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## Strengthening cooperation between telecommunications operators and national disaster offices in Caribbean countries

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UNITED NATIONS

ECLAC



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## Abstract

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In Caribbean countries, modern telecommunications infrastructure is vulnerable to an array of natural disasters, as exemplified by the impacts of Tropical Storm Erika in Dominica, Hurricane Joaquin in the Bahamas, and Hurricane Earl in Belize. At the same time, telecommunications service—especially mobile telephony and data services—can provide invaluable support to disaster management efforts by facilitating communication, coordination, and intelligence collection during emergency situations. Thus, as a matter of public safety, ensuring the resilience of telecommunications infrastructure in the face of natural hazards is of national importance.

One way this resilience can be enhanced is by strengthening the relationship between operators of telecommunications services and national disaster offices. This paper suggests numerous areas for engagement between these entities and recommends the development of more formalized frameworks for mutual support. Among other issues, it considers needs for improvements to information sharing practices, collaboration on public early warning systems, and the inclusion of telecommunications operators in disaster drilling exercises.



## Introduction

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Effective communications systems are vital in times of disaster —both to agencies coordinating disaster response operations, and to the public at large. In a post-disaster environment, responders can and do make use of specialized communications equipment such as satellite telephones and UHF radios, but engagement of the broader community in the recovery process relies heavily on the timely restoration of commercial telecommunications systems. It is therefore important to ensure that there is effective coordination between telecommunications operators and the national disaster offices that are responsible for coordinating efforts on disaster planning, mitigation, and response.

This need for enhanced cooperation between telecommunications companies and national disaster offices was recognized at the *Expert Group Meeting on Information and Communication Technologies for Disaster Risk Management in the Caribbean*, which was held in 2013 in Trinidad and Tobago. The report of this meeting included a recommendation that telecommunications operators be “brought into formalized agreements with regard to providing emergency response for disaster response and recovery operations”.<sup>1</sup> This paper builds on that recommendation; its purpose is to assess the current state of telecom-disaster office coordination in Caribbean countries, and consider what a more formalized relationship between these entities would entail. Based on this analysis, it provides guidance on the issues that should be considered by telecommunications companies and national disaster offices as they work together to develop these agreements.

This paper draws on several sources of information to support its findings, including interviews with representatives of national disaster offices in six Caribbean countries.<sup>2</sup> A representative of the Caribbean Disaster Emergency Management Agency (CDEMA) was also interviewed; CDEMA is responsible for the coordination of comprehensive disaster management efforts among CARICOM countries. The perspectives of telecommunications operators were solicited through coordination with CANTO, a telecommunications industry organization that represents operators in countries throughout the Caribbean. For background on the performance of telecommunications operations during past

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<sup>1</sup> ECLAC (2013).

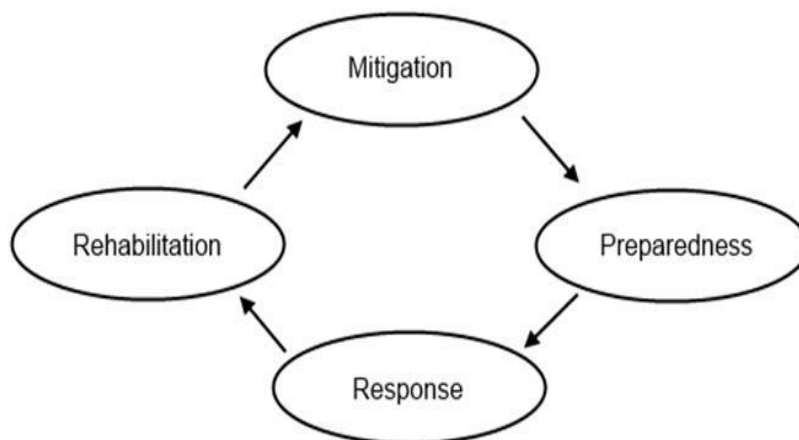
<sup>2</sup> The national disaster offices interviewed included those of the British Virgin Islands, the Cayman Islands, Jamaica, Montserrat, Saint Lucia, and Trinidad and Tobago. A full list of officials interviewed, and the set of interview questions, are included as part of the annex to this document.



disasters in the Caribbean, information has been found in damage and loss assessment (DALA) and post-disaster needs assessment (PNDA) documents authored by the Economic Commission for Latin America and the Caribbean (ECLAC) and other organizations. This paper also draws upon the experience of one of the authors in working as part of DALA teams to analyze impacts on telecommunications of hurricanes in the Bahamas and in Belize, and in the April 2016 earthquake in western Ecuador.

This research has identified a number of areas in which enhanced collaboration between telecommunications companies and national disaster offices can help to streamline disaster response efforts and benefit public safety. These are considered within the context of the four phases of a popular model for understanding disaster risk management: mitigation, preparedness, response, and recovery (see diagram 1). Under this model, mitigation and preparedness are activities pursued in advance of a potential disaster; mitigation entails measures taken to avoid losses or otherwise reduce the potential adverse impacts of a disaster, while preparedness entails ensuring the readiness of an organization to respond once a disaster occurs. After a disaster occurs, the initial response stage includes all the immediate activity required to save lives, ensure public safety, and to restore functionality to vital services and infrastructure. This is followed by a longer-term rehabilitation phase, which includes the physical, economic, and social reconstruction of a disaster affected area (Williams and Phillips, 2014).

**Diagram 1**  
**Disaster Management Cycle**



Source: Tomasini and Van Wassenhove (2009).

It is intended that this paper be used as a tool to support discussion between telecommunications companies and national disaster offices. To that end, this paper investigates a total of 19 different areas in which these two types of organizations can enhance their working relationship, and makes specific recommendations on how these issues may be approached.<sup>3</sup> To provide a context, this discussion is preceded by an examination of telecommunications in two recent disasters that have affected Caribbean countries —Tropical Storm Erika in Dominica, Hurricane Joaquin in the Bahamas, and Hurricane Earl in Belize. There is also discussion of the current institutional landscape that shapes the conditions under which this collaboration must be accomplished. The paper concludes with a consideration of the next steps that telecommunications companies and disaster offices can take in pursuing a more effective partnership.

<sup>3</sup> A condensed list of all 19 areas is included in annex 1.

## **I. Telecommunications and disasters in the Caribbean: Tropical Storm Erika, Hurricane Joaquin, and Hurricane Earl**

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Caribbean countries are vulnerable to a range of hazards. The subregion is frequented by hurricanes and other storms, which cause damage through flooding, landslides, and high winds. Geological hazards are also a risk, with recent examples including the earthquake that shook Haiti in 2010 and the volcanic devastation on the island of Montserrat. Tsunamis are also in the historical record, including events that affected Jamaica in 1692, the Lesser Antilles in 1755, the Virgin Islands in 1867, Puerto Rico in 1918, and the Dominican Republic in 1946. The risks posed by these hazards are exacerbated by the small and isolated geographical nature of Caribbean countries. In outlying islands in particular, disaster relief efforts face logistical, transportation, and capacity challenges that are qualitatively different from those faced in larger, terrestrial economies.

Three examples from 2015 and 2016 illustrate how some of these difficulties are experienced by telecommunications companies in their disaster response efforts. These are Tropical Storm Erika, which brought massive amounts of rainfall to Dominica on August 27, 2015, Hurricane Joaquin, which affected several islands in the southern Bahamas from September 30 - October 2, 2015, and Hurricane Earl, which blew through Belize on August 3 – 4, 2016. An examination of these three experiences can set the stage to promote a better understanding of how telecommunications systems in the Caribbean can be affected by disaster, and highlight potential areas for improved coordination between telecommunications companies and national disaster offices.

### **A. Tropical Storm Erika**

In Dominica, the heavy rains associated with Tropical Storm Erika caused extensive flooding and landslides. The majority of damage to telecommunications infrastructure came as a result of breaks in fiber-optic cables, especially those which had been buried below ground. Trenches that carried telecommunications lines alongside roads were scoured in places by running water, lines attached to

bridges failed when the bridges washed out, and manholes were flooded with mud and silt. There was some irony to this, as the burial of network cables had been considered an important element of the carrier's disaster resilience strategy. Above ground, landslides affected utility poles and microwave towers.

Of the island's 98 cellular sites, 68 had failed by the end of the storm, affecting 50% of cellular subscribers. At least two cellular sites were completely washed away, with many going off-line due to the loss of commercial power. Diesel generators were used to provide backup power to many sites, though some sites went down again three days after the storm when fuel ran out. Because roads on the island were impassable, refuelling these generators proved difficult. In at least one case, fuel had to be brought to an otherwise inaccessible tower site by boat. Notwithstanding these challenges—and with the help of supplies and personnel brought in from off-island—services were restored to 98% of subscribers within eight days after the storm.

As part of the interview conducted for this paper, a CDEMA official noted that, in the aftermath of the storm, there were delays in communication between the telecommunications companies—LIME and Digicel—and the national Office of Disaster Management (ODM), and considered that this may have been the result of a lack of clarity in lines of reporting. Rather than directly reporting to the Emergency Operations Centre (EOC), telecommunications companies were providing status updates to the regulator, which in turn relayed them to the EOC. This arrangement resulted in a delay in propagation of network status information during the critical period in the immediate aftermath of the disaster. Recognizing this communications shortfall, the Government of Dominica post-disaster Rapid Damage and Impact Assessment made the recommendation that:

“Standard incident reporting procedures need to be adopted and enforced during a disaster. The EOC should be the information and communications focal point of the government during and immediately after the disaster. Telecommunications companies should be required to make regular daily reports to the EOC as they assess and repair damages. The EOC should provide a standard template for reporting which is linked to an emergency management information system.”<sup>4</sup>

The report also cited a need for telecommunications carriers to conduct a review “of call/data handling procedures in the event of a disaster,” noting that “Measures need to be put in place to ensure first responders and disaster response personnel have priority access to networks.”

## **B. Hurricane Joaquin**

In contrast to the Tropical Storm Erika in Dominica, which could be characterized as an excess rainfall event, the damage to infrastructure during Hurricane Joaquin came primarily as a result of high wind and storm surge. The primary effects of the storm were felt in the southern islands of the Bahamas, including Crooked Island, Acklins, Long Island, Rum Cay, and San Salvador.

The remote and sparsely populated nature of these islands contributed to the difficulty in achieving the restoration of communications services. Whereas services had been restored to almost all customers in Dominica within a week following Tropical Storm Erika, restoration of cellular sites took well over a month in some areas of the Bahamas. In several instances, cellular towers had simply blown over, or otherwise suffered wind and water damage. Cellular-on-wheels (COW) systems were shipped in to replace failed cellular sites on a temporary basis. Additional generators to power cellular towers and switching facilities were also brought in. The extensive damage to the commercial power infrastructure—both generation and distribution capacities—was a major factor that hampered the restoration of services. Hundreds of utility poles had been brought down by the storm, and had to be replaced before wired networks could be fully repaired. This effort was itself delayed due to damage not only to roads, but to port facilities, which impeded the delivery of equipment and material.

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<sup>4</sup> Commonwealth of Dominica (2015) p. 37.

Significant damage was done to satellite ground stations and microwave communications relays, with dishes being destroyed or blown out of alignment by high winds. Replacement equipment had to be brought in by boat. One of the hardest hit areas, on Crooked Island, was home to a landing station for the ARCOS-1 fiber optic undersea cable. The roof of the shed housing the generator that provided power to the cable was damaged, and the ensuing entry of water caused the generator to automatically shut off. This caused the local section of the undersea cable to go dark, and the quality of internet service as far away as the Turks and Caicos and the Dominican Republic may have been affected as a result.

The lack of telecommunications services on the island was felt by residents and officials. It was reported that primary communications between the National Emergency Management Agency (NEMA) and the affected islands were cut off around noon on October 1. Satellite communication was still possible, but, in the days after the storm, maintaining battery charge on satellite phones became a concern. To mitigate this issue, a practice was established by some medical clinics in which satellite phones would only be turned on to accept incoming calls at prearranged times of the day. As weeks passed, telecommunications facilities in the most affected areas remained offline; one woman reported to ECLAC officials that she repeatedly drove over 20 kilometers on damaged roads to reach a location that had cellular reception.

It was immediately prior to the storm that the absence of efficient systems of communication had perhaps its most noteworthy impact. Hurricane Joaquin was a fast developing storm, and had been projected to take a more northerly track than it eventually did. The first tropical storm warning that covered Acklins and Crooked Island was issued by the National Hurricane Center at 5:00 pm on the afternoon before the storm—which arrived overnight and reached Category 4 intensity. Thus, there was very little time to warn the populace. In fact, a large portion of the population later reported having received no warning at all. This lack of warning put lives at risk, and contributed to property damage. One owner of a bonefishing lodge asserted that, given adequate time to prepare, he would have been able to board up windows and doors, which would have prevented \$US 20,000 in damages to his establishment.

No mobile phone-based public early warning system was in place on the affected islands; as such, there was no mechanism to deliver a timely advisory on the coming storm via text message. On this topic, the post-disaster damage and loss assessment noted that:

“There is an important role for telecommunications companies to play here; by implementing a technology called “cell broadcasting,” a warning text message could be quickly distributed to users of mobile phones within a specified geographic area. The implementation of this technology would require investment on the part of mobile phone operators, and the development of a protocol for its use, in coordination with officials at NEMA.”<sup>5</sup>

The assessment went on to recommend that regulators consider the institution of a requirement to implement a mobile phone-based alerting technology, as a condition for the issuance and renewal of licensing agreements for mobile service providers in the Bahamas.

## C. Hurricane Earl

Category 1 Hurricane Earl made landfall in Belize on the night of August 3, 2016. There had been ample warning, as the storm had entered the Caribbean nearly a week before, and had largely stuck to its forecast track. With an extended lead time, the two major telecommunications companies, Belize Telemedia Limited (BTL) and Speednet were able to make appropriate preparations for the storm, as documented in their Emergency Management Plans. These preparations included topping off diesel tanks, provisioning Emergency Operations Centres (EOCs), and releasing non-essential staff from active duty. SMS-based warnings were sent out to cellular customers in advance of the storm’s arrival.

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<sup>5</sup> ECLAC and IDB (2015).

During and after the storm, telecommunications companies coordinated with Belize’s disaster office —the National Emergency Management Organization (NEMO)— as well as with the power company, through participation in NEMO’s Utility Restoration Committee. In support of this Committee, NEMO provided member companies with passes to enable their vehicles to be on the road prior to the issuance of the “all-clear” announcement. Additionally, the members of the Utility Restoration Committee made use of a WhatsApp group as an effective and innovative means of communications with NEMO and among its various stakeholders. Through the use of this channel, telecommunications and power company staff were able to report status and incidents to NEMO in real time using text messages and cell-phone photographs.

One of the factors that enabled WhatsApp to be an effective means of communication was the resilient performance of wireless networks during the storm. Though BTL reported that there was a 60% increase in volume of pre-paid voice traffic during Hurricane Earl, their infrastructure was able to handle this increase without undue congestion. In most areas—even on the offshore islands—it was reported that voice service was available for the duration of the Hurricane. Wireless data services were also mostly functional, though they did experience some outages at the height of the storm, reportedly as a result of interference to microwave transmissions caused by high wind and rain.

This is not to say that cellular service remained universally available; approximately one-third of cellular base stations did not have backup electricity generation capacity, and a handful of these dropped service as a result of loss of commercial power and following the depletion of backup batteries. In addition, equipment was damaged on several towers, and one cell site was blown off the roof of an apartment building. Several small radio masts near the centre track of the hurricane also collapsed.

Wired networks endured a significantly higher impact. Though services to most areas were restored in a matter of days, in some cases the restoration of copper cable systems took up to a month. Damage might have been worse, if not for the generally high design standards of utility pole infrastructure. Still, some areas with older infrastructure that had been installed prior to the advent of these standards were more highly impacted than areas with upgraded utility poles.

In an interview with ECLAC staff, a representative of Belize Electricity Limited (BEL), which owns the majority of utility poles, noted that excessive numbers of communications wires attached to poles contributed to their failure. In some cases there were up to six or eight attachments per-pole per-carrier – both from national telecommunications companies and local cable television operations - and the additional weight and profile of these attachments created excessive lateral loads on the poles during high wind. A representative of the Public Utilities Commission suggested that this problem could be reduced if carriers were to share common wires, but opined that they had not been willing to do so.<sup>6</sup>

The telecommunications carriers of Belize, unlike those in many Caribbean countries, are not subsidiaries of larger, regional companies such as Cable & Wireless or Digicel. As such, they were not able to draw upon material help and manpower from corporate siblings outside the country. Several weeks after the event, BTL did make a request to the CANTO Secretariat for repair trucks and personnel, though this request may have come at too late a stage for CANTO to arrange effective help through its Mutual Assistance Programme. This experience uncovered a need for earlier, proactive engagement by CANTO with members in affected countries—especially those without access to a broad pool of corporate resources to draw from. It also highlighted concerns regarding the prospective deployment of repair trucks across far-flung areas of the Caribbean; there is a need for advance planning of these scenarios to ensure that appropriate transportation options can be arranged to send these assets to where they are needed.

In the days following the storm, it is notable that neither BTL nor Speednet offered free calling credit to people in areas affected by the storm. While both offered commercial promotions that provided a “double up” of airtime to those who bought additional credits, this course of action overlooked the problem that many retail locations at which one could purchase pre-paid airtime had been closed as a

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<sup>6</sup> ECLAC and IDB (2016).

result of the storm. Thus, simply offering a better deal on airtime following a disaster is not sufficient in cases where people may be physically unable to make such purchases. In other disasters, such as in Dominica and the Bahamas, carriers have automatically distributed top-ups to pre-paid subscribers, worth the equivalent of about three US dollars, which is sufficient for emergency calling needs; in some cases, there is a time limit on the use of this credit. If such a practice were put in place in Belize, this would significantly enhance the ability of persons with low air-time balance to make effective use of the cellular network for emergency purposes.

## **D. Discussion**

The experiences of Tropical Storm Erika, Hurricane Joaquin, and Hurricane Earl illustrate the diverse effects that disasters can have on telecommunications systems in Caribbean countries. While all three disasters were tropical cyclones, Erika was an example of a high-rainfall event on a mountainous, single-island state, while Joaquin caused damage through high wind and storm surge affecting several islands of a far-flung archipelago, and Earl was a relatively fast moving storm that affected a mainly terrestrial country. With Erika, extensive damage was incurred to the underground fiber optic network, while in Joaquin, the aerial network was damaged by high winds, as were a number of cellular sites. Earl caused significantly less damage overall, and most of the impact was concentrated on weak points in the infrastructure.

In both Erika and Joaquin, damage to the transportation infrastructure was an impediment to reconstruction. Roads were blocked by standing water in the Bahamas, and destroyed by landslides in Dominica, and this was an obstacle to the refuelling of cellular sites. In the Bahamas, damage to seaport facilities had a more significant impact on telecommunications recovery, because materiel for repair of telecommunications systems could not be shipped into remote islands from the capital until port repairs had been completed. Dominica, being a single-island state, did not face this challenge, and this may have allowed it to restore service to its telecommunications networks in relatively short order, while the restoration process in the Bahamas dragged on for weeks.

The comparatively quick recovery of telecommunications services in Dominica and Belize are perhaps a fairly typical experience following a disaster. Through an intense effort, repair crews that are deployed as soon as the “all-clear” is sounded are able to restore some level of service to the great majority of affected areas within a matter of days. Wireless services in particular tend to be recovered in fairly short order, though it may take longer to restore wired services to limited numbers of more isolated individual customers, and there may be a few outstanding instances where infrastructure has been most intensely damaged or is otherwise inaccessible. However, the experience in the Bahamas shows that there can be complicating factors, such as geography or weaknesses in infrastructure, which can delay the restoration of service for an extended period of time.

Regardless of the length of outage, the period prior to restoration of telecommunications services is a time of heightened vulnerability for members of the population, because they are constrained in their ability to communicate emergency needs to the outside world. Therefore, it is important to take steps in advance to reduce this period of vulnerability to the shortest possible window of time by hardening infrastructure and working to ensure the effectiveness of emergency response procedures.



## II. The institutional landscape

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It is important to examine the institutional landscape, to determine how structural factors may affect the implementation of cooperative agreements, as well as the roles of various entities within the system. Broadly, the primary institutions that this paper is concerned with are the national disaster office, the various telecommunications companies, and the telecommunications regulator. The disaster office and the regulator each report to their respective ministry within the government, and the telecommunications companies are often subsidiaries of large, multinational corporations.

In Caribbean countries, the national disaster office is typically a small executive agency charged with coordinating disaster planning and response efforts within the government and among various local, national, and regional institutions.<sup>7</sup> While some of these disaster offices do have a response capacity, their broader role in a disaster is to coordinate the efforts of other responding agencies, such as the police, fire-fighters, the coast guard, and local Community Emergency Response Teams (CERTs), as well as the political leadership, and regional and international agencies such as CDEMA and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA).

At the regional level, many, but not all, Caribbean national disaster offices are supported by CDEMA, which provides specialized disaster risk management expertise and coordinates the provision of disaster response efforts among its Member States. The capacity of disaster offices in the Caribbean is often constrained by their small size and limited access to human resources (Williams and Phillips, 2014, P.38). The presence of CDEMA as a regional entity that can draw resources from across national borders is in some measure a remedy to this problem.

The telecommunications sector in the Caribbean is, in many countries, dominated by two multinational companies —Digicel and Cable & Wireless (now a part of Liberty Global). In addition, there are a number of smaller, independent companies that offer services on a local or national level, as well as some small, regional networks of companies. In some cases, telecommunications companies are

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<sup>7</sup> The name of the office varies from country to country. For example, Trinidad and Tobago has the Office of Disaster Preparedness and Management (ODPM), the Cayman Islands has the Hazard Management Cayman Islands (HMCI), and Saint Lucia has the National Emergency Management Organisation (NEMO).



owned by the government, or have a shared ownership structure involving the government and a private entity. It should be noted that the region's telecommunications companies have recently experienced a wave of consolidation, with Cable & Wireless purchasing what had been the third largest network of companies in the region, Columbus Communications, prior to its own purchase by Liberty Global. This has led to a somewhat uncertain situation in countries where Cable & Wireless and Columbus had been the two major broadband carriers—for example in Grenada and in Saint Lucia—where their subsidiaries have continued to run as competing companies while sharing the same ownership.<sup>8</sup>

The ownership structure of telecommunications companies in the Caribbean is relevant to their disaster response capabilities, because these companies tend to be reliant on their corporate parent for assistance in disaster response and reconstruction. For example, after Hurricane Joaquin in the Bahamas, BTC was able to bring in linesmen and equipment from other Cable & Wireless-family companies in Caribbean countries to assist with repairs. This is a source of resilience for telecoms that are part of larger, multinational companies. On the other hand, as the experience in Belize has shown, smaller, single-country operators do not have this advantage, and so additional mechanisms to provide for their support are needed.

One mechanism to provide this support is through the establishment of a mutual assistance obligation among telecommunications operators for times of emergency. This has been practiced in the past, but is increasingly becoming a legal requirement. For example, the Telecommunications Act of the British Virgin Islands requires operators to “cooperate in the development and implementation” of plans for the provision of service during a public emergency. The 2015 draft template for the Electronic Communications Bill in ECTEL Member States includes similar language. There have also been cases where rival telecommunications companies have come to mutual aid even in the absence of a legal requirement, such as in the case of Tropical Storm Erika in Dominica, where LIME and Digicel reported having a mutually beneficial collaboration which aided the timely restoration of telecommunications services.

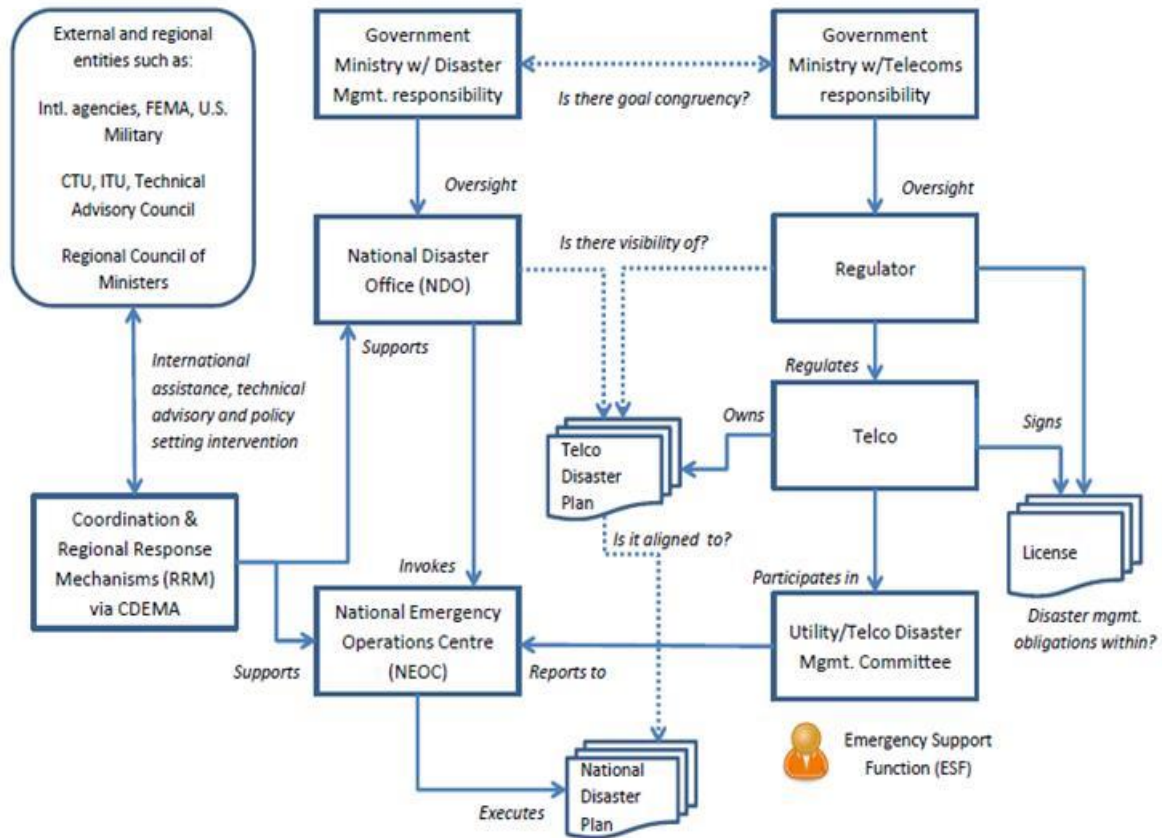
CANTO, as a regional organization of Caribbean telecommunications providers, has established a Mutual Assistance Programme so that disaster-affected companies can request assistance from operators in neighboring countries, though this mechanism has not yet been put into action. CANTO also supports a disaster risk management committee, which holds on-line meetings on a monthly basis, to which all members are welcome to attend. In 2015, as a preparatory exercise, this committee facilitated the Caribbean's first multi-country disaster simulation focused on the telecommunications industry. This exercise is expected to be repeated on an annual basis, and there are plans to use it to support telecommunications carriers in adopting some of the recommendations in this paper.

Some of the above-mentioned entities are illustrated in diagram 2, which illustrates the institutional relationships commonly found in this space, and maps out the roles, responsibilities and interactions necessary to achieve greater levels of cooperation on telecommunications issues in disaster management.

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<sup>8</sup> ECLAC (2015), p. 5.

**Diagram 2**  
**Relations among telecommunications and disaster management entities**



Source: Shiva Bissessar.

It should be noted that this diagram is by no means authoritative, and may not accurately reflect the existing relationship between disaster management entities in any single territory. For example, the Cayman Islands are not a member of CDEMA and so the regional coordination aspect would be somewhat different from what is presented. Additionally, in the British Virgin Islands, the relationship and reporting structure between the national development office, regulator and subcommittee is somewhat different than what is presented in this figure. Because each country has its own, somewhat unique structure, it would be useful for a nationally customized version of this type of responsibility mapping to be included within the national disaster plan of each country. Ideally, this would entail an even more detailed and explicit statement of the expectations held for each entity



### **III. Understanding needs and limitations**

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In a series of telephone interviews conducted by ECLAC, national disaster offices reported that telecommunications companies readily provide assistance with respect to disaster management. Telecommunications companies are seen to be active participants in annual preparedness meetings that proceed the hurricane season. There tends to be some understanding in place that these companies will provide support for priority service to the disaster office and its personnel, first responders and other important persons during disasters. In some cases, capacities such as the ability to send SMS-based warning messages are made available.

However, the interviews also revealed that many of these agreements for support exist as generally agreed-upon practices that have not been formalized. Because these mechanisms are highly reliant on individual relationships and capacities, their maintenance may not be resilient in the face of staff turnover or —of particular concern— in the uncertain environment of a post-disaster situation. This is a case where public safety and institutional reputations are at stake, so there is a need to ensure that the processes through which telecommunications providers and disaster offices support each other are appropriately scoped, clearly articulated, broadly understood, effectively maintained, enforceable, and reassessed from time to time.

It should be emphasized that a number of formalized mechanisms that facilitate cooperation between telecoms and disaster offices do exist. Commonly, though not universally, broadly-scoped support obligations are included in legislation, or as part of the operator's licenses (see box 1) issued by telecommunications regulators. It is also a common practice for telecommunications companies to participate in coordination committees that report to the national disaster office, with the operation of these bodies detailed as part of a National Disaster Plan. However, many telecoms laws and universal service rules do not anticipate the use of mobile phones as part of the disaster management system. Thus, they often do not require, as directly as they might, that operators use their networks in support of national disaster response efforts.

### **Box 1** **Operator's licenses**

Telecommunications companies provide their service under an operator's license, and these may have some provisions broadly outlining obligations with regard to support for disaster risk management activities. However, these operator agreements are managed by regulators, not disaster offices; their utility be limited by a possible lack of goal congruency within Government between line Ministries with responsibilities for telecommunications and disaster management. Moreover, while it is the responsibility of the regulator to ensure that telecommunications companies are in compliance with the disaster management provisions of the license, these regulators may face difficulty in this task due to limited capacity and a lack of specialist knowledge. Thus, the extent to which operator license agreements are effective in eliciting the type of cooperation needed from telecommunications companies may be reliant on a high level of coordination between the regulator and the national disaster office.

Source: Robert Williams.

Interviews with national disaster offices have indicated that, notwithstanding the presence of these high-level mechanisms, a number of opportunities for improvement remain. Here are three examples that will be discussed:

- 1) Representatives from national disaster offices in several countries, including the Cayman Islands, Jamaica, and Saint Lucia, indicated that they have little insight into telecommunications company's plans for disaster response and business continuity management (BCM). As a result, there may be limited alignment between these plans and national disaster response plans.
- 2) Telecommunications companies, through their representatives in CANTO, have expressed a need for high-quality hazard maps that can help them in the planning and hardening of network infrastructure. National disaster offices have access to these resources, and are generally willing to share them. The disaster offices also indicate that their GIS mapping systems would benefit from the addition of information related to the location of telecommunications infrastructure. Thus, an exchange of mapping information appears to be in order, though there is a need to set forth agreements regarding the allowable use of this data, and to ensure that data sets are updated when new information becomes available.
- 3) After a disaster, it is important for the national disaster offices to have information on the telco's network status and status of services. In some countries, telecommunications companies were recognized as effectively providing this information in a timely manner, but representatives from disaster offices in Montserrat and Saint Lucia expressed a desire for improvement in this area. There was general consensus among interviewees on the need for a formal agreement with telecommunications companies that would standardize post-disaster reporting practices.

These examples represent the types of issues where improved coordination between telecommunications companies and national disaster offices can provide important benefits, and they are expanded upon in further chapters. For now, however, we will consider the reasons that initiatives to address each of these three issues have not already been universally implemented. As we pursue this exercise, it will become clear that these reasons reflect institutional constraints and other limitations that will need to be considered in crafting agreements to achieve better cooperation and effectiveness.

To take the concern in the first of these examples, a large part of the reason that there is limited alignment between national disaster plans and the disaster plans of telecommunications companies is that telecommunications companies have an institutional reluctance to share proprietary information about their businesses. This reluctance is not borne out of selfish pique, but rather is an artifact of the highly competitive environment in which they find themselves operating. The default position for telecommunications operators is to avoid sharing information that could possibly be of use to a competitor, or which might draw unwanted attention from a regulator, or lead to complaints from the

public, or be disadvantageous for a vendor to have within the context of a price negotiation. Notwithstanding their desire and responsibility to contribute to national disaster response efforts, telecommunications companies do not wish to expose elements of their business to these types of risks, and therefore see it is necessary to guard against both the intentional and accidental release of sensitive information.

A large amount of sensitive information about telecommunications companies can be found in their disaster planning and business continuity management documents. This may include information about their network topology, operational procedures, and systemic vulnerabilities, for example. Some of this information—such as details on specific vulnerabilities—would be important for the national disaster office to understand. On the other hand, the disaster office does not require detailed information on the specific equipment housed in various locations or the telecommunications company's network topology. Thus, it would be possible for national disaster offices to manage with an abridged version of the telecommunications disaster plans. This is how the issue was handled by CDEMA, which requested abridged plans from telecommunications companies as part of a hurricane simulation exercise that it conducted for telecommunications companies, as organized by CANTO in October 2015.

Another approach has been taken by the British Virgin Islands Department of Disaster Management (DDM), which has provided active assistance to telecommunications companies in their development of business continuity management plans through the provision of workshops and templates. By providing this service to telecommunications companies, the DDM was able to gain insight into their needs and capabilities, while aligning their disaster response procedures with national disaster response planning goals. The telecommunications companies may have shared more information with the DDM than they might have otherwise been inclined, but in return they benefited through the development of a stronger plan than they would have been able to build on their own. Additionally, the exercise helped to build a working relationship between institutions and familiarity between personnel, which may prove valuable when an effective disaster response is required.

The strategy of sharing information for mutual benefit can also be used to attend to the need illustrated in the second example. Maps denoting hazard risk areas can be shared with telecommunications companies, as maps of telecommunications infrastructure are integrated into geographic information systems (GIS) used by disaster offices. In most cases, hazard maps are already available to the public, though disaster offices can work with telecommunications companies to provide for their specific needs. In this case, telecommunications companies will need assurance from disaster management offices of the confidentiality and security of any mapping data provided.

In some cases, telecommunications companies are already providing some subset of this mapping data to national regulatory agencies. For example, in the British Virgin Islands, the disaster office is able to make use of GIS data on the location of cellular towers, which was initially provided to the regulatory agency as part of an initiative to encourage tower sharing among mobile operators. This is useful information to the disaster office, although GIS maps indicating the location of exchanges, central offices, and fiber optic routes are not part of this dataset. A further concern is that, due to the importance of this information during an emergency situation, disaster offices will need assurance that the maps they have will be accurate. Thus, there must be a mechanism to ensure that maps are kept up to date as infrastructure changes, such as through a regular updating process, scheduled annually, prior to the hurricane season.

The case of mapping information is an illustration of how, though some information that a telco shares with a regulator can be reused by the disaster office, this is less effective than the direct sharing of information between the telco and the disaster office; regulatory needs and disaster response needs are different. While the regulatory agency may use mapping data to address concerns in areas such as adequate market competition and achieving universal service coverage, the disaster office is more interested in knowing where vulnerable infrastructure is located, or in having the ability to project the impact of a service outage on communications methods when deploying resources to a disaster area.

The third example is a case where disaster offices see a need for formalized agreements that would standardize post-disaster reporting practices in the telecommunications sector. This is another situation where telecommunications companies may be hesitant to share some information - both due to

the aforementioned commercial sensitivity issue, as well as because, operationally, the post-disaster period is a very difficult time for them. Telecommunications company personnel may be busy with other urgent responsibilities, and find it challenging to collect and report data on a timely basis.

Thus, there is a need to ensure that the reporting mechanism is effective at conveying useful information to the disaster office, while not being overly burdensome for telecom staff. It is important that an appropriate balance be struck in this regard, and that is one reason that this process will need to be customized between individual telecoms and disaster offices. In these discussions, as with other negotiations in the formalization of responsibilities, the regulator may have a role to play in stewarding the discussion to achieve consensus between the parties. The regulator has insight into the workings of the telecommunications company, and may be able to discern the difference between a feasible and appropriate request, and when the company has reasonable grounds to refuse.

In reviewing these examples, the common challenges that come to light include:

- Reluctance to share information – the competitive commercial environment constrains the inclination of telecoms to make potentially sensitive information available to disaster offices.
- Information maintenance – information that has been shared may become out-of-date, and must be updated on a regular basis.
- Limited congruity between the needs of regulators and disaster offices - information shared for regulatory purposes is not necessarily suitable for the purpose of disaster risk reduction

These considerations must be kept in mind as specific means of collaboration between telecommunications companies and national disaster offices are investigated.

## **IV. Coordination for disaster mitigation and preparedness**

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Mitigation and preparedness are the two segments of the disaster cycle that are addressed before a disaster occurs. Mitigation refers to measures taken to avoid or reduce the potential damage and losses associated with the impact of a disaster. An example of this would be the use of earthquake-resistant building practices for telecommunications exchanges located in areas of high seismic risk. Preparedness entails taking steps to ensure the ability of an organization to react effectively in the event of a disaster. The development of disaster response plans and their testing as part of regular drills are examples of preparedness.

### **A. Mitigation**

Telecommunications companies and national disaster offices can coordinate on the following disaster mitigation activities:

- Improving the use and sharing of GIS maps for hazards and telecommunications;
- Developing policy to prevent network congestion in a post-disaster environment;
- Enabling agreements for the sharing of capacity between telecommunications operators during an emergency situation;
- Preventing cell tower vandalism.

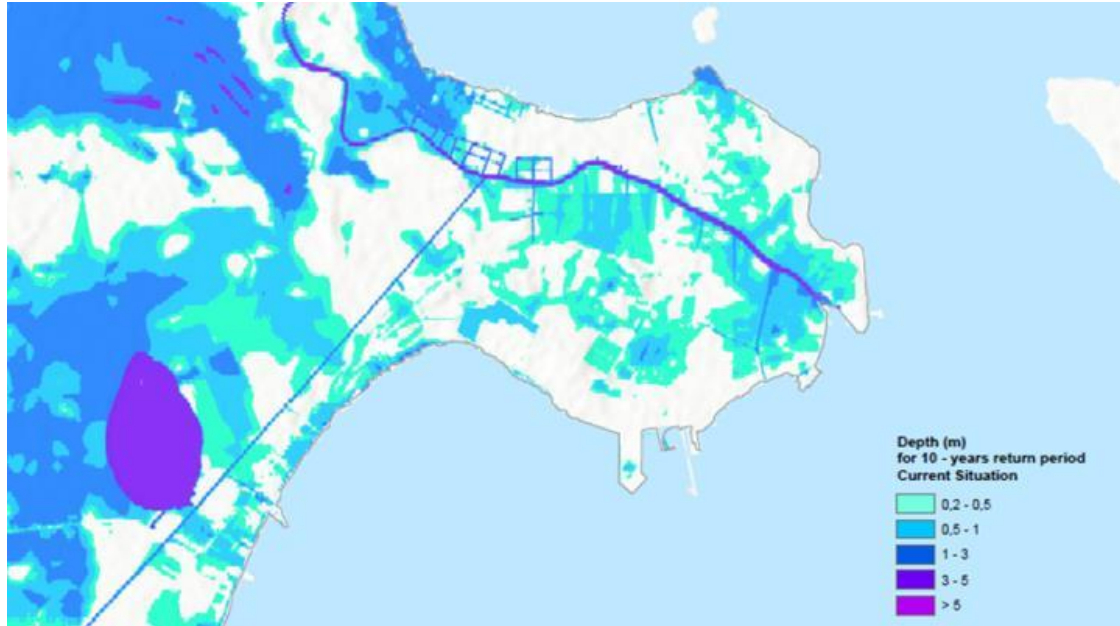
#### **1. Hazard maps and telecommunications overlays**

Hazard maps are maps that denote areas at risk of being affected by landslides, earthquakes, flooding, storm surge, tsunamis, and other hazards. An example of a hazard map is illustrated in figure 1, which denotes areas at high risk of flooding in Belize City. A telecommunications company could use such a map to ensure that outside plant interface cabinets are appropriately elevated in flood risk areas. While, in the past, these maps have been based on paper, or distributed in PDF format, the current typical use



case is distribution in a format compatible with modern geographic information systems (GIS). These maps are commonly used as an “overlay” in combination with other maps that display, for example, roads, infrastructure, and political boundaries.

**Figure 1**  
**Hazard map of flooding risk in the area of Belize City, Belize**



Source: Inter-American Development Bank (2016).

Like a hazard map, a telecommunications overlay is essentially a layer of mapping data that can be combined with other maps as part of a GIS system. Telecommunications overlays may denote infrastructure —such as cellular towers, central offices, switching cabinets, and fiber networks— or service availability, as in a mobile service coverage map. When combined together in a GIS system, hazard maps and telecommunications overlays can be used as part of the planning process for locating new telecommunications infrastructure, or for evaluating the need to relocate or harden existing infrastructure that has been situated in areas of high risk.

Interviews with representatives of disaster management offices indicate that hazard maps are used both for planning purposes and situational awareness during incidents. For example, the representative of the Trinidad and Tobago Office of Disaster Preparedness and Management (ODPM) shared a past experience of utilizing hazard maps to advise a telecommunications company that one of their buildings was in imminent risk of being overwhelmed by rising flood waters.

However, the use of telecommunications overlays is limited by a lack of access to them.<sup>9</sup> The representative of the Jamaican disaster office indicated that having a telecommunications overlay would create value by allowing that organization to plan their response and recovery efforts knowing which areas may be adversely affected by loss of certain telecommunications services. The Montserrat representative noted that having a telecommunications overlay would assist in visualizing data and support decision making in times of crisis, when external workforces may be assisting in the response and recovery process. Having access to such information affects how first responders are equipped with alternate communications equipment. For example, if mobile service is known to be lost in an area requiring assistance, UHF radios can be prioritized for responders in this area. A further use of

<sup>9</sup> The commercial requirements that have led telecommunications toward reluctance in sharing operational data, including maps of telecoms infrastructure, are discussed in Chapter III.

telecommunications infrastructure maps is to ensure that potential cascading effects can be understood and predicted. In a cascading event, the loss of certain critical sites and equipment can lead to further consequences to telecommunication and other services. This was the case in another example from Trinidad and Tobago, where several business and government institutions in the capital were negatively affected by an arson attack on a telecommunications cabinet.

Telecommunications companies, through their representatives in CANTO, have indicated that there is a desire within the industry to make better use of hazard maps for the purpose of disaster mitigation. Hazard maps, while generally available to the public, tend to be controlled by national disaster offices, and personnel at these offices have the best understanding of their availability, use, and limitations. Thus, the use of hazard maps by telecommunications companies should include more than simply downloading hazard map data from the disaster offices website; rather it should entail constructive and ongoing consultation with disaster office personnel. There is also a need for information sharing in the other direction—to ensure that the disaster office has access to telecommunications overlays, and that the information contained in those overlays is kept current with ongoing developments in the telecommunications infrastructure.

Thus, it is recommended that telecommunications and disaster management offices come together for a review of GIS resources on regular basis—perhaps scheduled annually, prior to the hurricane season—to ensure that both parties are up to date with the most recent maps appropriate to their purpose.

## 2. Planning to prevent post-disaster network congestion

It has become a common occurrence that, in the wake of a disaster, telecommunications networks become saturated with traffic. Especially following a sudden-impact disaster, such as an earthquake, members of the affected population take to their phones to reach out to loved ones and to make arrangements in relation to their personal needs for response and recovery. The impact of high traffic demand on top of potentially damaged infrastructure can result in an inability to communicate at a time when communication is of the highest urgency. For example, following the April 2016 earthquake in western Ecuador, it was reported to ECLAC investigators that mobile networks in the affected area were saturated for two days due to high demand.

The issue of how telecommunications networks can respond to such a disaster-induced surge in traffic was investigated following the 2011 Great East Japan Earthquake and Tsunami. In the months after that event, Japan's Ministry of Internal Affairs and Communications, in participation with telecommunications carriers and other stakeholders, set up a *Study Group on Maintaining Communications Capabilities during Major Natural Disasters and other Emergency Situations*. The report of this Study Group details a number of methods for managing the congestion issue. These include:

- The provision of additional network capacity around bottleneck areas;
- The use of a low-bandwidth message-board to enable people in disaster areas to let family members know that they are safe;
- Encouragement of text messaging instead of voice phone calls as a post-disaster communications method;
- The institution of a policy to limit post-disaster voice phone calls to a maximum length of time such as, for example, three minutes;
- The establishment of an appropriate balance between telecommunications capacity reserved for usage by emergency personnel and capacity available to the general public.<sup>10</sup>

While some of these measures reflect technical fixes, some have a social element as well. These reflect matters of public policy that should be agreed upon in advance, and open to public input, so that the tradeoffs associated with these policies can be understood by those it could potentially affect.

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<sup>10</sup> Study Group on Maintaining Communications Capabilities during Major Natural Disasters (2011).

For an example of a tradeoff, take the concern illustrated in the final bullet point above, regarding the balance between reserving capacity for emergency personnel, and for the general public. Disaster offices, first responders, and other government entities, have made clear the need to have network capacity set aside for their use, to ensure that they are able to communicate in a post-disaster environment. In the case of Japan's disaster, it was found that there were cases where the capacity on crucial nodes that had been set aside for these high priority communications was being underutilized. Had this capacity been put into service for use by the public, it could have helped to alleviate the problem of network congestion.

Clearly, these issues are multi-faceted. Their resolution should reflect deliberate policy choices made in advance, rather than ad-hoc decisions made hastily in the immediate aftermath of a disaster. Thus, it is recommended that an advisory committee be delegated to settle upon practices to be adopted that can reduce the problem of post-disaster network congestion. In many countries, a body already exists to advise the National Emergency Operations Center on issues related to telecommunications; such a group may be an appropriate forum to undertake this task. Once established, these procedures should be adopted by telecommunications carriers and documented as part of national emergency plans for telecommunications.

### **3. Capacity sharing between operators**

There is a need to have telecommunications companies agree to provide mutual assistance in a post-disaster environment. This may include potential sharing network transmission capacity. One can envision a case where, due to infrastructure damage, the only way a carrier can provide service to customers is to make use of facilities provided by another carrier.

It is important that carrier rivalries not preclude this from happening —both for the purpose of maintaining disaster resilience, as well as for maintaining robust market competition in the telecommunications sector. A telecommunications company cannot be allowed to gain competitive edge over a weakened rival by taking advantage of a post-disaster situation to poach their customers. Rather, procedures and rules that facilitate capacity sharing should be established far in advance of their actual need. The requirement for carriers to cooperate in this area has been written into law in many jurisdictions, often as part of *force majeure* clauses that are applicable under exceptional circumstances. For example, the 2006 Telecommunications Act of the British Virgin Islands states:

“Operators and service providers shall develop plans for operating networks and providing services during force majeure and where there is serious and substantial interruption in the provision of telecommunications services, and shall cooperate in the development and implementation of any such plans”<sup>11</sup>

In jurisdictions where this type of requirement is in place, it is an appropriate role for the disaster office, in conjunction with the telecommunications regulator, to act as a facilitator to ensure that appropriate plans for coordination between carriers are established and regularly updated. In jurisdictions where this is not yet a legal requirement, disaster offices and regulators should nonetheless encourage telecommunications providers to come to an agreement on plans for post-disaster cooperation and capacity sharing.

### **4. Preventing cell tower vandalism**

Caribbean mobile operators have identified vandalism as an ongoing threat to their operations. They have indicated that, specifically, battery backup systems as well as standby generators and their fuel supplies are commonly targeted for theft. Equipment cabinets, fuel tanks, and perimeter fencing are often damaged in the pursuit of these items.

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<sup>11</sup> Virgin Islands Telecommunications Act of 2006 – Part XVI, Section 89, Clause 5.

**Figure 2**  
**Vandalism damage to cellular site<sup>a</sup>**



Source: CANTO.

<sup>a</sup> In this photograph of a cellular base station, a hole has been cut in the perimeter fence and generator equipment has been stolen.

The targeting of backup electrical systems for theft has significant implications in the event of a disaster, because it means that critical telecommunications infrastructure cannot operate if there is a power outage. This problem contributed significantly to mobile network outages in Saint Catherine Parrish, Jamaica, during Hurricane Sandy in 2012.<sup>12</sup>

Representatives of telecommunications companies have expressed frustration that they have been unable to elicit an appropriate response to this problem from Caribbean governments. By highlighting the important implications that cell towers have with regard to post-disaster communication, it may be that national disaster offices can help telecommunications companies to gain traction in establishing the political will needed to confront the issue.

## **B. Preparedness**

National disaster offices and telecommunications companies can cooperate in the following areas with regard to disaster preparedness:

- Sharing of telecommunications company disaster response and business continuity management plans.
- Establishing a protocol to advise national disaster offices of telecommunications service outages.
- Establishing geographically-targeted mobile phone-based early warning systems.
- Integrating telecommunications providers into Common Alerting Protocol (CAP) systems.
- Co-location of emergency telecommunications equipment.
- Ensuring that emergency telecommunications facilities are regularly tested, and that telecoms companies are integrated into national disaster drills.

<sup>12</sup> Planning Institute of Jamaica (2013), p 48.

## 1. Sharing of disaster response plans

Telecommunications companies maintain their own planning documents that outline their internal procedures for responding to a disaster and maintaining the continuity of business operations in the face of potential damage to infrastructure and loss of personnel. As discussed in Chapter III, the information in these documents is considered to be quite sensitive, and companies tend to be reluctant to share it. As a result, national disaster offices have limited insight into the content of these plans. Their representatives have expressed a need for at least a subset of the information in these plans to be shared with disaster offices as a matter of national interest.

One concern is that these plans should be subject to an appropriate review, as occurs with disaster plans related to other elements of critical national infrastructure —airports and seaports for example. This would help to assure that disaster plans in the telecommunications sector are aligned with broader national plans for disaster response, and would provide national disaster offices with insight that may be useful in decision making during a time of emergency.

A specific element of telecommunications business continuity planning that disaster officials broadly indicated would be of value concerns the topic of backup power systems. The Trinidad and Tobago representative indicated that knowledge of the “runtime of facilities” can assist in planning what telecommunication gear first responders should be taking with them when venturing into certain areas where telecommunications services are believed to be lost, due to depleted backup power or otherwise. Advance knowledge of which sites may be offline after secondary power is calculated to be depleted can also assist disaster office planning in cases where telecommunications companies are not particularly strong in providing network status information. This information can also affect the decision making process, for example, in the prioritization of clearing of certain access roads to mobile tower sites or in the distribution of limited fuel supplies to keep certain sites operational.

Thus, while telecommunications may not wish to share all of their planning documents, clearly there are significant elements of these plans which are important to share, and to have reviewed by national disaster offices. Some of this information will naturally be shared if telecommunications companies enlist the help of disaster offices in the creation and update of these plans, as outlined in Chapter III. However, there is also a need for telecommunications companies and disaster offices to come to a broader understanding of what information can be shared, how its confidentiality can be protected, and how it may be used. This should be a regular, ongoing discussion that forms part of a broader programme of information sharing between the parties.

It would be useful to incorporate the outcome of these discussions into the format of the emergency plan itself. For example, less sensitive, procedural information could be included at the front of the document, with technical details that are not appropriate for sharing placed in an appendix at the back. The document —excluding the appendix— could then be shared with the disaster office, to ensure that they are adequately informed of disaster response procedures.

## 2. Advisory of planned outages

The representative of the Saint Lucia National Emergency Management Organisation (NEMO) indicated that the office does not receive advanced warning of planned outages from telecommunications operators, as they do from water and electricity utilities. In Trinidad and Tobago, this information is provided by just one of the carriers, which provides a daily report that details significant events in the past 24 hours and planned occurrences in the next 24 hours.

While it may be the case that telecommunications companies are reluctant to share information that reflects poorly on their network’s capabilities, this is nonetheless information that should be shared due to the possibility that a communications outage may have an impact in an emergency situation. Moreover, if a longstanding practice of sharing network status is in use prior to a significant disaster event, the same advisory practices can be adapted to provide network status updates in a post-disaster environment. This will help to smooth the path for information exchange at a time of critical need. Thus,

this need should be considered in conjunction with the need for the standardization of post-disaster response and rebuilding through the use of a common form, which will be discussed in chapter V.

With these factors in mind, representatives of disaster offices should work with all national telecommunications companies, as well as regulators, to develop a nationally standardized data format for the exchange of this information. If a common, standardized format for these advisories can be adopted, it should be a relatively simple task to integrate them into existing information systems—both on the part of telecommunications companies producing the advisories, and on the part of the disaster offices that are using them.

### **3. Early warning systems**

The need for more effective public early warning systems was illustrated in Chapter I's discussion of Hurricane Joaquin in the Bahamas. In that event, a hurricane took a track that was not consistent with prior predictions, and those who were in harm's way were not notified of the impending danger. An advanced warning, broadcast to mobile phones, could have reduced the risk to lives and loss to livelihoods.

While some mobile-based public warning systems exist in Caribbean countries, they are far from universally available. Typically these systems, where they exist, are based on Short Message Service (SMS) technology, a choice that poses a number of concerns. SMS systems are subject to congestion when a large numbers of messages are sent out at one time, and representatives of disaster management offices have reported that, in past experiences, it has taken an extended amount of time for all subscribers to receive SMS-based text message alerts. In some instances, it has been reported that SMS-based emergency alerts have been received up to 24 hours after they were sent. The chances of these alerts being received out of sequence is also high, which can cause uncertainty and confusion among message recipients in a disaster situation.

It may be possible that, with additional capacity or other technological fixes, the problems of message latency and mixed-up order can be reduced. Further, the low populations of some islands may limit the occurrence of problems that are experienced in larger communities. However, the scale of congestion-related concerns may not be well understood by either disaster management officials or telecommunications operators because, in some cases, these systems undergo only limited testing. Specifically, it is a concern that tests of these systems commonly involve sending messages to only a limited number of recipients, and this may not provide an adequate "stress-test" that is equal to what happens when emergency messages are sent out to a country's entire population with an expectation that they will be received in a timely manner. As a result, there may be a false confidence in the ability of these systems to provide effective service during a real emergency.

Another concern with regard to SMS-based early warning systems, as currently used, is their lack of ability to target messages to populations in limited geographic areas. Using SMS-based alerts, messages can be sent to all registered users in a country, but they cannot be limited to smaller geographic areas, such as, for example, all cellular phones within a certain coastal area.

One technology that exists which can address this issue is called cell broadcasting. As an alternative to SMS-based technology, cell broadcasting is also not subject to the problem of message congestion, as discussed above. Its avoidance of the congestion issue makes it better suited, not just for quick dissemination of alerts, but also for use in the highly congested post-disaster telecommunications environment. At such times, the system may be used to provide public advisory messages to inform citizens as to the availability of relief supplies and other services.

Representatives from several national disaster offices have indicated that telecommunications companies have been somewhat opposed to the implementation of cell broadcast technology. Telecommunications companies have cited cost as an issue, noting that there are significant licensing charges in relation to the technology. On the other hand, much of the equipment to support this system should already be in place, as it is a widespread standard that has been incorporated into the GSM, UTMS, and LTE specifications.

There are also vendors who offer proprietary software enhancements to SMS systems that provide congestion control and geo-fencing features, similar to what is possible through cell broadcasting. Such systems can identify cell numbers attached to a given cell tower, and can provide alerts customized by language and location. They can identify new numbers as they come into the danger zone, and can alert these new numbers accordingly. This “enhanced SMS” solution is another possible option that should be considered in the implementation of mobile public warning systems.

A final alternative is app-based technology, which can provide alerts to smartphones using special data plans designed to enable special-purpose disaster communication. It is a drawback that smartphones are not as ubiquitous as cellular phones in general, and thus, app-based messages cannot reach as large a portion of the population as can text-based methods. However, smartphones are quickly taking over market share from the older generation of cell phones; it may be that they have acquired sufficient reach that the additional benefits made possible through the establishment of a broadband disaster communication channel outweigh the disadvantages of their reduced availability. This is a consideration that should be evaluated on a country-by-country basis. If it is decided that an app-based public warning system is to be established, disaster offices will need to work with regulators and telecommunications companies to ensure that every cellular phone sold in that country is equipped with the app, and that a dedicated data channel is provided for its use.

Regardless of the technology chosen, it is clear that telecommunications companies are not inclined to fund such systems at their own expense. In as much as they would be providing a public service, it is not unreasonable that public funding should be arranged to cover the cost. Thus, disaster offices and telecommunications companies should work together to make the case to government that these are important public safety systems that are worthy of public funding. A potential source of funds for these initiatives can be found in the Universal Service Funds that have been established in a number of Caribbean countries. The mandate of these funds has tended to broaden in recent years; originally established to ensure that all citizens have access to telecommunications technology, in many cases they are now more broadly available to support technology projects in the public interest.

#### **4. Common Alerting Protocol**

Common Alerting Protocol (CAP) systems enable disaster management offices to publish public warning messages to an array of different mediums at the same time. For example, CAP systems can trigger radio interrupts, television scroll messages, and warning sirens, all at the same time from a single point of control at the disaster office. These systems have been deployed to several islands in the Caribbean, including Anguilla, Montserrat, and Tobago. There is an ongoing project by the United Nations Development Programme (UNDP) that plans to deploy CAP systems to Barbados, Dominica, Saint Lucia, and Saint Vincent and the Grenadines by the end of 2016.<sup>13</sup>

One capability of CAP systems is that they can trigger mobile-phone based alerts, provided the alerting infrastructure is made available by the mobile network operators. However, in the latest round of CAP system implementations, mobile network operators are not participating in the initial phases of system deployment (Clarke, 2016). This reflects that, in many cases, mobile-phone based early warning systems are either not established, or are not mature enough to be connected to the system. This is unfortunate, but should serve as a reminder that it is well past time for mobile phone-based early warning systems to become an established part of national infrastructure for disaster preparedness. In the short term, the establishment of app-based systems may be the quickest and most cost-effective means of providing a mobile early warning capacity that can feed off of the data provided through these CAP installations.

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<sup>13</sup> See [http://www.bb.undp.org/content/barbados/en/home/operations/projects/crisis\\_prevention\\_and\\_recovery/CAP.html](http://www.bb.undp.org/content/barbados/en/home/operations/projects/crisis_prevention_and_recovery/CAP.html).

## **5. Co-location of emergency telecommunications equipment**

In several cases, such as in the British Virgin Islands and in Montserrat, operational equipment owned by disaster management offices is housed in the facilities of telecommunications companies at no cost to the disaster management office. Some countries, such as Saint Lucia, maintain their own independent radio transmission networks, and these may also benefit from co-location at tower facilities owned by mobile network operators. This would enable emergency communications networks to benefit from superior tower locations held by telecommunications companies, and to make shared use of backup power systems at those facilities.

In some cases, telecommunications companies may wish to locate resources with disaster offices as well, such as offsite backup systems that may be needed to support corporate disaster recovery needs. Telecommunications companies and disaster offices should work together to keep each other informed of their co-hosting needs, as well as the availability of facilities for the purpose.

## **6. Testing and drilling**

A concern was expressed above about the limited scale of testing currently practiced for SMS-based warning systems. Another problem with the testing of these systems is in the lack of frequency. While the British Virgin Islands, commendably, indicated that their alerting system is tested every fourth Friday of the month, and another country indicated that testing occurs every six months, some other countries indicated that there was no testing of these systems at all or, in one case, that the alerting system had last been tested in 2012. One disaster official indicated that there is something of a cultural norm to trust the telecommunications provider that the necessary service would be available when needed. Regardless of the cultural norm, it should be recognized that, when procedures are not regularly practiced, the risk of failure is elevated.

The need to have regular drilling procedures extends beyond the area of early warning systems. Drills should touch upon every area of interaction between telecommunications companies and national disaster offices —particularly in the area of post-disaster information exchange, where ensuring that procedures are tested and practiced ahead of time will enable far less chaotic operations when a real disaster strikes. Disaster offices need to take the lead in ensuring that all national telecommunications companies are included in the planning and execution of regularly scheduled drills, such as the annual Caribe Wave exercise focused on regional tsunami preparation.





## V. Coordination for post-disaster response and rebuilding

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Response and rebuilding are the two parts of the disaster management cycle that occur following a disaster. *Response* refers to actions taken in the immediate aftermath of a disaster to save lives, provide humanitarian relief, and restore the operational functionality of critical infrastructure. *Rebuilding* is a long-term process that takes place in the weeks, months, and years following a disaster. Its purpose is to restore long term stability and vitality to infrastructure, social institutions, and the economy. A commonly expressed ideal is to “build back better,” so that infrastructure can better serve the needs of a post-disaster community, and so that the community is less vulnerable to the impact of future disasters.

### A. Response

Disaster response can be improved through collaboration between national disaster offices and telecommunications companies in the following areas:

- Standardization of protocols on the elevation of network priority for disaster-related communications.
- Establishment of an effective mechanism through which telecommunications companies can provide network status reports to disaster offices.
- Establishment of a mechanism through which intelligence collected by telecommunications crews in the field can be passed on to disaster management authorities.
- Coordination on the placement of Cellsite-on-Wheels (COW) facilities to locations of greatest need.
- Dissemination of public information notices and other outreach activities.

#### 1. Prioritizing disaster-related communications

Disaster offices reported that telecommunications operators have been accommodating in providing prioritized restoration and network access to telephone numbers used by disaster responders and key government ministries. Those on the list are given a high priority in efforts to restore service, and are

able to use bandwidth that has been set aside for emergency use in the post-disaster environment. This enables important communications to bypass congestion issues that may affect the publicly accessible portions of the network in the immediate aftermath of a disaster.

This type of service prioritization is common, and, in many cases, is even required by statute. However, the means for managing lists of priority numbers and other means of communication have tended to remain somewhat informal. When these lists are managed on an ad-hoc basis, it can lead to a situation where they are not kept sufficiently current. When a disaster strikes, personnel and offices that should be on the list may not be on it, and others may remain on the list when their presence may no longer be justified. It should be understood that there is cost to having a priority service list that is longer than necessary. As discussed in Chapter IV, in the section on post-disaster network congestion, it has been found that, when additional capacity is unnecessarily reserved for priority users after a disaster, it can contribute to congestion-induced communications difficulties experienced on the public portions of the network.

For this reason, the review and renewal of network prioritization lists and first responder contact lists should be an annual task, to be completed before the beginning of each hurricane season, and formally signed off on by representatives of both the telecommunications company and the disaster office. As part of this process, telecommunications operators should advise disaster offices of the technical means through which they are providing service prioritization, and explain any implications that this may have for congestion of the public network in a post-disaster environment.

## **2. Network status reporting**

The experience in Dominica after Tropical Storm Erika shed light on the need to ensure that there is an agreed-upon means for the provision of status updates between telecommunications operators and the national disaster office in the immediate aftermath of a disaster. This should include a mutual understanding of reporting lines, as well as a standardized format for the sharing of network status updates and service restoration plans.

It has been suggested that a standardized form be developed for the purpose of facilitating this reporting, and that this standard be integrated into existing information systems both at telecommunications operators and at the disaster office. Among representatives of disaster offices interviewed for this study, it was widely expressed that such a form would be useful. A template for such a form is illustrated in figure 3. This template, which is a Microsoft Excel spreadsheet, can be used as a model to be customized at a national level, based on the requirements of both the disaster management office and the telecommunications operators. An adapted version of this spreadsheet is being used by CANTO, as a reporting mechanism for their post-disaster Mutual Assistance Program. A digital copy of the template can be obtained by contacting the ECLAC Subregional Headquarters for the Caribbean.

The form template is divided into several sections. The top section includes contact information, as well as an indication of the date and time of the report. The contact details may be customized with additional fields, as, for example, CANTO has done by including details for a secondary contact. The date and time fields are an important element of the form, as it is intended that numerous copies of this form be submitted over the course of the disaster response period. The frequency of report submissions is a matter that needs to be agreed upon between the disaster office and the telecommunications operators; it is envisaged that this status report would be submitted on at least a daily basis, but it may need to be provided even more frequently in the first days after an event.

The second section of this form is designed so that crucial, summarizing information is available on the first page, so that conclusions do not have to be reached by drilling deep into a list of specific incidents that are being managed. The form asks for a summary of network status, and a summary of response efforts. It also asks for an indication of any outstanding requests for assistance from the disaster office, or other agencies. While this form is not an appropriate vehicle for an actual assistance request—that should be done through a direct interaction with the disaster office—it can be useful for tracking the status of requests that have been made.

**Figure 3**  
**Prototype for a telecommunications status reporting form**

	A	B	C	D	E	F	G	H
1	<b>Periodic status report on disaster impact to telecommunications service and infrastructure</b>							
2								
3	Name of telecom organization:						Contact name:	
4	Date:						Contact telephone:	
5	Time:						Contact e-mail:	
6								
7	<b>Summary of current network status:</b>							
8	Include estimated percentage of customers without service, list of areas without service, and other pertinent information.							
9								
10								
11	<b>Summary of response efforts:</b>							
12	Include information on assets deployed in the field, forecasted timetables for service restoration, status in fulfilling any requests for special assistance by external agencies, and any current challenges to response efforts.							
13								
14								
15	<b>Requests for assistance:</b>							
16	References to any current or outstanding requests for assistance, including the name of the agency from which assistance has been requested.							
17								
18								
19	<b>Damage and impact log</b>							
20		<b>Damage description</b>	<b>Location</b>		<b>Current Status</b>		<b>Notes</b>	
21	<b>Pat #</b>		<b>Name of locale</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Impact on service</b>	<b>Response efforts</b>	
22	1							
23	2							
24	3							

Source: ECLAC.

The third section of the form is a damage and impact log. This section should list the individual locations where infrastructure has been damaged, any related service impacts, and the status of response efforts. This section in particular will need customization based on the needs and capacities of telecommunications providers and disaster offices. For example, feedback from representatives of telecommunications providers that have reviewed the template indicates that there may be some difficulty in providing latitude and longitude-based location information for damaged infrastructure during the frenzy of a disaster response effort. However, these fields have been included because detailed location information is germane to the needs of the disaster office—especially if the data is to be integrated into a GIS-based mapping system. Thus, it may be that, if a set of infrastructure location coordinates has been shared with the disaster office prior to the event—and is already stored in the office’s GIS system—damaged infrastructure may simply be referenced through a locality name or a reference code. This is the type of issue that will need to be negotiated as part of the process of agreeing upon a finalized form design.

It must be recognized, however, that the adoption of a form based on this template will not, in itself, provide effective network status reporting. When a prototype of the form was tested during the 2015 CANTO Hurricane Simulation, it became clear that there was a need for training to develop a common understanding of how it was to be used; each company that used the reporting form filled it out with different types of information. A similar problem occurred in the aftermath of the April 2016 earthquake in Ecuador, when each of the three major telecommunications companies submitted a report on damaged infrastructure using a common spreadsheet, but had a different understanding of the kind of data that was to be included in each column. This posed a challenge to the aggregation and reporting of information concerning the entirety of the telecommunications sector.

What this indicates is that there is a need to come to a common understanding on the use of information collection tools prior to a disaster, and to ensure that training in this area is provided to all involved parties as part of regularized disaster preparation activities.

### **3. Integrating intelligence collection**

Looking beyond reporting needs specific to the telecommunications sector, it should be noted that telecommunications repair crews in the field are potentially a valuable source of information to support the broader national response effort. While these crews are appropriately focused on the timely restoration of communications services, as they travel from place to place, they are well positioned to provide reports of road conditions or infrastructure damage that is encountered.

Telecommunications companies can provide a valuable public service by ensuring there is an effective channel of communication that enables reports from repair crews to reach national disaster offices. They can go a step further by providing disaster offices with real-time information on the location of repair crews, so that if disaster offices have a query as to conditions in an area, they may be able to query the repair crew for needed information. For example, a telecommunications repair crew may be able to provide information verifying the location of a landslide that has been reported in their area.

One thing that worked well to facilitate this kind of reporting during the response to Hurricane Earl in Belize was the use of a WhatsApp group, which was used to communicate between telecommunications and power company staff in the field and representatives of the disaster office. A WhatsApp group can be an effective means of post-disaster coordination, although it may not necessarily be broadly available in the immediate aftermath of a disaster because of damage to telecommunications infrastructure. Thus, alternative channels of communication may also be needed.

With that in mind, disaster offices and telecommunications companies should come to an agreement on the most effective means of enabling post-disaster reporting mechanism, and their use should be rehearsed as part of annualized drilling activities.

### **4. Coordinating COW deployments**

Cellsite-on-wheels (COW) systems are used to provide temporary cellular service for an area, and are of special value in a post-disaster environment when permanent cellular infrastructure may be out of service due to damage. There are also of value in providing supplemental cellular service in areas where large numbers of people are temporarily congregating —such as refugee shelters and camps, or distribution centres for relief materials. Significant public benefits can be realized if national disaster offices are able to influence the positioning of COW systems in a manner that would support these needs.

To prepare for this potential need, mobile network operators should provide disaster offices with annual updates of their capacity for COW deployment. Disaster offices should provide the network operators with information on the location of facilities that are expected to be used as shelters or camps in the event of an emergency. Further, the request for and deployment of COW systems is an element that should be integrated into annual disaster drills.

### **5. Public information and outreach**

Telecommunications providers should be an important player in public information and outreach operations. Mobile providers can support the community by distributing public advisory notices via text, potentially making use of the same systems established to enable early warning systems. Ideally, such public advisories notices would be geographically targeted, and could provide information such as advisories to citizens on the location of relief supply distribution points, or guidance to psychological counselling services that may be available to survivors of disaster-related trauma. Additionally, carriers can establish “short codes” that people can dial to report problems, request assistance, or to make financial donations to relief efforts.

In past instances when telecommunications services have been interrupted by disasters, providers have stepped up to establish free calling centres at central offices and other locations, enabling members of the public to make outgoing calls via satellite connection. In as much as these facilities become places where people congregate, carriers can work with disaster offices to establish these locations as public information centers that can provide official information on resources that may be available to help citizens begin to rebuild their livelihoods.

The role that telecommunications carriers are expected to play in public information and outreach should be well-understood in advance of an event so that it can be appropriately prepared for. This understanding should be reviewed on an annual basis in discussions with the disaster office, and elements of this planning should be integrated into national disaster response exercises.

## **B. Recovery**

Recovery from disaster is a long term process. It is important that, at the outset of the recovery stage, telecommunications companies are integrated into post-disaster planning activities, to ensure that their rebuilding plans are aligned with national priorities, and that available company resources can be used to support the economic and social revival of affected areas. Specific means through which this can be addressed are:

- Telecommunications companies need to be more effectively integrated into the damage and loss assessment (DALA) and post-disaster needs assessment (PDNA) processes.
- Disaster offices can help to ensure that equipment used in the restoration of telecommunications infrastructure is granted the same import duty exemption available to other goods used in the rebuilding process.
- Data held by telecommunications companies should be used to understand how populations have migrated as a result of a disaster.

### **1. DALA and PDNA**

Damage and Loss Assessments (DALAs) are processes to document and quantify the impact of a disaster on a national economy so that priorities can be established for the rebuilding process. Post-Disaster Needs Assessments (PDNAs) perform similar analysis, with a greater emphasis on national development planning. DALA and PDNA processes are typically directed by national authorities charged with recovery planning, often in conjunction with international agencies such as ECLAC, the Inter-American Development Bank, or the World Bank. National disaster offices typically participate in these processes in an advisory role, in many cases having received prior training in the process.

The documents that come out of these processes are used to guide national discussions on rebuilding, and to negotiate funding arrangements with international lenders. The documents that come out of these processes are also important in that they provide a detailed historical record of the disaster's impact, which can be of value to future researchers working in the field of disaster risk reduction. The recommendations found in this very study are substantially informed by experiences described in past DALA and PDNA documents.

Telecommunications companies are among the many institutions that are expected to provide information to contribute to this process. Typically, they are requested to provide baseline data on the number of customers served in a disaster area, as well as the number of customers affected by disaster-related service outages, and a timetable of restoration of services in various areas. They are also requested to provide information on the cost of damages sustained to their infrastructure.

However, Caribbean telecommunications companies have had a mixed record of participation in past disaster assessments. In many cases, they did not provide requisite data was to investigators, resulting in very rough or incomplete estimates for the telecommunications sector. In some cases of disasters in countries with multiple carriers, only one telecommunications operator submitted costing data, while others did not. In these cases, estimates for damage incurred by the missing carriers were either left out of the document, or were pro-rated based on assumptions about market share in relation to the carrier for which data existed. As a result, the accuracy of these estimates was questionable, which may have led to decision-making that affected the telecommunications sector being based on poor data.

It is necessary that Caribbean telecommunications companies comply with their responsibility to provide accurate costing information as part of PDNA and DALA processes. It can be assumed that they have this data available inside their organizations, because it is known to be used as part of the process

for submitting insurance claims. However, there may be a reluctance to share it as a result of commercial privacy concerns, as outlined in Chapter II, or simply because of poor procedures regarding communication with the disaster authorities and planning organizations charged with assembling these reports. Regardless of the reason, the submission of this data is in the national interest, and, as licensed operators in a regulated industry, telecommunications companies should be required to provide it.

Disaster offices can help telecommunications companies to understand this responsibility in advance of a prospective disaster, and should ensure that the contact information for those inside the company who will be expected to provide this information is kept up to date. Personnel from telecommunications companies should also be invited to participate in training activities on DALA and PDNA processes, which are held from time to time in various Caribbean countries, often with local facilitation provided by the national disaster office.

## **2. Import duty exemptions**

A concern that has come to light as a result of review of past DALA and PDNA documents was noted in the report of the exercise that was completed following the impact of Hurricane Tomas in Saint Lucia in 2010. The report noted:

“One point that was raised by the Digicel management team was that the Government of Saint Lucia did not offer any concessions to the industry for equipment replacement. It was proposed that the granting of duty-free concessions after a disaster event be considered by the Government of Saint Lucia, to assist in the rehabilitation process.”<sup>14</sup>

It is common, after a disaster, for a duty free period to be declared on materials necessary to aid the rebuilding process, and this concession should be extended to cover the need to replace damaged telecommunications infrastructure. National disaster offices should be cognizant of this issue, and can help to provide telecommunications companies with the political support to ensure that their needs are considered in the establishment of concessions for post-disaster import duty relief.

## **3. Data on population movements**

Mobile network operators have access to geographic location information on their customers. When a customer’s cellular phone is connected to a tower in one location before a disaster, and following the disaster the customer is next found to connect to a tower location in another section of the country, this is a strong indication that customer may have become displaced as a result of the disaster. Taken in the aggregate, across a company’s customer base, this data, if properly analyzed, can be used to uncover information about large-scale population movements that have occurred as a result of the disaster.

Figure 4 illustrates how an analysis similar to this was performed to understand how populations shifted in the immediate aftermath of the earthquake that occurred in Haiti in 2010. In this case, anonymized call detail records were analyzed from before and after the earthquake. Using this data it was possible to uncover patterns in the amount of migration that occurred from the capital to surrounding areas. In general, it was found that migration patterns strongly corresponded to calling patterns prior to the event; in other words, displaced persons departed for areas with which they already had strong social ties. In fact, it was recognized that calling data has a strong predictive capacity that can be used to create a model of likely disaster-related population movements—even before a disaster occurs.

The timely analysis of this type of data has the potential to provide valuable support for decision making processes regarding the direction of social services after a disaster. It can expose a need to provide additional support to communities outside of the immediate disaster area, which may be under stress due to the absorption of large numbers of displaced people.

There are a number of challenges with regard to this type of data analysis. Subscribers’ right to privacy is one of them, which is why policies need to be established to ensure that this data is managed

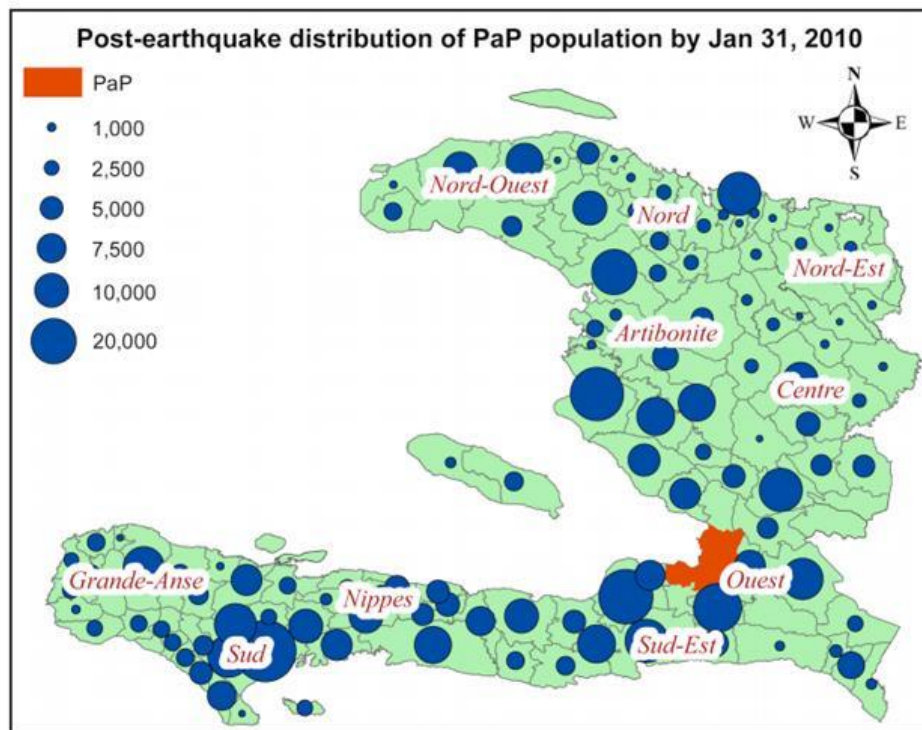
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<sup>14</sup> ECLAC (2010) p. 132.

anonymously, and in the aggregate, so that the movements of individual people cannot be picked out from the broader data set. Another concern is the significant difficulty that providers will have in providing this information in the immediate aftermath of a disaster. There is a significant amount of work required to identify, extract, and anonymize the data needed for this kind of report, and so it is not reasonable to expect a timely delivery of this information —especially if it is the case that such a report has never been generated before.

Thus, it would behoove disaster offices to discuss this issue with telecommunications companies prior to the occurrence of a disaster, so that appropriate control policies can be established, procedures for data extraction and anonymization can be put in place, and practice reports can be generated based on the data. Since cellular calling patterns before a disaster have a strong relationship with post-disaster migration patterns, it should be possible to create predictive maps for population movement under a number of potential disaster scenarios. It would be of significant value for disaster offices to have these maps on file prior to the occurrence of disaster, and the experience gained in producing the maps before an event would enable mobile network operators to produce maps after an event within a quick enough timeframe to help support decision making processes as the disaster response and recovery unfolds.

**Figure 4**  
**Map of post-disaster population movements based on call detail records from mobile phones**



Source: United Nations Global Pulse (2013).





## VI. Conclusion

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This study is the product of extensive engagement with representatives of both disaster offices and telecommunications companies. From these interactions, it is clear that there is good will among both groups, and a shared desire to reduce disaster risk and increase national resilience. The constraints that have been uncovered tend to be caused by limitations of capacity on the part of disaster offices, and commercial concerns on the part of telecommunications operators that limit their inclination toward information sharing. It is recognized that, while there may be a role for regulators to play in refereeing negotiations between the groups, the use of regulatory fiat to compel cooperation from telecommunications providers should be considered only as a last resort. Rather, more is to be gained through the cultivation of a productive partnership based on the pursuit of mutually beneficial goals.

This study highlights numerous areas in which telecommunications companies and disaster management offices can collaborate. In some jurisdictions, such as in the British Virgin Islands, a strong tradition of collaboration has already been developed. In other countries, it can be said that there is opportunity for improvement. As the entities responsible for the coordination of disaster management in their countries, national disaster offices should take the lead in inviting the telecommunications industry to work to strengthen this relationship. Telecommunications companies, recognizing their responsibility as corporate citizens, should engage with this effort. A suggested first step would be to foster the greater involvement of telecommunications companies in national disaster simulation exercises. A second step would be for telecommunications companies to share selected portions of their disaster response plans with disaster offices for their review and comment. A third step would be to establish procedures for the regular exchange of updated GIS mapping data, so that telecommunications companies will have up to date hazard maps while equipping national disaster offices with current information on the national communications infrastructure.

The report of the meeting that inspired the investigation into this topic —2013's *Expert Group Meeting on Information and Communication Technologies for Disaster Risk Management in the Caribbean*— suggested a need for more formalized mechanisms of agreement between national disaster offices and telecommunications companies. This study has found that, though a number of formalized mechanisms exist—including advisory bodies, telecommunications operator licenses, and acts of legislation— many of the operations-level practices are not codified, and are subject to either informal or

ad hoc procedures, or are governed by assumptions. These practices could be made more robust if responsibilities, procedures, and data transmission standards were formally agreed to, documented, and revisited on a regular basis. The Memoranda of Understanding (MOUs) signed between the British Virgin Islands Department of Disaster Management and various national telecommunications companies can be looked to as an example of this type of agreement. Regional organizations, such as CANTO and CDEMA, may wish to sponsor the development of model MOUs that can be adapted to this purpose.

The issue of instituting mobile phone-based public early warning systems stands out as perhaps the most important aspect of this agenda. Advance warnings of an impending disaster, delivered through mobile phones, hold the potential to save lives and reduce damage to property. These systems are crucial to building national resilience in Caribbean countries, but in many cases are unavailable or inadequate. There are several areas in which progress is required in order to establish effective early warning systems in the Caribbean subregion. First, there is a need to perform an in-depth evaluation of the competing technology options that can be used to implement this type of early warning system. Ideally, this could be accomplished at a subregional level to draw from a broad depth of experience and avoid the duplication of efforts. Organizations such as CANTO, CDEMA, ECLAC, and the Caribbean Telecommunications Union (CTU) can contribute to this effort. Second, there is a need to identify funding sources to provide the capital investment needed to implement these projects—Universal Service Funds may be an option here. Third, there is a need to effectively integrate these systems into existing communications control mechanisms, such as the Common Alerting Protocol (CAP) systems that are being deployed in a number of Caribbean countries, and to ensure that a regularised testing regime is put into place. This is a task that must happen at the national level.

In all of these areas, ECLAC and other international organisations can provide a certain amount of expertise and advice, but leadership must come from persons working inside of disaster offices and the telecommunications industry. Disaster resilience is a national concern that requires national champions if it is to be considered a national priority. By working together, national disaster offices and telecommunications companies can be those champions. While political will, institutional mandates, and financial support are all necessary ingredients to affect change, none of these will become available without pressure from conscientious individuals working inside of their institutions to push for improvement. It is hoped that this study can provide a roadmap to help those individuals understand how they can work together to do what needs to be done.

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## **Annexes**

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## Annex 1

### Condensed list of recommended areas for collaboration

Using the disaster management cycle as a framework, the following list of recommendations has been developed detailing ways in which telecommunications companies and national disaster offices can enhance their working relationship:

#### Mitigation

- Telecommunications companies should make effective use of knowledge resources available through the national disaster office, including instruments such as hazard maps, as part of the planning process for the development of resilient network infrastructure.
- Disaster offices and telecommunications companies should work together to develop a policy addressing the tradeoffs associated with preventing network congestion in a post-disaster environment.
- Agreements for the sharing of capacity between telecommunications operators during an emergency situation should be in place.
- Disaster offices can help telecommunications companies build political support for aggressive law enforcement action to prevent cell tower vandalism.
- Preparedness
- Disaster offices need insight into the disaster response and business continuity management plans of telecommunications companies.
- Disaster offices need GIS map overlays of telecommunications infrastructure.
- Telecommunications companies should inform national disaster offices of planned service outages.
- There is a need for the establishment of geographically-targeted mobile-phone based early warning systems.
- There is a need for technical cooperation on co-location of emergency telecommunications equipment within telecommunications company facilities.
- Emergency telecommunications facilities should be regularly tested, and telecom companies should be integrated into national disaster drills.

#### Response

- Elevated network priority must be granted to disaster response related communications.
- There is a need to establish a streamlined reporting mechanism to enable telecoms to efficiently provide disaster offices with regular updates on network status and projected restoration timeframes.
- Telecommunications crews in the field are often well positioned to report on local conditions, for example to provide information about whether a given road is passable. Disaster response activities would benefit from integrating their observations into the information stream.
- Disaster offices should be able to influence the placement of Cellsite-On-Wheels (COW) facilities to locations with the greatest need, such as in proximity to shelters for displaced persons.
- Telecommunications companies and disaster offices should coordinate on the dissemination of public information notices and other outreach activities.

**Recovery**

- Telecommunications companies need to be more effectively integrated into the damage and loss assessment (DALA) and post-disaster needs assessment (PDNA) processes.
- Disaster offices can help to ensure that equipment used in the restoration of telecommunications infrastructure is granted the same import duty exemption available to other goods used in the rebuilding process.
- Data held by telecommunications companies should be used to understand how populations have migrated as a result of a disaster.



## Annex 2

### List of interviewed representatives from National Disaster Offices and CDEMA

- British Virgin Islands, Department of Disaster Management
  - Jasen Penn, Emergency Communications Officer
  - Dale Lake, Communications Manager (on behalf of) Sharleen DaBreo, Director
- Cayman Island, National Emergency Operations Center, Hazard Management
  - Omar Afflick, Deputy Director Preparedness
  - Lee Madison, Deputy Director Communications and Operations
- Jamaica, Office of Disaster Preparedness and Emergency Management (ODPEM)
  - Horace A. Glaze, Senior Director, Preparedness & Emergency Operation
- Montserrat, Disaster Management Coordination Agency (DMCA)
  - Billy J Darroux, Director
- Saint Lucia, National Emergency Management Organisation (NEMO)
  - Fabian Lewis, Telecommunications Officer
- Trinidad and Tobago, Office of Disaster Preparedness and Management (ODPM)
  - Dennis Marcelle, Information Technology Services Provider
- Caribbean Disaster Emergency Management Agency (CDEMA)
  - Oronde Lambert, Information and Communications Technology Manager

## Annex 3

### Questionnaire for National Disaster Offices

- 1. Can you describe your interaction with Telecommunications Service Providers (Telcos) pre-event – during the Mitigation and Preparedness phases?
  - 1.1. Are there formal agreements governing such interaction? Are you satisfied with the level of interaction between your organisations during these pre-event phases? Please elaborate.
  - 1.2. Are there any deficiencies you can cite with respect to information sharing (communication protocol, level of detail, frequency of sharing, etc.) during these pre-event phases?
  - 1.3. How can these deficiencies be improved?
- 2. Using Figure 1 above as a guide, can you describe your interaction with Telcos post-event (Response & Recovery phases)?
  - 2.1. Are there formal agreements governing such interaction? Are you satisfied with the level of interaction between your organisations during these post-event phases? Please elaborate.
  - 2.2. What specific information is required from Telcos post-event, for example, network status, service area outages, estimated time for restoration, etc.?
    - 2.2.1. Can you describe the process for receiving this information at present?
    - 2.2.2. Would a standardised form for the collection and submission of same be of use?
    - 2.2.3. What information should be collected via such a form?
  - 2.3. Are there any deficiencies you can cite with respect to information sharing (communication protocol, level of detail, frequency of sharing, etc.) during these post-event phases?
    - 2.3.1. How can these deficiencies be improved?
- 3. In disaster planning, can you explain the importance of having accurate data from Telcos reflecting their network infrastructure layout within your **Hazard maps**?
  - 3.1. What is your relationship with Telcos with respect to sharing of data towards the creation of such maps and the sharing of the completed maps?
  - 3.2. Is the level of detail of the telecommunications layers of these maps sufficient at present? Would the availability of GIS data of various Telco network elements and infrastructure improve the quality and utility of these maps?
  - 3.3. How else can Telcos assist in the quality and utility of these maps?
- 4. Is there a defined protocol to have necessary critical information transmitted to the public via Telcos' **Early Warning Systems** (EWS)?
  - 4.1. Do you have an understanding of Telcos' current EWS capabilities and limitations?
  - 4.2. Do they meet your requirements and/or expectations in accordance with international best practice?
    - 4.2.1. If not, what may be the issue at hand (e.g. lack of technology implementation, EWS regulation, compliance, etc.)?

- 4.3. How else can EWS and dissemination of critical information to the public be improved?
- 5. Do you carry out any specific drills to gauge the preparedness of the telecommunications sector?
  - 5.1. Is there testing of Telcos' EWS?
  - 5.2. What information may be necessary to understand a Telco's preparedness to disaster management?
  - 5.3. Do you see a need for NDOs to have access to Telco's disaster plans? Please elaborate.
- 6. Given the various categories of emergency declaration:
  - 6.1. Under what circumstances does the Emergency Operations Centre (EOC) become invoked?
  - 6.2. Can you describe the role which Telcos are expected to play once the EOC becomes invoked? Do they meet your expectations?
  - 6.3. Can you describe the role which Telcos are expected to play in categories of emergency where the EOC is not invoked? Do they meet your expectations?
- 7. During disaster management do you receive timely updates from Telcos with respect to their **network status** and the impact of **service outages**?
  - 7.1. How detailed is this information? For example, for the different Teleco services (Mobile, DSL, POTS etc.) do you receive information on the status of individual service nodes or general service areas?
  - 7.2. Do the network status and service outage data obtained from Telcos meet your requirements and expectations in accordance with international best practice?
  - 7.3. How can the quality of the network status and the service outages information provided by Telcos be improved?
- 8. **Electrical power and backup** is often an issue in disaster management. Do you have an understanding of Telcos' ability to provide backup power to critical network elements within their network?
  - 8.1. Would the availability of such information assist your disaster management capabilities?
- 9. What role does the NDO play at present in coordinating assistance between Telcos and other entities in their Response and Recovery efforts (refueling of generators, spare parts, etc.)?
  - 9.1. Does such a role include coordination between Telcos themselves? Please elaborate.
  - 9.2. Are there formal agreements, MOUs, SLAs or other in place between; the Telcos and the NDO, competing Telcos or between other entities and Telcos to support such assistance?

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