Willow Island Cooling Tower Collapse

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Introduction

Development of Failure Case Studies in Civil Engineering in US

• N.Y. Times Square Scaffold Collapse
• Chicago U. S. Post Office Construction Collapse
• Harbour Cay Condominium Collapse
• The John Hancock Tower Structural Failures
• Rosemont Horizon Arena Roof Collapse
• Northridge Effect on Welded SMRF
• Willow Island Cooling Tower Collapse
Background

- Why is Important to Study Failures as Well as Successes?
  - Prevention

- Literature Review
Worst Construction Accident in American History

W. I. Cooling Tower Collapse
Cooling Tower Description

- Coal Fired Power Plant
- Hyperbolic Shape
- Reinforced Concrete Shell
- 430 ft. Tall, 358 ft. Diameter
Concrete Cooling Tower
Construction Method

Willow Island Cooling Tower

- Patented Lift-form Technique
- 5 foot Lift Per Day
- 28 lifts had been completed
- Anchoring of the temporary structure to recently poured concrete
Construction Method
Scaffolding Lift-form System
Collapse

- April 27, 1978, 10:00 a.m.
- Top portion of the concrete shell collapsed inward
- Scaffolding and working platforms also collapsed
- All 51 workers were killed
Collapse
Failure Investigation

- **On-Site Investigation**
  - Interviews
  - Laboratory Tests
  - Computer Analyses

- **Inadequate Strength of Lift 28 on Concrete Shell to resist Construction Loads**
Concrete Maturity

![Graph showing the relationship between concrete compressive strength and maturity (M, °F - day). The graph includes data points for NBS, Lift 28, and QVT-PTL.]
Aftermath

- **Sanctions**
  - Tower Designer-Contractor
  - General Contractor
  - Testing Laboratories

- **Legal Actions**
  - Civil Suits
  - Criminal Charges
Lessons Learned

- Changes to Guidelines were made
- Importance of on-site concrete tests
- OSHA’s Role
- Safety First
Conclusions

Failures will happen but...

- Human Nature of Engineers
- Discuss Failures, Learn from Mistakes...
- Prevent Future Accidents
- Learning Experience