Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

Axis: 4. Building Resilience for Cities, Infrastructure and Water
Key objective: 13. Resilient urban development, mobility and infrastructure
Solution: Implementation of Resilient and Adaptive Transport Infrastructure
Host initiative: International Coalition for Sustainable Infrastructure (ICSI), Coalition for Disaster Resilient Infrastructure (CDRI), with the support of the Ministry of Transport, Government of Brazil
Scope:

- Geographic: Global
- Sectoral: Rail, Road, Ports
- Key focus areas for this plan:
  - **Policies, regulations, codes, and standards** for resilient and adaptive transport infrastructure, with a focus on linking policies to National Adaptation Plans (NAPs) and leveraging procurement mechanisms.
  - **Integration of resilience and adaptation across the entire transport infrastructure lifecycle**, including climate risk-informed decision-making, adoption of advanced technologies, nature-based solutions (NbS) and innovative materials, and strengthening maintenance and retrofitting for resilience.
  - **Institutional and technical capacities and coordination**, emphasising knowledge sharing and partnerships to accelerate progress.
  - **Resilience and adaptation finance and innovative financial mechanisms**, focusing on building the business case, mobilising private capital (e.g., PPPs), and exploring instruments such as resilience bonds.

Levers assessment:
Note: maturity ratings should be considered as average, significant variability is unavoidably present across regions and country income levels

- **Risk-informed decision-making:** Low maturity
  - *Rationale: Despite advances in risk assessment practices, climate risks are still not routinely incorporated into planning and operational processes. As transport networks face increasing climate-related threats, existing approaches remain insufficient for delivering resilient infrastructure, with limited stakeholder coordination and constrained capacity to make climate risk-informed decisions continuing to pose significant challenges.*
- **Technology shifts:** Medium maturity
  - *Rationale: Emerging digital technologies are increasingly recognised and piloted to enhance infrastructure resilience; however, their widespread adoption remains limited by the absence of clear consensus, enabling legislation, and established data standards. Maturity levels vary across country income groups and are influenced by data availability, quality, accessibility, and technical capacity to utilize in decision*

making. Integration and interoperability challenges, along with outdated legal and contractual clauses that restrict data sharing, further constrain deployment.

- **Knowledge & Capacity building:** Medium maturity
  - *Rationale: Awareness and training for resilient and adaptive transport infrastructure are increasing; however, significant gaps remain in technical expertise, institutional capacity, and the integration of resilience considerations across the infrastructure lifecycle, largely due to limited capacity-building programs and insufficient access to guidance and practical examples of effective approaches.*
- **Inclusive decision-making governance & design:** Low maturity
  - *Rationale: Although the importance of stakeholder engagement and the inclusion of local and marginalized groups is widely recognized, implementation remains limited and inconsistent across projects and regions.*
- **Standards & Taxonomies:** Low maturity
  - *Rationale: There is no common global definition, taxonomy, or set of metrics for adaptation and resilience, which limits consistent target setting, investment tracking, and coordinated implementation.*
- **Supply:** Medium maturity
  - *Rationale:. Resilient and adaptive transport infrastructure solutions are technically feasible and increasingly demonstrated, but their widespread implementation is constrained by limited expertise, uneven access to knowledge and resources, and insufficient institutional and local capacity.*
- **Demand:** Medium maturity
  - *Rationale: Awareness of the need for resilient and adaptive transport infrastructure is growing, but a lack of consensus when defining and measuring adaptation and resilience has restricted the setting of global resilience goals and their targets as well as tracking progress. In certain contexts, mainstreaming of resilience is in early stages, reflecting weak institutional capacity and fragmented policy support.*
- **Public/private finance:** Low maturity
  - *Rationale: Adaptation finance remains limited, particularly for less visible resilience measures such as retrofitting and maintenance, despite these being the first line of defense against climate change. While public–private partnerships (PPPs) show promise in implementing adaptive and resilient transport solutions, their success depends on standardized risk assessment frameworks that balance public and private investment confidence. This must account for evolving and uncertain climate risks, as well as the limited flexibility of existing institutional and legal frameworks.*
- **Partnerships and collaboration:** Medium maturity
  - *Rationale: Several multi-stakeholder international initiatives, industry associations, platforms and partnerships support implementation of transport resilience and adaptation, their reach and impact remain uneven, and systematic integration into national and local implementation is still limited.*
- **Policy & regulatory:** Low maturity
  - *Rationale: Globally, policy and regulatory frameworks for resilient transport infrastructure remain fragmented, with no common definitions or mandatory standards for adaptation and resilience.*
- **Public opinion:** Medium maturity

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

- *Rationale: Political commitment to resilient and adaptive transport infrastructure is growing, as seen in major initiatives such as the EU Green Deal's transport adaptation goals, and the UN's decade of Sustainable Transport, consistent public engagement and long-term political sensitization and prioritization across regions remain uneven.*

If fully implemented, this plan is expected to significantly advance the resilience and adaptive capacity of transport infrastructure with a focus on EMDE countries, leveraging multiple strategic levers whose maturity is currently lagging behind:

- **Risk-Informed Decision-Making:** Embedding climate risks into planning and operational processes will improve the ability of agencies to anticipate and respond to climate hazards. Possible KPIs: proportion of projects incorporating climate risk assessments, the integration of adaptation plans into decision-making, and improved stakeholder coordination.
- **Technology Shifts:** Increased adoption of digital technologies and innovative materials will enhance infrastructure monitoring, predictive maintenance, and climate resilience. Possible KPIs: implementation of digital tools for asset management, interoperability of systems, and uptake of advanced materials and nature-based solutions.
- **Knowledge & Capacity Building:** Strengthened technical expertise and institutional capacity will enable transport agencies to apply resilience measures more effectively. Possible KPIs: the number of professionals trained, adoption of best-practice guidance, and integration of resilience into operational processes.
- **Standards & Taxonomies:** Development and adoption of common definitions, metrics, and standards for adaptation and resilience will improve consistency in planning and investment tracking. Possible KPIs: use of standardized resilience metrics in projects and alignment of national guidelines with international frameworks.
- **Public/Private Finance:** Expanded adaptation finance will mobilize resources for preventive and maintenance-focused interventions. KPIs include the volume and diversity of finance mobilized and the share of projects funded with resilience criteria.
- **Partnerships & Collaboration:** Strengthened multi-stakeholder networks will accelerate knowledge sharing and coordinated action. Possible KPIs: the number of active partnerships, cross-sector initiatives, and integration of global best practices at national and local levels.
- **Policy & Regulatory:** Improved regulatory frameworks will provide a clearer enabling environment for resilient infrastructure development. Possible KPIs: the adoption of national adaptation policies, codes, and standards, and alignment with NAPs.

Overall Impact by 2030:

- Broader adoption and operationalisation of climate-resilient standards and norms, particularly across EMDE countries.
- Full integration of risk assessment and adaptation planning in internationally co-financed transport projects.

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

- Increased institutional, technical, and financial readiness to respond to climate risks, resulting in more resilient and adaptive transport networks that safeguard socioeconomic development and reduce vulnerability to climate hazards.
- Promote technological innovation and nature-based solutions (NbS) as priority instruments in logistics corridors, coastal zones, and vulnerable urban areas.
- Regional centers of excellence in infrastructure adaptation, acting as hubs for innovation, technical cooperation, and technology transfer, strengthening local capabilities and South-South cooperation

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

Output	Action Scope	Action	Type of action	Implementation Lever	Responsible	Time horizon	Stakeholder engagement[1]	Committed Stakeholders
Template for National Adaptation Plans (NAP) for Transport	Global / Sectors: all	Promote integration of resilience and adaptation into policies, standards and regulations by: Convening a series of targeted dialogues bringing together standard-setting organisations, government ministries, and industry associations to discuss priorities for strengthening and accelerating uptake of policies and standards related to transport infrastructure resilience Leveraging cross-sectoral fora (eg ITF, UIC Resilience Groups) to input into the NAP transport template	New action	Standards & T… Policy & regul…	ICSI (NAP Transport) CDRI	Novemb…	Countries Utilities & Sys… Cities and loc… Multi-stakehol…	ITF UIC Resilience 4 Ports IRF
Digital platform to improve access to existing guidance, tools and standards	Global / Sectors: all	Building on previous stock takes, review of existing international, and national standards, codes, and guidance that address resilience and climate adaptation across transport sectors. Identify overlaps and critical gaps that hinder the mainstreaming of resilience across the transport infrastructure lifecycle. Identify needs to develop new guidance.	Existing a…	Standards & T…	ICSI	June 20…	Technical insti… Multi-stakehol… Utilities & Sys…	Resilience 4 Ports ELG
Standard template/ framework of climate risk assessment for each transport sector in agreement with sectoral association	Global / Sectors: all	Promote and support the integration of climate risk assessments, including consideration of future climate scenarios, across the full transport infrastructure lifecycle by convening a series of targeted dialogues	Existing a…	Risk-informed… Standards & T…	CDRI ICSI	Novemb…	Multi-stakehol… Countries Technical insti…	UIC Resilience 4 Ports

[1] Such as countries, companies, investors, cities and local governments, technical institutions, MDBs, regulators & public agencies, utilities & system operators, youth & indigenous groups, multi-stakeholders platform (non-exhaustive)

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

Output	Action Scope	Action	Type of action	Implementation Lever	Responsible	Time horizon	Stakeholder engagement[1]	Committed Stakeholders
		Build on existing sectoral methodology and approaches and cross-sectoral learning and experiences					Utilities & Sys… Cities and loc…	
Promote investment frameworks, financing and insurance mechanisms to support resilience implementation, both for new and existing infrastructure (risk-based maintenance and retrofitting)	Global / Sectors: all	Improve the business case for (both new and existing) resilient and adaptive transport infrastructure Demonstrate the cost-effectiveness of risk-based maintenance compared to reactive repair and reconstruction over the lifespan of the assets. Leverage existing task forces and multistakeholder groups in different sectors Leverage existing initiatives around climate resilient PPPs	New action	Public/private … Policy & regul…	CDRI ICSI	Novemb…	Utilities & Sys… Investors Countries Cities and loc…	Resilience 4 Ports ELG
Toolkit of solutions	Global / Sectors: all	Curate and promote toolkit of solutions - Particular focus on technological innovation and nature-based solutions (NbS) as priority instruments in logistics corridors, coastal zones, and vulnerable urban areas Leverage cross-sectoral fora (eg ITF, UIC Resilience Groups) Building on existing case study compendia Build on existing initiatives that integrate transport and biodiversity (e.g. SYMBIOSIS and GRID)	Existing a…	Technology sh… Risk-informed… Supply	ICSI	Novemb…	Utilities & Sys… Companies Technical insti… Cities and loc…	Resilience 4 Ports UIC IRF ITF
Establish regional centers of excellence	Global / Sectors: all	Leverage existing cross-sectoral fora (eg ITF, UIC Resilience Groups), knowledge	New action	Knowledge & …	ICSI CDRI	Novemb…	Countries	Resilience 4 Ports

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

Output	Action Scope	Action	Type of action	Implementation Lever	Responsible	Time horizon	Stakeholder engagement[1]	Committed Stakeholders
in infrastructure adaptation, acting as hubs for innovation, technical cooperation, and technology transfer, strengthening local capabilities and South-South cooperation.		hubs and the resources developed as part of this PAS to accelerate knowledge transfer and peer learning. Identify priority skills and gaps in the workforce in different countries and regions. Develop targeted knowledge modules to upskill transport infrastructure professionals on priority topics		Partnerships …			Utilities & Sys… Cities and loc… Companies	ELG

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

Supporting information:

Definition: Resilient and adaptive transport withstands, recovers from, and adapts to climate hazards through integration of climate-informed approaches in planning, design, delivery, and management of the infrastructure and adaption of new technologies, design and materials. It ensures safe, sustainable, and reliable connectivity, safeguarding economies, communities, and ecosystems amid evolving climate challenges.

Why this solution matters:

- Extreme weather events increasingly disrupt transport systems, threatening essential connectivity and safety worldwide.
- The transport sector represents over 50% of global exposed infrastructure, around US$ 90 trillion (as of 2022), making it especially vulnerable to climate hazards. For instance, 27% of road and rail assets face at least one major hazard per year, and 86% of ports are exposed to three or more hazards annually.
- Risks extend beyond direct physical damage, as disruptions in transport networks can trigger cascading failures across interconnected economic systems, impacting supply chains, manufacturing schedules, and overall economic output. For example, monetary impacts to businesses in LMICs amount to USD 107bn in annual losses.
- Resilient transport protects economic stability and productivity, preventing large-scale losses and enabling faster recovery.
- Reliable and accessible transport sustains livelihoods, mobility, and access to healthcare, education, and emergency services, especially for vulnerable populations.

References used to support levers assessment rationale:

Argyroudis, S. A., Mitoulis, S. A., Chatzi, E., Baker, J. W., Brilakis, I., Gkoumas, K., Vousdoukas, M., Hynes, W., Carluccio, S., Keou, O., Frangopol, D. M., & Linkov, I. (2022). Digital technologies can enhance climate resilience of critical infrastructure. Climate Risk Management, 35, 100387. https://doi.org/10.1016/j.crm.2021.100387

Boston Consulting Group, & Coalition for Disaster Resilient Infrastructure. (2024). Transport infrastructure reimagined: Forging resilient connections – An integrated framework to unlocking resilience dividends for South Asia. BCG & CDRI. https://dymez6ioe12by.cloudfront.net/media/wp-content/uploads/2025/05/27065327/transport_infrastructure_reimagined.pdf

Boston Consulting Group (BCG) & UN Climate Change High-Level Champions. (2023). Adaptation & resilience through land transport infrastructure systems: Protecting communities and economies. Boston Consulting Group. (Link)

Plan to Accelerate Implementation of Resilient and Adaptive Transport Infrastructure

European Commission. (n.d.). *Transport and the Green Deal.* https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/transport-and-green-deal_en

International Transport Forum. (2024). Transport system resilience: Summary and conclusions (ITF Roundtable Reports, No. 194). OECD Publishing. https://www.itf-oecd.org/sites/default/files/docs/transport-system-resilience.pdf

SLoCaT Partnership (SLoCaT) *Global Status Report (GSR).* Module 1, Section 1.2: *Transport Adaptation and Resilience* (3rd Edition of the GSR) https://tcc-gsr.com/module-1/transport-adaptation-and-resilience

Martin, P., Jamal, O., Bor zog, S., Khullar, T. & Workman, R. (2025) *Bridging the gap: Overcoming the barriers to AI adoption in transport*. Wokingham, Berkshire: TRL Limited, May. Report no. PPR2060.

UNFCCC COP27 Transport Implementation Lab. (2022). Engineering the vision for climate-resilient transport: Implementation Lab outcomes. UNFCCC Global Climate Action. (Link)

United Nations Department of Economic and Social Affairs. (n.d.). *Sustainable transport*. https://sdgs.un.org/topics/sustainable-transport

World Bank (2022) *Climate Toolkits for Infrastructure PPPs*. Washington, DC: World Bank. (Link)