1970

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

Parliamentary Standing Committee on Public Works

REPORT

relating to the proposed construction of

NATIONAL STANDARDS LABORATORIES

at

Bradfield Park, New South Wales

(TENTH REPORT OF 1970)

COMMONWEALTH GOVERNMENT PRINTING OFFICE
CANBERRA: 1970

C O N T E N T S

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

NATIONAL STANDARDS LABORATORIES
BRADFIELD PARK, N.S.W.

REPORT

On 16 June 1970, the Senate referred to the Parliamentary Standing Committee on Public Works for investigation and report to the Parliament the proposal to construct National Standards Laboratories for the C.S.I.R.O. at Bradfield Park, Sydney.

The Committee have the honour to report as follows:

THE REFERENCE

1. The proposal submitted to the Committee is for the construction of a building complex to house the C.S.I.R.O. divisions of Applied Physics and Physics which together comprise the National Standards Laboratory. The buildings planned are

- a lecture theatre and entry display area;
- a library, cafeteria and executive area;
- applied physics laboratories;
- physics laboratories;
- a force laboratory;
- divisional administration wings;
- a laboratory services building;
- a central plant building;
- a high voltage laboratory;
- a non-magnetic laboratory;
- a solvents building; and
- a caretaker's residence.

2. The complex is to be served by internal roads and car parks and the site landscaped to blend with the surrounding residential areas and National Park. The work is estimated to cost $13.5 million.

THE COMMITTEE'S INVESTIGATION

3. The Committee received written submissions and drawings from the C.S.I.R.O. and the Department of Works and took evidence from their representatives at a public hearing in Sydney. At that time, we also took evidence from representatives of each of the National Association of Testing Authorities and the National Standards Commission.

4. We inspected the existing National Standards Laboratory on the campus of the University of Sydney and the site for the proposed complex.

NATIONAL STANDARDS LABORATORY

5. History Recognising that important manufacturing processes and commercial transactions depend on measurement and the definition and maintenance of standards of measurement, the Commonwealth Government in 1936 appointed a committee to report on the need for testing and research for secondary industry in Australia. The Committee's report (Parliamentary Paper No. 30, 1937) emphasised the need for comprehensive and accessible testing and certification facilities. It pointed out that as Australian industrial centres lacked adequate means for routine calibration of measuring equipment, precision manufacture and mass production with interchangeability of components were almost impracticable. Formation of an Australian standards laboratory within the Council for Scientific and Industrial Research was recommended, and also that the C.S.I.R. negotiate with authorities controlling testing laboratories to establish a co-ordinated scheme for the organization of gauging, calibration, testing and certification services in industrial centres. Accordingly, in 1940, the National Standards Laboratory was formed by the C.S.I.R.

6. In 1948, the Weights and Measures (National Standards) Act made the C.S.I.R. responsible for setting up Commonwealth standards of measurement of various physical quantities with the object that these would become the sole legal standards for Australia. The Act also established a National Standards Commission to advise the Government on formal and legal aspects of standards and measurements.

7. The Weights and Measures (National Standards) Act 1960-66 which replaces the 1948 Act, made the C.S.I.R.O. responsible for standards of measurement of physical quantities. This function is now discharged through the divisions of Physics and Applied Physics which together constitute the National Standards Laboratory (N.S.L.).

8. Functions The N.S.L. is responsible for

- establishment and maintenance of national measurement standards and the related calibration service;
- research to improve these standards and the associated measuring techniques;
- Australia's participation in the Metric Treaty (1875); and
- advice and assistance to industry.

9. The calibration service checks the reference standards of other Australian laboratories and organizations to ensure that all measurements have a common basis, and are compatible nationally and internationally. The service is provided for both the British and metric systems.

10. N.S.L. policy has been to develop and maintain the basic standards and to provide calibration facilities of high accuracy over the important parts of each measurement scale to enable it to calibrate the reference standards of other laboratories. These laboratories are then encouraged to undertake the

major task of dissemination from that point. The facilities available at the main industrial centres have thereby grown and much delicate equipment is no longer exposed to transport damage.

11. In addition to N.S.L., the National Standards Commission and the National Association of Testing Authorities (N.A.T.A.) are concerned in this work. N.A.T.A., a non-government body formed in 1946, co-ordinates testing facilities. Laboratories may be registered with the Association if their facilities and techniques meet the criteria stipulated for a particular field of calibration and their reference standards are calibrated directly or indirectly against those held by N.S.L. Over 700 laboratories are so registered.

12. An important function of the National Standards Commission is the approval of verifying bodies such as State weights and measures authorities and other organizations holding standards calibrated by N.S.L. and equipped to calibrate standards for other users. For fundamental reasons, N.S.L. staff is heavily involved in the scientific and technical work of both the National Standards Commission and N.A.T.A.

13. The main aim of N.S.L. research is to establish better standards of measurement and to develop techniques providing an adequate basis for the future requirements of industry and science. Improvement in a standard can be in several directions such as accuracy, stability, availability and recoverability. Scientists appreciating that the best standards of measurement are properties of matter, and more particularly properties of single atoms or molecules have made dramatic advances in this direction in recent years. This has meant that N.S.L. has had to concurrently specialise in many branches of modern physics and the facilities thus required have become elaborate and diversified.

14. Australia became a signatory to the Metric Treaty in 1947. Under its terms, representatives of the signatory countries meet as the General Conference of Weights and Measures about once every four years as the international authority for decisions on the scientific aspects of units and standards of measurement. N.S.L. actively participates with other national laboratories and the International Bureau of Weights and Measures in inter-comparisons of standards and has gained a reputation overseas as one of the great national laboratories.

15. In addition, N.S.L. advises and assists industry directly in a wide variety of technical problems but in particular with measurement problems.

16. Present Facilities In 1938, C.S.I.R.O. obtained the agreement of University of Sydney to establish the National Standards Laboratory in the University grounds. The first portion of the building was occupied in 1940, and subsequent extensions occurred in 1943 and 1948. The accommodation was shared with the Division of Radiophysics until 1968 when the latter moved to new premises.

17. By the mid-1950s more extensive calibration facilities were required than originally planned, but as the University was unable to allocate more land due to its own expansion needs, it was not possible to permanently establish all equipment. Subsequently, the University requested the National Standards Laboratory to vacate the overcrowded campus and that its building should be converted for University purposes.

18. In total the N.S.L. currently occupies 115,800 sq. ft of net usable space, comprising 95,460 sq. ft in the premises in the University grounds and 20,340 sq. ft in a rented building formerly a knitting mill in the adjoining suburb of Newtown about half a mile away.

THE NEED

19. As early as 1957, a committee representative of industry, government and science and with overseas representation, reviewed the work of the National Standards Laboratory. It was found that the accommodation at that time was grossly overcrowded and although the acquisition of the area occupied by the Division of Radiophysics would provide some relief, the additional space would be inadequate to provide for future developments. It was also concluded that it was not essential for the National Standards Laboratory to be within the University campus and accordingly that planning for the future should envisage another site with ample provision for both field experiments and expansion of buildings over a long period particularly having regard to the future relationship of the Laboratory to Australian industry.

20. To cover each measurement field, special equipment has been developed much of which is unique and technically very advanced. The equipment requires a considerable specialist effort to set up and must have an environment closely controlled in relation to temperature, humidity, air cleanliness, vibration and noise. Efficiency also demands that such facilities should be permanently set up and ready for use. However, some installations requiring special buildings or large areas have had to be deferred, due to the inadequacy of the present complex.

21. The number of measurements and the variety of instruments needed in a modern industrial nation is considerable. It was clear to us that if the aims of uniformity and compatibility are to be achieved, adequate calibration facilities based on N.S.L. standards must be available.

22. The present premises are plainly not suitable for current needs and there is no possible way in which they can be improved or efficiently augmented to provide for the future. Despite the relief provided by rented

space and the use of the accommodation vacated by the Division of Radiophysics, the overcrowding is now worse than it was in 1957. Not only does the present building not provide the controlled environment required in many areas without the use of expensive expedient measures, but equipment which should ideally remain set up has to be dismantled from time to time. The use of rented space is inconvenient and inefficient. There is, furthermore, no room for expansion of current activities or for the needs of the future and there is pressure from the University for the N.S.L. to relocate itself.

23. The net result is that the Committee believe that there is a need for the work in this reference to enable N.S.L. to discharge its statutory obligations, to satisfactorily accommodate its present activities and to provide for expansion.

THE SITE

24. The site of 73 acres is some seven miles north-west of Sydney in the Ku-ring-gai Municipality. It is bounded to the north and east by Lady Game Drive and the Lane Cove River Park. Bradfield Road will be diverted to skirt the western and southern boundaries. Some 15 acres of the site is occupied by a migrant hostel but this land has been reserved for N.S.L. expansion when the hostel is eventually vacated.

25. Land adjacent to the site is already developed for residential purposes or dedicated as the Lane Cove River Park, the Pacific Highway and the nearest railway are about a mile away and no other main roads are planned in the vicinity. All of these factors should ensure that vibration and electrical interference will not increase significantly to affect work in the laboratories.

Although the local T.V. signal is strong, it can be reduced to acceptable levels by special building features.

26. The Committee were told that no development is proposed in the vicinity by the Council or the State Government, which would prejudice the planned use of the site. It was clear also that the land available will cater for expansion needs for some considerable time.

27. The Committee concluded that the site selected is suitable for the requirements of the National Standards Laboratory.

THE PROPOSAL

28. Planning Considerations Broadly the requirement was for accommodation for the N.S.L. with a staff of 450, with some in-built expansion space and master planned for further expansion in the long term.

29. A major technical requirement was for a minimum of vibration interference in about half the laboratory space. On investigation, it was found that this could be most satisfactorily provided by supporting the floor slab of such laboratories on compacted ground. Secondary needs were for offices for research staff close to related laboratories and for a reasonably compact grouping of buildings to ensure short travel distances by staff and economy of service lines.

30. It was also important for laboratories requiring close control of temperature and humidity to be shielded from solar heating by surrounding air conditioned space and other insulation.

31. Design The above requirements will be met satisfactorily by the plan which provides for three two-storey parallel laboratory/office wings whose long facades will face north/south to minimise solar heating. Laboratories requiring vibration-free conditions will be located at basement or ground floor

level, others with less stringent requirements being on first floors. The buildings providing services to the laboratory complex will be located at the western end of the group.

32. There is sufficient space on the site, south of the proposed complex for a fourth laboratory block when the need arises.

33. The architectural character of the complex will provide a "campus-like" atmosphere. By limiting the buildings to one or two storeys, they will not appear to overwhelm the surrounding domestic architecture. It is envisaged that the colour of the brick facing of the buildings will match the sandstone outcrops on the site. The colour of other external materials will complement the brickwork.

34. The landscaping proposals aim to retain the existing attractive and controlled natural parkland environment and where necessary areas which have been disturbed are to be redeveloped so that they appear as an extension of the adjoining National Park. Car parks for 250 cars are also be to carefully blended into the landscape.

35. Buildings and Facilities The three two-storey laboratory blocks will house the lecture theatre and entry/display area, the library, cafeteria and executive office area, the applied physics laboratories and offices, the physics laboratories and offices, the force laboratory, and the divisional administration wings. The blocks will be joined by enclosed corridors surrounding courtyards between the buildings. Similarly connected to the western ends of the middle and southern blocks will be the laboratory services building. The central plant building and the high voltage laboratory will be to the west. A small non-magnetic laboratory, a solvents building, a water tower and a caretaker's residence will complete the complex.

36. Facilities will include a lecture theatre to seat 250 and a cafeteria for 270 equipped to serve both hot meals and light refreshments. Their layout will permit them to be used in conjunction with the conference rooms for "open days" or special conferences. Special features will include the force laboratory which has been designed for a 50-ton capacity dead-weight testing machine and associated equipment, and the connection of the central plant building to the main buildings by a tunnel system.

37. The total gross area of the buildings will be 435,000 sq. ft. This figure includes 120,000 sq. ft for general purpose laboratories, 70,000 sq. ft for research offices and administrative facilities and 35,000 sq. ft for ancillary laboratory services, workshops and storage rooms.

CONSTRUCTION

38. Structure The buildings generally will have load bearing brick walls supporting reinforced concrete suspended floor slabs. The ground floor concrete slabs will be cast on the ground. Structural steel framing will support first floor areas where spans between bearing walls would otherwise be excessive and where crane rails, roof purlins and sheeting require support. The high voltage, laboratory services and central plant buildings will be steel framed.

39. As site investigations show that weathered sandstone rock will be encountered close to the surface, foundations of concrete spread footings bearing on the sandstone are to be used. However, to avoid the possibility of vibration being transmitted to other buildings, the central plant building will be founded entirely on earth fill.

40. Materials and Finishes Externally, the buildings will be brick faced structures. Exposed columns to the facades of the high voltage,

laboratory services and central plant buildings will be of special steel requiring no applied finish. Roofing, deep fascias and exposed metal facings will be of pre-coloured finished steel sheeting.

41. Windows will have P.V.C. coated steel frames. The laboratory buildings will be glazed with a reflective glass for protection from the T.V. signal in the area and solar radiation. Laboratories will also be protected from the T.V. signal by wire mesh built into the cavity between the brickwork of the external walls.

42. Internally, walls will be generally flush jointed and painted where necessary. Smooth faced concrete block partitions sub-dividing laboratories and offices will be painted.

43. Exposed concrete ceilings of the laboratory and corridor areas will be painted and suspended ceilings of offices, the cafeteria and the library will be acoustic tiles.

44. Floors will be finished with vinyl tiles, carpet, ceramic tiles or granolithic as appropriate. Standard built-in fittings will be provided in the laboratories.

45. Mechanical Services It is proposed to air condition all laboratories and offices, the cafeteria, library, lecture theatre and several areas in the laboratory services building. The system serving areas having special requirements such as the laboratories, the machine room in the force building and the measuring, grinding and instrument rooms in the laboratory services building will be designed to maintain the environment within the fine tolerances of $\pm$ 1°F in temperature and 5% in relative humidity. In other air conditioned areas comfort conditions will be maintained.

46. Refrigeration and boiler plant in the central plant room will supply treated water to the air handling plants in the various buildings and also the heat exchangers.

47. Three centrifugal water chillers are proposed with a total installed capacity of 120% of the design load. In the event of breakdown of one chiller, the remaining 80% capacity will be sufficient to serve the critical laboratory areas. Two oil fired water boilers of 100% load capacity will be installed. One boiler will be sufficient to meet the essential laboratory load. Hot and chilled water will be reticulated by insulated piping in service tunnels except to the high voltage building where the piping will be run in a drained trench.

48. Areas in the laboratory services and the high voltage buildings not being air conditioned will have projection heaters or electric strip heaters as necessary. Toilets, cleaners' rooms, tea rooms, storage areas, service tunnels, corridors and some areas in the cryogenics section, laboratory services building and high voltage building will be mechanically ventilated.

49. Reticulated services will comprise domestic hot water, cooling water, distilled water, town gas, compressed air, nitrogen, oxygen, hydrogen, helium and glycol brine. Miscellaneous mechanical services will include drinking water coolers, a sawdust extraction system, a petrol pump and tank, an incinerator, cafeteria, kitchen and laundry equipment, sanitary incinerators, motorised doors, fume cupboards, a paint spray booth, exhaust hoods, a number of fan coil units for air tempering and standby cooling, and hoist facilities.

50. Electrical Services Electricity from two separate supply zones will be supplied by the Sydney County Council. A high voltage underground ring main will inter-connect four transformer substations from which power at medium voltage will be distributed as necessary.

51. The installation within buildings will include cabling, switchboards, power outlets and lighting. It will be generally surface mounted to facilitate the provision of additional power supplies and periodic changes in partitioning.

52. The standards of lighting will accord with the recommendations of the S.A.A. Lighting Code.

53. Hydraulic Services Water, sewerage and stormwater drainage will be connected to adjacent mains. However, it will be necessary to purify water for use in the general purpose laboratories. An elevated storage will be provided for emergency purposes and the cold water reticulation system will be pressurised.

54. The sewerage system will have appropriate laboratory-waste plumbing including facilities for neutralising corrosive wastes.

55. Lifts Four goods/passenger lifts, one of 5-ton, two of 3-ton and one of 500 lbs maximum load capacity will be installed, in addition to three service lifts, each of 500 lbs capacity.

56. Fire Protection The fire detection system to be installed in all buildings is to include early warning detectors in the library and in laboratories. Externally, hydrants will be sited to cover all buildings and internally hose reels and extinguishers will be provided at appropriate points.

57. The Committee's Conclusion The Committee recommend the construction of the work in this reference.

ESTIMATE OF COST

58. The estimated cost of the work when referred to the Committee was $13.5 million made up as follows:

	$
Building work	6,600,000
Mechanical services	3,750,000
Electrical services	1,450,000
Hydraulic services	900,000
Site works	800,000
	13,500,000

PROGRAMME

59. It is expected that after an approval to proceed is given, the preparation of final drawings and tender documents and calling and analysis of tenders will take 22 months. Construction time for the complex is estimated at three years after a contract is let. However, it is planned to stage some of the work within that period to permit progressive installation of equipment.

SECURITY

60. The Committee noted that no specific mechanical devices are to be built into the fabric of the buildings to protect them and their contents from vandalism and theft. It was noted, however, that there will be a resident caretaker and consideration is to be given to the use of a watching service or similar arrangement.

61. We were not completely reassured that an adequate examination has been made of this problem, not only in the light of the value of the buildings but because of the very expensive equipment used by N.S.L. and the importance

of its work. It is our recommendation that the security measures proposed for the Laboratory and its facilities should be studied more closely to determine, before working drawings are finalised, whether the proposed arrangements are adequate.

RECOMMENDATIONS AND CONCLUSIONS

62. The summary of recommendations and conclusions of the Committee is set out below. Alongside each is shown the paragraph in the report to which it refers.

		Paragraph
1.	THERE IS A NEED FOR THE WORK IN THIS REFERENCE.	23
2.	THE SITE SELECTED IS SUITABLE.	27
3.	THE COMMITTEE RECOMMEND THE CONSTRUCTION OF THE WORK IN THIS REFERENCE.	57
4.	THE ESTIMATED COST OF THE WORK WHEN REFERRED TO THE COMMITTEE WAS $13.5 MILLION.	58
5.	THE SECURITY MEASURES PROPOSED FOR THE LABORATORY AND ITS FACILITIES SHOULD BE STUDIED MORE CLOSELY TO DETERMINE WHETHER THE PROPOSED ARRANGEMENTS ARE ADEQUATE.	61

(C.R. KELLY)
Chairman

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CANBERRA, A.C.T.

11 August, 1970.