

The background of the slide is a photograph of the Tacoma Narrows Bridge. The bridge's two tall, dark towers are visible, with the suspension cables fanning out to support the bridge deck. The sky is filled with heavy, dark, and dramatic clouds, suggesting an approaching storm. In the foreground, there is a field of tall, green grass. The overall mood is somber and historical.

The Tacoma Narrows Bridge Project

“From Triumph to Tragedy : The
Fall of Galloping Gertie”

The Fall of “Galloping Gertie”



What	Problem(s)	Tacoma Narrows Bridge Collapse
	Date	November 7, 1940
	Time	~10:00 am
	Different or unique	Decked had been moving up and down in light winds
When		Bridge just opened for service July 1940
		Extremely narrow deck relative to length, windy day
	Geographic location	Narrow section of Puget Sound, 8 miles west of Tacoma, WA
	Process being performed	Bridge was in service (vehicle traffic)
Where		

Impact to the Goals

Safety	None, potential was for serious injuries	
Transportation	Interrupted primary route to Kitsap Peninsula (Naval Shipyard)	
	Loss of revenue from tolls during bridge outage	\$ 1,600,000
Materials & Labor	Complete loss of bridge	\$ 6,000,000
	Salvage, removal of damaged bridge	\$ 350,000
	Construction of new (replacement) bridge	\$ 11,200,000
		This incident \$ 19,150,000
Frequency	1st major suspension bridge collapse in US	

Welcome to an exploration of one of the most instructive engineering failures in history—the Tacoma Narrows Bridge collapse of 1940. This project, serves as a foundational study in the interplay between engineering designs and natural forces. The bridge's collapse has provided invaluable lessons in structural engineering and risk management.

Genesis and Collapse of the Tacoma Narrows Bridge

The third-longest suspension bridge of its era, the Tacoma Narrows Bridge was built as a showcase of contemporary engineering and opened for traffic on July 1, 1940. Leon Moisseiff created this amazing creation, which took 19 months to finish and cost \$6.4 million. Nevertheless, in favor of a streamlined profile, the bridge's inventive design disregarded conventional trusses, rendering it incapable of withstanding aerodynamic pressures. Due to aeroelastic flutter, it collapsed abruptly during a windstorm on November 7, 1940, just four months after it was opened. This accident demonstrated how important it is for engineering designs to take into account natural forces, which had a profound impact on bridge building habits all over the world.



Engineering Challenges & Design Flaws

The Critical Miscalculations of Tacoma Narrows Bridge

- **Innovative Yet Flawed Design**
 - Eliminated traditional trusses for aesthetic appeal
- **Aerodynamic Stability Oversight**
 - Neglected crucial wind-resisting features
 - Featured shallow and narrow stiffening elements
- **Cost-Saving Over Structural Integrity**
 - Prioritized budget constraints
 - Chose a cheaper, less stable design
- **Susceptibility to Wind-Induced Vibrations**
 - Vulnerable to aeroelastic flutter
 - Common windy conditions in Tacoma Narrows
- **Dramatic Oscillations**
- **Adequate Funding and Resource Allocation**
 - Original design was rejected due to cost; a cheaper design compromised integrity (PLS, n.d.).
- ❑ **Stakeholder Management and Communication**
 - Conflicts between engineers and financiers.

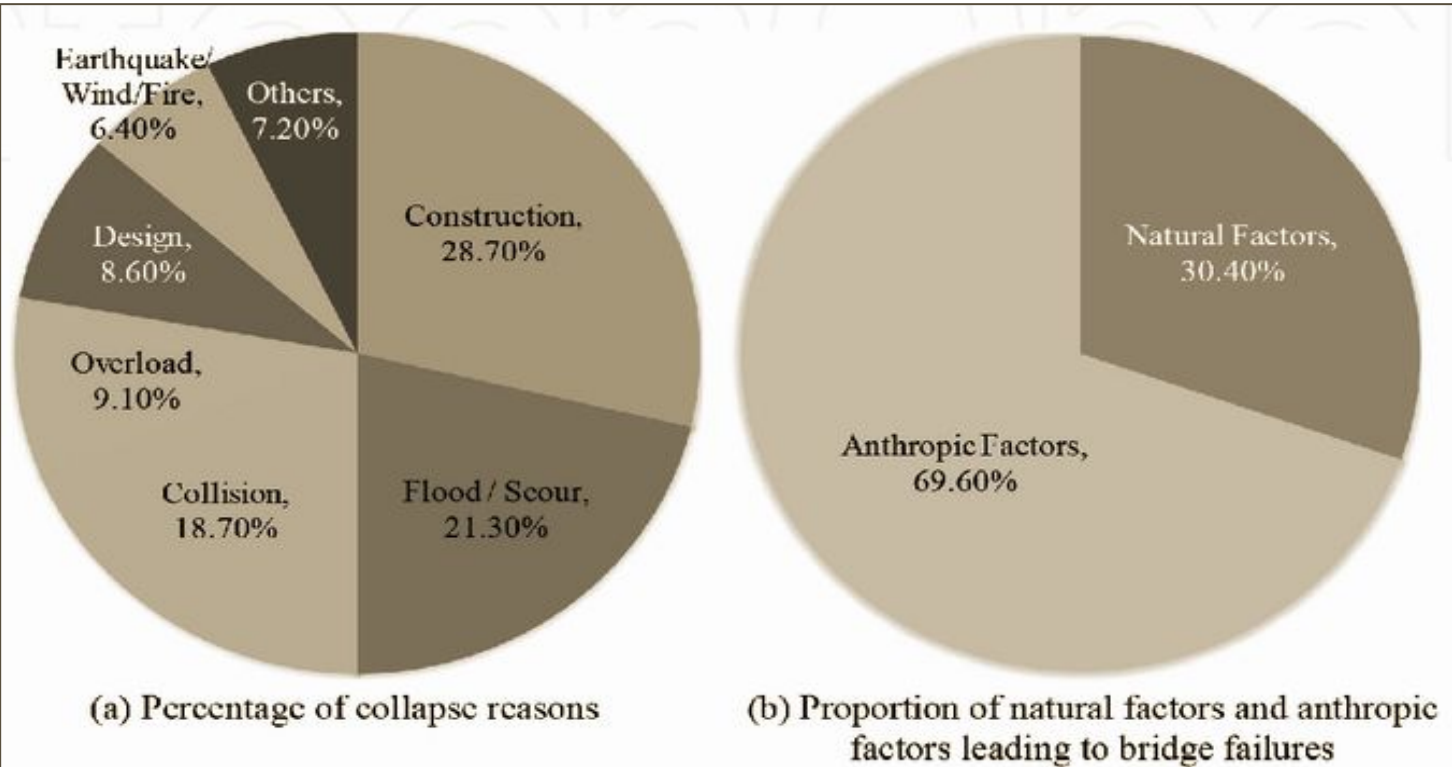




Crisis Response and Immediate Mitigation Efforts

- **Initial Mitigation Efforts**
 - Engineers installed hydraulic jacks to dampen motion
- **Commissioned Wind Tunnel Studies**
 - State Toll Bridge Authority enlisted Professor F. Bert Farquharson
 - Investigations identified temporary solutions
- **Temporary Stabilization Measures**
 - Installation of tie-down cables
 - Application of curved steel wind deflectors
- **Insufficient and Reactive Actions**
 - Measures did not address underlying design flaws
 - Actions were too late to prevent collapse
- **Lesson in Proactive Measures**
 - Emphasized the need for addressing design and construction issues early

Geographical Origin of recorded bridge failures



By Country

By Continent

WHAT THEY SHOULD HAVE WORKED ON : **Lessons learned**

Detailed risk assessment & management strategies



Aerodynamic Stability is Crucial

The collapse underscored the necessity of considering aerodynamic forces in bridge design, leading to advancements in wind tunnel testing and aerodynamic modeling.

Iterative Design and Feedback

Emphasized the value of iterative design approaches that take user feedback into account at various stages, particularly when reacting to test results.

Importance of Rigorous Testing

The incident highlighted the need for comprehensive structural testing before opening to public use. This has led to stricter regulations and testing protocols for bridges worldwide.

Impact on Engineering Standards & Practices: Transformative Changes in Engineering Post-Gertie



Public Safety Protocols

strengthened safety protocols and emergency response strategies for infrastructure projects, prioritizing public safety above aesthetic or financial considerations.



Introduction of Damping Systems

Post-collapse, the engineering community pushed for the integration of damping systems that could mitigate similar failures in future designs.



Increased Interdisciplinary Collaboration

Encouraged closer collaboration between aerodynamicists and structural engineers during the bridge design phase.



Effective Stakeholder Communication

Financial constraints overrode engineers' concerns, leading to critical design flaws (PLS, n.d.). Ensuring all stakeholder voices are heard & aligning goals with technical requirements is crucial.




Revamped Educational Curricula

Engineering curricula were updated to include more comprehensive studies on dynamic loads and environmental interactions with large structures.



Enhanced Design Standards

The failure led to revised standards and codes for suspension bridges, emphasizing the need for robust wind-resistant designs.

A nighttime photograph of a city street. On the left, a tall, light-colored building with many windows stands prominently. To its right, a series of palm trees line the sidewalk. Further right, another tall building with a distinctive tower-like structure is visible. The street is illuminated by streetlights, and a few cars are parked or moving in the distance. The overall scene is a vibrant urban nightscape.

“Each failure teaches us more about the structure of the physical world, and we find in the Tacoma Narrows Bridge collapse lessons that help us understand and mitigate risks, ensuring the safety and stability of future constructions.”

**—Henry Petroski,
engineer and historian**

”

The Horizon of Innovation and Safety in Bridge Construction

Integrative Technologies

- Exploration of smart technologies & IoT integration in bridge design for enhanced performance monitoring & maintenance prediction.

Sustainability and Resilience

- Focus on sustainable construction practices & materials that not only ensure safety but also minimize environmental impact.

Public Engagement and Education

- Increased efforts to involve the public & educational sectors in understanding bridge engineering, emphasizing the role of community in infrastructure safety.

Policy and Regulatory Evolution

- Discussion on the need for continuous evolution of policies & regulations to keep pace with technological advancements in engineering.

Conclusion and Reflection:

Embracing Challenges for Future Triumphs

- Recap the key lessons from the Tacoma Narrows Bridge collapse and their implications for future engineering projects.

Lessons Cemented

- Stress the importance of ongoing innovation in engineering to overcome challenges and improve safety standards.

Commitment to Innovation

- Encourage future engineers and policymakers to remain vigilant, proactive, and innovative to ensure the structural integrity and safety

Call to Action

THANKS

Credits :

Brynn - Background

Ray - Risk Analysis

Mel - Project Management Analysis

Ryan - Lessons Learned

Srishti - Presentation

