

HIS 2129



Technology, Society and
Environment since 1800
(Winter 2014)



Railroads: An Iron and Steel Web

- Steam-driven trains benefited from new advances in metallurgy and steam engine power
- They were characterized by speed and an ability to operate even in freezing weather, an important feature for their North American promoters
- While it's possible to go over (or through) elevations with canals, it's easier to do so with railway tracks
- Early trains required water and fuel, but the fuel could be wood as well as coal
- Trains accelerated the spread of new species and the process of settlement; they even facilitated the hunting of some species to the edge of extinction (the Plains bison)

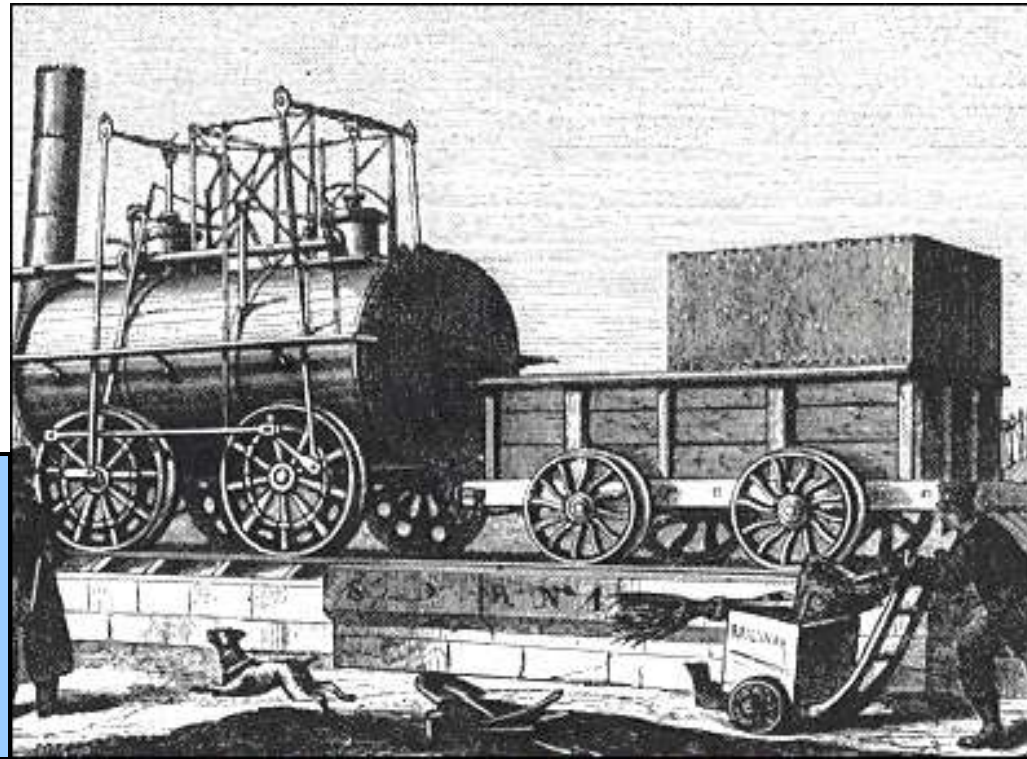


Outline

- Railways: Early Developments
- Railways: Consequences
- Trains in Canada
 - — Early developments
 - — Railway hotels
 - — Statistics
- The Chicago Story
- Railway infrastructure
 - — New bridges
- Accidents and Failures
- The Era of Consolidation

Railways: Early Developments (1)

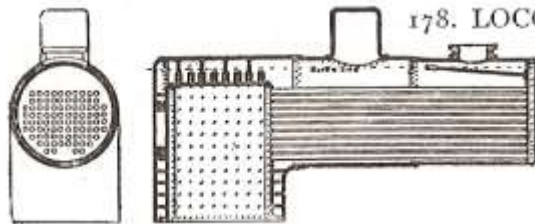
- In North America as in Great Britain, the earliest railways were run like turnpikes and canals, open to anyone who paid tolls and used vehicles in conformity with the way's charter (horse-drawn carts originally, using hardwood or cast iron rails, with steam engines only used to haul them up steep grades)
- Once steam engines were used to create locomotives, trains could grow bigger, and go anywhere



1825 Opening of the Stockton and Darlington railway in England, pitting horse against locomotive, with the latter winning decisively by 1833.

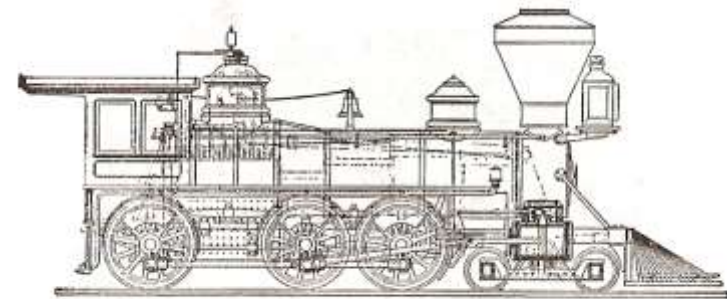
Railways: Early Developments (2)

- Steam locomotives reached the United States in 1829-1830, but they needed to be adapted to the often steep and winding rail routes (cheaper land, but higher labour costs) through the addition of a double set of smaller front wheels built on a swivel
- American engines also burned wood rather than coal, which produced larger sparks and required the use of mesh-built spark arresters in the smokestacks
- In a land with fewer fences, cowcatchers appeared as early as 1833 and bells were mandated by 1835 in some states



178. LOCOMOTIVE BOILER.—

All the fire-box surface above the grate and all the tube surface, divided by 14, equals the boiler horse-power.



1611. TEN-WHEEL FREIGHT LOCOMOTIVE.—Recent type.

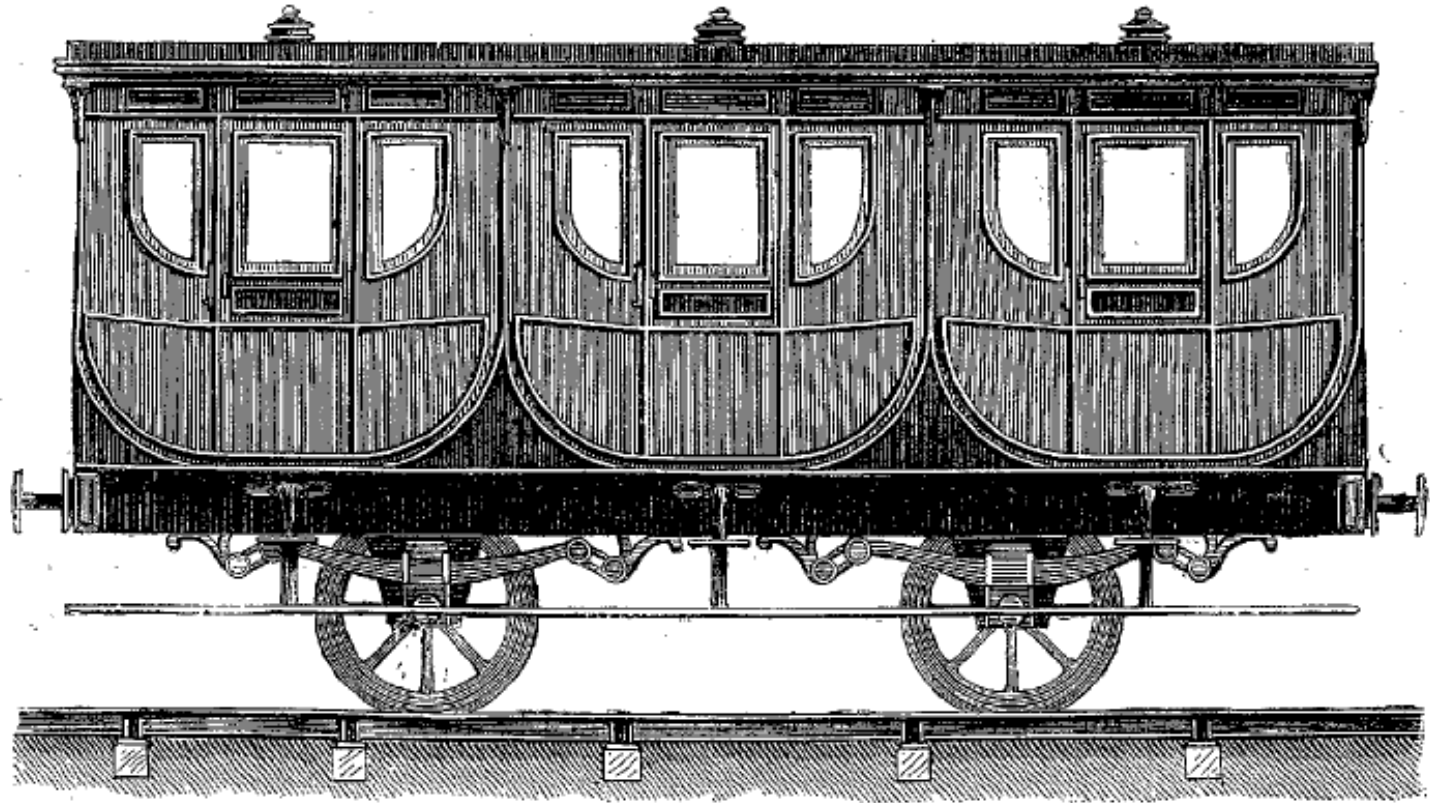


Railways: Early Developments (3)

- In North America, a public demonstration in 1836 proved that locomotives could handle grades as high as 363 feet per mile whereas early grades were limited to 1/8 of an inch per yard; this was momentous
- In 1854, British railways carried 111 million travelers an average distance of 19 km; they required a yearly total of 20,000 tonnes of iron for rail-laying and replacement
- By 1856, there were over 12,500 km of railway tracks in Great Britain; trains covered a yearly total of about 120 million kilometres, employed 90,000 people, and consumed 2 million tonnes of coal
- By 1860, the U.S. had hundreds of railroad companies and 49,000 km of tracks, the most in the world

First-class train car in France (c. 1870)

Louis Figuier, *Merveilles de la science* (c. 1870)



Note how the individual compartments are essentially built on the model of the body of the older horse-drawn stagecoaches.

United States Railroads (1870)





To recapitulate (1)

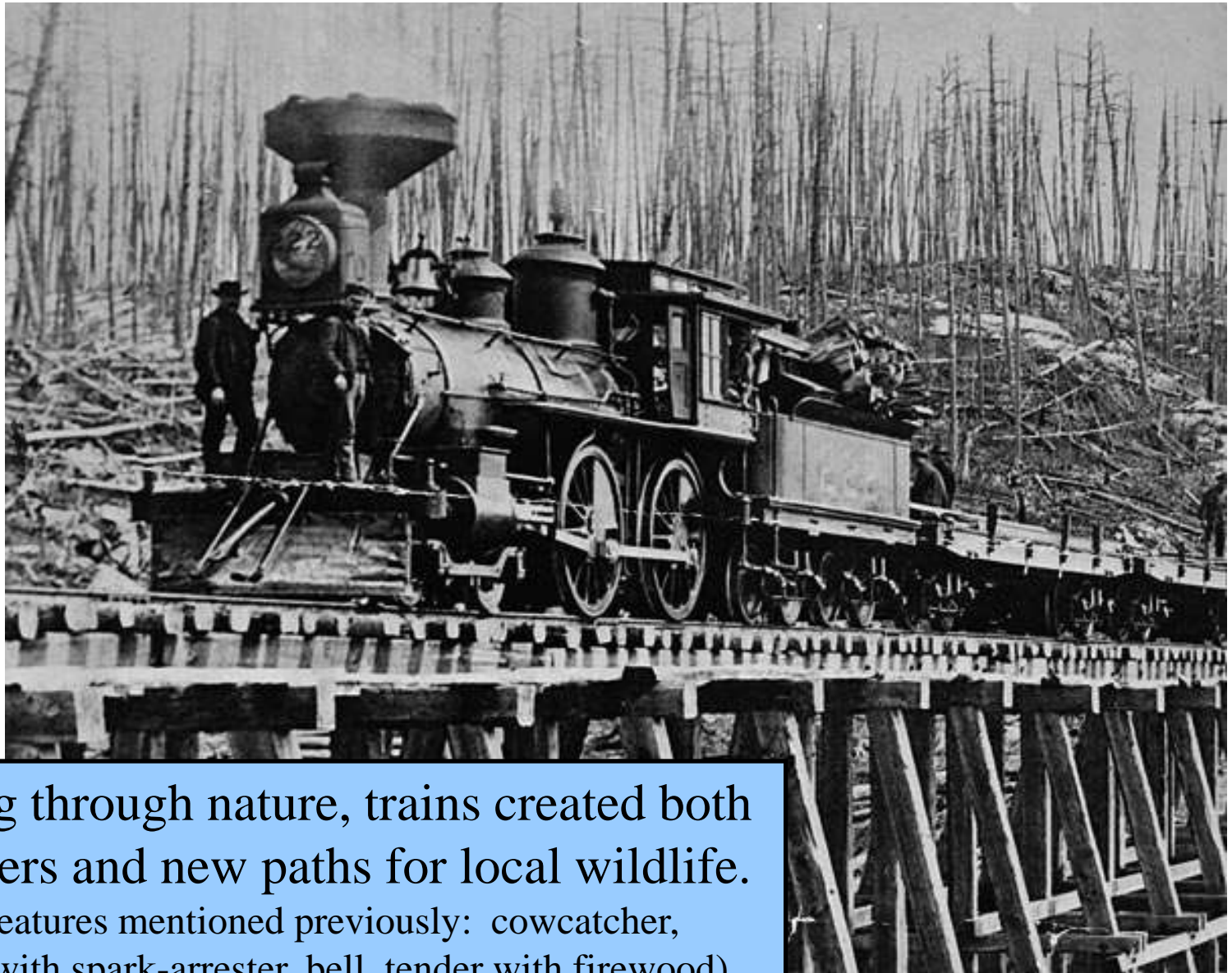
- What were three (3) advantages of trains over canals?
- When did the first railway to run a steam locomotive on a regular basis open? In what country?
- What were four (4) adaptations of British locomotive technology to North American conditions?
- By 1860, what country could claim the greatest total length of railways in the world?



Consequences... (1)

- The amazing speed of trains lent a new impetus both to (i) settlement on the frontier and (ii) to the spread of intrusive species
- New species could be moved deliberately, as part of the expansion of farming or for other purpose (the starling); trains made such moves easier than ever before
- New species could take advantage of train infrastructures (bridges, tunnels, embankments, cuttings) to move more easily from one habitat to another; short-lived ones could stow away aboard a train and survive a long but fast trip

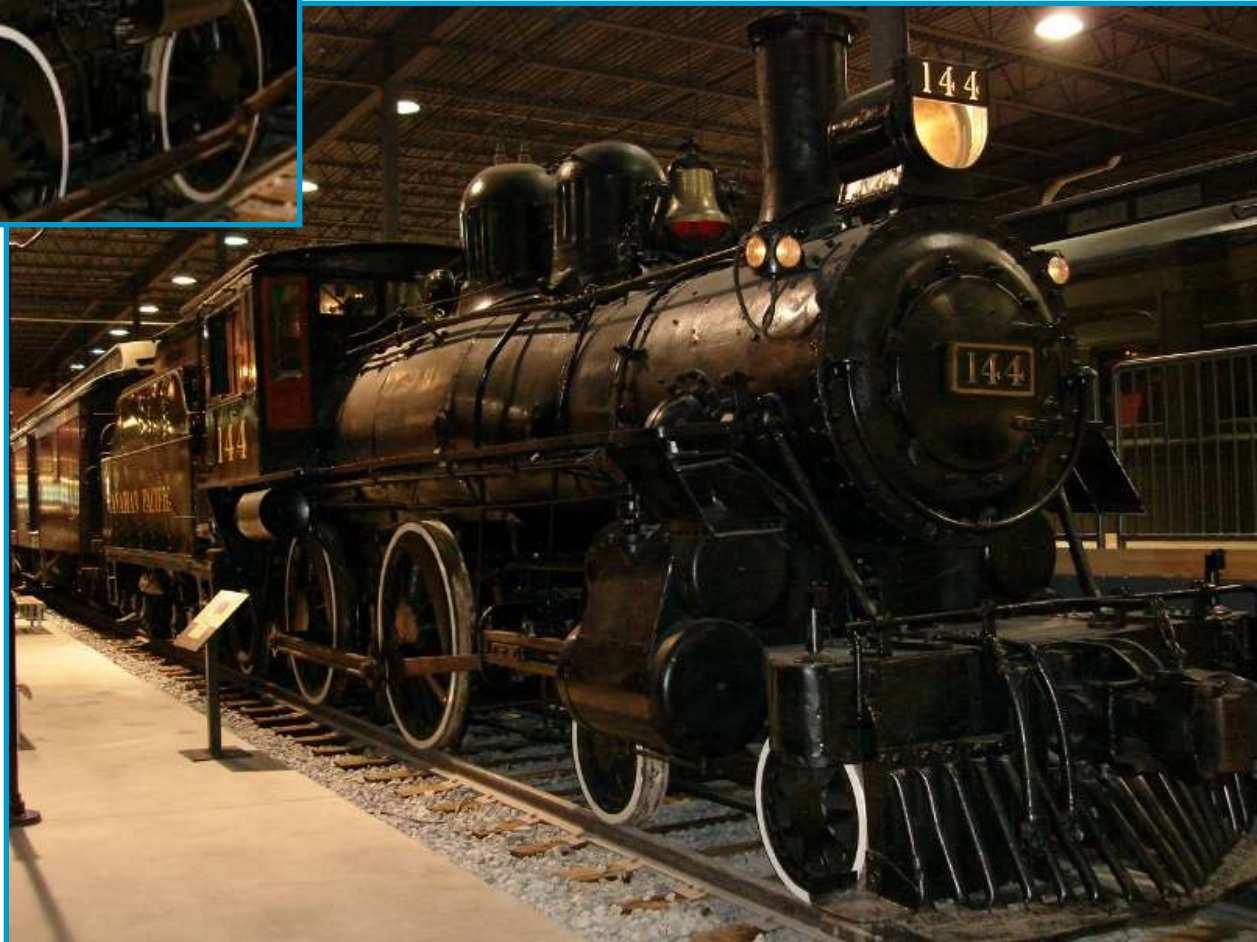
CPR Locomotive No. 222 (1883)



By cutting through nature, trains created both new barriers and new paths for local wildlife. (Notice the features mentioned previously: cowcatcher, smokestack with spark-arrester, bell, tender with firewood)



CPR Locomotive No. 144 (1886)





Species Arrivals and Extinctions

- According to biologist Edward O. Wilson, the top three causes of species extinction in the United States today are, in order, habitat destruction; “biological pollution” (the influx of alien species that outcompete and push back the native ones); and chemical pollution
- Early technologies (axes, guns, railways) facilitated habitat destruction in North America, but they also played a large role in facilitating deliberate species replacement (while allowing inadvertent invasions)



The End of the American Bison

- Early hunters of the Plains bison rode horses (that a bison could outrun) and used bows and arrows, or matchlock muskets (hard to shoot from a horse) or the more advanced single-shot flintlocks (range < 100 m)
- The Plains were sparsely populated, so the local market for bison meat or pelts was limited
- The situation changed with the advent of new guns and the spread of the railways, bringing settlers and hunters

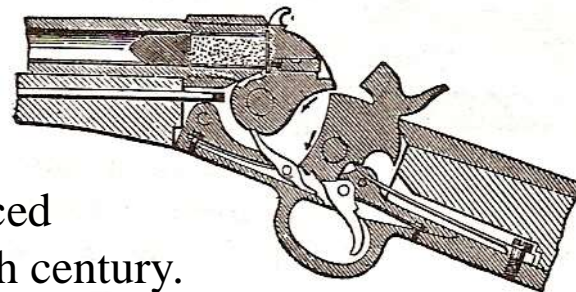
Bison bones on the Prairies



Guns: Rifles, Breechloaders, and Repeaters (1)

- By the middle of the 19th century, three innovations combined to increase the firepower of the European settlers in North America
- Rifling was not new, but once it could be performed mechanically, on a mass scale, rifles could be turned out by the thousands (the rifle-musket was first manufactured in 1855 in the United States)

Schematic of the rolling block action of the Remington rifle, produced during the last third of the 19th century.

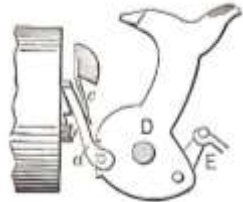


1643. REMINGTON RIFLE.—A breech block, operated by a handle, is pulled back to allow the cartridge to be charged by hand, when the breech and the block are locked. The hammer strikes a firing pin within the breech block.

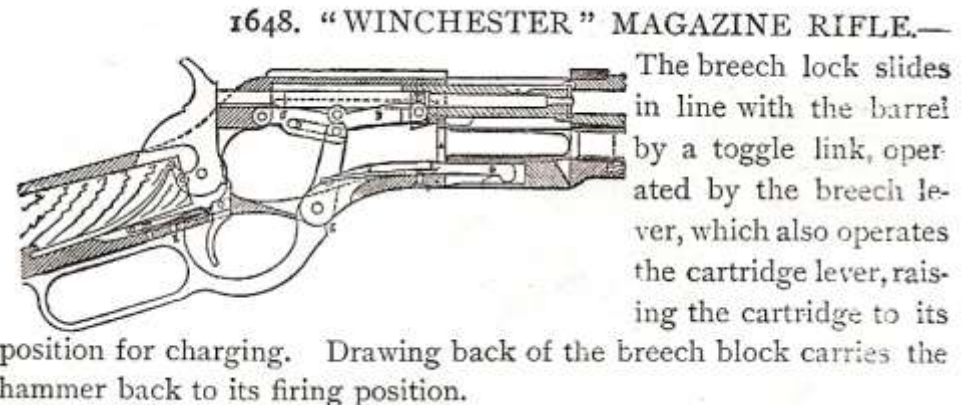
Guns: Rifles, Breechloaders, and Repeaters (2)

- Breech loading was also introduced, accelerating the once lengthy reloading of muskets
- Repeaters (such as the Colt revolver) were provided with magazines and eliminated the need for reloading after every shot
- The Civil War accelerated the adoption of these innovations and flooded the continent with guns

At the battle of the Little Bighorn, a quarter of the Indians may have been armed with Winchester repeaters while the opposing soldiers had single-shot Springfields.



1639. COLT CYLINDER REVOLVING DEVICE for firearms. *a*, the pawl that catches the circular ratchet *b*; *c*, a spring that pushes the pawl into the teeth of the ratchet; *D*, the hammer butt to which is pinioned the pawl and the spring *F*.



1648. "WINCHESTER" MAGAZINE RIFLE.—

The breech lock slides in line with the barrel by a toggle link, operated by the breech lever, which also operates the cartridge lever, raising the cartridge to its

position for charging. Drawing back of the breech block carries the hammer back to its firing position.

Symbol of the Vanishing West

Bison in Alberta's Banff National Park (1914)



It is now thought North America supported between twenty-five and thirty million bison before the arrival of Europeans. A thousand or so animals were left by 1885.

William James Topley, Library and Archives Canada, PA-011018



To recapitulate (2)

- What two (2) things did railways accelerate?
- What are the top three (3) causes of animal species extinctions, according to biologist Edward O. Wilson?
- Why did the spread of railways to the U.S. West lead to the near disappearance of the Plains bison?
- What three (3) innovations increased the firepower of guns in the United States?
- What event increased the availability of new guns in the second half of the 19th century?

Consequences (2)

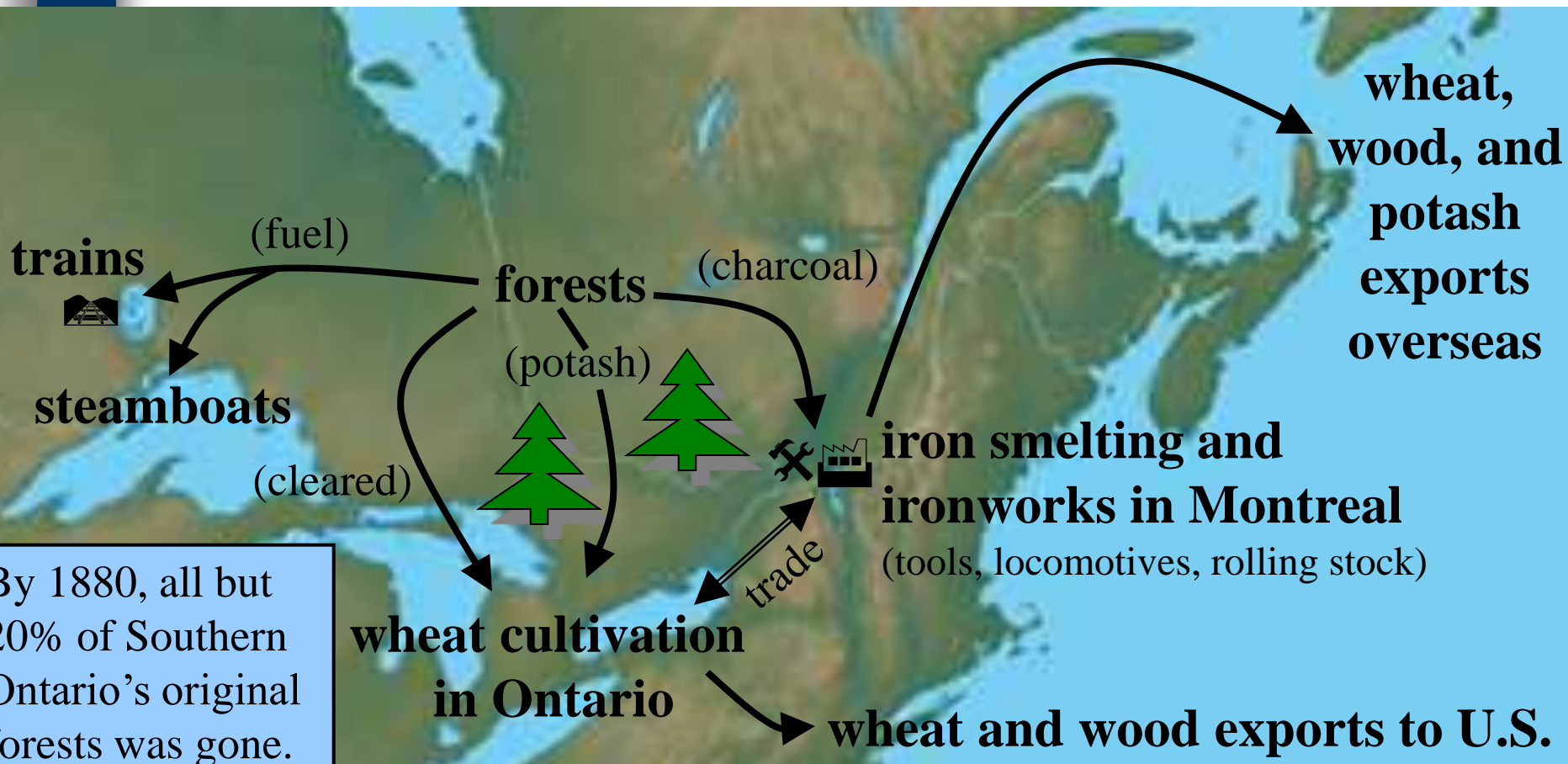
- Initially, North American trains needed wood, both as a fuel and as a construction material
- Trains helped move lumber and firewood, as well as other exports such as wheat, while making it easier to move heavy equipment into forests for logging operations and lumber mills
- Trains became a key part of Eastern Canada's early industrialization

This 1910, Montreal-made locomotive burned wood as a fuel (hence the spark arrester) and pulled lumber trains out of Algonquin Park.



Canada: Vanishing forests

The early Canadian economy was based on wood, as a fuel, a construction material, and a fertilizer. Before 1867, there were 17 million acres of cleared or “improved” land. By the early 20th century, there were up to 30 million acres of such land occupied by farmers, towns, cities, and industries.



By 1880, all but 20% of Southern Ontario's original forests was gone.



Consequences... (3)

- The greatest canal construction projects (such as that of the Erie Canal) served as a training ground for many young engineers
- Once the (first) railway boom got underway, older engineers continued to train younger engineers working under them on such projects
- However, the sheer magnitude of the railway construction projects of the 1840s forced railroad backers to support new ways to turn out engineers
- Soon, universities, colleges, and private schools were encouraged to set up the earliest engineering curricula in North America



Consequences... (4)

- In Canada, the first engineering classes were probably taught in 1854 at King's College in Fredericton, NB, though the first complete program had to wait until 1859
- In 1858, Canada's first engineering degree was awarded to a McGill University student in Montreal
- At the University of Toronto, the first civil engineering classes were taught in 1857, but the "School of Practical Science" was only created in 1877 and annexed by the university in 1889
- Montréal's "École Polytechnique" got its start slightly earlier, opening in 1874 as part of a second wave of engineering education expansion
- In Kingston, Queen's University started developing engineering courses in 1887

Consequences... (5)

- As the railway networks expanded, trains occupied a growing place in everyday life
- Trains moved commercial goods and supplies
- Trains moved people, including settlers and troops (U.S. Civil War, Canada's Northwest Rebellion) in North America, businessmen, commuters, and tourists
- Some trains were armoured, turning into military assets (China, Mexico)



Federal armoured train during the Mexican Civil War, *c.* 1915

War Trains

Armoured trains carried soldiers and served as fortified bases. During the second Anglo-Boer War, one was even used for scouting ahead of the main force, with disastrous results in November 1899. They were most useful where they did not face a strong opposition (China, Mexico)



Canadian War Trains (1)



Canadian troops, Company "C" in South African Constabulary, aboard the "Messenger Boy" No. 8 Armoured train, with a Maxim gun and search-light, in South Africa, 30 January 1902

(George F. Ramsey / Library and Archives Canada / C-003475)

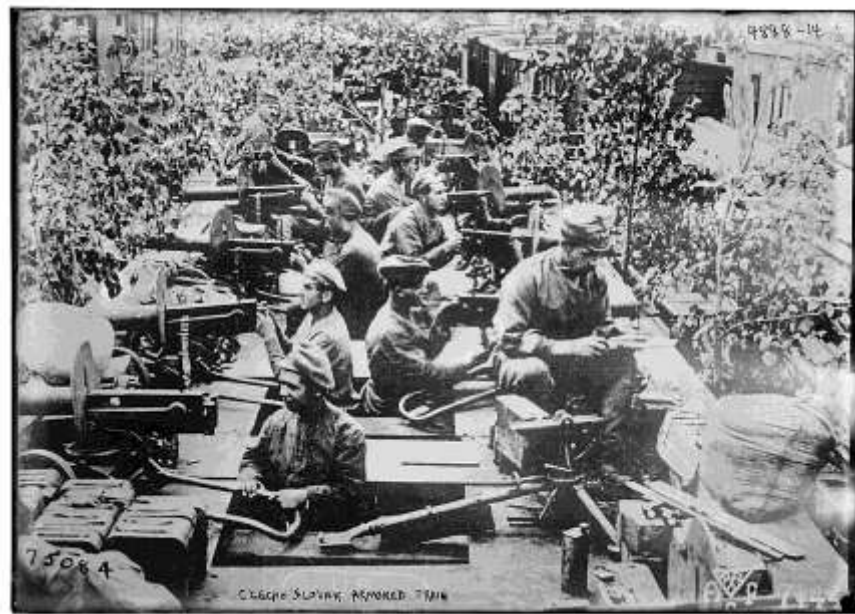


Canadian soldiers aboard a narrow-gauge armoured train taking ammunition up to the front line in France, September 1917

(William Rider-Rider / Department of National Defence / Library and Archives Canada / PA-001757)

Armoured Trains

Machine gunners →
aboard a Czechoslovak
armoured train (c. 1930)



← Armoured train
of the *Sud-Pacífico de México*
line
during the Mexican
Civil War (c. 1915)

Canadian War Trains (2)

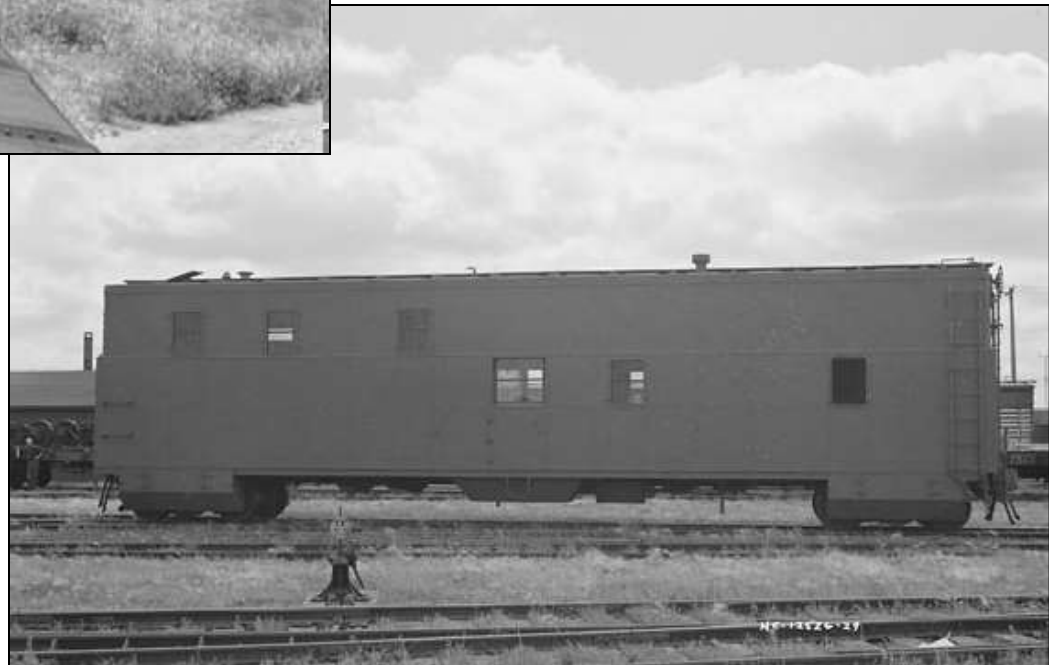


Canadian soldier with a Bren gun aboard No. 1 Armoured Train in Winnipeg, Manitoba, 15 July 1942

(Department of National Defence / Library and Archives Canada / PA-064267)

Armoured boxcar in Winnipeg, Manitoba, 16 July 1942

(Department of National Defence / Library and Archives Canada / e002852471)



School Trains in Canada

E, C.P.R. N°51

L'Éducation de l'Ontario décida
l'éducation des enfants de colons du nord
avait cinq communautés différentes et
le programme scolaire était celui en
Les élèves étudiaient et faisaient
de l'école.

Les élèves étaient de familles d'origine
compagnies de chemin de fer, s'adonnaient
à la coupe du bois dans les camps de bûcherons
à desservir la région entre Fort
William et White River.

Les sections: l'une est une classe avec
un salon et une chambre à

en 1967!!

C.P.R. SCHOOL CAR No. 51

In 1926, the Ontario Department of Education decided to provide six
school cars for the children of settlers in Northern Ontario. C.P.R. School Car No.
51 served five different communities and stayed at each for a week. The
classes followed the regular curriculum for the elementary grades. The
children were given homework to do between the car's visits.

Until the 1940's, most of the children were from immigrant families;
many of their parents worked for the railroad or logging companies, or
were farmers, hunters or fishermen.

In 1928, School Car No. 51 began serving the region between Fort
William and Kenora; after 1937 it operated between Chapleau and White River.

The school car has two sections: One half is a classroom with
115 desks; the other half contains a kitchen, living-room and bedroom
for the teacher and his family.

School Car No. 51 was retired in 1967.

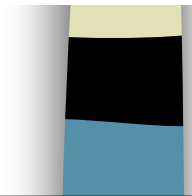


Private Cars and Trains

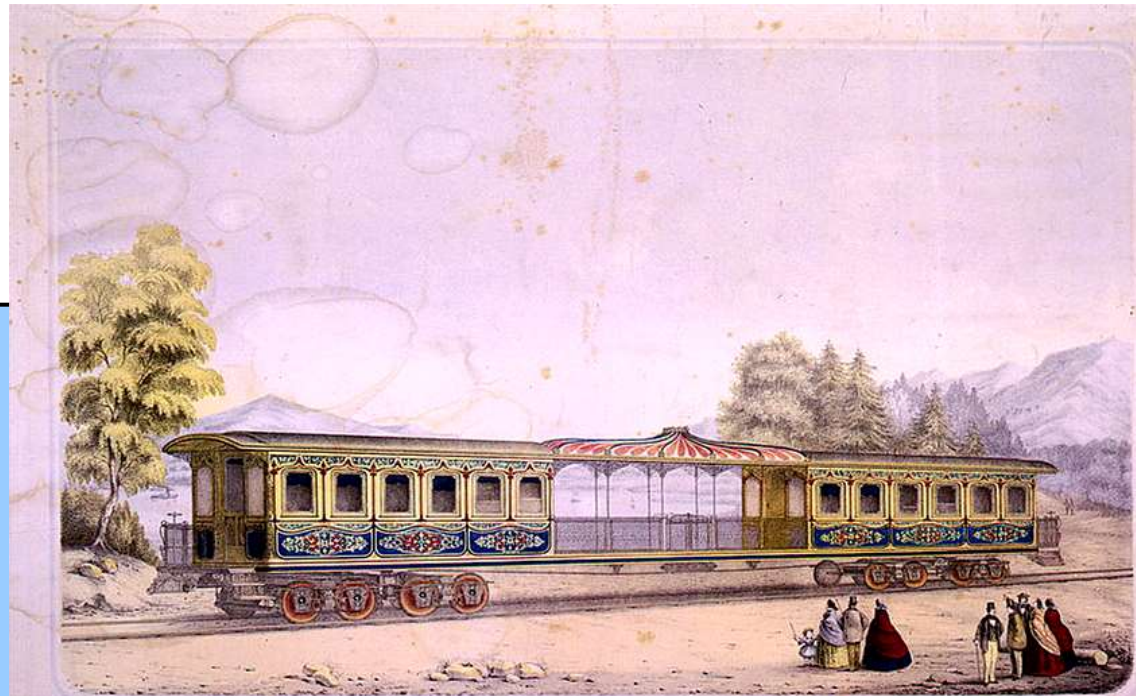
The ultimate in luxury and convenience was to have one's own private car. Heads of state often had their own private trains, for fast travel and diplomacy.



Hand-coloured lantern slide showing the private car used by members of the World Transportation Commission
Photo by William Henry Jackson (1843-1942), c. 1895



State carriage built for the Khedive of Egypt in 1860 by the Wason company of Springfield, Mass. Drawings were done by Milton Bradley, who founded a company that became famous for games. As late as 1978, the car was still used by the Egyptian government.



STATE CARRIAGE
FOR HIS HIGHNESS THE VICE-ROY OF EGYPT.
BUILT BY THE WASON & CO. SPRINGFIELD MASS U.S.



To recapitulate (3)

- Why did trains need wood as a construction material?
- How were new railway engineers trained before there were university, colleges, and engineering schools?
- What university awarded Canada's first engineering degree?
- In what three (3) conflicts were armoured trains used?
- Name two (2) other kinds of special-purpose trains of the 19th and 20th centuries.

Trains and Tourism (1)

- In Europe, by the end of the 19th century, many forms of tourism became possible for many more people than ever before, thanks to an ever denser railroad network



French Trains and Tourism (1)

CHEMIN DE FER D'ORLÉANS

Le Mont-Dore La Bourboule

Excursions en **Auvergne**

Conces de la Cier

BILLETS A PRIX RÉDUITS

1^{er} BILLETS DE FAMILLE, valables du 15 mai au 15 septembre pour les stations indiquées ci-dessous:

CHAMBALET-MERIS | NÉRIS | LÉVAUX-LES-BAINS
 MOULINS | BOURBON-L'ARCHAMBault | ROYAT
 LAQUEVILLE | LA BOURBOULE et LE MONT-DORE
 ROCKADOUR | MIERS | VIC-SUR-CÈRE
 DURÉE 30 JOURS

2^e BILLETS INDIVIDUELS, valables du 1^{er} juin au 30 septembre pour:

ROYAT et LAQUEVILLE | LA BOURBOULE et LE MONT-DORE
 DURÉE 30 JOURS

3^e BILLETS D'EXCURSION, valables du 1^{er} juin au 30 septembre
 DURÉE 30 JOURS

NOTE: Pour plus de détails, renseignements, consulter le VOYAGEUR
 officiel de la C^o d'Orléans, lequel se trouve généralement sur
 tous les trains et à la gare de destination.

L. Pons, Editeur à Paris.

IMP. A. BELLIET & C^o PARIS, Éditeurs.

Chemin de Fer du Nord

LE TRÉPORT-MERS

SAISON 1889

TRAJET PAR TRAIN RAPIDE
 en 3 heures $\frac{1}{2}$

PARIS A EU
 TRÉPORT-MERS

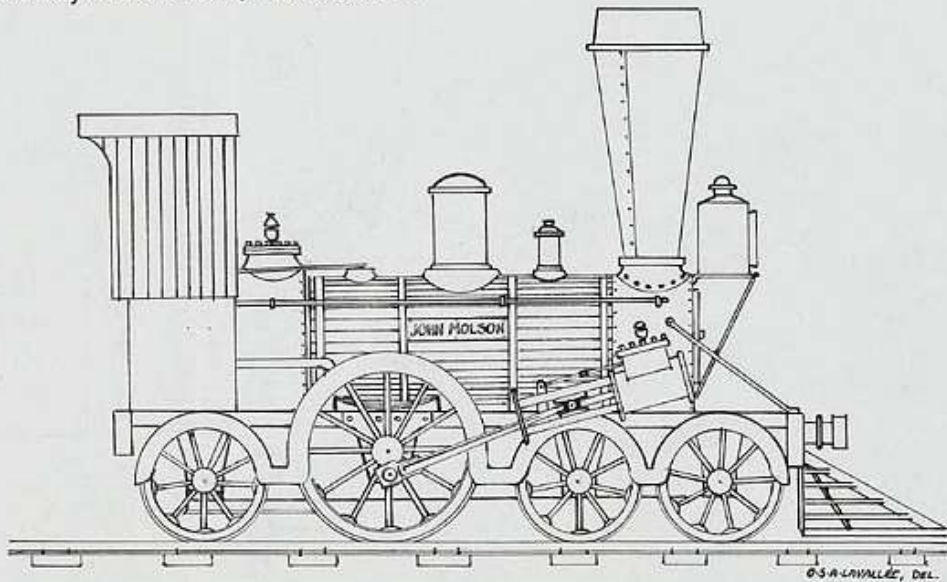
PAR BEAUVAIS		PAR ABBEVILLE	
1 ^{er} Class	10 00	1 ^{er} Class	10 00
2 ^e Class	6 00	2 ^e Class	6 00
3 ^e Class	4 00	3 ^e Class	4 00
4 ^e Class	3 00	4 ^e Class	3 00
5 ^e Class	2 00	5 ^e Class	2 00
6 ^e Class	1 50	6 ^e Class	1 50
7 ^e Class	1 00	7 ^e Class	1 00
8 ^e Class	0 75	8 ^e Class	0 75
9 ^e Class	0 50	9 ^e Class	0 50
10 ^e Class	0 25	10 ^e Class	0 25

IMP. A. BELLIET & C^o PARIS, Éditeurs.

Trains and Tourism in Canada (1)

CHAMPLAIN & SAINT LAWRENCE RAIL ROAD

LOCOMOTIVE "JOHN MOLSON"
KINMOND, HUTTON & STEELE, DUNDEE, 1849.



← A modern replica of the same with some changes

- As with steamboats, the Molson family backed railways early
- The first line connected La Prairie on the St. Lawrence near Montréal and St-Jean-sur-Richelieu on the Richelieu River, shortening the trip between the two rivers and providing access to both the lower and upper parts of the St. Lawrence
- It opened officially in 1836

Early Canadian Trains (1)



Close-up : note the use of metal-plated wooden rails

← 1936 replica of the first locomotive in Canada in 1836 (the “Dorchester”)

Early Canadian Trains (2)

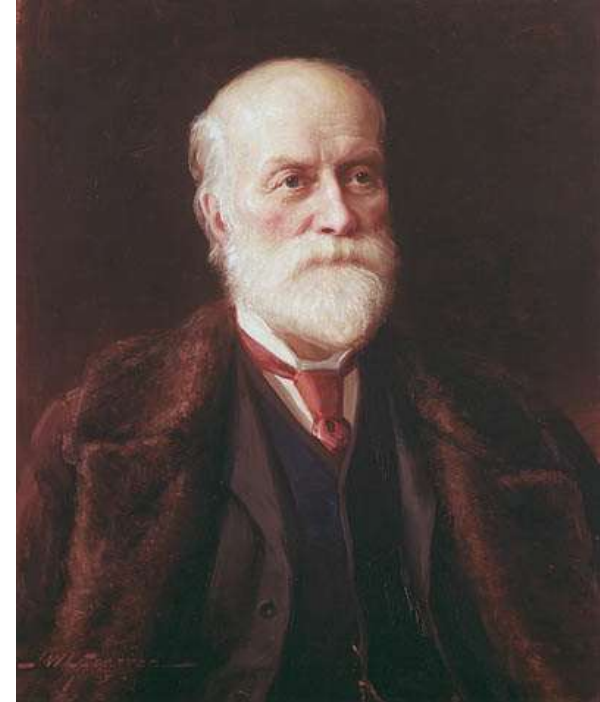


A Kawasaki-built, working replica of the “John Molson” (note the differences with the period drawing: some are due to safety features required by modern provincial law)



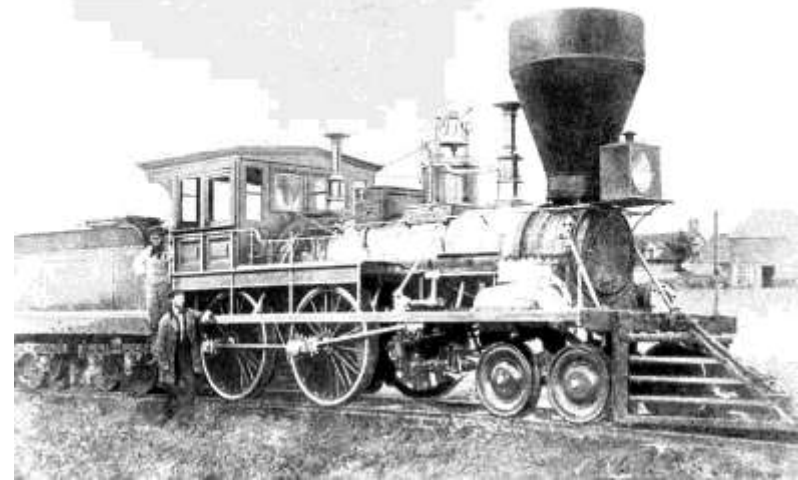
Canada's Rail Mania

- By 1849, government support (the *Guarantee Act*) spurred the building of longer lines
- The railway boom created a market for manufacturers (rolling stock, locomotives) and a demand for engineers
- Some came from overseas, like Fleming, but others had to be trained in Canada, leading to the founding of early engineering education



Sandford Fleming

The “Old Ottawa”



Railway Time

- Trains required timetables, but local time changed from town to town
- Scotland-born Sandford Fleming (1827-1915) became Canada's most prominent engineer
- He advocated the use of standard time, adopted by North American railways in 1883 and by the world in 1884

TORONTO, HAMILTON AND BUFFALO RAILWAY

TIME TABLE ISSUED JUNE 9th, 1901. EASTERN STANDARD TIME

NEW YORK, BUFFALO AND THE EAST TO HAMILTON, BRANTFORD, TORONTO, STAMPA AND MONTREAL.					MONTREAL, STAMPA, TORONTO, BRANTFORD AND HAMILTON, TO BUFFALO, NEW YORK.				
NEW YORK, N. Y. (N. Y. C.)	7:30 A.M.	7:20 P.M.	8:15 A.M.	8:05 P.M.	8:00 P.M.	7:50 P.M.	7:40 P.M.	7:30 P.M.	7:20 P.M.
ALBANY, N. Y. (N. Y. C.)	11:20	1:00	1:00	1:15	1:15	1:15	1:15	1:15	1:15
SARASOTA, N. Y. (N. Y. C.)	1:35	3:15	3:15	3:30	3:30	3:30	3:30	3:30	3:30
ROCHESTER, N. Y. (N. Y. C.)	3:50	5:30	5:30	5:45	5:45	5:45	5:45	5:45	5:45
Buffalo, N. Y. (M. C. C. & N. Y. R.)	7:45 A.M.	7:35 P.M.	8:30 A.M.	8:20 P.M.	8:15 P.M.	8:05 P.M.	7:55 P.M.	7:45 P.M.	7:35 P.M.
HAMILTON, ONT. (M. C. C. & N. Y. R.)	10:00	9:50	10:45	10:35	10:30	10:20	10:10	10:00	9:50
BRANTFORD, ONT. (M. C. C. & N. Y. R.)	11:00	10:50	11:45	11:35	11:30	11:20	11:10	11:00	10:50
NIAGARA FALLS, ONT. (M. C. C. & N. Y. R.)	12:00	11:50	12:45	12:35	12:30	12:20	12:10	12:00	11:50
TORONTO, HAMILTON & BUFFALO.	No. 71.	No. 81.	No. 69.	No. 73.	No. 75.	No. 77.			
Welland	8:45 A.M.	11:20 A.M.	8:00 P.M.	8:55 P.M.	8:55 P.M.	8:55 P.M.			
CHATHAM	9:45	12:15	9:05	9:50	9:50	9:50			
ESSEXVILLE	10:45	1:15	10:05	10:45	10:45	10:45			
BRANTFORD	11:45	2:15	11:05	11:45	11:45	11:45			
NIAGARA FALLS	12:45	3:15	12:05	12:45	12:45	12:45			
WINDSOR	1:45	4:15	1:05	1:45	1:45	1:45			
DETROIT	2:45	5:15	2:05	2:45	2:45	2:45			
CHICAGO	3:45	6:15	3:05	3:45	3:45	3:45			
ST. LOUIS	4:45	7:15	4:05	4:45	4:45	4:45			
MEMPHIS	5:45	8:15	5:05	5:45	5:45	5:45			
INDIANAPOLIS	6:45	9:15	6:05	6:45	6:45	6:45			
KANSAS CITY	7:45	10:15	7:05	7:45	7:45	7:45			
ST. PAUL	8:45	11:15	8:05	8:45	8:45	8:45			
MINNEAPOLIS	9:45	12:15	9:05	9:45	9:45	9:45			
MONTREAL	10:45	1:15	10:05	10:45	10:45	10:45			

Additional tables for routes to Detroit, Chicago and the West, and from Chicago, Detroit and the West to Brantford, Hamilton, Toronto, Ottawa and Montreal.

Trains and Tourism in Canada (2)

Train companies often collaborated with or owned shipping lines to extend their reach.

(1925)



**CANADIAN
PACIFIC**
PICTURESQUE ROUTE
by
**FAST STEAMERS
& TRAINS**
TRANSATLANTIC · TRANSCANADA
TRANSPACIFIC
TO
JAPAN & CHINA

SUMMER TOURS FOR 1893
TORONTO TO TORONTO
Canadian Pacific Ry.

AROUND THE WORLD \$610.00	AUSTRALIA & RETURN \$410.00	CHINA & RETURN \$447.50	HONOLULU & RETURN \$235.00	ALASKA & RETURN \$205.00	SAN FRANCISCO & RETURN \$125.00	PORTLAND & RETURN \$110.00
JAPAN & RETURN \$410.00	VICTORIA & RETURN \$110.00	BANFF & RETURN \$85.00	WINNIPEG & RETURN \$50.00	HALIFAX & RETURN \$40.00	ST. JOHN & RETURN \$35.00	
DULUTH & RETURN \$32.00	SEAR HARBOR & RETURN \$32.50	ST. ANDREWS & RETURN \$31.00	ST. ARTHUR & RETURN \$30.00	ST. JOHN & RETURN \$20.00		
ST. PAUL & RETURN \$30.00	ST. LOUIS & RETURN \$29.00	ST. LOUIS & RETURN \$28.00	ST. LOUIS & RETURN \$25.00	ST. LOUIS & RETURN \$20.00	ST. LOUIS & RETURN \$19.00	CHICAGO & RETURN \$19.00

FROM OTHER POINTS PROPORTIONATE RATES.

GET A COPY FOR 1893 OF THE
C.P.R. TOUR BOOK
"AROUND THE WORLD" "FISHING & SHOOTING"
"HIGHWAY TO THE ORIENT" BANFF & LAKES IN THE CLOUDS
"WESTWARD TO THE FAR EAST" TRIP TO ALASKA

RETURN TICKETS
DOWN THE ST. LAWRENCE TO THE SEA
TO THE MOUNTAINS TO THE GREAT LAKES

TORONTO TICKETS OFFICE **I KING ST. EAST** CORNER YONGE
W. R. COLLIER, General Passenger Agent, Montreal W. R. COLLIER, District Passenger Agent, Toronto

Railway Hotels in Canada (1)



HOTEL BANFF

C.P.R. HOTEL BANFF ALTA

COCKBURN
PHOTO

Railway Hotels in Canada (2)

- In Canada, railway tourism meant vacations at lakeside, riverside or seaside resorts; outings in new parks (such as Banff or Algonquin); hunting trips; travel to a big city for shopping and a taste of culture; religious retreats or pilgrimages; visits with relatives living on the farm; holidays in cottage country...

- The U.S. offered similar destinations





Banff Luxury



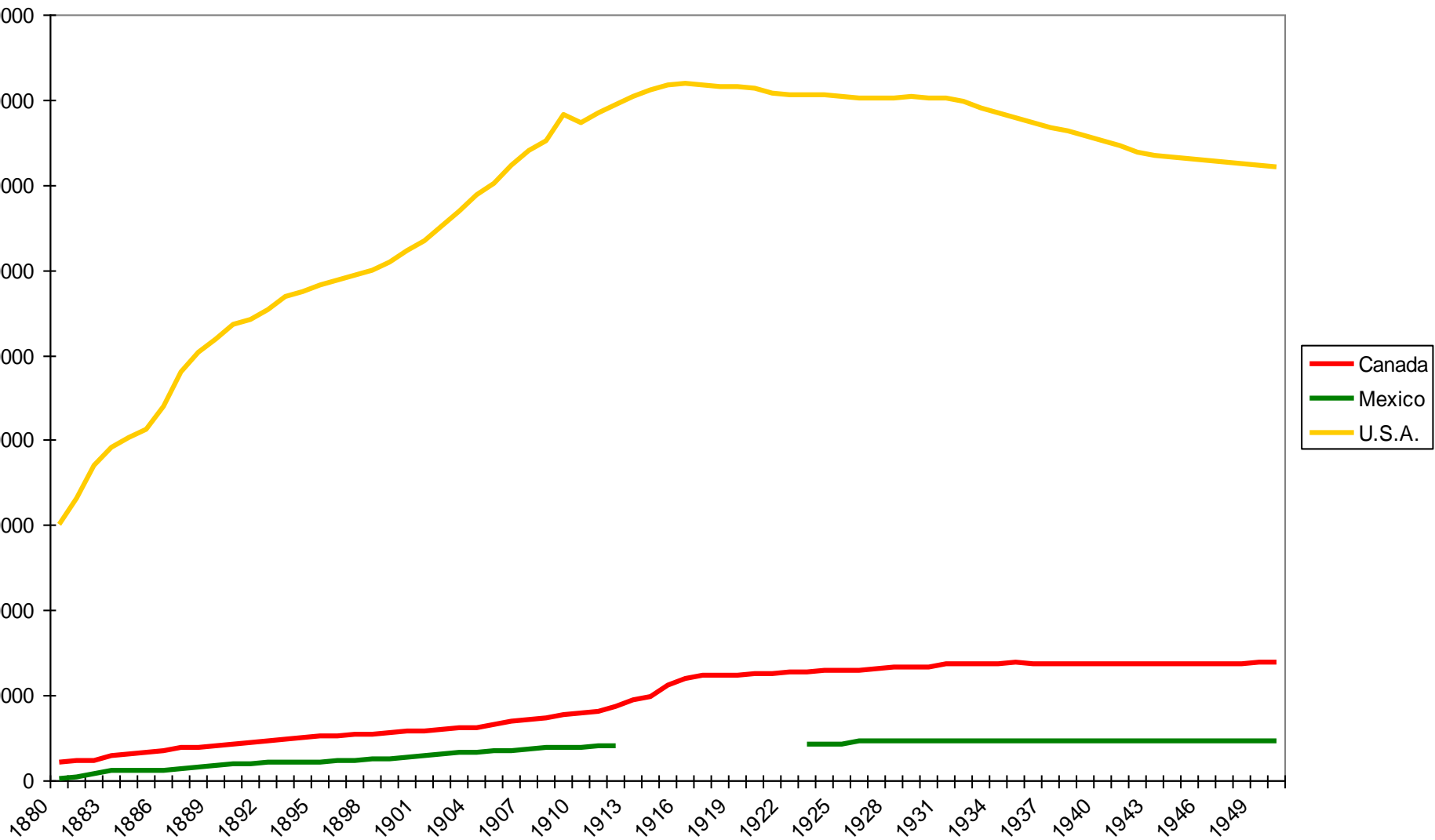
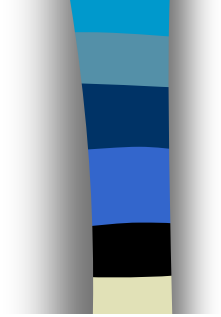


To recapitulate (4)

- Name three (3) tourist destinations reached by train in the 19th century.
- What Canadian family invested in Canada's first railway?
- In what province was Canada's first railway built?
- What Canadian engineer supported the move to a system of worldwide time zones?
- Name two (2) Canadian parks reached by train by the turn of the 20th century.

Railroad Networks

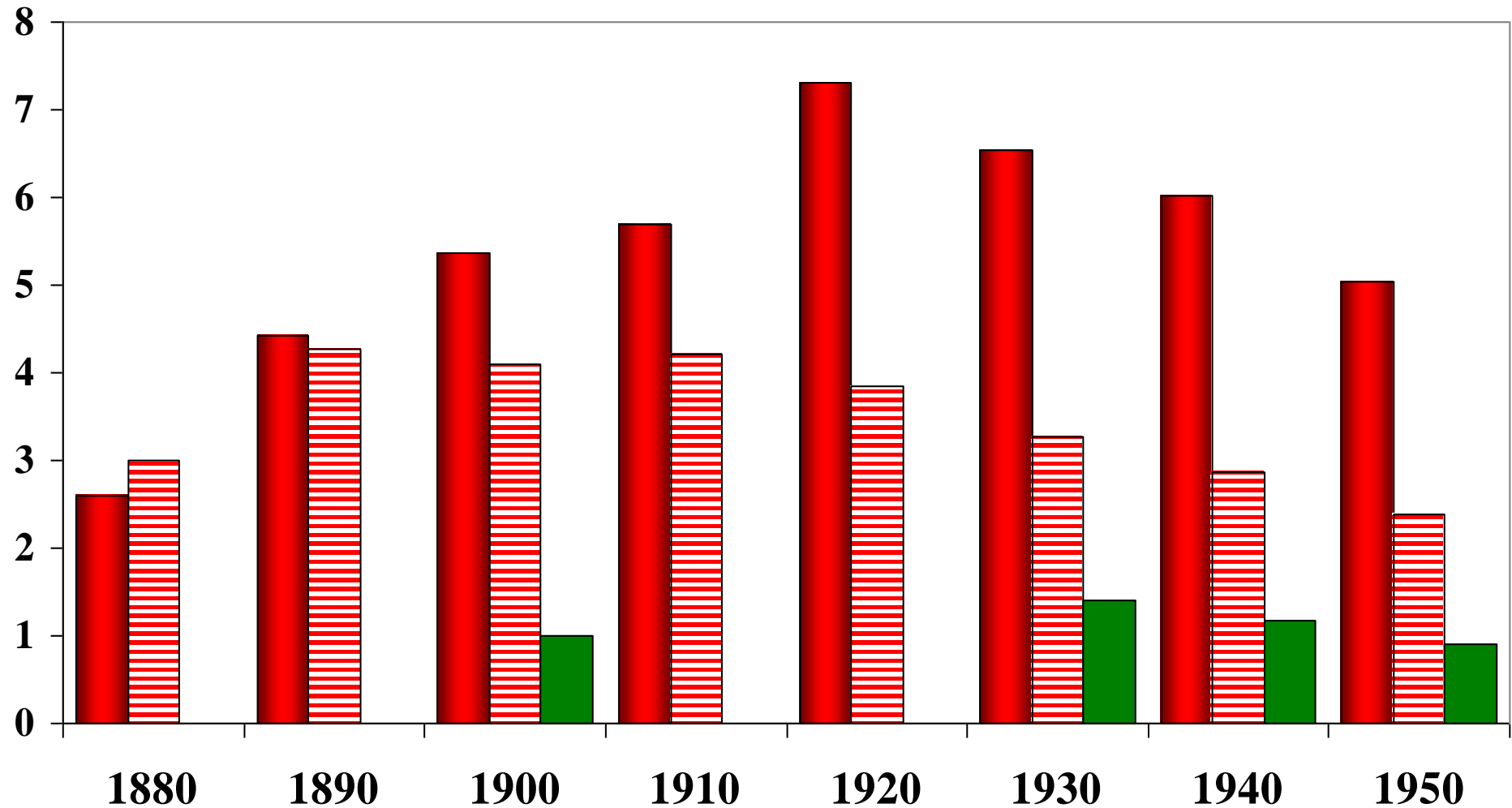
(tracks in km, 1880-1950)



Railroad Networks

(tracks in km per thousand inhabitants, 1880-1950)

Canada U.S.A. Mexico





Challenge Question of the Week

Why didn't the Romans eat cheeseburgers?

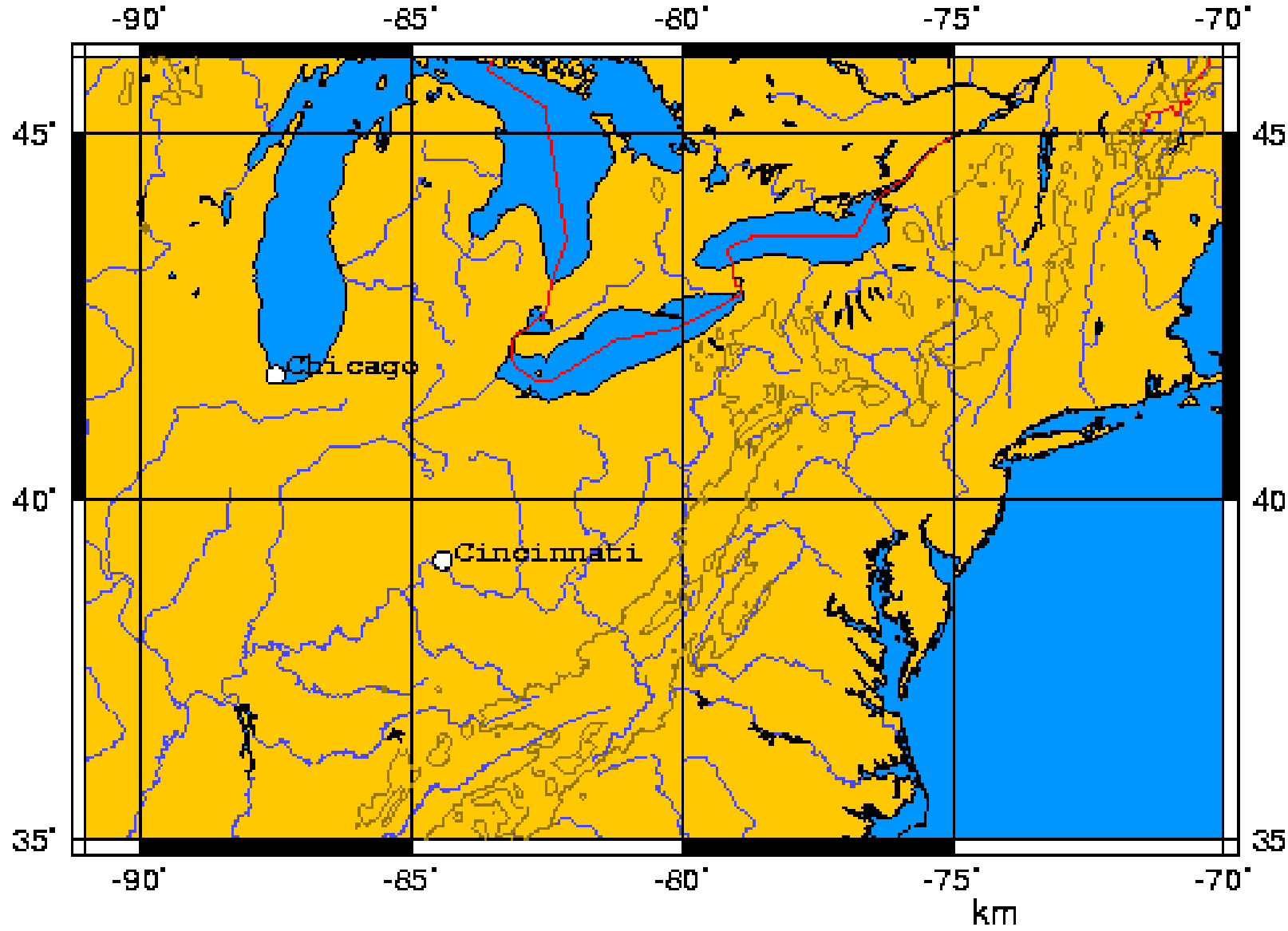
- Trivially, the tomato didn't arrive in Europe until after Columbus
- More significantly, lettuce wasn't in season (spring or fall) at the same time as livestock was killed (early winter)
- Nor was it possible to make ground beef from freshly slaughtered animals that would keep very long...



The Chicago Story (1)

- As the bison was swept from the Prairies, it was replaced by herds of steers and cows
- By then, Chicago was well on its way to replacing Cincinnati as the slaughter capital of the United States, if not the world
- In 1870, Chicago was the nexus of a railway network covering much of the Mississippi basin
- As hogs and steers were brought in by rail, the Chicago meatpackers introduced several innovations to profit (i) from the ability of railroads to operate year round, and (ii) from the sheer volume of animals to be processed, so large it could have overwhelmed any workforce using traditional methods and entailed much wastage

From Cincinnati to Chicago...





The Chicago Story (2)

- The meatpacking companies coordinated their operations with the railway lines, creating the Union Stockyards envisioned in 1864 and centralizing in one spot all of Chicago's livestock business
- The mobile chain "disassembly" line was adapted from Cincinnati's meatpacking operations
- Bulk ice was shipped by rail from the East to refrigerate the packing plants and let them operate even in high summer, using the ice to cure hog carcasses before preserving them with salt
- Ice was then applied to the refrigeration of railroad cars so that packed beef could be shipped fresh to Eastern markets; by 1883-1884, more beef was packed for export than was shipped live to Eastern plants

Brockville Slaughterhouse (c. 1907)

Brian Scott Collection, Archives Canada



The Chicago Union Stockyards

1878

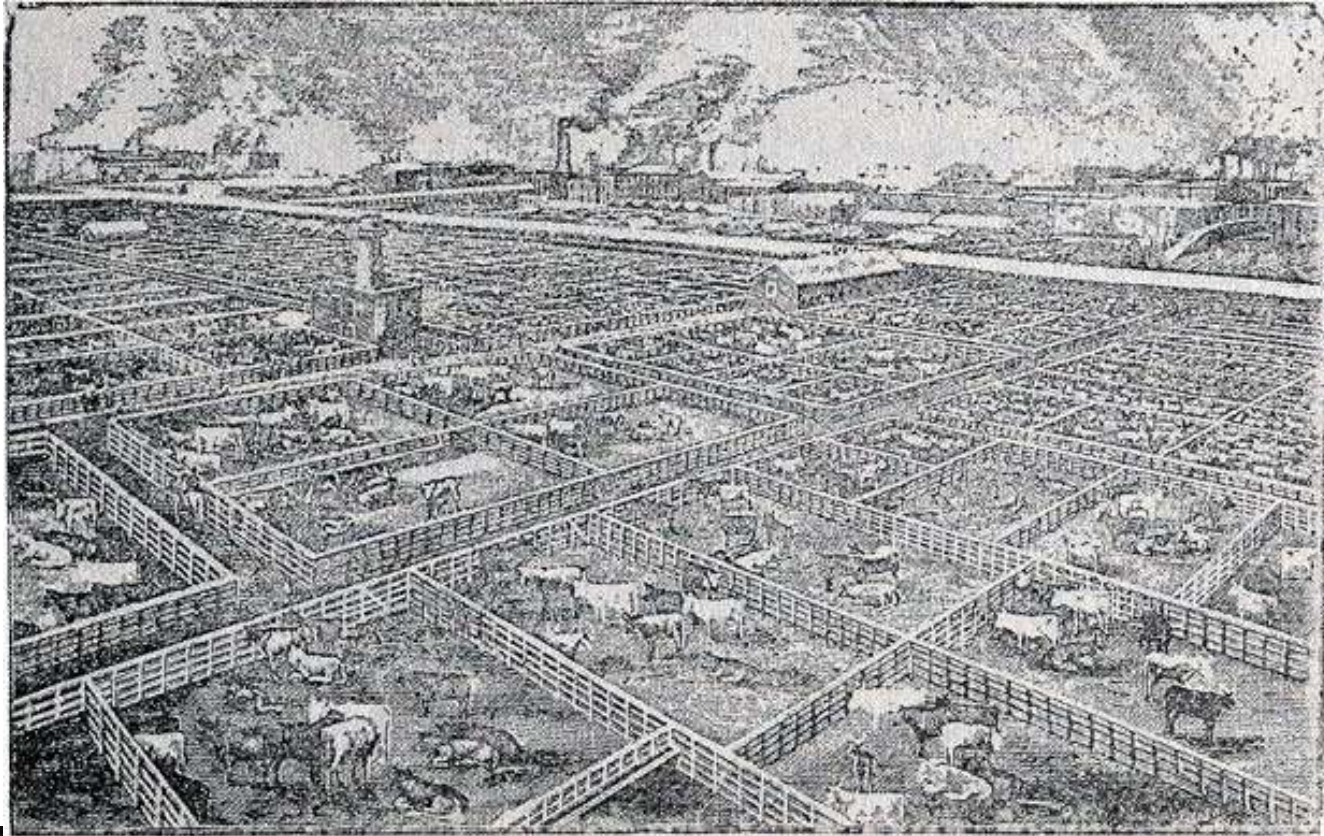


THE GREAT UNION STOCK YARDS OF CHICAGO.

Methodical planning is visible in the layout of the Union Stockyards

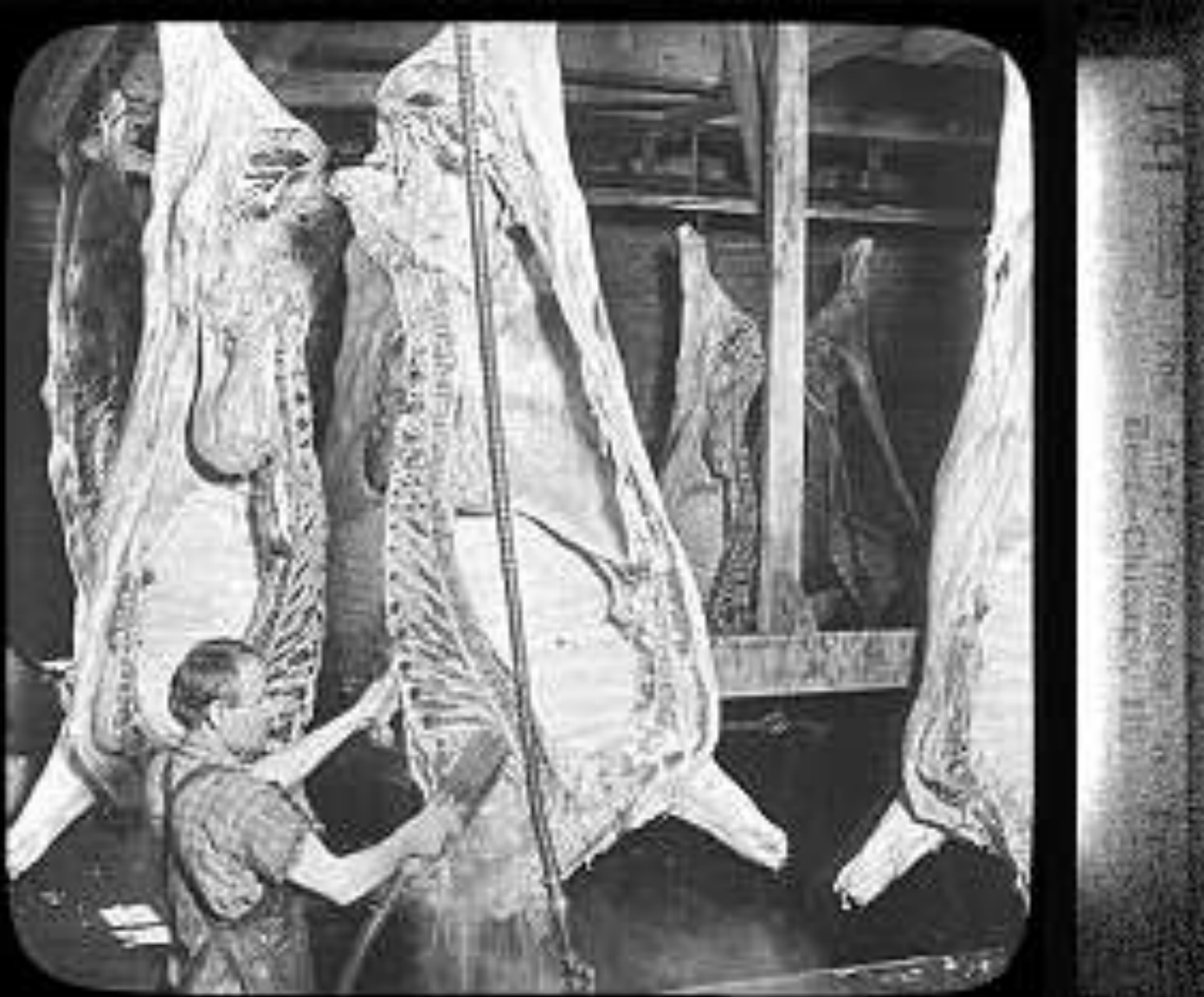


1894



Chicago's Union Stock Yards were a wonder of the age. Yet, their stunning scale was a mere prelude to the bloody spectacle inside the meatpacking plants that left visitors truly amazed.

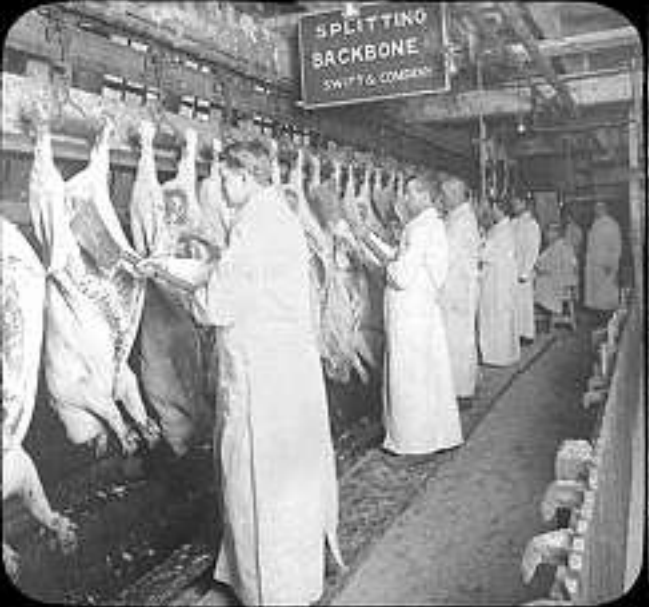
On the disassembly line...



In Chicago, the meatpacking plants processed each carcass into many body parts, some of which they alone could sell economically as a result of the volume produced. Initially, these provided a key margin of profit.

Storing the parts

The hog disassembly line



142
Splitting Backbones and
Horn of Hoses, Chicago, Ill.

The Chicago System



Fresh Meat for Everyone!

- Beyond the salted pork produced by the first meatpackers, customers hungered for fresh beef
- The first refrigerated cars were tried in 1867-1868, but northern routes and regions still enjoyed a certain advantage when it came to moving meat and ice
- By 1880, the first practical ice-making machines had been developed, and the meatpacking business was able to function continent-wide



To recapitulate (5)

- What city was the initial “slaughter capital” of the United States?
- Why did Chicago become the new “slaughter capital” of the U.S.?
- Identify the time period (late 19th century or early 20th century) when the total extent of the Canadian railway network nearly doubled.
- What was new and unique about the Chicago Union Stockyards? Why?
- How was fresh meat brought to Eastern cities before refrigerated train cars were developed?

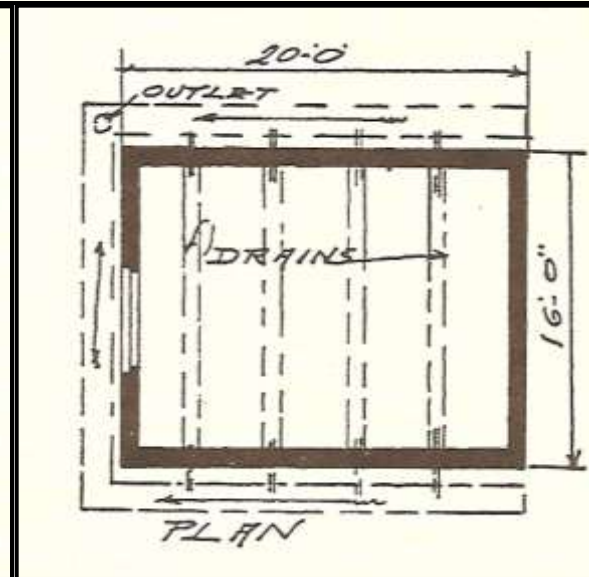
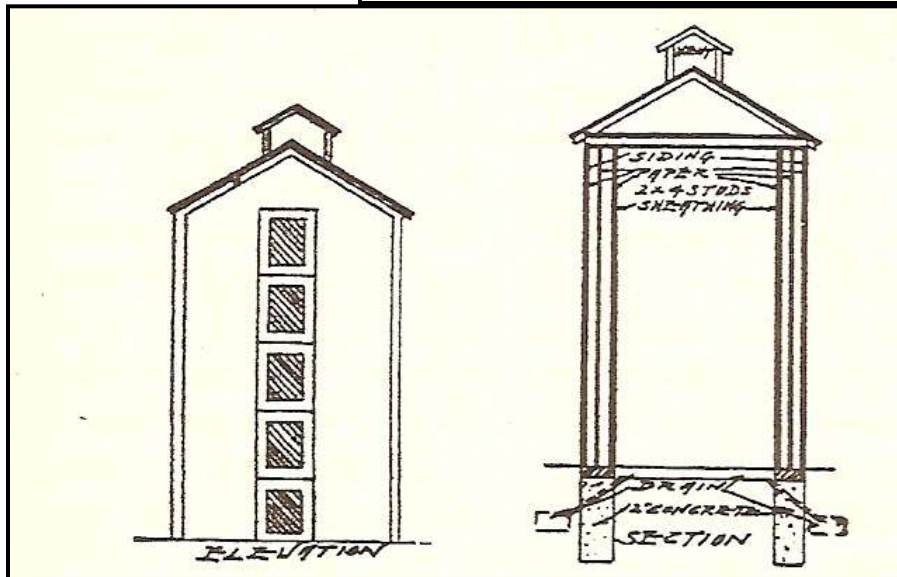
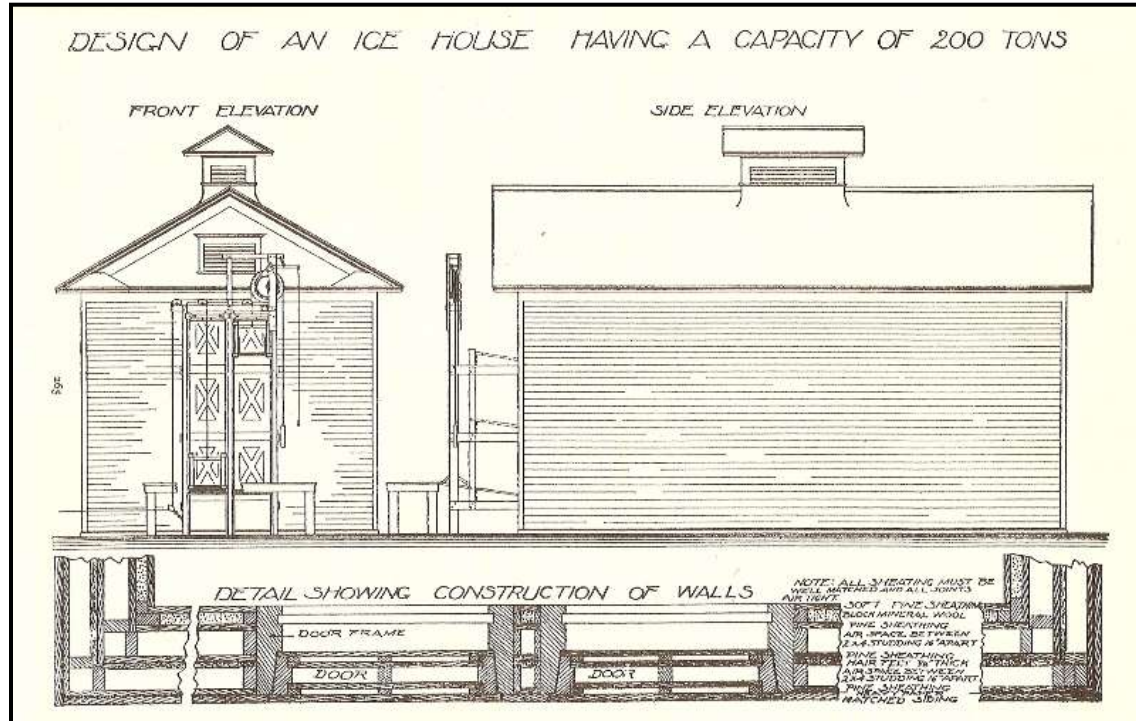
Ice houses in 1909

“A very cheap house will keep ice. All you really need is a roof to keep the rain off and boarding at the sides to hold the sawdust in place.”

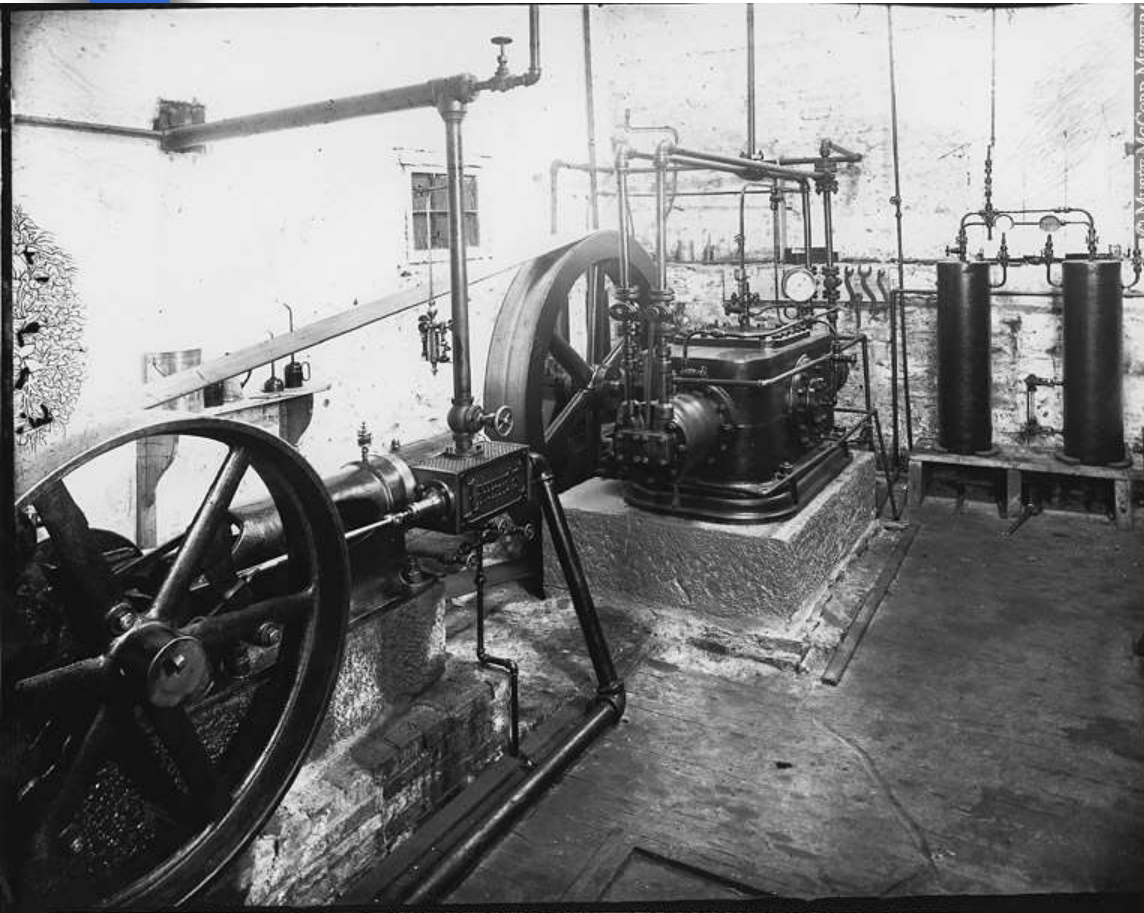
Design for a medium-sized (16'×20') ice house →

William A. Radford, ed. *Radford's Practical Barn Plans* (1909)

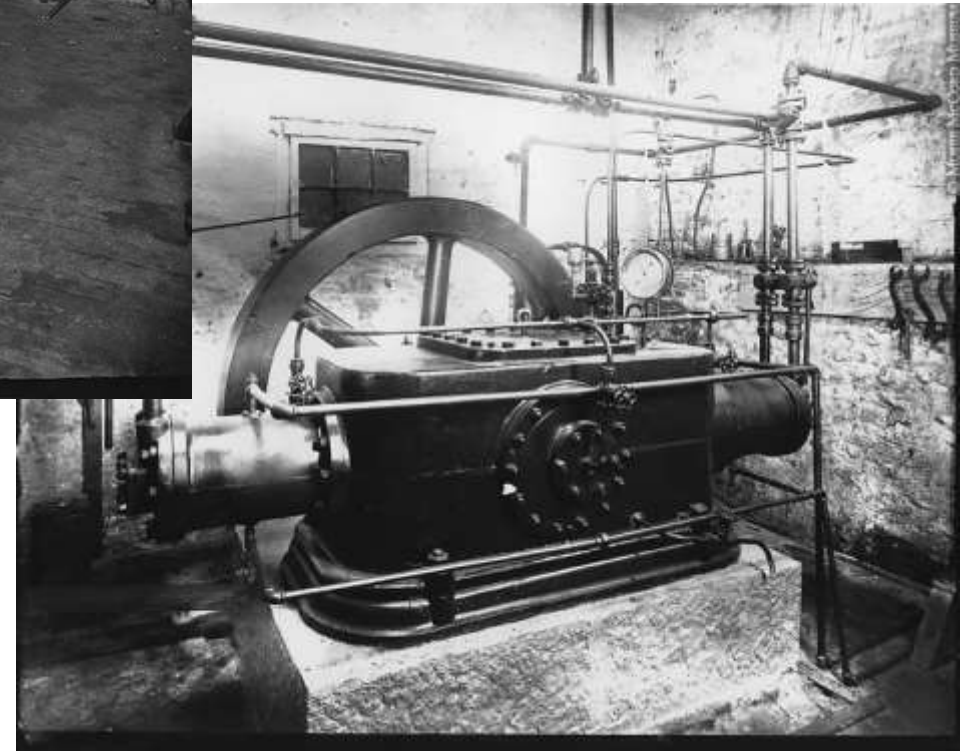
Design for a large (20'×30', 225 tons) ice house ↓
William A. Radford, ed. *Radford's Practical Barn Plans* (1909)



Making Ice... Without Winter



Two views of the ice-making machine of the Standard Ice Machine & Refrigeration Company in Montreal, 1893



William Notman & Son, Notman Archives,
McCord Museum

Montreal Meat Trolley (1895)

M. Scanlon, Notman Archives, McCord Museum



A Refrigerator Car used by Grand Trunk Pacific (1909)





Railway Technology: Rails and Bridges

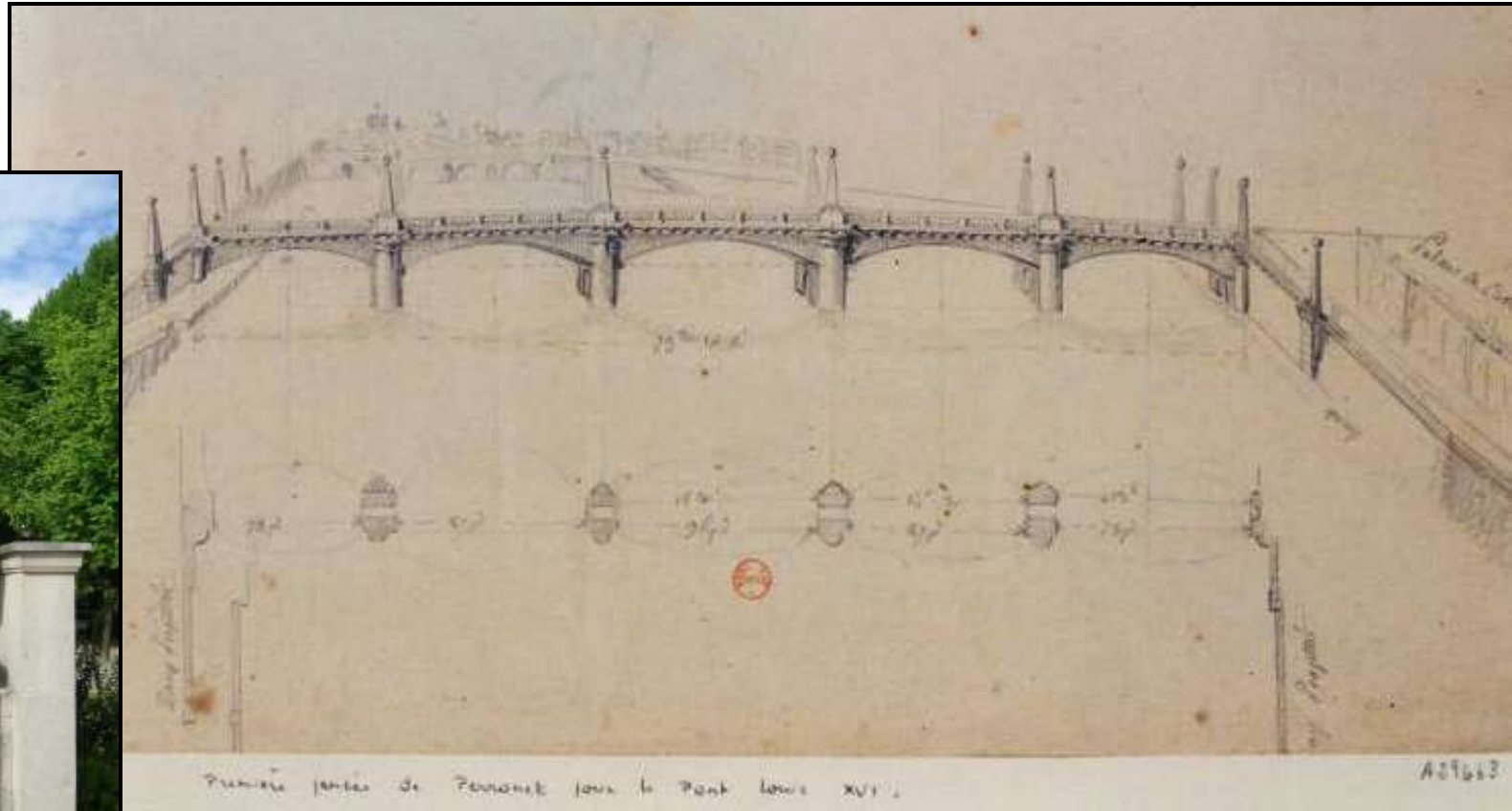
- As in other cases, the initial development of railways entailed a burst of technological experimentation
- Builders experimented with wooden rails, metal-plated wooden rails, metal rails, and even stone rails before settling on iron rails (cast iron quickly giving way to puddled wrought iron, later replaced by steel)
- Railway bridges and viaducts similarly tried out traditional stone construction as well as suspension designs, metal tubes, and simple spans

The Roman aqueduct over the Gard River in southern France



Late 18th-century sketch of a bridge planned in Paris by French engineer Perronet

© Jean-Louis Trudel, May 2013



(Project for the Louis XVI Bridge)

Bytown's Union Bridge (1844)

Samuel Keefer, Engineer; sketched by Frederick Preston Rubidge (1806-1897)





The Grand Trunk Bridges

- The **Grand Trunk Railway** became one of Canada's major railroad networks
- In 1851, it commissioned the building of a suspension bridge across the Niagara by Charles A. Roebling who demonstrated the advantage of cables over chains (and went on to build the Brooklyn Bridge)
- In 1860, it opened the Victoria Tubular Bridge in Montréal, designed by Robert Stephenson who had previously completed in 1850 the Britannia Tubular Bridge over Menai Straits in Great Britain

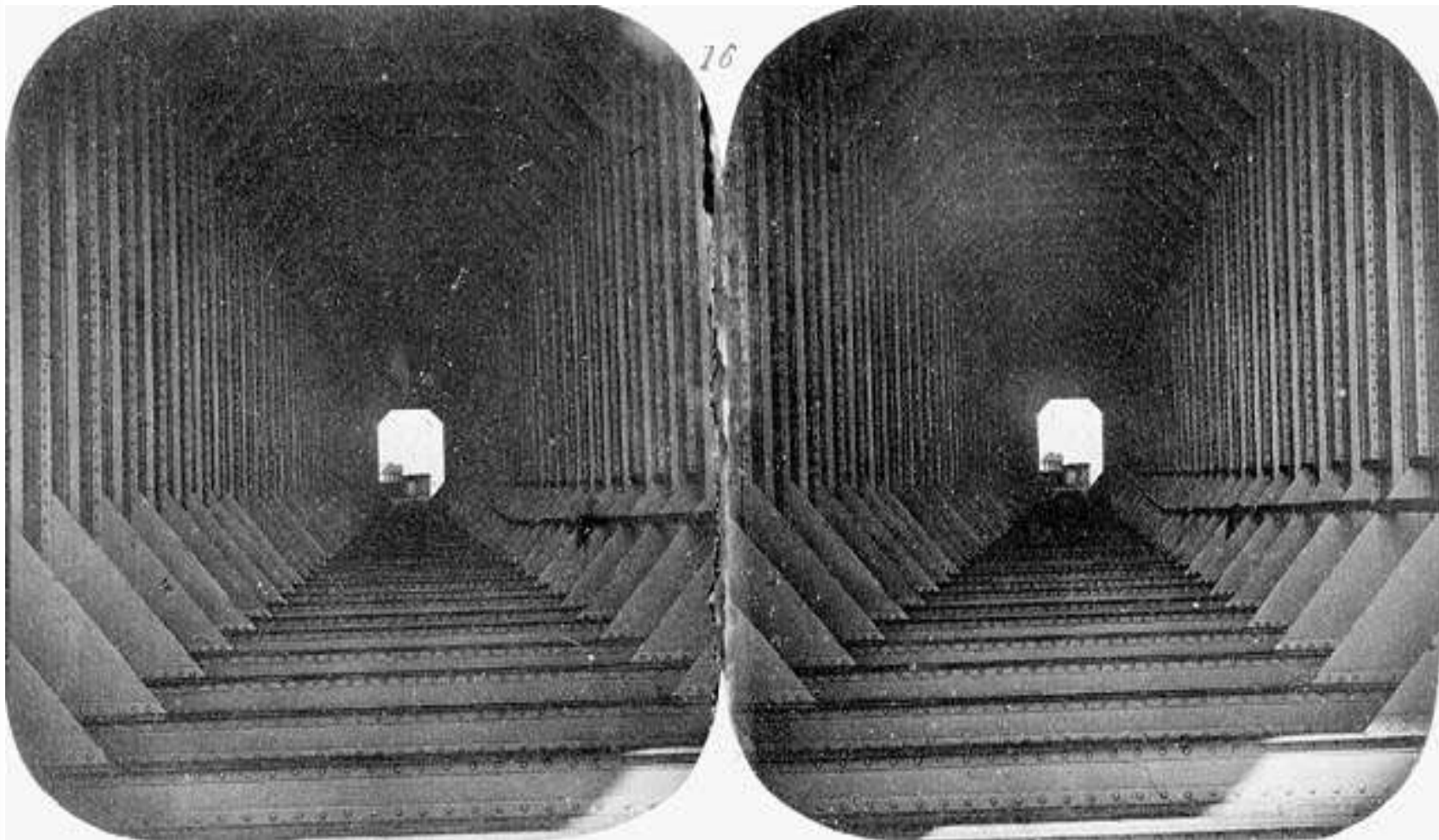
Second Niagara Suspension Bridge (sometime between 1855 and 1877)



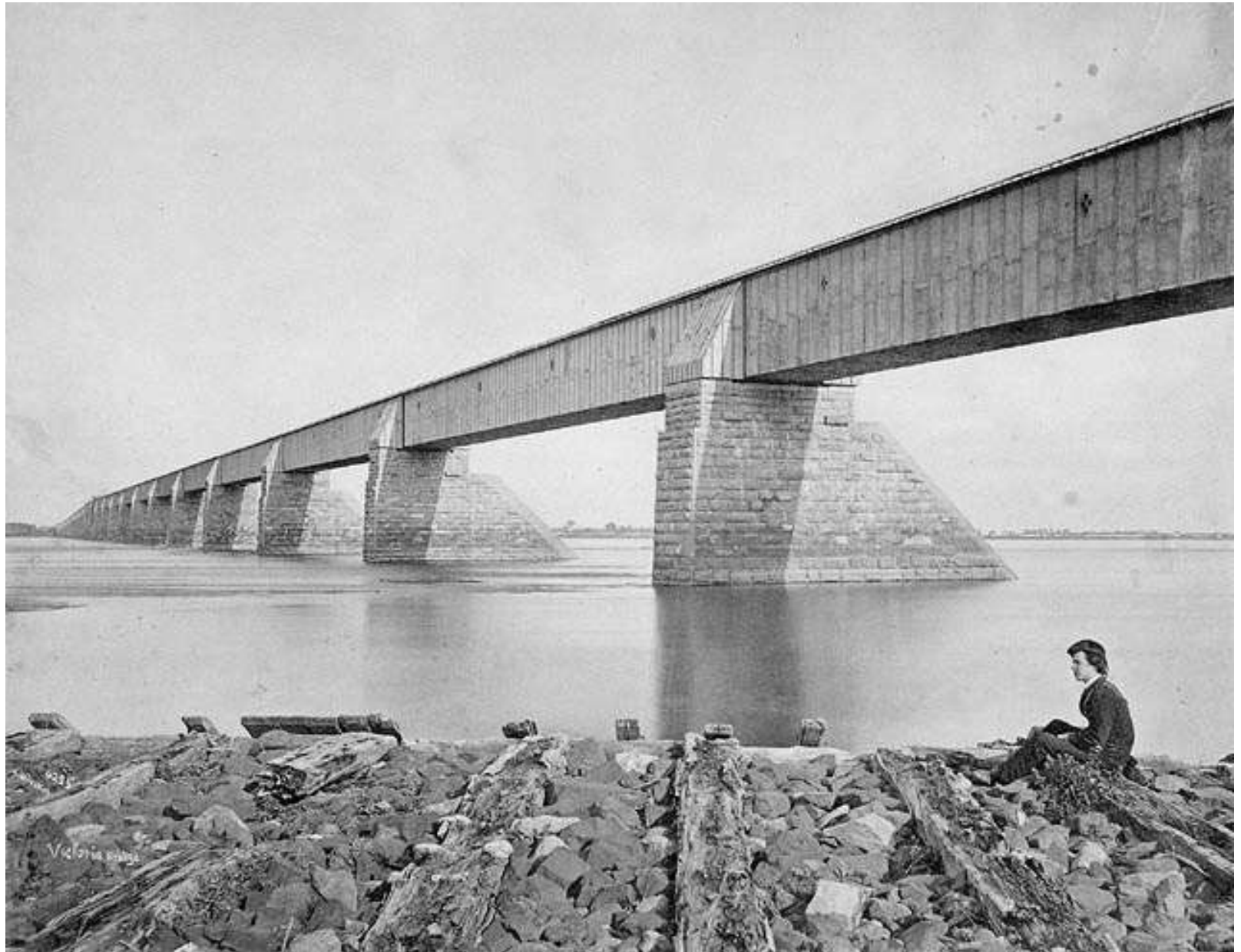
Another view of the second Niagara Suspension Bridge (1855-1877)



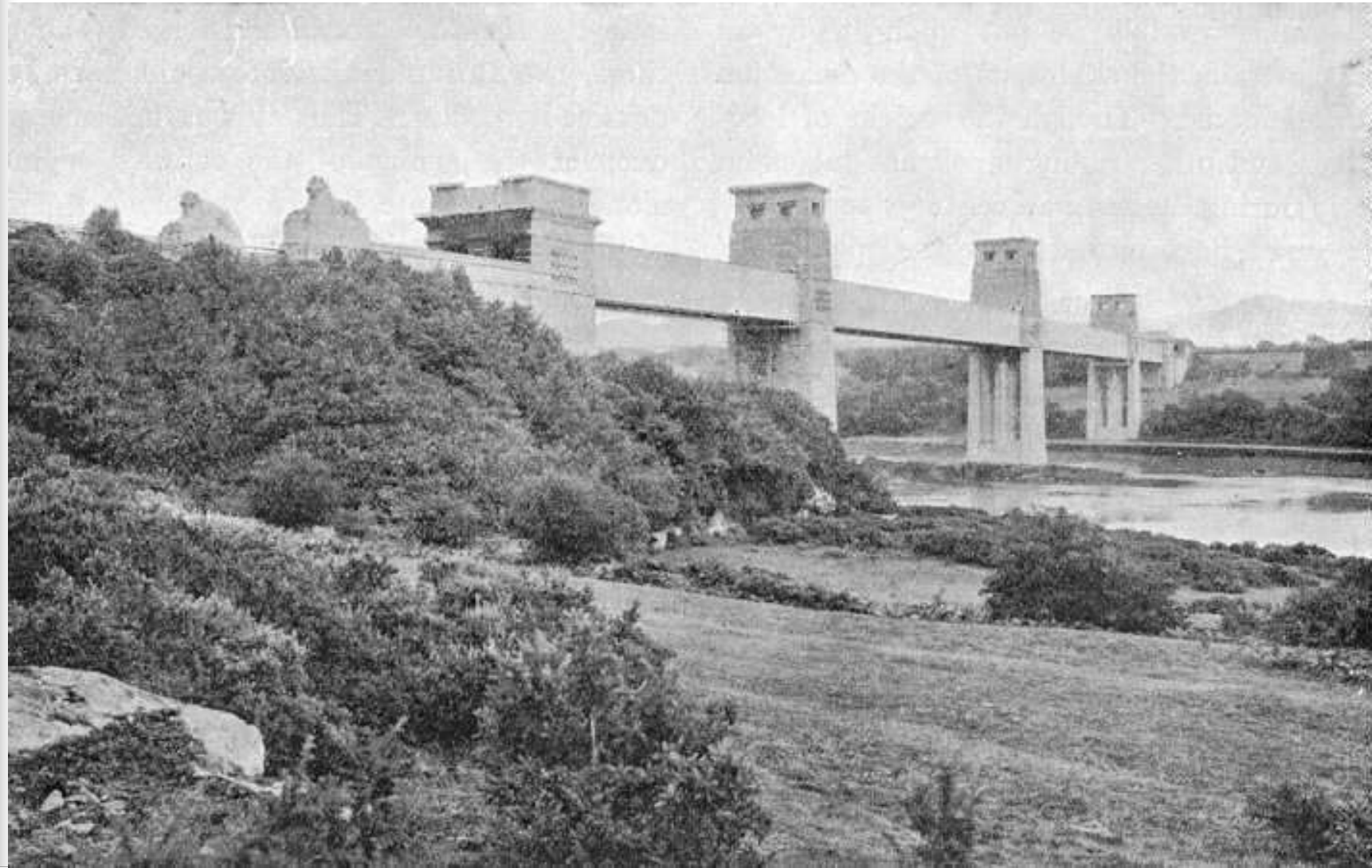
Inside the Victoria Bridge before the tracks were laid (stereo view)



Montreal's Victoria Bridge (1878)



Robert Stephenson's Britannia Bridge over Menai Straits (UK)



Victoria Bridge, South Entrance (1897)



The Victoria Bridge, improved (1898)



The Victoria Bridge, redone (1899)





To recapitulate (6)

- What three (3) types of railway bridges were tried during the 19th century?
- Name the engineer responsible for Brooklyn Bridge.
- Name the engineer responsible for Victoria Bridge.
- Why were tube bridges used?
- How was ice supplied to slaughterhouses and refrigerated trains before the development of the ice-making machines?

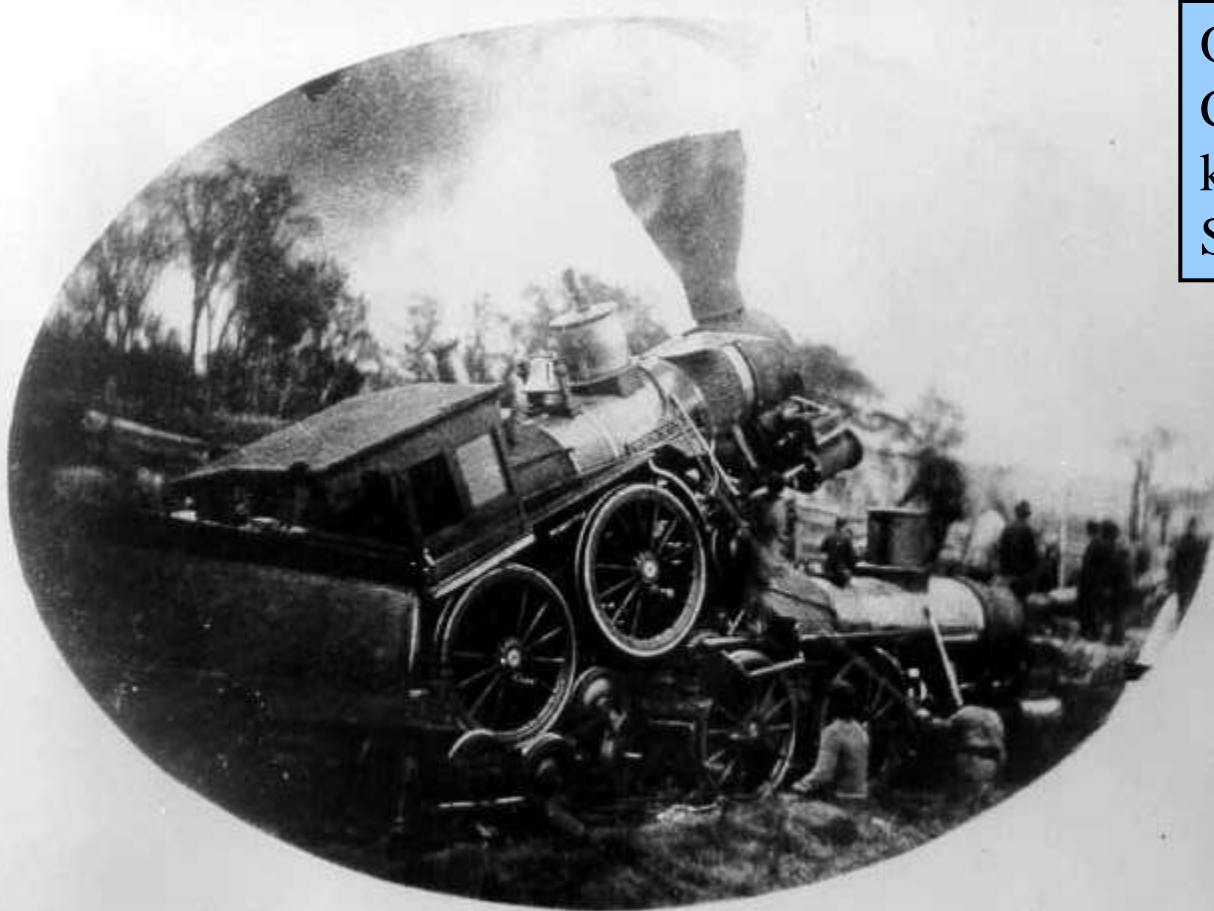


Speed and Its Perils

- Steam trains were fast from the first, and only got faster
- However, their mass meant that accidents were harder to prevent, while the numbers of people they carried increased the danger to users
- The pace of technological change probably played a role as well in keeping train managers from reducing risks quickly

A Train Collision near the Canadian Border (20 May 1864)

On the Vermont and
Canada Railroad, two
kilometres north of
St. Albans.



RAILROAD COLLISION,

On the Vt. and Canada Railroad, 1 1/2 miles North of St. Albans, near Brigham's Crossing, May 20, 1864.

PHOTOGRAPHED BY T. G. RICHARDSON, ST. ALBANS, VT.

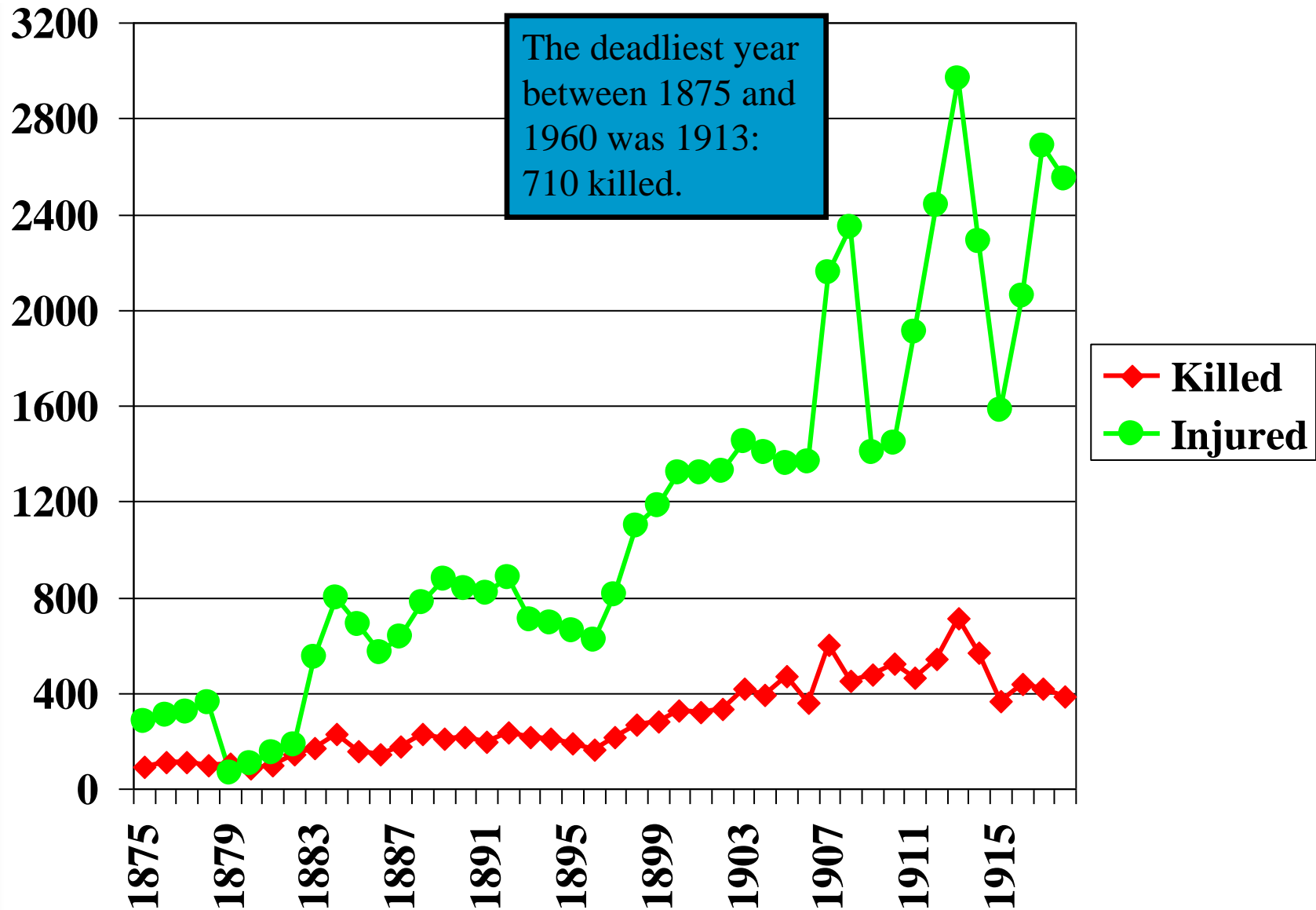
Human Error:

The Belœil train crash (1864)

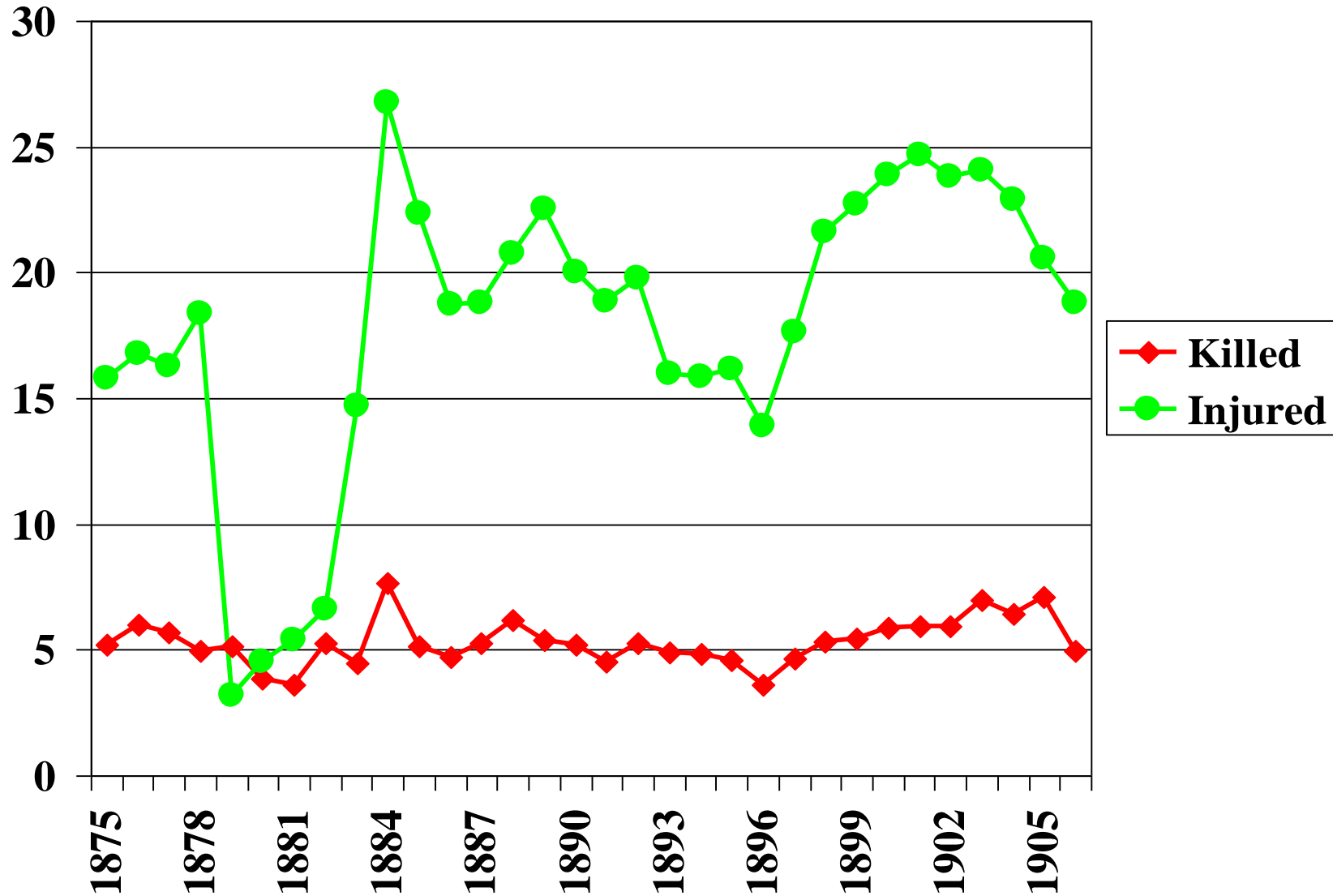
With a toll estimated at nearly 100 dead, it was the single deadliest railway accident in Canadian history.



Canada: The Human Cost (1875-1918)



Canada: Killed and injured per million miles travelled (1875-1906)



Mechanical Failure: The Quebec City bridge collapse (1907)



Before



“BEST AND CHEAPEST”

After

Human Error: The second Quebec City bridge collapse (1916)



The Quebec City Bridge today (1)

(Notice the increased support in the revised design.)



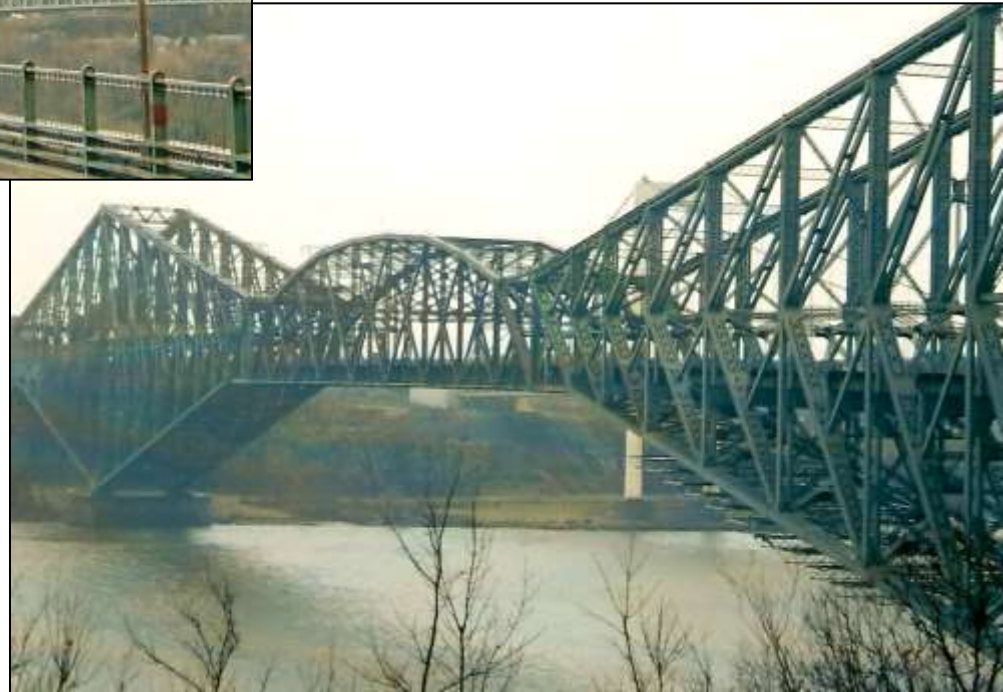
The Quebec City Bridge today (2)



Note the Pierre-Laporte Bridge in the background, ← used for a highway.

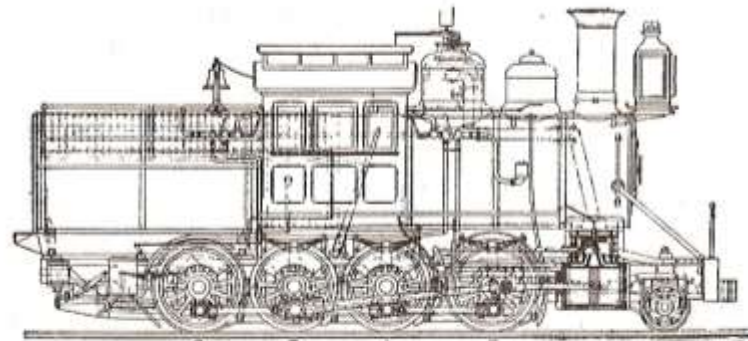
© Jean-Louis Trudel, 2006

The railway bridge now carries cars as well and pedestrians too.



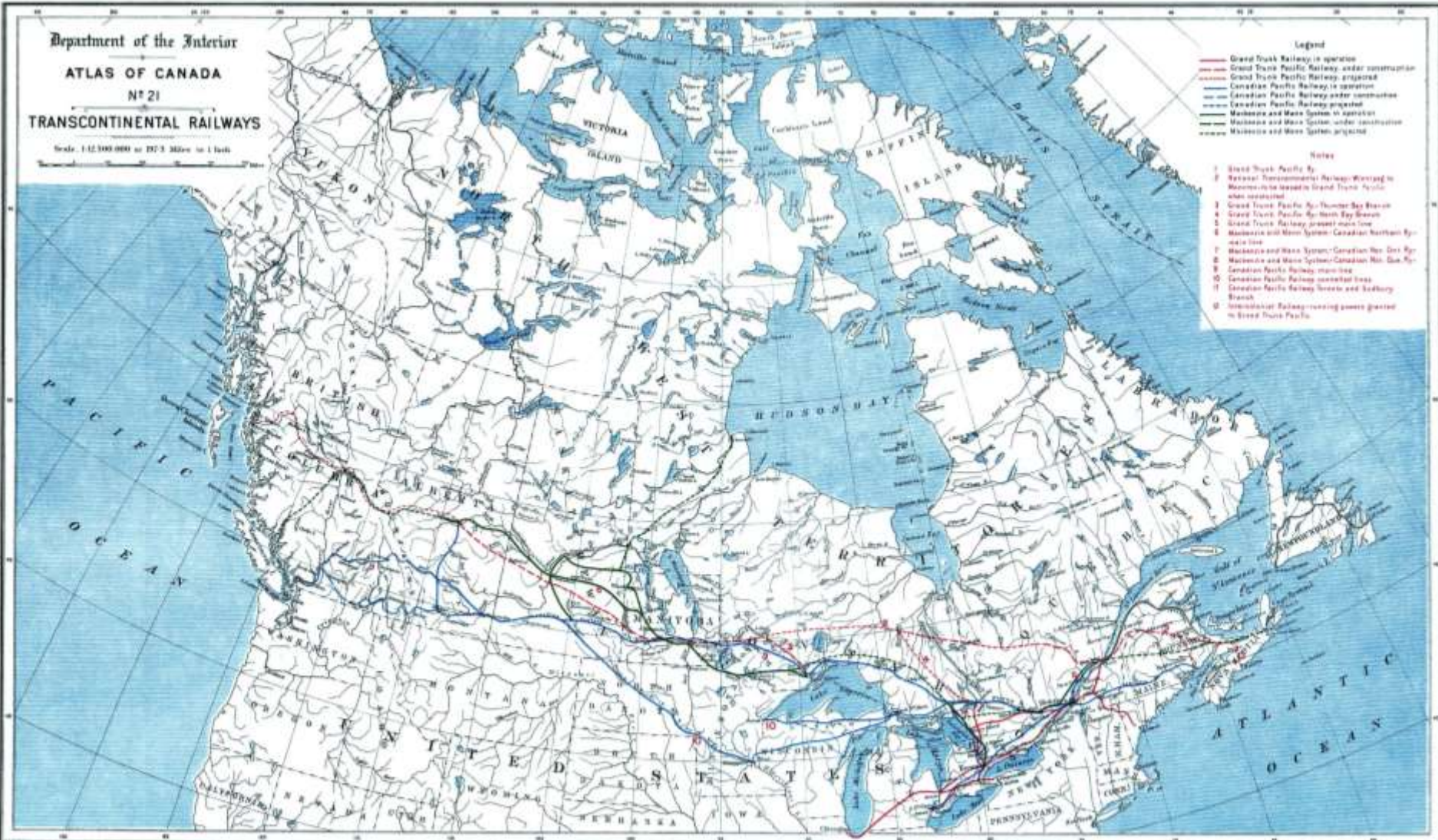
The Era of Consolidation (1)

- After the frenzy of railroad expansion, resulting in many competing lines and stations, both the railway companies and the public realized the advantages of an integrated network
- Larger companies gobbled up smaller ones to create more extensive networks
- In the United States, New York banker J. P. Morgan organised much of this consolidation



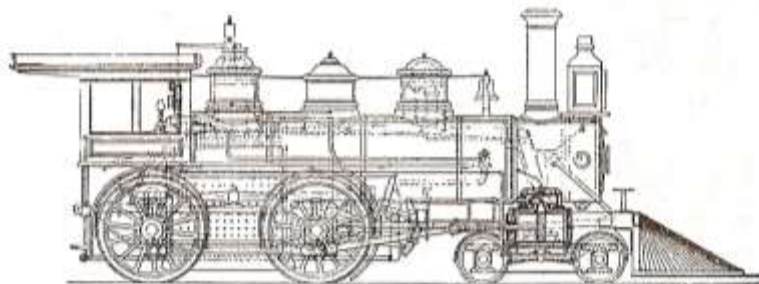
1612. FREIGHT LOCOMOTIVE.—Consolidation type.

Canadian railways (1906)

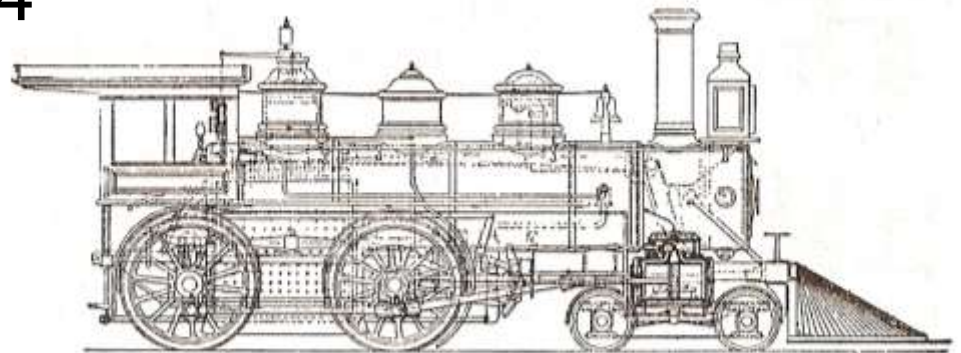


The Era of Consolidation (2)

- In Canada, the Grand Trunk expanded into the West with the Grand Trunk Pacific
- The company had been among the pioneers of refrigeration and continued to use it
- Consolidation happened in Canada after World War I (approx. 1918-1923), in the wake of the pre-war frenzy of construction that only stopped when immigration and British capital were cut off in 1914



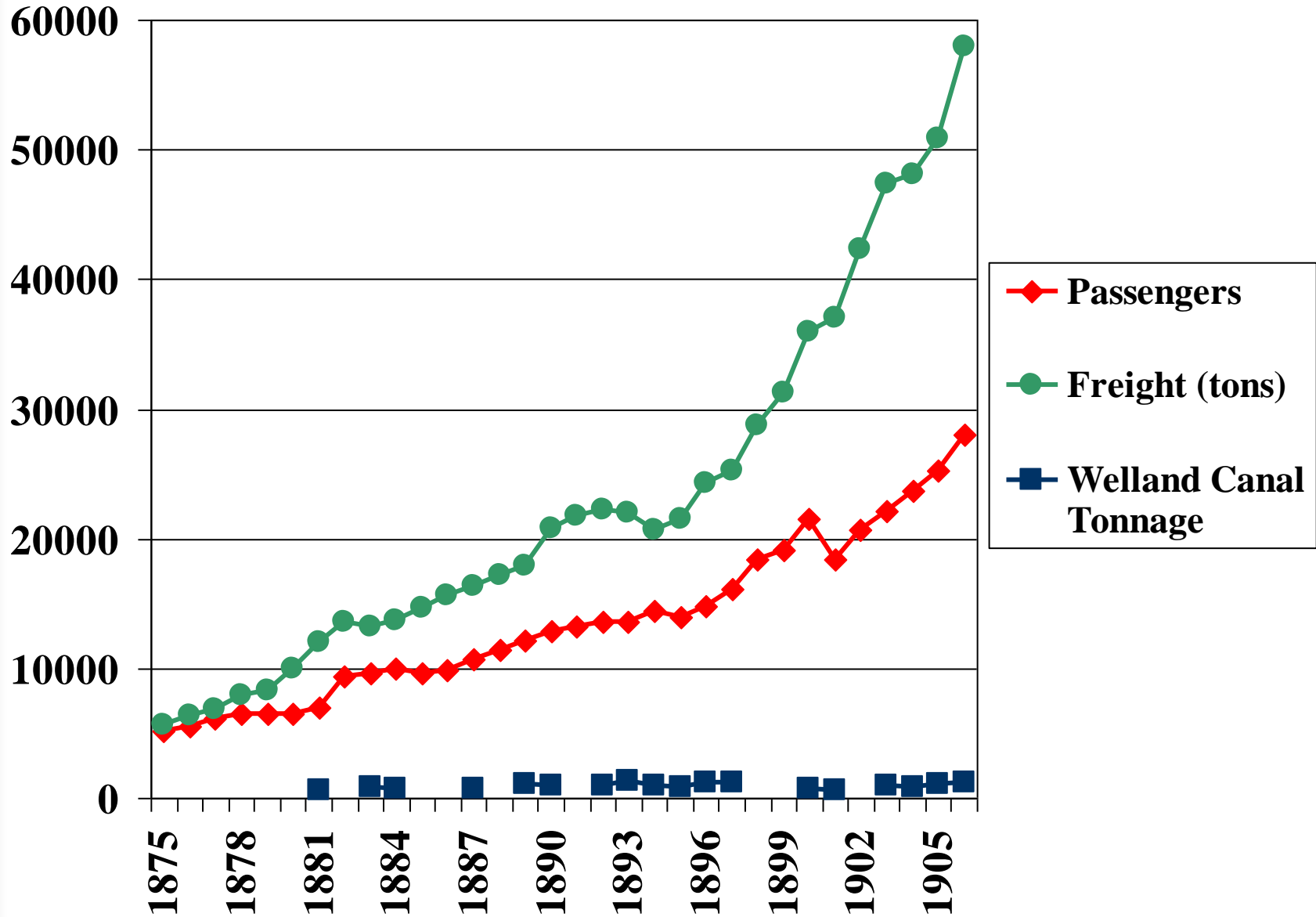
1610. PASSENGER LOCOMOTIVE.—Eight-wheel model.



1610. PASSENGER LOCOMOTIVE.—Eight-wheel model.

Railroad Expansion in Canada

(in thousands of units, 1875-1906)



The Era of Consolidation (3)

- Even mid-sized cities such as Ottawa might be served by several lines, such as the Ottawa, Northern & Western (later absorbed by Canadian Pacific) line that crossed over the Interprovincial or Alexandra Bridge



At the time, local train stations were often modest, such as this well-preserved station from Barrington, Qu ébec.



The Era of Consolidation (4)

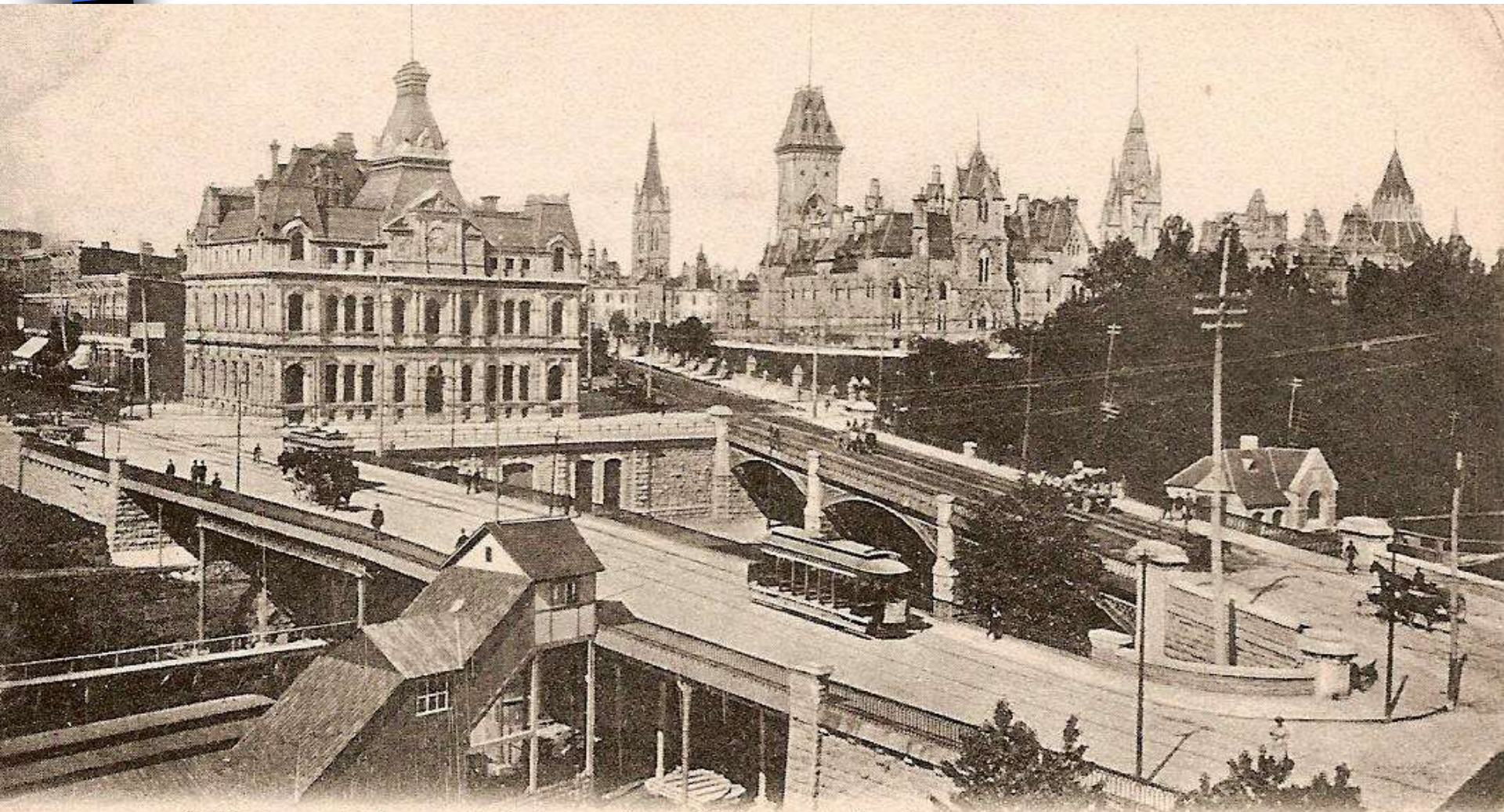
- Stations in large cities became matters of prestige (and advertising) for train companies, but they were expensive
- The answer was the *Union Station*, a train station where the lines of several companies (or all of them) converged, in cities across North America, including Washington, Winnipeg, and Toronto
- In Ottawa, a central Union Station was planned as early in 1891 and finished in 1912; earlier Union Stations had only involved a few companies or stayed on the outskirts



Ottawa's central Union Station

- In 1892, businessman J. R. Booth launched the Ottawa, Arnprior, and Parry Sound line and assembled land (by lease and purchase) intended to bring railways into the heart of the city
- These railway lands now account for: the Queensway from Lees to Bayshore; part of Colonel By Drive; what are now the Westin Hotel, National Defence H.Q., the Congress Centre, and part of the Rideau Centre; part of the Queen Elizabeth Driveway; the northern part of Lebreton Flats; and part of the Alta Vista Postal Terminal
- Booth undertook to build a Union Station, accepting a \$50,000 grant for this from the City of Ottawa
- He sold out to the Grand Trunk in 1904, which started construction on a different design three years later

Ottawa's core (c. 1900)



Dufferin and Sappers' Bridges, Post Office and Parliament Buildings, Ottawa.

Ottawa's Rideau Canal Locks (1903)



Rideau Canal (1910)



Design for a Railroad Terminal in Ottawa (c. 1910)



This design by John W. H. Watts (1850-1917) for a terminal station serving the Ottawa, Arnprior, and Parry Sound railway line is typical of the neo-Gothic style in vogue in both Ottawa and London, England

Peter Winkworth
Collection, Archives Canada

London, England: Western wing of the St. Pancras train station and hotel

Built in 1864-1868, the station comprises a main trainshed (the largest single span structure built until then) and a hotel (opened in 1873) fashioned in the Gothic revival style and formerly known as the Grand Midland.



Ottawa Union Station under construction in 1911



Union Station (1911)



The Chateau Laurier Hotel was an integral part of the Grand Trunk Railway's plans



Entrance of tunnel to the Chateau Laurier from inside the Grand Trunk Railway's Union Station



William James Topley (1845-1930),
Archives Canada