

**ENGLISH ONLY**

**UNITED NATIONS  
CENTRE FOR REGIONAL DEVELOPMENT**

**In collaboration with**

**Ministry of Physical Infrastructure and Transport (MOPIT), Nepal  
Ministry of the Environment (MOE), Japan  
United Nations Economic and Social Commission for Asia and the Pacific (UN  
ESCAP)**

**NINTH REGIONAL ENVIRONMENTALLY SUSTAINABLE TRANSPORT  
(EST) FORUM IN ASIA  
17-20 NOVEMBER 2015, KATHMANDU, NEPAL**

**Adaptation in the Transport Sector in Asia – Recommendations for  
COP21**

**(Background Paper for Plenary Session 7 of the Programme)**

**Final  
March 2016**

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This background paper has been prepared by the Partnership on Sustainable, Low Carbon Transport, for the Ninth Regional EST Forum in Asia. The views expressed herein are those of the authors only and do not necessarily reflect the views of the United Nations

## List of Abbreviations

|               |  |
|---------------|--|
| <b>100RC</b>  | 100 Resilient Cities   |
| <b>AASHTO</b> | American Association of State Highway and Transportation Officials                               |
| <b>ADB</b>    | Asian Development Bank   |
| <b>AF</b>     | Adaptation Fund  |
| <b>AfDB</b>   | African Development Bank   |
| <b>ARISCC</b> | Adaptation of Railway Infrastructure to Climate Change   |
| <b>BMUB</b>   | German Federal Ministry for the Environment, Nature Conservation,<br>Building and Nuclear Safety |
| <b>CAF</b>    | Cancun Adaptation Framework  |
| <b>CCA</b>    | Climate Change Adaptation  |
| <b>CCAITN</b> | Climate Change Adaptation for International Transport Networks                                   |
| <b>CEDR</b>   | Conference of European Directors of Roads  |
| <b>CIF</b>    | Climate Investment Funds   |
| <b>COP</b>    | Conference of the Parties  |
| <b>CRF</b>    | City Resilience Framework  |
| <b>CRGE</b>   | Climate Resilient Green Growth   |
| <b>CRVA</b>   | Climate risk and vulnerability assessment  |
| <b>CTF</b>    | Clean Technology Fund  |
| <b>EBRD</b>   | European Bank for Reconstruction and Development   |
| <b>ECA</b>    | Europe and Central Asia  |
| <b>EEA</b>    | European Environment Agency  |
| <b>EIB</b>    | European Investment Bank   |
| <b>ESIAs</b>  | Environmental and Social Impact Assessments  |
| <b>ESIF</b>   | European Structural and Investment Funds   |
| <b>EST</b>    | Environmentally Sustainable Transport  |
| <b>EU</b>     | European Union   |
| <b>FTA</b>    | Federal Transit Administration   |
| <b>GCF</b>    | Green Climate Fund   |
| <b>GEF</b>    | Global Environment Facility  |
| <b>GHG</b>    | Greenhouse Gas Emission  |
| <b>GIS</b>    | Geographic Information Systems   |
| <b>IADB</b>   | Inter-American Development Bank  |
| <b>ICT</b>    | Information Communication Technology   |
| <b>IDFC</b>   | International Development Finance Club   |
| <b>IFC</b>    | International Finance Corporation  |
| <b>IFI</b>    | International Financial Institution  |

|                |  |
|----------------|--|
| <b>IKI</b>     | International Climate Initiative                             |
| <b>INDC</b>    | Intended Nationally Determined Contribution                  |
| <b>IPCC</b>    | Intergovernmental Panel on Climate Change                    |
| <b>IsDB</b>    | Islamic Development Bank                                     |
| <b>ITS</b>     | Intelligent Transportation Systems                           |
| <b>LAC</b>     | Latin American and the Caribbean                             |
| <b>LDC</b>     | Least Developed Countries                                    |
| <b>LDCF</b>    | Least Developed Countries Funds                              |
| <b>LGSAT</b>   | Local Government Self-Assessment Tool                        |
| <b>LPAA</b>    | Lima-Paris Action Agenda                                     |
| <b>MDB</b>     | Multilateral Development Bank                                |
| <b>MRD</b>     | Ministry of Rural Development (Cambodia)                     |
| <b>MRV</b>     | Measurement, Reporting, and Verification                     |
| <b>NAMA</b>    | Nationally Appropriate Mitigation Action                     |
| <b>NAP</b>     | National Adaptation Plan                                     |
| <b>NAPA</b>    | National Adaptation Programmes of Action                     |
| <b>NCEP</b>    | National Commission on Energy Policy                         |
| <b>NDF</b>     | Nordic Development Fund                                      |
| <b>NTPP</b>    | National Transportation Policy Project                       |
| <b>PIANC</b>   | World Association for Waterborne Transport Infrastructure    |
| <b>PIARC</b>   | World Road Association                                       |
| <b>PPCR</b>    | Pilot Program for Climate Resilience                         |
| <b>REDD+</b>   | Reducing Emissions from Deforestation and Forest Degradation |
| <b>REST-AP</b> | Regional Environmentally Sustainable Transport Action Plan   |
| <b>Rio+20</b>  | United Nations Conference on Sustainable Development         |
| <b>RRIP</b>    | Rural Roads Improvement Project                              |
| <b>RUI</b>     | Risk, Uncertainty and Irreversibility                        |
| <b>SASEC</b>   | South Asia Sub-regional Economic Cooperation                 |
| <b>SCCF</b>    | Special Climate Change Fund                                  |
| <b>SDG</b>     | Sustainable Development Goal                                 |
| <b>SG</b>      | Secretary General  |
| <b>SID</b>     | Small Island Developing State                                |
| <b>SPCR</b>    | Strategic Program for Climate Resilience                     |
| <b>TAM</b>     | Transportation Asset Management                              |
| <b>TRAC3</b>   | Tracking Research on Adaptation to Climate Change Consortium |
| <b>UIC</b>     | International Union of Railways                              |
| <b>UN</b>      | United Nations   |
| <b>UNCRD</b>   | United Nations Centre for Regional Development               |

|               |   |
|---------------|---|
| <b>UNECE</b>  | United Nations Economic Commission for Europe         |
| <b>UNEP</b>   | United Nations Environment Programme                  |
| <b>UNFCCC</b> | United Nations Framework Convention on Climate Change |
| <b>UNISDR</b> | United Nations Office for Disaster Risk Reduction     |
| <b>US</b>     | United States   |
| <b>WB</b>     | World Bank  |
| <b>WMO</b>    | World Meteorological Organization                     |

## Table of Content

|   |    |
|---|----|
| List of Abbreviations .....   | 1  |
| Table of Content .....  | 4  |
| List of Figures.....  | 5  |
| List of Tables.....   | 5  |
| Introduction.....   | 6  |
| 1. Establishing a Case for More Ambitious Action on Transport Adaptation and Resilience .....                 | 9  |
| Scientific Arguments for Adaptation.....  | 10 |
| Policy Arguments for Adaptation .....   | 11 |
| 2. The Evolving Knowledge Base on Adaptation.....   | 13 |
| Summary Reports .....   | 13 |
| Development of Tools and Methodologies.....   | 19 |
| Conclusions .....   | 22 |
| 3. Adaptation and Resilience in the UNCRD EST Process .....   | 22 |
| Linkage between Climate Adaptation and Sustainable Development .....  | 22 |
| Adaptation and Resilience in EST Outcome Documents .....  | 25 |
| Conclusions .....   | 29 |
| 4. Examples of Key Programs Related to Transport and Adaptation in the Developing World.....                  | 30 |
| Conclusions .....   | 33 |
| 5. Overview of Country-Level Adaptation Policies with Transport Relevance.....                                | 33 |
| National-Level Adaptation Policies .....  | 34 |
| Intended Nationally-Determined Contributions (INDCs).....   | 36 |
| Conclusions .....   | 38 |
| 6. Multi and Bilateral Development Banks (MDBs) as Accelerators of Action on Adaptation in<br>Transport ..... | 39 |
| MDB Adaptation Policies.....  | 39 |
| MDB Climate Adaptation Tools and Guidance.....  | 47 |
| MDB Climate Adaptation Projects .....   | 49 |
| Conclusions .....   | 54 |
| 7. Climate Finance Funding for Adaptation in the Transport Sector in Developing Countries .....               | 54 |
| Trends in MDB funding for Adaptation in the Transport Sector.....   | 54 |
| Trends in Climate Finance Instrument Funding for Adaptation in the Transport Sector .....                     | 57 |
| Conclusions .....   | 60 |
| 8. Conclusions and Recommendations.....   | 60 |
| Annex 1: Transport Relevance of National Adaptation Policies in EST Countries .....                           | 66 |

## List of Figures

|   |    |
|---|----|
| Figure 1. Progress of Countries Around the World on Adaptation .....                        | 20 |
| Figure 2: Transport Targets and Global Goals on Sustainable Development .....               | 23 |
| Figure 3: National Adaptation Strategies and Plans in European Countries .....              | 36 |
| Figure 4. Share of Sustainable Transport in MCB Climate Finance Portfolio (2011-2014) ..... | 55 |
| Figure 5. MDB Climate Finance Portfolio (2011-2014) in USD billion.....                     | 55 |

## List of Tables

|  |    |
|--|----|
| Table 1: Evaluation of Bangkok 2020 Declaration Goals via Adaptation and Resilience .....      | 29 |
| Table 2: Nordic Development Fund Transport Adaptation Pilot Projects .....                     | 33 |
| Table 3: Proposed Mitigation and Adaptation Measures in INDCs .....                            | 37 |
| Table 4: Transport-Specific Adaptation Measures in INDCs .....                                 | 38 |
| Table 5: Climate Adaptation References in MDB Country Assistance Strategies in EST Region .... | 47 |
| Table 7 Climate Change Adaptation related tools and relevance to transport sector.....         | 49 |

# Climate Change Adaptation and Resilience in the Transport Sector in EST and Global Contexts

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## Introduction

Adaptation to climate change is gaining importance in global policy discussions, and it is expected that an anticipated global climate agreement at the 21<sup>st</sup> Conference of the Parties (COP21) will have a substantive section on climate adaptation as well as mitigation. The importance of adaptation is reflected in a general manner in the Intended Nationally Determined Contributions (INDCs) that countries are submitting to the United Nations Framework Convention on Climate Change (UNFCCC)<sup>1</sup> to record their climate change related policy commitments; in particular, developing countries (or non-Annex I Parties) have called for greater emphasis on adaptation.

### **Box 1: Climate Change Adaptation, Resilience and Vulnerability**

*Climate adaptation* is considered a group of active and deliberate decision-making to help a system absorb changes that have already occurred, or may be predicted to occur in the future. *Climate resilience* encompasses the dual functions of absorbing shocks as well as to self-renewal, which is its primary distinction from climate adaptation. In differentiating adaptation and resilience from a policymaking standpoint, the active, actor-centric notion of *adaptation* can be contrasted with the systems-based approach of *resilience*, which aims to build social-ecological networks that are capable of absorbing change and in the process developing into more efficient configurations. According to the IPCC, vulnerability is “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes,” with respect to exposure, sensitivity, and adaptive capacity.<sup>2,3</sup>

Adaptation in the transport sector is necessary for both developed and developing countries, as transport systems worldwide are vulnerable to the increasing impacts of extreme weather, and rapid motorization increase the potential for catastrophic impacts (Box 2). Crucially, sustainable transport systems must adapt to climate change to maintain reliability to enable transport’s role in economic

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<sup>1</sup> This report acknowledges that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change

<sup>2</sup> Nelson, Donald R., W. Neil Adger, and Katrina Brown. 2007. “Adaptation to Environmental Change: Contributions of a Resilience Framework.” *Annual Review of Environment and Resources* 32: 395–419. <http://bit.ly/1GOkqNL>

<sup>3</sup> <https://www.weadapt.org/knowledge-base/vulnerability/vulnerability-definitions>

and social development. Many sustainable transport solutions can combine increased mitigation potential and resilience as mutual benefits (e.g. during the Great East Japan Earthquake in 2011, high-speed rail proved to be more resilient than conventional transport infrastructure).<sup>4</sup>

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<sup>4</sup> Eighth Regional Environmentally Sustainable Transport (EST) Forum in Asia, Colombo, Sri Lanka, November 19-21, 2014

### **Box 2: Climate Change Impacts in the Transport Sector**

The daily functioning of most transport systems is sensitive to fluctuations in precipitation, temperature, winds, visibility, and for coastal cities, rising sea levels with the associated risks of flooding and damages. In road transport, paved roads are particularly vulnerable to temperature extremes, while unpaved roads and bridges are vulnerable to precipitation extremes. Rail system failures are known to be related to high temperatures, icing, and storms.<sup>5</sup> Urban public transport systems have shown to be vulnerable to flooding as was demonstrated in the case of Super-storm Sandy in New York in 2012.

Less-developed countries located in Asia, Africa and Latin American and the Caribbean (LAC) are already suffering in climate change due to their relatively higher vulnerability. Asia is subject to risks such as sea-level rise, changes in permafrost conditions and locations, changes in precipitation, and increases in the frequency and intensity of storms, floods and droughts, and all of these impacts have consequences on the design, construction and alignment of roads, railways and other transport infrastructure<sup>6</sup>. In the LAC region, a combination of increased rainfall, prolonged droughts, rising sea levels, and tidal surges puts the stability of the transport systems at risk, and thus poses significant impacts to the LAC countries' economies<sup>7</sup>.

Various regions in the developed world would have slightly different impacts for the transport sector to adapt to climate change. For example, in North America, significant climate impacts for transport systems are projected due to flooding of coastal roads, railways, transit systems, and runways because of rising sea levels<sup>8</sup>. In Europe, sea level rise, storm surges and waves are likely to induce major impacts, including flooding of airports, roads, rail lines and tunnels. Similarly, flooding from intensifying rainfall, as well as other associated extreme events (e.g. landslides), will increase the risks of disruptions or delays in air, rail and road transport<sup>9</sup>.

Yet despite rising interest in climate adaptation, relatively little comprehensive work has been done to organize the growing knowledge base on adaptation to climate change, and the same applies to documenting in a systematic manner potential measures on adaptation in the transport sector, as well national and global policy commitments on adaptation in the transport sector. Also, while much work has been accomplished on climate finance in the transport sector, the majority is on mitigation and only a small fraction relates to adaptation.

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<sup>5</sup> IPCC. 2014. *Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

<sup>6</sup> <http://www.adb.org/sectors/transport/key-priorities/climate-change>

<sup>7</sup> <http://bit.ly/1M2Vnhq>

<sup>8</sup> <http://www.camsys.com/pubs/TransportationAdaptation.pdf>

<sup>9</sup> UNECE. 2014. *Climate Change Impacts and Adaptation for International Transport Networks*.

It is encouraging, however, that building blocks for greater action on adaptation in the transport sector are being developed, with substantive work on the development of a knowledge base, guidelines and toolkits in process, and initial steps are being taken to increase the profile of climate adaptation in national climate policies and in the transport portfolios of international financing institutions (IFIs) and climate finance instruments. Importantly, such climate adaptation initiatives for transport can contribute substantially to achieving the recently adopted sustainable development goals (SDGs), as consistent with long-term strategies of inclusive growth in developing countries.<sup>10</sup> In the case of the Environmentally Sustainable Transport (EST) Forum region accelerated action on adaptation will also benefit the realization of EST principles and the goals of the “Bangkok 2020 Declaration – Sustainable Transport Goals for 2010-2020”.<sup>11</sup>

This paper is organized in the following sections:

- Establish a case for more ambitious action on adaptation and resilience in the transport sector;
- Describe the growing knowledge base on adaptation in the transport sector;
- Summarize treatment of adaptation and resilience in recent United Nations Center for Regional Development (UNCRD) Environmentally Sustainable Transport (EST) Forums;
- Summarize key programs related to transport and adaptation in the developing world;
- Provide an overview of country-level adaptation policies with transport relevance;
- Investigate the role of multi and bilateral development banks (MDBs) as accelerators of action on adaptation in transport;
- Assess availability of climate finance funding for transport sector adaptation in developing countries;
- Draw general conclusions and formulate recommendations to advance global efforts on climate adaptation in the transport sector.

## **1. Establishing a Case for More Ambitious Action on Transport Adaptation and Resilience**

The field of transport sector adaptation may still be in its infancy, but it is on the verge of growing up fast. This section establishes a case for accelerated action on adaptation in the transport sector by presenting scientific and policy arguments for acceleration adaptation through the lens of the Intergovernmental Panel on Climate Change (IPCC) and the [United Nations Framework Convention on Climate Change](#) (UNFCCC).

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<sup>10</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

<sup>11</sup> [https://sustainabledevelopment.un.org/content/documents/bangkok\\_declaration.pdf](https://sustainabledevelopment.un.org/content/documents/bangkok_declaration.pdf)

## Scientific Arguments for Adaptation

The IPCC is the leading international body for the assessment of climate change. The IPCC was established under the [United Nations Environment Programme \(UNEP\)](#) and the [World Meteorological Organization \(WMO\)](#) to provide an objective scientific view of climate change and its potential environmental and socio-economic impacts.<sup>12</sup> For the past two decades, the IPCC has developed assessments of climate-change impacts, adaptation, and vulnerability.

IPCC's Working Group II assesses scientific, technical, environmental, economic and social aspects of vulnerability (i.e. sensitivity and adaptability) to climate change, as well as potential negative and positive consequences for ecological systems, socio-economic sectors and human health.<sup>13</sup> IPCC Working Group II has identified a number of climate impacts that pose particular risks to urban areas (i.e. heat stress, extreme precipitation, inland and coastal flooding, landslides, air pollution, drought and water scarcity), and notes that these risks will be amplified in areas lacking essential infrastructure and services. Therefore, reducing basic service deficits, improving housing and building resilient infrastructure can significantly reduce vulnerability and improve livelihoods in urban areas. Adopting existing technologies from other geographical and climatic conditions may reduce the cost of adapting new infrastructure as well as the cost of retrofitting existing pipelines and grids.<sup>14</sup>

In the [Fifth Assessment Report \(AR5\)](#)<sup>15</sup>, IPCC Working Group II pointed out that the number of scientific publications available for assessing climate-change impacts, adaptation, and vulnerability more than doubled between 2005 and 2010, with especially rapid increases in publications related to adaptation.<sup>16</sup> Yet, there is currently still less attention to vulnerability, impacts, and adaptation in the literature on urban transport and climate change, compared to the knowledge base on mitigation.

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<sup>12</sup> <http://www.ipcc.ch/organization/organization.shtml>.

<sup>13</sup> IPCC Working Group II: Impacts, Adaptation and Vulnerability. <http://www.ipcc-wg2.gov/index.html>. Accessed November 4, 2015.

<sup>14</sup> IPCC. 2014. *Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

<sup>15</sup> IPCC. 2014. *Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

<sup>16</sup> IPCC. 2014. *Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

## Policy Arguments for Adaptation

On the policy side, negotiating processes of the [United Nations Framework Convention on Climate Change](#) (UNFCCC) contain a growing emphasis on adaptation, to balance out an initial focus on mitigation in the process. Climate change adaptation was solidly established in the UNFCCC dialogue through the [Least Developed Countries \(LDC\) Work Programme](#) at the Seventh Conference of the Parties (COP7) in Marrakesh, and has increased in stature through the Cancun Adaptation Framework at COP16.<sup>17</sup>

At last years' COP20 in Lima, Parties made a concerted effort to raise the profile of adaptation within a forthcoming agreement. The preamble to the Lima outcome draft negotiating text emphasizes that "adaptation is a global challenge and a common responsibility...that must be addressed with the same urgency as, and in political / legal parity with, mitigation". In a separate section on adaptation and loss and damage, numerous options highlight the evolving dynamic between developed and developing countries (and in particular LDCs and Small Island Developing States (SIDS)) and the need for directing limited climate finance resources toward adaptation efforts.

At the conclusion of the recent September 2015 UNFCCC negotiating session of the [Ad Hoc Working Group on the Durban Platform for Enhanced Action](#) (ADP) 2-10, the Co-Facilitators issued a [working document](#)<sup>18</sup> which identified points of convergence, including the need for national adaptation actions to be nationally-determined and country-driven; the potential to harness co-benefits and mitigation-adaptation synergies; and the requirement for a flexible country-driven system of measurement, reporting, and verification (MRV). During the session, adaptation finance emerged as a strategic, cross-cutting issue, spanning discussions in both the finance and adaptation areas.<sup>19</sup> At ADP 2-11, the final pre-COP21 session in October 2015, Parties highlighted the fact that human rights was missing in the guidance for adaptation action and expressed concern

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<sup>17</sup> UNFCCC. Focus: Adaptation. <http://unfccc.int/focus/adaptation/items/6999.php>

<sup>18</sup> UNFCCC. 2015. Ad Hoc Working Group on the Durban Platform for Enhanced Action Working Document. Version of 8 September 2015 at 18:00. <http://bit.ly/1FAMbe7>

<sup>19</sup> International Institute For Sustainable Development (IISD). 2015. Summary of the Bonn Climate Change Conference: 31 August-4 September 2015. <http://www.iisd.ca/download/pdf/enb12644e.pdf>

that the importance of adaptation as a primarily nationally-driven process was not adequately reflected in the negotiating text.<sup>20</sup>

While this measured progress on adaptation in recent negotiations bodes well for greater action on adaptation in general, the transport sector (like other specific sectors) has received little attention in the UNFCCC process. As a key example, the [COP21 input report](#)<sup>21</sup> from the UNFCCC Adaptation Committee gives little detail on sectoral approaches to adaptation, and associated references make only superficial reference to transport; thus, this mechanism could benefit from further detail on sectoral approaches, including transport.

The Paris Agreement recognizes the adaptation efforts of developing countries as well as the need for adaptation regardless of the level of mitigation reached, as a greater level of mitigation can reduce the need for additional adaptation efforts. This is particularly true for sustainable transport solutions that can combine increases in mitigation potential with resilience as a mutual benefit. The COP21 outcome documents call for countries to engage in the implementation of adaptation planning processes and actions, including development or enhancement of relevant plans, policies and contributions which includes adaptation actions, national adaptation plans, and nationally determined prioritized actions. Each party shall submit an adaptation communication, which may include priorities, support needs, plans and actions. The COP21 outcome documents also request Parties to strengthen cooperation on adaptation by establishing regional centers and networks, reporting progress on their implementation of their national adaptation plans every two years and encouraging them to work closely with non-Party stakeholders to catalyze efforts to strengthen adaptation actions

Primary challenges to scaling up adaptation remain on the funding front. Despite the goal to commit half of the \$100 billion Green Climate Fund (GCF) target to resilience, funding remains insufficient as extreme weather events around the world increase. The importance of adaptation in COP21 was also illustrated by a series of concurrent financial announcements. The Adaptation Fund received USD 75 million from Germany, Italy, Sweden and the Walloon Region of Belgium. France also announced that by 2020 it will triple its annual adaptation finance to EUR 1 billion. Ireland has ensured EUR 175 million over the period of 2016-2020, mainly for adaptation. Other countries like the United Kingdom will increase its climate finance to GBP 5.8 billion between 2016-2020, aiming

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<sup>20</sup> International Institute For Sustainable Development (IISD).. 2015. Summary of the Bonn Climate Change Conference: 19 – 23 October 2015. <http://www.iisd.ca/download/pdf/enb12651e.pdf>

<sup>21</sup> UNFCCC. 2015. Report of the Adaptation Committee. <http://unfccc.int/resource/docs/2015/sb/eng/02.pdf>

to spend half on adaptation. The ADB, as part of efforts by the MDBs, will double its annual climate finance to USD 6 billion by 2020, of which USD 2 billion will be focused on adaptation.

## 2. The Evolving Knowledge Base on Adaptation

A limited knowledge base on adaptation in the transport sector has hampered global and national adaptation actions in recent decades, despite increasing vulnerability and damages of transport systems due to extreme weather events. Recent efforts have helped to expand the knowledge base on adaptation among transport sub-sectors, which is an essential step toward clarifying key concepts and definitions, developing consensus on catalogues of measures, and agreeing on relevant metrics for monitoring progress over time.

The following sections outline efforts to expand the knowledge base on climate change adaptation among various subsectors (e.g. roadways, railways, maritime and public transport) through a sample of adaptation summary reports and tool development (presented in chronological order).

### Summary Reports

#### 1. **Adaptation To Climate Change In The Transport Sector: A Review (Potsdam Institute For Climate Impact Research, 2009)**

This paper identifies the literature dealing with adaptation to climate change in the transport sector and presents a systematic review of references available at the time of publication. The paper shows that a broad range of stakeholders is relevant for adaptation in the transport sector, including service providers, public and private sector actors, and individual transport users and households. This review asserts that the existing literature either focuses on overly general proposals, or on detailed technical measures. The paper concludes that knowledge on adapting transport to climate change is still at an early stage and suggests fields for further research.

#### 2. **Adapting to Climate Change in Europe and Central Asia (World Bank, 2009)**

The Europe and Central Asia (ECA) region is vulnerable to its current climate extremes (e.g. extreme heat, drought, freeze-thaw cycles), which will only be intensified by projected long-term climate changes. This [report](#)<sup>22</sup> from WB presented an overview of what adaptation to climate change might mean for ECA by discussing emerging best practice adaptation planning and possible actions to improve resilience in the region. In this context, the report suggests investments in

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<sup>22</sup> Baettig, M. B., Wild, M., and Imboden D. M.. 2007. "A climate change index: Where climate change may be most prominent in the 21st century." *Geophysical Research Letters* vol. 34.

maintenance improvements and rehabilitation programs to prepare structures for climate-related stresses.

The reported concludes with some transport-specific recommendations, which include establishing protocols for monitoring climate impacts to transport infrastructure, updating design standards for transport systems according to climatic projections, establishing evacuation routes and emergency plans, acquiring new technologies to understand and manage climate-related challenges, and creating mechanisms for knowledge sharing among climate scientists and transport professionals.

### **3. Railways: Adaptation of Railway Infrastructure to Climate Change (International Union of Railways and Partners, 2009-2011 First Phase)**

The [Adaptation of Railway Infrastructure to Climate Change \(ARISCC\)](#)<sup>23</sup> is a project led by the International Union of Railways (UIC) to assess effects of climate change on railway infrastructure and analyze how the industry can improve performance and minimize damages of climate-related natural hazards to railway infrastructure assets.

The project addresses the following key areas:

- Collecting weather information, warning and monitoring systems for railway infrastructure;
- Mapping of natural hazards and identifying locations of possible impacts;
- Monitoring status of infrastructure assets and protective measures;
- Creating vulnerability maps of railway assets with respect to different natural hazards;
- Conducting risk assessment and management of railway operations under different natural hazards;
- Proposing adoption of standards for new and for existing infrastructure due to expected impacts of climate change in different European countries;
- Compiling recommendations for adaptation strategies and measures.

The project incorporates case studies to provide a framework to assess the effects of various early and late adaptation measures on actual infrastructure networks. Two cases have been investigated in detail: the [railway lines in the Rhine Valley in the Alpine region](#) and the [West Coast Main Line from London to Glasgow, UK](#). Using regional climate models, the case studies analyze the expected climate loads for the area (out to 2050 and 2080) in terms of temperature changes, precipitation, storms, and other extreme weather events in the past. It then gives a vulnerability study for the rail

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23 Adaptation of Railway Infrastructure to Climate Change (ARISCC). <http://ariscc.org/index.php?id=37>

system in the area. A [draft final report](#) was released in July 2011 to summarize the workings and recommendations offered by ARISCC.

#### **4. Maritime and Inland Navigation: A Review of Climate Change Drivers, Impacts, Responses and Mitigation (World Association for Waterborne Transport Infrastructure, 2010)**

A [report](#)<sup>24</sup> was conducted by the World Association for Waterborne Transport Infrastructure (PIANC)'s to review the impacts of climate change on maritime and inland navigation, including sea level rise, wind, waves, and tidal conditions, storms, sea chemistry, and other extreme hydrological events. Potential measures and responses for adaptation are also identified in the research:

- Summary of climate change-related issues for navigation;
- Identification of potential climate change impacts on maritime and inland navigation through a summary of impact scenarios and climate models;
- Adaptation-oriented analysis of appropriate measures to adapt navigation infrastructure, equipment, and operations for the projected climate scenarios;
- Mitigation-oriented analysis on how the navigation sector can contribute to reducing climate change.

The report concludes that more pro-active actions must to be taken to develop adaptation strategies in the navigation sector, and that these strategies must be implemented comprehensively across infrastructure, vessels, and transport management, including planning and operational processes.

#### **5. Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation (US Federal Transit Administration, 2011)**

This [report](#)<sup>25</sup> was prepared by the Federal Transit Administration (FTA) to provide transit professionals with information and analysis relevant to adapting US public transport assets and services to climate change impacts. Starting with examining anticipated climate impacts on U.S. transit systems and current climate change adaptation efforts by domestic and foreign transit agencies, it further examines available tools for vulnerability assessment, risk management, and adaptation planning, as well as their applicability to public transport agencies. The paper also introduces numerous adaptation strategies (including technical and design-oriented strategies) to address flooding from intense precipitation, extreme heat, sea-level rise, and storm surges.

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<sup>24</sup> PIANC EnviCom Task Group 3. No date. Waterborne, ports and waterways: A Review of Climate Change Drivers, Impacts, Responses and Mitigation. <http://bit.ly/1MrTbIQ>

<sup>25</sup> FTA. 2011. Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation. [http://www.fta.dot.gov/documents/FTA\\_0001\\_-\\_Flooded\\_Bus\\_Barns\\_and\\_Buckled\\_Rails.pdf](http://www.fta.dot.gov/documents/FTA_0001_-_Flooded_Bus_Barns_and_Buckled_Rails.pdf)

The paper concludes by pointing out that mainstreaming climate change considerations into existing transit agency processes offers a streamlined approach to resilience. By assessing both existing and planned infrastructure and services, it is possible to ensure that vital assets are protected, and that future investments are guided by the best available information about projected climate conditions. Furthermore, the paper provides suggestions for transit agencies to integrate adaptation into their practices in areas such as asset management systems; environmental management systems; real estate acquisition and relinquishment of assets; emergency preparedness, response, and recovery; performance measures, and organizational culture and budget.

#### **6. Integrating Extreme Weather Risk into Transportation Asset Management (American Association of State Highway and Transportation Officials (AASHTO), 2012)**

This [paper](#)<sup>26</sup> investigates the potential of transportation asset management (TAM) as a mechanism for integrating extreme weather risk into transport agency decision-making. Effective TAM systems collect data that are valuable in understanding which agency assets are most vulnerable to changing weather conditions. Transport agencies with strong TAM systems in place are therefore better prepared to reduce risks of extreme weather events to the network by targeting assets for, reinforcement or reconstruction.

The paper describes TAM as a 14-step process which includes setting direction, aligning agency components, and developing a TAM plan, in the form of processes, tools and systems. The paper places particular emphasis on enabling processes and tools for service, life-cycle management and asset preservation, and tam integration, in addition to information systems to enable data collection and decision-making.

The paper concludes, that TAM systems can also function as a tool to mitigate risk, and thus that there is no need to restructure TAM in terms of climate change adaptation for transportation, with the exception of incorporating risk management perspectives which specifically relate to extreme weather events more fully into the process.

#### **7. Adaptation of Transport to Climate Change in Europe (European Environment Agency, 2014)**

This synthesis [report](#)<sup>27</sup> by the European Environment Agency (EEA) underscores that transport systems are cross-model and trans-boundary by nature, and thus disturbances brought by climate-

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<sup>26</sup> AASHTO. 2012. Integrating Extreme Weather Risk into Transportation Asset Management

[http://climatechange.transportation.org/pdf/extrweathertamwhitepaper\\_final.pdf](http://climatechange.transportation.org/pdf/extrweathertamwhitepaper_final.pdf)

<sup>27</sup> European Environment Agency. 2014. Adaptation of Transport to Climate Change in Europe. <http://bit.ly/16GHwwr>

related events in one part of the transport system might be likely to affect other parts as well. In some cases, the indirect costs of damage to the transport network can be many times higher than direct costs to transport infrastructure.

The report concludes that the dominant approach to reducing the vulnerability of transport systems to date has been to make incremental changes, which will be insufficient to deal with disruptive changes in climate. Transport systems will thus need to adopt more comprehensive strategies for managing transport supply and demand, including alternate approaches to constructing and maintaining transport infrastructure (incorporating new materials and technologies), in addition to increasing the resilience of the transport services (through operations and management strategies).

#### **8. Roads: Climate Change Adaptation Framework (World Road Association, 2015)**

The World Road Association (PIARC) has developed a [report](#)<sup>28</sup> with a framework to guide road authorities in developing relevant climatic variables for identifying risks, developing robust adaptation responses, and integrating assessments into decision-making processes. The framework aims to help PIARC member countries adopt a consistent approach to analyzing climate change impacts on their road networks and thus prioritizing the most appropriate measures to mitigate risks associated with extreme weather events.

The framework proposes a four-stage approach to guide road authorities through the process of increasing the resilience of their road networks and assets:

- **Stage 1** guides road authorities through a series of steps to establish scope and define which assets, risks and climate change scenarios should be included in an assessment.
- **Stage 2** takes findings from Stage 1 and provides guidance for assessing the probability and severity of climate change risks, enabling road authorities to quantify risks posed to their network.
- **Stage 3** outlines the process for the identification, assessment, selection and prioritization of adaptation responses to the climate risks and opportunities identified in Stages 1 and 2.
- **Stage 4** provides guidance on effectively incorporating findings into road infrastructure programs, processes, investments, strategies and systems such as Transport Asset Management (TAM).

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<sup>28</sup> Kidnie, Murray et al. 2015. International climate change adaptation framework for road infrastructure. World Road Association-PAIRC. <http://bit.ly/1LXuJP8>

PIARC has also created a [workbook](#)<sup>29</sup> to be used by road authorities when undertaking an assessment of climate risks to their networks, assets and operations. The workbook can be used to guide each of the four stages of an assessment and to record findings and progress.

#### **9. Roads: ROADAPT (Conference of European Directors of Roads (CEDR), 2015)**

CEDR is the road director's platform for cooperation and promotion of improvements to the road system and infrastructure as a part of sustainable transport system in Europe. In May 2015, CEDR released [Guidelines on ROADAPT: Roads for Today, Adapted for Tomorrow](#)<sup>30</sup> with the aim to provide methodologies and tools to facilitate consistent climate data information, efficient communication between climate researchers and road authorities, and a preliminary scan for estimating climate change-related risks for roads. CEDR calls for stronger vulnerability assessments and socioeconomic impact analyses for the road sector, and an action plan for adaptation as related to geotechnics and drainage, pavement and traffic management.

#### **10. Transport Adaptation to Global Climate Change (Cambridge Systematics/Rockefeller Foundation, not dated)**

This [white paper](#)<sup>31</sup> was commissioned by the National Transportation Policy Project (NTPP) and the National Commission on Energy Policy (NCEP) to identify policy options to support proactive transport adaptation measures in the US at the federal level. The paper suggests that the greatest climate impacts to North American transport systems will likely be flooding of coastal roads, railways, transit systems, and runways due to rising sea levels, while Arctic transport systems face a unique set of concerns related to climate change.

The report points out that climate adaptation is an increasingly important focus of legislative and executive activity, but most adaptation policy is not directed specifically at infrastructure, but rather toward ecosystems (e.g. rivers, ocean, coastal areas), with a primary intent to remediate the effects of climate change and ocean acidification on fish, wildlife, and habitats. To date, 38 states have developed, or are in the process of developing, climate action plans, which generally place greater emphasis on mitigation than adaptation and resilience, and currently no state has yet put adaptation recommendations into law or pending legislation.

The report ultimately calls for federal legislative and executive action in five areas: research; transport planning processes; project development; design and engineering considerations; and

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<sup>29</sup> Kidnie, Murray et al. 2015. International climate change adaptation framework for road infrastructure. World Road Association-PAIRC. <http://bit.ly/1LXuUP8>

<sup>30</sup> CEDR. 2015. ROADAPT: Roads for Today, Adapted for Tomorrow Guidelines. <http://bit.ly/1LND4M1>

<sup>31</sup> Bipartisan Policy Center and National Transportation Policy Project. No date. Transportation Adaptation to Global Climate Change. <http://www.camsys.com/pubs/TransportationAdaptation.pdf>

specific programs and funding. The report suggests a national approach to transport adaptation, that involves intergovernmental collaboration while respecting regional differences, and recommends that adaptation planning be intermodal and system-oriented to strengthen existing and planned assets.

## **Development of Tools and Methodologies**

This section gives a sample of known tools for defining and organizing adaptation strategies. While some tools are transport-specific, others are more generic in character and do not specifically incorporate transport into their scope of investigation.

### **1. Climate Change Project Screening Criteria (Nordic Development Fund, 2011)**

Screening criteria for climate change projects developed by the Nordic Development Fund (NDF) represents an innovative approach for project approval.

First, each Climate Change Adaptation (CCA) road transport project is assessed applying three Core Project Approval Criteria (e.g. consistency with mission, economic justification, and climate relevance), which are followed by a set of criteria pertaining to implementing agency commitment and capacity. The next set of screening questions focus on potential value added beyond co-financing agencies and the implementing agency contributions, and a final set of questions target potential social impacts in the context of alleviating poverty and contributing toward achievement of the SDGs.

NDF's detailed CCA screening of projects has helped identify areas where weaknesses could cause cost overruns, delays and costly conflicts between funders and clients. These findings provide incentives for further strengthening the dialogue with co-financing MDBs and recipient agencies to reduce project failure risks by altering and improving potentially problematic project components.<sup>32, 33</sup>

### **2. Tracking Research on Adaptation to Climate Change Consortium (TRAC3, 2014)**

[TRAC3](#)<sup>34</sup> was launched in 2014 by Dr. Lea Berrang-Ford (McGill University, Montreal), Dr. Robert Biesbroek (Wageningen University), and Dr. James Ford (McGill University) to facilitate new collaborations that addresses conceptual, methodological, and practical challenges and issues associated with tracking progress on climate adaptation in public health, urban areas, and other sectors. The initiative focuses on operationalizing measurement indicators for adaptation,

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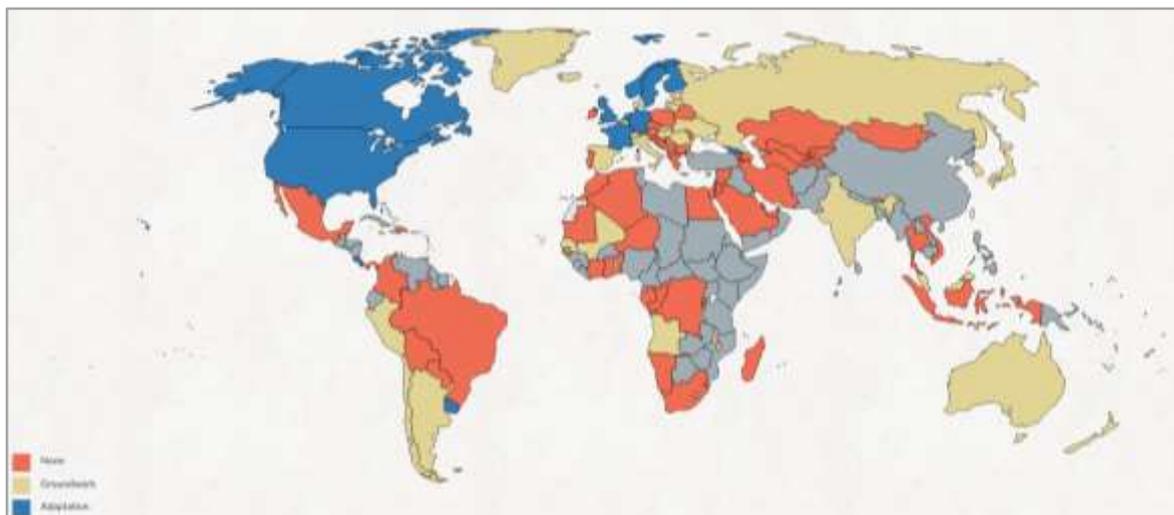
<sup>32</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

<sup>33</sup> More general background on NDF's pilot transport adaptation projects is given in Section 4.

<sup>34</sup> Tracking Research in Adaptation to Climate Change Consortium (TRAC3). <http://trac3.ca/>

standardizing analysis baselines, testing hypotheses, and applying systematic data collection techniques to build comprehensive datasets for adaptation.

The TRAC3 program has now established one of the largest datasets on adaptation policies, programs and initiatives with the WORLD Policy Analysis Center, containing information from 2008 to 2012 for 117 countries (Figure 1).



**Figure 1. Progress of Countries Around the World on Adaptation<sup>35</sup> (Grey area = data not available; Orange = none; Beige = groundwork; Blue = adaptation)**

The database shows that among low and middle-income country groups, approximately 70% countries have not taken any steps towards adaptation (orange in color), and about 20% of both the low and middle-income country groups have conducted groundwork on adaptation (beige color), such as vulnerability analyses, strategic planning and decision-making processes. However, less than 10% of these countries have taken tangible steps to increase the resilience of communities through legislative action, public awareness programs, or infrastructure improvement.

Among high income countries, nearly 40% have not taken any specific steps towards adaptation actions, but slightly more than 40% have done groundwork on the topic, with approximately 20% of these countries taking tangible steps to act on climate adaptation. The results show that much more work needs to be done in the low and middle-income countries to introduce adaptation in the policy and strategic planning processes, and more efforts must be made to increase the systematic approaches to adaptation.

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<sup>35</sup> World Policy Analysis Center. 2015. How Much Progress have Countries made on Climate Adaptation in Infrastructure and Transportation Sectors? <http://bit.ly/1NSRdbw>

### 3. Urban Adaptation Support Tool (Covenant of Mayors, no date)

As part of the [Mayors Adapt Initiative](#)<sup>36</sup> under the Covenant of Mayors, the [Urban Adaptation Support Tool](#)<sup>37</sup> was developed in 2015 to provide practical knowledge support to its 137 signatory cities and other interested stakeholders for more effective adaptation planning and implementation. The tool consists of 43 questions for self-assessment, a database of 70 country case studies, and an adaptation measures database covering a wide number of climate impacts and sectors.

There are at least 13 adaptation measures in the database that contain transport elements, covering topics on road transport infrastructure and evacuation routes, water sensitive urban and building design, adaptation of dikes and dams, and groundwater management. Transport is also highlighted in a 2015 case study on [adaptation in the design of the Copenhagen Metro](#) and other case studies on flood management, storm water management, and urban heat waves.

### 4. Making Cities Resilient Campaign (United Nations Office for Disaster Risk Reduction, no date)

Under the Making Cities Resilient campaign, The United Nations Office for Disaster Risk Reduction (UNISDR) has developed the [Local Government Self-Assessment Tool \(LGSAT\)](#)<sup>38</sup> to help cities and other local actors to set baselines, identify gaps and collect comparable data to measure resilience advancement over time. The LGSAT sets out local adaptation indicators, which including cross-sectoral coordination, budgetary approaches, data availability, and risk reduction capacity. Among these indicators, transport plays a key role under the criteria for risk-reducing infrastructure and planning regulations.

In addition, UNISDR (in conjunction with IBM and AECOM) has developed a [Disaster Resilience Scorecard for Cities](#)<sup>39</sup> to help cities assess resilience to natural hazards. The scorecard consists of 80 questions to rate the city's preparedness for and ability to recover from events such as, floods, hurricanes, tsunamis, earthquakes and extreme heat events. Transport is listed as one of 10 assessment areas to measure readiness to provide services, evacuation routes, and access to supplies, and vulnerability of roadway, railway, air transport, seaport, and public transport systems.

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<sup>36</sup> Mayors Adapt. <http://mayors-adapt.eu/>

<sup>37</sup> Mayors Adapt. 2015. Tailored Support for Cities: The Urban Adaptation Support Tool. <http://bit.ly/1P3Ut5s>

<sup>38</sup> UNISDR. Local Government Self-Assessment Tool (LGSAT). <http://bit.ly/1WhMJNx>

<sup>39</sup> UNISDR. UNISDR Disaster Resilience Scorecard for Cities (Working Document). <http://bit.ly/1xpudYu>

## Conclusions

Although there have been limited recent efforts to document and organize work on transport and adaptation in a comprehensive manner, the current compilation of materials shows that activity appears to be accelerating in this area, with a number of key studies emerging in the past five years.

It is important to note that the knowledge base is to some extent common for transport sub-sectors (e.g. based around vulnerability assessments, risk analysis, and action planning), but also differs in certain respects (e.g. relative focus on infrastructure vs. operations; specific focus on asset management). Furthermore, it is noted that adaptation efforts are focused on a growing set of transport sub-sectors including roadway, railway, public transport, and maritime, and that tools and methodologies are being developed to support both urban and rural transport projects; however, a challenge remains in compiling statistical data to support indicators to measure progress in this area.

While rapid progress is being made on adaptation in the transport sector, much of the work described here was only recently started and in several cases is ongoing; therefore, many of these studies are still early in the development curve. But in general, the developed world (e.g. Europe, US) appears to be several steps ahead of the developing world in terms of building a knowledge base on adaptation in the transport sector.

Progress is also being made on the development of tools in support of accelerated action on transport. Detailed information on their use is not available; it appears though that these are more rapidly being introduced and used in the developed world where there is a greater institutional and organizational capacity for their use.

## 3. Adaptation and Resilience in the UNCRD EST Process

Transport systems in EST member countries are increasingly vulnerable to the impacts of climate change. Extreme climate events such as floods, hurricanes, heat waves, and droughts are common climate-related disasters in many countries in the region. Many human lives could be saved and much loss and damage could be prevented with better communication technologies, climate warning and monitoring systems, disaster and evacuation management, and resilient transport system planning in both urban and rural areas.

## Linkage between Climate Adaptation and Sustainable Development

A global expansion of sustainable transport infrastructure and services is fundamental to the realization of sustainable development goals as described in the Post-2015 Development Agenda,

which was finalized with the adoption of 17 SDGs in September 2015, and which sets out quantified targets and indicators to guide sustainable development in the next 15 years,<sup>40</sup> and which will complement climate change mitigation and adaptation efforts underway through the UNFCCC.

The transport sector is not represented by a single, standalone goal within the SDG framework, but rather is distributed across a number of separate goals related to health, energy, infrastructure, urban issues, and climate change, among others. A SLoCaT Partnership analysis has determined that the SDG framework includes at least five targets that are *directly* impacted by transport, and at least seven targets that are *indirectly* impacted by transport, as shown in Figure 2 エラー! 参照元が見つかりません。



Figure 2: Transport Targets and Global Goals on Sustainable Development

A number of these targets can be seen as directly supporting climate change adaptation (CCA) actions in the transport sector, including targets on road safety, energy efficiency, resilient infrastructure, and urban transport, in addition to a general target on climate adaptation on an economy-wide scale.<sup>41</sup>

- *Target 3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents.* CCA components reduce the vulnerability of roads in climate change-exposed areas to damage

<sup>40</sup> [http://www.slocat.net/sites/default/files/u13/2015\\_transport\\_commitments\\_report\\_2.pdf](http://www.slocat.net/sites/default/files/u13/2015_transport_commitments_report_2.pdf)

<sup>41</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

from extreme climatic events (e.g. floods, avalanches, earth and rock slides, desertification), and in this way can also contribute toward improved road traffic safety.

- *Target 7.3. By 2030, double the global rate of improvement in energy efficiency.*  
CCA measures can help improve road traffic fuel efficiency by providing for reduced down time of roads due to climate impacts such as floods, avalanches, earth and rock slides, and sand dunes across roads. In this way the CCA actions can prevent long detours and difficult temporary passages due to rough road surfaces, which lead to increased fuel consumption and shorter vehicle life expectancies.
- *Target 9.1. Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.* Climate-adaptative road investments in rural areas can help secure year-round, all-weather access to essential services and prevent isolation of fragile communities, thus contributing to economic development and well-being.
- *Target 11.2. By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.* Urban transport systems also require strategic investment and design to increase resilience to climate change impacts, which in turn can increase personal mobility, reduce public expenditures, and improve air quality and public health.

In addition, improved resilience of roads to provide year-round access to remote and vulnerable communities is a critical enabler of achieving a broad set of sectoral targets, including agricultural productivity (Target 2.1), air pollution (Target 3.9), access to safe drinking water (Target 6.1), urban sustainability (Target 11.6), and reduction of food waste (Target 12.3), and climate change adaptation and mitigation beyond the scope of the transport sector (Target 13.1)<sup>42</sup>

Therefore, it is critical that ongoing efforts to increase the sustainability of transport infrastructure and services in the EST region focus not only on mitigation strategies but also include a significant adaptation component to complement mitigation efforts.

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<sup>42</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

## **Adaptation and Resilience in EST Outcome Documents**

In light of the projected risks of climate change in the Asia and substantial benefits of adaptation enumerated above, adaptation and resilience are not widely reflected in key outcome documents of recent EST Forums, which include the following:

### **AICHI STATEMENT: Towards establishment of the Regional Forum for the promotion of environmentally sustainable transport (EST) in Asia**

The [Aichi Statement](#)<sup>43</sup>, the founding document of the EST Forum which lays the basis for subsequent EST policy documents, declarations and statements only contains passing reference to climate change and no specific reference to climate change adaptation.

### **Kyoto Declaration - Asian Mayors' Policy Dialogue for Promotion of Environmentally Sustainable Transport in Cities (2007)**

The [Kyoto Declaration](#)<sup>44</sup> recognizes the implications for transport in the context of public health, economic well-being, and social equity under the Millennium Development Goals with the focus on city and local-level actions. The Declaration calls for more “people-friendly urban transport infrastructure,” better “public transport planning”, and more inclusive transport from “social equity and gender perspectives.” Nonetheless, the Declaration does not detail concrete strategies for adaptation measures in the transport sector.

### **Seoul Statement Towards the Promotion of Environmentally Sustainable Transport (EST) for a Low-Carbon Society and Green Growth in Asia (2009)**

As a comprehensive statement for the promotion of environmentally sustainable transport in Asia through the EST process, the [Seoul Statement](#)<sup>45</sup> highlights the importance of addressing the transport-energy-carbon emission nexus and shifting to low-carbon transport modes; using ITS, market mechanisms and other strategies to reduce transport sector emissions; and forging city, regional, and international partnerships to advance low-carbon transport projects and policies. However, this document contains no direct reference to adaptation and resilience.

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<sup>43</sup> [http://www.uncrd.or.jp/content/documents/200508\\_Aichi-Statement.pdf](http://www.uncrd.or.jp/content/documents/200508_Aichi-Statement.pdf)

<sup>44</sup> UNCRD (2007). Asian Mayor's Policy Dialogue for Promotion of Environmentally Sustainable Transport in Cities. <http://bit.ly/20yTqQg>. Accessed November 6, 2015.

<sup>45</sup> [http://www.uncrd.or.jp/content/documents/200902\\_Seoul-Statement.pdf](http://www.uncrd.or.jp/content/documents/200902_Seoul-Statement.pdf)

## Bangkok 2020 Declaration (2010)

The [Bangkok Declaration for 2020](#)<sup>46</sup> was officially adopted by 22 EST countries in 2010, to demonstrate a commitment a decade of sustainable actions and measures for achieving safe, secure, quick, reliable, affordable, efficient, people-centric, and environmental friendly transport in Asia. The Declaration outlines 20 goals on sustainable transport strategies under the avoid-shift-improve framework plus a section on cross-cutting strategies, covering a range of transport subsectors and focusing on policy, technical, and development planning.

There is no direct reference to adaptation and resilience within the Bangkok 2020 Declaration; however, many of the goals of the Declaration have direct or indirect relevance to adaptation and resilience, as shown in Table 1:

| Bangkok 2020 Declaration Goal  | Relevance to Adaptation/ Resilience (Scale: 0–3) | Examples of Linkages to Adaptation and Resilience   |
|--|--|---|
| <b><i>I. Strategies to Avoid unnecessary travel and reduce trip distances</i></b>  |  |   |
| 1) Integrate land-use and transport planning, processes and related institutional arrangements at the local, regional, and national levels | 2  | Coordination of planning processes at varying scales can help to better integrate adaptation strategies, including optimizing allocation of financial resources, and providing redundancy in transport options. |
| 2. Achieve mixed-use development and medium-to-high densities along key corridors within cities  | 1  | High population and employment density can increase demand for varied transport options (e.g. rail, bus, bike share, pedestrian infrastructure), increasing redundancy and thus adaptive capacity.              |
| 3. Information communication technologies (internet, teleconferencing, telecommuting)  | 3  | Telecommuting demand may increase under more extreme climatic conditions.<br>Improvement of warning systems for extreme weather events, and transport system re-routing and evacuation information.             |
| <b><i>II. Strategies to Shift towards more sustainable modes</i></b>   |  |   |
| 4. Non-motorized transport (NMT) components in transport   | 1  | Increased extreme weather events (e.g. extreme temperatures, heavy precipitation, strong winds) are likely to discourage trips by non-motorized transport.  |

<sup>46</sup> UNCRD EST (2010). Bangkok Declaration for 2020. [http://www.uncrd.or.jp/content/documents/201008\\_Bangkok-Declaration.pdf](http://www.uncrd.or.jp/content/documents/201008_Bangkok-Declaration.pdf). Accessed November 4, 2015.

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master plans and prioritize

NMT transport

infrastructure investments

|   |   |  |
|---|---|--|
| <b>5. Implement high-quality public transport services on dedicated infrastructure along major city corridors</b> | 3 | Design standards and planning for roads, rail and other public transport infrastructure should incorporate resilience to extreme temperatures and heavy participation (e.g. improved drainage)<br>Encourage planning for bus reroutes and strengthen public rail transport networks to increase overall system resilience. |
|---|---|--|

|   |   |     |
|---|---|-----|
| <b>6. Transport Demand Management measures, including pricing measures that internalize congestion and pollutant costs, measures aimed at gradually eliminating subsidies</b> | 0 | N/A |
|---|---|-----|

|   |   |   |
|---|---|---|
| <b>7. Significant shifts to more sustainable modes for inter-city passenger and goods transport</b> | 2 | Increase resilience of inter-city infrastructure (e.g. rail, roadways and waterways for both freight and passenger transport) and enhance capability to deliver supplies under more intense climatic conditions and during extreme weather events |
|---|---|---|

***III. Strategies to Improve transport practices and technologies***

|   |   |  |
|---|---|--|
| <b>8. Diversify towards more sustainable transport fuels and technologies</b> | 2 | Resilience is needed to maintain reliable low-carbon transport technologies (e.g. electric vehicles and charging stations) |
|---|---|--|

|   |   |     |
|---|---|-----|
| <b>9. Progressive standards for fuel quality, fuel efficiency, and tailpipe emissions</b> | 0 | N/A |
|---|---|-----|

|  |   |   |
|--|---|---|
| <b>10. Annual vehicle inspection and maintenance (I/M)</b> | 2 | Vehicle maintenance cycles may require acceleration under more extreme climatic conditions. |
|--|---|---|

|  |   |  |
|--|---|--|
| <b>11. Intelligent Transportation Systems (ITS), such as electronic fare and road-user charging systems, transport control centers, and real-time user information</b> | 2 | Real-time user information will be increasingly important to notify transport users of service disruptions and re-routes in cases of extreme weather.<br>Collection of mobility data during extreme weather events to enhance research on transport system resilience. |
|--|---|--|

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|   |   |  |
|---|---|--|
| <b>12. Improved freight transport efficiency through policies, programs, and projects on freight vehicle technology, fleet control and management systems, and logistics and supply chain management</b>                                    | 2 | <p>Increased efficiency in freight sector must incorporate adaptation and disaster response measures in infrastructure and management systems.</p> <p>Increased resilience in supply chain management will enhance efficiency of food and material supply in times of emergency.</p> |
| <b>IV. Cross-cutting strategies</b>   |   |  |
| <b>13. Zero-tolerance policy with respect to roadway safety</b>   | 1 | Increasing adaptive capacity of roadways can increase potential roadway safety (e.g. drainage systems, temperature-proof construction materials, efficient route planning)   |
| <b>14. Monitoring of the health impacts from transport emissions and noise</b>  | 2 | <p>Health impacts from transport emissions will become more pronounced in conditions of higher heat and humidity.</p> <p>Transport noise travels farther in high-heat conditions.</p>  |
| <b>15. Establish progressive and enforceable air quality and noise standards and mandate monitoring and reporting</b>   | 2 | Air quality issues are exacerbating in high heat conditions.   |
| <b>16. Mitigate the causes of global climate change to fortify national energy security, and conduct a full inventory of all GHGs emitted from the transport sector</b>   | 1 | Increasing adaptive capacity is complementary to increasing mitigation potential (e.g. maintaining public transport ridership requires reliable and attractive transport systems).   |
| <b>17. Adopt social equity as a specific design criteria in the development and implementation of transport initiatives</b>   | 3 | Resilient transport systems are required to increase social equity by maintaining access (e.g. for those who lack private means of transport, or who are limited by insufficient rural transport infrastructure and services).   |
| <b>18. Create innovative financing mechanisms for sustainable transport infrastructure and operations (e.g. carbon markets, parking levies, fuel pricing, time-of-day automated road-user charging, and PPPs such as land value capture</b> | 2 | Adaptation strategies in transport (and other sectors) will require funded by non-traditional sources (e.g. elimination of fossil fuel subsidies, levies on aviation and maritime emissions).  |

|  |   |   |
|--|---|---|
| <b>19. Ensure wide-spread distribution of information and awareness on sustainable transport to all levels of government and to the public</b> | 2 | Raise awareness of government ministries of the need to integrate resilient and climate-proof elements into transport planning processes.<br>Raise public awareness of the need to lobby governments to allocate sufficient funding to resilient transport infrastructure and services.   |
| <b>20. Develop dedicated and funded institutions that formally address sustainable transport and land use policies and implementation</b>      | 3 | Dedicated government agencies and budgets to address adaptation measures are required to develop more systematic approaches (e.g. creation of city 'Chief Resiliency Officers').<br>Integration of climate change considerations into national transport and land use policy is needed to maintain resilient transport infrastructure (e.g. in coastal and permafrost areas). |

**Table 1: Evaluation of Bangkok 2020 Declaration Goals via Adaptation and Resilience**

### **Colombo Declaration for the Promotion of Next Generation Low-Carbon Transport Solutions in Asia (2014)**

The most recent EST outcome document, the [Colombo Declaration](#)<sup>47</sup> makes direct reference to “resilience of cities” in the context of the Rio+20 outcome document, and notes the role of sustainable transport in realizing the (in particular) the transport-related SDGs and associated targets; however, the document focuses chiefly on mitigation strategies and does not detail any specific approaches to transport adaptation strategies.

### **Conclusions**

The development of sustainable transport in Asia could benefit from a more concerted approach to confronting observed and projected climate impacts throughout the 21<sup>st</sup> century. Achievement of the majority of Bangkok 2020 Declaration Goals will require increasing adaptive capacity along with increasing mitigation potential. The Declaration can contribute to adaptation and resilience in the transport sector significantly in the areas of 1) information communication technologies by enhancing warning systems for extreme weather events; 2) public transport by improving adaptation-oriented standards and planning for transport infrastructure to guarantee system resilience; 3) social equity by increasing access options for all; and 4) government funds and budgets to change the current status of adaptation measures to a more systematic approach supported by stable financial resources.

For the first time, the 9<sup>th</sup> EST Forum will make resilience and adaptation central themes, in anticipation that the upcoming COP21 will result in an agreement with a “substantive section on

<sup>47</sup> UNCRD EST (2014). Colombo Declaration For the Promotion of Next Generation Low-Carbon Transport Solutions in Asia. <http://bit.ly/1MCxiu3>. Accessed November 4, 2015.

adaptation on climate change.”<sup>48</sup> The 9<sup>th</sup> EST Forum can contribute greatly to the mainstreaming of adaptation within the EST framework, and thereby help accelerate needed investments in resiliency strategies for transport systems across the region, and to increase coordination in addressing extreme weather events and changing climatic conditions.

#### 4. Examples of Key Programs Related to Transport and Adaptation in the Developing World

Transport relevant adaptation programs are often part of larger economy wide or city specific programs. In some cases they also combine work on mitigation and adaptation. This section describes efforts to advance adaptation broadly (as well as more specifically within the transport sector), which includes work by foundations, regional commissions, academic institutions, and development banks.

##### 100 Resilient Cities

[100 Resilient Cities \(100RC\)](#)<sup>49</sup> is an initiative pioneered by the Rockefeller Foundation, which is dedicated to helping cities around the world become more resilient to physical, social and economic challenges. 100RC supports a view that includes not just resilience to discrete *shocks* (e.g. earthquakes, fires, floods) but also to daily or cyclical *stresses* that can weaken a city’s fabric (e.g. high unemployment; inefficient transport; protracted violence, food and water shortages). By addressing both shocks and stresses, cities can become more able to respond to adverse events.

The 100RC Challenge, is open to cities with population greater than 50,000, it currently includes cities from every global region. Cities in the 100RC network are provided with resources to develop a resilience roadmap along four main pathways: guidance in establishing a Chief Resilience Officer, to lead the city’s resilience efforts; expert support for development of a robust resilience strategy; access to partners from the private, public and NGO sectors to help implement resilience strategies; and membership in a global network of cities to share successes and obstacles.<sup>50</sup> 100RC began working with its first group of 32 cities in December 2013 and [announced a second group of 35 cities of in December](#) 2014. The [third 100 Resilient Cities Challenge](#) closed in November 2015.

100RC’s City Resilience Framework (CRF) provides a lens to understand cities and the drivers that contribute to their resilience. The CRF is built on four dimensions of urban resilience: [Health & Wellbeing](#); [Economy & Society](#); [Infrastructure & Environment](#); and [Leadership & Strategy](#). Each of

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<sup>48</sup> UNCRD. 2015. Intergovernmental Ninth Regional Environmentally Sustainable Transport (EST) Forum in Asia. Draft Concept Note as of 21 October 2015. <http://bit.ly/1LUkYbi>

<sup>49</sup> <http://www.100resilientcities.org/>

<sup>50</sup> 100 Resilient Cities. [http://www.100resilientcities.org/about-us#/-\\_/](http://www.100resilientcities.org/about-us#/-_/). Accessed October 26, 2015.

these dimensions in turn contains three “drivers,” which reflect actions cities can take to improve their resilience. The Infrastructure & Environment dimension contains the driver “Provide Reliable Communication and Mobility,” which focuses a free flow of people, information, and goods, including Information and Communications Technology (ICT) networks as well as physical movement through a multimodal transport system.<sup>51</sup>

100RC network cities are grouped by common challenges, and those characterized as facing the challenge of a “poor transportation system” include Bangalore, Bangkok, New York City, Porto Alegre, Rio de Janeiro, and Sydney. Thus, transport is expected to be a central focus of forthcoming resiliency plans in these cities, which are given 100RC backing to act a sub-network to address transport adaptation issues collectively in the context of local conditions.

### **CLIMATRANS: Coping with Climate: Assessing Policies for Climate Change Adaptation and Transport Sector Mitigation in Indian Cities**

The [CLIMATRANS](#) project of the Institute of Transport Economics/Norwegian Centre for Transport Research will assess climate change and environmental impacts related to the urban transport sector in India with an aim to develop strategies for climate change mitigation and adaptation.<sup>52</sup> CLIMATRANS is a collaboration among two Norwegian and four Indian research environments, and India’s three largest cities, Delhi, Mumbai and Bangalore have been selected as the case cities, with the aim to reduce negative impacts such as congestion, noise, local and global emission of pollutants and traffic accidents. The project will focus on the transport sector’s potential to increase economic competitiveness and social equity, as well as environmental sustainability. The project also aims to provide knowledge to increase institutional capacities in climate decision-making strategies.

CLIMATRANS is an interdisciplinary project, which considers macro level perspectives as well as determinants for individual attitudes and behavior. Developing climate change mitigation and adaption strategies implies integrating risk, uncertainty and irreversibility (RUI) into the transport policy arena (and in particular, for those projects with longer time horizons). The project approach will thus focus on five broad areas of analysis, which include evaluating existing conditions, projecting trends to 2050, scenario analysis, scenario evaluation, and identification of barriers to institutional change. The main planned outputs of the project are recommendations on methodological and theoretical approaches, identification of interactions between mitigation and adaptation strategies, and recommendations on scenarios for mitigation and adaptation.

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<sup>51</sup> 100 Resilient Cities. <http://www.100resilientcities.org/resilience#/-/>. Accessed October 26, 2015.

<sup>52</sup> Institute of Transport Economics/Norwegian Centre for Transport Research. <https://www.toi.no/background/category1493.html>. Accessed October 26, 2015.

## Climate Change Adaptation for International Transport Networks (CCAITSN)

In late 2013, UNECE released the expert group report, *Climate Change Impacts and Adaptation for International Transport Networks (CCAITSN)*,<sup>53</sup> which recommends development of adaptation-relevant datasets, integration of adaptation and mitigation strategies, and addressing key data gaps.

In February 2015, the Inland Transport Committee of UNECE decided to extend the CCAITSN commitment until 2017, with the second phase to focus on establishing inventories of transport networks in the UNECE region that are vulnerable to climate impacts (where possible using geographic information systems (GIS)): developing tools, methodologies, and practices to address potential extreme hazards to inland transport infrastructure in the UNECE region under different scenarios; and analyzing case studies on the potential economic, social, and environmental consequences of climate change, providing cost/benefit analyses of adaptation options.<sup>54</sup>

## Nordic Development Fund Program on Adaptation and Transport

NDF is a multilateral development finance institution owned by the five Nordic countries. During its first two decades, NDF provided almost 275 million dollars to 32 road infrastructure projects in Africa, Asia and Latin America, which typically consisted of investments in new road construction, upgrading of existing roads, and other transport infrastructure (e.g. bridges).<sup>55</sup> In 2009, NDF's mandate was changed to include providing grant financing for climate change-related interventions in low-income countries, which introduced the objective of making road transport systems more resilient to the impacts of climate change and extreme weather events.<sup>56</sup>

In 2010, NDF initiated a program to address climate change adaptation through provision of technical assistance, CCA-relevant capacity strengthening, mapping vulnerability of project roads to potential climate impacts, revising road design, reconstruction and maintenance standards to increase resilience, and application of these standards in implementation of eight pilot projects, of which three are in the EST region, including two in Cambodia and one in Vietnam (Table 2).<sup>57</sup>

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<sup>53</sup> UNECE. 2013. Climate Change Impacts and Adaptation for International Transport Networks. <http://bit.ly/1KFlaKM>

<sup>54</sup> SLoCaT Partnership (2015). [Contribution of Transport Commitments to the Global Goals on Sustainable Development](http://www.slocat.net/sites/default/files/u13/2015_transport_commitments_report_2.pdf). [http://www.slocat.net/sites/default/files/u13/2015\\_transport\\_commitments\\_report\\_2.pdf](http://www.slocat.net/sites/default/files/u13/2015_transport_commitments_report_2.pdf). Accessed October 26, 2015.

<sup>55</sup> Nordic Development Fund. 2015. EOI Short-term Consultancy on Transport and Climate Change. <http://bit.ly/1WKHOF5>

<sup>56</sup> Hansen, Stein (2015). NDF Support to Climate Change Adaptation in the Road Transportation Sector: Lessons Learned and Best Practices. Unpublished draft report.

<sup>57</sup> Additional details on the NDF projects in Cambodia, Vietnam and Zambia (which include involvement from co-financing MDBs, as noted in the following table) are given in Section 6.

| Country    | Project Name   | MDB Partner |
|------------|--|-------------|
| Cambodia   | Adaptation Approaches for the Transport Sector Project                         | ADB         |
| Cambodia   | Rural Roads Improvement Project II   | ADB         |
| Mozambique | Developing Capacity for a Climate Resilient Road Sector                        | AfDB        |
| Nicaragua  | Road Sector Support Program - Developing Adaptive Capacity for Climate Change  | IDB         |
| Rwanda     | Developing Capacity for Climate-Resilient Road Transport Infrastructure (prep) | AfDB        |
| Senegal    | Integrating Climate Change Adaptation to Transport                             | WB          |
| Viet Nam   | Integrating Climate Change Adaptation to Transport                             | ADB         |
| Zambia     | Developing Climate Resilient Infrastructure Standards                          | WB          |

**Table 2: Nordic Development Fund Transport Adaptation Pilot Projects**

These NDF-funded projects bring innovative approaches to transport sector climate adaptation in their countries of implementation. Furthermore, the application of the NDF screening criteria (described before) to the eight pilot projects suggests that applying thresholds for project acceptability is both useful and feasible. The screening has further revealed inadequate institutional and technical capacity in transport adaptation on the recipient side, and all eight projects were designed to drive improvements in this area, with follow up and replication anticipated in each of the country contexts (Hansen 2015).

## Conclusions

The emergence of a number of general and specific adaptation programs with a transport sector component is indicative of growing momentum to better integrate transport among broader adaptation efforts. However, (as in the case of knowledge base described in Section 2 above), there is no coordinated effort to date to document and disseminate lessons learned from these various programs. Such efforts will be required to ensure that implementation of pilot projects on adaptation in the transport sector are further scaled up and accelerated, and to ensure that short-term strategies to increase transport sector resilience are incorporated and mainstreamed through long-term policy adoption.

## 5. Overview of Country-Level Adaptation Policies with Transport Relevance

This section reviews progress being made in mainstreaming of transport related adaptation to climate change in national policies through two key international mechanisms: National Adaptation Plans (NAPs) and Intended Nationally-Defined Contributions (INDCs).

## National-Level Adaptation Policies

At COP7, the Global Environmental Facility (GEF)'s Least-Developed Countries Fund (LDCF) was established to fund preparation and implementation of National Adaptation Programmes of Actions (NAPAs),<sup>58</sup> which are intended to identify priority activities that respond to immediate national needs for climate change adaptation.<sup>59</sup> To date, 50 least-developed countries (LDCs) have submitted NAPAs to the UNFCCC Secretariat (some of which have subsequently graduated from the LDC group)<sup>60</sup>, out of which 14 countries have listed infrastructure (including transport infrastructure such as dams, roads and bridges) among their priority adaptation areas<sup>61,62</sup>. This includes in the EST region the following countries: [Bangladesh](#), [Cambodia](#), and [Timor Leste](#). Bangladesh has launched a USD 2 million project to enhance resilience of urban infrastructure and industries to impacts of climate change. However, the order of priority for infrastructure of Bangladesh is on the lower side. The majority of Bangladesh's projects focus on food security, education and capacity building. In contrast, Cambodia lists adaptation actions in infrastructure as top priority among its adaptation projects, which includes a USD 30 million project to rehabilitate waterways in Upper Mekong and other Provinces and another USD 1.5 million project to rehabilitate canals in the Kampot Province. Lastly, Timor Leste launched a USD 2 million project to review and revise legislation, regulations and standards to enhance climate change resilience infrastructure.<sup>63</sup>

Building upon the development of NAPAs, the NAP process was established in 2011 under the UNFCCC's Cancun Adaptation Framework (CAF) to help countries conduct comprehensive medium- and long-term climate adaptation planning<sup>64</sup>. A UNFCCC expert group has published a set of detailed guidelines focusing on the planning process itself so as to allow some flexibility for each country's existing adaptation activities<sup>65</sup>. However, the corresponding UNFCCC Adaptation Committee has made no significant references to adaptation in the transport sector to date.

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<sup>58</sup> GEF. Adaptation to Climate Change The Least Developed Countries Fund: Review of the Implementation of NAPAs. 2014. <http://bit.ly/1H3Ss2o>

<sup>59</sup> GEF. Adaptation to Climate Change The Least Developed Countries Fund: Review of the Implementation of NAPAs. 2014. <http://bit.ly/1H3Ss2o>

<sup>60</sup> UNFCCC. 2015. NAPA Priorities Database. <http://bit.ly/1NDBrmu>

<sup>61</sup> The 14 countries are: Bangladesh, Cambodia, Chad, Comoros, Djibouti, Ethiopia, Guinea, Madagascar, Maldives, Samoa, Sao Tome e Principe, Sierra Leone, Solomon Islands, and Timor-Leste. <http://bit.ly/1SCCzH9>

<sup>62</sup> UNFCCC. 2013. National Adaptation Programmes of Action: Index of NAPA Projects by Country. <http://bit.ly/1Qd2g2y>

<sup>63</sup> UNFCCC. 2013. National Adaptation Programmes of Action: Index of NAPA Projects by Country. <http://bit.ly/1Qd2g2y>

<sup>64</sup> UNFCCC. 2015. National Adaptation Plans. <http://bit.ly/1G8pZxK>

<sup>65</sup> WRI. 2014. Clarifying the UNFCCC National Adaptation Plan Process. <http://bit.ly/1HBPAu8>

Among 24 EST member countries, nine have published reports focused on national climate change or disaster management strategies, and while eight other countries have touched upon or integrated adaptation in their national development strategies, most of the rest are still at the stage of NAPAs. Furthermore, for those countries that have developed climate change strategies, the transport sector focus is generally on mitigation rather than adaptation measures, or included in the context of enhancing infrastructure resilience of transport assets (e.g. roads, ports, bridges, railways, airports). While more developed EST countries (e.g. Korea, Japan), have more developed adaptation plans than less developed countries, the attention given to transport is very limited across the board.

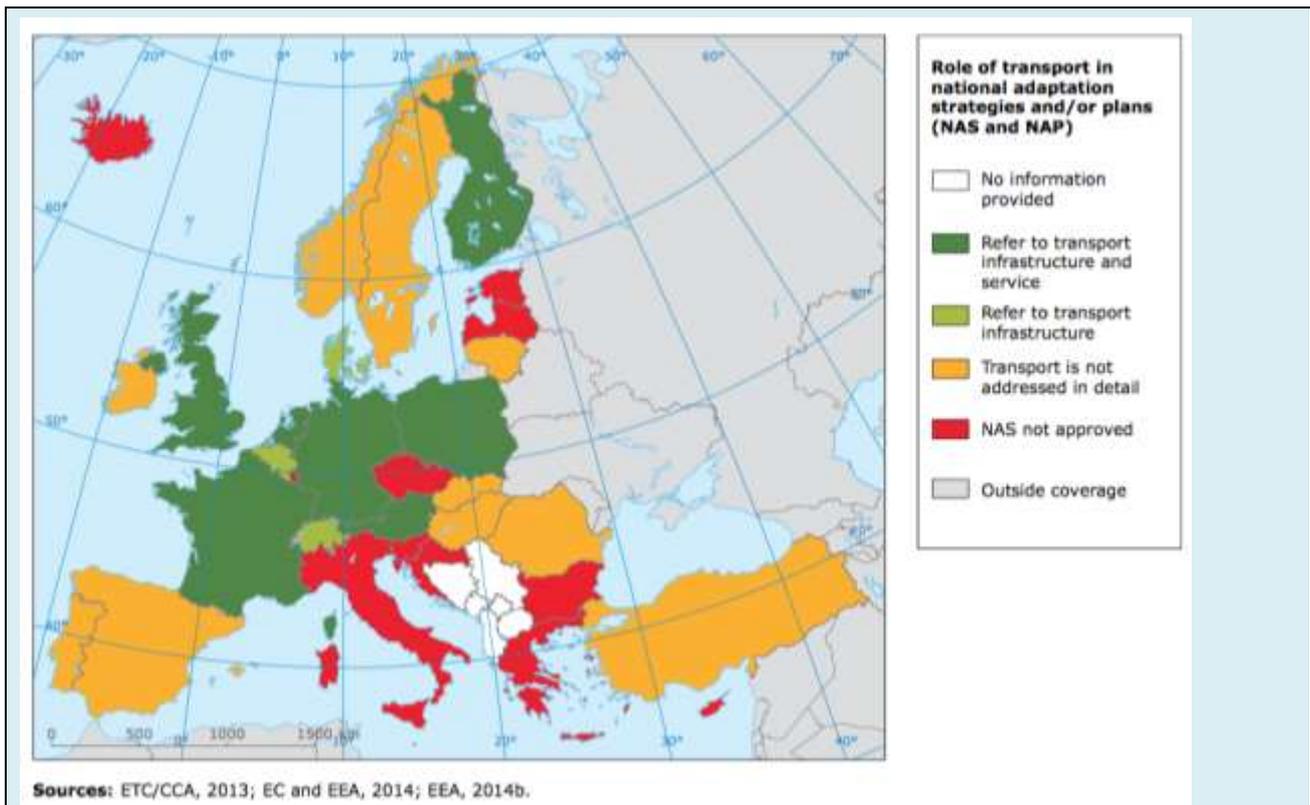
### **Box 3: National Adaptation Strategies and Plans in Europe**

In contrast to Asia, climate change adaptation has been more centrally integrated in the European Union (EU), where adaptation has already been mainstreamed in legislation in sectors such as transport but also here further efforts to ensure effective and efficient mainstreaming will be needed.

The EEA has established the [European Climate Adaptation Platform \(Climate-ADAPT\)](#),<sup>66</sup> to assess adaptation strategies among EEA members. A strong majority (21 out of 23) of country members have developed national adaptation strategies or plans, and the transport sector is specifically addressed in most of them (Figure 3). The analysis finds that out of the 19 EU countries that responded to the self-assessment on adaptation, 15 countries had recognized the need for action in the transport sector, 10 had started coordination activities or have identified adaptation measures, and 5 had moved toward implementing such measures.

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66 European Climate Adaptation Platform (Climate-Adapt). <http://bit.ly/1H9Tbj> .



**Figure 3: National Adaptation Strategies and Plans in European Countries**

In addition, various European funding mechanisms have been made available to aid the development of climate change adaptation innovations in various ways, including through transport systems. These mechanisms include the European Structural and Investment Funds (ESIF) (e.g. European Regional Development Fund (ERDF), European Social Fund (ESF), Cohesion Fund (CF), European Agricultural Fund for Rural Development and the European Maritime & Fisheries Fund<sup>67</sup>), and the LIFE programme, which is the EU's financial instrument supporting environmental, nature conservation and climate action projects<sup>68</sup>.

### **Intended Nationally-Determined Contributions (INDCs)**

INDCs communicate to the UNFCCC secretariat country-level commitments and strategies to reduce carbon emissions and increase resilience for the post-2020 period<sup>69</sup>. 'Intended' refers to planned commitments. 'Nationally Determined' acknowledges that each country faces a unique set of circumstances influencing reduction strategies, including socio-economic development patterns,

<sup>67</sup> [http://ec.europa.eu/contracts\\_grants/funds\\_en.htm](http://ec.europa.eu/contracts_grants/funds_en.htm)

<sup>68</sup> <http://ec.europa.eu/environment/life/>

<sup>69</sup> [http://unfccc.int/focus/indc\\_portal/items/8766.php](http://unfccc.int/focus/indc_portal/items/8766.php)

historic emission trajectories, and varying financing requirements. ‘Commitments’ refers to the binding nature of the proposed actions.<sup>70</sup>

INDCs represent a departure from the top-down approach taken in the UNFCCC process through COP15 Copenhagen in setting country specific targets on climate change mitigation. They introduce a bottom-up process to define country-level mitigation and adaptation efforts that are guided by national development priorities, equity, and common responsibility. Since INDCs represent a bottom-up, nationally determined process, they have the potential to drive progress in countries, especially in the global south, that are shaping emerging climate policies.

Climate adaptation has generally received less attention than mitigation in INDCs, although being mentioned in an economy-wide scope in 109 of 129 INDCs submitted (as of November 5, 2015). Most countries have included adaptation in a broad sense as part of their INDCs, yet the number of countries that have specified transport specific adaptation measures is relatively small compared to corresponding mitigation measures (Table 3).

| General                          | Mitigation in INDCs                                   |  |   | Adaptation in INDCs                           |  |   |
|----------------------------------|---|--|---|---|--|---|
| <i>Number of INDCs Submitted</i> | <i>INDCs that Specify General Mitigation Measures</i> | <i>INDCs Prioritizing Transport Sector for Mitigation<sup>71</sup></i> | <i>INDCs that Specify Transport Mitigation Measures</i> | <i>INDCs that Specify Adaptation Measures</i> | <i>INDCs Prioritizing Transport Sector for Adaptation<sup>72</sup></i> | <i>INDCs that Specify Transport Adaptation Measures</i> |
| <b>129</b>                       | <b>129</b>  | <b>96</b>  | <b>81</b>   | <b>109</b>                                    | <b>21</b>  | <b>6</b>  |

**Table 3: Proposed Mitigation and Adaptation Measures in INDCs<sup>73</sup>**

As noted in the final column above, six countries identify transport-specific adaptation strategies, which focus mainly on vulnerability assessments and infrastructure resilience planning (Table 4).

<sup>70</sup> The upcoming global agreement at COP21 in Paris would be the first time that all countries, including developing countries will take on binding commitments to take action on climate change.

<sup>71</sup> This number refers to INDCs which directly mention the transport sector as a priority sector for mitigation action. If we include INDCs which consider transport either directly or indirectly (e.g. as part of the energy sector), the total is 122.

<sup>72</sup> INDCs for countries prioritizing adaptation in the transport sector include Algeria, Bangladesh, Belize, Bhutan, Burkina Faso, Cambodia, Central Africa Republic, Colombia, Côte d'Ivoire, Dominican Republic, Gambia, Kenya, Lao PDR, Maldives, Madagascar, Malawi, Mexico, Republic of Moldova, Singapore, Tajikistan, and Uruguay.

<sup>73</sup> This table is derived from a SLoCaT Partnership analysis based on a compilation of INDCs (refer <http://www.slocat.net/docs/1503> and <http://cait.wri.org/indc/>).

| Country                    | Transport-Specific Adaptation Measures   |
|----------------------------|--|
| <b>Bangladesh</b>          | General adaptation priorities include climate resilient infrastructure, and improvement of drainage systems to address urban flooding, with specific transport projects underway through the Bangladesh Inland Water Transport Authority and the Ministry of Road Transport and Bridges. |
| <b>Belize</b>              | Vulnerability assessment of transport infrastructure, particularly in urban areas and areas critical to sustaining the country's productive sectors (tourism, agriculture and ports).  |
| <b>Gambia</b>              | Improved resilience of road networks under changing climate conditions.  |
| <b>Madagascar</b>          | Effective application of existing or newly established sectorial policies, including flood-resistant terrestrial transport infrastructure standards.   |
| <b>Maldives</b>            | Coastal protection measures to protect the shoreline of Hulhule, the island which contains Ibrahim Nasir International Airport, as well as for other air and sea ports.  |
| <b>Republic of Moldova</b> | Analyzing adaptation options, including altering assumptions about infrastructure design and operations, and incorporating uncertainty into long-range decision making.  |

**Table 4: Transport-Specific Adaptation Measures in INDCs**

Raising the profile of transport adaptation measures in the elaboration of current INDCs as well as future iterations of INDCs can help to ensure that investments in mitigation measures are well-protected, which can be achieved by incorporating in INDCs a growing number of transport adaptation and resilience efforts currently underway at national and regional levels.

## Conclusions

A growing number of developing countries are creating National Adaptation Plans. The coverage of transport in these plans is quite mixed, with a significant number of NAPs, making no mention of transport at all, or treating transport only superficially, and often in a mitigation-focused context.

While country-level examples from the developed world shows that comprehensive transport-relevant adaptation policies are feasible at a national level, in general, there is still much progress to be made in this area among countries in the developing world. On the other hand, proposed transport sector adaptation measures in INDCs are heavily skewed toward the developing world, underscoring their higher levels of vulnerability relative to the developed world.

While it is encouraging to see that a subset of EST member countries are making initial forays in to adaptation in the transport sector, much remains to be done in defining comprehensive transport sector-specific adaptation plans, though countries such as India, Sri Lanka and Russia (in NAPs) and Bangladesh and Maldives (in INDCs) are drawing preliminary roadmaps for others to follow.

## 6. Multi and Bilateral Development Banks (MDBs) as Accelerators of Action on Adaptation in Transport

MDBs have the potential to act as change agents in the area of adaptation in the transport sector, through their mandate and mission to place significant emphasis on environmental sustainability. Collectively (not counting bilateral efforts) the MDBs approve from \$20-25 billion each year in transport spending on infrastructure and transport services, and this level of investments offers considerable opportunities to assist developing countries in adapting their transport sectors to changing climate conditions.

In addition, MDBs are often at the forefront of transport sector policy dialogues based on their ongoing bilateral interaction with governments, thus development banks have a significant degree of leverage to advance the cause of adaptation in the transport sector. This section reviews potential MDB levers to increase resilience in the transport sector through adaptation policies, investments, and tool development.

### MDB Adaptation Policies

This section gives an overview of adaptation references in MDB policy documents pertaining to transport strategy and country strategies among EST member countries. While the majority of MDBs acknowledge adaptation as a key issue, translation from broad organizational priorities to transport-specific strategies varies widely from organization to organization and is generally still very much an ongoing effort.

### Adaptation in MDB Transport Sector Strategies

Adaptation is making its way into transport sector strategies of the MDBs, as shown in a growing number of references to resilience both in general terms (e.g. creating more resilient infrastructure (AfDB, WB) and minimizing (AfDB, IADB)) and in transport-specific terms (e.g. mainstreaming adaptation measures in transport operations (ADB), minimizing impacts to coastal transport infrastructure (EBRD, EIB), developing analytical tools (ADB, IADB) and conducting adaptation case studies (ADB, IADB) (Table 5).

| MDB  | Adaptation references in Transport Strategy  |
|------|--|
| AfDB | At the Center of Africa's Transformation Strategy for 2013–2022 (2013) <sup>74</sup> |

<sup>74</sup> AfDB. Strategy for 2013-2022. <http://bit.ly/1RXCRbb>

**Linkages between climate resilient infrastructure and green growth:**

*Africa's people and economies must become more resilient in the face of shocks, whether triggered by environmental or socioeconomic events. This requires identifying adaptation and mitigation measures to reduce climatic, economic and social risks... Options include climate-proofing infrastructure...*

**Strengthening resilience by increasing access to transport and other services:**

*...to become more resilient in the face of climate change. By incorporating green principles in development plans, African countries will extend access to water, energy and transport...*

**Building resilience:**

*Africa's people and economies must become more resilient in the face of shocks, whether triggered by environmental or socioeconomic events. This requires identifying adaptation and mitigation measures to reduce climatic, economic and social risks and avoid the loss of lives, incomes and productive assets. Options include climate-proofing infrastructure... Africa can develop transport systems compatible with environmental concerns. And in the face of rising urbanization, it can reduce pollution, improve the provision of basic services and build sustainable cities to minimize disaster risk.*

The East African Trade and Transport Facilitation Project - East African Transport Strategy and Regional Road Sector Development Program (2011) <sup>75</sup>

No adaptation relevance found.

**ADB**

**Sustainable Transport Initiative Operational Plan (2010) <sup>76</sup>**

**Mainstreaming climate adaptation measures into transport operations:**

*These will include making climate adaptation adjustments to engineering specifications, alignments, and master planning; incorporating associated environmental measures; and adjusting maintenance and contract scheduling.*

**Conducting case studies and analytical tools for transport and adaptation:**

*To address these challenges, ADB is undertaking a number of case studies and developing improved analytical tools to systematically integrate adaptation measures into ADB transport operations.*

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<sup>75</sup> <http://tinyurl.com/neg27tu>

<sup>76</sup> <http://bit.ly/1RXpVIH>

**EBRD**      **Transport Sector Strategy (2013)** <sup>77</sup>

**Adaptation in coastal areas:**

*Adaptation is particularly applicable to coastal transport infrastructure, such as coastal roads and ports, which have a high susceptibility to these climate change impacts.*

*Ports may raise particular concerns in relation to possible future sea level rise or storm surges. The Bank will therefore ensure that the project is climate resilient through appropriate design and operating measures.*

**EIB**

**EIB Transport Lending Policy (2011)** <sup>78</sup>

**Adaptation for all transport modes:**

*In line with EU policies, EIB believes that the construction of efficient and adapted transport systems in the 21st century requires a sophisticated combination of all available transport modes.*

**Adaptation on coastal area:**

*Ports may raise particular concerns in relation to possible future sea level rise or storm surges. The Bank will therefore ask promoters to ensure that the project is climate resilient through appropriate design and operating measures.*

**IDB**

**Sustainable transport**<sup>79</sup>

**Capacity building and studies development:**

*In 2010, the Bank launched the Regional Environmentally Sustainable Transport Action Plan (REST-AP) ... Initial activities have focused on building knowledge and capacity through international seminars and workshops, developing studies, and training IDB staff and clients in sustainable urban passenger and freight transport...*

**Tools development:**

*REST-AP Strategic Priorities includes i) enhance the knowledge base on climate change mitigation and adaptation priorities. ii) Develop guidelines, tools and criteria for mainstreaming climate change mitigation and adaptation in IDB transport operations*

**Climate Change and IDB: Building Resilience and Reducing Emissions. Sector Study: Transport (2014)**<sup>80</sup>

**Risk identification:**

*Some LAC countries' strategies have focused on identifying the risks presented by the effects of climate change.*

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<sup>77</sup> <http://bit.ly/1MadZ0U>

<sup>78</sup> <http://bit.ly/1MadZ0U>

<sup>79</sup> <http://bit.ly/1LYLLER>

<sup>80</sup> <http://bit.ly/1M2Vnhq>

The study further notes, “...while the explicit adaptation portfolio is highly relevant, it is still young and has a ways to go to develop robust indicators on CC resilience impacts and to apply them consistently across projects.”

**IsDB** No information found

**WB**

**Transport for Development: The World Bank Group’s Transport Business Strategy 2008-2012 (2008)**<sup>81</sup>

**Adaptation in terms of infrastructure sustainability:**

*The World Bank Group’s activities in the transport sector in the years ahead will cover the issue of greenhouse gas emissions from transport as a priority for action, with attention paid to both mitigation in terms of operational services and adaptation in terms of infrastructure sustainability to climate change effects...In line with this direction, the work will encompass the domain of technology policy to support the adoption of carbon saving technologies and to help the adaptation of current technologies to the conditions and needs of the Bank Group’s client countries.*

**Table 5: Climate Adaptation References in MDB Transport Sector Policies**

**Adaptation in MDB Country Strategies**

Considerable differences also exist in whether and to what extent adaptation is covered in economy-wide and transport-specific sections of MDB country assistance strategies in the EST region. エラー! 参照元が見つかりません。 references the role of transport adaptation in country assistance strategies from a representative subset of EST countries (representing varying sizes, locations and climatic characteristics), which include flood prevention (Bangladesh), agricultural productivity (Bangladesh) emergency preparedness (Bangladesh, Philippines). While some country assistance strategies make direct reference to transport subsectors (Vietnam: roadways and urban transport) or indirect reference to transport-enabled sectors (Nepal: infrastructure resilience, food security), others make no direct reference to adaptation in the transport sector (Cambodia, India, Indonesia, Mongolia).

| Country    | Adaptation References in Country Strategy  |
|------------|--|
| Bangladesh | ADB:<br>No information found <sup>82</sup> |

<sup>81</sup> <http://bit.ly/1QVDcuh>

<sup>82</sup> <http://bit.ly/1jDqINq>

| Country          | Adaptation References in Country Strategy  |
|------------------|--|
|                  | <p><b>WB:</b></p> <p><b>Agricultural productivity:</b><sup>83</sup></p> <p><i>Investments to expand the road system and increase the share of paved roads lowers transport costs...lessening the impacts of floods.</i></p> <p><b>Flood prevention:</b><sup>84</sup></p> <p><i>All national and regional roads in Bangladesh were previously designed to lie above the highest flood level (HFL) with a return period of 50 years, and feeder roads were constructed to lie above normal flood levels (NFL) . These standards have not been sufficient to prevent large losses in recent major floods.</i></p> <hr/> <p><b>Emergency preparedness planning:</b><sup>85</sup></p> <p><i>WB supports strengthened emergency preparedness planning, since annual flooding is likely to worsen as global warming raises the sea level and causes more extreme weather.</i></p> <p><i>Review how to ensure continuity of essential services, including government mandates for mobilizing private transport providers in times of disaster.</i></p> |
| <b>Cambodia</b>  | <p><b>ADB:</b></p> <p><b>Lack of climate change resilience as one of the sector problems:</b><sup>86</sup></p> <p><i>For climate adaptation to be successful, a firm technical basis is required. ...The problem requires a centralized solution through adaptation of design manuals and technical specifications to achieve better use of more durable natural or processed materials, even though there appear to be cheaper alternatives.</i></p> <p><b>WB:</b></p> <p>No information found<sup>87</sup></p>   |
| <b>Indonesia</b> | ADB: <sup>88</sup>   |

<sup>83</sup> WB . 2010. Economics of Adaptation to Climate Change: Bangladesh. <http://bit.ly/1Rnrh8k>

<sup>84</sup> WB . 2010. Economics of Adaptation to Climate Change: Bangladesh. <http://bit.ly/1Rnrh8k>

<sup>85</sup> WB. 2009. Bangladesh Transport Policy Note. <http://bit.ly/202xOvp>

<sup>86</sup> ADB. 2011. Cambodia: Transport Sector Assessment, Strategy, and Road Map. <http://bit.ly/1W8Aqsi>

<sup>87</sup> WB. 2005. Country Assistance Strategy for the Kingdom of Cambodia. <http://bit.ly/1PFELPg>

<sup>88</sup> ADB. 2012. Country Partnership Strategy: Indonesia (2012–2014). <http://www.adb.org/sites/default/files/institutional-document/33590/files/cps-ino-2012-2014.pdf>

**Disaster preparedness and adaptation in terms of water management:**

*Processes for greener growth are to be fostered with (i) improved environment and natural resources management by strengthening institutions and community participation in rehabilitation and conservation, with integrated approaches to marine development, and disaster preparedness and response.. (iv) climate change adaptation programs including integrated management of river basins, flood risk, and coastal resources. Enhanced early warning systems and improved disaster risk management capacity are designed to complement other environmental management actions.*

**Capacity development:**

*ADB assistance will reinforce national initiatives in sustainable management of natural resources, reduction in pollution and land degradation, and capacity development to mitigate and adapt to climate change as outlined in the government's climate change sector road map.*

**Inclusive growth:**

*Since the poor are most vulnerable to adverse impacts of poor environmental quality and climate change, pillar II will also promote inclusive growth.*

WB: <sup>89</sup>

**Adaptation on REDD+:**

*WBG engagement is expected to support development results that include enabling the implementation of Indonesia's REDD+ Strategy, protection for coral and marine resources, and scaling up disaster and climate risk reduction and adaptation measures*

**Institutionalizing community-based settlement reconstruction:**

*Development results to be supported by the Bank will include efforts to identify and scale up disaster and climate risk reduction and adaptation measures, including institutionalizing community-based settlement reconstruction.*

**Risk identification, integrating risk reduction & catastrophic risk financing:**

*With support from the Global Facility for Disaster Reduction and Recovery (GFDRR), the Bank provides technical assistance for risk identification, integrating risk reduction in investment projects, and identifying options for catastrophic risk financing. Disaster contingent components have already been included in several Bank-financed projects.*

**Post disaster recovery & the shift to preparedness:**

*The Bank is also supporting a standing mechanism for multidonor support in post disaster recovery through a trust fund with an initial contribution of NZ\$2 million in funding from the New Zealand Government. This could represent a major shift from a focus on recovery to an approach focused on preparedness. In parallel, existing Bank engagements in settlement rehabilitation, infrastructure and*

| Country         | Adaptation References in Country Strategy   |
|-----------------|---|
|                 | <i>education and health that form the core of reactive investment will be further targeted to fully integrate disaster resilience measures.</i>   |
| <b>Mongolia</b> | <p>ADB: <sup>90</sup></p> <p><b>Investment to promote urbanization:</b></p> <p><i>(For water supply and other municipal infrastructure and services) assistance will be provided to improve the urban development process, together with catalytic investment support to improve urban services especially in Ulaanbaatar. ADB will focus on (i) enhancing service provision in water supply and wastewater management through a multitranche financing facility and supporting efforts toward climate change adaptation by encouraging water reuse.</i></p> <p><b>Support adaptation by emergency assistance, climate-proofing projects and uses of natural resource:</b></p> <p><i>ADB will support sustainable transport and urban development, including investments in transportation and improved mobility through both its public and private windows.. ADB will help Mongolia to adapt to the unavoidable impacts of climate change by supporting (i) emergency assistance; (ii) “climate-proofing” projects; (iii) the efficient use and sustainable management of natural resources such as water bodies, forest reserves, and grasslands; and (iv) the protection of biodiversity.</i></p> <p>EBRD: <sup>91</sup></p> <p><b>Water resources as the foci of adaptation:</b></p> <p><i>Climate change adaptation for Mongolia includes the improved management of water resources, including encouraging the efficient use of water resources... Reducing the loss of water from its distribution and water transmission systems is also identified as a priority. Improvements in water efficiency will help overall water resource management, as well as public health and environmental benefits.</i></p> <p><i>In response to these needs, the Bank will look for opportunities to support optimizing water efficiency in water-intensive sectors and industries such as agribusiness, manufacturing and mining, and improvements in water infrastructure to contribute towards water conservation.</i></p> |
| <b>Nepal</b>    | ADB: <sup>92</sup>  |

<sup>89</sup> <http://www->

[wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/04/10/000442464\\_20130410105833/Rendered/PDF/765010ESW0P1320A0CPS0EN003290lowres.pdf](http://wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/04/10/000442464_20130410105833/Rendered/PDF/765010ESW0P1320A0CPS0EN003290lowres.pdf)

<sup>90</sup> ADB. 2012. Country strategies: Mongolia (2012-2016). <http://bit.ly/1Q33hdi>

<sup>91</sup> EBRD. 2013. STRATEGY FOR MONGOLIA. <http://www.ebrd.com/downloads/country/strategy/mongolia.pdf>

<sup>92</sup> ADB. 2013. Country strategies: Nepal (2013-2017). <http://bit.ly/1Qd3ACA>

| Country     | Adaptation References in Country Strategy   |
|-------------|---|
|             | <p><b>Building resilience by building institutional capacities:</b></p> <p><i>ADB assistance will focus on disaster and climate change risk management by building institutional capacities (including knowledge base and management systems), ensuring resilience of infrastructure against the risks, and applying risk-screening tools in designing projects. ADB will also help develop an integrated water resources management system.</i></p> <p>WB: <sup>93</sup></p> <p><b>Adaptation in terms of agriculture and Food Security:</b></p> <p><i>the most vulnerable populations are the smallholder farmers who are not yet equipped to mitigate or adapt to the impact of climate change. In this context, NAFSP, by identification and promotion of drought tolerant crop varieties and resilient livestock breeds will contribute directly in mitigating the effects...Strengthening climate resilience, building adaptive capacity and improving food and nutrition security, especially for at-risk women, are key pillars of the WB's development partnership with Nepal.</i></p> |
| Philippines | <p><b>ADB: <sup>94</sup></b></p> <p><b>Institutionalizing adaptation:</b></p> <p><i>In relation to climate change adaptation and mitigation of natural disasters, the PDP calls for these issues to be institutionalized in infrastructure development through their incorporation in plans and designs.</i></p> <p>WB: <sup>95</sup></p> <p><b>Focus for transport is mitigation while adaptation on natural resources:</b></p> <p><i>...Currently, it appears likely that the focus will be on mitigation through transport and energy sectors. For adaptation, the likely focus will be on natural resources and disaster management, particularly in coastal and other vulnerable areas exposed to typhoons, and longer-term sea level rise and storm surges.</i></p>   |
| Vietnam     | <p><b>ADB: <sup>96</sup></b></p> <p><b>Adaptation for roadways:</b></p> <p><i>Mainstreaming climate change adaptation measures into the road and expressway subsector will require (i) impact assessment; (ii) assessment of uncertainty and/or certainty of the impacts; and (iii) identification of necessary, cost-effective measures... of the existing and proposed transport infrastructure. For roadway and expressway embankments, bridges, and other structures, the primary adaptation measures will be (i) to conduct climate change impact, vulnerability, and adaptation</i></p>   |

<sup>93</sup> WB. 2013. Improving Food Security and Livelihood Opportunities; Building Climate Resilience for Nepal's Vulnerable Populations. <http://bit.ly/1kjFDMY>

<sup>94</sup> ADB. 2010. Philippines: Transport Sector Assessment, Strategy, and Road Map. <http://bit.ly/1i7KJtH>

<sup>95</sup> WB. 2010. A Strategic Approach to Climate Change in the Philippines. <http://bit.ly/1kGleS4>

<sup>96</sup> ADB. 2012. Vietnam: Transport Sector Assessment, Strategy, and Road Map. <http://bit.ly/1GC0F34>

| Country | Adaptation References in Country Strategy  |
|---------|--|
|         | <p><i>assessment to identify how climate change may affect infrastructure design and alignment risks; and (ii) to make a comparative assessment between the project and the alternatives to determine the cost effectiveness of taking adaptive measures.</i></p> <p><b>Adaptation for urban transit systems:</b></p> <p><i>In terms of climate change adaptation, the MRT and other structures will be designed to adapt to such effects as flooding by having raised entrances to MRT stations and higher pumping capacity to discharge flood water.</i></p> <p>WB: <sup>97</sup></p> <p><i>No relevance to adaptation</i></p> |

**Table 5: Climate Adaptation References in MDB Country Assistance Strategies in EST Region**

### **MDB Climate Adaptation Tools and Guidance**

There is a growing array of adaptation and resilience tools in place in MDBs; however, the transport sector has received limited specific references in these tools to date. Adaptation related risk identification tools, the counterpart of mitigation related GHG assessment tools for adaptation, have been gaining in popularity among MDBs in order to evaluate project sustainability. These tools are mostly in development stages and unlike in the case of mitigation related GHG assessment tools no efforts have been made to harmonize these between MDBs.<sup>98</sup> This supports conclusions in earlier sections of this paper that adaptation has not reached same level of policy maturity among MDBs and other global stakeholders as mitigation in the transport sector.

<sup>97</sup> WB. 2006. Vietnam Transport Strategy: Transition, Reform, and Sustainable Management. <http://bit.ly/1RwqWjJ>

<sup>98</sup> The SLoCaT Partnership has developed a database on GHG assessment methodologies for the transport sector and intends to utilize work in support of this background document to develop also a database of Adaptation Tools in the Transport Sector

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**MDB**     **Adaptation tools and relevance to transport**

**ADB**

**(i) Risk screening tools that enable rapid risk assessment at the project preparation stage; (ii) Sector briefings on adaptation (iii) Technical guidelines for the assessment of climate impacts evaluation of risks, identification and prioritization of adaptation options, and monitoring and evaluation of adaptation measures.**<sup>99</sup>

Methods and tools aim to assist ADB and DMCs in managing climate change risks throughout the project cycle.

**Technology evaluation scoring method**<sup>100</sup>

The technologies are scored against nine criteria: effectiveness, relative cost, co-benefits, co-costs, barriers, feasibility of implementation, scale of implementation, applicable locations and conditions, and potential financing and markets.

**EBRD**     **Adaptation toolkit:**

In 2010 the Bank developed a toolkit for identifying and managing climate change risks to investments.<sup>101</sup>

This process helps project promoters consider in a comprehensive way how the project and the system it pertains to are vulnerable to climate variability and change, quantify climate risks to the viability of the project, and identify relevant adaptation options to increase climate resilience.<sup>102</sup>

**WB**     **Climate Screening Tools**

The World Bank has developed the Climate and Disaster Risk Screening Tools to mainstream short- and long-term climate and disaster resilience in key development policies, programs and projects. The screening tools were broken down to project level tools for roads, non-road transportation (e.g. aviation, marine transportation, multi-modal and transit systems, rail, and river transport), energy, and other sectors.<sup>103</sup>

**Outcome-based results framework**<sup>104</sup>

A framework was delivered in FY12, but the sections dealing with climate resilience are not strongly outcome-oriented, instead leaning heavily on inputs: expenditure on projects with “adaptation co-benefits.”

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<sup>99</sup> ADB. 2014. Climate Proofing ADB Investment in the Transport Sector.

<sup>100</sup> ADB. Technologies To Support Climate Change Adaptation In Developing Asia . <http://bit.ly/1RXUfwq>

<sup>101</sup> EIB. 2014. Climate risk & vulnerability assessment: Poznan case study. <http://bit.ly/1hYYtH7>

<sup>102</sup> EBRD. 2011. The EBRD and adaptation to climate change. <http://bit.ly/1Qd3vPk>

<sup>103</sup> WB. 2015. Climate & Disaster Risk Screening Tools – Road Projects. <http://bit.ly/1GOgPH8>

WB. 2015. Climate & Disaster Risk Screening Tools – General Projects. <http://bit.ly/1ky52IE>

<sup>104</sup> WB. 2013. Adapting to Climate Change: Assessing World Bank Group Experience Phase III of the World Bank Group and Climate Change. [http://ieg.worldbankgroup.org/Data/reports/chapters/cc3\\_full\\_eval.pdf](http://ieg.worldbankgroup.org/Data/reports/chapters/cc3_full_eval.pdf)

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**MDB      Adaptation tools and relevance to transport****Operational Risk Assessment Framework (ORAF)<sup>105</sup>**

In FY11, the World Bank put in place a new comprehensive system for rating project risks through the entire project cycle. Risks are categorized as stakeholder level, operating environment, implementing agency level, or project level... Climate risks do not fit neatly into this system, and are not treated consistently. Sometimes they are characterized as country risks and sometimes as design risks.

**Table 6 Climate Change Adaptation related tools and relevance to transport sector**

In addition, a recent ADB [technical guidance](#)<sup>106</sup> identifies and evaluates a number of existing and emerging technologies to help support its developing member countries (DMCs) in planning proactively for climate change and adapting to climate change in various sectors. The applicability of four transport-relevant technologies were evaluated (i.e. warm-mix asphalt, engineered cementitious composite, active motion-dampening systems, and ITS).

### **MDB Climate Adaptation Projects**

MDBs are undertaking a growing number of projects specific to adaptation in transport, or incorporating adaptation components into existing transport projects. While progress is evident at the level of individual projects, funding trends for adaptation projects in the transport sector are currently insufficient to create transformational change in this area.

#### **Examples of MDB Transport Adaptation Projects**

MDBs have shown initial success in funding standalone adaptation projects, as shown in the following examples in Latin America (IDB), Georgia (EBRD), China and Bhutan (ADB).

#### ***Regional Project Meso America<sup>107</sup> (IDB)***

The Mesoamerica Project was created in 2008 to further the integration of 10 countries: Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and the Dominican Republic, with the support of IDB. The project seeks to foster the development, financing, and implementation of regional infrastructure and social development projects. It also works toward connecting markets within the region by reducing transport and trade costs.

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<sup>105</sup> WB. 2013. Adapting to Climate Change: Assessing World Bank Group Experience Phase III of the World Bank Group and Climate Change. [http://ieg.worldbankgroup.org/Data/reports/chapters/cc3\\_full\\_eval.pdf](http://ieg.worldbankgroup.org/Data/reports/chapters/cc3_full_eval.pdf)

<sup>106</sup> <http://www.adb.org/publications/technologies-support-climate-change-adaptation-developing-asia>

<sup>107</sup> <http://www.oecd.org/aidfortrade/47750990.pdf>

### ***Support to the Transportation Sector in Nicaragua<sup>108</sup> (IDB)***

IDB's adaptation measures in Nicaragua includes three operations to improve road transport efficiency. The program documents the poor condition of the country's road infrastructure and its vulnerability to recurring natural phenomena. This program contains an intervention sequence to map hot spots in the network; finance feasibility studies of a national roadway; and to finance improvements to critical road access points at Nicaragua's border with Honduras.

The project includes a results indicator to measure traffic disruptions lasting for more than 24 hours, as well as complementary indicators regarding vulnerability to climate change. A project assessment describes a noticeable effort to link design of the adaptation-related components to impacts related to projected extreme weather events, rising sea levels and tropical storm intensity.

### ***Building climate resilience into port infrastructure in Georgia (EBRD)<sup>109</sup>***

A pilot project in Georgia is being used to test an approach to integrating a climate change assessment into Environmental and Social Impact Assessments (ESIAs) that are performed on projects with potentially significant environmental and social impacts. This project involves investing in the expansion of a major port on the Black Sea coast, which is highly sensitive to climate change impacts such as sea level rises and changes in sedimentation. Recommendations on adaptation measures to cope with climate change risks will be developed as part of the ESIA and will then inform the detailed technical design of the project.

### ***People's Republic of China: Anhui Intermodal Sustainable Transport Project<sup>110</sup> (ADB)***

This project, partly funded by ADB, includes elements such as transforming a river channel into a navigable waterway, developing two low-water rubber dams, and a new bridge and port. The project area is characterized by high variability in temperature and precipitation, which pose a continuous threat of downstream flooding. Furthermore, frequent severe floods cause erosion that endangers embankments, bridges, and roads, and pose a threat to river navigation.

As a result, a climate risk and vulnerability assessment (CRVA) is focused on modeling changes in precipitation and the ensuing changes in water discharges and floods. The project assessment concludes that existing design criteria will be sufficient to maintain a minimum navigable water level, and projections of flood volume can be compounded with hydrological models to optimize dam management procedures under different rainfall conditions, thus increasing the resilience of the waterway transport.

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<sup>108</sup> <https://publications.iadb.org/bitstream/handle/11319/6710/Background-Paper-Sector-Analysis-of-Transportation-and-Climate-Change.pdf?sequence=1>

<sup>109</sup> EBRD. 2011. The EBRD and adaptation to climate change.

<sup>110</sup> <http://www.adb.org/sites/default/files/publication/152434/climate-proofing-adb-investment-transport.pdf>

*Bhutan: South Asia Sub-regional Economic Cooperation Road Connectivity Project<sup>111</sup> (ADB)*

The South Asia Sub-regional Economic Cooperation (SASEC) road connectivity project aims to improve land transportation efficiency in Bhutan. Since road design, construction, and maintenance in Bhutan do not explicitly account for projected changes in temperature and precipitation, a CRVA was undertaken to identify key climate risks and adaptation needs for a 68.3 km road segment.

Through literature reviews, hydrological assessments, and vulnerability mapping, the CRVA report examines both engineering measures and soft measures such as the review of design guidelines. The report concludes with a list of good practices and adaptation measures corresponding to each risk identified (e.g. heat waves for pavement, flooding for bridges, elevated water levels for drainage systems and road embankments).

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<sup>111</sup> <http://www.adb.org/sites/default/files/publication/152434/climate-proofing-adb-investment-transport.pdf>

#### Box 4: NDF co-financing of adaptation transport projects

Each of the NDF adaptation projects enumerated in Section 4 incorporates involvement from MDBs.

##### *Cambodia (NDF/ADB)*

The first project to address climate change adaptation in the transport sector consists of a component in the Rural Roads Improvement Project in Cambodia<sup>112</sup>. The project is co-financed with the Asian Development Bank (ADB), with the primary objective of the NDF component to improve institutional and technical capacity of the Ministry of Rural Development (MRD) in the area of climate change adaptation. The Cambodia project is one of the first attempts by a multilateral development bank (MDB) to systematically address climate change impacts in the road transport sector.<sup>113</sup>

The main activities of the first NDF Cambodia project (RRIP I) include improved planning for rural road infrastructure development (e.g. preparation of vulnerability maps, identification and prioritization of adaptation approaches, review of designs, standards and guidelines, training for MRD) and increased resilience of road infrastructure. Such measures will result in smoother road surfaces and thus less road damage and reduced fuel consumption and emissions per vehicle-kilometer. Furthermore, the project will reduce the frequency and duration of downtime due to flooding and earth-slides, and in turn will reduce costly detours, which will therefore increase the cost-effectiveness of planting, harvesting and sales from farmers and private sector enterprises.

The second [Cambodia rural roads improvement project \(RRIP II\)](#)<sup>114</sup> comprises five components including improving about 1,200 km of rural roads to climate resilient paving and plantings; improving rural road asset management through a strong capacity-building program; increase awareness and application of road safety and safeguards; strengthening the capacity of MRD to provide efficient project management support; and rehabilitating roads and jetties within a five-island cluster in the Mekong River in the context of a broader adaptation framework.

All components under RRIP II have been designed based on lessons learned from RRIP I, which have been thoroughly integrated into the proposed project's climate change adaptation activities, to reduce risk of marginalization. Specific activities to be incorporated into RRIP II include adopting climate resilient road designs in flood prone areas; extending emergency management approaches developed under RRIP I; and reducing erosion in project areas through coordinated tree planting.

##### *Vietnam (NDF/ADB)*

In [Vietnam](#),<sup>115</sup> NDF activities are designed to reduce vulnerability of the ADB-financed project roads and enhance awareness of climate change impacts through vulnerability mapping of the six mountainous provinces in the project area; identification and prioritization of vulnerable sections along selected roads for rehabilitation; detailed design to increase resilience of selected project road infrastructure; capacity building of provincial staff; and strengthening of adaptation-supportive policies.

The planned and expected outcome of NDF funded actions in Vietnam are similar to those described for Cambodia, which include improved rural accessibility providing for more reliable access to markets and social services for people in remote and climate-vulnerable mountain areas. While mitigation impacts of these actions are not anticipated to be significant, adaptation interventions will result in GHG emission reductions per kilometer of motorized transport. (Hansen 2015)<sup>116</sup>

#### *Zambia (NDF/WB)*

The overall goal of [a planned joint NDF/WB project in Zambia \(the Strategic Program for Climate Resilience \(SPCR\)\)](#)<sup>117</sup> is to mainstream climate adaptation in the most vulnerable sectors of the country's economy. The objective of the NDF component is to increase government capacity to plan for a climate resilient road transport sector. The major outcomes of NDF support will be ensuring that key sector stakeholders have necessary adaptive capacity to address climate variability. Furthermore, adaptation to climate change will be integrated into key policy documents, design standards, and technical guidelines.<sup>118</sup>

In the projects described above, both NDF and co-financing partners are learning from cooperation experience over time. Thus, lessons learned from co-financing activities in the course of NDF's adaptation pilots may be useful in streamlining forthcoming cooperative processes among global institutions, which will be essential to address the growing demand for financing and expertise in transport adaptation projects<sup>119</sup>.

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<sup>112</sup> <http://www.ndf.fi/project/adaptation-approaches-transport-sector-ndf-c15>

<sup>113</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

<sup>114</sup> <http://www.ndf.fi/project/rural-roads-improvement-project-ii-rrip-ii-ndf-c63>

<sup>115</sup> <http://www.ndf.fi/project/integrating-climate-change-adaptation-transport-ndf-c25>

<sup>116</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

<sup>117</sup> <http://www.ndf.fi/project/strengthening-climate-resilience-project-developing-climate-resilient-infrastructure>

<sup>118</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

<sup>119</sup> Hansen, Stein. (2015). How Climate Change Adaptation Support can contribute in a SLoCaT Context: The NDF Approach and Experience. Unpublished.

## Conclusions

MDBs are in the process of scaling up action on adaptation and climate change on many fronts (MDB wide policies, sector strategies, tools and pilot projects), and there are clear efforts towards raising the profile of climate adaptation across a broad set of sectors, including the transport sector.

Overall, attention to adaptation in the transport sector lags significantly behind corresponding mitigation efforts in the sector, and thus, there remains an opportunity to strike a more optimal balance among transport projects in the mitigation and adaptation areas.

## 7. Climate Finance Funding for Adaptation in the Transport Sector in Developing Countries

This section reviews funding for adaptation related programs and projects in the Transport sector as well as the use of International Climate Finance for this purpose.

### Trends in MDB funding for Adaptation in the Transport Sector

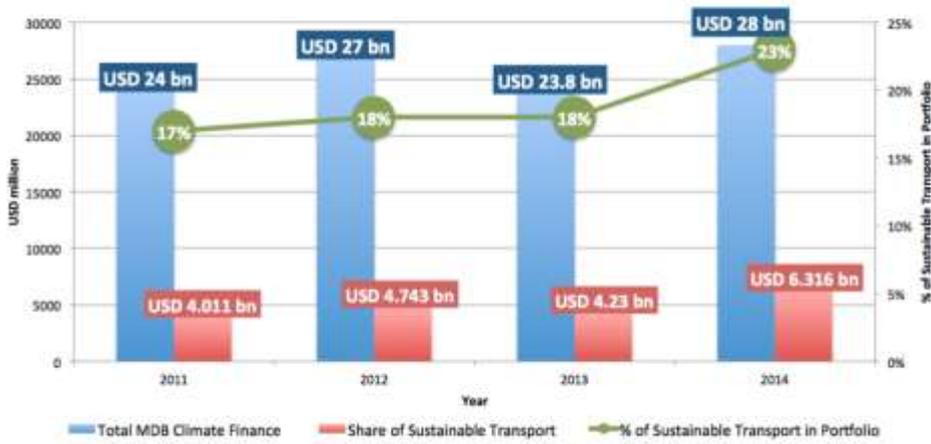
The [2014 Joint report on Multilateral Development Banks' Climate Finance](#) indicates that MDBs (including ADB, EBRD, EIB, IDB, and the WB Group) collectively provided over USD 28.3 billion to climate finance in 2014, of which sustainable transport accounted for 23% (USD 6.3 billion)<sup>120</sup> of the total portfolio. 91% of the portfolio came from the MDBs' own resources, while the remaining 9% came from external climate finance instruments such as bilateral or multilateral donors, GEF, and the Climate Investment Funds (CIF).

The 2014 report, along with the previous reports from 2011, 2012, and 2013, shows that the share of sustainable transport in the MDBs' climate finance portfolio has increased from 17% in 2011 (USD 4 billion) to 23% in 2014 (USD 6.3 billion), as shown in Figure 4:

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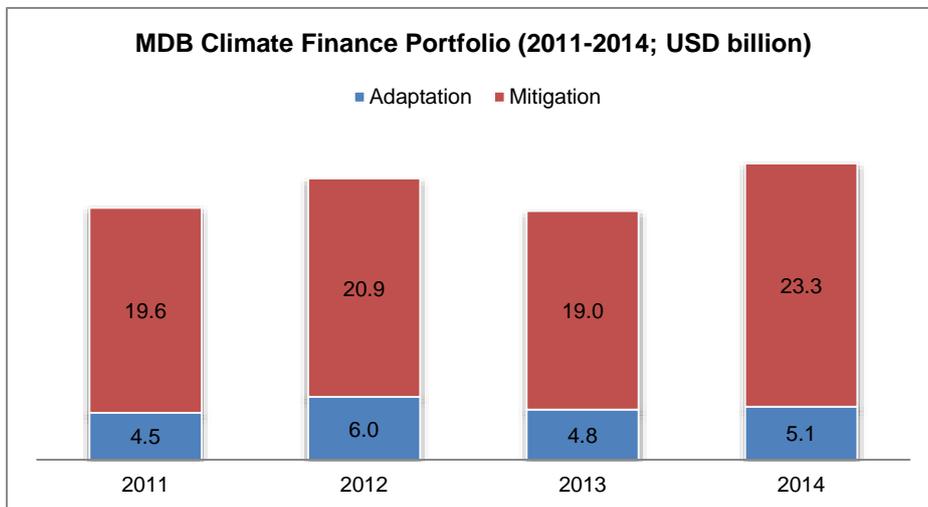
<sup>120</sup> Amount of climate finance for sustainable transport used in the graph is provided under the MDBs' mitigation finance portfolio. Specific amounts for financing transport activities under the adaptation portfolio are not provided in the reports.

**Share of Sustainable Transport in MDB Climate Finance Portfolio (2011-2014)**



**Figure 4. Share of Sustainable Transport in MCB Climate Finance Portfolio (2011-2014)<sup>121</sup>**

Funding for adaptation as a whole still falls behind mitigation by a significant margin in the MDBs annual climate finance portfolio. In 2011, MDB finance to adaptation accounted for about USD 4.5 billion, which is approximately 19% of the total climate finance portfolio. The share for adaptation increased to 22% (USD 6 billion) in 2012, but decreased to 20% (USD 4.8 billion) in 2013 and consequently 18% of the portfolio (USD 5.1 billion) in 2014 (Figure 5).



**Figure 5. MDB Climate Finance Portfolio (2011-2014) in USD billion**

Reporting on MDB climate finance for mitigation does not single out transport (as in the case of mitigation funding). In 2014 23% of the MDB’s total adaptation finance portfolio was dedicated to the category designated “Energy, Transport and Other Built Environment and Infrastructure,”

<sup>121</sup> MDB Joint Report on Climate Finance (2011, 2012, 2013, 2014)

accounting for approximately USD 1.15 billion, exceeding other categories such as agricultural and ecological resources, coastal and riverine infrastructure, and crop production.

The WB Group (including IFC) contributed 61% of adaptation finance in the 2014 MDB climate finance portfolio, with project approval of more than USD 2.3 billion. The effort was followed by AfDB and ADB, which accounted for 15% and 14% of adaptation finance respectively.

In an effort to harmonize reporting of adaptation finance, the MDB working group on climate finance (including AfDC, ADB, EBRD, EIB, IDB, and the WBG) announced jointly with the International Development Finance Club (IDFC) in March 2015 to work together to improve definitions and principles for climate change adaptation finance tracking. Since adaptation projects are crosscutting and interdisciplinary by nature, the group has agreed on a set of [Common Principles for Climate Change Adaptation Finance Tracking](#),<sup>122</sup> which include the following:<sup>123</sup>

1. Adaptation must be “material” (not incidental) to the financed activities in question;
2. Adaptation finance can encompass stand-alone projects, multiple projects under larger programs, or project components, sub-components or elements;
3. For finance to be counted as adaptation finance, there must be a context of risks, vulnerabilities, and impacts related to climate change; and
4. Adaptation finance tracking should be applied to adaptation activities at the finest possible degree of project disaggregation.

The group is expected to continue to refine adaptation tracking processes and collect good practices on the subject as next steps of the harmonization effort. It is not clear how the proposed common principles would deal with reporting of adaptation efforts at the sector level including the transport sector.

**Box 5: World Bank’s Efforts to achieve parity in mitigation and adaptation funding in the transport sector**

As an MDB that has approved a significant portion of adaptation finance, the WB has initiated a concept note to increase parity in mitigation and adaptation funding in the transport sector. The concept note calls for a systematic approach to manage climate risk and build resilience at the project level, increase access to relevant data, develop risk-based planning practices, and integrate climate considerations into infrastructure design and other investments.

<sup>122</sup> World Bank. 2015. Development Banks Agree Common Approach on Measure Climate Finance. <http://bit.ly/1M4wbr6>

<sup>123</sup> Loreta Rufo. 4 Principles for better tracking climate finance for adaptation. Asian Development Blog. <http://bit.ly/1K3I40H>

## Trends in Climate Finance Instrument Funding for Adaptation in the Transport Sector

In addition to climate finance specifically originating from or leveraged by MDBs, several sources of international climate finance have the potential to advance measures on adaptation in the transport sector, which include the Adaptation Fund (AF), GEF, GCF, CIF, Nationally-Appropriate Mitigation Actions (NAMAs) and the International Climate Initiative (IKI). As noted in the following sections, attention to adaptation in the transport sector across these funding sources has been varied to date.

### Adaptation Fund

The [Adaptation Fund](#) (AF)<sup>124</sup> was established in 2001 to finance climate adaptation projects and carry out readiness programs in developing countries that are particularly vulnerable to the adverse impacts of climate change. Since 2010, the AF has approved 51 projects under the categories of agriculture, coastal zone management, disaster risk reduction, food security, rural development, water management, and multisectoral projects. While transport projects are included among the qualifying areas, the Fund currently does not indicate any dedicated projects in the transport sector.

### Global Environment Facility (GEF)

The [Global Environment Facility](#) (GEF) is the first entity under the financial mechanism of the UNFCCC to finance concrete adaptation actions through three of its trust funds: the [Least Developed Countries Funds \(LDCF\)](#)<sup>125</sup>, the [Special Climate Change Fund \(SCCF\)](#)<sup>126</sup>, and the [Strategic Priority on Adaptation \(SPA\)](#)<sup>127</sup> under the GEF Trust Fund. Together, the LDCF and SCCF now hold the largest adaptation portfolio among developing countries, with the expectation that GEF will program up to USD 1.4 billion to facilitate enhanced resilience, adaptation and disaster risk reduction under GEF-6.<sup>128</sup>

Transport projects have been able to access GEF funds for adaptation, although they account for a small portion of the facility's transport portfolio. An example of a recent GEF transport adaptation project involves defining transport sector wide approaches to adaptation in Timor-Leste (エラー! 参照元が見つかりません。):

**Box 6: [Upscaling Climate-Proofing in the Transport Sector in Timor-Leste: Sector Wide Approaches](#)**

<sup>124</sup> UNFCCC. Adaptation Fund. <https://www.adaptation-fund.org/>

<sup>125</sup> GEF. Least Developed Countries Funds (LDCF). <https://www.thegef.org/gef/ldcf>

<sup>126</sup> GEF. Special Climate Change Fund (SCCF). <https://www.thegef.org/gef/SCCF>

<sup>127</sup> GEF. Strategic Priority for Adaptation (SPA). <https://www.thegef.org/gef/SPA>

<sup>128</sup> GEF. Climate Change. [https://www.thegef.org/gef/climate\\_change](https://www.thegef.org/gef/climate_change)

Timor-Leste completed its National Adaptation Program of Action (NAPA) in 2009. The NAPA analysis concludes that Timor-Leste's road infrastructure is highly vulnerable to disasters, and that this vulnerability will increase with projected climate change impacts. A proposed GEF project would provide USD 4.56 million in funding (of a total project cost of USD 123.31 million) to reduce the vulnerability of road infrastructure in Timor-Leste through the implementation of proposed measures in their NAPA.

The project has three focal areas, which include reducing vulnerability of road infrastructure; conducting risk and vulnerability assessments; and strengthening adaptive capacity of national and regional centers to respond rapidly to extreme weather events. Intended key outputs of the project include climate-proofing of the 90 km Manatuto-Natarbora link road; improvements to watershed management and road infrastructure in several strategic locations; development of road maintenance programs to increase climate resilience; and building capacity to plan and implement climate adaptation measures for road projects countrywide.

GEF has also contributed to several adaptation projects indirectly related to the transport sector, including a [project to enhance the resilience of the port sector in Morocco](#), a [project to increase resilience of poor communities to urban flooding in Cameroon](#), a [project to increase resilience of urban development in Sri Lanka](#), and a [project to promote climate resilience in Vietnamese cities](#).

### Green Climate Fund

According to an [analysis](#)<sup>129</sup> by the GCF on the expected role and impact of the Fund, the investment priority for the transport sector in the Asia region has high potential, with Africa, Eastern Europe, and Latin America assessed as having medium investment priority and relatively limited investment prospects in the Small Island Development States. Currently, transport is listed as one of the key results area under GCF's priority for climate-compatible cities, with the targeted geographical regions including Asia, Africa, Latin America, and Eastern Europe.

Although investment in the transport sector traditionally has a heavy focus on climate mitigation, GCF specifically states that its investments can also support adaptation, "particularly by helping to strengthen the resilience of the livelihoods of urban people and communities and to increase the resilience of urban infrastructure (while also reducing associated emissions)." In summary, GCF emphasizes that its priority areas are crosscutting in nature and can "create new and holistic entry

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<sup>129</sup> [http://www.gcfund.org/fileadmin/00\\_customer/documents/MOB201503-9th/06\\_-\\_Analysis\\_of\\_the\\_Expected\\_Role\\_and\\_Impact\\_of\\_the\\_Green\\_Climate\\_Fund\\_20150228\\_fin.pdf](http://www.gcfund.org/fileadmin/00_customer/documents/MOB201503-9th/06_-_Analysis_of_the_Expected_Role_and_Impact_of_the_Green_Climate_Fund_20150228_fin.pdf)

points for realizing the balance across adaptation and mitigation.” However the initial batch of 8 GCF approved projects did not include transport.<sup>130</sup>

### **Climate Investment Funds (CIF)**

The [CIF](#) was established in 2008 to provide country-led investments in clean technology, renewable energy, sustainable management of forests, and climate-resilient development. Under the Clean Technology Fund (CTF) by CIF, there are at least 13 projects dedicated to the transport sector (approximately 7% of CTF’s portfolio) spanning nine developing countries. However, all transport projects presented so far are mitigation-oriented and do not make specific reference to climate resilience or adaptation.

The CIF initiated the Pilot Program for Climate Resilience (PPCR) with a USD 1.2 billion fund to assist developing countries in integrating climate resilience into development planning, by building on NAPAs and other existing public and private sector solutions. The PPCR has so far allocated USD 1.1 billion for 75 projects and programs and it is active in nine pilot countries and two regional programs.<sup>131</sup>

Transport is currently not listed as one of the key priorities for investment under the program. Nonetheless, according to the [PPCR Country and Regional Portfolio](#)<sup>132</sup>, there is currently a pilot project under implementation to enhance the climate resilience of the West Coast Road in Samoa. Moreover, increasing the resilience and climate-proofing capacity of roads, is an element in many crosscutting adaptation projects, such as the Coastal Town Infrastructure Improvement Project in Bangladesh, the Climate Resilience of Rural Infrastructure project in Kampong Cham, Cambodia, and Roads and Bridges Management and Maintenance Program (APL2) in Mozambique.

### **Transport Projects in Nationally-Appropriate Mitigation Actions**

As of October 2015, transport Nationally-Appropriate Mitigation Actions ([t-NAMAs](#)) are still heavily focused on mitigation actions, with few exceptions for adaptation action.<sup>133</sup> Among those, Ethiopia has demonstrated a high degree of commitment with the approval for three adaptation projects in the rail sector under its [Climate Resilient Green Growth \(CRGE\) Strategy \(2011\)](#). Under this mandate, Ethiopia has developed a USD 8.9 million project to increase ridership of [Light Rail Transit](#)

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[http://www.greenclimate.fund/documents/20182/38417/Green\\_Climate\\_Fund\\_approves\\_first\\_8\\_investments.pdf/679227c6-c037-4b50-9636-fec1cd7e8588](http://www.greenclimate.fund/documents/20182/38417/Green_Climate_Fund_approves_first_8_investments.pdf/679227c6-c037-4b50-9636-fec1cd7e8588)

<sup>131</sup> <http://www-cif.climateinvestmentfunds.org/>

<sup>132</sup> Climate Investment Funds. 2015. PPCR Country and Regional Portfolios (as of March 2015). <http://bit.ly/1HfX7OW>

<sup>133</sup> <http://www.transport-namadatabase.org/>

[\(LRT\) and enhance Transit-Oriented Development \(TOD\) in Addis Ababa](#) and the construction of an [interurban electric rail powered by renewable energy](#); to complement these efforts, Ethiopia has developed a [NAMA to assess the climate vulnerability of rail networks](#) in the country, focused on adverse impacts to rail infrastructure (e.g. floods, high temperature, landslides). The project aims to develop a range of climate scenarios and integrate vulnerability into long-term investment decisions in the rail sector.

### **International Climate Initiative (IKI)**

The [International Climate Initiative \(IKI\)](#) was established by Germany's Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) in 2008 to finance climate projects, placing clear emphasis on mitigation adaptation, and protection of biological diversity. For its adaptation portfolio, IKI focuses on projects that are ecosystem-based, climate-related, and focused on the development and/or implementation of national adaptation strategies.<sup>134</sup>

As of October 2015, IKI had approved approximately 14 transport projects (4% of total IKI projects) spanning nine countries mostly in Asia and the LAC region; however, no clear adaptation elements have been identified in transport projects to date.

### **Conclusions**

While international climate finance instruments have the potential to boost a range of climate adaptation transport projects in developing countries, these instruments are still heavily skewed toward mitigation projects, and several have not registered a single adaptation project to date. Within the adaptation specific financing mechanisms transport sector is barely represented. Greater parity in funding of transport sector projects along adaptation and mitigation lines could also increase the co-benefits of investing in these areas. In addition, funding conditions requiring adaptation planning in mitigation projects could help to incorporate resiliency strategies across a wider range of projects.

## **8. Conclusions and Recommendations**

Considerable progress has been made in the last decade to promote mitigation of climate change in the transport sector, and it is encouraging to see that initial building blocks for greater action on adaptation in the transport sector are in the process of being developed. Substantive work on improving the knowledge base on adaptation to climate change in the transport sector is ongoing, which includes guidelines and toolkits for major modes of transport, including roads, railways, and waterways, and sector-wide summary reports capture comprehensive efforts to increase resilience

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<sup>134</sup> <http://www.international-climate-initiative.com/en/>

for public transport, roadways, and the transport sector more broadly in the United States and Europe.

Furthermore, a number of bilateral and multilateral development organizations are implementing a first generation of pilot projects on adaptation in the transport sector, and are in the process of developing policies and screening tools to assess climate risks for projects, including those in the transport sectors. In particular, the Nordic Development Fund is drawing lessons from eight adaptation-oriented projects in developing countries it is in the process of funding through co-financing with regional MDBs in Asia, Africa, and Latin America.

Despite these encouraging steps toward broader transport adaptation measures, the attention of country delegations, subnational actors, and international funding institutions is still largely focused on climate change mitigation in the transport sector. This is reflected in the sizeable number of mitigation-oriented projects, and the large number of countries that have specified mitigation activities through INDCs submitted to the UNFCCC. In contrast, far fewer countries have included transport-specific adaptation measures specific in their INDCs. Similarly, NAPs in developing countries show little detail toward transport measures, and the portfolios of funding institutions and climate finance instruments are still largely skewed toward mitigation rather than adaptation projects, especially in the transport sector.

Based on these conclusions, it is clear that while climate adaptation strategies in the transport sector are taking shape and gaining steam, there is much need for more substantive and comprehensive approaches in the area of transport adaptation and resilience. Initial recommendations for advancing adaptation efforts in the transport sector include the following:

- ***Strengthen the integration of Climate Change adaptation and resilience in the EST process.*** The EST framework on sustainable transport (e.g. Bangkok 2020 Declaration) offers considerable potential for a greater focus on adaptation and resilience. Greater prominence for adaptation and resilience in the EST Framework will help member countries of the EST Forum to follow-up on the outcomes of COP21 in Paris, where it is expected adaptation will be a key part of a new global agreement on climate change. The EST Forum is well placed to help apply the growing knowledge base on climate change adaptation in the transport sector in national level policies in Asia.
- ***Increase opportunities for developing countries to learn from the developed world in transport sector adaptation planning.*** Studies such as the European Environment Agency's report on climate adaptation in Europe's transport sector (and counterparts on the United States transit and roadway subsectors) are highly relevant to the developing world and should be

emulated in other regional contexts, especially in Asia, Africa, and Latin America. By the same token, developing countries have taken the lead in incorporating transport sector adaptation measures into their INDCs (likely due to their higher degree vulnerability in this area), and this degree of foresight could be emulated by developed country parties.

- ***Adaptation in transport could be better integrated in global policy mechanisms on climate change and sustainable development.*** As previously noted, the COP21 input report from the UNFCCC Adaptation Committee gives little detail on sectoral approaches to adaptation, and associated references make only superficial reference to transport; thus, this mechanism could benefit from further detail on sectoral approaches, including transport. Likewise, discussions on climate change under the Sustainable Development Goals are also mostly mitigation focused. However, the Paris Agreement on climate change offers renewed opportunities for EST countries to engage more closely with (and benefit more extensively from) the UNFCCC process on climate adaptation, and to link outcomes from this process more closely to sustainable development objectives.

As noted above, the COP21 outcome documents call for countries to engage in the implementation of adaptation planning processes and actions, including development or enhancement of national adaptation plans and nationally prioritized adaptation actions. In the context of this UNFCCC call to greater action, the UNCRD Regional EST Forum in Asia could provide a more structured platform for filling gaps in adaptation plans and priorities among participant countries, ideally through an annual track in the Forum dedicated to adaptation which would be integrated through each day the Forum (i.e. not as a single standalone session).

The COP21 outcome document also requests Parties to strengthen cooperation on adaptation by (a) establishing regional centers and networks, (b) reporting bi-annual progress on their implementation of their national adaptation plans, and (c) encouraging greater collaboration with non-Party stakeholders. The UNCRD Regional EST Forum provides an ideal mechanism for convening and coordinating such a network, in which EST participant countries could refine national adaptation strategies and develop biennial reports with the benefit of peer country experiences, which represent a wide range of adaptation priorities and financial circumstances.

In addition, the EST Forum could expand the participation of non-Party stakeholders to assist in identifying and prioritizing adaptation actions through a structured set of peer exchanges supported by analytical approaches. These interventions could be based on lessons learned in ongoing NDF/ADB adaptation projects in Cambodia and Vietnam, parallel ADB efforts in Bhutan and China, and a proposed GEF project in Timor-Leste. Finally, with the ADB announcement to allocate USD 2 billion to adaptation by 2020 (and a renewed focus on adaptation through the

GCF, GEF, and the Adaptation Fund), the EST Forum could provide a platform to help strengthen the position of transport projects to secure climate finance in the Asia region, while simultaneously establishing more programmatic approaches to adaptation in national plans.

- ***National and local-level policies on climate change and sustainable development could more fully incorporate strategies on adaptation in the transport sector.*** NAPs, and notably those in developing countries in the EST region, could include more detailed strategies for adaptation in the transport sector; this would allow countries to meet projected mobility demands, reduce life-cycle costs due to damage, and increase mitigation potential with efficient and reliable transport systems. While regional coordination is key, it is also important to recognize that each country is different and that projects should be designed to fit into local institutional contexts by means of thorough project preparation. Finally, successes at the project level increase the likelihood of national and local implementing agencies taking ownership and lift these to sectoral levels through mainstreaming in policy reforms.
  
- ***Transport should be more comprehensively represented in programs and projects on climate change adaptation.*** Specifically, climate adaptation principles could be more effectively incorporated into several areas relevant to transport projects, which include the following:
  - *Action Planning:*  
Adaptation should be reflected in strategic approaches, which address transport infrastructure, and operations, and maintenance. In an infrastructure context, it is useful to mainstream adaptation measures into large investment projects rather than limiting measures to small stand-alone efforts, which can increase the likelihood of a higher level of local/national ownership. In addition, transport project benefits can be increased by incorporating operations planning into infrastructure adaptation efforts (e.g. to ensure that rolling stock are protected during extreme weather events). Finally, in many cases damage to transport assets could be prevented by improving maintenance practices of existing infrastructure through robust asset management systems and data collection regimes, which should include climate change-related parameters to reduce future climatic impacts to infrastructure, and subsequent economic and social losses for users.
  
  - *Capacity Building*  
National road agencies and transport authorities in developing countries have limited knowledge of climate change and are often primarily focused on shorter-term financing of equipment and construction activities, and place less focus on longer-term climate impacts

and adaptation measures. Capacity building should facilitate a longer term view on climate change adaptation.

Many MDBs deliver large loans to road construction projects, and climate adaptation are often limited to site specific activities linked to the specific infrastructure investment. This approach could be modified to increase the adaptive capacity of national road agencies and other key stakeholders by investing in long-term technical assistance efforts that facilitate institutionalizing adaptive capacity.

- *Development of tools/standards/guidance*

Ex-ante risk assessments can result in improved project preparation, contract negotiations, procurements, transparency, and cost control, and thus tool availability and application could be expanded in climate adaptation projects in the transport sector. Further, efforts could be expanded to mainstream climate change adaptation principles into the design standards of transport authorities so that future infrastructure investments will incorporate climate change features. Finally, tools could be expanded to quantify potential life-cycle savings through incorporating climate resilience standards within transport infrastructure investments.

- *Funding for adaptation*

Governments will have to put more priority on funding adaptation related activities, including in the transport sector. Since MDBs mainly provide funding in the form of credits, there is a tendency from road agencies to avoid applying credits to long-term technical assistance. , IFIs could emulate the co-financing model established among NDF and regional MDBs (ADB, AfDB, IDB) to expand funding availability for transport adaptation projects and to provide balanced funding for infrastructure development and technical assistance.

- ***Climate change financing facilities could increase coverage of adaptation activities in the transport sector.*** Climate finance instruments could raise the priority of climate adaptation in project selection criteria and policy frameworks, and outreach efforts to better address capacity building needs and make progress toward sustainable development goals. In addition, the global sustainable transport community could work more closely with international financing institutions to increase the inclusion of adaptation strategies in sustainable transport projects through shared developments of project standards. Finally, since CFI funding is driven by recipient demand, the sustainable transport community should increase outreach to country representatives to submit robust transport adaptation project proposals base on past successes.

- ***Advancing adaptation in the transport sector requires consolidation of efforts and coordination of a broad set of stakeholders.*** The growing interest in adaptation to climate change offers an excellent opportunity to galvanize stakeholders into more ambitious action on adaptation in the transport sector. Stakeholders in such an initiative could include knowledge organizations on adaptation in transport sector (e.g. PIARC, PIANC, UIC, EEA); intermediaries to countries, cities and companies (e.g. MDB Working Group on Sustainable Transport; bilateral development agencies; 100RC, Global Partnership on Sustainable Mobility, International Road Union); and organizations providing funding for adaptation oriented activities (e.g. GEF's Least Developed Countries Fund and Special Climate and Development Fund, Adaptation Fund, GCF and NDF).

Joint activities included in such an initiative could include coordinated efforts to document the knowledge base on adaptation in the transport sector; to develop an open access database of adaptation oriented policies, measures and projects in the transport sector; and to develop coordinated approaches to policy dialogues with countries, cities and companies to initiate projects and build capacity on adaptation in transport sector.

Such an initiative would be particularly relevant to developing countries, which often have the greatest need and least experience in terms of adaptation and climate change; however, the initiative would also be pertinent to developed countries, since levels of dissemination of knowledge on climate change and adaptation options in the transport sector are often quite low. The ongoing implementation of such an initiative would be funded in part through ongoing contributions of stakeholders backing the announcement; in addition, to support common activities under the initiative, a three-year Action Plan could be established with a more modest level of funding.

## Annex 1: Transport Relevance of National Adaptation Policies in EST Countries

| Countries/ Document  | Document Overview   | Transport relevance   | Adaptation-related program   |
|--|---|---|--|
| <p>1</p> <p><b>Afghanistan</b><br/> <a href="#">Joint NSCA and NAPA (2009)</a></p>   |   | <p>Contributing to rural development, the Government's flagship National Solidarity Program (NSP) for community development supports small-scale reconstruction and development activities identified by locally elected Community Development Councils (CDCs) across the country. The program has facilitated the establishment of some 16,343 CDCs and financed over 22,458 community projects. About 88 percent of the community projects involve infrastructure such as irrigation, <i>rural roads</i>, electrification, and drinking water supply.</p> |  |
| <p>2</p> <p><b>Bangladesh</b><br/> <a href="#">Vision 2021, Making Vision 2021 A Reality, National Plan for Disaster Management (2010)</a></p> | <p>Eliminate poverty and make Bangladesh a middle-income country by 2021. Vision 2021 has social, economic and environmental dimensions and it declares that all efforts will be made to protect Bangladesh from the adverse effects of climate change.</p> | <ul style="list-style-type: none"> <li>- Aims to reduce air pollution from industry and transportation</li> <li>- Transport as economic driver to reduce poverty</li> <li>- Aims to reduce air pollution from industry and transportation</li> </ul>  | <p>Bangladesh participates in the National Adaptation Plan Global Support Programme, jointly coordinated by the UNDP &amp; UNEP and financed by the LDC Fund</p> |

| Countries/ Document                                 | Document Overview  | Transport relevance   | Adaptation-related program   |
|---|--|---|--|
| 3<br><b>Bhutan</b><br><a href="#">NAPA</a> (2006)   |  | <ul style="list-style-type: none"> <li>- Project "landslide management and flood prevention", potential long term outcomes includes safe and convenient mode of communication/ transportation facilities &amp; increased safety for communication/ transportation facilities</li> <li>- Essential infrastructure as one criteria for Assessing the Proposed Activities</li> <li>- Building roads as poverty alleviation strategy, road protection as adaptation strategy</li> </ul> | Artificial Lowering of Thorthormi Glacier Lake, Disaster management strategy planning for food security and emergency medicine to vulnerable communities, Weather Forecasting System to serve farmers and agriculture etc. |
| 4<br>Brunei Darussalam<br>No Submission             |  |   |  |
| 5<br><b>Cambodia</b><br><a href="#">NAPA</a> (2006) | The main objective of the NAPA is to identify priority activities and urgent actions needed by a Least Developed Country (LDC) to expand the current coping range and enhance resilience in a way that would promote the capacity to adapt to current climate variability and extremes, and consequently to future climate change. | Water transportation, flooding affecting transportation of the region of rivers, boats as means of transportation, Development of Drainage Systems for Road Protection  |  |

| Countries/ Document  | Document Overview   | Transport relevance  | Adaptation-related program  |
|--|---|--|---|
| 6 <b>China</b><br><a href="#">China's National Strategy for Climate Change Adaptation</a> ,<br><a href="#">国家适应气候变化战略 (Part of the 12th Five Year Plan)</a> (2013) | Contains clear guidelines and principles for climate change adaptation and proposes some specific adaptation goals  | <ul style="list-style-type: none"> <li>- Transport as one of the vulnerable area in which the corresponding department does not have the sufficient capacity to deal with extreme weather event</li> </ul>   |   |
| 7 <b>Indonesia</b><br><a href="#">National Action Plan on Climate Change Adaptation (RAN-API)</a> (2013)   | RAN-API document consists of national adaptation actions that will be implemented within the next 1-2 years (2013 – 2014) and actions that will be mainstreamed to the next RPJMN (2015- 2019 and 2020-2025). | <ul style="list-style-type: none"> <li>- A transport demand management project is also operating in Jakarta</li> <li>- Risk reduction on disruption to the transport accessibility functions on road, bridges, railways, ports and airports due to climate change impacts</li> </ul> | Provides adaptation programs and activities for the short-term (to 2014), medium-term (2015-2019) and long-term (2020-2025) |

| Countries/ Document |  | Document Overview  | Transport relevance  | Adaptation-related program                    |
|---------------------|--|--|--|---|
| 8                   | <b>India</b><br><a href="#">National Action Plan</a><br>(2008) | The plan identifies eight core “national missions” running through 2017 and directs ministries to submit detailed implementation plans to the Prime Minister’s Council on Climate Change by December 2008. | <ul style="list-style-type: none"> <li>- National Mission on Sustainable Habitat as one of the NMs (for promoting energy efficiency), including the following: <ul style="list-style-type: none"> <li>• Strengthening the enforcement of automotive fuel economy standards and using pricing measures to encourage the purchase of efficient vehicles</li> <li>• Incentives for the use of public transportation.</li> </ul> </li> <li>- Better urban planning and modal shift to public transport. Making long-term transport plans will facilitate the growth of medium and small cities in ways that ensure efficiency and convenient public transport.</li> <li>- The mission will address the need to adapt to future CC by improving the resilience of infrastructure, community based disaster management, and measures for improving the warning system for extreme weather events. Capacity building as important component.</li> </ul> | Indian Himalayas Climate Adaptation Programme |

| Countries/ Document   | Document Overview   | Transport relevance               | Adaptation-related program |
|---|---|-----------------------------------|----------------------------|
| 9 <b>Japan</b><br><a href="#">Approaches to Climate Change Adaptation</a><br>(2010) , A new comprehensive report on observation and prediction of climate change (2012) | This Study is mainly for national and local government departments responsible for adaptation. It summarizes basic approaches common across multiple sectors, with the following three objectives: indicate various approaches to adaptation; indicate the basic factors of adaptation measures common to all sectors; and to raise awareness | No specific examples on Transport |                            |
| 10 <b>Korea</b><br>National Climate Change Adaptation Master Plan (NCCAMP) 2009-2030 (2008), National Strategic Plan for Climate Change Adaptation 2011-15 (2010)       | NSPCCA has 87 major projects, covering 10 sectors: public health, disaster management and infrastructure, agriculture, forestry, marine and fisheries, water, eco-system, climate change monitoring and projection, adaptation business and industry, and publication, education and international cooperation.                               | No specific examples on Transport |                            |

| Countries/ Document  | Document Overview   | Transport relevance   | Adaptation-related program |
|--|---|---|----------------------------|
| 11 <b>Laos</b><br><a href="#">NAPA</a> (2009)  | Identified 45 projects proposals according to 4 priorities to implements<br><br>1. Activities must deal with a variety of degrees of severity of impacts from climate change;<br>2. Contribute to poverty reduction;<br>3. Linkages with other Multilateral Environmental Agreements;<br>4. High value for economy and society. | River as a mean of transportation, transportation is required for transporting saplings and forest seeds to drought and flood prone areas   |                            |
| 12 <b>Malaysia</b><br><a href="#">Housing and Local Government's National Physical Plan 2</a> (2013) | Specifically determining measures to aid adaptation of water resources to threats and emerging threats, is also mentioned in the NWRP.  | "Integrating National & Urban Transportation Network" as one of the 7 themes, including integrated Transportation Network, rail, road, airports & seaports, TOD, urban & public transport |                            |

| Countries/ Document   | Document Overview  | Transport relevance   | Adaptation-related program  |
|---|--|---|---|
| 13 <b>Maldives</b><br><a href="#">National Adaptation Programme of Action</a><br>(2006) | <ul style="list-style-type: none"> <li>- A coherent framework to climate change adaptation that enhances the resilience of natural, human, and social systems and ensures their sustainability in the face of predicted climate hazards.</li> <li>- Stresses a plurality of values to construct a framework that brings climate change into the national agenda while allowing for flexibility in implementation.</li> </ul> | No specific examples on Transport   |   |
| 14 <b>Mongolia</b><br><a href="#">National Development Strategy -2021</a> (2008)        | NDS calls for the promotion of Mongolia's "capacity to adapt to climate change and desertification, to reduce their negative impacts", with adaptation activities and measures identified.   | <ul style="list-style-type: none"> <li>- As a part of the Tourism development policy: Phase one (2007-2015):<br/>Strategic objective 1. Increase the capacity to transport and receive tourists, improve roads, communications and power supply in main tourist areas:</li> <li>- Increase the number of direct flights to countries, which represent the main tourist markets for Mongolia, launch flights to new destinations.</li> <li>- Ensure coordination between the work of improving roads, communications and power supply in main tourist</li> </ul> | The Livestock Programme, includes directives relevant for climate change adaptation in animal husbandry |

| Countries/ Document | Document Overview  | Transport relevance   | Adaptation-related program  |
|---------------------|--|---|---|
|                     |  | <p>areas with policies and plans to develop other sectors of the economy.</p>   |   |
| 15                  | <p><b>Myanmar</b><br/> <a href="#">A National Adaptation Programme of Action (NAPA) to Climate Change</a> (2012)</p> | <ul style="list-style-type: none"> <li>- Strategy 2: Support the country's aim to reduce greenhouse gas emissions through increasing carbon sinks and utilizing sustainable development practices e.g. fuel, electricity, transport, efficiency; industrial efficiency as well as sustainable agriculture and forestry that reduces emissions and increases absorption.</li> <li>- Development of road and transport infrastructure as adaptation options that should be considered for effective adaptation in the Energy and Industry sector</li> </ul> | <p>The 'Knowledge Center on Climate Change: Adaptation and Best Practices in Agriculture and Natural Resources Sectors' project funded by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) and the 'Adaptation Knowledge Platform' funded by the Swedish International Development Corporation (SIDA).</p> |

| Countries/ Document   | Document Overview   | Transport relevance  | Adaptation-related program  |
|---|---|--|---|
| 16 <b>Nepal</b><br><a href="#">Implementation of the Climate Change Policy, NAPA</a> (2011) | <p>The National Planning Commission has emphasized the need to screen development plans for economy and infrastructure resiliency</p> <p>The Policy encourages development sectors to incorporate climate change concerns into policies and other instruments of relevant sectors. It also emphasizes development and use of clean and renewable energies</p> | <p><u>NAPA</u></p> <p>Step 2: Vulnerability and Adaptation Assessment</p> <ul style="list-style-type: none"> <li>- Access to resilient transport services enables mobility and livelihood diversification opportunities</li> </ul> | <p>Nepal Climate Change Support Programme (NCCSP) (2013-2015)</p> |

| Countries/ Document  | Document Overview   | Transport relevance  | Adaptation-related program   |
|--|---|--|--|
| 17 <b>Philippines</b><br><a href="#">Eco-Town Framework, Philippine Disaster Reduction and Management Act</a> (2010), <a href="#">Strategic National Action Plan on Disaster Risk Reduction for 2009-2019</a> (2009), <a href="#">Supplemental Guidelines in Mainstreaming Climate and Disaster Risks</a> (2014) | <ul style="list-style-type: none"> <li>- Eco-Town Framework includes initiatives for climate resilient communities</li> <li>- The Strategic National Action Plan on Disaster Risk Reduction for 2009-2019 aims to enhance the capacities of Local Disaster Coordinating Councils</li> <li>- These guidelines support the national strategic priority on mainstreaming disaster risk reduction and climate change adaptation in the development processes with emphasis on the formulation of climate- and risk-sensitive Comprehensive Land Use Plan and Zoning Ordinance.</li> </ul> | Capacity building: Conduct DRR (Disaster Risk Reduction) capability building programs for key response and coordinating agencies of NDCC as well as for sector agencies (infrastructure, education, health, water resources, housing, tourism, transportation, etc.), and LGUs | Participates in several international adaptation initiatives, such as the Philippine Climate Change Adaptation Project (PhilCCAP), a five-year project funded by the Global Environment Facility (GEF) through the World Bank and co-financed by the government. |

| Countries/ Document   | Document Overview  | Transport relevance   | Adaptation-related program   |
|---|--|---|--|
| 18 <b>Pakistan</b><br><a href="#">Pakistan 2025</a> (2014)  | <ul style="list-style-type: none"> <li>- Promote mitigation and adaptation, in view of the</li> <li>- Refers to mitigation measures for energy efficiency and conservation, transportation, forestry, industry, agriculture, livestock and town planning.</li> </ul> | <p>Also as driver for economic development.</p> <ul style="list-style-type: none"> <li>- Pakistan's strategic position will not yield dividends itself. It will happen only if the requisite investments are made in regional connectivity, economic corridors, and transport and communications infrastructure, including rail and road networks to Central Asia, China and India.</li> <li>- Cut down usage of private transport in urban centers, public transport including mass transit systems will be carefully devised and implemented. In addition, cities will be made pedestrian friendly. These measures will not only reduce demand for oil and fuels, but will also lead to cleaner more eco-friendly cities</li> </ul> | <p>Pakistan has been running projects on disaster risk management and climate change adaptation under the funding and guidance from the Global Facility for Disaster Reduction and Recovery (GFDRR) managed by the World Bank.</p> |
| 19 <b>Russia</b><br><a href="#">Climate Doctrine</a> (2009) | <p>Reducing natural disaster damage and other negative climate events</p>  | <ul style="list-style-type: none"> <li>- While formulating climate policy, including the positioning of the Russian Federation within the international community, it is necessary to take into account the combined effect of the low average population density and immense territory leading to higher transportation needs (both directly for the population and for the infrastructure serving the needs of the government, population and economy) and cold climate resulting in additional heating needs, as well as the production and transportation of significant volumes of fuel and energy resources.</li> </ul>   |  |

| Countries/ Document   | Document Overview  | Transport relevance  | Adaptation-related program |
|---|--|--|----------------------------|
| 20 <b>Singapore</b><br><a href="#">Singapore's Third National Communication and First Biennial Update Report</a> (2014)   |  | <ul style="list-style-type: none"> <li>- Organized transportation related courses</li> </ul>   |                            |
| 21 <b>Sri Lanka</b><br><a href="#">National Climate Change Adaptation Strategy for Sri Lanka 2011-2016 (NCCAS)</a> (2010) | Outlined a comprehensive National Climate Change Adaptation Strategy | <ul style="list-style-type: none"> <li>- Transport as one of the Key Economic Drivers for Climate Resilience</li> <li>- Transport infrastructure in certain coastal areas could be under severe threat due to sea level rise</li> <li>- One of the priority areas as to “Identify climate change risks on transport infrastructure, and invest in adaptive measures”</li> </ul> <p><b>Specific actions examples:</b></p> <ul style="list-style-type: none"> <li>- Identify climate change risks on transport infrastructure, and invest in adaptive measures</li> <li>- Update standards/guidelines for infrastructure design and development</li> </ul> |                            |

| Countries/ Document  | Document Overview  | Transport relevance   | Adaptation-related program |
|--|--|---|----------------------------|
| 22 <b>Thailand</b><br><a href="#">Strategic Plan on Climate Change 2008-2012</a> (2008), <a href="#">Climate Change Master Plan 2014-2050</a> (2013), the 11th National Economic and Social Development Plan 2012-2016 | NCCAS lays out a prioritized framework for action and investment                             | <ul style="list-style-type: none"> <li>- GHG emission</li> <li>- In the CC master plan, transportation is listed under mitigation.</li> </ul>   |                            |
| 23 <b>Timor-Leste</b><br><a href="#">NAPA</a> (2010), <a href="#">Strategic Development Plan (SDP)</a> (2010)  | 2016 period aimed at systematically moving Sri Lanka and its people towards a climate change | <ul style="list-style-type: none"> <li>- Transportation needs to be improved to attract foreign business/ investment</li> <li>- Transport infrastructure as one focus of issues (roads, bridges, airports; ports, jetties, piers, seawalls) - p.70 for SDP               <ul style="list-style-type: none"> <li>• Deliver a comprehensive roads maintenance program</li> <li>• Rehabilitate all existing roads</li> <li>• Construct new bridges to provide all-weather access on major routes within five years and the remainder of national and district roads by 2030</li> <li>• Build the road infrastructure required to support the development of the south coast</li> <li>• Establish national ring road standards and</li> </ul> </li> </ul> |                            |

| Countries/ Document | Document Overview   | Transport relevance  | Adaptation-related program   |
|---------------------|---|--|--|
|                     |   | <p>establish a ring road to these standards by 2030.</p> <ul style="list-style-type: none"> <li>- Fund Allocation per Sector in 2010 for transport is 5%</li> </ul> <p><b>Specific action examples:</b></p> <p>Joint research across ministries on the impact of GHG air emissions due to transportation – land, sea, air, their reduction with pollution control and identification of vulnerable areas in urban cities</p> |  |
| 24                  | <p><b>Vietnam</b></p> <p><a href="#">Socio-Economic Development Plan for 2011-2015</a> (2011),</p> <p><a href="#">Vietnam Sustainable Development Strategy for 2011-2020</a> (2012)</p> | <p>Aim to create a Resilient future</p> <p>Pollution/ mitigation oriented, transportation as economic driver</p>   | <p>Build a system to monitor climate change and sea level rise.</p> <p>Modernize observation system and technology for hydro-meteorological forecasting for early warnings of extreme weather events. To enhance awareness, responsibility and capacity to cope with climate change and prevent natural disasters of relevant stakeholders; enhance science and technology activities, organization capacity, and institution;</p> |