# WHAT WE DO AND DON'T KNOW ABOUT ALABAMA'S DAMS AND WHY IT MATTERS

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# History of Dam Safety Efforts in Alabama

- Alabama is only state without a Dam Safety program
- Previous legislative attempts
  - 2002 – "Dam Security & Safety Act" initiate by ADECA/OWR with a coalition including ALFA and APCO; due to lack of consensus the proposed legislation was not introduced in 2003
  - 2008 – "Alabama Dam Inventory and Classification Act" by Representative Randy Wood and cosponsored by Canfield, McCutcheon, Laird, Bridges & Fite; merely required Alabama to count and classify dams and included ability of OWR to enter on to private lands as a part of the data gathering effort
  - 2014 – Legislation was introduced based on ASDSO model legislation by Mary Sue McClurkin in response to the mayor of Indian Springs concerns of the condition of a dam at Oak Mountain Park. Thanks to efforts by ASCE member Ben Gallagher
- Other progress
  - After 2008, ADECA's Office of Water Resources has been slowly working on developing an inventory of dams using a small annual grant from the federal government
  - ASCE National and Alabama Section joined with ACEC to research previous efforts and reach out to stakeholders

# Safe Dams Efforts in 2015/2016

- Report card research to create 2015 report on dams for Alabama Infrastructure Report Card
- Dams received a "?" or Incomplete due to lack of information; media attention continues
- Small committee formed in Spring 2016 to focus on issue and how to move forward
  - Using SPAG funds, Alabama Section funds and funding from ASCE, The Carter Group was hired to help facilitate research and develop a plan of action
  - Results
    - Continued to learn what we did not know to help develop path forward
    - Successful meeting with ADECA & OWR gaining insight on current status of inventory efforts
    - Reached out to other agencies that would be affected by a dam failure – EMA, ALDOT, ADEM
    - Reviewed most recent legislation
    - Gathered & reviewed dam safety regulations from other states
    - Big takeaway is there is APATHY and LACK of AWARENESS of the potential risk

# Why worry? Why care? Why us?

- ALABAMA HAS THE BIGGEST DAM PROBLEM IN THE U.S., Montgomery Advisor, Andrew J. Yawn, Feb. 17, 2017
  - "Of the 676 high-hazard and significant-hazard dams in Alabama, 625 didn't have an EAP in place, according to the 2015 Army Corps of Engineers survey. The dams that have EAPs are primarily federally regulated, hydroelectric utility dams that require oversight from the FERC."
  - EAP's talks "about how we communicate with the state, EMA, first responders. They also include inundation maps, which show where the water would go, when it would get there and what the depth would be." Richard Mickwee
  - "The Alabama EMA is confident in its ability to handle a dam failure, EMA Executive Operations Officer Jeff Byard said. While the state doesn't have a database of EAPs for each individual dam, Byard said the state employs a one-size-fits-all "all-hazards plan" that is expected to handle any disaster scenario. The same plan that is in place for a dam failure would also be used for a tornado or hurricane……"
- Things to consider
  - Importance of prevention
  - Roughly 25% of dams that would be required to have an EAP in any other state in the nation, have an EAP in Alabama
  - Is it as simple as a plug and play assumption indicates?

# Want to Help?

- Why does it matter?
  - EVERYONE is at risk – home owners, residents, business owners, employees, motorists
  - Who else is better prepared to explain these risks?
- Do you know your Risk?
  - Do you live or work downstream from a dam or on a lake supported by a dam?
  - Do you drive/ride across a road on a dam or downstream from a dam?
  - What about members of your family?
- How do we combat APATHY and LACK of AWARENESS?
  - Within ASCE
  - Public agencies and officials
  - Members of the public
- Based on all you have heard what comes to mind?
  - A few short words that pack a punch & are memorable!
  - Something that "compels people to be better do more or go further"
  - Think of all the memorable and effective messages you have heard in the past

# What is the message for safe dams???

- Where is the beef
- Buckle up
- You're in good hands
- You deserve a break today
- Like a good neighbor
- A diamond is forever
- A little dab'll do ya
- Be all you can be
- Betcha can't eat just one
- When it rains it pours
- Please don't squeeze the Charmin
- Think different
- Can you hear me now
- Don't leave home without it
- Fly the friendly skies
- Finger licken good
- Good to the last drop
- Plop plop fiz fiz
- Snap crackle pop
- What happens here stays here
- Reach out and touch someone
- Just do it
- Our roads Our Future Our Responsibility
- Give a dam

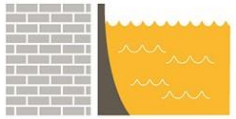
# Help us find our message and define the problem!

# Now what?

- We need:
  - People that are fired up and ready to make a difference; share knowledge with others
  - People to help on the committee
  - People to talk to officials and general public
  - People to reach out to legislators
  - People to engage the media, pursue op-eds, articles, interviews
  - People to make social media posts and tweets, retweets
- We will provide:
  - The message
  - Information and backup
  - Assistance preparing op-eds and articles and preparing for interviews

# 5 CIVIL ENGINEERING FAILURES *that led to* DESIGN BREAKTHROUGHS AND NEW TECHNOLOGIES

## 1 ST. FRANCIS DAM



CONSTRUCTION
San Francisquito Canyon
1924 - 1926

185 FT. TALL — Could store 38,168 acre-feet of water

Modeled after the Mulholland Dam, completed by the chief engineer **William Mulholland** the year prior.

### FAILURE

**March 12, 1928: The dam failed**

It flooded the San Francisquito Canyon 140 ft. above the stream bed and continued down the Santa Clara River Valley

52 MILES - 5.5 HOURS


600 LIVES LOST

The dam had been built on a Pleistocene-age landslide, and the engineer, Mulholland, had exacerbated the problem by adding 20 feet in height to the original design

### INFLUENCE

NEW FEDERAL DAM SAFETY LEGISLATION WAS PASSED and **GEOLOGICAL FACTORS** are now taken into account in civil engineering

In California, thorough inspections were made on **827 EXISTING DAMS**

1/3 of which were determined to **NEED REPAIRS**

The failure affected future dam design and delayed the Boulder Canyon Project, which included construction of the Hoover Dam

## 2 TACOMA NARROWS BRIDGE

Tacoma Narrows
Opened in MAY 1940
$6 MILLION building cost

Link between communities, merchants and military operations during WWII

3RD LARGEST SUSPENSION BRIDGE

Earned the nickname **"GALLOPING GERTIE"** due to the way it bounced or galloped under stress from strong winds

### FAILURE

**November 7, 1940**

**10 AM** THE BRIDGE BEGAN TO "GALLOP"
It twisted up to 28 ft. on one side and reached angles up to 45 degrees on the other side, all while moving up and down

**11 AM** THE BRIDGE BROKE APART
A 600-ft.-long center section broke off, snapped from its cables, flipped over and fell into Puget Sound

All suspension bridge design of the time considered wind as only a minor factor, so many others experienced similar movements to Galloping Gertie

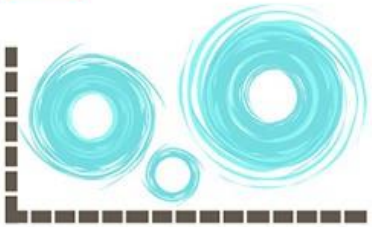
### INFLUENCE

A NEW NARROW BRIDGE TOOK ITS PLACE: **"STURDY GERTIE"**
Redesigned, heavier, stronger and wider, the bridge was completed in October 1950 and still stands today

TODAY, DESIGNS OF ALL MAJOR SUSPENSION BRIDGES

TAKE INTO ACCOUNT aerodynamic effects
UTILIZE wind tunnel studies
CALCULATE stresses from the wind load

## 3 NEW ORLEANS HURRICANE PROTECTION SYSTEM



Designed to contain the river DURING PERIODS OF HEAVY FLOODING

FIRST LEVEES AND FLOODWALLS were initially built between 1717 to 1727

MEASURED THREE FEET IN MOST LOCATIONS

1985 Surge barriers replaced with TALLER LEVEES

AUGUST 29, 2005 HURRICANE KATRINA made landfall

### FAILURE

**LEVEES AND FLOODWALLS** in place were breached DUE TO ENGINEERING and ENGINEERING-RELATED policy failures

#### CAUSES

**COLLAPSE OF SERVER LEVEES** with concrete floodwalls (I-walls)

**OVERTOPPING** – water poured over the tops of the levees and floodwalls, eroding structures away

Levee **BUILDERS USED INCORRECT DATA** to measure levee elevations

Levees were **NOT BUILT HIGH ENOUGH**, some 1 to 2 feet lower than intended design elevation

Hurricane protection system was **CONSTRUCTED AS INDIVIDUAL PIECES**

**HURRICANE KATRINA AND SUBSEQUENT LEVEE FAILURES RESULTED IN**

| 1,118 | 135 | $21 BILLION | $6.7 BILLION | 124,000 |
|---|---|---|---|---|
| deaths | missing, presumed dead | in residential property damage | in public infrastructure damage | thousand jobs lost |

### INFLUENCE

#### NEW ORLEANS

**$14.5 BILLION NETWORK** of levees, floodwalls and pumps installed around New Orleans metro area

**BEST FLOOD CONTROL SYSTEM** of any coastal community in the U.S.

**ELIMINATES FLOODING** for most so-called 100-year events

Offers significant **REDUCTION IN FLOODING** from 500-year surge event, larger than Hurricane Katrina

#### LEVEE AND FLOODWALL ENGINEERING

THE OUTDATED "STANDARD PROJECT HURRICANE" FORMULA WAS ABANDONED

**BASED ON** storms that preceded the large Category 3 **HURRICANE BETSY** and the compact, extremely strong Category 5 **HURRICANE CAMILLE**

**REPLACED BY MODERN METEOROLOGICAL UNDERSTANDING** of the potential for hurricanes and sophisticated risk-based **COMPUTER MODELING**

Levees are now required to **WITHSTAND OVERTOPPING** **BY 500-YEAR** surge events

**IMPROVED MATERIALS,** including sheet piling and diagonal structure piles

**DESIGNS** must account **FOR SINKING SOILS** and projected **SEA LEVEL RISE** caused by global warming

# 4 QUEBEC BRIDGE

Saint Lawrence River

COMPLETED IN 1917

**1,801 FT. SPAN**

LONGEST CANTILEVER BRIDGE in the world at the time

**67 FT. WIDE,** accommodating:

**2**

- RAILWAY TRACKS
- STREETCAR TRACKS
- ROADS

## FAILURE

**TWO COLLAPSES:**

**August 29, 1907**

19,000 TONS OF STEEL FELL INTO THE WATER KILLING 86 WORKERS

**September 11, 1916**

5,000 TON SECTION OF THE CENTER SPAN FELL INTO ST. LAWRENCE RIVER KILLING 13 PEOPLE

## INFLUENCE

The first collapse was due to **ENGINEERING NEGLIGENCE,** ignoring a bend in compression chords

The Quebec Bridge was redesigned with **the subsequent bridge design WEIGHING 2.5 TIMES AS MUCH as the first bridge design**

The final redesigned Quebec Bridge was one of the first large projects to use a **NICKEL ALLOY STEEL** that supported stresses at **40 TIMES MORE THAN CARBON STEEL** and still stands today

# 5 RONAN POINT APARTMENT TOWER

East London

**THE 22-STORY APARTMENT BUILDING** was built using a panel system of precast panels joined together without a structural frame

This type of panel system was popular because **it was FAST and CHEAP** in a city with an ongoing housing problem, **BUT IT WASN'T RECOMMENDED for BUILDINGS TALLER THAN SIX STORIES**

## FAILURE

**May 16, 1968**

18th floor tenant Ivy Hodge ignited a gas leak, causing an **EXPLOSION** that blew out the supporting walls

**4 FLOORS COLLAPSED** before the building's entire corner gave way, **KILLING FOUR PEOPLE**

Poor design and construction were to blame:
**FAULTY JOINTS, SHODDY BUILDING and A LACK OF STRUCTURAL SUPPORT outside of the corner walls**

## INFLUENCE

**BUILDING CODES WERE UPDATED** and **REQUIREMENTS FOR STRUCTURAL REDUNDANCY WERE CREATED** in the U.S. and parts of Europe

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