

Safe products, systems and environments: Engineering structures and mechanisms: Industrial Technology

Answers

Activity 1

Visit the web site

<http://www.washington.historylink.org/output.cfm?file_id=5048> and locate answers to the following questions about the failure of the Tacoma Narrows Bridge in the United States in 1940.

1. What was the basic cause of the classic failure of the Tacoma Narrows Bridge in the USA in 1940?

The basic cause of the failure of the Tacoma Narrows Bridge in the USA in 1940 was over confidence in design, and lack of proper awareness of earlier problems by the American bridge designer, John Roebling.

2. As suspension bridges became progressively lighter and more slender and graceful during the first 30 years of the 20th century, what sort of unexpected behaviour did they show?

They all exhibited wind-induced oscillations and required modifications to bring them to acceptable and safe loads.

3. What nickname was the Tacoma Narrows Bridge given and why?
It was nicknamed *Galloping Gertie* even before it had opened by people who had experienced its oscillations, even in relatively light winds.

4. Identify and describe the conditions under which the Tacoma Bridge failed.

In relatively mild winds of 58 to 67 km per hour the bridge developed undamped oscillations which built up to an amplitude of 7.5 m eventually tearing the bridge apart.

Activity 2

Visit the web sites below and complete the following questions.

<http://www.kidscastle.si.edu/channels/air-space/articles/air-spacearticle13.html>

<http://www.smithsonianmag.si.edu/smithsonian/issues02/jun02/comet.html>

1. What was the main lesson which engineers learned from the Comet a year after its first flight?
On May 2, 1952, the Comet 1 became the first jet passenger plane to ever fly a scheduled commercial route. Flying at 460 miles per hour, it left all of the propeller-driven planes in its dust. In its first year, Comet jetliners carried 28 000 passengers millions of miles. But exactly a year later, it taught engineers a grave lesson about how metal responds to changes in pressure.
2. How many Comet aircraft crashed before the British Ministry of Civil Aviation went looking for answers?
After three Comets crashed, the British Ministry of Civil Aviation went looking for answers.
3. What did their engineers do to find out the reasons for the crashes?
To find out the reasons for the crashes engineers put the body of a Comet in a giant tank of water, and filled the body with water. Then they started increasing and decreasing the pressure inside the plane. By pumping water into and out of the submerged plane body, the investigators were able to simulate what the plane would go through in flight. When the plane body had undergone the equivalent of 9 000 hours of flight, the metal simply wore out and could no longer contain the pressurised water inside.
4. What conclusion did the engineers come to?
The engineers concluded that at high altitude, after many pressurisation cycles, the planes had burst with bomb-like force. The Comet 1 never carried another passenger.