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Canadian Grain Facility Undergoes Major Transformation

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1. The Port of Quebec

Historic and beautiful Quebec City, the capital of Quebec Province which was founded in 1608, is Canada's oldest city. It is strategically located at the intersection of the St. Lawrence and St. Charles Rivers. The junction of these two waterways provided a geographic "natural" for the development of the Port of Quebec, which ranks as one of North America's most important commercial distribution centers. Linking the Atlantic with the heartland, this year-round St. Lawrence Seaway port is accessible to the largest ocean-going vessels. Its critical position, long recognized as the ideal trans-shipment terminal for sea, river and lake-going vessels, was instrumental in Bunge du Canada, Ltee.'s decision to locate here in May of 1967.

2. Bunge du Canada, Ltee.

Bunge du Canada, Ltee., a subsidiary of Bunge Corporation, operates a grain receiving, storage and shipping facility owned by National Harbours Board of Canada, which dominates the Port of Quebec. It is the third largest facility of its kind in the region. The firm's major commodity is wheat, followed by barley and corn. Grain arrives at Bunge du Canada, Ltee. from the Thunder Bay area of Canada and from Duluth, Toledo and Saginaw of the United States. Outgoing grain shipments are discharged from here into the Common Market including Great Britain, Spain and Italy; Russia and other Asian countries.

3. Growth Despite Limitations

During the 1978 grain season, March through December, the Bunge du Canada, Ltee. operation received and unloaded 125 large lakers (with an average capacity of 960,000 bushels each), loaded 110 ocean-going ships and reported a more than fourteen-time turnover of the elevator. Of the 120 million bushels of grain handled, 26 million were distributed for Quebec region domestic use and the remaining 94 million were exported.

In spite of its rapid growth from sixth to second place in the grain handling industry, Bunge du Canada, Ltee. was burdened by antiquated equipment (some as much as 65 years old) plus extremely limited versatility. Both conditions, complicated by the unavailability of replacement parts, combined to prevent operation at peak efficiency.

Existing shiploading gantries operated at a rate of 20,000 bushels/hour or a total of 80,000 bushels/hour for the four loaders. The maximum horizontal reach of the loaders over the ships was 21 ft and maximum vertical clearance was 38 ft above Mean High Water, which necessitated repeated moving and turning of ships during the loading operation. The outdated system proved costly in terms of time expenditure as well as in profitability.

4. R.S. Fling & Partners, Inc. Consulted

It was a trade magazine article detailing an R.S. Fling & Partners, Inc. engineering project for an improved shiploading facility in Baltimore, MD, that led the Canadian firm to investigate the feasibility of applying a similar concept to increasing their production. Following initial meetings and a feasibility study, Bunge du Canada, Ltee. selected the Fling concept out of a group of studies performed by three independent engineering companies.

Of prime concern was whether the existing timber cribbed wharf, constructed in 1916, was stable enough to support new construction loads. Fling's analysis included an underwater inspection plus several subsurface soils borings. In order to determine the wharf's reaction to proposed installation of Franki piles, a trial pile was driven and the wharf monitored for vibration and movement. The studies determined that wharf rebuilding, which would have involved an additional three-plus million dollars, was not necessary.

Engineering then proceeded on an innovative pivoting and shuttling shiploader, comprised of a belt conveyor supported by plate girders cantilevering over ships (Fig. 1). The project

Fig. 2: View inside the shipping gallery

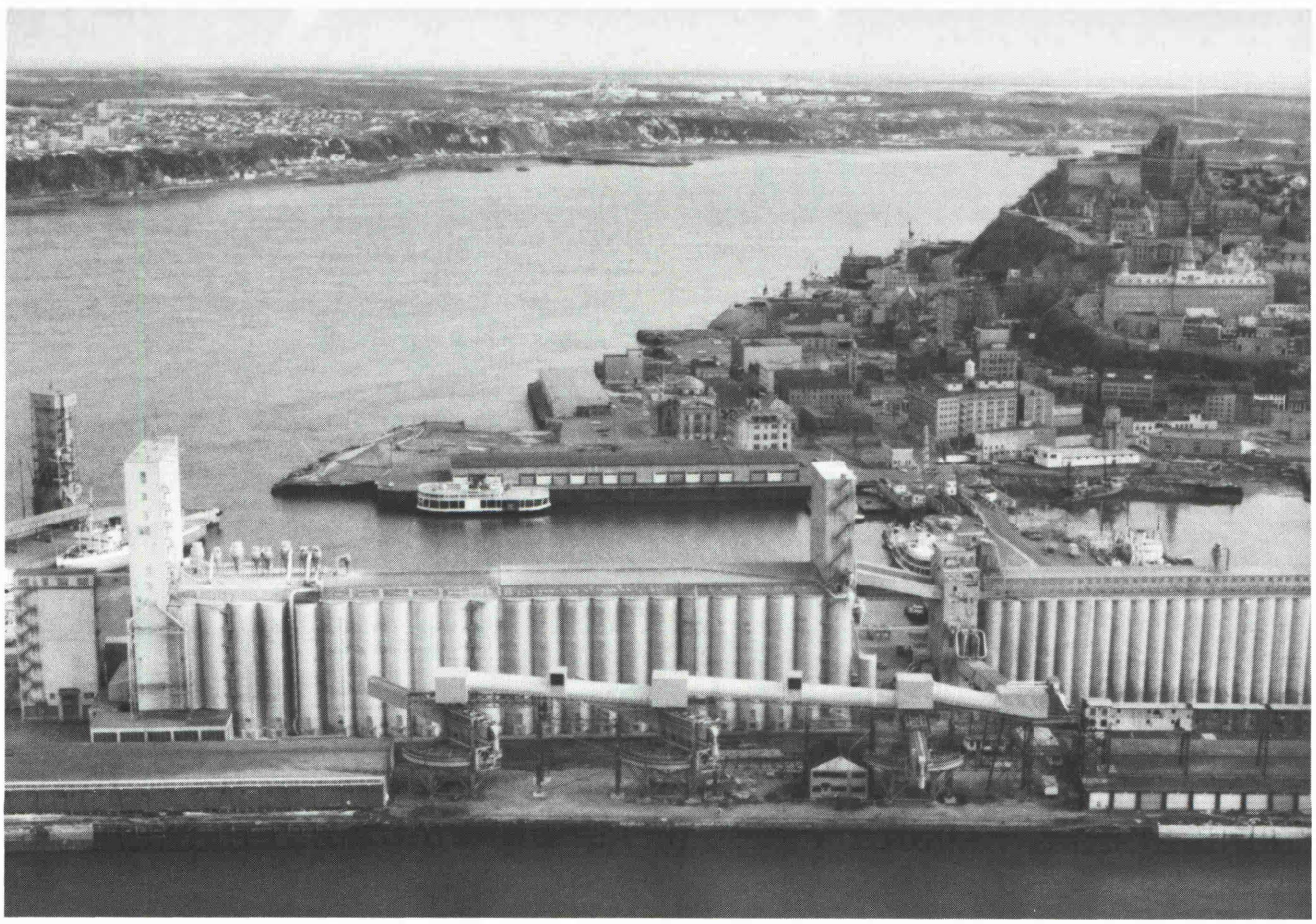
Fig. 1: Fling-designed shiploader allows efficient and economical loading of ocean-going vessels

involved the rebuilding and upgrading of four bucket elevators, four scale systems, associated spouting, and dust control systems. The plan also incorporated the construction of four new shipping belt conveyors, three new shiploaders and a new gallery (Fig. 2).

5. Practical Design Principles

The newly constructed gallery houses two new control cabins, each of which is capable of controlling two of the three shiploaders. All remaining operations are performed from a main control panel located in a new waterfront control building. This enables operators at the main control panel to attend to binning, weighing, and other functions at the headhouse while monitoring all shiploading procedures. Electrical control is achieved by use of a mini-computer (programmable controller) which has the capability of being expanded at any future time. Sensors monitor critical items such as bearing temperature, plug switches, motion detectors and limit switches. Visual and audible alarms are provided at the main control panel and shiploader control panels in the event of malfunction (Fig. 3).

Fig. 3: Aerial view of Bunge du Canada, Ltee. facility, Quebec City



The Fling shiploaders are comprised of two 13′—0″ deep plate girders which cantilever 133 ft 6 inches from a horizontally curved radial beam. Pivoting of the plate girders is accomplished by an 8′—0″ diameter Rotek bearing placed 40′—0″ behind the radial beam. Length from pivot point to maximum extension is 173 ft 6 inches. Each new shiploading boom extends to a horizontal reach of 105 ft over the ship. To accommodate the largest of ships, each provides a vertical clearance of 50 ft above Mean High Water. The loading spout, which at full extension is 109 ft in length, retracts to 17 ft. The system permits loading ships with beams of 140 ft and eliminates the need to move and turn the vessels. A unique, automatic tilt switch at the bottom of the telescoping spout reduces the amount of dust generated by the loading process by keeping the spout within very close proximity of grain in the ship. The design included separate dust control systems for all newly constructed work and dust supressors at the end of the retracting spouts to capture fugitive dust and transmit it to dust collectors positioned on the galleries.

Electrical improvements were made for power distribution, control and lighting in the galleries and shiploaders, as well as for heating and lighting in the new control building and cabins.

6. Unique Design Considerations

Among the special considerations R.S. Fling & Partners, Inc. engineers faced in this extensive project were the requirements that all specifications and drawings be prepared in French, and that all dimensions and equipment information be expressed in metric units only. Drawings required meeting the standards of the National Building Code of Canada, Canadian Institute of Steel Construction (CISC), plus those of the Canadian Standards Association (CSA).

7. Contractors Complete Project

Following the design specifications formulated by R.S. Fling & Partners, Inc., the Bunge du Canada, Ltee. project was completed under the general contractor, Construction Omega of Montreal, P.Q. All required steel fabrication, including galleries, shiploader towers, plate girders and belt conveyor support steel, was performed by Dominion Bridge Company, Ltee. of Montreal, P.Q. Electrical contracting was executed by Cribtec Ltee. of Quebec, P.Q. All equipment and materials required for the project were Canadian manufactured with the exception of the three main shiploader bearings.

8. Efficiency and Versatility of Project Realized

Following a nine month period of construction, Bunge du Canada, Ltee. became fully operational on April 19, 1979. The totally mechanized, low maintenance shiploading system now requires only two employees to conduct the loading process. As an added bonus, the shiploading rate has been increased by 25 %, the new method being capable of a 100,000 bushels/hour output.

Because the problems of obsolete equipment and limited versatility were resolved through creative engineering and construction techniques, Bunge du Canada, Ltee. now operates at peak efficiency and profitability.