Propuestas Innovadoras para Reinventar la Red de Transportación de Puerto Rico del Siglo 21
EXPO CUMBRE CIAPR 2018

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CATEDRÁTICO UPRM

CENTRO DE CONVENCIONES PEDRO ROSSELLÓ GONZÁLEZ

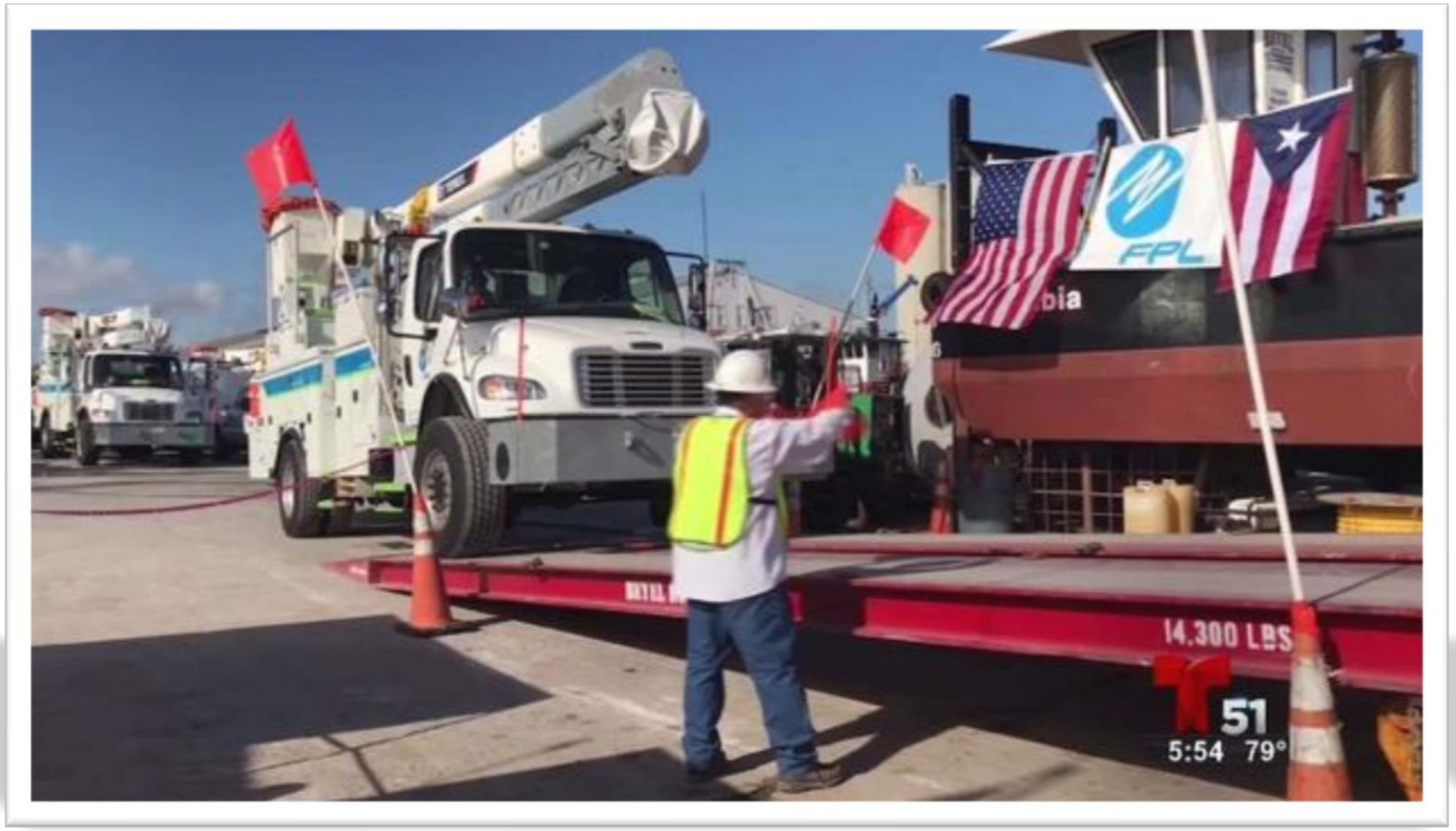
VIERNES, 25 DE MAYO DE 2018

¡Buenos Días!

¡Felicidades a los Ingenieros y Agrimensores!

¡Celebración de nuestro Octogésimo Aniversario!

… En solidaridad con nuestra gente, en particular aquellos que sufrieron pérdida de vida y familiares. #PRSeLevanta



Source: https://www.telemundo51.com

Source: http://www.laprensa.hn/

Visión panorámica…
Infraestructura de carreteras y transportación de Puerto Rico

20 de septiembre de 2017

"It is critical to get the island's infrastructure ***in working condition*** *as soon as possible so* ***relief supplies and other assistance can be delivered*** *to the people of Puerto Rico."*

Elaine L. Chao
Secretary of the United States Departament of Transportation

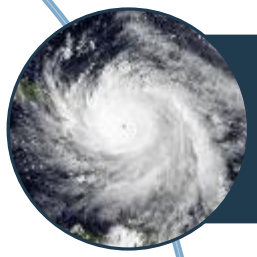
Source: https://www.fhwa.dot.gov/pressroom/fhwa1716.cfm

“Our highways were already in a delicate state, but the damages that occurred would have happened even if they had been in good condition. […] We had two category 5 hurricanes, back-to-back. We had never experienced this before in Puerto Rico.”

Eng. Carlos M. Contreras Aponte
Secretary of the Puerto Rico
Department of Transportation and Public Works

Fuente: https://www.elnuevodia.com/

Contenido de la presentación/Agenda

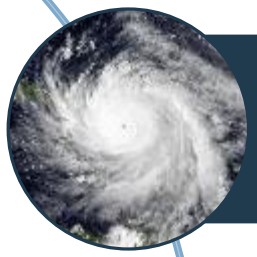


PARTE 1: Huracán María: Estatus y retos en la infrastructura de transportación de Puerto Rico

PARTE 2: Lecciones aprendidas en la resiliencia del sistema de transportación a raíz del paso de desastres naturales extremos

PARTE 3: La ACT y el Plan Fiscal Certificado por PROMESA:2018-2023

Contenido de la presentación/Agenda



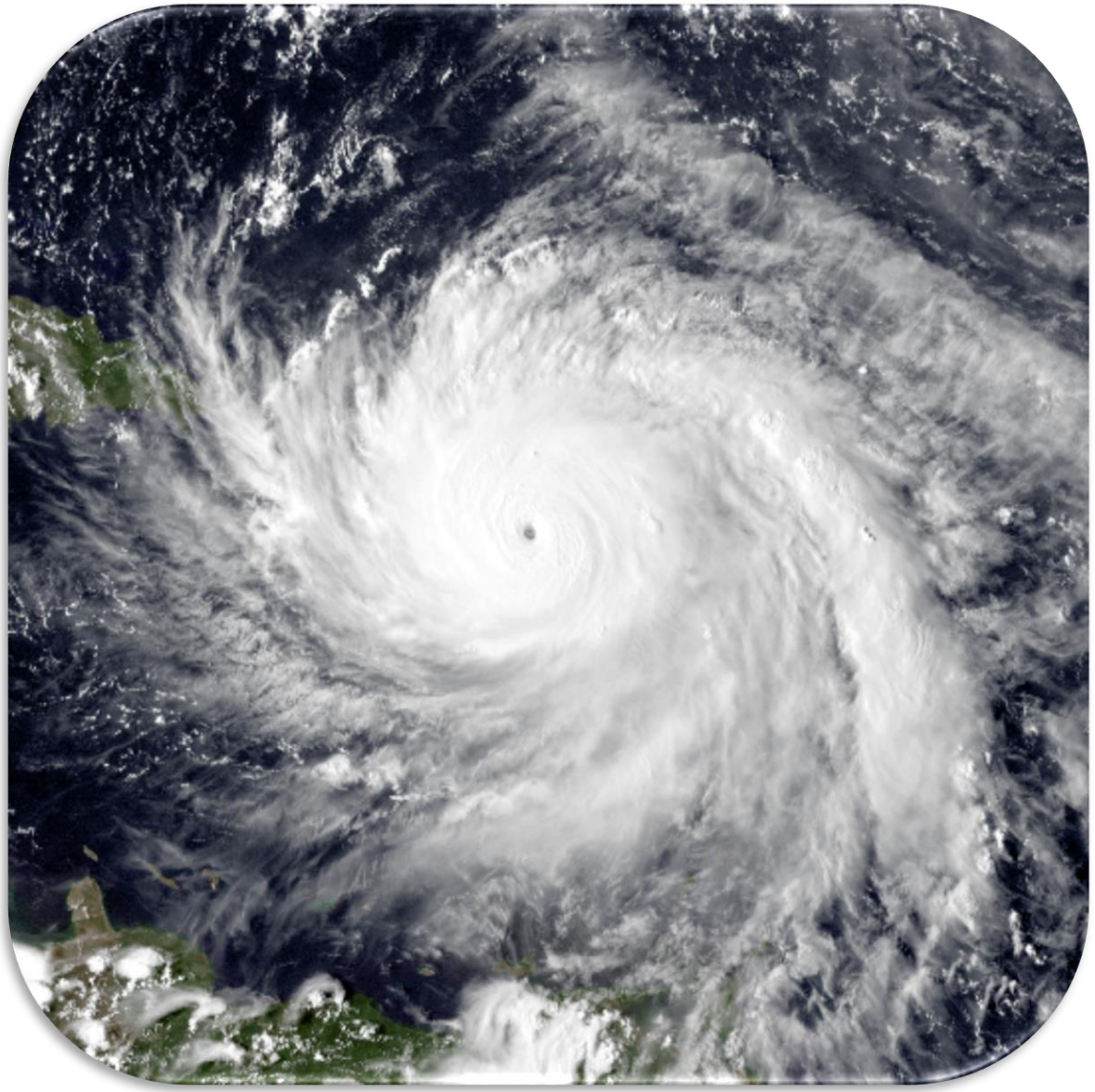
PARTE 4: Innovación/ Resiliencia de Infraestructura de Transporte para desastres naturales y eventos extremos climatológicos

PARTE 5: Iniciativas del programa federal Cada Día Cuenta (EDC) relacionadas a Resiliencia y cambio climático

PARTE 6: Propuesta del CIAPR'S para el Desarrollo de Puerto Rico

Parte 1

Huracán María: Estatus y retos en la infrastructura de transportación de Puerto Rico



Source: Naval Research Laboratory, NOAA

Datos pertinentes del Huracán María y su paso por Puerto Rico

Source: CNN, National Weather Service

Upon landfall (Sep. 20, 6:15 AM):

- Pressure: 917 mBar (27.08 in Hg)
- 1-Minute sustained winds: 155 mph (250 km/h, Category 4)
- Hurricane strength winds reach 60 miles (100 km) from center

Officially documented deaths: 64 (January 1, 2018)

Hurricane Maria is the most intense hurricane to landfall in Puerto Rico since 1928

Puerto Rico

Source: http://www.oceanvillaparadise.com

Source: http://welcome.topuertorico.org

Land area:
9,104 km^2 (3,515 mi^2)

Population (July 2017): 3,337,177

Coastline: 501 km (311 mi)

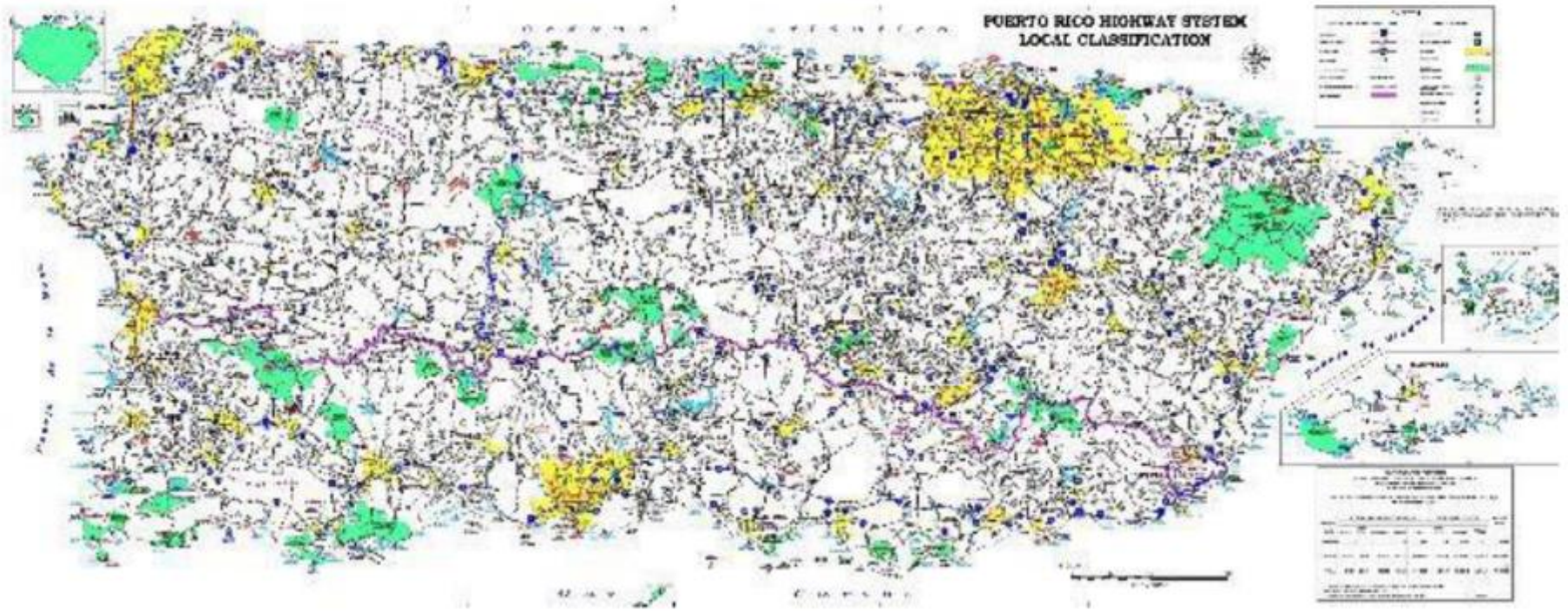
Transportation

- **Highway Network:** 26,860 km (16,694 mi)
- **Bridges:** 2,343 in total (2018)
- **Airports:** 11 total, 5 directly adjacent to sea
- **Seaports:** 12

Sources: US Census Bureau, CIA World Factbook, Eng. Héctor Laureano (FHWA, March 2018), Puerto Rico Ports Authority

Sistema de Carreteras de Puerto Rico según Plan Certificado por PROMESA

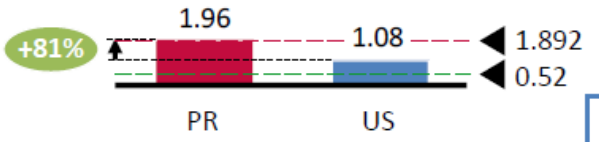
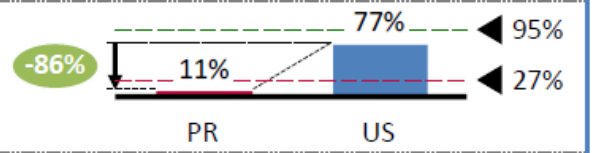
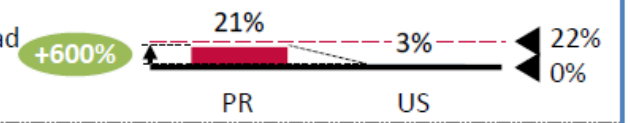
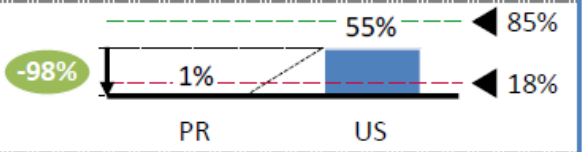
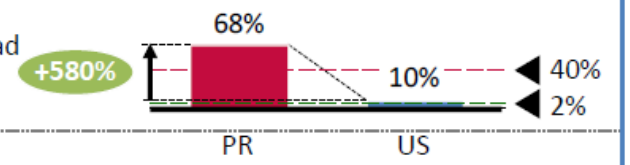
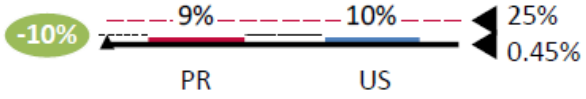
- HTA is a public corporation founded with the purpose of continuing the government's effort of providing the public with the best highways, easing the flow of vehicles, and minimizing the risks and inconveniences that traffic congestions may cause.
- HTA is charged with constructing, operating, and maintaining Puerto Rico's toll road network, major highways and mass transportation facilities, which are financed by revenue bonds, federal grants and specified tax revenues.
- The Puerto Rico State Highway System consists of a total of **4,605 miles**:



Breakdown by type of Road:
Toll Roads (incl. PR 22 & 5) – 185.6 miles
Primary Roads (incl. Urban) – 986 miles
Secondary & Tertiary Roads – 3,434 miles
Total = 4,605 Miles

SOURCE: http://www.dtop.gov.pr/historia.asp

Comparación de métricas de comportamiento de la red de carreteras de Puerto Rico con los Estados Unidos antes del paso del Huracán María: Key Performance Indicators (KPIs)

Performance Metric	Description	Metric Results
1 Fatality Rate	Ratio of total number of fatalities to the number of VMT (2015)	
2 % Pavement in Good Condition – Interstate (IS)	Pavement rating with an IRI value of less than 95 or Good condition (2014)	
3 % Pavement in Bad Condition - IS	Pavement rating with an IRI value greater than 170 or Bad condition (2014)	
4 % Pavement in Good Condition - Non-IS	Pavement rating with an IRI value of less than 95 or Good condition (2014)	
5 % Pavement in Bad Condition - Non-IS	Pavement rating with an IRI value greater than 170 or Bad condition (2014)	
6 Bridge Area Condition (NHS)	% of total bridge deck area classified as structurally deficient (2016)	

- National Safety Goal on is to have a significant reduction in the fatality rate, while target is set by state at 1.85 for fatalities by 2018.
- National goal is to maintain the highway infrastructure asset system in a state of good repair.
- HTA will monitor performance against these key metrics, and strive to make improvements in road and bridge conditions and safety within its budgetary constraints.

Condición de la Infraestructura de Puerto Rico: Antes del Impacto del Huracán María

Bridges

Inventory: 2,304 bridges (2015)

- National Highway System: 780
- Deficient classification: 1,269
- Functionally obsolete: 968
- Structurally deficient: 301

Design life: 50 years

- 33.1% (762) of bridges are 50 years or older
- 12.5% (287) of bridges are 75 years or older

Source: Eng. Javier Arroyo, PRHTA-DTPW, August 2015

Pavements

Approximately 16,694 miles (26,860 km) of roads.

Inspected in 2014: 7,467.59 km of National Highway System

Pavement network rating:

- 80.4% poor
- 16.7% fair
- 2.9 % good

Source: *Pavement and Bridge Condition, Puerto Rico NHS Network 2014*
Eng. Cándido Camacho Ayala, ACT

Impact of Hurricane María on PRHTA Operations and Finances

- **Infrastructure Damage:** Roads, bridges, were damaged in the hurricane, and major projects were delayed due to the temporary realignment of resources towards recovery.HTA was unable to execute planned capital improvements, focusing instead on emergency repairs to bring infrastructure back online.
- **Public Transit Damage:** Several Tren Urbano (TU) stations were damaged by Maria, with limited service returning in late December.

La importancia de la Infraestructura de Transportación en el Desarrollo Económico de Puerto Rico

Transportation infrastructure is a key asset to the economy

- Access to employment and services
- High value manufacture exports
- Consumer good imports
- Tourism
- Construction
- Government income related to transportation activities
- Economic competitiveness component

Item	Value in 2016
GDP in transportation and warehousing	$985 million (1%)
Net income in transportation	$720 million (0.8%)
Visitor expenditures	$3,985 million (3.8%)
Federal funding for transportation government agencies and public corporations	$234 million
Total value of exports	$71,856 million (68.4%)
Total value of imports	$43,320 million (41.2%)
Personal expenditure in transportation	$6,226 million (5.9%)

Source: Statistical Appendix of the Economic Report to the Governor 2016

Estimado de Costos de Reparación de Puerto Rico subdividido por sectores

$94.392 billion

SECTOR	COST (BILLIONS OF DOLLARS)
HOUSING	$31.068
POWER GRID	$17.789
HEALTH	$14.946
OTHERS	$30.589

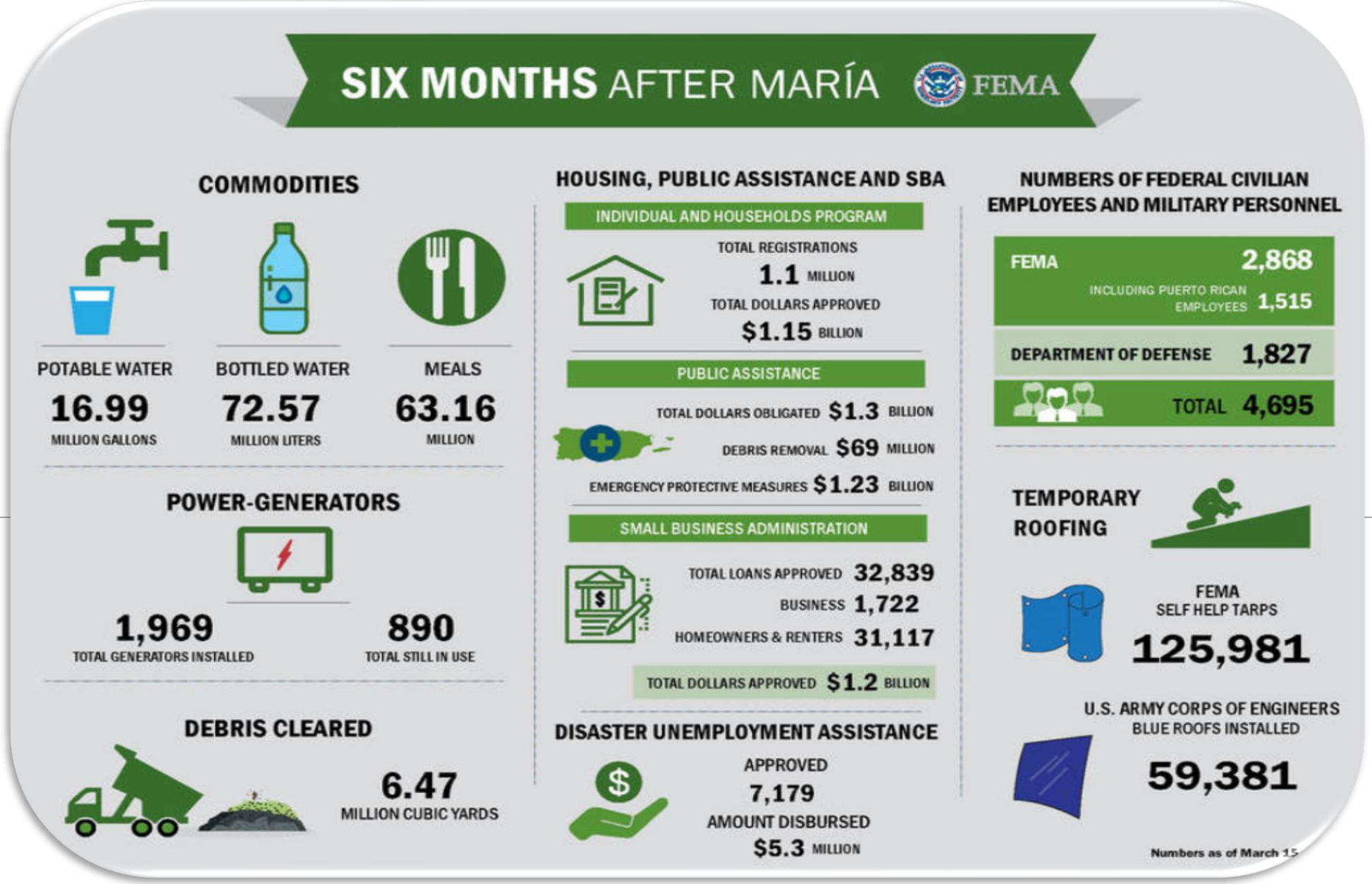
SECTOR	COST (BILLIONS OF DOLLARS)
HIGHWAY AND BRIDGES	$4.497
SEAPORTS AND AIRPORTS	$1.345
RESTORATION OF PUBLIC BUILDINGS	$0.153
DRAINAGE SYSTEMS	$1.409

Source: Office of the Governor

Estatus de la Restauración de Servicios Esenciales de la Isla

- PREPA: 97.27% generation and 95.93% of customers (April 20, 2018)
- PRASA: 98.93% of customers, 1,216,159 active water meters (April 14, 2018)
- Telecommunications: 99% of customers (April 14, 2018)
- Reopened seaports: 100% (January 24, 2018)
- Service stations: 88% (December 26, 2017)
- MBA Routes: 100% (January 24, 2018)
- Tren Urbano: 14 out of 16 stations reopened (December 2017)
- Post Offices: 100% (January 24, 2018)

Source: http://status.pr/



Source: Mr. Sonny Beauchamp, FEMA (March 15, 2018)

Estatus de Restauración del Sistema de Semáforos en Intersecciones

- 1,224 signalized intersections (February 27, 2018)
  - 100% of intersections sustained damage
  - 600 powered and operational
  - 200 intersections remain with severe damage.
  - 424 repaired but not operational

Evaluarán el jueves las intersecciones que serán energizadas primero

La Autoridad de Energía Eléctrica y el Departamento de Transportación y Obras Públicas comenzaron a intercambiar información

martes, 27 de febrero de 2018 - 5:32 PM Por Javier Colón Dávila

Thursday, March 1, 2018

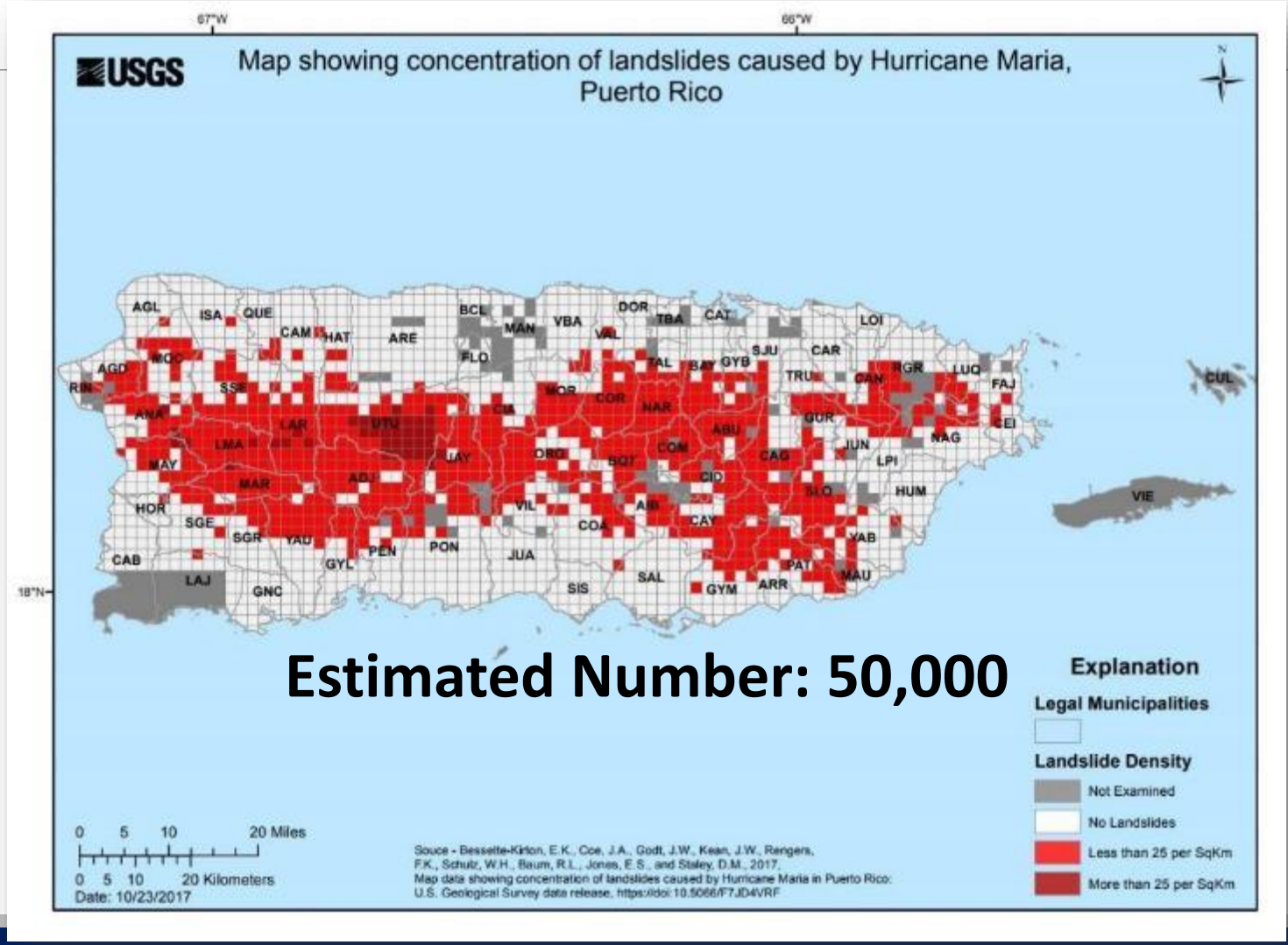
Source: El Nuevo Día

Efecto del Huracán María en el Inventario de Puentes

- Bridge Inventory: 2,343 (2017):
  - 1,772 over water bodies (75.6%), 571 over highways and other depressions (24.4%)
- Collapsed bridges: **26 (1.1%)**
- Collapsed bridge approaches (bridge closure): **31 (1.3%)**
- Other damages: **331 (14%)**
- Total number of damaged bridges: **388 (17%)**

  National Highway System bridges with damage: **42 (1.8%)**
- Average year of construction of collapsed bridges: **1968**
- (Average age: 50 years)

Estimado de Deslizamientos de Terrenos en la Isla



Fuente: https://landslides.usgs.gov/

Deslizamientos de tierra y derrumbes

OROCOVIS, PUERTO RICO
Source: Univision Noticias

COROZAL, PUERTO RICO
Source: Getty Images, Univision Noticias

Erosión e inundaciones en la Zona Costanera

MAYAGÜEZ, PUERTO RICO
Source: Authors

PR-64 in MAYAGÜEZ, PUERTO RICO
Source: Authors

Inundaciones Urbanas

GURABO, PUERTO RICO
Source: gfrmedia.com

SAN JUAN, PUERTO RICO
Source: Getty Images, Univision Noticias

Inundaciones por desbordamientos de los cauces de ríos

PR-2 in YAUCO, PUERTO RICO
Source: Carlos García Rawlings, REUTERS, Univision

GUAYAMA, PUERTO RICO
Source: Carlos García Rawlings, REUTERS, Univision

Fallas de Accesos a Puentes

Destrucción rotulación, mastiles y mobiliario a la orilla de la carretera

YABUCOA, PUERTO RICO
Source: Carlos García Rawlings, REUTERS

TOA BAJA, PUERTO RICO
Source: www.wapa.tv

PR-3 in LUQUILLO, PUERTO RICO
Source: Getty Images, Univision

BAYAMÓN, PUERTO RICO
Source: Authors

Logística de la cadena de suministro, combustible, cajero automático

Parte 2:

Lecciones aprendidas en la resiliencia del sistema de transportación a raíz del paso de desastres naturales extremos

Source: http://www.primerahora.com

Puerto Rico Faces the Island-Wide Challenge of Recovery

Post-Disaster Recovery Activities Within the Highway Network

Repair and reconstruction of highway facilities
- Coastal erosion, landslides
- Bridge erosion and wash-outs

Repair of roadside appurtenances
- Traffic signals and signs
- Utilities (power, water, telecommunications)

Clean-up of rubble and debris

Delivery of disaster relief supplies

All of these activities affect traffic operations

Source: play.mobicast.tv

Hazardous Conditions Requiring Temporary Traffic Control (TTC) In a Post-Hurricane Setting

Source: http://bahiia.com

Source: http://www.utuadohoy.com

Inoperative traffic signals → police and access management for traffic control

Bridge failures, landslides and debris obstruct or destroy highway segments

- Barriers, channelizing devices and signage to block/restrict passage are essential

Challenges Affecting Infrastructure Repair in the Face of Climate Change and Extreme Weather Events

Challenges

Physical damage to highway network

Limited capacity to sustain deployment of essential goods and services

Generalized need for temporary traffic control for recovery activities

Obsolete designs that do not demonstrate resilience against natural disasters

Recovery Activities

Reconstruction, repair and rehabilitation amid a shortage of resources

Logistical support to public and private entities associated to essential goods and services

Judicious application of temporary traffic control and safety protocols

Modernization and/or retrofit of infrastructure assets to increase resilience

Use of Resilient TTC Equipment

Source: http://www.roadsafetraffic.com

Source: https://www.3m.com

Source:
http://www.bethsbarricades.com

- Solar-powered ITS equipment
- Retroreflective elements
- Provisional intersection control systems
- Benefits
  - Minimize dependency on external energy supply
  - Reduce exposure of traffic control staff
  - Ensures nighttime availability, especially when power outages occur

Flexible-but-judicious use can save lives!

Maritime Terrestrial Zone Infrastructure

- Rigorously enforce laws and regulations in maritime terrestrial zone in the Caribbean
- Revise standard drawings of bridge and pavement infrastructure adjacent to coastal areas
- Analyze feasibility of applying hard engineering, green engineering and/or planned relocation for protection of critical assets

PR-64 in MAYAGÜEZ, PUERTO RICO
Source: El Nuevo Día

Bridges with Scouring Potential

PR-52 in JUANA DÍAZ, PUERTO RICO **Source: El Nuevo Día**

The design of bridge abutments requires further review where high speed and turbulent flow are expected in their design life and potential scouring may occur.

Benching for Stability of Roadside Slopes

Standard Drawings of PRHTA associated with the cut slope sections with clay soils and/or unstable soil rock formation needs to be revisited.

Use of benching in cut sections with the appropriate slopes needs to be incorporated in future designs.

Source: Authors (above), Panoramio.com (below)

Shotcrete for Stability of Roadside Slopes

Mesh to contain rock falls in areas where recurrent falls occurred, needs to be revaluated.

Shotcrete in cut sections in highways can be further evaluated to be implemented in the central mountain range as a potential alternate cost-effective design.

Source: http://bestsupportunderground.com

Benefits of Shoulders

Shoulders in major highway corridors with cut section in mountains with moderate height (less than 800 feet) minimizes the impact of mud and rock slides, thus allowing roadway reconfiguration with at least one lane open to traffic on both directions.

Shoulders can also accommodate queueing for essential services while minimizing adverse congestion impacts.

Source: https://upload.wikimedia.org

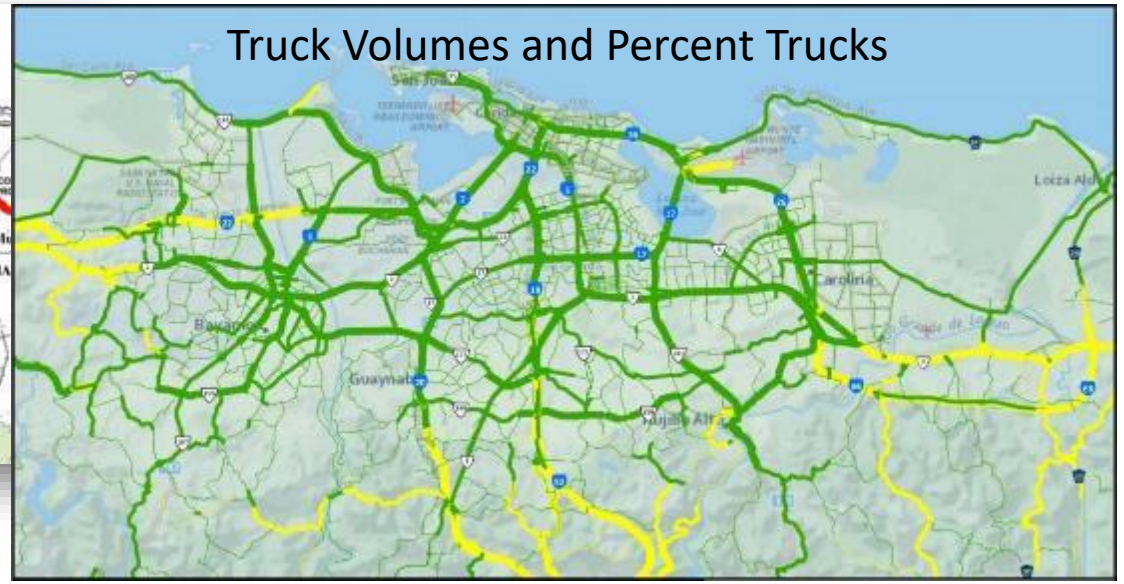
Preventive Maintenance

Preventive maintenance of urban drainage systems is essential to minimize the potential for flooding.

Source: Authors

Source: https://www.montgomerycountymd.gov

Redundancy in Strategic Corridors



Source: Puerto Rico Highway and Transportation Authority

The importance of strategic redundancy of principal highway transportation corridors was evident for the mobility of people and goods during the emergency post hurricane María.

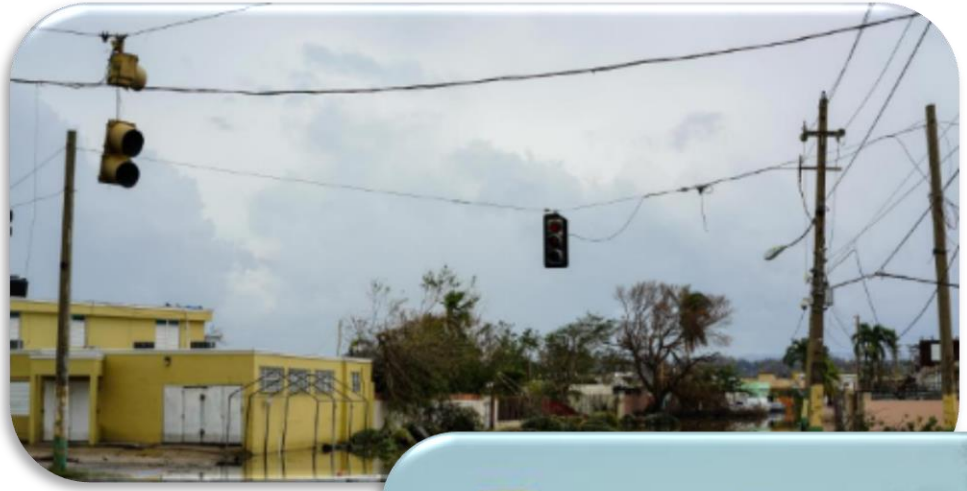
Careful planning of redundant routes should take into consideration both traffic volumes and freight, in order to facilitate both emergency response and recovery.

Lessons learned: Traffic Signal Supports

The catenary design used in intersections to mount traffic signals needs to be revisited.

The consideration of mast poles to replace catenary designs is pertinent in category 3 and above hurricane alley such as Greater Antilles that include Puerto Rico.

Review design codes for mast poles in the state of Florida, USA after the pass of hurricane Andrew in 1991.



Source: Getty Images, Univision

Source: http://www.kdlt.com

Lessons learned: Traffic Sign Supports

PR-2 km 126.6, AGUADILLA, PUERTO RICO
Source: Authors

BAYAMÓN, PUERTO RICO
Source: Authors

Freeway overhead and roadside guide/directional signs, according to MUTCD with breakaway device in the base that yields on impact, needs to be revisited.

Lessons learned: Utility and Luminaire Poles

Utility and luminaire poles of all materials (concrete, wood and steel) that failed in the base and the upper 1/3 of their length need to be evaluated for strength against wind loads.

Vegetation control along utility line corridors is essential to minimize the chance of collapse of entire rows.

Source: https://images-cdn.wapa.tv

Parte 3:
La ACT y el Plan Fiscal Certificado por PROMESA:2018-2023

PRHTA New Fiscal Plan 2018 - 2023

As Certified by The Financial Oversight and Management Board for Puerto Rico
April 20, 2018

Four critical/vital activities that PRHTA should successfully implement to achieve a comprehensive transformation in the transportation sector

- **Improving governance and performance management:** The New Fiscal Plan outlines a strategy to develop organizational KPIs to incentivize and monitor performance across the organization at the operational level and to ensure that the leaner organization can deliver on its capex plan. The New Fiscal Plan also calls for the recruitment and engagement a Board of diversified professionals to define and implement HTA's long term strategy.
- **Pursuing greater revenue opportunities:** The New Fiscal Plan details strategies to pursue additional operating revenue opportunities including toll increases and optimization (to ensure that purchasing power of toll revenues keeps up with inflation), discretionary federal funding (including the Community Development Block Grant allocation to Puerto Rico), and ancillary revenue opportunities from real estate, signage, and advertising.

Four critical/vital activities that PRHTA should successfully implement to achieve a comprehensive transformation in the transportation sector (cont.)

- **Focusing on operational excellence including capital efficiency:** The New Fiscal Plan optimizes capital expenditures through improved project prioritization based on economic benefits/safety, enhanced delivery, and soft cost reductions. To also optimize operating expenses, the New Fiscal Plan requires that certain contracts are re-bid using Title III processes to be in line with competitive benchmarks. To right-size the organization and become a best-in-class lean department of transportation, HTA will complete early retirement programs (Law 211) that are already in progress, and further workforce transition efforts to reduce personnel cost by 15%. HTA will also continue to evaluate concession opportunities that create value, and capture pension savings related to the reform of the Employees Retirement System as detailed in the New Commonwealth Fiscal Plan dated April 2018.
- **Reducing traffic to drive economic growth:** HTA will complete projects already in progress to reduce traffic (e.g. DTL, BRT) and plan for additional projects to further promote economic growth and revenue benefits.

Puerto Rico Highways and Transportation Authority's Mission and Vision

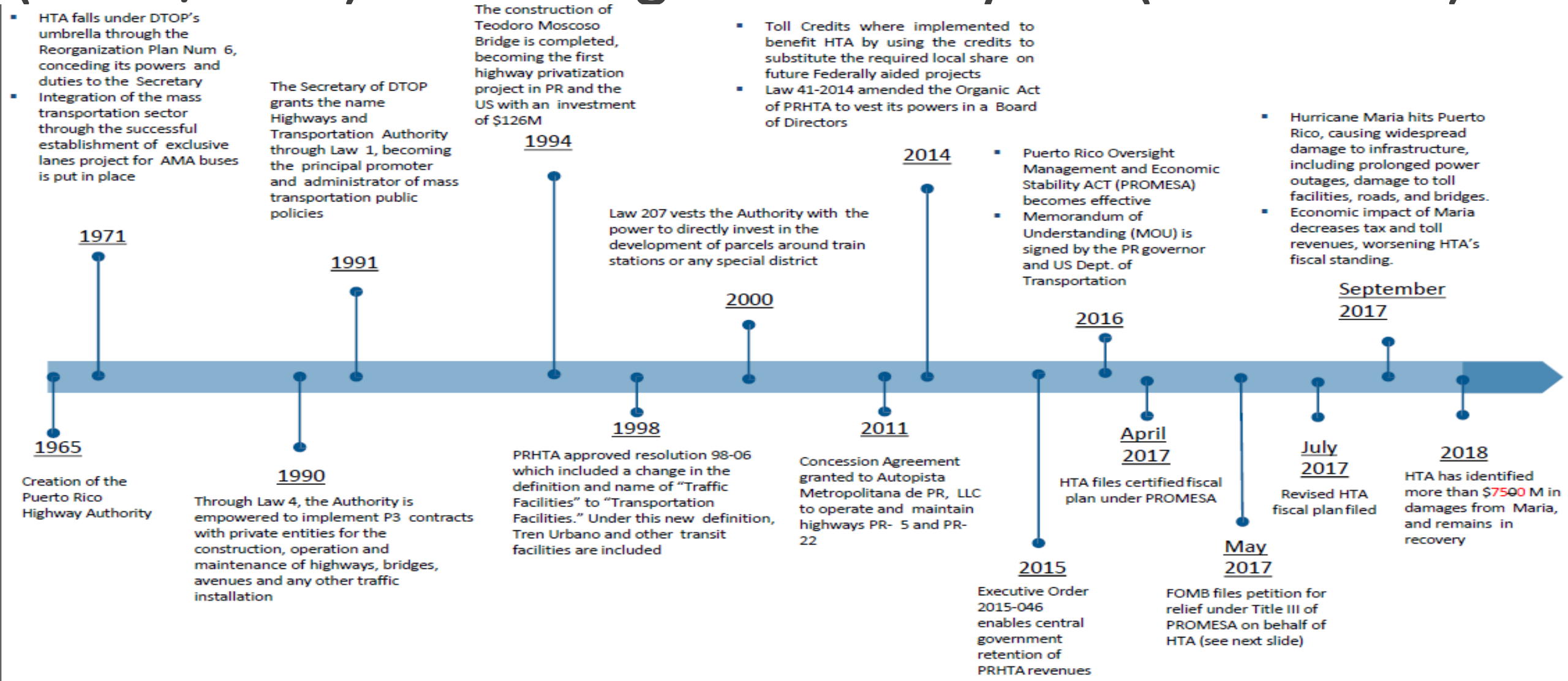
Mission

Lead Puerto Rico towards economic development through an efficient transportation system, safely and in accord with the environment, while procuring the delivery of excellent service

Vision

Develop and promote an integrated transportation system that, along with a highway infrastructure and service delivery, will facilitate the economic development of Puerto Rico in harmony with the environment

An Evolving Mission of PRHTA since its creation (PRHA/1965) and during the last 53 years (1965-2018)



Impact of Hurricane Maria on PRHTA Operations and Finances (cont.)

- **Revenue:** Revenue from operations were severely depleted in the wake of Hurricane Maria. Toll plazas were damaged or left without power, TU and several bus lines were left temporarily inoperable, and both traffic and ridership were greatly reduced.
- **Economy:** Hurricanes contributed to greater-than-anticipated economic decline, leading to along-term reduction in revenue, traffic, and ridership.
- **Insurance and aid:** FEMA grants and Insurance proceeds are expected to partially finance some capital improvement projects necessitated by Maria's damage, and offset some of the negative economic impact of the storm.

Estimated damages caused by Hurricane María ($114M to HTA's non-highway assets)*

- HTA's direct loss assessment to-date indicate that Maria caused $71M in damages, excluding damage to the highway network.
- At the time received, the assessment (shown to the right) was only complete for 62% of assessed categories.
- Assuming a linear distribution, HTA estimates total costs in the fiscal plan to be $114M.Additional loss estimates are likely.
- HTA estimates that the vast majority of the direct costs, or $108M,will be covered by emergency funds and insurance payments, with a local funding need of $6M. HTA will meet the local share of all additional federal funding it receives.
- Some indirect costs, including lost revenues may not be covered

*Hurricane Maria damages are almost all covered by Emergency Relief (ER) and insurance coverage

Estimated damages caused by Hurricane María ($114M to HTA's non-highway assets)*

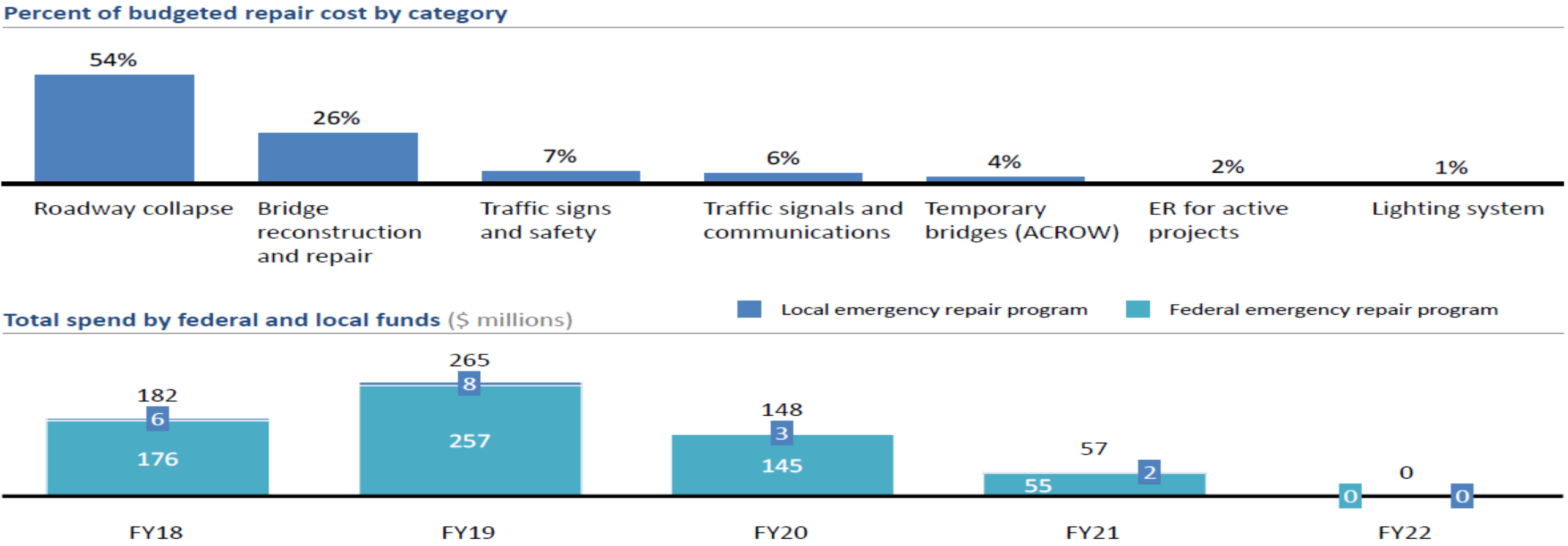
PW Assistance Project - PW Listing
PR Highway and Transportation Authority (PRHTA)

Category	Sub-Category	Costs
Force Account Labor and Equipment	Force Labor Account Payroll	184,111
	Total	**184,111**
Emergency Protective Measures	First Transit Buses for Military Personnel	44,686
	First Transit Buses use during Emergency	29,236
	Security Protection for Toll System Facilities	21,392
	Health & Safety Inspections Facilities	3,500
	Provision of Foods, Water and Other Essential Items to COE (Central Operacional de Emergencia)	20,287
	First Transit Security Protection	63,000
	Direct Administrator Cost	17,078
	Temporary Generators Facilities Rental (including Maintenance and Diesel)	346,691
	Vehicle Rentals, Equipment, Parts	213,829
	Total	**759,699**
Emergency Road Repairs	Emergency Road Repairs	1,800
	Total	**1,800**
Building and Equipment Damages	PRHTA Offices Damages and Repairs	1,508,049
	PRHTA - Toll System Equipment Damages and Repairs	97,191
	PRHTA- 2% Mapfre Insurance Deductible	958,687
	PRHTA Vehicles Damages and Repairs	18,311
	First Transit Bus Damages	16,142
	Total	**2,598,380**
Debris, Emergency Protective Measures & Building and Equipment Damages	Debris, Emergency Protective Measures & Building and Equipment Damages	67,668,704
	Total	**67,668,704**
	Total	**71,212,694**

*Hurricane Maria damages are almost all covered by Em

Preliminary Damage Estimates. Subject to Change / Finalization

Estimated damages caused to the PRHTA Highway Network by Hurricane María ($652M; 97% covered by Federal Funds/FHWA, etc.)

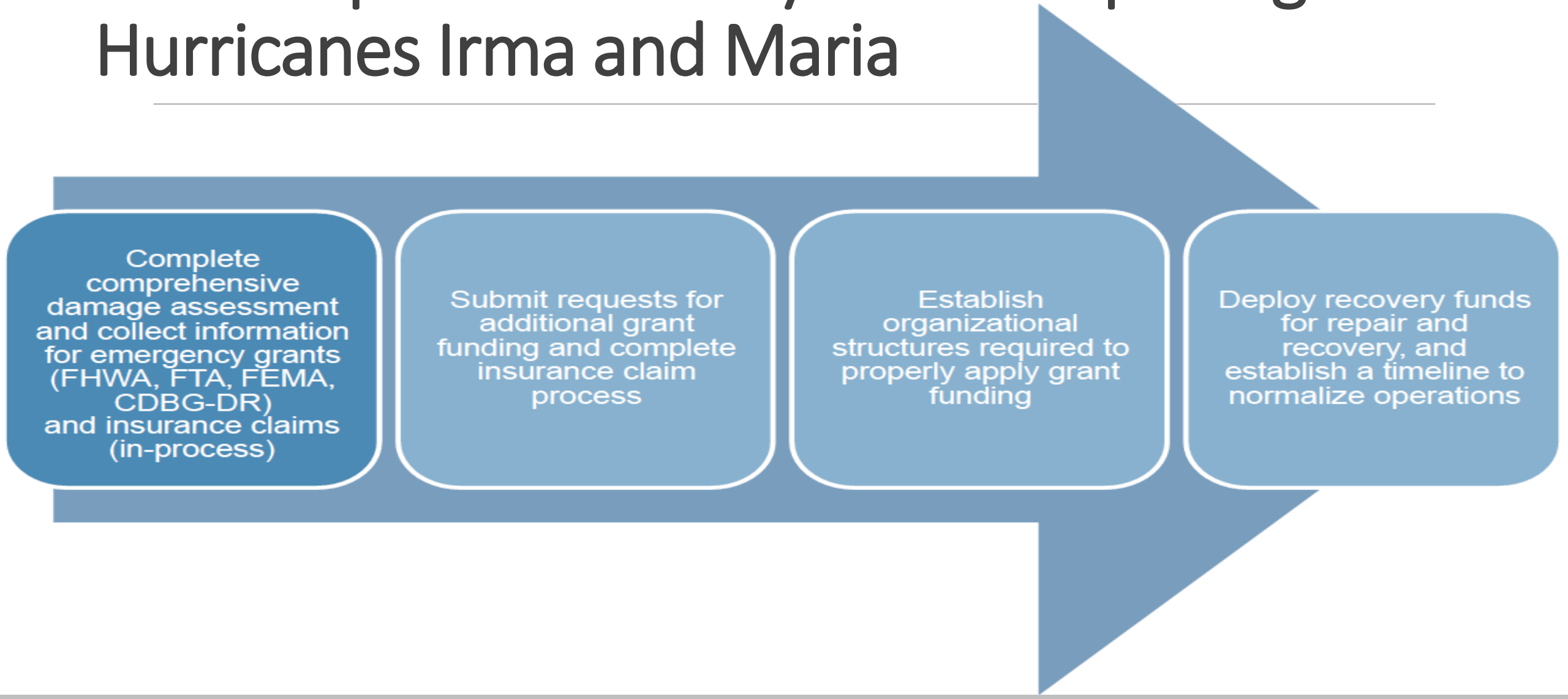


1 Bipartisan Budget Act of 2018, 115th Cong., 2d Sess. (2018). Page. 88; line 8.

Estimated damages caused to the PRHTA Highway Network by Hurricane María ($652M; 97% covered by Federal Funds/FHWA, etc.)

- As of February 19, HTA estimated that repairs would cost a total of **$652M**. Of this total, **$20M** is projected to come from local funds assuming a 100% federal match for all FHWA expenses and some local spending for design management and a share of FEMA expenses. Over half of the total spend will go towards repairing collapsed roads, with another 26% going towards bridge repair and reconstruction.

Next Steps for Recovery after the passage of Hurricanes Irma and Maria



Strategy

- Focus CIP on maintaining the existing highways asset in an adequate operating condition
- Continue aggressive plan to maximize funds anddevelop best-in-class infrastructure
- Expedite projectdelivery:
  - Engage expediteddesign services to accelerate preliminary designs and obligate funds
  - Increase project supervisionthrough additional qualified resources
- Utilize P3's and outsourcing as strategies to achieve a more efficient and modern infrastructure, inaccordance with Puerto Rico's government publicpolicies

Focus

Planned projects for thenext six years will mainly focuson:

- Highway Safety Projects
- Improvement of existing transportation infrastructure, including: pavement reconstruction and preservation; bridge repairs and preservation; and the upgrade of trafficsignals.
- Congestion Mitigation
- For the Transit Asset, the CIP will focus on the replacement andupgrades of buses and the TU train system

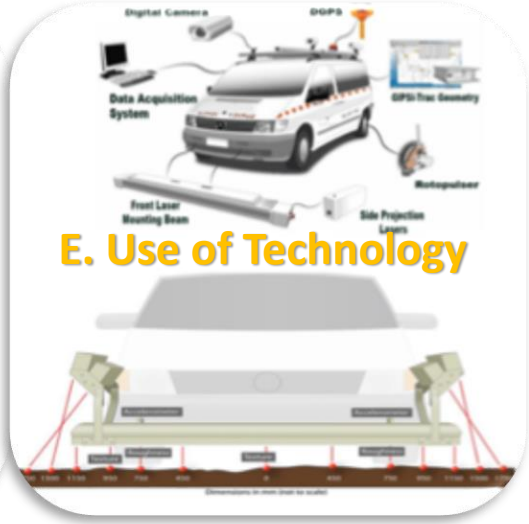
Funds

- Obligate as much Federal Funds as possible to support economic growth
- Current federal match is 80.25% of project costsfor eligible projects, with the state matching 19.75% (exception: 100% for emergency relief).
- Currently, HTA uses toll credits to cover thespend requirements of the state match.
- Transfers agreed upon in CW plan to fund projects beyond federal funds

Projects and execution

- The current CIP has been developed to maximize the deployment of already-assigned federal funding on existing projects and optimize the use of future funding by prioritizing infrastructure needs in order to keep the roadnetwork in a safe operatingcondition.
- As part of a Memorandum of Understanding (MOU) between the HTA and the FHWA, HTA is undergoing a transformation geared at revamping its project and program delivery capabilities to eliminate its project backlog.HTA feels confident that it will be able to deliver the described CIP in this fiscal plan, oncethis transformation iscompleted.
- HTA has included in the fiscal plan aCIP for the Transit Assets at $5M per year, previously allocated on PRITA's budget, to ensure availability of funds to overhaul any bus units and train system components in disrepair.

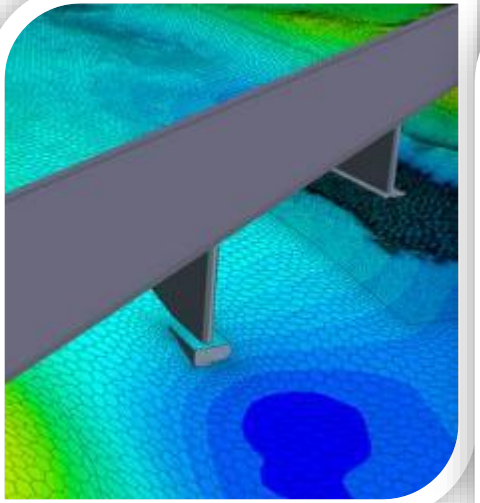
Adaptation Strategies



Supported by information and efficient resource use

A. http://uconn-today.universityofconn.netdna-cdn.com
B. https://classconnection.s3.amazonaws.com
C. https://sites.google.com
D. http://www.climatetechwiki.org
E. http://www.ssesb.com

Iniciativas del Programa Federal Cada Día Cuenta (EDC) relacionadas a Resiliencia y cambio climático



Collaborative Hydraulics

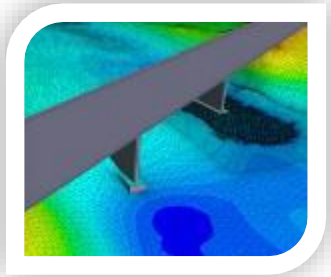
Road Weather Management

Advanced Traffic Signal Performance Measures

Integration of NEPA and Permitting

Using data to improve Traffic Incident Management

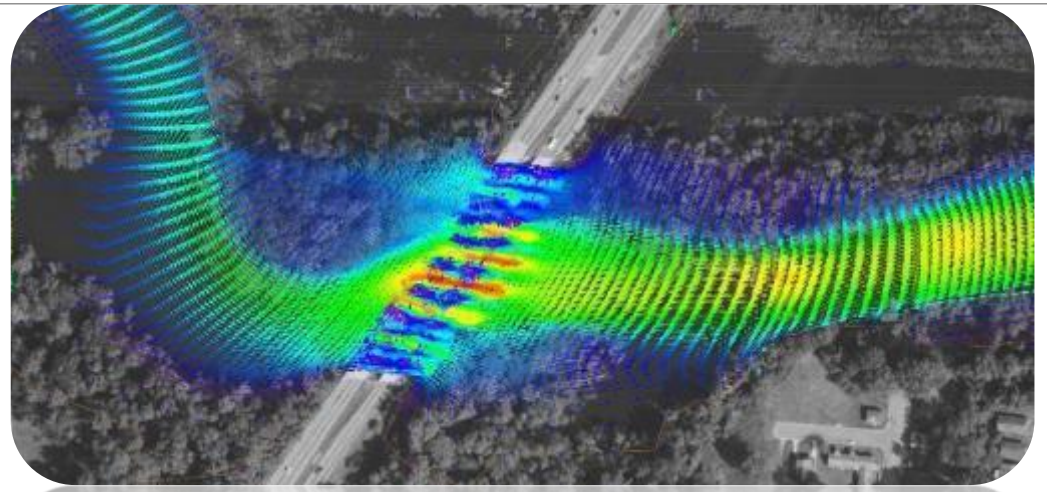
Sources: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/, El Nuevo Día



Collaborative Hydraulics

On-Ramp to Innovation
every day counts

- Use of advanced software for detailed hydraulic models
  - Coastlines
  - Rivers and floodplains
  - Scouring
  - Flood mapping
  - Stability of hydraulic systems
  - Mitigation for natural systems



- Expected benefits
  - Reduction of design uncertainties
  - Effective communication between agencies
  - Adaptation for extreme events

Source: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/CHANGE.cfm https://nc.water.usgs.gov

Road Weather Management

Implementation of Pathfinder

- Multisector collaboration between state government, federal government //and weather companies
- Consistent weather information for the public
- Documenting weather impacts to highways

Integrated Mobile Observations

- Instrumented government vehicles and equipment (ex. Maintenance machines) to gather weather data
- Instrumented pavements
- Informed decision-making to determine magnitude of impacts and intervention locations

Source: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/roadweather.cfm

Using Data to Improve Traffic Incident Management

- Performance measures
  - Time to clear incident
  - Time to clear highway
  - Incidence of secondary crashes
- Implementation Plan for Puerto Rico
  - Staff training at Traffic Management Center
  - Integration of crash databases → TraCS and SunGuide
  - Digitalization of crash form (PPR-93, Police of Puerto Rico)

Source: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/timdata.cfm
Puerto Rico Highway and Transportation Authority

Integrating NEPA and Permitting

Objectives:

- Reduction of bureaucratic obstacles between permitting and environmental impact statements → duration of process
- Interagency collaboration between highway agencies and permitting agencies (ex. AEE, AAA, DRNA, JP, OGPE, FEMA, USACE, Coast Guard, among others)
- Identification of main problems

→ Exposure to natural hazards related to climate change

→ Adverse effects of interaction between infrastructure and natural systems

Source: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/nepa.cfm

Automated Traffic Signal Performance Measures (ATSPM's)

Objectives:

- Direct and continuous monitoring of traffic signal operations → real-time adjustments and for different scenarios
- Reprogramming signals using real data rather than only simulations or citizen complaints
- Cost savings
- Traffic incident management response time reduction
- Contributes to system resilience in coordination with other government agencies (police, medical services, firefighting, among others)

Source: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/atspm.cfm

Driver Simulation for Training First Responders in Natural Disaster Contexts

Research tool that can be used to evaluate driver behavior

Enables testing of resilient highway network design for improved efficiency, safety and recovery capabilities

Evaluation of hypothetical emergency scenarios without risking life or property

Drones (UAV) para reconocimiento e inspección de la condición de la infraestructura de carreteras y puentes

Source: https://www.roadsbridges.com/uav-state-dots-employing-drones-improve-safety-collect-data-slash-costs

Key benefits of drones as infrastructure inspection tool

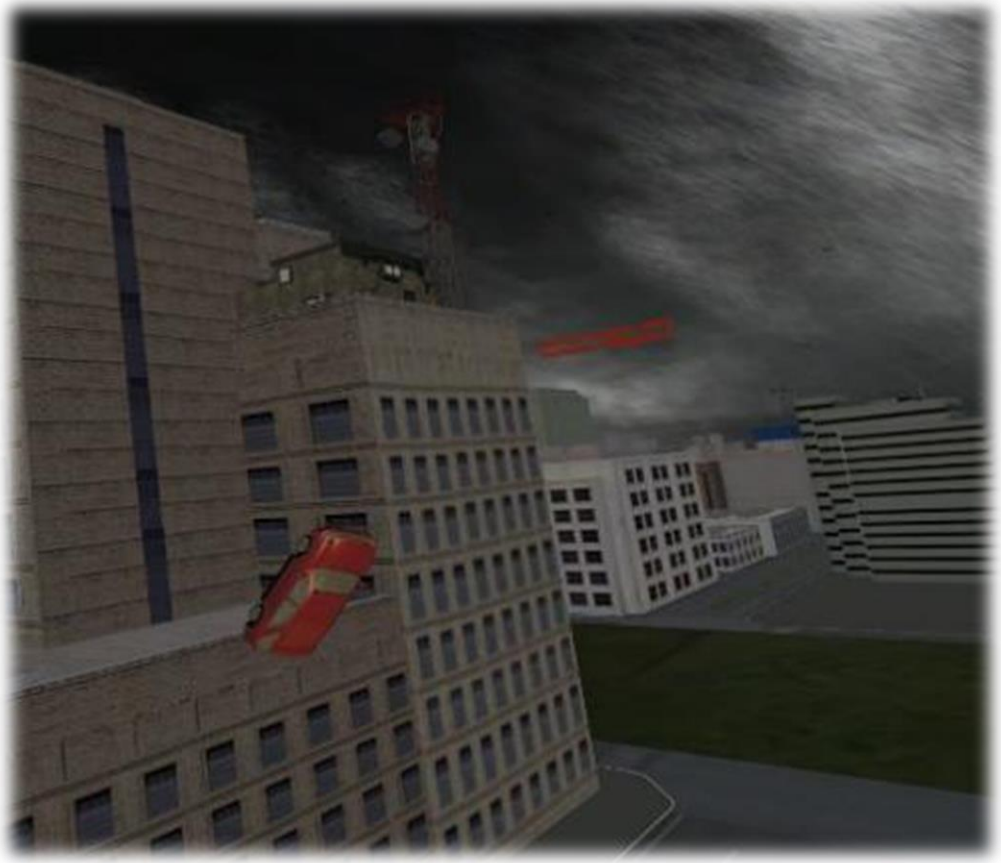
- Rapid inspection (up to 75% less time)
- Cost reduction (up to 95% less)
- Reduced exposure of crews to dangerous conditions
- Easier access to difficult locations
- Use of instruments to document findings

AASHTO reports growing interest in drones from State DOTs

Realidad virtual para adiestramiento y capacitación en el contexto de infraestructura de transportación y desastres naturales

Virtual reality can be used to represent hypothetical scenarios in an immersive, interactive and safe manner

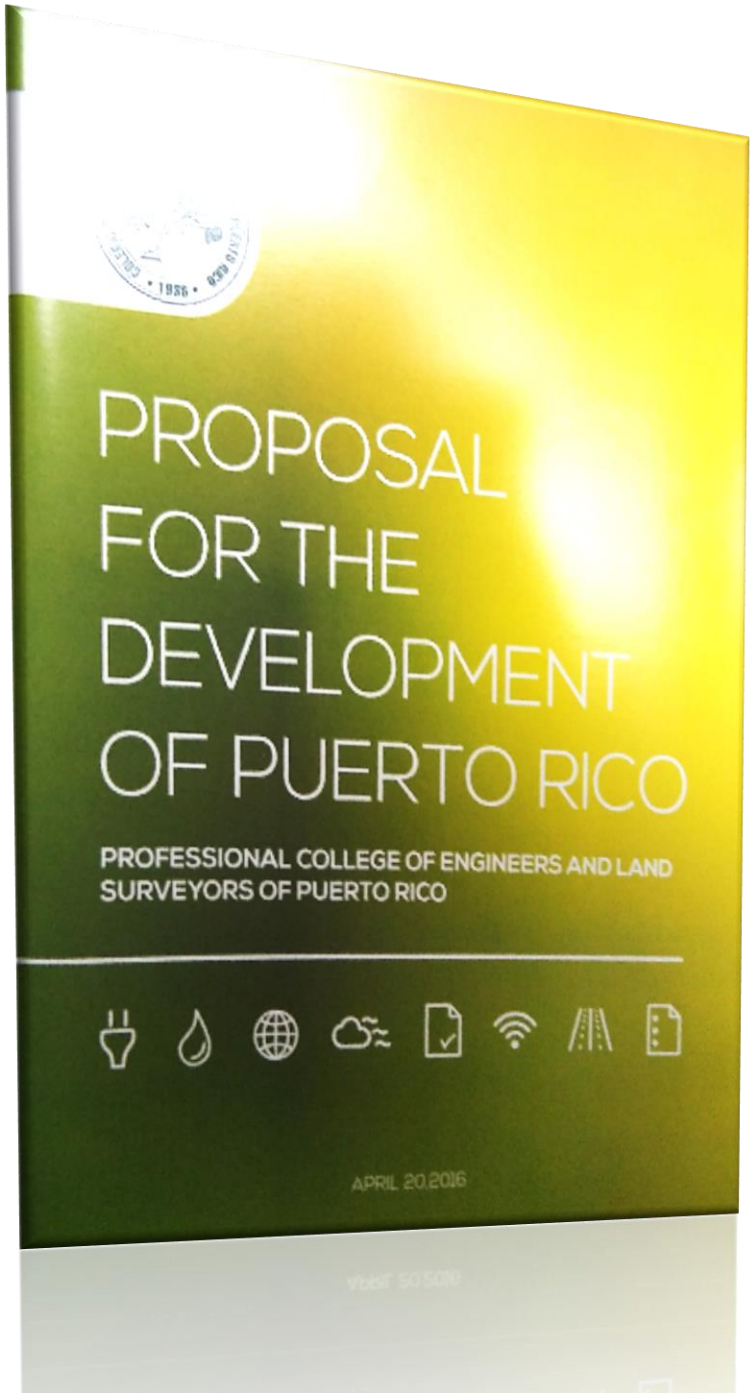
Government agencies, at local and national levels, have growing interest on its use for training personnel, research and public education.



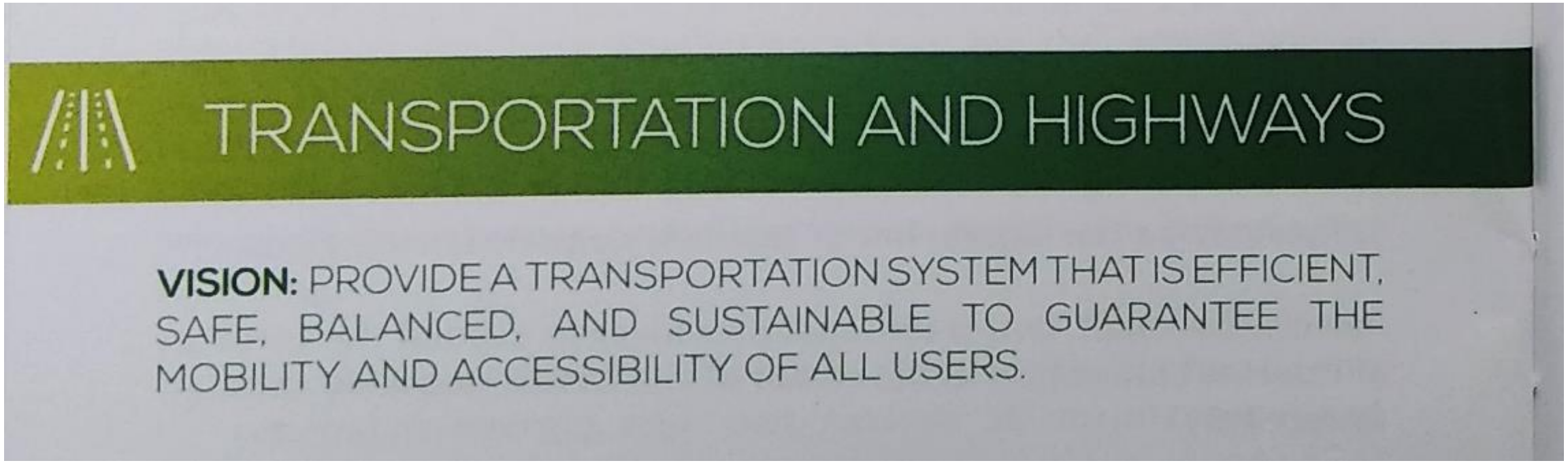
Fuente e imagen:
https://www.eonreality.com/portfolio-items/virtual-disaster-preparedness/

Parte 6:

Propuesta del CIAPR'S para el Desarrollo de Puerto Rico



CIAPR's Proposal for the Development of Puerto Rico: Vision for the Transportation and Highway Sector



CIAPR

Proposal for the Development of Puerto Rico: Transportation and Highway Sector

RECOMMENDED ACTIONS:

1. Prioritize rehabilitation, restoration, and optimization of existing infrastructure over new construction.

Focus efforts on the maintenance and strategic restoration of the land transportation infrastructure and its assets.

2. Use new materials and technologies.

Explore the use of new techniques, technologies, and materials (including recycled products) for the development of transportation projects. For example, warm asphalt mix, permeable concrete, accelerated bridge construction, and roller-compacted concrete. Continue promoting initiatives such as "Every Day Counts" (EDC4) and the Strategic Transportation and Innovation Council (STIC).

3. Promote the development of mass transportation.

Review the regulations to promote transit-oriented development and mixed uses. Review regulations related to truck overloads and their impact on the premature damage of the road infrastructure and bridges.

CIAPR's Proposal for the Development of Puerto Rico: Recommended actions for the Transportation and Highway Sector

4. Revitalize urban areas.

Promote urban revitalization projects in primary urban corridors (such as Piñero, Roosevelt, and Muñoz Rivera avenues) along with the development of business improvement districts. Promote the geometric reconfiguration of main roads to provide better access to businesses, lanes for bicycles, and transform traditional intersections into modern roundabouts and complete streets.

5. Access additional funds.

Identify sources of local matching funds to capitalize on the funds available through the federal FAST Act (Fixing America's Surface Transportation) to strengthen mass transportation service, promoting its efficiency, and expand the operation of the system.

CIAPR's Proposal for the Development of Puerto Rico: Recommended actions for the Transportation and Highway Sector

6. Foster research.

Provide local research funds that allow the development of new technologies and techniques to meet the Island's needs, motivate the retention of professionals, and serve as sources of export. These funds could help to research measures for the reuse of elements such as car tires, which today have become a critical issue in Puerto Rico.

7. Educate citizens.

Increase awareness campaigns for citizens to foster a culture of road safety, touching subjects such as aggressive driving, security in construction zones, consolidation of agencies, and public aesthetics versus infrastructure.

¡Muchas gracias por la oportunidad!

¡Felicidades a los Ingenieros y Agrimensores!

¡Celebración de nuestro Octogésimo Aniversario!