علیرضا معصومی

اطلاعاتی درباره پلهایی که بر اثر رژه ی سربازان تخریب شده اند.

یکی از پلها پل معلقی که در اسپانیا بود بر اثرتخریب آن ۲۰ نفر زخمی شدند.

Broughton Suspension Bridge

Broughton Suspension Bridge was a suspended-deck suspension bridge built in 1826 to span the River Irwell between Broughton and Pendleton, now in Salford, Greater Manchester, England. One of Europe's first suspension bridges, it has been attributed to Samuel Brown, though some suggest it was built by Thomas Cheek Hewes, a Manchester millwright and textile machinery manufacturer.

On 12 April 1831, the bridge collapsed, reportedly due to mechanical resonance induced by troops marching in step and as a result of the incident, the British Army issued an order that troops should "break step" when crossing a bridge. Though rebuilt and strengthened, the bridge was subsequently propped with temporary piles whenever crowds were expected. In 1924 it was replaced by a Pratt truss footbridge, still in use.

Construction

In 1826, John Fitzgerald, the wealthy owner of Castle Irwell House (later to become the site of the Manchester Racecourse), built, at his own expense, a 144-foot suspension bridge across the River Irwell between Lower Broughton and Pendleton. According to John Marius Wilson's Imperial Gazetteer of England and Wales (1870–72) all users of the bridge were required to pay a pontage to cross. The bridge was a source of great local pride, as the Menai Suspension Bridge had opened only that year and suspension bridges were then considered the "new wonder of the age.

1831 collapse

On 12 April 1831, the 60th Rifle Corps carried out an exercise on Kersal Moor under the command of Lieutenant Percy Slings by Fitzgerald, the son of John Fitzgerald MP and brother of the poet Edward FitzGerald. As a detachment of 74 men returned to barracks in Salford by way of the bridge,[7] the soldiers, who were marching four abreast, felt it begin to vibrate in time with their footsteps. Finding the vibration a pleasant sensation some of them started to whistle a marching tune, and they began to "humour it by the manner in which they stepped", causing the bridge to vibrate even more. The head of the column had almost reached the Pendleton side when they heard "a sound resembling an irregular discharge of firearms. Immediately, one of the iron columns supporting the suspension chains on the Broughton side of the river fell towards the bridge, carrying with it a large stone from the pier to which it had been bolted. The corner of the bridge, no longer supported, then fell 16 or 18 feet (4.9 or 5.5 m) into the river, throwing about 40 of the soldiers into the water or against the chains. As the water was only about two feet (60 cm) deep at that point none of the men were killed, but 20 were injured, including six who suffered severe injuries including broken arms and legs, severe bruising, and contusions to the head.

Cause

An investigation found that a bolt in one of the stay-chains had snapped at the point where it was attached to the masonry of the ground anchor. There was criticism of the construction method used, as the attachment to the ground

anchor relied on one bolt rather than two, and the bolt was found to have been badly forged. A number of other bolts were also bent but had not broken. It emerged that three years previously the distinguished Manchester engineer, Eaton, had expressed some doubt about the strength of the stay-chains compared with the suspension chains. He had said that they should be rigorously tested, but they were not. It also came to light that some time before the accident one of the cross bolts had started to bend and crack, although it was believed to have been replaced by the time of the accident. The conclusion was that, although the vibration caused by the marching had precipitated the bolt's failure, it would have happened anyway.

یکی دیگر از پلها پلی در فرانسه است. که بر اثر تخریب آن بیش از۲۰۰ نفر کشته شدند.

Angers Bridge

Angers Bridge, also called the Basse-Chaîne Bridge, was a suspension bridge over the Maine River in Angers, France. It was designed by Joseph Chaley and Bordillon, and built between 1836 and 1839. The bridge collapsed on April 16, 1850, while a battalion of French soldiers was marching across it, killing over 200 of them.

The bridge spanned 102 m (335 ft.), with two wire cables carrying a deck 7.2 m (24 ft.) wide. Its towers consisted of cast iron columns 5.47 m (17.9 ft.) tall.

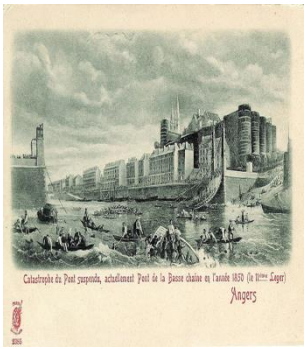
Collapse

Soldiers stationed in the region frequently used the bridge, and two battalions of the same regiment had crossed earlier that day. The third battalion arrived during a powerful thunderstorm when the wind was making the bridge oscillate. When the soldiers began to cross, they gave the wind still more purchase. Survivors reported that they had been walking as if drunk and could barely keep themselves from falling, first to one side and then to the other. As usual in crossing that bridge, the soldiers had been ordered to break step and to space themselves farther apart than normal. However, their efforts to match the swaying and keep their balance may have caused them to involuntarily march with the same cadence, contributing to the resonance. In any case, the oscillation increased. At a time when the bridge was covered with 483 soldiers and four other people (though the police had prevented many curiosity seekers from joining the march), the

upstream anchoring cable on the right bank broke in its concrete mooring, three to four meters underground, with a noise like "a badly done volley from a firing squad". The adjacent downstream cable broke a second later, and the right-bank end of the deck fell, making the deck slope very steeply and throwing soldiers into the river. Many of those who fell were saved by their fellow soldiers who had not yet crossed and by residents of Angers who came to the rescue, but a total of 226 people died.

The failure was attributed to dynamic load due to the storm and the soldiers, particularly as they seem to have been somewhat in step, combined with corrosion of the anchors for the main cables. The cable anchorages at Angers were found to be highly vulnerable, as they were surrounded

by cement, which was believed to rustproof them for the indefinite future. However, the wire strands separated from their cement surrounds. This allowed water to penetrate and corrode the w



از دیگر پلها که بر اثر طوفان نیز تخریب شده اند می توان به پل رویال انگلیس،پلی در اسکاتلند،پلی در ولز،پل تاکوما در آمریکا و پل میلینیوم در لندن که بر اثر طراحی نادرست تخریب شدند.

Related bridge failures

The Angers Bridge was not the first suspension bridge to collapse. Previous failures included the Dryburgh Abbey Bridge in 1818 and the The Royal Suspension Chain Pier in Brighton in 1836. The Menai Suspension Bridge was damaged by wind in 1825, 1836 and 1839. The Broughton Suspension Bridge had collapsed in 1831 when soldiers marched over it in step. Subsequent spectacular suspension bridge collapses caused by wind include the failure of the Tacoma Narrows Bridge in 1940. However, the Angers bridge failure caused by far the greatest number of casualties.

When the Millennium Bridge was opened in 2000, the motion of pedestrians caused it to vibrate, and they fell into step with the vibrations, increasing them.[4]This mechanism may have increased the vibrations of the Angers Bridge. The problem at the Millennium Bridge was corrected during the next two years.

برای کسب اطلاعات بیشتر می توان به مقالات زیر مراجعه کرد:

این مقاله که مجموعه از سخنرانی های نویسنده ی آن می باشد با ادبیاتی ساده به بررسی فواید و مزایای ارتعاشات می پردازد.

R.E.D. Bishop, Vibration, Cambridge University Press (1965) for a discussion of the engineering problems of unwanted vibrations

J.P. Den Hartog, Mechanical Vibrations, Dover Publications (1985)