Organisation for Economic Co-operation and Development

Planning and Financing Sustainable, Climate-Resilient Infrastructure in Central Asia: The Case of the Transport Sector

Background Note

Green Finance Summer Academy: Planning and financing sustainable, climate-resilient infrastructure in Central Asia

This background note is circulated to support presentations and discussions during the Green Finance Summer Academy organised jointly with the German Kazakh University (DKU) under the project "Planning and financing sustainable, climate-resilient infrastructure in Central Asia" project, and to provide participants with additional detail on the analytical work undertaken to date. The OECD Secretariat will continue to develop and refine the contents of this note in view of the production of a final report, and would welcome any comments, corrections, or suggestions from participants.

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Context

1. **This background note serves as a supporting document for the Green Finance Summer Academy in Kazakhstan of the OECD Project on *Planning and Financing Sustainable, Climate-Resilient Infrastructure in Central Asia* (hereafter the Project), supported by the GIZ Project: Policy dialogue and knowledge management on climate protection strategies (DIAPOL-CE).** The Project aims to support capacity building within governments of Central Asia and Mongolia for mainstreaming climate resilience into infrastructure planning and financing, with a focus on the transport sector. Climate-resilient infrastructure is here defined as infrastructure that is planned, designed, built and operated in a way that anticipates, prepares for, and adapts to changing climate conditions. It can also withstand, respond to, and recover rapidly from disruptions caused by climate change (OECD, 2018[1]).

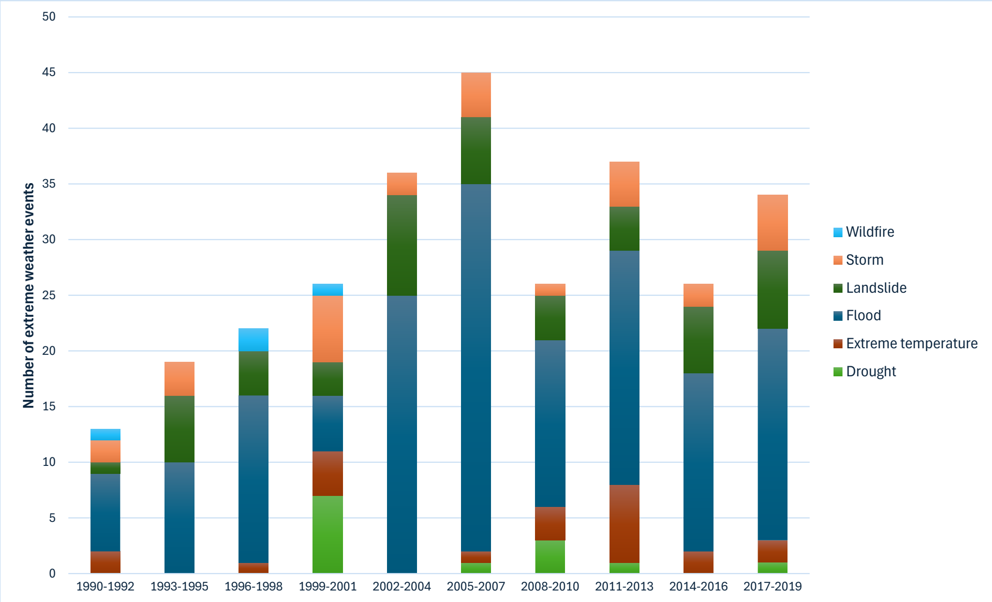
2. **In this context, this note frames the issue of climate resilience integration in transport infrastructure plans in Central Asia.** It starts by providing contextual information about climate-related risks facing transport infrastructure in the region and presents the economic implications of climate-resilient infrastructure investments. It then highlights the opportunity for better integrating Central Asia's agenda for transport infrastructure development with its climate adaptation agenda, highlighting expected benefits. Finally, it provides a detailed overview of the Project's proposed 4-pillar approach for developing policy measures and tools supporting climate resilience integration into transport infrastructure development plans.

3. **As climate change accelerates, infrastructure is increasingly exposed to intensifying physical climate risks.** Several studies focusing on Central Asia observe a warming trend at a rate surpassing the global average, with a temperature rise of + 0.30°C per decade over the past fifty years, compared to the global average of +0.19°C (Broomandi et al., 2025[2]). Warming trends are also accelerating permafrost thaw and affecting the timing and rate of snowmelt and glacial melt in mountainous regions. Extreme weather events – such as floods, droughts, wildfires, snow and dust storms, landslides, heatwaves and cold waves – are becoming increasingly frequent and intense (Figure 1).

4. **The infrastructure damage generated by these extreme events can have far-reaching economic, social and environmental consequences.** In March and April 2024, Kazakhstan experienced two of its largest flooding events in the past 80 years, which, according to official estimates, caused over USD 623 million in damages (UNDRR, 2025[3]), including the loss of housing stock and critical infrastructure such as bridges and roads (ACAPS, 2024[4]). In the same year, Kyrgyzstan saw its highest number of mudflows and landslides in 30 years, causing USD 14.5 million in infrastructure damage (24 KG, 2025[5]). Beyond direct economic costs, such infrastructure damage often reduces emergency response capacity, displaces populations, and generates cascading impacts across multiple economic sectors, including agriculture (OCHA Reliefweb, 2024[6]).

Figure 1. Extreme weather events in the Central Asian Regional Economic Cooperationregion increased significantly between 1990 and 2010, with floods and landslides being the most frequent

Occurrence of extreme weather events in the CAREC Region, 1990-2019 (3-year averages)



Note: Combines data from the EM-DAT international disaster database, World Bank, and International Monetary Fund (IMF) The Central Asia Regional Economic Cooperation (CAREC) countries include Afghanistan, Azerbaijan, PRC, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan.
Source: Based on (CAREC, 2023[7]) after (German Watch, 2021[8]).

Social and environmental costs from climate-induced infrastructure damage disproportionately affect the most vulnerable segments of the population. Women and vulnerable groups such as children and the elderly, often bear the brunt of these impacts due to existing social inequalities and different exposures and vulnerabilities (OECD, 2021[9]). Damage to critical infrastructure such as healthcare and transportation networks can exacerbate these vulnerabilities by limiting access to essential services, reducing livelihood opportunities and increasing displacement risks. This underscores the need to integrate climate-resilient infrastructure, as well as gender and social equality objectives.

Recent OECD analysis shows that, despite progress made in the past few years, infrastructure policies in Central Asian countries require stronger integration of climate resilience and broader sustainability considerations to avoid climate-vulnerable assets (OECD, 2026[10])**.** Aligning infrastructure project pipelines with resilience and sustainability objectives requires strengthening national planning frameworks, including the development of robust national climate adaptation plans and the systematic integration of their objectives and measures across all relevant national and sectoral plans. It also requires scaling up the application of planning tools, including comprehensive Strategic Environmental Assessments (SEA), Environmental Impact Assessments (EIAs), climate risk assessments and integrated cost-benefit analyses that explicitly account for resilience criteria. Sectoral regulatory and policy that operationalise adaptation objectives, as well as sustainable finance mobilisation, also play a key role.

Planning and financing climate-resilient infrastructure should become a policy priority in Central Asia. Building climate-resilient infrastructure is directly linked to national climate adaptation objectives, which aim at reducing vulnerability and exposure to future climate impacts. Importantly, resilience reduces – but does not fully eliminate – risks. Hence, adaptive management throughout the entire infrastructure lifecycle is essential, reflecting an approach in which risks are identified and managed to achieve an acceptable level of performance under uncertainty (OECD, 2018[1]) (OECD, 2024[11]).

The economic case for mainstreaming climate resilience into infrastructure planning

Strengthening the climate resilience of infrastructure can require higher upfront costs. For instance, annual adaptation costs for the European Union (EU)'s transport sector until 2050 range from EUR 7-8 billion under a moderate-emissions scenario to EUR 11-20 billion under a high-emissions scenario (Neumann, 2026[12]; European Environment Agency, 2026[13]). Given the long lifecycles and capital-intensive nature of infrastructure projects, such investments involve significant initial capital costs, longer payback periods and additional preparatory work. These factors highlight the need to integrate climate-resilience considerations early in investment planning and financing decisions.

When assessed over the full lifecycle of infrastructure assets, however, there is a strong economic rationale for investing in climate-resilient transport infrastructure. While resilience measures may increase initial investment requirements, they generate significant and often underappreciated long-term returns by prolonging asset lifespans, improving service reliability, and reducing repair and retrofitting costs by avoiding preventable losses. In transport networks, resilient infrastructure helps maintain critical connectivity during extreme weather events, reducing economic disruption and ensuring continuity of supply chains and mobility for people and goods. Across infrastructure sector and in the median scenario, the net benefit of investing in more resilient infrastructure in low- and middle-income countries is USD 4.2 trillion, with $4 in benefit for each $1 invested (World Bank, 2019[14]). Conversely, failing to integrate resilience considerations at planning and appraisal stages risks locking in costly vulnerabilities, potentially leading to stranded infrastructure assets and escalating future losses.

Beyond avoided damages and long-term cost savings, investments in climate-resilient infrastructure also generate wider social, environmental, and economic co-benefits. For example, research indicates that each USD 1 billion invested in flood-resilient infrastructure in the United States could generate up to 40 000 additional jobs (OECD, 2024[11]). For transport specifically, resilient roads, bridges, and railways can reduce delays and improve accessibility for underserved regions. In addition, climate adaptation investments can help safeguard public financing by reducing contingent liabilities and climate-related shock exposure, supporting long-term national budget sustainability and sovereign creditworthiness (ADB, 2024[15]).

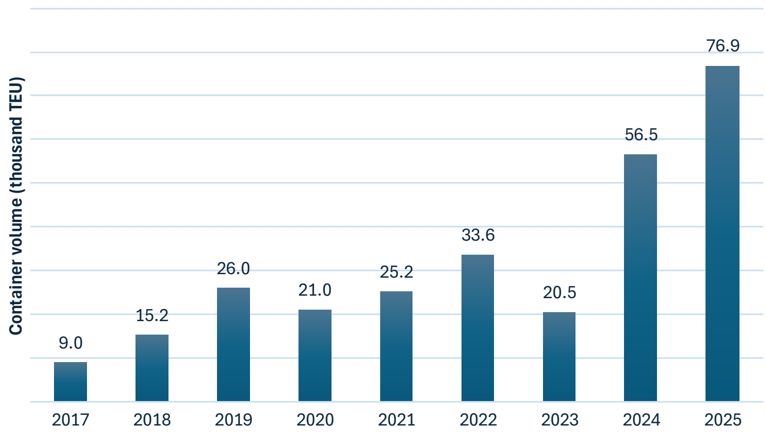
Innovative project appraisal tools, such as integrated cost and benefit analysis, help uncover broader costs and benefits associated with climate resilience, along with other sustainability benefits. These tools help quantify the economic value of resilience benefits, enabling a more comprehensive assessment of infrastructure returns beyond upfront costs. Some of these tools are presented later in this note.

The opportunity for investing in climate-resilient transport infrastructure in Central Asia

Investing in transport infrastructure is essential to Central Asia's sustainable development plans. Infrastructure plays a central role in achieving economic, social and environmental sustainability objectives. In Central Asia, the financing gap for delivering needed energy, transport and other critical infrastructure is estimated to be around USD 33 billion per year (ADB, 2017[16]). In recent years, the development of regional transport corridors has become central to the strategic co-operation agenda of Central Asian countries and their trading partners, and their importance is likely to further grow in light of the geopolitical tensions affecting neighbouring countries. The volume of goods transported via the Trans-Caspian Transport Corridor (TCTC)[1], for example, is growing rapidly: between 2023 and 2024 alone, transport traffic increased by 62%, from 2.8 to 4.5 million tons (OECD, 2025[17]). Future projections suggest even higher volumes, with estimates indicating up to 11 million tons of goods transiting via the Caspian Sea by 2030 (World Bank Group, 2023[18]).

Figure 2. Trans-Caspian Transport Corridor (TCTC) container traffic trends

Thousand TEU (Twenty-foot Equivalent Unit), 2017-2025



Source: (Middle Corridor Trans-Caspian International Transport Route, 2026[19]).
Note: A Twenty-foot Equivalent Unit (TEU) is a standard unit of measurement used in maritime and intermodal transport to express cargo capacity. It is based on the volume of a standard 20-foot-long ISO shipping container, which equals 1 TEU.

The region's transport systems are highly vulnerable to climate shocks and extreme weather events. They remain heavily reliant on road networks, many of which are ageing and inadequately designed to withstand intensifying climate risks (Nirandjan S. Koks E.E., n.d.[20]). Evidence shows increasing instances of asphalt melt across Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan, with traffic incident rates closely correlated with periods of extreme heat. At the same time, many roads and bridges have insufficient drainage capacity, which exacerbates their vulnerability to heavy rainfall and landslides (CAREC, 2026[21]). Weather-related damage to road and rail assets already imposes annual costs of approximately USD 45 million in both Kazakhstan and Uzbekistan, with losses projected to rise over time. In Kazakhstan alone, where around 10% of transport infrastructure is exposed to natural hazards, firms could incur additional costs of up to USD 1.1 billion – equivalent to 0.5% of GDP – due to the inefficient use of existing transport infrastructure (UK Met Office, 2024[22]). These climate vulnerabilities directly increase logistics and transport costs, undermining competitiveness and constraining sustainable development.

These reflect broader international trends. Under a moderate emission scenario, for example, 6.8 million km of road and rail assets globally are projected to face increasing exposure to extreme precipitation (Liu et al., 2023[23]). Table 1 provides an overview of typical risks affecting selected modes of transport infrastructure.

[1] The Trans-Caspian Transport Corridor (TCTC), also referred to as Middle Corridor, or Trans-Caspian International Transport Route (TITR), refers to several emerging routes of railways and ports linking Europe, Türkiye, the rest of the Black Sea, Armenia, Azerbaijan, and Central Asia.

Table 1. Climate risks affecting selected transport infrastructure

Mode	Climate hazard	Infrastructure impacts
Land (roads, railways)	Extreme heat	Pavement softening (rutting), thermal rail expansion (buckling)
	Extreme precipitation and riverine flooding	Washouts and flooding of roads and railways
	Storms, high winds	Blockage of roads and railways due to fallen trees or damaged assets
	Permafrost melt	Buckling and destabilisation of roads and railways
Riverine	Droughts	Riverine transport routes (temporarily/seasonally) becoming unnavigable
	Riverine floods	Damage to ports, ships and cargos; riverine transport routes temporarily becoming unnavigable
	Storms, high winds	
Marine	Sea level rise and storm surges	Inundation and erosion of ports
	Temperature rise	Changing demand for ports
	Storms, high winds	Damage to ports, ships and cargo, temporary disruptions of transport routes
Aviation	Storms, extreme precipitation, cold waves, wildfires	Disruptions to flight schedules, damage to aircraft and airport infrastructure, risks to safety (e.g. accidents), need for extensive de-icing of aircraft and runways, impacts on mechanical operations, runway buckling

Source: Based on (OECD, 2024[11]).

Investments in transport connectivity projects, notably transport corridors, provide a strategic opportunity to align infrastructure spending with both long-term economic growth, climate-resilience, and gender policy objectives. Transport infrastructure investments have surged in recent years along the TCTC, with the EBRD increasing its investments in the Central Asian transport sector from EUR 350 million in 2023 to EUR 950 million in 2024, and the Asian Development Bank tripling its commitments to USD 925 million (EU4Digital, EY Baltic UAB, 2026[24]). Both the EBRD and the World Bank have pinpointed investment needs related to the Almaty Railway Bypass Project, Caspian port capacity upgrades in Kazakhstan, and the Nukus-Beyneu rail link between Uzbekistan and Kazakhstan (EU4Digital, EY Baltic UAB, 2026[24]; AIIB, 2025[25]). By putting the right policy frameworks in place, governments can help ensure that these projects catalyse further investments in sustainable, robust, climate-resilient regional transport infrastructure, including with funding coming from the private sector (Box 1).

Box 1. Assessing the Economic Viability of Climate-Resilient Infrastructure Investments Along the Middle Corridor

The 2026 study “Natural hazard risks in the Middle Corridor” analyses geophysical and climate risk exposure of railways and road networks along the Middle Corridor (MC). The study also undertakes a corridor-wide cost-benefit analysis (CBA) assessing whether climate-resilience investments can be economically justified.

According to the results contained in the study’s extended abstract presented at the International Conference on Resilient Systems in March 2026 in Delft, the Netherlands, the MC is exposed to multiple, overlapping hazards. Under current conditions, pluvial flooding represents the largest source of railway risk (around 44%), followed by earthquakes (37%) and fluvial flooding (15%), while landslides are more localised but potentially critical in specific countries. Future climate scenarios show a clear increase in flood-related and rainfall-triggered landslide risks across the corridor, with combined rail and road flood damages projected to rise from approximately USD 92 million historically to over USD 100 million by 2080. While aggregate risk levels increase, the distribution of exposure varies significantly across countries and hazard types, underlining the need for locally tailored risk management and investment strategies.

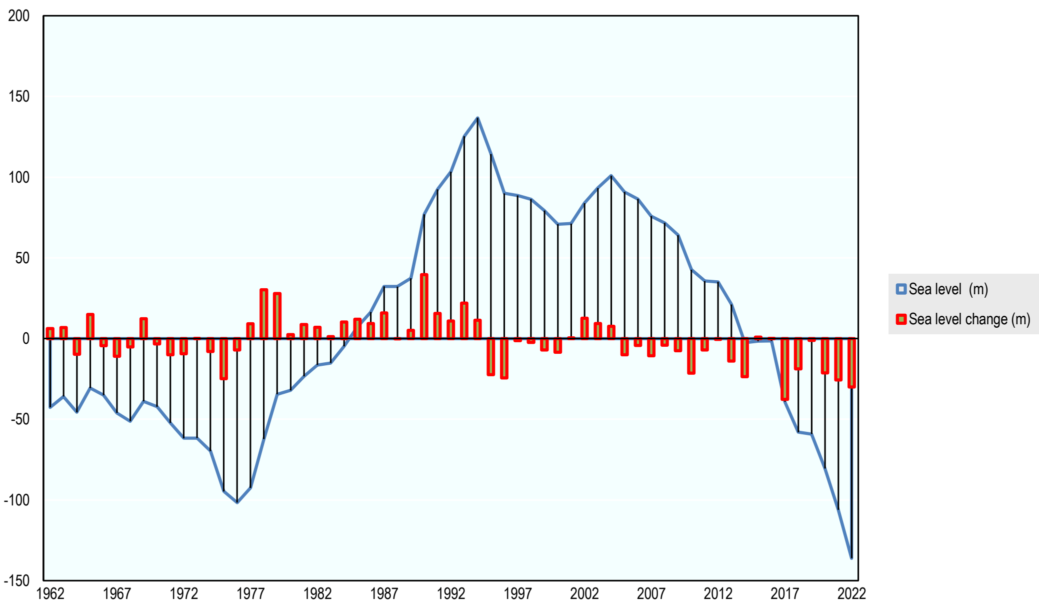
According to preliminary results of the CBA applied to the Georgian railway, 33% of flood-exposed railway segments show a positive benefit–cost ratio of resilience investment under conservative assumptions. Upgrading around 838 km of railway, at an estimated cost of USD 25.2 million, could reduce annual flood-related damages to USD 10.7 million and generate discounted benefits of over USD 100 million over a 15-year period.

Source: (Nirandjan S. Koks E.E., n.d.[20])

Awareness of climate-related risks and of the broader environment–transport infrastructure nexus is present across the region, but not yet systematically translated into planning and investment decisions. Recent high-level political statements suggest that awareness of the risks associated with declining Caspian Sea water levels is increasing across the region and acknowledged among policymakers and stakeholders involved in transport and connectivity initiatives (Figure 3). Scientific evidence and recent high-level policy discussions highlight that climate-driven sea-level decline poses material risks to coastal infrastructure, ports, ferry operations and multimodal logistics chains across the Caspian Sea, with direct implications for trade, competitiveness and regional connectivity. As the Caspian Sea constitutes a critical maritime segment of the TCTC, these risks are also recognised as relevant to the corridor's long-term reliability and performance. While the TCTC agenda has so far primarily focused on scaling up capacity, improving inter-modality and removing regulatory bottlenecks, emerging awareness of climate-related hydrological risks is beginning to inform discussions on the need to factor environmental sustainability and climate resilience into corridor planning and investment decisions, including port adaptation, navigation standards and coordinated regional responses (OECD, 2025[17]).

Figure 3. Trends in water levels in the Caspian Sea (1962-2023)

Caspian Sea Level (m) and Changes in Caspian Sea level (m)



Note: The blue line shows Caspian Sea level relative to the 1962 reference, while the red bars show annual changes. After significant fluctuations in the late 20th century, water levels have declined sharply since the 1990s, with accelerated declines in the 2010s and early 2020s.

From Aktau hydrological station (Kazakhstan). Dataset: *General Catalogue of the Caspian Sea Level*, updated monthly until 2023 by the Coordinating Committee for Hydrometeorology and Pollution Monitoring of the Caspian Sea (CAPSCOM).
Source: (CAPSCOM, 2026[26]).

Recent evidence suggests that declining Caspian Sea water levels constitute a structural and long-term transformation rather than a cyclical fluctuation. Water levels have fallen by approximately 2 metres since 2006, reaching historically low levels, and are projected to decline by a further 9 to 18 metres by 2100 under medium- to high-emissions scenarios, potentially reducing the sea's surface area by up to one third (UNEP-DHI, 2024[27]; ISDP AFPC, 2023[28]; Carnegie Russia Eurasia Center, 2025[29]). This trend is driven by a combination of increasing evaporation due to rising temperatures and declining river inflows, particularly from the Volga River, which accounts for around 80–90% of total inflow. Upstream water regulation and expanding agricultural withdrawals have significantly reduced river discharge, contributing to a measurable decline in inflows and accelerating the imbalance in the basin's hydrological system (Carnegie Russia Eurasia Center, 2024[30]; Duku, 2026[31]; Central Asia Climate Portal, 2025[32]).

These changes have direct implications for the Trans-Caspian Transport Corridor (TCTC), which relies on maritime transport across the Caspian Sea. Declining water levels are already constraining port operations and navigation, reducing vessel loading capacity to around 70–75% in some cases and increasing reliance on dredging and other adaptation measures (World Ports, 2025[33]; ISDP AFPC, 2023[28]). As a result, cargo capacity can decline by up to 20%, increasing transport costs and reducing corridor efficiency (Eurasia Review, 2025[34]). Over time, continued sea level decline may lead to shoreline retreat, increased infrastructure exposure, and the risk of stranded port assets, thereby undermining the long-term economic viability and reliability of the corridor. These dynamics highlight the need to integrate climate-related hydrological risks into transport infrastructure planning and financing strategies.

Although early steps have been taken to embed climate resilience in the design of regional transport infrastructure projects, approaches remain fragmented and largely confined to individual investments, rather than embedded within a coherent corridor- or network-level framework. Donor-supported projects have often been at the forefront of this agenda. The Jezkazgan-Karagandy sections of the Middle Corridor, financed by the Asian Infrastructure Investment Bank (AIIB), illustrate how international partners and financiers can support the mainstreaming of climate resilience within regional connectivity projects. Existing environmental certifications schemes adopted by ports along the Caspian Sea show some potential to further link climate and transport policy objectives, though their contribution to climate resilience remains indirect.

Some of the regional structural risks, such as those associated with declining Caspian Sea levels, are acknowledged (UNEP-DHI, 2024[27])**, but regional co-operation mechanisms, even when they exist, have yet to translate this recognition into an actionable, coordinated strategy to address such risks**. The Tehran Framework Convention for the Protection of the Marine Environment of the Caspian Sea (2006) brings together Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan and serves as an overarching governance framework for managing environmental risks and enabling sustainable development in the Caspian Sea region. Its protocols address transport-related environmental issues through provisions on oil spill preparedness and response in maritime transport and ports (Aktau Protocol), pollution from land-based and transport-related infrastructure, including ports (Moscow Protocol), and biodiversity protection measures that may constrain transport development in sensitive areas (Ashgabat Protocol). More recently, the Protocol on Environmental Impact Assessment in a Transboundary Context, which entered into force in 2025, enhances project-level environmental scrutiny and cross-border consultation for transport infrastructure. The Convention, however, does not address system-wide or long-term transport risks linked to declining sea levels, despite the threat they may pose on the sustainability of the TCTC development (UNEP, 2025[35]).

Box 2. Integration of Climate Resilience in Regional Transport Initiatives

TRACE Project

TRACE (Transport, Resilience and Connectivity Enhancement) is an AIIB and World Bank-supported initiative aiming at upgrading a selected section of the Middle Corridor between Jezkazgan and Karagandy, focusing on improving road conditions and implementing climate-resilient standards. The project entails the upgrading of existing road infrastructure and transport systems to align with climate-resilient standards and safety measures, the introduction of integrated design, build and maintenance contracts, and the incorporation of road sustainability features. It also includes the review and adaptation of national road design standards to better account for climate risks and the identification of actions to improve functionality and efficiency of the Corridor, while also reducing emissions.

Eco-certifications of Caspian Ports

Selected ports along the Caspian Sea, notably Port Kuryk and Port Aktau, have adopted internationally recognised environmental, health, safety and quality management standards. These certifications demonstrate an institutional commitment to environmental management and risk control in port operations, but their contribution to climate resilience remains indirect.

Port Kuryk's Environmental, Health and Safety Policy references certification under ISO 14001 and ISO 45001, while Port Aktau holds certifications under ISO 14001, ISO 45001, and ISO 9001, and is additionally certified under the Port Environmental Review System (PERS).These ISO standards are internationally recognised management systems, enabling ports to structure environmental and safety practices through documented procedures, monitoring, audits and continuous improvement.

While ISO certifications help strengthen risk awareness, monitoring and management processes, they do not impose explicit performance targets and do not directly address climate resilience. Elements relevant to resilience, such as risk assessment, environmental monitoring and adaptive management, are present only indirectly, through general requirements for identifying risks and improving management systems over time. As such, ISO certifications support enabling conditions for resilience but do not ensure systematic planning for climate-induced hazards or long-term climate risks.

By contrast, PERS is a port-specific environmental management standard tailored to the operational realities of ports. It focuses on addressing key environmental risks typical of port activities, including air emissions and water pollution, through structured environmental reviews, dedicated management and monitoring systems, and external audit requirements. Although PERS similarly does not constitute a dedicated climate-resilience framework, its sector-specific focus and emphasis on continuous environmental performance monitoring provide a more targeted basis for managing environmental pressures in port operations.

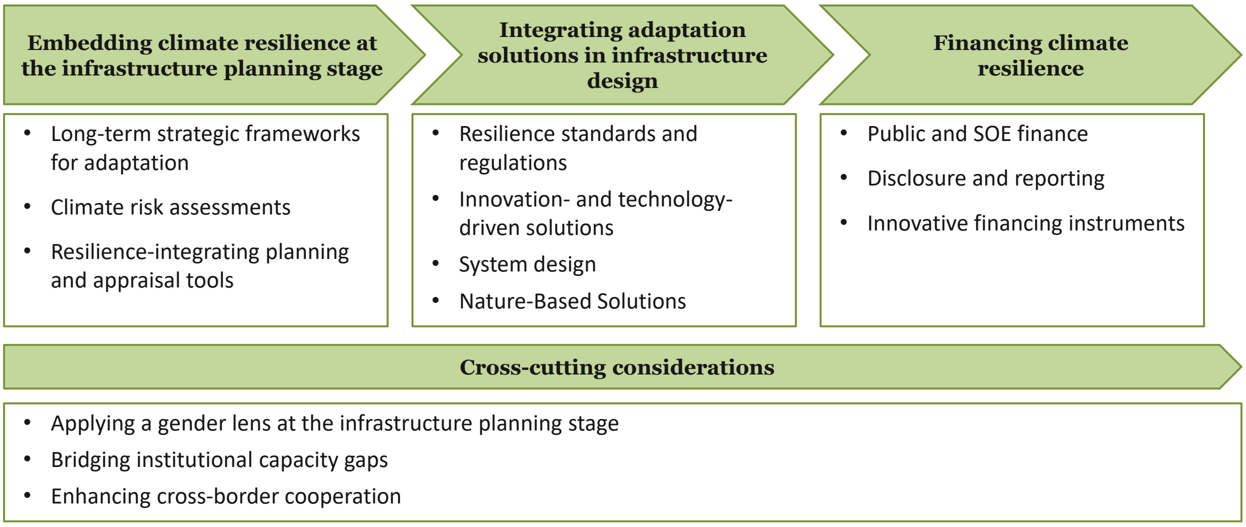
Source: (AIIB, 2024[36]; EBRD, 2026[37]; ECOSLC, 2025[38]; Quryq Port, 2026[39]).

Policy measures and tools for delivering climate-resilient transport infrastructure

Public policy has a major role to play in aligning public and private infrastructure investments with climate adaptation goals. This means moving beyond traditional design and construction standards to embed forward-looking risk assessments, risk-informed design solutions, as well as climate-resilience considerations into every stage of infrastructure lifecycles. By building institutional capacity and crafting policy frameworks that incentivise private sector investments and increased leverage for public and international financing options, policymakers can help ensure that the infrastructure developed today will deliver benefits for decades, aligning with climate, Sustainable Development Goals and economic development agendas.

Embedding climate resilience in infrastructure delivery requires integrating climate risk considerations throughout the entire project cycle, from planning and design to project selection, construction, operation and maintenance. Figure 4 provides an overview of a proposed approach policymakers can use to design and implement policies supporting the mainstreaming of climate resilience into infrastructure planning and financing. The approach is structured around four pillars. Three pillars – planning, design and financing – broadly follow the infrastructure planning and financing cycle, while recognising that this cycle is not strictly linear and that, in practice, processes often overlap and iterate. A fourth, cross-cutting pillar focuses on policies that operate across all stages of the cycle.

Figure 4. Proposed approach for embedding climate resilience into infrastructure planning and financing



Source: Authors.

Embedding climate resilience at the infrastructure planning stage

Long term strategic planning frameworks for adaptation

The development and implementation of National Adaptation Plans (NAPs) offer a critical entry point for embedding climate resilience and equity considerations into long-term investment planning. Well-designed NAPs can guide governments, businesses, households and other stakeholders in their respective roles and responsibilities in building climate resilience across communities, ecosystems and economic value chains, including infrastructure. They can also provide a coherent framework to drive sound public and private investment decisions in support of climate resilience. Evidence from OECD work shows that progress on the ground is conditional on the alignment of regulatory, institutional, fiscal and economic policies with climate adaptation goals (OECD, 2024[40]).

Progress in the adoption of NAPs varies across Central Asia. While Mongolia and Tajikistan have already adopted their NAPs, plans in other countries remain at earlier stages of development. Kazakhstan, Uzbekistan, Kyrgyzstan, and Turkmenistan have launched processes to develop their NAPs with support from the United Nations Development Programme (UNDP). However, other relevant climate strategies and plans in place in these countries, such as the Nationally Determined Contributions (NDC) already include climate adaptation measures.

Although NAPs and other climate policy documents identify adaptation measures relevant to the transport sector, these measures remain relatively limited and unevenly developed (Table 2). Transport is addressed mostly under broader measures targeting infrastructure at large, as in the case of Mongolia, or under measures for cities and urban infrastructure, limiting their ability to effectively strengthen the resilience of transport networks. Most existing measures, in addition, tend to focus on disaster risk management and ignore prevention measures and adaptive system design (OECD, 2026[10]).

Table 2. National Adaptation Plans (NAP) and transport coverage in Central Asian countries

Country	Status	Title	Transport coverage
KAZ	In development since 2024	-	The forthcoming NAP plans to be linked with the National Development Plan 2029 and result in climate adaptation objectives in sectoral and territorial development plans. The NDC 3.0 plan already mentions the strengthening of climate resilience through national rules for emergency evacuation and the protection of critical transport, energy, and water infrastructure.
KGZ	In development since 2021	-	The forthcoming NAP plans to deliver climate adaptation objectives for transport and infrastructure planning.
MNG	Adopted in 2025	National Adaptation Plan to Climate Change Mongolia 2024-2030	Section 4.3.4 is dedicated to "Infrastructure and Climate Resilience. Several adaptation actions outlined in the Annex aim to improve the adaptive capacity of the infrastructure sector, including: (i) revising and embedding standards, norms and regulations in the urban planning to improve resistance to extreme weather (Action 1.2); (ii) ensuring accessible financing for infrastructure adaptation (Action 2.2); (iii) using environmentally friendly engineering to mitigate permafrost impacts (Action 4.6); (iv) applying "Evaporation Management" for lake and aquatic ecosystem restoration and protective infrastructure (Action 6.7); (v) improving flood protection preparedness (Action 8.6).
TJK	Adopted in 2019	National Strategy for Adaptation to Climate Change of the Republic of Tajikistan 2030	Section 4 of the NAP is dedicated to the transport sector. Table 5 outlines 10 transport adaptation measures, including improving long-term operation and maintenance, updating construction practices, applying engineering standards focused on resilience, mountain road landslide protection, access improvement, structural modernisation, and strengthening regulatory frameworks and standards.
TKM	In development since 2021	-	No specific information is available on transport adaptation measures.
UZB	In development since 2020	-	The forthcoming NAP plans to set goals for water, agriculture, health, and housing. Transport is mentioned only in relation to agriculture and water but is not treated as a separate sector.

Source: (MENR, UNFCCC, 2025[41]; Republic of Kyrgyzstan, UNFCCC, 2025[42]; MECC, UNDP, 2025[43]; Republic of Tajikistan, 2025[44]; UNDP, 2026[45]; UNFCCC, 2025[46]).

Conversely, national transport and connectivity plans are found to contain limited to no reference to climate resilience (OECD, 2026[10])**.** While measures to enhance efficiency and competitiveness, such as multimodal investments and digitalisation, have the potential to yield positive climate resilience outcomes (International Transport Forum, 2025[47]), adaptation and resilience considerations could be further embedded in those plans, which would in turn help ensure that more capacity and resources are devoted to this topic. There is ample room for transport and connectivity plans to more systemically promote resilience measures and tools presented in the rest of this document (OECD, 2026[10]).

Climate risk assessments

Risk assessments are the first step to supporting the integration of climate resilience into infrastructure planning and management. By systematically assessing exposure to climate hazards and underlying vulnerabilities, they help guide decisions on infrastructure location and design, and inform the incorporation of resilience measures, including the selection of suitable construction materials, structural reinforcement, and protective solutions such as dykes or slope stabilisation. Risk assessments also support more robust project appraisal and cost–benefit analysis by enabling decision-makers to factor long-term climate risks into investment decisions. In addition, they can inform the development of appropriate operation and maintenance strategies, contributing to lower lifecycle costs and enhanced infrastructure resilience over time.

Public authorities play a central role in setting methodological guidelines and institutional frameworks for climate risk assessments and in enabling access to high-quality climate risk data (Box 2). Access to robust, reliable data is a prerequisite for sound climate risk assessments. Most countries within and beyond the OECD have developed national climate risk assessments, often also tailored to specific infrastructure sectors. However, these assessments are frequently too aggregated or generic to directly inform infrastructure investment and asset-level decision-making, which typically require high-resolution, locally relevant data on current and projected climate risks. While creating comprehensive, high-quality databases covering all risks across all infrastructure asset classes may be too resource-intensive in some countries, policymakers can support implementation by encouraging local initiatives and clearly signposting relevant data sources in guidance documents. They can also foster the progressive improvement of climate risk databases by leveraging advances in information technologies and data management tools.

Box 3. Case study: Climate risk assessment guidance for the UK transport sector

The United Kingdom has developed dedicated Climate Risk Assessment Guidance for the transport sector in response to growing evidence of climate-related risks to transport infrastructure, including impacts from flooding, extreme temperatures and severe weather events. Background analysis identified uneven quality and coverage of climate change risk assessments across the sector, notably for ports, airports and local highways. To address these gaps, the Department for Transport developed sector-wide guidance, which provides a structured, step-by-step methodology covering the scoping of assessments, identification of assets and climate hazards, analysis of current and future climate baselines, risk assessment and scoring, and the identification of adaptation actions. It also flags useful data sources for carrying out CRAs. The framework supports more consistent and systematic identification and prioritisation of climate risks by infrastructure owners and operators, strengthening resilience and improving adaptation planning across the UK transport sector.

Source: https://assets.publishing.service.gov.uk/media/67d94416975fce529e32f459/dft-climate-risk-assessment-guidance.pdf

There are recent examples of international partner-supported initiatives advancing frameworks for climate risk assessments in Central Asian countries. In November 2025, Kazakhstan, with the support of the UNDP and the Green Climate Fund, adopted its Climate Risk Assessment Methodology. This methodology provides a standardized, structured framework covering project preparation, risk identification, analysis and evaluation, in alignment with IPCC Assessment Report 6, ISO 14091 and ISO 31000 recommendations. This methodology can be applied to infrastructure systems, including transport networks. It enables asset-level analysis by combining climate hazard data (e.g. from Kazhydromet[2]) with

[2] Kazhydromet is the National Hydrometeorological Service of the Republic of Kazakhstan. As a state entity, it is responsible for nationwide meteorological, hydrological, agrometeorological, climate, and environmental monitoring, as well as for forecasting and issuing warnings on dangerous and adverse hydro-meteorological phenomena. Its data and products cover key climate-related hazards in Kazakhstan, including heatwaves and cold spells, droughts, floods,

spatially explicit exposure data, including roads and rail infrastructure available through sources such as OpenStreetMap, and by assessing vulnerability factors that influence the sensitivity and adaptive capacity of infrastructure assets. The use of impact chains and geospatial mapping is explicitly promoted to capture causal pathways, cascading effects and risk hotspots, supporting the prioritization of adaptation measures and their integration into sectoral planning and the National Adaptation Plan. While the methodology is cross-sectoral and does not include a transport-specific toolkit, it establishes core analytical, institutional and data foundations for systematic climate risk assessment of transport assets in Kazakhstan (GCF, UNDP, 2025[48]).

Resilience-integrating planning and appraisal tools

Climate risks should be embedded in infrastructure project planning and assessment mechanisms. A range of planning and appraisal tools accounting for environmental and sustainability impact, such as SEAs at policy level, and EIAs and integrated cost-benefit analyses at project level, have been already tested or are in use across Central Asian countries under national environmental legislation (Box 4). The OECD finds that these tools and their implementation can be further developed and strengthened (OECD, 2026[10]). Ensuring the integration of climate risk in SEAs and EIAs can help strengthen climate resilience of infrastructure development in Central Asia, including in transport when these assessments are required.

Box 4. Applying integrated Cost-Benefit Analysis in Asian countries

Cost-benefit analysis undertaken under SIPA by the UNDP and ENTEC, in the context of climate-proofing transport across Thailand, especially the climate-proofing of road infrastructure (e.g., drainage, resurfacing, elevation measures) shows that project feasibility is highly sensitive to the scope of benefits considered. For instance, when only direct costs were included, most measures had negative net present value (NPV) and benefit-cost ratios (BCR) below 1, whereas including indirect costs made the projects economically viable, increasing the BCRs to 2.87-5.29, and further incorporating gender equality, disability and social inclusion considerations raised BCRs to 3.45-6.31 (UNDP and ENTEC, 2025[49]).

Complementary SIPA work undertaken by the International Institute for Sustainable Development (IISD) on nature-based solutions (NbS) for road resilience in Indonesia further reinforces this finding, demonstrating that incorporating the ecosystem services (such as flood regulation, erosion control and avoided service disruption) that are retained through prudent project planning can significantly increase the estimated economic benefits of resilience investments beyond what is captured through conventional appraisal approaches. Recognising indirect and induced social, economic and environmental benefits increased the BCR of selected road segments in Indonesia from 2.41 to 6.53, a 2.7-fold increase (IISD, 2025[50]).

Sources: OECD, IISD.

Governments can institutionalise climate risk assessments and resilience criteria by explicitly integrating them into mandatory screening and assessment frameworks that govern infrastructure project planning, appraisal and approval. Several governments require climate and disaster risk screening tools to be applied before projects are approved or financed, particularly for infrastructure. This approach is widely promoted through public investment management reforms assessed under the IMF's

heavy precipitation, strong winds, snowstorms, and other extreme weather events, and underpin official early-warning and climate services at national and regional levels.

Climate-Public Investment Management Assessment (C-PIMA) framework, now applied in more than 50 countries. In 2023, the Philippines established mandatory climate and disaster risk screening for all strategic public investment projects into its national development authority (NEDA)-led appraisal and project approval under the Philippine's Development Plan 2023-2028 (OECD, 2024[51]).

Integrating adaptation solutions and disaster preparedness into infrastructure design

Resilience standards and regulations

While planning and appraisal tools are essential to ensure that climate risks are systematically identified and considered in infrastructure investment decisions, they do not, on their own, guarantee that resilience is embedded in infrastructure design. This requires complementary action through binding regulations and technical standards that translate risk assessments into enforceable engineering requirements.

Regulatory frameworks and technical standards set binding expectations for planning, design, construction and asset management throughout the full infrastructure lifecycle. When climate considerations are incorporated into enforceable rules, they help ensure that resilience is applied consistently across all infrastructure projects, rather than relying on case-by-case or voluntary approaches.

The literature consistently highlights gaps in the alignment of Central Asian infrastructure technical standards with internationally recognised norms and practices. For example, in 2024, the World Bank published a Climate Adaptation and Resilience Assessment of Uzbekistan. While its coverage of the transport sector is limited, the report notes that urban plans and infrastructure standards are outdated and do not adequately integrate disaster risk management guidelines for resilient infrastructure. It recommends developing a government-wide strategy to increase the resilience of infrastructure systems and public assets, and to integrate disaster risk management and climate adaptation in urban planning and development (World Bank, 2024[52]).

Upgrading regulations and technical standards with climate resilience considerations offers an avenue for reducing climate vulnerability of transport assets in Central Asia. Recent OECD examples show how such standard upgrades can enhance infrastructure resilience outcomes (Box 3).

Box 5. Case study: Climate-resilient bridge design standards in Canada

The Canadian Highway Bridge Design Code (CSA S6) is the national reference standard for highway bridge design. Although issued as a voluntary standard, it functions in practice as a de facto mandatory code, as provincial and territorial authorities systematically require compliance for publicly funded bridge projects.

The 2025 edition (CSA S6:25) introduces explicit requirements to account for projected climate conditions over the full-service life of bridges, moving beyond reliance on historical climate data. The Code integrates predictive climate modelling and recognises non-stationarity in climate hazards, including flooding, scour, temperature extremes, wind, ice, sea-level rise and permafrost degradation. As a result, climate-informed design has become a standard requirement for bridge planning, design and rehabilitation across Canada.

Source: https://www.csagroup.org/news/canadas-new-highway-bridge-design-code-first-in-canada-to-provide-guidance-for-future-climate-change-risks/?srsltid=AfmBOorJlyKrxCiDx4WrCUhV-236Xex59-yzH0ZHK84l2RdVpB3j7CK0

Innovation- and technology-driven solutions

Fostering innovation and technological development is central to building climate-resilient infrastructure. Prioritising climate resilience in infrastructure planning and delivery drives the development of new materials, adaptive design approaches and resilient construction techniques. This, in turn, supports the uptake of innovative and digital solutions across the infrastructure lifecycle, from planning and construction to operation and maintenance. By creating demand for new materials, advanced technologies and resilient practices, climate-resilient infrastructure policies can foster a culture of innovation and entrepreneurship, open opportunities for local industries and support the diffusion of cutting-edge technologies in infrastructure systems.

Digital and non-digital innovation can also significantly strengthen prevention and response capacities in developing and emerging economies, where institutional and technological constraints remain substantial (Box 4). In particular, many developing countries have limited capacities in Early Warning Systems (EWS) and Multi-Hazard Early Warning Systems (MHEWS), which are critical for anticipating and managing climate-related hazards. Only a small number of Least Developed Countries have MHEWS in place, and coverage of EWS remains uneven across regions (OECD, 2024[11]). Innovative technologies, including artificial intelligence, can help maximise the effectiveness of investments in early warning infrastructure by improving risk identification, real-time monitoring and the accuracy of climate models. While gaps persist, some progress illustrates the potential of integrated approaches that combine technology, infrastructure and community engagement, as in Mozambique's national EWS, which links meteorological monitoring, communication networks and local response mechanisms (OECD, 2024[11]). To scale such solutions, developing countries need to move beyond a narrow "technology transfer" model towards co-creation and partnership-based approaches, enabling local innovation ecosystems to develop climate-resilient solutions jointly with international partners and helping close persistent gaps in innovation and adaptation capacities.

Box 6. Digital solutions to enhance resilience of regional transport infrastructure

Cross-border digital platform for transport infrastructure resilience (Italy–Switzerland)

The Lombardy region (Italy) and Canton Ticino (Switzerland) share cross-border motorway and rail infrastructure that is critical for regional and international connectivity. Climate-related disruptions such as intense snowfall and extreme weather events pose risks to coordination and continuity of transport services across the border.

Authorities developed a cross-border digital platform (Critical Infrastructure Platform – PIC) to support the joint management of transport critical infrastructure. The platform enables participating Italian and Swiss organisations to exchange, visualise and analyse information in real time during disruptive events affecting transport infrastructure.

The platform supports coordinated cross-border response and decision-making when climate-related hazards affect transport networks, helping authorities manage disruptions that span national jurisdictions. The documented use case demonstrates its application during an extreme snowfall scenario affecting a transboundary motorway, highlighting the role of shared digital systems in managing climate-related transport disruptions at corridor scale.

Digital twin to strengthen resilience of a multimodal regional corridor (Twente region, Netherlands)

The Twente region in the eastern Netherlands relies on a multimodal transport corridor linking inland waterways, roads and logistics facilities to regional and international supply chains. Climate-induced droughts in 2018 and 2022 disrupted inland navigation, triggering spillovers to road transport and affecting corridor performance.

In response, regional stakeholders initiated the development of a digital twin of the multimodal corridor. The digital twin is designed to monitor corridor activities, performance and infrastructure in real time, and to provide alerts and information to stakeholders during disruptions. The referenced study documents the requirements analysis underpinning the digital twin's development, validated and prioritised by corridor stakeholders.

The digital twin is explicitly framed as a tool to help corridor actors prepare for, respond to, recover from and learn from climate-related disruptions, particularly drought-related impacts on inland waterways. While the study focuses on requirements rather than full implementation outcomes, it demonstrates how digital systems can support resilience management at corridor level, rather than at individual asset level.

Source: Petrenj, B. et al. (2023), *Cross-border Digital Platform for Transport Critical Infrastructure Resilience: Functionalities and Use-case*, Proceedings of the ISCRAM Conference; Guizzardi, R. et al. (2025), *Requirements Analysis for a Digital Twin to Increase the Resilience of Multimodal Corridors: A Case Study in the Twente Region*, Springer, Lecture Notes in Business Information Processing.

Network design

Studies undertaken by the International Transport Forum (ITF) under SIPA show that climate resilience in transport depends not only on the robustness of individual assets, but critically on the structural characteristics of transport networks as a whole. Redundancy, defined as the degree of substitutability within a transport network, is closely linked to network resilience, as it determines how a system can ensure service continuity when a specific infrastructure segment or node fails. Multi-modal networks (with one or more transport modes) have greater redundancy and are thus typically more resilient, although practical constraints may limit the ability to shift transport modes rapidly (Verschuur, 2024[53]).

Regional freight transport systems in Central Asia exhibit limited redundancy, constraining their resilience to external and climate-related shocks (Verschuur, 2024[53])**.** Regional transport development plans should therefore place greater emphasis on building redundancy alongside network expansion. Integrating systematic redundancy analysis and criteria into project planning, and identifying concrete measures to enhance redundancy, such as modal diversification and substitution, with a focus on critical segments with low redundancy, would help reduce disruption risks and strengthen the climate resilience of regional freight transport systems (Verschuur, 2024[53]).

Climate resilience of transport networks should be addressed through a holistic approach that jointly considers connectivity, decarbonisation, and resilience objectives, recognising their mutual interdependence. Analysis highlights that these dimensions are often mutually reinforcing, although trade-offs can emerge and require active management (McKinnon, 2024[54]). For example, greater network redundancy can enhance both connectivity and resilience, but may also result in higher emissions if assets are underutilised (McKinnon, 2024[54]). Connectivity, however, continues to dominate the priorities of regional freight transport stakeholders, while climate resilience remains the least systematically considered dimension (International Transport Forum, 2025[47]). Integrating climate resilience more explicitly into regional transport planning and design frameworks would therefore help address this imbalance, while enabling policymakers to better exploit synergies and manage trade-offs across objectives.

Nature-Based Solutions

Nature-based solutions (NbS), defined as measures that protect, sustainably manage or restore ecosystems, offer policy makers a cost-effective and flexible approach to strengthening the climate resilience of transport infrastructure. Transport networks are highly exposed to climate risks such as flooding, heat stress and land degradation, which can increase maintenance costs, shorten asset lifespans and disrupt economic activity. By maintaining or enhancing ecosystem services, NbS can help manage these risks either as standalone measures or as complements to grey infrastructure. Their increasing uptake in climate and infrastructure policy reflects not only their resilience benefits, but also their potential to reduce long-term costs while delivering additional environmental and social co-benefits.

Integrating NbS into transport infrastructure planning and investment decisions can support more resilient and economically efficient connectivity outcomes. Case studies using integrated cost benefit analysis and other alternative valuation approaches show instances where NbS are more cost effective than grey infrastructure solutions (Box 5). Where ecologically and hydrologically appropriate, measures such as protecting riparian zones along corridors, restoring wetlands and floodplains near transport assets, stabilising erosion-prone areas and incorporating green infrastructure in urban transport systems can reduce climate-related damage and lower lifecycle costs when combined with engineered solutions. When considered early in project design, appraisal and financing, NbS can help safeguard infrastructure performance under increasing climate variability, reduce future repair and disruption costs, and improve the reliability of transport services. By strengthening the resilience of both infrastructure assets and the value chains they underpin, NbS can contribute to more competitive and sustainable transport corridors across the region.

Box 7. Cost effectiveness of NbS vs. grey solutions based on alternative valuation approaches

Evidence from comparative assessments shows that NbS can reduce both upfront and ongoing costs relative to grey alternatives: in Aarhus (Denmark), a retention pond to manage heavy precipitation was found to be almost 11 times cheaper than a closed basin, with annual maintenance costs 4.6 times lower, while offering a similar operable lifespan. In São Paulo (Brazil), restoring 4 000 ha of forest to reduce sedimentation was USD 4.5 million cheaper than dredging reservoirs and generated a net benefit of USD 69 million over three decades. Similarly, land restoration measures in Indonesia's Barantas River Basin were found to be more cost-effective than building a water reservoir and were expected to deliver USD 104–131 million in net benefits over two decades through avoided flood and erosion damages and wider co-benefits; and in Johannesburg (South Africa), full stream renaturalisation yielded higher avoided flood damages than a hybrid option and provided additional water supply benefits.

Source: OECD (2024), Infrastructure for a Climate-Resilient Future, OECD Publishing, Paris, https://doi.org/10.1787/a74a45b0-en

Financing climate resilience

Financing climate-resilient transport infrastructure differs fundamentally from financing climate mitigation. While mitigation investments often generate new revenue streams through energy savings, carbon markets or other financial returns, resilience investments primarily create value by avoiding future losses. Investments in climate resilience reduce asset damage, minimise service disruptions, extend infrastructure lifetimes and improve operational reliability, but these benefits are often realised over the long term and accrue largely to users and society rather than infrastructure operators. As a result, many resilience investments are less likely to generate direct commercial returns, making them more difficult to finance through private capital alone.

This distinction has important implications for how resilience investments are financed. Integrating climate resilience into infrastructure finance requires assessing project viability over the full asset lifecycle rather than focusing solely on upfront capital costs. Climate-risk assessments, resilient engineering standards and adaptation measures may increase initial capital expenditure (CAPEX) and extend project preparation. However, these costs can often be offset through lower operating expenditure (OPEX), fewer service interruptions, reduced maintenance requirements and longer asset lifetimes. By reducing physical climate risks, resilience measures can also improve the predictability of future cash flows and strengthen long-term financial sustainability (OECD, 2024[55]). Life-cycle appraisal approaches that incorporate avoided damages and broader economic benefits therefore provide a stronger basis for investment decisions than traditional approaches based primarily on upfront costs.

These characteristics are particularly relevant for Central Asia. Across the region, transport infrastructure investment continues to rely predominantly on domestic public finance and multilateral development bank (MDB) lending, while private participation remains comparatively limited. Public finance is therefore likely to remain the cornerstone of climate-resilient transport infrastructure investment. However, given the scale of future investment needs, public resources alone are unlikely to be sufficient. Mobilising additional finance, particularly from commercial sources where projects demonstrate commercial viability, will therefore become increasingly important.

Governments can draw on a range of complementary financing sources to support climate-resilient transport infrastructure (Table 3). Rather than acting as substitutes, these financing sources perform different functions across the project lifecycle. Public and development finance remain essential for investments that generate substantial public benefits but limited commercial returns, while commercial finance becomes increasingly important where projects demonstrate sufficient bankability and revenue potential. Blended finance can help bridge these two by using development finance strategically to mobilise additional commercial investment.

Unlocking additional finance

While different financing sources play complementary roles, governments can increase access to these sources by improving project quality, reducing investment risks and strengthening the enabling environment for investment. In practice, this means integrating climate resilience into existing infrastructure investment and financing systems rather than treating resilience as a separate financing objective (OECD, 2024[55]).

Improving project preparation is central to making climate-resilient transport infrastructure projects bankable. Robust climate-risk assessments presented earlier in this note demonstrate that physical climate risks have been systematically identified and addressed, reducing uncertainty surrounding future infrastructure performance and strengthening project quality and bankability (Global Center on Adaptation, 2025[57]). As multilateral development banks (MDBs), climate finance providers and sustainable finance markets increasingly incorporate physical climate risks into investment appraisal, strong climate-risk assessments may become increasingly important for accessing international finance. The CAREC Corridor 2 Resilience and Modernization Project in Uzbekistan illustrates how MDB financing can support the integration of climate resilience into mainstream transport investment through sovereign lending, resilient infrastructure design and institutional strengthening (Box 8).

Box 8. Mainstreaming resilience through sovereign transport finance: CAREC Corridor 2, Uzbekistan

The CAREC Corridor 2 Resilience and Modernization Project in Uzbekistan illustrates how climate resilience can be integrated into conventional public and MDB-financed transport investment. The project is financed through an Asian Development Bank sovereign loan, complemented by Government of Uzbekistan counterpart funding.

Rather than relying on a dedicated adaptation finance mechanism, the project embeds climate resilience within a mainstream road investment by upgrading a strategic section of the A380 highway with climate-resilient design features, while also supporting road asset management and institutional strengthening. The project demonstrates how public finance and MDB lending can finance resilient transport infrastructure while strengthening the systems needed for long-term asset performance.

Source: (ADB, 2025[58])

Mobilising finance for climate resilience at scale critically depends on the broader national investment framework. For climate-resilient transport infrastructure, governments play a central role in creating the institutional, regulatory and policy conditions that encourage both public and private investment. Rather than relying on dedicated adaptation financing mechanisms, strengthening the enabling environment helps integrate climate resilience into mainstream infrastructure investment and improves the bankability of projects across a range of financing sources (OECD, 2024[55]).

Strengthening public investment management is an important starting point. Public policy instruments such as green budgeting and performance-based procurement can strengthen incentives to incorporate climate resilience into investment decisions while improving long-term infrastructure performance (OECD, 2024[55]).

Institutional capacity and regulatory certainty are also important for attracting commercial investment. Clear investment frameworks, transparent procurement processes and predictable regulatory environments reduce uncertainty for investors and improve the attractiveness of long-term infrastructure investments. Together with robust climate-risk assessments and high-quality project preparation, these measures help improve project bankability and facilitate access to both development and commercial finance (OECD, 2024[55]).

Concessional and blended finance

Concessional finance can support climate-resilient infrastructure where resilience measures generate substantial public benefits but limited financial returns. Grants, concessional loans and technical assistance can complement domestic public investment by reducing financing constraints and supporting the integration of climate resilience into infrastructure projects, particularly where adaptation measures are unlikely to be financed on commercial terms. (OECD, 2024[55])

Blended finance extends this approach by strategically combining development finance with commercial finance to mobilise additional private investment. By using concessional finance or other public resources to address specific investment risks, blended finance can improve project bankability and attract commercial capital that would not otherwise be mobilised. Rather than replacing either public or commercial finance, blended finance seeks to combine them in ways that allocate risks appropriately and maximise development impact (OECD, 2025[56]).

Although experience remains limited within the transport sector in Central Asia, financing structures developed for climate-resilient energy infrastructure demonstrate how blended finance can mobilise commercial investment where projects demonstrate sufficient long-term viability (Box 9). The use of blended finance for financing transport infrastructure such as ports in other regions suggests that this approach could be mobilised to finance transport and logistics assets within the TCTC.

Box 9. Blended finance in practice: The Zhanatas Wind Farm, Kazakhstan

The Zhanatas Wind Farm in Kazakhstan illustrates how blended finance can mobilise private investment in climate-related infrastructure. The project combined financing from the European Bank for Reconstruction and Development (EBRD), the Asian Infrastructure Investment Bank (AIIB), the Industrial and Commercial Bank of China (ICBC) and concessional finance from the Green Climate Fund (GCF).

By combining concessional climate finance with MDB and commercial lending, the financing structure improved the project's financial viability and enabled private investment that may not otherwise have been mobilised. Although the project is in the energy sector, it demonstrates how blended finance can help address investment risks and improve bankability for climate-related infrastructure, providing useful lessons for future transport investments with commercial potential.

Source: (AIIB, 2019[59])

Public-private partnerships

Public-private partnerships (PPPs) can mobilise private investment where projects demonstrate sufficient commercial viability and where risks can be appropriately allocated between the public and private sectors. PPPs can create stronger incentives for lifecycle asset management by linking private returns to long-term infrastructure performance. This provides opportunities to incorporate climate resilience through resilient engineering specifications, performance-based maintenance standards and contractual risk allocation.

However, PPPs remain relatively limited across the transport sector in Central Asia and are unlikely to replace public finance as the primary investment model. Instead, they should be viewed as a complementary mechanism for projects capable of attracting private participation. The Nairobi-Mombasa Expressway (Box 10) illustrates how climate resilience can be integrated into transport infrastructure PPP design through project preparation, contractual arrangements and long-term performance requirements.

Box 10. Nairobi–Mombasa Expressway (Kenya): using PPPs to integrate climate resilience into transport corridors

The Nairobi-Mombasa Expressway is a flagship public-private partnership (PPP) under development to upgrade the main road corridor linking Kenya's two largest economic hubs. Led by the Kenya National Highways Authority (KeNHA), the project is being structured as a long-term PPP and is explicitly designed to integrate climate resilience from the outset, with technical support from the Global Center on Adaptation (GCA) under the Africa Adaptation Acceleration Program.

The project incorporates climate risk assessments, the identification of cost-effective adaptation measures, and the development of a climate-resilient PPP contractual framework, aiming to ensure the expressway can withstand floods, extreme rainfall and heat stress over its lifecycle.

Estimated at USD 3.6 billion, the expressway would demonstrate how PPP models can mobilise private capital while embedding resilience standards contractually, offering a replicable approach for climate-vulnerable transport corridors in emerging economies.

Source: (Global Center on Adaptation, 2024[60])

Sustainable finance

Financial markets are also beginning to develop instruments that explicitly recognise climate resilience as an investment objective (Box 11). Although the application of resilience-focused sustainable finance instruments remains limited in Central Asia, these developments highlight a broader shift in infrastructure finance. Rather than treating adaptation as a standalone investment category, financial institutions are increasingly integrating physical climate risks into investment appraisal, financing criteria and portfolio management. As sustainable finance markets mature, such approaches may create additional opportunities to mobilise institutional capital for climate-resilient infrastructure, particularly where supported by robust climate risk assessments, resilient infrastructure standards and enabling regulatory frameworks.

Box 11. Emerging sustainable finance instruments for climate resilience

Financial institutions and standard-setting organisations are increasingly developing frameworks to support the identification and financing of investments that strengthen resilience to physical climate risks.

The Climate Bonds Initiative (CBI) has developed the Climate Resilience Principles and accompanying Climate Resilience Taxonomy to support the identification of investments that address physical climate risks. Rather than establishing a separate asset class for adaptation, the framework provides principles and screening criteria that can be applied across sectors to assess whether investments systematically identify climate risks and incorporate appropriate adaptation measures.

The European Bank for Reconstruction and Development (EBRD) has developed a Climate Resilience Bond Framework to guide the issuance of climate resilience bonds. Under the framework, bond proceeds are allocated to a portfolio of eligible climate resilience investments that demonstrate physical climate risks have been assessed and appropriate adaptation measures incorporated into project design. Eligible investments include transport transport, as well as water, energy and urban development, across the EBRD's countries of operation, including Central Asia.

Source: (Climate Bonds Initiative, 2024[61]) (EBRD, 2025[62])

Risk-transfer instruments

Even with robust climate-resilient infrastructure, some climate risks cannot be eliminated entirely. Risk transfer instruments – including indemnity insurance, parametric insurance, public insurance pools, guarantees and disaster-risk financing mechanisms – can complement investments in resilience by reducing the financial consequences of climate-related disasters and supporting faster recovery following extreme events (OECD, 2024[55]). Rather than replacing investments in resilience, these instruments help manage residual risks and strengthen the financial resilience of infrastructure systems.

Cross cutting considerations

Applying a gender lens at the infrastructure planning stage

Climate-resilient infrastructure is a key lever for advancing gender equality while strengthening communities' capacity to adapt to climate change. Investments in sectors such as energy and transport shape access to essential services, economic opportunities and exposure to climate risks – dimensions that affect women and men differently. Integrating gender considerations early in planning can improve the effectiveness, inclusiveness and long-term value of infrastructure by ensuring adaptation measures reflect diverse needs and capacities. Recent OECD work shows that although countries in Central Asia (Kazakhstan, Mongolia and Uzbekistan) have strengthened legal frameworks and national gender strategies, gender mainstreaming in infrastructure plans and delivery remains limited. The work also shared recommendations to mainstream gender considerations through practical tools, indicators and guidance for planners and decision-makers (OECD, 2026[10]).

Structural gender inequalities continue to constrain women's ability to adapt to climate change in Central Asia, even as they play a vital role in building resilience. Limited access to assets, finance, land and decision-making reduces women's adaptive capacity, increasing their vulnerability to climate impacts. At the same time, evidence from Uzbekistan and Tajikistan highlights women's contributions to resilience through natural resource management, agriculture and community-based adaptation efforts

(UNDP, 2025[63]). Infrastructure systems, particularly in climate-sensitive sectors, should both address structural inequalities and actively support women's participation in decision-making to maximise resilience outcomes.

Bridging institutional capacity gaps

Strengthening governance and institutional capacity is a prerequisite for developing countries to plan, deliver and manage infrastructure in ways that are resilient to climate change. This includes putting in place inclusive processes that allow stakeholders to meaningfully contribute to infrastructure decisions across the project lifecycle. Mechanisms for public consultation, community engagement and collaboration with civil society and the private sector help ensure that infrastructure projects respond to the needs and priorities of local communities, including vulnerable groups. National and subnational governments play a central role in translating policy objectives into practice, particularly when implementing innovative approaches to climate-resilient infrastructure. Building technical capacity within public administrations and across the private sector is therefore essential.

Capacity building and empowerment at the local level are critical. Local authorities are well positioned to understand how climate change is affecting their communities and infrastructure, and, when supported by appropriate policy frameworks and a systems approach to reform, they can play a decisive role in reducing climate risks. However, many local governments and communities in developing countries face acute constraints in both fiscal resources and technical expertise. Targeted measures are therefore needed to strengthen their capacities and enable them to contribute effectively to climate-resilient infrastructure development.

Enhancing cross-border cooperation

Effective climate resilience requires co-ordination beyond national borders, as climate risks and natural systems do not align with administrative boundaries. Geological and hydrological interconnections create spillovers that call for joint data collection, shared analysis and co-ordinated planning and crisis response between neighbouring countries. The interconnected nature of river basins, for example, offers a good illustration of why cross-border collaboration is needed when strengthening infrastructure resilience to floods and other natural hazards (OECD, 2024[11]).

The transboundary and systemic nature of regional transport corridors strengthens the case for cross-border collaboration. Such collaboration is already taking shape in practice, notably through cooperation platforms established along key connectivity routes such as the TCTC, where governments and partners work jointly to address shared connectivity challenges and align priorities. These platforms illustrate how a common understanding, shared standards and coordinated approaches can support more coherent infrastructure planning and operation across borders. Building on this foundation, elevating climate resilience within these cooperative frameworks can help ensure that infrastructure systems are not only more robust to climate-related shocks, but also that the value chains they underpin become more reliable and adaptable. In doing so, climate-resilient regional corridors can enhance both infrastructure performance and the competitiveness of the trade and production networks that depend on them.

Policy considerations

- **Make explicit reference to the transport sector in national adaptation plans.** Mainstreaming climate resilience into transport infrastructure decision-making requires embedding climate resilience upstream in national development strategies and sectoral plans, so that project-level decisions are anchored in systemic risk considerations rather than treated as an ex-post adjustment.

- **Consider integrating climate risk assessments and resilience criteria into mandatory screening and assessment frameworks that govern infrastructure project planning, appraisal, and approval.** Climate risk criteria should be systematically incorporated into SEAs, EIAs, and economic appraisal processes. Governments should also strengthen the availability, quality, and accessibility of climate risk and resilience data to support consistent and decision-relevant assessments across the project cycle.

- **Embed climate resilience through a combined approach that links binding technical standards, innovation, and system-level transport network design.** Updating regulations and engineering standards to integrate climate resilience, while promoting the adoption of advanced materials, digital tools, and data-driven solutions, can translate climate risk assessments into enforceable outcomes across the infrastructure lifecycle. At the same time, policymakers need to embed climate resilience in system design. Multimodality and network redundancy, in particular, should be integrated into planning frameworks, along with connectivity and decarbonisation objectives, to ensure that innovation and standards collectively strengthen service continuity and adaptability under climate stress.

- **Consider the use of Nature-based Solutions where relevant.** NbS are increasingly reflected in climate and infrastructure policy due to their potential to enhance resilience while delivering broader environmental and social co-benefits. Governments can draw on international experience with the use of NbS in transport infrastructure, both as standalone measures and as complements to grey infrastructure, and assess where NbS can be appropriately and effectively integrated into transport infrastructure development.

- **Align public investment frameworks, SOE financing arrangements and PPP structures with climate-resilient transport objectives.** Incentives for climate-resilient transport investment could be improved by aligning public investment decision-making frameworks, financing arrangements and procurement practices with resilience objectives. In this context, SOEs play an important role through their investment mandates and tariff-setting frameworks. PPP models may also offer opportunities to better allocate and manage climate risks, where contractual arrangements explicitly reflect resilience considerations and lifecycle performance requirements.

- **Integrate gender and social equality considerations into climate-resilient transport investment decisions.** Incorporating gender-responsive approaches into cost-benefit analysis, for example, improves the assessment of resilience and other measures by accounting for differentiated impacts on users and communities. Another important consideration for governments is to ensure that women are adequately represented in infrastructure decision-making processes and consultations such as those carried out under SEAs and EIAs.

- **Strengthen cross-border cooperation on climate adaptation and make climate resilience an integral part of regional cooperation on transport, trade and connectivity.** Such cross-border cooperation is critical given the cross-border and systemic nature of both natural and transport systems.

References

24 KG (2025), *Landslides and mudflows cause $14.5 million in damage in Kyrgyzstan in 2024*, https://24.kg/english/350342_Landslides_and_mudflows_cause_145_million_in_damage_in_Kyrgyzstan_in_2024/ (accessed on 4 May 2026). [5]

ACAPS (2024), *Kazakhstan Floods*, https://www.acaps.org/fileadmin/Data_Product/Main_media/20240423_ACAPS_briefing_note_Kazakhstan_floods.pdf. [4]

ADB (2025), *Central Asia Regional Economic Cooperation Road Corridor 2 Resilience and Modernization Project*, https://www.adb.org/projects/55244-002/main. [58]

ADB (2024), *Asia Pacific Climate Report 2024*, https://www.adb.org/sites/default/files/publication/1008086/asia-pacific-climate-report-2024.pdf. [15]

ADB (2020), *PRINCIPLES OF CLIMATE RISK MANAGEMENT FOR CLIMATE PROOFING PROJECTs*, https://www.adb.org/sites/default/files/publication/621021/sdwp-69-climate-risk-climate-proofing-projects.pdf. [91]

ADB (2017), *Meeting Asia's Infrastructure Needs*, https://www.adb.org/publications/asia-infrastructure-needs (accessed on 4 May 2026). [16]

AIIB (2025), *Kazakhstan: Almaty Railway Bypass Project*, https://www.aiib.org/en/projects/details/2025/approved/kazakhstan-almaty-railway-bypass-project.html (accessed on 10 April 2026). [25]

AIIB (2024), *Kazakhstan: Transport Resilience and Connectivity Enhancement Project (Jezkazgan-Karagandy section of Trans-Caspian International Transport Route (Middle Corridor)) (Previously: Strategic Road Connectivity and Sector Modernization Project)*, https://www.aiib.org/en/projects/details/2024/approved/kazakhstan-transport-resilience-and-connectivity-enhancement-project.html (accessed on 10 April 2026). [36]

AIIB (2019), *Kazakhstan: Zhanatas 100 MW Wind Power Plant*, https://www.aiib.org/en/projects/details/2019/approved/Kazakhstan-Zhanatas-100-MW-Wind-Power-Plant.html. [59]

Broomandi, P. et al. (2025), "The Escalating Threat of Heatwaves in Central Asia: Climate Change Impacts and Public Health Risks", *Global Challenges*, Vol. 9/12, https://doi.org/10.1002/gch2.202500401. [2]

CAPSCOM (2026), *General Catalogue of the Caspian Sea Level (Raw Dataset)*, http://www.caspcom.com/%d1%83%d1%80%d0%be%d0%b2%d0%b5%d0%bd%d1%8c/ (accessed on 13 April 2026). [26]

CAREC (2026), *Regional Climate Risk Portal*, https://centralasiaclimateportal.org/climate-risk-portal/ (accessed on 10 April 2026). [21]

CAREC (2023), *CAREC 2030: Supporting Regional Actions to Address Climate Change*, https://www.carecprogram.org/uploads/Supporting-Reg.-Actions-to-Address-Climate-Change_WEB-ENG.pdf (accessed on 15 April 2026). [7]

Carnegie Russia Eurasia Center (2025), *Aral Sea Syndrome: Why Is the Caspian Sea Shrinking?*, https://carnegieendowment.org/russia-eurasia/politika/2025/03/caspian-environment-crisis (accessed on 27 May 2026). [29]

Carnegie Russia Eurasia Center (2024), *Russia's War in Ukraine Is Aggravating the Caspian Sea Environmental Crisis*, https://carnegieendowment.org/russia-eurasia/politika/2024/08/caspian-sea-ecology (accessed on 27 May 2026). [30]

Caspian Post (2025), *Experts: Declining Caspian Sea Levels Threaten Russia and China's Key Projects*, https://caspianpost.com/environment/experts-declining-caspian-sea-levels-threaten-russia-and-china-s-key-projects (accessed on 18 June 2026). [70]

Central Asia Climate Portal (2025), *Shallowing Caspian: Kazakhstan turns to Russia to stabilize Volga flow*, https://centralasiaclimateportal.org/shallowing-caspian-kazakhstan-turns-to-russia-to-stabilize-volga-flow/ (accessed on 18 June 2026). [32]

Climate Bonds Initiative (2024), *Climate Bonds Resilience Taxonomy*, https://www.climatebonds.net/expertise/resilience-finance. [61]

Court, R. (2025), "Rapid decline of Caspian Sea level threatens ecosystem integrity, biodiversity protection, and human infrastructure", *Communications Earth & Environment*, Vol. 6/261, https://doi.org/10.1038/s43247-025-02212-5. [85]

Ding, H. et al. (2021), *Accelerating Climate-resilient Infrastructure Investment in China*, https://www.wri.org/research/accelerating-climate-resilient-infrastructure-investment-china. [86]

Dredging Today (2025), *Aktau Port dredging set for June*, https://www.dredgingtoday.com/2025/04/25/exclusive-aktau-port-dredging-set-for-june/ (accessed on 18 June 2026). [76]

Duku, J. (2026), "The Shrinking Caspian Sea: Eco-Hydrological Responses to Human and Climate Pressures", *Earth's Future*, Vol. 14, p. 17, https://doi.org/10.1029/2025EF008028. [31]

EBRD (2026), *Aktau Port Modernisation - Environmental and Social Summary*, https://www.ebrd.com/home/work-with-us/projects/psd/53786.html#customtab-3f6de51614-item-0b442f28f9-tab (accessed on 10 April 2026). [37]

EBRD (2025), *Climate Resilience Bond Framework*. [62]

ECOSLC (2025), *ECOSLC Foundation congratulates JSC NC Aktau International Commercial Sea Port, Kazakhstan, on achieving ECOPORTS PERS Certification in April 2025 for the second time after validation by the independent auditor LRQA Netherlands.*, https://ecoslc.eu/news/ecoslc-foundation-congratulates-jsc-nc-aktau-international-commercial-sea-port-kazakhstan-on-achieving-ecoports-pers-certification-in-april-2025-for-the-second-time-after-validation-by-the-independent-auditor-lrqa-netherlands (accessed on 10 April 2026). [38]

EU4Digital, EY Baltic UAB (2026), *Meta Study - Advancing a Cross-Regional Connectivity Agenda with Central Asia, Türkiye and the South Caucasus*, https://enlargement.ec.europa.eu/meta-study-advancing-cross-regional-connectivity-agenda_en. [24]

Eurasia Review (2025), *Declining Caspian Water Levels Threaten Russian And Chinese Corridor Plans – Analysis*, https://www.eurasiareview.com/19032025-declining-caspian-water-levels-threaten-russian-and-chinese-corridor-plans-analysis/. [34]

Eurasianet (2024), *Kazakhstan confronts water scarcity head-on*, https://eurasianet.org/kazakhstan-confronts-water-scarcity-head-on (accessed on 27 May 2026). [73]

European Environment Agency (2026), *Making agriculture, energy and transport climate resilient: how much money is required and what will it deliver?*, [13] https://www.eea.europa.eu/en/analysis/publications/costs-and-benefits-of-adaptation-actions-in-europe.

GCF, UNDP (2025), *Climate risk assessment methodology of the Republic of Kazakhstan*. [48]

German Watch (2021), *Climate Risk Index 2021*, https://www.germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf (accessed on 16 April 2026). [8]

Global Center on Adaptation (2025), *Climate Resilient Infrastructure Handbook*, https://gca.org/wp-content/uploads/2025/06/Climate-Resilient-Infrastructure-Handbook_20250613.pdf. [57]

Global Center on Adaptation (2024), *Kenya developing Climate Resilience Nairobi-Mombasa Expressway Project, in partnership with GCA*, https://gca.org/news/kenya-developing-climate-resilience-nairobi-mombasa-expressway-project-in-partnership-with-gca/. [60]

GRID-Arendal (2012), *Annual discharge into the Caspian Sea*, https://www.grida.no/resources/5724. [65]

Grishin, V. (2025), "Central Asia in Transition: New Regionalism, Geopolitical Realignment, and the Post-Carbon Future", *PONARS* Eurasia Policy Memo No. 949. [72]

Haven Dredging (2024), *The economics of dredging: Maximising returns while minimising costs*, https://havendredging.com/2024/09/19/the-economics-of-dredging/ (accessed on 18 June 2026). [79]

Holstein, A. (2018), "Oil spill detection in the Kazakhstan sector of the Caspian Sea with the help of ENVISAT ASAR data", *Environmental Earth Sciences*, Vol. 77/198, p. 11, https://doi.org/10.1007/s12665-018-7347-0. [68]

Hoseini, M. (2024), "Projected changes in Caspian sea level under CMIP6 climate change scenarios: probabilistic and deterministic approaches", *Climate Dynamics*, Vol. 63/44, p. 18, https://doi.org/10.1007/s00382-024-07548-w. [84]

IISD (2025), *Developing and Piloting a Model for Estimating the Direct and Indirect Benefits of Nature-based Solutions for Road Resilience in Indonesia*, https://www.iisd.org/system/files/2025-03/indonesia-nature-based-solutions-road-resilience.pdf. [50]

International Transport Forum (2025), *Enhancing the Connectivity, Sustainability, and Resilience of Regional Freight Transport in Central Asia*. [47]

IPCCC (2022), *Climate Change 2022: Impacts, Adaptation and Vulnerability*, https://www.ipcc.ch/report/ar6/wg2/. [88]

IPSC (2025), *The Negative Consequences of the Declining Water Level in the Caspian Sea*, https://peace-ipsc.org/2025/03/05/the-negative-consequences-of-the-declining-water-level-in-the-caspian-sea/ (accessed on 18 June 2026). [71]

ISDP AFPC (2023), *Decreasing Water Levels in the Caspian Sea: Causes and Implications*, https://www.cacianalyst.org/publications/analytical-articles/item/13769-decreasing-water-levels-in-the-caspian-sea-causes-and-implications.html. [28]

Kostianoy, A. (2025), “Main Reasons for Changes in the Caspian Sea Leve”, *Izvestiya, Atmospheric and Oceanic Physics*, Vol. 61/1, p. 15, https://doi.org/10.1134/S0001433825701178. [66]

Kursiv (2025), *Kazakhstan is set to deepen the port of Aktau*, https://kz.kursiv.media/en/2025-02-18/engk-tank-kazakhstan-is-set-to-deepen-the-port-of-aktau/. [74]

Liu, K. et al. (2023), “Global transportation infrastructure exposure to the change of precipitation in a warmer world”, *Nature Communications*, Vol. 14/1, https://doi.org/10.1038/s41467-023-38203-3. [23]

McKinnon, A. (2024), *Evaluating the relationships between connectivity,*. [54]

MECC, UNDP (2025), *National Adaptation Plan to Climate Change Mongolia*, https://unfccc.int/sites/default/files/resource/NAP_Mongolia_2025.pdf. [43]

MENR, UNFCCC (2025), *Nationally determined contribution (NDC 3.0) of the Republic of Kazakhstan to the global response to climate change until 2035*, https://unfccc.int/sites/default/files/2025-11/NDC_Kazakhstan 3.0 eng.pdf. [41]

Middle Corridor Trans-Caspian International Transport Route (2026), *Middle Corridor container traffic, thousand TEU*, https://middlecorridor.com/en/ (accessed on 10 April 2026). [19]

Neumann, T. (2026), *Knowledge Development and Application Concerning Costs of Adaptation Compard to Costs of Inaction*, https://www.ecologic.eu/20040. [12]

Nirandjan S. Koks E.E., C. (n.d.), “Fromr Risk to Resilience: Assessing Geophysical and Climate Vulnerability and Adaptation Strategies for Transport Infrastructure in the Middle Corridor”, *International Conference on Resilient Systems (ICRS) 2026*, pp. 216-219, https://pure.tue.nl/ws/portalfiles/portal/385555545/ICRS-2026-Book_of_Abstracts-260403.pdf#page=216. [20]

OCHA Reliefweb (2024), *Kyrgyzstan Flood 2024 - DREF Final Report (MDRKG019)*, https://reliefweb.int/report/kyrgyzstan/kyrgyzstan-flood-2024-dref-final-report-mdrkg019. [6]

OECD (2026), *Accelerating Sustainable Infrastructure Investments*, https://www.oecd.org/en/publications/accelerating-sustainable-infrastructure-investments_031d486e-en/full-report.html. [90]

OECD (2026), *Accelerating Sustainable Infrastructure Investments: Assessing Policies for Planning, Delivery and Financing in Central and Southeast Asia*, OECD Publishing, Paris, https://doi.org/10.1787/031d486e-en. [10]

OECD (2025), *Enhancing the Competitiveness of the Trans-Caspian Transport Corridor in Central Asia*, https://doi.org/10.1787/f261e7fa-en. [17]

OECD (2025), *OECD DAC Blended Finance Guidance 2025*, https://www.oecd.org/en/publications/oecd-dac-blended-finance-guidance-2025_e4a13d2c-en/full-report/overview_a751d23e.html. [56]

OECD (2024), *Adapting infrastructure to changing climatic conditions: the case of the Philippines (OECD ENVIRONMENT POLICY PAPER NO. 46)*, https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/09/adapting-infrastructure-to-changing-climatic-conditions_f790d733/a4c3f35a-en.pdf. [51]

OECD (2024), *Climate Adaptation Investment Framework*, Green Finance and Investment, OECD Publishing, Paris, https://doi.org/10.1787/8686fc27-en. [40]

OECD (2024), *G20/OECD Report on approaches for financing and investing in climate-resilient infrastructure*, https://www.oecd.org/en/publications/g20-oecd-report-on-approaches-for-financing-and-investing-in-climate-resilient-infrastructure_8f6d436a-en.html. [55]

OECD (2024), *Infrastructure for a Climate-Resilient Future*, https://www.oecd.org/en/publications/infrastructure-for-a-climate-resilient-future_a74a45b0-en.html. [11]

OECD (2024), *Infrastructure for a Climate-Resilient Future*, https://www.oecd.org/en/publications/infrastructure-for-a-climate-resilient-future_a74a45b0-en.html. [89]

OECD (2021), *Women in Infrastructure*, https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/11/women-in-infrastructure_3203555b/9eab66a8-en.pdf. [9]

OECD (2018), *Climate-resilient infrastructure*, https://www.oecd.org/en/publications/climate-resilient-infrastructure_4fdf9eaf-en.html. [1]

OECD (Forthcoming), *Accelerating sustainable infrastructure investments - Assessing policies for planning, delivery and financing in Central and Southeast Asia*. [87]

Quryq Port (2026), *ISO Quality and Environmental Policy*, https://portkuryk.kz/en/klientam/politika-v-oblasti-kachestva-ekologii-professionalnoj-bezopasnosti-i-ohrany-truda (accessed on 10 April 2026). [39]

Republic of Kyrgyzstan, UNFCCC (2025), *Concept for Achieving Carbon Neutrality in the Kyrgyz Republic*, https://unfccc.int/sites/default/files/resource/%D0%9A%D0%94%D0%A3%D0%9D_ENG_31.10.25 %282%29.pdf. [42]

Republic of Tajikistan (2025), *National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030 (NSACC 2030)*, https://climate-laws.org/documents/national-strategy-for-adaptation-to-climate-change-of-the-republic-of-tajikistan-for-the-period-up-to-2030-nsacc-2030_0496?cfn=transportation+and+logistics+sector. [44]

Reuters (2025), *Azerbaijan sounds the alarm over shallowing of Caspian Sea*, https://www.reuters.com/sustainability/climate-energy/azerbaijan-sounds-alarm-over-shallowing-caspian-sea-2025-08-21/ (accessed on 3 July 2026). [75]

Samant, R. (2023), "Climate-driven 21st century Caspian Sea level decline estimated from CMIP6 projections", *Communications Earth & Environment*, Vol. 4/357, p. 12, https://doi.org/10.1038/s43247-023-01017-8. [80]

Times of Central Asia (2025), *Kazakhstan Launches Dredging Project to Expand Aktau Port on Key Trans-Caspian Corridor*, https://timesca.com/kazakhstan-launches-dredging-project-to-expand-aktau-port-on-key-trans-caspian-corridor/ (accessed on 18 June 2026). [77]

Trend News Agency (2025), *Caspian sea water level decline hampers ferry transport capacity - official*, https://www.trend.az/azerbaijan/business/4013436.html (accessed on 3 July 2026). [78]

UK Met Office (2024), *Climate risk report for the Central & South Asia region*, https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/services/government/climate-risk-report-for-csa---v10-final.pdf. [22]

UNDP (2026), *Developing a National Adaptation Planning Process in Turkmenistan*, https://www.undp.org/turkmenistan/projects/developing-national-adaptation-planning-process-turkmenistan (accessed on 10 April 2026). [45]

UNDP (2025), *Women, Resilience, and Climate Change*, https://www.undp.org/eurasia/publications/women-resilience-and-climate-change. [63]

UNDP and ENTEC (2025), *Developing a Guideline for Sound Climate Investment for Sustainable Infrastructure towards Thailand's NDC goals, with a Specific Focus on Resilient Transport*. [49]

UNDRR (2025), *When rain, snow, and soil align: The triple threat behind 2024's deadly Central Asian floods*, https://www.preventionweb.net/news/when-rain-snow-and-soil-align-triple-threat-behind-2024s-deadly-central-asian-floods#:~:text=More%20than%20118%20000%20people,over%20the%20past%2030%20years. (accessed on 10 April 2026). [3]

UNECE (2025), *Social Justice and a Just Transition in a Shrinking Town: The case of Muynak in the Aral Sea Region*, https://unece.org/sites/default/files/2025-12/UZB%20JET%20Aral%20Sea%20Case%20Study%20Brief_0.pdf. [67]

UNEP (2025), *Boost for Caspian Sea protection as new environmental rules come into force*, https://www.unep.org/news-and-stories/press-release/boost-caspian-sea-protection-new-environmental-rules-come-force (accessed on 10 April 2026). [35]

UNEP (2024), *Caspian Sea Fluctuations and Climate Change*. [64]

UNEP-DHI (2024), *Caspian Sea Fluctuations and Climate Change*, https://unepdhi.org/wp-content/uploads/sites/2/2024/11/Caspian_Sea_working_paper.pdf. [27]

UNESCAP (2022), *Managing in-land water disasters in the Aral Sea: sub-regional pathways for adaptation and resilience*, https://www.unescap.org/sites/default/d8files/knowledge-products/Aral%20Sea%20report_Part%20II_22%20April.pdf. [81]

UNESCAP (2022b), *The Aral Sea, Central Asian Countries and Climate Change in the 21st Century*, https://www.unescap.org/sites/default/d8files/event-documents/ESCAP-2022-WP-Aral-Sea-central-Asian-countries-climate-change.pdf. [82]

UNFCCC (2025), *Updated Nationally Determined Contibutiion of the Republic of Uzbekistan (NDC 3.0) for the period up to 2035*, https://unfccc.int/sites/default/files/2025-11/Uzbekistan%20Third%20NDC.pdf. [46]

Verschuur, J. (2024), *Enhancing Freight Transport Resilience Through Analytical*. [53]

Wolrd Bank (2025), *Disaster and Climate-Resilient Transport Guidance Note*, https://documents1.worldbank.org/curated/en/099032625173042760/pdf/P180423-670950ea-9b3e-4cb2-a416-bf19ee625e3e.pdf. [69]

World Bank (2024), *Uzbekistan Climate Adaptation*. [52]

World Bank (2022), *The Challenges of Landscape Degradation in the Aral Sea*, [83] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099140101312268601.

World Bank (2019), *Lifelines: The Resilient Infrastructure Opportunity*, https://openknowledge.worldbank.org/entities/publication/c3a753a6-2310-501b-a37e-5dcab3e96a0b. [14]

World Bank Group (2023), *Middle Trade and Transport Corridor: Policies and Investments to Triple Freight Volumes and Halve Travel Time by 2030*, https://thedocs.worldbank.org/en/doc/6248f697aed4be0f770d319dcaa4ca52-0080062023/original/Middle-Trade-and-Transport-Corridor-World-Bank-FINAL.pdf. [18]

World Ports (2025), *Shallowing of Caspian Sea Impacts Oil Trade*, https://www.worldports.org/shallowing-of-caspian-sea-impacts-oil-trade/ (accessed on 18 June 2026). [33]

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