



# Roadmap to Climate & Disaster Resilient Transportation

Towards Sustainable  
Development in India



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SAR Transport GP  
The World Bank  
India

# OUR GOAL

Our goal is to build awareness around the challenges and strategies to enhance the resilience of communities and businesses through more sustainable Transport Infrastructure, Systems, and Services in India.



Roads &  
Bridges



Urban  
Transport



Railways



Ports &  
Waterways



Logistics



Climate Change & Disasters  
are more evident than ever



What's at Stake with  
Climate Change?

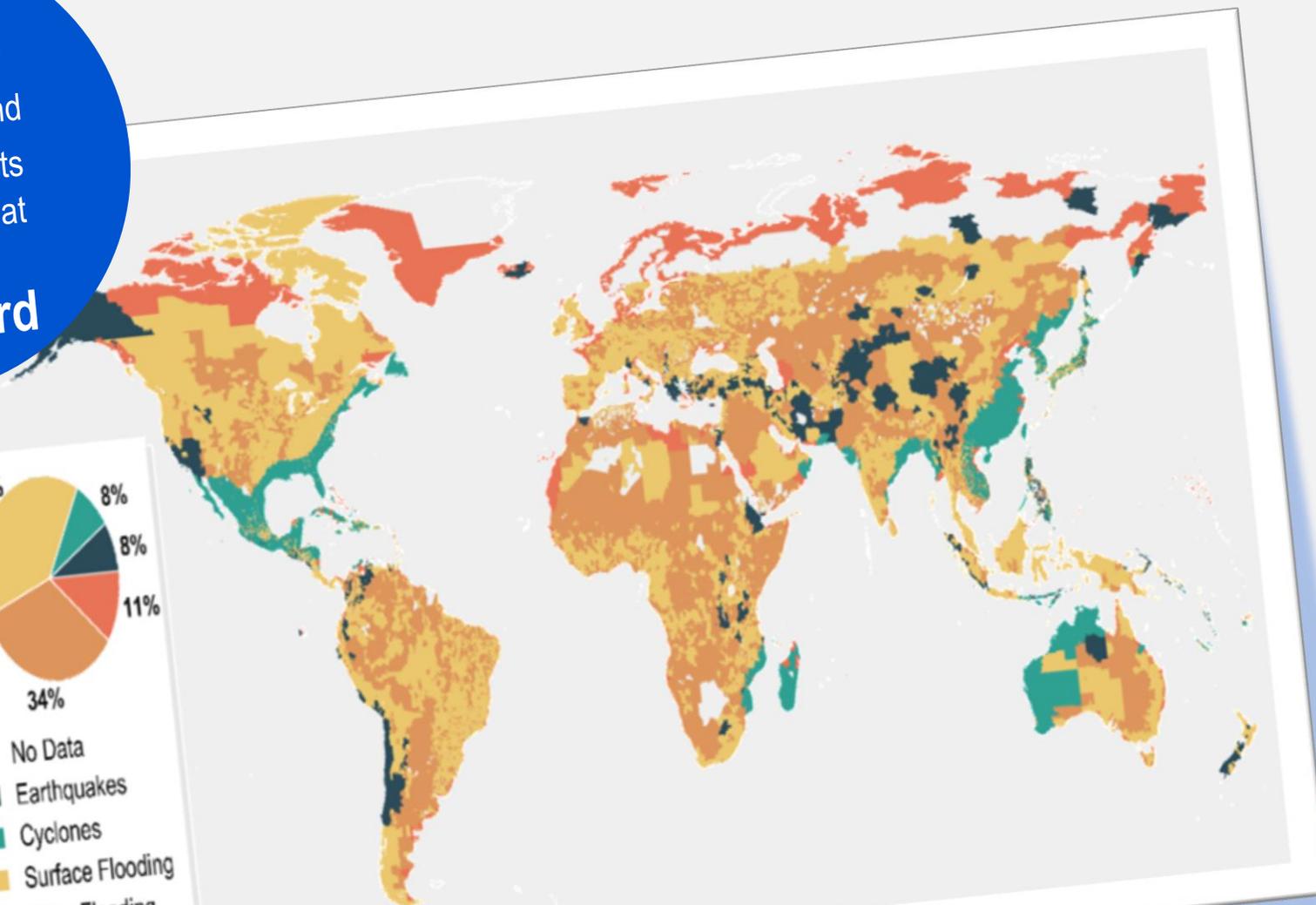
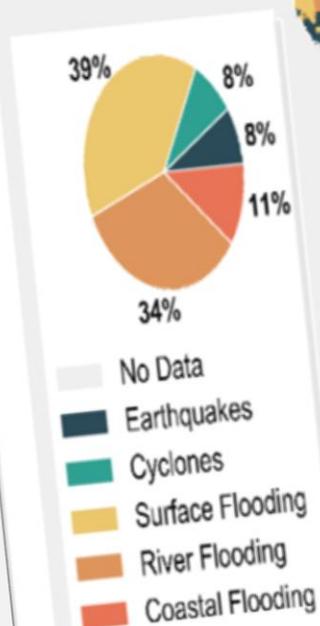


Transport  
Infrastructure is getting  
severely impacted  
causing huge  
economic losses



# Global Disaster Impacts on Transport

**27%** of all global **Road** and **Railway** assets are exposed to at least **one hazard**



The [World Meteorological Organization](#) and [UNESCAP](#) estimate that the **financial losses** in 2021 due to disaster events in **Asia** amounted to about **USD 35.6 billion**

Out of which **~80%** of losses were caused by **floods** and **storms**

# Socio-Economic Impacts

## South Asia Region

**-1.8%**  
**of**  
**GDP**

Economic loss in South Asian countries due to climate change by 2050

**800**  
**million**  
**people**

People in South Asia today living in vulnerable locations

**15**  
**Billion**  
**USD**

Transport infrastructure losses per year globally

**23 x**

Compounding effect: cost of disruption



# Socio-Economic Impacts

## India

Severity

**30-40%**

Road network exposed to  
flooding



Flood Losses (last  
20yrs)

People Killed /affected  
**> 370 Million**

Damage Caused  
**~ USD 45 Million**



# Why Resilience is Critical in India?

GOVERNMENT OF INDIA | MINISTRY OF COMMERCE AND INDUSTRY | DEPARTMENT FOR PROMOTION OF INDUSTRY AND INTERNAL TRADE

A A A Helpline (IND) 1800114556 USD (US) - Login | Register

PM GatiShakti National Master Plan for Multi-Modal Connectivity

INDIA INVESTMENT GRID

HOME OPPORTUNITIES ANALYTICS RESOURCES Add Opportunity Search

## NATIONAL INFRASTRUCTURE PIPELINE

Sectors such as energy, roads, urban and railways are among the key sectors of the projected infrastructure investments in India.

EXPLORE →

आर्थिक कार्य विभाग  
DEPARTMENT OF  
ECONOMIC AFFAIRS

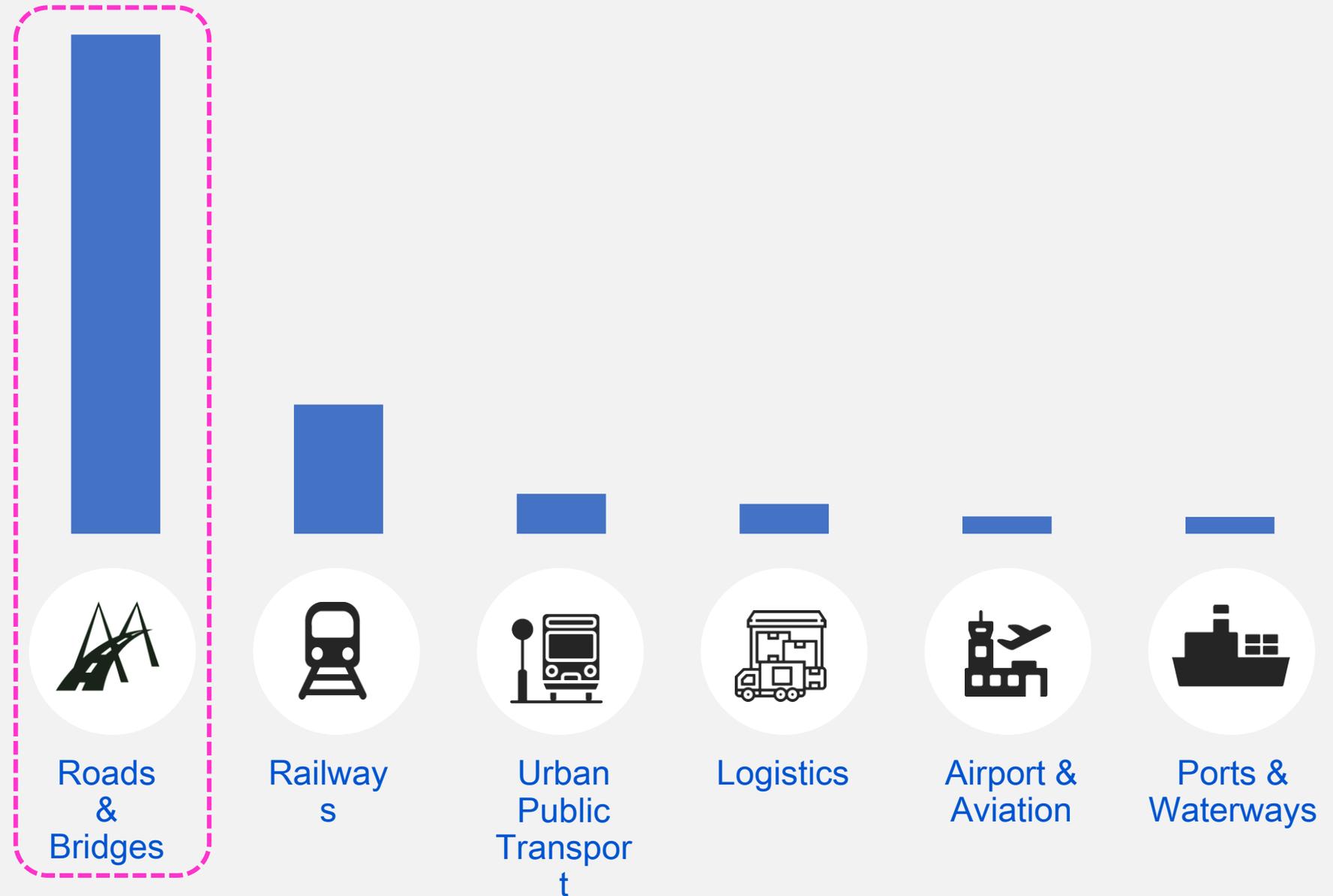
9666 PROJECTS	USD 1809.67 bn TOTAL PROJECT COST	2016 PROJECTS UNDER DEVELOPMENT	55 SUB-SECTORS	 INVEST INDIA NATIONAL INVESTMENT PROMOTION & FACILITATION AGENCY
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Use Only

# India's NIP Transport Sub-Sector Projects

~40,000  
Projects

~ USD  
1.50  
Trillion



# Gaps in Country Systems

- 1 Policy & Legislative Frameworks
- 2 Project Design & Implementation
- 3 Research & Technical Standards
- 4 Maintenance and Asset Management
- 5 Institutional Structures & Capacity
- 6 Climate Financing
- 7 Community Preparedness



# Ongoing efforts in India towards Adaptation

## India's Intended Nationally Determined Contribution (NDC) target under the 2015 Paris Agreement

### Mitigation Strategies

- Clean & Efficient Energy system
- Enhancing Energy Efficiency in Industries
- Enhancing Energy Efficiency in Industries
- Developing Climate Resilient Urban Centers
- Promoting Waste to Wealth Conversion
- Safe, Smart, and Sustainable Green Transportation Network
- Planned Afforestation
- Abatement of Pollution

>85%

### Adaptation Strategies

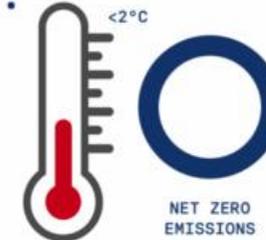
- Agriculture, Water & Health
- Coastal Region & Islands
- Disaster Management
- Protecting Biodiversity & Himalayan Ecosystem
- Rural Livelihoods Security
- Adaptation Actions under State Action Plans on Climate Change
- Knowledge Management & Capacity Building

<15%

Carbon sink of 2.5-3.0 billion tones of CO<sub>2</sub> equivalent by 2030

## PARIS CLIMATE AGREEMENT

1.



Limit the avg. global temperature increase to <math>< 2^{\circ}</math> centigrade + achieve net zero emissions by mid-century

2.



Enhance resilience and adaptation to climate impacts certain to occur

3.



Align financial flows in the world with these objectives

# World Bank's Support towards Adaptation

## World Bank Statement for Adaptation

45%

Lending Projects will account for Climate  
Mitigation & Adaptation



about  
50%

Will account for  
**Climate Adaptation**



# World Bank's Collaboration with CDRI



Collaborating  
With



Coalition for Disaster Resilient Infrastructure

The CDRI is a global partnership that aims to promote the resilience of infrastructure systems to climate and disaster risks, thereby ensuring sustainable development.

RESILIENCE of TRANSPORT  
INFRASTRUCTURE



Roads



Railways



Airways



Seaports



Mass Transits

## Collaboration **TOPICS**



Strategic Roadmap & Policy Influence



Capacity Building and Knowledge Exchange



Risk Assessment & Digital Tools



Joint Events & Global Advocacy



Knowledge Products & Publications



# The World Bank Approach to Resilience

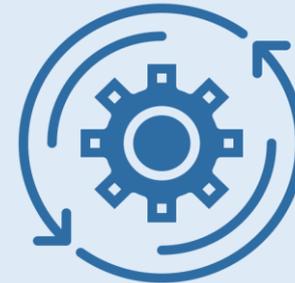
## LIFE CYCLE APPROACH 5 PILLARS of RESILIENCE



Network  
Planning



Design &  
Engineering



Operations &  
Maintenance



Emergency  
Planning



Institutional & Financial Capacity



# The World Bank Approach to Resilience

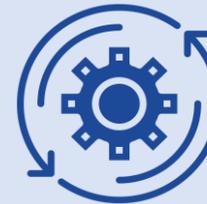
## “RESILIENCE OF” – Transport Asset Resilience



Network  
Planning



Design &  
Engineering



Operations &  
Maintenance



Emergency  
Planning



Financial & Institutional Capacity



# The World Bank Approach to Resilience

## “RESILIENCE THROUGH” – Community Resilience



Network  
Planning



Design &  
Engineering



Operations &  
Maintenance



Emergency  
Planning

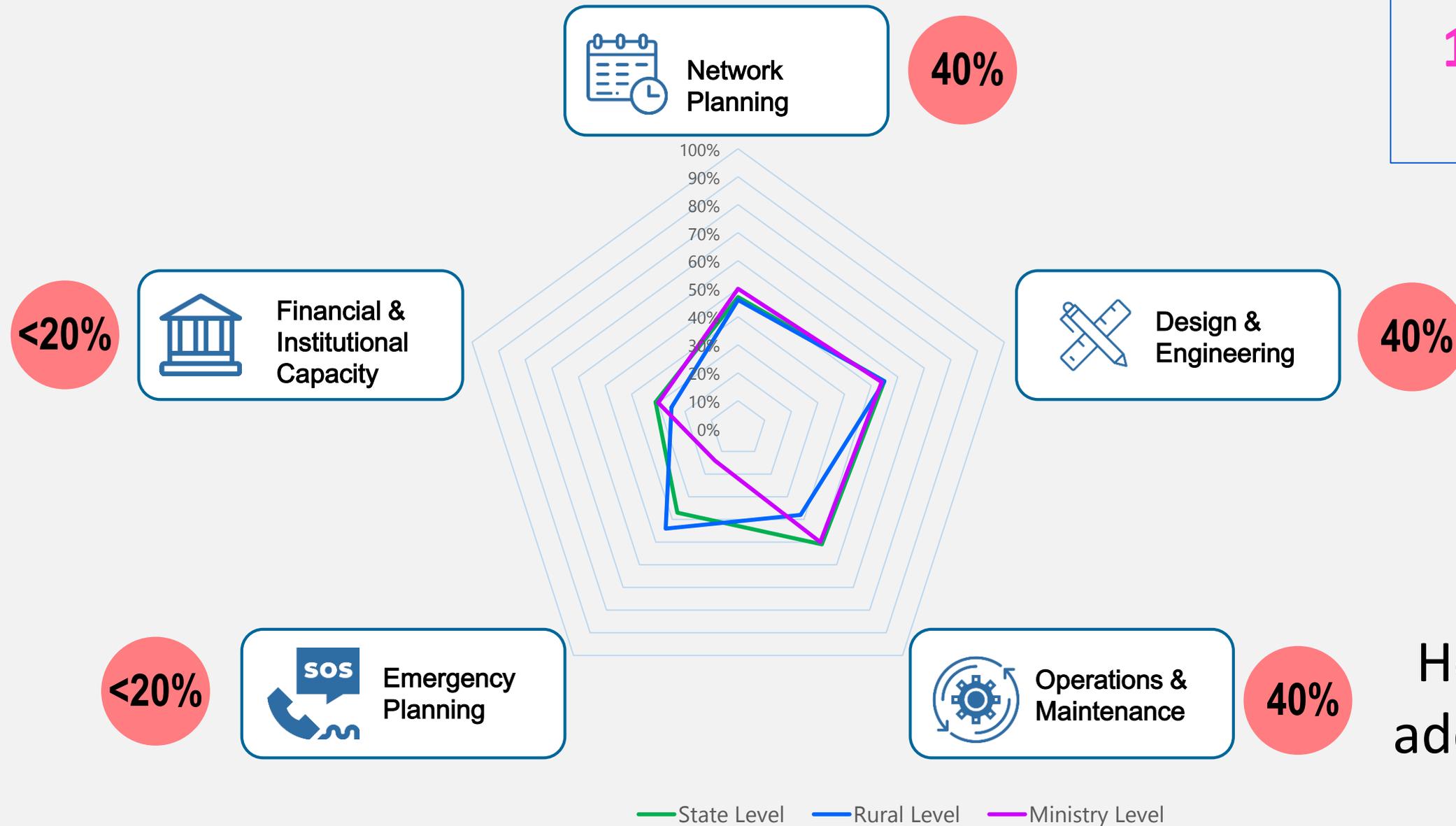


Financial & Institutional Capacity



# World Bank's 'Gap Analysis' from 2021 Survey

Sample Size  
**18 States**  
in India



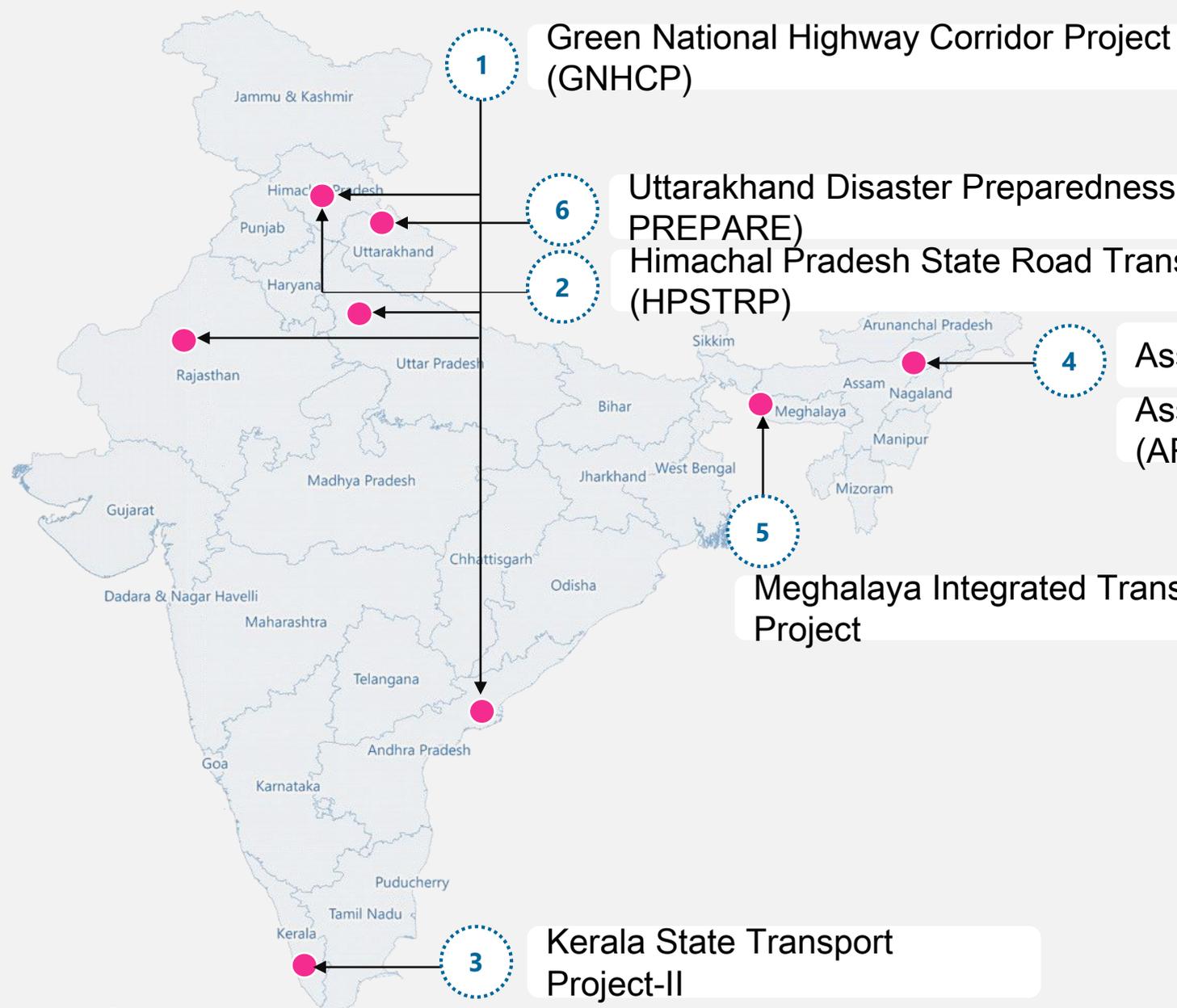
How are we  
address these  
**GAPS?**



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# Tackling Resilience under WB's Ongoing Projects

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**PIPELINE PROJECTS**

Assam Disaster Resilient Hill Roads Development Project (ADRHRDP)

**PAST PROJECTS**

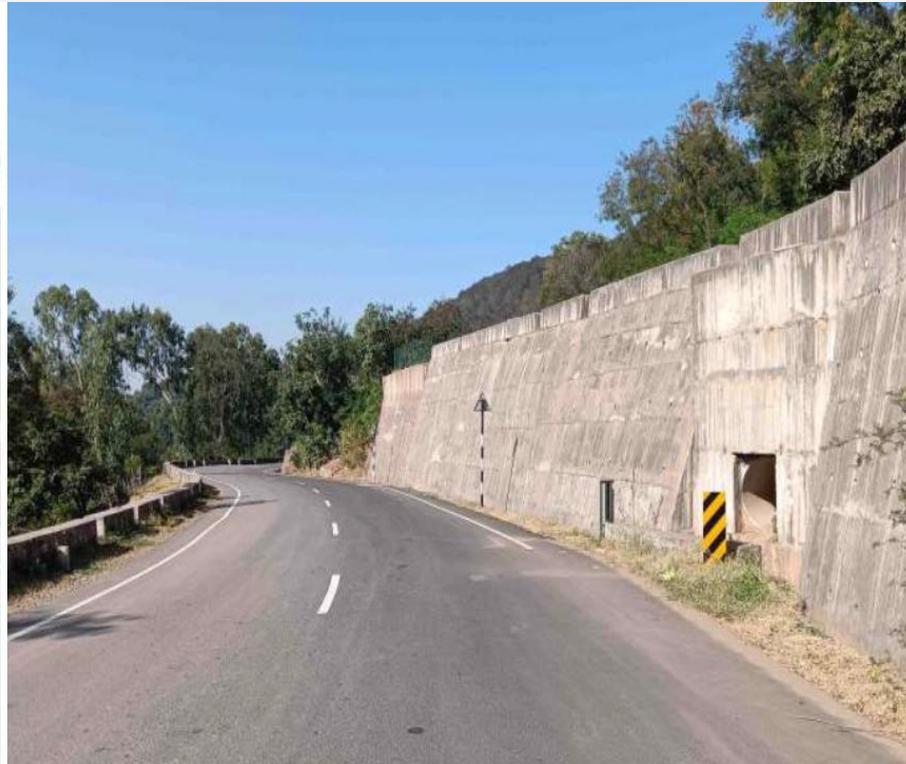
The India Pradhan Mantri Gram Sadak Yojana plan (PMGSY-Rural Roads)

EDFC (Railways)

Map not to scale

# Resilient Measures - Best Practices

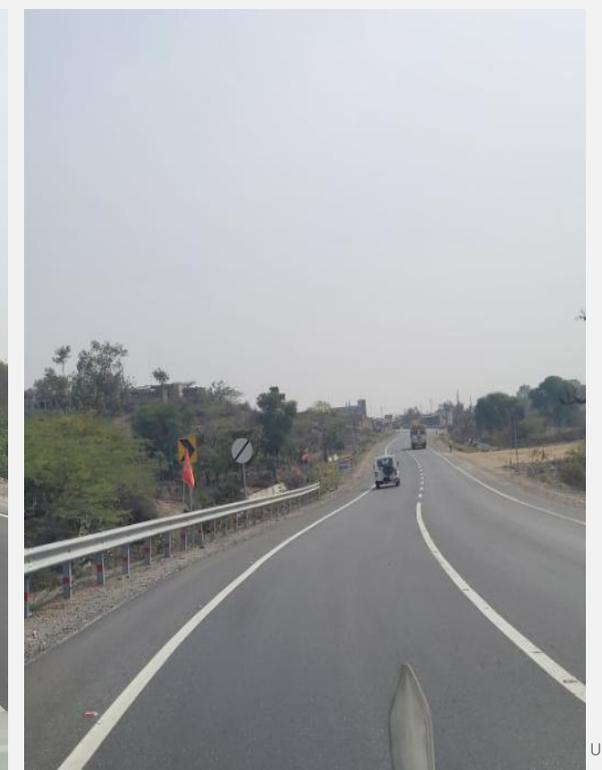
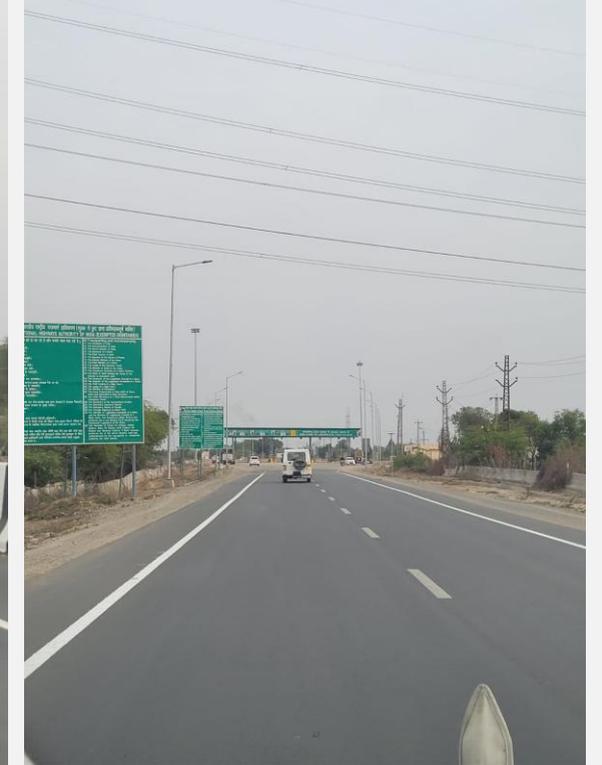
Slope protection Measures for  
Landslides  
Gabion Walls  
Breast Walls  
Toe Walls



# Bio-Engineering Solutions for Slope Protection



# Green Facia for Retaining Walls CTSB Heat Resistant Roads (VG40 grade)

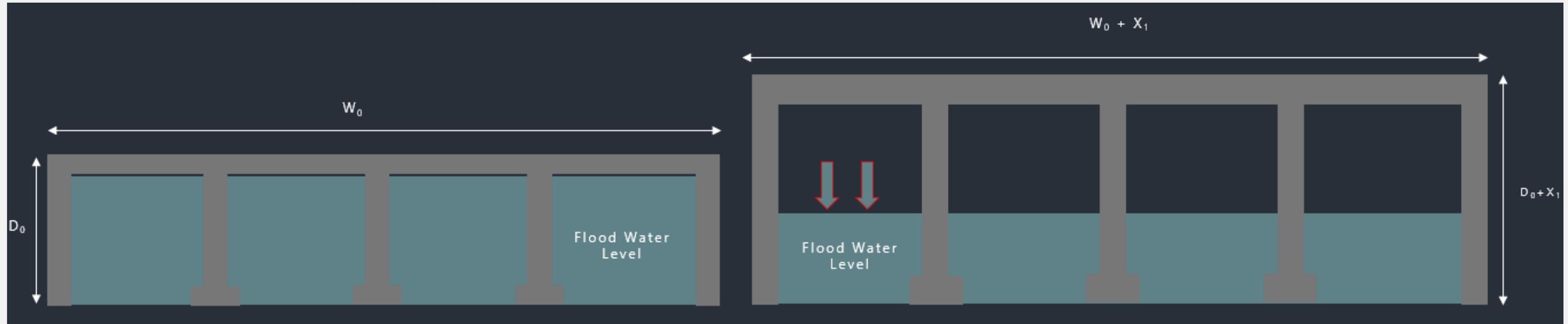


# Resilience Incorporated in Structures

Major & Minor Bridges

Culverts

Drainage System



# WB Steps Toward Enhancing Resilience in India “Spreading Awareness”

National Level  
(**>250** participants online)

Webinar-1  
(April 2021)



Written by Vijetha Bezzam,  
Ocean Keou, Rashi Grover

Blogs  
(2022) [Bio-Engineering](#)  
[Climate Resilient Roads](#)

Workshop  
(November 2025)



Webinar-2  
(December 2021)

Global Director, WB India  
Opening Remarks

(**approx. 250** participants  
online)

Country Director, WB  
India  
Opening Remarks

**Technocrats/Decision Makers**  
Transport Sub-Sector Ministries,  
Disaster Management Agencies,  
Past & Ongoing project states,  
Think Tanks, Academia  
Developing Partners, etc.

Workshop  
(November 2023)

(**150** participants in-  
person)

Practice Manager, SAR  
Transport, World Bank  
Keynote Speech





**ACT NOW**

To avoid 23x disruption Cost

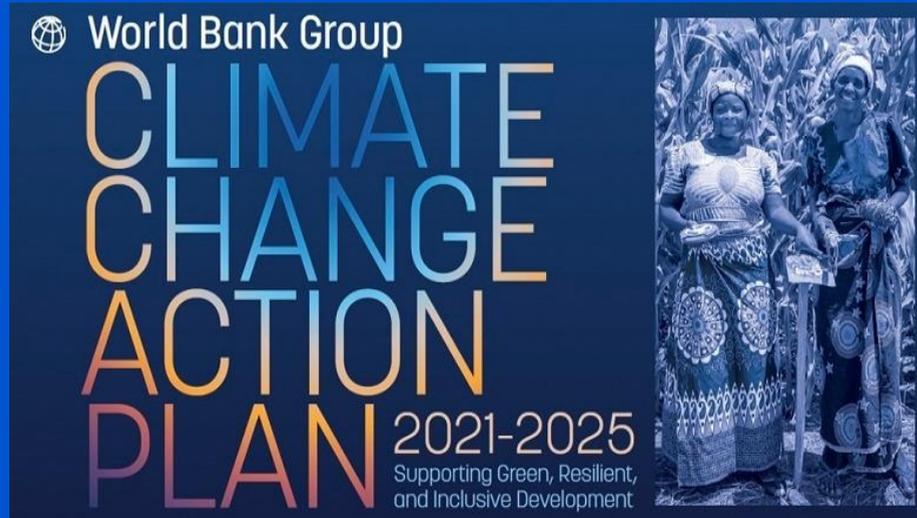
**IMPROVE**

Transport Asset Resilience

**ENABLE**

Community Resilience

# WB RESOURCES



<https://openknowledge.worldbank.org/server/api/core/bitstreams/19f8b285-7c5b-5312-8acd-d9628bac9e8e/content>

## Upcoming India's CCDR



Let's together build  
Resilient Transport  
Infrastructure

&

Resilient Communities

# Thank You



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