Future Development of Harbor and Rail Facilities for Seattle

By G. F. Nicholson, Chief Engineer, Port of Seattle

SEVERAL general principles have been formulated for the development of a first class seaport, such as deep and ample channels to the sea, and accessibility to an extensive agricultural and industrial territory. Equally important is the proper location of the harbor lines, the establishment of public waterways, a wide waterfront marginal street paralleling the waterfront and a terminal railway. These principles should be of first consideration, as they form the foundation upon which is developed an efficient terminal and industrial system.

A port terminal, to the average person, means wharves and docks. As a matter of fact, a wharf or pier is more or less a detail in a general terminal scheme. The complete port terminal system is a combination of wharves, transit sheds, warehouses, railway tracks, marginal streets, and all the facilities that have to do with the transfer of commodities between land and water carriers. Each one of the facilities mentioned is a detail unit which, to be fully efficient, must be co-ordinated with other units so as to make of the whole a well-balanced terminal system. The articulation of the waterfront with railroads, warehouses, and industrial sites, is of particular importance.

The modern port terminal should comprise not merely a group of well designed and equipped wharves, but it should have good waterside warehouse provisions, as close to the transit shed as possible, to decrease the distance of trucking the cargo for storage. The space between the transit shed and warehouse should be taken up with only sufficient trackage to accommodate both facilities. The most important requirement of this layout, and which should be emphasized, is that the long dimension of the warehouse should parallel the long dimension of the transit shed. These warehouses will take care of the overflow cargo held pending the arrival of ships, or be used for storage on account of delayed delivery through the tributary country. In this group of warehouses should be found cold storage facilities in order to retain the perishable commodities until ready for market. Sufficient streets of access to and from the piers should be constructed with good grades for vehicular traffic in distributing freight locally, and also land areas provided for the future location of industrial establishments nearby the warehouse and terminals, from the piers of which they could expect to import their raw materials, and in turn export their surplus output of manufactured goods at a minimum rehandling cost. It is a well known fact that a general terminal plan without adequate railroad facilities for receiving and handling freight is useless. The intimate physical relation between the railroads and the waterfront, and its facilities for the prompt interchange of freight between the piers and all the railroads entering the city practically means a terminal railway or belt line.

Economical freight handling equipment is one of the most essential requirements of the modern port, and the necessity for more efficient methods of handling freight at marine terminals is increasing daily, and is due, in a large measure, to the passing of cheap labor and the increasing proportion of time lost in terminals, as compared with the time consumed between terminals. To offset rising costs, not only the cost of handling must be reduced, but more freight must be handled in a given space than ever before in order to reduce the liability of congestion resulting from the increased amount to be handled. As the terminal acts as a sort of elastic reservoir between carriers, its area must be utilized to as large an extent as possible in order to reduce the terminal charges by reducing the overhead, and to reduce the time element so as to keep the ratio of time during which the carrier is at the terminal to the time consumed between terminals as low as possible, thus increasing the returns on the carrier itself.

Comprehensive Development of the Seattle Harbor

Nature has endowed Seattle with a deep harbor and channels, and with the necessary dredging from time to time will be able to provide more waterfront as she needs it. Five transcontinental railroad lines and its branches connect the harbor with rich agricultural lands and busy industrial centers. The harbor lines, along the waterfront, with a few exceptions, have been well located, and numerous public waterways and street ends have been established, giving the public access from the waterside; also a wide marginal street parallels the waterfront. However, the two features that are most notably lacking are, first, a comprehensive plan of development of adequate terminal facilities, as is

VIAMAL UNIVAT2 Digitized by Google

seen from the few modern wharves and warehouses scattered on the main waterfront; second, a terminal railway operated under one management.

Although the Port Commission has fought hard to remedy these evils, the first step taken by the commercial organizations of the city was the appointing of a Terminal Survey Commission by the Seattle Chamber of Commerce. The Honorable Richard A. Ballinger is chairman of this Commission and a very thorough and complete report has been submitted. At the outset the Port Commission were called upon for suggestions as to the most efficient development for the future needs of the Seattle harbor.

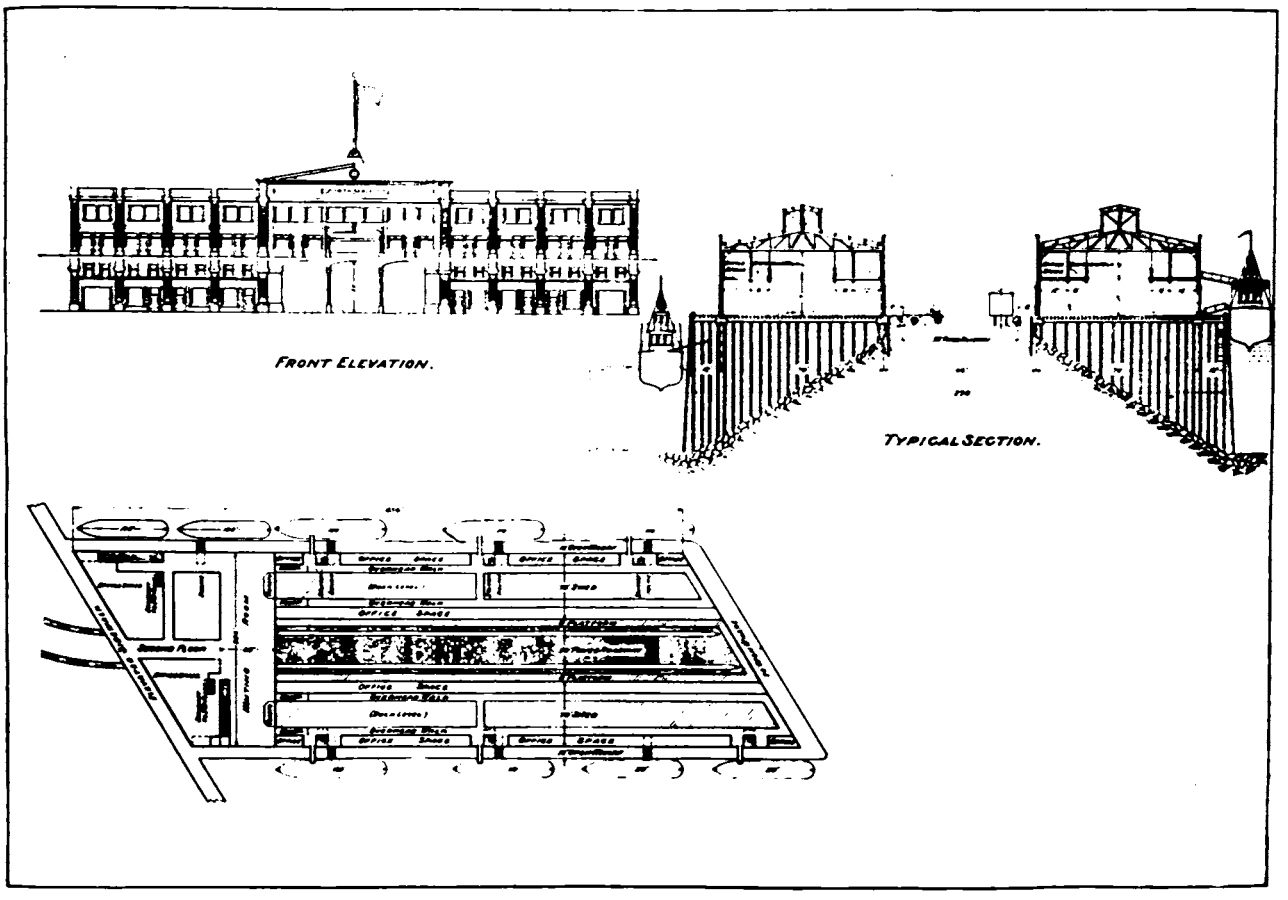
In order to obtain the maximum of terminal efficiency a comprehensive plan should be prepared, approved, and followed, and the carrying out of such a plan in its fundamentals would insure the various sections of the waterfront to be utilized to the best advantage for the purpose to which they are best suited. In considering the future development of any port, two fundamental facts can be learned with the experience of port development in the past.

1. The lack of planning ahead has nearly always proven to be very detrimental to the growth of port cities and to the well-being, and especially to the pocketbooks, of the city inhabitants.

2. Since the needs and ideals of modern port development differs fundamentally from the ideals of past centuries, even the best plans made for great cities in the past can be adapted to the growth of modern cities only after very material changes to fit local conditions.

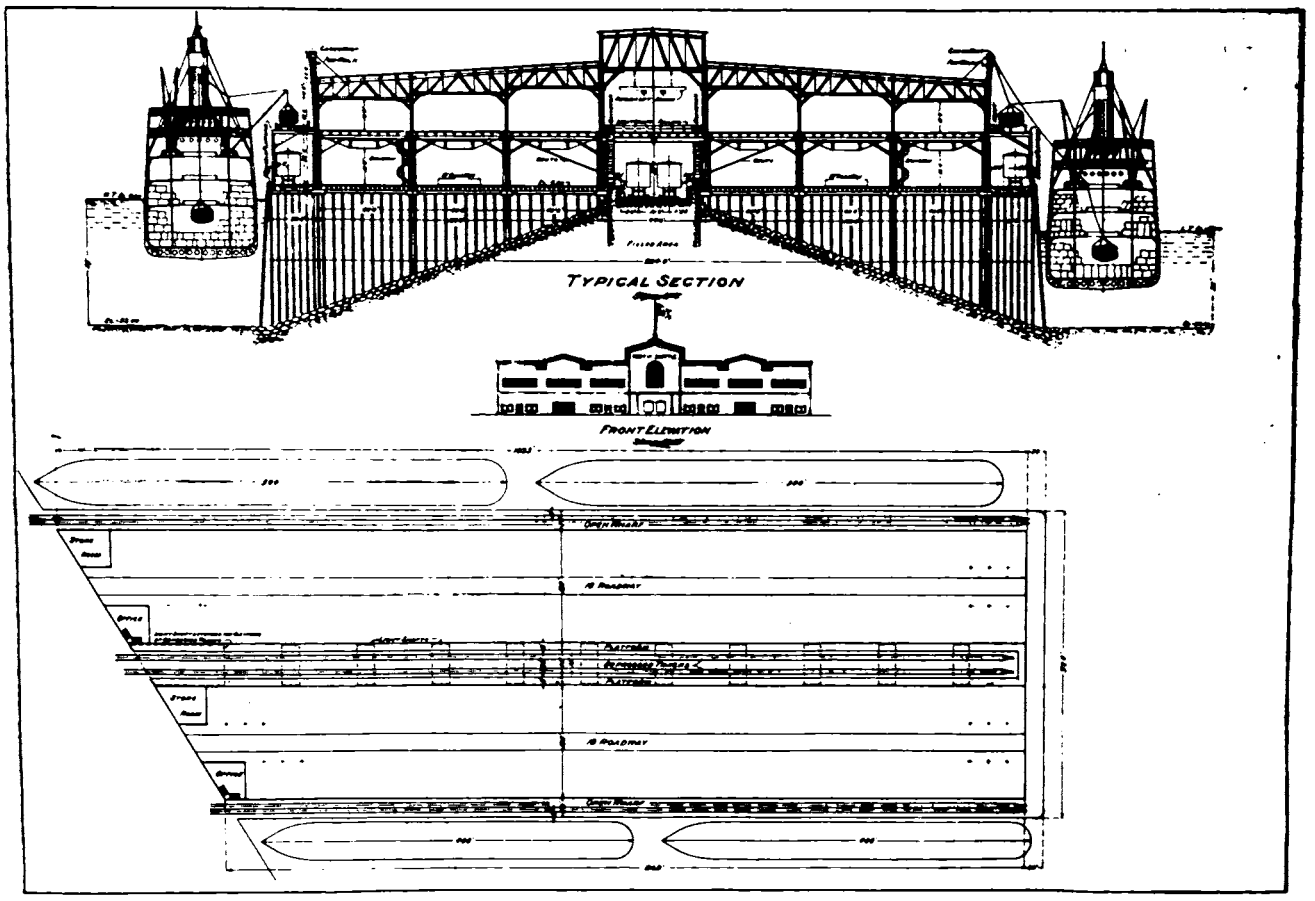
Improvements along certain definite lines is most desirable. Where large amounts of given kinds of freight are handled, the wharves and docks can be profitably specialized. Overseas commerce should be handled in the outlying districts, namely, the Smith's Cove territory and the South City district on either side of the East and West Waterways, including Harbor Island, thus relieving the central waterfront from congestion.

Between Yesler Way and Broad Street, this section of the central waterfront should be reserved for what we might term local freight and passenger traffic, such as coastwise and Alaskan trade, together with the small local boats plying on the Sound. Through freight should not be handled along the central waterfront, as is the case now. Since a large percentage of the local freight that comes into the harbor is transferred in motor trucks or horse-drawn vehicles, the location of these local docks should be near the business section. Railroad facilities should be provided for convenience, however, to take care of the small percentage that goes out by car, but the fact that this district is reserved for the local freight docks would relieve congestion of railroad traffic along the marginal way. A public terminal station is also suggested at the foot of Union Street to accommodate the ferry and Sound boat passenger and freight traffic.



Proposed plan for coastwise and local passenger and freight traffic wharf.

Digitized by Google



Proposed wharf and transit shed plan adapted to overseas traffic.

The district between Broad Street and the Smith's Cove Waterway should be reserved for piers to take care of the overseas business and through freight, and the warehouses should be excluded. The addition of warehouses on this section of the waterfront would only add to congestion of the marginal way.

South of Yesler Way, as far as Spokane Street, this east shore of the East Waterway should be reserved for piers, backed by six-story warehouses, and the slip system should have preference over the quay wharf plan. There seems to be an idea that the main waterfront, especially south of Yesler Way, should be developed along the quay wharf plan. It would be a serious mistake to adopt the quay system on any part of the mainland waterfront between Spokane Street and Smith's Cove.

Notwithstanding the general opinion, to the contrary, Seattle's waterfront will be limited in a few years for overseas commerce. It is only by including Lake Washington, Lake Union and narrow strips of shore line under the many bluffs, that we approach the extent of a commercial waterfront of many large cities.

The strip of waterfront along the east side which has a large warehouse and industrial area to the rear of it, should be made the most use of. Pier development gives four times the berthage on this high priced frontage that quay wharves would. Besides the increased berthage and transit shed space, better access can be had to the different terminals by trucks and railroad traffic. The depressed tracks along the quay wharf would interfere materially with team traffic or motor trucks operating between the main thoroughfare and the wharves and warehouses. In other words, the quay system requires street ends for railway and team access. Street ends tend to be wasted, while the slip street end is more valuable than the land street end. The quay system also necessitates berthing ships in a channel under conditions effected by tidal currents, and in the above case also river currents; then too, lighters alongside ships would tend to congest the fair way. No modern engineer advocates the quay system where it is possible to develop piers. A survey of the plans of the great river ports of the world show that in later years dock basins have been dredged alongside the river to expand the port's facilities, and in these dock basins the pier system has been uniformly adopted; also along the riverfronts slips have been dredged and the pier system adopted. The advantages of the slip system are so evident that there should be no question about the adoption of this scheme along the main east front of the East Waterway.

The quay wharf system should be adopted on the east and west side of Harbor Island; also on the west side of the West Waterway on the main land. The pier system should prevail on the north end of Harbor Island and the main land to the west of

Digitized by Google

West Waterway. Harbor Island affords a fine opportunity for industrial development to the rear of the quay wharves and warehouses alongside the waterways. Waterside warehouses should be one of the first considerations in future development planning, and we should profit by the mistake made by other ports in the adoption of the head house plan, where freight has to be trucked the full length of the transit shed to reach the warehouse.

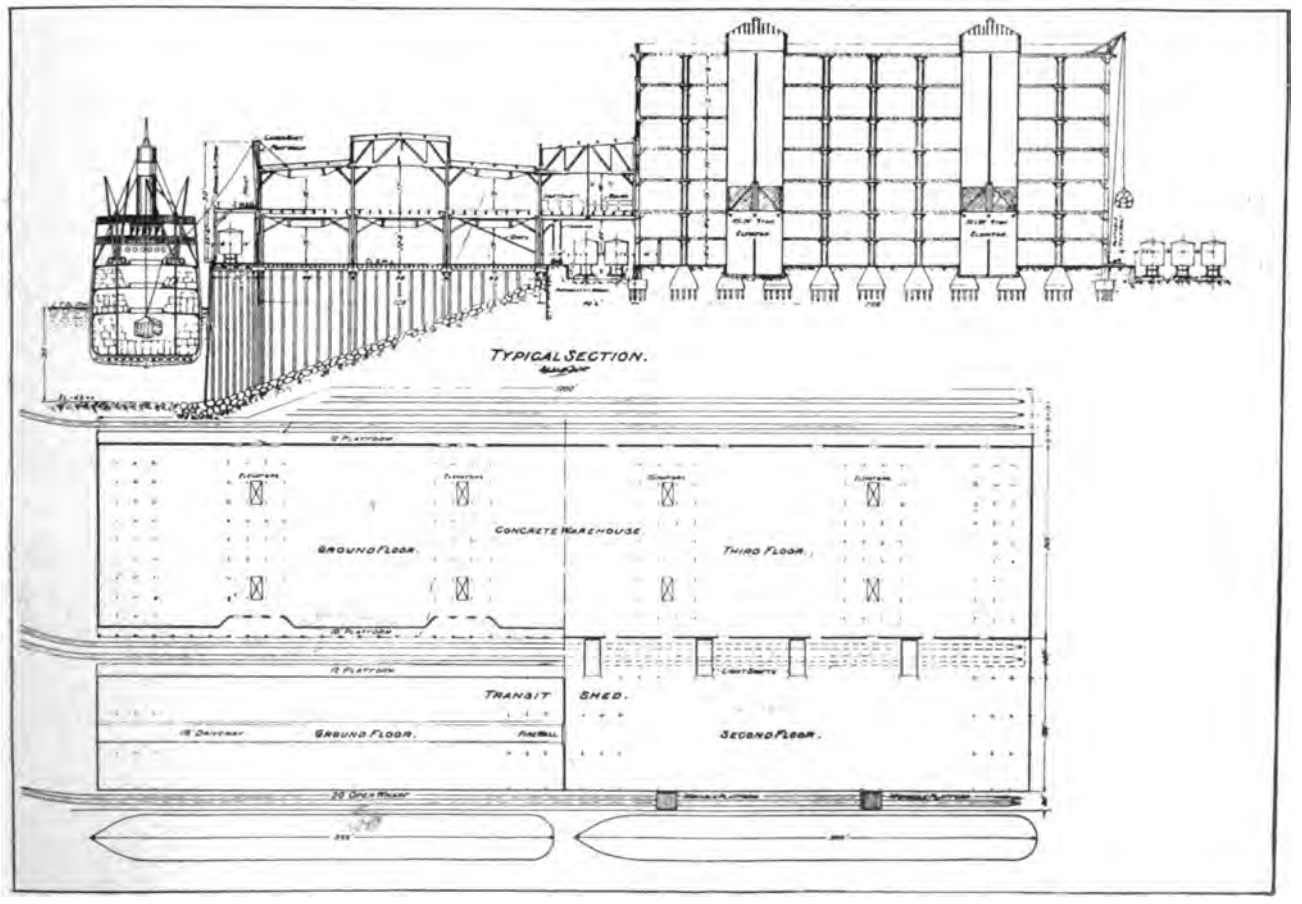
The trackage on Railroad Avenue, the marginal street back of the terminal facilities, should be rearranged and some eliminated, in order to obtain a through street from end to end, upon which the vehicular traffic will not be obstructed by switching. That property east of the east line of the marginal way can be utilized for warehouse and industrial purposes as far as the street line.

A coaling station should also be provided in the general scheme, preferably in the south end of the bay, in order to relieve congestion along the main waterfront. The point where the mainland west of the West Waterway forms an abrupt angle with the West Seattle district would be a good location, since it is well protected by Duwamish head from the sweep of winds across the bay, and the track facilities in connection with coaling station would run on the west side of the Duwamish waterway and cross well to the south in order to avoid any congestion on the east side of the Duwamish. The latter should be the primary reason for the location of coal dock as suggested. This pier should accommodate four vessels and several barges at the same time, and be equipped with the latest mechanical devices to reduce the cost of handling to a minimum.

Street ends are not taken into consideration in the planning of the future development, because there is no connection between the street end and the terminal facilities beyond the bulkhead.

Modern Piers and Wharves

The development of modern marine transportation has necessitated the corresponding development of marine terminals. This has meant piers and pier sheds of greatly increased size, heavier construction, fire resisting qualities, and equipped with extensive freight handling equipment. Since there is a tendency for ships to increase their freight carrying capacity by adding to their length and beam, the effect is to require wider piers and sheds of greater capacity than have been constructed in the past. Although the Port Commission sheds are even wider than the majority of the privately owned piers along the waterfront, we consider that the 90 or 100 feet is not sufficient width, and that 120 feet would be the proper width for such a shed. Since an 8800-ton vessel requires approximately 60,000 square feet of floor space, a 120-foot shed would accommodate such a vessel to good advantage. A shed wider than this would cause an increase in the cost of handling, due to the fact



Proposed plan for quay wharf connected up with warehouse facilities.

Digitized by Google

The Stacy Street concrete warehouse, a fine structure fitted with handling machinery.

that cargo would have to be trucked a greater distance than necessary. Assuming that the length and physical construction of the quay wharf is fixed by the length of the vessel it is to berth, a pier should have double its capacity, since a pier may be considered as two quays placed back to back, and can take care of double the number of ships. Heretofore, it has been the custom to construct a pier wharf the same size as a quay wharf, when, as has been pointed out, it should be twice the size.

Two-Story Transit Sheds

The Port Commission in the construction of its latest transit sheds has adopted the two-story plan, and this type of construction should most certainly be carried out in the future. As valuable a piece of waterfront as the wharf and transit shed is constructed upon, it should be recognized that this area should be put to fullest use possible. The additional cost for providing heavier foundations to carry a second floor is comparatively small compared with the additional space gained. If a mechanical freight handling equipment would permit a third floor to be as adaptable for the transfer and short time storage of transient freight, then it would be advisable to make such an addition. At present the Port Commission is adding mechanical equipment in order to place the second floor on a par with the first floor, and, in fact, with the aid of gravity wooden or steel chutes, loading out can be done cheaper from the second floor to car or ship than from the first floor. The two rows of posts necessary to support the second floor are not an objectionable feature at all. They do not interfere with trucking, and the electric tractors with their fourwheel drive and steer make the sharp turns with ease. A very grave mistake has been made in some of the large ports, especially those with a limited waterfront, in the adoption of the one-story shed idea. In the past year a noted Eastern terminal engineer designed and constructed a terminal with a high ceiling one-story transit shed, 60 feet in width, in order to accommodate an overhead mechanical freight handling device, thus decreasing, instead of increasing, the capacity of shed room to meet the demands of present day modern freighters. From experience, we should realize that it is only possible to load a very small percentage of a ship's cargo direct from ship to car, even with the best of track facilities. The cargo has to be sorted, and there is a limit to trackage alongside shed, so that adequate space is needed to take care of this transit freight.

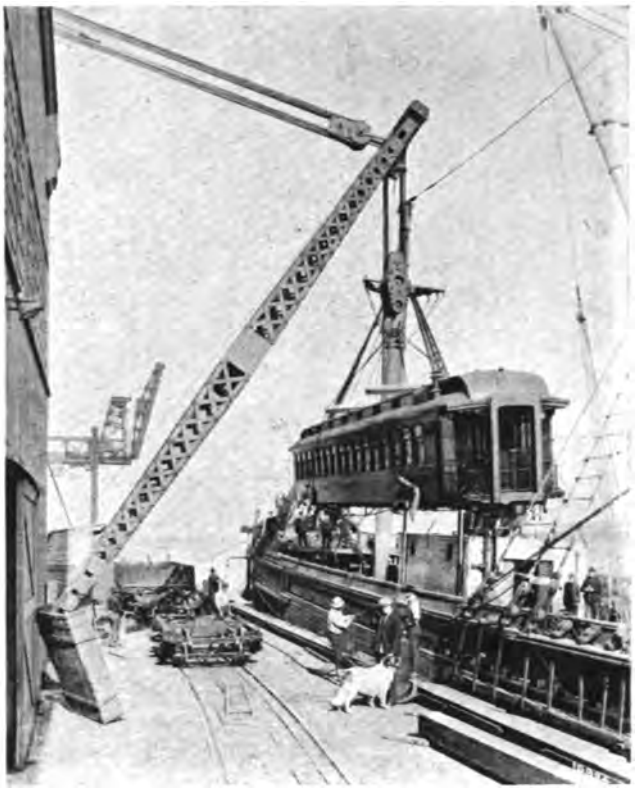
Why Timber Docks and Concrete Warehouses are Preferable

The trend of modern port construction is to the wooden type of dock and concrete warehouse. Before a port terminal is improved, there is always an agitation for concrete docks, especially when funds have been voted for improvements by a municipality, the public generally making a strong plea, and many engineers contending that it should be used, thereby making a more substantial and permanent structure. But even so, wooden docks are still being constructed, and even those ports which have built the expensive concrete type, have in many cases changed their construction to wood, recognizing the value of the latter. Port engineers

Bell Street terminal, showing cargo shed and fireproof warehouse in foreground.

Digitized by Google

have been sent on extensive trips to ascertain the best type of construction, and generally come back strongly convinced that wooden docks are the best, and recommend such. In Seattle, a thorough investigation was made before building the Port Commission terminals, and timber wharves on creosoted pile foundations, carrying freight sheds of timber frame with board walls covered with corrugated iron, and wooden roofs covered with tar and gravel or other fire retarding roofing, were decided upon. A good argument in favor of the cheaper creosoted pile and timber construction is that in case of fire the loss to such a dock would not be so great, and there would be some salvage, while in a concrete structure there would be scarcely any, and the cost of wrecking the latter would be expensive. There is no doubt that there are advantages in the concrete structure, which we should all recognize. The insurance rate on a concrete structure, is, of course, lower, and I am informed by the State Insurance Rating Bureau it is approximately one-half of the rate on a timber wharf. The maintenance cost of a concrete structure is also lower than of a timber building, and in the Middle West and Eastern territory, they are compelled to pay more for lumber, probably three times as much in some inland cities, so that the difference in cost between the timber and concrete structure is much less. Again, in some tropical ports, such as Honolulu, the marine borer is much more prevalent than here, and even creosoted piles are very short lived. However, the advantages of the timber wharf in Seattle should overrule the advantages of the more permanent structure. Wharves and transit sheds, as have been built by the Port Commission, will have a life of probably twenty-five or thirty years, which is about the economically useful life of such a structure, while in that length of time a concrete dock may become antiquated, since conditions of water transportation and mechanical freight handling equipment for the quick dispatch of cargo are constantly changing. Then again, at some time in the future, when labor costs rise to such a level that the shipper will make a radical change from the present day methods, ships will be loaded in a systematic manner,—in fact, loaded the same way as they are unloaded,—so that instead of several markings in one sling, there will be only one marking. A one-package continuous conveyor may be employed for cargoes of the same commodity, or even the handling of some mixed freight. There are new mechanical appliances being experimented with every day in order to decrease the handling cost. In time, it may be only five years, some very efficient handling device may be perfected to take care of mixed freight. It may be that this new handling device could not be installed in a concrete structure, making same obsolete, whereas in the timber structure necessary changes might be made to take care of same, or on account of the saving in labor, it might even pay to dismantle the structure and erect one suitable to the mechanical handling device. Too much emphasis cannot be put on this argument for timber docks. There are several European concrete docks which are not now in use on account of them not being adaptable for improved mechanical handling equipment. The creosoted foundation piles of the timber dock can always be replaced or changed at any time, as well as any other part of the dock, at a nominal expense. In the Northwest, on the Pacific Coast, a timber structure will cost approximately one-third that of a concrete structure. This being the case, the same amount of money can be made to produce more terminal facilities to invite new business than could be provided if the more expensive type of construction were adopted. In our case in Seattle, the Port



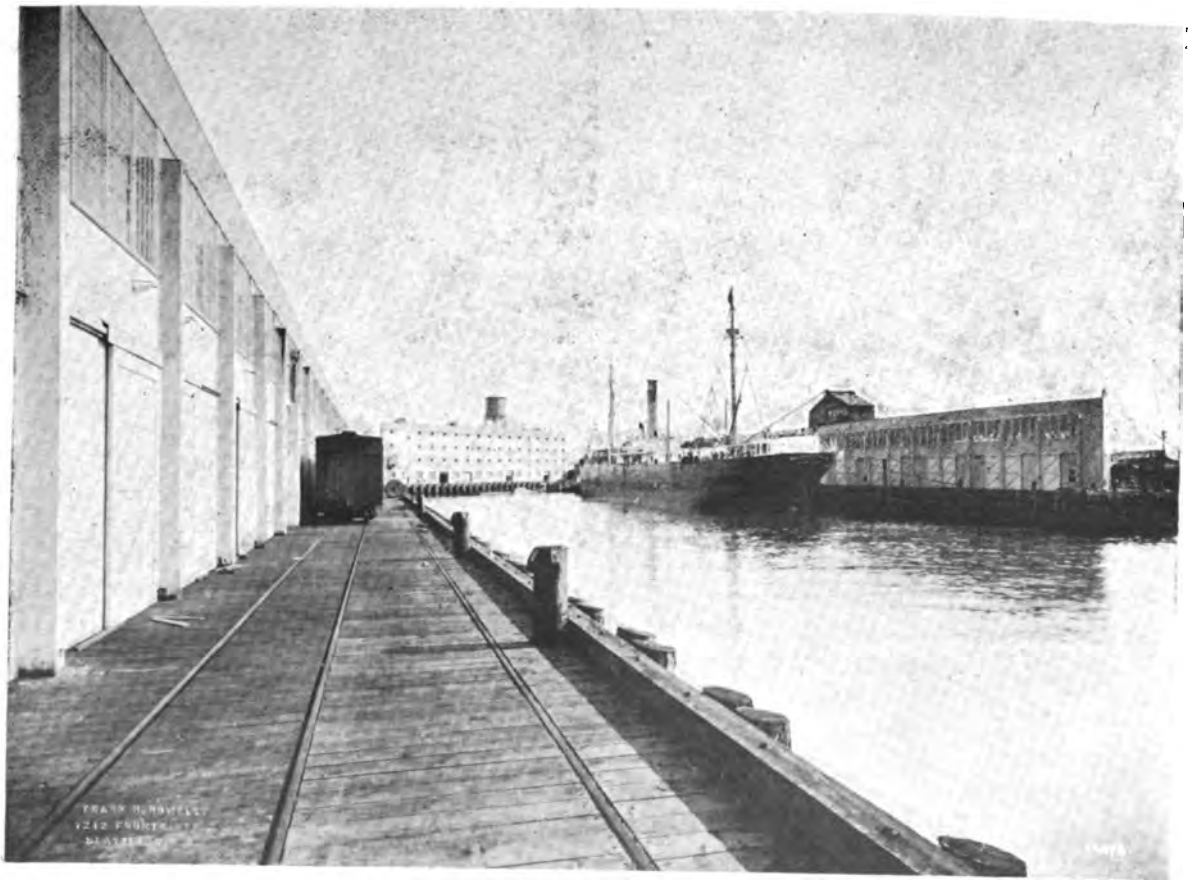
Smith's Cove terminal. The 100-ton shear leg derrick loading passenger coaches for Federal Railway in Alaska.

Commission instead of having six terminals would have two, if concrete had been decided upon. It has not been demonstrated that concrete made of Portland cement is permanent in salt water. If it does not prove to be permanent, then the added cost of concrete is not in any way justified, and if it does prove permanent, then the physical life of the wharf would exceed its useful life, which is not economical.

No serious criticism has or can be well made of the use of the Port Commission reinforced concrete, fire proof warehouse construction, in view of the resulting longer life, decreased maintenance repairs, and fire insurance over any type of timber construction. On account of being relieved of the difficulties of foundation construction that we have in the

Digitized by Google

The Hanford Street terminal, showing cargo shed and the 1,000,000-bushel grain elevator.



The water side of the Stacy Street terminal, showing cargo sheds with warehouse in the background.

Digitized by Google

The Smith Cove terminals. Showing handling equipment consisting of a five-ton gantry crane, a fifteen-ton stiff leg derrick and two locomotive cranes.

5,000,000 gallons of soya bean oil, worth approximately $6,000,000, piled on Smith Cove terminal's open wharf ready for bulking.

Digitized by Google

A general view of Seattle's central waterfront, showing the port's typical skyline.

concrete wharf, such as salt water, tidal changes, riprapping, etc., the difference in cost between concrete and timber construction for warehouses is not sufficient to warrant the adoption of timber warehouses. Again the warehouse is not subject to the radical change on account of improved mechanical freight handling devices as is the transit shed.

Terminal Railway

In the first place, the term "Terminal Railway" should be adopted and used instead of "Belt Line Railway", which has been used in this connection heretofore. The term "belt line railway" is misleading, since it is doubtful that a terminal proposition of this kind in Seattle would encircle the city. A terminal railway should consist of all the track facilities on the Seattle side of the classification yards, so that when cars are delivered to the above yards they are picked up by the terminal railway company and switched to terminal facilities and industrial plants.

That the terminal tracks on the Seattle side of the classification yards should be controlled and operated by a single management cannot be questioned. Also that same could be operated more efficiently and more economically cannot be questioned. That such articulation of the waterfront with railroads, steamships, warehouses and factory sites would be advantageous to commerce there is no doubt, advantageous to the terminal and industrial facilities without the least doubt, and advantageous to the railways there is also no doubt. At New Orleans the municipality, through a belt line railway commission, operates a 58-mile public belt line along the entire riverfront, with a large number of industrial sites, wharf and railroad switch connections, and provides almost complete co-ordination between the wharves, railroads and industrial establishments, and ultimately will encircle the entire city. Although the Southern railroads fought the establishment of this railroad, the leading officials of these same railroads today consider it a step in the right direction, and agree that it has been beneficial and satisfactory in regard to their operations and traffic considerations. The Seattle terminal railway would co-ordinate the public and private harbor improvements, railroads and steamship lines in a thorough and efficient manner, by simplifying and decreasing the operation cost and facilitating the quick delivery of cars. The terminal railway would also equalize competitors on all waterfront and industrial sections of the city by establishing a new form of flat switching rate, abolishing the zone system of exorbitant charges, making impossible the duplication of switching bills. It would also invite new railroad and steamship lines to Seattle on a basis of absolute equality with the existing companies, and would be advantageous to the individual and the Seattle industries in assisting them in competition with other cities.

At the present time there is very little car drayage, for example, car movement from one industry or wharf to another industry or wharf, on account of the car shortage, especially since the railroads have been taken over by the Government. In fact, there has never been very much, because the railroads are not interested in this business—only in the long haul. However, after the war, in normal times, the terminal railway would increase this car drayage and build up the outlying industrial sections and put them in communication with the central portion of the city by cheap transportation, which would do more to build up Seattle than any one thing.

It is extremely important that all track and terminal facilities be operated under one management in order to eliminate a duplication of trackage and to develop industrial waterfront property.

The yards of the transcontinental railroads entering Seattle are not well laid out from a terminal point of view, and the various tracks of the different roads cross one another entering the business section of the city. In planning for a terminal railroad under one management we should have one well located classification yard instead of four, and also parallel all trackage and eliminate the conflicting crossings that we now have. Another evil of the present system that prevailed before the Federal Government took over the railroads was the duplication of operation. Almost any day along Whatcom Avenue in the East Waterway district one could see the four railroads each operating a switch engine, and serving the East Waterway properties with the use of the Milwaukee passing track, which is now a common user, whereas, a single locomo-

Digitized by Google

A general view of the Hanford Street terminal from the water side.

tive operated efficiently by one organization could have taken care of all the switching without any trouble whatever.

The late Mr. Virgil G. Bogue, former New York consulting engineer and chief engineer of the Northern Pacific Railroad Company, is quoted from his report to the Seattle Municipal Plans Commission under the heading "Transportation", as follows:

"A terminal railway, owned and operated by the Port of Seattle would give all railways equal access to the districts served thereby, and new railways entering the city instead of gaining access to the waterfront by condemnation, could use the terminal tracks. This would invite new railroads to enter the city, while now, it would be almost prohibitive.

The plans suggesting methods of developing industrial and waterfront property all provide for switching tracks wherever necessary, whether along marginal ways or other streets. It is important that all these tracks and facilities be co-ordinated and operated under one management, serving the entire city and vicinity, for the following reasons:

1. It would eliminate the duplication of trackage and terminal facilities.

2. It would be an economic advantage to the community as a whole in the reduction of the amount of land used for yard purposes, and the land thus released would, in most cases, be desirable business or industrial property.

3. It would simplify and reduce the cost of operation.

4. It would greatly facilitate prompt delivery of cars.

5. It would make of the port and the city a terminal unit, which should work to the advantage of Seattle's industrial and business concerns, and assist them in competition with other cities."

The mere construction of terminals will not alone give the full advantage of the harbor which the people have a right to expect. There should be a comprehensive system of co-ordination for the interchange of freight between the railroads and the harbor, and it should be so provided that the beneficial effects of the cheapness of water transportation shall not be lost or even minimized as a result of such interchange.

Since we have increased our commerce in the last five years from $120,000,000 to over $500,000,000, we have the advantage of Montreal, San Francisco, New Orleans, and other cities operating a public belt line, and we are handling more business over our terminal facilities. The three ports mentioned are now all making a profit from charges of $2.00 to $2.50 per car for switching, and are handling less commerce over their docks, so there is no reason to believe that Seattle cannot do as well. Another advantage that Seattle has over these cities is that our private and public terminals are limited to a seven-mile waterfront, whereas at Montreal and New Orleans, especially, the terminals are more scattered, necessitating a belt line of over fifty miles, making the operation and maintenance most costly. Another extremely important advantage that Seattle has over these competitors is that we do not have to condemn practically any land for right-of-way purposes. Out of the $5,000,000 appropriated by the Dominion Government of Canada for a municipally owned belt line at Vancouver, $2,000,000 has to be spent for the condemnation of land for right-of-way and yard purposes.

Lighterage

In studying the engineering problem of freight transference along our waterfront, it is apparent that much study should be given to "lighterage". A "lighter" is a vessel with an open dock, used for the movement of freight about harbors or contiguous waters. A "barge" is a covered lighter. The term "barge" is used with a great deal of freedom, and is often misused. In planning our future harbor improvements, careful consideration should be given to affording ample facilities for the transferring of lighterage freight between vessels and between wharves and vessels, and vice versa There should be slip room between piers equal to four or five times the widest steamship to be berthed, so that there may be sufficient space for the lighters on the off pier side.

The lighter is really a water dray, and works in competition with a land dray. There is no question but that lighterage is more economical than the railroad car or motor truck drayage, since the usual harbor lighter can transport from 500 to 800 tons

Digitized by Google

The outer end of Smith's Cove wharf, a structure which is over one-half mile in length.

of miscellaneous freight, while the land dray only carries from two to four tons. One lighter load may equal 200 or more dray loads. Including loading, delays, congestion and unloading, the time consumed by drayage would average several times as long. The one dominant provision to which everything else has been sub-ordinated, so as to secure rapidity, economy, and the least breakage, has been freedom from rehandling by manual labor.

Again, this mode of transportation would relieve congestion of car and vehicular traffic in the waterfront and industrial districts. The narrow strip of land paralleling the main waterfront is practically wholly occupied by the marginal street known as Railroad Avenue, so that it is very difficult to connect the north and south waterfront districts by rail on street grade without congesting this main thoroughfare and obstructing vehicular traffic that plies between the local passenger and freight docks and the business section of the city. Also, Harbor Island being separated from the mainland, as it is, makes railroad connections more difficult. The lighterage system will go a long ways toward solving this problem. Lighters are being used successfully and economically in New York, Baltimore and other United States harbors, also Oriental ports, so there is no reason why they should not be used just as advantageously in the Seattle harbor. At the Port of New York, seventy-five per cent of the freight is moved on lighters and similar vessels. It is true, of course, that some of this is caused by the few connections between the railroads and the piers. Railroad cars could also be lightered and freight loaded and unloaded direct between ship and car. Gondolas could be used in this manner, and if the method of lifting car roofs from box cars were adopted, as done in European countries, then the latter could be used likewise.

Public Ownership of Waterfront

Where the traffic of a port includes freight of a similar commodity or a few bulky articles, and is in the hands of a few large industrial companies and railroads to whose interests it is that the terminal facilities be adequate and unified, private ownership and management of wharves and track connections may meet the requirements. At Duluth on Lake Superior, which is pronounced the best harbor on the Lakes, the waterfront and wharves are largely owned and administered by railroads and private concerns; at Galveston, Texas, a private wharf company, to whose interest it is to provide facilities and direct connections with railroads and industrial concerns, is meeting the demands.

At other American ports, however, with a large general trade, industrial, as well as commercial, the private ownership of waterfront and wharfage is unsatisfactory. Frequently it is not to the interests of the railroads, navigation companies, or private concerns owning the waterfront to promote a large general movement of freight by water, and it is difficult at times for independent vessels to find wharfage facilities. At all such ports it would seem that the necessary facilities and harbor unification can be best obtained by some degree of public ownership and administration. It is no mere coincidence that two of the most efficient ports in the United States are New Orleans and San Francisco, where state ownership and administration of wharves prevail. It is also significant that probably the best river terminal in North America is the Port of Montreal, which is operated by a public trust, a board of three Harbor Commissioners, appointed by the Dominion Government. When practically all the water terminal facilities are publicly owned and operated, as they are at the above three ports, conditions approaching the ideal are obtained, although the operation of the Port Commission facilities are upon an advanced plan, they being operated entirely by the public. In fact, Seattle is the only port in the United States where terminals are publicly operated. This method gives equal rights to all steamship companies, and will attract commerce to this port. The leasing of public wharves for long periods of time has proven inadvisable, and short term leases or leases revocable at the will of the port district may be advisable for a portion of the public frontage, but the major portion should be open to all vessels seeking loading or unloading facilities. The experience of the many

Digitized by Google

American terminals makes it clear that wherever a large general shipping business exists, the necessary harbor unification is best obtained through public control.

It is essential, whatever be the form of port administration, that the combined terminal charges on vessels and freight be reasonable. It has been th policy of the Port Commission from the beginning to reduce these rates in order to compete with other Pacific Coast ports. There is no doubt that this alone accounts for a large share of the increased commerce coming to our port. The rates should be at least as low as those of our rival ports.

Gradually the entire main waterfront of Seattle should be municipalized in order that the maximum use may be obtained from it at the minimum cost. Private corporations involve the necessity of proceeds over and above interest, and are subject to taxes, while public terminals are not subject to these additional burdens. Profits from public terminals can be returned to those who paid it, in the shape of increased accommodations and appliances for the benefit of trade. Under public ownership, charges are levied upon all classes of goods, and equally upon all individuals. Favoring of particular lines of trade is avoided.

Conclusions

Summing up the most important requirements for the future development of harbor and rail facilities of Seattle, it may be said that the following conclusions are most important, and no delay should be made in putting them into effect.

1. That the terminal railway plan, operated under one management, should be permanently adopted and made to include all track facilities on the city side of the classification yards, since it must be conceded that greater harbor efficiency will be obtained if a terminal railway is owned and operated by a single management.

2. That a comprehensive plan covering all the Seattle waterfront, including the Elliott Bay waterfront, Harbor Island district, Duwamish waterway, Washington Canal and Lakes Union and Washington, should be prepared and approved by a majority of the representatives of the public boards and private companies interested and that same be followed as nearly as possible in the construction of new terminal facilities.

3. Since our harbor can only be built up by united effort, harmony, order and method, so essential to its development and successful operation, it is desirable that its waterfront improvement should not only be planned in a comprehensive way, but a municipal policy of control and administration should be involved with the development of the physical plan, which shall look to the gradual substitution of public for private ownership without undue hardship to the private companies.

4. That especial attention should be given to mechanical freight handling equipment, and that such installations which will lessen the handling cost of cargoes should be installed on our present harbor facilities.

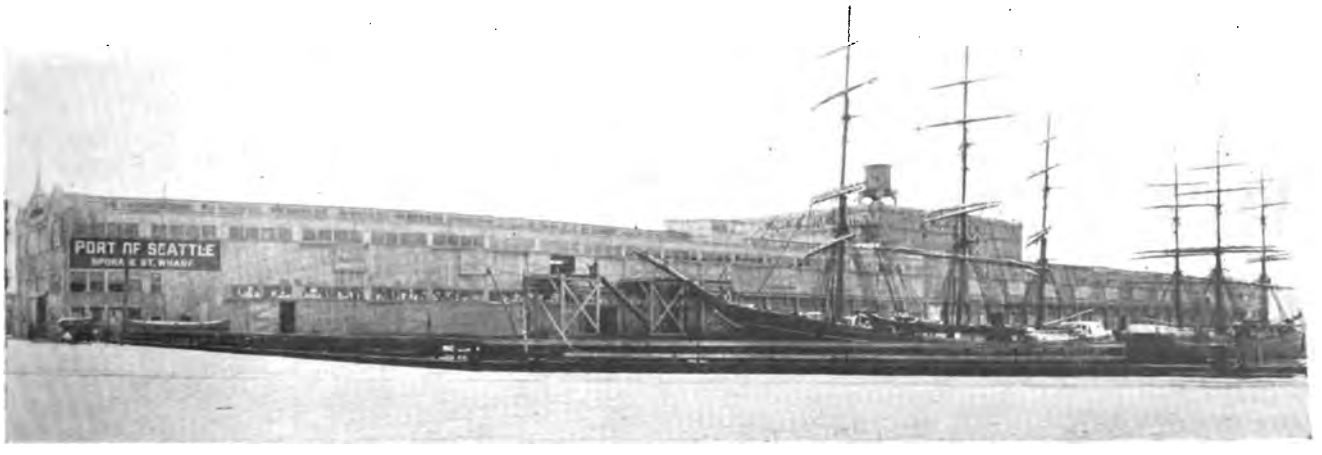
5. That the timber construction type of wharf and transit shed be used in the building of new terminal facilities until such time that it is certain that a more permanent structure meets all requirements. Also that wooden construction be used in the building of temporary warehouses, and that reinforced concrete construction be adopted in the erection of permanent warehouses.

A general description of the Seattle Port Commission's terminal units follows:

Smith's Cove Terminal

Smith's Cove, lumber, heavy machinery and general merchandise terminal, is one-half mile long and 310 feet wide, the largest pier on the Pacific. It is equipped with three miles of public railway tracks, a $40,000 gantry traveling crane, which is electrically driven and lighted for night loading, and covers a section of the pier nearly 900 feet in length, and will reach the depressed tracks in the center of the dock, also 40 feet from face of pier, so that

(Continued on Page 102.)



The Spokane Street terminals, showing the seven-story cold-storage warehouse in the background.

Digitized by Google

A battery of lathes in the machine shop of the J. F. Duthie & Company's shipbuilding plant.

The plant has outgrown the present restaurant, and has started work upon a new one, which will accommodate 1500 men at one sitting.

J. F. Duthie & Company broke ground for their new plant on September 10, 1916, and on November 29, 1916, the keel of the first vessel reposed on the keel blocks, and a completely finished plant stood ready to turn steel into ships as fast as it arrived.

This company has a great many fine vessels to its credit, as well as several records for delivery, among them being the S. S. "Western Sea", launched on May 25th, and completely finished and inspected on June 7th.

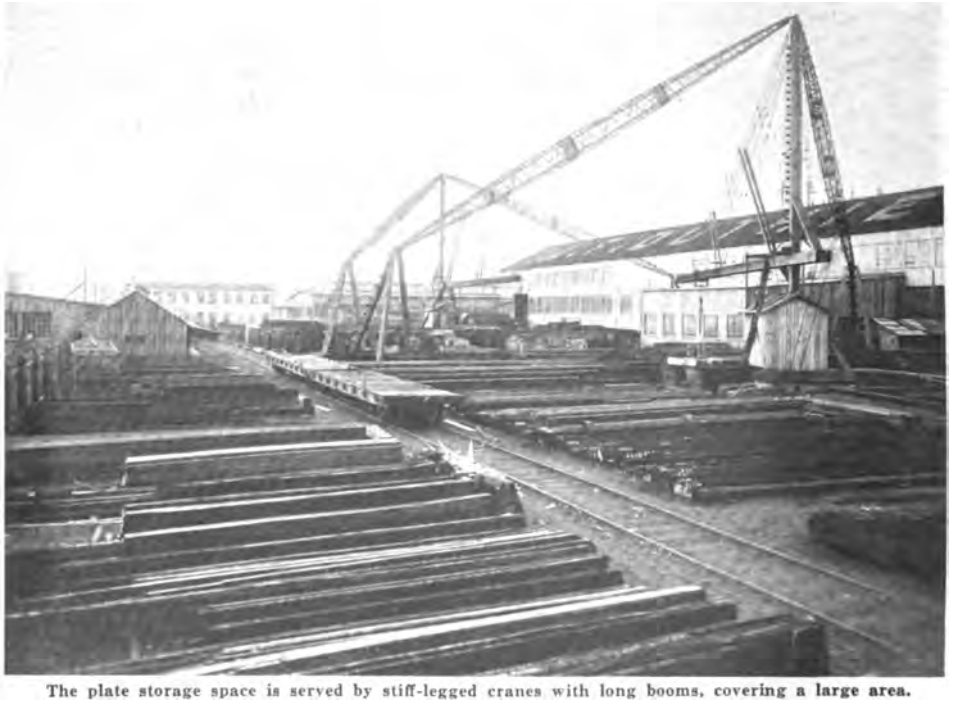
Mr. Duthie, president of this company, not only possesses the experience necessary to make a successful shipbuilder, but he is to be admired for his courage and tenacity in developing the huge organization now bearing his name, despite tremendous odds to be overcome during his first few years as a shipbuilder. He has accomplished much, and has largely contributed to making Seattle the center for an industrial activity in shipbuilding such as has never before been known in the history of the Pacific Coast.

His company has adopted for its slogan: "Speed, efficiency and co-operation", and has been able to accomplish wonderful results with utmost speed, consistent with high efficiency, and has been fortunate in the choice of its men, who have given their heartiest co-operation to make this possible.

(*Continued from Page 83*)

FUTURE DEVELOPMENT OF HARBOR AND RAIL FACILITIES FOR SEATTLE

cargo can be loaded direct from car to ship, and vice versa. Also a $16,000 structural steel 100-ton shear leg derrick for heavy lifts, and two locomotive cranes of 15 and 35-ton capacities each, which are indispensable for handling freight on the open wharf. Two sheds of 140,000 square feet, protected by an automatic sprinkler system, supply a large area for dry storage of lumber, bag grain, salmon and general merchandise. The open wharf has proven advantageous for the transshipment and storage of lumber, oil, steel and machinery. Two underground concrete oil storage tanks, of 8000-barrel capacity, have been constructed to facilitate the handling of oil. This type of construction does not take up valuable dock space, and the several compartments formed by the roof supporting walls, are very necessary on account of the many small shipments of the different kinds of oil. Also pipe lines have been provided together with dumping



The plate storage space is served by stiff-legged cranes with long booms, covering a large area.

Digitized by Google

The main bay of the machine shop, showing the character of the work handled in this shop.

table and centrifugal pumps for the economical handling of oil to tank cars.

Bell Street Terminal

Bell Street public wharf and transit shed is a two-story sprinkler protected dock with nearly 1200 feet of deep water frontage. The two floors each have approximately 60,000 square feet of space. The shed is equipped with three Barlow marine elevators, so arranged as to be lowered to the water's edge at any stage of the tide, enabling vessels to easily load or discharge freight from port hatches. Each elevator has a lifting capacity of ten tons. Five public spurs connect the wharf with railway tracks running parallel to the waterfront.

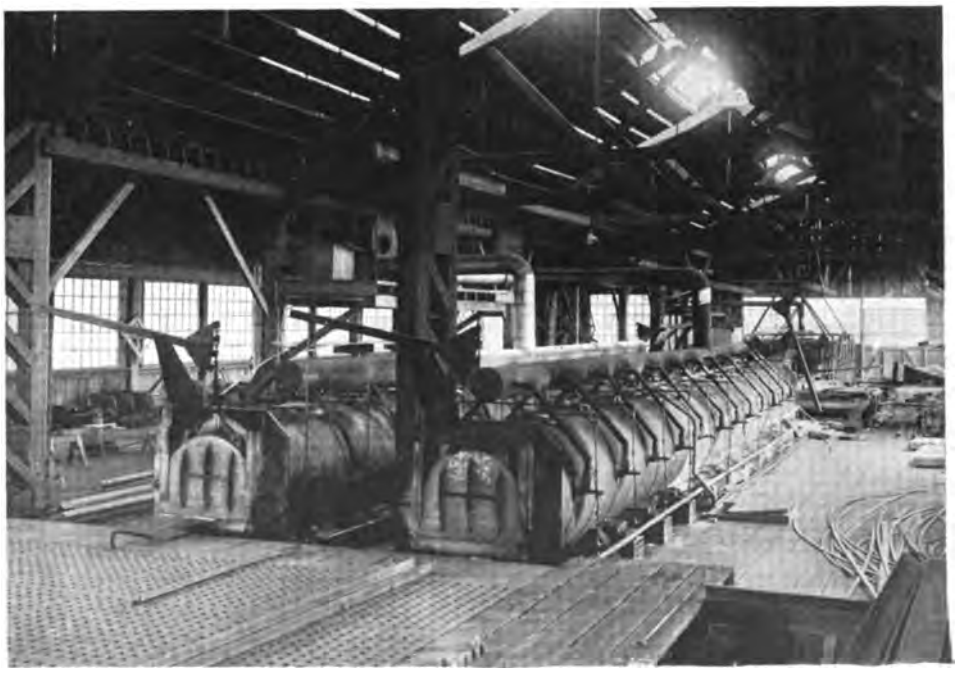
The Bell Street reinforced concrete warehouse is 422 feet long and 80 feet wide, and is used mainly as a general storage warehouse, although the north 100 feet is equipped as a modern cold storage plant with compressor machinery in the basement, and five floors of cold storage rooms above. About thirty strictly modern offices occupy the top floor. Approximately a dozen of these are required as the headquarters for the Port Commission, and the remainder are rented out.

That portion of the waterfront where the Bell Street terminal is located, was practically cut off from the adjacent part of the city by very steep grades. In order to overcome this, a system of inclined roadways has been built, which makes it possible to reach the business and public market district from the waterfront on grades not exceeding five per cent. In connection with these inclined roadways, provision is made for a truck stand serving the third story of the warehouse.

Stacy Street Terminal

The Stacy and Lander Street wharves and transit sheds are 90 feet wide and 750 feet long, with the roof carried on trusses spanning the full width so the floors are unobstructed by columns. A slip 212 feet by 800 feet separates the wharves. Two railroad tracks on the open wharf and four depressed tracks serve these wharves.

The Stacy Street warehouse, situated at the head of the above mentioned slip, is a modern, reinforced concrete fireproof building, four stories in height. Each floor has a storage capacity of about half an acre. Provision has been made for handling freight within the warehouse by the installation of three electric elevators, two spiral chutes, one electrical vertical conveyor and portable electric tractors and trailers.



Sectional angle furnaces and a portion of the slab-bending floor at the J. F. Duthie & Company plant.

Digitized by Google

Hanford Street Terminal

The Hanford Street wharf is located on East Waterway at Hanford Street. The transit shed is of timber construction, covered with corrugated galvanized iron. Floors are double plank construction. An asphalt driveway 20 feet wide extends down the center. The transit shed is fitted with an automatic sprinkler system throughout. The length of the transit shed is 1278 feet, and the width 90 feet. The second floor is 780 feet long and 90 feet wide. Both floors are lighted with continuous rows of windows five feet high on each side, and with 300 electric lamps for night work. Berthing space on the south side is 1000 feet, and on the west side is 479 feet, with water depth 35 feet at extreme low tide. This dock is well equipped with mechanical handling equipment, such as Brownhoist portable conveyors, gravity rolls, electric elevator, and inclined chutes for the economical handling of sacked grain and baled hay.

The Hanford Street grain elvator is a reinforced concrete building and consists of 55 circular bins of 16,000 bushels each, 46 interspace bins of 3600 bushels each, and 32 workhouse bins. The height of the storage bins is 90 feet, and height of workhouse, 165 feet,—the highest solid concrete grain elevator in the United States. The bulk receiving capacity per day of 24 hours is 95 cars, and the bulk shipping capacity per hour, 20,000 bushels. The machinery is of the most modern type, driven by electricity. The total capacity of the grain elevator is 1,050,000 bushels. Bulk grain is delivered by a conveyor from the elevator to a conveyor house on the roof of the Hanford Street transit shed, where it is spouted into vessels by means of two traveling cranes, and spouts anywhere along 780 feet of its length.

The Hanford Street hay shed is constructed at the extreme west end of the Hanford Street properties. It is equipped with two large hay balers. The largest of the two balers is capable of compressing one ton of hay into fifty-five cubic feet, and the total hay baling capacity is 80 tons per eight-hour day. The shed has a floor area of 4600 square feet and will accommodate twenty-five carloads of hay for storage, and since it joins the Hanford Street transit shed, the latter can be used for storage if found necessary. A vertical conveyor has also been installed to convey the hay for storage to the second floor of the Hanford Street dock.

Spokane Street Terminal

The Spokane Street fruit storage building is a seven-story concrete, fireproof building, 150 feet wide and 200 feet long, having a floor space of nearly 210,000 square feet. It is a strictly modern cold storage building, built for the storage of fruit, and has a net capacity of 20,000 tons. It is equipped with three high speed electric elevators, and is sprinkler protected. The building is completely insulated with cork board, and the insulation of the outside walls is practically continuous. The building is operated on what is known as the forced air circulating system, the air being cooled and put in proper condition as regards moisture content in bunkers overhead in the corridors of each floor. The air then is forced through the bunkers and rooms by means of electrically actuated blowers, the air being conducted into the rooms in spruce air ducts, which are placed along the floor at the walls where possible, and taken out of the rooms by means of a similar duct on the ceiling near the center of the room. This system has proven to be most satisfactory for holding fruit and other commodities in cold storage. The humidity of the air in the rooms can be accurately governed, and any contamination in the outside air used can be removed by the application of the brine spray provided in the bunkers.

The fish and ice storage building is of timber construction, approximately 120 by 200 feet in plan, and insulated with granulated cork, which is retained in place and protected from moisture by two thicknesses of tongue and groove lumber and two thicknesses of waterproof building paper. The fish storage building is one story in height and contains four sharp freezers for the freezing of fish, six large rooms for the cold storage of fish, and a car precooler for the cooling of refrigerating cars, and is capable of freezing 120,000 pounds of fish per day, and has a storage capacity of about 2,000,000 pounds of fish. Two electrically operated derricks, of five tons capacity each, have been installed adjacent to the fish freezers and storage to facilitate the unloading of fish from boats. Two electrically actuated elevator ice crushers, with necessary spouting and conveyors, having a capacity of 75 tons per hour, also have been installed for the icing of boats and the packing of fresh fish on the wharf. The ice cold storage building, approximately 35 by 100 feet in plan, and 50 feet high, has a capacity of 5000 tons of ice, and a temperature of twenty-eight degrees Fahrenheit can be maintained in this room. It is equipped with two automatic ice elevators, one of which elevates the ice as it is delivered from the ice tank in the compressor building, through a tunnel for piling in the ice storage room. The other elevator serves to deliver the ice from the storage room to car icing platforms or to inclined chutes on the roof of the fish storage building, which carries the ice by gravity to the ice crushers from where it may be distributed to vessels or to the fish packing rooms.

The compressor building is a one-story, reinforced concrete building, approximately 100 by 120 feet in plan, and contains the refrigerating units, which consist of three horizontal, double acting ammonia compressors, each having a capacity of 110 tons at 20 pounds of evaporated pressure and 175 pounds of condensing pressure at 70 r.p.m., also a single

(*Continued on Page 133*)

Digitized by Google

Launch of the steamship "Masuda", from the plant of the Todd Dry Dock & Construction Company's plant, Tacoma.

The Osaka Shosen Kaisha during May had the largest number of vessels at Tacoma in the history of the line's activities at this port. There were six ships berthed at the Milwaukee docks in one day, or an aggregate tonnage of 24,000. During the entire month there was at all times from two to four of the company's vessels in port.

Coastwise lumber business out of Tacoma has been very light when compared with former years. There is some movement by steam schooners and the Peruvian bark "Belfast" got away with 1,600,000 feet of lumber for the West Coast. Local exporters declare that the off-shore markets are extremely quiet.

The auxiliary schooner "Roye", named in honor of the French city of that name, was launched at the Foundation Company's Plant Number Four on June 1st. This makes the third vessel launched at these yards since May 1st and the tenth wooden vessel to be launched by Tacoma builders since the Shipping Board's great shipbuilding program was started. At present it looks as though the Tacoma yards would average one launch per week. The "Roye", like her sister ships from this yard, is 280 feet long over all by 45 feet 6 inches beam. She will be rigged as a baldheaded five-masted schooner and powered with two triple expansion engines of 400 horsepower each. Among those present at the launching were Captain H. H. Williams, Captain Mannoni, Frank Walker of Seattle; Colonel Frank Ross and Mr. Cox of Cox & Stevens, the New York naval architects.

The "Gerberviller", the first vessel to be launched by the Foundation Company, she having gone down the ways on May 1st, was put through her trial runs on June 1st. The engines were in charge of George Kingsbury, who is superintendent of installation at the plant, and the ship in the hands of Captain H. H. Williams, French Government representative here. According to those in charge for the French Government, the trials proved highly satisfactory.

FUTURE DEVELOPMENT OF HARBOR AND RAIL FACILITIES FOR SEATTLE

(*Continued from Page 104*)

acting vertical ammonia compressor at 150 r.p.m., which is being used as a pump-out machine and general scavenger. All necessary equipment, such as condensers, pumps, etc., are installed in this building. In consideration of the human factor, safety appliances have been installed in the piping and on the compressors. The ice plant is located in the west half of this building, and has an ice making capacity of 100 tons of ice per twenty-four hours. The coils in the tanks are operated on what is known as the flooded system, and all the mechanical ice handling machinery and conveying appliances for the economical and convenient handling of the ice, have been installed.

The fish handling shed is one-story high, 101 feet by 109 feet, with a net floor area of 9640 square feet. This shed is used for the accommodation of fish brokers handling their fish in our cold storage plant.

Salmon Bay Terminal

On the south shore of Salmon Bay, about a mile above the locks in the Lake Washington Ship Canal, is located the Salmon Bay Improvement, comprising thirty-six acres of very valuable land. This occupies a strategic location in that it is the first site above the locks which is adapted for a terminal to accommodate large ships. Its ultimate development will await the coming of commerce through the canal, and will be governed largely by the nature of this commerce. A dock, net warehouse, and transit shed have been built to accommodate the fleet of Northwest fishing boats, and at times, there have been as high as 350 boats berthed at this terminal. One 300-ton and one 50-ton marine ways have been installed, and have been put to almost constant use by the fishermen, which makes it convenient to have such equipment near the mooring basins for their vessels.

A large area of this improvement, which was filled by hydraulic means recently, has been leased to the Meacham & Babcock Shipbuilding Company, who are building wooden vessels for the Emergency Fleet Corporation.

WIRELESS MANUFACTURING PLANT IN SEATTLE

The Kilbourne & Clark Company has purchased a three and a half acre site in Seattle, which will be developed into one of the world's largest wireless plants.

The old location has been purchased by the Skinner & Eddy Corporation, who occupy the adjacent area.

Digitized by Google