lecturer at the National Graduate School for Policy Studies in Tokyo while working for ICHRAM. He has published numerous technical papers in international peer-reviewed journals and contributed to the Asia Pacific Water Summit (APWS), World Water Day, and other international publications. He has more than 30 years of both professional and research experience. He is involved in research on urban transport; the water sector; and the private sector (Rio Grande do Sul, and management (Paraná and Bahia). Fred has worked as a consultant in the field of transport in Brasilia and as an assistant professor at the University of Parana in Brazil. He holds a bachelor’s degree in civil engineering from the Pontificia Universidad Salesiana and a master’s degree in transportation at the University of Brasilia, a doctorate in civil engineering from the University of Parana and a postdoctorate in urban logistics and humanitarian logistics from Kyoto University in Japan.

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

Yoganath Adhikari 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, middle-income countries while working for the Food and Agriculture Organization of the UN, Nippon Koei, the International Center for Water Hazard and Risk Management (ICHRAM), and the Forestry and Forest Products Research Institute of Japan. He also taught as a visiting lecturer at the National Graduate School for Policy Studies in Tokyo while working for ICHRAM. He has published numerous technical papers in international peer-reviewed journals and contributed to the Asia Pacific Water Summit (APWS), World Water Day, and other international publications. He has more than 30 years of both professional and research experience. He is involved in research on urban transport; the water sector; and the private sector (Rio Grande do Sul, and management (Paraná and Bahia). Fred has worked as a consultant in the field of transport in Brasilia and as an assistant professor at the University of Parana in Brazil. He holds a bachelor’s degree in civil engineering from the Pontificia Universidad Salesiana and a master’s degree in transportation at the University of Brasilia, a doctorate in civil engineering from the University of Parana and a postdoctorate in urban logistics and humanitarian logistics from Kyoto University in Japan.

Keiichi Tamura
Chair | Technical Committee on Disaster Management, World Bank (DRM)

Keiichi Tamura is chair of the Technical Committee on Disaster Management, World Bank (DRM). He is a professor at the Toyohashi University of Technology, 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 Toyohashi University of Technology, where he had developed various specifications, standards, and guidelines related to highway bridges, geotechnical structures such as road embankments and retaining walls. Takeda’s extensive experience includes road and disaster management and developing technical tools in countries such as Brazil, Vietnam, Indonesia, and Nepal. He has been the head of a research project since 2013 while on leave from the Kyoto University for three years to work for the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). His current research interests cover various management techniques of infrastructure such as risk and asset management, and he coauthored two books on road disaster management techniques. From 2013 to 2014, he worked as a project manager of the Transportation Management Technology Institute 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 the Transportation Management Technology Institute 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 the Transportation Management Technology Institute 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 the Transportation Management Technology Institute 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 the Transportation Management Technology Institute in the Road Management Technology Center, Japan, as chief researcher, to develop road disaster management techniques.

Monique Cornish
Principal Advisor | Sustainability, Risk & Resilience

Monique Cornish specializes in corporate- and programme-level strategy development and the engineering of geohazard risk management, engineering geology, road disaster management, and comprehensive technical management.

Julie Rozenberg
Economist | GGSVP CE, World Bank

Julie Rozenberg is an economist with the Office of the Chief Economist for Asia Pacific at the World Bank. Julie holds a doctorate in Economics from the University of California, Berkeley. Prior to joining the World Bank, she worked for the National Science Foundation in the United States. She has worked as a consultant for the World Bank and the Asian Development Bank on various projects. She has also worked as a consultant for the United Nations Development Programme (UNDP) on various projects. She has also worked as a consultant for the United Nations Development Programme (UNDP) on various projects.

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 of transport and infrastructure 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 Ministry of Environment as well as by the Ministry of Education. He will be the president of the Japan Society of Civil Engineers in 2019. He is also a member of the editorial boards of several international journals including the American Journal of Civil Engineering, the Annals of Regional Science, the Journal of the 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 of the World Bank and a council of the Japan Society of Civil Engineers, and a council of the Japan Society of Civil Engineers. He is also a member of the Council of Japan, a committee of the World Bank and a council of the Japan Society of Civil Engineers. He is also a member of the Council of Japan, a committee of the World Bank and a council of the Japan Society of Civil Engineers. He is also a member of the Council of Japan, a committee of the World Bank and a council of the Japan Society of Civil Engineers.
ANNEX 2: EXPERT PROFILES

Kensuke Ichikawa
Senior Manager | International Consulting

Kensuke Ichikawa is a senior manager for international projects at the Japan International Cooperation Agency, the World Bank, and the United Nations. He has a master’s degree in engineering since he joined the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in 1997. After 14 years of experience there, he taught at the Interdisciplinary Information Studies, Graduate School of Interdisciplinary Information Studies, University of Tokyo, as an associate 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.

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, in 2010 and 2011, 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 areas of interest include asset investment, national resilience, global resources, risk and uncertainty, emergency management, advanced technologies, and natural hazards.

Kensuke Ichikawa
Manager | International Consulting Department, Kousai Kogyo Co. Ltd.

Kensuke Ichikawa is a senior geotechnical engineer with over 20 years of experience in a variety of geotechnical engineering works 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. He has a master’s degree in transport engineering and has specialized in water and disaster management since he joined the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in 1997. His career in Japan covers more than 10 engineering positions in the government, at the Interdisciplinary Information Studies, Graduate School of Interdisciplinary Information Studies, University of Tokyo, as an associate professor for three years. He has also worked at the Japan International Cooperation Agency and the World Bank.

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 dewatering, 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 developing as well as beginning research toward his doctorate. Stefan’s research topic is “Optimising the Waterproofness of Chipseal Surfacing,” 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 resistance to 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.

Osamu Uemura
Manager, Disaster & Risk Management Team, Operational Planning & Coordination Section, Operational Department

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 inspections, surveying, and management of expressways and experienced the Great East Japan Earthquake (March 11, 2011). Currently, he is responsible for DRM work, including liaising with the Ministry of the built environment under the headquarters of NEXCO-East.

Kazushige Endo
Deputy Director General | Internal Affairs, 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 Kyushu 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 the Interdisciplinary Information Studies, Graduate School of Interdisciplinary Information Studies, University of Tokyo, as an associate 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.

Juan Gaviria
Senior 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 projects in the Western Balkans, 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$55 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 experience in the private sector, working in strategic development, partnerships, and marketing covering Europe, Latin America, Central Asia, South Asia, and Africa. He has also experienced as chief operating officer of a medium-size global container shipping line, formulating and implementing new company strategy, carrying out organizational and cultural assessment, and developing regulatory strategy, value creation, integration management, and corporate development. He has a PhD in transport economics from the University of California, Berkeley.

Shanika Hettige
Consultant | GSURR, World Bank

Shanika Hettige joined the World Bank in 2014 as a senior transport economist and has contributed to the DRM practice by working on the Urban and Climate Change 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 communication, 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 design and implementation of hard and soft resilience measures. She has worked in 17 countries and resilience from the Harvard Global Resilience 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, Typhoon, which is an innovative pilot set up in 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 advisor 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 London School of Economics 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 2005 and has held appointments in Athens, Addis Ababa for three years, and now a further three years in the Caribbean region. She has worked on projects in the Middle East and Central Asia region. Before joining the World Bank, Fiona worked as a civil engineer and project manager, specializing in telecommunications and infrastructure. Her 30 years of work experience spans the World Bank and other development partners, road agencies, contractor work, and...
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Yohannes Yemane Kesete
Disaster Risk Management Specialist | GFSWR, World Bank
Yohannes Yemane Kesete is a civil engineer, with specialization in infrastructure and transportation systems. He has more than 10 years of both professional and research experience. He currently works in Latin America and the Caribbean region on infrastructure improvement projects. He also leads several technical assistance projects that aim to integrate natural disaster risk into 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 engineering and a master’s degree in urban regional planning and public policy.

Akiko Toya
Junior Professional Officer | GFDWR, World Bank
Akiko Toya is a junior professional officer who works on GFDWR’s technical assistance grant portfolio. She connects local and global urban 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 Pacific region, the Caribbean, 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 the South Asia and Central Asia regions of the World Bank, 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.

Luquan Tian
Senior Transport Specialist | Transport and ICT, World Bank
Luquan Tian specializes in transport infrastructure and planning, having joined 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 advance the World Bank’s work in Africa. He has also worked at several international organizations and local organizations in Afghanistan and abroad, such as the United Nations Children’s Fund (UNICEF), the Afghan Construction and Logistics Unit (ACL), the Construction Control Services Corporation (CCSC), the United Nations Drug Control Programme (UNDCP), the United Nations Office on Drugs and Crime (UNODC), the International Rescue Committee (IRC), and the International Relief and Development (IRD).

Noori Mohammad Salam
Senior Roads Design Engineer | THIRC, MPW, Kabul, Afghanistan
Noori Mohammad Salam works as a road design engineer with the Ministry of Public Works’ (MPW) Trans-Hindukush Road Connectivity Project (THIRC). Before joining the MPW, he worked as an 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 Nations Agency for International Development (USAID)-funded project located at the Blue Nile State and in Gulli. He studied engineering at Kabul University in Afghanistan. He has also worked for the United Nations Children’s Fund (UNICEF), the World Bank’s Transport and ICT unit, the United Nations Children’s Fund (UNICEF), and the Danish Committee for Aid toAfghan Refugees (DACAAR). He has also worked for the United Nations Children’s Fund (UNICEF), the World Bank’s Transport Unit, the United Nations Children’s Fund (UNICEF), and the Danish Committee for Aid to Afghan Refugees (DACAAR). He has also worked for the United Nations Children’s Fund (UNICEF), the World Bank’s Transport Unit, the United Nations Children’s Fund (UNICEF), and the Danish Committee for Aid to Afghan Refugees (DACAAR).

Veronica Raffo
Senior Infrastructure Specialist | Transport and ICT, World Bank
Veronica Raffo is a senior infrastructure specialist at the World Bank. She is responsible for advising on and communicating infrastructure 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 governments to integrate 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 Manvel, Farrell & Marial. She has also worked at the Economist Intelligence Unit as an intern. She has worked as an economist at the Economist Intelligence Unit as an intern. She has also worked at the Economist Intelligence Unit as an intern. She has also worked at the Economist Intelligence Unit as an intern. She has also worked at the Economist Intelligence Unit as an intern. She has also worked at the Economist Intelligence Unit as an intern. She has also worked at the Economist Intelligence Unit as an intern.
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 Albireu
General Manager | Valdial Nacional
Emma Albireu is a general manager of projects at Valdial Nacional, the National Roads Council, which is a part of Argentina’s Transportation Ministry. She also has held an executive director at the Highway Concession Control Body (El Órgano del Concello de Concesiones Viales, OCOCVI), an infrastructure coordinator for the Argentina Operations Center (AROC), and at the United Nations Office for Project Services (UNOPS).

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) 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.

Cameroon

Chain Manopinives
Infrastructure Specialist | Transport and ICT, World Bank
Chain Manopinives 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 partnership, 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 Vietnam.

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 planning, 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.

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 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 Tomás in Colombia.

Gia Sopadze
Head | Environmental Department, Road Department, Georgia
Gia Sopadze has been the 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 2011, 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

Vinay Kumar Kumar
Secretary | Rural Works Department, 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 director of the Animal Husbandry & Fish Resources. He holds a master’s degree in physics.

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 in India and other developing countries. He has also worked on community road projects and assignments in Afghanistan, China, Mongolia, Indonesia, Nepal, the Philippines, and Sri Lanka.

Czechia

Robert Mutyaba
Transport Specialist | Transport and ICT, World Bank
Robert Mutyaba is a transport specialist at the World Bank country office in Prague, focusing on transport projects in East Africa, and a program specialist focusing on road safety, transport policy, and urban transport projects in East Africa. He also focuses on 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 mobility 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.
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<tr>
<td><strong>Zhamshibek Kalilov</strong></td>
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**ANNEX 2: EXPERT PROFILES**

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**RECENT PUBLICATIONS**


**ANNEX 3: EXPERT PROFILES**

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transport projects for the Philippine Republic's Department of the Interior and Local Government. In her 20 years with the Philippine Republic’s Department of the Interior and Local Government (DILG), she has worked around the world on post-disaster projects and information management. She is particularly interested in civil engineering from the Civil Engineering Department of the University of Novi Sad in Serbia.

**Shyamalee Karunasekera**

Senior Infrastructure Specialist | Transport and ICT, World Bank

Shyamalee Karunasekera leads the Road Development Authority of Sri Lanka. She is also responsible for traffic in 2011. He holds a degree in civil engineering from the Civil Engineering Department of the University of Novi Sad in Serbia.

**Amali Rajapaksa**

Senior Infrastructure Specialist | Transport and ICT, World Bank

Amali Rajapaksa leads the dialogue on public private partnerships (PPP) and manages the transport portfolio. She joined the World Bank in 2003 as an infrastructure specialist managing the World Bank’s portfolio in energy, water and in Sri Lanka. She has contributed greatly to the growth of the transport sector 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.

**Nimai Chandrasiri**

Additional Director General (Construction Design) | Road Development Authority

Nimai Chandrasiri 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 positioning systems (GPS), as well as raised project management standards. 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 Technology in the Philippines.

**Aidai Bayalieva**

Transport Specialist | Transport and ICT, World Bank

Aidai Bayalieva works on transport programs in the Kyrgyz Republic and 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 and disaster risk governance at the sub-national levels. This includes risk information financing windows.

**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 development from the World Maritime University in Sweden.
Contact

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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.