1948-49.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

# PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

# REPORT

RELATING TO THE PROPOSED CONSTRUCTION OF A

# WHARF

#### $\mathbf{AT}$

# DARWIN, NORTHERN TERRITORY.

Presented pursuant to Statute; ordered to be printed, 14th October, 1949.

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS. (TWELFTH COMMITTEE.) (Appointed 3rd December, 1946.)

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Senate.

(3) Senator Charles Henry Brand. Senator RICHARD HARRY NASH.

(4) Senator NEIL O'SULLIVAN.

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Resigned 6th June, 1947.
Appointed 6th June, 1947.
Ceased to be a member of the Senate, 30th June, 1947.
Appointed 24th October, 1947.

#### EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES, No. 22, DATED 8TH OCTOBER, 1948.

7. PUBLIC WORKS COMMITTEE-REFERENCE OF WORK-CONSTRUCTION OF WHARF AT DARWIN.-Mr. Lemmon (Minister for Works and Housing) moved, pursuant to notice, That, in accordance with the provisions of the Commonwealth Public Works Committee Act 1913-1947, the following proposed work be referred to the Parliamentary Standing Committee on Public Works for investigation and report, namely :-- The construction of a new wharf at Darwin.

Mr. Lemmon having laid on the Table plans in connexion with the proposed work-Question-put and passed.

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# THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

# DARWIN WHARF.

# REPORT.

The Parliamentary Standing Committee on Public Works, to which the House of Representatives referred for investigation and report the question of the construction of a new wharf at Darwin, Northern Territory, has the honour to report as follows :—

## SECTION I.

## INTRODUCTION.

### Historical.

1. The question of the provision of wharfage facilities at Darwin has arisen a number of times in past years, and several very thorough investigations have been made to determine the most desirable type of wharf for the purpose, in consideration of the many important factors affecting the work. In addition to certain examinations of the whole question by eminent engineers, proposals have been referred to the Parliamentary Standing Committee on Public Works, on two occasions, and each project was rejected, largely on the score of the high cost involved.

2. Original Wharfage Facilities.—The original jetty constructed by the South Australian Government at Darwin in 1887, at a cost of  $\pounds 54,743$ , was of timber, and it occupied a position at the foot of Stokes Hill. It was built on a curve so that a railway locomotive could bring trucks alongside ships using the jetty.

3. After a few years it became badly eaten by teredo and had to be demolished. In 1894 a proposal was made that a stone wall should be built along the line of the edge of the mud-bank between Fort Hill and Stokes Hill. However, this scheme, which involved a wall of some 60 feet in height, was condemned by the Engineer-in-Charge of Railways, South Australia.

4. Subsequently plans were prepared for a new jetty at the foot of Stokes Hill, and it was built, at a cost of £66,000 by the South Australian Government in 1904, being constructed with cast iron piers filled with concrete, and with steel bracings and timber deck. Its length when erected was 559 feet and it was 32 ft. 6 in. wide, but, in 1916 it was widened by an addition of 11 feet on timber piles and the turn-table was enlarged. The approach to the jetty was made by an embankment on the shore end and a viaduct 350 feet long and 20 feet wide, of similar construction to the jetty. The viaduct, with the jetty, formed a structure in the shape of the letter L, and the turn-table, worked by a steam-engine and capable of accommodating two trucks at a time, served to convey trucks to and from the ships at berth.

5. In 1923 one of the narrow gauge railway tracks on the approach jetty was removed and a cattle-race substituted to facilitate the loading of live cattle, which at that time were becoming an important item of export.

6. The jetty was partly destroyed in 1942 by Japanese bombing and resulting fires, and it was subsequently repaired temporarily by the erection of steel spans of Army design across the damaged portion, thus providing a wharf which has been maintained in condition for use by shipping intil the present time.

7. Additional Provisions.—During the war the timber jetty, situated on the opposite side of the bay to the town jetty, was built as an emergency wharf to handle large ships, as a temporary expedient. The timber piles were not treated, and the wharf has been damaged by the ravages of teredo and other marine organisms to such an extent that it can only be kept in use for a short time. It is being repaired with the hope of prolonging its life so that it may be used while the proposed new wharf is being constructed.

8. The Navy also has two wharfs at the foot of Fort Hill, one constructed of concrete to handle vessels connected with the maintenance of the harbour boom during the war, and also a small wharf for repair of Naval vessels. A small jetty built out from the approach to the town jetty and a small Naval landing stage nearby have also been of some use in recent years.

9. *Pre-war Contract.*—Shortly before the war a contract was let for the construction of a new wharf on a site similar to that chosen for the present proposal, and a certain amount of material was prepared for the work. However, the war intervened, the work was not proceeded with, and the contract was cancelled.

## SECTION II.

#### THE PROPOSAL REFERRED. The Structure Planned.

10. The plans referred to the Committee by Parliament provided for a wharf constructed of steel tubular piles, and measuring 650 feet long by 140 feet wide. It was to provide for a transit shed 200 feet long and 60 feet wide on the wharf and an approach to carry an 8-chain curve for rail connexion to the outer face of the wharf. Allowance was also to be made for an approach to carry a second rail track to serve the inner face of the wharf at a future date.

11. The approach was to be made from Stokes Hill, where the present town jetty commences, and the site of the wharf was to cover part of the existing jetty and extend to the area at present occupied by part of the wreck of the *Neptuna*. This wreck is the remains of the munitions ship which was blown up by Japanese bombing during the war, and it remains a danger to shipping in close proximity to the town jetty. The proposal to place the wharf in this position assumed that the removal of the wreck would be essential in the construction of the new wharf.

# Reasons for the Proposal.

12. The planning of a wharf of the size decided upon was made as a result of the recommendations of the Inter-departmental Committee on Darwin for the development of the port. In 1946 Cabinet had agreed to the construction of a wharf 380 feet long and 140 feet wide, but, in 1947, following an approach by the Department of the Navy and the Commonwealth Railways, approval was given to plan a structure 650 feet long instead. The estimated requirements for the port of Darwin were made at that time on the basis of a population of 25,000, including a large percentage of service personnel to be stationed in that area. However, since that time the estimated number likely to be stationed in the area has been reduced, and the basis of population is now stated as 5,500.

## SECTION III.

# THE PRESENT PROPOSAL.

# Type of Wharf.

13. The plans submitted to the Committee for consideration at the time the first evidence was given were amended, in comparison with those referred by Parliament, particularly in regard to the site and the immediate section to be constructed. For various reasons, referred to at a later stage, the site of the structure was to be placed slightly further from the land, clear of the wreck of the *Neptuna*, and approximately in line with her keel.

14. The complete scheme provides for a wharf to be built in three stages, having completed dimensions of 650 feet long by 140 feet wide, with a transit shed measuring 200 feet by 60 feet. Construction is to be of steel tubular piles supporting structural steel girders and beams, which in turn will carry hardwood bearers and decking, and allowance will be made for rail connexion to the wharf at a later date, when the type and quantity of trade to Darwin demands such a facility.

#### Stages of the Proposal.

15. Because of the needs of other urgent projects throughout Australia and of the comparatively small quantity of cargo passing through Darwin, it was considered that wharf construction in Darwin at the present time should be limited to that which is absolutely necessary for immediate requirements. It is therefore recommended that, to begin with, an initial stage 380 feet long by 140 feet wide should be built, and the transit shed should be provided on it. This stage would be followed, when practicable, by an extension 270 feet by 40 feet to the south-west, thus completing the outer face of the full wharf to the total length of 650 feet, but leaving for the third stage the western corner of the proposed wharf. This corner comprising 270 feet by 100 feet would complete the inner face, but it is not proposed to proceed with its construction until such time as circumstances demand it in the future.

#### Estimated Cost.

16. The cost of the project, as referred, was set down at  $\pounds 540,000$ , but the figure given as the amount of expenditure necessary under the amended plan recommended by the Department of Works and Housing was shown as  $\pounds 459,000$ , omitting the amount of  $\pounds 112,000$ allocated to the third stage, the construction of which was to be indefinitely deferred.

#### Time for Completion.

17. It is estimated that it would take approximately two years to complete the first stage of the structure, from the time work on the project actually starts. The first stage is deemed to be sufficient to meet the needs of the port for the next ten years, or possibly more than that, and it is designed for that purpose.

# SECTION IV.

#### THE COMMITTEE'S INVESTIGATIONS.

#### General.

18. At the outset of the inquiry the Committee realized that the question of wharfage facilities for the port of Darwin had been the subject of a great deal of thought and consideration for many years past, and special attention was given to the previous proposals as well as to the details of the various reports and methods put forward as desirable for the purpose.

19. The plans referred to the Committee were studied, and comparison of them with the subsequent amended plans was made in the light of explanations supplied by the designing engineers. Details of the requirements stated as essential for the port, the many factors influencing the particular design and choice of materials, the site proposed for the wharf, and all the other items affecting the establishment of the structure as proposed by the Department were noted for investigation.

20. A visit of inspection was made to Darwin while the Committee was undertaking the journey to make inquiries into a number of other references in that town and in Alice Springs. The existing town jetty, the approaches, railway, and other adjacent wharfs were included in the Committee's inspections, and special attention was given to the unusual problems met with in Darwin as a result of its large tidal range and its situation in tropical waters. Evidence was taken in Sydney, Melbourne, Adelaide and Darwin from various officials and persons connected with the use of the wharf or likely to be able to inform the Committee regarding the points being considered.

# Previous Investigations.

21. Public Works Committee Reports.—Amongst the data available in regard to the problems to be met with in providing wharfage facilities in Darwin two reports of the Parliamentary Standing Committee on Public Works in past years offered a wealth of detail which was valuable to the members of the Committee in their inquiry and specifically related to the problems affecting the proposal.

22. Sir William Clarkson's Proposal.—In July, 1923, investigation was made of a proposal submitted by Engineer Vice-Admiral Sir William Clarkson for the construction of a new wharf at Darwin. The work contemplated was a solid wharf running south-westerly from the point of Stokes Hill, and a few feet shorewards of the mud-bank between Stokes Hill and Fort Hill. The proposed structure was to be 600 feet long and 130 feet wide, and it was to be extended later to a length of 1,200 feet. Its cost was estimated to total £120,050, but, after taking exhaustive evidence on the matter the Committee recommended that the proposal be not approved. However, it was recommended that, with the re-opening of the Meat Works and the adoption of systematic development of the Northern Territory, further examination of the harbour should be made so that a wharf could be provided which would offer an efficient and economical proposal.

23. In 1924 it was decided to obtain a report on harbour improvements from Mr. J. F. Ramsbotham, N.Inst.C.E., M.Am.Soc.C.E., Director, Commonwealth Lighthouse Service, and a proposal on the line of his recommendations was subsequently referred to the Committee for investigation and report to Parliament.

24. Mr. J. F. Ramsbotham's Proposal.—The scheme submitted by Mr. Ramsbotham was designed to give improved facilities to meet all the shipping needs of Darwin, and it aimed at the systematic development in successive stages of the whole of the bay lying between Fort Hill and Stokes Hill, to provide sufficient wharfage accommodation to meet any probable development of the port for many years.

25. Construction was to be of reinforced concrete caissons with a concrete wall on top, and it was to provide two docks comprising seven quays with a total quayage of 6,190 feet, the completed cost being estimated at  $\pounds 630,398$ .

26. As a result of its investigations the Committee found that, although the existing wharfage accommodation could not be regarded as modern, it was meeting the demands made upon it, and there was nothing to show that a better wharf would encourage development. Under the circumstances, the Committee, after giving the matter most careful consideration, agreed to recommend that while, in its opinion, the first stage of the scheme submitted by Mr. Ramsbotham would eliminate all the disabilities complained of in respect of the Darwin jetty, and could be progressively extended as the business of the port expanded, it was not considered that the existing or immediately prospective trade of the port warranted any additional wharfage construction at that time.

27. Sir George Buchanan's Suggestions.—During the progress of the Committee's investigation of the proposals by Mr. Ramsbotham the Government took advantage of the visit to Australia of a prominent British engineer, Sir George Buchanan, to seek additional

advice in regard to the provision of modern port facilities for Darwin. He was supplied with a copy of Mr. Ramsbotham's proposals as well as details of previous investigations on the matter, and, in his report he expressed criticism of certain parts of Mr. Ramsbotham's proposals. He suggested two alternative schemes, one to comprise a deep-water wharf and a tidal dock, and the other a deep-water wharf and a wet dock. It was anticipated in his schemes that the wharf section would be constructed first and the remainder in later stages as required. The wharf was to be 1,800 feet long, of which 1,200 feet would be required immediately.

28. In either scheme the first stage, comprising the deep-water wharf, would provide ample facilities for some years and would cost £587,657, while the completed costs of the schemes were shown as £1,915,979 for the first alternative scheme and £1,900,220 for the second. Construction was designed to be of steel cylinders filled with mass concrete, and steel superstructure of substantial construction, the decking being of steel troughing filled with mass concrete.

29. The Committee at that time carefully considered Sir George Buchanan's report, but was handicapped by the fact that many details were not available, and there was no opportunity of obtaining evidence from Sir George Buchanan, as, while he was in Australia, he had intimated that he had not given sufficient thought to the matter at that stage to enable him to formulate any scheme or supply any definite information. From the information available the Committee was of opinion that, while the accommodation suggested by him would be more than sufficient to handle any trade likely to pass through the port of Darwin for very many years, the cost at which it was proposed to provide the facilities was much higher than the Committee considered warranted and these proposals were rejected at that time.

30. The Port Equipment and Development Committee.—During the Committee's inquiry regarding the present proposal, evidence was taken from Mr. H. C. Meyer, one of the members of the Port Equipment and Development Committee. This Committee was set up during the war to assist in war-time problems, and it advised on difficulties which cropped up from time to time in the various ports of Australia. It was responsible to Sir Thomas Gordon, Director of Shipping, and, in 1945, produced a report on the Post-war Development of the Port of Darwin, for transmission to the Commonwealth Inter-departmental Committee dealing with the re-building of Darwin.

31. The report dealt at length with all the details of the possible needs of Darwin as a port, and was based on an estimated population of 25,000 people. Regard was paid to the possible exports and imports likely to be handled, the needs of the Services, the depth of water to be provided, the sheds and other equipment that would be required, and the location and design of the new wharf, having regard to available depths, necessary shelter and existing currents and tides.

32. It was emphasized, however, that this Committee, which was an honorary one, had neither the time nor the staff to prepare a complete design, and the sketches accompanying the report were to be regarded as indicative of the size or dimensions that may be required, and subject to possible modification after careful analysis of the stresses involved had been made.

33. The recommendations made indicated that, on the basis of a population of 25,000, not less than two modern deep-water berths with transit sheds and rail and road connexions, together with one shallow berth for small vessels, were required. Neither the town jetty nor the timber jetty was regarded as of any use for incorporation in any proposal for a wharf.

34. The design recommended was for a tapering, solid filled pier, 260 feet wide at the outer end and 700 feet wide at the inner end, with an average length of over 1,000 feet. It was to be constructed in three stages, the first including 1,000 feet of wharf with transit sheds, and road and rail access. The design was to include the use of hollow reinforced concrete caissons filled with sand for the faces providing the berths planned, while the filling would consist of dredged material excavated from the bay by a suitable dredge.

35. The cost of the first stage was estimated at  $\pounds 670,000$  and the total completed cost estimated for the three stages and equipment was shown as  $\pounds 1,250,000$ . It was stressed that these figures were given in the absence of detailed designs or estimates, and on the assumption that material to be dredged from the bay would be suitable for reclamation purposes.

36. Mr. Meyer explained in his evidence that the report of the Port Equipment and Development Committee presented, in his opinion, the ideal type of wharf to suit the Darwin conditions, though it was dependent upon the conditions indicated in the report. He demonstrated to the Committee on an inspection in Adelaide, various types of wharfage construction in use in South Australia, and the Committee was able to see at close quarters wharfs in operation, others being constructed, and several obsolete ones which indicated the damage against which modern wharf engineers have to plan and build.

# Use of Available Information.

37. The Committee made full use of all the available information contained in its previous reports and in the report of the Port Equipment and Development Committee, submitted by Mr. Meyer. It approached the inquiry with the intention of ensuring that the wharf to be recommended would be one planned for the present conditions, making use of past experiences and all the information now at hand. The Committee was able to view the existing wharfs in Darwin, and to examine the various features of the harbour and its requirements, keeping in mind the problems to be faced and the present-day difficulties of construction, material, labour and costs.

38. During its inspection of the types of wharfs being used in Port Adelaide the Committee saw many of the advantages of the solid type of wharf construction, and it subsequently sought evidence during the course of the inquiry regarding the advisability or otherwise of establishing that kind of structure in Darwin under the conditions operating there at the present time.

39. The caisson type of construction suggested by Mr. Meyer appeared to be ideal if it could be used successfully under Darwin conditions, and the Committee studied carefully the plans appended to the report of the Port Equipment and Development Committee. Evidence was sought from the departmental officials and engineers responsible for planning the proposed wharf, and their views were sought regarding the comparison between the proposed piled wharf and the caisson type being considered.

40. The Committee was informed by the engineers that the caisson type of wharf and other types of solid-pier wharfs had been carefully considered and their advantages and disadvantages had been weighed before they had arrived at their decision not to adopt that form of construction. It was pointed out that, after mature consideration of the problems involved, it had been found that some of the assumptions, used as the basis for the suggestions of the Port Equipment and Development Committee's report, had been made on wrong premises, with the result that the conclusions regarding cost as well as materials would have to be seriously amended. A number of items included in the estimates, especially sand for the concrete, were known to be reckoned on a considerably lower basis than that demanded by present circumstances. As a result of the unavailability of basic materials close to the port, and of increases in costs generally since the proposal was developed, they consider that the present cost of the caisson wharf suggested would be approximately three times the estimate made for it in 1945.

41. Under present circumstances the engineers consider it difficult to envisage development which would require more than the first stage of the 1945 plan, particularly having regard to the fact that the present basis of population is taken as 5,500 instead of 25,000. In this case the opinion was advanced to the Committee that the solid pier type of structure would present a first stage which would be a particularly uneconomical one. Other considerations concerning the stresses imposed on the walls at low tide, the possibility of silting, and cost and difficulty of dredging, were also discussed, and it was stated, in evidence, that it would not be possible to use material dredged from the bay for filling purposes. This has been proved by investigation of similar filling used in the reclamation of part of the bay for the Naval Boom Depot, where the filling has not been found satisfactory. There is very little sand in the bay, and the dredged material is of a very soft, soupy nature, unsuitable for the loads to be carried on it.

42. Following upon consideration of all these factors, and in the light of the latest information available, the Committee was constrained to agree with the engineers that the caisson type of wharf will not be suitable for Darwin under the present circumstances.

#### Necessity for the Proposed Wharf.

43. Commercial Needs.—A considerable amount of detailed evidence was taken from Darwin residents and officials concerning the amount of trade which has been experienced at the port in past years, and the amount anticipated in the future.

44. General Cargoes.—At the present time shipping to Darwin is largely confined to general cargoes supplying the needs of the locality and the building activity there, as well as a number of tankers carrying fuel. The wealth of detail supplied by Customs and other officials made it possible to obtain a comprehensive view of the kinds of cargoes and the amounts involved, and it is obvious that the purely commercial needs of the port are comparatively restricted. On the basis of present trade the demand for improved wharfage accommodation is not sufficient to warrant the construction of extensive wharves or the expenditure of large sums of money.

45. Development of the Northern Territory.—As the present commercial trade is small the Committee sought information regarding the likely increase in demand for wharfage facilities as a result of extensive development of Darwin or the surrounding country.

46. Meat Export.—At the present time first consideration turns to the provision of meat for export and the development of the cattle trade in the Northern Territory to meet the growing needs of the world for additional food supplies. A great deal of publicity has been given recently to various plans for the development of the Northern Territory in this connexion, and the Committee endeavoured to obtain information which would be a guide to determining the real effect upon Darwin of any development taking place or projected in the near future.

47. The extensive development of the meat export trade anticipated to follow the establishment of Vestey's Meat Works did not materialize in the past, and careful inquiry by the Committee failed to give any hope that the Company would re-open a meat works in Darwin. All the information supplied to the Committee by various men of experience in the Territory indicated that the northern section of the Territory, comprising all the area around Darwin, was unsuitable for cattle raising.

48. It was also pointed out in unmistakable terms that any development of the meat and cattle trade in the Northern Territory would result in additional increases to the volume passing through Wyndham in the west, Alice Springs in the south, and certain routes through Queensland, rather than to the north through Darwin. It was generally understood that, unless steps were specially taken by the Commonwealth Government to establish a meat works at Darwin, there was little likelihood of an expansion of the meat export trade through that port. The view is widely held that the Darwin area is unsuited to such trade and the Government would be more likely to develop the other more promising localities to the south. As this port has been used in the past for the meat export trade, and the possibility of aerial transport as well as refrigerated rail trains in the future cannot be overlooked, the Committee noted the possibilities of future development to be weighed with the other factors affecting the provision of wharfage facilities.

49. Local Products.—In considering the potential trade for the future a number of other commodities came to notice. The Committee was informed that an important development is anticipated in the export of meat extracts from the new Bovril works being constructed at Katherine. The possibility of rice and cotton growing is being investigated, and progress is expected in the production of peanuts. Development of Darwin as a result of all these and other similar activities was considered likely by the more optimistic witnesses, though the weight of opinion from men of experience in the Territory indicates that the northern section is of very little use for agricultural development.

50. Defence Requirements.—It is recognized that Darwin has been used extensively for defence purposes, and, having a fine harbour which is the only suitable one for many purposes in that part of Australia, its value must be preserved for the future. A great amount of money has been spent on Naval installations in Darwin, and the Boom Depot, developed during the war, will continue to be an essential establishment to be maintained. Naval authorities desire wharfage facilities at Darwin, and have indicated the necessity for a modern wharf which will be constructed in such a way that it will be of use for Naval craft using the harbour from time to time.

51. A military force will always be required in Darwin and its supplies will have to be brough mainly by boat to the port. Although the original figures of the personnel to be established in Darwin have been considerably reduced, the presence of troops in the area is essential, and they will form part of a defence service which is regarded as important at this point. It is important from a defence point of view, therefore, that a serviceable wharf shall be available.

52. Condition of Present Wharfs.—Probably the most important reason which makes a new wharf necessary is the state of the present wharfs in Darwin. The town jetty, repaired after the Japanese bombing, has been maintained to cater for the ships which have to use the port, but it will not last many more years. Use of this wharf at the present time is also made dangerous by the presence of the wreck of the *Neptuna* only a few feet away from the head of the pier where ships have to berth. There is also a lack of handling facilities on the wharf, and this is stated to aggravate the position and add to the time taken in discharging cargoes.

53. The timber jetty is badly damaged by the ravages of marine organisms, and it is estimated that it will not last more than approximately another two years. This jetty is being repaired, as well as it is possible to do so, with the object of using it while the proposed new wharf is being constructed.

54. The engineers take a very serious view of the position and state that the existing wharfs are deteriorating rapidly and cannot remain serviceable much longer, while further delay could well result in the port facilities becoming inoperable before the new wharf can be completed.

55. The Committee is convinced, therefore, that a new wharf is essential and should be constructed as soon as possible.

#### Construction.

56. In dealing in an earlier paragraph with the report of the Port Equipment and Development Committee regarding the solid wharf type of construction the Committee has indicated its opinion that the caisson type of construction is undesirable under the circumstances obtaining in Darwin. A considerable amount of evidence was obtained concerning other types of construction which have been used in Australia and in other parts of the world.

57. The use of wooden piles, treated in various ways or sheathed with metal, was explained to the Committee. Inquiries regarding concrete piles were also made, having in mind the shortage of steel for the work. However, it was pointed out that, owing to the unusually big variation in the tides at Darwin, the piles are required to be of a length which makes those composed of concrete difficult to handle with safety. They are liable to crack, and subsequent exposure to the sea water soon causes considerable damage.

58. It is therefore recommended that the type of structure suggested, comprising steel tubular piles supporting structural steel girders and beams, shall be adopted.

#### Tidal Range.

59. One of the striking features of the Darwin harbour is the extreme range of tides which have to be provided for in the wharf. The tidal range, approximately 27 feet at spring tides, necessitates the construction of the wharf deck at a level at least 62 feet above the sea bed in order to give a 30-ft. minimum depth of water at the wharf face. As a result the use of unusually long piles is unavoidable, and special steps are necessary to ensure that the wharf is constructed to withstand the stresses to be imposed upon it.

#### Site.

60. The most difficult question to determine was the most suitable site for the new wharf, and a great deal of evidence was necessary to enable the Committee to recommend a site which would provide for a wharf suited to the many requirements which presented themselves.

61. The factors to be considered in fixing upon the best site include the depth of water necessary, the contour of the sea bed, the position of the wreck of the *Neptuna*, the length and width of wharf necessary, the necessity for road and rail approaches, the proximity of a shoal to the present site, the direction of wind and tide, and many other considerations of varying importance.

62. Depth of Water Necessary.—The depth of water to be provided at Darwin will of course be affected by the size of ships attracted to the port. At the present time it is regarded as necessary to provide for 30 feet at low tide, and the proposed wharf has been designed with this in view. Evidence from the representative of some of the shipping companies, however, envisaged the necessity for taking into the harbour large refrigerator ships engaged in the meat export trade, and for this purpose it was stated as necessary to provide a depth of 35 feet at the outer berth.

63. In studying the possible future development of Darwin the Committee paid special attention to the meat export trade, arriving at the conclusions that increase in activity in Darwin from this source was improbable in the near future. Consequently it will not be necessary to provide at present for large ships used in the trade and drawing nearly 35 feet of water. However, the possibility of their use in future was not overlooked, and this factor was weighed when arriving at the ultimate decision on the site.

64. Contour of the Sea Bed.—The latest Navy charts were used to study the positions in which the wharf could be built, and the distance from the shoal which is the cause of anxiety to those responsible for piloting ships to the berth at the jetty. Some doubt appears to exist regarding the accuracy of some of the soundings shown on the charts, measurements near the site of the wharf having been found by the engineers to differ slightly from the soundings. As it will be necessary to carefully measure all sections of the site before construction actually begins on the wharf it will be possible to correct any slight defects in the contours indicated.

65. Position of the "Neptuna".—Although the site suggested in the proposal is planned to allow the outer face of the new wharf to be in line with the wreck, thus avoiding most of the danger at present encountered when berthing at the town jetty, a considerable amount of criticism was made of the proposal to place the new wharf in close proximity to the wreck. In seeking the ideal site to meet all requirements the Committee kept this factor in view, particularly as opinions obtained from mariners using the port indicated a preference for a site near the timber jetty. 66. Road and Rail Approaches.—The advisability of making provision to approach the new wharf both by road and rail made it necessary to site the structure in such a position that the standard railway rolling-stock could be moved on to it without difficulty. The proposal before the Committee envisaged complete preparations in the structure to allow for railway connexion, but it was not suggested that the railway should be connected to the wharf until the standard gauge railway is constructed to Darwin.

67. The Committee considered this aspect of the proposal, together with a further suggestion from the Commonwealth Railways Commissioner that the railway should be constructed immediately, and that the length of the wharf should be increased by 90 feet additional to the original completed scheme, to give a total length of wharf of 740 feet in order to facilitate shunting of trucks at the ship's side.

68. As a result of its review of all the evidence on this point the Committee recommends that preparation be made to take the railway, but that it should not be connected to the wharf until circumstances make it necessary. It also recommends that the 90-ft. extension suggested in connexion with the railway requirements be deferred until the railway is constructed on to the wharf.

69. Other Factors.—A considerable amount of evidence was sought concerning the effect of wind, tides, currents, and the distance from the adjacent shoal, in order to determine whether a site could be found which would give maximum protection from any of the risks involved, and also provide a site to which ships could be brought with a minimum of difficulty in adverse weather. It was also necessary that the site should allow for practical use of the inner face of the wharf for berthing ships.

70. The Timber Jetty Site.—Some of the evidence obtained from those experienced in handling ships, and in the use of the harbour facilities at Darwin in particular, showed a preference for a site near the present timber jetty, and the Committee made extensive inquiries to ascertain whether a suitable site could be obtained there. Considerable weight of evidence was obtained against such a proposal, however, especially from those who viewed the project from other points of view than a purely navigational one.

71. In order to use this site it appeared necessary, either to bring the railway and approach through the Navy Boom Yard, or, alternatively to construct a long and expensive approach across the mud flats of the bay. Very weighty opposition was expressed to the suggestion to approach the site through the Navy Boom Yard, owing to the fact that a large amount of money had been spent in reclaiming part of the bay in order to provide a flat space for the boom construction and maintenance equipment, which would be rendered useless under this proposal. Some doubt was also expressed regarding the ability of the reclaimed ground to carry the necessary weight of railway transport.

72. The approach across the bay was opposed by the engineers on the score of the very heavy cost which would make the proposition a most uneconomical one. Opposition to this site was also made on the ground that the inner face of the wharf would not be of use for normal ships, as the approach from the Fort Hill side would prevent ships coming in from the normal south-westerly direction.

73. In spite of the fact that, from a purely navigational standpoint, the site near the timber jetty is preferable, it was therefore decided by the Committee that, under all the circumstances, such a site should not be recommended.

74. The Compromise Site.—In order to obtain a site with as many of the advantages of the timber jetty site as possible, and yet with an approach from Stokes Hill, a compromise site was proposed, as shown on Plan H.C. 1586A. This provided for the construction of the first stage of 380 feet of wharf in a position approximately 300 feet from the Neptuna, on an angle which would allow future extension to be made into deeper water, but it would be necessary to provide an additional length of approach wharf. This approach would be almost 300 feet long costing an additional £34,000, and some members were of opinion that any advantage gained in that position would not be worth the increased expenditure. It was therefore suggested, as a further alternative, that the main section of the wharf 380 feet by 140 feet should be constructed in the same line, but 300 feet nearer the Neptuna, while at the same time an extension of the outer face should be made by adding the second section, 270 feet by 40 feet. This would make it possible to provide a berth in the position desired, well removed from the wreck, and without the long approach, the cost of which could be effectively used for the extension. 75. The designing engineers were then requested to draw up another plan indicating this position, and the following decision was arrived at :---

The compromise site shown on Plan H.C. 1586A, 300 feet from the *Neptuna*, and not less than 800 feet from the three-fathom line shown on the Navy chart, is agreed to, subject to the following modifications demonstrated by the hachured section on Drawing H.C. 1586B:—

- The section of the wharf 380 feet by 140 feet to be moved approximately 300 feet towards the Neptuna to replace the outer 300 feet of approach.
- (2) At the same time the 270 feet by 40 feet extension to be constructed to provide a berth approximately 300 feet away from the wreck.
- (3) The direction of the wharf to be slightly altered, as may be shown necessary by subsequent soundings, to ensure the possibility of providing for future extension to give up to six fathoms of water if required in time to come.

#### Cost.

76. Original Estimate.—The details of the estimated cost of the proposal, when referred to the Committee, as planned on Drawing No. H.C. 923, are as follows :—

Drawing H.C. 923-Proposal as originally sub-	mitted to	Parlia	ment—
First stage—			£
Approach and main wharf, 380 feet by	140 feet		248,000
Transit shed, 200 feet by 60 feet	••		12,000
Services (oil, water and power)	••	• •	15,000
			275,000
Contingencies (10 per cent.) $\dots$			28,000
Cranes	••	••	80,000
Second stage—			383,000
Additional wharf, 270 feet by 40 feet			45,000
Third stage—			
Additional wharf, 270 feet by 100 feet	• •	• •	112,000
			540,000

77. Amended Estimate.—The cost of the amended proposal submitted to the Committee by the departmental engineers in their original evidence concerning Drawing No. H.C. 1525 was shown as  $\pounds 459,000$ . This figure included the first and second stages only, as it was anticipated that the third stage would be deferred and would not be necessary for many years to come. For purposes of comparison the addition of the cost of the third stage to the proposal on this site would increase the total for the first two stages by  $\pounds 112,000$ , showing the completed cost as  $\pounds 571,000$ . The details are as follows :—

Drawing No. H.C. 1525-Amended proposal (in	line	with	Neptuna	wreck)-
First stage—				£
As Drawing No. H.C. 923, first stage			38	3,000
Additional length of approach, 200 feet	•••		2	2,500
Dolphins	••			8,500
Second stage—			41	4,000
Additional wharf, 270 feet by 40 feet	•••		4	5,000
Third stage—			45	9,000
Suggested to be deferred	• •		11	2,000
${\rm Total}\qquad \dots \qquad \dots$	• •		57	1,000

(Note that Commonwealth Railways desire an additional 90 feet by 40 feet beyond Stage 2 when rail connexions are made. This would cost approximately  $\pounds 15,000$  more.)

78. The Timber Jetty Site.—When the alternative site near the timber jetty was considered the Committee was informed that the structure would cost approximately the same in that position as that given for the plan shown on Drawing No. H.C. 1525.

79. The Compromise Site.—During the inquiry consideration of various sites brought the Committee's attention to the possibility of constructing the first stage of the proposal at a distance of 300 feet from the wreck of the Neptuna, and a plan demonstrating this site was submitted on Drawing No. H.C. 1586A. This allowed for a first stage similar to the amended proposal, costing £414,000, with the addition of 300 feet extra approach, involving a further expenditure of approximately £34,000. If this site were to be adopted the expenditure up to the first stage would be £448,000, and the second and third stages would have to be added later.

80. The Final Site Cost.—As it was finally decided to discard the 300 feet of additional approach, and adopt the site shown on Drawing No. H.C. 1586B, the estimate for the proposal recommended, which includes the first and second stages, will be £459,000. The cost involved in constructing the wharf on this site, therefore, will be approximately the same as that shown for Drawing No. H.C. 1525 above, though the position of the structure is altered to provide for the various factors affecting the proposal, both at the time of commencement and in future years, and only the first and second stages, to be constructed simultaneously, are recommended at present.

#### The Transit Shed.

81. Provision was made in the original estimate for a sorting shed to be included on the wharf. The shed was planned to be 200 feet long by 60 feet wide, and it was to be framed of steel and sheeted with galvanized iron, with timber planking to protect the lower walls against excessive damage. It was to have 18 feet clearance under the roof trusses, and ample doorways on both sides to facilitate handling of cargo by means of mechanical equipment. Provision was made for a bond store, amenities, and office accommodation at the approach end.

82. The Committee gave consideration to the provision of the sorting shed on the wharf because it involved the construction of the wharf to a width of 140 feet to carry it. Where the length of steel piles is required to be great, owing to the tides, and the consequent construction cost is very high, the inclusion of the sorting shed entails a very considerable increase in the expenditure necessary. Evidence was therefore sought to establish the necessity for providing for the shed on the wharf rather than on the land as at present.

83. The Present Discharge System.—A considerable amount of evidence was submitted to the Committee regarding the disadvantages of continuing the present system of transferring cargoes to the sorting shed on land, by the use of motor lorries, for sorting and delivery. The cost of cartage between the ship and the present sorting shed was stated to be 10s. per ton, and owners of goods are not permitted to go on to the wharf to collect their goods at the ship's side to obviate this charge, only trucks of the Darwin Master Carriers' Association being allowed on the wharf. It was also pointed out that a considerable amount of pillage takes place between the time when goods are landed from the holds until they are unloaded in the transit shed. A further reason against the sorting shed on the land was advanced by the Customs authorities whose duties will be simplified if Customs officials can supervise the unloading of goods from the holds straight into the sorting shed on the wharf. The Customs Act requires it and it is the only way to exercise effective Customs control.

84. The amount to which a sorting shed on the wharf is used depends upon the type of cargoes discharged at the port. It was explained to the Committee that, in the case of cargoes consisting almost solely of one type of cargo, such as meat, wheat, coal, or some other similar commodity, sorting is not necessary, and the cargo can be discharged from the ship's side. However, the cargoes coming into Darwin are mainly composed of an assortment of goods to various consignees, and sorting is essential.

85. One of the factors which is also causing great concern is the slow rate of discharge which obtains in Darwin. This seriously affects the trade to the port and the turn-round of ships, and it is regarded as essential that every possible means of increasing the rate of discharge shall be sought.

86. In the future, when railway connexion is made to the wharf, it will be more than ever necessary to have the sorting shed on the wharf, and, after considering all the factors involved, the Committee is of opinion that it is necessary to construct the wharf to carry the sorting shed and to provide the shed required.

#### Mechanical Equipment.

87. Provision was included in the estimates for cranes to be supplied for the wharf. Two 6-ton cranes from disposals sources were reserved but may not be used if more suitable units can be secured for the purpose. One 30-ton crane will be mounted on the north-east corner of the wharf to cater for heavy lifts beyond the capacity of the travelling cranes or the ship's gear.

88. The general necessity for mechanical equipment for handling cargo on the wharf is stressed by most witnesses, and it was stated that fork lift trucks, tow motors, and other appliances would materially assist in increasing the rate of cargo discharged at the port. It was pointed out that fork lift trucks depend very largely upon palletizing of cargoes, and cannot be used to full advantage with the general type of cargoes coming into Darwin, but it is nevertheless essential to adopt all available methods of mechanization on the wharf. The Committee recommends, therefore, that modern methods of mechanical cargo handling should be studied and applied on the Darwin wharf as widely as is practicable.

### SECTION V.

#### THE COMMITTEE'S RECOMMENDATIONS.

List of Decisions.

	89. The :	following is a summary of the decisions made by the Committee after	study of
the	evidence a	and consideration of all the factors involved :	Paragraph in Report.
	(1)	A new wharf is essential	. 55
	(2)	The caisson type of construction is not practicable for Darwin unde	r 49
	(3)	The proposed construction of steel piles supporting structural stee	42
		girders and beams is agreed to	58
	• (4)	Provision should be made for a railway to be laid on the wharf but it	5
		should not be connected until trading conditions demand it	. 68
	(5)	The extension by an additional 90 feet, recommended by the Common wealth Railways Commissioner, should not be made to the what	- f
		at present	. 68
	(6)	The timber jetty site is not recommended for the wharf	. 73
	(7)	The site shown hachured on Drawing No. H.C. 1586B and described in	1
		paragraph 75, is agreed to	75
	(8)	The first and second stages should be constructed simultaneously, at an estimated cost of £459,000, but the third stage should be deferred	ı d
		indefinitely	. 80
	(9)	A sorting shed is necessary on the wharf and should be constructed a	S
		proposed	86
	(10)	Modern methods of mechanical handling of cargo should be applied a	S
		widely as practicable	. 88

### CHARLES A. LAMP,

Chairman.

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