

Financing for Climate Resilient Development



# The Road Ahead

Road Transport  
and Climate Change Adaptation:  
A Portfolio Review

**COP21 Conference Version**

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Photos: Jørgen Schytte/Danida and Klaus Holsting/Danida.

The Nordic Development Fund (NDF) is the joint development finance institution of the five Nordic countries. The objective of NDF's operations is to facilitate climate change investments in low-income countries.

NDF finances in cooperation with bilateral and multilateral development institutions. The operations mirror the Nordic countries' priorities in the areas of climate change and development. NDF's capital is provided from the development cooperation budgets of the five Nordic countries.

NDF provides grant financing and other support for projects that facilitate climate change mitigation and adaptation in 18 selected low-income countries.

Since starting to operate under a climate change mandate in 2009, NDF has provided almost 250 million euros in funding to 88 projects, with half of the funding going to projects in Africa.

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## List of Abbreviations and Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
CIF	Climate Investment Funds
COP	Conference of the Parties to the UN Framework Convention on Climate Change
CPF	Country Partnership Framework
EIA	Environmental Impact Assessment
EU	European Union
GCF	Green Climate Fund
GIS	Geographical Information System
IDB	Inter-American Development Bank
INDC	Intended National Determined Contributions
MDB	Multilateral Development Bank
MTI	Ministry of Transport and Infrastructure
NAMA	Nationally Appropriate Mitigation Action
NCC	National Climate Change Communications
NDF	Nordic Development Fund
RRIP	Rural Roads Improvement Project
TA	Technical Assistance
TOR	Terms of Reference
USD	United States Dollar
WB	World Bank

## 1. Introduction

The Nordic Development Fund (NDF) is the joint development finance institution of the five Nordic countries. The objective of NDF's operations under its climate change mandate from 2009 is to facilitate climate change investments in selected low-income countries by means of grants in cooperation with bilateral and multilateral development institutions. The operations mirror the Nordic countries' priorities in the areas of climate change and development. NDF's capital is provided from the development cooperation budgets of the five Nordic countries.

Transport remains a critical support system for the smooth functioning of societies and economies. It facilitates accessibility of services that are vital for business and for the quality of life of citizens. It enables economic growth and job creation, and has - along with energy - been the main sector for NDF investments since its establishment in 1989. The NDF projects prior to the new climate change mandate consisted typically of investments in new road construction, rehabilitation and upgrading of existing roads, plus other types of transport infrastructure such as bridges. With the new climate mandate NDF took the opportunity to continue support to the transport sector but now with the objective of making road transport systems more resilient to the potential impacts of climate change and extreme weather events.

This report reviews the NDF experience and lessons learned so far from its climate change adaptation project portfolio in the road transport sector covering eight projects in seven low income countries (Cambodia, Vietnam, Nicaragua, Senegal, Mozambique, Rwanda and Zambia).

The report emphasizes the crucial role of NDF's unique approach to preparatory screening project application in order to secure relevant and feasible project components for co-financing with the established multilateral development banks. Next it describes the design features of the approved projects in its transport adaptation portfolio, before moving on to a more detailed description of three of the projects (one in Asia, one in Central America and one in Sub-Saharan Africa) which illustrate how lessons learned from the first projects are drawn upon when designing the subsequent projects in close cooperation with national road authorities and the co-financing MDBs. Based on the accumulated experience the report presents lessons learned as regards what has worked and why, and what is replicable for wider application in each country and transferable to other countries, and what conditions has to be met in order to succeed.

The report finds that by providing grant funding for such adaptation projects, NDF has pioneered the task of awareness raising, training and capacity building to prepare national road authorities for the coming impacts of climate change, and since neither domestic budgets nor MDB credits would have been used for adaptation investments and associated capacity building, one can safely conclude that what NDF has provided is genuinely additional, and should be followed up by replication and introduction to more such climate vulnerable low income countries in an attempt to convince their governments and the co-financing MDBs of the need to mainstream such adaptation activities into their regular road sector planning.



## 2. Nordic Development Fund and Climate Change

The Nordic Development Fund (NDF) is a multilateral development finance institution owned by the five Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. NDF was established in 1989 and provided almost 200 concessional credits to low-income countries in Africa, Asia and Latin America in its first two decades with a total value of approximately EUR one billion. Energy and transport were the main sectors for these investments and in total NDF provided almost 275 million dollars to 32 road infrastructure projects. The projects consisted typically of investments in new road construction, rehabilitation and upgrading of existing roads, plus other types of transport infrastructure such as bridges.

In 2009, the NDF mandate was changed to providing grant financing for climate change-related interventions in low-income countries. This decision was taken based on the massive social and economic consequences expected to result from climate change. Both economic efficiency and social justice support the emphasis given to adaptation in NDF's project selection. While physical and economic circumstances vary considerably, it is clear that climate change will require adaptation activities in all of the NDF partner countries.

Transport is a critical support system for the smooth functioning of societies and economies. Reliable systems make vital services for business accessible and improves the quality of life for citizens. It enables economic growth and job creation.

Gradual climate change resulting in temperature increases, sea level rise and more frequent and intense rainfall and other harmful weather events will seriously challenge the transport sector. Transport disruptions caused by recent extreme weather events serve to illustrate what could happen in the future; it is important to anticipate the impacts of climate change on the transport system and prepare in time. However, climate change adaptation to the unavoidable impacts registers relatively low in political awareness and is only at an early stage. It focuses on early planning stages and less, so far, on implementation.

Considering future climate trends now helps in keeping the costs for adaptation bearable and avoiding lock-ins into an unsustainable development path of the transport system. Mainstreaming adaptation into regular road transport planning, and into other policies and plans, has barely started in developing countries. Many tools developed for natural disaster risk management or contingency plans can easily be made relevant for climate change adaptation, too. There is a widespread need to create the enabling framework for integrated and innovative transport adaptation action, comprising standards, targeted funding, governance, culture and collaboration.

With the new climate mandate, NDF continues to support the transport sector but now with the objective of making road transport systems more resilient to the potential impacts of climate change and extreme weather events.



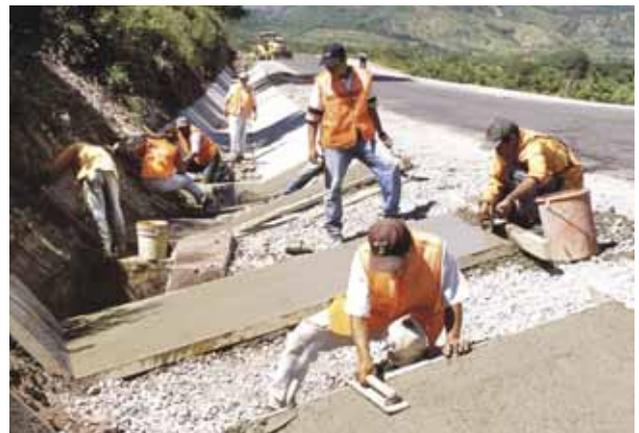
### 3. Addressing Impacts of Climate Change in the Road Transport Sector

Climate change is expected to increase earth surface temperature and increase the number of severe weather events such as hurricanes with intense rainfall, which often results in flooding that causes damage or total destruction of road infrastructure. More specifically, climate change leads to an increase in frequency and intensity of fluvial and surface water flooding of roads; higher temperatures causing heat-induced damage to road surfaces; increased storm surge flooding of the road network causing damages to roads, bridges and culverts. Climate change impacts in the road sector lead to loss of human lives, increasing economic costs for the country, and often results in rural populations being cut off from markets and services, with the associated harmful effects on rural income and welfare.

NDF's rationale for support to the transport sector is that road networks (roads, bridges, and drainage) in low-income countries, while crucial for economic development and poverty alleviation by providing much-needed accessibility to markets and public services, are highly vulnerable to the impacts of climate change. The consequences of climate change go far beyond the mere physical damage to the road network, and can affect a country's economy and social fabric. Thus, adaptation measures are fundamental to avoiding threats to people's well-being, damage and accidents caused by the changing climate. Adaptation is about reducing vulnerabilities, and requires dealing with both the long-term effects of climate change and the more short-term or acute extreme events.

In order to develop realistic adaptation strategies, NDF starts by building an understanding of the potential impacts of climate change on road networks. Vulnerability mapping is an important adaptation activity that identifies sections or areas along the road network that may be particularly affected by climate change, and as a result can have serious adverse impacts on the prospects of vulnerable, mostly poor, residents.

Thereafter, appropriate climate-proofing measures can be identified. Furthermore, reviewing and revising policies and standards for road infrastructure and training of relevant staff help to ensure that climate change considerations are mainstreamed in all road development plans. Incorporating climate change considerations into road design can be expensive, but may create considerable cost savings both in the immediate and longer term. More costly initial climate-proofing investments may reduce future road maintenance cost as the impacts of climate change events on roads will be reduced due to the fact that the roads have, from the beginning, been designed to withstand such events.



The role of NDF finance of climate change adaptation in road transport is illustrated by comparing business-as-usual scenarios versus additional climate change costs scenarios in annex 3.

#### 4. NDF Road Transport Project Portfolio

The first project to address climate change adaptation in the transport sector was approved by the NDF Board in June 2010 and consists of a component in the Rural Roads Improvement Project in Cambodia. The project is co-financed with the Asian Development Bank (ADB) and the primary objective of the NDF component is to improve institutional and technical capacity to adapt to climate change in the transport sector. 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. The project was quickly followed by another adaptation component in a larger MDB project. This time the focus was on Senegal, where NDF in December 2010 approved support to integrating climate change adaptation to transport as part of the World Bank's Transport and Urban Mobility Project (STUMP).

The two first projects have by 2015 been followed by another six projects. At present, NDF collaborates on transport adaptation with the World Bank (WB), African Development Bank (AfDB), Asian Development Bank (ADB), and Inter-American Development Bank (IDB). At present, the NDF transport adaptation portfolio consists of the following interventions (see more details in annex 1):



1. Cambodia: Adaptation Approaches for the Transport Sector Project
2. Cambodia: Rural Roads Improvement Project II
3. Vietnam: Integrating Climate Change Adaptation to Transport
4. Senegal: Integrating Climate Change Adaptation to Transport
5. Zambia: Developing Climate Resilient Infrastructure Standards
6. Mozambique: Developing Capacity for a Climate Resilient Road Sector
7. Nicaragua: Road Sector Support Program - Developing Adaptive Capacity for Climate Change
8. Rwanda: Developing Capacity for Climate-Resilient Road Transport Infrastructure

These NDF financed transport projects are linked to larger MDB investments and are presently at different stages in their implementation.

## 5. The Project Screening Phase

NDF uses its *Guidelines for Project Identification and Screening* to assess new proposals. All eight of the transport adaptation projects met the screening criteria for adaptation. In each case, the projects were designed to remedy inadequate institutional and technical capacity to adapt to climate change. The projects all are innovative for their country and should be followed-up and replicated. Crucially, all the projects have private sector activities.

The screening revealed that NDF's participation brings the possibility for Nordic actors to be involved in several of the projects. In addition, without NDF funding, the climate change components would be unlikely in all the projects. NDF is involved in the design and planning of each of the projects.

Most of the financing for these projects is through MDB loans and NDF is a minority co-financing partner.

Overall, the climate change components of these projects meet one or more of the Sustainable Development Goals. Their environmental impacts are benign and their social impacts are positive, as they are designed to reduce poverty.

### NDF Screening Criteria

The current NDF 'Guidelines for Project Identification and Screening' is from June 2013 and can be downloaded from the NDF webpage: [www.ndf.fi](http://www.ndf.fi)

The screening criteria can be summarised as follows:

**Adaptation projects** should be defined as those that are primarily aimed at responding to the adverse consequences of climate change. Specifically, the criteria should be as follows:

- Projects should satisfy standard economic and social tests (or be expected to if not easily quantified) at the national level, i.e. excluding global impacts.
- Projects should be primarily climate-related, i.e. at least 50% of total project investment costs would be incurred due to the actual or expected impacts of climate change.

**Mitigation projects** to be supported by NDF will have to pass the following criteria:

- Projects should satisfy standard economic and social tests (or be expected to if not easily quantified) at the national level.
- Projects should have a significant climate component, i.e. the global benefits of GHG emission reduction or carbon sequestration should be at least 10% of project investment costs. In addition, the project screening also includes a checklist of aspects to be considered in assessing the merits of a proposed project.

In addition, the project screening also includes a checklist of aspects to be considered in assessing the merits of a proposed project.

Finally, each of the eight projects has undergone comprehensive risk assessments and risk mitigation planning either by the co-financing MDB, NDF or both. Risks have been identified and assessed at different stages in the project cycle, and where risks have been assessed as high, substantial or medium, specific risk mitigation measures have been developed for application in the form of specific covenants applied to the contracts.

## 6. Design Features of the Transport Adaptation Portfolio

The NDF transport adaptation projects share some similarities in design. They are all grant-financed and form part of a larger road transport investment program financed through loans from an MDB. Another shared feature is the long-term technical assistance consisting typically of 2-3 years of full-time specialised support. The following elements are found in all or most of the projects:

### ‣ **Training and capacity development**

The mapping of relevant stakeholder capacity at central and municipal level identifies capacity needs and leads to a plan for institutional capacity development through workshops and training.

### ‣ **Climate modelling and vulnerability mapping**

Credible climate data are collected to prepare climate change profiles and vulnerability scenarios. Relevant climate models will help to identify precisely potential climate impacts on road infrastructure. The data will be combined with field verification to enable GIS-based mapping of the vulnerability of the road transport network.

### ‣ **Norms and design standards for road transport infrastructure**

Technical standards, manuals, and design criteria are reviewed in order to include the issue of vulnerability to climate change in planning, design and operation of new road infrastructure.

### ‣ **Policy and plans**

The legal and institutional framework for transport sector is assessed to incorporate climate change aspects. Another step is to have climate change integrated into national transport sector plans.

### ‣ **Tools development**

Climate screening tools are developed to assess during planning stage the potential climate impacts on existing and new road transport infrastructure. Such tools will be used for decision-making for road adaptation measures. The tools will take into account both the potential risks and use economic assessments in order to make informed decisions that address short- and long-term sustainability issues.

### ‣ **Road asset management**

A road asset management system consisting of information on road infrastructure assets and their condition is essential for carrying out effective and targeted maintenance. However, it needs to be updated with information regarding areas where climate change impacts pose a threat to the road infrastructure and its functionality.

### ‣ **Pilot projects**

Pilot projects are designed and implemented to explore concrete adaptation measures (engineering options, design methods, technology choices, and organisation). The outcomes of pilot projects will feedback into policy-making, plans, and knowledge management processes.

### ‣ **Ecosystem-based adaptation**

Ecosystem-based adaptation strategies focused on environmental and green planning for road projects are used for road development to improve flood and drought management and erosion control.

## 7. Case: Cambodia Rural Roads Improvement Project

The Rural Roads Improvement Project (RRIP) in Cambodia is now in its second phase. The project is the first example of NDF co-financing a special component on transport and adaptation to climate change vulnerability with an MDB, and the project is the first ADB effort on climate change adaptation linked to the transport sector. The project was approved in 2010, shortly after NDF began providing grants for climate change projects.

This project is a good illustration of NDF's potential to exert leverage at both project and policy levels. When ADB presented the project to NDF, the climate change activities were very limited. Through dialogue with ADB, the climate change consultancy services and pilot adaptation measures were added to the project design. It is likely that the climate change activities would have remained very limited without NDF's participation in the project funding.

The climate change adaptation component is considered by ADB to be a pilot initiative in Southeast Asia. The component activities are:

- (i) vulnerability mapping for rural roads to improve planning for climate changes;
- (ii) introducing ecosystem-based adaptation strategies, in particular increasing ground cover and infiltration of flood water during floods and water retention during droughts, with the added benefit of enhancing rural livelihoods by improving the soil structure for agriculture;
- (iii) piloting the use of climate monitoring systems for road maintenance scheduling, since some work can only take place during the dry season (which has become less predictable);
- (iv) developing a pilot program for an early warning system for rural roads; and
- (v) developing a pilot program for emergency management planning for rural roads.



The intervention is expected to build long-term capacity for relevant stakeholders to ensure that both current and future transport infrastructure planning and construction, as well as maintenance, will include substantial measures to make such infrastructure resilient to climate change-related conditions. This will also lower the cost of future maintenance while ensuring that local people in the targeted rural provinces will have uninterrupted transport access whatever the weather. Further, the actual implementation of such measures for part of the project roads will serve as demonstration projects to further increase the understanding of and interest for such measures among local stakeholders, as well as show the benefit of such measures for the local population, and thus prepare the grounds for replication nation- and region-wide.

The NDF support is anchored in the Ministry of Rural Development (MRD). The MRD has contracted an international consultancy firm to provide long-term technical assistance, training and capacity development. The tools for rural road climate-proofing have been developed and tested in this project. One of the big challenges is how to prioritise the limited funding available for the MRD for construction and maintenance of rural roads. Therefore, the project focuses strongly on vulnerability mapping to identify the weak spots in the rural road network, followed by the development of tools to prioritise interventions (e.g. cost-benefit assessments).

A second phase investment from the ADB, along with a second phase of the NDF technical assistance has already been approved and is under early implementation. The lessons learned from the first phase were incorporated in the design of the second phase. Further, successful technical solutions from first phase for increasing climate resilience will be expanded for project roads in the second phase of the investment.

## 8. Case: Nicaragua Road Sector Support Programme

The Cambodia project inspired the Ministry of Transport and Infrastructure (MTI) in Nicaragua to request similar support from NDF. MTI is responsible for the national transport policy and for planning, preparing, contracting and administering road improvement, construction and rehabilitation projects. MTI currently has no methodology for considering the impacts of climate change phenomena when planning its investments. The knowledge base in the Ministry is insufficient, technical capacity and tools are needed, norms and standards are outdated, and climate change aspects are not part of the present road planning system.

The National Road Maintenance Fund (FOMAV) was established in 2005 to provide regular maintenance of the existing road network. FOMAV is financed by a gasoline and diesel tax that, presently, brings in about USD 25 million annually. However, the ongoing efforts by MTI and FOMAV to maintain the national road network are not adequate since there is a large backlog of rehabilitation and maintenance needs exceeding the available funding. Furthermore, many existing roads are of sub-standard quality, and the weight control of vehicles is insufficient. These issues are interrelated in the sense that poor or inadequate maintenance increases the climate vulnerability of existing roads and decreases the life span of individual roads, impacting the entire road network. This situation has led to an adaptation deficit in the road sector that will continue to grow unless a robust adaptation program is put in place.

The Inter-American Development Bank (IDB) provides credit to the Government of Nicaragua to implement the Road Sector Support Programme which addresses several of the key issues related to road quality, weight control, capacity and funding. The general objective is to make road transport in Nicaragua more efficient in order to stimulate economic activity and contribute to the well-being of the population, while facilitating integration within the country and with the rest of Central America.

NDF developed in close collaboration with IDB and MTI a special component to build adaptive capacity in key institutions. The NDF component focuses on:

- a) Development of adaptive capacity in Ministry of Transport and Infrastructure and the National Road Fund;
- b) Strengthening the knowledge base for planning and decision-making; and
- c) Practical experience of climate change adaptation through pilot projects.

The main beneficiaries are the key institutions that are responsible for road transport infrastructure in Nicaragua. NDF support fills a gap because currently the MTI technical staff has no experience in dealing with adaptation to climate change. This lack of experience is also a reason for the strong emphasis on technical assistance; training and capacity-building. The NDF support will secure results at all levels: a) mainstreaming and institutional development; b) capacity-building; and c) hands-on experience through the implementation of selected pilot projects.

Other benefits from the NDF project include:

- a) Updated road design standards with climate change aspects where relevant;
- b) Legal and institutional framework for the transport sector to incorporate climate change where relevant;
- c) Design solutions for vulnerable hot spots in the national road network.

The ultimate beneficiaries are the Nicaraguan population, who will benefit from a more resilient road transport network.

## 9. Case: Mozambique Developing Capacity for Climate-Resilient Road Sector

In 2012, NDF received a proposal from the African Development Bank (AfDB) to support transport and adaptation under the new AfDB Nacala Road Corridor project. There was at the same time a need for better integration of such an NDF component with World Bank support to climate resilience and rural roads in the Zambezi Valley. NDF financed extensive preparatory work and the final NDF proposal was approved in late 2013. The NDF support is well-integrated into the AfDB project and includes long-term TA to the national road agency ANE, which none of the other donor-financed projects provide.

From the outset, ANE staff had almost no experience for ensuring the resilience of infrastructure and communities to climate change, and no methodology for considering the impacts of climate change phenomena when planning its investments. Technical capacity and tools were needed, norms and standards were outdated, and climate change aspects were not part of the present road planning system. This lack of experience and appropriate climate change adaptation capacity was the reason for the strong emphasis on long-term technical assistance, training and capacity-building in the NDF climate change project. The NDF adaptation project complements the AfDB project's capacity-building component and the activities include:

- a) Capacity Development and Mainstreaming of Climate Change Adaptation within National Roads Authority;
- b) Climate change proofing of the Nacala Corridor road (Muita-Mandimba-Lichinga road);
- c) Road network vulnerability mapping;
- d) Economics of climate change; and
- e) Road asset management and technical issues.

In addition, NDF will share with the World Bank the costs of consultancy for revision and updating of design standards and norms for road infrastructure. Likewise, the vulnerability mapping is shared between several donors. The NDF transport adaptation project in Mozambique is also the first to include focused work on using the road asset management system to improve climate resilience. This approach has been replicated in the new Rwanda transport adaptation project.



## **10. The Road Ahead**

The review of the NDF transport adaptation portfolio provides a number of lessons regarding both the planning and design of such efforts and concrete experiences from their implementation.

It is clear that individual countries will start incorporation of climate change adaptation in transport in national and local level policies when they fully realise the impacts and what may be done. This requires the type of specific support to national road agencies that NDF provides.

More specific recommendations for supporting transport and climate change adaptation in developing countries based on the full NDF review of all eight projects include the following:

### **Integrated approaches work better than stand-alone**

The review of the NDF experience found that it is important to build an adaptation component into a larger investment project instead of offering it as a smaller stand-alone effort. The likelihood of a higher level of local/national ownership increases when the larger project allows for concrete adaptation interventions linked to specific road construction. The larger project is also often a high priority for management/Minister so the adaptation component receives more attention and priority.

### **One size does not fit all**

While this is hardly news anymore, there is a tendency to repeat the same patterns in many projects without taking local context sufficiently into consideration. The eight NDF projects show that each country is different and that a new project should be designed to fit well into the local institutional context. While some elements may work well in one place, they may not be relevant in another place. Thorough project preparation adapted locally is essential for good results.

### **Designing more resilient infrastructure**

Efforts should focus on mainstreaming climate change adaptation into transport agency tools, such as technical standards, norms, design criteria and guidelines. There should be a process to update and develop new standards and specifications for road works which are appropriate to the conditions found in each country. This step will result in significant financial savings and economic benefits to the government.

### **Improve maintenance of existing infrastructure**

In many cases, damage can be prevented by improving the maintenance of existing infrastructure. In some cases, national road agencies do not have an asset management system while in other cases the system is outdated. Data collection for creating or updating the road asset management system, while including climate change information, could improve the maintenance efforts on the present road network and thus reduce future damage induced by climate change events and reduced economic and social losses for those dependent on these roads .

### **Develop the capacity of a range of stakeholders**

Capacity development should not only focus on the main national road transport entity but include selected other stakeholders that play important roles in maintaining the viability of the road network. Therefore, all capacity efforts should be based on comprehensive stakeholder consultations and institutional assessments. All institutions should have better knowledge of the impacts of climate change on their activities.

### **Broaden the focus of road agencies and transport authorities**

National road agencies and transport authorities in many developing countries tend to prioritise finance for equipment and construction activities, and have little or no focus on climate change adaptation and the associated institutional capacity-strengthening required to deal with the adaptation challenges. Project preparation consultants need to work with national authorities to facilitate a broader view on climate change risks and long-term impacts.

### **The value of time**

One needs to allow for sufficient time for information and negotiations at all stakeholder levels to secure complete local confidence in and ownership to climate change adaptation components as an integral part of the planning and budgeting for road construction and maintenance in the future. With such mutual trust established, the extra time and effort spent will pay off when it comes to achieving timely and sustained implementation.

### **Technical Assistance offers long-term capacity**

Most MDBs include climate change adaptation in large loans for road construction for very site-specific activities linked to their own infrastructure investment. This approach will never build national climate change adaptive capacity. There is a need for investing in long-term technical assistance that will allow for building and institutionalising the necessary climate change adaptive capacity.

### **Grants have a niche**

Another observation regarding MDBs is that since they mainly provide credits, there is a tendency from local road agencies not to want to use the credit for long-term TA. NDF has been able to fill this gap on a grant basis due to its unique mandate focused on climate change.

### **Risk assessments bring stronger projects**

Risk assessments have led to concrete risk mitigation measures in the agreed NDF contracts, several of them accompanied by grant-funded technical assistance. These assessments have resulted in improved overall project preparation, contract negotiations, speed and smoothness of procurements, better transparency, better cost control and improved quality of planning, technical and engineering works.

### **Go beyond the individual project level**

The lessons learned from Cambodia's first NDF project resulted in recommendations that were to a large extent used in the design of the second phase. Successes at the project level increase the likelihood of implementing agencies taking ownership of reforms introduced through projects and lift these to sector levels for use in national policy reforms.

The review concludes that by providing grant funding for such adaptation projects, NDF has pioneered the task of awareness-raising, training and capacity-building to prepare national road authorities for the coming impacts of climate change. Since neither domestic budgets nor MDB credits would have been used for adaptation investments and associated capacity-building, one can safely conclude that NDF's contribution is genuinely additional. These activities should be followed up by replication and introduction to more such climate-vulnerable low-income countries in an attempt to convince their governments and the co-financing MDBs of the need to mainstream such adaptation activities into their regular road sector planning.



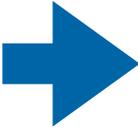
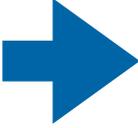
## Annex 1: NDF's Transport Sector Climate Change Adaptation Portfolio -Finance

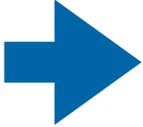
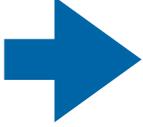
No.	Project	NDF Grant funding USD Mill.	Total Funding USD Mill. Incl. NDF grant	Year approved/Status	Financing partners
1.	<b>Cambodia</b> – Adaptation Approaches for the Transport Sector under the Rural Roads Improvement Project	USD 4.77 mill (EUR 4 mill)	USD 55.65 mill	2010-16 Almost completed	ADB; USD 35 mill, KEXIM; USD 19.35 mill Gov. Cam: USD 0.3 mill
2.	<b>Senegal</b> – Transport and Urban Mobility Project (STUMP) – Integration Climate Change Adaptation to Transport	USD 4.54 mill (EUR 4 mill)	USD 45.43 mill	2010-15 Under implementation	World Bank (WB): USD 49.5 mill
3.	<b>Vietnam</b> – Integrating Climate Change Adaptation to transport	USD 2.27 mill (EUR 2 mill)	USD 2.27mill	2011-17 Under implementation	ADB: USD 80 mill, VN-Govt funding USD 25.1 mill
4.	<b>Nicaragua</b> – Road Sector Support Program, Developing Adaptive Capacity for Climate Change	USD 5.0 mill EUR 4.4 mill)	USD 56.33 mill	2012-17 Under implementation	IDB: USD 59.3 mill GoN: USD 0.3 mill
5.	<b>Zambia</b> – Strengthening Climate Resilience Project – Developing Climate Resilient Infrastructure Standards.	USD 4.54 mill (EUR 4 mill)	USD 69.39 mill	2013-18 Under implementation	WB: USD 36 mill AfDB; USD 39 mill GoZ: USD 10.8 mill
6.	<b>Mozambique</b> – Developing Capacity for a Climate Resilient Road Sector – Nacala Road Corridor Project Phase III	USD 4.32 mill (EUR 3.8 mill)	USD 112.21 mill	2013-18 Under implementation	AfDB: USD 61.21 mill JICA: USD 50.61 mill GoM: USD 17.68 mill
7.	<b>Cambodia</b> – Rural Roads Improvement Project (RRIP II)	USD 4.54 mill (EUR 4 mill)	USD 132.68 mill	2014-20 Under implementation	ADB: USD 54 mill GoAus: USD 6.67 mill GoKorea: USD 41 mill GoFrance: USD 36 mill GoCamb: USD 14.65 mill
8.	<b>Rwanda</b> – Developing Capacity for a Climate resilient Road	EUR 4.4 mill	EUR 21.43 mill	2015-20 Approved Nov. 2015	AfDB: EUR 12.5 mill GoRw: EUR 4.43 mill

## Annex 2: NDF's Transport Sector Climate Change Adaptation Portfolio - Design

No.	Project Title	Main elements and activities
1.	<b>Cambodia</b> – Adaptation Approaches for the Transport Sector under the Rural Roads Improvement Project	<ol style="list-style-type: none"> <li>1. Vulnerability mapping for rural roads, due to climate change, to improve planning for climate changes;</li> <li>2. Introducing ecosystem-based adaptation strategies focusing on environmental/green planning for project roads to improve flood and drought management (i.e., increasing ground cover and infiltration of flood water during floods and water retention during droughts, and this has the added benefit of enhancing rural livelihoods by improving the soil structure for agriculture);</li> <li>3. Piloting the use of climate monitoring systems to improve the road maintenance and management program, since certain maintenance works can only take place during the dry season but, as seasons are shifting, planning is becoming more difficult;</li> <li>4. Developing a pilot program for an early warning system for rural roads; and</li> <li>5. Developing a pilot program for emergency management planning for rural roads.</li> </ol>
2.	<b>Senegal</b> – Transport and Urban Mobility Project (STUMP) – Integration CCA to Transport	<ol style="list-style-type: none"> <li>1. Increasing capacity of transport experts to integrate climate change adaptation into their activities;</li> <li>2. Improving information base for decision making related to climate change-proofing of roads; and</li> <li>3. Developing experience through pilot projects.</li> </ol>
3.	<b>Vietnam</b> – Integrating CCA to transport	<ol style="list-style-type: none"> <li>1. Capacity building of provincial staff;</li> <li>2. Vulnerability mapping of roads selected for rehabilitation;</li> <li>3. Identification and prioritisation of adaptation approaches;</li> <li>4. Detailed design to increase the resilience of the project road infrastructure to climate change;</li> <li>5. Policy strengthening.</li> </ol>
4.	<b>Nicaragua</b> – Road Sector Support Program, Developing Adaptive Capacity for Climate Change	<ol style="list-style-type: none"> <li>1. Development of adaptive capacity in Ministry of Transport and Infrastructure (MTI) and National Road Fund;</li> <li>2. Strengthening the knowledge base for planning and decision-making; and</li> <li>3. Practical experience of climate change adaptation through pilot projects.</li> </ol>
5.	<b>Zambia</b> – Strengthening Climate Resilience Project – Developing Climate Resilient Infrastructure Standards.	<ol style="list-style-type: none"> <li>1. Comprehensive vulnerability assessment of the Zambian transport sector to climate change and to natural disasters and development of adaptation options and tools;</li> <li>2. Development and implementation of a training program for national stakeholders on adaptation to climate change in the transport sector;</li> <li>3. Assistance to the Government in integrating climate change adaptation into the National Transport Policy, Master Plan and Investment Framework;</li> <li>4. Integration of climate change adaptation into construction and maintenance guidelines and tools;</li> <li>5. Development and implementation of tools &amp; protocols for preventative measures during climatic hazards.</li> </ol>
6.	<b>Mozambique</b> – Developing Capacity for a Climate Resilient Road Sector – Nacala Road Corridor Project Phase III	<ol style="list-style-type: none"> <li>1. Capacity Development and Mainstreaming of Climate Change Adaptation within National Roads Authority (ANE);</li> <li>2. Climate change proofing of the Nacala Corridor road (Muita-Mandimba-Lichinga road);</li> <li>3. Road network vulnerability mapping;</li> <li>4. Economics of climate change; and</li> <li>5. Road asset management and technical issues.</li> </ol>
7.	<b>Cambodia</b> – Rural Roads Improvement Project (RRIP II)	<p>The component has a multisectoral approach:</p> <ol style="list-style-type: none"> <li>1. Ensuring transport mobility and access to critical services during extreme events, particularly floods;</li> <li>2. Ensuring safe access to water during climate extremes, such as drought; and</li> <li>3. Ensuring sustainable and diverse rural livelihoods to reduce vulnerability to climate change. <ol style="list-style-type: none"> <li>a. Income Diversification for Climate Resilience</li> <li>b. Improving Water Access and Reducing Vulnerability of Agriculture to Climate Change</li> <li>c. Income through Renewable Energy</li> <li>d. Improved Health and Safety during Climate Extremes</li> <li>e. Inclusive-growth Strategy for Rural Roads</li> </ol> </li> </ol>
8.	<b>Rwanda</b> – Developing Capacity for a Climate resilient Road	<ol style="list-style-type: none"> <li>1. Strengthening the knowledge base and tools development;</li> <li>2. Physical works put in place to enhance landslide protection in right-of-way areas prone to landslides and erosion while providing benefits to local populations;</li> <li>3. Increased involvement by transport sector experts in disaster risk management</li> </ol>

### Annex 3: Business-As-Usual vs Adaptation in Road Transportation Sector

Baseline Business-As-Usual		With Climate Change	
<p><b>Problem description</b></p>	<p>The Government of a low income country is facing a number of challenges with regard to their road transportation system. The existing road network has insufficient coverage and most of the roads are unpaved with inadequate storm water drainage, restricting accessibility and integration of major population centres.</p> <p>Furthermore, more than 50 percent of the existing road network is found to be in poor or bad conditions due to lack of maintenance.</p> <p>The traffic levels are increasing and so is the number of traffic accidents, many of which are caused by poor road conditions. Specific areas of the country are susceptible to periodic intense rainfall, which occasionally results in flooding and causes damages to road infrastructure and disrupts local economic and social activities due to sudden road closure for extended periods.</p> <p>The Government has therefore undertaken a national road transport sector program to rehabilitate the existing road network, strengthen institutional capacity to manage road traffic (weight and dimensions); strengthen the road maintenance system, and manage the disaster aspects of the extreme weather events.</p>		<p>Climate change is expected to increase temperature, increase the number of severe weather events such as hurricanes with intense rainfall, which often results in flooding that causes damages to and periodic closure of road infrastructure.</p> <p>More specifically climate changes lead to increase in frequency and intensity of fluvial and surface water flooding of roads; higher temperatures causing heat induced damages to road surfaces; increased storm surge flooding of the road network causing damages to roads, bridges and culverts.</p> <p>Climate change impacts in the road sector lead to loss of human lives, increasing economic costs for the country, and often results in rural populations being cut off from markets and services, with the associated harmful effects on rural income and welfare.</p> <p>To address the problem of climate change, the Government has asked the Implementing Agency to incorporate climate change adaptation considerations into the new national road transport sector program.</p>
<p><b>Problem components</b></p>	<p><b>Component 1: Improvement of main productive roads and rural feeder roads;</b> this includes design and construction to upgrade existing roads, installation of weight stations, and paving of selected unpaved roads.</p>		<p>Support to vulnerability mapping of national road network, planning and prioritizing areas to be improved and upgraded based on climate-change considerations.</p> <p>Climate change considerations to be integrated into the design of upgrades to existing roads. This includes surface materials, flood protection measures, selective raising of road embankments, and rerouting of important roads to avoid potential flooding in low-lying, vulnerable areas.</p> <p>These 'hard' measures will be complemented by measures to adapt maintenance approaches to improve preventative actions such as clearing river channels around bridges and other drainage structures to improve flow characteristics and use of vegetation as a means of improving erosion resistance.</p>

Baseline Business-As-Usual		With Climate Change	
	<p>Component 2: Road maintenance. Works and services that contribute to the conservation of key national roads and important rural roads, as well as institutional strengthening to improve future planning, disaster management and implementation of road maintenance.</p>		<p>Review existing road maintenance procedures with the aim of improving these in the light of climate change considerations. Increase road inspection frequency through involvement of local governments and communities.</p> <p>Adapt maintenance approaches to improve preventative actions such as clearing river channels around bridges and other drainage structures to improve flow characteristics. Use of vegetation and ecosystem management as a means of improving drainage and erosion resistance. Development of an innovative rapid response mechanism to road ruptures and bridge washouts to restore transitivity of affected roads as quickly as possible. This initiative might include the establishment of a fund earmarked for emergency works to reopen roads that have been closed due to climatic events. Administrative procedures would aim to reduce response time and ensure the timely disbursement of funds.</p>
	<p><b>Component 3: Institutional strengthening</b> of national road authorities particularly in the control of weights and dimensions, strengthening the Municipal Road Management (DCM) and the management of the national road network.</p>		<p>Review existing policies and development plan objectives to identify needed policy improvements that will support the implementation of new adaptation strategies.</p> <p>Support to a review of existing engineering design, standards and guidelines. Development of revised standards and norms for road infrastructure (roads, bridges, drainage) with necessary capacity according to projected climate change.</p> <p>Training of staff in vulnerability analysis, climate data and information management and analysis, identification and prioritization of climate change adaptation measures, methods and standards for climate proofing of infrastructure, and hands-on learning from pilot demonstration projects.</p> <p>Awareness raising and field visits for key national and regional stakeholders to showcase technology and its potential as an adaptation measure for the road infrastructure sector.</p>
<b>Costs</b>	<b>Business-As-Usual Development Costs</b>		<b>Additional Adaptation Costs</b>
<b>Financed by</b>	MDB, Bilateral donors, national road authorities		Nordic Development Fund

