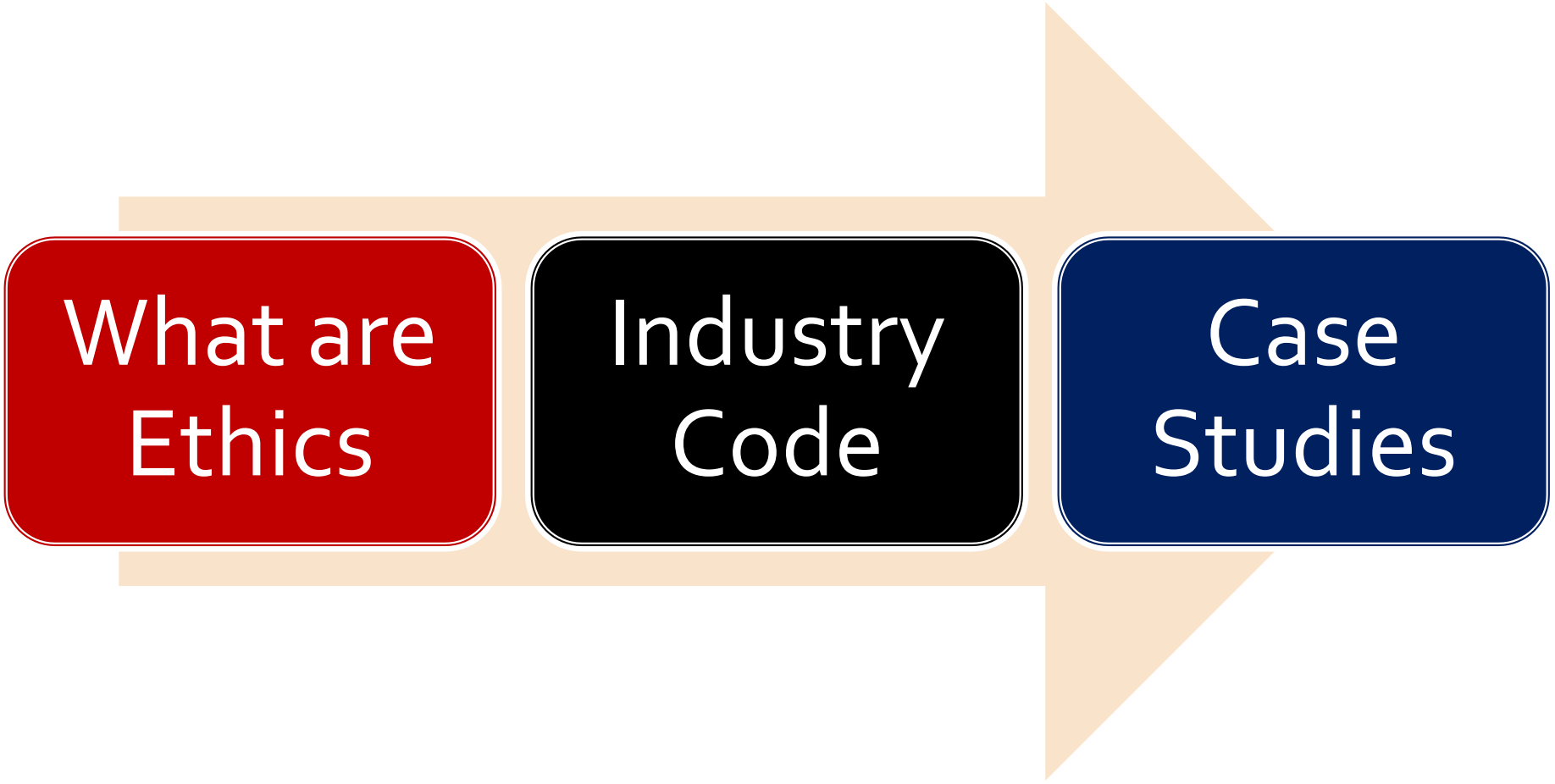
American **Concrete Pipe** Association

Engineering Ethics and Liability

Presented by Aimee Connerton and Liza Kirk, P.E.

Agenda

Engineering Ethics and Liability



ETHICS

The basic concepts and fundamental principles of decent human conduct. It includes study of universal values such as the essential equality of all men and women, human or natural rights, obedience to the law of land, concern for health and safety and, increasingly, also for the natural environment.

The BIG picture

- ✓ Codes of ethics are not law.
- ✓ Ethical behavior is not always protected by the law.
- ✓ Companies realize that ethical behavior is essential to their long term prosperity.

- ✓ Ethically aware companies provide
  - help to employees facing ethical conflicts
  - allow employees to raise ethical concerns
  - explicitly prevent forms of retaliation for reporting unethical behavior

QUESTION 1: For Our Big Picture

In how many states do you have a P.E. license?

- 1?
- 2?
- 3?
- 4?
- 5+?

QUESTION 2: For Our Big Picture

How frequently does your continuing education requirement include Ethics?

- Never?
- One PDH credit every 2 years?
- One PDH credit every year?
- More?
- Don't know?

NSPE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

The National Society of Professional Engineers

dedicated to the non-technical concerns of licensed professional engineers across all disciplines

David B. Steinman, P.E.
•Chief Engineer of the Mackinac Bridge
•Founder of the National Society of Professional Engineers

The Engineering Code of Ethics

The Engineering Code of Ethics has three components:

- **The Fundamental Canons:** which articulate the basic components of ethical engineering.
- **The Rules of Practice:** which clarify and specify in detail the fundamental canons of ethics in engineering.
- **Professional Obligations:** which elaborate the obligations that engineers have.

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

RULES OF PRACTICE

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Hold Safety, Health & Welfare of the Public Paramount

- If professional judgment is overruled where public is endangered you shall inform your client
- Do not engage or lend your name to fraudulent or dishonest persons or firms

- Strive with principles of sustainable development
- Sign and seal only documents you have done or reviewed

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Perform services only in areas of their competence.

- Undertake assignments only when qualified by education or experience
- Do not affix your signature to plans or documents where you lack competence

"Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. , Expiration Date: ."

- You may seal the entire project as long as technical engineers signed their segments

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

SIGNING & SEALING

- In 2014 a five story residence was constructed directly over DC Waters North East Boundary Trunk Sewer Line
- Only about 2 feet of soil between the bottom of the basement and the top of the **22** foot diameter masonry sewer.
- Building caused cracks.
- Did not notify DC Water of the building till complete
- All engineering done by Structural Eng.

- Repair $$$$$$

- Building????

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Issue public statements only in an objective and truthful manner

- Avoid material misrepresentation or omission of fact
- Do not take credit for work performed by others
- Be objective and truthful in reports, statements or testimony

QUESTION 3: Is this Ethical?

Engineer B wrote an article for a publication where a substantial portion of text came from a prior article written and published by Engineer A. Engineer A contacted Engineer B on the identical word-by-word text and Engineer B stated he had submitted him (Engineer A) as a reference but the Editor had omitted it.

Did Engineer B act ethically?

- Yes?
- No?
- Maybe ?

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Act for each employer or client as faithful agent or trustee

- Disclose all known or potential conflicts of interest to influence judgement
- Do not receive compensation from more than one party for services on the same project unless fully disclosed
- Engineers in public service shall not participate in decisions with respect to services provided by them or their firm
- Do not solicit from or contract with a governmental body on which you serve as principal or officer of their organization

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Avoid deceptive acts

- Do not falsify qualifications or misrepresent you or your associates qualifications.
  - Includes brochures or presentations
- Do not offer, give, solicit, receive directly or indirectly any contribution to influence award of a contract.

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Fundamental Canons

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

QUESTION 4: Is this Ethical?

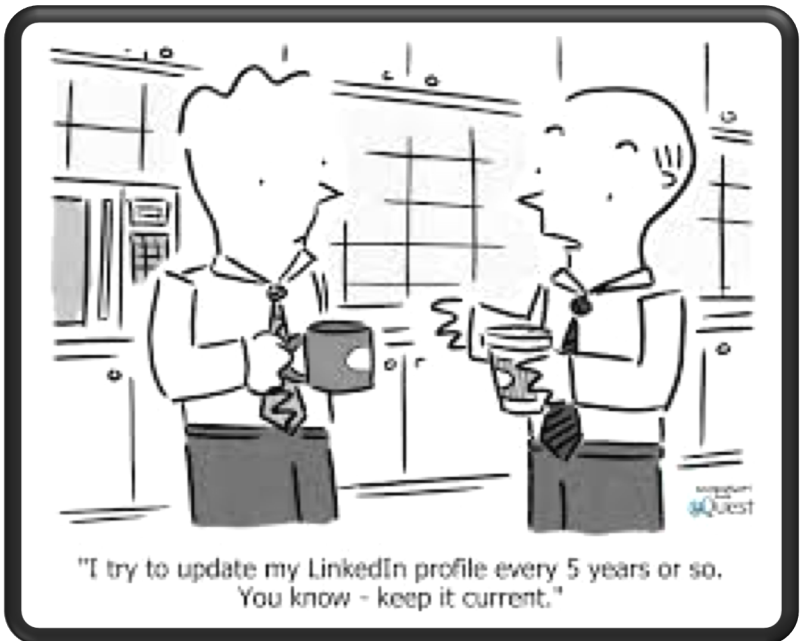
Does this activity happen today with Engineering Firms paying to obtain Government Contracts?

- Yes?
- No?
- Don't know?

Fundamental Canons – Rules of Practice

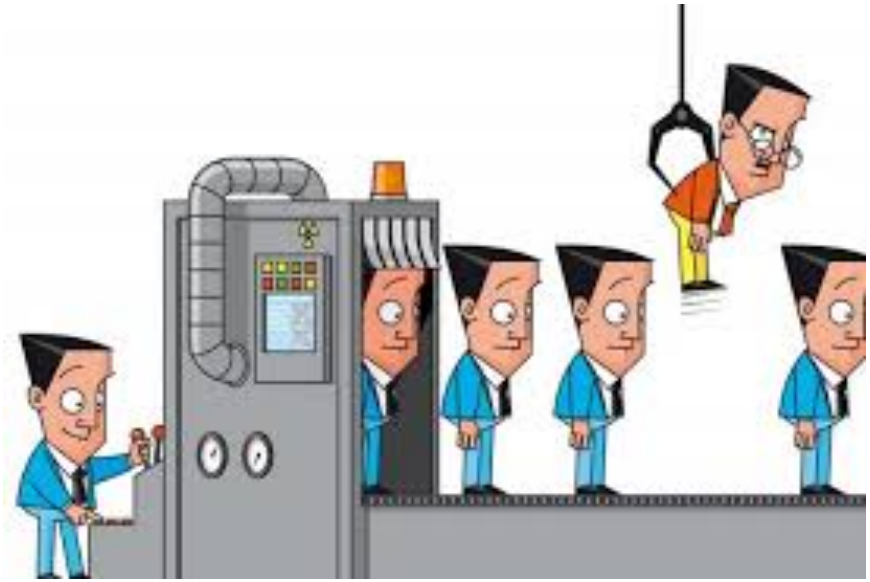
Continue Professional Development

- Keep current in your field of specialty
- Encourage employees to become registered, attend meetings and present papers.



Fundamental Canons

- **8th Fundamental Canon- July 2017**
- Engineers shall,
  - ✓ in all matters related to their profession,
  - ✓ treat all persons fairly and encourage equitable participation
  - ✓ without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status



Ethics

Our Decisions as Engineers have Consequences

- If you have affixed your seal to a Drawing or Specification you are legally responsible for that drawing or specification.
- If any product or material shown on a plan sealed by you experiences a failure you will most likely be required to defend your decision and determine why the failure occurred.

PROFESSIONAL OBLIGATIONS

Professional Obligations

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Honesty & Integrity

- **Engineers shall be guided in all relations by highest standards of honesty & integrity**
  - **Advise clients if believe a project will not be successful**
  - **Do not do outside jobs to detriment of employment**
  - **Do not attract an engineer from other employer by falsification**

- **Engineers shall strive to serve the public interest**
  - Shall not sign/seal projects not within standards
  - Participate in civic affairs and community
  - Adhere to sustainable development

Serve Public Interest

Avoid Public Deception

- **Engineers shall avoid all conduct or practice that deceives the public**
  - Avoid material misrepresentation of fact or omission of fact
  - You may prepare articles but not imply credit for work performed by another

Professional Obligations

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Champion | Guide | Advance | Unite

Confidential Info

- **Engineers shall not disclose confidential information without consent**
  - Specialized project knowledge promotion shall have written consent of all parties
  - Shall not share disclose business affairs of former clients or employers

Influence on Professional Duties

- **Engineers shall not be influenced in professional duties by conflicting interests**
  - Engineers shall not accept fees or free engineering from a material or equipment supplier for specifying their product

Improper Practices

- **Engineers shall not obtain employment or advancement by untruthful criticizing others or improper methods**
  - Salaried engineers shall accept part-time work only consistent with employers policies
  - Do not untruthfully criticize others to gain work

Professional Obligations

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

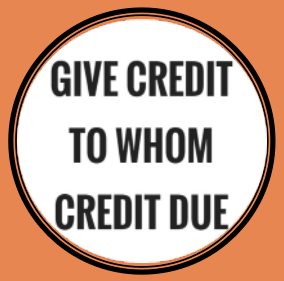
Champion | Guide | Advance | Unite

Unethical Acts Disclosure

- **Engineers shall not harm professional reputation of others**
  - Engineers in private practice will not review another engineers work except if disclosed or work was terminated
  - Engineers in government, industrial, or education employ can review others work when required by their duties

Accept Responsibility

- **Engineers shall accept personal responsibility for their progessional activities**
  - Engineers accept personal responsibility
  - Do not use others as a "cloak"



Give Credit Where Due

- **Engineers shal give credit to those to whom credit is due**
- Recognize proprietary interests of others
- Engineers design, data, records, & notes are the employers property
- Designs for a client should not be duplicated without premission

CASE STUDIES

Liability

LIABILITY

An obligation that one is bound in law or justice to perform

Condition of being actually or potentially subject to an obligation

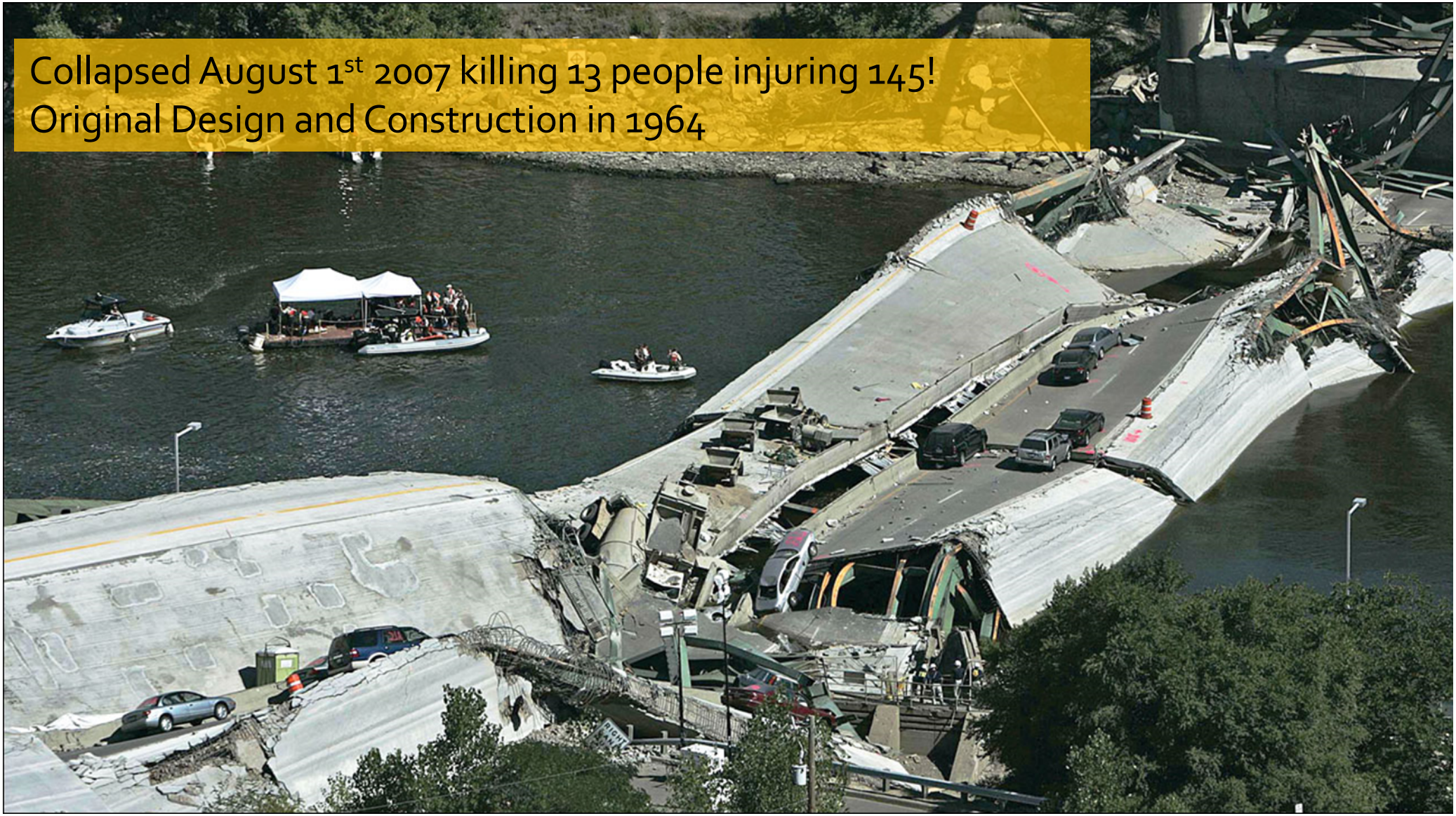
Condition of being responsible for a possible or actual loss, penalty, expense or burden

Liability & Case Study

35 W Bridge Collapse, Minnesota

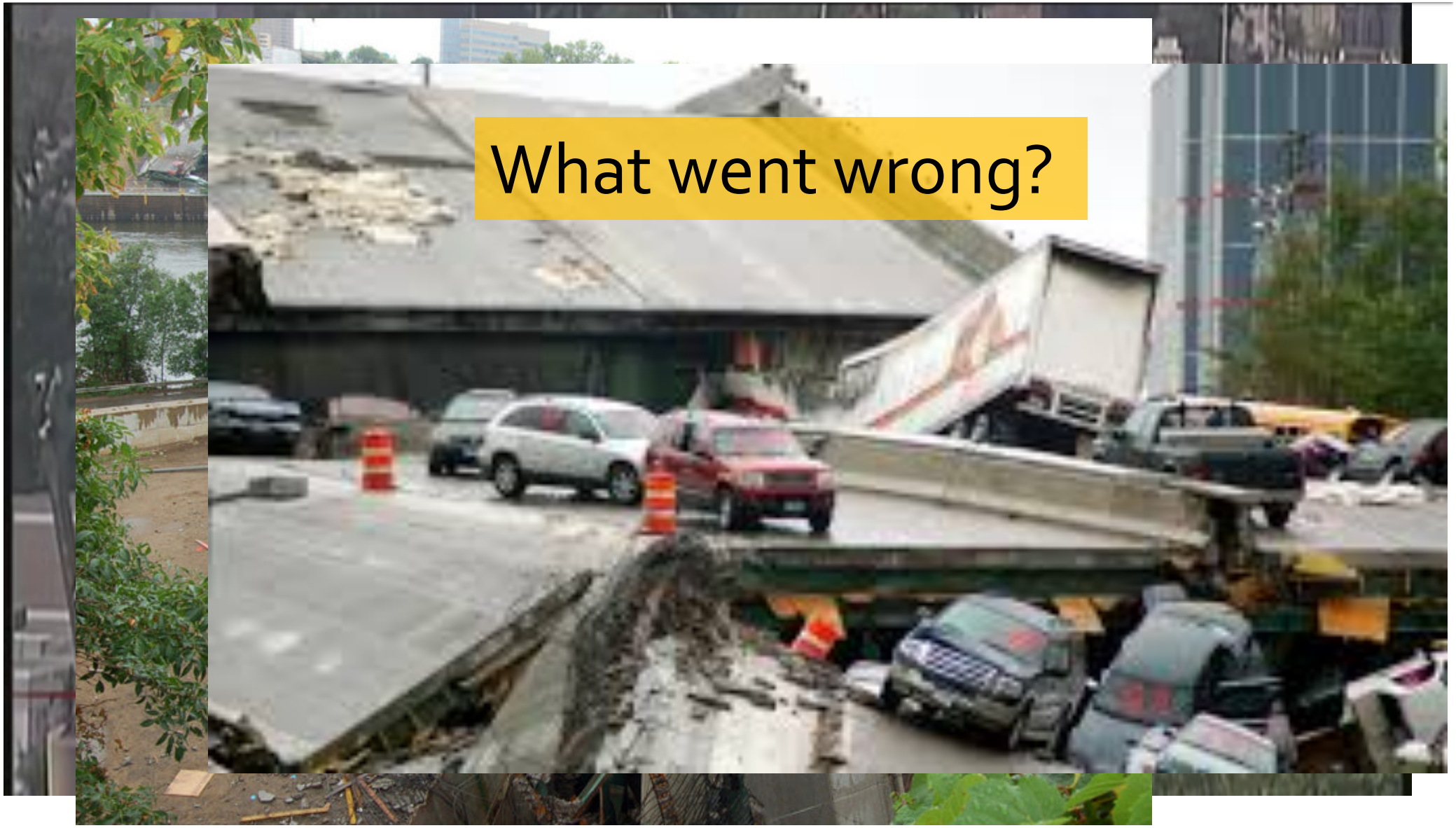
Liability & Case Study

35 W Bridge Collapse, Minnesota



Liability & Case Study

35 W Bridge Collapse, Minnesota



Liability & Case Study

35 W Bridge Collapse, Minnesota

Forensic Investigators reviewed the wreckage to determine the cause

Liability & Case Study

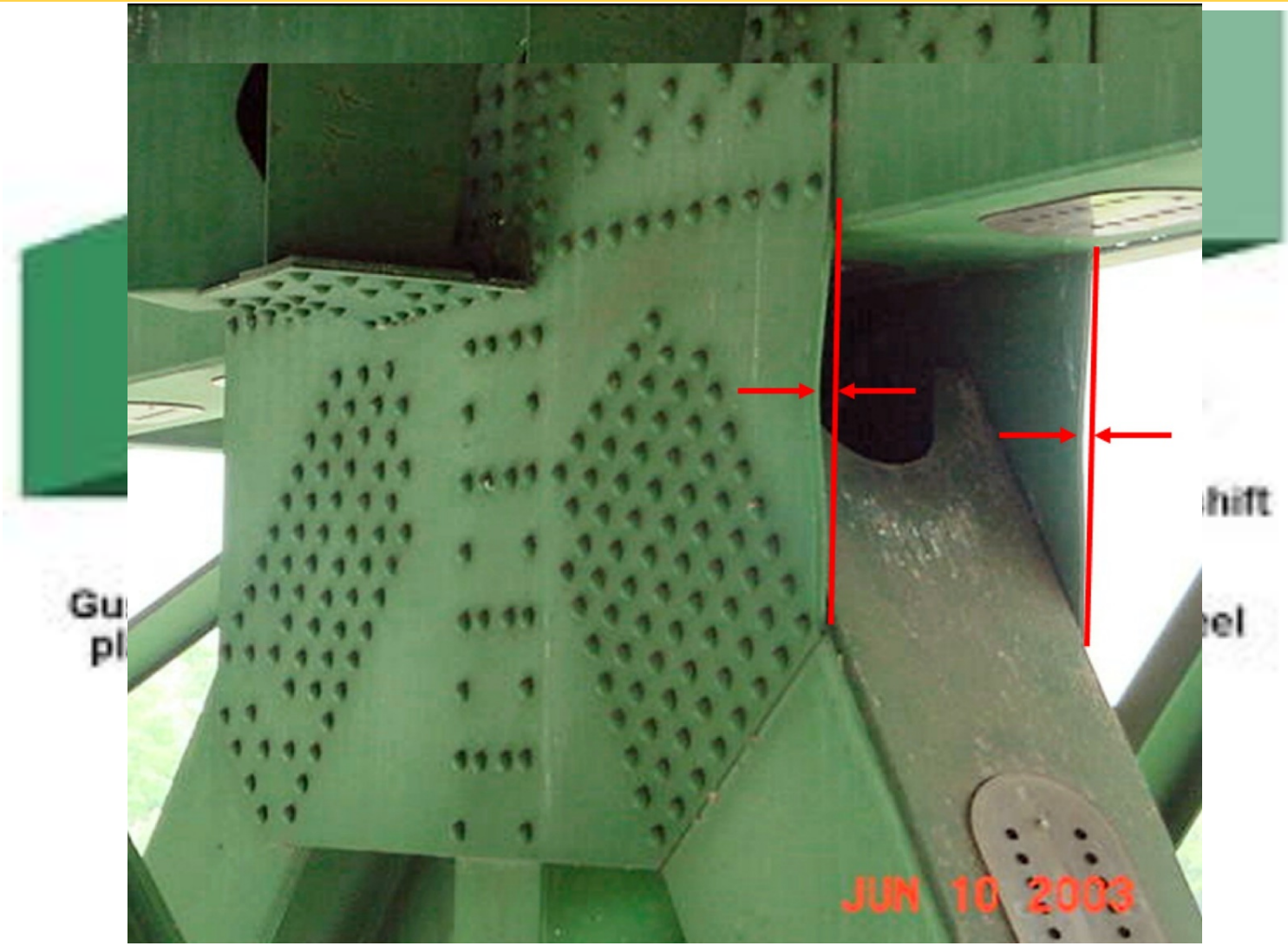
35 W Bridge Collapse, Minnesota

The gusset plates failed

Liability & Case Study

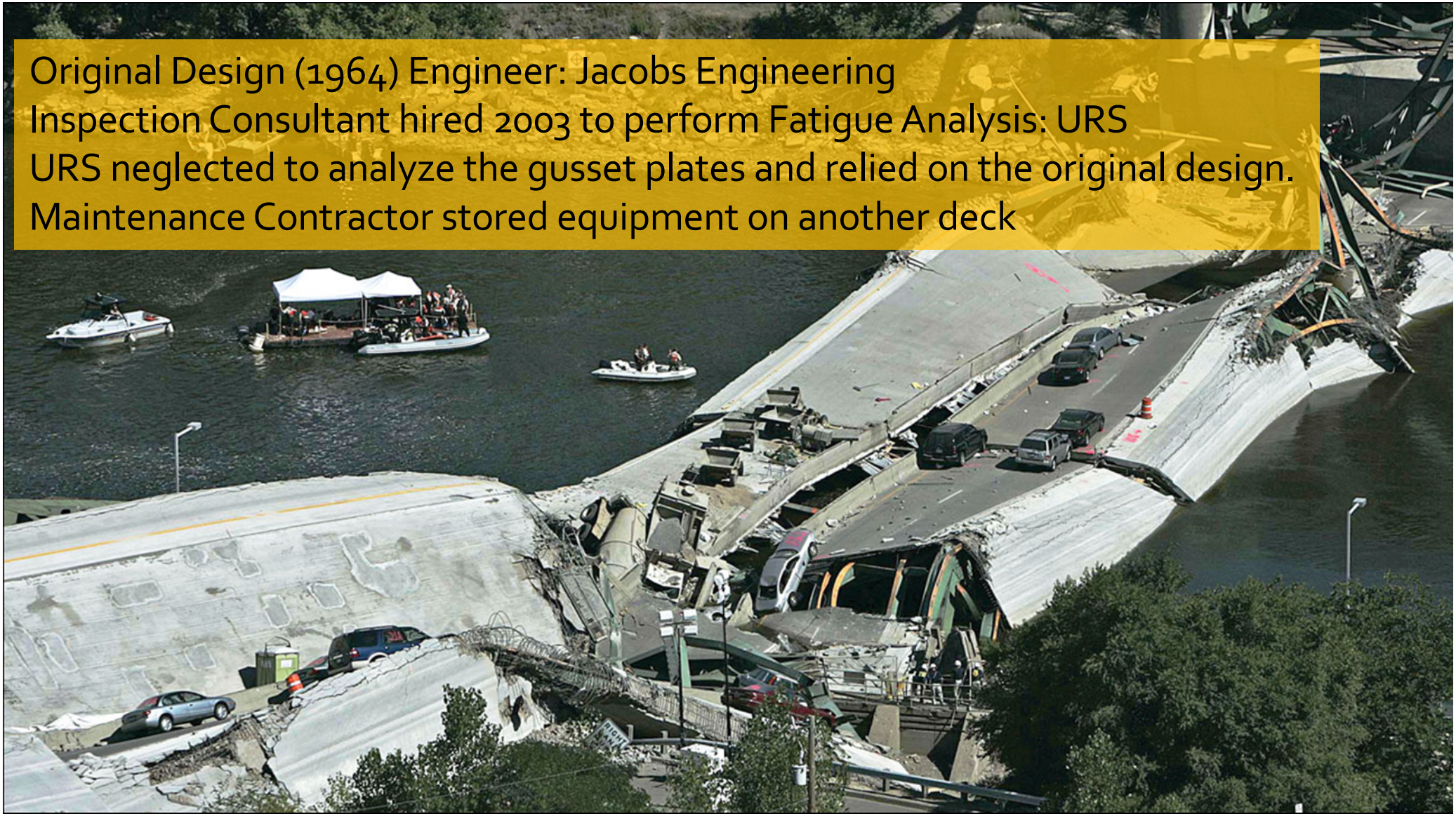
35 W Bridge Collapse, Minnesota

The original design of the gusset plates was called into question…



Liability & Case Study

35 W Bridge Collapse, Minnesota



Original Design (1964) Engineer: Jacobs Engineering
Inspection Consultant hired 2003 to perform Fatigue Analysis: URS
URS neglected to analyze the gusset plates and relied on the original design.
Maintenance Contractor stored equipment on another deck

QUESTION 5: Who is Responsible?

Who is Financially Responsible for the Failure?
(select all that apply)

- Design Engineer
- Original Construction Contractor
- Fatigue Analysis Engineer
- Repair Contractor

Liability & Case Study

35 W Bridge Collapse, Minnesota

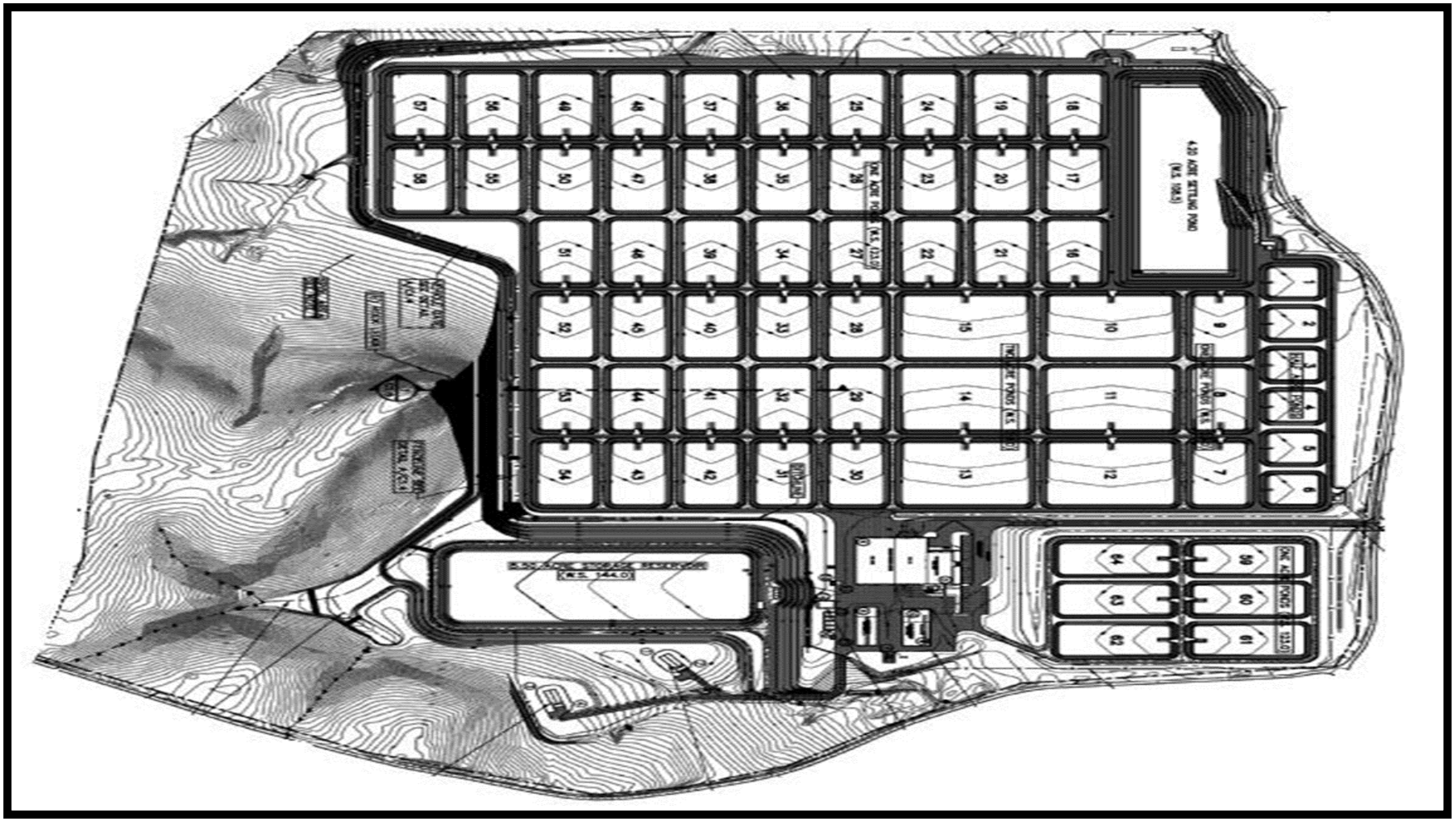
Final Outcome:

Jacobs paid $8.9 million in settlement - WITHOUT ADMITTING TO ANY WRONGDOING

URS paid $52.4 MILLION to resolve the issue– WITH NO ADMISSION OF LIABILITY OR FAULT

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage



Project Valuation: **$27 Million**

Project Start **July 2008** using Flexible Pipe

Quantity of Pipe: **11,000 ft of HDPE (30", 48" & 60" Dia.)**

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Design / Installation / Failure / Liability

Collapses Discovered: **April 2009**

HDPE **Deflections**: 30", 48" and 60" Dia.

Project Completion: **30%**

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Design / Installation / Failure / Liability

Flexible Pipe Sizes:
30" – 48" – 60"

Overall Project 30% Complete at Discovery of Fail

Forensic Investigation Ordered

Cause of Failures:
EXCESSIVE DEFLECTION

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Fish Hatchery Design Failures

- Incorrectly using a design chart for the design that did not include the effect of groundwater
- Not providing adequate construction phase services such as site visits and reviews of field compaction efforts and records
- Not using available geotechnical reports that provided critical information of the in-situ soil conditions necessary for a proper pipe design, and
- Specifying improper backfill and compaction for the project

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Fish Hatchery Installation Failures

- Inadequate Compaction
- Utilizing a Trench Box that was too narrow to obtain Compaction
- Disturbing Compacted backfill by dragging the trench box
- Not dewatering beneath the pipe trench
- Inability to use RFI Process to resolve identified discrepancies related to soils / compaction

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Inspection Criteria

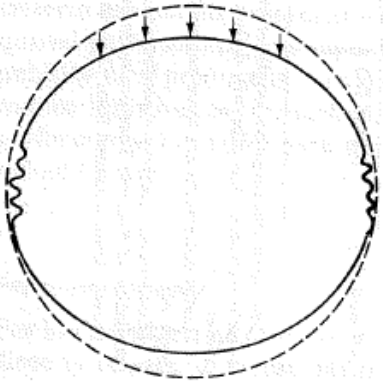


Figure 3.14 Wall crushing at the 3 and 9 o'clock positions.

Wall Crushing

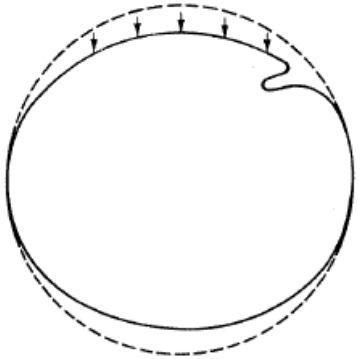


Figure 3.15 Localized wall buckling.

Localized Buckling

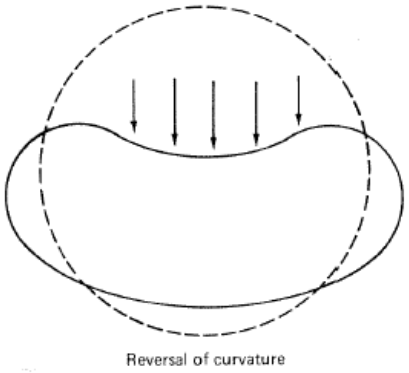


Figure 3.17 Reversal of curvature due to over-deflection.

Reverse Deflection

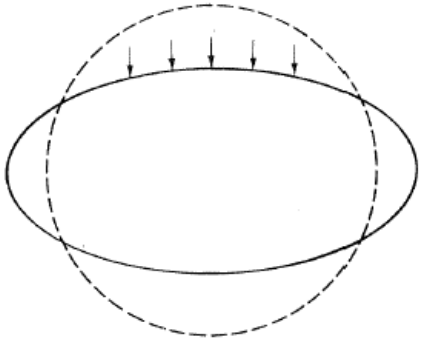


Figure 3.16 Ring deflection in a flexible pipe.

Over Deflection

Liability & Case Study

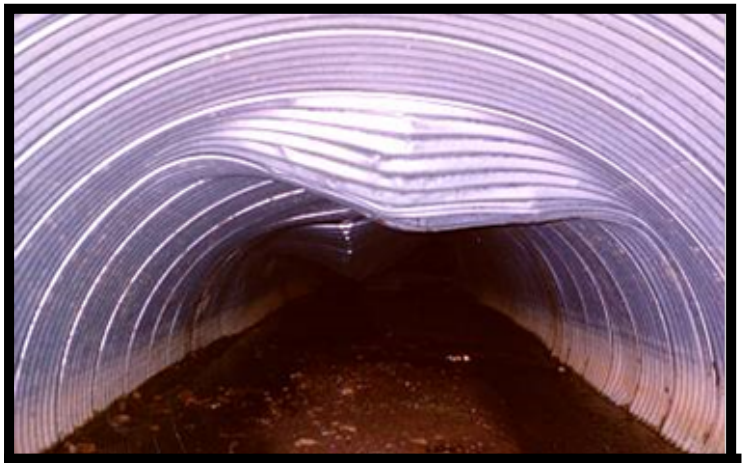
Jasper, TX Fish Hatchery – Design & Install Drainage

Wall Crushing

Reverse Deflection

Inspection Criteria

Localized Buckling



Over Deflection

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Case Study: Liability & Risk

Who is to blame?

The projected cost of the hatchery when construction finally got underway during July 2008 was around $27 million.

However, Boruff said the figure ***could rise exponentially, possibly by several million dollars, before the problem with the failed drainage pipe is ironed out.*** ***ANOTHER UNKNOWN IS WHO IS GOING TO FOOT THE BILL TO PAY FOR THE GLITCH.***

"We are still going through a lot of engineering analysis and testing at this point to determine exactly what caused the problem," said Phil Durocher, TPWD director of inland fisheries. ***"If it turns out to be as bad as it looks initially, it is certainly not going to be cheap to fix.***

BOTH THE CONSTRUCTION COMPANY THAT INSTALLED THE PIPE AND THE ENGINEERING COMPANY THAT DESIGNED THE PROJECT ARE SAYING THEY DID EVERYTHING RIGHT, BUT IT IS REAL OBVIOUS SOMETHING WENT BAD WRONG HERE.

It could be that multiple parties have some culpability here. We'll just have to wait and see."

Matt Williams, Outdoors Writer, Outdoor News, September 30, 2009

QUESTION 6: Who is Responsible?

Who is Responsible? (select all that apply)

- Manufacturer
- Design Engineer
- Contractor
- Public Agency (Owner)

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Back on track: Design firm bears brunt of repair bill on fish hatchery

Story | Comments | Image

Share | Print | Font Size:

TPWD Photo

HDR/FishPro, a fish hatchery design firm based in Omaha, Neb., recently paid out $3.2 million to make good on a design flaw with the underground drainage system at the TPWD's John D. Parker East Texas Fish Hatchery. Approximately 11,000 of feet of HPDE pipe was replaced with more rigid pipe made from PVC and Class 5 reinforced concrete (pictured here). Located on 200 acres of land below the Sam Rayburn dam, the new hatchery is now expected to be complete by early Spring 2011.

Posted: Sunday, August 29, 2010 1:00 am

Matt Williams | 0 comments

Just call it a mountain of a mistake.

After months of evaluation, legal wrangling and dirty work, more than two miles of faulty underground drainage pipe has been exhumed and replaced at the new John D. Parker East Texas Fish Hatchery.

he cost? A healthy $3.3 million.

The state-of-the-art facility is currently under construction below the Sam Rayburn Reservoir dam near Jasper. The projected completion date is early Spring 2011.

The drainage system in question is linked to a dozens of production ponds that will be used for rearing about 5 million Florida bass, blue catfish and bluegill annually. Water will flow through the pipe to the hatchery outfall, Beef Creek, then into the Angelina River about a mile downstream.

How Would You Assign Liability?

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

Concrete Pipe

Engineer
Manufacture per ASTM C76
Install per ASTM C1479

↓

Manufacturer
C76 - OKAY

↓

Installer
C1479 - OKAY

Flexible Pipe

Engineer
"as per manufacturer's recommendations"

→

Manufacturer
"As per ASTM D2321"

↙ ↘

ASTM D2321
Engineer referenced 29 times

Liability & Case Study

Jasper, TX Fish Hatchery – Design & Install Drainage

THE VOICE OF PROFESSIONALS SERVING AMERICA'S COMMUNITIES

Public Works

WWW.PWMAG.COM MARCH 2011

Hanley Wood

Ideas & Opinions

Something fishy with failures?

High-density polyethylene pipe and reinforced concrete pipe are not interchangeable.

The April 2009 collapse of the plastic drainage system at a state-of-the-art fish hatchery in Jasper, Texas, should send shudders throughout the civil engineering community. Not only was the failure entirely avoidable, virtually everything that could go wrong did go wrong.

Completion of the $27 million Texas Parks and Wildlife Department project was delayed by more than a year, thanks to an improperly designed pipeline and inadequate installation, a resulting follow-up investigation, months of legal jockeying by various parties hoping to avoid or mitigate their liability and, finally, a complicated repair process.

After breaking ground in July 2008, the hatchery was scheduled to open in March 2010. Now, the department hopes to complete construction in June 2011.

HDR/FishPro, the design firm that managed the project, absorbed nearly 100% of the financial liability for the repairs. The Omaha, Neb.-based company eventually agreed to cover $3.2 million of the $3.3 million bill. That figure doesn't include the hefty legal tab the company surely incurred.

In the end, roughly 11,000 feet of high-density polyethylene (HDPE) pipe was replaced with 2 miles of reinforced concrete pipe (RCP) and polyvinyl chloride pipe (PVC).

An avoidable failure

Designed to raise roughly 5 million Florida bass, blue catfish, and bluegill every year, the John D. Parker East Texas Fish Hatchery's construction was funded entirely by Texas anglers who bought millions of specially commissioned $5 freshwater fishing stamps.

The failure was discovered in April 2009 when inspectors found sections of 60-inch and 48-inch HDPE pipe had collapsed under 10 to 17 feet of earth fill. An engineering firm hired to investigate the matter pinned the blame on the design firm. A replacement design determined that 60-inch and 48-inch corrugated HDPE pipe should be replaced with reinforced concrete pipe and more rigid PVC should be substituted for the smaller diameter, 30-inch HDPE drainage pipes.

As Todd Engeling, the parks and wildlife department's chief of inland hatcheries, says, "We came out of this deal with a drainage system that's much more rigid and robust than what we originally had, and that's a good thing."

That statement is undeniably true. Unfortunately, the lesson cost his department $140,000 and a year of downtime.

It appears that the first and biggest mistake was in specifying HDPE for an application that was much more suited to reinforced concrete. It was an accident waiting to happen from the very beginning.

Corrugated HDPE pipe is flexible, so a successful installation is driven by the soil envelope that surrounds it. It's imperative that designers and engineers account for a wide range of pipe-soil variables ranging from material properties to installation conditions to external loads, any of which can lead to catastrophic failure. If design and installation aren't essentially perfect, the chances of failure at some stage are unacceptably high.

Reinforced concrete is load-bearing, rigid pipe designed, built, and tested as a structure before it arrives at the jobsite. As a result, it's almost universally backed by manufacturers' warranties. It's ideal for most applications, and successful installation isn't contingent on a plethora of complex environmental variables.

In short, there are vast engineering differences between the two materials, so engineers must understand that HDPE and RCP are not interchangeable.

Read the manufacturer's warranty

As the Jasper failure illustrates, when something goes wrong with an HDPE installation, the liability almost always rests with the designers and/or engineers, not the manufacturer. HDPE pipe warranties make it clear the manufacturer's not responsible when the product is specified for unintended purposes or is improperly installed. Disproving those two factors is extremely difficult when so many variables are in play onsite.

That explains why drainage designers and engineers need to research and analyze a number of factors and conditions for the intended application before specifying the type of pipe to be used, since it has now become standard practice in the industry and thus represents, as is required by, the industry's standard of care.

Don't rely on inspectors to ensure HDPE design and installation plans are correct. In many states, including Texas, budget belt-tightening has led to the dismissal of a large number of qualified inspectors, leaving those still employed with a heavier workload than they should be expected to effectively handle. Relying on these over-taxed professionals to identify one of the myriad issues that could negatively affect an installation's success is risky business.

While the fish hatchery debacle is just one of many similar cautionary tales, it should serve as a wake-up call to every civil engineer and drainage-pipe contractor for the stark lessons it offers.

First, engineers must recognize that the designs of HDPE and RCP piping systems are vastly different. Designing an HDPE system under the same conditions that would be perfectly acceptable for an RCP system invites the unacceptable risk that the plastic piping won't perform as intended or, worse, ultimately fail.

On top of that, because of the way HDPE pipe manufacturers have devised their warranties, liability often falls back on the engineer. Even if a legal judgment is averted, the damage to your professional reputation — not to mention your bank account — could be substantial.

Learning from the mistakes of others is much less expensive. PW

— Patricia D. Galloway, Ph.D., (p.galloway@pegasus-global.com) is CEO of infrastructure-industry consultant firm Pegasus-Global Holdings Inc., headquartered in Cle Elum, Wash.

Photo: Stephen Inglis / iStock.com

Designers and engineers need to research and analyze a number of factors and conditions for the intended application before specifying the type of pipe to be used.

Engineering Ethics:
The Decision is Yours!
It's Your License,
It's Your Responsibility

American **Concrete Pipe** Association

Engineering Ethics and Liability

Presented by Aimee Connerton - Rinker Materials
aimeej.connerton@rinkerpipe.com (301) 357-0324
and Liza Kirk, P.E. – Forterra liza.kirk@forterrabp.com (281) 705-7077

American Concrete Pipe Association

RIGID RUGGED RESILIENT

concretepipe.org

EVERY DAY MATTERS

Save the Date!!

ACPA 2020 Pipe School & Pipe Show

Embassy Suites in San Marcos, Texas

January 6-9, 2020

American **Concrete Pipe** Association

American Concrete Pipe Association

RIGID RUGGED RESILIENT

concretepipe.org

EVERY DAY MATTERS

Save the Date!!

ACPA 2020 Webinar Series

Post Installation Inspection

by Doug Holdener, Sarah Matin, and Angel De Jesus

February 20, 2020

American Concrete Pipe Association