

Ad Hoc Expert Meeting on

**Climate Change Adaptation for
International Transport:
Preparing for the Future**

16 to 17 April 2019

**Airport Adaptation Measures
Preparing for the Future**

Presentation by

John Lengel
Adaptation Task Lead
Airports Council International (ACI)

Airport Adaptation Measures Preparing for the Future



John Lengel, PE, ENV SP
Vice President
Environmental Stewardship And Resiliency

RS&H

UNCTAD AD HOC EXPERT MEETING
ON CLIMATE CHANGE ADAPTATION
FOR INTERNATIONAL TRANSPORT

GENEVA, SWITZERLAND

APRIL 16, 2019

ARCHITECTURE | ENGINEERING | CONSULTING



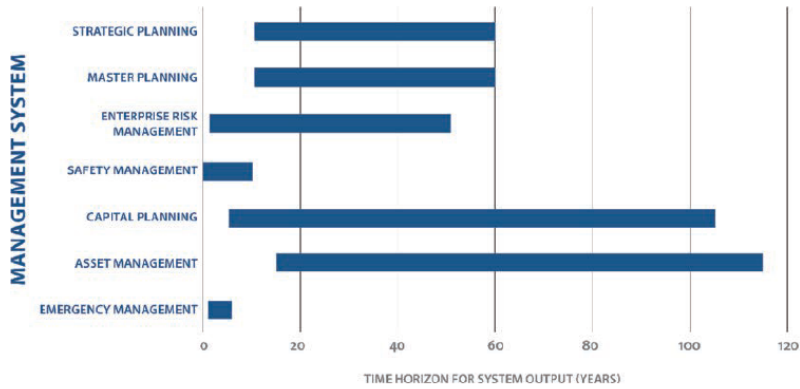
Airports Prepare for Challenges in Many Ways

- » Strategic Plans
- » Master Plans/Capital Plans
- » Sustainability Management Plans
- » Asset Management Systems
- » Safety Management Systems
- » Continuity of Operations Plans
- » Emergency Response Plans
- » ACRP Reports and Tools



RS&H

Typical Time Horizons



ACI Resolution No. 3 (June 2018)

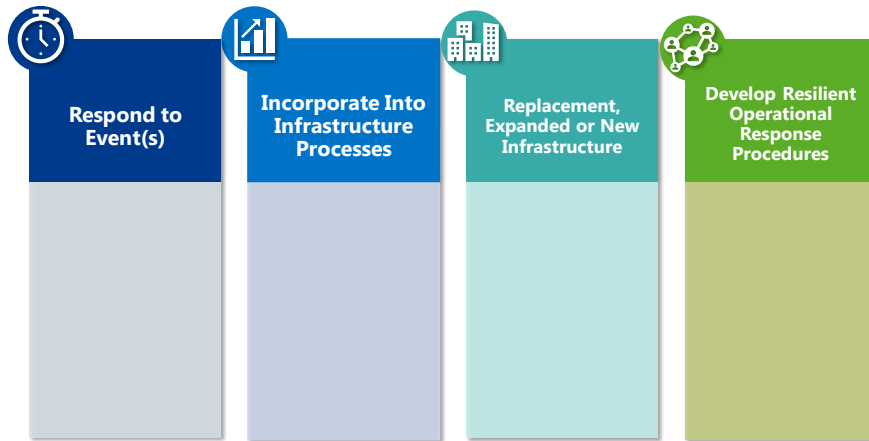
» Encouraging Airports to Take Action on Resilience and Adaptation to Climate Change, Resolves to:

- Consider all practicable steps to reduce their GHG emissions through the use of the Airport Carbon Accreditation programme and by other means;
- Support efforts in international forums such as ICAO and the UNFCCC in assessing the potential impacts of climate change on critical infrastructure, including airports;
- Encourage member airports to take into consideration the potential impact of climate change as they develop their Master Plans;
- Encourage member airports to conduct risk or criticality assessments for their operational procedures and existing infrastructure which considers the risks imposed by more adverse weather events and climate change;
- Encourage member airports to develop and incorporate actions in accordance with their risk or criticality assessments at an early stage and in line with their overall business continuity management and emergency planning; and
- Encourage member airports to plan and develop effective communication channels and collaborate with internal airport staff, aviation stakeholders, including airlines, ANSPs, communities and municipality authorities responsible for weather monitoring and disaster management.



ACI Briefing Note: <https://store.aci.aero/product/policy-brief-airports-resilience-and-adaptation-to-changing-climate/>

Triggers for Incorporating Adaptation



\$1 in proactive planning/upgrades saves \$4 to \$6 in response/rebuilding costs

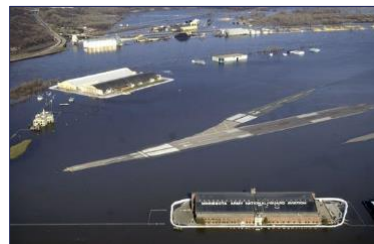
RS&H



**Respond to
Event(s)**

River Flood Wall St Paul Downtown Airport, Minnesota, USA

- » Frequent River Flooding
- » Developed Removable Flood Wall Reducing Economic Losses
- » Deployed 5 times in last 10 years
 - 3,600 ft (1000m) long
 - 8.5 ft (2.5m) high



RS&H



Incorporate Into Infrastructure Processes

PANYNJ Design Standard

» Assessed Infrastructure

- Vulnerabilities
- Risk
- Adaptations

» Developed design guidelines

- Temperature
- Precipitation
- Sea level
- Flood



THE PORT AUTHORITY OF NY & NJ
Engineering Department

Engineering Department Manual THE PORT AUTHORITY OF NY & NJ
Climate Resilience

1.3 TEMPERATURE CHANGE GUIDANCE
Designs of infrastructure assets should account for the following temperature changes over the asset's design life. Current climate projections do not include vertical intensity curves.

	2020	2025	2050	2055
Mean annual air temperature (a)	54°F	55.5°F	59°F	59°F
Days at or above 85°F	15	20	45	45
Days at or below 32°F	72	55	45	30

1.4 PRECIPITATION CHANGE GUIDANCE
Designs of infrastructure assets should account for the following precipitation changes over the asset's design life. Current climate projections do not include vertical intensity curves.

	2020	2025	2050	2055
Mean annual precipitation	53.1	52	47.5	52
Average Winter Rainfall (in)	3	3	4	4
Summer Rainfall (in)	2	2	2	2

1.5 SEA LEVEL RISE GUIDANCE
Designs of infrastructure assets should account for the following sea level rise estimates (in sea level).

	2020	2025	2050	2055
Mean Sea Level	Baseline	+ 4"	+ 10"	+ 20"

2.0 FLOOD RESILIENCE
To establish the flood resilience criteria for a project, employ the following steps. Determining the criteria is a collaborative effort led by the Project Engineer or architect with information and support from various agency departments, stakeholders.

For large-scale projects (institutions and large projects cost over \$10M), the Project Engineer or architect is encouraged to seek a flood resiliency assessment and to follow the steps below with a Resiliency and Sustainability Group representative. For smaller-scale projects, the Project Engineer or architect may consult with a Resiliency and Sustainability Group representative for more information.

Step 1: Asset Resilience
The Engineer shall determine using the best available information:

- Airfield**
- John F. Kennedy International Airport and LaGuardia Airport (runways and taxiways)**
- Extreme events and storm surge with sea level rise
- Increased flooding risk from nor'easters and hurricanes

LAST UPDATED: 1/22/2015

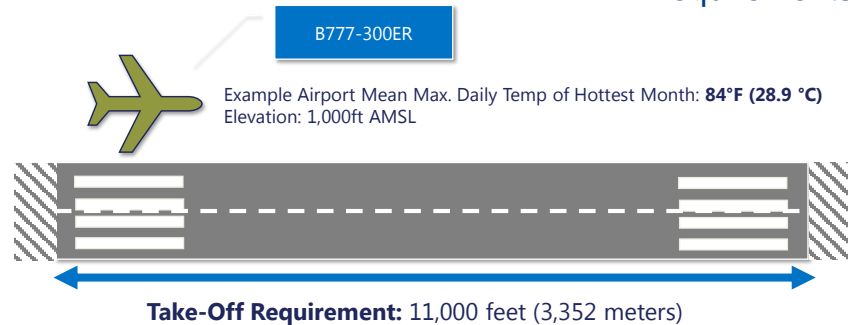
Page 6



Incorporate Into Infrastructure Processes

Airport Runway Length Revisited

- » **Climate Risk:** Current 2010 Temperature
- » **Airport Impact:** Take-Off Runway Length Requirements





Incorporate
Into
Infrastructure
Processes

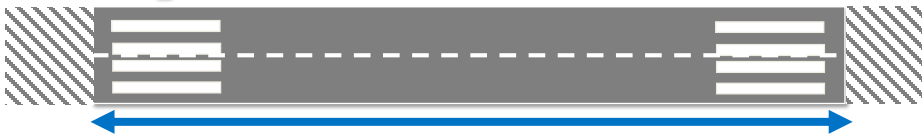
Airport Runway Length Revisited

- » **Climate Risk:** Future 2075 Temperature
- » **Airport Impact:** Take-Off Runway Length Requirements



B777-300ER

Example Airport Mean Max. Daily Temp of Hottest Month: **108°F (28.9 °C)**
Elevation: 1,000ft AMSL



Take-Off Requirement: 13,700 feet* (4,175 meters)

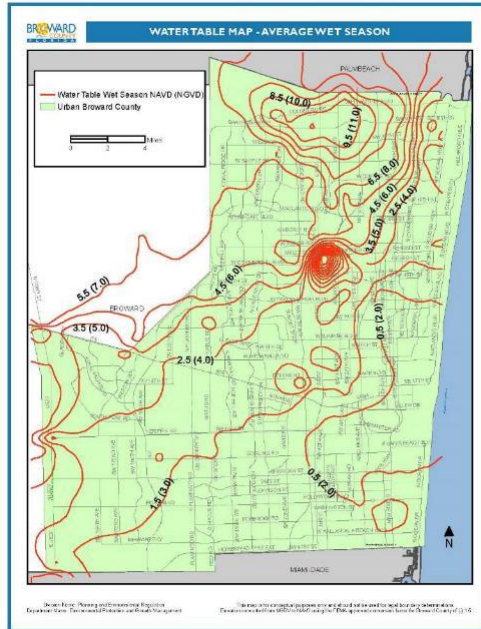
****Must reduce maximum take-off weight!***



Incorporate
Into
Infrastructure
Processes

Broward County, FL Predictions

- » 2060-2069
- » Precipitation depths – 9% increase
- » Sea level rise – 2 to 3 feet (1 meter)
- » Groundwater elevations rise

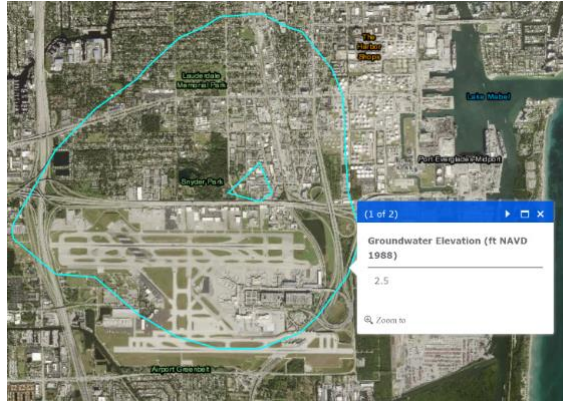




Incorporate
Into
Infrastructure
Processes

Ft Lauderdale-Hollywood Int'l Airport Implications

- » Rising Groundwater Elevations
 - Compliance challenge
 - *Reducing stormwater storage and treatment capacity*
 - Significantly higher flood elevations



RS&H



Incorporate
Into
Infrastructure
Processes

Available Alternatives

- » Flood Impact
 - Fill above flood elevation
 - Flood proof structures
- » Stormwater Impact
 - Lower groundwater
 - Pump storm water offsite for treatment

Broward FEMA Flood Map Effective August 18, 2014



RS&H



Replacement, Expanded or New Infrastructure

Hillsborough County Aviation Authority TPA Office Complex

- » Replacement Office Complex
- » Adjacent to Tampa Bay
- » 100-year storm event elevation
 - 1988: 9 ft (3m)
 - 2018: 10-12 ft (4m)



12.6.A - SITE OVERVIEW
12.6.A.1 - 12.6.A.1.1
 AIRPORT DEVELOPMENT OFFICE BUILDING COMPLEX (12.6.A.1.1) - 12.6.A.1.1.1



Replacement, Expanded or New Infrastructure

TPA Office Complex Recommendations

- » First floor elevation at 15 ft (5m) AMSL
- » All critical HCAA areas at 30 ft (10m) AMSL (3rd floor)
 - Network Ops Center
 - Airport Ops Center
 - Incident Command Center
- » Hardening structure and glass for high winds

Surge Heights for a Landfalling Storm/Hurricane		
Storm Strength	Potential Surge Height(s)*	
	Low Tide	High Tide
Tropical Storm	Up to 4'	Up to 6'
Category 1	Up to 6'	Up to 8'
Category 2	Up to 12'	Up to 14'
Category 3	Up to 17'	Up to 19'
Category 4	Up to 21'	Up to 23'
Category 5	Up to 27'	Up to 29'

*Feet Above Mean Sea Level (AMSL)



12.6.A - BUILDING OVERVIEW





Develop
Resilient
Operational
Procedures

Hong Kong. Taking Control of Rapid Recovery from Adverse Weather

- » Severe Events
 - Achieving rapid response and recovery
- » Response
 - Ongoing coordination with local community on early warning system
 - Airport leading coordination
 - Assist with ground control
 - Coordinates with all stakeholders i.e., airlines, ground and ramp services agents, Government depts, public transport operators, retail and catering outlets in the terminal and passengers



RS&H



Develop
Resilient
Operational
Procedures

FIGI. Nadi Floods Challenge Airport Resources

- » Flooding Effect
 - Runway handling 747s closed for 16 hours
 - All roads to airport closed for 1.5 days
- » Response
 - Ongoing coordination with Department of Town and Country Planning on new developments effecting runoff
 - Improving both landside and airside drainage to ensure fast free flow of water to sea



The main runway was flooded disrupting operations for 16 hours.

RS&H

Conclusions

- » Each Airport and the Community It Serves is Unique
- » Significant Challenges Ahead for Many Airports
 - Financial
 - Insurance
 - Regulatory
- » Solutions Will be Found by Working Closely with All Stakeholders

RS&H

