SECOND TECHNICAL KNOWLEDGE EXCHANGE ON RESILIENT TRANSPORT SUMMARY REPORT
This Technical Knowledge Exchange (TKX) was organized by the Global Facility for Disaster Reduction and Recovery (GFDRR) and the World Bank’s Resilient Transport Community of Practice (CoP) and Green Transport CoP, in partnership with the government of Serbia. The TKX also benefited greatly from contributions by the following: World Bank Serbia Country Office, Faculty of Mining and Geology at University of Belgrade, Arup, and IMC Worldwide.
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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We thank the participating officials and project task teams for their presentations, active involvement, and knowledge sharing.
EXECUTIVE SUMMARY

O VER the next 20 years, humans will build more infrastructure than has been built over the last 2,000 years. While transportation infrastructure represents a significant public and private investment that is fundamental to the functioning and development of our economies and societies, these investments are increasingly exposed to disaster and climate hazards, including landslides, flooding, and earthquakes.

Our ever-changing world urges a shift away from traditional reactive approaches since we are living through a rare opportunity to lock in either resilience or risk in many fast-growing parts of the globe. Proactive methodologies, based on a multidimensional disaster risk management approach that incorporates people, the environment, hydrology, and geology need to be nurtured, in order to provide for resilient transport infrastructure. It is estimated that such an approach can result in 60–70 percent life cycle cost savings, reductions in economic losses and improvements to the resilience of people and assets.

On January 22–26, 2018, building on the first Resilient Transport Technical Knowledge Exchange (TKX) that took place in Tokyo in May 2017, the second Resilient Transport TKX was organized in Belgrade, Serbia, in partnership with the Belgrade country office, World Bank’s Resilient Transport Community of Practice (CoP) and Green Transport CoP, and GFDRR. With the objective of further building the resilient transport community to influence Bank Technical Assistance (TA) and operations, 11 country delegations and a total of 65 participants attended the workshop. The exchange drew upon Serbia’s experience 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 Serbia’s challenges and successes with large-scale disasters. The Task teams and clients conducting climate vulnerability analysis for the transport sector funded by GFDRR showcased the outcomes of their work and lessons learned at this event. One key lesson was that institutional and regulatory support through strong leadership in implementing resilience measures is critical to approach resilient transport in a holistic way.
A week-long innovative learning exchange was structured around key practical themes:

1. Climate Science
2. Resilient Transport Design
3. Geohazards and Landslides
4. Co-Benefits and Adaptation Strategies for Roads
5. Economic Appraisal of Resilience Interventions
6. Road Maintenance as an Adaptive Response

**Key Takeaways**

**WHILE** the concept of resilience is increasingly being embraced in the transport sector, resilience is not only about an extra cost and effort added at the engineering and design phase, but rather an important consideration at the systems and planning, O&M, and contingency and response phases. As the life cycle approach (Figure 1) shows, a holistic approach covering all aspects of transport asset management is essential for integrating climate and disaster resilient transport interventions into decision making and implementation. Actions, for example, could involve mapping hazards, identifying highly vulnerable assets, understanding the magnitude of the consequences of asset failure, planning to prevent disruptions rather than only reacting after disasters, and building back better after events.

**COMPARE**d with traditional reactive approaches, proactive and adaptive investments in collecting accurate risk data, including hazards, and economic and social vulnerability, identifying priority interventions and implementing disaster mitigation measures can result in 60–70 percent life cycle cost savings and increase the resilience of people and assets. 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.

**PARTICIPANTS** emphasized the importance of cross-sector and cross-line ministries’ collaboration through further enhancing capacity building of stakeholders, training and site visits, and promoting well-coordinated, long-lasting, and effective resilient transport planning. Legal and regulatory frameworks that define clear responsibilities and roles of different stakeholders, such as governments, municipalities, media, and the private sector, are required to effectively centralize available risk data, implement effective decision-making processes, and achieve a comprehensive disaster risk management (DRM) approach for resilient transport.

**THE** Resilient Transport CoP identified the urgent need to invest more in knowledge management given the increasing demand from the World Bank teams and clients to mainstream resilience in the transport sector. The CoP will establish a technical expert team to further advance this agenda and convene knowledge exchange events to share the best practices globally.
Background on the Resilient Transport CoP

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 (GFDRR), Social, Urban, Rural, and Resilience Global Practice (GPSURR), and Transport and Digital Development GP (T&DD 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 of 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.
BUILDING on the first Resilient Transport Technical Knowledge Exchange (TKX) in Tokyo where the Resilient Transport CoP was officially launched, the World Bank’s Resilient Transport CoP reiterated the need of further building the resilient transport community to influence the Bank’s technical assistances and operations because more resilient transport infrastructure helps avert asset and well-being losses from natural disasters and climate change impacts. In addition, such efforts can reduce required investments in reconstruction and rehabilitation funds, and saved resources can be invested back into transport asset management systems for further improving maintenance and minimizing impacts from future events.

Given this context, the Resilient Transport CoP will seek to accomplish the following objectives that should enable scaling up and systematization of global engagements:

1. Define key areas where technical assistance interventions can mainstream resilience across the life cycle of infrastructure from systems and planning to engineering and design, then to asset management and finally to contingency and response.
2. Build an informal community of practice to deepen technical knowledge and establish the best practices based on inputs from transport and DRM experts.
3. Support an external effort to convene and engage donors, bilaterals, and other partners that could provide support to deliver technical assistance.
4. Define operational approaches to identify new projects and investments that have material impact beyond technical assistance for more transformative operations.

Serbia’s Experience in Transport DRM

In May 2014, Serbia was affected by the most severe flooding in 120 years. The disaster affected more than 1.6 million people (22 percent of the total population) in 38 municipalities in central and western Serbia. This caused significant economic hardship and disproportionately affected the poor and vulnerable. Mr. Miodrag Poledica, State Secretary, Ministry of Construction, Transport and Infrastructure, and Mr. Marko Blagojevic, Acting Director, Public Investment Management Office, highlighted the government’s strong efforts in improving and addressing disaster risk management (DRM) systematically for multiple hazards in Serbia after the floods when it developed and approved the National Disaster Risk Management Program (NDRMP) in December 2014.

The NDRMP helps mobilize international donor funding, facilitate coordination across donors and key stakeholders, and ensure that financing will be directed to prioritized investments by comprehensively covering various aspects of DRM. These aspects include: (i) institutional strengthening; (ii) risk identification and monitoring; (iii) structural and nonstructural risk reduction measures; (iv) preparedness and early warning; (v) disaster risk financing and insurance solutions; and (vi) recovery planning. Serbia’s experience emphasized the urgent need for the following activities:

•• Shifting focus over time from flood prevention and recovery to multi-hazard risk management at both the local and national levels.
•• Expanding DRM approaches to selected sectors such as transport and urban planning for improved resilience.
•• Strengthening financial protection mechanisms to protect against fiscal shocks of natural hazards (CAT DDO)
•• Mitigating the impact of climate change and making the economy more disaster resilient.
•• Managing and implementing the NDRMP through supporting regional initiatives on risk assessment, resilient planning, preparedness, and response.
Connectivity is a critical driver of competitiveness, and the quality of infrastructure networks is a crucial factor for Serbia to shift the economy toward export orientation. However, Serbia's transport infrastructure is exposed to various natural hazards, and the two most extreme climate and weather episodes were the drought in 2012 and the floods in 2014. Total damage caused by extreme climate and weather conditions, since 2000, exceeds 5 billion EUR.

Ms. Vukanovic shared the World Bank Transport team's work on mainstreaming climate resilience in the road sector through interventions and policy support by providing diagnostics of the current framework and identifying the areas of improvements with pilot testing of the Geohazard Risk Management Handbook and Toolkit. The preliminary analysis from the Handbook testing suggests that there is no established methodology for systematic management of the network vulnerability in Serbia. In particular:

- Climate resilience is considered only on an ad-hoc basis and is usually driven by the expert knowledge of a few employees from operators of infrastructure.
- There is no clear regulation governing how the investments in potentially critical locations should be planned or financed.
- While design legislation and guidelines for geohazards in the road network have been defined as sufficient and recently strengthened to comply with the European standards, insufficient funding limits their application considerably and results in insufficient instrumentation and geotechnical designs.

With additional technical assistance funded by GFDRR, the team is assisting the government in establishing a foundation for mainstreaming climate resilience considerations in the road transport sector by assessing vulnerability of the road transport network to the climate-related risks, improving capacities of key stakeholders in road network resilience planning, and setting the path for development of structured and systematic response plans.
The procedure for landslide hazard vulnerability assessment on the Valjevo road network test area and results of road vulnerability analysis from landslides were presented to explain phenomenology of landslide processes, their varieties (rock falls, debris flows, mud flows, and landslides) and risks on the transport network. To effectively conduct climate change and natural hazard road network vulnerability assessment, Ms. Abolmasov explained the following steps: (i) review the current state of affairs and data availability, (ii) review international methodologies, (iii) identify and rank geographical areas with high hazard and risk exposure, (iv) assess the likely risk impacts for all major road links and the effect of the loss of connectivity and access in priority areas, and (v) develop a list for priority interventions based on vulnerability and critical criteria.

She highlighted the importance of having guidelines for effective vulnerability assessment including key questions such as: What parts of the road network cross areas with high climate related hazard(s)? What is the relative level of risk for the road network? What kind of socioeconomic impacts could be generated in the case of hazardous events on particular road(s)? How to prioritize critical road interventions for investment (both in the current climate conditions and related hazards and for future climate change projections), and How to develop estimated budgets prioritizing mitigation and adaptive measures with respect to climate and natural hazard events.

As part of the ongoing project to define guidelines for mainstreaming climate change resilience into the management of Serbia’s road network, a criticality analysis has been undertaken. The objective was to identify the most critical links within the Valjevo pilot area. Mr. Reeves presented the methodology that has been used to complete this criticality analysis, which incorporates a range of socioeconomic data related to population, the locations of key social infrastructure, and measures of criticality, including overall traffic intensity and the effects of dislocation in terms of extended journey distances that result from the need to use alternative routes. The methodology a Multi-Criteria Analysis (MCA) to identify a criticality index for each road section in the pilot area network. Lastly, he discussed the requirements and limitations of the methodology in how to deal with situations where data availability is limited.
While assessments of climate change impacts and resilience measures have been discussed and implemented by engineering and design teams, Ms. Pina highlighted the challenges of utilizing various data for a robust climate change vulnerability assessment of people, buildings, and infrastructure. She also emphasized the need for developing adaptation and resilience measures to reduce risks through a strategic approach by informing and influencing government policies and practices, focusing on proper urban development. To deal with uncertainty and ensure resilience, she explained the following approaches: (i) no regret actions are cost effective under current climate conditions and under future climate projections, (ii) low regret actions are relatively low cost and provide relatively large benefits under a range of projected changes, (iii) win-win actions increase resilience while also having other social, economic, and environmental benefits, (iv) flexible actions that can deal with uncertainties in climate change projections, and (v) adaptive management structure and iterative approach to improve actions through monitoring, modelling, and assessing.

Resilient infrastructure is essential for the safety, well-being, sustainability, and economic prosperity of cities. The forthcoming World Bank’s publication ‘Urban Rail Design Guidebook’ will provide high-level guidance to decision makers and practitioners throughout the urban rail project life cycle, to support decision making that will enhance resilience. Ms. Carluccio presented the principles and strategies for enhancing resilience of rail projects to climate and natural hazards by reiterating the need for cross-sector collaboration considering city’s interconnected system-of-systems based infrastructure by enhancing institutional and stakeholder coordination. One of the key takeaways was that resilience thinking should extend beyond specific climate-related and other natural hazards to encompass the ability of urban rail systems, and the cities within which they operate, to prepare and plan for, absorb, recover from, or adapt to any adverse events during the system’s operational life. International experience suggests that investment in measures that enhance the resilience of urban rail systems pays off in the face of hazards and can enhance efficiency and safety of the rail system during normal operations.
Modern building codes do not solely focus on earthquake resilience—the ability of an organization or community to quickly recover after a future earthquake. Resilience-based guidelines and criteria were created based on lessons learned from past earthquakes, by identifying limitations in the traditional code approach, by adopting some codified criteria for essential facilities, and by adopting non-codified best-practice approaches. This single integrated and actionable framework aims to help owners, engineers, and architects achieve ‘beyond-code’ resilience objectives. To qualify for a REDi™ rating, people have to satisfy the mandatory requirements for that rating in each of three Resilience Design and Planning categories, and select appropriate non-mandatory recommendations to help achieve the desired Resilience Objectives. **FIGURE 7** REDi™ outlines a resilience-based design approach which includes design and planning criteria in each of three categories:

- Building resilience can be achieved by reducing earthquake demands on the building and/or increasing the capacity of building components, including architectural components, to accommodate the demands with only minor damage—this is one of the key components of resilience-based earthquake design, and it encourages innovative design approaches and systems.
- Organizational resilience can be achieved by contingency planning for utility disruption and business continuity.
- Ambient resilience can be achieved by reducing the risk that threats outside the building envelope, such as adjacent collapse-prone buildings and high liquefaction risks, would restrict site access or otherwise hinder functionality.

The tool includes a detailed checklist to ensure proper organizational planning for resilient construction and operation of buildings and related assets, as well as a quantitative evaluation of the physical facility using fragility data and quantified hazard statistics based on location. The outputs are projected losses as a result of defined threat and calculated downtime to return the asset to a functional state based on repair requirements.

**SESSION**

**GEOHAZARDS AND LANDSLIDES**

**Geohazard Handbook**

**MS. YUKA Makino, Senior Natural Resources Management Specialist and DRM Officer, World Bank**

Geohazards do not need to become disasters, if: (a) hazards are understood and anticipated; (b) exposure and vulnerabilities are reduced, and (c) resilience capacities are enhanced. Road transport networks need to be proactively managed, monitored, and maintained to maximize their disaster resilience. Disaster risk management is about understanding how an extreme natural event affects people; how vulnerable people react to natural hazards; to what extent communities can cope with emergencies and disasters, and how the responsible organizations can take preventive, mitigation, and preparedness measures to face natural hazards now and in the future. Ms. Makino explained that the geohazard risk management process is an essential series of steps to guide the development of key management and technical processes.

<table>
<thead>
<tr>
<th>Stages of Road Management</th>
<th>Institutional Setup</th>
<th>Road Geohazard Risk Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-concept</td>
<td>1. Geohazard and disaster risk assessment, including hazard, exposure, and vulnerability assessment</td>
<td>New Road: Geohazard risk evaluation of geohazard</td>
</tr>
<tr>
<td>Concept</td>
<td>2. Assessment, identification, and prioritization of geohazard risk reduction measures</td>
<td>Existing Road: Geohazard Risk Management</td>
</tr>
<tr>
<td>Design and Construction</td>
<td>3. Development of a geohazard risk management plan, factoring in sources of funding</td>
<td>Structural measures Design and Construction</td>
</tr>
<tr>
<td>Operation and Maintainace</td>
<td>4. Institutional collaboration and regulatory mechanism for the effective implementation of the plan</td>
<td>Non structural measures: Maintenance Monitoring Emergency preparedness and response plan Institutional coordination Road disaster awareness raising</td>
</tr>
<tr>
<td></td>
<td>5. Regular and consistent monitoring, maintenance, and evaluation</td>
<td>Post-disaster: Emergency inspection or post-disaster need assessment Emergency traffic regulation and public notice Reconstruction</td>
</tr>
</tbody>
</table>

**FIGURE 8**

Framework for Road Geohazard Risk Management
Source: Adapted from Yuka Makino’s Presentation.
Tajikistan WB Project Tool

Mr. Yannis Fourniadis, Chartered Geologist and Specialist, Arup

Tajikistan is located within a mountainous region with a large number of glaciers and mountain rivers. The country is prone to numerous natural hazards, including floods, earthquakes, and landslides. Tajikistan also has high vulnerability to climate change-related hazards. Mr. Fourniadis shared an approach for a World Bank-funded natural hazard assessment project implemented by the team comprised of University of Zurich and Tajik experts. Hazard assessments for flooding, landslides, and earthquakes were undertaken for 25 critical bridges and flood protection infrastructure sites that are proposed for rehabilitation and reconstruction. Historical data were collected for the entire region and Global Climate Model (GCM) data were obtained looking at the change in mean and variance of climate variables (namely temperature and precipitation). Then, a mathematical model was implemented to apply the GCM results to the observed weather data. This approach produced a time series of “future weather data”.

This type of analysis helped the local stakeholders effectively conduct natural hazard assessment and manage reconstruction of transport infrastructure by building back better.

Resilience of Geotechnical Assets to Severe Weather—Vulnerability Framework to Categorize Assets and Prioritize Interventions Pre- and Post-Weather Events

Ms. Savina Carluccio, Chartered Civil Engineer, Arup

A resilient transport system is essential to a functioning society as it supports economic growth by connecting people and goods. However, 100 percent physical resilience to all hazards would be impractical. Hence, there is a need for proactive resilience planning and management because such a proactive approach can achieve smarter use of asset information for decision making and resilience planning and efficiency savings on whole-life costs due to proportionate interventions.

Ms. Carluccio shared two case studies for the resilience of geotechnical assets: the main transport asset owners in the U.K., Highways England and Network Rail. The Highways England case study presented a high-level framework for resilience management with a focus on identification and management of ground-related hazards. The Network Rail case study showcased an example of how advanced data analytics can now support enhanced decision making through establishing operational warning thresholds in case of adverse and extreme weather. She concluded by emphasizing that resilience is managed through a combination of preventative design, proactive risk mitigation, event readiness, and operational preparedness.
**SESSION**

**PRACTICAL APPROACHES 1**

**Optimizing Road Infrastructure for Beneficial Water Management and Resilience under Climate Change**

**MR. FRANK van Steenbergen, Consultant, World Bank**

Roads and water are often seen as enemies: water is the major cause of damage to road infrastructure, but roads are also a major cause of local flooding, erosion, and sedimentation (typically 15–40 percent in a catchment) and as such a major contributor to watershed degradation. Roads have a major imprint on surface hydrology, and this can be used to manage water by making use of road infrastructure as protection (channeling road drainage to storage or recharge areas) or by adjusting the design of roads to better manage watersheds and to harvest water. Embanked roads used as flood and/or coastal protection measures, retention basins, and rainwater storage facilities stored alongside and under roads (i.e., green streets, linear rain gardens, permeable pavements, etc.) are examples of multipurpose infrastructure that serve both transport and disaster risk management needs. Combining efforts offers opportunities to reduce total costs, combine funds, and address issues across sectors in ways that are ultimately more effective and efficient. This approach will create a triple win: less road damage and downtime, less erosion and flooding, and the beneficial use of water. This ‘roads for water’ movement has already started in ten countries (www.roadsforwater.org).

**USE OF GIS and Remote Sensing Technologies, Geotechnical DataBase Management:** Mr. Yannis Fourniadis, Chartered Geologist and Specialist, Arup

Digital technologies can improve the accuracy and cost-effectiveness of geohazard assessment. For instance, remote sensing consisting of earth observations made from space and aircrafts can help monitor geohazards, and improve our understanding of geohazard mechanics and evolution. Also, geohazard database management comprises software systems that can let us gather, manage, and report geotechnical data efficiently and according to the needs of different users. Mr. Fourniadis highlighted that utilizing Geographic Information Systems (GIS), remote sensing, and geotechnical database management in a geohazard assessment and management project can lead to greater efficiency and cost savings, improved, more transparent decision making, and improved communication. However, there are some barriers to adoption of such digital technologies due to lack of trained experts and institutional inertia to commit to an open, transparent, and inclusive data management system because of ownership and data control issues.

**SESSION**

**RESILIENCE FINANCING AND ECONOMIC APPRAISAL**

**Resilience Financing Mechanisms**

**MS. YANA Waldman, Senior Consultant, Arup**

Repair costs and the cost of lost business opportunities collectively increase as a result of compounding natural disasters and increased economic development. In 2017, the major credit rating agencies began dropping the credit scores of countries and municipalities with an elevated risk of climate impact, damaging their assets. Resilience financing includes funding resilience development, providing post-disaster financial relief, allocating ownership of risk, and creating incentives for resilience. While there are some barriers to financing resilient infrastructure due to difficulties in capturing and monetizing resilience value, Ms. Waldman emphasized that development of business case models identifying unique funding sources best suited for projects in each dimension of resilience and a value for money exercise are keys to determine what scale of revenue is possible for resilient funding and financing.
Economic Appraisal of Resilience Interventions—Serbia, Caribbean and Pacific

Mr. James Reeves, Senior Technical Director, IMC Worldwide

Mr. Reeves described the various difficulties of feasibility studies to assess interventions to strengthen resilience of transport infrastructure by assessing the costs of different events in terms of damage to infrastructure, socio-economic costs, and the costs of emergency response. He discussed the key issues including the need for risk-based appraisal techniques and how these can be incorporated into an overall appraisal, difficulties in assessing the probabilities of future events, and how to present the results of this kind of analysis to decision makers. The focus of this discussion was around data availability and how to deal with data gaps, and the difficulties in trying to mechanize these processes due to the fact that every country and every situation is unique. He concluded the session by raising a number of general issues around economic appraisal that still need to be resolved, including how to monetize the value attached to the maintenance of remote communities, how decision makers should balance infrequent long closures and frequent short closures, and how to appraise situations where no intervention is the most viable option or there is no political will to commit to the interventions.

DFID Briefing Notes on Climate Resilient Infrastructure

Ms. Maria Sunyer Pina, Climate Change Adaptation Consultant, Arup

The Infrastructure and Cities for Economic Development (ICED) is looking to deepen the public understanding and knowledge on climate-smart infrastructure, with the aim to build understanding and enhance the practice of Department for International Development (DFID) advisers across all cadres and countries. Ms. Pina shared practical application of industry knowledge to programs based on the review of key questions and gaps in the methodology and in embedding climate resilience in program design. Three key drivers are: (i) “Must Do” through developing legislation, policy frameworks, and funding requirements, (ii) “Should Do” through promoting awareness of climate risks, ‘peer pressure’, and competitive advantages, and (iii) “Could Do” through enhancing foresight and innovation, and enlightened self-interest. Examples for the “Must Do” driver includes making climate change adaptation and resilience assessments as part of the Environmental Impact Assessment for infrastructure projects.
Role of Road Asset Management in Emergency Response

Mr. Ian Greenwood, Consultant, World Bank

Mr. Greenwood presented the role of Road Asset Management (RAM) emergency response with a key focus on the operational and maintenance tasks, funding, and service delivery models. It was also noted that the presence of non-road assets within the carriageway (e.g., water, power, and other utilities—often privately owned) can dramatically increase the time needed to make permanent repairs to the road assets following an emergency. To make operations and maintenance more effective in times of emergencies, there must be a clearly understood priority of routes to get open based on criticality to society. Critical ‘lifelines’ should be defined well ahead of the emergency event and incorporated into all other aspects of RAM. Based on previous emergency events (especially flooding), proactive routine maintenance of known trouble spots should be undertaken to lessen the impacts. Mr. Greenwood also showed how parts of the Auckland (New Zealand) motorway network go under water in exceptionally high tides, the emergency was managed through soft measures such as media campaigns and operational activities—rather than through hard measures such as investing heavily in infrastructure. With regard to funding, it is imperative that there is an understanding of how emergency works will be funded—insurance, disaster funds, or others. While the private sector is just as capable as the public sector in responding to emergency events, contractual arrangements need to be in place ahead of the events to enable the private sector to be agile and responsive. While the major works might only impact on a small portion of roads in a region, it is important that the scope of the contract permits the contractor to be deployed to any road in the region during an emergency event because payment is typically on a provisional sum basis.

Developing Asset Lifecycle Strategies

1. What has to be done?
2. How will it be paid for?
3. How will it be done?

Asset Management Enablers
- Asset Management Teams
- Asset Management Plans
- Information Systems & Tools
- Asset Management Service Delivery
- Quality Management
- Continuous Improvement
- Capital Works Strategies and Plans
- Maintenance Strategies and Plans
- Operational Strategies and Plans

Develop the AIP Policy
Define Levels of Service and Performance
Forecast Future Demand
Understanding and Define Requirements
Identify Asset & Business Risks

FIGURE 12
Road Asset Management Framework from the International Infrastructure Management Manual Source: Adapted from Ian Greenwood’s presentation.

SESSION
PRACTICAL APPROACHES 2
Performance-Based Contracting (PBC) Responses to Climate Change

Ms. Yana Waldman, Senior Consultant, Arup

Climate change presents serious challenges to maintenance and operations and long-term viability of roadway assets since historic data do not reliably represent future climate, which affects the economic and social benefits of a project. Therefore, integrating climate risk into Performance-Based Contracting (PBC) by defining and scoping risks from a contractual perspective, and enhancing performance-based contracting (PBC) is essential. Examples of such enhancement include:

- Incorporating climate risks into PBC contracts to incentivize resilience and reduce exposure to climate impacts.
- Developing Climate Change Adaptation Strategies (CCAS) to mitigate impacts with PBC strategies.
- Aligning PBC with Risk Management (RM) to comprehensively address climate risks.

FIGURE 13
Stakeholder Engagement and Challenges Source: Adapted from Yana Waldman’s presentation.

<table>
<thead>
<tr>
<th>PARTY</th>
<th>TAKEAWAYS</th>
</tr>
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<tbody>
<tr>
<td>Contractors/Developers</td>
<td>The costs associated with recovering from climate shocks and stressors will impact project profit.</td>
</tr>
<tr>
<td></td>
<td>Uncertainty around climate risk could dissuade contractors and/or lead to increases in price to buffer the climate risk contingency.</td>
</tr>
<tr>
<td></td>
<td>Responsibility for maintenance of the mitigation facilities provides one mechanism for control.</td>
</tr>
<tr>
<td></td>
<td>The definition of force majeure will likely need to evolve with respect to climate change.</td>
</tr>
<tr>
<td>Owners/Client Countries</td>
<td>When the contingency budgets for storm repairs, increased drainage maintenance, and unforeseen conditions have been exceeded, the regional government and asset owners are hit with additional service requests.</td>
</tr>
<tr>
<td></td>
<td>Threats posed by off-site causes such as poor land use planning, agriculture, and logging are hard to manage.</td>
</tr>
<tr>
<td>Funders/Investors</td>
<td>Duration of investment terms need to be extended.</td>
</tr>
<tr>
<td></td>
<td>Contractual language should be augmented to incentivize resilience planning by developers.</td>
</tr>
<tr>
<td>Communities</td>
<td>Local involvement in project development, execution, and transition of ownership is vital to ensuring the ongoing feasibility of investments.</td>
</tr>
<tr>
<td></td>
<td>Project evaluation should consider the economic impact of roadways on local communities from both the positive perspective of increased commerce and the negative perspective of business continuity downtime associated with reduced availability.</td>
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<td>Insurers</td>
<td>As providers increasingly experience claims as a result of intensifying climatic events, they will need to balance these with higher premiums.</td>
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<td>Many countries without insurance markets lack coverage and are forced to self-insure with rainy day funds or turn to government bailout options.</td>
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</table>
perspective helps define and clarify transparency of risk ownership throughout the life cycle of roadway assets to ensure proper protection of investment. This approach may also reduce the volume of transportation downtime which often results in financial losses associated with recovering from climate-related shocks and stresses. Based on some studies conducted by Arup, Ms. Waldman pointed out that the procurement process does not easily provide a vehicle for climate change adaptation requirements due to challenges and lack of incentives and defined roles among stakeholders. FIGURE 13

In addition, risk allocation within operations contracts is toggled from contractors to government parties solely through force majeure and unforeseen conditions terminology that defines these events, using generic language unspecific to an event scale. She suggested utilizing assessment tools in order to systematically identify Key Performance Indicators (KPI) as critical to assist government organizations and infrastructure investors with capitalizing on the value capture of avoided risk associated with resilience planning.

While systematic knowledge on roadside planting is currently limited, Mr. Steenbergen emphasized potential contributions of roadside tree planting on the reduction of dust by removing dust and other pollutants from the air and protecting crops and roadside communities. In addition, roadside tree planting can sequester carbon, reduce soil erosion by holding soils together and creating productive assets, and act as flood control by slowing and absorbing road runoff. In order to effectively utilize roadside planting methods, the right selection of trees, the right porosity of the hedges, and observing road safety and visibility standards are required.

FIGURE 15

Planning Roadside Plantations Safety Considerations
Source: Adapted from Frank van Steenbergen’s presentation.
Road Maintenance as an Adaptive Response

Mr. Ian Greenwood, Consultant, World Bank

Based on the 2017 World Bank report ‘Integrating Climate Change into Road Asset Management’ co-authored by himself, Mr. Greenwood explained what additional activities are needed to be undertaken at each stage of the RAM cycle to ensure climate change is appropriately incorporated. He reiterated that climate change is not a separate task, but rather a task that should be fully integrated into everyday RAM activities—from a high-level policy, through to data collection, risk management, and life cycle decision making. A key focus of the presentation was on the need to have a clearly defined service level that defines the level of resilience that is to be provided on each road (or road class). Without these service levels, it is difficult to define and implement ‘climate resilience.’ While the RAM process might be consistent between developed and developing nations, the service levels might vary significantly due to the operational and maintenance cost and capacity of implementers. Data collection was emphasized as being essential to develop a full understanding of climate impacts—including simple records of the size, location, and duration of events (flooding, landslides, etc). The data are important for the development of risk registers and risk allocation within road maintenance contracts, along with calibrating predictive models. Finally, the presentation clarified what actions need to occur before, during, and after disasters, with the majority of actions needing to be undertaken prior to the event.

FIGURE 16
Effects of Climate Change and Road Asset Management Framework
Source: Adapted from Ian Greenwood’s presentation.
Mainstreaming Climate Resilience in Road Transport Management: Valjevo Pilot Testing

In May 2014, the cyclone Tamara swept through the Western Balkans, resulting in extreme precipitation over a short period, which caused flash floods, flooding, and massive landslides in the western parts of Serbia. The highest 48 hour rainfall was registered at the Loznica and Valjevo cities, which corresponds to an extreme rainfall that statistically occurs once in 1,000 years. The following flood events and landslides were triggered instantly, and many of the locations in the Valjevo area were affected by flow-type landslides, which had never previously been reported.

Participants visited municipalities severely affected by the floods in 2014 to see rehabilitation work and various interventions implemented by the World Bank. Participants also learned the steps of the World Bank financed technical assistance which aims to mainstream a climate resilience-led approach in the national management of road transport by developing an effective vulnerability assessment methodology to analyze the risk of Serbia’s road network assets to climatic events.

Valjevo Pilot Testing has been implemented through the following steps:

1. Collect and review road network (200 km) data in the Valjevo pilot area
2. Collect and review climate related hazards data in the Valjevo pilot area (900 km²)
3. Collect and review social and economic data for the Valjevo pilot area
4. Collect and review climatological data for the Valjevo pilot area
5. Conduct risk assessment for the road network in the Valjevo pilot area
6. Identify priority interventions

A participatory approach was also used to consult regional and national key stakeholders to draw on local knowledge and identify priority areas of interventions.

SITE VISITS

Valjevo Road Vulnerability Map
Source: Adapted from Biljana Abolmasov’s presentation.
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. Consisting of four components of the life cycle approach, participating countries reconfirmed the importance of addressing country-specific needs assessments and transition plans, implementation of resilience measures and transport asset management systems, avenues for local capacity building and knowledge exchange, and fundraising and reassessing capital needs for continued enhancement of transport systems resilience.

OUTCOMES AND CONCLUSIONS

Systems Planning and Solutions Identified by the Workshop Participants
- Infrastructure is built in highly hazard-prone areas
- Risk assessments are not properly used in the planning of infrastructure systems and networks. Infrastructure systems planning does not properly address connectivity (redundancy) and continuity options in case of disaster
- Collect risk data including hazards, social, and economic vulnerability, and new or existing road networks
- Identify hot spots based on collected risk data, map hazards, and various risk data
- Establish prioritization criteria for priority interventions
- Define resilience targets to establish effective M&E (Monitoring and Evaluation) system and implement value engineering
- Implement effective and inclusive land use planning
- Define critical infrastructure including routes, utilities, and social infrastructure such as hospitals, schools, shelters

Engineering and Design Solutions Identified by the Workshop Participants
- Geotechnical, hydrometeorological, and other studies carried out prior to design and construction often do not include climate change risks
- Design codes, data, and standards are not updated or recalibrated to reflect changing average and extreme conditions
- Infrastructure is not designed for safe failure
- Tools needed to address these vulnerabilities
- Limited industry capacity to recognize hazards and climate change risks, which in turn will exacerbate losses in the transport network, that would then negatively impact mobility, and economic activities
- Climate resilient infrastructure can have high upfront costs, especially in the case of retrofitting
- Develop climate adaptive design standard by upgrading design standards and specifications.
- Combine cyclone shelter and net lowing multi-standard-stored warehousing/rigid pavement
- Expand use of bank protection and storm shelter with innovative bank protection, riverside measures
- Use innovative materials to strengthen the resilience of infrastructure systems
- Mandate the need of performing hazard and infrastructure-level vulnerability assessments.
- For areas affected by disasters, implement “Build Back Better” approach based on lessons learned
- Conduct technical audit with tools and guidance notes

Institutional Capacity and Coordination Challenges and Solutions Identified by the Workshop Participants
- Policy and planning related to transport development don’t address disaster and climate risks
- Develop integrated government-wide objective setting and results monitoring for climate resilience to provide the required focus and incentives during implementation
- Implement alternative coordination mechanisms to facilitate cooperation across institutional mandates
- Balance capacity building with capacity supplementation to ensure long-term sustainability of management systems

INSTITUTIONAL CAPACITY AND COORDINATION
CHALLENGES AND SOLUTIONS IDENTIFIED BY THE WORKSHOP PARTICIPANTS
- Policy and planning related to transport development don’t address disaster and climate risks
- Develop integrated government-wide objective setting and results monitoring for climate resilience to provide the required focus and incentives during implementation
- Implement alternative coordination mechanisms to facilitate cooperation across institutional mandates
- Balance capacity building with capacity supplementation to ensure long-term sustainability of management systems
OPERATIONS AND MAINTENANCE
CHALLENGES AND SOLUTIONS IDENTIFIED BY THE WORKSHOP PARTICIPANTS

- Lack of updated and easily accessible asset management system in place
- Lack of funding and political will for maintenance of infrastructure and supporting its resilience
- Infrastructure is poorly maintained making it more likely to fail

- Establish RAMS, procedure, and data collection
- Make annual plans and strategies based on needs identified through inspections
- Improve capacity of service providers and awareness of users on how to best manage transport interruptions by providing certification of maintenance to trained workers
- Encourage innovative use of equipment for monitoring automation, GIS based technology
- Redesign O&M concentrate by integrating performance parameters and risk elements related to climate adaptation
- Enforce implementation of early warning systems based on river information system
- Explore innovative contracting for disaster management
- Explore “commerce use alternatives” for disaster management shelter
- Create “disaster management fund” from river tourism/cruise levy
- Improve institutional, financial, and contractual arrangements for infrastructure maintenance
- Mobilize local communities in operations and maintenance of road assets using a gender inclusive approach

CONTINGENCY PROGRAMMING
CHALLENGES AND SOLUTIONS IDENTIFIED BY THE WORKSHOP PARTICIPANTS

- Disaster recovery process and protocols are needed
- Poor financial planning to allow for rapid recovery/reconstruction post-disaster
- Poor understanding of systems functioning in the aftermath of a disaster or partial/total failure, and its socioeconomic consequences

- Invest in safe hubs such as churches and schools so that these facilities can act as shelter in the case of emergency
- Establish emergency response stations and shelters which contain clinics including trained rescue teams, emergency vehicles, repair materials, and equipment
- Invest in emergency preparedness to meet local and regional evacuation, response, and recovery needs, and to prepare for relief distribution
- Perform pre-qualification of goods and service providers for faster procurement post-disaster
- Develop financial protection strategies, including disaster reserve funds, contingency budgets, and insurance programs to repair and replace public transport infrastructure components damaged by a climate-related disaster
- Prepare evacuation plans and trainings by establishing evacuation procedures, evacuation centers, communication pipelines, and supply of tools
- Train community volunteers for disaster management
- Increase awareness of various contingency financing mechanisms

OUTCOMES AND CONCLUSIONS
Summary of Community of Practice (CoP) Work Plan Development

Considering the growing operational and corporate interest in a well-established and successful Resilient Transport Partnership Program, the Resilient Transport CoP will continue to strengthen its knowledge management activities, including establishing a technical expert team to further support and implement its ongoing technical assistance and systematically centralize its knowledge management efforts. In FY18, the Resilient Transport CoP core team successfully developed a knowledge management platform which contains Terms of Reference (ToR) and various tools/guidance notes collected from Task Teams, mainly from Transport GP and GSURR. As the CoP becomes more mature, the need for strong KM activities, including prioritizing the engagement area, disseminating existing knowledge products, convening knowledge exchange events, and creating another flagship report was highlighted by its key stakeholders.

Moving forward, the Resilient Transport CoP will continue to leverage information, tools, and technical expertise 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. Given the successful results of two major technical knowledge exchanges (TKXs) conducted in Tokyo, Japan, (May 2017) and Belgrade, Serbia, (January 2018) in partnership with country offices and GFDRR, the CoP will continue to host international workshops while systematically centralizing World Bank’s existing efforts in resilient transport by strengthening its knowledge creation and management efforts.

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>ACTIVITY DESCRIPTION</th>
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<tbody>
<tr>
<td>Further enhancing of Resilient Transport CoP’s knowledge management activities and products including guidance notes, reports, and ToR shared by CoP members</td>
<td>Since the official launch of the Resilient Transport CoP in September 2016, the core team has created several key knowledge management products such as flagship reports, conference summary reports, and tools. In addition, the CoP has collected various ToRs from relevant Task Team Leader (TTLs) (Transport and DRM Task teams) to provide technical support through its knowledge management platform. Going forward, the CoP will systematically extract lessons and guidance from the existing Knowledge Management (KM) system, and leverage this knowledge to inform operations.</td>
</tr>
<tr>
<td>Integration of climate and disaster risk considerations in the prioritization of investments in transport asset management</td>
<td>The World Bank has piloted and deployed climate and disaster risk modules in systems for prioritization of investments in transport asset management (maintenance, rehabilitation, expansion) by utilizing network models to quantify disaster risk in network models and prioritize interventions that increase the resilience of the network. Analyses were conducted in Peru, Mozambique, Tanzania, Bangladesh, and Fiji, and are currently starting in Vietnam, Argentina, and the Balkans.</td>
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<tr>
<td>Development of practical methodologies for integration of climate and disaster risk considerations along the transport infrastructure life cycle</td>
<td>The CoP will further support the broad Resilient Transport initiative at the World Bank with specific focus on developing practical methodologies for the integration of climate and disaster risks considerations along the transport infrastructure life cycle.</td>
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<tr>
<td>Knowledge exchange events</td>
<td>Since the official launch of the Resilient Transport CoP in September 2016, the core team has organized several key knowledge exchange events, including the technical knowledge exchange (TKX) in Tokyo, Japan, (May 2017) and Belgrade, Serbia, (January 2018) in partnership with country offices and GFDRR, and various workshops at the World Bank Washington DC office. The CoP will further create knowledge exchange opportunities to share results of this program and promote cross-sector partnerships.</td>
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<tr>
<td>Targeted support to enhance resilience of transport systems in Small Island Developing States (SIDS)</td>
<td>The Resilient Transport CoP launched a report at COP23 making the case for strengthening support to SIDS to enhance resilience of transport systems. Going forward, needs assessment plans will be conducted in interested client countries, and technical support provided to implement resilience measures. Capacity building activities include the creation of a designated knowledge platform accessible to client countries, and the organization of regional TKXs focused on SIDS.</td>
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# Annex 1: Agenda of TKX

## 2nd Technical Knowledge Exchange on Resilient Transport:
Learning from the Serbian Experience in DRM for Resilient Transport

### Monday, January 22, 2018

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:30 AM</td>
<td>Registration—Nikola Tesla Ballroom</td>
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<tr>
<td>9:00 AM</td>
<td><strong>Session 1: Opening</strong></td>
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<td></td>
<td>Welcome and Opening Remarks (10 minutes)</td>
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<tr>
<td></td>
<td>Mr. Juan Gaviria, Practice Manager, World Bank</td>
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<td></td>
<td>Mr. Marc Forni, Lead DRM Specialist, World Bank</td>
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<tr>
<td></td>
<td>Learning Objectives (10 minutes)</td>
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<tr>
<td></td>
<td>Ms. Fiona Collin, Lead Transport Specialist, World Bank</td>
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<tr>
<td></td>
<td>Keynote Presentation (15 minutes)</td>
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<td></td>
<td>Mr. Miodrag Poledica, State Secretary, Ministry of Construction, Transport and Infrastructure</td>
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<td>Mr. Marko Blagojevic, Acting Director, Public Investment Management Office</td>
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<tr>
<td></td>
<td>Q&amp;A to Panel (10 minutes)</td>
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<tr>
<td>9:45 AM</td>
<td><strong>Session 2: Serbia Resilience</strong></td>
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<tr>
<td></td>
<td>Overview of Serbia Resilience (5 minutes)</td>
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<tr>
<td></td>
<td>Ms. Svetlana Vukanovic, Transport Specialist, World Bank</td>
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<tr>
<td></td>
<td>Introduction to the Project Team (5 minutes)</td>
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<td></td>
<td>Mr. James Reeves, IMC Worldwide</td>
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<td>Guidelines and Tool Development (15 minutes)</td>
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<td>Ms. Biljana Abolmasov, IMC Worldwide</td>
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<td>Landslide Assessment (10 minutes)</td>
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<td>Ms. Biljana Abolmasov, IMC Worldwide</td>
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<td>Prioritization Methodology (15 minutes)</td>
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<td>Mr. James Reeves, IMC Worldwide</td>
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<td>Q&amp;A to Panel (10 minutes)</td>
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<td>10:30 AM</td>
<td>Coffee Break</td>
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<tr>
<th>Time</th>
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<tr>
<td>11:00 AM</td>
<td><strong>Session 3: Geohazards and Landslides</strong></td>
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<td>Tajikistan WB Project Tool (20 minutes)</td>
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<td></td>
<td>Mr. Yannis Fourniadis, Arup</td>
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<td></td>
<td>Geohazard Handbook (20 minutes)</td>
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<td>Ms. Yuka Makino, Senior Natural Resources Management Specialist and DRM Officer, World Bank</td>
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<td>Use of GIS and Remote Sensing Technologies, Geotechnical Database Management (20 minutes)</td>
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<td>Mr. Yannis Fourniadis, Arup</td>
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<td>Q&amp;A to Panel (15 minutes)</td>
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<tr>
<td>12:15 PM</td>
<td>Lunch (44 Parallel Restaurant)</td>
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<td>1:00 PM</td>
<td><strong>Session 4: Client County Presentations</strong></td>
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<td></td>
<td>3 Countries TBD (10 minutes each)</td>
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<td></td>
<td>Exchange of Views, Small Group Discussions (15 minutes)</td>
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<td>1:45 PM</td>
<td><strong>Session 5: Climate Science and Resilient Design</strong></td>
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<td>Climate Science (20 minutes)</td>
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<td></td>
<td>Ms. Maria Sunyer Pina, Arup</td>
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<td>Climate and Natural Hazard Resilience of Rail Projects for the WB Urban Rail Design Guidebook (20 minutes)</td>
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<td>Ms. Savina Carlucio, Arup</td>
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<td>REDI™—Resilient Engineering Design Initiative—Floods and Earthquakes (20 minutes)</td>
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<td>Ms. Yana Waldman, Arup</td>
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<td>Q&amp;A to Panel (15 minutes)</td>
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<td>3:00 PM</td>
<td><strong>Session 6: Practical Approaches 1</strong></td>
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<td></td>
<td>Optimizing Road Infrastructure for Beneficial Water Management and Resilience under Climate Change (20 minutes)</td>
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<td>Mr. Frank van Steenberg, Consultant, World Bank</td>
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<td>Resilience of Geotechnical Assets to Severe Weather—Vulnerability Framework to Categorize Assets and Prioritize Interventions Pre and Post-Weather Event (20 minutes)</td>
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<td>Ms. Savina Carlucio, Arup</td>
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<td>Q&amp;A to Panel (15 minutes)</td>
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<td>Coffee Break</td>
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<td>4:05 PM</td>
<td><strong>Session 7: Client County Presentations</strong></td>
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<td>3 Countries TBD (10 minutes each)</td>
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<td>Exchange of Views, Expert Panel (15 minutes)</td>
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<td>4:50 PM</td>
<td><strong>Session 8: Action Planning</strong></td>
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<td>Introduction to Action Planning (10 minutes)</td>
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<td>6:00 PM</td>
<td>Wrap-Up</td>
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<td>Wrap-up of Day 1 and Overview (10 minutes)</td>
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<td>Logistics for Day 2 (5 minutes)</td>
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<td>World Bank Team</td>
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<td>6:20 PM</td>
<td>Welcome Reception</td>
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<tr>
<td>8:45 AM</td>
<td>Coffee</td>
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<td>9:00 AM</td>
<td><strong>SESSION 1: DAY 2 OPENING COMMENTS</strong></td>
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<td>9:10 AM</td>
<td><strong>SESSION 2: RESILIENCE FINANCING AND ECONOMIC APPRAISAL</strong></td>
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<td>10:25 AM</td>
<td>Coffee break</td>
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<td>10:35 AM</td>
<td><strong>SESSION 3: CLIENT COUNTY PRESENTATIONS</strong></td>
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<tr>
<td>12:05 PM</td>
<td>Lunch (44 Paralel Restaurant)</td>
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<tr>
<td>12:50 PM</td>
<td><strong>SESSION 4: READINESS OF ROADS FOR FLOODS AND PBC</strong></td>
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<td>1:50 PM</td>
<td><strong>SESSION 5: PRACTICAL APPROACHES 2</strong></td>
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<td>2:45 PM</td>
<td>Coffee break</td>
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<td>2:55 PM</td>
<td><strong>SESSION 6: PRACTICAL APPROACHES 2</strong></td>
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<td>3:50 PM</td>
<td><strong>SESSION 7: ENGAGEMENT AND ACTION PLANNING</strong></td>
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<td>5:30 PM</td>
<td><strong>WRAP-UP</strong></td>
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<tr>
<td>6:30 PM</td>
<td>Buffet Dinner (44 Paralel Restaurant)</td>
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**WEDNESDAY, JANUARY 24, 2018**

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<th>Activity</th>
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<tbody>
<tr>
<td>8:45 AM</td>
<td>Coffee</td>
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</table>
| 9:00 AM | **SESSION 1: DAY 3 OPENING COMMENTS**  
Recap of Day 2 and Overview of Day 3 (5 minutes)  
Mr. Marc Forni, Lead DRM Specialist, World Bank  
Logistics Issues for Day 3 (5 minutes)  
Darko/Svetlana |
| 9:10 AM | **TRANSPORT TO FIELD TRIP**  
- drive to Mali Zvornik (route: Belgrade–Šabac–Loznica–Mali Zvornik) (3 hours)  
- break at Mali Zvornik and review of the rehabilitation works done after floods in 2014 (30 minutes)  
- drive to Krst and review rehabilitation works (route: Mali Zvornik–Loznica–Krst) (30 minutes)  
- drive from Krst to Krupanj with review of the rehabilitation works/landslides, bridges, Stalice Dam, torrential floods, Korenita River regulations (60 minutes)  
- coffee break in Krupanj and meeting with local authorities in the Krupanj Municipality building (60 minutes)  
- drive to Krupanj–Zavlaka and review of partially rehabilitated road and rehabilitation works on landslides and bridges (30 minutes)  
- drive to Koceljeva (route: Zavlaka–Valjevo–Koceljeva) and review of rehabilitation works on bridges, different slope stability measures, regulation of Jadar River, rehabilitation on Tamnava River and bridge (90 minutes)  
- lunch at Koceljeva in Hotel Dvorac Ivanovi (2 hours)  
- return to Belgrade through the Obrenovac and Ub that are the most affected municipality by the floods in 2014 (route: Koceljeva–Ub–Obrenovac–Beograd) (90 minutes) |
| 7:30 PM | Arrival in Belgrade |

**THURSDAY, JANUARY 25, 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
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<tbody>
<tr>
<td>8:45 AM</td>
<td>Coffee</td>
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</tbody>
</table>
| 9:00 AM | **SESSION 1: DAY 4 OPENING COMMENTS**  
Recap of Day 3 and Overview of Day 4 (5 minutes)  
Mr. Marc Forni, Lead DRM Specialist, World Bank  
Logistics Issues for Day 4 (5 minutes)  
Ms. Nadia Islam, Program Analyst, World Bank |
| 9:10 AM | **SESSION 2: BRINGING IT HOME**  
Stock-Taking and Multi-Stakeholder Dialogue (30 minutes)  
How to Operationalize Key Take-Aways (30 minutes)  
Coffee break |
| 10:30 AM | **SESSION 3: COUNTRY-SPECIFIC ACTION PLAN DEVELOPMENT**  
Small Group Discussion by Clients and TTLs (60 minutes)  
Action Plan Pitch #1 (60 minutes)  
Country Presentations  
Panel Discussion after Each Pitch  
Lunch (44 Parallel Restaurant) |
| 1:30 PM | **SESSION 4: COUNTRY-SPECIFIC ACTION PLAN DEVELOPMENT**  
Action Plan Pitch #2 (120 minutes)  
Country Presentations  
Panel Discussion after Each Pitch  |
| 3:00 PM | Coffee break |
| 3:45 PM | **SESSION 5: CONCLUSION AND WRAP-UP**  
Conclusions and Take-Aways (20 minutes)  
Closing Remarks (10 minutes)  
Certificate Presentation (10 minutes)  
Buffet Dinner (44 Parallel Restaurant) |
**INTRODUCTION TO THE SESSION**
Ms. Akiko Toya, Junior Professional Officer, GFDRR, World Bank

**INTRODUCTION OF RESILIENT TRANSPORT PARTNERSHIP PROGRAM**

**REVIEW OF THE WEEK**
- Reflections on the week and implications for Transport and DRM partnership value proposition
- Key takeaways on what worked well/not so well for planning future events

**COMMUNITY OF PRACTICE - REVIEW OF ONGOING ACTIVITIES**
- Tour de table to identify ongoing TA and lending operations in resilient transport
- Knowledge management dashboard
- What GFDRR can offer (ThinkTank hazard, GeoNode, GeoSafe, various tools/resources)
- Technical and peer review
- Update on SIDS flagship report and potential fundraising
- Communications and outreach - blogs, BILs, materials

**COMMUNITY OF PRACTICE - WORK PLAN AND NEXT STEPS**
- Brainstorm and discussion session for ideas on next flagship
- Discussion on how CoP aims to secure sources of funding
- Systematizing JIT support
- Open discussion on expectations and mandate for CoP

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**ANNEX 2: EXPERT PROFILES**

**Organizers**

Marc S. Forni
Lead DRM Specialist, GSURR, World Bank
Marc Forni joined the World Bank in 2003, working for four years in 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.

Shomik Mehndiratta
Practice Manager, TDD, World Bank
Dr. Shomik Mehndiratta is the World Bank's Practice Manager for Transport in Latin America and the Caribbean. He has been at the World Bank since 2002 (except for a short break in 2015) working primarily in East Asia, Latin America, and Africa. He has served in the past as the Transport Sector's technical lead on urban mobility and climate-informed transport. In the period 2007-2010 he lived and worked in China and is the co-editor and author of an edited book on Low Carbon Urban Development in China. In 2015 he briefly worked with Uber as Director of Policy, and prior to the World Bank he worked at CRA International, a business and economics consulting firm, with Uber as Director of Policy, and in China. In 2015 he briefly worked with Uber as Director of Policy, and prior to the World Bank he worked at CRA International, a business and economics consulting firm, with Uber as Director of Policy; and in China. In 2015 he briefly worked with Uber as Director of Policy; and in China.

Darko Milutin
DRM Specialist, GSURR, World Bank
Darko Milutin worked as a Project Manager for the DRM Team in Serbia, prior to joining the ECA Urban and DRM Unit (GSURR) as a DRM Specialist in 2016, where he was responsible for support to the implementation of the National Disaster Management Program of Serbia. Most of his career, he spent working in development cooperation, combined with academic work in the Netherlands and Serbia. His international experience as a consultant stretches over more than 20 years, with the last eight years prior to joining the World Bank being a donor representative for Luxembourg bilateral development cooperation projects in Serbia and Montenegro. A Serbian and Dutch national, Darko holds a PhD degree in Environmental Sciences from Wageningen, the Netherlands, with a BSc degree in Hydrology and Water Resources Management Engineering from Belgrade, Serbia.

Fiona Collin
Lead Transport Specialist, TDD, World Bank
Fiona Collin joined the World Bank as a senior transport specialist in 2011, initially based in Addis Ababa for three years, and now a further three years in headquarters within the Europe and Central Asia region. Before joining the World Bank, Fiona worked as a civil engineer and project manager, specializing in transport and connectivity. Her 30 years of work experience span the World Bank and other development partners, road agencies, consulting firms, and the private sector. Geographically, Fiona has worked in Europe, Central Asia, East Africa, East Asia, Australia, and the Pacific Islands. With a significant amount of time spent in tropical latitudes, Fiona has firsthand experience of extreme weather, particularly in relation to cyclones and flooding, and in post-disaster recovery and adaptation. This professional and personal exposure brings with it an interest in addressing the impacts of climate change and extreme weather and its effects on road infrastructure, and her professional background as a development practitioner and engineer who has designed, built, and maintained roads provides perspectives on how to deal with it.

Nadia Islam
Program Analyst, GFDRR, World Bank
Nadia started her career at the World Bank with the first VP for SAR working on annual and spring meetings. She has extensive experience in working in operations with the agriculture department and has handled corpora te events for the President and one of the largest Bank organized ministerial conferences in Egypt. She recently moved to GFDRR from Social Safeguards in SAR where she was the manager of the TSP database and monitored nearly 100 percent tracking of social performance rates in projects and monitoring the Unit's portfolio and budgets on which she has been part of the core team of the GSURR Forum organizing team. Nadia worked in the Cairo country with the Country Director's office on portfolio monitoring. In GFDRR, she will contribute and support monitoring and management of the overall GFDRR programs with a focus on visibility events for the secretariat as well as post-disaster needs assessments. She will be providing cross support to the GPs and CRP given her extensive operational experience in the

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**ANNEX 1: AGENDA OF TKX**

9:00 AM
- World Bank Only. Objective: To develop a strategy for the Resilient Transport Community of Practice (CoP) and Partnership Program

12:00 PM
World Bank Teams

Svetlana Vukanovic
Transport Specialist, TDI, World Bank

Svetlana Vukanovic is a Transport Specialist in the World Bank, for the past nine years, she has been working on transport infrastructure investment and road and rail sector reform projects, ITS (intelligent transport systems), road safety, and resilience. Before joining the World Bank, she was working on putting together innovative EU mobility projects and was technical department manager for ITS in Siemens. She has a PhD in ITS from the Technical University of Munich. World Bank

Juan Gaviria
Practice Manager, TDI, World Bank

Juan Gaviria is a practice manager of transport projects within the World Bank and responsible for managing the transport infrastructure practice in 22 active programs in the European Union, Eastern Partnership, Western Balkans, Caucasus, Central Asia, and the Russian Federation. He oversees a portfolio in excess of US$5 billion and has managed projects in 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 has broad professional experience in project design, public infrastructure development and management, public utility companies and concessions, state change and infrastructure operations, management of complex assignments, project appraisal, finance, management, and marketing covering Europe, Latin America, Central Asia, South Asia, and Africa. He also has experience as Chief Operating Officer of a medium-size global container shipping line, formulating and implementing new company strategy, carrying out organizational and cultural alignment; and developing regulatory strategy, value creation, integration management, and concluding transactions. He has a Doctorate in transport economics from the University of California, Berkeley.

Arnab Bandyopadhyay
Lead Transport Specialist, TDI, World Bank

Arnab Bandyopadhyay works as the Lead Transport Specialist with the Transport & ICT Global Practice in the World Bank and is based in the team office in New Delhi. He holds a bachelor’s degree in Civil Engineering and is currently working on a number of projects in the Philippines, Indonesia, Vietnam, and India. His areas of expertise include project economics, cost-benefit analysis, and operational and financial aspects. He has worked in the infrastructure sector for more than 10 years in various roles and has been involved in projects in the fields of transportation, irrigation, and energy. He has extensive experience in the areas of transportation planning, road safety, and infrastructure development. His work has contributed to improving transportation systems in developing countries, focusing on sustainable and inclusive transportation solutions. He has a strong background in project management and has worked on projects in various countries, including India, Bangladesh, and Nepal. His work has involved working closely with government agencies, stakeholders, and other partners to develop effective solutions for transportation challenges. His expertise in project management, financial analysis, and infrastructure development has contributed to the success of several projects, leading to improved transportation systems and increased connectivity in the countries he has worked in.
ANNEX 2: EXPERT PROFILES

Biljana Abolmasov

Associate Professor of the Faculty of Mining and Geology, University of Belgrade

Biljana Abolmasov is the Associate Professor of the Faculty of Mining and Geology, with more than 26 years of experience at the Department of Geotechnics and Geology of the University of Belgrade. She holds a PhD degree from the University of Tiraspol, Moldova, and a Master’s degree from the University of Tiraspol, Moldova. She has been involved as an expert and a visiting professor in the USA, Canada, and Australia in the field of infrastructure asset management. Her research interests include performance-based management of water assets, risk management of natural hazards, and climate change. She has published extensively in these fields and has served on the editorial boards of several international journals. She is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.

Frank van Steenbergen

Franchise Director, Consultant, World Bank

Dr. Frank van Steenbergen is a transport economist who has been working on transport projects for more than 25 years. He started his career at the World Bank in 2000 and has since held various senior positions within the organization. He has worked on transport projects in Africa, Asia, Latin America, and the Middle East. His research interests include transport economics, transport planning, and transport infrastructure development. He has published extensively in these fields and has served as an expert witness in several legal cases.

Yana Waldman

Senior Consultant, Arup

Yana Waldman has over 15 years of experience in transport and infrastructure projects. She has held a number of senior positions within Arup, including project manager, senior consultant, and technical director. She has worked on a wide range of projects in various countries, including the USA, Canada, the UK, and Australia. Her areas of expertise include transport planning, transport infrastructure development, and transport project management. She has published extensively in these fields and has served on the editorial boards of several international journals. She is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.

Ervin Dervishi

Transport Infrastructure Consultant, TDD, World Bank

Ervin Dervishi is a transport infrastructure consultant at the World Bank. He has worked on a number of transport infrastructure projects in the Balkans, Middle East, and Africa, including the development of transport plans for vulnerable countries, the appraisal of specific infrastructure change-related interventions, and the development of processes and guidelines for the inclusion of resilience within asset management systems. His expertise includes transport planning, transport infrastructure development, and transport project management. He has published extensively in these fields and has served on the editorial boards of several international journals. He is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.

Ian Greenwood

Senior Infrastructure Consultant, World Bank

Dr. Ian Greenwood, with over twenty-five years of experience, is an internationally recognized leader in the field of infrastructure asset management and performance-based contracting. He has worked on more than 30 projects in 23 countries—covering both developed and developing nations, with projects covering the full spectrum of public infrastructure. In 2016, the Institute of Asset Management (UK) presented Ian with the Individual Achievement Award for asset management for his contribution to the development of good practice in the field of asset management. Ian was also the lead author of the World Bank guidance on performance-based contracts in the road sector, and was co-editor of the 2017 World Bank publication “Integrating Climate Change into Road Asset Management.” Ian has guided many AM implementations and was one of the two New Zealand industry representatives for the development of the ISO 55000 standard for asset management, along with coauthoring the 2011 International Infrastructure Management Manual. Ian was the Chair of the Business New Zealand Transport Infrastructure Group from 2011-2013 and a member of the New Zealand government task force on road maintenance.

James Reeves

Senior Technical Director, IIM Worldwide

Dr. James Reeves is the IIM’s Senior Technical Director. He has over 25 years of experience in the transport sector and has been involved in numerous international transport projects covering the full spectrum of transport infrastructure across developed and developing nations. He has a wealth of experience in developing transport plans for vulnerable countries, the appraisal of specific transport change-related interventions, and the development of processes and guidelines for the inclusion of resilience within asset management systems. James is an expert in transport planning, transport infrastructure development, and transport project management. He has published extensively in these fields and has served on the editorial boards of several international journals. He is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.

Yannis Stavropoulos

Senior Geotechnical Engineer, Arup

Yannis Stavropoulos is a senior geotechnical engineer at Arup. He has extensive experience in the field of geotechnical engineering and has worked on a wide range of projects in the UK, Europe, and the Middle East. His areas of expertise include geotechnical engineering, landslide hazard and risk assessment, and the development of performance-based contracts for infrastructure projects. He has published extensively in these fields and has served on the editorial boards of several international journals. He is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.

Giorgio Torelli

Transport Infrastructure Consultant, TDD, World Bank

Giorgio Torelli is a transport infrastructure consultant at the World Bank. He has worked on a number of transport infrastructure projects in the Balkans, Middle East, and Africa, including the development of transport plans for vulnerable countries, the appraisal of specific infrastructure change-related interventions, and the development of processes and guidelines for the inclusion of resilience within asset management systems. His expertise includes transport planning, transport infrastructure development, and transport project management. He has published extensively in these fields and has served on the editorial boards of several international journals. He is currently working on a project to develop a new methodology for assessing the resilience of infrastructure assets in the face of changing climate conditions.
He has a University degree on Law from the “Arista” University as well as a University degree on Safety Engineer from the Police Academy of the Ministry of Infrastructure in Ankara, Turkey. He has a good experience working in organizing, directing, and controlling all departmental resources to ensure public order and security, enabling the physical security and inviolability of citizens’ property, traffic management, administration of personnel, and prevention of accidents, etc. His professional carrier includes different positions as Chief of Police Traffic in different cities of Albania. He is fluent in English, Italian, and Turkish.

**Zana Joca (Guzia)**

**Expert of IPA Projects Preparation and Feasibility, Ministry of Infrastructure and Energy of the Republic of Albania**

Mrs. Zana Joca (Guzia) is an Expert of IPA Projects Preparation and Feasibility, and Directorate of Concept and Feasibility of Infrastructure and Territorial Projects at the Ministry of Infrastructure and Energy of the Republic of Albania. She holds a bachelor degree from the University of Tirana and a master’s degree in Public Administration. Mrs. Joca has previously served as Expert of European Integration and Appointment, and Deputy Director in the Reproductive Integration Division, and General Directorate of Integration in the former Ministry of Transport and Infrastructure. In this function, she was responsible for the “acquis communautaire” and the implementation of the Stabilization and Association Agreement. In addition, from 2007 she serves as SEETO National Coordinator for Albania and has coordinated the transnational issues under the Connectivity Agenda, in the framework of the Berlin Process. From 2007, she is a Certified Trainer of the Albanian School of Public Administration (ASPA) for the issues of European Integration, Regional Cooperation, and the management of IPA Funds.

**BANGLADESH**

**Md. Hasan Ali**

**Superintendent Engineer, Bangladesh Land Port Authority, Ministry of Shipping**

Mr. Md. Hasan Ali is serving in the Bangladesh Land Port Authority (BLPA) under the Ministry of Shipping (MoS), Bangladesh, as Superintending Engineer. He joined this organization on 22 November 2004. Mr. Ali is a graduate in Civil Engineering from Khulna University of Engineering and Technology (KUET), Bangladesh. He has recently been deputed in the project office “Banglad- badesh Regional Connectivity Proj- ect-1” funded by World Bank and executed by BLPA as Deputy Project Director. His main responsibility is to look after the engineering and managerial works in the project. Before this, he worked in World Bank, Asian Development Bank, and government funded projects in the Bangladesh Land Port Authority under Ministry of Shipping.

**Abdelazim Mohamed Ali Mohamed**

**Chairman, River Transport Authority, Ministry of Transport**

Dr. Abdelazim Mohamed Ali Moh- hamed was appointed as Chairman of the River Transport Authority in October 2017. Dr. Abdelaziz has broad experience, covering different aspects of hydraulic engineering, gained during his 27 years of practice. His main experience has been achieved in the fields of irri- gation and hydraulic structures, designing hydraulic modeling. He also attained vast experience in the field of Coastal Engineering in both physical and mathematical modeling. This ex- perience was gained through his involvement in studies conducted about the stability of breakwa- ters, wave agitation inside harbors, shoreline changes, field measure- ments, power plant cooling sys- tems, and different coastal prob- lems along the Egyptian coast.

**Shri Akhtarul Hanif**

**Deputy Secretary and Deputy Financial Adviser, Ministry of Road Transport and Highways**

Shri Akhtarul Hanif, M.Sc & LL.M, is currently working as the Deputy Secre- tary and Deputy Financial Adviser, Ministry of Road Transport and Highways and is associated with World Bank Program of the minis- try and has also worked as under- secretary in the office of Finance Minister, Director (Vigilance, Per- sonnel, and Transport) New Delhi Municipal Council (NDMC), under- secretary in Ministry of Finance, Revenue, Deputy Director (Finance and Confidential) Doordarshan, Assistant Registrar Debt Recovery Tribunal (DRT) Delhi, Assistant Assessor and Collecting Municipal Corporation Delhi (MCD), and As- sistant Haj Officer Makka and Ma- dina. He is also Guest Faculty on Vigilance/Finance matters to var- ious institutions/organizations. He has visited countries like Saudi Ara- bia, Thailand, Malaysia, Singapore, Slovenia, Italy, Austria, Germany, Belgium, France, and Switzerland. He has published a book in Hindi “Smitam”. He has also attended various national/interna- tional training programs.

**NEPAL**

**Rohit Kumar Bisural**

**Senior Divisional Engineer, Foreign Cooperation Branch, Department of Roads, Ministry of Physical Infrastructure and Transport**

Rohit Bisural is presently working as Senior Divisional Engineer in Foreign Cooperation Branch, Department of Roads, Ministry of Physical Infrastructure and Transport, Nepal. He has also professionally worked in the road transport sec- tor for the last 26 years as a Civil Engineer, Highway Engineer, Con- struction Management team lead- er, Supervisor of Road and Bridge construction works, Project Man- ager, Procurement manager, Coor- dinator of Road Project, and Public Procurement In-Charge. Rohit has worked on plain, hilly and mountainous regions all over Nepal with experiences in various aspects of road/bridge construction and maintenance problems. He has also worked as Deputy Project Director, Project In-Charge in ADB-funded projects in Nepal.

**FAO**

**Jorge Luis Maguilla Villon**

**Senior Officer, Policy and Planning Department of Ministry of Roads and Transport Development of Mongolia**

Jorge Luis Maguilla Villon currently holds the position of Executive Di- rector of ProVia Descentralizado, a Market Economy: Public-Private Partnerships” at the Harvard Uni- versity, Boston, Massachusettes, USA, developing expertise in four key areas—choosing the appro- priate public-private partnership model, building and maintaining political support, navigating pri- vate finance and capital markets, and attracting foreign direct invest- ment of consumer’s interests (2009). In the course of his professional career, he has engaged at the Ministry of Transport and Mar- itime Affairs, Mr. Zvikov partici- pated in various analyses, strategies, terms of ref- erences, studies, design-planning documents, and other documents related to the scope of competence of the Ministry.

**MONTENEGRO**

**Angelina Zivkovic**

**State Secretary, Ministry of Transport, Road Transport and Highways**

Angelina Zivkovic, since April 2017, was appointed by the Government of Montenegro as the State Secretary in the Ministry of Transport, Road Transport and Highways. She graduated by the Faculty of Civil Engineering—University of Montenegro with the thesis, “Comparative Analyses of the Effective Yugoslav and European Semantic Codes on the Example of Design of the Tire Building Dual System” and hold a Master’s degree in Engineering—University of Montenegro. She was the chief of the entity in charge of strengthening the road management in regional and local governments in Peru. She has held various positions in the public sector in Peru in the Minis-
tries of: Transports and Commu-
nication, Infrastructure, Construction and Sanitation; and Agricultures and Irrigation. Out-
side the public sector, he worked as project official in Development Organiza-
tions, such as in Fondo de Desarrollo del Con- 
travalor Perú-Canadá and in the Balkans Alumni network. Petar lives in Belgrade, Serbia.

Predrag Mari
Assistant Minister of Interior and Head of 
Sector for Emergency Management 

Miodrag Poledica
State Secretary, Ministry of Construction, 
Transport, and Infrastructure 

Miodrag Poledica finished elemen-
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member of the Board of Directors of 
the Soros Foundation in Serbia.

Marko Blagojevic
Director of the Serbian Government’s Office for Flood and Disaster Management 

Marko Blagojevic is the Director of the Serbian Government’s Public Inspectorate Ministry for Infrastructure. He joined the Government of Serbia in 2014 after the catastrophic floods to become the Director of the newly established Office for Flood Protection and Disaster Re-
construction. His task at the time was to ensure a smooth operation of the post-flood reconstruction process. During 2014, he had been in charge of the transition of the mandate of this office, the flood recovery and reconstruction to disaster risk management and is now involved in the establishment of the flood risk management system in Serbia. In December 2015, the Government of Serbia appointed him the Dire-
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Transport Safety Council. He is also a member of the Inter-Serbian Flood 
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transport investments programs by fostering a regional approach to transport systems in the region. She started her professional career as Project Manager for EU-funded projects at Albanian General Road Authority to progress further in several positions as part of the EU Technical Assistance team to Ministry of Transport in Albania and for four years as Transport Director at Municipality of Tirana. She has more than 20 years’ experience in the field of transport and transport planning. She is equipped with deep and up-to-date knowledge on transport policies, institutional development and project management, transport resilience, and intelligent transport both on the national and regional level. After her graduation from the University of Tirana, Faculty of Civil Engineering, she had pursued her academic qualification further by obtaining a Master in Engineering (MEng) degree from IHE/TU Delft, The Netherlands, in Roads and Transport Planning, and a Master in Science (MSc) degree from Oxford Brookes University, United Kingdom, in Transport Planning Management.
Contact

The Global Facility for Disaster Reduction and Recovery (GFDRR)
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GFDRR is a global partnership that helps developing countries better understand and reduce their vulnerabilities to natural hazards and adapt to climate change. Working with over 400 sub-national, national, regional, and international partners, GFDRR provides grant financing, technical assistance, training, and knowledge sharing activities to mainstream disaster and climate risk management in policies and strategies. Managed by the World Bank, GFDRR is supported by 37 countries and 11 international organizations.

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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.