DEPT. OF THE SENATE
No. 3642
Received 28 APR 1948
John Edwards
CLERK OF THE SENATE

1946-47-48.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

For Senator Lamp -

I bring up the Report of the Parliamentary Standing Committee on Public Works, ~~together with minutes of Evidence~~, relating to the following work -

Proposed erection of a Tribophysics Laboratory for the Council for Scientific and Industrial Research, Melbourne,

~~and I move that the Report be printed.~~

28-4-48

DEPT. OF THE SENATE
No. 3642
Presented 28 APR 1948
John Edwards
CLERK OF THE SENATE

1946-47-48.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

REPORT

RELATING TO THE PROPOSED ERECTION OF A

TRIBOPHYSICS LABORATORY, MELBOURNE.

Presented pursuant to Statute,

[*Cost of Paper.*—Preparation, not given; copies ; approximate cost of printing and publishing,]

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(TWELFTH COMMITTEE.)

(Appointed 3rd December, 1946)

SENATOR CHARLES ADCOCK LAMP (Chairman).

Senate.	*House of Representatives.*
(3) Senator CHARLES HENRY BRAND.	WILLIAM PATRICK CONELAN, ESQUIRE, M.P.
Senator RICHARD HARRY NASH.	(1) HENRY BAYNTON SOMER GULLETT, ESQUIRE, M.P.
(4) Senator NEIL O'SULLIVAN.	(2) HOWARD BEALE, ESQUIRE, M.P.
	JOHN BROOKE HOWSE, ESQUIRE, M.P.
	DONALD McLEOD, ESQUIRE, M.P.
	GEORGE JAMES RANKIN, ESQUIRE, M.P.
	EDGAR HUGHES DEG RUSSELL, ESQUIRE, M.P.

(1) Resigned 6th June, 1947.
(2) Appointed 6th June, 1947.
(3) Ceased to be a member of the Senate, 30th June, 1947.
(4) Appointed, 24th October, 1947.

EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES, No. 103, DATED 3RD DECEMBER, 1947.

10. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—TRIBOPHYSICS LABORATORY, MELBOURNE.—Mr. Lemmon (Minister for Works and Housing) moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act* 1913-1936, the following proposed work be referred to the Parliamentary Standing Committee on Public Works for investigation and report, namely:—Erection of Tribophysics Laboratory at Melbourne University, for the Council for Scientific and Industrial Research.

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.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH TRIBOPHYSICS LABORATORY, MELBOURNE.

REPORT.

The Parliamentary Standing Committee on Public Works to which the House of Representatives referred for investigation and report the question of the erection of a Tribophysics Laboratory, Melbourne, has the honour to report as follows :—

SECTION I.

HISTORICAL.

Original Establishment.

1. The Tribophysics section of the Council for Scientific and Industrial Research was formed in 1940 to investigate the possibility of reclaiming lubricating oil, in view of the limited supplies coming forward from the United States of America. Another reason for its formation was to conduct investigations into the manufacture of bearings for aircraft, because it was no longer possible to obtain replacements.

2. Dr. Bowden, one of the leading scientists in this field of research, was in Australia at that time and he was asked to undertake the investigation. He and his staff set out to discover how lubricants could be reclaimed; how the wear on bearings could be minimized; and how bearings could be designed and manufactured, particularly for Rolls Royce engines.

Growth during the War.

3. Investigations were also carried out to ascertain the effect of producer gas fuel on internal combustion engines, and how to produce lubricants to prevent the extra wear which arose from the use of such fuel. Lubricating oils used by the services were also examined in order to see that they were up to specifications.

4. The investigations into lubricating and friction problems led naturally to studies of bearings and the most suitable metals to be employed in their manufacture, and, as a result of the special knowledge and experience gained, service difficulties associated with aircraft engine bearings became the responsibility of the Tribophysics Section.

5. During the war the Section consisted of a small number of highly trained engineers, metallurgists, physicists and chemists, carefully chosen and trained with the object of providing a complete team capable of tackling any kind of light engineering problem, including the design and manufacture of bearings, which might arise and demand urgent solution.

6. Many problems and troubles were investigated during the war and the results achieved proved to be, in many cases, accomplishments of outstanding merit and of great value.

Post-war Activities.

7. When the war ended the demands made by the Services were greatly reduced, but it was considered essential that this organization, which had grown into a co-ordinated team of enthusiastic scientists, expert in their sphere and in some respects leading the world, should be kept going as a nucleus for research into problems associated with secondary industries.

8. A great deal of research work relating to problems arising in secondary industries has been carried out since the war, and the Section has become a recognized authority on physical metallurgy as applied to the production of bearings and special alloys for particular purposes.

9. As a result of investigation on the cause of certain accidents, thought to have been due to friction on explosives, a great deal of knowledge has been accumulated which had not been previously discovered. There is no one in Australia with the special knowledge which some of the scientists possess about the properties of liquid explosives used in mining and as rocket propellants. This work is being pursued, and some of the staff are in England following developments in this field, so that it will be possible to give advice regarding suitable explosives to be used as propellants or for other dangerous purposes.

Original Accommodation.

10. The original investigations were carried out in a section of the Chemistry School at the University of Melbourne. This was arranged simply because vacant space was available there at that time, owing to the fact that many students were away at the war.

Temporary Premises.

11. As the work grew more important and the problems more varied it became necessary to expand. No other premises were available, but, with pressing war problems to be solved, it was essential to provide some sort of temporary rooms for the purpose. Some huts were erected alongside the chemistry building, and the work has grown and progressed in them until the present, when the staff are working in most crowded and unsatisfactory conditions.

SECTION II.

The Present Proposal.

The Building.

12. The plans and estimates have been prepared for a three-storey building, the frame and foundations of which have been designed to take two additional storeys at some future date. This provision is in conformity with the recently adopted policy of the Melbourne University Council, that all new buildings in the University grounds shall have foundations sufficiently strong to carry five storeys.

13. The design is to be in keeping with the adjacent Chemistry School, and, as far as possible to harmonize with the older scholastic buildings in the surrounding areas.

14. The area covered by the building at ground floor level will be 7,265 square feet, and the total area inside the walls, including basement, ground floor, first floor and second floor, will be 20,514 square feet.

The Site.

15. The building will be situated to the east of Wilson Hall, between the Chemistry and Metallurgy Schools and it will be erected facing a road which provides easy access to Grattan-street. Part of the site is at present occupied by temporary buildings which will be removed.

Estimated Cost.

16. The estimated cost, after provision for rises in costs of labour and materials following the introduction of the 40-hour week, is £94,000, made up as follows :—

	£	£	£
Building			74,600
Engineering services—		£	
Plumbing, drainage, &c.		5,200	
Electrical		5,600	
Mechanical—	£		
Heating	2,880		
Hot water supply	710		
Gas supply and cold water	570		
Sump pump, light area	155		
Ventilation	1,235		
		5,550	
Contingencies		560	
			16,850
Furnishings, linoleum, &c.			2,550
			94,000

SECTION III.

The Committee's Investigations.

General.

17. The Committee studied the plans of the proposed building and visited Melbourne to take evidence from the Director of Architecture and the Chief Mechanical Engineer of the Department of Works and Housing, and from other witnesses, connected with the University and the Council for Scientific and Industrial Research, who were in a position to give their opinions to the Committee and to inform the Members on the essential points to be decided.

18. A visit of inspection was paid to the proposed site of the building, and also to the premises at present occupied by the Tribophysics Section. The type of work being carried on was demonstrated to the Committee, and an opportunity was presented to see the conditions under which the staff were working.

Explanation of the Work.

19. It was apparent from the outset that the work of the Tribophysics Section, which had sprung up of necessity during the war, was of a highly technical character, and very little was known about it by persons not directly connected with its growth and expansion. Even the name of the Section was completely unfamiliar to most people. The reason for this became apparent when it was explained to the Committee that the title of " Tribophysics " was adopted after the word had been coined for the purpose to describe as accurately as possible the main work of the establishment. It was pointed out to the Committee during their inspection that the main function of the Section was to carry out particular research concerning the science of friction, and the term to describe it comes from the word meaning " to rub," originally of Greek derivation.

20. The necessity to pursue special studies concerning friction arose during the war when difficulty was being experienced in obtaining adequate supplies of lubricating oil from the United States of America. The possibility of reclaiming used lubricating oil for subsequent use made it essential to study the physical properties of the oils and their effect in reducing friction on bearings.

21. In addition it became impossible to obtain replacements of bearings for aircraft, and investigations into the design and manufacture of bearings, particularly for Rolls Royce engines, was undertaken.

22. It became necessary to discover how wear on bearings could be minimized, and how the most suitable metal could be prepared for the manufacture of bearings which would withstand the friction during prolonged periods of heavy work.

23. The metallurgical research in connexion with these investigations was carried out by the staff of the Section, bearings were designed, and, in association with the Department of Aircraft Production, all the main bearings for the Merlin engines were produced.

24. When shortage of fuel gave an impetus to the use of producer gas units on motor vehicles the Section was required to investigate the effect of producer gas fuel on internal combustion engines, and the possibility of producing lubricants which would prevent the extra wear which arose from the use of such fuel.

25. Examination was also made of lubricants used by the armed services in order to ensure that they were supplied according to specifications, as a check upon the introduction into Australia of lubricants of poor quality.

Wear in Guns.

26. During the war an investigation was required into the problem of wear in gun barrels, and it was necessary to find out why wear occurred, and whether it was possible to decrease the rate of wear by altering the composition of the driving band of the shells. In the course of the investigation it became necessary to find how fast the shells travelled out of the gun, and equipment had to be devised and developed for measuring the speed.

27. From that equipment apparatus was evolved by the staff for measuring the muzzle velocity of shells from such guns. It was pointed out that this equipment was highly technical and costly to make, and special attention was given by the experts to perfecting it. It was accepted by the authorities as a great advance on their former methods of calibrating their guns, as it could be carried out on the ships, whereas formerly calibration could only be performed by dismantling the guns for testing.

28. Sets of this equipment, manufactured by the staff, are being used by the Australian and British Navies, and the Canadian Navy is also considering it.

Present Work.

29. As pointed out in the early part of this Report, the work grew rapidly during the war and, as the team of workers continued to co-operate in research which yielded important results, so they were able to expand and undertake problems in fields leading from former investigations.

30. At present a good deal of work is also undertaken on behalf of secondary industries. If a firm encounters a special difficulty, and the matter is of scientific interest, an investigation is conducted free of cost to the firm. All manufacturers of bearings are in constant touch with the Section.

31. In connexion with the armed services special apparatus has been evolved to measure recoil in gun carriages. The work has been extended to include apparatus for calibrating 25-pounder guns for the Army, and members of the staff act as advisors in connexion with such equipment. Lectures are also delivered to the Staff College on the simpler aspects of such subjects as atomic bombs, gas and bacteriological warfare, &c.

32. Members of the staff assist the University by a certain amount of teaching and demonstrating to students. This is important to the Tribophysics Section because, in addition to maintaining close contact with the library and equipment of the University, it provides the opportunity for training students in some of the advanced work which will make a proportion of the students suitable for the special research work carried on by the Section. The Tribophysics Laboratory in Melbourne is the only one of its kind in Australia and nearly all members of the staff have been trained in Australia.

Accommodation.

33. As the work expanded the original laboratory in the Chemistry School became too small and staff working on various problems have had to be accommodated in wooden huts grouped near the laboratory, and in any space which could be found in the building where a piece of apparatus could be squeezed in for the time being.

34. The Committee, on its inspection, was impressed with the difficulties being experienced in the work by reason of the crowded and unsatisfactory conditions under which the staff are carrying on. Since the return of many students who were away at the war when the Tribophysics Section was established, the accommodation has dwindled by more than one-half. The present workshop was originally designed for special University work as part of the training of chemists. This part of the building is now urgently required, and the University training for which the building was designed is held up until that part of the premises can be vacated by the Tribophysics staff.

35. It was apparent that the delicate and expensive instruments and equipment could not be expected to work with thorough efficiency in the temporary wooden premises in which they are at present housed, nor could the staff maintain their efforts for outstanding results while they are working under such unsatisfactory conditions and in such crowded rooms as were demonstrated to the Committee. In some rooms the conditions appeared definitely unhealthy in spite of apparent efforts to provide some degree of artificial ventilation.

Need for the Building.

36. The Committee is therefore convinced that there is an urgent need for the erection of the proposed Tribophysics building, both to provide space for the valuable work being carried on by the Tribophysics Section and also in order that the University work, already hampered by lack of space, may proceed in the premises which were built for it.

Architecture.

37. The building was designed to appear similar to the chemistry building beside it, and, although it is of comparatively modern design, it will harmonize with the older buildings around it. Wilson Hall and some of the other adjacent buildings are of widely varying designs and cannot be economically duplicated in these days, even if it were deemed desirable, and, to achieve harmony with those older buildings, the design for the more modern Chemistry School included certain features which might help to bridge the gap in architectural periods. The present building will have external brick walls, panelled and faced with "Salmon" coloured bricks to match the Chemistry and Metallurgy School buildings. The coping, main entrance surround, and trim to windows and spandrel panels will be carried out in Stawell freestone. The general effect should therefore prove a satisfactory solution of the architectural problem which is involved in the erection of such a building on this site, surrounded as it is with architectural examples representing widely differing periods.

38. The grinding room and workshop on the ground floor will project beyond the general line of the building, while the upper floors will maintain the line. This presents a somewhat unbalanced appearance which attracted the Committee's attention. However, it is stated that it will create a feature to the front elevation which is deemed to have considerable architectural value, while at the same time it will provide the necessary accommodation and height required for the rooms concerned.

Services.

39. The total cost of the engineering services is estimated as £16,850, and includes:—

Heating.—The ground, first and second floors of the building will be heated by a central oil fuel hot water system circulated to cast iron radiators, though certain of the work rooms and cupboards will be excluded.

40. *Gas and Water Supply.*—Various laboratory sinks, showers, basins and cleaners' sinks would be supplied by a down feed hot water reticulation system serving all floors. Gas and cold water would be provided at the laboratory benches.

41. *Ventilation.*—Mechanical ventilation would be supplied to the high speed photography laboratory, foundry, welding room, furnace room and dark room No. 3 on the second floor.

42. *Lift.*—As the building will ultimately be of five storeys provision is made for a lift well sufficiently large to allow the installation of suitable lifts. At present the lift is not required, and the space for the lift well will be used for store rooms.

Floors.

43. Study of the plans showed that a considerable area of floor space on the ground floor was to be covered with parquetry flooring, and inquiries were made regarding the amount of timber necessary and the availability of supplies, especially as hardwood is one of the materials used extensively in home construction.

44. *The Entrance Hall.*—The floor of the entrance hall is planned to be of parquetry, but, as timber is in short supply the Committee considered the advisability of using terrazzo for this area. Terrazzo was stated to be slightly more expensive, but it gives a more enduring surface, suitable for this purpose. The Committee therefore recommends that the entrance hall and the long corridor leading from it be of terrazzo.

45. *The Work-shop.*—The work-shop, grinding room, mechanical engineering room and electronics laboratory, comprising a large section of the ground floor are to have parquetry floors, and the Committee questioned the desirability of using a large amount of timber to provide floors of such finish to rooms where a good deal of heavy work is usually carried on. However, it was explained to the Committee that, apart from the fact that wood is more comfortable for the staff to stand on, it is necessary to have flooring of a material which will stand up best to the vibration of the machines. It was stated in evidence that wood is preferable for this purpose, and the Committee is satisfied, therefore, that the floors to the rooms mentioned should be of parquetry, as planned.

Effect on Housing.

46. The Committee gave consideration to the possible effect upon the housing programme of the use in the proposed building of quantities of material and substantial amounts of labour. It was stated, in evidence, that materials for this building have been chosen with a view to reducing to a minimum the competition with housing programmes. It was generally recognized as inevitable that a certain amount of material and labour needed for this building would be similar to that necessary for house construction. However, the evidence, while stressing the difficulty of making a decision upon the relative merits of housing as against large building construction, emphasized the fact that the need for progress in secondary industries, and the pressing demands for space in which to educate University students, made it essential that this building should be proceeded with at the earliest possible moment.

The Committee therefore recommends that the building be erected as soon as materials and labour can be made available.

Comparison with Other Projects.

47. In recommending that this work should be proceeded with as urgently as possible the Committee is not unmindful of the fact that many other scientific projects are demanding urgent attention also. The Tribophysics work is of urgent importance to secondary industry and has a bearing upon the development of research for defence and other confidential work. Buildings are also urgently necessary for projects connected with primary industries, education, and many other fields, and the relative importance of the buildings required for such purposes cannot be decided by this Committee, but must be considered by Cabinet, for purposes of final priority.

Cost.

48. The Committee gave consideration to the estimate of cost for the building, and details were furnished, in evidence, by the officials concerned. It was explained to the Committee that 10 per cent. of the cost was planned to be required in respect of the operation of the 40-hour week to this building. This amount was considered necessary from actual experience in building operations in New South Wales ~~building~~. The Committee is satisfied that the estimates have been made from the most reliable data obtainable in these difficult times of rising costs, and the building has been planned according to requirements with due regard to economy.

Time for Completion.

49. It was stated in evidence, that, under present conditions, it is almost impossible to estimate accurately the time it will take to construct the building. However, assuming that labour and materials are available, it will probably take not less than eighteen months to complete the building from the time the contract is let.

Location of the Building.

50. The building is to be located on ground which will provide relatively good foundations, the subsoil having good bearing capacity. Owing to the value of the land upon which the building is proposed to be built, and having in mind the pressing need for the University itself to expand, the Committee made inquiries with a view to deciding whether it would be suitable for this building to be erected in connexion with other Council for Scientific and Industrial Research work being carried on at Highett, where the land is much less valuable, and future expansion would be possible.

51. Considerable evidence was taken on this point and the views expressed were unanimous that it was essential for this work to be carried on in intimate contact with the University work. It was explained that the work largely concerns metallurgy and chemistry, and must be carried on in co-operation with the respective sections of the Metallurgy and Chemistry Schools in the buildings adjacent to the proposed Tribophysics building. Moreover, the Tribophysics staff assists with some of the advanced teaching necessary to train some of the University students. This would not be possible unless the buildings were situated in close proximity to each other. It was also pointed out that the work at Highett, being of an applied character, requires closer contacts with industry than with the University, while the opposite is true of the Tribophysics Section.

52. The Committee is therefore of the opinion that it will be preferable to locate the proposed building within the University grounds as proposed.

Lease of the Land.

53. Inquiry was made regarding the conditions under which the land, which belongs to the University, was to be held and used by the Council for Scientific and Industrial Research in connexion with this building. The Committee was informed that there was no actual lease in existence and it was not considered necessary that any should be insisted upon. Satisfactory arrangements have been in existence in the various Universities for many years in connexion with the use of University property for research purposes. The agreement with the University is in the nature of a gentleman's agreement and is to the effect that the site may be occupied free of charge. There is an exchange of letters on the subject, and that is considered as binding as a legal agreement. A building may be erected on the land on the understanding that the Council for Scientific and Industrial Research shall have the right to occupation in perpetuity, and the only condition made by the University was that the design should harmonize with the adjacent University buildings to the satisfaction of the University authorities. The University authorities will exercise no supervision over the staff, and the Council for Scientific and Industrial Research will be solely responsible for the work of the Section.

54. It was explained that this arrangement has worked satisfactorily with various Universities for many years, and the Committee is therefore satisfied that it should continue in this case.

SECTION IV.

SUMMARY OF CONCLUSIONS.

55. The following is a summary of the conclusions reached by the Committee after consideration of the information gained by study of the plans and evidence, and the inspection of the site and present work :—

	Paragraph in Report.
(1) There is an urgent need for the building	36
(2) The buildings should be erected as soon as materials and labour are available	46
(3) Priority should depend upon comparison with other scientific projects ..	47
(4) The floor of the entrance hall and corridor should be of terrazzo ..	44
(5) The estimates have been prepared as reliably as possible and with due regard to economy	48
(6) The location of the building should be in the University grounds as planned	52
(7) The arrangements for use of the land by the Commonwealth are regarded as satisfactory	54
(8) The proposed plans should provide a satisfactory solution of the architectural problems involved	37

CHARLES A. LAMP,
Chairman.

The Office of the Parliamentary
Standing Committee on Public Works,
Parliament House,
Canberra, A.C.T.

9th April, 1948.

By Authority: L. F. JOHNSTON, Commonwealth Government Printer, Canberra.