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CASE STUDY: CHIGNECTO SHIP RAILWAY

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1 PROJECT OVERVIEW

The site of the Chignecto Ship Railway was designated as a national civil engineering historic site by the Canadian Society for Civil Engineering (CSCE) in 1989. While CSCE has made effort to designate many historic sites across Canada, these accomplishments are not well known amongst engineers and the general public. The purpose of this case study is to provide insight into this project, and thereby promote more interest in it and civil engineering history in general. It is also intended that this will help promote engineering history as a regular session at annual CSCE conferences.

The topic is meant to have a general appeal to civil engineers, particularly with regard to history, heavy civil construction, transportation and the allure of visionary mega-projects. The 27 km long project is located in Nova Scotia, but immediately adjacent the New Brunswick border.

The approach is to briefly explore the engineer and his dream, followed by the construction, associated problems and aftermath.

2 THE ENGINEER

Henry George Clopper Ketchum was born in Fredericton NB in 1839. During the 1850's he was excused from classes at King's College to obtain engineering experience in railway building in New Brunswick. He went on to distinguish himself on the difficult Sao Paulo Railway in Brazil. Returning to Fredericton, he obtained the first diploma in civil engineering from the University of New Brunswick in 1862. As such, he was truly a pioneer of the "co-operative program" of engineering education in the Atlantic region.

Ketchum continued as a resident engineer in railroad construction including the section of Intercolonial Railroad between Amherst NS and Moncton NB. This work on the Isthmus of Chignecto conceived the idea of a ship railway, which would be an innovative transportation scheme to traverse the low lying terrain between the upper reaches of the Bay of Fundy and the Northumberland Strait. This revolutionary concept was to have a pair of locomotives pull ocean-going vessels on a rail-mounted cradle. At either railway terminus, hydraulic machinery would be required to lift or lower the cradle to and from its submerged location to the level of the roadway.

Ketchum was convinced that the ship railway concept was far superior to digging a canal across the route. His dogged determination was evident in the fact that he:

- Devised the ship railway concept
- Carried out the detailed design

- Prepared (and redrew) the engineering drawings
- Was responsible for promotion of the project and negotiations with government and private funding sources
- Provided engineering supervision during construction

The dreamer was therefore responsible to design, document, promote, raise funds, negotiate, and supervise construction of his dream project. The Chignecto Ship Railway would be all-consuming for over 20 years of Ketchum's life.

3 THE IDEA

The controversial isthmus had been considered for construction of a canal in at least 18 studies between 1686 and 1875. In fact, a company was set up in 1870's to build the canal, only to be foiled by the defeat of the Macdonald federal government and a subsequent royal commission which recommended against the \$7 million venture. The major difficulty cited was the large differential in tides, 15 m on the Bay of Fundy side and only 2 m at Northumberland Strait.

Instead, Ketchum promoted the ship railway, which could transport vessels quicker than the canal and estimated at less than half the cost. The benefits of the ship railway were described favourably:

- Up to 800 km could be saved for vessels between Saint John and the eastern U.S. ports and the Gulf of St. Lawrence rather than using the Strait of Canso. Even greater savings would be realized for vessels having to pass around Cape Breton.
- The navigation season could be extended due to ice in the Strait of Canso.
- The protected waters would be attractive to smaller vessels than necessary for the ocean route around Nova Scotia

Ketchum felt that this introduction of a ship railway would be precedent for subsequent ship railways at Panama, Mexico, Cape Cod, and at isthmuses in the Great Lakes.

4 GETTING STARTED

After preparing detailed design plans in 1875, these documents were lost in the Great Saint John Fire of 1877. Ketchum was not deterred. He redrew the plans and personally financed a route survey. In 1881 he made application for federal government aid to Sir Charles Tupper, the Minister of Railroads and Canals and conveniently also the MP for Cumberland County in Nova Scotia – the location of the project. The proposal was accepted under the Macdonald government and the Chignecto Marine Transport Company was incorporated in 1882.

Upon completion, parliament was supposed to provide an annual subsidy of \$150,000 for 25 years. The land was provided as a gift from Cumberland County. To provide initial funding, \$650,000 was raised privately in London, England. The three joint engineers appointed for the project were the renowned British engineers Sir Benjamin Baker and Sir John Fowler in association with Ketchum. As a possible omen to the project, the contract between the forming members of the company went overboard en route to New York. The blurred and water-stained documents were nonetheless signed in Ottawa.

5 THE DESIGN

The route of the ship railway was completely straight in plan, just south of the New Brunswick border. The western terminus was at Fort Lawrence near Amherst on the Bay of Fundy while the eastern terminus is at Tidnish on the Northumberland Strait. The profile was flat for over half the 27 km length, with a maximum grade of 0.2%, which would permit the masts of ships to be seen from one end to the other.

The huge masonry dock at the Fort Lawrence end would accommodate the Fundy tides and up to six ships of 1000 tons each. It included a 160 m long and 12 m deep wet dock, together with a lifting dock which was

equipped with hydraulic presses to lift a 2000 ton vessel. At the Tidnish end, the dock and basin were constructed using rock-filled timber cribs extending 800 m into the strait. The only river crossing was a stone culvert near the eastern end at Tidnish River.

The railway consisted of double track with rails 5.5 m apart straddled by a cradle. Two locomotives would be required on each track to pull the vessel and cradle over the land crossing in two hours, plus raising and lowering of the vessels.

6 THE CONSTRUCTION

After review of the final plans, formal approval was given by the federal government in May 1888. The general contractor was Meiggs and Son from Montreal. Subcontractors included firms from Amherst and Saint John. The special steel rails were rolled in England and at the time were the heaviest ever used for a railway.

Construction began in October 1888 and the workforce quickly grew to a maximum of 5000, as much of the work was accomplished by man-power using pick and shovel, horses and dump carts. As local labour was limited, there was an influx of Italian immigrants and Quebec workers. The construction camps came with an abundance of rum shops, and the local people reportedly stayed indoors on Saturday night fearful of strangers and their strange languages.

During construction, frequent visitors observed the work with a view of building ship railways in other parts of the world. The stone culvert over the Tidnish River was constructed by masons recruited from Scotland. Their work was so precise that the keystone, which also came from Scotland, slid perfectly in position.

Work progressed steadily, although the rail bed proved particularly difficult. The marshland soils meant that bog removal and replacement with rock ballast was up to 18 m deep. By July 1891, the Fort Lawrence dock was virtually complete while the Tidnish dock was within a year of completion. Over 25 km of rail bed had been prepared, with track laid for 21 km.

7 NOT GETTING FINISHED

With the project 80% complete and another \$1.5 million needed, construction was halted in 1891. Due to an international economic recession, the financial backing from London was exhausted. Ketchum tried desperately to revive the project. With the new Thompson government in Ottawa, and Sir Charles Tupper now High Commissioner and no longer in cabinet, the final attempt to secure federal government assistance was defeated by one vote in the House of Commons in 1892. This effectively killed the project. Ketchum tried desperately to revive the project, but suffered “an affliction of the heart” while sitting quietly on the verandah after dining at the Amherst Hotel in September 1896. The dreamer had died with his dream.

8 AFTERMATH

Little remains of the ship railway today. The overgrown rail bed is visible intermittently, particularly because of its straight alignment. (The alignment can be readily identified on Google Earth.)

The docks at Fort Lawrence are largely in ruins. Masonry and equipment have long since been removed. There are many “dinosaur eggs” here, referring to the nests of now-hardened cement shapes in the form of their decomposed wooden casks. Reportedly, there are many “Ketchum chimneys” in the local area made from salvaged stone work, and some of the armour rock used in the ferry terminal at Cape Tormentine was apparently removed from the ship railway.

At the eastern end, the stone culvert at Tidnish River stands intact today, but the river has defiantly returned to its original course. The location of the Tidnish dock is now included in a provincial picnic park. It includes a small interpretive display, a hiking trail and a monument for the commemorative plaque erected by CSCE.

The Chignecto Ship Railway is a tale of individual perseverance for over 20 years, involving many age-old engineering challenges:

- A new and innovative design requiring intense promotion to gain acceptance
- Financial woes including ongoing public and private fundraising, then a depression
- Mixed political support, over an extended project
- Difficult site conditions, notably including soils and tides
- Feasibility was subject to evolution of technology and changing methods of transportation

The project is unusual as it was incomplete, but nonetheless honoured as a national civil engineering historic site. Since 1897, in accordance with Ketchum's will, the Ketchum Medal is awarded annually to the top graduating student in civil engineering at the University of New Brunswick – a reminder of a remarkable engineer and his lifetime project.

References

Higgins, Bruce. The Chignecto Ship Railway, Ketchum's Dream. *The Engineer*, Association of Professional Engineers of Nova Scotia, November/December 1990: p6-7
UNB Archives and Special Collections – Henry George Clopper Ketchum Virtual Exhibit, Chignecto Ship Railway, https://lib.unb.ca/archives/finding/ketchum/chignecto_railway.html