UNCTAD National Workshop Saint Lucia

24 – 26 May 2017, Rodney Bay, Saint Lucia

"Climate Change Impacts and Adaptation for Coastal Transport Infrastructure in Caribbean SIDS"

Training

Identifying operational thresholds for vulnerability assessment

By

Cassandra Bhat

ICF, United States

Reference Handout

Objectives

Breakout objectives:

- Participants will identify sensitivity thresholds for the purpose of assessing and reducing climate vulnerabilities (and know how to continue the process as needed)

Context for how thresholds may be used in climate assessment:

- Identify specific climate variables or hazards of interest, to determine how frequently thresholds may be exceeded over time, given climate change projections
- Determine “risk tolerance” in light of projections
- Identify priorities for adaptation investments
- Identify any research needs (e.g., if local projections are not available for key thresholds)
- Document and share critical institutional knowledge
- Inform monitoring and evaluation over time

Breakout Instructions

Using the accompanying handout:

1. Identify at least **three components** of concern for your facility (see definitions below)
2. For each component, determine applicable **hazards**
3. For each component/hazard combination, identify **thresholds/increments**.
4. Assign a spokesperson to report your findings to the larger group

Example 1: Container cranes are affected by wind speeds above 25 m/s

Component	Hazard	Threshold/ Increment	Impacts
Container Cranes	***High winds***	***Max sustained winds***	***Crane operations and damage***
		25 m/s	*Crane operations suspended*
		40 m/s	*Cranes break free of tie downs*
		55 m/s	*Cranes blow over*

Example 2: If water elevations rise 1 foot above current high tides, waters would reach

Component	Hazard	Threshold/ Increment	Impacts
Docks	***Tidal flooding***	***Water levels above current MHHW***	***Flooding and disruptions***
		1 foot	*Water reaches dock edge, increased risk of overtopping, minor damage to ships*
		2 feet	*Water overtops dock, operations limited*
		3 feet	*Water overtops dock, potential damage to ships*

Definitions

- **Component** – The specific place, asset, or other facility component that may be of concern.

Port components may include:	Airport components may include:
▪ Docks ▪ Navigation channel ▪ Cranes ▪ Utilities ▪ Generators ▪ Buildings and warehouses ▪ Drainage system ▪ Access roads ▪ Personnel	▪ Runways, taxiways, and aprons ▪ Terminals and other buildings ▪ Air traffic control ▪ Communication systems ▪ Access roads and parking lot ▪ Utilities ▪ Personnel ▪ Navigational aids ▪ Weather instrumentation ▪ Drainage system

- **Hazard** – The climate hazard drivers that may cause damage or interruption

Climate hazards:
- Tidal flooding
- Storm surge
- Waves
- Heavy rainfall
- Wind
- Heat

- **Impact** – What specific impact(s) are you concerned about that result from the hazard driver (e.g., generator gets flooded and stops operating, residents evacuate, road becomes impassible, crane is inoperable).

- **Threshold increment –** The level(s) at which various impacts occur. This is a specific measurement (e.g., wind speed, water level, rain/hour).

Example:

Tidal flooding: 1, 2, or 3 feet above current mean higher-high water (MHHW)

Wind: 25 m/s, 30 m/s, 35 m/s

Storm surge inundation 1, 5, or 10 times per year

Example Thresholds

Example thresholds and their impacts from a variety of vulnerability assessments and literature source.

Hazard	Component	Impact	Example Threshold	Source
Ports				
Extreme Heat	Operations	Energy costs	1°C warming = 5% increase in energy costs (in one illustrative terminal)	IDB, 2015
	Paved surfaces	Asphalt pavement softening	Depends on asphalt pavement grade	U.S. DOT, 2014
Heavy Rain	Cranes	Low visibility inhibits crane operation	In Manzanillo, intense rainfall > 20 mm within 24 hours reduces visibility enough to impair operations	IDB, 2015
	Goods handling	Inability to handle water-sensitive goods	Precipitation > 1 mm within 24 hours	IDB, 2015
Flooding	Operations	Flooding in some locations of the port could impair operations.	Conditions that cause flooding will vary by facility.	
Tidal Flooding	Docks	Flooding	Dock elevation/quay height	IDB, 2015
Wind Speeds	Cranes	Ability to operate	Varies by crane type. For example, 25 m/s (56 mph, 48.6 knots) for a CONTECON SSA	IDB, 2015
	Navigational channel	Ability to berth ships (due to waves)	Varies by facility. For example, at Kingston Container Terminals (KCT) in Jamaica: • Winds ≥ 18 m/s (40.3 mph, 35 knots) force operational shutdown • With winds of 12.8-18 m/s (28.8-40.3 mph, 25-35 knots), discretion is applied At Falmouth Cruise Terminal: • Winds > 12.8 m/s (28.8 mph, 25 knots) create unmanageable docking trajectories	Smith Warner, 2017
Airports				
Extreme Heat	Runways	Ability of aircraft to take off	Runway length requirement varies based on plane type, weight, and runway length. Rule of thumb: Runway length requirements increase by 1% for every 1°C by which the mean daily maximum temperature of the hottest month exceeds 15°C (assuming runway is at sea level) (ICAO, 2006)	ICAO, 2006, Chapter 3
	Flight operations	Aircraft maximum take-off operational temperature	47.7°C (118°F)	ACRP, 2016
	Personnel	Reduced employee ability to work safely outdoors (need for more breaks)	Heat Index* over 39.4°C (103°F) is "high" risk Heat Index* over 46°C (115°F) is "very high" risk	ACRP, 2016
Heavy rain	Flight operations	May decrease runway friction to aircraft cannot take off	Varies by airport	ICAO, 2002, Chapters 6-7

Hazard	Component	Impact	Example Threshold	Source
Flooding	Flight operations	Inability of aircraft to land or take off	Any flooding on the runway can impair operations. Conditions that cause flooding will vary by airport.	ICAO, 2002, Chapter 2
Sea Level Rise	Flight operations	Flooding on the runway	Runway elevation	U.S. DOT, 2014
Wind Speeds	Flight operations	Inability of aircraft to land or take off	Commercial airports: sustained winds of 20 m/s (45 mph, 39 knots) or frequent gusts of 26 m/s (58 mph, 50.4 knots) General Aviation airports: 11.2 m/s (25 mph, 21.7 knots)	ACRP Report 160

*Heat Index is a function of temperature and relative humidity. See http://www.nws.noaa.gov/om/heat/heat_index.shtml. For a relative humidity of 70%, Heat Index would exceed 39.4°C (103°F) at 32.2°C (90°F) and would exceed 46°C (115°F) at 34°C (94°F).

Sources:

ACRP (2016). Addressing Significant Weather Impacts on Airports. ACRP 02-49. Airport Cooperative Research Program Description available at: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3695

ICAO (2002). Airport Services Manual, Part 2: Pavement Surface Conditions. Fourth Edition. International Civil Aviation Organization (ICAO). Available at: https://www.bazl.admin.ch/bazl/fr/home/experts/reglementation-et-informations-de-base/bases-legales-et-directives/annexes-a-la-convention-de-l-organisation-internationale-de-l-av/manuels-associes-a-lannexe-14-de-l-oaci.html

ICAO (2006). Aerodrome Design Manual, Part 1: Runways. Third Edition. International Civil Aviation Organization (ICAO). Available at: https://www.bazl.admin.ch/bazl/fr/home/experts/reglementation-et-informations-de-base/bases-legales-et-directives/annexes-a-la-convention-de-l-organisation-internationale-de-l-av/manuels-associes-a-lannexe-14-de-l-oaci.html

IDB (2015). Port of Manzanillo: Climate Risk Management (Final Report). September, 2015. Available at: https://publications.iadb.org/handle/11319/7649Smith Warner International Ltd (2017). Case Study Report – Jamaica. Framework for Assessing the Climate Impact on Coastal Transportation Infrastructure in Small Island Developing States (SIDS).

U.S. DOT (2014). Transportation Climate Change Sensitivity Matrix. United States Department of Transportation. June 2014. Available at: https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/gulf_coast_study/phase2_task2/sensitivity_matrix/