



Climate Change, Urban Mobility and Green Growth



This presentation is one of the support materials prepared for the capacity building program *Building Leaders in Urban Transport Planning (LUTP)*.

Objectives

- Establish a general understanding of climate change, its causes, and adverse impacts to development and transport
- Give an overview of global initiatives and financing landscape to address climate change
- Introduce the concept of climate change mitigation and adaptation in the transport sector
- Give examples of best practices addressing climate change in the transport sector

Setting Context

Climate Change: what is it and what causes it



Climate change is long-term change of climatic patterns

It results in an increasing frequency and intensity of extreme climatic events

Climate change is caused by the Greenhouse Effect

Instead of the sunlight bouncing off the surface of the Earth, it gets trapped in the blanket of GHGs

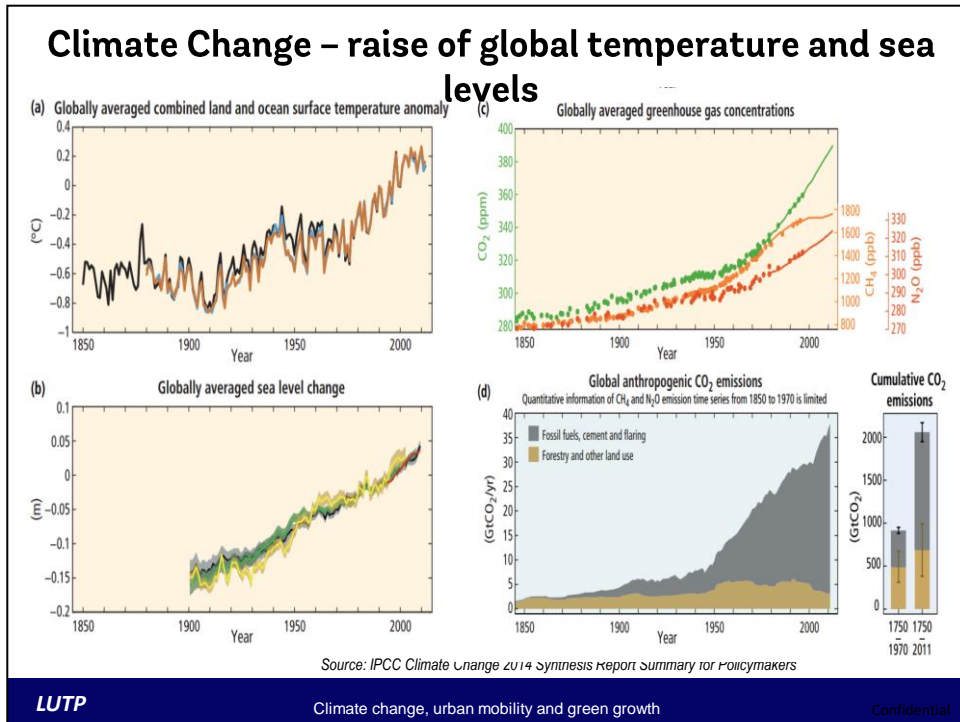
The Greenhouse Effect

Most of the heat is absorbed by greenhouse gases and reflected in all directions, warming the Earth

climate.nasa.gov

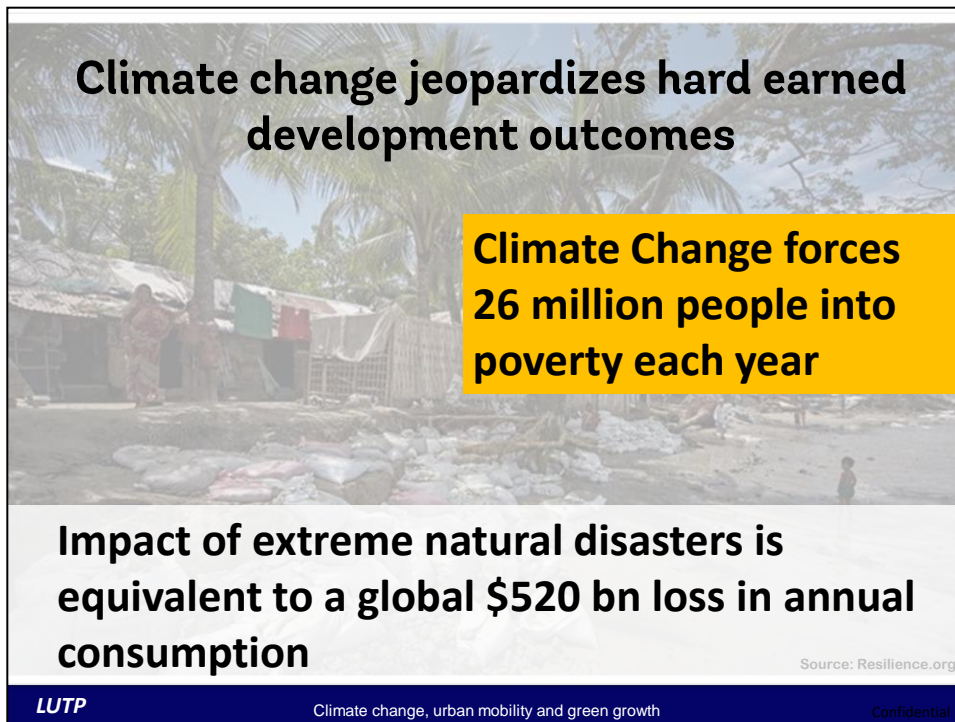
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Climate change is a pattern in which the average temperature of the Earth keeps rising due to the accumulation of Greenhouse gases (GHG). Instead of the sunlight bouncing off the surface of the Earth, it gets trapped in the blanket of GHGs. As a result, average temperatures are rising in the atmosphere, on the Earth's surface and in the oceans.



The most noticeable effect of climate change is the rise of **global** temperature and sea level rise (Chart A). The consequences of climate changes however, vary based on the geographical location (e.g. certain region may experience weather getting hotter, colder, wetter, dryer, windier etc.). The sea level has been rising consistently (Chart B), due to glaciers shrinking world wide.

The international community of scientists have reached a consensus that climate change is largely caused by emissions of greenhouse gases (Chart C and D). Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.



Climate change jeopardizes hard earned development outcomes

Climate Change forces 26 million people into poverty each year

Impact of extreme natural disasters is equivalent to a global \$520 bn loss in annual consumption

Source: Resilience.org

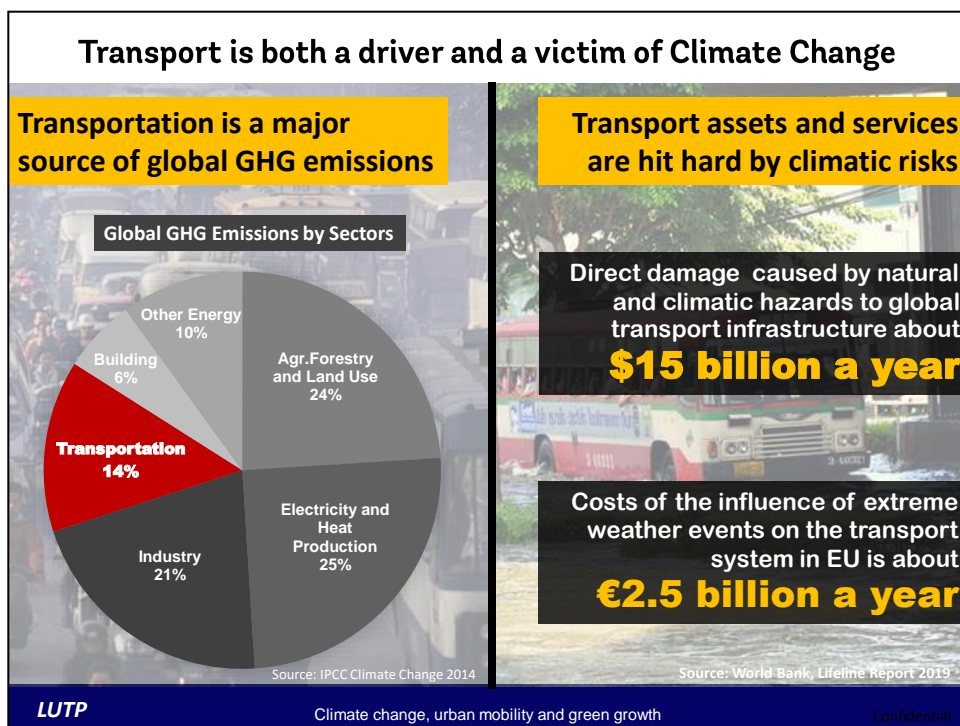
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Countries already struggle with the impacts of natural disasters like floods, landslides, cyclones. The impact of extreme natural disasters is equivalent to a global \$520 billion loss in annual consumption, and forces some 26 million people into poverty each year. Climate change forecasts show an increase in climate variability and in the frequency and intensity of extreme events.

Aligning climate policy with sustainable development requires attention to both adaptation and mitigation (International Panel for Climate Change- IPCC, 2014). Delaying global mitigation actions may reduce options for climate-resilient pathways and adaptation in the future.

Mitigation is an effort to “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner” (from the [2014 report on Mitigation of Climate Change](#) by the UNIPCC). For example, governments incentivize corporations and individuals to use less fossil fuels and to shift to renewable energy to reduce the emission of GHGs.

Adaptation aims to reduce our vulnerability to expected and already present devastating effects of climate change. For instance, millions face the threat of sea level encroachment in the East Asia and Pacific region. In order to deal with such immediate harms of climate change, governments engage in policies such as sustainable forest and land management, land restoration and building coastal resilience, as well as developing risk and recovery support system.



Along with electricity generation and factories, transport is one of the biggest emitters of GHGs (14% of GHG emissions in 2019). Greenhouse gas (GHG) emissions from the transport sector have more than doubled since 1970, and have increased at a faster rate than any other energy end-use sector. Around 80 % of this increase has come from road vehicles and demand for transport services is rising. The final energy consumption for transporter reached 28 % of total end-use energy in 2010, of which around 40 % was used in urban transport (EIA, 2013). The transition required to reduce GHG emissions could arise from new technologies, implementation of stringent policies, and behavioral change.

When planning for urban transport, it is essential to do so with a long-term sustainability in mind, so as to not create lock-ins where newly designed transport systems aggravate climate change and pollution.

Global Initiatives and Financing

Global Initiatives to Tackle Climate Change

United Nations Climate Change Conferences of Parties (CoP)

Reached historic Paris Agreement at COP 21 in 2015 aims to keep the rise in global temperature in the 21st century **below 2 degrees Celsius**

United Nations 2030 Sustainable Development Goals

United Nations 2030 Agenda for Sustainable Development calls for urgent actions to combat climate change and its impacts under **SDG 13 Climate Action**

United Nations Climate Action Summit

Turning Commitments into Actions

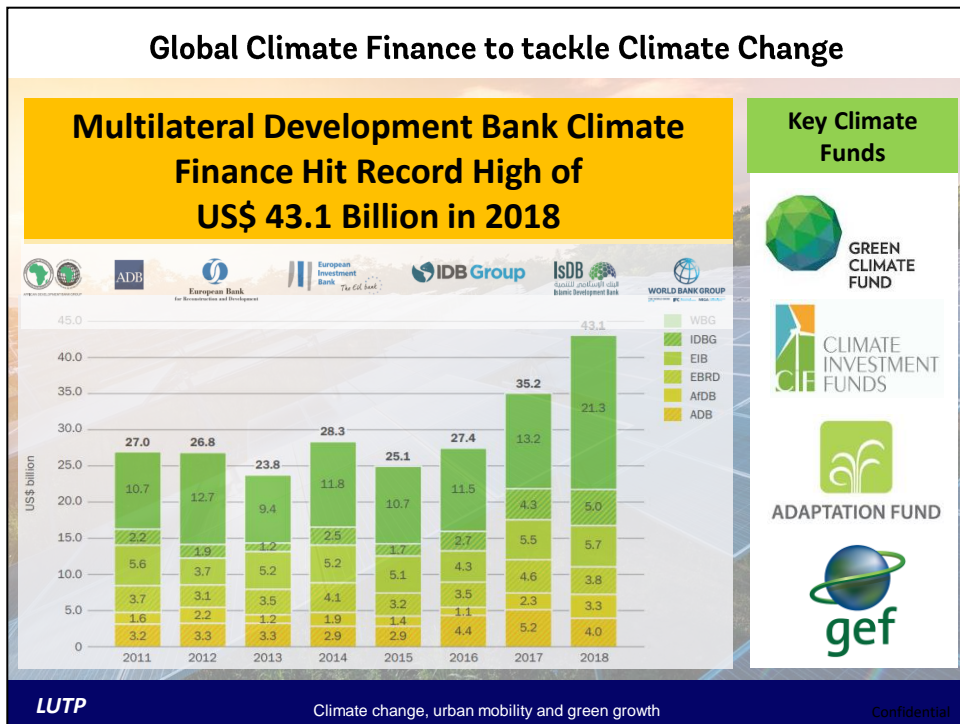
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Several initiatives have been taken around the world to tackle climate change:

The Conference of Party (COP) are yearly conferences serving as the meeting of the United Nations Framework Convention on Climate Change (UNFCCC). Parties assess progress in dealing with climate change and negotiate legally binding obligations.

The COP 21 held in Paris in 2015 adopted the Paris Agreement. In October 2016, 143 parties have ratified the agreement, achieving the threshold for its entry into force. Member nations had publicly outlined climate actions they intended to take post-2020, called Intended Nationally Determined Commitments. These commitments became Nationally Determined Commitments—binding policies—when the Paris Agreement entered into force.

The Sustainable Development Goals address the global challenges, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. Transport contribute directly to 5 targets (I. Road Safety II. Energy efficiency III. Sustainable infrastructure IV. Urban access V. Fossil fuel subsidies) and indirectly to 7 SDG goals (I. Agricultural productivity II. Air pollution III. Access to safe drinking water IV. Sustainable cities V. Reduction of food loss VI. Climate change adaptation VII. Climate change mitigation. (www.slocat.net/sdgs-transport)








Climate finance refers to the commitments taken by stakeholders, (governments, NGO's...) for climate change mitigation and adaptation projects and programs

Around \$90 trillion of investment is needed for infrastructure by 2030 (The New Climate Economy Report)

\$4.2 Trillion can be saved by investing in more resilient infrastructure (*Lifelines: The Resilient Infrastructure Opportunity*, 2019, GDFRR)



Transport initiatives by Non State Actors for Paris agreement goals

				
<p style="text-align: center;">Urban Transport</p>	<p style="text-align: center;">Freight and Logistics</p>	<p style="text-align: center;">Electric Mobility</p>	<p style="text-align: center;">Cycling & Walking</p>	<p style="text-align: center;">Transport Technology</p>
<ul style="list-style-type: none"> • Eco-Mobility Alliance • Taxi4SmartCities • C40 Clean Bus Declaration 	<ul style="list-style-type: none"> • Global Green Freight Action Plan • Navigating a Changing Climate coalition 	<ul style="list-style-type: none"> • EV100 • Below50 • Urban electric mobility initiative 	<ul style="list-style-type: none"> • Global Sidewalk Challenge • Cycling delivers on global goals 	<ul style="list-style-type: none"> • ITS for Climate • Train for Future
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Through the Marrakech Partnership for Global Climate Action (MPGCA) many initiatives have transport Initiatives have been taken by non state actors (cities, NGOs....). The initiatives are voluntary commitments towards the implementation of the Paris agreement and 2030 agenda for sustainable development.

Climate Change and Transport

Climate Change Mitigation and Adaptation in Transport

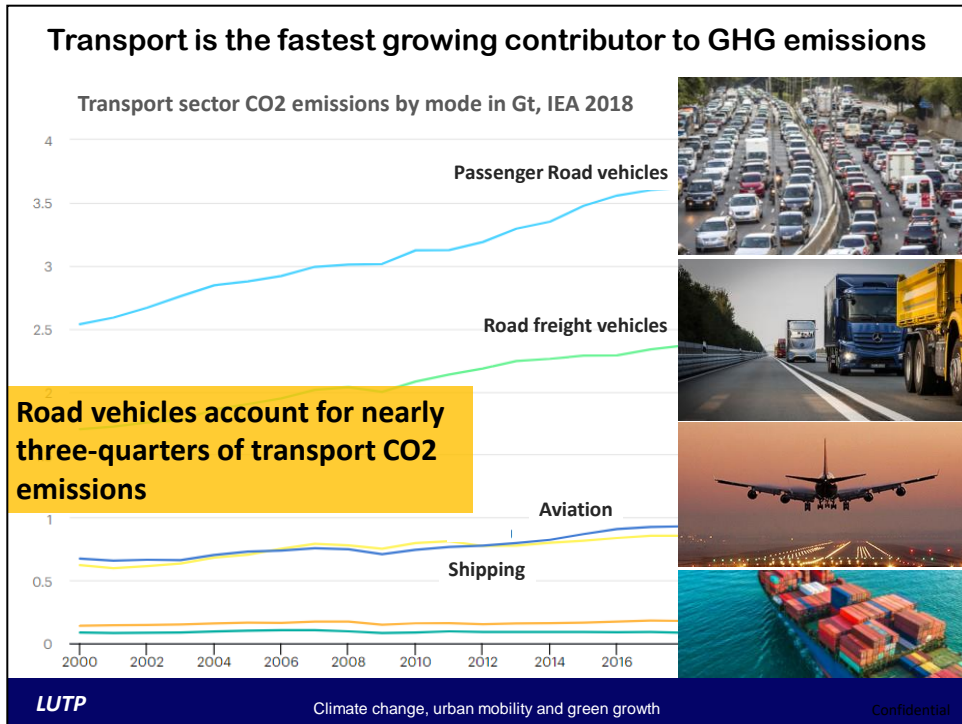
 <p>Climate Change Mitigation in Transport Sector</p> <p>Reducing GHG emissions from transport by avoiding transport demand, shifting to less emissive modes, or improving fuel efficiency</p>	 <p>Climate Change Adaptation in Transport Sector</p> <p>Making the transport assets and services more resilient to climatic hazards and shocks by integrating risks into transport lifecycle management</p>
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Cities have different ways dealing with climate change.

Mitigation is an effort to “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner” (from the [2014 report on Mitigation of Climate Change](#) by the UNIPCC). For example, governments incentivize corporations and individuals to use less fossil fuels and to shift to renewable energy to reduce the emission of GHGs.




Adaptation aims to reduce our vulnerability to expected and already present devastating effects of climate change. For instance, millions face the threat of sea level encroachment in the East Asia and Pacific region. In order to deal with such immediate harms of climate change, governments engage in policies such as sustainable forest and land management, land restoration and building coastal resilience, as well as developing risk and recovery support system.

Climate change and transport Deep Dive on Mitigation



As afore-mentioned, the transport sector is the fastest growing contributor to climate emissions. The main drivers of global transport energy growth are land transport, mostly light-duty vehicles, such as cars, as well as freight transport. Transport accounted for about 23% of global carbon dioxide emissions in 2010 which persists in the atmosphere for over a century, with long-term warming effects (IPCC, 2014).

Climate Mitigation in transport – Avoid, Shift, Improve

		
Avoid	Shift	Improve
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Cities are challenged with meeting steadily increasing mobility demands. What is required to mitigate GSG emission is a fundamental rethinking of the paradigm by which mobility and city planning is guided. Inspired by the principles of sustainability, the Avoid, shift, improve approach focuses on the mobility needs of people instead of car infrastructure. It seeks to achieve significant GHG emission reductions, reduced energy consumption, less congestion, with the final objective to create more livable cities.

“Avoid” measures should be implemented first, then “shift” and “improve” ones. These notions mean:

Avoid: or decrease the distance travelled achievable through a careful land use planning that aims to maintain mobility while reducing the km travelled.

Shift: policies aim at getting people to shift to more efficient and low emission modes of travel, like public transport and non-motorized modes.

Improve: policies seeking to reduce the negative effects of motor vehicle use, such as the amount of fuel consumed or pollutants emitted, per unit of travel. This could be achieved through policies such as improving vehicle fuel efficiency, deployment of low emission vehicles such as electric and hybrid electric vehicles.

Mitigation case study: Seoul and green transport

Increased the bus routes and improved reliability of the service

Introduced and integrated fares with free transfers between buses and metro

The results was:

- ✓ Energy consumption in road sector lowered
- ✓ Congestion and congestions costs decreased
- ✓ CO2 emissions from the transport sector were reduced

Seoul

LUTP

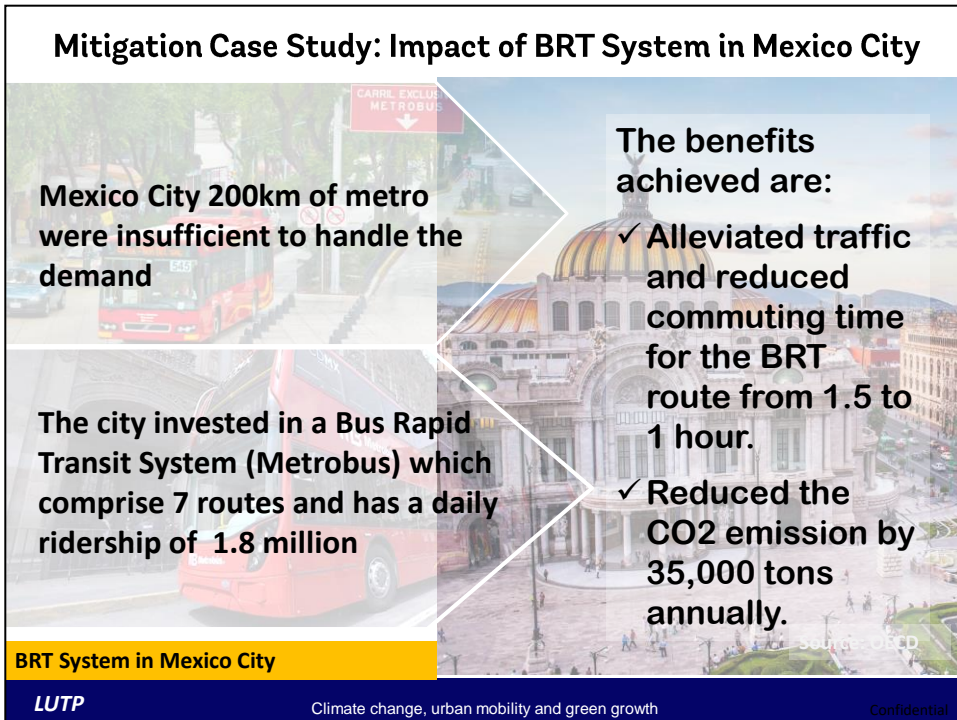
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To encourage more passengers to shift away from private vehicles, the Government modernized and expanded the bus system and integrated it with both metro and a new system of feeder buses. Exclusive BRT lanes and efficient transit centers allowed faster and more reliable service as transfers were made more convenient. The introduction of distance-based fares and free transfers between buses and metro played a significant role in swinging private vehicle users to public transport modes.

The key in Seoul's transition to greener transport was in maximizing the reliability of the public transport and user convenience through implementing multimodal solutions. As a result, energy consumption in Korea's road sector is lower than in other countries with similar GDP. Congestion costs have been decreasing, and CO2 emissions in the transport sector have been kept under control.

Mitigation Case Study: Impact of BRT System in Mexico City



Mexico City 200km of metro were insufficient to handle the demand

The city invested in a Bus Rapid Transit System (Metrobus) which comprise 7 routes and has a daily ridership of 1.8 million

The benefits achieved are:

- ✓ Alleviated traffic and reduced commuting time for the BRT route from 1.5 to 1 hour.
- ✓ Reduced the CO2 emission by 35,000 tons annually.

BRT System in Mexico City

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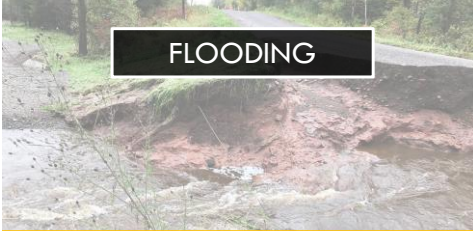


The **Mexico City** Metrobús is a bus rapid transit (BRT) system that opened its line 1 on June 19, 2006. Between 2005 and 2015, it is estimated that the Metrobús corridor reduce emissions of, on average, 144 tons of total hydrocarbons, 690 tons of oxides of nitrogen, 2.8 tons of fine particulate matter, and 1.3 tons of sulfur dioxide annually. These emissions reductions avoid an average of 6100 work loss days, 660 restricted activity days, 12 new cases of chronic bronchitis, and 3 deaths annually. These health improvements are estimated to result in \$3 million (U.S. dollars) in health benefits each year.

Locally, Metrobus grew out of a greater effort to address poor air quality in Mexico City, but evolved into a low-carbon, climate-change mitigating project due to World Bank

participation. 15% of users report having left their vehicles in order to use the Metrobus system, amounting to about 122,000 fewer daily trips in personal vehicles.

Climate Change and Transport Deep dive on Adaptation

Transport assets and services are vulnerable to climate shocks

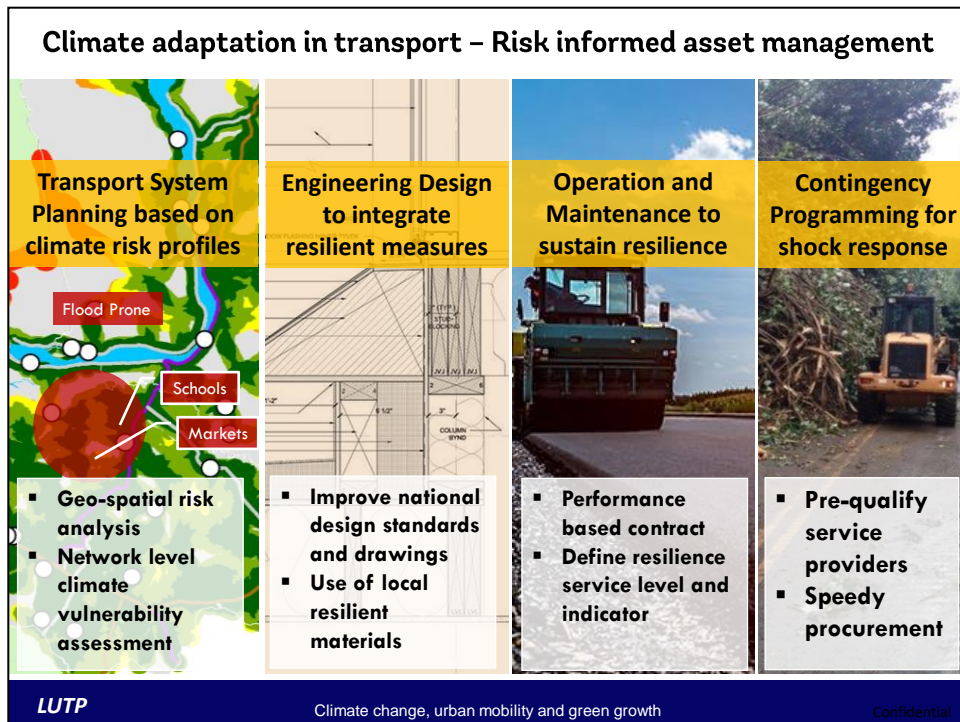
 <p style="text-align: center;">HEAT WAVES</p> <p style="text-align: center;">Road pavement melting</p>	 <p style="text-align: center;">FLOODING</p> <p style="text-align: center;">Rural connectivity cut off</p>
 <p style="text-align: center;">SNOW STORMS</p> <p style="text-align: center;">Railway operation disruption</p>	 <p style="text-align: center;">CYCLONE</p> <p style="text-align: center;">Maritime asset damaged</p>

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Coastal cities are particularly affected by climate change, with increased exposure of people and economic assets to sea rising level but inland cities also face challenges.

Climate change increases the risk of natural disasters and can materialize differently around the world. All modes of transport can be negatively affected.

Further reading: <https://www.nap.edu/read/12179/chapter/5#112>



To enhance the resilience of transport systems, a holistic approach of integration of climate risks in infrastructure lifecycle management must be considered:

- **Systems Planning:** Promote development in less hazard prone areas, explore transport infrastructure flood/coastal protection function, analyze transport systems at network level to understand critical infrastructure and thresholds and use this to prioritize investments in resilience.
- **Engineering & Design:** Apply innovative materials, upgraded design standards and specifications to enhance robustness of infrastructure as well as its ability to be retrofitted in the future.
- **Operations & Maintenance:** Improve inventory and mapping of transport infrastructure assets, improve institutional and financial arrangements for maintenance and deploy routine and ongoing maintenance programs,.
- **Contingency Programming:** Invest in emergency preparedness and response to meet local and regional evacuation, response and recovery needs and relief distribution; pre-qualify goods and service providers to support speedy procurement processes and effective post-disaster damage assessment.


Adaptation case study: Tokyo's underground cathedral



Tokyo has the is the world's largest diversion floodwater facility



The pumps in the Discharge Channel could empty a 25m swimming pool in less than three seconds



Tokyo's rivers - so beautiful for much of the year - can pose a danger in times of heavy rainfall

Source: BBC

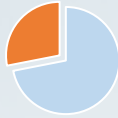
World Bank on Climate Change: Lead by example

Strong results achieved under World Bank climate action plan

WBG is making all operations climate informed through four mainstreaming efforts



Climate and Disaster Risk Screening



Climate Co-Benefits



GHG Accounting



Internal Carbon Price

All data are as of April 2018



18 gigawatts of additional renewable energy into electricity grids



Investing \$784 million in improving climate-resilient transport systems



Providing 38 million people in 18 countries with access to reliable climate information and early warning systems

The World Bank committed for a new ambitious plan towards 2025

1	Deepening Climate Mainstreaming and Increasing Direct Climate Financing	 Low-Carbon and Resilient Cities <table border="1"><tr><td>100 Cities</td><td>with low-carbon and compact urban planning</td></tr><tr><td>100 Cities</td><td>with integrated city-based resilience approach</td></tr></table>	100 Cities	with low-carbon and compact urban planning	100 Cities	with integrated city-based resilience approach
100 Cities	with low-carbon and compact urban planning					
100 Cities	with integrated city-based resilience approach					
2	Increasing Leverage of Private Finance and Creating Markets for Climate Action					
3	Systematically Investing in a Better Adapted World					
4	Driving Larger Systemic Impact at the Country Level					
5	Elevating Climate Actions in Key Sectors and Areas					

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World Bank will invest in low-carbon and resilient transport systems by: - leveraging new and emerging technologies to reduce GHG emissions and to enhance resilience of the transport sector.

- Investing in enhancing adaptation and resilience in the transport sector.