REPUBLIC OF FIJI

Post-Disaster Needs Assessment Guidelines

Road Transport Sector

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The Post-Disaster Needs Assessment (PDNA) Guidelines for the Road Transport Sector in the Republic of Fiji were commissioned by the United Nations Development Programme (UNDP). As the general PDNA guidelines cater to a broad range of countries with differences in institutional, cultural and infrastructural systems, adapting the guidelines to the country context can be challenging, before applying them through sector-specific assessments. Accordingly, this document is contextualized for Fiji's road sector and is intended to assist the government officials focused on disaster management and the road sector officials from several departments to collaboratively and comprehensively assess post-disaster needs for the road transport sector.

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List of acronyms

ADB Asian Development Bank

EU European Union

FRA Fiji Roads Authority

FSC Fiji Sugar Corporation

GFDRR Global Facility for Disaster Reduction and Recovery

MPWMST Ministry of Public Works, Meteorological Services & Transport

MRMDDM Ministry of Rural and Maritime Development and Disaster Management

NDMC National Disaster Management Council

NDMO National Disaster Management Office

NEOC National Emergency Operations Centre

NGO non-governmental organization

PDNA Post-Disaster Needs Assessment

SPO Strategic Planning Office

UNDP United Nations Development Programme

1

1 Introduction and background

The post-disaster setting is a complex and demanding environment. It needs a fast-paced response that assesses immediate needs and provides life-saving relief while also assessing the damages and losses and effectively planning for recovery by explicitly considering disaster risk reduction. If such assessment and recovery planning are conducted in silos by various individuals, public agencies and humanitarian donor groups, parallel efforts with varied scope and rigour are duplicated, thereby utilizing more resources with less streamlined outcomes.

> **The need for a quick and efficient response after a disaster means a comprehensive and streamlined strategy across all relevant stakeholders in a Post-Disaster Needs Assessment (PDNA) is critical.**

Understanding this need, in 2008, the European Union (EU), the World Bank and the United Nations Development Group (UNDG) agreed to mobilize member institutions and resources to harmonize post-disaster assessment methods in order to better support governments and affected populations. This agreement led to establishing the PDNA procedural and technical guidelines and the Disaster Recovery Framework guide. These guides were officially launched at the third UN World Conference on Disaster Risk Reduction on 14 March 2015 in Sendai, and have since become part of the systematic approach to developing global stakeholder consensus on the PDNA and the Disaster Recovery Framework, particularly for regions most vulnerable to disaster impacts. (World Bank, 2013).

> **The PDNA is an approach to analysing disaster effects and disaster impact for the purpose of identifying recovery needs, defined from a human, sociocultural, economic and environmental perspective (World Bank, 2013).**

It serves as a common action-oriented platform for analysis within and across sectors. Providing a comprehensive picture of post-disaster conditions and the distinct needs and priorities of different sectors, social groups and subgroups, the PDNA is jointly developed and promoted by the World Bank, the EU, and United Nations systems and agencies. The Global Facility for Disaster Reduction and Recovery (GFDRR) hosts general guidance on the PDNA process, with the PDNA Guidelines Volume A (World Bank, 2013) covering the general methodology and Volume B (Global Facility for Disaster Reduction and Recovery, 2014) focusing on various specific sectors. This new guidance uses the Volume B general guidelines for the road sector as the basis for developing Fiji's context-specific road sector guidelines for PDNA.

The key objective of a PDNA is to provide an empirical basis for evaluating the effects and impacts of the disaster and identifying the post-disaster recovery and reconstruction needs. This informs how national and international donors support post-disaster recovery. As the assessment and recovery strategy developed during the PDNA needs to be completed relatively quickly, it requires comprehensive proactive planning, particularly when assessing damages, losses and recovery needs in the aftermath of large-scale disasters. Since the general PDNA guidelines cater to a broad range of countries with differences in institutional, cultural and infrastructural systems, adapting the guidelines to the country context can be challenging.

In order to bridge the gap, this guidance presents one of the country- and sector-specific guidelines for PDNA and disaster recovery, derived from the general guidelines and contextualized for Fiji's road sector. It is intended to assist the government officials focused on disaster management and the road sector officials from several departments to collaboratively and comprehensively assess post-disaster needs for the road transport sector in Fiji.

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2 Context

The Republic of Fiji (hereinafter Fiji) is an island nation in the South Pacific Melanesia region. It consists of 332 islands, many of them small islets. Around 110 islands are inhabited. Fiji's population, which has seen consistent growth despite proportionately high rates of net outmigration, currently stands at around 900,000 people.

Fiji is exposed to various natural hazards and frequently experiences tropical cyclones and flooding. The country's vulnerability is exacerbated by climate change, which is bringing rising sea levels, more intense cyclones, and flooding, with a variety of secondary effects.

Though Fiji faces relatively low disaster risk levels, ranking 116 out of 191 countries under the INFORM Risk Index 2024,[1] its vulnerability score ranks 77 out of 182 countries according to the 2020 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index.[2]

Fiji has high exposure to flooding, specifically coastal, and very high exposure to tropical storms and their associated hazards. The post-disaster assessment of the impact of floods, conducted by the Government of Fiji, suggests significant losses are caused by both fluvial (2.6 percent of gross domestic product [GDP] per year) and pluvial (1.6 percent of GDP per year) flooding. A very large number of tropical cyclones pass through the Melanesia region of the Pacific Ocean every year. These are of major economic consequence to Fiji, costing the nation around 5 percent of GDP every year.

Road transport infrastructure and services underpin Fiji's economic growth and social development. Rural industries, such as sugar cane farming and forestry, rely on roads to transport produce from plantations to processing plants. Similarly, tourism is also dependent on access roads. Remote, rural and many island communities in Fiji depend on rural access roads and small island wharves/jetties in order to access economic opportunities and social services. Fiji's topography has restricted the road network to spine or circumferential main roads along the coast with feeder roads, and few alternate routes. Inter-island freight and passenger transport relies on serviceable coastal and island jetties with adequate navigation aids.

The Ministry of Public Works, Meteorological Services & Transport (MPWMST) is responsible for the management of policy, administrative and regulatory activities of all national transport modes. A board-governed corporate body, Fiji Roads Authority (FRA), is the central body responsible for all of Fiji's roads and bridges and for 48 wharves/jetties throughout the country. Assets managed by FRA are shown in Table 1.

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1 See https://drmkc.jrc.ec.europa.eu/inform-index. All country data sets can be downloaded from the link provided on this page.

2 https://gain.nd.edu/our-work/country-index/

Table 1: National road assets by division

Division	National roads (kms)			Bridges / Cross drainages	Jetties/ wharves/ landings[3]
	Sealed	Unsealed	Total		
Central-Eastern Division	675	1,681	2,356	487	27
Western Division	677	2,406	3,083	488	6
Northern Division	356	1,730	2,086	415	15
Total country	1,707	5,818	7,525	1,390	48

Urban/town roads are managed by the Ministry of Local Government, Housing and Community Development while rural roads are managed by the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM). In Fiji, 'cane access roads' are another category of roads under the aegis of Fiji Sugar Corporation (FSC). While some of those assets are delegated to FRA for maintenance, FSC maintains others. Cane access roads play a critical role in the lives of sugar cane farmers and their families, who constitute a significant portion of the population.

In the past five decades, Fiji has been affected by multiple natural hazards impacting large numbers of people (see Figure 1). In 2012 alone, Fiji experienced two major flooding events and Tropical Cyclone Evan. After Tropical Cyclone Winston, an extremely destructive Category 5 cyclone, hit Fiji in 2016, a formal PDNA was undertaken. The PDNA estimated a damage and loss of F$108.5 Mn to the road sector. It noted damages to land transport assets including: roads; bridge approaches, undermining the structural integrity of bridges and crossings; sea walls; and associated structures, such as bus shelters, signs, traffic signals and street lights. While tropical cyclones of Category 1 to 4 are an almost regular event in Fiji, Tropical Cyclone Yasa, a Category 5 cyclone, hit Fiji in December 2020 and was the most destructive cyclone since Tropical Cyclone Winston in 2016. Tropical Cyclone Yasa triggered flash flooding, landslides and severe coastal inundation of up to 33 feet.

The Cane Access Road Programme is an important scheme run by the Ministry of Sugar Industry. Its objectives are:

1. Upgrading cane access roads to motorable condition to ensure consistent supply of sugar cane to the mills during the crushing season
2. Ensuring that at the end of the season, there is no stand-over cane owing to poor cane access roads.

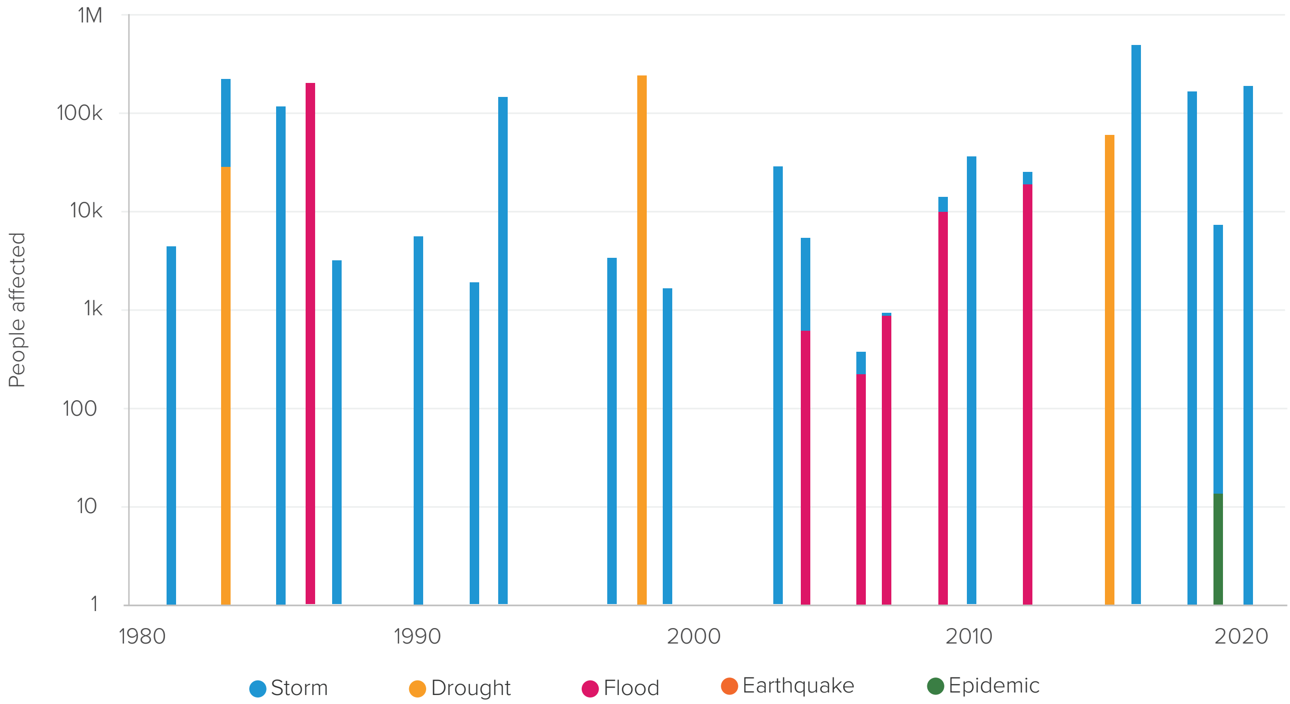
Between 2012 and 2020/2021, the government spent F$37.4 million on the Cane Access Road Programme. For the 2022/2023 financial year, the programme has been allocated F$2.0 million to provide grants for upgrading cane access roads. It aims to:

1. Upgrade 3,422.52 km of cane access roads
2. Repair and maintain crossings
3. Supply culverts as required.

The funds of the Cane Access Road Programme will be administered by Fiji Sugar Corporation, which implements the programme with support from the Sugar Cane Growers Council and the Ministry of Sugar Industry.

3 A few of the jetties and wharves are also owned by Fiji Ports, the Ministry of Forestry, the Ministry of Fisheries, or Government Shipping Services, or are privately owned.

Figure 1: Number of people affected by Fiji's natural hazards (1980-2020)



Source: Center for Excellence in Disaster Management & Humanitarian Action, 2023, Figure 4, page 21.

Conducting a multi-stakeholder PDNA reduces duplication and harmonizes assessment efforts, both of which are critical in the aftermath of a disaster. It also serves as a tool for planning and programming recovery and resource mobilization. For Fiji, the PDNA conducted after Tropical Cyclone Winston was instrumental in highlighting the key gaps in the country's disaster recovery approach at that time and established a process for streamlined reconstruction and recovery efforts.

The assessment of damage and loss in various sectors in Fiji highlights which sectors to prioritize in the Disaster Recovery Framework and how to streamline the short-, medium-, and long-term recovery needs that align with Fiji's overall growth directions.

The PDNA also highlighted the need for a structured process of data collection and management for assessing damages and losses, and for capacity-building among the line ministries and executing agencies such as MPWMST, FRA, MRMDDM, FSC, the National Disaster Controller, Divisional Commissioners, and Provincial and District Officers who all have a critical role in the disaster preparedness, management and recovery process.

This guidance will support Fiji government officials in conducting a systemic PDNA for the road sector. Outputs from an assessment in the road sector will synergize within a common PDNA framework with outputs from assessments in other sectors. This will facilitate meta-synthesis and help plan coordinated post-disaster recovery actions.

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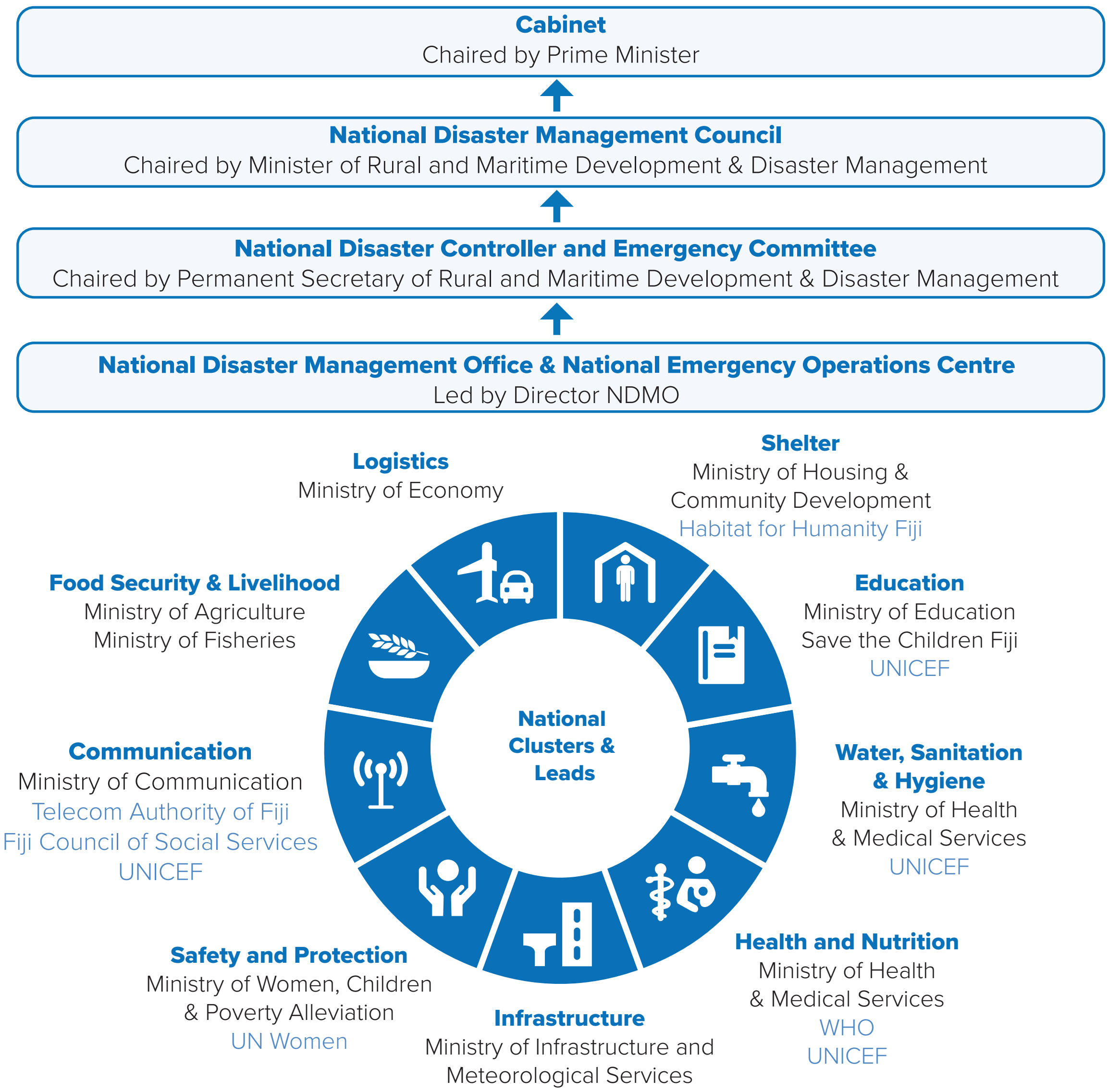
3 Fiji's current post-disaster assessment and recovery approach

The national disaster management structure is defined by the Natural Disaster Management Act 1998 and the National Disaster Management Plan 1995, which describe the governance and institutional arrangements for disaster risk management in Fiji. The National Disaster Management Council (NDMC) is the overarching disaster management body responsible for ensuring policy coherence. The National Disaster Management Office (NDMO) is the chief implementing organization for disaster risk management and response. It is active in both coordinating response and formulating policy by advising the Cabinet, the NDMC and the National Disaster Controller. The NDMO is under the jurisdiction of MRMDDM.

Figure 2 represents the organizational structure of the national disaster response, including the leads and co-leads for the national cluster system.

Figure 2: Fiji's national disaster management structure



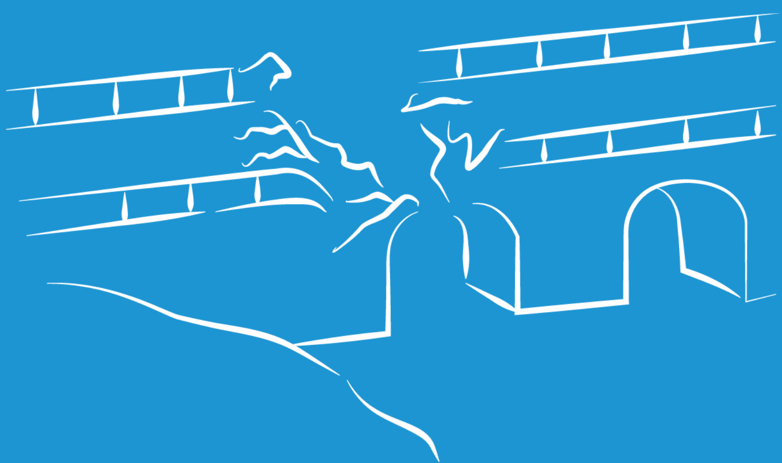
Source: Center for Excellence in Disaster Management & Humanitarian Action, 2023, Figure 7, page 32.

The NDMO implements NDMC policies and establishes the National Emergency Operations Centre (NEOC) during emergencies. When a disaster is declared, the NDMO gathers information on the event from the meteorological services or other interested agencies and manages communication among government agencies regarding the threat, conditions and response actions. It is also responsible for communicating with the mass media.

When early warning mechanisms signal the potential for an extreme event, the NDMO is responsible for communicating key messages, activating and running the NEOC, and supervising the operation of provincial and district emergency operations centres. Although a lot of work occurs within the division-province-district-village structure, in practice these local emergency operations centres are frequently insufficiently resourced or manned to handle a full-scale disaster.

The NEOC accommodates personnel from ministries and agencies relevant to the emergency to ensure communication and information-sharing is centralized and streamlined. In addition to government ministries and their agencies, the national response capacity in Fiji includes an active network of humanitarian partners, including United Nations agencies, non-governmental organizations (NGOs) and the Red Cross.

4

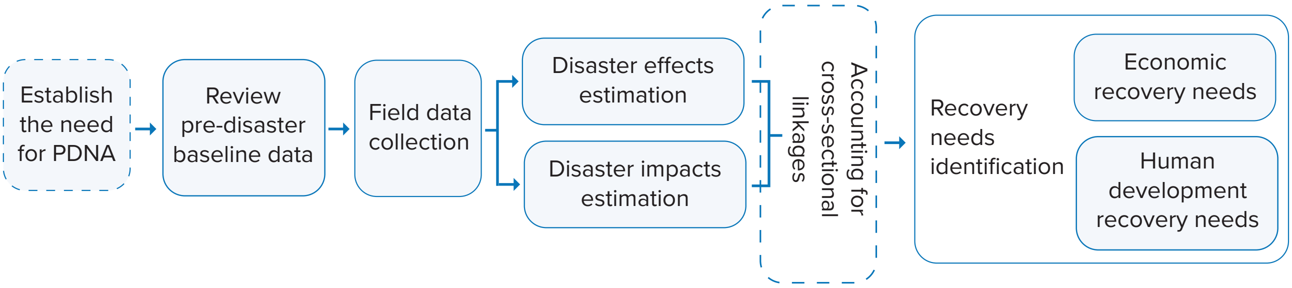


4 Overall approach

The PDNA approach (Figure 3) has four key components:

- reviewing pre-disaster conditions
- collecting data
- estimating effects and impacts
- identifying recovery needs.

Figure 3: PDNA approach



Source: Adapted from Global Facility for Disaster Reduction and Recovery, 2015

The overall process is preceded by a standard procedure of identifying whether a PDNA is needed based on the disaster context. When conducting a PDNA for a specific sector (in this case, the road sector), accounting for cross-sectoral linkages is critical throughout the impact and effect assessment and the recovery needs identification.

The approach presented in this document follows the PDNA approach set out in Volumes A and B of the PDNA guides (Global Facility for Disaster Reduction and Recovery, 2014; World Bank, 2013), where Volume A presents the general PDNA guidelines and Volume B presents the transportation sector-specific guidelines applicable to all countries.

In this guidance, specific standard operating procedures (SOPs) for carrying out each step of the PDNA are presented, tailored to the context of the road sector and jetty infrastructure in Fiji. The next section (section 5) goes over the specific process to be followed to successfully execute the framework, followed by a detailed methodology describing each step. The overall intention is for the participating agencies to adopt each methodological step as they carry out dynamic reviews of various process aspects over time. This is essential to ensure that the guidance is helpful in the long term.

The first step in the PDNA process (after the need for it has been identified) is to assess the pre-disaster situation, creating a baseline for comparison with the post-disaster damages and impacts.

This process also supports optimized recovery efforts by pairing the damage assessment with the existing vulnerability assessment of the system, thus allowing assets that are highly vulnerable to high damage to be prioritized for building back better.

The pre-disaster baseline assessment also guides which context-relevant stakeholders to invite into the assessment process. After verifying the baseline data and identifying the key stakeholders to be involved in the PDNA, the next step is to collect the post-disaster data. This includes training the PDNA team on the process and drafting the logistics plan for data collection – involving but not limited to an aerial assessment, identification of the best mode of transportation to access the affected regions, and establishing communication systems and back-ups.

Once the data have been collected, they will be integrated into a digital platform with the baseline data to assess the damages and losses. The assessment includes estimating immediate effects on physical infrastructure systems, traffic flows, governance and decision-making processes, and how the general vulnerabilities of the region have changed due to the specific disaster. The assessment also includes estimating the disaster's long-term macroeconomic and human impacts. Estimating immediate and long-term impacts requires an overarching understanding of the cross-sectional linkages and associated impacts. The outcomes are then used to inform the disaster response and recovery process.

5

5 Standard operating procedures for PDNA

This section goes over the SOPs necessary to initiate and conduct a successful PDNA in Fiji. This includes the chronological assignment of relevant ministries and officials to different stages of the PDNA process.

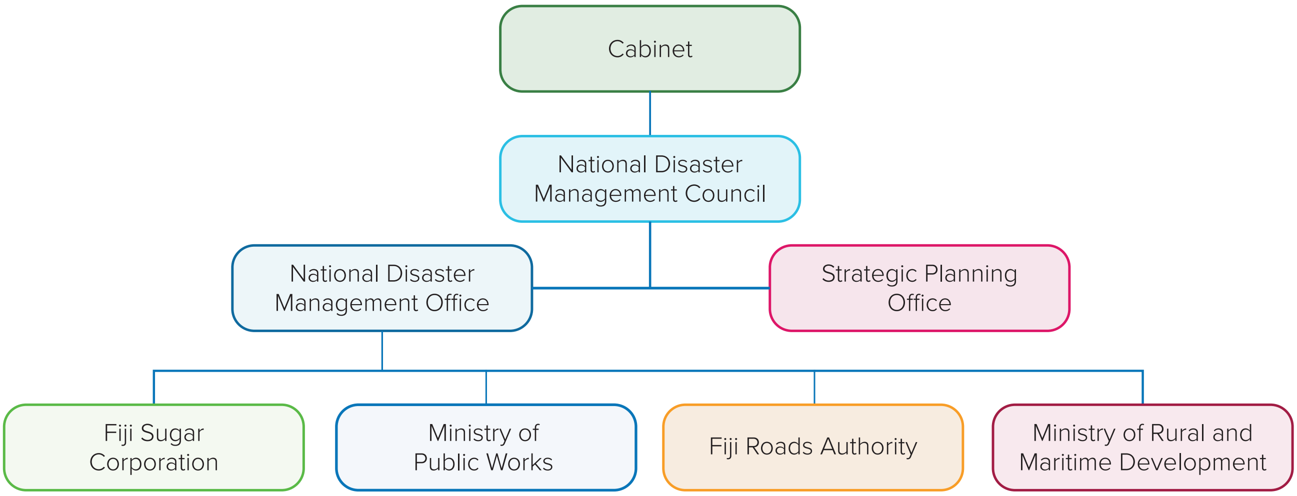
5.1 Key stakeholders

In order to manage the disaster, the NDMO and the NEOC function under MRMDDM. Either the NDMO or the NEOC is assisted by Disaster Service Liaison Officers from government agencies acting as the main points of contact for liaison and coordination. At the division and district levels, the Divisional Commissioner and the District Officer, respectively, are responsible for the emergency operation, in close coordination with the National Disaster Controller and either the NDMO or the NEOC.

Divisional Commissioners have the overall authority to manage and direct disaster emergency operations within their respective divisions and are subordinate to the National Disaster Controller and the NDMC Emergency Committee. However, the Commissioner has the autonomy to activate Divisional Emergency Operations if a warning of an approaching disaster is issued, and the powers to control all agency resources within the Division. Specifically for the land transportation sector (roads) and small island wharves/jetties, the key stakeholders to collaborate with are the NDMO, the NEOC, the Divisional Commissioners and the District Officers along with representatives from MPWMST, FRA and other authorities. The departments shown in the organizational chart (Figure 4) will play a critical role in undertaking a PDNA in the road sector.

Other stakeholders relevant to the PDNA assessment and recovery planning for the road sector will be from the Ministry of Local Government, Housing and Community Development (formerly the Ministry of Local Government, Housing and Environment). Given that the road sector is closely linked to Fiji's economic growth, the Ministry of Economy should be kept up to date on the damage and loss assessment to ensure it has the most accurate information to assess the economic impacts of the damages to strategic roads and jetties/wharves.

Figure 4: Organizational chart relevant to the road sector PDNA assessment process



Source: Author's own elaboration.

Following an event of sufficient magnitude and impact, the Strategic Planning Office (SPO) will work with the NDMO to submit a proposal to the NDMC for a PDNA to be conducted. Once the NDMC endorses it to do so, the SPO will draft a Cabinet Paper to be presented to Cabinet by the Minister for Rural and Maritime Development and Disaster Management in his/her capacity as Chair of the NDMC, for Cabinet's approval for the PDNA process to commence.

The SPO will work with the NDMO to direct and coordinate the road sector agencies and stakeholders during the PDNA process, using the NDMO's convening and coordination powers during disasters as stipulated under the Natural Disaster Management Act 1998. Thus, all road sector agencies such as FSC, the Ministry of Public Works, FRA and MRMDDM will work with the SPO through the NDMO's disaster governance structure on the initial and intermediate stages of a PDNA, typically right up to the data gathering and consolidation phases.

Once the required data have been gathered, the SPO will be responsible for analysing and developing the PDNA report and recommendations to guide long-term disaster recovery and reconstruction efforts.

5.2 Timeline for PDNA

Table 2 presents the PDNA process along with the recommended timeline. The tasks are divided into six categories:

» pre-PDNA activities

» PDNA preparation

» data collection

» analysis

» review

» PDNA completion.

The completed PDNA is then used to develop the recovery strategy, through the process outlined in the Disaster Recovery Framework guide. The chronological process is developed based on the timeline set in PDNA best practices and is contextualized here for the road sector's PDNA process.

Table 2: PDNA process and timeline tailored to the road sector

<table>
<tr><th>Task category</th><th>Task</th><th>Time needed</th><th>Outcome</th><th>Lead agency</th><th>Other involved agencies</th></tr>
<tr><td rowspan="3">Pre-PDNA activities</td><td>Immediately after the disaster (State of Emergency), the NDMO convenes the NEOC.</td><td>1-2 days</td><td>Convenes all Disaster Service Liaison Officers into the NEOC

Plans out the response initiatives, including the timeline</td><td>MRMDDM</td><td>Ministry of Finance

SPO

Ministry of Foreign Affairs

Emergency services (police, fire, navy)

Ministry of Health

Ministry of Agriculture

Ministry of Transport

Ministry of Housing</td></tr>
<tr><td colspan="5">This is where the demarcation of roles between the NDMO and the SPO begins. Ideally, the SPO will take the lead from this stage, including in preparing the PDNA Cabinet Paper in collaboration with the NDMO and informing government agencies of the Cabinet’s approval for a PDNA to be conducted.</td></tr>
<tr><td>The SPO submits a Cabinet Paper recommending the use of PDNA in coordination with the SPO.

If the need for a PDNA is approved, the NEOC sends a request to the MPWMST and Divisional Commissioners.</td><td>1-3 days</td><td>PDNA request letter sent and other local and global agencies such as UNDP, Asian Development Bank (ADB), and the World Bank are also informed</td><td>Ministry of Finance

SPO</td><td>Disaster Service Liaison Officers and officials at the Commissioner’s Office</td></tr>
</table>

Task category	Task	Time needed	Outcome	Lead agency	Other involved agencies
Pre-PDNA activities	Government (via Cabinet approval) makes a decision to conduct the PDNA, including one for the road sector. The SPO takes the lead role and immediately communicates the decision to the relevant line ministries / agencies (Department of Roads / FRA / MPWMST) and Divisional Commissioners.	1-3 days	Official letter indicating intent to conduct PDNA	SPO	MPWMST, FRA, UNDP, ADB, the World Bank and other relevant agencies
	The NDMO can assist the SPO with arranging coordination meetings with the relevant stakeholders, using its networks. These coordination meetings are scheduled with representatives from the identified stakeholder list such as MPWMST, Divisional Commissioners, District Officers and international disaster management experts in the road sector from the global agencies.	1 day	Meeting invitation sent to the representatives of the stakeholder agencies	SPO	MPWMST, FRA, Divisional Commissioners, Provincial and District Officers, UNDP, ADB, the World Bank and other relevant agencies

Task category	Task	Time needed	Outcome	Lead agency	Other involved agencies
Pre-PDNA activities	The SPO takes the lead here and the NDMO assists. The NDMO can provide the general disaster situation briefing while the SPO presents the PDNA component. In the coordination meeting, using the information from Disaster Service Liaison Officers, the SPO provides a detailed briefing on the disaster situation, presents the need to conduct PDNA for the road sector (among other identified sectors) and proposes/ identifies the team for the broader PDNA and for the road sector PDNA (in coordination with the sector-specific representatives).	1-2 days	Coordination meeting minutes; PDNA agreement; tentative national and road sector PDNA team (along with other sector-specific teams)	SPO	Ministry of Infrastructure and Transport, FRA, Divisional Commissioners, Provincial and District Officers, UNDP, ADB, the World Bank and other relevant agencies

Task category	Task	Time needed	Outcome	Lead agency	Other involved agencies
PDNA preparation	The SPO, with support from the NDMO, prepares the logistics plan such as budgeting, human resources, information systems and training to conduct a PDNA in the road sector. (Similar steps will be undertaken in parallel for other identified sectors.) This preparation is done in collaboration with the Ministry of Infrastructure and Transport, FRA, MPWMST, Provincial and District teams, and FSC (for cane access roads).	1-2 days	Budget agreement; resource agreement (information and human resources); training plan agreement	NEOC, MPWMST, FRA	Divisional Commissioners, District Officers, UNDP, ADB, the World Bank and other relevant agencies
	The SPO leads and the NDMO assists (supported by the United Nations, ADB, the World Bank) the PDNA training for MPWMST, FRA and the Provincial and District team on assessing the collected data (training the assessment team for the road sector).	1 day	PDNA training notes; official nomination and mission letters with terms of reference for the assessment team	SPO	Divisional Commissioners, Provincial and District Officers, UNDP, ADB, the World Bank and other relevant agencies
	PDNA team reviews and updates baseline data on the road sector.	1 day	MPWMST, FRA baseline data	MPWMST, FRA (PDNA team)	Divisional Commissioners, District Officers and local NGOs
	National PDNA team briefs local road sector PDNA team on the schedule of field data collection by the latter.	1 day	Data collection schedule; travel plans	MPWMST, FRA (PDNA team)	Divisional Commissioners, Provincial and District Officers and local NGOs

Task category	Task	Time needed	Outcome	Lead agency	Other involved agencies
PDNA data collection	Data collection by the district authorities under the supervision of the PDNA team, consultation of the public and other agencies, field visits carried out by the road sector PDNA team.	4-7 days	Field damage and loss data sheets	MPWMST, FRA (PDNA team)	Divisional Commissioners, District Officers and local NGOs
PDNA data analysis	The PDNA team cross-checks, validates and synthesizes the collected disaster and loss data into aggregate assessments.	1-2 days	Synthesized damage and loss assessments at the district, divisional and national levels	MPWMST, FRA (PDNA team)	NEOC, UNDP, ADB, World Bank and other relevant agencies (disaster specialists)
PDNA review	SPO validates the damage and loss assessment completed by the PDNA team.	1 day	Reviewed damage and loss assessment	SPO Finance	MPWMST, FRA (PDNA team)
	The road sector PDNA team submits the PDNA report to the SPO and the NDMO.	1 day	Draft PDNA report for the road sector	MPWMST, FRA (PDNA team)	UNDP, ADB, the World Bank and other relevant agencies (disaster specialists)
	The SPO cross-checks the road sector PDNA report with other sectors interacting with the road sector to ensure cross-cutting priorities and identified and recovery needs are synchronized across sectors. Once complete, the Cabinet Subcommittee on Budget (CSB) endorses the revised PDNA report and shares it with all relevant ministries and other stakeholders.	1-3 days	Revised PDNA report for the road sector	SPO Finance	MPWMST, FRA, UNDP, ADB, the World Bank and other relevant agencies (disaster specialists)

Task category	Task	Time needed	Outcome	Lead agency	Other involved agencies
PDNA completion	SPO synthesizes reviews from all consultations and creates and signs the final PDNA report.	1-3 days	Final signed PDNA report	SPO	MPWMST, FRA, UNDP, ADB, the World Bank and other relevant agencies (disaster specialists)
		30-37 days (allowing for buffer time)			

Note: If the timeline presented in Table 2 is to be followed successfully by Fijian officials, it will have to rely on quality baseline data already collected and frequently updated. Learnings from previous PDNAs have indicated the lack of pre-existing reliable baseline data as a major roadblock in successfully conducting a PDNA in a timely manner.

6

6 PDNA methodology

As PDNA is a data-driven exercise (covering both quantitative and qualitative data) focused on assessing and reporting damages and losses, it is important to keep in mind the SOPs for collecting, analysing, updating and sharing the data. Only then can the PDNA become a foundation to plan responses, prepare reconstruction plans and introduce other recovery measures. The PDNA data analysis and review steps discussed in Table 2 mention the procedures that the Fijian officials need to take to:

1. review and update the baseline data
2. collect and validate the data on damage
3. assess and aggregate the damage and loss data at various levels (provincial and national levels).

The data collected need to be disseminated to all relevant stakeholders and to be stored at an accessible location for any stakeholder to use at a later date. The data also need to be accessible in case of a future disaster in which this data set might be useful for gaining insights.

The PDNA provides the methodological framework for assessing damages and post-disaster recovery needs in a way that can provide inputs to planning coordinated recovery responses and building disaster risk resilience. Conducting a PDNA involves a range of steps, starting with understanding the pre-disaster situation. This, *inter alia*, involves:

1. Developing (when not already available), reviewing and updating the baseline data.
2. Collecting post-disaster damage and loss data for each sector through the institutions. In this case, data collection through MPWMST, FRA, FSC and other involved agencies.
3. Verifying the damage and loss data through field visits in a sample of affected locations.
4. Integrating damage and loss data with the baseline data to infer disaster effects.
5. Conducting assessments using the baseline (pre-disaster) and damage and loss (post-disaster) data. This includes calculating and aggregating the damage and loss data at the national and subnational levels, as required.
6. Assessing disaster effects and impact using damage and loss data (quantitative and qualitative).
7. Identifying the key recovery needs based on the evidence gathered.
8. Formulating a recovery strategy and delineating recovery actions.

The next sections describe in detail the steps that Fijian officials must take to apply the PDNA methodology for the road sector.

6.1 Pre-disaster situation

To accurately assess the damages caused by a disaster, it is critical to establish the system's pre-disaster baseline conditions. The key steps for this process start with identifying the divisions of Fiji affected by the disaster, thus focusing on those regions for baseline data review and damage data collection. The next step is to bring together the government officials from these divisions who manage the road sector and jetty assets and who can provide accurate information about the pre-disaster conditions in the regions.

A detailed inventory of Fiji's road and jetty infrastructure already exists and can be obtained from MPWMST/FRA, Provincial/District Road Agencies and FSC. This inventory will serve as the starting point for the baseline data. In Fiji, cane access roads are under the aegis of FSC, with some of these assets delegated to FRA for maintenance. These (mostly dirt) roads play a critical role in the lives of sugar cane farmers and their families, providing a vital link for cane trucks to the sugar mill. They also serve as the only pathway for children to reach school and for people who are sick to get to hospital. During natural disasters such as cyclones and floods, cane access roads may be the only access routes for relief supplies.

This existing baseline data inventory reduces the effort needed to gather the baseline data as part of the PDNA process and improves data reliability, as collecting pre-disaster information after a disaster might rely on memory, which could lead to human errors in the damage estimation. As the damage and loss assessment is carried out relative to the baseline pre-disaster situation, the asset inventory collected in the baseline data set will be used to check for damages and loss. For example, having the inventory of all the critical road segments will allow for the PDNA assessment team to ensure these road segments are assessed for any damages. Hence a comprehensive inventory of road assets in the baseline data collection process is important for more reliable PDNA results. In order to utilize the data for any future PDNAs, it will be important to ensure that the database is updated. Table 3 presents a short checklist to be distributed to the different road agencies to help them identify the places in the existing baseline data that might need updating before post-disaster data collection.

Once the review and revision of the baseline data on the pre-disaster conditions of the road sector are complete, these baseline data are shared with the PDNA team.

Table 3: Baseline data review sheet

Baseline data review sheet (for different road management agencies)

- Division/ Province
- Year of the last update to the baseline data: XXXX
- Year of disaster: YYYY

Select the actions conducted between years XXXX and YYYY:

Action	Check [✓]	If checked, updates needed in the section	Relevant ministries/ organization to get updates from
New national roads constructed	[ ]	Whole of Fiji, national roads 1. Sealed 2. Unsealed	FRA
New rural roads constructed	[ ]	Whole of Fiji, rural road network	Ministry of Local Government, Housing and Community Development
New municipal roads constructed	[ ]	Whole of Fiji, municipal road network	MRMDDM
Cane access roads constructed	[ ]	Whole of Fiji	FSC
New jetties/wharves	[ ]	Whole of Fiji	FRA and others
New equipment acquired	[ ]	Other public assets	FRA

6.2 Data collection process

The steps of the data collection process are as follows:

1. PDNA team formation
2. Training
   a. Team collaboration training
   b. Baseline data usage training
   c. Damage and loss templates usage training
3. Field visit
4. Data integration

The data collection process begins with forming the PDNA team. The team is then trained on the PDNA process (including the cross-sectoral collaboration processes, baseline data use, and field data collection template use), then conducts the field visit, and finally integrates the collected data with the baseline data. The data collection process through field visits for the PDNA should also serve to triangulate the existing information, especially in the case of incomplete or obsolete existing baseline data sets. The following subsections describe each step of the data collection process in detail.

6.2.1 PDNA team formation

Forming the PDNA team is the first step in the post-disaster data collection process. The team should comprise the set of stakeholders identified in section 5.1.

> **It is important to maintain a balance between creating a comprehensive set of stakeholders involved in this process and keeping the team size manageable to ensure swift processing.**

The PDNA team needs to be composed of members with the expertise presented in Table 4.

Table 4: Required expertise for the PDNA team

Personnel	Role in PDNA implementation
PDNA-trained technical staff (road engineers, structural engineers, city planners, transport economists strongly encouraged) assigned by their line ministries They must all be familiar with procurement, construction, repair, costs of equipment and materials, and replacement of other assets. Knowledge of economic flows or losses, including estimating foregone incomes and additional costs and impacts on respective sectors, is also recommended.	Lead and coordinate.
Staff from FRA, FSC, provincial and local road departments and who are familiar with physical infrastructure, building/construction, equipment, unit costs, procurement etc. for roads, bridges and jetties/wharves	Validate baseline information and facilitate field assessment of damage and losses.
Deputation of local government officials/officers (from the affected commune/district, FSC) who are conversant with the affected areas and are from a sector closely connected with the road, bridges and jetties/wharves	Facilitate field assessment of indirect losses and impacts on other systems due to the road sector damage.
Development partners, private sector (if active in the sector)	Participate in field assessment and provide input to, and validation of, the immediate effects and long-term impact on community due to the road sector damages.

6.2.2 Training

The PDNA team needs to be trained on some critical aspects of the PDNA process before conducting the data collection field visits. As some team members will have previous training or experience in the process, they can be leveraged as in-house training resources. The key aspects of training the team include presenting a shared understanding of the collaborative nature of the PDNA process, establishing a clear understanding of the pre-disaster baseline conditions, and reviewing the data collection templates for efficient application in the field. As the PDNA for the road transport sector is part of the overall PDNA for the country, the road sector PDNA team needs to work with other sectoral PDNA teams, and others such as the communication team, NEOC support team, and governmental and development partners.

After establishing an understanding with the overall PDNA team, the road sector team will ensure the baseline data are validated, present the damage and loss data collection templates, and explain the overall process for data collection (quantitative and qualitative), integration with the baseline data, and assessing the effects and impact. A short presentation demonstrating this process and some pre-recorded videos accompanying a live training session with a Q&A focus will make the training process more efficient. The appendices present the baseline data with examples and the damage and loss data collection templates for roads as well as jetties/wharves.

6.2.3 Field visit

> **Field visits by the PDNA team, along with synthesizing data collected from local officials, form the basis of the damage and loss assessment and must be conducted comprehensively to ensure accurate estimates.**

This assessment uses a gap analysis approach, whereby the difference between the post-disaster condition and the pre-disaster condition provides an estimate of the damage and losses. If the majority of data collection is to be done by local officials, using the local language when the PDNA team briefly trains them will be helpful in ensuring quality data collection.

It is also important to consider what to do if a comprehensive field visit is not possible. In such cases, sample data collection on a representative section of the region (assessing a set of road segments that have an average traffic count and serve a representative population, and some representative jetties/wharves from across divisions) is needed, accompanied by projections for the rest of the affected areas.

After a disaster, the standard procedures for a field visit will include an initial aerial survey (wherever possible or if the magnitude of the disaster requires it) to identify which regions are worst affected and are likely to have suffered the maximum damage, and to plan an optimal route for further data collection. The next steps will focus on establishing the logistics of the field visit (which can be for certain stretches only), including but not limited to:

- planning for the team to use different available modes of transportation
- communication redundancies
- printing and distributing data collection materials.

As the field visit will be happening after a significant disaster, regular transportation modes and communication systems might be damaged. Hence, back-up plans will be needed to ensure the data collection process runs smoothly. When assessing damage to road assets, the data collection team must be aware of the indirect damage the disaster has caused to the systems, such as weakening of the substructure, increased susceptibility to erosion of pavements, weakened foundations of bridges, and destroyed traffic signs and signals. The technical expertise of the team's transportation engineers will be helpful in this respect.

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The transportation economist and city planner will also need to observe changes in the travel patterns with additional detours or complete disconnection of communities from essential services and similar disruptions to freight movement due to the observed road damages.

6.2.4 Data integration

Once the data have been collected in the damage and loss templates from the field visit, the team will consolidate the data with the baseline data on the pre-disaster conditions and the associated costs of replacement and rehabilitation to estimate the damage and losses. The cost values in the baseline data set should reflect the pre-disaster cost values (i.e. unaffected by the disaster conditions). A review of unit costs of repair and replacement in light of changes in the prices over time since the baseline data were collected is needed to estimate the damage values more accurately. In the absence of new information, the unit cost estimates collected in the baseline data collection can be used. The field data collected using the templates provided in the appendix should then be aggregated in a tabular format (Table 5).

Table 5: Roads damage data synthesis template

	Paved (Bituminous)			**Concrete**			**Gravel**		
Category	Length completely damaged (km)	Length with medium damage (km)	Length with light damage (km)	Length completely damaged (km)	Length with medium damage (km)	Length with light damage (km)	Length completely damaged (km)	Length with medium damage (km)	Length with light damage (km)
National roads									
Cane access roads									
Other categories									
Total									

Categorizing damage into complete damage, medium damage or light damage is consistent with the existing damage assessment approach of FRA and other road management agencies. A description of what constitutes each type of damage is provided in the appendix along with the field data collection sheet, to ensure the information is readily available to the officials collecting data. Using the baseline data on the cost of reconstruction (for completely damaged roads) and rehabilitation (for partially damaged roads), the damage cost for each category of road segment can be calculated.

Similar integration of the data on jetties/wharves (Table 6), bridges, culverts and other road sector assets will provide total damage costs in each category.

Table 6: Wharves/jetties synthesis template

Division	Number of wharves	Number of jetties	Number of landings	Total numbers

As transportation is based on derived demand, the data integration should also investigate integrating the damages data for roads, bridges, culverts and jetties/wharves with their impact on other sectors such as health (access to hospitals), education (access to schools) and the national/local economy (agriculture and other sectors affected by reduced mobility).

Integrating this information will require collaboration with the other PDNA sector teams. Such collaborative outcomes will synergize rapid assessment findings to (a) derive the immediate effects and the medium-to-long-term impact, and (b) prioritize recovery efforts accordingly.

6.3 Disaster effects estimation

The disaster effects on roads and jetties fall into four categories:

» total or partial destruction of physical assets (damages)

» disruption to the production of, and access to, goods and services; changes in transportation flow; and direct losses to the transport sector (losses)

» effect on governance and decision-making

» effect on general risk and vulnerabilities.

The monetary effects of the disaster primarily cover the first two categories. Damage refers to either the total or partial destruction of the piece of infrastructure, physical assets, equipment, stocks and capital.

Damages are valued first in physical terms – number, size (length, area, surface, or weight) – and then in monetary value.

Damage is estimated through the cost to repair partially destroyed roads, structures (bridges, culverts, sea walls, rip raps), jetties/wharves, equipment and other assets to pre-disaster condition, and the cost to replace completely destroyed structures, equipment, materials, supplies and other assets to pre-disaster condition, valued at market prices prevailing just before the disaster. Any additional costs to upgrade or improve the condition of buildings and their contents are computed at a later stage when addressing recovery needs.

'Loss' refers to changes in economic flow (income and expenditure) arising from the disaster.

Losses are expressed in current monetary values of foregone revenues or income during the recovery and rehabilitation stages, at the current value of goods and services that were not and/or will not be produced due to the disaster until full recovery is attained. They include:

» a decline in output in the productive sectors, higher production and operational costs, lower revenues, and increased demand for social services by the affected population

- changes in the production of, and access to, goods and services, at current market prices
- additional costs to maintain the administrative, policy and planning functions of the government
- additional expenses to clean up the debris of destruction, retrieve buried assets and restore facilities, roads, water systems, buildings, etc.
- increased expenditures for managing new risks arising from the disaster.

The direct loss to the transport sector mainly relates to higher vehicle operating costs and increased passenger travel times along key national corridors, which can be disrupted due to the presence of debris on roads, or bridge washouts and approach scouring. The impact of the disaster on the tourism industry, which is a major source of income for Fiji, also leads to direct loss to the transport sector in terms of reduced travel, hence reduced toll collections and fuel tax income. Damage to rural roads leads to lack of access to agricultural fields and households, higher vehicle operating costs, longer freight and passenger travel times, and improvised substandard repairs for short-term transport needs.

The most recent Category 5 Tropical Cyclone Yasa impacted the transport sector heavily, with 72 roads in the country closed due to fallen trees, power lines and flooding at a total estimated loss of around F$500 million. The increased travel time, especially on worsened road conditions, also resulted in higher fuel consumption and faster vehicle deterioration. Generally, the PDNA process faced challenges in estimating the losses due to a lack of traffic data. It is therefore critical to collect such data as a baseline for a faster and more accurate PDNA.

The value of damages and loss is assessed using the field data collected post-disaster, and the baseline cost and condition data collected pre-PDNA. Table 5, along with similar integrated tables of other road infrastructure, is used to estimate the total damages, by adding up the damages across different components.

To estimate the losses, the key details to gather after the disaster are the volume of traffic flows, the resulting higher unit operating costs of vehicles, and the time required for the rehabilitation or reconstruction of roads.

The volume of traffic flows is gathered in the baseline condition data, with average daily users for the key roads, bridges and jetties/wharves recorded. To calculate the higher unit operating costs, the PDNA team will need to identify how long it will take for the roads to be reconstructed/rehabilitated. The generally accepted time periods range from a minimum of three months for full rehabilitation, to about six months for the construction of alternate short road sections, and one to five years for full reconstruction (which may involve mitigation works through redesign and reinforcement) of the entire road sections (Global Facility for Disaster Reduction and Recovery, 2014). The change in operating cost can be estimated using the standard values of marginal operating costs based on type of vehicle. United Nations Economic Commission for Latin America and the Caribbean information on the subject is presented in Table 7 using US cents per vehicle-kilometre for 2003. When using these data, the costs need to be adjusted for inflation based on the year the PDNA is conducted.

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Table 7: Marginal operating costs in US cents based on vehicle and road type (2003 US$ value)

Type of road	Type of terrain	Type of vehicle				
		Cars and other light vehicles	Medium-sized buses	Large buses	Flatbed and other trucks	Rigs and trailer trucks
Paved roads	Flat	29–32	63–69	80–91	107–126	139–154
	Undulating	30–33	65–75	112–120	125–156	155–181
	Mountainous	31–34	69–80	144–157	156–182	156–225
Gravel roads	Flat	44–56	106–126	135–163	179–220	203–243
	Undulating	49–63	111–136	157–189	180–225	204–267
	Mountainous	46–67	114–144	197–234	184–249	207–246
Dirt roads	Flat	44–56	90–111	125–147	179–223	203–243
	Undulating	45–63	92–113	127–162	180–226	206–246
	Mountainous	46–57	96–113	134–176	184–249	207–267

Source: Global Facility for Disaster Reduction and Recovery, 2014

The region's transportation experts can also use a different source for this information, if it provides more up-to-date and contextually focused information. For example, academic research in the neighbourhood universities might be a good source of such information.

6.3.1 Findings

A significant component of loss is the cost of removing debris such as accumulated sand, uprooted trees, gantry, towers, poles, traffic signs, hoardings and street lights. The volume of debris can be obtained from the field data, while the unit costs of debris removal can be obtained from the baseline data or expert input.

In order to estimate the disaster-related loss to the administrative and government systems, inputs from the NEOC and PDNA teams are needed. The losses include but are not limited to additional costs to manage the post-disaster planning, and compensation for the temporary staff required for immediate support.

Major disasters such as extreme floods and storms can cause long-term vulnerabilities in the system, from both a social and infrastructure perspective. Firstly, by affecting the regular economy, disrupting transportation used by the working class to reach their jobs, and disconnecting people from hospitals and other critical services and schools, such disasters reduce the community's capacity to respond to another similar or even minor event in the near term. Secondly, the physical infrastructure also sustains long-term vulnerability. For example, a significant flood event can weaken the substructure of a roadway, meaning even smaller rain events in the future could cause landslides. A tropical cyclone can weaken sea wall structures and coastal protection works, eventually leading to wash away of coastal roads.

To manage the immediate effects of the disaster on the general risk and vulnerability of the system, the PDNA team must be able to identify the nuances across different overlapping disasters in the affected region, understand its socio-economic demographics and account for the effects in the team's assessment.

High tidal waves, storm surges and winds during tropical storm events can impact the structural integrity of fixed jetties and weaken the support systems used in floating jetties such as piles, cables or chains with an anchor. The entire system of pontoons and gangway roofs/hand railings can be dislodged due to high-speed winds, while shore protection works, break waters and fenders can be washed away by high waves and winds.

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After the disaster, a re-assessment of the major disaster maps is needed. This will also ensure that disaster mapping is carried out for the regions previously not flagged as at risk.

6.4 Disaster impact assessment

While the main objective of the road sector PDNA is to estimate the damage and losses, the road sector assessment team also needs to provide a cursory estimation of the impacts of the disaster and subsequent transportation disruptions on the macroeconomy and human development in Fiji. The detailed macroeconomic assessment is then carried out by a separate team focused specifically on assessing the overall impact of the disaster across all sectors on the macroeconomy and human development in the country. The road transport sector PDNA team therefore needs to provide the necessary information so that the macroeconomic assessment team can accurately attribute the road sector's impacts.

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Fiji's economy has almost doubled in the last 10 years, with real per capita incomes rising every year. Growth has been broad-based and spurred by record tourist arrivals, a booming construction industry, strong consumption, and thriving manufacturing, finance and transportation sectors (Fiji, Ministry of Economy, 2017). The agriculture sector relies on road transport for exports, the tourism sector depends on international air carriers and water and road transport, manufacturing relies on road and water transport to deliver the materials needed and export finished products, and the construction sector relies on water and road transport to deliver materials (Fiji, Ministry of Economy, 2017). Hence, disruption to transportation can directly impact the revenue generated by these sectors. As the macroeconomic assessment team (which is part of the PDNA team) develops its assessment, the road sector PDNA team needs to be aware of the elements being assessed and contribute its road sector input for each segment.

To estimate total disaster impact, two components are typically assessed:

1. Macroeconomic impacts

These look at the post-disaster performance of three key indicators:

i. Gross domestic product (GDP): The impact on GDP refers to the temporary negative economic repercussions of disaster losses, and the positive effects on construction and other sectors of the economy. The impact of damage on gross investments is measured in the following years as asset restoration or replacement commences (depending on construction sector capacity and available financial resources). The labour needed for road sector rehabilitation should be included in this assessment.

ii. The balance of payments (BoP): The impact on the BoP involves estimating possible increases/decreases in imports/exports arising from the disaster, as well as possible reinsurance payments and relief donations from the international community. The transport sector damage assessment should include the necessary breakdowns so that estimations can be made of the value of rehabilitation and reconstruction items that must be imported from abroad – including equipment, machinery, construction materials and skilled labour – due to the absence of domestic production (Global Facility for Disaster Reduction and Recovery, 2014).

iii. The fiscal sector: The analysis of disaster impact on the public-sector budget is estimated in terms of increased operational costs and lower revenues; wherever the public sector directly owns sectoral enterprises, its budget would sustain losses. The impact of losses on the government budget must be ascertained in terms of increased operational costs and lower revenues when the government directly owns transport enterprises and services.

2. Human and social impacts

These represent the disruption of normal livelihoods and income, as well as access to goods and basic services persisting long after physical reconstruction.

> **Human impact is measured using social and personal welfare indicators such as changes to living conditions, livelihoods and employment opportunities, food security, women's participation in decision-making processes, and social inclusion.**

Personal and household income loss and employment may also be measured. The effect of people being unable to access the workplace, resulting in a loss of person-days and hence wages, should be assessed as part of this segment.

Additionally, when the transport sector assessment team has completed the estimation of higher transport costs faced by households and individuals when using private transport means (i.e. their vehicles), such additional expenses are to be delivered to the assessment team in charge of analysing disaster impact on human development (Global Facility for Disaster Reduction and Recovery, 2014). Transport sector damages can worsen this by blocking the distribution routes and access to key social services such as health and education. It is important that transport sector PDNA officials take note of the social services and informal job spaces being disrupted due to road damage and share the information with the human impact analysis team. The information on resumption of job opportunities and essential services due to road recovery is valuable information in recovery planning for the human impact assessment team.

6.5 Recovery and reconstruction needs estimation

The financial requirements or needs for the transport sector's economic recovery are defined as the amount of financing required to ensure the service's progressive return to normalcy. Human development recovery needs in the transport sector are the amount of financing required for affected individual households to continue to have adequate access to transport services without incurring additional costs of living during the recovery and reconstruction stages (Global Facility for Disaster Reduction and Recovery, 2014).

The higher costs associated with these financial and human development recovery needs are to be assessed and accounted for in the separate assessment focused on the economy and human recovery needs assessment (rather than the transportation damage and losses assessment). Nevertheless, the transport sector PDNA team must provide its input in defining the needs related to the transportation sector, being the team closest to the disaster impacts and the road sector. The critical elements of recovery needs, accounting for the intention to build back better, are presented in Figure 5.

Figure 5: Generic elements to be estimated for recovery needs

Recovery needs =

(i) Reconstruction of infrastructure and physical assets in improved condition
+
(ii) Resumption of production of goods
+
(iii) Resumption of access to service delivery
+
(iv) Restoration of governance and decision-making processes
+
(v) Reduction of risks

For each of these elements, the recovery needs should be planned for the short term (one to two years), medium term (around five years) and long term (10–20 years). This timeline should be scaled up for assets that have a longer lifespan. The recovery needs are built on the damage costs but should also incorporate the costs associated with building back better. Hence for each of these categories, the transport PDNA team needs to identify what 'building back better' looks like and provide estimates of the required costs.

For example, elevating certain coastal roads or road segments that are very vulnerable to flooding, establishing sensors and other monitoring systems on the most vulnerable bridges/jetties, rehabilitating the road segments to a higher standard and installing breakwaters alongside coastal roads witnessing regular breaches all need capital investment. They should be accounted for in the recovery needs if the transport PDNA team deems this appropriate.

Using international standards on road condition performance such as the International Roughness Index (used to assess the quality of the road segment, and subsequently used in road maintenance and management programmes) (Arhin, Noel and Ribbiso, 2015) and the Present Serviceability Rating (a visual inspection-based rating system for highways, primarily used in the United States for pavement management) (United States of America, Federal Highway Administration, 2014) and integrating them into the general maintenance of the roadways will reduce future disaster-related damage to the system.

Additionally, establishing climate information, creating cyclone and flood hazard maps, and updating design specifications for traffic signs, gantries, street lights and other structures to accommodate higher wind speeds are important intervention areas. Considering the high number and intensity of tropical cyclones in Fiji, there is a need for a geography-specific road tree planting strategy to incorporate:

- cyclone-resistant species
- configuration of the plantation to reduce wind speed or to minimize damage
- lateral stiffening of plantation blocks
- pre-cyclone pruning to reduce the damaging effect.

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At the jetty site, the wave climate may comprise waves, ocean swells and vessel wash. Jetty/wharf design must therefore consider wave loads – both short-period local wind waves and long-period swells resulting from storm or wind activities offshore as well as high wind speeds. The concrete should be reinforced with hot-dipped galvanized steel or corrosion-resistant steel and provided with adequate covers. The authority managing the jetties and wharves should be equipped with tide tables and early warning systems for safe operations.

Once the impacts of disaster in each category have been estimated, the next step is to prioritize different regions and assets for recovery. This is important due to budget and time constraints, meaning there is a need to prioritize and sequence recovery actions. Various prioritization approaches can be used, but the key aspect to consider is whether the recovery and reconstruction protect communities from future disaster risks. However, additional costs and capacities to reduce disaster risks included in the recovery budget should not inflate it and create long-term development deficits.

6.6 Recovery strategy development

The damage and loss assessment conducted in the PDNA process needs to be summarized into a recovery strategy, which will feed into a detailed recovery framework that provides guidance on how to successfully implement the strategy. As part of the PDNA process, the recovery strategy should focus on identifying priorities, a cost structure, the key stakeholders and an estimated time-frame of reconstruction based on the post-disaster assessment of the affected region. The Disaster Recovery Framework, for which separate guidance is available, will then utilize this strategy and include information on policy and institutional arrangements, financial mechanisms, and monitoring and evaluation of the recovery systems. The recovery strategy should serve as the link between the PDNA assessment results and the Disaster Recovery Framework (World Bank, 2013).

The main elements to include when developing a recovery strategy are:

- **identifying and outlining recovery and reconstruction needs** for the four elements: reconstruction of physical assets, restoring access to goods and services, restoring governance and decision-making, and reducing risk and vulnerabilities
- **identifying the overall vision and guiding principles** agreed upon across stakeholders
- **identifying intended sectoral results**, specifically the priority needs and interventions, recovery costs, expected outputs and intended outcomes
- **developing a broad sectoral implementation strategy** accounting for cross-cutting themes and key assumptions and constraints of the region, focusing on partnership coordination and management, and linking the strategy to development plans.

For the road sector, the approach should follow the outline set out in Volume A of the PDNA guidelines, focusing on identifying the interventions required to respond to priority needs and produce the intended outcomes while accounting for the recovery costs. For example, the priority of rehabilitating the transport sector is focused on the intended outcome of providing the general public with mobility and access to goods, services and work. To do so, the specific interventions might include road reconstruction supplies and labour, temporary alternate transport modes and so on. The expected outputs of such interventions might include enabling people who are sick to reach hospitals, farmers to distribute their produce and children to reach their schools. The cost of interventions will be the cost of recovery which, when invested in the recovery process, will lead to the intended outcomes.

Based on the sector most affected by the disaster, the prioritization of identified needs should change. For instance, if the disaster majorly affects the agriculture sector (as has been the case for many previous disasters), the road sector team will need to prioritize the road segments that are most relevant to the agriculture sector in terms of distribution and workers' commutes. On the other hand, if the key sector affected by the disaster is the manufacturing and production industry, the road sector team will need to prioritize the rehabilitation of freight routes.

Essentially, the prioritization must use the gap analysis between the pre- and post-disaster conditions.

A key guiding principle here is to ensure that the recovery and reconstruction efforts protect the community from future risk, hence incorporating the building back better paradigm within the budget constraints so as not to inflate the recovery budget and create long-term deficits. Phasing the build back better plan is potentially an efficient solution to ensure long-term financial stability while actively reducing future disaster risks. This will involve planning road sector development while accounting for future risks, and intentionally incorporating resilient elements into future rehabilitation plans, but phasing the different regions and assets based on priority and incorporating some of the resilience-building efforts into the operation and maintenance plan.

Segregating the recovery and reconstruction needs into short-, medium- and long-term phases, identifying the stakeholder who will be leading the activity, and assigning a tentative budget estimate to each need will be helpful in operationalizing the recovery process. Table 8 presents the template that can be used to prioritize the reconstruction and recovery needs accordingly.

Table 8: Reconstruction and recovery needs template

Province/region	Short-term needs	Medium-term needs	Long-term needs
Infrastructure needs: To repair / rebuild damaged infrastructure and physical assets (restore to pre-disaster level with build back better for reconstruction of infrastructure and physical assets)			
Governance needs: Build back better needs for governance and disaster risk management			
Risk management needs: Mitigation risks and vulnerabilities to future disasters			

The arrangements for implementing the recovery strategy should include the stakeholders identified in section 5.1, for whom a management system needs to be developed to ensure coordination. This will include assigning leadership of various interventions to the various stakeholders, establishing a recurring meeting timeline for the group and setting up corresponding services such as offices.

The implementation plans also need to consider the cross-cutting themes, which for the road sector will include employment disruption due to lack of transport to and from work, disrupted access to health and education services, disruption to the water supply during the road reconstruction process, and a disproportionate impact on accessibility based on gender, age and income. The recovery strategy should be implemented in a way that aligns with and enhances Fiji's development goals. A simultaneous review of the transportation sector strategy and development goals will help in drafting the recovery strategy and implementation plans.

Additionally, the recovery strategy should aim to mobilize the resources needed for recovery. Accurate and detailed damage and loss assessments and the recovery costs information will be critical in securing funds for the recovery programme. The resource mobilization plan should include provision for donor round tables or conferences if the internal or national resources are insufficient. A pre-planned conference might save valuable time post-disaster if the need for it arises. The conference should be planned to be convened by the National Disaster Controller along with the NEOC, MPWMST and FRA.

It is important to note that this guidance and the successful completion of a PDNA are based on certain assumptions, such as active participation of the key stakeholders, no aftershocks following the main disaster, and Fiji's institutional system being stable enough and the road sector having sufficient administrative capacity to conduct the inter-agency PDNA process. These assumptions need to be reviewed, and interventions need to be made, where possible, to account for any deviations. These assumptions, along with a potential lack of financial and human resources, might limit the successful or timely application of the recovery strategy.

Finally, it is critical for the assessment to be validated by a broader audience beyond the PDNA team. As part of a collaborative effort with all other sectoral PDNA teams, the transport sector PDNA should be shared with all relevant stakeholders for validation and revisions as necessary. This set of stakeholders will include the NEOC, the road sector representatives from MPWMST, and representatives from FRA, other relevant line ministries, agencies and local NGOs.

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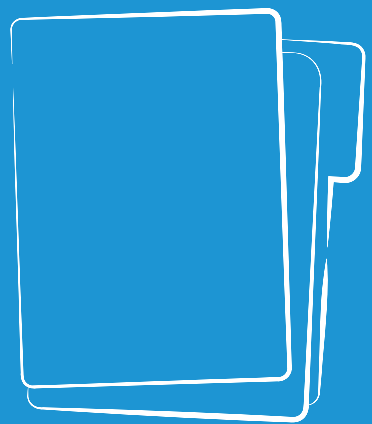

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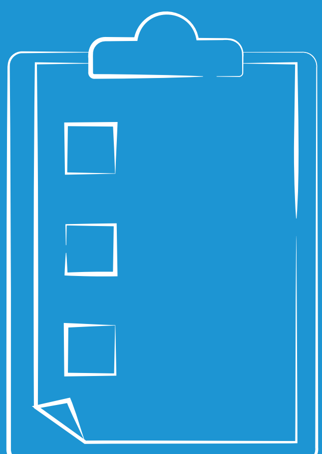

8 Appendices

These appendices include illustrative templates for collecting the baseline data and the field data for post-disaster assessments.

Appendix 1: Baseline data

Cost estimates: Roads

Table 9: Baseline data – cost estimates for roads

Road type	Terrain								
	Flat			Undulating			Mountainous		
	Rebuild cost (per km)	Major repair cost (per km)	Minor repair cost (per km)	Rebuild cost (per km)	Major repair cost (per km)	Minor repair cost (per km)	Rebuild cost (per km)	Major repair cost (per km)	Minor repair cost (per km)
Paved (bituminous)	$	$	$	$	$	$	$	$	$
Concrete	$	$	$	$	$	$	$	$	$
Gravel	$	$	$	$	$	$	$	$	$

Note: Similar tables are to be created for different road categories: single-lane, intermediate, two-lane and four-lane.

Unit costs: While the baseline data should have a regular estimate of these costs, it is important for the PDNA team to review and adjust the costs according to when the disruption occurred.

Cost estimates: Culverts

Table 10: Baseline data – cost estimates of culverts

Culvert type by material	Unit cost for single-lane road	Unit cost for intermediate lane road	Unit cost for two-lane road
Concrete pipe	$		$
Concrete box	$		$

Cost estimates: Other road sector public assets

Table 11: Baseline data – cost estimates of other road infrastructure assets

Equipment and assets	Average acquisition value per unit ($)	Average replacement cost per unit ($)	Average repair cost per unit ($)
1. Heavy equipment			
1.1. Bulldozers			
1.2 Graders			
1.3 Loaders			
1.4 Trucks			
1.5 Others (specify)			
2. Other equipment			
2.1 Communication			
2.2 Security (cameras)			
2.3 Others (specify)			
3. Roadside assets			
3.1 Signboards			
3.2 Street lights			
3.3 Others (specify)			
4. Private vehicles			
4.1 Cars			
4.2 Motorcycles			
4.3 Bicycles			
4.4 Buses			
4.5 Taxis			
4.6 Trucks			
4.7 Other vehicles			

Equipment and assets	Average acquisition value per unit ($)	Average replacement cost per unit ($)	Average repair cost per unit ($)
5. Bus companies			
5.1 Buses			
5.2 Garage			
5.3 Equipment			
5.4 Bus stations			
6. Taxi companies			
6.1 Taxis			
6.2 Garage			
6.3 Equipment			
7. Tuk companies			
7.1 Tuk tuks			
7.2 Garage			
7.3 Equipment			

Baseline condition and usage data

To use the pre-disaster conditions of the road sector to establish a baseline for comparing the post-disaster conditions, it is helpful to regularly assess the condition of the key road sector infrastructure. This can include a five-year assessment of the road conditions, which involves categorizing the conditions into one of four categories:

- good
- fair
- poor
- bad.

The classification can be based on sample calculations of the International Roughness Index (Arhin, Noel and Ribbiso, 2015) or on the expert opinion of the data collection personnel in the absence of International Roughness Index data. These data, along with the year of construction, last year of major rehabilitation and the usage information will be helpful in identifying the general vulnerabilities of the system. This information will help in prioritizing response and recovery efforts. The user's information can be obtained from the most recent travel surveys or census data.

Table 12: Baseline data – Road condition and usage

Road No.	Route (town/village A to town/village B)	Category of road (national roads/cane access road/others)	Length (km)	Pavement type (bituminous/ concrete/gravel)	Carriage-way width (m)	Year constructed	Year of last major rehab.	Condition (as per year XXX)	Vehicular traffic (No.)

Table 13: Baseline data – Bridges

Road No.	Bridge identification No.	Chainage	Length (m)	Width (m)	Type of bridge*	Year constructed	Remaining life	Condition (as per year XXX)	Vehicular traffic (No.)

* Reinforced cement concrete, timber, multi-arch, girder with cement concrete deck, footbridge

Note: Table fields are based on the data shared by FRA on bridges and cross-drainage structures.

Table 14: Baseline data – culverts

Road No.	Culvert identification No.	Chainage	Type of culvert (pipe/slab/box)	Condition (as per year XXX)

Table 15: Baseline data – jetties and wharves

Location	Province	Island	Jetty /wharf/ landing	Material (wooden/ concrete)	Reinforced cement concrete area (m^2)	Causeway area (m^2)	Pile type	Year constructed	Condition (as at XXX)	Passengers served per day	Cargo handled per day and capacity

Note: Table fields are based on the data shared by FRA on jetties/wharves and landings.

Appendix 2: Damage and loss assessment – Field data collection templates

Roads

The road number/district code can be used to map the data with the baseline data, providing geospatial understanding of the damages, while the type of road, terrain information, and estimated detour and debris volume can be used to integrate the unit cost baseline data to estimate the damages and losses. Damage can be categorized into complete, medium and light damage using the following guide:

Light damage: slight erosion of the road surface, small surface-level potholes, signboards damaged – minor repair needed

Medium damage: surface eroded completely, partial damage to the subgrade – rehabilitation needed

Complete damage: road damaged all the way to the subgrade – road needs to be completely replaced

Roads – Damage and loss field data template

Table 16: Damage and loss data – roads

Road No.*	Route (town /village A-town/village B)	Category of road (national roads/ cane access road / other) *	Province	Carriageway width (m)	Type of road (bituminous /cement/ gravel)	Length with complete damage (km)	Length with medium damage (km)	Length with light damage (in km)	Estimated detour length (in km)	Estimated debris volume (m3)	Terrain (flat / undulating / mountainous)

* The road category will be either: 1. national roads, 2. cane access road or 3. other.

Bridges and culverts – Damage and loss field data template

If an indexed inventory of bridges on various national and provincial routes exists, the damage can be categorized as completely damaged (in which case the entire bridge would need to be replaced) or partially damaged (in which case the length of damage will be measured).

If the baseline data do not have an index related to the bridge, an identifier along with the road number will be helpful.

Table 17: Damage and loss data – bridges

Road No.	Bridge identification No.	Chainage	Length (m)	Width (m)	Type of bridge*	Description of damages	Estimated cost of damage repairs/ replacement, as applicable ($)

Note: Table fields are based on the data shared by FRA.

A count of culverts by type with complete damage and partial damage per route will be sufficient to calculate the damage data for culverts. Table 18 can be used to gather data on culvert damage.

Table 18: Damage and loss data – culverts

		Culverts totally damaged on two-lane roads (No.)			Culverts totally damaged on intermediate lane roads (No.)			Culverts totally damaged on single-lane roads (No.)		
Rd No.	Route	Pipe	Concrete slab	Box	Pipe	Concrete slab	Box	Pipe	Concrete slab	Box
	Town A-Town B									

Note: Table fields are based on the data shared by FRA.

Additional assets and equipment – Damage and loss field data template

For additional assets and equipment, the number of units completely damaged (needing replacement) and partially damaged (needing repair) for each province will be useful. Table 19 can be used in the field to collect the damage data for each province.

Table 19: Damage and loss data – additional road infrastructure assets

Division/ province number and name: Province A (P No. 1)

Road No.	Units completely damaged (No.)	Units partially damaged (No.)
1. Heavy equipment		
1.1 Bulldozers		
1.2 Graders		
1.3 Loaders		
1.4 Trucks		
1.5 Others (specify)		

Division/ province number and name: Province A (P No. 1)

Road No.	Units completely damaged (No.)	Units partially damaged (No.)
2. Other equipment		
2.1 Communication		
2.2 Security (cameras)		
2.3 Others (specify)		
3. Roadside assets		
3.1 Signboards		
3.2 Street lights		
3.3 Others (specify)		
4. Private vehicles		
4.1 Cars		
4.2 Motorcycles		
4.3 Bicycles		
4.4 Buses		
4.5 Taxis		
4.6 Trucks		
Road No.	**Units completely damaged (No.)**	**Units partially damaged (No.)**
Other vehicles		
5. Bus companies		
5.1 Buses		
5.2 Garage		
5.3 Equipment		
5.4 Bus stations		
6. Taxi companies		
6.1 Taxis		
6.2 Garage		

Division/ province number and name: Province A (P No. 1)		
6.3 Equipment		
7. Tuk tuk companies		
7.1 Tuk tuks		
7.2 Garage		
7.3 Equipment		

Table 20: Damage and loss data – jetties/wharves/landings

Type (jetty/ wharf/ landing)	Location	Island	Province	Age of the structure	Remaining life of the structure	Description of damages and repair requirements	Estimated cost of damages ($)

Note: Table fields are based on the data shared by FRA.