International Training Workshop on Smart Cities for Building Inclusive, Resilient, Livable, and Sustainable Cities and Communities in Asia and the Pacific, Nagoya, Japan, 29 August - 1 September 2023

Importance of Smart Mobility and Transport Solutions for Achieving Sustainable Urban Development and SDGs

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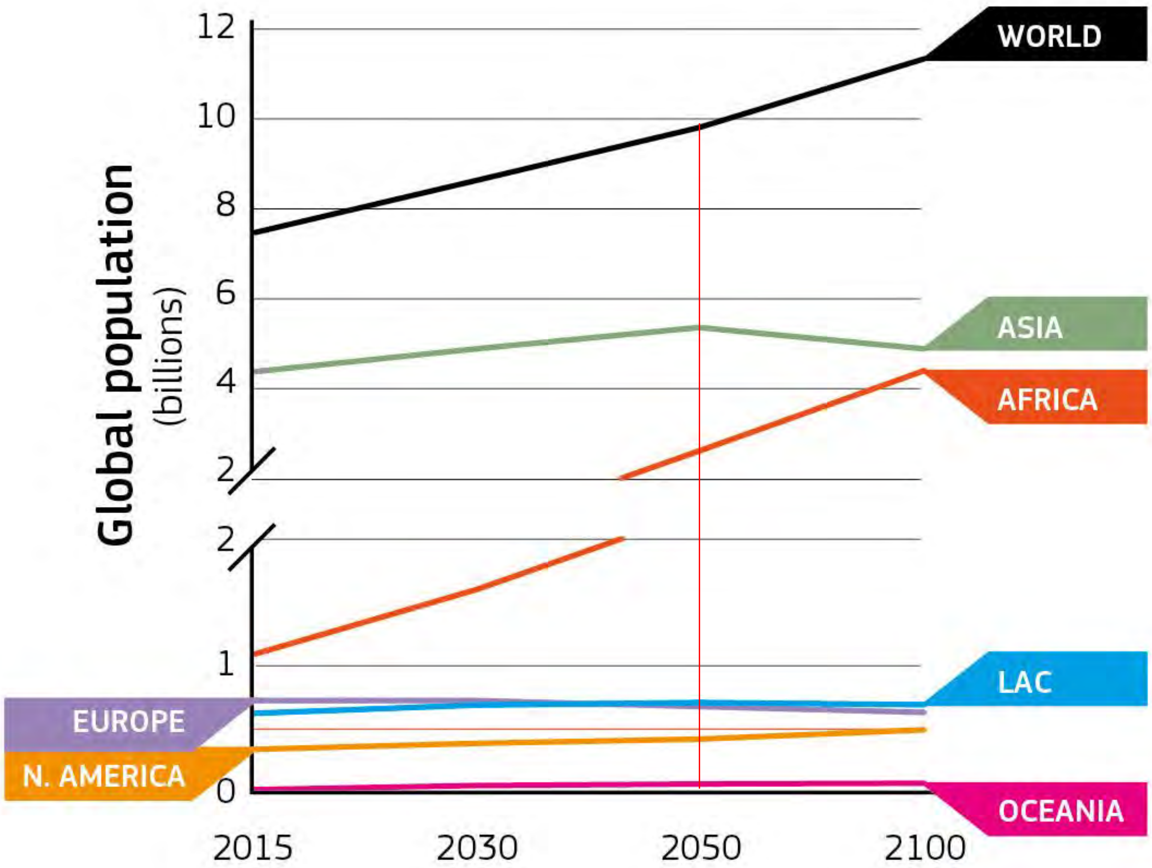
30 August 2023

UNCRD

United Nations Centre for Regional Development

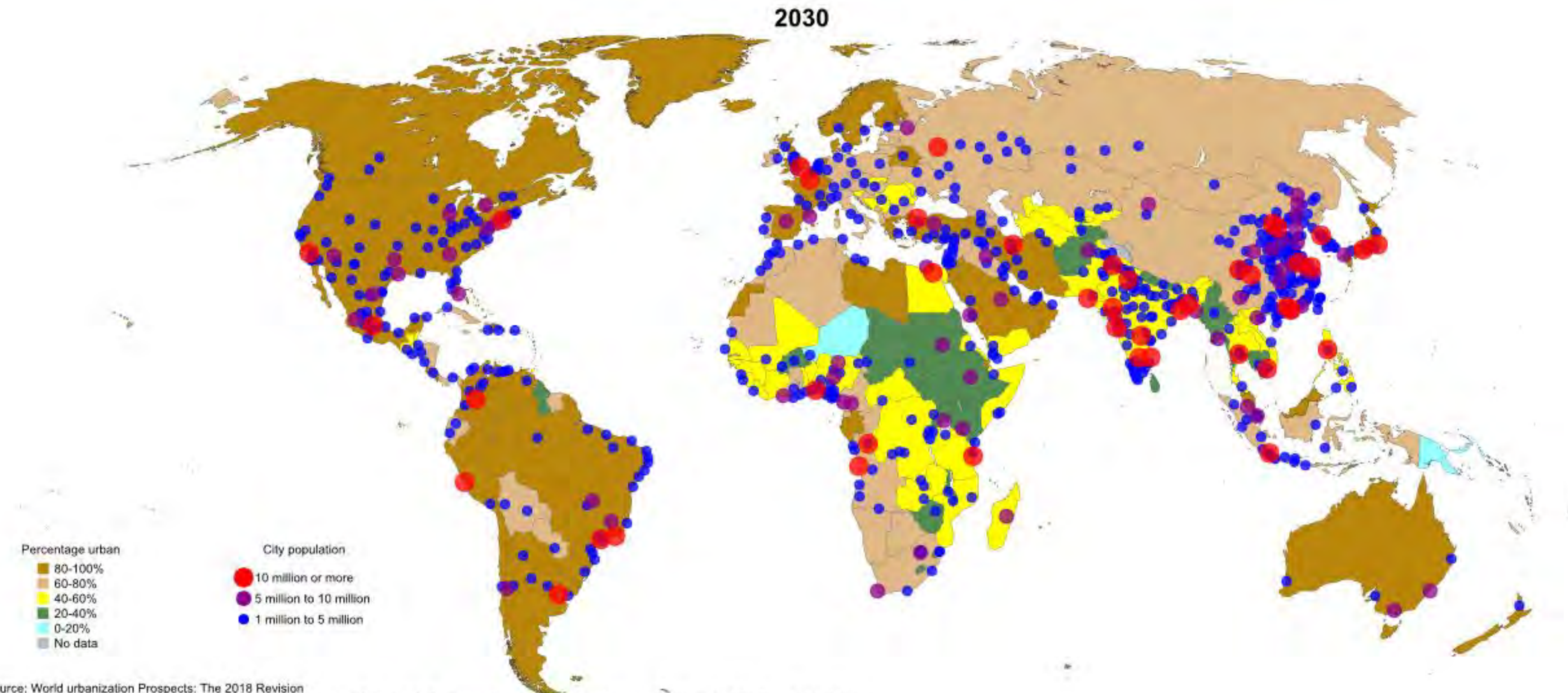
Population and Economic Growth



- According to the UN, the global population will reach 8.5 billion by 2030 and **9.7 billion by 2050**.
- **Approx. 68% of the world population is** projected to live in cities by 2050. And 2.2 billion urban residents will be living in Africa and Asia.
- World Economic Forum predicted that by 20**30** **Asia will have 50% of the global population with 60 %** of global economic growth.

Urbanization and Motorization

Asia is the most urbanizing region in the world, with an average annual urbanization rate of 3 %. More than two-thirds of the world's megacities will be located in Asia by 2025.



Data source: World urbanization Prospects: The 2018 Revision
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

About 95 % of urban expansion in the next decades will take place in the developing world.

Urban Development in Asia and the Pacific

Out of 390 surveyed cities by Tomtom in 2022, Asian cities ranked on the top- Bangularu-2^{nd}, Sapporo-$4^{th,}$ Pune -6^{th}, Nagoya -20^{th}, Tokyo – 22^{nd}, and Jakarta ranked 29^{th}

Urban dweller in these cities spends in traffic congestion is between 214 and 260 hours per year i.e up to <u>867 days or 2.36 years in a lifetime</u>.

https://en.wikipedia.org/wiki/Ranganathan_Street

Jakarta spent 214 hours, Bangkok 192 hours, and Kuala Lumpur, 159 hours in rush-hour traffic in 2021

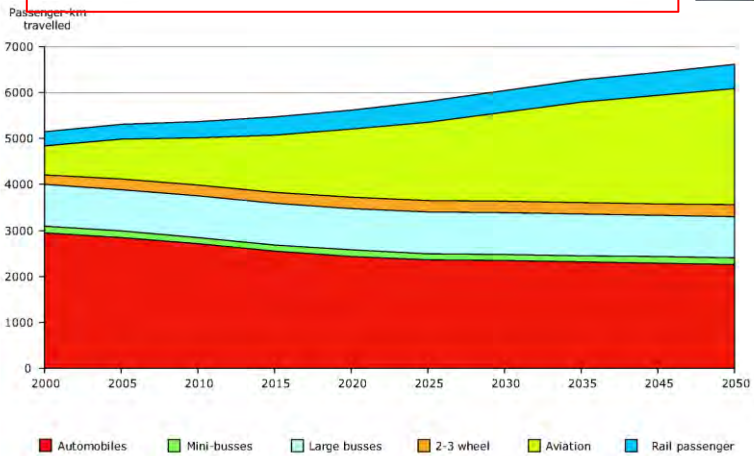
www.tripadvisor.com

By 2050 world transport demand will increase by 2.6 times (ITF, 2021)

Congestion costs Asian countries 2-5 % of their GDP per year due to time delays, the waste of fuel, and higher transport costs. (The Future of Urban Mobility Report).

Private car ownership is projected to increase by up to 500% outside the OECD by 2050.

(New Climate Economy Report, 2018).



Bangkok drivers spent an average of 14,703 baht i. e. US$ 434 on fuel in 2022.

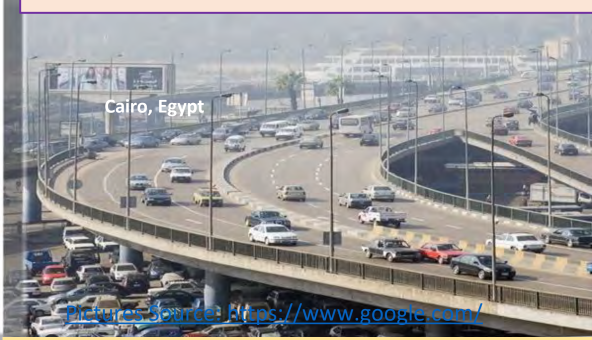
By 2050, the average time an urban dweller spends in traffic congestion will be three times more than today which is equivalent to almost 400 days in a lifetime.

(The Future of Urban Mobility Report).

Air Pollution

An estimated **92 % of the world's population is currently exposed to air pollution** greater than the WHO air quality guidelines.

WHO reports air pollution kills 7 million people a year (WHO, 2021). However, a recent study reveals that air pollution kills **more than 10 million people each year (Vohra et al., 2021).**



Pictures Source: https://www.google.com/

Exposure to air pollution costs almost **US$ 5.11 trillion in welfare losses globally** (WHO, 2018).

Air pollution from the transport sector

- It is predicted that by 2030 **Asia will account for one-third of global transport CO2 emissions** (SLOCAT, 2020)
- Transport **CO2 emissions will grow 20% by 2050.**
- Even if today's commitments to decarbonize transport are fully implemented **CO2 emissions from transport will increase by 16%** by 2050 (ITF, 2021).

Road Crashes and Fatalities

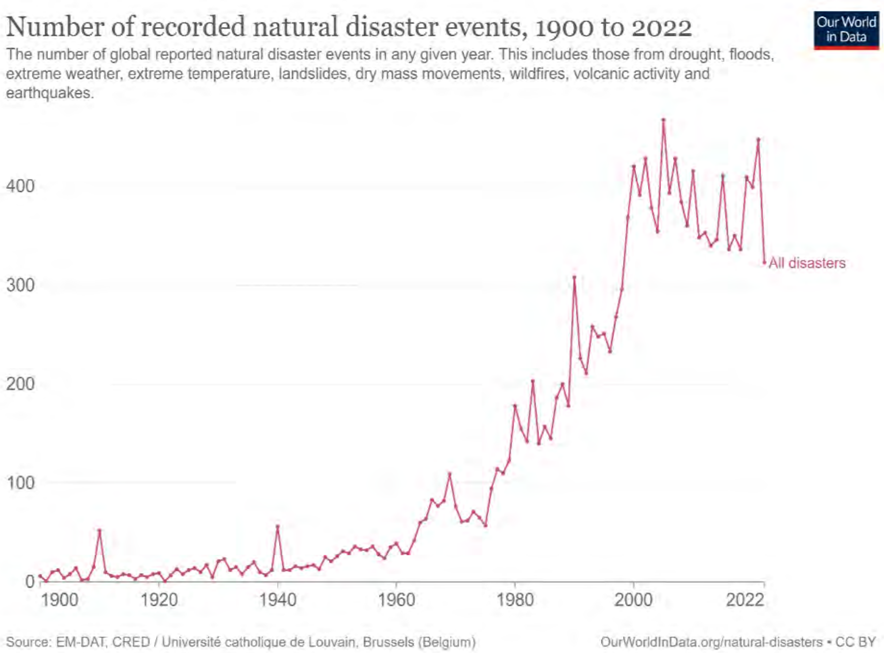
- Approximately 1.3 million people are killed annually due to road traffic crashes (WHO, 2021).
- More than 60% of the global road fatalities occurred in the Asia-Pacific region (UNESCAP, 2020).
- It costs countries 3% -5% of their gross domestic product (GDP).

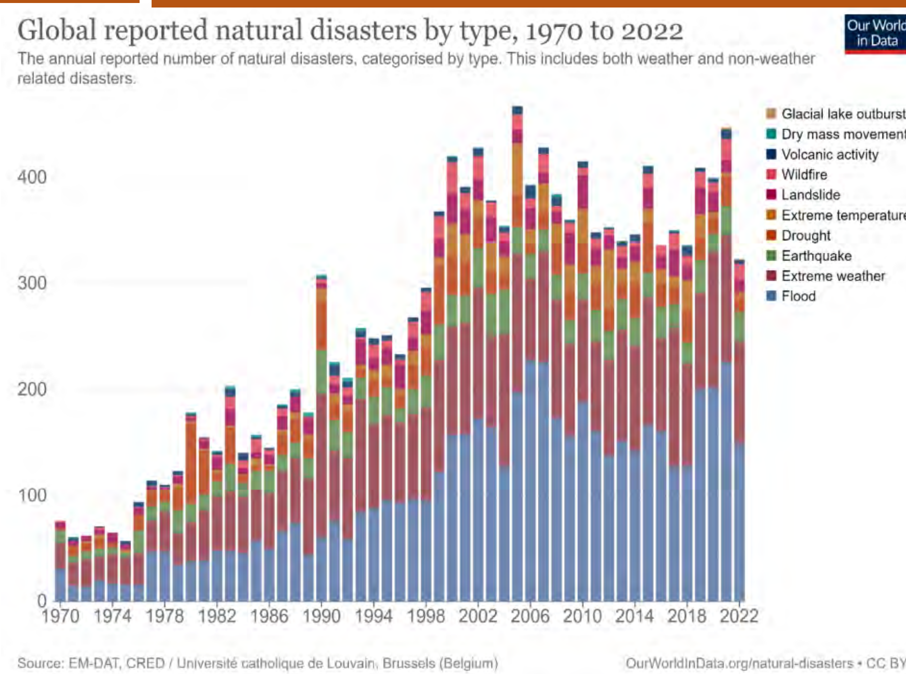
Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years.

Natural Disasters

People in Asia are 4 times more likely to be affected by natural disasters than in Africa, and 25 times more likely than in Europe or North America.

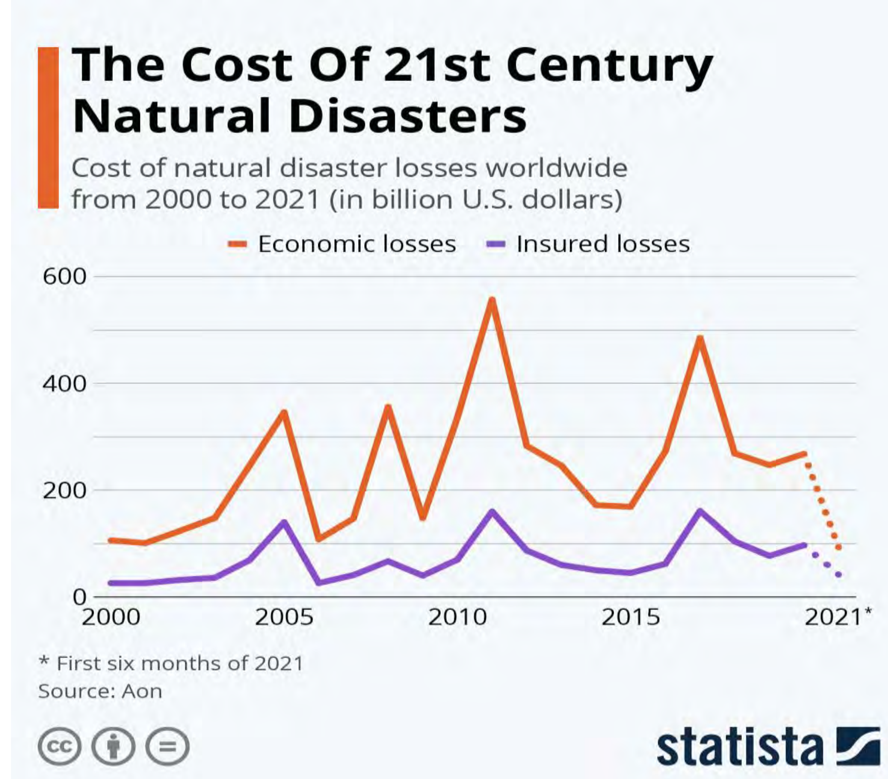
As per the disaster risk index 2022, the countries with the highest disaster risk worldwide are the Philippines, India, and Indonesia.





Water-Induced Natural Disasters in Asia and the Pacific


Bangkok floods in 2011
Photo: www.asianews.it




Flooding in Quezon City, 2021
Photo: Alamy Stock


Mumbai floods in 2022
Photo: www.bbc.com

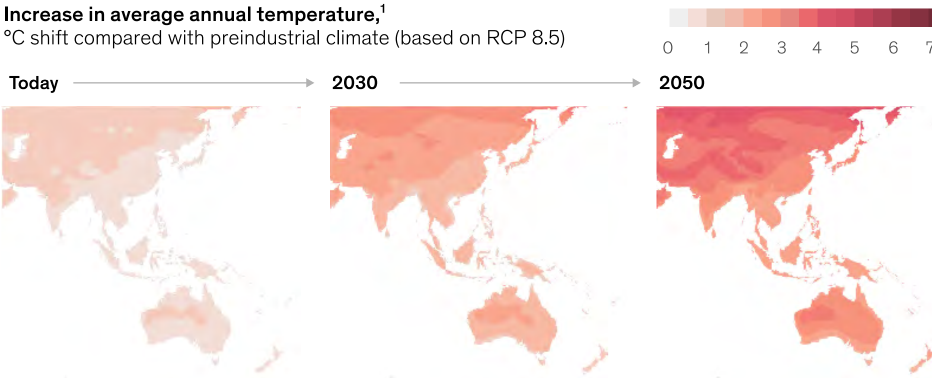
Natural disasters caused 31,300 deaths and $313 billion in economic loss in 2022 (Aon, 2022).

Climate Change and Global Warming

As most of the megacities in Asia and the Pacific are located along the coastline, they are at high risk of global warming and sea level rise. Over 800 million people live in 570 coastal cities and these areas are at high risk of coastal flooding (C40, 2019).

Average temperatures are projected to increase in many parts of Asia.

Increase in average annual temperature,[1]
°C shift compared with preindustrial climate (based on RCP 8.5)



Note: See Technical appendix, *Climate risk and response: Physical hazards and socioeconomic impacts,* McKinsey Global Institute, January 2020, for why we chose RCP 8.5. Projections based on RCP 8.5 CMIP 5 multimodel ensemble. Heat-data bias corrected. Following standard practice, we typically define current and future (2030, 2050) states as average climatic behavior over multidecade periods. Climate state today is defined as average conditions between 1998 and 2017, in 2030 as average between 2021 and 2040, and in 2050 as average between 2041 and 2060.
[1]Taken from KNMI Climate Explorer, 2019, using mean of full CMIP5 ensemble of models. Preindustrial levels defined as period between 1880–1910.
Source: KNMI Climate Explorer, 2019; Woodwell Climate Research Center; McKinsey/United Nations (disputed boundaries); McKinsey Global Institute analysis

McKinsey & Company

Flood in Zhengzhou, PR China's Henan Province, on 23 July 2021. Source; asia.nikkei.com © Reuters

In a business-as-usual scenario, the global economy will losses from coastal flooding may exceed US $1 trillion annually by 2050 unless the major coastal cities prepare for it (C40, 2019).

Impacts of Climate Change on Transport Infrastructure and Built Environment

According to the Global Climate Risk Index 2021, between 2000 and 2019, over US$ 2.56 trillion (in PPP) was lost worldwide due to more than 11,000 extreme climate-induced weather events.

Urban heat Island

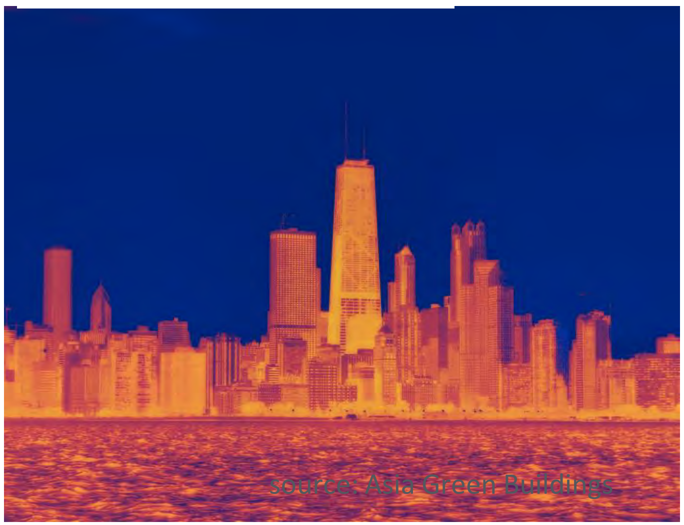


Photo: dhakatribune.com

Melting road infrastructure

Photo: telegraph.co.uk

Extreme weathers and roads

Photo: climatechange.novascotia.ca

IPCC estimates the costs of damage from global warming by 2100 for 1.5 C and 2° C are US$ 54 trillion and US$ 69 trillion, respectively.

Issues Associated with the Public Transport System

- ✓ **Safety and security**
- ✓ **Availability and affordability**
- ✓ **Connectivity and frequency**
- ✓ **Reliability and flexibility**
- ✓ **Integration and inclusiveness**
- ✓ **Efficiency and effectiveness**
- ✓ **People & environment friendly**


Source: hqdefault

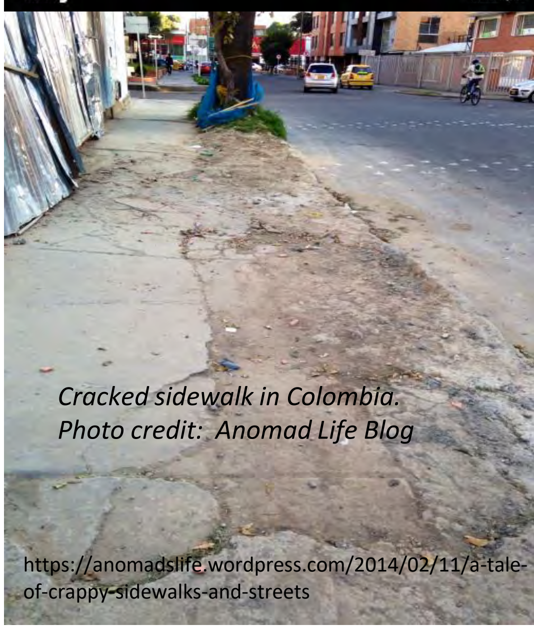

Source: tumblr_inline_mna6q5INNk1qz4rgp

Source :kathmandupost.ekantipur.com


www.gmanetwork.com

(Photo by Marie Thynell)

Issues with NMT and Pedestrian Facilities



Cracked sidewalk in Colombia.
Photo credit: Anomad Life Blog

https://anomadslife.wordpress.com/2014/02/11/a-tale-of-crappy-sidewalks-and-streets

Excavated soil on top of a pedestrian sidewalk.
Photo credit: Pallavi

Source: https://www.tripadvisor.com/

Which city do you prefer?

Haphazard urban development with less mobility

Sustainable urban development with better mobility

Source: https://walkabilityasia.org

Shibuya Crossing, Tokyo

A Significant transformation is required on ***how city designed, how they function, how they are managed and how we live in these cities that all determine our future survival.***

Source: rediff.com

Source www.businessinsider.com

Source: theherald.com.au

Smart City and Smart Mobility

- **Smart City:** A city that uses information and communication technology to improve the quality of life of its citizens.

- **'Smart Mobility'** is the use of technology to enhance mobility in cities through a **focus on interconnected transport systems and services for better mobility options.** Such technologies can reduce travel costs, air pollution, and GHG emissions.

Smart Mobility City

- Smart technologies can enhance multiple outcomes:
  - to inform the effective and efficient expansion and operation of **shared transit** services (such as train lines, metro lines, light rail and tram lines, bus services etc);
  - to enable **seamless mode changes** as part of a journey to streamline ticketing between modes;
  - to allow for **predictive maintenance** to reduce associated costs; and
  - to enable the transport system to deliver **enhanced mobility across** a city.

Smart Mobility Principles

The overarching goal of smart mobility is to **provide safe, clean, affordable, accessible, and efficient mobility for all** sectors of society with the help of smart technologies and solutions.

1. **Safety and Security**
2. **Improved accessibility and connectivity**
3. **Encourage non-motorized transport**
4. **Promoting clean, green, and low-carbon transport solutions**
5. **Social equity and inclusiveness**
6. **Planning dense and human-scale cities**
7. **Optimizing existing transport infrastructure**

8. **Discouraging private vehicles**
9. **Harnessing technology**
10. **Encourage public-private partnership**
11. **Data collection and sharing**
12. **Promote community engagement and participation**
13. **Encourage innovation, research, and development**
14. **Promote economic growth**
15. **Protect urban biodiversity and ecology**
16. **Providing a healthy environment for all**

Transport Infrastructure and Systems

- ***Physical Infrastructures*:** This includes all ***physical infrastructure associated with transport systems*** such as rail, roads, bridges, ports, airports, vehicles, traffic signs, singles, etc.
- ***Transport Actors*:** Direct or indirect ***transport users and beneficiaries*** including drivers, passengers, transport operators, producers, managers, and other actors associated with the transport infrastructure and services.
- ***Technology Used:*** All used and associated and ***interlinked technology*** for the transport infrastructure and services such as ICT, IoT, ITS, AI, GIS and GPS, Automation, Blockchain Technology, among others.
- ***Policy, Planning, Operation, and Management System*:** This includes the ***policy implementation, planning ideas, operation mechanisms, and management plans*** of the involved stakeholders in the transport infrastructure and system.

Principles of Mobility Planning

By connecting people, commodities, and data, smart mobility policies and planning keep the city inclusive, liveable, and attractive.

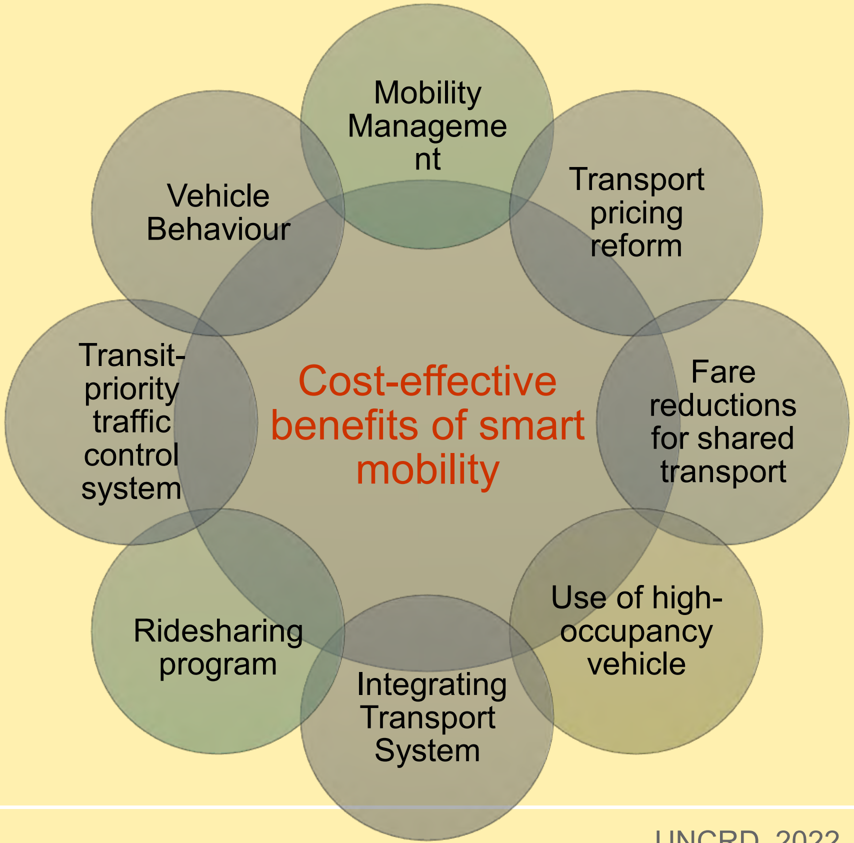
The following Principles of Mobility Planning have been developed for smart mobility solutions:

- ✓ **Integrated Planning:** Integrated Land use, Urban and Transport Planning
- ✓ **Multimodal Integration:** Seamless connectivity between different modes
- ✓ **Mixed-use Development:** Combines different facilities that are well-integrated and connected
- ✓ **Transit-Oriented Development:** The dense, compact, and connected urban development
- ✓ **Transportation Demand Management:** TDM emphasizes the movement of people and goods giving priority to public transit,
- ✓ **Transit Activated Development:** High-density urban regeneration along the main corridor
- ✓ **Universal Urban Design** for Accessible, Usable, and Better Connectivity
- ✓ **Low-carbon Public Transport and Non-motorized Transport**
- ✓ **Use of Smart Technology and Innovative Solutions**

Benefits of Smart Mobility

- Reduce traffic congestion, air, and noise pollution
- Decrease traffic accidents, injuries, and fatalities
- Enhance greater mobility, connectivity, and access
- Reduce GHG emissions
- Reduce household spending on transportation
- Reduce urban sprawl
- Improve the natural environment and green growth
- Active and healthier lifestyle with more walking and cycling
- Improve the resilience of cities by access to high-quality public transport
- Businesses grow in the local community
- Enhance energy security by reducing oil dependency
- Increase property values
- Improve the quality of life with a better living and working environment

Cost-effective Solutions for Smart Mobility



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Smart Mobility Design

Barrier-free and People-Friendly Urban Design

Accessible design: It focuses on the needs of people with physical handicaps and physical disadvantages.

Usability design: It focuses on effectiveness, efficiency, and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment.

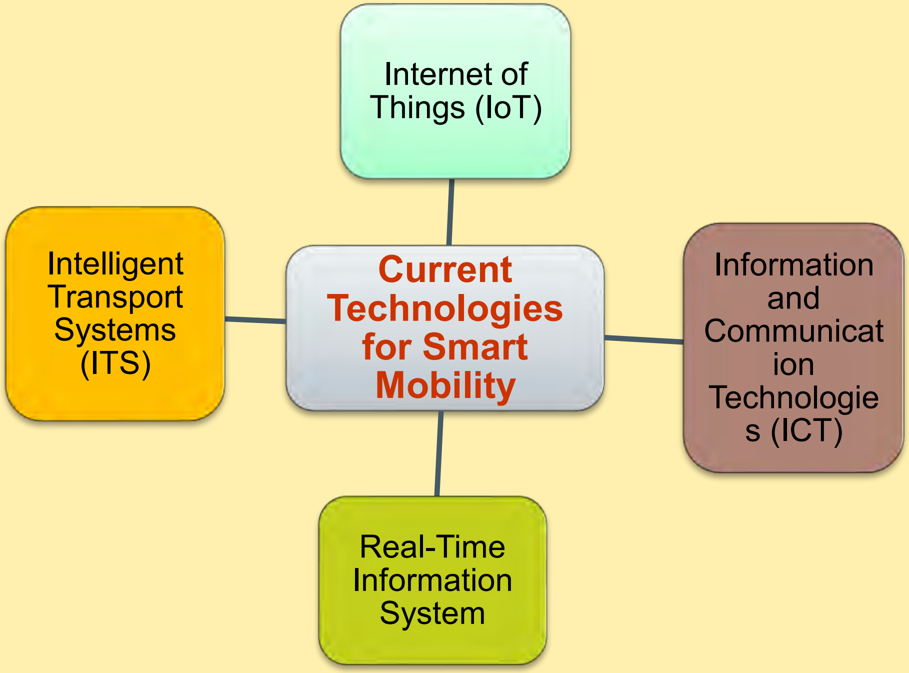
Universal design: It is focused on being usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Seven principles of universal designs

Principle 1: Equitable use
Principle 2: Flexibility in use
Principle 3: Simple and intuitive use
Principle 4: Clear information
Principle 5: Tolerance for error
Principle 6: Low physical effort
Principle 7: Sufficient size and space for approach and use

Picture source: kilolimacode.com

Current Technologies for Smart Mobility



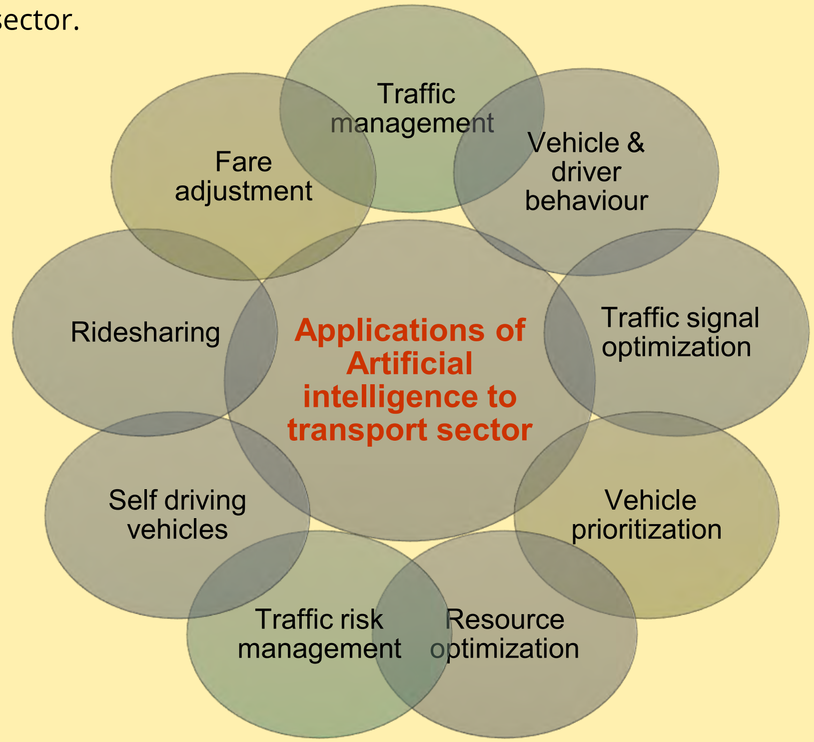
Emerging Smart Mobility Technologies

Use of state-of-the-art advanced smart technologies and solutions such as IoT, ITS, ICT, GPS, sensors, smart cards, mobile apps; and other advanced technologies like automatic vehicle location (AVL), automated fare collection (AFC), Self-driving vehicle, automated vehicle inspection system, automated stop announcements (ASA), computer-aided dispatch (CAD), live cameras, transit apps can bring several benefits.

Advanced Technologies for Smart Mobility

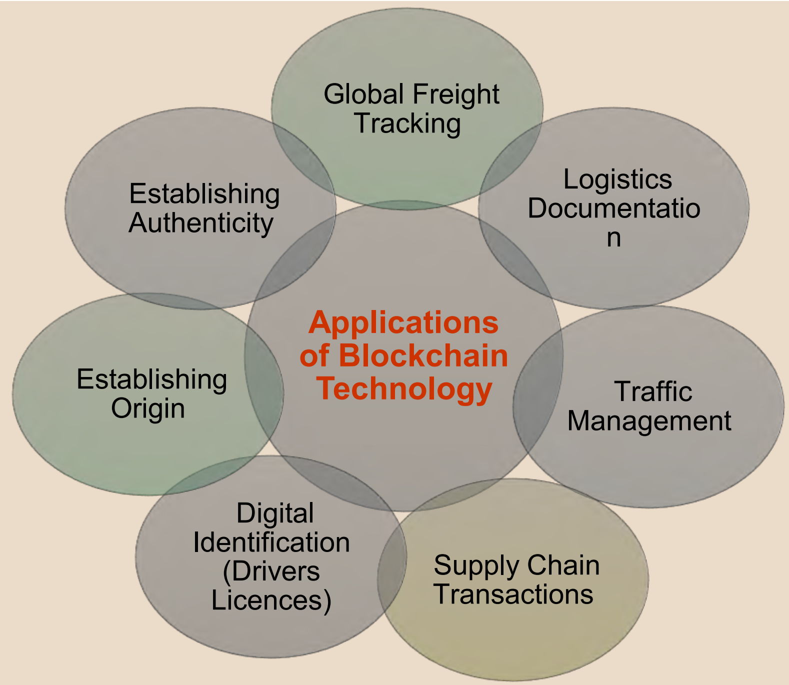
Artificial Intelligence

Artificial Intelligence can be a powerful tool for learning how to manage and predict flows of vehicles, people, and objects, making it particularly useful for the transport sector.



Blockchain Technology

Blockchain enables network participants to exchange data with a high degree of reliability and transparency. Blockchain is essential to create more secure, transparent, efficient, and resilient cities.



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Smart Mobility: Best case from Japan

JAPANESE CASE
Shinjuku Tokyo, Japan

The world's busiest railway station and largest bus terminal where more than 53 platforms over 200 exits and **1600 buses operate** every day connecting 300 cities in 39 prefectures across Japan

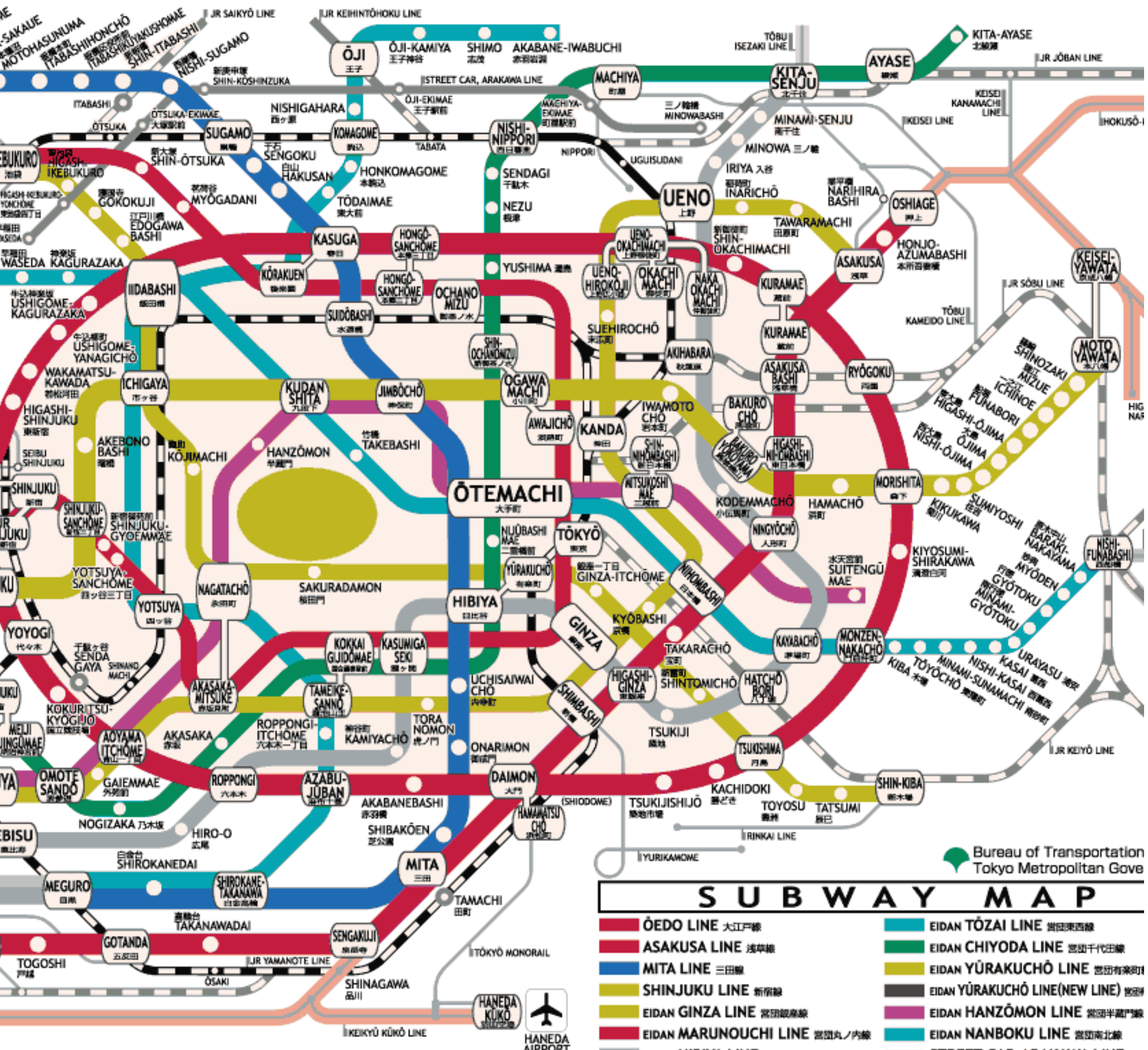
Photo source: dreamstime.com

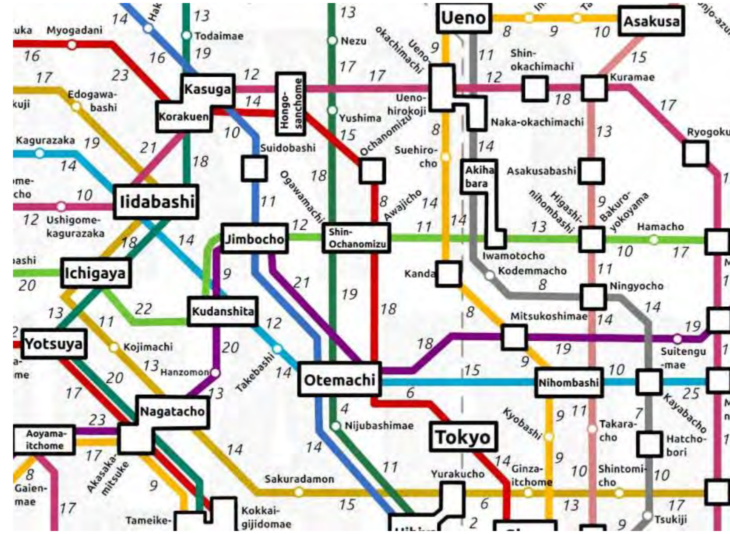
Shinjuku Station opened in 1885 and has a many department stores and shopping malls which are well-connected to the station.

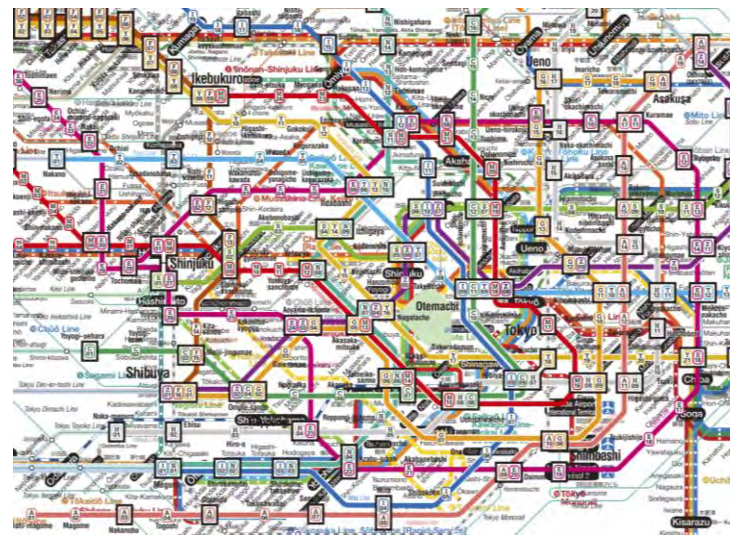
Shinjuku Station, Tokyo

According to Guinness World Records, Shinjuku station is used by about **3.59 million people per day (in 2018)** which makes it the world's busiest station.

Tokyo Subway and Railways Map







Integrated Land use, Urban and Transport Planning

Integrated urban and transport planning and better road design can significantly *enhance the quality of the urban mobility and **transport system** by improving safety, comfort, accessibility,* ***and reliability for all sectors of society.***

Photo sources:
www.google.com

Japan Great Earthquake (9.1 Mw) and Tsunami on 11 March 2011

A tsunami triggered by the Great East Japan Earthquake in Miyagi Prefecture on 11 March 2011

Impact of Japan’s Great Earthquake and Tsunami

About 15,853 people died, 3282 missing and 6023 were injured and cost 16.9 trillion yen of damage.
(Source: https://www.bbc.com/news/world-asia-17219008)


Picture source: https://tinycards.duolingo.com/decks/LM2Bh2Ud/hic-eq-sendai-japan-asia-2011


Photo source: https://earthquake-case-study.weebly.com/impacts.h

Best case from Japan

Aerial view of destruction at Kesennuma after the Great East Japan Earthquake and tsunami (top), and the same site in February **2014 after reconstruction.** Source: Kyodo News

About 25 million tons of debris were cleaned in the affected area. (Source: bbc.com)

Destruction on Kanto Highway in Naka due to the Great East Japan Earthquake was repaired just in six days (bottom).

Picture source: https://inhabitat.com/japanese-workers-take-just-6-days-to-fix-earthquake-shattered-road/

Best cases: Japan

On **16 March 2022, a powerful 7.3 M earthquake** hit the Tohoku region in Japan causing roads along several highways to crack.

Japanese authorities took just 6 hours to repair several sections of the Tohoku Expressway

Photo source: wrap car

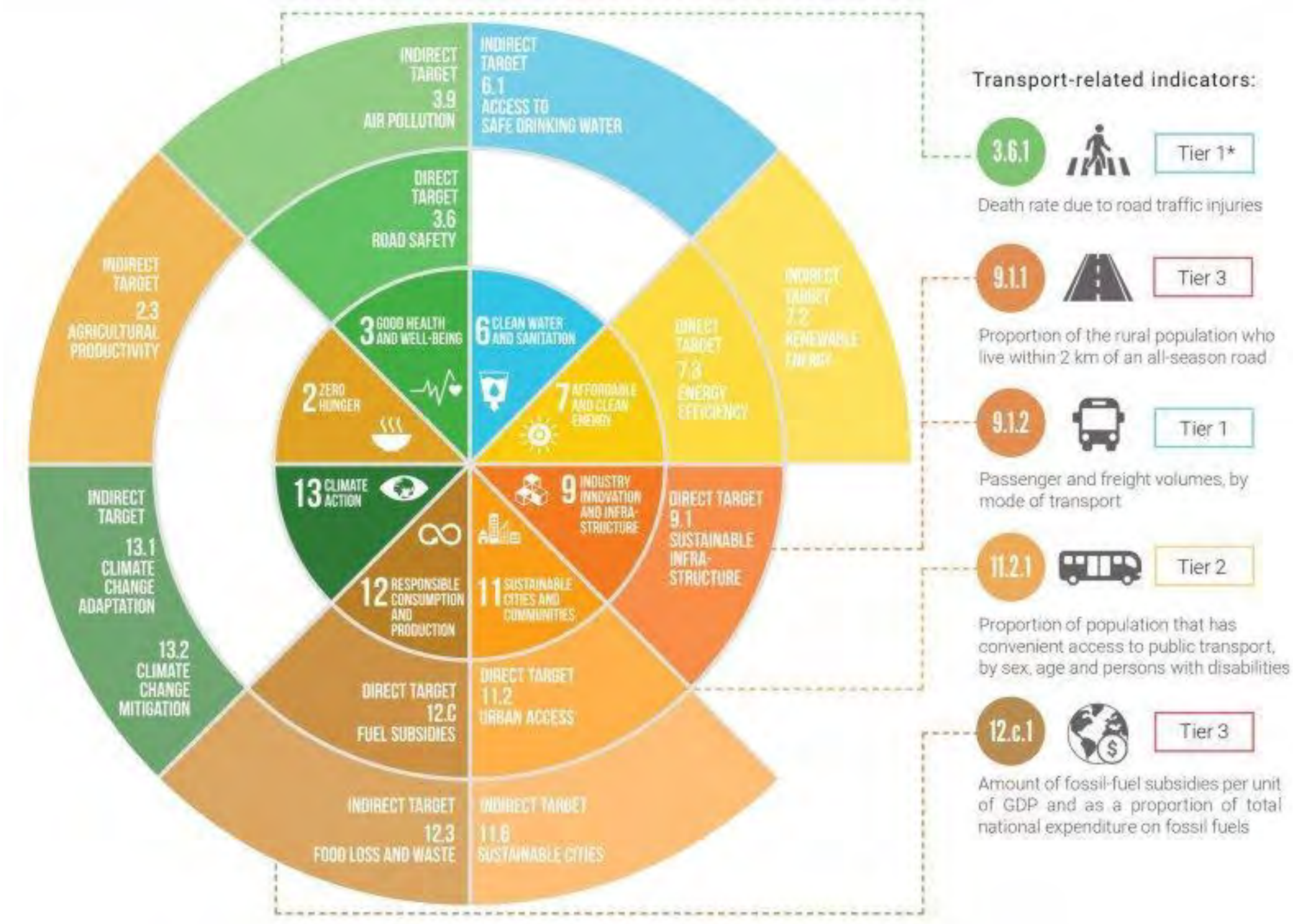
Photo source: Daily

Best cases: Japan cont……

A 7.3 M earthquake hit the coast of Fukushima Prefecture on 13 February 2021 causing damage to Tohoku Shinkansen facilities at about **940 locations** that took **11 days to fix**.

Picture source: asahi.com

Sustainable Transport and SDGs



Source: SLOCAT

Photo Source: Getty Image

Thank you

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