Potential Impacts of Climate Change on Transport

Current and future extreme events can reduce mobility and damage critical infrastructure.
- Landslides and mudflows onto roads result in road closures as well as human and social risks.
- Debris flows and rock falls reduce road safety, damage infrastructure, and cover roadways, which reduce both mobility and returns on investments.
- Floods can cause river channels to migrate, particularly in alluvial fans, damaging stream crossings.

In coastal areas, storm surges and sea-level rise put critical infrastructure at risk.
- Increased salinity increases corrosion of materials, which can cause premature failure.
- Roadways are eroded by increased wave action.
- Increased flooding can result from overtopping of roadways by seawater, or saltwater intrusion into groundwater, leading to subsurface flooding.
- Storm surges and wave action put coastal ecosystems at risk, removing natural buffers that protect coastal infrastructure.
- Increased wave action induces scouring and collapse of abutments and embankments.

Changes in temperature and precipitation patterns can have numerous impacts.
- Reduced water availability during construction can compromise the ability to compact materials.
- Increased subsurface moisture content can result in increased penetration of water into the fill, leading to road collapse.
- Surface and subsurface flooding (rising water tables) can result in permanent submerging of roads.

Integrating Climate Change Resilience into a Transport Project in Cambodia

Many parts of Cambodia already experience regular flooding, and this may increase due to climate change. The Government of Cambodia has identified areas where rainfall is expected to increase as a result of changing climate. An ADB transport project is incorporating climate change adaptation measures, which include modifying engineering designs and developing vulnerability maps and early warning systems. The Ministry of Rural Development will use these to improve its master planning and to improve flood management through revegetation using flood- and heat-tolerant indigenous species.

Source: ADB. 2010. Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Kingdom of Cambodia for the Rural Roads Improvement Project. Manila.

- Reduced effectiveness of drainage can lead to a reduction in the bearing capacity of the soils when saturated.
- Increased runoff can lead to gully erosion and damage roads.
Increased debris flows in water catchments can damage stream crossings and bridges.
Increased desertification can lead to sand cover on roads, reducing road safety and increasing maintenance costs.
Melting permafrost can reduce road bearing capacity.

Increased wind strength can damage the transport infrastructure in multiple ways.
Vertical signage may not withstand high wind velocities.
Fallen trees increase accidents and road closures.

Transport Sector Activities Can Increase Climate Change Vulnerability of Local Environment and Communities

Mobility networks can facilitate the relocation and growth of population and economic activity within increasingly fragile and inhospitable zones.
Paving reduces water infiltration locally, enhancing runoff and sediment movement into adjacent ecosystems, and can reduce ecosystem flood management capacity.
The location of transport infrastructures may impede species migration driven by climatic alterations in ecosystems.

Adaptation Options
A wide range of “hard” and “soft” adaptation options can enhance the resilience of critical infrastructure to natural hazards and climate change.

“Hard” adaptation measures include
- Retrofit structures to ensure appropriate protection.
- Redesign or relocating road facilities.
- Protect road corridors with engineered structures such as seawalls and levees.
- Increase drainage capacities to accommodate more intense rainfall and erosion events.
- Increase attention to temperature variation as a factor in the selection of asphalt cements and asphalt emulsions to maintain pavement integrity.
- Promote shore protection techniques that do not destroy surrounding habitat.

“Soft” adaptation measures include
- Conduct vulnerability and impact assessments as inputs to master planning in the transport sector to ensure protection of infrastructure, minimize the creation of vulnerability, and ensure that mobility goals can be met.
- Improve integrated spatial planning with respect to road alignments to ensure that adjacent critical ecosystems, which serve as buffers against floods, droughts, earthquakes, and other extreme events, are maintained and protected.

Essential Data Sources from the Global Transport Knowledge Partnership
Transportation managers use advisory, control, and treatment strategies to mitigate environmental impacts on roadways. Each of these requires detailed site-specific information, often in real time. The Global Transport Knowledge Partnership facilitates the provision and dissemination of relevant information. For example, information on atmospheric and other physical conditions may be integrated with intelligent transport systems, such as automated traffic-control and traveler-advisory systems, to address transportation challenges. This information encompasses data on water levels and wind speed, output from early warning systems, flood hazard mapping for storms, and safety-related messages.

Source: Global Transport Knowledge Partnership. Available online at www.gtkp.com

- Provide road access to hospitals and evacuation centers and enable distribution of medical supplies, especially during emergencies.
- Adopt environmental measures to help conserve fauna and flora, including protection and enhancement of migration corridors to allow species to migrate as climate changes.
- Improve early warning systems and hazard mapping for floods, storms, and geotechnical risks.

There is no universal single-best adaptation measure. Possible options need to be appraised against a set of predefined criteria, which may include technical feasibility, costs and benefits, or cost effectiveness. These, in turn, are determined by local geographical conditions and the socioeconomic characteristics of the population to whom the transport network is providing services.

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