

1926.

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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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PARLIAMENTARY STANDING COMMITTEE ON  
PUBLIC WORKS.

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REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE PROPOSED ERECTION OF

PERMANENT ADMINISTRATIVE OFFICES,  
CANBERRA.

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*Presented pursuant to Statute ; ordered to be printed 7th July, 1926.*

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(Fourth Committee.)

(Ceased to have existence, 3rd October, 1925.)

The Honorable HENRY GREGORY, M.P., Chairman.

Senate.

Senator John Barnes. †  
 Senator Hattil Spencer Foll.\*  
 Senator Patrick Joseph Lynch. †  
 Senator John Newland.\*  
 Senator William Plain. †  
 Senator Matthew Reid. †

\* Resigned 23th June, 1923.

† Ceased to be a Member of the Senate 30th June, 1923.

House of Representatives.

Arthur Blakeley, Esq., M.P.  
 Robert Cook, Esq., M.P.  
 David Sydney Jackson, Esq., M.P.  
 George Hugh Mackay, Esq., M.P.  
 James Mathews, Esq., M.P.

‡ Appointed 5th July, 1923.

(Fifth Committee.)

(Appointed 22nd January, 1926.)

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Senate.

Senator John Barnes.  
 Senator Patrick Joseph Lynch.  
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House of Representatives.

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EXTRACT FROM THE MINUTES OF THE EXECUTIVE COUNCIL.

No. 253, DATED 19TH MAY, 1925.

Home and Territories Department,  
 Melbourne, 18th May, 1925.

MINUTE PAPER FOR THE EXECUTIVE COUNCIL.

Subject.—Reference to the Parliamentary Standing Committee on Public Works.

Recommended for the approval of His Excellency the Governor-General in Council that, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1921*, the following proposed works be referred to the Parliamentary Standing Committee on Public Works for investigation and report, viz. :—

- (a) The erection of a building at Canberra for accommodation of Commonwealth Departments.
- (b) .....
- (c) .....
- (d) .....

Departmental  
 No. 253.  
 Executive  
 Council No. 25.  
 Approved in  
 Council.  
 (Sgd.)  
 L. L. ATKINSON,  
 for Governor-  
 General.  
 19th May, 1925.

Filed in the  
 Records of the  
 Council.  
 (Sgd.)  
 J. H. STARLING,  
 Secretary to the  
 Executive  
 Council.

(Signed)  
 G. F. PEARCE,  
 Minister of State for Home and Territories.

## EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES.

No. 14, DATED 11TH FEBRUARY, 1926.

4. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—COMMONWEALTH DEPARTMENTS BUILDING, CANBERRA.—  
Mr. Marr (Minister representing the Minister for Home and Territories) moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1921*, the following work be referred to the Parliamentary Standing Committee on Public Works for investigation and report thereon, viz.:—The erection of a building at Canberra for accommodation of Commonwealth Departments.

Mr. Marr having laid on the Table plans, &c., in connexion with the proposed work—

Debate ensued.

Question—put and passed.

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# PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

## PERMANENT ADMINISTRATIVE OFFICES, CANBERRA.

# 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 permanent Administrative Offices at Canberra, has the honour to report as follows :—

### INTRODUCTORY.

1. On the 9th March, 1923, the House of Representatives, on the motion of Mr. Stewart, the then Minister for Works and Railways, referred to the Parliamentary Standing Committee on Public Works a proposal for the construction at Canberra of provisional administrative offices with accessory engineering and other services. The work projected was the erection of twelve separate single-story office buildings of light timber frame construction; also two buildings of brick or concrete to accommodate departments and records whose preservation from fire was considered specially important. The estimated cost of these buildings, including engineering services, was set down at £135,000, and the time for completion two years from date of approval.

2. The Committee after investigation of the proposal recommended, on the 21st June, 1923, that the provision of these temporary structures be not approved, but that steps be taken to erect two units of permanent buildings. Further, that competitive designs for these buildings be invited amongst the architects of Australia, to honour a promise made by a previous Government that any permanent Government buildings in contemplation for Canberra should be the subject of competition.

3. On the 24th August, 1923, on the motion of Mr. Stewart, then Minister for Works and Railways, the House of Representatives agreed :—

That it is not expedient to carry out the construction of Provisional Administrative Offices, with accessory engineering services, at Canberra—a proposed work which has been investigated and reported upon by the Parliamentary Standing Committee on Public Works, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1921*; but that it is expedient to invite competitive designs for Permanent Administrative Offices, as recommended by the Parliamentary Standing Committee in its Report.

4. Competitive designs were then invited for the first of the permanent Administrative Offices at Canberra, and 94 designs were submitted by architects from all States. The adjudicators were Sir John Sulman, Mr. H. E. Ross, Professor Wilkinson, and Mr. J. S. Murdoch, Chief Commonwealth Architect, and the premium was awarded to Mr. George Sydney Jones, of Sydney.

5. In accordance with the conditions of the competition, Mr. Jones was then instructed to proceed with considered drawings of the building, to the extent of being able to sufficiently illustrate his scheme for submission to the Public Works Committee.

6. On the 19th May, 1925, Parliament being in recess, His Excellency the Governor-General in Council referred the matter to the Parliamentary Standing Committee on Public Works for investigation and report, and considerable evidence was taken by the Fourth Committee; but by the dissolution of Parliament on 3rd October, 1925, that Committee ceased to have existence before being in a position to submit its Report.

7. On the 11th February, 1926, on the motion of Mr. Marr (Minister representing the Minister for Home and Territories), the House of Representatives referred the matter for investigation and report by the Fifth Committee.

#### PRESENT PROPOSAL.

8. The proposal as submitted to the Committee aimed at the construction of a large utilitarian office building 430 feet long and 54 feet high, comprising five floors, and capable of accommodating eight Departments of State with office space sufficient for about 1,100 officials.

#### DESCRIPTION OF THE BUILDING.

9. It is suggested that the main structure should be built of reinforced concrete, the space between piers and beams where possible to be filled in with brick in cement. The lower ground floor is to be 11 feet high, the ground floor 23 feet, allowing for the introduction of a mezzanine floor 11 feet high; the first floor is 15 feet high, and the top floor 12 feet high—all measurements being from floor level to floor level.

10. Under the scheme as submitted, the effective office floor space would be—

	sq. ft.
Lower ground floor .. .. .	50,862
Ground floor .. .. .	48,467
Mezzanine floor .. .. .	26,382
First floor .. .. .	50,286
Second floor .. .. .	39,354
	215,351

11. The designer considers that all parts of the interior should be finished without elaboration in a manner economical but befitting one of the national buildings at Canberra. He therefore suggests that the walls and ceilings should be of plain white plaster, excepting in vestibules and essential corridors, where the ceilings might be slightly enriched and the walls of essential corridors and staircases lined with marble to a height of 7 or 8 feet. Floors of vestibules, essential corridors, staircases, and lavatories, he suggests, might be paved with marble.

12. It is proposed that office space should be provided with suitable super-flooring; lifts should be electrical, with enclosures of marble and doors of bronze. Important internal doors are to be of bronze and glass; window frames and sashes of steel and of standardized sizes. All internal angles of the building are to be rounded.

13. A conduit the full length of the building and centrally situated below the lower ground floor is designed to take all main services and main wastes. Ducts for secondary service pipes and chutes for wastes and sweepings are distributed to serve each floor. While realizing that it is advisable to provide for wash basin and water filter service in each room subdivision, the designer suggests that, as it is impossible to foretell what may be the position of these, service and waste pipes should be laid at points in the building where they may at any time be required, and put into use by the installation of a fitting at very short notice.

14. Strongrooms are suggested to be placed in positions that are most serviceable for staffs, viz., 28 in basement, 24 on ground floor, 8 on the mezzanine, 24 on the first, and 2 on the second floor, or a total of 86.

15. The question of the treatment of the surface of the building, in the opinion of the designer, requires very careful consideration, having in mind that the treatment determined may influence the treatment of future buildings in the official group. He suggests four possible methods, viz. :—

- (i) Facing the concrete in sandstone with a base of granite;
- (ii) Facing the concrete in white terra cotta with base of granite;
- (iii) Facing the concrete in marble with a base of granite;
- (iv) Facing the concrete in white cement plaster with a base of granite.

16. Other points in the design which may be considered important are :—

- (a) External light courts giving external light, sunlight, and perflation of air to office spaces.
- (b) One essential corridor, and staircases, lifts and lavatory blocks concentrated at three points in its length, thus minimizing essential communication and economizing expenditure.
- (c) Subsidiary corridors within departments which may be used as corridors for their whole length or part of their length or alternatively may be absorbed as office space.

- (d) Steel staircases within departments, enclosed by grilles and locked gates at each floor which give access to upper and lower floors for extension of department if required. For instance, extension of ground floor office accommodation to second floor, or lower ground floor to first floor as may be required without interference with intervening floors. The plan therefore allows of reduction of departmental floor area horizontally and extension of departmental floor area either horizontally or vertically, or both as desired, independently of other floors or associated with other floors, or, if required, the whole of each floor by this arrangement can be used as a self-contained department.
- (e) The introduction of a mezzanine floor between part of the ground floor and first floor, thereby increasing floor area. It is suggested that this may be used as the ministerial floor.
- (f) Standardization of parts ensuring economy in expenditure, but owing to the arrangement of the plan, not uniformity or lifelessness in external appearance.
- (g) Unit of subdivision, 22 feet x 11 feet.

#### ESTIMATED COST.

17. The estimated cost of the proposal as first submitted to the Committee was set down at £451,572, and the time for completion about four years and seven months from date of approval.

#### COMMITTEE'S INVESTIGATIONS AND RECOMMENDATIONS.

18. A considerable amount of evidence taken by the Fourth Committee was available for the information of the present Committee. In addition, this Committee visited Canberra inspected the site of the proposed building to the north-east of Parliament House and its complementary building on the other side of the main axis, examined plans, and took evidence from the designer, Mr. Jones, the Chief Commonwealth Architect, the President of the Federal Council of the Australian Institutes of Architects, the Chairman and Chief Engineer and other officers of the Federal Capital Commission, officers of the Department of Works and Railways, architects, geologists, and others.

19. Previous investigations of the Committee had shown the necessity for the provision of a building of this nature, and the fact that this design had been selected by four qualified architects from 94 designs submitted satisfied the Committee of the general suitability of the structure for the purpose for which it is intended.

20. In the course of evidence it was suggested that, in lieu of reinforced concrete as proposed, the skeleton structure should be erected with steel stanchions and girders. It was pointed out, however, that if this were done the cost of the building would be approximately £40,000 greater.

21. The advantages claimed for reinforced concrete are that it is homogeneous and monolithic, and being of this character is more durable than a conglomerate structure; and it is hygienic and more fire-resisting.

22. Under these circumstances, the Committee agreed to recommend that the skeleton structure be of reinforced concrete as proposed by the designer.

#### ALTERATION OF DESIGN.

23. It was stated in evidence that, subsequent to the decision in his favour, Mr. Jones was asked by the adjudicators to submit plans embodying certain alterations in the premiated design, and to these suggested alterations the Committee directed its attention.

#### *Second Story.*

24. In the case of the second or top story of the building, an amended plan was submitted showing the restriction of that story to the centre part of the structure only. This alteration, which was favoured by the designer and others, as providing a more pleasing architectural composition, would reduce the cost of the building by approximately £48,000, and diminish the effective floor space by about 22,640 square feet.

25. Evidence received by the Committee indicated that requirements of Departments are increasing, and that any curtailment of space in this building would hasten the time when it would be necessary to proceed with the erection of a similar complementary building on the other side of the main axis. Under the circumstances, the Committee considers that full advantage should be taken of the opportunity of providing as much accommodation in this building as is reasonably possible, and recommends that the building be constructed with the complete top story as shown in the premiated plan.

*Shape of Building.*

26. The original design of the building provided for square ends, but opinions were expressed that a more pleasing feature would be gained by providing the outer or south-easterly extremity with a rounded end, which would be repeated on the north-westerly end of the complementary building to be erected at some future date, on the other side of the main axis. Mr. Jones submitted two sketches to illustrate this idea—one a full rounded or semi-circular end, and the other with a smaller segmental or apsidal end.

27. It was pointed out that the outer end of the building will face an avenue which is not parallel with the structure itself, and from the plans supplied it was apparently the intention of the author of the design adopted for the lay-out of the Federal Capital that a rounded end should be placed in this position. The judges of the competition for this building were all of opinion that a rounded end would be more attractive than a square end, and with this opinion the Committee is in agreement. After carefully considering the matter, therefore, it was decided to recommend that the smaller segmental or apsidal end be provided, as indicated on the amended sketch furnished by Mr. Jones.

*Dome.*

28. Evidence was taken as to whether a dome should be erected on this building, and Mr. Jones submitted a sketch showing what the effect of such a feature would be. Although costing a sum estimated at £15,000, the dome would not provide any extra accommodation, and should be considered purely as affecting the architectural appearance. It was represented that a dome on this building would exert undue restrictions in respect of the design of future buildings. It would immediately suggest something that would not harmonize with future construction, and it was thought that the dominating features in the Governmental group should be the Capitol, the permanent Parliament House, and other buildings on the main axis. For these reasons, it is recommended that a dome be not included on this building.

## FOUNDATIONS.

29. In giving evidence before the Committee, Mr. Jones stated that he had been informed that there was a possibility of obtaining good solid foundation about 4 feet below the surface; consequently his estimate for foundations embraced a depth of 2 feet below the lower ground floor level. Subsequently, he intimated that he had added another 4 feet, making 6 feet in all, and had increased his estimate for foundations to £20,000. During the investigations of the Committee, it was ascertained that, although when examined in June, 1925, the Chairman, Federal Capital Commission, expressed some doubt as to the foundations, and intimated that tests would have to be made, yet when he again gave evidence in April, 1926, the Committee learned with regret that no actual tests had been made to discover at what depth a proper foundation could be secured. Excavations made in connexion with the construction of the main sewer, however, showed that it was possible that it might be necessary to go to a depth of 15 to 25 feet. On this information being conveyed to Mr. Jones, he intimated that if it were necessary to go to a depth of, say, 22 feet, the cost of foundations would be increased to about £80,000.

## SITE.

30. The site upon which it is proposed to erect this building is the second block from the north-east of the provisional Parliament House, on the eastern side of the main central axis and fronting Federal-avenue. When necessity arises, it is proposed to erect a complementary building on the western side of the main axis, fronting Commonwealth-avenue. The competition provided that the 1,870-ft. datum ground floor level, as provided in Mr. Griffin's design for the lay-out of the Capital, should be adhered to, which meant that the site of this Administrative building would have to be filled up nearly 20 feet from its present level of 1,849 feet, involving an enormous cost for earthworks. As a result of more thought and consideration than it had been possible to give in the earlier stages, and a visualization of what is involved in the development of roads and grounds, not only in relation to the provisional Parliament House but to the future permanent Parliament House—it was decided to alter the datum level to 1,860 feet.

31. The Committee gave considerable attention to this subject, and after ascertaining the opinion of architects and engineers, is satisfied that besides tending to economy it will have no detrimental effect on the future buildings in the Governmental group, and for this reason the change has its approval.

32. In view of the discovery made as to the probable cost of foundations, however, the Committee is of opinion that immediate tests should be made to ascertain at what depth suitable foundations can be obtained on the site fronting Commonwealth-avenue. As the Committee is satisfied that the building now under consideration would be equally suitably located on the east or west of the main axis, it is recommended that the first of these two complementary buildings should be erected on the site which investigation shows requires the less expenditure for foundations.

## EXTERNAL FACING.

33. In present-day building construction, solid stone is seldom used, the custom being to cover the external brick or reinforced concrete skeleton with a veneer of stone varying from 3 to 6 inches in thickness according to the class of stone used.

The question of the class of stone which should be selected to clothe the reinforced concrete skeleton of this building was one to which the Committee gave a considerable amount of thought and attention. Evidence was taken from architects and others, and opinions as to the material to be used were found to differ widely. While the designer was definite as to his preference that the base of the building should be of grey granite, portions of which should be dressed and polished, he left it to the Committee to determine the class of facing for the upper parts of the building.

The Committee realizes that the question of the facing of this building requires very careful consideration, having in mind that what is decided upon may influence the treatment of future buildings in the official group. Moreover, the class of stone selected now should be available in 10, 50, or 100 years hence, to enable the counterbalance which is essential to the scheme of design for the Federal Capital to be exactly reproduced on the opposite side of the main axis. It follows that the stone chosen should be available in sufficient quantities to insure a supply being forthcoming at any future date; and also be of such a character that it does not vary in colour with age—making it difficult to match it when required.

34. All witnesses agreed that the building should be light in colour, and as it is intended to be more or less of a monumental character, the facing to be utilized should be as durable as possible. Evidence was taken as to the advantages and disadvantages of white cement plaster, synthetic stone, terra cotta, sandstone, limestone and granite, each of which had its advocates.

*White Cement Plaster.*

35. White cement is not Australian made, although it may possibly be made in Australia. It is a substance in sympathy with reinforced concrete, and its cost is moderate compared with other materials. The effect on the mind of most people, however, is that of cheapness and wanting in suggestion of durability. The Committee, therefore, had no hesitation in eliminating this substance from consideration.

*Synthetic Stone.*

36. Although examples were quoted of buildings in Melbourne and elsewhere in which synthetic stone had been successfully used, the Committee did not seriously consider this proposition, regarding it as artificial in character and not suitable for a Government building of the class contemplated.

*Terra Cotta.*

37. Architectural terra cotta or faience is a class of covering which has much to recommend it, and to which the Committee gave serious thought. A visit was paid to the terra-cotta works of Wunderlich Ltd., at Rosehill, near Sydney, the only firm in Australia which is producing this material, and an inspection made of the method of manufacture and various samples of the finished article.

Terra cotta is manufactured from selected clay, carried during the process of manufacture to a temperature exceeding 2,000° Fah., and is produced in the form of large tiles or blocks. It may be bonded as a veneer to either brickwork or reinforced concrete. As it can be manufactured in any colour and with any texture of surface, it fulfills the condition of being easily matched when required at any future time. It is also extremely durable, and it was stated in evidence that it is now being extensively used in all classes of buildings in the United States and elsewhere. The Committee inspected several buildings in Sydney and Melbourne which had been faced with this material, but were of opinion that it did not give the imposing and monumental appearance which is aimed at for the Administrative Offices.

*Sandstone.*

38. Sandstone is extensively used in Australia, and produces pleasing buildings of a monumental character; but the inquiries of the Committee showed that even in Sydney many of the larger buildings showed considerable weathering, and experts limited the life of this material to about 100 years. With the more severe climate at Canberra, with its frequent and heavy frosts, it was feared the life of sandstone would be even shorter. Moreover, its cost is high, and it offers the disadvantages of varying in colour with age, so that it might be difficult to match it for other buildings in future. For these reasons, it did not commend itself to the Committee.

*Granite.*

39. Granite is an attractive stone having a sense of life, and suggestive of permanence and solidity. Several deposits of grey granite, which is the only colour which should be considered, are available, from which the Committee is of opinion suitable blocks could be obtained to produce a building having all the characteristics it is desired that this building should possess. It has, however, the drawback that it is very expensive.

*Fairy Meadow Limestone.*

40. During the course of its investigations, the attention of the Committee was directed to a deposit of crystalline limestone at Fairy Meadow, about 35 miles from Canberra, and 2 miles from the railway between Queanbeyan and Goulburn, on certain land which was acquired by the Commonwealth some years ago, with the intention of entering upon the manufacture of Portland cement for use at Canberra and in other Government buildings throughout Australia. Inquiries showed that this stone is really a true marble, and samples obtained showed it to be of a fine texture, dark grey in colour, and light grey when axed. The Chief Commonwealth Architect and others were enthusiastic in regard to it, and the Government Petrologist of Victoria, who visited the deposit and examined samples of it, likened it to Buchan marble and classified it as a first-class building stone. At a conservative estimate, there are said to be 3,000,000 tons of the deposit above creek level, while with quarrying probably double that quantity could be obtained.

41. From the samples examined and the information obtained in regard to it, the Committee is of opinion that this stone, if axed, would be suitable as regards colour, and evidence showed that there is no doubt as to its lasting qualities. It also fulfils the condition as to quantity available for future buildings, and the fact that it is the property of the Commonwealth and at no great distance from Canberra should give it an advantage in price over any competing stone.

42. Unfortunately, sufficient exploration work has not yet been carried out to warrant a definite opinion being expressed as to the possibility of quarrying the stone in sizes suitable for building, but the Chairman, Federal Capital Commission, has now put in hand certain work on the deposit which, in the course of a few months, should settle the question beyond all doubt.

43. The Committee, however, is unwilling to delay the presentation of its report until these investigations shall have been completed, as the general work of construction can be advanced a considerable distance irrespective of the class of external covering which may be eventually decided upon. It was therefore unanimously agreed that the Committee should express itself as being very favorably disposed to the facing of the building with Fairy Meadow limestone, if investigations now being made show that sufficient quantities of the stone, of size and quality suitable for building are obtainable. As no work on the facing can possibly be commenced for at least two years, the Committee recommends that the construction of the skeleton structure be proceeded with in the meantime; but stipulates that when the investigations now being conducted at Fairy Meadow are sufficiently advanced to enable full information to be furnished as to whether the stone improves as it recedes from the surface, the extent of the deposit which will furnish blocks in sizes suitable for building purposes, and the price at which it can be delivered at Canberra, the matter be again referred to the Committee for the purpose of its submitting a definite recommendation as to the class of facing to be used in this building.

44. Figures obtained by the Committee as to the cost of facing this building with the various types of material suggested were:—

	£					
Granite, 3-inch veneer .. .. .	..	..	..	..	..	97,420
Freestone, 6-inch veneer .. .. .	..	..	..	..	..	82,350
Terra Cotta .. .. .	..	..	..	..	..	122,178
Plaster .. .. .	..	..	..	..	..	3,500

No figures were available as to the cost of using Fairy Meadow limestone, but, in the opinion of the Committee, the cost of that material should be considerably less than freestone.

## METHOD OF CONSTRUCTION.

45. It should be realized that the work of introducing into this building stone facing of whatever variety decided upon would necessarily be a slow process. It is therefore recommended that the interior of the building be proceeded with in such a way that departments may enter into occupation as early as possible and the facing work be gone on with subsequently.

In this way it is thought probable that the occupation of the building might be accelerated by about two years, with a consequent saving in interest of probably £40,000.

## INTERNAL FITTINGS.

46. The Committee is in agreement with the designer that the internal treatment of this structure should be carried out with due regard for economy, but in a manner befitting the importance of the building. In all joinery work, it recommends that representative Australian woods be used.

## CEILINGS AND WALLS.

47. The Committee supports Mr. Jones' recommendation that the ceilings in vestibules and essential corridors should be slightly enriched, and also that in the case of vestibules, staircases, and essential corridors, the walls should be lined with Australian marble—if possible introducing suitable varieties from various States. It is thought, however, that there is no necessity to carry this marble lining to the height of 7 or 8 feet as suggested by Mr. Jones, but that a height of 4½ to 5 feet should be sufficient.

## FLOORS.

48. Floors of vestibules, corridors, staircases, and lavatories might, it is considered, be paved with marble, but the Committee recommends that in the case of the general offices the floors should be of Australian hardwood.

## STRONG ROOMS.

49. In the opinion of the Committee, the number of 86 strongrooms provided appears to be on the liberal side. It is recognized that this number is purely tentative, and no information is at present available as to the actual number that will be required. The Committee considers, however, that there should be no necessity to provide each of these strongrooms with burglar-proof doors costing £110 each, as suggested by Mr. Jones, and recommends that in the majority of cases a cheaper class of fireproof door should be sufficient, and that the expensive variety should be used only where considered absolutely necessary. This would reduce the cost of this item from £9,400 to about £3,000.

## STAIRCASES, LIFTS, AND LAVATORIES.

50. After an examination of the plans and hearing the evidence of the various architectural witnesses examined, the Committee is satisfied that the staircases, lifts, and lavatories provided will be sufficient for all purposes.

## ENGINEERING SERVICES.

*Heating Service.*

51. The heating service proposed embraces two systems with boilers in the basement and what is known as the overhead drop system, necessitating vertical risers to the second floor and mains completely round the top and bottom floors. This will mean the installation of at least 80 drop pipes extending from the ceiling of the second floor to the lower ground floor. Although recognized as a good system, it does not commend itself to the Committee, as it is considered the pipes, if left exposed, will be unsightly, and if concealed will be difficult to get at for repair work. It is therefore recommended that a system be provided similar to that adopted for Parliament House, viz., horizontal hot water pipes connected with two or more vertical risers. The largest of these risers, where exposed, would not exceed  $2\frac{1}{2}$  inches in diameter, and the minimum would be  $1\frac{1}{2}$  inches, while the largest horizontal loop serving the radiators would have a maximum diameter of  $1\frac{1}{2}$  inches and a minimum of 1 inch. All the circuits should be connected to a battery of four cast-iron boilers with the necessary valves to permit of the isolation of any one circuit for repairs or other purposes. It is further suggested that the system be split into eight circuits, four on the main walls and four around the light courts. The cost of this system would not be greater than that proposed, but it would have the advantage of enabling repairs to be carried out in any particular part of the building without interfering with the heating of other portions of the administrative block. Moreover, the pipe system can be made inconspicuous by being placed on top of the skirting, and might actually take the place of moulding. It is also recommended that the wall type radiator be adopted in place of the two-column radiator suggested by Mr. Jones.

*Vacuum Cleaning.*

52. The proposal to use wet centrifugal separators and discharge all dust into the sewer is not approved, as under the system of sewage treatment proposed at Canberra it is feared that this might lead to a dislocation of the sewage treatment works. In a building of this description, the Committee considers that it would be preferable to use portable vacuum cleaners, as is done in the Commonwealth offices. The adoption of this system, the Committee is assured, would reduce the estimate for vacuum cleaning from £2,700 to about £1,000, for the purchase of the necessary vacuum-cleaning machines and the installation of additional power plugs in the building. On account of this and other reasons, it is considered that Mr. Jones' provision of 500 electric power plugs should be increased to 800.

*Hot Water to Lavatory Basins.*

53. No provision is made by the designer of this building for the supply of hot water to the lavatory basins. In a climate like Canberra this is considered necessary, and is unanimously recommended by the Committee. The estimate furnished to the Committee for this service, consisting of a cast-iron water boiler, copper-lined cylinder, and copper pipe reticulation to serve the basins in the eight lavatory blocks, sets down the cost at £2,500.

*Fire Alarms.*

54. In giving evidence before the Committee, Mr. Jones suggested the adoption of the Reichel fire alarm system—1,020 points at a cost of £3,650. Most witnesses, however, agreed that in a reinforced concrete building of this description very little danger from fire need be anticipated. There are ample water mains in the streets around the building, and fire hydrants are fixed at 120-yds. intervals in accordance with the recommendation of the Commonwealth

Fire Consultant. In addition, the Committee was informed that it is the intention to install at Canberra the same system of watching as adopted in the Commonwealth offices. Under this system, watchmen have to punch clocks in various locations in the building. If they fail to do so at stated intervals the clocks, being connected with the Fire Brigade Station, give an alarm, and the brigade turns out to ascertain the reason. For the Administrative building, the adoption of this system would involve the installation of about 50 points at an estimated cost of £750, as against £3,650 proposed for the Reichel system.

After giving the matter careful consideration, the Committee is unanimously of opinion that the proposal to install the Reichel fire alarm system be not approved—reliance being placed on watching, the provision of portable chemical fire extinguishers inside the building, and the usual fire hydrants outside.

#### CONDUIT UNDER BUILDING.

55. The provision of a conduit the full length of the building, centrally situated below the ground floor, and designed to take all main services and main wastes, is a feature of the plan that commended itself to the Committee. Likewise the installation of ducts for secondary service pipes and chutes for wastes and sweepings, which are distributed to serve each floor.

#### REVISED ESTIMATES.

56. Since the acceptance of his design in 1924, Mr. Jones has given considerable thought and attention to various details of the building which, at his first appearance before the Committee, were put forward more or less tentatively. Having received his more considered opinion, and taking into account the alterations recommended by the Committee, it is now possible to give a more accurate idea of the expenditure proposed on the various items, and compute the total cost of this building to the Commonwealth.

With the base and facing of granite for which Mr. Jones, at his last examination, definitely expressed a preference, the estimate may be set down as follows:—

	£	£
Reinforced concrete walls, floors, and piers .. .. .	168,642	
Base facing, part polished .. .. .	55,000	
Colonnades and columns .. .. .	51,800	
3-in. veneer of granite facing .. .. .	97,420	
	<hr/>	
	372,862	
Add for inclusion of whole of top floor, the wings of which were eliminated in Mr. Jones' estimate .. .. .	48,000	
	<hr/>	420,862
<i>To this amount should be added—</i>	£	
Plaster walls and ceilings .. .. .	12,200	
Flooring .. .. .	15,000	
Strong rooms .. .. .	3,170	
Windows .. .. .	22,250	
Foundation works .. .. .	80,000	
Other items .. .. .	30,150	
	<hr/>	162,770
<i>Engineering Services—</i>		
Lifts (six) .. .. .	12,000	
Fire alarm watching system .. .. .	750	
Electric lighting and power points .. .. .	14,837	
Heating .. .. .	15,000	
Vacuum cleaning .. .. .	1,000	
Refectory apparatus .. .. .	1,500	
	<hr/>	
	45,687	
Add for provision of hot water service to lavatory basins .. .. .	2,500	
	<hr/>	48,187
	<hr/>	210,957
Which brings the total for Building and Engineering Services to .. .. .		631,819
Architect's commission and expenses .. .. .	37,909	
Quantity surveyor's fees and expenses .. .. .	6,318	
	<hr/>	44,227
Contingencies, 5 per cent. .. .. .		31,591
	<hr/>	707,637

	£
Brought forward .. .. .	707,637
Federal Capital Commission's inspectors and supervisors .. .. .	10,000
Compound interest, at 6 per cent. for four years, payable half-yearly, say .. .. .	102,352
	819,989
To this should be added the cost of the competition for architectural designs .. .. .	2,629
and the cost of subdividing the various floors into offices, estimated at .. .. .	20,000
	842,618
making the total cost to the Commonwealth of this building .. .. .	842,618

These figures are based on Mr. Jones' estimate, assuming that the building is to be faced with granite. If, however, after investigation it is found that Fairy Meadow limestone can be successfully used, a very large saving will be effected, which conceivably might amount to £20,000.

57. Included in the above estimate is an amount of £6,318, representing quantity surveyor's fees and expenses. As inquiries made indicated that this work could be effectively carried out by the qualified quantity surveyors employed by the Department of Works and Railways in the usual course of their official duties, the Committee was unanimously of opinion that this be done.

58. The Committee views with some trepidation the figure which the cost of this building has reached, and recommends that in its construction expensive detail be as far as possible eliminated, and an effort be made to produce a plain building without embellishment, to conform to the modern tendency of observing simplicity of architectural expression, for the purpose of combating the prevailing high cost of building.

59. The Committee gave considerable thought as to the method of carrying out this work which would prove most advantageous to the Commonwealth. While some members were desirous of having it carried out by day labour, the majority were in favour of public tenders being called. After much discussion, it was eventually agreed that the Committee recommend that tenders be called for the erection of this building, and that at the same time the Federal Capital Commission be invited to submit a tender for carrying out the work by day labour—the most advantageous offer from the Commonwealth point of view to be accepted.

#### SUMMARY OF RECOMMENDATIONS.

60. Briefly summarized, the recommendations of the Committee are :—

- (a) That this building should be erected on the site east or west of the main axis which investigation shows to be the more economical for foundations (par. 32).
- (b) That the skeleton structure should be erected in reinforced concrete (par. 22).
- (c) That the whole of the top story should be included (par. 25).
- (d) That the outer extremity of the building should be constructed with an apsidal end (par. 26).
- (e) That no provision be made for a dome (par. 28).
- (f) That the ground floor level of this building be fixed at 1,860 feet (par. 31).
- (g) That when investigations being conducted at Fairy Meadow are sufficiently advanced, the matter be again referred to the Committee for a decision as to the class of external facing to be used in this building (par. 43).
- (h) That the interior of the building be proceeded with in such a way as to permit of occupation before work commenced on facing (par. 45).
- (i) That representative Australian woods be included in the joinery work (par. 46).
- (j) That walls of vestibules, essential corridors, and staircases be lined with marble to a height of 4½ to 5 feet (par. 47).
- (k) That floors of vestibules, staircases, corridors, and lavatories be paved with marble, and that floors of general offices be of Australian hardwood (par. 48).
- (l) That Australian marbles from various States be introduced in the marble work (par. 47).
- (m) That a cheaper class of fireproof door be used for strong rooms except in special cases (par. 49).
- (n) That the heating system be similar to that installed in Parliament House with wall radiators (par. 51).
- (o) That vacuum cleaning be carried out with portable cleaners (par. 52).

- (p) That a supply of hot water to lavatory basins be provided (par. 53).  
 (q) That a clock fire alarm be installed with a system of watching coupled with portable chemical fire extinguishers inside the building and the usual fire hydrants outside (par. 54).  
 (r) That the preparation of quantities be carried out in the Department of Works and Railways (par. 57).  
 (s) That tenders be called for the erection of the building, the Federal Capital Commission being at the same time invited to submit a tender for carrying out the work by day labour (par. 59).

#### SAVINGS EFFECTED BY THE COMMITTEE.

61. If the Committee's recommendations be carried out, the following savings in expenditure will be effected, viz. :—

	£	£
Restriction of burglar-proof doors to essential strong rooms ..	6,200	
Alteration of fire alarm system .. .. .	2,900	
Elimination of quantity surveyor's fees and expenses .. .. .	5,800	
Occupation of building before facing completed .. .. .	40,000	
		56,600
Less additional cost of heating system proposed .. .. .	1,800	
Provision of hot water service to lavatory basins .. .. .	2,500	
		4,300
		<hr/> 52,300

If, as previously mentioned in paragraph 57, later investigations show that Fairy Meadow limestone can be successfully used to face this building, this saving will be substantially increased.

G. H. MACKAY,  
 Chairman.

Office of the Parliamentary Standing Committee on Public Works,  
 Federal Parliament House, Melbourne,  
 15th June, 1926.

# MINUTES OF EVIDENCE.

(Taken at Sydney.)

FRIDAY, 29TH MAY, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Barnes,	Mr. Cook,
Senator Reid,	Mr. Mackay.
Mr. Blakeley,	

Malcolm Morrison, Geological Surveyor for the State of New South Wales, Sydney, sworn and examined.

1. *To the Chairman.*—I understand the Committee are making investigations in connexion with proposal to erect a permanent administrative building at Canberra, plan of which I have inspected, and desire some information concerning the various classes of building stone available in New South Wales, a careful study of which I have made. There are many factors to be taken into consideration in arriving at the main essentials necessary to constitute a satisfactory building stone, included in which is the quality, crushing strain, and also the colour, which is largely a matter of taste. Nearly all the building stones in New South Wales are sufficiently strong to carry the weight of any building. There are many high-class granites suitable for base work; but owing to the limited demand for the stone, the deposits have not been opened up to any extent. We have a fair variety of both grey and red granite in New South Wales. Only two granite quarries are now working, one of which is at Gunning and the other near Goulburn. The one near Goulburn has been opened up only eighteen months, and consequently the extent to which it has been developed is not great. In some cases the surface granite is somewhat lighter in colour than the stone found at depth. The surface granite is of equally good quality, although it has been exposed to the weather; but the stone taken from a depth is not likely to show defects so soon as that taken from the surface. If there were a demand for good granite, it could easily be supplied in almost any variety. We have not as yet a red granite equal to the Balmoral stone, simply because development has been retarded owing to the absence of any demand for this product. For the information of the Committee, I produce samples of the Balmoral and Peterhead granites, and also a sample of the local granite. The quarries near Goulburn can supply granite of good quality and suitable for the base work of any building. In selecting the stone, a good deal depends upon the architect in control, as some may prefer a fine, and others a coarse, granite. Personally I favour a coarse granite, with large crystals, for base work. The Goulburn granite is, I understand, easy to dress. The granite quarries here are not at present sufficiently equipped to produce dressed stones of any particular size or shape, but there are works in Sydney capable of producing almost any size of column. There is no plant at the Goulburn quarry capable of doing the work which would mean that if stone were selected

from that deposit it would have to be sent to Sydney for treatment, which would make the cost prohibitive. Granite is used in Sydney for columns and base work, but a good deal of it is Victorian Harcourt granite, polished and dressed. A smaller quantity is obtained at Gunning, but I understand that little work is being done there. Harcourt granite is being largely used merely because it is favoured by some architects. Trachyte is also used in the base of many buildings in Sydney. It makes a very good foundation, and is giving very satisfactory results. There are deposits of trachyte on the main southern lines, which have been opened up to some extent. Personally, I prefer granite to trachyte, although both stones will be practically everlasting. The use of sandstone could also be considered for base work, but I would not recommend it for that purpose. I do not consider Harcourt granite superior to any we have here. I also favour granite in preference to trachyte for columns. I have no objection to sandstone for general building purposes, but consider granite or trachyte more imposing. I have visited Canberra, but I have not made a very close inspection of the building stones available in that locality. I have never seen the granite deposits about 12 miles south of Canberra, although I have seen the porphyritic rock in the vicinity of the Federal Capital, which for lasting purposes should be satisfactory. It is, however, a brittle stone, with a glassy fracture, and one which may chip or break in certain circumstances. Its appearance is not as good as that of granite or trachyte. I do not know of any large buildings constructed of this material, but it may be suitable for such purposes. There is only one variety of New South Wales sandstone that can be considered first-class building stone, and it is that known as the yellow block, which is used in many of the public buildings in Sydney. It is light grey or white in colour, but gradually becomes a warm brown after exposure to the weather. It is regarded in Sydney as a superior building stone. There are numerous other kinds of sandstone obtained in New South Wales, but most of them disintegrate very rapidly after exposure. Free-stone and sandstone are the same. The stone in the upper portions of the quarries from which the yellow block is taken is usually lighter in colour because the iron has been leached out of it, and that stone will not change its colour. We have a number of quarries which produce a white sandstone, but that is rarely used for building purposes. Sandstone absorbs a certain percentage of moisture, and when there are impurities in the air the stone becomes discoloured more readily. Even at Canberra, where public buildings will not be in close proximity to industrial centres the stone would discolour in time. I regard the brown sandstone as the most efficient, as after it has been exposed to the air it becomes covered with a thin skin, which prevents the moisture entering, and in that respect it is unlike the white sandstone, which discolours very easily. In my opinion, the Bundanoon sandstone is too friable for use in large buildings, as it would disintegrate after exposure. It contains a

clayey binding, and would rapidly break up even under normal atmospheric conditions. I have never seen the Bundanoon sandstone used in the Goulburn Court-house. Sandstone usually becomes affected at the base-line. There are, of course, exceptions, one of which is to be found in a monument at Macquarie-place, Sydney, which has been erected over 100 years and which was not constructed of picked stones, such as would be used at present. The wearing of sandstone at the base-line is not due to rain alone, but the action of organic matter in the dust which comes into close contact with the base-line may be the cause. Sandstone should not be used in base-courses in any big buildings. There are a variety of marbles in New South Wales, but, like the granite, the demand is not great, and consequently the deposits have not been opened up to any extent. The main quarries are situated at Borenore and Caleula, near Orange. There are others, but they are not working. There are also deposits at Cudgegong, Caloola, and Spring Hill, from which ample supplies could be obtained. We have no white marble suitable for statuary. What we have is considered to be too coarse in the grain. I do not think any one would recommend the use of marble for outside work, as it is usually readily attacked by sulphuric acid. Fully fifteen marble quarries have been opened up, but I do not think that more than three are working. All the cutting and polishing of marble is done in Sydney.

2. *To Mr. Cook.*—If marble for use at Canberra had to be treated in Sydney, it would add considerably to the cost. Granite, similar to the samples submitted, has not been in use sufficiently long to test its wearing qualities, but there is no reason why it should not last as long as the Scotch or Swedish granite. I produce a geological map of New South Wales, which shows that Canberra is in a granite belt, and therefore supplies of this stone suitable for building purposes should be easily obtained. I do not think bricks will last as long as granite. Building stone from basalt, which is almost black and is used largely in Melbourne, up to an almost white granite, is available in New South Wales, but it is largely a matter of taste, as their durability and crushing strain are about the same. I do not think there is a prejudice against granite; it is principally a matter of cost. The Bank of New South Wales, in Macquarie-place, Sydney, which has just been completed, has a base of Victorian granite; it is faced with terra-cotta. We are sending our granite to Victoria and the Victorian granite is coming to New South Wales.

3. *To Mr. Blakeley.*—From a geological point of view, there is a difference between marble and limestone, but for commercial purposes there is practically no difference. If necessary, I can supply the Committee with a map showing the limestone areas in the Federal Capital Territory. The marble used in the interior work of the Commonwealth Bank, Sydney, is of Australian production, and was obtained from Cudgegong, Caleula, and Spring Hill. It would be possible to obtain the necessary lengths of Caleula marble for use in columns, but it would be a matter for the architect to determine whether they could carry the required strain. The breaking strain of marble is fairly high, although the Caleula marble is considered to be somewhat weak in parts. The green strip in marble, which consists of chlorite, is really a fracture, and would not stand a great crushing strain. I do not know whether the columns in the Commercial Bank, Sydney, are a solid marble, or are only faced in order to combine strength with architectural beauty. I am in favour of granite for exterior work, but consider marble more suitable for interior work.

4. *To Senator Reid.*—If granite quarries were to be equipped with expensive rock-cutting and drilling plants, the cost of opening them up would be great; but if that were not done the expenditure would not be heavy, as practically all that would be required

would be a crane. Most of the samples of granite submitted were taken from quarries on the western line. The nearest deposits to Canberra are those at Gunning and the one near Goulburn. The granite in the base of Union House, Sydney, was obtained at Gunning. If suitable supplies of granite were available near Canberra the cost of opening a deposit would be very small. I believe a suitable deposit could be found between Queanbeyan and Cooma. Granite, if cut and polished, would cost two or three times as much as yellow sandstone; but if the granite were rock faced, that is as it comes from the quarry, it would cost only as much again as sandstone. A Mr. Wilson, who is not a geologist, submitted a report to the Federal Government, about ten years ago, on the quality of the building stone available in the Federal Capital Territory, and that report should be available.

5. *To Mr. Mackay.*—The deposit at Gunning and the one near Goulburn are the nearest to Canberra. The former has been developed to a fair extent, and the deposit near Goulburn is now being opened up. There may be a dressing plant at the Bowral quarries, but I am not sure. The cost of quarrying depends largely upon the methods adopted. It would, of course, be more expensive to quarry granite than sandstone. Some bricks which have been in use in Sydney for 100 years are now looking the worse for wear, and there are also sandstone buildings near Circular Quay, Sydney, which are becoming dilapidated. Basalt, porphyry, granite and syenite all would have about the same life, and it would be 200 to 300 years before any of them would show signs of deterioration. Next to granite, I would recommend sandstone for outside work, and picked material should have a life of 100 years. Some country buildings are constructed of porphyritic rock. A fine red granite obtained from Gabo Island was used in the construction of the General Post Office, Sydney, but the bases and columns consist of marble obtained from Moruya and Montague Island. The Commonwealth Statistician's Bulletin No. 9 of 1916 contains some very valuable information concerning the building stone available in all the States.

(Taken at Sydney.)

SATURDAY, 30TH MAY, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Reid,	Mr. Cook,
Mr. Blakeley,	Mr. Mackay.

John Leaver, Barrister-at-law, Denman Chambers, Phillip-street, Sydney, sworn and examined.

6. *To the Chairman.*—My father, Mr. Robert Leaver, of "Ferrodale," Raymond Terrace, is the owner of certain lands  $2\frac{1}{2}$  miles on the Goulburn side of Bundanoon, on which there are extensive deposits of sandstone. These deposits, according to the railway time-table, are 102 miles from Sydney and 100 to 101 miles from the Canberra railway station. At present there is no siding at the spot, but an approved site for a railway siding has been located at the 103-mile peg. In a direct line to the railway on an easy grade, the distance from the deposit is a little over 10 chains. No promise has been made by the Railway Department to erect a siding, but we have investigated the question of erecting a siding, which must be at our own expense, and a suitable site has been located by the shire engineer at approximately the 103-mile post. There is a level spot suitable for a siding almost directly opposite the sandstone deposit. The area on which it stands covers,

roughly, 40 acres. The deposit comprises two sections consisting of a small section of about 7 acres, part of which has been worked for 30 or 40 years, and which is known as the Town Hall Quarry, as it was from that deposit that stone was taken for the Goulburn Town Hall. That deposit is not being worked at present. The other portion of the deposit is now being operated by a Mr. Turner, a monumental mason of Goulburn, who holds a lease from my father subject to a six months' notice of termination on either side. Mr. Turner has been operating under the lease for about five years, but has been taking stone from these quarries for about 35 years. He is using the stone for monumental purposes. He sends it to Goulburn, and it is generally used in the southern districts for monumental purposes. Bundanoon stone has also been used in the construction of the Wagga Roman Catholic cathedral, and although all the stone in that building was taken from Bundanoon, I do not know if it was taken from this quarry. Mr. Turner could give the Committee all the information required concerning the stone he has taken from the quarry. I have not seen the Bundanoon stone used in the Court-house at Goulburn. For the information of the Committee, I submit the following letter from the curator of the Technological Museum, Sydney:—

Technological Museum,  
Harris-street,  
Sydney,  
10th May, 1925.

Mr. W. M. Fleming,  
25 O'Connell-street, Sydney.

Dear Sir,

In reply to your inquiry of the 14th regarding the sandstone in the Bundanoon district, I find that the work entitled *Building and Ornamental Stone, N.S.W.*, published by R. T. Baker, late Curator of this Museum, contains the following particulars, which I understand were supplied by Mr. C. F. Laseron:—

Bundanoon, N.S.W.—This is one of the best sandstones in N.S.W. for big buildings. It has been used in the Goulburn Court-house, and generally in all buildings of any size in the southern district. Varies in colour from white to pink. It forms the base and pedestal of the Soldiers' Memorial, Goulburn. I understand, also, that the Bundanoon stone was used for the Soldiers' Memorial Chapel, Goulburn Cathedral.

(Sgd.) G. HOOPER,  
Curator.

My father, who is now advanced in years, is not desirous of operating the quarry on his own account, and would prefer to negotiate with the Federal Government for the disposal of the property. He would be willing to allow the stone to be taken out on a royalty basis, but would rather dispose of the property. Specimens of the Bundanoon stone are on view at the Technological Museum, where they can be compared with similar products from Pymont and Maitland. The depth of the stone is from 50 to 60 feet. There is a cliff face of over 50 feet, but of course the stone exposed is well weathered.

7. *To Senator Reid.*—I do not know of any building in Sydney constructed of the Bundanoon sandstone. It is not brought to Sydney for building construction.

8. *To Mr. Mackay.*—I understand the Bundanoon sandstone has been used in the construction of public buildings in Yass, but I could not say if such buildings are constructed entirely of this stone. Mr. Turner has opened up the deposits for a distance of about 200 yards, and it is quite obvious that he has been following up the top of the face for that distance.

9. *To Mr. Cook.*—The question of royalty could not very well be discussed with the Federal authorities at this juncture, as obviously some part or parts of the deposit might be found more satisfactory for the Government's purpose than others. I was not aware that

F.8694.—2

Mr. Morrison, the Government Geologist, is of the opinion that the Bundanoon sandstone is likely to disintegrate after exposure. I should like a representative of the Government to make tests concerning the quality and value of the deposit. The data available at the Sydney Technological Museum shows that in the crushing tests the Bundanoon stone compares favorably with the Sydney sandstone. In fact, the tests of the Bundanoon stone showed that it was slightly superior as regards crushing stress.

(Taken at Sydney.)

MONDAY, 1st JUNE, 1925.

Present:

Mr. GREGORY, Chairman;  
Senator Reid, | Mr. Cook,  
Mr. Blakeley, | Mr. Mackay.

George Sydney Jones, A.R.I.B.A., Architect, 113 Pitt-street, Sydney, and Past President of the Institute of Architects of New South Wales, sworn and examined.

10. *To the Chairman.*—I understand the Committee are inquiring into the erection of permanent administrative offices at Canberra. As you are aware, a competition was recently held in connexion with a suitable design for the proposed building, and I was the successful competitor. The competition, which was confined to Australian architects, was held in 1924, and the award made public in December of that year. The problem is unusual, but very interesting to an architect. Briefly, it is required to design a building with accommodation for, say, eight departments of state on such a plan that any department would be architecturally and with economy quickly capable of being extended or reduced in floor area in accordance with the requirements of the department, at the same time insuring that each department when extended or reduced would be self-contained and independent of other departments. In other words, the plan has to be as elastic as possible, because it is not possible to foretell what floor area will be required by each department at any time. The points in this design which may be considered important are—

1. External light courts giving external light, sun-light, and perfilation of air to office spaces.
2. One essential corridor, and staircases, lifts, and lavatory blocks concentrated at three points in its length, thus minimizing essential communication and economizing expenditure.
3. Subsidiary corridors within departments which may be used as corridors for their whole length or part of their length or alternatively may be absorbed as office space.
4. Steel staircases within departments, enclosed by grilles and locked gates at each floor which give access to upper and lower floors for extension of departments if required. For instance, extension of ground floor office accommodation to second floor, or lower ground floor to first floor as may be required without interference with intervening floors. The plan therefore allows of reduction of departmental floor area horizontally and extension of departmental floor area either horizontally or vertically or both as desired, independently of other floors or associated with other floors, or, if required, the whole of each floor by this arrangement can be used as a self-contained department.
5. The introduction of a mezzanine floor between part of ground floor and first floor, thereby increasing floor area. It is suggested that this may be used as the ministerial floor.

6. Standardization of parts ensuring economy in expenditure, but owing to the arrangement of plan, not uniformity or lifelessness in external appearance.
7. Unit of subdivision 22 x 11 feet.
8. The proportion of light courts and light areas to the whole area (430 x 200) is as  $\frac{1}{4}$  to 1, or one-fourth for a building of two full floors and raised basement in latitude about 35 deg. south. The angle the sun rays make with the horizon at Canberra at 12 noon winter solstice is just on 31 deg.

As to character of design and external appearance it may be said that this building, although large in size, is not monumental in the sense that Houses of Parliament should be, or symbolic of a nation's ideals such as a national war memorial should be. It is to be only a large utilitarian office building to house staffs who are at present occupying buildings for which more or less high rents are chargeable to the Commonwealth. It is thought, therefore, that simplicity, variety in mass, dignity, reasonable economy, and a scale commensurate with the importance of the structure as one unit in the permanent official buildings of Canberra might be made to express function and method of construction, and suggest something of that spirit of resourcefulness associated with British tradition which characterizes Australian thought to-day. Further, that if the design can be made to suggest "Spirit of Empire" it might sound the keynote of what may be the architectural expression of future generations when "Architecture of Empire" may become a phrase full of meaning to the British race of 75 or 100 years hence. A square end is more serviceable and economical structurally than a rounded end, which, if used, involves loss of floor space as compared with a square end, and difficulty in arranging office fittings, desks, &c. The external effect of a rounded end from the avenue would in course of time be screened by foliage of trees, and its value, if any, lost.

The 1,860 ground floor level as datum proposed is a departure from the previously suggested 1,870 ground floor level. This affects the administrative building in theory only, but not actually, because even if Parliament may, say 25 years hence, decide to adhere to the 1,870 level, the filling in earthworks would not affect the structure in any important particular though the building would appear less in height than future buildings in the official group, but would not be seriously affected architecturally. On the other hand, by the adoption of 1,860 as datum for ground floor level a great saving in cost in earthworks is effected; the advantages also include direct light and access to lower ground floor from at least three sides of the building.

As there is abundant and good aggregate for concrete in the Federal Territory, it is suggested that the main structure should be built of reinforced concrete as being reasonably fireproof and homogeneous in character. The space between piers and beams where possible might, perhaps, be filled in with brick in cement. The interior, it is suggested, should be finished as follows:—Walls and ceilings plain white plaster, except vestibules and essential corridors, ceilings of which might be slightly enriched, and walls of essential corridors and staircases lined with marble to a height of, say, 7 or 8 feet. Floors of vestibules, essential corridors, staircases, and lavatories paved with marble—all office spaces super-floored with suitable super-flooring at, say, 15s. per square yard laid; lifts, electric; enclosures of marble; doors bronze, important internal doors bronze and glass; window frames and sashes steel, standardized sizes, all angles internally rounded. It is not proposed to include partitioning, being an unknown quantity, nor clocks nor telephones, as the number of these cannot be foretold.

A conduit full length of building centrally situated below lower ground floor should take all main services and main wastes. Ducts for secondary service pipes,

&c., and shutes for wastes and sweepings are distributed to serve each floor.

It is advisable to provide for wash basin and filter services in each room subdivision, but as it is impossible to foretell what would be the positions of these, it has been suggested that service and waste pipes should be laid at points in the building which might or might not at any time be required, and put in use by the installation of a fitting within very short notice.

Strong rooms are situated in positions thought most serviceable for staffs, viz.:—Basement, 28; ground floor, 24; mezzanine, 8; first floor, 24; second floor, 2. Total, 86.

All parts of interior finished without elaboration in a manner economical, but befitting one of the national buildings of Canberra. The question of treatment of the surface of the building requires very careful consideration, having in mind that the treatment determined may influence the treatment of future buildings in the official group. It is thought that there may be four (4) possible methods, viz.:—

1. Facing the concrete in sandstone on a base of granite.
2. Facing the concrete in white terra cotta with base of granite.
3. Facing the concrete in marble on a base of granite.
4. Facing the concrete in white cement plaster on a base of granite.

The cost of No. 1 would probably be prohibitive. The cost of terra cotta material for No. 2 would be about £100,000. The cost of No. 3 would depend upon the possibility of obtaining marble of a quality in grain, colour, and durability which would be suitable for use in such a building. There is said to be a large deposit about 40 miles from Canberra, but the face has not been opened up, and information is not available. The cost of white cement material required for plaster in No. 4 would be about £400. Stone is durable but costly, and does not convey an idea of the material of main structure, if reinforced concrete, but would appear monumental. Terra cotta is a material more in sympathy with reinforced concrete, but its effect is not monumental, and its cost if of Australian manufacture is high. White cement is not Australian made, but may possibly be made in Australia, and is in sympathy with reinforced concrete, and its cost is moderate compared with other materials. The effect on the mind of most people, however, is that of cheapness and wanting in suggestion of durability. A treatment consisting of granite for base, main cornice and free columns or piers with the surfaces of other parts in white cement plaster may be successful, and would be reasonable in cost, but the effect of a combination of such materials on such a large scale is doubtful.

Having in mind the idea that a central dominant feature in the skyline may be advisable, a sketch suggestion is submitted, but the cost may be thought too great, and the architectural necessity of such a feature on an utilitarian office building, although of national importance, may also be considered as doubtful.

The effective office floor areas are as follows:—

Lower ground floor	...	...	50,862
Ground floor	...	...	48,467
Mezzanine floor	...	...	26,382
First floor	...	...	50,286
Second floor	...	...	39,354
Total	...	...	215,351 square feet
If centre block only of second floor be included, deduct	...	...	22,640 square feet
Total	...	...	192,711
Cubic contents measuring from 2 feet below lower ground floor to flat roof	...	...	4,129,227 cubic feet
If portions of second floor be omitted, deduct	...	...	481,344
Total	...	...	3,647,883 cubic feet

It is estimated that a building on the drawings submitted at 2s. per 1 cubic foot, excluding deep foundations and partitioning, but including the following estimates, viz. :—

	£
Eighty-six strong-room doors ... ..	9,400
Terra cotta material required for facing ...	100,000
Superflooring, at 15s. per square yard, laid	5,982
Six lifts (three dual control) ... ..	12,000
Granite base ... ..	51,000
Reinforced concrete skeleton, at 6d. per cubic foot ... ..	113,000
Collonades ... ..	13,800
Pavilions ... ..	3,000
Steps ... ..	3,500
	£311,682
Would cost about ... ..	£412,922
To which should be added—	
	£
1. Lighting, 1,800 points, at £6 ... ..	10,800
2. Heating by low-pressure hot water ... ..	13,800
3. Vacuum cleaning installation ... ..	2,700
4. Fire-fighting installation by sprinkler system ... ..	9,850
5. Cooking apparatus by electricity for, say, 700 persons per day ... ..	1,500
	£38,650
	£451,572

I submit 1/16th scale sketches as follows :—

- No. 1—Lower ground floor plan.
- No. 2—Ground floor plan.
- No. 3—Mezzanine floor plan.
- No. 4—First floor plan.
- No. 5—Second floor plan.
- No. 6—Sections.
- No. 7—Elevations.
- No. 8—Perspective view.
- No. 8A—Sketch perspective of rounded end as alternative.
- No. 8B—Sketch perspective of apsidal end as alternative.

also—

- No. 9. Sectional elevation (1/80th-in. scale) of relative heights of Administrative Building and Provisional Houses of Parliament.
- No. 10—Longitudinal elevation (1/8-in. scale) 1,870 datum.
- No. 11—End elevation (1/8-in. scale) 1,870 datum.

The site of the building is the second from the north-east of the provisional Parliament House and third to the north-east from the site of the suggested permanent House of Parliament, and fronting Federal-avenue. The competition provided that the 1,870 datum ground floor level should be adhered to, which meant that the site of the administrative building would have to be filled up nearly 20 feet from its present level, which is about 1,849 feet, and which would, of course, involve an enormous quantity of earthworks. At the suggestion of the Federal Capital Commission, I have made an alteration in the datum level. The saving in cost at present will be considerable, but the building when completed will be set at a lower level than the future permanent buildings at Canberra, should the 1,870 datum level be adhered to later. So far as the design of the building is concerned, the architectural effect of the structure would not be seriously interfered with. The ground level shown on the sketches I produce would be lifted at least 10 feet, which would mean that the administrative building, if the same height of floors be adhered to in future buildings, would be somewhat lower, but being a building on an isolated site the effect will not be serious. It will not detract from the building, although the original design was prepared for the 1,870 level. The complementary building facing Commonwealth-avenue, if proceeded with shortly on the 1,860 level, would be interfered with no more and no less than the building of which this is a design. It will be quite feasible, without

additional expense, to erect a complementary building on the 1,860 level. As to the necessity for insisting on the 1,870 level for this building being adhered to, I would say there would be no great gain excepting that the permanent Houses of Parliament would be lifted 60 feet above the official group instead of 50 feet as intended on the contour plan. Assuming that the official building fronting Commonwealth-avenue is of exactly similar design to the administrative building and the 1,860 level is varied at all, it might affect that building, but it is assumed that it will be a repeat building. Architecturally, the group is not affected, assuming all the official buildings were erected with the 1,860 level adhered to for the ground floor. The only difference in effect would be that the permanent Houses of Parliament would be 10 feet higher than is at present shown on the contour plan. Even looking forward 100 years, I do not think that that could be regarded as an architectural evil. As it is at present, there would have to be nearly 20 feet of filling to adhere to the 1,870 level. The amended sketches indicate what the building would be like on the 1,860 level. Architecturally, the suggested alteration fully meets with my approval. I suggest that there should be uniformity when the complementary building is erected. I also suggest that the base of the building should be of granite, portions of which should be dressed and polished. The effect of a building of this nature, which is more or less monumental, would not be enhanced by a rock-faced surface of granite. I prefer tooled granite. Possibly some portions should be of polished granite. It requires a good deal of study to decide as to what portions, if any, should be polished. It is not suggested that the whole of the base should be of polished granite. I have given consideration to the question of the likelihood of obtaining suitable granite for the work. Several types of granite are available, and in preparing estimates of cost I have considered Uralla grey granite from northern New South Wales, and the Harcourt granite from Victoria; but I take it that the whole of the merchants in Australia interested in the supply of this commodity should be given an opportunity to submit suggestions as to what could reasonably be used in the proposed buildings which is to be a Commonwealth, and not a State structure. Uralla is about 13 miles south of Armidale. I have been into the question, and have been informed that Uralla granite could be delivered at Canberra at a cost of 37s. per ton in freight, and Harcourt granite at about 55s. per ton. I consider the Harcourt granite not equal to the Uralla product; the latter is somewhat superior, inasmuch as the large felspar spots in Harcourt granite are not as frequent in the Uralla granite, and are also very much smaller. The Uralla quarry has not been opened up very long, but it is of considerable extent. I shall supply the Committee with information concerning the Sydney buildings, in which there are columns of Uralla granite. I feel that we should have the best, irrespective of the State from which it comes. I have given consideration to the type of stone available at Canberra for the manufacture of concrete. It would need crushing and would have to be tested. I prefer bluestone to gravel for concrete, but I have no objection to offer concerning the gravel. Sand of a satisfactory quality, I understand, is also available. The concrete skeleton referred to in my estimate is for the bare reinforced concrete piers, beams, and floors, and the estimated cost is 6d. per cubic foot. Similar work could be done in Sydney for 4d. per cubic foot. The price I have stated does not include the walls. The proposed building will be largely one of piers, beams, and floors, with the intervening spaces taken up with either windows, doors, or brickwork. Adding 50 per cent. to the cost in Sydney makes the rate 6d. per cubic foot. The superflooring might consist of magnesite. There are many similar floorings on the market. The essential corridors, vestibules, staircases, and lavatory blocks should be paved with marble or some similar

material. The whole of the office floor space, to ensure reasonable lightness and durability to the tread, should be treated directly on to the concrete, as magnesite can be. I have not allowed in my estimate for the whole of the floor area to be covered with a superflooring. I presume the whole of the basement floor will be of solid concrete, and probably nearly the whole of the second floor. We cannot get superfloors laid down at less than 12s. 6d. per square yard, and I did not allow for that in my estimate of cost. I suggested earlier in my evidence that the columns should be of granite, and the estimate of £13,800 is not for granite, but for reinforced concrete covered with a suitable material, such as architectural terra cotta. There are 44 columns, totalling about 17,000 cubic feet, which at £3 per cubic foot equals £51,000. If the pillars were granite covered, the difference in cost would be about 30s. to 40s. per cubic foot. If square, they could be covered with terra cotta, but advisedly not if round. I prefer round columns of granite, only if the main cornices are also of granite. I would not recommend that round granite columns should be placed on a granite base supporting, perhaps, terra cotta or plastered cornice. The cornices should be of granite if the columns are. You could have reinforced concrete columns veneered with granite, but I would not recommend it. I do not think stone suggests the type of structure at the back of it. Stone facing on reinforced concrete does not suggest structure. It would mean placing a skin on the building which might affect its durability. A reinforced concrete structure is a homogeneous one, but if it is clothed with stone it is a covering that is not in sympathy with reinforced concrete. I do not think freestone columns and cornices would, architecturally, fit in with a terra cotta covering over concrete, as there would be too many different kinds of material. If any class of stone were to be used for columns, &c., above the base, it should be the same as in the base. When you leave the base the balance of the building, including the columns and the main cornices, might be of granite, as the building would then be reasonably harmonious from an architectural point of view. A white plaster might be desirable, particularly one made from crushed white marble and cement, which would have a more or less scintillating effect. The plaster would be a special preparation, and one quite distinct from an ordinary rendered surface of cement. It would present a semi-opaque appearance. I take it that nearly all these buildings excepting the Capitol will in time be set in green foliage, and unless they are visible for some miles away their effect as a group will be lost. I would not favour concrete columns with a coloured terra cotta covering, a sample of which is before you. Ample supplies of dressed marble are available in New South Wales for use in the internal portion of the building. I should prefer various designs in marble throughout the structure; possibly a different marble on each floor would be an advantage, as that would give each State in which supplies are available an opportunity of supplying material. I would eliminate as far as possible all angles in the building. I mentioned it earlier in my evidence, but I wish to amplify it now by saying that instead of internal angles I would as far as possible have rounded corners and a curve between the walls and the floor level to simplify the work of cleansing the building. The number of strong-rooms specified has been included after consultation with the chief architect. The number provided was thought advisable, and I was directed to distribute them throughout the building. The price I have included is for burglar-proof as well as fire-proof doors. The inside dimensions of the doors are 6 feet by 2 ft. 6 in., and the cost per door is estimated at £110. I have not had any instructions as to whether the doors should be burglar or fire proof, and, therefore, I have included the cost of a type that will cover both. For the internal treatment I suggest marble and white plaster. The ceilings will have to be

rendered. I would, if possible, expose all pipes and arrange for the electric light leads and tubes of all kinds to be exposed, as far as possible, to facilitate locating faults when they occur. That can be done quite in keeping with the design of the building. The pipes should have a covering, but they will be a part of the design. I have also allowed for a 6 feet by 6 feet conduit below the basement, which will carry all the necessary pipes except those of the sewer, although, personally, I should be prepared to put it there also. I arranged the conduits so that all the main services would be easily accessible at all times. I do not think there would be any danger in placing the electric light wires in the same conduit as the water pipe, provided the conduit was sufficiently ventilated.

11. *To Mr. Blakeley.*—The unit of 22 feet by 11 feet was one which I had first laid down on my original competition plan, and, after consultation with Mr. Murdoch, it proved to be one that was acceptable. I could not give any definite information concerning the quality of the different superflooring in use before I had studied the result of tests made with many that are on the market. One known as "Duraflor," consisting of magnesite, has been used by me with satisfaction, but it has not been in use long enough to prove that it will have a very lengthy life. So far, we have had only four or five years' experience of it, but it is claimed that it will last for twenty years. Repairs could be effected with the greatest ease. It is a material that is soft to the tread, more or less resilient, cool, fire-resisting, and waterproof. Notwithstanding this, I am not wedded to this particular material. My estimate does not allow for a base of granite blocks, but for a facing on an average of 12 inches thick. In my opinion, the building should appear as light as possible. To achieve that objective, and at the same time to obtain a reasonable amount of monumental effect, I think it is essential that the base should be of grey granite, and, to continue the monumental appearance, the columns or piers together with the main cornices should be of granite. The whole of the walls enclosing the structure other than those mentioned might be covered with white plaster into which white ground marble had been worked, in order to obtain a marble-like effect and at the same time it would be a material which would be in sympathy with reinforced concrete. I should prefer the columns to be round and polished. A sprinkler system of fire-fighting would be more or less dangerous in consequence of the possible damage that would be done to documents when the sprinklers were operating. The May-Otway fire alarm system is fairly effective. There are several thermostats of an electric type which can be set in operation to extinguish a fire. I installed a system very much resembling the May-Otway in the Hotel Sydney, which included thermostats in the ceiling, so that if the temperature reached a certain degree the apparatus became operative and the fire brigade was notified. There has not been a fire in that building, and consequently a test has not been made of the apparatus under actual fire conditions. I have also installed Grinnell sprinklers in different buildings in Sydney. I think this building should be so fire-resisting that no sprinklers would be required. I should like to omit them from the exterior of the windows, because they will not improve the appearance of the building. I have included them because I was asked for estimates. In the conditions of the competition reference is made to the use of local materials, and in designing the structure I, as an Australian, have most decidedly given particular consideration to materials of Australian production. I prefer reinforced concrete to bricks, because it makes a more homogeneous structure; but as there are large supplies of bricks at Canberra, I think it desirable to use them where practicable. By using reinforced concrete we get solidity, the strength required, less labour cost, and save money per bay. Professional opinion is very divided concerning the architectural beauty of the building recently erected for the

Commercial Bank, Sydney, which is wholly veneered with freestone. Personally, I am not in favour with that style of work. Although there may not be any danger in that form of construction, possibly in 100 years such buildings may lose a portion of their skin, but it is very unlikely, as they are well tied. There is very little space through which air or dampness can reach the ties. The wires are coated with cement, and the risk of corrosion is very small indeed. In the matter of lighting, I would suggest that if the offices are to be 22 feet by 11 feet it would be advisable to have two pendant lights in each subdivision, so placed that if the office partitions were to be entirely removed and the whole thrown into one, these pendants would be equally serviceable. I favour the semi-indirect system of lighting. I would suggest that the partitions be designed in multiples of 3 feet or 4 feet, according to the width of the doors, so that they could be put up rapidly in sections if desired.

12. *To Mr. Mackay.*—One of the conditions of the competition was that the successful competitor should be appointed the architect controlling construction, if the Government decided to proceed with the erection of the building, and consequently I should have the sole supervision of the work if it is carried out. I think it desirable that I should. On the other hand, certain equipment was not supposed to be included in the estimates asked for from the competitors. For instance, lighting, heating, vacuum-cleaning and fire-fighting appliances were not to be included in the estimates to be supplied. Having in view the necessity, in my opinion, of the buildings in the Governmental group being as light as possible and also that terra cotta is not sufficiently monumental in structures of this type, I have come to the conclusion that a building consisting of granite for the base, main cornices, and columns with a surface in the other parts of white cement plaster would be the most successful treatment for a building of this character. It would be durable, reasonably economical, and, I think, sufficiently monumental in appearance. That would be a building of granite and white plaster, as mentioned in suggestion number 4 mentioned earlier in my evidence; but for the columns and main cornices I would recommend solid granite. The building would be constructed of concrete on all sides, it would be perfectly symmetrical, and what was done on the one side would have to be done on the other. Sandstone would have to be from 6 inches to 12 inches in thickness, whereas concrete walls would be from 9 inches to 12 inches at the most. Sandstone would have to be wired on and naturally form a part of the concrete, thus making it a solid wall, but one which would not be homogeneous. It would not have the same strength as the same thickness of concrete, but it would be strong enough for all purposes. Sandstone is not more expensive than terra cotta, but, in view of the cost incurred in cutting and carting sandstone, I anticipate that it will cost more to place in a building. For effect, I would prefer sandstone to terra cotta. The cost of sandstone facings would, I think, be prohibitive. No filling would be required if the 1,860 datum ground floor level is adopted.

13. *To Senator Reid.*—The only effect on the permanent Parliament House building of altering the level will be to make that structure appear higher than it would have been were the 1,870-foot level adopted. If the 1,860-foot level is adhered to, Parliament House will predominate more than was originally intended. The proposed level will to some extent also affect the Capitol when built. If the permanent Parliament House should be at the 1,920-ft. level, as originally intended, and the departmental buildings at Canberra are, as it were, lowered 10 feet, it will mean that from the principal terrace where the waterway is planned the Capitol might be screened from view by the permanent Houses of Parliament, more so than would have been the case if the 1,870-ft. level were adhered to. The Federal Capital Commission suggested a drop of

10 feet. I produce a plan received from the Federal Commission showing the roads proposed, pathways, and a general layout of the avenues in connexion with that portion of the official buildings. It will readily be seen that if the whole of the area between the two administrative buildings were to be filled up for 10 feet or 15 feet an enormous amount would be involved in constructing earthworks that would be of very questionable benefit. My opinion is that we can build the administrative block so that, should it be decided to lift the level to the 1,870-ft. ground-floor level, these buildings will not be in the least affected. The design of the structure allows for a 10-foot rise in the permanent level of the ground all round the building, without any interference with the structure as a whole excepting in some very minor respects. If the 1,860-foot level is retained expenditure in earthworks will be considerably reduced. The level of the provisional Parliament House is 1,877 feet, which is nearly 20 feet higher than the proposed ground floor of the administrative block. That is the ground floor of the provisional Parliament House, not the ground surface, the difference in height between the roof of the administrative block and the roof of Parliament House being 26 feet. The roof of the provisional Parliament House is about 26 feet higher than the roof of the administrative block. The difference in the fall of the ground is about 30 feet, and the distance between the two buildings mentioned is about 1,200 feet. If the other buildings were dropped to the 1,860-foot level the only disadvantage would be that the Capitol when built, unless it is lofty—the design of the permanent House of Parliament is framed in such a way that it would allow the Capitol being visible—would be partly screened. Even if the ground were raised another 10 feet it would not seriously affect the general appearance of the structure as a whole. Shafts have indicated that almost immediately below the surface there is a limestone formation, making a very solid foundation. I do not think any blasting would be necessary on the 1,860-foot level. I had anticipated that there would be heavy expenditure in foundations if the 1,870-foot level had been adhered to, because the whole of the basement would have to be lifted 10 feet from the solid ground. It seems most uneconomical to waste the whole of the surface now available. I am informed that there is a likelihood of good solid foundation about 4 feet below the surface, and if that is so it is very satisfactory. The work could be done more quickly with concrete than with brick, as practically the only time taken is in putting up the forms. On the whole, concrete work is cheaper and the time occupied in construction in comparison with brick work would be less. There are not to be any timber joists in the floor. I have dealt with the flooring material desirable in the general portion of the building, but in the rooms used by Ministers I think parquet might be used. The window frames will be of steel, as also will be the shelving; whilst the most important interior doors will be of bronze and glass. I do not know if it is necessary to have safe-doors burglar-proof as well as fire-proof. The difference in the cost would be £85, as against £110 for the best doors. The strong-rooms have to be distributed, and at present it is not known what area each particular department will require. In gauging the floor space we have not taken the present accommodation as a guide. It was stated in the particulars governing the competition that about 170,000 square feet was the area required, but as to how it was to be subdivided it was impossible to say. For heating purposes I strongly recommend a low-pressure hot water service as the safest and, on the whole, most economical. Such a service is the most easily managed. I favour the white plaster mentioned partly on account of economy. I must prove to this committee that I can construct this building for about £412,000, which is slightly more than my original estimate. I have to maintain that, and an estimate is of no use if it is to be exceeded by 50 per cent. White

plaster is a material which suggests the class of structure at the back of it. If it is possible to secure a plaster that will have a more or less scintillating effect by using small, crushed marble, we might get a surface that would be particularly attractive as against an ordinary rendered cement which looked cheap and generally unattractive. Fractures would show in stone work as in plaster in the event of cracks developing in consequence of the structure settling. I cannot foresee a concrete structure easily cracking, as it would be stronger than one of brick or stone, which consists of a number of small parts. All the permanent buildings in Canberra in the future will, I think, be of reinforced concrete, perhaps of a formation concerning which we know practically nothing at present. I do not think there will be any stone-faced structures, but there may be granite facing, so the proposed building will not be entirely out of date in, say, 100 years' time. The white facing will not be glaring, and in my opinion it is better to have too much than not enough white. The crushed marble might produce a somewhat creamy colour, but that would be better than a dead white. I would strongly suggest that the cornices should not be plastered; I would sooner see them covered with architectural terra cotta than plaster.

14. *To Mr. Cook.*—I would not say that I would prefer to work on a level lower than 1,860 feet. I do not like variations, and unless there is some economical benefit to be obtained one does not like to vary the levels. In this scheme it was asked that the ground floor be 1,870 feet datum level, which meant a drop of 10 feet. The proposed administrative building was really designed for the 1,870-foot level, but it appeared to me, when the information came from the Federal Capital Commission, that the 1,860-foot level might possibly be advisable. I considered the whole matter for a time, and came to the conclusion that I did not think it would be in the interests of the public to unnecessarily expend the extra sum of money that would be involved if the 1,870-foot level were adhered to. The 1,870-foot level was originally arranged, and the permanent Parliament House was to be 50 feet above that, whilst the Capitol was to be 80 feet higher still. The permanent Parliament House building will be then 60 feet above the level of the departmental buildings at Canberra, which may seriously interfere with the appearance of the Capitol, which building may, however, not be built for 250 years. The skyline might be out of harmony as the result of such treatment. There are several methods of treating reinforced concrete, the simplest of which is to remove the forms and leave the surface without any treatment; but that is generally regarded as unsatisfactory, because of the rough appearance. On the other hand, quite a number have suggested means by which it would be possible to pour in the concrete after having treated the forms internally with sheets of some non-absorbent material, which would enable the concrete to settle with a smoother surface. That system does not appear to be satisfactory, with the result that rendering is more or less resorted to. The rendering is not sufficiently monumental in effect for a building such as that proposed, and the surface, therefore, requires relieving somewhat, as I have suggested. I have had fifteen years' experience in reinforced concrete work, and although this system of construction cannot in any sense be regarded as in its infancy, it has not yet reached perfection. Improvements are still to be made, and eventually all forms will be standardized. A reinforced concrete building is a structure of piers, with beams connecting the piers, between which a covering is placed. We build up on the beams to the height desired, and have a reinforced concrete structure which should be expressed in the external design. There are columns supported on a base which represents the foundation, and on top of the columns there are cornices completing the order or tradition in architecture. If the design does not express structure, the design is wrong. In constructing other buildings, I have not used granite for the base columns and cornices

with a wall faced with plaster such as I suggest, but I have used ordinary plaster. My price of £451,572 is, of course, purely an approximate estimate of the cost; but after going into the matter more carefully, I should say that the building could be constructed at the price I have stated, excepting the foundation below a depth of 2 feet. The structure proposed is economical and good, and it is of a design that will, I think, not be out of date in, say, 50 years hence. Such a structure should, under normal conditions, last 1,000 years. I have not had any experience with terra cotta facing, which is more costly than the plaster I suggest, but is more lasting. The price of the terra cotta material required for the face of the building, which is set down at £100,000, might be reduced, as I have allowed for the Australian price, whereas the imported material could be obtained at a cheaper rate. If it were to be a stone-faced building, I would recommend that it be a structure of other than reinforced concrete, and would recommend that it be built of brick with steel stanchions; but if that is done it will mean reducing the floor area. It would cost an additional £50,000 to build in brick and stone. Such a building would be quite as efficient, but from a structural point of view it would not be as up to date, as reinforced concrete is the material of to-day and of the future.

15. *To the Chairman.*—There is not a roof above that portion behind the free columns and cornices. The mezzanine floor goes through the centre of the building from end to end. Part of the ground floor is divided into two floors, lighted from the exterior. The second floor covers the whole of the building with the exception of a certain space on either side of each projected block. That will be above the cornices and kept back. The height is 12 feet. If that portion were dispensed with, the appearance of the whole structure would be seriously affected. If the building were to be an isolated structure, without any relation whatsoever to any future building in Canberra, I should say that a central dominant feature would be advisable, but, having in view that it is only one unit in the official layout of Canberra—and not the most important unit, because the permanent Parliament House will be the most important—I do not think it necessary. The provisional Parliament House will be the dominant feature for a long time, and it would appear somewhat strange if the administrative building had a domical feature and Parliament House had not. Such a feature would cost about £15,000. My drawings do not include a dome, but the adjudicators in the competition suggested that it might be desirable to provide a dominant feature of that form; but whether they had in their minds a structure rising 64 feet higher than the roof of the administrative block I do not know. If a dome were to be placed there later, provision would have to be made for carrying the weight and also in the general formation of the design. I have endeavoured to get definite information concerning the difference in price of the Australian and imported terra cotta, and from the information I have gathered it would appear that we would have to pay from 20 to 25 per cent. less for the foreign terra cotta and 33 per cent. less for the British than for the Australian product. I cannot say if electrical cooking appliances, if installed in the building, would be altogether satisfactory, although electricity as a means of cooking has certainly come to stay. From the information I have gathered, it would appear that in one instance electrical cooking is being done for 600 to 700 persons daily at an average consumption of current per person per meal of .4 to .5 of a unit. At 2,000 persons are catered for, at .8. At the Commonwealth Bank in Sydney the consumption of electrical energy for 475 persons is 1.175 units Debenham's, the softgoods people, in England, over 1,800 persons are catered for at an average consumption of electric current per head per meal of .37, and at the works of the General Electric Company, where

per person per meal, but that figure cannot be compared with the others I have quoted, because a certain quantity of energy is used for water heating, and since this estimate has been prepared it has been added to. Room will be available in the lower ground floor for a hot water service, and at least one-half of the lower ground floor will be available for office purposes if required. The building is not designed to carry more stories than are provided for in the plan.

16. *To Mr. Blakeley.*—The light areas extend from the top down to the lower ground floor, and each light area will be 20 feet by 20 feet. Mild steel will be used for the reinforcing, and the size of the steel will depend upon the weight to be carried. It is the general practice in buildings such as that under consideration to cover the steel with at least 2 inches. The distribution of the strong-rooms is shown on the plan and, as will be seen, are in similar positions on all the floors. I have the "Ideal" hot water system in my mind as one that is likely to be the most effective. The white marble plaster to which I have referred has been used very little in Australia. A plaster known as "Medusa" is used somewhat extensively, and a product known as "Atlas" white, and handled by an agency just opened in Sydney, is also on the market.

17. *To the Chairman.*—If authority were given for the construction of this building it would be four years before it would be completed. That includes the time required to prepare plans and specifications and calling for tenders, but does not include the work of providing the partitions and furnishing the building. It would take another six months to furnish it. If I were given instructions at the beginning of July of this year to proceed with the work it would take me to the end of the year to complete the working drawings, get out the quantities, and get tenders in. Any further information the committee require I will readily supply.

(Taken at Canberra.)

WEDNESDAY, 3RD JUNE, 1925.

*Present:*

Mr. GREGORY, Chairman;	
Senator Reid,	Mr. Jackson,
Mr. Blakeley,	Mr. Mackay.
Mr. Cook,	

Percy Thomas Owen, Chief Engineer, Federal Capital Commission, Canberra, sworn and examined.

18. *To the Chairman.*—The present proposal is to proceed with the administrative offices to accommodate the several departments of the Commonwealth that will be transferred to Canberra as soon as possible after the Parliament assembles here. It is anticipated that the Secretariat building, which is the first administrative building, will be completed by the time it is necessary to move the staffs to Canberra. It is expected that the section of the Secretariat building which is to accommodate the automatic telephone exchange will be finished about the end of the third quarter of the present calendar year. It will be necessary to dry off that portion of the building to enable the Postmaster-General's Department to erect the necessary switchboards. The portion of the building required for conducting postal work will next be dealt with, and later the portion to accommodate the administrative staff will be completed. It is anticipated that the whole of the building will be finished early in the financial year 1926. I understand from the Federal Capital Commission that, according to the proposals put forward by the Cabinet, it is the intention of the Government to largely increase the number of officials that will come to Canberra soon after the seat of government is established here. The number of officials

from the Defence Department will be much larger than was originally intended. The Secretary of the Commission will be able to give you the numbers which were submitted in the latest proposal of the Government. I might remark in this connexion that when the first Secretariat scheme was being considered, and the departments consulted, the Defence Department, so far as I am aware, stated the number which would be necessary to carry on as a Secretariat. When the Advisory Committee made its report as to the number of officials who would come from the several central staffs, I informed the Department of Defence that the opinion then was that the administration of that department would be carried on in Melbourne for some time after Parliament met here, instead of at Canberra. In other words, the removal of the Defence Department's central administration to Canberra need not necessarily be concurrent with that of the other departments, and it would come within the second stage of construction. What reason there is now for the removal of the Defence Department to Canberra is a matter that that department only can explain. I am of the opinion that the construction alone of the proposed permanent administrative building will take at least four years. I do not know how long it will take the architect to complete his design, but assuming the building will be constructed under contract, and allowing for the time that will elapse before the working drawings, specifications, and bills of quantities are available, I do not think it can be anticipated that the building will be ready for occupation within less than five years from the present time. The architect, Mr. Rolland, can submit a drawing of the lay-out of the gardens which discloses the present ground levels, and the levels proposed to be adopted, so far as I am aware, for the building itself. A site on the eastern side of the governmental group has been selected in preference to one on the west, because, I think, it is the easier site to tackle from a constructional point of view, because of the existing ground levels. Further, it is a site closer to where the administrative officers will reside. It will form a comprehensive part of the entire group. The same floor levels will be adopted for a corresponding building on the western side. When the drawings were asked for in connexion with the completion the floor level was fixed at 1,870 as a basis to work on, but has since been altered to 1,860. In my opinion, the 1,860 level will be as satisfactory as the 1,870 level. When the 1,870 level was first mentioned, I pointed out that it was one that did not lend itself to a half-sunken basement, and, further, that although Mr. Griffin had mentioned that level in his design I did not think, on closer examination, that it was one that we could economically adopt. I am not sure whether Mr. Griffin did not advocate a level of 1,872, but if it was not that it was one very near to it. All the buildings in this group must be on the same level, and their main floors must be carried right through. The problem involves consideration of the treatment of the whole area in the governmental triangle. The natural levels to the west are higher than those to the east. For instance, the old Acton-road at a corresponding distance from the main axis on the eastern side is on a level of 1,843, and on the western side of 1,852. In preparing a scheme for the parliamentary gardens I anticipated that there should be some little difference in the levels between the eastern and western end of the gardens. That involved a reduction of the level of the road to the western side of the bank, and the raising of the level of the road on the eastern side. A plan has been prepared which shows the finished levels of the gardens on the western side at the 1,840-56, and on the eastern side at the 1856-40 level. There is a general slope following the natural levels from the west to the east. The central portion would be practically level. I mention this matter of the gardens because it becomes very pertinent to the levels of the floor of the eastern building. The natural

level on the site of the eastern building, which has been proposed for administrative offices, is about 1,847. The level on the corresponding side is about 1,850, which means that there is a cut to be made on the western side, and filling will be required on the eastern side. Working out the levels for the remodelling of the surface on this governmental area, allowance is made for reducing the western side and for filling in on the eastern side, but there is no doubt that it must be accomplished with the floor levels of these two buildings the same. Under Mr. Griffin's scheme the buildings further north, which were to consist of the Law Courts, will extend over what is now a hill, which the committee has seen, and will be symmetrical with the axis. This matter was the subject of evidence before the Public Works Committee some years ago when Mr. Griffin's plan was under consideration. It was pointed out that this hill was very much in the way of this longitudinal development, and then Mr. Griffin proposed that the whole of the buildings in the group should have one floor level. There should be a horizontal line taking up one floor of the whole group, and although that is sound in principle it is hard to accomplish. To carry that level right through the whole of the governmental group would involve the removal of the hill lying about 600 feet south of the Molonglo Boulevard, and also filling up on the north-eastern corner of the triangle to construct Federal Avenue and the boulevard over what is at present the Molonglo River. It is going to be an expensive thing to do, and very probably the development of the judiciary group of buildings will not be accomplished for 150 years, and that part of the scheme might well look after itself. If Mr. Griffin's scheme of one-floor level were to be carried out it could be done, but it would cost a large sum of money. The present building constructed on the 1,860 level will not destroy the view from the other side, and the skyline will not be interfered with. I have not studied Mr. Sydney Jones' design, but I suggested that he should adopt the 1,860 level, as it is one that will suit both the eastern and western side, and certainly buildings to be erected in the south-west, and eventually those in the north-west. When the competition closed I pointed out that the proposal to have a half-sunken basement would have meant building an earth formation, but the present proposition admits of there being a floor level close to what will be the ground level, but without any excavation. There will be some sinking towards the front to gain access to the main floor of the building. The lower floor will not be the basement, but the ground floor. It will rise from the terrace, and be served by steps from one of the roads parallel to the main access, and then by a flight of steps to the first floor. We have excellent material in the Federal Capital Territory for making concrete of the highest class. That is a very important question, because presumably this building will be expected to last for several hundred years. The concrete aggregate to be used is most important. In a building of this character the contractor should avoid the use of any material with a high percentage of quartz, but, on the other hand, he must have a material which is strong, and which is essentially durable. The stone we are getting from the quarries at Mugga is a dacite—a plutonic rock—and although it is called quartz porphyry it is really a dacite. It is extremely hard, dense, and strong, and I could not conceive of a better stone for use in the manufacture of concrete. In addition to that we have river grit of an admirable quality, free from shell. The quantity of humus is small, and it is admirably suited to the manufacture of concrete. With the use of these materials, including good Portland cement, the concrete should have a life equal to that of the cement, and so far as we know that is indefinite. The bricks we make are engineering bricks, and are almost equal to igneous stone or rock, and are, therefore, practically as everlasting as the old Roman bricks. The other materials, such as steel, so far as we are able to judge, may be expected to last almost indefi-

nitely. Whether the next 50 or 100 years will disclose that reaction has set in in the steel itself we do not know, but we should be able to say that in the circumstances in which it is used it should be practically everlasting. On the experience of engineers of the day we should be able to say that we cannot assign a time in which it will deteriorate. The water is excellent for the manufacture of concrete. We are not at all well off in the matter of granites, but that at Mugga is hard, ugly, difficult to work, and too sombre. It is fairly white except for diorites, and shows flaws and irregularity. Part of it is quite light, but there are patches which are darker. I visited the Tharwa deposit with Mr. Mahony, and we came to the conclusion that we could not recommend the stone. It is not a granite that could be economically worked, or one which used in a building would be satisfactory in appearance. The sandstones are indurated, and cannot be regarded as of any use. There are specimens of the Black Mountain sandstone in the little church at Canberra, which disclose that this stone would be unsuitable as regards both appearance and durability. The Bundanoon sandstone has been mentioned, but I would not in any circumstances advocate the use of sandstone irrespective of the place from which it came, particularly in a building which is expected to last some hundreds of years. The mere fact that it is sandstone is sufficient to condemn it, because the frosts which are prevalent here will have a very detrimental effect upon it. The next possibility is an indurated limestone, which is really a marble, and which is at Fairy Meadow. The property was first of all entertained in connexion with the manufacture of cement, and I believe that the land on which the deposit is situated now belongs to the Crown. It has a good colour, and there is an enormous mass of it. I had inquiries made concerning the advisability of using it for monumental buildings, either as a veneer or in main portions of the structure, and as a result was somewhat discouraged with the report. It shows some fine crazing or fine hair-like lines when it has been polished which do not show up in the rock. It may be that these specimens, which were obtained from where we were driving, had been obtained from a spot where explosives had been used in driving, and that these hair cracks were caused in consequence. I mentioned this matter to the Chairman of the Commission a little while ago, and he wished me to open out a face in order to ascertain the actual quality of the stone. We have not had time to do that yet. There is a possibility of that stone being used as a veneer or in any other way the architects might apply it on the curtain walls of this structure. A stone which I think is admirable in every way for the proposed building is trachyte, as, in my opinion, it is a most beautiful stone, and so far as we can learn will last indefinitely. It is an easier stone to work than our granite at Tharwa. I regard the stone at Bowral as a magnificent asset for Canberra in the future. Bowral is about 130 miles by rail from Canberra. The committee will see numerous examples of this beautiful stone in prominent public buildings in Sydney. From the investigation I have made in connexion with the construction of a permanent administrative block, I would recommend that the base be of trachyte. I would have some hesitation in expressing a definite opinion concerning the form in which the different materials should be used, as that is really a matter for the architect, but I should think that a combination of quarry-faced trachyte with a proportion of polished trachyte would always be attractive. The construction of the curtain walls is a matter for the architect to determine. I cannot say when a report will be available concerning the deposit at Fairy Meadow, as at present it is entirely a matter of securing men to conduct the investigations. It has been impossible for me to make any definite inquiries, and Mr. Richmond, the officer I would like to send, is at present fully occupied. But if it is the wish of the committee and of the commission, the work will have to be

undertaken, but we could not open a face without the use of explosives in less than three weeks or a month. It would mean sending a party there to undertake the work. We drove to ascertain the percentage of magnesia, as on that depended whether it was useful for cement making. In driving we got out some boulders, one of which we had polished. We drove straight into the side of the hill from the creek. As to whether the commission is satisfied that the building will provide all the accommodation required in the first stages I can only say that the matter can be considered from the stand-point of the actual number of officers it will hold. The provisional Parliament House is being finished with a white cement washing. I have seen some of the buildings in Sydney faced with terra cotta. I have never been in favour of the terra cotta faience unless it can be made with a dull, or marble face. A light-coloured marble veneer would improve the appearance of the building, and such a facing would not be likely to become dull. If we were to introduce a marble veneer we would get a fine texture into the building in considerable mass, instead of having a texture in small mass. I would suggest that the columns be of trachyte, and I think the building should be completed without a dome.

19. *To Mr. Blakeley.*—Bowral stone is not a granite but a grey stone of fine texture without any felspar showing. I do not remember the Uralla granite distinctly. If the main pillars and the base are to be of reinforced concrete I would be inclined to use bricks for the intervening portion; that would be with 11-in. cavity walls. The brickwork would not be showing, and would weld into the building. Possibly concrete would be cheaper than bricks. For a building which is to be constantly occupied by human beings I look upon brick as a more "kindly" material for construction than concrete. I have had many discussions, and have been a member of committees which have ascertained that people who live in concrete houses say that there is something harsher in them than in brick buildings. We have in bricks a material for curtain walls, which, in my opinion, would last for 100 years. I understand that it is proposed to have the floors of concrete and the main corridors paved with marble. Some of the rooms are, I understand, to be covered with a super-flooring. Some patent materials for super-flooring are on the market, but they would not be everlasting. On the more important floors I would be in favour of the use of a super-flooring, and for the most important I would use some material such as magnesite. I would not be in favour of one design of flooring for the whole building. I do not like plain cement for the floor of a room in which people are working. A covering of rubber over concrete makes a fine floor, and I should think that such a covering would be acceptable to the occupants of the room. Rubber floor-covering of this type is made in Australia. I do not think the lowering of the level by 10 feet will affect the harmony in building line provided for in the original scheme. So long as we maintain the one floor level we may have some buildings higher than others, but we must have a horizontal line right through. If, on the other hand, we had a building on one side at the 1,870 level, and one on the other side at the 1,865 level, it would be a vital mistake. Mr. Griffin's predominating level was 1,872, but we will have a floor level at 1,871. It will be an advantage having to keep the level of these buildings down. If they had been kept at a higher level they would have, to some extent, smothered Parliament House. The more we can keep down the level the better it will be. I have had many discussions on the subject of fire-prevention with the consultant of the Commonwealth Fire Board, who is undoubtedly an expert, and he is strongly in favour of fire alarms such as the May-Otway. The Fire Board made certain recommendations, and during its investigations was in constant touch with the British Fire Prevention Association. I have not been a member of that board for the last year, but Mr. Lee,

the consultant, was most emphatic concerning the advantages to be derived from the use of Grinnell sprinklers. It is not the danger of a building burning, but of the contents being destroyed, and this, Mr. Lee says, is always a liability. If the contents of a building become ignited serious results may follow from quite a local fire. Personally, I think, that in a building of this description primary protection should be afforded by making provision for careful watching, and for that purpose Mr. Lee has perfected a check watching system which is the only reliable one. Under this system the watchman has to press a recording button periodically, otherwise an alarm is given, and the fire brigade immediately turns out. Any other system can be tampered with, and consequently does not give the desired results. The automatic fire alarm system is a good one, as it means that any sudden rise in the heat of the building is reported by the apparatus at the fire station. I do not think that sprinklers are necessary for the whole building, although there are certain portions which should be provided with sprinklers. I am of the opinion that Australian materials should be used wherever possible. With the exception of some portion of the electrical equipment, practically everything required could be made in Australia. The whole of the steel and copper could be obtained here. The number of strong-rooms, 85 in all, each of which is to have burglar and fire-proof doors, seems somewhat excessive, as I do not think the ordinary department requires strong-room accommodation. Each department may require a certain amount of storage accommodation, which should be protected from any one having access to it who had not the right. I prefer the building to be completed with a square finish at the end. A small amount of rounding to dispense with unnecessary angles may be an advantage, but I do not think that the rounding of the ends in a building of this sort is highly essential.

20. *To Senator Reid.*—I cannot recall any Government building in Australia in which valuable papers have been lost in consequence of a fire. There is, however, always a risk of fire, and conflagration frequently occurs by a lighted match being carelessly thrown into a waste-paper basket. Protection against fire, however, should be afforded with discretion, and that can only be done by studying the use to which various parts of the building are put. Sprinklers would not be an advantage in, say, a draughtsman's office, or in a Department of Lands where there are very valuable documents. For reinforced work I would prefer to use crushed dacite or Mugga stone, because it is capable of producing a higher grade of reinforced concrete. At present prices Mugga stone would cost 15s. per cubic yard more than the river gravel. The stone quarried, trucked, and delivered here is costing 20s., but we are going to reduce that figure. We were sending it out at too low a rate, which meant that we were mounting up an overdraft. We are now wiping off the account and charging a higher rate for the stone. In the first place, the quarry was laid out for three crushers, whilst we have had only one. We are now putting in a heavier crusher, and we will increase the output and save 2s. per cubic yard on our production of stone. Moreover, the larger output will reduce the cost of our product, and, further, the transport which is covered by the rate of 20s. mentioned has, up till now, been expensive. We are improving the road so that I would not put down 20s. per yard as the likely cost of the Mugga stone. We could get the river gravel out for 7s. a yard, and would save 8s. a cubic yard by using that material. As to the value of the concrete aggregate, the crushed stone is undoubtedly better, but then we have the extra expense. I would not dream of constructing this building with concrete in which river gravel was used, and if Mr. Sydney Jones favours it I disagree with him. For non-structural work I would, I think concrete would be cheaper than brick for inside walls.

The inside walls are not structural, but simply partitions. If they are not to be structural we could put up anything we liked, because, after all, they might have to be altered. A wall in which cinder concrete was used would be cheaper than brick, but we would have to get cinders from Sydney, as the quantity obtained from the power-house here is very small. I think if the work were done with concrete it would be cheaper than with bricks. Although I cannot at the moment give the cost of transporting trachyte for the base to Canberra, I think it would be fairly expensive. The only examples of trachyte here are in General Bridges' tomb and the foundation stone on Capitol Hill.

21. *To Mr. Cook.*—I understand that Mr. Sydney Jones states that, as there is an abundance of suitable material for the manufacture of concrete in the Federal Capital Territory, he suggests that the structure should be of reinforced concrete. I, too, am of that opinion, but I do not think river gravel should be used in a building of the importance of the one proposed. As I have said, I favour a reinforced concrete skeleton, except for such stones as the architect might be inclined to use in the base, cornices, and piers; but it should be fundamentally a reinforced concrete building. The only expert opinion I have heard concerning the bricks manufactured in Canberra is to the effect that they are the finest bricks made in Australia. I would use bricks for the exterior curtain walls if bricks are decided upon, whilst the inner walls might be of concrete. I favour the 1,860 level, which I understand is to be adopted for this building after a close study of the general contour of country. With our natural ground level we must start off at the 1,860. The 1,870 level was stipulated in the conditions governing the competition to afford a basis, but the question of altering it to the 1,860 level arose long before designs were sent in. I came to the conclusion that a half-sunken basement would not suit the site. The Mulga quarry is  $3\frac{1}{2}$  miles out. The river gravel is naturally water-worn, and I do not care to use it in concrete for work of this kind, as there is a good deal of quartz in it, which is an unsatisfactory feature in concrete work, because it expands in the event of fire. Under heat, quartz is also liable to disintegrate. We have never used it in a building of such importance as that proposed.

22. *To Mr. Jackson.*—The Grinnell sprinklers only operate when the temperature in a building reaches a certain point in consequence of the outbreak of fire, and if there was sufficient fire to start the sprinklers a fair amount of damage might be done. Steel shelving will be used throughout the building. I should think that steel or iron strong-room doors costing £18 to £20 each would serve to protect the documents in some portions of the building. On the other hand, doors of a better quality would necessarily have to be used to protect the more important documents. The strongrooms are fairly well distributed, and if the number were reduced inconvenience might be caused in removing documents to a strongroom some distance away in order to protect them in the manner desired.

Charles Studdy Daley, acting secretary to the Federal Capital Commission, Canberra, sworn and examined.

23. *To the Chairman.*—I submit, for the information of the committee, plans of the proposed permanent administrative offices at Canberra. I understand that the chief engineer to the Federal Capital Commission (Colonel Owen) has indicated, in general terms, the manner in which the proposal has been changed. In a previous report of your committee it was recommended that two buildings should be erected on sites nearer to Parliament House, but, after going into the matter, it was found that sufficient accommodation could be provided in one building on another site. I believe the matter was discussed, with you as chairman of the Public Works Committee, and a competition for designs was

accordingly held, with a proviso that if two buildings were needed we could utilize the plans without paying architect's commission on the second building. It was suggested that if a second building were constructed it could accommodate the Government Printing Office, and also the National Library until such time as a building for the latter could be erected. Since then the proposal to accommodate the printing office in such a building has been modified, and temporary arrangements have been made for the establishment of a printing office. A proposal probably will be put forward suggesting another site for the permanent printing office. It is thought that it will be necessary to accommodate the printing office staff in a building adjacent to the railway, in view of the large amount of traffic in paper and goods which will necessarily have to be handled. As this office will, in a sense, be an industry, it is not considered desirable to have it in the Governmental group. For these reasons it is not likely that a second administrative building will be proposed for some time, more particularly as in the building designed by Mr. Sydney Jones more accommodation will be provided than was anticipated in consequence of the introduction of a mezzanine floor. The building will accommodate approximately 1,600 public servants, each of whom will have about 125 square feet of space, as suggested by the advisory committee. We have had information from the Government recently concerning the number of officials to be accommodated here when Parliament meets. Although we have sought definite information concerning the number and condition of public servants who will require to be accommodated, we have experienced great difficulty in getting reliable data. Instead of the particulars desired, we were supplied with figures showing the total strength of the various departments, excluding such branches as the Weather Bureau and the Commonwealth Statistician, which could be accommodated here later. We were then asked whether we could provide accommodation for the officials of the departments by the time Parliament met at Canberra, which was quite impossible. The last advice from the Government is that approval is given to adhere to the secretariat scheme, under which representative sections of departments can be accommodated when the seat of Government is transferred. We were also asked if we could accommodate practically the whole of the Central Administration by 1927, which will be some time before the proposed administrative block is ready for occupation. It may mean erecting buildings to accommodate these staffs in order to meet the Government's wishes, and using the buildings for other purposes later. Apparently, the Government desires to make a move as soon as possible; it does not wish to have staffs operating in two centres. The commission is not able to dictate in the matter of the Government's requirements, but the Government may, of course, make a request to the commission to do certain things. We have been asked to go into certain matters and submit proposals for consideration by your committee. The chairman of the commission, Mr. Butters, is anxious that we should give as much information of a detailed character as is possible in regard to the proposed administrative block, but I understand that most of the details have been given. The number of officials, so far as we know, to be transferred to Canberra by 1930 would not exceed 1,600, although it is difficult for us to say whether it will be possible for the Government to transfer the Taxation Department, sections of the Defence Department, the Commonwealth Statistician's Branch, and others. The advisory committee estimated that in the first ten years possibly 2,600 public servants would be employed at Canberra, and to accommodate such a number would necessitate the erection of additional buildings. The number we worked on for the first stage of the advisory committee's plan was 1,100, which could easily be accommodated in the building designed by Mr. Sydney Jones. It will at least provide accommodation for between 1,500 and

1,600 officers, basing the capacity per employee at 125 square feet, as suggested by the advisory committee. The proposed building is a large one, and after provision has been made for Ministerial rooms, a fairly large floor space per person would be available. With the conveniences provided in the provisional Parliament House, some of the accommodation there can be utilized by officers. I shall supply the committee with the exact cost, delivered at the Parliament House site, of the stone rubble being delivered from the Mugga quarry. The commission has not taken over the assets of Canberra at a valuation, because it has not as yet been supplied with the necessary information to do so. Before the commission obtains the actual cost of the various utilities, such as the power house, it cannot determine a fair price for electric energy by making allowance for interest on capital in the ordinary way. The ordinary book-keeping methods adopted by the Treasury do not afford information of a commercial character upon which a fair rate can be fixed. The present charge for lighting is 9d. per unit, and that for power is fairly high. This, in common with other utilities, will have to be written down in order to give a proportionate value as compared with the density of population. A number of these undertakings cost a great deal to plan and construct, and have been designed to meet the requirements of a much larger population than will be here for many years. The present rates, based on the cost of operating, may be considered almost prohibitive. I have instanced one of the difficulties in providing highly-developed utilities in the early stages. No provision has been made for the supply of gas for heating purposes, one of the reasons being the cost of distributing gas over a sparsely-populated area. The chairman of the commission is very much in favour of using electricity, and has been considering ways and means of reducing the cost of energy, with the idea of it being used for cooking and other purposes. We have submitted the architect's estimate of the cost of the administrative block, because in this case it is practically his scheme. We would have to add to that estimate other charges, such as the architect's own commission, interest on capital during construction, and overhead expenses of the commission, which would bring the estimate up to about £535,000, including the cost of conducting the competition, but exclusive of the cost of furnishing. Many of the departments to be accommodated in the proposed building are already completely furnished, and it is anticipated that in many instances the equipment now in use will go a long way towards providing the department with the necessary furniture.

(Taken at Canberra.)

THURSDAY, 4TH JUNE, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Reid	Mr. Jackson
Mr. Blakeley	Mr. Mackay.
Mr. Cook	

John Henry Butters, Chairman of the Federal Capital Commission, Canberra, sworn and examined.

24. *To the Chairman.*—I do not think that the alteration of the base line of the proposed administrative block from the 1,870 to the 1,860 level will be in any sense detrimental; in fact, I think it is an improvement. The design of Mr. Sydney Jones which was awarded the first prize in the competition held last year was decided upon independent of the Federal Capital Commission. He has shown us two alternatives, and we believe that the proposal under consideration is the best. At the moment I am not satisfied as to the

foundations on the right hand side, but do not think there will be any difficulties, judging from the excavations made in connexion with sewerage operations. It is proposed that the foundations will be of concrete. I understand that Mr. Jones has suggested granite for the base of the building. The investigations we have made are not conclusive, but so far they do not reveal the presence of any good building stone that we could obtain at an economical figure. I do not know the extent to which the granite deposits at Michelago have been opened up, although they have been reported on by Mr. Mahony. The principal obstacle is the cost of transport from the deposit, which is in very difficult country, and it would appear that the quarry would be too expensive to work for some time. The architect will submit his recommendation concerning the stone he thinks should be used for the base, and we will examine it from an economic stand-point. I am in favour of reinforced concrete construction, but in this instance also the architect will submit his opinions, which we must substantiate. The investigations indicate that the stone available locally is probably unsuitable for facing work, owing either to inequality in grade, appearance, cost of winning, and transport. I should say with the architect that a combination of rough and dressed stone would be suitable for the basement, as it gives a very pleasing effect; but that is a matter largely for the architect, as one can only express an opinion on such matters from the point of view of personal taste. I should not like to submit an opinion concerning the columns at this stage, and should like to examine the matter from the point of view of cost. This is to be a monumental structure, and one that should be practically everlasting; and therefore great care should be exercised in selecting the materials to be used in its construction. The proposed interior arrangements should be satisfactory, but the only sound way to meet the situation is by arranging the accommodation in the manner required. If the cost would not be excessive, I should be in favour of marble being used in the corridors and lavatories, such as has been done in the Commonwealth Bank, Sydney. An ineffective strong-room is worse than nothing at all, and although the number proposed is somewhat large and the cost fairly high, every structure of this type is well equipped in storage and strong-room accommodation. If fireproof doors are to be installed, they should be of the best quality. In going into the design with the architect, the impression I gathered was that under the first contract we should at first eliminate the ends of the top floor. By the time the building is approaching completion we shall probably know whether these two extra wings are needed or not. Personally, I do not think it will be wise to erect a dome, as the principal dome of a monumental character should be on the Capitol, which should be the central feature of the place or, failing that, on Parliament House. I prefer the horizontal line for the time being. The provision made for staircases and lifts should, I think, be ample. I have not analysed in detail the accommodation to be provided for dining purposes, and cannot at this juncture say whether all the space provided will be required. It seems somewhat large, but, on the other hand, it is difficult to forecast what the requirements will be in four or five years time. Assuming it is found to be excessive, it could be used, as an alternative to the two wings. I like the mezzanine floor, which is an excellent proposal, economically. Generally speaking, I like the plan as a whole.

25. *To Mr. Mackay.*—Although hotels are being erected, many of the public servants living in hotels in the early stages will be occupying homes of their own when the administrative block is completed, and consequently may desire to use the dining-room. The commission has not had an opportunity of going thoroughly into the plans and specifications, but we will examine

them very carefully later. It was decided that a competition was to be held in order to obtain the best design, and so, as a commission, we have to be very careful before we start to interfere. We must not relieve the architect of his responsibility. On the other hand, we must safeguard the position so far as we are able. In regard to the foundations, for instance, we, as well as the architect, must be satisfied. It will be the duty of the commission to see that no excessive costs are incurred, and that modifications are made if necessary. Before tenders are called we will very carefully examine the specifications and drawings from an economic stand-point. Mr. Sydney Jones is a capable and reasonable man, and I do not anticipate any trouble, as he would not be influenced in the direction of incurring unnecessary costs. He might desire to spend money to achieve architectural effect, which we might say from an economic point of view we were not justified in spending, but I think we can control him from that stand-point.

26. *To Mr. Blakeley.*—I am inclined to think that as the building will be essentially fire-resisting, the only risk that is likely to be incurred is that of a fire originating in, say, a waste-paper basket. Fires of that kind can be prevented by careful watching. It would be the duty of the caretakers to see that no fires were burning when the building was vacated, and the electrical system would be so protected that there would be no risk of fire.

27. *To Senator Reid.*—The cost incurred in connexion with the granite at Michelago would not be so much in the working of the deposit as in the transport to the railway. It is, however, a somewhat inferior stone. The commission is making an examination of the whole position in regard to a requisite building material. The commission will also be interested in the manner in which the exterior of the building will be treated. We have not yet received the plans, and have to arrive at a starting point before anything can be done. We shall have to test the foundations, and realizing that the proposed structure is to be a monumental building, and one which will in a sense set a standard for other buildings, the greatest care must be exercised.

28. *To the Chairman.*—A building with a round end does not seem an economic form of structure, as too much would have to be sacrificed in fitting the building to the road. I prefer the square end. We are diverting slightly from Mr. Griffin's plan on that particular point without interfering with any of its main features. Before we adopted a white plaster consisting of cement and crushed marble, as has been suggested, we would have to conduct experiments in order to ascertain its effect. Parliament House is to be finished with a white surface, such as is being used at present. It is rather a glaring white, but there is no economical way of improving it.

(Taken at Sydney.)

FRIDAY, 5TH JUNE, 1925.

*Present:*

Mr. GREGORY, Chairman;

Senator Reid,	Mr. Jackson,
Mr. Blakeley,	Mr. Mackay.
Mr. Cook,	

George John Oakeshott, F.I.A., Commonwealth Works Director for New South Wales, sworn and examined.

29. I have inspected the plan for the proposed permanent administrative offices at Canberra. In my opinion the base of the building should be of some solid material, and for preference I should say rock-faced or axed trachyte, or rock-faced or axed granite. For the information of the Committee I submit specimens of Bowral trachyte, quarry and axe-faced and polished.

If the cost was not too great, undoubtedly the polished trachyte looks the best. Many of the banks in Sydney are treated with trachyte with a polished surface, and it is very rich in appearance. If that is considered too expensive, I regard quarry-faced granite as the next best for the base. Axed granite costs 16s., and polished granite 22s. per super. foot. The difference in the cost of the two grades of trachyte would also be practically the same. I also submit specimens of the Uralla granite, which I prefer because of its colour. Bowral is the only place from which trachyte is obtained, but granite may be obtained from several reliable sources. I submit three samples of granite, one from Uralla, another from Clyde, on the Bellingen River, and another from Marulan, which is in the Goulburn district. Much would depend upon the type of superstructure as to whether I would recommend granite or trachyte for the base. I understand the proposal is to construct a reinforced concrete building, and from my experience I regard that as an excellent proposal. There are three methods of treating the external columns, walls, and cornices, i.e., that they should be entirely of stone, terra cotta, or cement, or a combination of the three. I would not advocate a cement facing, although it is used. For a monumental building I would favour, if the cost was not excessive, stone from the base upwards, including the capitals, but not necessarily the columns. The columns, being ornamental, might be done in trachyte, granite, or sandstone. I also produce two samples of sandstone; one is known as the Maroubra stone, from the Government quarry, and is really an excellent material. The colour is somewhat deceptive, because, when it has been exposed for some time, it becomes a more decided yellow, but in some instances the colour has been hastened a good deal by the use of an acid solution in order to more generally produce the desired yellow tint; but that I do not advocate for a moment. An excellent stone quarry has just been opened up near the Hawkesbury Bridge, from which stone with a beautiful grain is produced. This product also takes on a more marked yellow tint after it has been exposed to the weather. The Maroubra quarry is in the Long Bay district. The Hawkesbury quarry is right on the Hawkesbury River, and, therefore, stone from that deposit can easily be railed or lightered. The Maroubra sandstone is used largely in connexion with State contracts. The whole of the Central Railway Station, Sydney, is constructed of Maroubra sandstone, and the same material is also used in the arches for the new city railway, and in the Education building in Bridge-street, Sydney. The Hawkesbury sandstone is strongly favoured by Professor Wilkinson, and is being extensively used in the additions to the Sydney University. Messrs. Scott and Green have also used it in the Canadian Assurance Building in Bond-street, and Messrs. Wright and Apperly are using it in a branch of the Bank of New South Wales at Crow's Nest. Doubtless it is being used in other centres. This quarry can be said to be properly opened up. The Maroubra product has been on the market for some time, and is practically a freestone. The Pymont and other quarries are working out of the best stone. In a reinforced concrete structure we would not use more than 6 inches of stone except for anchoring overhanging cornices; any embellishments would depend upon the design. Including mouldings, cornices, but excluding capitals and carvings, this stone would cost about 11s. 6d. per super. foot fixed on the building. There are three kinds of terra cotta used in Sydney, viz., the English, the American, and the Australian; the last-mentioned being produced by the Wunderlich Company. It is most difficult to correctly estimate the cost of this material, as it all has to be moulded, and in some instances only one cast is made, and in others perhaps some thousands. To estimate the cost of covering a large area of plain work would be easy, and the cost comparatively would be very much cheaper than for a few yards. I have taken out an average for a

building of this description, and the prices will include a reasonable quantity of moulding, cornices, architraves, and windows, but will not include capitals, carvings, or embellishments of any high degree and artistic merit. The British product as used in the Bank of New South Wales in Macquarie-place on that basis would be about 17s. 6d. per super. foot, the American terra cotta as used in the Union Building in George-street would be 22s. per super. foot, and the Australian product, approximately 25s. It is difficult to arrive at a reliable estimate for ornamental work; but, roughly, I think you would have to calculate on paying about 32s. 6d. per cubic foot. Two American white cements, namely, "Atlas" white and "Medusa," are being used for exterior purposes in Melbourne, but I do not know at the moment of any instance here, although they are used extensively for internal work. Sandstone is about 6s. per super. foot cheaper than the foreign or British terra cotta, and although the terra cotta has a very fine appearance, I prefer stone for this class of building. I should prefer the columns of the proposed building to be of the same stone at the base, only polished. For instance, if the base was of rock-faced granite I should like the columns to be of polished granite, and if the base were of trachyte I should like the columns to be of polished trachyte. The cornices should be of the same material as the walls. If you had a stone surface I should advocate stone cornices, and if the walls were faced with terra cotta the cornices should be similarly treated. As a rule the cornices correspond with the exterior walls of the building. The Maroubra quarry is controlled by the State Government. There are granite deposits somewhere in the Federal Capital Territory, and although I have seen samples of the stone I cannot say exactly where the deposits are. The sample I saw was a beautiful one, but the stone would be costly, as the quarry had not been opened up. Stone of this type would be more expensive than cement, but cheaper than terra cotta. In considering stone, it has to be remembered that it has to be quarried, shaped, and faced, and then has to bear the cost of cartage. For durability, I suppose granite is preferable, and then trachyte and sandstone a long way behind. Terra cotta, if looked after, is quite as lasting as sandstone, but would not last as long as granite.

30. *To Mr. Blakeley.*—I should favour unpolished granite or trachyte for the base, sandstone for the upper portion of the building and cornices, and the columns to be made of the same material as the base, but with a polished surface.

31. *To Mr. Cook.*—I know there are valuable stone products in the other States, but I do not consider myself qualified to speak concerning their respective merits. Harcourt granite, which is obtained in Victoria, is a beautiful stone, and is being fairly extensively used in New South Wales. But so far as I have been able to gather, the New South Wales granites are equal to those produced at Harcourt. In my opinion the Uralla stone is of a more homogeneous texture, and is lighter in colour. The Marulan stone is rather too dark for my taste. There are no blemishes or flaws in the Uralla stone, but occasionally it carries big black spots. The prices of granite do not vary much owing to the competition which prevails, and you can assume that most of the New South Wales granites would be delivered in Sydney at practically the same price.

32. *To Senator Reid.*—I believe that the Central Railway Station in Sydney was one of the first large buildings to be constructed of Maroubra sandstone. The quarry at Hawkesbury Bridge has only recently been opened up, but it produces the best sample of sandstone I know of. I have never known it to "weather" on a vertical base. Even in the climate such as exists at Canberra, where the frosts are somewhat severe, I think we would find that it would last hundreds of years. I believe sandstone will last just

as well as those which have been in use in London for very many years. Some of the stone used in London has fretted a little, but it must be remembered that in that city the rain is more persistent than it is here. In Australia we have heavy rains, sometimes followed by severe frosts, which are very detrimental to sandstone. I do not think the thickness will affect the wearing capacity, and I would be prepared to recommend the Maroubra and the Hawkesbury sandstone; but I prefer the latter, because of its closer texture. The Hawkesbury stone cost 5s. 6d. per cubic foot at the quarry and 6s. 6d. per cubic foot in the Sydney metropolitan area. I think it would be the greatest possible mistake to use a plaster consisting of crushed marble for an exterior finish. It is a rich and beautiful material, but the added beauty is not commensurate with the extra cost. The veneer is usually thin, owing to the cost, and I do not think its lasting properties are all that they should be.

33. *To the Chairman.*—I do not think the frosts at Canberra last long enough to penetrate sandstone. The Bundanoon sandstone is very beautiful, but I should prefer to use it for internal rather than for external work, as I do not think it has the weathering properties of the Sydney stone.

34. *To Mr. Mackay.*—I do not like the suggested apsidal end of the proposed building, as it would not lend itself to the design, and would entail considerable difficulty in planning the building internally. Of the three proposals submitted I prefer the square end which should be made architecturally attractive.

35. *To Senator Reid.*—If the white cement consisting of crushed marble were homogeneous, I would not be so afraid to use it at Canberra, because the water could get away quickly, but with the use of small pieces of marble there may be a little cement in certain places where the material might commence to fret.

36. *To the Chairman.*—In a monumental building such as it is proposed to construct, I would strongly advocate the use of marble in the main corridor floor, because it is everlasting and always has a clean appearance. For the information of the committee I produce Mr. Baker's book on marbles, which is beautifully illustrated, and gives one an idea of the different varieties which are on the market. Generally speaking, one has to accept these offerings unless one is prepared to go to the expense of opening up a quarry. For the corridors in the main hall in the lower portion of the building I should prefer marble flooring, but for the floors where officers are working I would suggest concrete floors with a jarrah super-flooring such as we are putting down in the additions at the Sydney General Post Office. We are laying down battens between which is a light concrete, and when that is dry we flood it over with tar. The jarrah, samples of which I submit, is then placed in position and nailed on to the battens. I would not advocate parquet flooring. The ordinary super-flooring is too thin, with the result that it becomes "drummy" owing to portions becoming loose. The jarrah flooring is comparatively silent, is comfortable to those who have to use it, and will last practically for ever. The ordinary super-floors vary in price from 25s. to 32s. per yard; jarrah and Tasmanian oak being about the cheapest. Silky oak is 32s., Tasmanian oak 25s., Tasmanian blackwood 32s., and jarrah 25s. I would advocate a 4 x 1 inch flooring nailed to battens on concrete, which in jarrah would cost 90s., hardwood 67s., and Richmond River pine, which I do not advocate, 76s. To these prices would have to be added 6s. per super. yard if the material were planed and polished with an electrical machine. I should advocate planing in the general rooms and polishing only in the Ministers' rooms. As regards the staircase, I would carry out the same system of reinforced concrete from floor to floor. Marble steps are slippery. There are several very fine treads that I should like to use, one of which is an artificial stone, the name

of which I cannot give at the moment, but which consists of carborundum. It makes a very good surface and prevents slipping. For the main staircase I favour all marble, but for the less important staircases I would use patent treads. I would not use marble to the first floor. There is a great saving of space in having the staircases in the vicinity of the lift. I do not know why there should be quite such a large number of strong-rooms in the proposed building, and I believe a good fire-resisting door could be obtained at a lower price than that included in the estimate, which appears too high for ordinary departmental use. The documents accommodated in these strong-rooms are of great importance to the department, but of no commercial advantage to any one. We give £60 each for suburban post office fire-resisting doors, and I know of no instance in which the contents have been affected. These safes are practically thief-proof. In these circumstances I should think the price of the proposed strong-room doors could be reduced by one-half. I favour the use of metal shelves, and the price at which these can be supplied depends upon the design. Metal shelving, however, costs about three times as much as wooden shelving, but it is adjustable, everlasting, and fire-resisting. I consider it an excellent idea to divide the interior of the building into units of 22 feet by 11 feet, as Mr. Jones has done, because the departments can be enlarged or decreased as desired. The unit principle he has adopted would help the department considerably. I would not advocate the use of spiral staircases, and, generally speaking, I regard them as an abomination.

37. *To Mr. Blakeley.*—For the information of the committee I produced a specimen of " Battleship " linoleum, which makes an excellent floor covering, is comfortable for the employees, but which does not last as long as jarrah flooring, which gives practically the same comfort. This material costs 12s. per super. yard, and the jarrah flooring 90s. for a 10-ft. square. I advocate the use of magnesite flooring in such portions of the building as the lavatories, bathrooms, &c., where a floor covering is required without joints. It can be laid in one piece, and turned up against the walls so that the whole floor can be hosed down without any possibility of the water penetrating it. It can be laid on either a wooden or a concrete floor. The Grinnell sprinklers can be regarded as a very good investment, as they really pay for themselves on an insurance basis. Even if a fire occurred it would do considerable damage to the contents of a reinforced concrete building before it could be extinguished, whereas with the use of sprinklers the damage can be minimized. If no objection is taken to the appearance of the apparatus it is a very effective way of safeguarding valuable documents. A system of fire alarms which has recently been installed is excellent. We have, as you know, a Commonwealth Fire Board in Melbourne, which has recommended the use of this apparatus, the principle of which is that the fire brigade is automatically notified of any rapid rise in temperature. One was installed in the War Museum, and gave the alarm when a slight fire occurred.

38. *To Senator Reid.*—There would be more danger with a floor covering of linoleum than with a jarrah floor. In a well conducted office the risks of fire are slight, as in the daytime there is usually a number of people about. During the night the building should be watched.

39. *To Mr. Mackay.*—I understand that there is to be one strong-room on the refectory block, 35 on the lower ground floor, 24 on the ground floor, 8 on the mezzanine floor, and 22 on the first floor, and, as I have stated, I consider that number in excess of the requirements. There may, however, be circumstances of which I know nothing necessitating the number for which provision has been made.

*The witness withdrew.*

Herbert Ernest Ross, architect and civil engineer,  
Sydney, sworn and examined.

40. *To the Chairman.*—I have been associated with the Federal Capital as a member of the Advisory Committee and as one of the adjudicators in connexion with the competition held for designs of a permanent administrative building to be constructed at Canberra. After a most extended investigation I was quite satisfied that the original proposal as regards levels in what we term the governmental area would have to be modified, because the development of roads, access, and the relation to the provisional Parliament House and grounds were all-important. But being important for the time being, the matter had to be regarded not only as for the next 100 years, but from the stand-point of what would eventually develop on this area when the permanent Parliament House is located, or shall I say anywhere in that governmental area in view of the probabilities of such a position as might be adopted. The alteration in levels, I think, was a direct outcome of more thought and consideration than had been possible to give to the subject in the earlier stages. In my opinion the adoption of the 1860 level will prove satisfactory. As regards the base of the proposed building, I may say that not only for structural, but for aesthetic reasons, the use of New South Wales or Canberra granite is desirable. I do not want to be too definite in this respect, until the Canberra deposit is opened up, because at present it is impossible for any one to say how it will develop. From the point of view of modern construction, however, granite is less a structural material than would appear. It gives a mere aesthetic feeling suggesting strength rather than actual strength. Concrete, reinforced or otherwise, is economical structurally, and from the point of view of strength it is altogether preferable to any other material. While granite could be used as a facing material to give the suggestion of masonry, which is desirable on aesthetic grounds, cut granite in the mass for foundations would be a waste of money. In regard to the upper facade of the building, I most distinctly hold that the proper material to adopt is faience or glazed pottery. It is more everlasting probably than any stone we know of, is capable of being manufactured to architectural form at less cost than carved stone, and affords the opportunity in 10, 50, or 100 years hence of the counterbalance which is essential to the scheme being exactly reproduced on the opposite side of the main axis, whereas if any particular stone is used it may be that in 50 or 100 years, or even a shorter period, that stone will not be available. Apart from these considerations, there are others. We are compelled in the matter of colour to take what nature offers; but dealing with the artificial products, the artist in the architect is able to obtain any colour he desires. On the ground of appearance also, I may say that this material keeps cleaner and fresher than any other material excepting polished stone, which is quite out of the question owing to the cost. Of the beautiful coloured stones available, marble is the only one worth considering, and it is well known that it is quite unsatisfactory for exterior work, particularly in city buildings. It is subject to the effect of acid vapours which permeate every city, and which come from the sulphur in the coal consumed, and which will be consumed in all cities to some extent for some time to come. Marble under these conditions will rapidly lose its colour, and for economic reasons is undesirable. The same remarks would apply to the columns which could be built very effectively of any dimensions in terra cotta. I am putting in columns in the city to-day which are not only the largest in Australia, but as columns in building are the largest in the world, and that is in the new Savings Bank in Castlereagh-street. These columns, which are 90 feet long and 9 feet in diameter, are of reinforced concrete, and are to be covered with terra cotta. There we have the advantage in colour of being able to make some hundred

colour samples in order to get the precise shade we require. By using an artificial product we have been able to harmonize with the natural product, which is red granite, and which would have been quite impossible if we had to use two natural substances. The material is being made in Australia, and I can only describe the colour by saying that it is of a warm tone. In view of the large amount of facing work which will be necessary in the building I have mentioned, it was necessary for the Commissioners to establish an Australian industry, which they have done by guaranteeing large orders of the material. Modern ceramic works have been opened up by Wunderlich Limited at Rose Hill, near Sydney, and expert artisans and machinery have been imported from abroad. The price at which we are getting the material will be less than the imported, and I shall quote some figures from which comparisons can be made. At present granite would cost 28s. per cubic foot fixed, so that we may take it that for face work per foot of face the cost would be about 20s. per square foot for granite such as would be used for external work. Some mouldings, perhaps, and some special dressings would be more, but granite as is commonly used for the base work of buildings would cost 20s. per square foot. Terra cotta would cost about one-half of that. Marble would cost probably 35s. per foot dressed, finished, and fixed. On the other hand, sandstone would cost somewhat less, or 8s., as against 10s., and if moulded 15s. to 18s. The price of terra cotta is inclusive of all kinds of moulding, as the labour is merely repetitive work. Therefore, with terra cotta there is the opportunity for producing a variety of ornamental work which with other material would be very costly. The climate of Sydney might be taken as being more favorable for the use of sandstone than Canberra, as we have no severe frosts here. The best of the Sydney sandstone has gone. The finest sandstone used in Sydney came from the Hell Hole and the Purgatory Bed at Pymont. There is none of this stone which has been in use for 50 years which has not fretted to some extent, and there is no stone in the recently developed beds as good as that taken from the stocks I have mentioned. Trachyte is an excellent material, but to my mind is not so pleasing as granite, and I should say would cost more at Canberra. Trachyte would not last as long as terra cotta. Trachyte has what we term a neutral tint, with which it is difficult to get a colour to harmonize. Still, it is an excellent material, but it cannot be depended upon to bear a great weight. It is only reliable as a facing material. I prefer red granite to grey granite from the point of view of beauty and effect in construction. I prefer grey granite to blue trachyte. We have excellent grey granite in New South Wales, and we can get as good a quality in the red as in the grey. If the use of granite is to be seriously considered, the quarries in the Federal Capital Territory should be fully investigated in consequence of the cost to be incurred in freight, and in other ways in obtaining supplies from other sources. To open up a quarry would necessitate a detailed examination extending over six or eight months, and it will take about that time before the complete plans of the proposed building will be ready. I do not know of any granite at Canberra that would be as good as the Mourilyan red granite, or the good grey granites in northern New South Wales. Victorian Harcourt granite costs 10s. 9d. per cubic foot delivered in block on the site, but not erected. The Uralla granite, which is the best of the granites, would cost 11s. per cubic foot delivered in block at the site, and the Mourilyan granite, which is nearer but not so good, would cost 12s. 6d. per cubic foot. If sandstone were used, the best source of supply would be the Hawkesbury basin, where the cost per cubic foot would be 3s. 6d. in blocks at the quarry. The Bundanoon sandstone is a fine stone, but I do not know of any instance in which it has not been found to be inferior to the Sydney sandstone in durability. The only marble which is at all

satisfactory in Australia for outside work is the coarse crystalline Rockhampton marble, which does not polish very well, but which has a nice texture. I favour marble for interior work. The Queensland marble does not cost any more than the New South Wales product. In an administrative building marble should not be used extensively for interior paving work owing to the expense incurred in keeping it clean. It is also noisy and slippery for traffic, and its sole merit is that it brightens up the corridors. I believe on all other grounds it is far cheaper to cover the concrete floors with a rubber covering cemented down, as such a covering should last for 50 or 60 years. It would also lend to efficiency in a place of business, as the tread would be silent. Marble would not last as long as the covering I suggest. In the main vestibule we should not be governed by the same rules, but there something would have to be sacrificed for effect. Either the rounded end or the end with the segmented rounded portion is aesthetically necessary on this block, and on the counter-part block on the other side of the main axis. These two buildings, when complete, will form the external limit of the buildings of their class on the main axis, and it would be much more harmonious as a town planning matter to mark the fact right and left with a rounded end or some such feature. From a distance a full rounded end would be more attractive, but viewed from the immediate locality of the building I think that segmented portion is preferable. I do not express a definite opinion one way or the other. The inner end, which faces the garden, should be square, but the outer end should have a feature. I think the dome should be omitted on the ground that it places an undue pressure on the future design of other buildings. It immediately suggests something that will not harmonize with future construction, and I believe the dominating feature in that governmental area will later on be the capitol—the purpose of which has never been definitely laid down—the permanent Parliament House and other buildings on the main axis. For these reasons I think all kinds of domes should be excluded from buildings off the main axis. It would give confusion on the skyline. I have no objection to the skyline being broken by an additional floor as long as the lifted portion is towards the axis line rather than away from it. I would not like to see a building dip on the skyline to a lower level nearing the axis.

41. *To Mr. Blakeley.*—The cornices should be treated in terra cotta; as a matter of fact, cornice construction in terra cotta is more durable than in stone. The Savings Bank of New South Wales to which reference has been made is being constructed under the Height of Buildings Act, under which all the necessary provision is made for the prevention of fire. That building is to be provided with concrete floors, fire-proof doors, automatic fire alarms, certain avenues of escape, and enclosed staircase walls. The system of fire alarms has not yet been decided upon. What we do is to investigate the merits of any fire alarm as it arises, as there are changes from year to year.

42. *To Senator Reid.*—The colour design of the proposed building would depend upon the colour of the base. Generally speaking, I would favour a warm colour as a contrast with the green colour of the trees. I would get away from pure whites and greys, which from a distance look like cement. A rich cream is a good colour, which shades away to a light pinkishness against green trees and hills. I would favour terra cotta in all such buildings to be constructed at Canberra, and a concrete base veneered with granite. I would not hide away granite when concrete is stronger and cheaper. Moreover, it would be difficult to obtain the services of the right type of granite masons in Australia for some time, particularly as all those available will be engaged in granite work on the North Shore bridge, the construction of which has just been commenced. I doubt whether there will be sufficient men for that work. All the walls, including the courts,

should be of concrete and covered with terra cotta. Doubtless many of the inside walls will be altered from time to time. The main structural walls should be of concrete. I would favour concrete instead of brick for inside walls. Any of the subdivision walls which are likely to be altered should be of brickwork. For the staircase I would favour concrete with marble facings and a rubber tread. I would have the floors of the building covered with rubber, because if that is done the fire risk is not so great. In some of the rooms where wooden flooring was used, linoleum would have to be laid.

43. *To Mr. Mackay.*—In the event of terra cotta being extensively used, it would govern the erection of other buildings in this group. Whether you build in marble, sandstone, granite, or any other material you will be governed in such a way that you will eventually lose control. In dealing with terra cotta it will be possible to harmonize and control the colours.

44. *To Senator Reid.*—I am sure terra cotta will become a prevailing factor in architectural construction, and in buildings of the larger class it is going to be very largely used. The whole indication of industrial advancement is that terra cotta will be used in order to avoid the employment of labour.

45. *To Mr. Cook.*—Although this product has reached a certain stage of perfection, I believe it will still improve. The terra cotta made now is at least as good as that which comes from the old Roman cities, and which has now had a life of between 2,000 and 3,000 years. The stone and tile work in Samarkand, in Persia, is 2,000 years old, and is in a beautiful condition, as also is the tile work from Pompeii, which is over 2,000 years old, and which is as perfect as it was the day it left the potter's hands. I have had considerable experience in the manufacture of concrete made from various stones, and in making concrete in Canberra I would use the natural rock found at Mugga, which is ideal for the purpose. It is cheap and plentiful. I would not recommend river gravel. I admit that broken gravel is stronger than rock, because it has already stood the test of time in the river. It is the strong residue of other material which is left, but if it is used it should be broken, and there is no need to incur that expense. For a cement facing I would not use marble, but would prefer "Medusa" or "Atlas" white. Marble is not durable mixed with cement. Some terra cotta blocks are wired into position until the cement sets. I do not approve of the modern system of fastening, but of building the terra cotta in with the material as was adopted by the Florentines, and as we are doing in the Bank of New South Wales. If construction is planned out in this way it costs no more, but the method is rather unusual here. So far as I am aware it has not been done here before, and in reviving it I am not claiming any credit. The only place in which it cannot be built in is in the columns, but it can be built in the piers. At the Savings Bank of New South Wales the terra cotta blocks are being laid like bricks. The form is placed at the back to support the blocks, and the concrete is then poured in. We are building up 2 feet at a time. The cement concrete is run right in, and no wires are used.

46. *To the Chairman.*—In regard to the provision of light areas, I think it can be taken that every precaution has been exercised. I think it was anticipated even when the prize for the successful design was awarded that the inevitable consequence would be that amendments would be made. We believed that necessary alterations in detail would be undertaken by the department in view of the special knowledge of their officers, but in general principles the plan as accepted by the Committee of Adjudication was considered to be satisfactory. The question of light areas could be very well left to Mr. Murdoch, who, I am satisfied, will see that everything is all right. The Committee need not deal with that aspect, as it has already been dealt with by us.

(Taken at Melbourne).

TUESDAY, 7TH JULY, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Barnes	Mr. Jackson
Senator Lynch	Mr. Mackay
Senator Reid	Mr. Mathews.
Mr. Cook	

John Smith Murdoch, Director-General of Works and Chief Architect, Department of Works and Railways, sworn and examined.

47. *To the Chairman.*—I am aware that the Committee has before it a proposal for the erection of permanent administrative offices at Canberra. The Government, on the recommendation of the Public Works Committee, instituted a competition for designs for the first of the permanent buildings at Canberra, and the competition was duly held. Designs totalling 94 were submitted by architects from each State. The adjudicators were Sir John Sulman, Mr. H. E. Ross, and Professor Wilkinson, of Sydney, all men of very great experience, embracing every phase of architecture, and myself. When the winning design was found to be that of Mr. Sydney Jones, of Sydney, I was relieved to know that the work would be placed in the hands of such a well-known, accomplished, and honorable architect. The Canberra Commission then instructed Mr. Jones to prepare his scheme in sufficient details to illustrate it to this Committee. Subsequently, with the approval of the Committee, full drawings will be prepared from which a contract can be let. In the opinion of the judges, the superiority of Mr. Jones's design lay chiefly in the superior character of the planning, inasmuch as it afforded the greatest amount of floor space at the most reasonable cost. If his design can be carried out for a sum not exceeding the estimate, which I think can be done, the Government will have an excellent building at a comparatively low cost, considering the floor space provided. The Canberra office buildings will be built of fire-resisting materials, and, although concentrated, will be amply supplied with open spaces, while the annual cost should not exceed, and will probably be less than, what the Government now pays for average privately-owned office premises in the various capitals. It must be remembered, when considering the comparative cost, that this building would provide better accommodation than that of the offices at present occupied. The cost of building at Canberra is higher than in any of the capital cities, but, on the other hand, the cost of the land there is less. At present, for rented premises, the Government is paying from about 7s. to about 2s. 6d. per square foot of floor space per annum. The scheme of Mr. Jones should provide accommodation of a better type at about 4s. per square foot per annum. The convenience of having all the Departments associated in one building will lead to economy in administration. The adjudicators considered construction and design also. In some quarters it has been thought that, in a new city such as Canberra, it might be possible to make considerable departures from conventional design. Departure from convention is, however, a dangerous policy, unless in the hands of an accomplished man. The design submitted by Mr. Jones, while it does not depart from well-established principles, contains certain new ideas; and I have no doubt that, in his safe hands, further amendments, in the direction of originality, will be made. But, whether that be so or not, the design before the Committee must be regarded as a scholarly architectural effort, which, without any material alteration, will provide a building upon which Australia may safely congratulate herself. The judges also gave consideration to the question of construc-

tion. Mr. Jones proposes to have sufficiently massive walls, strong concrete floors, and to employ for the exterior a material which should be practically imperishable. Upon a granite base he proposes to construct walls which will be faced with terra-cotta. He was not alone in proposing to use this material for facing the walls. I agree with those who hold that, with the exception of granite, terra-cotta will provide an exterior that will last longer than any other material. In any case, should defects become apparent, it will be possible to make them good by terra-cotta exactly similar in colour and texture. The manufacture in Australia of terra-cotta has lately assumed rather extensive proportions. Thirty years ago I used this material, but in the intervening years it has not been used to any great extent. The present manufacturers are working on a larger and more scientific basis than was the case 30 years ago, and I have no doubt that they will be able to meet in a satisfactory manner any demand which may be made for this material. Although the plan of Mr. Griffin provided that this building should be erected on the 1,870-ft. level, it is proposed to construct it on the 1,860-ft. level. That alteration has been decided upon because of the amount of earthworks which the 1,870-ft. level would entail. This alteration is not so serious as one might at first suppose, because this building, and its contemplated counterpart on the other side of the area, will be detached from those which will be erected between them. These intervening buildings, under Mr. Griffin's scheme, are planned to be on one level, and connected with each other. So long as the intervening buildings are erected on Mr. Griffin's level, I do not consider that the erection of these detached buildings on a lower level will have any serious effect on the whole group. The earthworks for the building on the western side would be much the same as for that on the eastern side, as the levels are practically the same. The official area falls from the middle towards the avenues on either side. To erect the building on the 1,870-ft. level would mean that it would rest on a large quantity of made ground, or that heavy foundations would be required. Mr. Griffin's plan for the distribution of the buildings is being followed. This building is about the size that he indicated. Personally, I was anxious that it should be of the same form that Mr. Griffin proposed; but Mr. Jones proposes to omit the semi-circular apsed end of the building which Mr. Griffin provided for in his scheme. I think that Mr. Griffin's idea provides a more pleasing arrangement than a building with a square end would. The circular ends of Mr. Griffin's scheme were situated on the end of this building, next Federal-avenue, and on the end of the future building, next Commonwealth-avenue. I think that the principle underlying Mr. Griffin's scheme would be adequately respected if a smaller semi-circular end were provided. While Mr. Jones does not consider the circular end to be aesthetically important, he has put forward alternative ideas, providing for either a small apse or a large one. If the smaller apse provided a better plan, and meant economy, I think that it would meet all requirements. The question of the comparative costs and the amount of floor space which each proposal would provide would involve considerable calculation. At present I am not prepared to go further than to say that a semi-circular apse would, in my opinion, make the building more beautiful than would square ends. The cost of semi-circular ends might be slightly less than for a square-ended building, but the question of the floor space would have to be considered in this connexion. I think that it would be advisable for the Committee to obtain comparative costs of a building with (1) a square end, (2) a small circular end, and (3) a large circular end. I think that the reason for Mr. Griffin's choice of a circular end was that the end of the building is not parallel with the avenue which

passes it. I discussed with Mr. Jones the omission of one-half of the second floor, which he estimates would mean a saving of approximately £48,000. I think that the appearance of the building would be improved by confining the attic story to its central part. I fancy Mr. Jones has that idea also. The original design of Mr. Jones did not allow for a dome or tower, and I have never considered that a dome or tower for this building was necessary. Whether the introduction of a tower would improve these two large buildings which form the flank of an extensive and important group of buildings is a debatable matter. Although it may be decided not to erect a tower at present, there is no reason why provision should not be made for its erection at a later date if desired; the cost would not be a great deal more. While the future Parliament House will be the dominating feature of the group, towers of the type that Mr. Jones proposes on these two buildings would not be on a scale which would interfere with the domination of the future Parliament House, wherever it might be built. Until the permanent Parliament House is erected, it might be better to omit the tower from these buildings, but provision could be made for them. A number of the competitors provided for domes and towers for this building, and, naturally, the subject was discussed by the judges. They were of the opinion that it would be quite legitimate for these flanking buildings to have towers. I think that the Committee would be wise in recommending that the building should be so erected that towers could be added later, if desired. I have a fair knowledge of Australian stone suitable for building, and know that geological investigations have been made in the vicinity of Canberra to ascertain whether suitable building stone could be obtained locally. So far the result has been disappointing. Sandstone can be obtained, but not of the kind that is desirable. For the base of the building I prefer granite, although Bowral trachyte is one of the most beautiful building stones in existence. It could be obtained at a slightly less cost than granite, and is not quite so hard to work. The only other stone that I should care to see used in the base of a monumental building such as this would be basalt, the best available example of which is Melbourne bluestone. The cost of this stone would probably not exceed that of either granite or trachyte. The reason that so much Harcourt granite finds its way to the Sydney market is that the Harcourt quarries have perhaps reached a greater stage of development than others in New South Wales. In my opinion, the best granite in Australia comes from Mahogany Creek, near Perth. I consider it to be one of the most beautiful granites I have seen. I do not think that the cost of obtaining granite from Mahogany Creek would be prohibitive, as I understand that vessels returning from Western Australia usually have lighter cargoes than when travelling westward; shipowners might, therefore, be prepared to offer a flat rate for the transport of the granite. I used this granite for the General Post Office at Perth. The alternative to obtaining granite from Perth is to obtain it in New South Wales, probably from Moruya. Mahogany Creek is 19 miles from Perth, or about 30 miles from Fremantle. The railway goes into the quarry, and blocks of practically any size can be obtained. Granite from there would be railed to Fremantle, then carried by boat to Sydney, and again railed to Canberra. I do not think that the Moruya quarries are connected with the railway. If it is decided to use trachyte, the best trachyte quarries that I know of are at Bowral, near Mossvale. As Bowral is practically half-way between Sydney and Canberra, the cost of transport should be comparatively low. I should be glad to collaborate with Mr. Jones in the preparation of estimates of the cost of using various kinds of stone. I prefer granite, but if the difference in cost is considerable, trachyte would do very well. If either granite or

trachyte is used, I suggest that it be axed. In a building such as this, which is comparatively low for its length and size, a more beautiful effect would be obtained from axed granite than from hammer-dressed granite. Very little, if any, of it need be polished. Behind the terra-cotta facing I should prefer brick to concrete. It would be cheaper, and quite as effective. Brickwork is cheaper than concrete, because, with concrete, forms have to be used, and the work is slow, whereas the bricklayer goes straight ahead, without any forms. There would be no difficulty in facing the columns with terra-cotta. I do not favour the use of Sydney freestone for the outside of the building, because of its limited life, and because of the difficulty that would probably be experienced in obtaining exactly similar stones in years to come. Freestone changes colour after exposure, whereas it is desirable to have all the buildings, not only of the same material, but of the same colour. Sandstone, and, indeed, any aqueous stone, means considerable cost in repairs and maintenance. The only stone in England which successfully stands the sulphurous atmosphere of the big cities is limestone, the chief of which is Portland stone. St. Paul's Cathedral, St. Martins in the Fields, and most of the churches built by Wren, were constructed of Portland limestone; and all the important buildings which have been erected in London in recent years are of the same material. The British Houses of Parliament are built of freestone, but their upkeep costs a considerable sum each year, as repeated applications of liquid silica have to be given to the stone; the pores become filled, and thus the stone is made capable of resisting the weather. For the effects of the weather on sandstone, one need not go farther than the Treasury Buildings, in Spring-street, or to St. Paul's Cathedral, in Swanston-street. Colonel Vernon, who was Government Architect of New South Wales, and an eminent man in his profession, regarded the life limit of Sydney freestone as 100 years. The use of terra-cotta for facing what should be a handsome memorial building is justified on the ground that it would be cheaper than stone of any kind; its use can also be defended from the aesthetic point of view. Marble would probably be the most expensive material which could be used. I know of no quarries in Australia which have been sufficiently developed to warrant the expectation that marble could be employed with any degree of economy. It is, of course, possible to use marble with plaster; the question of finishing the building externally in plaster is worth the Committee's consideration. The work could be done more quickly, and at less cost, in plaster than if any other material is employed, while beautiful effects can be obtained by its use. By using a composition of crushed quartz and white Portland cement, a beautiful effect can be obtained. From the aesthetic point of view, this combination can be defended. If it were decided to use plaster for the external finish of the walls, I should employ it in conjunction with granite. The base, columns, and mouldings could be of granite, and the walls of plaster. Professor Wilkinson, of the Sydney University, told me that an eminent British architect used stone and plaster in successful combination many years ago. If the Committee proposes to obtain alternative prices for the work in various materials, I suggest that quotations be obtained for finishing the walls in plaster. As to the durability of terra-cotta, there is no doubt. Moreover, it has the advantage that at any time, say 100 years hence, exactly the same shade of colour could be obtained. So long as we make reasonably sure that we are getting terra-cotta of good quality, and thoroughly vitrified, its life should be indefinite. I have not yet seen the special type of brick that Mr. Ross is using in connexion with the Savings Bank in Sydney, although I have arranged with him to visit the works. I have seen the terra-cotta manufactured by Wunderlich,

and consider it to be very good. The terra-cotta used on the Union Steamship building in Sydney was, I believe, imported from America, while that used on the Bank of New South Wales building, in Macquarie-place, Sydney, was, I understand, manufactured by Doulton, in England. I consider, however, that Australian-made terra-cotta is in no way inferior to the imported article. If terra-cotta is used in this building at Canberra, I should have it of the palest tint possible. It would not be as dazzling to the eyes as is rough-cast. I do not think that it is possible to obtain terra-cotta which is as white as white cement; the whitest terra-cotta would really be somewhat of an ivory shade. If a building with a granite base and walls faced with terra-cotta were erected, I should use terra-cotta cornices. The Committee may feel disposed to consider the use of synthetic stone. Not 100 yards from here there is a building of synthetic stone, which has been standing for many years, and does not show the slightest signs of deterioration. The use of this material may be objected to on the ground that it is not what it purports to be. It looks well, however, and is durable. It was used to a considerable extent in London 50 years ago, but, probably because it is not what it purports to be, it has gone out of use.

(Taken at Melbourne.)

WEDNESDAY, 8th JULY, 1925.

Present:

Mr. GREGORY, Chairman;

Senator Lynch	Mr. Jackson
Senator Reid	Mr. Mackay
Mr. Cook	Mr. Mathews.

John Smith Murdoch, Director-General of Works and Chief Architect, Department of Works and Railways, recalled and further examined.

48. *To the Chairman.*—As to the suggestion that the entrance steps, some of the corridors, and the lavatories in the administrative building should be faced with marble, I think that an effort will be made in the interests of the marble producers of Australia to encourage the use of this material. I believe that from Caleula, in New South Wales, and particularly from Buchan, in Victoria, marble is procurable. In the construction of Australia House in London, in addition to Carrara marble, Caleula, Angaston, and Buchan marble was used. It is all fairly satisfactory, especially the coloured varieties, but so far the Australian white marble does not compare favorably with the Italian article. There is also the marble deposit at Ulam, near Rockhampton. Examples of Kapunda marble from South Australia are to be seen in the incompleting Parliament House in Adelaide, and it is certainly a beautiful stone, but I am afraid that when the completion of the building is undertaken there will be difficulty in obtaining further supplies of similar marble of good quality. In the Kapunda quarry explosives have been used, and the rock in the vicinity of the quarry face seems to be very much shattered. If it is decided to use Australian marble in the erection of the permanent administrative building at Canberra, inquiries should be made as to which would be the most economical stone to employ. I have not seen any detrimental black veins in the Angaston marble. Its colour is white, but it is not very close in structure, and it readily becomes discoloured. Examples of this stone may be seen in the General Post Office, Spencer-street. Being situated close to the railway station it has absorbed impurities from the atmosphere. Probably at Canberra marble would be less subject than in Melbourne to deterioration on account of atmospheric impurities. Angaston marble is well represented by the

Cross of Sacrifice erected in memory of fallen soldiers in the West Terrace Cemetery, Adelaide. I should not favour utilizing any imported marble in the building, and I think the Committee would be justified in recommending the use of some Australian marble for interior decoration. The choice of colour and the best variety should be left to the discretion of the architect. I do not favour the installation at Canberra of automatic fire alarms, but ordinary alarms should be installed, although there should be little danger of fire.

49. *To Senator Lynch.*—Although the idea of calling for competitive designs for the building originated immediately from this Committee, the architects of Australia have had a standing promise for the last thirteen or fourteen years that the permanent buildings at Canberra would be erected according to the designs of the best architects of Australia. The only fair and possible means of discovering such architects is by holding competitions. Many of the best architects sent in competitive designs for this building, and I have heard that they regarded the conditions as the most satisfactory they had experienced. The conditions were drawn up by the Department, and were referred to the Council of the Federated Institutes of Architects for examination. That body suggested one or two amendments, but apart from that, satisfaction with the conditions was expressed. Architects were invited to ask for enlightenment regarding any obscurity, and answers were supplied to every intending competitor who sought information. No less than 94 designs were received, it being the largest competition of the kind held in Australia. Some cavilling over the decision was to be expected. The Institute of Architects of New South Wales congratulated the winner, Mr. Sydney Jones, and presented him with a printed address. So far as I am aware, the Public Service Inspector has not officially inspected the plans. It might be of interest to obtain an expression of opinion from him on the proposed layout of the building. The plan is of such a type that the space can be subdivided without economic loss. Any alteration of the design that may be regarded as an improvement can still be made. The cost of 4s. a square foot is rather under the average amount that the Commonwealth now pays for office accommodation. This fact, to some extent, provides an argument in favour of proceeding with the erection of the proposed building as soon as possible. It will be superior in construction to any building now occupied as a Commonwealth office. The contiguity of the various offices will lead to easy and effective administration. Since the Seat of Government is to be transferred to Canberra, offices must be provided, and therefore I think that the erection of this permanent building is justified. The Government has already decided that a temporary structure would not be warranted. Four or five years would be occupied in the erection of the proposed offices, whereas a temporary building could probably be put up in about eighteen months. I suggest that the building be not constructed by instalments, but completed without delay. The fact that the apsed end will face a main avenue should not be detrimental from an architectural standpoint. This is not a building of fronts or backs. Each elevation may be said to possess features as attractive as any others. There is a colonnade on the west side, which, in my opinion, is just as valuable as an architectural feature as the apsed end. The original intention was that the printing office should be erected on the opposite side of the official area as the nucleus of the building required to balance the present structure, for it was considered highly desirable to have the printing office near Parliament House. But I understand that the present intention is to locate the printing office some distance away and connect it with Parliament House by pneumatic tubes. In these circumstances, I suppose that as departmental require-

ments grow a beginning will be made with the complementary building, which may be extended unit by unit to meet the needs of government. One does not like to prophesy, but I should say that the development of the second building would extend over 40 years, or possibly more. So far as one can say at the present time, the provisional Parliament House, the two secretariat buildings, the administrative building on the right flank, and a building similar to that now under consideration on the other flank will meet requirements for the next 50 years. It may be that the National Library, Museum, and Art Gallery will be brought within the official area. The relationship of the administrative buildings to the permanent Parliament House will not be prejudiced, no matter which site is chosen for the latter. The building is planned for the anticipated requirements of the services at the date when it is likely to be occupied, that is, four or five years hence. I think that it would be quite safe to go on with the work. Accommodation will be provided for about 1,100 officers. The effect of eliminating 22,000 square feet of floor space by leaving out two wings would be to hasten the time when the second building will be required. In reality, five stories are provided for, but the mezzanine floor covers only portion of the ground floor. That is one of the advantages of the plan. Mr. Jones, instead of making the ground floor 15 or 16 feet high, allowed 23 feet for it, and thus made room for the mezzanine floor, which gave 26,382 square feet of extra floor space, and at the same time did a good deal towards improving the design. The basement is 11 feet from floor to floor. Mr. Jones describes it as the lower ground floor, because with the newer levels adopted it is really no longer a basement. Merely a small area of the floor at its west end is all that has been sunk below ground level. The second floor is 15 feet high, and the top or attic floor 12 feet high. I have given the measurements from floor to floor, the thickness of the floors having to be allowed for. According to the system of reinforced concrete adopted, this would be anything from  $7\frac{1}{2}$  inches to 4 inches. The mezzanine floor which is intended to give a clear height of 11 feet—a most useful height—is of particular value in that it is located in the centre of the building, and the officials occupying it will be in a position to look down on the ground floor. This will conduce to excellent supervision of staff. It will probably be the floor on which all Ministers will be located, so that they will have easy access to one another, and to their principal officers. For this reason I, having experience of Government offices, was particularly favorable to Mr. Jones's plan. It admits of the expansion of departments not only laterally, but also vertically, as their needs require. I am not afraid that this building will make the provisional Parliament House look insignificant architecturally, for the latter building stands on higher ground. It should be realized that the provisional Parliament House will go out of existence within a generation or two, whereas the building now under consideration will no doubt last for centuries. I have not investigated the subject of granite facings, but I understand that Mr. Jones has done so. The granite obtainable at Canberra would probably not be suitable for facing the whole of the building. I think it would not contrast well with the sombre landscape. In my opinion, the structure should contrast as much as possible with its surroundings. Sandstone has not the lasting qualities sufficient to justify its employment in a building that is expected to stand for many generations. That criticism does not apply to terra cotta, in the use of which a fairly strong revival occurred in the middle of last century. It was employed in the erection of the Museum of National History, London, the Birmingham Law Courts, and various buildings in Glasgow and elsewhere, and is regarded as having very long life. In the United States of America, where buildings costing

tremendous sums are erected, every care has been taken to discover by scientific investigation which is the most lasting building material. Terra cotta is employed there fairly generally and the Woolworth Building in New York, the highest in the world, is constructed of that material. Sandstone is going out of demand for buildings in cities. The sulphur and other impurities in the atmosphere of cities have a deleterious effect, and frost also assists in the process of disintegration. The conditions at Canberra, however, should be more favorable than those in large cities, so far as the lasting qualities of stone are concerned.

50. *To Mr. Mackay.*—It is understood that the successful architect will be appointed to supervise the construction of the building. The usual remuneration is 6 per cent. of the cost of construction. It is not customary for the architect to decide whether the work shall proceed by day labour or be carried out by contract. That is a matter for the Government. In the estimate of cost provision is made for lighting and heating, and for fire fighting appliances. Messrs. Campbell and Sons, of Brisbane, manufactured terra cotta second to none 30 years ago and exported it to Sydney. Its present popularity is indirectly due to its wide use in America. Terra cotta blocks could be fastened to brickwork by means of wire, just as they are attached to concrete. The real use of the wire is to hold the terra cotta blocks in position until they become homogeneous with the wall. You ask me whether this method of construction would involve the covering up of beautiful brickwork. I point out that brickwork, where terra cotta was to be employed, would be rough in finish. The experience of the Department is that brick work is cheaper than concrete construction. Where alternative tenders have been called, even for cottages, the price of concrete construction has never been as low as that of brick. I prefer bricks, and I regard them as having qualities as lasting as concrete. The allowance of 86 strong rooms is merely provisional. It is not necessary they should have burglar-proof doors in every instance. A large number of these rooms is desirable, and perhaps a dozen should have steel doors. All the others could be furnished with concrete doors at a cost of about £25 each, which would be quite as good looking as the steel burglar-proof doors estimated at £110 each. The official employer of Mr. Jones will be the Canberra Commission, who will have the supervision of buildings. The Commission has its own architects, and no doubt it will consult with Mr. Jones whenever necessary. The staircases, lifts, and lavatories will be sufficient for all purposes. The reason why Oregon is being used in the erection of the provisional Parliament House is that very great lengths of timber are required. But in the building under consideration Australian woods will be sufficient for all requirements. Australian ironmongery should be used, and it should not be necessary to import any requisite except glass. The marble deposits in the vicinity of Canberra have not been developed sufficiently to justify the use of that material. The accommodation to be provided for will be sufficient unless the Government increases the personnel of the departments beyond what is anticipated.

51. *To Mr. Cook.*—I should say that brick work is cheaper than concrete construction in Melbourne. If bricks and bricklayers can be readily obtained it will probably always be the cheaper method of construction. I am not aware that there is any feeling against brick and cement combines. One reason why concrete is largely utilized in Melbourne is the high value of building land in the city. Under the building regulations concrete walls need not exceed 6 inches in width, whereas in brick work they have to be thicker. A saving could be effected by confining the attic floor to the centre of the building. That would mean that the complementary building would have to be erected at an earlier date than otherwise. I believe that the soil

for foundation is entirely satisfactory, as in the case of the provisional Parliament House, being capable of bearing a load of 4 or 5 tons to the super foot. A reasonable time should be taken in the construction of this building. There is no necessity to rush the work. Although I favour the use of terra cotta, as suggested by the architect, I am not averse to considering the suitability of other materials. It is employed extensively in England and America because of its lasting qualities, and therefore I think it could be safely adopted. It might be a good idea to consult Mr. Jones as to whether alternative tenders should be called. I realize that marble is most beautiful building material, but on account of its high cost I do not suggest its employment in this case. When Australia is as old and as wealthy as the United States of America we may be able to select marble for the exterior of public buildings.

52. *To Senator Reid.*—Personally, I like the idea of the rounded end for the administrative building. Mr. Griffin provided for it on his original plan. If the building had right-angular corners the avenue would not be parallel with the lines of the building, and therefore I think that the rounded end is preferable; but it is a debatable matter. There would be no waste of space in the building if the rounded portions were parts of large rooms. The use of white cement is worthy of consideration, for it is a beautiful material. It can be used with either marble crushings or ground quartz, which would take the place of sand. I do not know what would be the difference in the cost of using terra cotta blocks for stretchers and headers, as in ordinary brickwork, and attaching the blocks by means of wire. I think that the cost would be about the same in each case. I should say that it would be well to have thin marble slabs for the steps on the staircases, and if in time it became necessary to renew the treads this could be done at no very great expense. In a fine building such as is proposed this might be regarded as a legitimate outlay. But I am inclined to the use of jarrah blocks, which are casier on the feet and warmer to walk upon, although they have not the monumental character of marble slabs. Apart from the appearance, I claim that the advantage is on the side of wood. For the walls, however, nothing more sanitary than marble linings could be chosen. The corridors could probably be floored with marble, but I favour the use of wood blocks for covering the office floors. There would be a concrete foundation, and wood block flooring laid down in bitumen. Terazzo would be better looking than wood, but not so comfortable to walk upon. I should be inclined to follow the advice of Mr. Jones and use terazzo for the corridors. I am not afraid of too many strong rooms being provided, for they provide convenient space for the safe keeping of valuable documents. Mr. Jones very cleverly utilized for strong room accommodation space which the design of the building made available, and that is why so many of these rooms have been provided. For 75 per cent. of the strong rooms concrete doors would be sufficient, and the rest could be fitted with steel doors, although there is not much to be feared from burglars.

53. *To Mr. Jackson.*—It is expected that 700 persons will utilize the luncheon room. I do not see how the distance from the servery to the most distant table can be avoided. The single central corridor is one of the most valuable features of the plan.

54. *To Mr. Mathews.*—Latest flood level was about 1,830 in the locality of this building, which will be about 30 feet higher. No matter whether the work were done by contract or day labour the cost of the architect's supervision would still be 6 per cent. of the cost of construction. The salary of the clerk of works would have to be paid by the Government. If the building were erected by day labour more supervision would be required, for the clerk of works would have to assume the duties of a

contractor. There is no desire to scamp work under the day labour system. It is the duty of the clerk of works to see that the work is properly done; in fact, he practically assumes the responsibility of a contractor. Although he is not required to watch the building personally the whole time, he has other duties which are more onerous than those of an ordinary clerk of works. On day labour work the department pays the clerk of works a higher salary than he receives on contract work. I have not heard of any quarries being opened up at Canberra containing stone suitable for building purposes. The additional strength which terra cotta would give to a building would not be considerable, but it would prevent water penetrating the surface. I am not aware of any clay being available in the neighbourhood of Canberra suitable for the manufacture of terra cotta. You inform me that in the designing of the post office building in Sydney, Melbourne, and Adelaide utility was sacrificed for architectural effects. There will be no such disabilities in the present building. The lighting will be ample. The mezzanine floor will be adequately lighted naturally. Provision is made for quarters for a caretaker. These will be in the basement, which is, as I previously indicated, almost wholly on the ground level.

55. *To the Chairman.*—I am satisfied with the sewerage conduit. There are also a series of ducts, and the principal object in providing them was to admit wires and pipes. The use of some of them for the quick and cheap removal of rubbish is well worthy of consideration. They could also be utilized for the posting of letters.

(Taken at Melbourne.)

WEDNESDAY, 12TH AUGUST, 1925.

Present:

Mr. GREGORY (Chairman);

Senator Barnes	Mr. Jackson
Senator Reid	Mr. Mackay
Mr. Cook	Mr. Mathews.

William Baragwanath, Director of the Geological Survey of Victoria, sworn and examined.

56. *To the Chairman.*—I understand the Committee desires some information concerning the building stone available in Victoria, and which would be suitable for use in connexion with the construction of the proposed administrative building at Canberra. The evidence I can submit on this question will be purely from a geological aspect, as I have not taken into consideration architects' views, and I do not know what colour of stone or style of architecture is desired. We have in Victoria a large variety of building stones from which a selection could be made to meet almost any requirements. At present the demand for building stone is not great, as nearly all modern structures are built of concrete, brick, or other materials which have largely taken the place of building stone. In consequence of this departure various deposits of building stone have not been opened up to the extent they otherwise would have been. The practice nowadays appears to be to erect concrete structures with a veneer of marble or granite instead of using solid building stone. This method, I believe, has been adopted largely in the interests of economy. For the information of the Committee, I submit the following summary of the various building stones and marbles produced in Victoria:—

Igneous rocks—

- (a) Granite, granodiorite, syenite, diorite, epidiorite and porphyry;  
(b) Basalt, dolerite, gabbro.

Sedimentary rocks—

- (c) Limestone, marble;  
(d) Freestone and various sandstones.

In colour the granite group (a) comprise red, pink, salmon, green, grey, black, and white, and in texture they range from coarse porphyritic crystals to fine granular types.

The basalts (b) are chiefly dull in colour and suitable more for strength than appearance when used as building stones.

The limestones and marbles (c) are chiefly used for interior work, and range in colour from black with white markings to grey and buff, red, pink, yellow, and shades of white.

The freestones (d) vary considerably in texture, and are from fine to coarse-grained rocks of white, grey, and buff colour.

The more important granitic rocks, basalts, limestones, and freestones, many of which have been used in buildings around Melbourne, are enumerated as follows:—

*Granites (Red).*

Woolamai, Phillip Island—

Character—Medium to coarse texture, salmon red rock.

Quantity—Large. Quarry at water's edge.

Example—Equitable Buildings, Collins-street, Melbourne, and others.

Gabo Island—

Ch.—Fine to medium texture, red rock.

Q.—Large. Some quarried.

Ex.—Parts of Customs House, and Australian Insurance Company, Melbourne.

Colquhoun—

Ch.—Medium texture, red.

Q.—Large. Now quarried.

Ex.—Sample in Geological Museum.

Cudgewa—

Ch.—Coarse porphyritic texture, red.

Q.—Large.

Ex.—Used for monumental purposes.

Talbot—

Ch.—Fine to medium texture, red rock.

Q.—Large.

Ex.—Sample in Geological Museum.

Mt. Taylor—

Ch.—Porphyritic granite, red.

Q.—Large.

Ex.—Sample in Geological Museum.

Dergholm—

Ch.—Medium to coarse texture, red rock.

Q.—Large. Now being opened up.

Ex.—Sample in Geological Museum.

Korong—

Ch.—A fine grained, dark red rock.

Ex.—Specimen in Geological Museum.

Becchworth—

Ch.—Coarse pink granite.

Q.—Large.

Ex.—Sample in Geological Museum.

*Granites (Grey).*

Harcourt—

Ch.—Medium grey granite.

Q.—Large. Huge blocks obtainable.

Ex.—Equitable Buildings; State Savings Bank; Federal Parliament House, Melbourne.

Elphinstone—

Ch.—Medium grey granite.

Q.—Large.

Ex.—New *Herald* Office, Melbourne.

- Beechworth—  
Ch.—Medium black and white crystals evenly distributed.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Beechworth—  
Ch.—Coarse grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Everton—  
Ch.—Coarse grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Shelley—  
Ch.—Medium grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Tallangatta—  
Ch.—Fine grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Violet Town—  
Ch.—Medium dark grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Casterton—  
Ch.—Medium light grey granite.  
Q.—Large.  
Ex.—Used for monumental purposes.
- Kyneton—  
Ch.—Medium grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Broadmeadows—  
Ch.—Medium grey granite.  
Q.—Large.  
Ex.—Flinders-street Railway Station (basement).
- Gong Gong, Ballarat—  
Ch.—Medium grey granite.  
Q.—Large.  
Ex.—Used locally. Sample in Geological Museum.
- Maldon—  
Ch.—Medium grey granite.  
Q.—Large. Quarry opened.  
Ex.—Used locally. Sample in Geological Museum.
- Orbost—  
Ch.—Fine texture dark grey granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Mt. Taylor—  
Ch.—Coarse porphyritic grey to white granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Dandenong—  
Ch.—Finely crystalline dark grey granite.  
Q.—Large. Quarry opened.  
Ex.—Used for monumental purposes.
- Trawool—  
Ch.—Coarse to medium dark grey granite.  
Q.—Large. Quarried.  
Ex.—Sargood Bros.; Griffiths Bros., Flinders-street, Melbourne.
- Morang—  
Ch.—Medium grey granite.  
Q.—Large.  
Ex.—Granite terrace, Gertrude-street, Fitzroy.

*Granites (Mixed Colours).*

- Wangaratta—  
Ch.—Fine salmon to yellow granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.

- Beechworth—  
Ch.—A fine green granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Dromana—  
Ch.—Fine green and pink granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Maldon—  
Ch.—Medium black granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Mt. Taylor—  
Ch.—Coarse porphyritic pink and green granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Beechworth—  
Ch.—Light salmon coarse granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Beechworth—  
Ch.—Pale yellow to grey coarse granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Beechworth—  
Ch.—Dark pink coarse granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Beechworth—  
Ch.—Fine pink granite.  
Q.—Large.  
Ex.—Sample in Geological Museum.

*Porphyry, Dacite, &c.*

- Tallangatta Creek—  
Ch.—Fine dark green porphyry.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Emerald—  
Ch.—Black dacite.  
Q.—Large.  
Ex.—E. S. and A. Bank, Swanston-street, Melbourne.
- Lancefield—  
Ch.—Dark green to black diabase.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Avenel—  
Ch.—Bright green epidote rock.  
Q.—Large.  
Ex.—Sample in Geological Museum.
- Wangaratta—  
Ch.—Fine dull pink porphyry.  
Q.—Large.  
Ex.—Collins House, Melbourne; Cathedral, Wangaratta.
- Ceres, near Geelong—  
Ch.—Fine to coarse dark green epidiorite.  
Q.—Large.  
Ex.—Handsome monumental stone. Sample in Geological Museum.

*Basalts.*

- Leithbridge—  
Ch.—Close crystalline dark basalt.  
Q.—Large quantity quarried.  
Ex.—Steps of Parliament House, Melbourne; Crown Law Offices, Melbourne; Government Offices and Railway Buildings, Spencer-street, Melbourne.

## Malmsbury—

Ch.—Of open texture and subject to jointing.

Q.—Large.

Ex.—Foundations of Government Offices, Melbourne; Records Office, Melbourne. Much used for foundations and kerbings around Melbourne.

## Footscray—

Ch.—Dense dark blue-black basalt.

Q.—Large. Extensively quarried.

Ex.—St. Patrick's Cathedral, Melbourne; Telephone Exchange, Melbourne.

Besides the above there are numerous basalt quarries in Victoria; those around Melbourne including Collingwood, Burnley, Clifton Hill, Sunshine, and Epping. All are valuable for road making, paving and kerbing, and some of the heavier types have been used for pier and breakwater construction.

*Freestones.*

(Samples in Geological Museum.)

## Grampian Ranges, Stawell—

Ch.—Hard compact with some hard silica segregations. White.

Q.—Large. Several quarries have been worked.

Ex.—Parliament House; portion of National Museum; portion of Town Hall, and General Post Office, Melbourne

## Mt. Abrupt, Dunkeld—

Ch.—Fine, even grained, brown stone, at times current bedded.

Q.—Large. Not much used.

Ex.—Women's Hospital, Melbourne; Presbyterian Church, Hamilton.

## Barrabool Hills—

Ch.—Fine, even grained, soft stone. Green to grey in colour.

Q.—Large. Several quarries opened.

Ex.—Portion St. Paul's Cathedral; Working Men's College; Ormond College, and Medical School, University, Melbourne.

## Apollo Bay—

Ch.—Even, fine grained stone. Light brown in colour.

Q.—Large. Quarry opened.

Ex.—Windsor Exchange; Cape Otway Lighthouse.

## Bald Hill—

Ch.—Soft, even grained stone. Light brown colour and not uniform in hardness.

Q.—Large.

Ex.—Treasury Buildings, Melbourne. (Blocks have had to be replaced).

## Darley—

Ch.—Soft, fine grained, buff coloured stone; poor quality.

Q.—Large. Several small quarries.

Ex.—Parliamentary Library, Melbourne. Replacing blocks in Treasury, Melbourne.

## Ballan—

Ch.—Close grained white to brown.

Q.—Large.

Ex.—Utilized locally.

## Greendale—

Ch.—Buff serviceable stone.

Q.—Large.

Ex.—Utilized locally.

## Kyneton—

Ch.—Buff and brown stones of fine even grain.

Q.—Large.

Ex.—Extensions Melbourne University, 1924. Art School.

## Longwarry—

Ch.—Buff, even grained stone.

Q.—Limited in width of block.

## Briargolong—

Ch.—Grey, fine grained stone.

Q.—Large.

Ch.—Medium grey granite.

## Mt. Taylor—

Ch.—White, even grained stone; good quality.

Q.—Large.

Ex.—Used at Bairnsdale.

## Mansfield—

Ch.—Buff, even grained stone. Fine and coarse.

Q.—Large.

Ex.—Locally used.

*Marble.*

(Samples in Geological Museum.)

## South Buchan—

Ch.—Dove grey, dark grey, black with white veins.

Q.—Large. Now quarried.

Ex.—Public Library; Carlyon's Hotel; Commonwealth Offices, Melbourne; Commonwealth Offices, London. Awarded Gold Medal at Panama Exhibition, 1915.

## Limestone Creek, Upper Murray—

Ch.—Varied colours and mottled with red, green, white, grey, and yellow.

Q.—Large.

Ex.—Quarried for exhibition purposes.

## Thompson River, Toongabbie—

Ch.—Grey encrinital limestone.

Q.—Large.

Ex.—Mantelpieces and table tops, &c.

## Martin's Creek, Orbost—

Ch.—Salmon pink and dove grey. Handsome stone.

Q.—Large. Quarry opened.

Ex.—Agent-General's Office, London. Awarded medal Franco-British Exhibition, 1908.

Palaeozoic marbles also occur at Mt. Wellington, Lilydale, Loyola, Deep Creek (Walhalla), Tyers River, Platina, Waratah, Bindi, Wonnangatta, and Wombat Creek. Some of these have been quarried for limestone.

*Limestones (Tertiary).*

## Batesford—

Ch.—Yellow limestone, soft, and at times hard.

Q.—Large.

Ex.—New Police Court Buildings, Melbourne; Malvern Post Office; Bendigo Cathedral.

## Waurin Ponds—

Ch.—Brown impure limestone.

Q.—Large. Quarried for many years.

Ex.—Portion of Working Men's College, St. Paul's Cathedral, &c.

## Portland—

Ch.—White limestone.

Q.—Large.

Ex.—Locally used.

Other Tertiary limestones occur at Greenwald, Torquay, Drysdale, Grange Burn, Sorrento, Warrnambool. I think an architect could select any colour of stone which would be suitable either in the matter of uniformity or blending which he desired from those mentioned in the foregoing list. It is the wish of the Minister for Mines and also of the Secretary of the Mines Department that the members of your Committee should visit the Geological Museum, adjacent to Federal Parliament House, where samples of practically all these stones are available for inspection. Unfortunately, a few samples are at the Wembley exhibition, but duplicates are available for inspection.

which, however, are not quite as good as our dressed specimens. There are typical specimens of all building stones available. I have studied our building stones only from a geological and utilitarian aspect. Building stone is going out of use at present chiefly owing to the difficulty of obtaining trained men to work the deposits, and in consequence of the lower rate at which concrete buildings can be constructed. A lack of architectural taste is also to some extent responsible for the change from stone to concrete buildings. Many years ago buildings were constructed with the intention of allowing them to remain in position for almost indefinite periods, but the practice nowadays seems to be to erect a less costly structure, which may in the course of a few years be demolished in order to make room for a larger building on more modern lines. The initial cost of stone buildings is considerably greater than that of concrete buildings. In recommending the type of structure for permanent administrative offices at Canberra one would be guided largely by the cost, but if that aspect was immaterial I would suggest construction of a building of stone of the best quality. I understand that trachyte is used in some important buildings in Sydney, and it is also used to some extent in Melbourne. The life of trachyte is equal to that of any other similar building stone, and, in fact, can be regarded as practically everlasting; but the colour is not as pleasing as that of some of our granites. It is not, however, as sombre in colour as basalt. There is practically no difference in the lasting qualities of granite, trachyte, and porphyry. Porphyritic rock would have the same life as the granites, particulars of which I have given. In considering the appearance and the lasting qualities of granite, porphyry, or trachyte one would have to be guided largely by the manner in which the stone was set. Personally, I think blue stone or trachyte looks better near the base, but there again it would depend upon the opinion of the architect. There are some granite buildings such as the *Herald* office, in which granite is used right to the base, but they do not appear to have any foundation. I prefer to see a contrast between the superstructure and the foundation. Some of the granites I have mentioned would be quite suitable for columns, and the one I would recommend as being most suitable for that purpose is that obtained from Gabo Island, which is red and of a fine to medium texture. I have, however, rather a weakness for that obtained at Dergholm, which is also red with a medium to coarse texture. This deposit, which is in the Western District, is just being opened up, and the stone is just coming on the market. It is a handsome stone, and resembles the Aberdeen granite. It has plenty of life in it, and has the appearance of strength. The coarse-grained rocks appear to have more strength than the fine-grained ones; but crushing tests show there is no difference. Large blocks of sufficient size could be obtained to produce columns such as would be required for the proposed building. The deposit is about 12 miles from the railway, but mention has been made of a possible railway connexion. Most of our Victorian quarries are some distance from the railway, and even the Harcourt quarry, which is supplying hundreds of thousands of cubic feet of granite, is not served by a railway. Although this material is sent all over Australia, it all has to be carted from the quarry to the railway. The Harcourt product is able to compete with other granites merely because the quarry has been able to keep up a steady supply and meet the requirements of contractors, although one could hardly say that the methods employed are up to date. For monumental buildings I favour the use of stone. I see no reason why a building constructed of freestone, such as that obtained in the Grampians, and which is used in this building, should not last for from

500 to 1,000 years. There are other freestones and sandstones which, if not properly laid, would not last that time. If there are portions of the coping of the rear of Federal Parliament House which have broken away it is probably due to the fact that the stone was inferior, or that it has not been properly laid on what is termed its original bed. Stone has to be cut according to the grain, and laid on its natural bed. A good type of freestone, such as that obtained in the Grampians, should last for from 500 to 1,000 years, because it hardens with exposure. Some of the New South Wales freestones are very good, but inferior material may be obtained from any freestone quarry. The rock at Bacchus Marsh was laid down under glacial conditions, and its particles are superior to those in ordinary sandstone. They have been ground off from the rock by the action of ice and since solidified. There has been no decomposition. The ordinary sandstone is formed from particles resulting from natural decomposition of the stone. Usually this results in an inferior stone, because the rate of decomposition has been fairly rapid. In the Treasury building and in St. Paul's Cathedral, Melbourne, some of the freestone has fretted, but such disintegration does not occur in igneous rock. I cannot speak authoritatively concerning terra cotta. One of the difficulties associated with the use of terra cotta is that of maintaining uniformity in the colour and quality of the clay required in its manufacture. A number of cathedrals and other public buildings in Great Britain which have been constructed of freestone have been in use for from 500 to 700 years, and although some stones have been replaced, the material appears to have given satisfactory results. I do not think fog, frosts, smoke, or sulphur fumes would have a disintegrating effect on good freestone, but in a moist climate the stone would be likely to discolour. If the freestone in the base of some buildings has fretted it would probably be due to dampness and not to the effect of sulphur fumes. Fumes would only effect freestone containing an excessive percentage of lime. A good quality freestone, carefully selected, should have a life of at least 500 years at Canberra. We have a variety of good marbles in Victoria, some of which have been used in buildings in Melbourne. In the State Electricity Commission building in this city the steps are made of Victorian marble, and the same material is used in the panelling of the main entrance. Victorian marble has also been used in the Public Library and at Carlyon's Hotel at Spencer-street. Italian marble is often used in preference to the Victorian product, mainly because architects stipulate the use of a marble of a certain colour. Queensland marble was used at the Orient Hotel in Bourke-street, because a marble white in colour was desired. Marble should not be used for exterior work where it is liable to be scratched or to become discoloured. Victorian marble from South Buchan was used in Australia House and in the Agent-General's Office in London. Preference is often given to the imported article because Victorian producers have, in the initial stages, to compete with the product from quarries which have been opened up for perhaps five centuries. As we have not the market for large supplies, we are at a disadvantage in competing with the Italian producer. Only Italian marble of the best quality is sent to Australia, and in the initial stages of production here the stone is not of a uniform colour. Moreover, quarry-owners here are anxious to sell as much as they can of the material they raise, sometimes irrespective of its quality. Labour is also much cheaper in Italy, and that is an additional handicap in competing with the Italian product.

57. *To Senator Reid.*—There are ample supplies of marble in Victoria, and the Harcourt quarry, for instance, which has been working for 50 years, has

only operated on 1 acre, although the deposit covers a very large area. I believe supplies could be maintained for hundreds of years without any risk of a shortage in supplies occurring. As a rule, only from 10 to 20 per cent. of the marble handled is marketed. Only 10 per cent. of the Carrara marble quarried is sold. I do not know if our marble quarries are at present able to supply large quantities, as the demand for marble has been so small that the quarries have not been opened up. In most instances only small deliveries have been made to meet local requirements. If large orders were placed, there would be difficulty in obtaining the services of experienced quarrymen. Those operating the granite quarry at Dergholm were unable to obtain the services of a master quarryman, and have had to go abroad to obtain a man capable of opening up the deposit. There is a good supply of granite at Dandenong, which is about 20 miles from Melbourne, and the company, which obtained quarrymen used to quarrying basalt, provided machinery such as air-compressors and rock-drills, so that there would be no trouble in drilling, but the men did not work on the grain. They put down vertical and horizontal holes, with the result that every stone was long-cornered owing to the fact that the men did not understand the work. I recently read that, in Washington, men had to be trained as quarrymen to produce stone required for a certain building, because they could not obtain, even in America, men with sufficient experience. I do not think frost at Canberra would interfere with freestone, because there are many instances in which this stone has been exposed to frost for perhaps thousands of years without showing any signs of fretting. In the Grampians freestone with sharp corners has been exposed for tens of thousands of years without being affected by the weather. Some is irregular, but other has stood the ravages of time without any detrimental effect. The same can be said of granite. In regard to clay for terra cotta, there is a possibility of the material being coloured for blending purposes, but when one commences blending difficulties very often arise. Chemical analysis does not always assist in the mixing of clay. Tile manufacturers and others engaged in similar work are somewhat hard pushed in the matter of suitable clays, and there may be the same difficulty in regard to the manufacture of architectural terra cotta. Experiments have been made in dipping the raw material, and the colouring of Marseilles tiles is often due to the adoption of this process. Real terra cotta is coloured right through.

58. *To Mr. Jackson.*—It is possible that colours would be able to so nearly blend that the difference, if any, would not be noticeable at a distance of, say, 700 yards, but I cannot speak authoritatively on that point. Architects favour an antique effect, which can only be obtained by the use of the porous tile. The beauty of terra cotta seems to be in its antique appearance, and this can only be obtained when the tile has life and growth on it. I would prefer granite to freestone, because its life is indefinite. The life of freestone can only be gauged by the time it has been in use in the cities. The conditions at Canberra may be different from those in the capital cities.

59. *To Mr. Mathews.*—The bluestone used in the foundation of buildings in Melbourne is just as good to-day as it was when placed in position. Bluestone makes a good foundation, but it is too sombre in colour for use in a monumental building. I do not know if bluestone is used to the same extent in other States as it is in Victoria, but it has been sent to other States for foundation work. It is as easy as any other similar stone to work, and it is easier in one respect, inasmuch as no attempt is made to polish it. Generally speaking, freestone does not last as long as sandstone. Freestone

can be cut with an ordinary hand-saw. There is an unlimited supply of sandstone in the Grampians, and also in New South Wales. Sandstone is durable, and some freestone is also durable. A fine freestone is obtained at Mount Gambier which hardens on exposure, and which, after being in use 70 or 80 years, does not show any signs of disintegration. Considering the time the Mount Gambier stone has been in use, one could not easily condemn it, but I would not say it is a stone that would last indefinitely. There is an ample supply of building stone in Australia to meet all demands.

60. *To Senator Barnes.*—The Mount Gambier freestone is usually termed coralline, and I believe it would be suitable for a building such as the committee has under consideration. It is, however, a material which an architect or a geologist would have a tendency to condemn on account of the ease with which it can be broken. A building at the corner of Glenferrie-road and Riversdale-road is constructed of Mount Gambier freestone, and the designer showed that he was taking some risks in constructing piers of this stone to carry girders, but they are standing all right. The material can easily be obtained and worked, and in some instances is being used here in place of bricks.

61. *To Mr. Cook.*—I would not like to recommend the use of Mount Gambier freestone in a monumental building, but we cannot overlook the fact that it is a wonderful stone. If cost did not enter into consideration, I would favour the use of granite. Ample supplies can be obtained in Victoria and New South Wales, but there would be difficulty in obtaining quarrymen to open up a deposit. There is a shortage of stone quarrymen and stonemasons. I favour marble for interior decorations, but not for exterior work, as any limestone is likely to be affected by organic action. I believe we have building stone in Victoria as good as any in any part of the world. Our marble quarries have not been opened up sufficiently to enable them to be properly tested.

62. *To Mr. Mackay.*—Most of the deposits I have mentioned are on Crown lands. I only know of one marble deposit on private property. The State has no control over the mineral rights on lands alienated from the Crown prior to 1892, except those in relation to gold and silver. The marble marketed from our deposits is used mainly for monumental purposes.

63. *To the Chairman.*—If the proposed building had a freestone facing, columns of Harcourt granite—which is grey—would, I think, be suitable. If you were building with grey granite, one of the red granites would make a pleasing contrast. All the dressing and polishing of Victorian marble is done chiefly at South Melbourne. Granite is also handled in the same way. The Angaston marble in South Australia is, I think, dressed in Adelaide.

(Taken at Melbourne.)

WEDNESDAY, 19th AUGUST, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Barnes	Mr. Jackson
Senator Reid	Mr. Mackay
Mr. Cook	Mr. Mathews.

Philip Burgoyne Hudson, architect, President of the Royal Victorian Institute of Architects, sworn and examined.

64. *To the Chairman.*—I understand the nature of the building which the Committee has under discussion, and know that it is more of a utilitarian building than one of a monumental nature such as Parliament House or the Capitol. I understand, also, that

the building should be so designed as to enable alterations to be made should such be found necessary in the future to meet the requirements of the several departments. I understand, further, that the building is supposed to fit in with Mr. Griffin's proposals regarding the Administrative area at Canberra, and that the level has been altered from 1,870 feet to 1,860 feet. I visited Canberra recently and while I have not considered the possible effect of the alteration of the level on the surrounding streets, or as affecting other buildings, I do not think that the alteration of 10 feet would materially effect the position generally. I consider that the site for the building is a very good one. I have seen the plan which has been accepted by the board appointed to consider the designs submitted by competitors. For a building of this nature, which should be substantial and permanent, I consider that a steel frame building, or one of reinforced concrete with a stone face, would be best. For the base I suggest polished granite or trachite. I have had no great experience with New South Wales stone, but am well acquainted with the granite obtainable at Harcourt, in Victoria. It is of good quality, and can be obtained in large quantities. Having viewed the plan of Mr. Jones, I am inclined to think that the most elastic construction could be obtained by the use of reinforced concrete. I prefer that to a steel frame building. Regarding a covering, or facing, to the reinforced concrete, I should not suggest marble, because of its great cost, and because I do not know of any place in Australia where light-coloured marble can be obtained in sufficient quantities. Having seen Canberra, and realising that it is surrounded by mountains and contains comparatively dark soil, I consider that it should be a "white city." If a light colour scheme is adopted a beautiful city should result. The white cement used for the provisional parliament house looks very well, but in a permanent building, such as that under consideration, I should prefer some other material for the exterior finish. A building finished with cement cannot be cleaned down as easily as one faced with stone or terra-cotta. Regarding stone as a facing, there is always the possibility of stone of bad quality being obtained from a quarry from which good material is generally supplied. If freestone were used, I suggest that obtainable at Stawell, in Victoria, as it would fit in with the idea of a white city, and because it is permanent. It has the drawback that it is costly to work. Stawell freestone is used in Federal Parliament House, Melbourne. The Treasury buildings, Melbourne, are not constructed of this stone, but of a freestone from Risdon in Tasmania. Some of the stone from the Risdon quarry is very good, but there are bad patches. The same remarks apply to stone from Geelong. To some extent the crumbling of freestone is due to the way in which it is quarried. Stones should be laid with the laminations parallel to the bed. If they are vertical, water can get in, and cause crumbling. It is difficult at times for even experienced quarrymen to know which way the grain of a stone runs. Stawell stone in addition to being permanent and of light colour, can be matched without difficulty. I think, however, that for a building of this nature the best material to adopt would be terra-cotta or faience. This material is now made in Australia, and I believe that its quality compares favorably with imported terra-cotta. The Union Building, in Sydney, is faced with imported terra-cotta, while the Temple Court Building, in Melbourne, is faced with the Australian-made article. In my opinion the faience in the latter compares favorably with that in the Sydney building. Temple Court has the advantage of having a southern aspect, which is a matter of some importance, as terra-cotta is inclined to twist in the burning, and where the sun shines on a flat surface there is always the possibility that any winding of the material will be shown. At times the sun shows up the Union Building in Sydney rather unfavorably. I prefer for Canberra the color of the terra-cotta used in the Temple

Court, Melbourne, to that of the Union Building, Sydney. I have no doubt that terra-cotta, which is practically everlasting, can be manufactured in Australia. I understand that the industry here has been firmly established by experienced men. I have not made a comparison of the cost of Australian-made and imported terra-cotta, but have some knowledge of the difference between the cost of terra-cotta and stone. Terra-cotta is more lasting than any freestone, not excepting that from Stawell, and is more durable than any stone, excepting that of an igneous nature. I consider that terra-cotta should last for centuries without flaking. We have evidence of its durability in the examples left us by the Romans. Medusa cement is made in America, and has a good appearance. The portico at the St. Kilda Town Hall is constructed of this material. If cement were used for the exterior finish, I think that a better effect would be obtained if a little yellow were mixed with the white, as that would minimise the glare. I do not anticipate any difficulty regarding the supplies of the clays used in the manufacture of terra-cotta. For the floors of the building, either a wood floor covered with linoleum, or linoleum laid directly on the concrete, would be satisfactory. A wood floor would be warmer, but I have had experience of concrete floors covered with linoleum only, and have not found them cold when the rooms have been heated with hot water radiators. For the staircases I should recommend reinforced concrete in preference to steel. The provision of marble steps in the main approaches is entirely a matter of cost. Marble, undoubtedly, would add to the appearance. If the corridors to a height of from five to seven feet were faced with marble, I think that the stairs should be of marble also. While there is a difficulty in obtaining large quantities of light coloured marble in Australia, that difficulty is not so great in the case of black or brown marble. Good supplies of beautiful marble are obtainable at Buchan. Marble from Angaston, in South Australia, is light in colour, but I doubt if it is obtainable in large quantities. If the buildings are finished externally in a light colour there would be no objection to dark marble being used in the corridors. The necessity for strong-rooms provided with burglar-proof, as well as fire-resisting doors, depends entirely on the nature of the articles to be deposited in them. I have heard of devices other than the sprinkler system for automatically giving an alarm of fire, but I am not familiar with them. Although I consider that the design of Mr. Jones is a splendid one, I think that in regard to lighting it exhibits weakness, and feel that this matter is worthy of attention. The design provides for external courts which will give well-lit sections, but the portion which I consider is not well provided for is that adjacent to the corridors in the centre of the building. From the external light courts to this internal portion of the building is a distance of about 25 feet. There is a possibility of this internal space being sub-divided for small offices, and light for them will be obtainable only from light courts which will be halved by lavatory blocks. These light courts are either 14 feet or 10 feet wide, and, in my opinion, are not sufficient. If the lavatories were placed elsewhere sufficient light would be obtainable. I think that the removal of the lavatories from this position to the vicinity of the lift enclosures might be referred to Mr. Jones for his consideration. The suggestion that portion only of the upper floor should be constructed involves the consideration of the necessity for a circular end to the building. This is a very vexed question. To my mind the problem set the competitors practically demanded a circular end to the building. If the building is to be erected on the suggested site, it certainly should have a circular end, but the more I study the plan the more I am convinced that a circular end should not be provided. If the site of the building were shifted so that the south-east end did not project beyond a line across the ends of the arc a symmetrical

building with a square could be obtained. That, of course, would affect the construction of the upper floors. From an architectural point of view, it would be detrimental to the building to remove the attic planks, but, on the other hand, if the building were symmetrical and rectangular it would improve it to drop the flanking features. Regarding the provision of a dome for this building, the design placed third by the adjudicators included an elaborate sketch showing the whole of the administrative group, with the capitol at the top of Kurrajong Hill. The sketch provided for this building to have a dome, the idea being that it and the corresponding building on the opposite side of the main group, were flanking features, and that the two domes on the side would lead up to the main dome of the capitol. To my mind, however, the building would be better without a dome. I do not consider that provision should be made for the erection of a dome at a later date, as I do not think that the expense would be justified. I think that the design of the building generally makes possible any alterations which may be required later. So far as the mezzanine floor is concerned, I look upon it as an additional floor. It is 10 ft. 6 in. in height, and is, therefore, as high as many rooms which are used as offices. But, while I regard it as another floor to the building so far as internal arrangement is concerned, I realize that the wings that project in front, although of one storey only, are equal in height to the two storeys internally. The provision of rubbish chutes and pipe ducts, as well as a tunnel for water and sewerage purposes, I consider to be advisable. The addition of means for cleaning the building by a vacuum-cleaning process should meet all requirements.

65. *To Senator Reid.*—I recommend the construction of the building in reinforced concrete for the reason that supplies of much of the necessary materials are obtainable locally, and also because this type of building provides in the most effective way against damage by fire. I realize that bricks are obtainable at Canberra, but, nevertheless, I prefer concrete, as it is a better material. In any case, the floors will be of concrete, and I regard a homogeneous structure as being better than a composite structure of brick and concrete. Where the two materials are used together, difficult is experienced because their expansion and contraction are different. Of course, any shrinkage at the ceiling could be covered by fibrous plaster cornices, but I prefer concrete for both the walls and the floors. I do not know the extent, if any, to which the colour of a cement building would be affected by long exposure to the sun. Regarding the covering of the floors, a great saving would be effected if the linoleum were laid directly on the concrete, instead of first covering the concrete with wood. My office floor is covered in that way, and I have not felt the room, which is heated by hot water radiators, to be excessively cold. Taking everything into consideration—the permanence of the structure, and the desirability of matching the colour in buildings which may be erected later—I should prefer a polished granite base with a terra-cotta facing above.

66. *To Mr. Jackson.*—It is not usual in designing buildings to allow more than about £30 each for strong room doors, where protection against fire only is required. In this connexion it might be worth noting that in many buildings in Australia the ordinary tin-clad door is used for strong rooms, and has been found satisfactory in cases of fire.

67. *To Mr. Mathews.*—The bricks made at Canberra, while probably not better than those obtainable in Melbourne, are as good as any in Australia. A concrete floor could be placed in a brick building without weakening it; it has been done in many cases with entire satisfaction. If the building were faced with stone, the foundations should, in my opinion, be of concrete. It would really be a reinforced concrete building, the facing—granite for the base, and terra-cotta or faience above—being only a veneer. While bluestone would be suitable for the base, as it is everlasting and there

are unlimited supplies available in Victoria, I much prefer granite or trachite.

68. *To Mr. Mackay.*—The information obtainable as to the relative cost of terra-cotta and stone is very contradictory. Freestone from Stawell is the most expensive freestone in Australia, and terra-cotta would probably prove to be less costly, but I do not think that terra-cotta would be cheaper than Sydney freestone. Chiefly because of the expense, buildings constructed entirely of stone are not now erected to any extent. The labour costs in a building of this description would be greater than in the case of a concrete building faced with stone, or a stone building backed with brick-work. Taking into consideration the nature of the building, the necessity for future development, and the supplies of material available, I prefer terra-cotta to stone as a facing. I do not know how the absence of orders can be regarded as the reason for white marble being unobtainable in large quantities, as I do not know of any extensive white marble deposits in Victoria. I consider that adequate provision has been made for staircases and lifts.

69. *To Mr. Cook.*—I have not read the report of Mr. Jones, but I consider that the design of the building generally is very good, and, apart from what I have already mentioned, I regard it as being well provided with light and ventilation, while adequate precautions have been taken against damage by fire.

(Taken at Melbourne.)

THURSDAY, 20TH AUGUST, 1925.

*Present:*

Mr. GREGORY, Chairman;

Senator Barnes	}	Mr. Jackson
Senator Reid		Mr. Mackay
Mr. Blakeley		Mr. Mathews.
Mr. Cook		

William Kinsey Bolton, Master Builder and Contractor, sworn and examined.

70. *To the Chairman.*—I am at present engaged on a large building work at Temple Court, Melbourne. In my opinion the most suitable class of construction for the permanent administrative building at Canberra is a steel frame lined with brickwork and cement. In the United States of America it was discovered that it was almost imperative to have a steel frame, no matter what the general lining might be, in order to give the stability and security that are desirable for a building of any height. You point out that the building under consideration will not be more than about 70 feet from the basement to the roof, but that does not induce me to qualify my statement in favour of a steel framework, since it is expected to last for centuries. I have seen buildings in Egypt and other places in a remarkable state of preservation that have been finished with terra-cotta tiles. Their condition is as perfect as on the day when they were completed, both as regards the material and the colour. If you adopt a method of construction which will keep the building together, the material will stand practically for all time. By using steel with cement work you eliminate a number of risks of bad work or inferior material. No matter how careful the supervision may be, a builder cannot always rely absolutely on the workmanship and material being of the character necessary in a building of this description. The method I have suggested is the most reliable, with the exception of solid stone construction. The approximate additional cost should not be more than 20 per cent., and I think that the extra amount would be justified. Otherwise, I prefer solid stone construction. I have not used any of the

trachyte now employed, but I should say that it is a very fine stone. You tell me that the opinion is largely held that to lend harmony to a garden city it is desirable to have white or light coloured facings with a tiled roof. Of all the stone I have seen I have most admired the trachyte used in the Commonwealth Bank in Sydney, and I prefer it to granite. If the base were of a dark colour the light coloured stone above would be shown off to advantage. In my opinion, the base should be rock-faced. You inform me that the trachyte is quarried not a great distance from Canberra. Even if its cost were equal to that of other stone, I should prefer its use. I do not advocate a brickwork finish. A lining or veneer of some other material such as terra-cotta, stone, or cement is desirable. The terra-cotta my firm is now using at Temple Court is the first of its kind of which I have had experience, and I am glad to know that it is a first-class material. I went into some detail to make myself familiar with it. At Temple Court we are employing terra-cotta blocks in connexion with concrete construction, and the blocks have to be secured with bolts and wires, but the blocks are really designed for use with brickwork, into which they should be grouted with liquid cement, thus forming a solid mass. In using the terra-cotta blocks with concrete construction every precaution is taken against electrolysis of the wires and bolts by the employment of steel beams. In my opinion, it is much more costly to fix the terra-cotta to reinforced concrete than it would be to bricks. You tell me that you have been shown a model of a brick used in connexion with the State Savings Bank in Sydney. The terra-cotta I am using is somewhat similar in construction. The weight is 20 lb. per superficial foot, the depth from the front to the rear is 6 inches, and the hollow space is 4 inches, with a rib 2 inches around it, making a bond of 4½ inches into the stonework. These blocks are made in Sydney by the Wunderlich Company, and I should say that there would be every possibility of a large supply of them being obtainable, say, in 30 or 40 years' time. There is no danger of the supply of clay being exhausted; in fact, I should imagine that the supply would be even greater, and the quality better, than at the present time. They are equal in quality to the blocks being used in the State Savings Bank in Sydney. The faults discovered in the terra-cotta tiles as supplied to me are so slight as to be almost negligible. In my opinion, the appearance of the finished job will be most striking and satisfactory. You tell me that every side of the building at Canberra will be conspicuous, and will need to be finished alike. I do not think that the sun will have any effect on the terra-cotta being used at Temple Court. In my opinion, it will last for all time. I cannot undertake to say that it is equal in quality to the terra-cotta I have seen in Egypt, but it has every appearance of being so. Terra-cotta has not been extensively employed in the past, more because of defects in manufacture than because of any objection to this class of material. In the course of time stone shows signs of wear. The fault in many cases is due to bad bedding of the stone, but in my opinion a century's exposure to the elements affects its appearance. I believe that there are freestone buildings in London that have stood the test of hundreds of years, but I have not seen them. Terra-cotta would be preferable to a freestone veneer because its colour would not change. If you put up a freestone building at Canberra, and 50 years' hence desired to erect a similar building alongside it, one would be dark in colour and the other light. Terra-cotta is obtainable in dark browns and reds, but not in a beautiful green that I saw in Egypt. Suitable marble for lining the staircases, corridors, &c., is obtainable in Australia. I do not think that the marble quarries lay themselves out well for this class of business. I suppose that the demand for marble and the amount of capital invested in the industry

affects the position. At Temple Court we have been held up for some time because of the difficulty in obtaining the marble we require. There is not sufficient capital invested in the industry to do it justice. We are using Buchan marble at Temple Court for the base and for panels in the corridors. It is very dark with a light-coloured grain, and is most suitable for the purpose. The price is much about the same as that of the imported article. The suppliers manage fairly well to supply slabs of fine appearance, matching one another. There would be no difficulty in putting in concrete floors with the steel frame construction suggested by me. The steel supports would be concealed by the concrete. I suggest cork linoleum for the floors. It would be much cheaper than jarrah blocks, and it would not be so cold as ordinary linoleum. Cork linoleum would have to be imported. No matter how anxious one might be to advertise his own country and have faith in its products, I must say that Australian hardwoods, though excellent for flooring so far as specific gravity and cost are concerned, give great trouble on account of shrinkage. It is impossible to season them. You may consider you have seasoned jarrah, but two or three years after it has been put down it will be found to have shrunk just as if it had not been seasoned at all. I am speaking of ordinary tongued and grooved flooring-boards. If the committee has in mind the thin blocks that are put down on a floor of bitumen, any kind of Australian timber may be used. For that purpose, I should prefer well-seasoned red gum even to jarrah. Automatic fire-alarms are not installed at Temple Court, but we have automatic appliances consisting of roller shutters and smoke doors which are operated by a trigger which melts when a certain temperature has been generated. On each floor there are four roller shutters along the corridor, and if a fire occurred in any one portion of a building the trigger would melt and isolate that portion by operating an iron shutter. An outlet is provided in each section of the building. There are also smoke doors at the end of each staircase landing. A postal chute which will prove very useful and convenient to the occupants of the building has been installed. There is a postal box on each floor, and the postal matter passes into a large receptacle on the ground floor which is cleared regularly by the Department. There is also a similar receptacle for rubbish, even on the eleventh floor. I also suggested at Temple Court a tunnel under the building for water supply and wires, and I was glad that the architects and the owners adopted the idea. It has saved a great deal of expense in construction, and it will reduce the cost of maintenance. In my opinion, a dome would spoil the character of the proposed building at Canberra.

71. *To Mr. Jackson.*—The strong-room doors at Temple Court are fire-resisting and burglar-proof. The average cost works out at about 12s. per super. foot and the doors measure about 7 feet by 3 ft. 3 in. They are steel doors about 5 inches thick and have good Chubb locks. I do not think that doors costing £110 each are required on the building at Canberra. You tell me that it is suggested that they should be strong enough to resist oxy-acetylene burners, but by that process I should think a burglar would be able to open any door. There would not be the slightest danger of the steel work rusting with the method of construction I have recommended.

72. *To Mr. Mathews.*—No impression can be made on the face of a terra-cotta tile except by the use of acids. I do not suppose that it would matter, from an artistic point of view, if freestone were employed and different shades of colour were noticeable. Tiles of varying colours are used, and in the opinion of some people a variation in shades adds to their appearance.

73. *To Senator Reid.*—If I had an unlimited supply of good machine-made bricks equal to any in Australia, and had to erect an ordinary building five

stories high with a terra-cotta front, I might adopt plain brickwork construction, but I am given to understand that the administrative building at Canberra is expected to stand for centuries. Although brick and cement are good, I maintain that brick and cement with steel give an even better construction. I do not say that I can point to any case where good machined bricks have shown signs of deterioration, but in a large building there are possibilities of settlement taking place, and if it is not bound together with steel any slight settlement will show immediately. You ask me whether terra-cotta tiles used in conjunction with brickwork would not stand for ages. I point out that the terra-cotta blocks we are using at Temple Court are manufactured for the special purpose of being built in with bricks. These terra-cotta blocks are much larger than ordinary bricks, but I think they have just as good a surface and are just as strong, when built in with ordinary brickwork, as if they were manufactured 9 inches by 3 inches. I rather approve than otherwise of the building at Canberra being faced with terra-cotta.

74. *To the Chairman.*—Perfect columns are obtainable by the use of terra-cotta. I was agreeably surprised with the fine appearance of the columns at Temple Court. The arches, columns and cornices, which are very beautiful and difficult of construction, were prepared in Sydney, and when they were put into place they fitted perfectly, so accurate was the work of the manufacturers. Polished granite columns and terra-cotta facings should look splendid. I prefer grey granite. The best comes from Harcourt, from which only the rough stone is supplied. The Footscray people do the polishing.

75. *To Senator Reid.*—We have had no rejects among the terra-cotta blocks used at Temple Court.

(Taken at Sydney.)

TUESDAY, 8TH SEPTEMBER, 1925.

SECTIONAL COMMITTEE.

*Present:*

Senator LYNCH, in the chair;  
Senator Reid                      Mr. Mackay.  
Mr. Blakeley

Richard Worrall, General Secretary, Stonemasons Federation of Australia, sworn and examined.

76. *To Senator Lynch.*—I have attended before the Committee to urge the use of stone in buildings to be erected at Canberra. I am authorized to express the opinions of the whole society, State and Federal. The use of stone in public buildings ought not to need any advocacy. It is the natural building material. Its value has been proved by centuries of use. It is the only material that has stood the test of time. In support of this statement, I can point to the old Gothic cathedrals and Grecian temples. We claim that, at the Federal Capital, stone should be the first material considered, especially as, in this State, we have such an unequalled variety. I know of no other part of the world where there is such a great variety of building stones. Our sandstone or freestone is of a quality not surpassed anywhere in the world. I cannot make definite comparisons between stone and other building materials. We can furnish figures of the actual cost of stone landed at Canberra. I advocate granite for the base, and freestone above. The quantity of freestone available is practically unlimited. In the city of Sydney, stone is coming more and more into use. It seemed to be a fashion for some time to substitute other materials, but with the introduction of machinery for

quarrying and dressing the stone, the product has been so cheapened and production improved that stone is now coming into use again. The new methods ensure regularity of supplies. For facing purposes, stone is ousting other materials. The large bulky walls of stone are not being built now. There is no difficulty in obtaining experienced quarrymen, and there has never been any difficulty even in the biggest rushes. A large number of men follow the tide round in the different countries. There is plenty of labour for getting the stone and working it. There are no wearing defects in granite. Some freestone has certain defects, but if the stone is picked, it will last as long as is wanted. There is no sign of wear in the Sydney Post Office building, but other jobs that have not been finished a quarter of the time are showing signs of weathering. That is not the fault of the stone, but of the selection of it. On a job I have in mind, on which I worked myself, we told them that the stone would not last, but as it was cheap to get, and cheap to work, it was used. Consequently, it is now weathering. Good and bad stone can be obtained in the same quarry. The post office stone was taken out of Pymont quarry. When stone is found to be weathering, it can be said with certainty that it was taken from either the top or the bottom of the quarry. There is no good building stone in the neighbourhood of Canberra. A yellow freestone is obtainable anywhere round Sydney or the Hawkesbury River. There are a dozen or more quarries to pick from. The prospect of getting defective material must be faced, but any practical man could safeguard the Government against that. I was a stonemason for from eighteen to twenty years.

77. *To Mr. Mackay.*—It does not matter what material is used for walls that are to be faced with freestone. Terra-cotta is coming into fashion, but I believe it is only a temporary fashion. Fashions in building are almost as changeable as women's fashions. When considering the discoloration of stone in Sydney buildings, it should be remembered that Sydney is an industrial city, that soot and sulphur in the air discolour the stone, and that freestone wears better the farther it is from the sea. The promenade wall near Circular Quay was built from surface boulders quarried near the gardens. They were quite unsuitable for building purposes. The pier for the Hawkesbury River bridge has been built about the same length of time, and shows no sign of fretting. I am prepared to guarantee an adequate supply of expert quarrymen. All stone should be set in a wall in its natural bed. A practical man would never face-bed a stone. One of the worst examples of that is St. Paul's Cathedral, Melbourne. That is not a freestone, but a limestone. The cause of the trouble there is face-bedding. It was a case of bad supervision.

78. *To Senator Reid.*—I have seen stone buildings that showed no sign of decay. The Sydney Post Office is an example. Trinity Church, which was erected, I think, in 1855, is another. I do not think that church shows any sign of decay. The stone there was bedded on its natural bed, and that is why it has not deteriorated. Any proper stone properly set will last. The top and bottom blocks in a quarry may be bad weathering stone. An example of weathering is the coping stone of the Sydney railway station in Pitt-street. When we were working it, we told the authorities that the stone would fret. It was taken from the bottom of a quarry. If a stone is properly quarried, it will come out on its natural bed. The correct bedding of stone makes no difference to the amount of wastage in cutting. Any quarry in the neighbourhood of Sydney could supply all the stone wanted for Canberra. There is enough stone round the Hawkesbury River to build 500 Canberras, and you would never notice where it was taken from. If

the Government wants to stick to a certain stone, it could open its own quarry. There is sufficient stone to build the whole of Canberra with solid walls 500 times over.

79. *To Mr. Mackay.*—I would certainly recommend stone for monumental buildings intended to last for centuries. In an inland place like Canberra, freestone would be almost everlasting. When you get away from the influence of salt air freestone shows very little deterioration.

80. *To Mr. Blakeley.*—Members of my union do similar work to that done on the Commercial Bank, Sydney. The stone is attached by anchor holds and cramps into the concrete that surrounds the steel uprights. Galvanized wire a  $\frac{1}{4}$  of an inch thick is used for the anchor holds. The ashlar are from 10 inches to 14 inches. The cornice and big projections are a little more. Some of the cornices that stand out 3 or 4 feet are only about 18 inches on the wall. They are tied in with bolts and anchors to the concrete at the back. For a heavy cornice they sometimes use heavy galvanized bolts. I have sometimes used copper bolts. It is almost impossible for rust to set up in such a structure. That method is a new American departure in building practice. There is no building in this country that could be investigated to ascertain how the process is standing. My opinion is that it is quite sound provided it is put up properly and grouted in correctly. The freestone in the Commercial Bank was supplied by Stuart Brothers, Bondi. That in the city railway bridges came from the State quarry at Maroubra. The last addition to the Fisher Library at the University was built of stone from the State quarry. The stone for the first portion of the library came from Saunders's Quarry, Claremont. That work was done by members of my society. We can see very little difference in the stones from the different quarries. It is mostly of the same texture. Good freestone is to be found 18 inches from the surface of the stone. There is a whole mountain of trachytes at Bowral, and there are small deposits in other places. There are deposits of granite all over New South Wales and Victoria, and, in fact, all over the Commonwealth. Harcourt granite, in Victoria, is outstanding in quality, and good granite is also obtainable from Uralla, Marulan, and the south coast. Marulan granite is grey. A good, red granite has not yet been discovered in New South Wales. Moruya granite is being used by Messrs. Dorman, Long, and Company, and the same stone is used in the columns of the post office. The base of the Commonwealth Bank building is a trachyte. There are 900 members of my society in Sydney. Employment is not good at present. We have quite a number of men idle. A number of them have gone up to Brisbane, and others to New Zealand. Those men are all anxious to get home again, and would return if the work was here.

(Taken at Melbourne.)

WEDNESDAY, 14th APRIL, 1926.

*Present:*

Mr. MACKAY, Chairman;

Senator Barnes	Mr. McGrath
Mr. Cook	Mr. Seabrook.
Mr. Lacey	

John Smith Murdoch, Director-General of Works, sworn and examined.

81. *To the Chairman.*—I am aware that since I last gave evidence in connexion with the proposal to con-

struct Administrative Offices at Canberra the personnel of the committee has changed and understand that you now desire me to give a general outline of the scheme. The object of this large building, is to provide office accommodation for the departmental staffs at Canberra. The structure is to be the first of what will eventually become a large group of similar buildings, which will later be required for the accommodation of the departments. As the members of the committee are aware the Houses of Parliament at Canberra are being erected in the form of a provisional building. The original intention was to provide a more monumental parliamentary building, but that policy has been departed from on account of the financial exigencies of the Commonwealth in consequence of the war. Owing to the advice received by the Government and the recommendations of this committee the parliamentary building is being constructed in a comparatively temporary form. The administrative offices which will be necessary as soon as Parliament meets at Canberra were first of all considered by the committee in the form of temporary buildings; but a recommendation of the committee which Parliament adopted was that it would be wise to proceed with the construction of at least one permanent building at the Federal Capital. The building now under consideration is therefore to be the first one of a permanent character to be constructed. In accordance with the promise of the Government that the best architectural talent in Australia should be enlisted in designing the principal permanent buildings at Canberra a competition which was open to all architects in Australia was held. From memory I believe 94 designs were received and as a result of the adjudication on these designs that submitted by Mr. George Sydney Jones, a Sydney architect, was considered the best. In accordance with the conditions of the competition Mr. Jones was instructed to proceed with the preparation of considered drawings of the building up to the extent of being able to sufficiently illustrate his scheme before further action should be taken. The previous Public Works Committee took a good deal of evidence on the subject including the quality of the design and the methods of construction intended to be undertaken, and seeing that the design of Mr. Jones was considered by architectural experts to be the best of the 94 submitted, naturally there can be little doubt as to the suitability of the building proposed. As far as I understand the position at present the principal aspect of the whole project which is now exercising the minds of members of the committee is that of coming to some conclusion in regard to what may be termed the best material with which to face the building. The proposed structure is likely to cost between £400,000 and £500,000, and the time which its erection will occupy will possibly be four or five years. It is, of course, the intention to transfer the seat of Government to Canberra long before that period has expired. Seeing that the administrative building cannot be completed in time other provision has been made to house elsewhere departments or at any rate sections of departments pending the completion of the administrative block. The provision being made for temporary accommodation is by constructing two secretariat buildings into both of which proposals the committee has inquired. These buildings are of a provisional class of construction on the same constructive lines as Parliament House, and will be capable of lasting for possibly 70 years. One of these structures is about completed and tenders are about to be called for another. The building which is approaching completion in addition to providing office accommodation room will also provide room for a district post office and a district telephone exchange, both of which utilities must necessarily be in working order by the time Parliament meets at Canberra. The second building for which tenders are about to be called by the Federal Capital Commission will accommodate the remainder of the departments, or nucleus staffs of

them, until the main building is completed, and will also accommodate the nucleus of a national library, which is now housed at the Parliament Houses in Melbourne. It has been mentioned, and on various occasions I have recommended it to the committee, that the two secretariat buildings might later be used by members of Parliament each of whom would have an office on the same lines as in the United States of America. These secretariat buildings have been so planned as to be capable of being divided into rooms of the size suitable for members. The first secretariat building is to be a two-story structure and the second, which is on a lower level, will be a three-story structure, in order that both buildings will reach the same height. When giving evidence before the committee on a previous occasion I expressed the opinion that an administrative block with a rounded end of some form, either with a small apse or a completely rounded end would suit the site better than one with a square end. Mr. Sydney Jones favours a building with a square end, but he has also submitted to the committee alternative plans of a building with a large circular end and a small circular end. On a previous occasion I mentioned that either of the schemes would meet with my approval, and I suggested that it might be better to adopt the rounded end in one form or another; but personally I do not care very much which form is adopted. If I were to be asked for a definite opinion on the matter I would be guided largely by the views of the architect, Mr. Jones. I think, however, that a building with a rounded end would be more attractive. The judges in the competition were Sir John Sulman, Professor Wilkinson, Mr. Ross, and myself, all of whom are of the opinion that a building with a rounded end would be preferable. My chief reason for favouring this form of construction is that as the end of the building will face a large avenue which is not parallel with the structure itself a rounded end would be more attractive than a square end. Mr. Griffin, the author of the design adopted for the lay out of the city, seemed to think that a building with a rounded end would be preferable. The committee cannot, in my opinion take too serious a view or give too much consideration to the question of the best material with which to face the exterior of the building. I have already mentioned that the administrative building is to be the first structure of what will eventually become a great national group of legislative and administrative buildings at Canberra. These buildings will go on developing for centuries and from an aesthetic point of view the committee will realize that it is desirable that each building in the group should be of the same colour. It is therefore necessary in the first instance to adopt some material which can be matched in colour in years to come. This subject engaged the attention of many architects who submitted designs of the building, and the opinion was generally expressed that the ground floor should be constructed of granite, and that the remainder of the building should be faced with material to be decided upon. Some favoured freestone, some granite, some even suggested brick, others terra cotta or faience, and others plaster. I know the committee has already given a great deal of thought to this particular subject, and I think it desirable to get a leading opinion from the committee as to what the building should be faced with, particularly as the members of the committee have had an opportunity to gather a good deal of valuable information on the subject. Mr. Sydney Jones, the architect of the building, of whom I have the highest opinion as an architect and as a man, should be given the benefit of the committee's investigations in this regard, including the information obtained as to the lasting qualities and prices of different materials when I think he would be prepared to express a definite opinion which would be very useful to the committee. I do not think the committee could place itself or the country in a safer position than by adopting

that course, because Mr. Jones is a man who will give the matter the most serious consideration. He is not biased in any way. I know that when he submitted his design the material which he recommended and which he designed the building for was terra cotta, beautiful varieties of which are being produced in New South Wales. I have seen the British and American terra cotta, and I think that produced in Australia is in every way equal to that manufactured in other countries, but unfortunately it is rather costly. Terra cotta would be more expensive than stone, slightly less costly than granite or trachyte, and of course very much more costly than plaster. It is, however, a beautiful product and one which can always be matched in colour in generations to come. The terra cotta used in the construction of the bank of New South Wales in Sydney is of British manufacture. I have seen the terra cotta used in the Temple Court building in Collins-street, Melbourne, and although it is not of a colour which I might have selected, it is quite satisfactory. Another example to which I would direct the attention of the committee is the State Savings Bank in Sydney, which is being done with a special ceramic brick which is chemically treated to give the desired appearance. The Nicholas building in Swanston-street, Melbourne, is being faced with terra cotta with a granitic finish, manufactured by the Wunderlich Company. I think the Nicholas building provides a splendid specimen of terra cotta. The work is sufficiently advanced to enable a definite opinion as to its appearance to be formed. I do not favour the variety of tints which are shown in the Temple Court building. The little diversity between the blocks is not altogether an unwelcome effect. I used terra cotta in construction work over 30 years ago, and its irregularity is a characteristic which will have to be accepted. It is never likely to have the same appearance as granite. It is possible that a synthetic stone facing might be advantageously introduced at Canberra. I do not mean a burnt clay, but a synthetic stone moulded into blocks the basic composition of which would be Portland cement. I have seen synthetic stone in American buildings which to all intents and purposes appear to be wholly constructed of granite, but which, above the lower story, are built of imitation granite. Crushed granite is mixed with cement and moulded into facing slabs of the size required. Such material was used in London years ago. An example of work of this kind is to be seen in Collins-street. If the building were faced with synthetic stone I would not suggest an imitation freestone or sandstone, but imitation granite. If granite were to be used for facing purposes I would prefer axed to polished granite. With the great open spaces such as there are at Canberra it is desirable to avoid small trivialities of detail; and to construct on broad lines that will assert themselves. I am not opposed, of course, to the limited use of polished granite in places where it may be considered an advantage. Mr. Sydney Jones thinks that the columns of the building should be square, whilst another authority said that they should be round. I know of the Fairy Meadow deposit, which is about 35 miles from Canberra and about two miles from the railway between Goulburn and Queanbeyan, but I have not visited it. The land was acquired by the Commonwealth Government some years ago with the intention of entering upon the manufacture of Portland cement for use at Canberra and in other Government buildings throughout Australia. The acquisition of the property became the subject of rather important litigation and I believe that in consequence of legal and other expenses the property has cost the Commonwealth approximately £40,000. I understand that at present at any rate the Government has no intention of undertaking the work of cement making in that locality. Colonel Owen stated in evidence before the committee at Canberra that he

had been instructed to take out samples of the stone with a view to testing its usefulness or otherwise as a building stone, but owing to pressure of work I understand that no such tests have been made. When Colonel Owen was in Melbourne about a month ago I discussed the subject with him and he is still of the idea that the Fairy Meadow deposit will provide a very useful building stone. I am not, of course, in a position to say whether geologically, structurally, or chemically it is suitable, but if it is it would be economical to use it. No royalty would have to be paid on the material, and owing to its proximity to the Federal Capital its cost would compare most favorably with material obtained elsewhere. I have an impression, which, unfortunately, is not based on scientific opinion, that it would make a good building stone. I believe that the committee would be justified in making further inquiries into its suitability. I am afraid that there is a possibility that under surface treatment the stone could not be made to wear a light enough appearance to meet what I think should be a suitable colour stone for buildings at Canberra. I would suggest the committee obtain a foot cube sample showing on different sides how it appears when axed, rubbed, polished, and hammer fractured. Before I would care to express a definite opinion on the use of sand-stone, terra-cotta, granite, or white plaster, I should like to be supplied with information in tabulated form as to lasting qualities and prices such as I suggested should be supplied to Mr. Sydney Jones. If I had at my disposal all these particulars I could, I think, come to a decision without much difficulty. I would not like sand-stone in any form, as although it might last 150 years, its wearing qualities would not be sufficiently lasting. The best free-stone obtainable in Australia is possibly that from the Pyrmont beds in Sydney, but even that stone has in many instances shown signs of fretting. In these circumstances I would not consider the use of sand-stone for such an important building. A decision would then have to be made between terra cotta, granite, either in natural or synthetic form, trachyte from Bowral, or the Fairy Meadow stone. I would not seriously consider white plaster. I cannot give the cost of the Fairy Meadow stone. In placing these materials in the order of cost granite would be most expensive, then trachyte, terra cotta, and synthetic granite. If the Fairy Meadow stone were suitable it would, I consider, be the least expensive and perhaps equally satisfactory; but I am doubtful as to the colour, and unless it could be brought down by some process to a light colour I would not consider it. A sample block such as I have suggested would be sufficiently large to give an indication as to the colour of a building constructed of that material. If the internal structural work is to be of reinforced concrete it should be covered with plaster except where the use of Australian marble such as in corridors and on staircases is warranted. The skeleton structure should be of reinforced concrete as also should be the vertical supports. The spaces between the members of the frame should be filled in with brick work, which would be cheaper than concrete. I consider the use of sprinklers unnecessary, as they are not only a disfigurement but are also costly. Ample provision could be made for the protection of the building, which will be practically fireproof, without incurring such expense. The base of the building should be of granite or trachyte and the columns should be faced with the same material adopted for the walls. Instead of a single line of columns at the court yard I would prefer a double line. The cornices should be of the same material as the columns and the walls. Above the level of the ground floor, which should be of granite or trachyte, every portion of the external face of the building should be of the same material. If Fairy Meadow limestone can be adopted the whole building from top to bottom could be successfully faced with it.

82. *To Mr. Seabrook.*—I favour the use of terra cotta because of its lasting qualities, and the ease with which future buildings could be constructed in the same colour. I have inspected the sample of 9 x 6 terra cotta produced, which is a size I do not favour, and I admit that it contains irregularities. I favour a terra cotta block of at least 18 x 12. If terra cotta is adopted we must accept its characteristics. The defects which have been pointed out to me in the sample block are characteristics inseparable from terra cotta. After many years of experience of terra cotta I have trained my mind to what to expect in terra cotta construction and if I wish to use it I must put up with it. In considering the irregularity of the joints the aesthetic effects are perhaps stretched too far. There is a strong architectural opinion in favour of this irregularity. The Liverpool Cathedral, which I visited some years ago, is regarded as one of the greatest buildings in the British Empire, but the joints on the inside are thick. Such work would have been condemned by the office in which I was engaged as a young man and yet the great architect who built it went out of his way to have these emphasized joints. Amongst the great terra cotta examples I may mention the Natural History Museum in London, the Law Courts in Birmingham, the offices of the Anchor Line in Glasgow, and I think the Hotel Russell in London. All these buildings have these irregularities some of which are very pronounced. The Temple Court building is a sample of this type of work which some architects say constitute its beauty. I do not necessarily favour a billiard-table type of wall. A large percentage of the great buildings erected in the United States of America are faced with terra cotta, including the great Woolworth building and many of the important banks in New York, Chicago, San Francisco, Montreal, and elsewhere. All these possess the characteristics which we have been discussing so that in looking at a building of terra cotta one must realize that these so-called irregularities are not defects, but only inherent qualities in the use of that material. When the committee is next in Sydney an inspection should be made of the new *Sydney Morning Herald* building, the ground floor of which is of axed trachyte. I consider that work preferable to that on the new Commercial Bank or the Commonwealth Bank in Sydney, where polished trachyte is used which costs a great deal more. Free-stone would be cheaper than granite. The oldest buildings in Sydney constructed of free-stone are approaching 150 years of age, and an inspection of these will show a sad state of decay. I cannot, however, say whether deterioration at Canberra would be so rapid, as the sulphurous and other gases in the air will not be so prevalent as in the big cities. Even if free-stone lasted for hundreds of years there would be great difficulty of matching the colour when subsequent construction was undertaken. I have seen no evidence of sand-stone being put into a building, a great portion of which has not decayed in a hundred years. If I were constructing the proposed building I would have a reinforced concrete frame filled in with brick, and faced with granite, trachyte, Fairy Meadow limestone, terra cotta, or synthetic granite, whichever I considered preferable after making fullest possible investigations. The columns should be of concrete and faced with the same material as the walls. The floors should be of concrete covered with jarrah blocks laid in bitumen, as linoleum would then be unnecessary and the floors silent and warm, and in keeping with the architecture. In some of the corridors and staircases it may be advisable to utilize a little Australian marble paving.

83. *To Mr. Lacey.*—The Fairy Meadow stone has never been used in building construction. The synthetic stone I mentioned is used only above the ground floor.

(Taken at Canberra.)

FRIDAY, 16TH APRIL, 1926.

Present:

Mr. MACKAY, Chairman;

Senator Barnes

Mr. Cook

Mr. Gregory

Mr. Lacey

Mr. McGrath

Mr. Seabrook.

John Henry Butters, Chairman, Federal Capital Commission, sworn and examined.

84. *To the Chairman.*—When I gave evidence before the Committee in June last, I expressed some doubt as to the foundations on the south-east corner of the proposed monumental administrative office. The matter has not since been investigated. We thought that, unless there was a strong reason to the contrary, we should not start on this building until the vote was approved by Parliament. In any case, we know that we can get a satisfactory foundation. It is only a question of what the cost might be. The architect, Mr. Jones, has not made a recommendation to the Commission as to the material to be used for the base of the structure. As a matter of fact, he has not been formally commissioned, and he cannot be until the vote is approved by Parliament. I suppose that he is really working on hope, carrying on his duties connected with the competition for the design. The Commission have been making fairly exhaustive inquiries into all possible building stones for use in the monumental buildings of Canberra, but we are not yet in a position to make a recommendation. Our minds have been fully occupied in other directions during the last twelve months and, not knowing the intent of the Public Works Committee, we have not regarded a decision as to the facing stone of the administrative office as a matter of urgency. The question has been somewhat side-tracked, because we thought we would have a reasonable amount of time to take it in hand. But when we learnt that the Committee was immediately interested in this question of building stone, we expedited our investigations. We knew all about the reports that had been obtained prior to our coming into existence, but we found that there was nothing in them to give us a definite line to indicate that building stone of a certain quality could be obtained from a particular quarry at a certain cost, or that any particular stone had satisfactory weathering qualities. That was the information we had to obtain. We proceeded to engage a consulting quarrying expert. He has been out to Tharwa to make a preliminary investigation, which is not very satisfactory from a building-stone point of view. However, when we get a little more opening-up work done at Tharwa, the question of the quality of the stone there ought to be definitely settled for all time. For the moment the expert's report is not conclusive. The quarry is not sufficiently opened up. We do not find the Michelago marbles at all satisfactory for outside work. They are satisfactory for internal work, but we do not like the economics of them. That point is being further investigated, because we think that we can get a cheaper and equally satisfactory marble at Fairy Meadow, where there is a most excellent limestone deposit. We have had small samples brought in, and we are getting estimates prepared for the necessary equipment to produce building stone there, so that we can ascertain exactly what it will cost delivered at Canberra. We have had preliminary prices and samples supplied from all the other quarries in New South Wales. Of course, every one knows that freestone is one of the cheapest media for facing a building, but we are a little in doubt as to whether the freestone available will stand up to the climate at Canberra. In order to settle that point, we have had a sample block placed on an exposed hill, where it will remain during the winter. It will be carefully watched and gauged to see whether it will show any appreciable

weathering. We think it will be a sufficient test to tell us whether there will be any serious weathering, which would be a disadvantage from a public building stand-point. We are also investigating the possibility of using artificial stone, made up of granite chips. Very beautiful stone can be made from these chips, and as Tharwa is only 8 miles away, the granite could be delivered in the city in a crushed form very economically. It might even be cheaper to crush it in the city itself. We have had experiments in the making of artificial stone carried out in Sydney, but so far they are not conclusive. We are now setting out on additional experiments to determine definitely the economics of that class of building material. It is a question of great importance to determine what stone should be used in the administrative buildings, because whatever is used will set a standard and tone with which all future buildings in the Government area will have to be blended. For that reason we are anxious to make no mistake in this case. The investigations will take up at least six months. It would be a disadvantage to the Commission if the report of the Public Works Committee was delayed until these investigations were completed. We want to be in a position to commission the architect definitely and go ahead with getting the plans ready and calling for tenders. We want to get on with our examination of the foundations. That is a work which should be undertaken before tenders can be called or the design finalized. I was hoping that the Committee would see its way to recommend that it should be left to the Commission to decide what facing material should be used in the building. We think that trachyte would be suitable for the base, but that granite would be preferable. Trachyte, although otherwise quite suitable, has a rather heavy and dull appearance, and from the tone point of view we think it would be better to use granite. We think that the columns should be of the same material as the base. We would leave it to the architect to say whether the columns should be square or circular, but we think that the main cornices, like the columns, should be of the same material as the base. We are strongly of opinion that terra cotta should not be used. We think that it would strike a wrong note in Canberra. Where there are several alternatives, we think that we should follow the recognized definite principle in building construction of using local material as near to its natural state as possible. I am aware that terra cotta is being made in Australia, but it is made at a point which is a long way from Canberra. When I speak of local materials, I mean those which can be obtained close at hand—as near as you can get them to the place where you are building. We are hopeful that either Tharwa or Fairy Meadow will provide us with the stone we want, and we shall exhaust every possibility before condemning those two localities. They have both been examined by Mr. Mahony, the Victorian Geologist. Terra cotta is an artificial material. When you look at a piece of terra cotta you see inequalities in the face which are bound to be reflected on a building. I have never yet seen a terra cotta building which did not look artificial. Stone gives a solid natural appearance which is not obtainable with any terra cotta I have seen. If the latter were used, I think it would give a ginger-bread effect, which would be a regrettable feature in our first semi-monumental building in Canberra. I would not go so far as to say that we have determined to recommend the use of either the Tharwa granite or the Fairy Meadow limestone. We have still to consider the economics. If freestone should prove to be satisfactory from a weathering point of view, the economics might force us to make use of it between the granite base and the copings. We are totally opposed to the use of terra cotta. The only alternatives we have considered are trachyte, granite, Fairy Meadow limestone, artificial stone made from chips of Tharwa granite or Fairy Meadow stone, and freestone. I do

not think any error will be made if the building is built the full size as planned. Judging by my experience of the requirements of the Departments, I have not the slightest doubt that the space indicated to be required by them will be exceeded within five years, so that we cannot go wrong if we provide the full space as designed. When I previously gave evidence, I said that there seemed to be rather more provision for dining purposes than was likely to be required, but, if it is found that the diningroom accommodation is excessive, the excess is sure to be utilized for offices. Therefore, I would not recommend any further curtailment of the space provided on the plan. I do not imagine that there will be any shortage of bricks, because we are duplicating the brick works now, but if bricks are used in this building it will probably take an additional year to build it.

85. *To Mr. Gregory.*—I think that the building should be a concrete frame structure. There would not be the slightest danger of cracking or collapsing in a concrete building of this size. That would all be provided against in the design. You can design in concrete anything that can be designed in steel or any other material. The foundations of this building should be of concrete. I would not do anything to jeopardize its appearance. If we found that local materials would not give the architectural effect necessary, I would not use them, but I see no reason why they should not. I agree with Mr. Murdoch that here we should refrain as far as possible from the use of dull heavy stone, and have our buildings of a light appearance. For that reason I prefer granite to trachyte. The Fairy Meadow limestone will have a light appearance. As a matter of fact, it may be too light. It lightens in weathering. We have to see to what extent it does so, but I do not think it will be too light to use. In fact, I think it will be quite a satisfactory building stone. A piece of the stone has been chiselled to-day to show to the Committee. In regard to my suggestion that it be left to the Commission to decide what facing stone should be used, if there was any doubt in our mind that our decision might not be acceptable, we should get the opinions of architects and sculptors. It is just a question of whether the responsibility of coming to a determination upon what the future stonework of the city should be should be left to the Commission or some other body. The Commission should either be allowed to determine the matter, with the assistance and advice of others, or some other body on which the Commission was represented might be set up to determine it. Mr. Jones, the successful architect in the competition for the design, will be an officer of the Commission, and we should not go against his advice except for some very serious reason. And, if we did so, we should certainly give a very full report to the Government, and it would probably be a matter for Parliament itself. I do not like terra cotta. The artificial granite to which I have referred has no similarity to terra cotta. Artificial granite is made by crushing granite and making it into the form of a concrete. Its appearance is such that 99 people out of 100 cannot tell it from the natural stone, and there is no kiln effect in it, which gives terra cotta its distorted form. It is cast in blocks. The fine granite is mixed with cement and subjected to hydraulic pressure. It is made of a harder natural material than terra cotta, and has not that irregular appearance that terra cotta has. There are inequalities and imperfections in terra cotta which are unavoidable, and which are even seen in imported terra cotta. I am afraid it will be some time before the Australian manufacturer can reach the perfection of the terra cotta manufacturer of the Old Country. I do not know of any building in Australia where artificial granite has been used, but I have seen one or two large buildings in America and England on which it has been used. I think that freestone will give an everlasting life, but I want to prove it, and to remove all doubt by exposing it to a winter's test, as I have already suggested. Even if it would have life of a

couple of hundred years, I should have to give due weight to the question of cost. It will be very much cheaper to use freestone here than granite or limestone. The use of a freestone facing with a granite base and granite columns would satisfy me from an aesthetic point of view. The heavy frosts experienced here would not cause the freestone to crack, but I want to satisfy myself that they would not disintegrate the surface. I think that a test for twelve months would give a sufficient idea of the effect of the climate on the freestone block I have selected for the test. The most likely effect on the stone would be from moisture getting into the outside skin and then being frozen by the frosts. This action, combined with the wind, might start a fretting of the surface. I think that in one year we can get a very good indication of the effect of the climate on this class of stone. But, even if the freestone were suitable for this district and would give an efficient life, I would not say now that I would prefer it to natural or artificial granite. I would first need to examine the cost of the one as compared with that of the other. Mr. Mahony is an expert petrologist. He was adviser to the Government prior to the appointment of the Commission, and he has continued to act in the same capacity since the appointment of the Commission. He is our adviser on the petrology and geology of the Federal Territory. I have great confidence in him. He says that there is any quantity of granite at Tharwa. But its appearance is the trouble. Its economics are also bad from a building-stone point of view. The faces already exposed are too much striped. To get a uniform crystalline black and white granite effect we should have to discard about 75 per cent. of the material, which puts the cost of it very high. The rejected material would not be of sufficient character to be useful as a building stone. However, they have not gone down very far yet. I think the deposit would have to be worked on the cliff principle. It goes down by seams and layers. We are not yet satisfied that we have exhausted its possibilities, and are having other faces opened up to see if there are bigger veins of the darker material available. At Fairy Meadow there are the usual veins you get with limestone, but until we open it up we cannot say definitely how it will develop. We propose to tunnel into it in the right method. The level of the administrative building has been reduced below the level shown on Mr. Griffin's plan, but that will not affect the ultimate plan when the whole scheme of Government buildings is completed. My inclinations are against a circular end on the building, because it will mean extra cost combined with less efficient floor space, but the apse is such an important architectural feature that I think in such a matter I should be guided by the architect. In regard to having a dome, I should certainly advise making provision for some central feature, but I would not recommend having a dome at the present time. Every consideration has been given in the plans to getting rid of rubbish quickly. At present the drawings are only in sketch form. The detail has not yet been dealt with. The whole of the plans will have to be approved by the Commission before tenders are called for, and the Committee can rely on the Commission making every provision for bringing services into the building without breaking us up. I refer to water conduits, drainage pipes, and so on. We shall not have to tear up a road every time a service has to be given. Before we build a road we leave tunnels underneath so that everything can be brought into the proposed building through one of these tunnels. Sprinklers would be very unsightly in this building. I do not think the risk of fire will be very considerable. Watchmen and caretakers will be employed. The greatest danger will be from a person throwing a lighted cigarette butt into a waste-paper basket. There is a new system which raises a fire alarm when the heat in a building reaches a certain temperature. I think that really good fireproof doors will be needed for the strongrooms where papers are kept, but as the floors will be of concrete the risk from

fire will not be very great. I do not know what Mr. Jones had in his mind when he estimated that the strongroom fireproof doors would cost £110 each, but I agree with him that for the strongroom you would need really recognized strongroom doors, although they might be made of a little cheaper type. It is very rarely that any one wants to burgle a safe containing Government papers. Of course, something special would be needed in the Treasury.

86. *To Mr. Cook.*—I would not use local material irrespective of its cost. Its cost might put local material right out of question. By local material I mean the nearest economical material obtainable close to Canberra. One of the ideals of building construction is to use all the materials available and to hand, but against that you have to study the architectural effect to be achieved. That might not be obtainable at an economic price from the materials right alongside, and you may have to go further afield. A local material which is faulty is not suitable for use in a monumental building. I would not favour the cheaper material against the better irrespective of price. It is rather a sweeping thing to say that nothing but the best that can be obtained in Australia should be put into this building. You have first to take into consideration what the difference in cost is likely to be. We are not worrying about the weathering properties of the local granite or limestone; it is the freestone, or sandstone, we need to understand. There is no doubt about the weathering qualities of trachyte granite or limestone. The only doubt that we have is in regard to how freestone will weather here. It is still a matter of doubt with us whether we have in the Territory itself a stone which will give satisfaction. We are quite satisfied that the Tharwa granite cannot be obtained in suitable sizes and blocks to justify the quarry being opened up. We also know that the limestone at Fairy Meadow gives every indication of its being possible to get a quite satisfactory building stone there, but that has still to be definitely proved. I have not had any porphyry brought under my notice that would be good for our purpose. We have not made any tests to ascertain to what depth we are likely to go for a foundation, but the main sewer which is running close by is a fairly good guide to us. We know enough to prove that a foundation can be obtained. In this regard also we are studying the economics. The shafts we put down must be where they can be used as portion of the excavations in the final structure. At the same time, they are necessary to make absolutely certain what the cost of and the design for the foundations will be. The foundations at the provisional Parliament House would not be good enough for a monumental building. Most of the brickwork at the provisional Parliament House was up before the Commission was appointed. I think that we shall have to get down to a depth of from 15 feet to 25 feet to get a foundation for the administrative office. That is a greater depth than at Parliament House. I would not favour making provision for extra accommodation in the administrative office. What is proposed will fit the proposition excellently. We shall have to start a second building to balance this one as soon as it becomes inadequate, bearing in mind that as soon as there is justification for even starting a reasonable proportion of the second building the National Library will move into it. The present accommodation for that library is only temporary, the idea being that ultimately the building it occupies will be turned into members' rooms. I do not need experts to tell me that artificial stone is a suitable material. I have seen it used in one of the most monumental buildings of New York. A layman, looking at it from below, would not know that it was artificial stone. I do not know what the difference in price would be between it and real stone. That is one of the points we are investigating. Artificial stone has one big advantage, that it could be made in slabs 3 inches or 4 inches thick for facing work, whereas slabs of natural stone would need to be at least double

that thickness. It ought to be distinctly cheaper than natural stone, because its making should not involve very much skilled labour, whereas on a monumental masonry work of this type skilled labour will be a big trouble. Artificial stone, while equally as strong as natural stone, has better weathering qualities than many building stones. All the materials are available in the Territory for making it.

87. *To Mr. Seabrook.*—It would not be an unusual depth for a big building to have to sink 25 feet for a foundation. I do not think there is the slightest doubt that the indications we get from the sewer shafts are absolutely reliable. The whole of the country is of the same material. We know that we will get rock of some sort, but if we do not get really good rock we shall have to spread the foundations out. There are plenty of ways of treating foundations. We shall get rock of some sort, depending on the depth to which we have to go, and it will be certainly close enough to the surface to avoid piling. I would hate having to pile on a job like that. Piles are used only when there is no economic alternative. If the freestone proves to be suitable to the climatic conditions after the test to which I am submitting it, I am divided between that and artificial stone. For that reason I should like to get samples of the artificial stone made to study it, to consult architects, and to argue about it before coming finally to a conclusion. I should say that a freestone facing would require to be at least 6 inches thick, but that is more a matter for the architect to determine. Tasmanian freestone is as good as any other, but the Commission has not asked for quotations for freestone from any place outside New South Wales. The cost of transport would rule out stone from any other State. I do not know that any saving would be achieved by having the stone dressed in Tasmania. Any saving that might be effected in that way would be counterbalanced by the necessity for careful packing. The base of the building and the columns and copings could be of granite with freestone in between. Geologically the structure of the Tasmanian freestone is the same as the New South Wales freestone, and the same problems would have to be met by the Tasmanian stone as are met by the New South Wales stone. I refer to the effect of the climate. The climate at Canberra is more severe on freestone than the Tasmanian climate. The fact that 75 per cent. of the Tharwa granite would be practically waste would be sufficient to rule that granite out as a suitable building stone for the administrative office. It would increase the cost of building to so great an extent that the Commission could not avoid refusing it. But not much of that granite has been quarried yet. I would rather build the administrative office to the full extent proposed than entertain the possibility of having to proceed at once with a second building. The floors will be all concrete, an important factor in fire prevention. I do not know what the architect proposes in regard to the woodwork, but I should think that the joinery would be representative of the woods throughout Australia. I think it is essential that that should be done in a building of this character. There will be a flat roof, but I do not know what the architect proposes to cover it with. The Commission's view is that it should be covered with asphalt.

88. *To Mr. Lacey.*—There are no buildings of freestone in this district. There are plenty in Sydney, and probably in towns a little lower down than Sydney. It is better for us to test the freestone here. We get heavy frosts and high winds in the winter, and rains which get into the outer layer of the stone, possibly causing disruption.

89. *To the Chairman.*—Our experiments on artificial granite would probably take a few months. Before you reach finality you have to get a certain amount of trial and error. There are various degrees of crushing

to make artificial stone from almost powder to various sized screened material. Furthermore, the blocks when made have to be compared from the point of view of appearance. We are anxious to make these experiments exhaustive. I think one winters' exposure will be a quite sufficient test to give the Commission an indication of how the freestone will stand the climate here. We have in the Commission itself and at its disposal experts in this class of thing and line of thought, and we know that if a piece of freestone with an absolutely perfect and smooth face has still at the end of the winter an absolutely perfect and smooth face, and has not started any flouing effect, we shall be satisfied that there is no fretting due to frost action. On the other hand, if we find that there has been a fairly serious lifting of the skin, we can measure the degree of attrition. At the end of the winter it will be either perfect or showing a measurable degree of attrition. We get sufficient rain each winter to give the piece of stone a proper test from the moisture standpoint. A freestone facing would cost less than a terra cotta facing. I do not think that granite would be very much more expensive than terra cotta.

90. *To Mr. Gregory.*—It is true that you can get one piece of freestone that will stand for all ages and another piece that will fret very badly in a short period, but you overcome that by your inspection. When you find that a sample is right, you take precautions to see that it is repeated. If the consistency is exactly the same, and if the stone is obtained from the same bed and under the same conditions, the chances of getting a uniform quality are excellent. We overcome the danger of freestone going at the wind and water line by not using it at that line. The surface of freestone can be treated to make it a very pleasing colour. My observations of freestone lead me to say that where an isolated piece has started to fret it is an immature piece of stone as compared with the rest of the bed. Where the stone is of the same standard geologically, its weathering qualities are fairly uniform. We have porphyry at Black Mountain, but it is not the class of material one would use on a building like this. It is too heavily coloured for this class of work. I agree with the architect that we should use some Australian marble in the corridors and in the staircases. Some of the Michelago marble will probably be found to be suitable for that purpose, but I doubt if it would pay to polish it. There are excellent marbles obtainable in Australia, but one of the troubles is that we cannot get it as regular as we can in Italy. I think that Buchan marble would be suitable.

(*The witness withdrew.*)

Arthur Francis Pope, registered quarry manager, sworn and examined.

91. *To the Chairman.*—I have had 20 years' experience in quarrying hardstone in New South Wales. I have merely passed through other States. The Federal Government asked me to report on the quarrying possibilities of the granite deposit at Tharwa. I was not asked to do more than look at the limestone deposits at Fairy Meadow. I have made a hobby of the study of stone for building purposes. I have seen whatever stone was available in any place I have visited; I have collected samples, and I have studied stones in general, particularly granite and trachyte. I have served my time as a stone-mason, and have worked a little sandstone in my time. The life of sandstone depends upon the quarry from which it is obtained. There are some quarries with good sandstone; others have inferior stone. I would not compare good sandstone with hard stone, but good sandstone is classed as a good building stone. My general experience is that in nearly every quarry you will find good and bad stone. For the purpose of this building, where a large quantity of freestone would be required, there would not be any possibility of the sandstone widely differing in quality

and making the building unsightly. There is also a variation in the output of hard stone quarries, but it is not so important as it is in the case of sandstone, because there is always a certain amount of hardness, and you always get a stone that will take the stress. I have had no experience of limestone for building purposes. I inspected the Fairy Meadow deposit today. There are several tunnels driven into the hills. They run in, in some cases, as far as 200 feet. We went through every tunnel, and the limestone showed uniformity of colour right through, but whether you would get that stone thoroughly solid I do not think any man could say, until a fresh trial is made from the outside and a face stripped down. All the tunnels have been shot with gaignite, leaving bad fractures. No one can tell how the stone will open up until a fair test is made from an outside face. There are certain fissures running through which are an advantage in quarrying, because you have always backs to work through. It is in a solid mass, but as for its suitability for building purposes, I do not think that any man can say until a fair trial has been made. It is twelve years since the tunnels were driven, and the stone shows a good wearing quality and a hard surface. The limestone samples available have been taken from the interior of the tunnels. Until I have seen a piece done in a proper manner I cannot say whether it is likely to look well when chiselled or polished. Whether the axing will remain I cannot say. A geologist would probably decide that point. You get a certain amount of stunning on the face when you mark it with an axe, and it is for a geologist to say how it would stand up. I inspected the granite deposit at Tharwa. There is a large deposit there. I do not say it is suitable as a building stone. If the colour is any detriment, it is not very uniform. Practically every boulder we examined showed a different colour. I am not sure whether I am correct or not, but it shows a copper spot, like a mineral spot. If it is a mineral spot it will run as soon as it gets the weather on it. I have seen this happen in grey granite. When it runs it leaves a streak down the face. This, again, is a matter for the geologist to determine. He can say whether the brown spot in this stone is a mineral spot. If it is, it condemns it as a facing stone used in large blocks. Surface stone is generally defective. I do not think any one can say what the limestone deposit will turn out to be until a face is cleaned down. My impression of the granite at Tharwa is not too favorable. There are a lot of white bands running through it. If a quarry were opened up with white bands and markings throughout, there would be at least 40 per cent. of waste, and then you would not have what I should call a first-class granite.

92. *To Mr. Lacey.*—At Gosford, Harrison and Company have a quarry. They are in liquidation at the present time. The Hawkesbury Sandstone Company are supposed to have very good sandstone. They are in the Gosford district, and they are supplying a lot of it to Melbourne. Sandstone and freestone are the same. I suppose the proper name would be freestone, but the term sandstone covers a multitude of stones. Hard and soft sandstone can be obtained out of the one quarry. You can get out of the one quarry sandstone that will wear well, and stone that will fret very much. A good quarryman, or a good clerk of works, could tell inferior stone. Any man accustomed to sandstone could do it, and I could do it in regard to granite or trachyte.

93. *To Mr. Seabrook.*—It is claimed that sandstone hardens when exposed to the weather. It is also claimed that planing machines have a tendency to fret the face of sandstone. All the stone used in St. Mary's Cathedral, Sydney, has to be hand-worked. They will not allow the use of machines on exposed faces.

94. *To Mr. Cook.*—I am well acquainted with Harcourt granite. I suppose there are better granites in

small deposits, but it is classed as the best building granite in Victoria. The only objectionable features in it are the black patches that occur at times. It is hard to get a perfect stone in large quantities. The only really perfect or nearly perfect granite deposit I know of is at Marulan, near Goulburn. It is used largely for monumental purposes, but it could not supply enough for building purposes. There is a large deposit at Gunning. Granite is termed the Rock of Ages; it lasts for all time. There are white bands 3 feet to 4 feet wide running through the Tharwa granite. When you have these bands running each way, it is hard to get a big clean block. The biggest deposit of suitable clean granite nearest to Canberra is at Gunning, on the southern line.

95. *To Mr. McGrath.*—I have not been to Harcourt, but I know it is supposed to be the best granite quarry in Australia. When my firm opened up at Gunning, architects who had specified the use of Harcourt granite in two contracts accepted Gunning granite from us.

96. *To Senator Barnes.*—The freestone for St. Mary's Cathedral, Sydney, is obtained at Pyrmont.

(Taken at Sydney.)

MONDAY, 19TH APRIL, 1926.

Present:

Mr. MACKAY, Chairman;	
Senator Barnes	Mr. Lacey
Senator Reid	Mr. McGrath
Mr. Cook	Mr. Seabrook.
Mr. Gregory	

Sir Charles Rosenthal, Member of the New South Wales Institute of Architects, and President of the Federal Council of the Australian Institutes of Architects, sworn and examined.

97. *To the Chairman.*—Mr. Jones's design for the administrative offices at Canberra has not been referred to the New South Wales Institute of Architects for an opinion, but members of the Institute have expressed themselves in very favorable terms in regard to it. Without having a contour plan before me, and without knowing what sites are available for future buildings, I take it that the decision to build the administrative buildings on the 1,860-ft. level, instead of on the 1,870-ft. level, will affect the whole of the proposed group, and so long as it does so I cannot see any disadvantage in choosing the lower level. I do not know what reasons actuated the choice of either level. I think this building should be of a monumental type second only to the ultimate Houses of Parliament. The question of cost must enter into consideration in deciding what material should be used for the external covering of the building, but not to such a degree as to mean the use of a material which, over a long period of years, would not prove to be the best. Bearing in mind the difficulties of building at Canberra, and from the point of view of the supply of material, it certainly looks as if granite and trachyte from New South Wales should be the two materials mostly used. I do not know if there is any feeling on the part of the Government that materials from every State should be used in this building, as a matter of sentiment, but if that were the case there is no more suitable Victorian material than Stawell freestone. The Parliament House in Melbourne is built of it. On the other hand, if there is a desire to make use of materials reasonably accessible and available, the Commission will be bound by Sydney freestone, Bowral trachyte, Bundanoon sandstone—a beautiful stone, but more suitable because of closeness of grain for interior work than for exterior work—and granite, from the neighbourhood of Gunning or Tharwa, of which there are inexhaustible sup-

plies. I know the Bundanoon district well, and it is questionable whether the deposits there are big enough to ensure a sufficient supply of material for other Federal buildings. I do not want to see a building of this kind with various kinds of material used in the superstructure. Only two materials should be used, one for the base and one for the superstructure, and I suggest trachyte from Bowral for the base, and local granite for the superstructure. The local granite is at Tharwa, a little distance to the south of Canberra. There is also granite at Gunning, about 60 miles to the north. The deposits there are large enough to meet all the requirements of this building and others. In most quarries the stone nearest the surface is usually the least suitable. Not until a good face is opened up can the best stone be obtained. I am not partial to any artificial facing, whether it be terra cotta or artificial stone. My suggestion is that rock-faced granite or fine-axed trachyte should be used for the base and granite for the superstructure. If portions of the superstructure, such as columns, are of polished granite, it could be obtained from Victoria or elsewhere, where there are deposits of granite of first-class quality. If the building is faced in granite the columns must necessarily be of granite. In fact, I should do the whole thing in granite. If a fine medium character granite is used the other varieties of stone introduced would tend to break up the general uniformity of treatment. The base is different. It will give a setting to the whole building. Bowral trachyte, when polished, is very effective, but experience in Sydney has shown that where it has to bear pressure there is always liability to fracture. If polished trachyte were used in the columns it would be necessary to have a core of reinforced concrete to carry the load, and a facing only of trachyte. I have seen synthetic granite, but I do not think a building of this kind should be a sham. Because of its flexibility reinforced concrete should be used in the interior, but Mr. Jones can well advise you whether it should be structural steel or reinforced framework. I should say that it would be difficult to get a suitable surface on the limestone from Fairy Meadow for facing work, but it appears to have possibilities. The whole of the building should not be fine-axed; it would be too expensive to do that; but if you did not fine-axe the Fairy Meadow limestone you would have large veins showing through it, which would detract from the general body. I should say that granite is the right thing for the facing. If I were the architect of the building I would strenuously oppose the use of terra cotta. If the Commonwealth Government is to set the pace by using terra cotta in a building of this kind, it will augur ill for the future treatment of Canberra as a whole. I think Stawell stone would be suitable for the future Parliament House. The present Federal Parliament House, in which it is used, is the most beautiful in Melbourne. The stone is comparatively easy to work when it is green, and it becomes very hard with exposure to the atmosphere. Unfortunately, Stawell is some distance inland, and there would be heavy freights to pay if Stawell stone were used. Sydney freestone is probably economically the best that could be got for Canberra. Its weathering properties can be traced. When the Union Bank in Sydney was redesigned and more or less remodelled fifteen years ago, the old structure was left intact with the exception that the top story was removed and the height of the building increased. It was found that the building was in an excellent state of repair, although it was twenty years old. It all depends upon how the stone is quarried in relation to its natural bed. Against the frosts in Canberra are the atmospheric conditions brought about by the smoke of a large city. I do not think the sea air has any severe influence on freestone. Tests of one, two, or three seasons are not very convincing. In some stone veins are noticeable running at an angle, showing that it has been quarried off its

natural bed. Under such circumstances, the stone is liable to flake off when exposed to rain, frosts, &c. The only real substantial test is that of time. Sydney offers the best illustration of the lasting capabilities of freestone. It has been used in Sydney for 50 or 60 years. If a quarry could be opened up at Goulburn of sufficient extent and quality to justify the Commonwealth Government using it in this building, it could be used in other buildings, and the requisite plant for dressing it could be installed there. It would not be a question of polishing it. It would simply be a question of giving it a fine-axed finish. Some of that work is now done at Bowral. If the columns were to be turned out of local granite it would probably have to be sent to Sydney to be treated; that would make it very expensive. But as the granite is reasonably accessible to Canberra it is a question of whether the cost would compare with the use of any other stone. Probably a better granite can be obtained for the columns at Tilba Tilba, on the New South Wales coast. It could be sent by boat to Sydney and treated there. The same coloured granite can be used on a building, although the granite need not necessarily come from the same quarry. I think that the columns should be round. If the frosts and the cold are to affect the building, they will have a more deleterious effect on square columns than on round. One would, I think, prefer a circular column, but a treatment which sometimes embraces a half-square column against the wall with a circular column next to it is very helpful from an architectural point of view. While the apsidal end might look symmetrical on the plan, it might not harmonize with the lay-out of streets or plantations. I like the effective stability given by a square angle. However, the apse in the centre is effective. The small apse appeals to me. It will give a pleasing effect, while not losing the effect gained by the square return. I do not think there is the slightest necessity for installing sprinklers. I take it that all shelving and material of that kind will be of steel, or marble slabs. There will be so little woodwork in the building that the danger of fire must be localized. A system of mains and hydrants should be installed through the building; they could be suitably concealed.

98. *To Mr. Gregory.*—I prefer a solid building of granite. By that I mean a steel structure reinforced, and granite facings. It will not be a high building, and there is no reason why the whole of the internal work should not be done in brick, except that it would take up much more room than steel construction. Steel frame construction will hold its own irrespective of what may be said about reinforced concrete as we know it to-day. We have very definite data concerning the one; the data in regard to the other has yet to be established. Provided the foundations of the building are adequate, there should be no question about its stability. There are innumerable cases in America where buildings going right up into the sky and weighing hundreds of thousands of tons are reinforced. I would recommend steel frame construction. I have not inspected the Tharwa granite. If it is inferior, the same remark may be applied to Sydney freestone if the top layers are considered. It is possible that the stone on which Tharwa is judged is taken from boulders. When a proper face is obtained it may prove to be of good quality. If trachyte is used for the base, a judicious blending of rock-faced stone with fine-axed should give the best results. Trachyte in its natural form is somewhat dark. It is lighter than Melbourne bluestone, but is too sombre for a main building, although perfectly good for a base. If fine-axed it comes to a lighter general colour, and if polished it is a beautiful green. For base work I think it is admirable. I should say that the cost of quarrying Bowral trachyte or Harcourt granite would be very much the same, but the railway freight would be higher in the case of the Harcourt granite. Tilba Tilba

granite is a magnificent deposit, but it would be necessary to ship it to Sydney and transport it by rail to Canberra. Unfortunately, any experiments made in erecting a small building to test the lasting qualities of stone at Canberra would be of little value so far as the administrative office is concerned. The use of new material in Australia could only be thoroughly tested by time. Artificially you could induce frost and thawing conditions which would give you some idea of the insidious effect of frost after frost, winter after winter. I should say that the Fairy Meadow stone, a sample of which has just been shown to me, would not take the crushing strain which more regularly laminated stones will take. Furthermore, I think the face would have a tendency to fly off. It is now usual to treat face work as a veneer; solid stone is not used throughout. The facing blocks are from 6 inches to 8 inches thick. If the columns are not too large they can be built up in sections, but if they are very large a core of concrete and steel may be used and faced. Red granite is obtained from Gabo Island. It is a beautiful stone. A polished base, with fine-axed work above, would give a most beautiful effect. There are unlimited supplies of this class of granite at Gabo. Recently I built a small war memorial at Randwick of red granite from Uralla. It was fine-axed, and gave a most beautiful effect. It is not a pronounced red, but is rather light in colour. It is questionable, however, whether it would pay to bring it from Uralla. Terra cotta has been used effectively in England, America, and elsewhere, but for a building of this kind it should not be used. The Commonwealth should be prepared to face a sufficient expenditure to ensure the use of stone. Terra cotta makes a most beautiful finish, but I do not think it should be used by the Government in a monumental building of this kind. The only way in which this building can be correctly estimated at its true value is in relation to other big buildings yet to be erected. As a matter of fact, it would have been better to have a competition for the whole of them simultaneously. Therefore, it is hard to say what should be the treatment of this building, when one remembers that behind it is the hill on which the Capitol—the most dominating building in the city—will be erected. I think that a dome on the administrative office would detract from the ultimate skyline of the city. But provision could be made, if necessary, to put up a dome later on. I do not recommend that it should be done. The dome suggested would be inadequate for a building of this size. Whatever is done in that direction should be something which is led up to from every side and affording extra accommodation. It should not be a purely ornamental excrescence, having no value except as affecting the architectural appearance. If anything is done to alter the skyline, it should be by a re-adjustment of the plan admitting of another story, or part of a story, going on. The building of a dome would appear to be an afterthought. It would look as if it were something that was not in the original scheme. At the back of my mind is the fear that something may be done to this building to ultimately detract from Parliament House.

99. *To Senator Barnes.*—I do not know anything about Coraline stone at Mt. Gambier.

100. *To Senator Reid.*—I have no data to guide me as to how Sydney freestone will stand the climate at Canberra. We do not get serious frost here, but we get cold westerly winds. But whether Sydney freestone would or would not stand the climate, I would not recommend it for Canberra. I do not think the colour is suitable. I suggest the use of local trachyte or granite, bearing in mind the consideration of cost and the fact that they are suitable from the point of view of colour and material. I should be just as happy to use Stawell stone on a trachyte or granite base. I know that the idea is to have Canberra a light city so far as its buildings are concerned. If trachyte were

used for the whole of this building it would not be sufficiently light, but as a base it would give the effect of solidity and strength to the whole structure. Fine, axed granite would be good enough, but I think there will be too much white at Canberra even after the plantations reach maturity. A dull white superstructure on a dark base would be the best for this structure. Terra cotta itself is satisfactory, but it should not be used in a building of this kind. There is no reason why the Capitol should be of the same material as is used in the administrative office, but the second administrative office would need to conform with the first in treatment, stone, and material. I would not concede that the other buildings would need to be on similar lines. If Stawell stone can be shown to be practicable for the Capitol it should be used, letting it stand out over the other buildings below which it will dominate. It is not right to imagine that I have no objection to the use of a variety of stones in the Government group of buildings. I would not like to use granite in the administrative office and Victorian bluestone in the Capitol, or some other building. I would use Bundanoon stone, but not Sydney freestone. I would use the red granite from Uralla. All these granites vary in colour, but the variation is not such as to make an objectionable distinction. On the contrary, the use of various varieties of granite in different buildings would enhance the different types. At the same time, the general effect of all would be a white, whether a grey, a red granite, or Stawell freestone was used. As the fine-axing of the front would be done perpendicularly, the possibility of dust finding a harbour on it would not arise. I would favour a building of steel and concrete faced with granite and trachyte. It would be simpler, more flexible, and generally a better way of treating it. I would use steel frame construction as against reinforced construction. I am old-fashioned enough to still think that steel-frame construction is one that should be applied to a building of this kind. That style, of course, provides for reinforcing the floor under a modern system. The steel frame is clothed in concrete, and it can be made any shape one likes to bond with the brick work or stone work. I would have no objection to the use of brick for the internal work in this building. As it is not more than four stories high, it should not involve a great thickness of walls. But it will be more extravagant, from the point of view of space lost, to use bricks, although the fact that excellent bricks can be obtained at Canberra should cheapen the cost of construction. My preference is for a granite superstructure on a trachyte base.

101. *To Mr. Cook.*—I do not think that cost should be a secondary consideration. I think the Commonwealth should lead the way in economical construction work. Commonwealth works should not be as Government work usually is, the most expensive. Stawell stone would have to be superior to other stone to be used at Canberra. If the local granite should prove upon thorough examination to be unsuitable, Stawell stone might be able to compete with granite from down the coast, or with other stone. I would not use anything but first-class granite. If local granite should prove after test to be not satisfactory enough, and the cost of Tilba Tilba granite from the coast would work out at more than the cost of Stawell stone, I should use the latter. The only test really worth while to apply to granite is the test of time. You can test a cube of granite, a cube of Stawell stone, or a cube of trachyte, and the chemist can tell you the constituent parts of each of them, and how they are likely to be affected by weathering, but the only practical test is to see the stone in use in a building erected for 50 years. We have granite presumably of the same constituent parts which has been used at Goulburn and elsewhere for many long years. It is obvious that if the granite deposits near Canberra are thoroughly opened up a good quality of

stone may be obtained, particularly if the boulders when broken indicate that the rock below will be of first-class quality. Bowral is 80 miles from Sydney. The trachyte for the base of the building should be obtained there. The granite for the superstructure could be obtained at Tharwa to the south of Canberra, or at Gunning, about 60 miles to the north. In the latter case it would have to be carried over 100 miles of railway. If it is a matter of sentiment to make use of materials from every State, I do not think it should be indulged in to such an extent as would affect the outside appearance of this building. The first consideration should be the quality of the material. Wrapped up with that is, of course, the question of cost; but, other things being equal, local material should have preference. It would be possible to utilize the limestone deposit at Fairy Meadow, using dark stone for the base and light stone for the facing work on the superstructure. But it is questionable how far that stone will remain permanently white; it might go darker. I am afraid, however, that the general structure of the Fairy Meadow stone is hardly suitable for walling purposes. I should certainly say the deposit is worth while opening up. Any material suitable for building purposes in the Territory should be opened up at the earliest possible moment in order that it may be tested. Even if really suitable slabs could be obtained from the Fairy Meadow deposits, I would not use them in the administrative office construction. Granite and trachyte should be used in that building. This marble at Fairy Meadow probably cannot be quarried to give anything like regular blocks. It may have to be sawn, as in the Belgian quarries. I do not know how it would stand up to a crushing strain. That would be a matter for testing. In these days you can get in steel structural work all you want for partitions such as you can get in brick or any other material. At the same time you have the advantage that it is fireproof and occupies less room. I cannot at the moment compare the cost of steel with concrete or brick, but concrete would be the cheaper and simpler form to adopt. It takes up less space, and I think it can safely be said that it would be a great deal cheaper than steel. The plan is so designed that the building is carried on piers, and partitions can be put up just where desired. In that case, 4½-in. brick walls could be used; they can easily be removed. From my knowledge of the locality, the spot where this building is to be erected borders on alluvial land, and it will probably be found that when the ground is opened up it will be imperative to pile it. That will involve a very substantial expenditure. You cannot commence building until you get to a solid bottom, and if that bottom is so deep from the ground level as to necessitate an undue amount of brick or concrete work, it will probably be found cheaper to pile it and put down piers which will carry the whole weight. In buildings at Lismore, on the Richmond river, very satisfactory results have been obtained in alluvial ground after piling has been provided. The clothing of the proposed building is what the general public will see. Therefore the most important architectural feature is the treatment of the base and the outside of the superstructure. The interior finish will be more or less normal.

102. *To Mr. Lacey.*—In granite districts such as Goulburn or Bathurst, where the country generally is inclined to be poor, the granite is usually rotten or disintegrated. Boulders when broken up are found to be soft and inclined to crumble. The bigger boulders give a better granite than those which are merely offshoots from the main bed. It is reasonable to assume that when the hills at Tharwa and Gunning are further opened up granite of first quality will be obtained. The time to open up these deposits was fifteen years ago, but it should be done even now. Everything should be opened up with a view to getting data for

future buildings. To put a block of sandstone in an exposed position for twelve months would be of very little value as a test of its possibilities of deterioration. Artificially, conditions could be created to get a test equivalent to the action of the weather for 25 years. But I would rather pin my faith to a test of sandstone in a building which has stood the test of time in Sydney. The climatic conditions may not be as rigorous here as they are in Canberra, but we have atmospheric and chemical combinations which are not to be experienced at Canberra. The composition of granite is such that normally polishing is not effective. Axing is the treatment for granite. For the base of the structure, trachyte, polished in some cases, and in others rock finished, would be the most suitable. There is nothing finer in the world than our New South Wales trachyte if it is polished. For steps it could be polished on the rise and fine-axed on the tread. The best treatment for the base would be polished, fine-axed, and rock-faced trachyte. I would not suggest polishing the whole of it. I would polish only those portions it was desired to feature, such as the steps and the top of the base from which the granite rises. When fine-axed the trachyte is grey, and it remains grey. Limestone may go whiter, but granite retains its whiteness.

103. *To Mr. McGrath.*—I think that long before tenders are called for this building all the information obtainable about building stone in the neighbourhood of Canberra should be obtained. All that information could be obtained within two or three months, and I should certainly wait for it, but I would not waste time experimenting with a freestone for twelve months. I am certain I would not have terra cotta on my mind. Sydney sandstone is quite a suitable stone, but it is not the colour for Canberra. Harcourt granite is particularly good. The same can be said of Tilba Tilba and Gabo granite. The granite work at Goulburn has stood for many years. Leaving out the question of cost, and in an endeavour to get the best granite, I should recommend getting it from Tilba Tilba. Harcourt granite would be very expensive to work and forward to Canberra. Probably the best method would be to send it to Melbourne for transshipment to Sydney, whence it could be forwarded by rail to Canberra. Of course, if we had a uniform railway gauge it could go direct to Canberra. I should think that the granite facing would cost 50 per cent. more than a terra-cotta facing. If a foundation can be obtained at 25 feet I would not recommend piling; I would recommend pier work and inverted arches. If at 25 feet they get anything like the material they are getting out of the sewer tunnels, obviously the right thing to do would be to go down to it. If a first-class foundation can be obtained at 25 feet, piling will not be necessary. Across the bridge towards Ainslie an admirable foundation is obtainable, but on this side of the river it may be a different matter because of the alluvial formation.

104. *To Mr. Seabrook.*—Subject to tests proving that the stone is satisfactory, there will be enough granite in the Tharwa, Gunning, and Goulburn districts to build half a dozen Canberras. I do not think that steel framing would be more than 10 per cent. more costly than ordinary reinforced concrete. With reinforced concrete work as we know it to-day so much is necessary in the way of forms and casing, which in a building of this kind would run into a large sum. I do not think that steel framing is necessary for a building of four stories high, but we know where we are with a steel frame better than we do with reinforced work. So much unskilled labour is employed in the setting of concrete in reinforced work. If Bundanoon stone is used it will be cheaper than freestone from Stawell for facing work. If Sydney freestone is used it would be cheaper than Stawell stone, but it would probably be more costly than Bundanoon. I do not think that the limestone at Fairy Meadow could be effectively quarried after the

Australian style. I think we would need to follow the Belgian method, where large sections are sawn from the main face. There is no such thing as blasting there. The percentage of waste in granite depends on its qualities, but it is fairly large. The stones to be used on this building will be a big size. However, I would not like to pin myself down to the actual percentage of waste. The staircases and corridors could be lined with marble. The Australian marbles are quite effective, but experience has shown that until we get down to more consolidated levels the polish put on it does not stand. On the other hand, the polish on trachyte is everlasting, but trachyte would be too dark and sombre for inside treatment. Probably some style of terra cotta might be used. If it is decided to use freestone in this building it should be all freestone. There is nothing so destructive to repose in the architectural treatment of a public building as to find different materials used in the facade. The base is carrying out a specific purpose, but the superstructure should be all of the same material, whatever it is. I would not think of putting polished trachyte into a granite facing. I would not have polished granite on the face. The only polished stone I would have would be portions of the trachyte base.

105. *To Mr. Lacey.*—If it were decided to use freestone it would be very advantageous to have Stawell stone with a granite or trachyte base.

106. *To Mr. McGrath.*—I do not recommend Sydney freestone, because of its colour. I would recommend Stawell freestone if its cost would render it possible to use it.

107. *To the Chairman.*—It is questionable whether there are sufficient deposits at Bundanoon to justify this building to be built of that material. If it were the Capitol and there was enough stone, I should say the deposit is worthy of consideration. I urge at all times the use of a trachyte base and a granite superstructure.

108. *To Senator Reid.*—If it were decided to use freestone I would not favour having a freestone base. It would help the building immeasurably to have the base of some other class of stone, fine-axed trachyte, or granite. Either would be suitable. If Sydney stone is used it would hardly appear to be suitable to rest on fine-axed granite. It would be rather white in appearance. Trachyte, being dark, would be quite satisfactory as a base for the yellow Sydney stone.

109. *To Mr. McGrath.*—Leaving out all considerations of cost, I prefer Stawell stone to Sydney stone.

(Taken at Sydney.)

TUESDAY, 20th APRIL, 1926.

Present:

Mr. MACKAY, *Chairman*;

Senator Barnes	Mr. Lacey
Senator Reid	Mr. McGrath
Mr. Cook	Mr. Seabrook.
Mr. Gregory	

George Sydney Jones, Architect, sworn and examined.

110. *To the Chairman.*—The competition for a design for the first permanent administrative building at Canberra was confined to Australian architects, and was held in 1924, the award being made public in December of the same year. The problem was unusual, but very interesting to an architect. Briefly, it was required to design a building with accommodation for say eight (8) Departments of State on such a plan that any department would be architecturally, and with economy, quickly capable of being extended or reduced in floor area in accordance with the requirements of the department, at the same time ensuring that each department, when extended or reduced, would be self

contained and independent of other departments. In other words the plan has to be as elastic as possible, because it is not possible to foretell what floor area will be required by each department at any time. The points in the accepted design which may be considered important are:—

1. External light courts giving external light, sunlight and perflation of air to office spaces.
2. One essential corridor, and staircases, lifts and lavatory blocks concentrated at three points in its length—thus minimizing essential communication and economizing expenditures.
3. Subsidiary corridors within departments which may be used as corridors for their whole length or part of their length or alternatively may be absorbed as office space.
4. Steel staircases within departments, enclosed by grilles and lock gates at each floor which give access to upper and lower floors for extension of departments if required: for instance, extension of ground floor office accommodation to second floor, or lower floor to first floor, as may be required without interference with intervening floors. The plan, therefore, allows of reduction of departmental floor area horizontally and extension of departmental floor area either horizontally or vertically, or both, as desired, independently of other floors or associated with other floors, or if required, the whole of each floor by this arrangement can be used as a self-contained department.
5. The introduction of a mezzanine floor between part of ground floor and first floor—thereby increasing floor area. It is suggested that this may be used as the Ministerial floor.
6. Standardization of parts, ensuring economy in expenditure, but not uniformity or lifelessness in external appearance.
7. Unit of subdivision, 22 feet x 11 feet.

As to character of design and external appearance, this building, though large in size, is not monumental in the sense that Houses of Parliament should be monumental, nor symbolic of a nation's ideals, such as a National War Memorial should be. It is to be only a large utilitarian office building to house staffs that are at present occupying buildings for which more or less high rents are chargeable to the Commonwealth. It is thought, therefore, that simplicity, variety in mass, dignity, reasonable economy and a scale commensurate with the importance of the structure as one unit in the permanent official buildings of Canberra, might be made to express function and method of construction, and suggest something of that spirit of resourcefulness associated with British tradition which characterizes Australian thought to-day. The 1860 ground floor level as datum proposed is a departure from the previously suggested 1870 ground floor level. Neither the structure in any important particular nor its effect architecturally would be seriously affected. On the other hand by the adoption of 1860 as datum for ground floor level a great saving in cost in earthworks is effected; the advantages also include direct light and access to lower ground floor from at least three sides of the building. As there is abundant and good aggregate for concrete in the Federal Territory, it is suggested that the main structure should be built of reinforced concrete as being reasonably fireproof and homogeneous in character. The spaces between piers and beams where possible might be filled in with brick in cement. The interior it is suggested should be finished as follows:—Walls and ceilings, plain white plaster, except vestibule and essential corridors, ceilings of which might be slightly enriched and walls of essential corridors, staircases, lined with marble to height of say seven (7) or eight (8) feet. Floors of vestibules, essential corridors, staircases and lavatories might be paved with marble. Office spaces might be superfloored with suitable superflooring at say 15s. per square yard laid. Lifts should be electric, and the enclosures of marble. Doors should be of bronze. Im-

portant internal doors might be of bronze and glass. Window frames and sashes should be of steel, of standardized sizes. All angles internally should be rounded. A conduit the full length of building centrally situated below lower ground floor should take all main services and main wastes. Ducts for secondary service pipes, &c., and chutes for wastes and sweepings are distributed to serve each floor. It is advisable to provide for wash basin and water filter services in each room subdivision; but as it is impossible to foretell what would be the positions of these, it has been suggested that service and waste pipes should be laid at points in the building which might at any time be required, and put into use by the installation of a fitting within very short notice. Strong rooms are situated in positions thought most serviceable for staffs, viz.—Basement 28, ground floor 24, mezzanine 8, first floor 24, second floor 2—total 86. All parts of the interior should be finished without elaboration in a manner economical, but befitting one of the national buildings of Canberra. The question of treatment of the facing of the building requires very careful consideration, having in mind that the treatment determined may influence that of future buildings in the official group. It is thought that there may be several possible methods, viz.:—

1. Facing the concrete in granite, or freestone on a base of granite.
2. Facing the concrete in white terra cotta with a base of granite.
3. Facing the concrete in white synthetic stone on a base of granite.

Stone is durable and would appear monumental, and produce the best effect. Terra cotta is not monumental and its cost, if of Australian manufacture, is high. It is not suitable for facing the national buildings at Canberra. White synthetic stone may possibly be made in Australia, and is in sympathy with reinforced concrete, and its cost is moderate compared with other materials. The effect on the mind of most people, however, is that of cheapness and wanting in suggestion of durability; and it is not suitable for use as the facing of national buildings. A treatment consisting of granite for base, and granite or freestone for superstructure would be successful and would suggest durability and permanence. The fact, however, that the structure will be the first of the permanent administrative buildings necessitates the most careful consideration of the material to be used for facing the reinforced concrete. It would be advisable to give the Federal Capital Commission an opportunity to test in a practical manner at Canberra the weathering capabilities of various granites and freestones during the next twelve months. In the meantime working drawings may be prepared and other matters arranged for, so that no delay in erection need occur. The effective office floor areas are as follows:—

		sq. ft.
Lower ground floor	... ..	50,862
Ground floor	... ..	48,467
Mezzanine floor	... ..	26,382
First floor	... ..	50,286
Second floor	... ..	39,354
	Total	215,351
If centre blocks only of second floor be included, deduct	... ..	22,640
	Total	192,711
		cubic feet.
Cubic contents measuring from 2 feet below lower ground floor to flat roof	... ..	4,129,227
If portions of second floor be omitted, deduct	... ..	481,344
	Total	3,647,873

I have given further consideration to the following matters and estimates of cost, viz. :—

1. The difference in cost if steel stanchions and girders be used in place of reinforced concrete piers in a structure of this type would be approximately £40,000 greater.

I recommend reinforced concrete for the following chief reasons:—

- (a) It is homogeneous and monolithic.
- (b) Being of this character it is more durable than a conglomerate structure
- (c) It is hygienic.
- (d) It is fire resisting.

2. If the walls be built of brickwork in cement instead of reinforced concrete the cost, irrespective of whatever facing may be decided on, would be approximately £37,100 less. The relative costs of structure, excluding floors and facing, therefore work out approximately as follows:—

—	With Steel Stanchions and Girders.	With Reinforced Concrete Piers.
Walls, if Brickwork .. ..	£190,100	£150,100
Walls, if Reinforced Concrete..	208,642	168,642

The relative approximate costs of granite and trachyte for the base are as follows:—

—	Axed.	Polished.	Parts Polished.
Granite ..	£51,000	£62,100	£55,000
Trachyte ..	44,400	62,900	..

I recommend granite for the base for the following reasons:—

- (a) It suggests a solid foundation.
- (b) Its colour is lighter in mass than trachyte.
- (c) It is not so subject to the likelihood of atmospheric fractures.
- (d) It is not so noticeably variant in tone.

I recommend that the columns should be treated as follows:—

- If of granite they should be round and solid.
- If of freestone they should be round and solid.
- If of terra cotta they should be square and veneered.

The relative approximate costs would work out as follows:—

Per Column.	Round.		Square.	Veneered.	
	Axed.	Polished.		Axed.	Polished.
Granite ..	£550	£700	..	..	..
Terra-cotta ..	..	..	£750 (Matt surface veneer)	..	..
Freestone ..	273	..	..	£360	..

I think the design would gain in architectural effect if the range of columns between blocks be double instead of single. The approximate cost of one additional range of columns to the colonnades would be:—

—	Axed.	Polished.	Veneered.
Granite ..	£15,096	£18,096	..
Freestone ..	9,556	..	..
Terra-cotta ..	..	..	£19,096

Assuming the second floor covers central blocks and central part of ends only, approximately the costs of facing would be with—

1. White plaster and crushed quartz, at 6s. yard ... .. £3,500
2. Australia terra cotta, at 23s. sq. foot 122,178
3. Freestone veneer, 6-in., at 15s. 6d. sq. foot ... .. 82,350
4. Granite veneer, 3-in., at 18s. sq. foot 97,420

I recommend that granite be used for facing as being the more durable natural material and sufficiently light in colour to be seen from a distance in a setting of green foliage; or, as an alternative, freestone on a grey granite base. Further, the building would be isolated so that if other facing were decided upon for other buildings its effect in association would not be decreased. Engineering services are estimated to cost—

Electric Lighting—

2,000 electric lights, including distribution boards, £2 15s. each	£5,500
Main light switchboards ..	} 1,070
Main conduits and cables ..	
Fittings—2,000 100 W. lamps, £2 15s. each .. ..	5,417
	£11,987

Electric Power—

500 power points, including distribution boards, £3 each ..	£1,500
Main power switchboard ..	} 1,100
Main conduits and cables and sub-main conduits and cables ..	
	2,600
Main control for light and power ..	250
	£14,837

For heating and a hot water service I recommend a low pressure system. I would have two systems, each separate, with boilers in basement. Each system would require two cast iron boilers, with a capacity of transmitting 1,350,000 British thermal units at 65 degrees Fahrenheit. The cold supply would be on the roof. An overhead drop system is suggested necessitating a vertical riser to the second floor, with horizontal mains extending along ceilings and carried to drop mains through pipe ducts and with branches at each floor to feed various radiators supplied from each drop main. The drop mains would terminate at the ceiling in basement. The horizontal return mains would be similar to the system of flow mains. There would be two column ideal radiators in position on each floor to provide for the temperature I have indicated. Expansion pipes would extend from the highest portions of the horizontal flow mains.. Eight hundred radiators would be required, each with a 40 square feet heating surface, making a total of 32,000 square feet surface. The estimated cost of this system is:—

	£
Steam piping and wrought iron fittings	3,800
Wrought iron fittings (Australian manufacture) ... ..	400
Radiator valves and accessories (Australian manufacture) ... ..	800
Cast iron radiators (British) ... ..	5,600
Insulation material (Australian manufacture) ... ..	300
Two circulating pumps with electric motors (Australian manufacture) ...	160
Four cast iron sectional boilers, with accessories (British) ... ..	1,280
Labour on site, at work erecting piping system, boiler equipment, &c. ...	1,240
Supervision, freights, cartage, and sundries ... ..	220
	Total £13,800

I recommend a vacuum cleaning system providing for a capacity of simultaneous operation of six (6) hoses and cleaning equipment. The machines I propose are of the wet centrifugal type, all dust being received into collector and discharged direct into the sewer through a centrifugal pump forming part of the machine. I propose to instal two separate systems and plants. Machines requiring  $7\frac{1}{2}$  horse-power alternating current electric motors would have a capacity of 6-inch mercury vacuum at the machine, with suction piping, 3-inch main, to ceiling level of basement and extended horizontally along basement ceiling to fifteen points to each system. There would be vertical risers from each of fifteen points through pipe ducts to the skirting level of the second floor, the risers being of 2-inch diameter. Total cleaning points required would be 150. The machines would have velocities of a minimum of 2,450 lineal feet per minute, and a maximum of 4,900 lineal feet per minute. These velocities would ensure freedom from stoppages. The amount of air handled by each cleaning tool would be 80 cubic feet per minute, ensuring rapid cleaning. The estimated cost would be—

	£
Wrought iron black piping (imported) ...	277
Pipe fittings, cast iron (Australian manufacture) ... ..	318
Vacuum valves, nickel-plated gunmetal (Australian manufacture) ... ..	112
Hangers and clips, black, wrought iron (Australian manufacture) ... ..	40
Labour on site at works ... ..	543
Rail freight and cartage, supervision, and sundries ... ..	170

	£
Two centrifugal wet type vacuum cleaning machines, with all connexions ...	740
Two $7\frac{1}{2}$ -horse-power alternating current electric motors, 415 volts, 3-phase, 50 cycles, and accessories (Australian manufacture) ... ..	172
Hoses and cleaning tools (Australian manufacture) ... ..	120
Cleaning tools, nickelplated gunmetal (imported) ... ..	90
Electric starting gear (Australian manufacture) ... ..	42
Labour, erecting machines, waste, and water pipe connexions ... ..	46
Freight and cartage ... ..	30
Total	£2,700

For fire fighting the Reichel fire alarm is suggested (1,020 points), £3,650. The cooking apparatus would be electric, with a capacity of 600 or 700 persons per day, with teas, hot water, &c. The average number of units used would be from 0.4 to 0.5 per meal per person, and the cost of the apparatus would be about £1,500. In regard to lifts, the cost would include cars (say £250 each)—including doorlocks, contacts and mounting of cars. Enclosures and doors not being included in the price. Dual control is suggested, with a 3,000-lb. load (20 persons), and a speed of 250 feet per minute. Cost, £12,000.

The total estimate of project is approximately as follows:—

Building.	—	Granite Facing.	Freestone Facing.		Terra-cotta Facing.	Plaster Facing.
		£	£	£	£	£
Including double collonades, reinforced concrete walls, floors, and piers, and including facing and partly-polished granite base	Walls and R.C. floors and piers ..	168,642	..	168,000	168,000	168,000
	Base facing, part polished ..	55,000	..	55,000	55,000	55,000
	Collonades and Columns (74) ..	51,800	..	20,202	55,500	51,800
	Facing .. ..	97,420	..	82,350 (6")	122,178	3,500
	£	372,862	..	325,552	400,678	273,300
<i>Add—</i>						
Plastering walls and ceilings .. ..	12,200					
Super. flooring .. ..	15,000					
Strong room (8 <sup>2</sup> ) .. ..	9,400					
Windows .. ..	23,250					
Foundation works .. ..	20,000					
Other items .. ..	30,150					
	110,000	110,000	..	110,000	110,000	110,000
		482,862	..	435,552	510,678	388,300
<i>Engineering Service—</i>						
Lifts (6) .. ..	12,000					
Fire alarm system .. ..	3,650					
Electric lighting and power points .. ..	14,837					
Heating .. ..	13,800					
Vacuum cleaning .. ..	2,700					
Refectory apparatus .. ..	1,500					
	48,487	48,487	..	48,487	48,487	48,487
<i>Building and Engineering Services—Total</i> ..	..	531,349	..	484,039	559,165	436,787
Architect's commission and expenses .. ..	31,880	..	29,040			
Quantity Surveyor's fees and expenses .. ..	5,300	..	4,840			
	..	37,180	..	33,880		
Contingencies, 5 per cent. .. ..	..	26,567	..	24,200		
	..	595,096	..	542,119		
Federal Capital Commission Inspectors and Supervisors .. ..	..	10,000	..	10,000		
Compound interest at 6 per cent. for four years, interest payable half-yearly .. ..	Say	85,000	..	85,000		
<i>Total Estimate</i> .. ..	..	690,096	..	637,119		

All estimates are based on the assumption that work will be carried out under system of lump-sum contracts.

One-sixteenth scale sketches I am now submitting, as follows:—

- No. 1.—Lower ground floor plan.
- No. 2.—Ground floor plan.
- No. 3.—Mezzanine floor plan.
- No. 4.—First floor plan.
- No. 5.—Second floor plan.
- No. 6.—Sections.
- No. 7.—Elevations.
- No. 8.—Perspective view.
- No. 8A.—Sketch perspective of rounded end as alternative.
- No. 8B.—Sketch perspective of apsidal end as alternative.

also—

- No. 9.—Sectional elevation (1/80-in. scale) of relative heights of administrative building and provisional houses of parliament.
- No. 10.—Longitudinal elevation ( $\frac{1}{4}$ -in. scale), 1,870 datum.
- No. 11.—End elevation ( $\frac{1}{4}$ -in. scale), 1,870 datum.

My estimate for granite is based on Uralla granite which can be landed at Canberra at 37s. per ton of 9 cubic feet. Harcourt granite can be landed on the site for £2 14s. 1d. Uralla is the best granite on the market. It might be dressed in Sydney or at works erected for the purpose at Canberra. It entirely depends on the merchants. They may prefer to dress it at Sydney, but it is not a common thing to dress granite at the building in which it is to be used. If freestone were used it would be dressed at Canberra. In my calculations I have worked on the basis of Sydney freestone. It is white when first quarried. Bundanoon freestone is no doubt very beautiful, but it is more suitable for internal work. However, it must be taken into consideration that Canberra is a granite and not a sandstone country, and that it is advisable to use a material which is natural to the district. Freestone is more likely to fret the nearer you get to the ground where it may be subjected to moisture. I should think it would stand pretty well at Canberra, but I do know how the frosts would affect it. I do not recommend the use of freestone, but next to granite I would. No one could do better than recommend granite if the cost were a matter of no concern. When I submitted my report in connexion with the competition I was rather favorable to the use of terra cotta, but since then I have given the matter a lot of consideration and for several reasons I think it would not be advisable to use it. It is not monumental in effect; it consists of small parts. It is impossible to prevent it from being out of winding; with the sunlight on it each little turn is seen most clearly, the arrises do not meet thoroughly well, and there is always more or less shrinkage which cannot be prevented, however perfect it may be in a selected body. In most plain wall faces the defects are easily seen. One most unsatisfactory terra cotta job is in O'Connell-street, Sydney. The terra cotta has given a most unsatisfactory surface. It would be more expensive than granite or freestone facing. The figures I obtained were f.o.r. Rosehill. The amount was £100,000. It was for Australian terra cotta. In regard to synthetic granite, on giving the matter further consideration I am afraid that there is a considerable risk of the cement affecting the surface of the granite particles. It was not exactly granite I suggested in the first instance; it was marble. The only practical way of putting it on a wall proves that the effect we want to gain would not be achieved. I am afraid the cement would seriously affect what I did recommend to the committee, namely a sort of scintillating surface. I do not think it can be done practically. I have seen a sample of the limestone from Fairy Meadow. It is rather small to express an opinion on, but the axed surface seems good. No doubt it is a kind of marble, but whether it will be possible to quarry it so as to secure a satisfactory face without the possibility of fretting or disintegrating in the future is a matter for

experiment. I think that all synthetic material, whether made up of granite or otherwise, would have that effect on the minds of the people I have already explained. It could be used in buildings in a city and it will be in the future, because it is sympathetic with reinforced concrete and can be made to be part of the building far better than a stone facing can, because in the latter case the two materials are not exactly alike. The exposure of a block of freestone throughout a severe winter would give some indication as to the effect of the variation in temperature below and above zero, but the actual effect of an experiment for such a short period would not be very conclusive. However, it is the only thing to do if the Government desires to proceed with this building. The test would need to apply only to freestone and the stone from Fairy Meadow. This latter stone being on Commonwealth property should considerably reduce the cost of construction. I expected to go to a depth of 6 feet for foundations, but I am told that possibly we may have to go down to a depth of 22 feet. That depth is not unusual. The only question is the cost. I could not estimate now what the foundations would cost. The figure of £20,000 I have included in my estimate is purely arbitrary. My experience tells me that the articles which I mention as being of British manufacture are not obtainable in Australia. The articles I specify as of Australian manufacture are procurable here at a satisfactory price as compared with British articles. In my first estimate I included a sprinkler system, but I now have abandoned that in favour of the Reichel Automatic Fire Alarm. The following is a description of that fire alarm:—

The gear and all wiring, instruments, &c., will be of British manufacture. More than half of the apparatus will be manufactured in Australia. The system has a great advantage over sprinkler systems, being less than  $\frac{1}{3}$ rd of the cost, and operating at a much lower temperature rise, thus giving a quicker alarm. The Reichel is thoroughly adjustable to suit all climatic and local temperature conditions. It works as efficiently in an ice chest as in a boiler-room. All adjustments are centralized at the indicator board, and once made need never be altered. A broken wire or loose connexion rings a loud bell on the board, notifying the occupants that a fault is present in the system, and the bell will not stop ringing until the fault is remedied. The only contacts in the system are situated on the indicator panel, where they are under the constant supervision of the daily tester. All other electrical systems rely on a pair of contacts at each thermostat, and these contacts must be tested separately to ensure that they are operating. This is the only alarm system that does not rely on either expansion of metals or fusing of metals. Each thermopile is ever ready to generate the required amount of electricity to operate the alarm, and so this is the only alarm that does not require a battery to detect the fire. As there are no contacts or springs in the thermostats, there is nothing to go wrong, and the thermostat is not affected by vibration or dirt, acids, or water. The system will still function correctly when the insulation test of the wiring is reduced to a very low point. The thermopile will only generate the required current when acted upon by a sudden rise of temperature. This is the most sensitive thermostat made, and it remains constant throughout its lifetime. If the thermopile is broken an alarm is given as already described. Although the most sensitive of thermostats, the thermopile relies on the simplest principle to make it thoroughly compensating, and it is claimed that it has never been known to give a false alarm due to ordinary atmospheric changes, or other gradual temperature rises, when once adjusted. The thermopile is one of the smallest thermostats ever made, and may be painted the same colour as the ceiling thus

making it practically invisible on the ceiling. Every portion of it can be painted without affecting the thermopile in any way. It is installed in Sydney in the premises of the Commercial Banking Company of Sydney, head office, in England, at Buckingham Palace, and Windsor Castle, and in Canada in the Ottawa Parliamentary Buildings. When the sudden heat occasioned by a fire strikes the thermopile, the exposed parts of the thermocouples become warmer than the hidden parts. As long as this difference is maintained a current of electricity is generated and flowing along the wires deflects a pointer on the floor or section indicator. When the pointer has moved a certain distance a magnet pulls it against itself, completes the circuit, operates the relay, and this calls the fire brigade, by a special telephone line.

Tests of its efficiency have been made. I believe the Melbourne Fire Brigade has installed it. If we can avoid using the sprinkler system it would be as well to do so. Apart from the cost it is somewhat ugly in appearance, takes up a great deal of space and collects dust. With concrete floors, steel window frames and shelvings there will not be nearly the usual danger from fire. In my first estimate I included £9,400 for strongroom doors. I was not then in a position to say what class of door the committee would like, and I am still in the dark as to what the committee thinks advisable. It is not at all necessary to install heavy doors on every strongroom. I shall carefully watch the matter in the specifications I prepare. Of course whatever I specify will need to have the approval of the Commission and the Government. Seeing that Federal Avenue is not square on to the main axis of this administrative building, and that the layout of Mr. Griffin's plan shows a rounded end to the building—which I do not consider an economical shape to adopt—I thought it advisable to have an apsidal end that would not interfere in any sense with the general layout of the city, and as a matter of fact would harmonize with it and a little more perhaps, I would say with Federal Avenue than would an absolutely square end. I could not recommend a rounded end which would mean extra cost and less floor space and would not be a convenient plan. I have suggested only a centre block on the top storey. I have been actuated in doing so almost wholly from an architectural standpoint. It will serve the purpose of containing cold water tanks and the hot water system. It could very easily be utilized to provide space for other purposes. It would certainly mean reducing the available floor space by 22,640 square feet. I had it in mind that it might be possible to construct the building in such a way that the whole of the second floor could be built later on if required. I admit that no one wants to see the demand for space so great that before this building is erected another will be required, but even then I think it wise from an architectural point of view to adhere to my proposal for a centre block, although from the point of view of the effective use of floor space and economy it would be advisable to utilize the whole of the second floor as I provided in my competition plan. From an architectural point of view, seeing that the building is 430 feet long and 54 feet high, the height being only  $\frac{1}{8}$ th of the length, it is essential that as far as possible elevation should be obtained, and that would be strengthened by building the central portion high and eliminating the outer portions of the second floor. If this were a city building I would recommend a plaster facing, but as it is a national structure to uphold the prestige of Australia for nearly all time it would be advisable to face it with granite. The cost of granite would be considerable. Next to terra cotta it would be the highest, but I feel that a granite faced structure would last practically for all time. No mistake could be made as to the class of finish. It would necessitate a very plain structure, and there would be no elaborate carving about it, but as a matter of fact this was never intended. On the other hand, it would

provide durability, and a sense of permanency which in my opinion is important in what will be the most important official city of Australia. If it were possible to provide the money I would recommend a granite facing. As an alternative, assuming that freestone would stand the climate, frosts, &c., which I think it will, I would recommend a freestone superstructure on an axed granite base. A building finished in either granite or freestone should be reasonably reflective of the aims of Australia at the present time. I would use grey granite, not red. I am not in favour of having a variety of tints and colours in a structure like this. The simpler it is, the better it will be in every respect, and it would be far more likely to last as a building of taste to the people of future generations than it would be if it were faced with any other material. My estimate of the cost of the structure in granite is £690,096. I do not know what the competition cost—it was probably about £2,500. That amount would have to be added to the £690,096. My responsibility, so far as the competition was concerned, ceases with the first building. I have no claim on the Government for any other building.

111. *To Senator Barnes.*—Next to granite, trachyte for the base would please me very well. It is a very fine material, but it varies in colour a little. You get a pink and a greenish tint in some slabs, which is not quite pleasant. I would not favour polishing trachyte all round the building at Canberra. The only reason why I have specified articles of British manufacture is that they cannot be produced in Australia.

112. *To Senator Reid.*—I am very definite in my opinion that this building should be built of granite, because it is a national building. My second choice is freestone. The difference between the cost of granite and that of freestone is too small to be taken into consideration in a structure of this size and class which is to be built for all time. It would be another matter altogether if it were to be built for ten years' service, as is ordinarily done in cities. For the base I would recommend tooled granite and partly polished. The shafts of the columns should be polished; the rest would be axed. I would axe a considerable portion of the base. I would polish the top mouldings, the lowest course or plinth of the base, the faces of the entrance steps, which are a fairly large flight, and the pylons on either side of the entrance steps. The rest would be axed. But the question of what parts should be polished is a matter of considerable study, and what I have said now is only tentative. I am opposed to trachyte only because it is lifeless in appearance as compared with granite. The Uralla quarry is pretty old, although it has not been opened up very extensively until lately. The company which has it in hand has a capital of £50,000, and is operating very extensively now. I have not been to the quarry, and I do not know the depth reached. The most practical example of the effect the Canberra weather is likely to have on granite is the fact that it is a granite district. Almost any class of granite would stand there whether it be from Uralla or Tharwa. But I would not recommend Tharwa. It would be a good thing for laboratory purposes to place a piece of granite in cold storage and take it out frequently into the sunlight. When starting permanent buildings at Canberra full records should be carefully kept of the effect of climate on all materials that might be utilized in permanent buildings. I do not know that such tests have already been made. The cold storage test suggested should be reliable; it is an extreme test to place something in cold storage and then expose it to the heat of the sun. In any case it would save time. It would not be well to have too many tints about a building of this kind.

113. *To Mr. Lacey.*—I have seen samples of the Tharwa granite. It is rather dark in appearance. The samples I saw were in very poor shape, indeed, and did not come out at all well. So far it has not been tested in a practical way, nor so far as I know in a

laboratory. It would be well to have the deposit opened up and tested prior to starting this building. The polish on trachyte is inclined to get a bit dull in the course of years owing to the effect of acids and smoke. There is always a very fine craze on polished work which has to be seen through a microscope. The acids get into it and affect it, causing the stone to lose its polish slightly. But that is not the reason why I do not recommend trachyte. My chief reason for not recommending it is that although it is a very fine igneous stone it has not the life in it which granite has. By "life" I mean "lively appearance"; it is a dead looking stone. If a trachyte base were used the cost would be slightly less than granite. I would polish all the granite columns. I recommend round solid columns and not a veneer. A veneer shows too many joints.

114. *To Mr. Seabrook.*—My original estimate of 2s. per cubic foot for foundations included a depth of 2 feet below the lower ground floor level. I have added another 4 feet, making it in all 6 feet; and on this depth I have based my estimate of £20,000. If it were necessary to go to a depth of 22 feet for a foundation, the cost of the foundations would be nearly £80,000. It is quite an unknown quantity. We have not reached that stage when trial holes should be sunk to test for a foundation, but at the same time I admit that it would have been better to have had these tests made before the committee took this evidence. I do not anticipate that it will be necessary to go to a great depth all over the area covered by the building. It will probably be found that we may have to go down to 22 feet for about one-third of the full length of the structure. It is a fairly good foundation as it is, even at 3 feet or 4 feet; but in carrying out the sewerage it was necessary to go down to 22 feet, and that is how the information was secured. If we cannot find a bottom we may have to pile, as is done in Chicago every day. I think we can go down to 22 feet. The sewerage operations indicate that we shall get fairly solid rock at that depth. At any rate that is the greatest depth so far reached. I strongly recommend fine axed granite for the base with the top series of mouldings polished. Assuming that granite would be beyond the means of the Commission and it was necessary to choose a freestone, I think I would prefer a brown. Most of the freestone is white, but Sydney stone weathers a beautiful brown. Terra cotta will not do for this job. It is entirely a matter for the contractor to say where he will have the stone dressed. A test of twelve months' exposure is not sufficient to indicate what life freestone may have at Canberra, but it is the most that can be done in the circumstances unless this building is to be delayed for another five or ten years. It makes all the difference how the stone is laid in the building. In one position it will weather very quickly. It needs careful supervision to see that every stone is on its natural bed. Through bad supervision in that respect when St. Paul's Cathedral, Melbourne, was being built quite a number of the stones have had to be replaced. I would not use a veneer of freestone less than 6 inches thick, but a 3-in. veneer of granite should be sufficient. A 2-in. skin would be too thin for a building of this kind. I have designed the windows to have a square return and a plain architrave round them. I think that the ceilings in ground floor and the mezzanine floor and possibly in some of the principal corridors on the other floors should be enriched. There will be no arches nor will there be any centre flowers in the ceilings. I would use Australian timbers for the doors; in fact I would like to see timbers from various States in this structure. I think the same arrangement could be made in regard to the marble for use on certain floors. The woodwork will all need to be well finished; I do not think it should be varnished in a building of this character. The fire alarm system I recommend has been approved by the Fire Brigade Board. It is a successful modern system of fire alarm. In all

the essential corridors and lavatories marble should be used. In the Ministerial floor, presumably the mezzanine, I would have a parquet of some sort. All the other floors would be of some form of magnesite flooring. A rubber composition would be suitable at Canberra. I would not use tiles. On an office floor you want something warm and resilient to the feet. The marbles to be used should come from various States, but should be used in a way to create a satisfactory colour scheme and a general ensemble. For the main entrance there should be a simple and dignified arrangement with not too many colours. The electric wiring should be encased in tubing. Some of these offices are 200 feet by 50 feet. Next week perhaps they may be subdivided into smaller areas. I have in mind a scheme for the electric lighting and the fire alarm whereby the wiring may be installed in a series of effective moulds arranged so that the partitions would fit into them. In that way the wires should be easily accessible throughout the building. I hope to round off the internal and external angles. The external angles will have Keene's cement around them. The roofing will be asphalt on top of concrete. I would not recommend anything else. There will probably be two layers.

115. *To Mr. Gregory.*—The alteration to the 1,860 feet level will not affect Mr. Griffin's plan. On the original level the permanent Parliament House was to be 50 feet higher than the 1,870 feet level. By reducing this building to the 1,860 feet level the only effect it will have will be to make the permanent Parliament House 60 feet higher than it. There is no reason why this building should not be put up to the left instead of the right of the provisional Parliament House, unless there is some departmental objection. The site to the right will be nearer the residential areas and nearer the Government Printing Office. From the aesthetic point of view, there would be no objection to the building being on the left except possibly that the view from the Hotel Canberra might be somewhat interfered with. However, that must come about sooner or later. If a better foundation could be found on the left, I would prefer to build there, because the cost would come nearer to my estimate. I have no objection to either site. Loveridge and Hudson's price for rock-faced trachyte is 15s. per cubic foot f.o.r. Canberra. For axed it is 21s., and for polished 27s. 6d. I have not obtained comparative prices for New South Wales granite. I think Uralla granite is better and more attractive than Harcourt granite. The spots in it which you always get in granite are nothing like as large as in the other. It is lighter in colour, and it does not appear to vary in colour to the same extent as Harcourt granite does. The price of Uralla granite is 37s. per ton of 9 cubic feet f.o.r. Canberra as against £2 14s. 1d. for Harcourt. The quotation is for undressed stone in both cases. I would not object to a base of trachyte with a facing of granite except that the trachyte has not the appearance of life in it that granite has. Again there is always the risk of fractures showing in trachyte. Being an igneous stone it does not appear to be as compact as granite when exposed to the atmosphere over a number of years. We have had many instances of fractures in trachyte when it is used vertically in columns. I do not think it is good enough to face these risks. The size of the building, its length and height, must be taken into consideration when considering what effect the mingling of trachyte and granite would have. The height is only 54 feet, whereas the length is 430 feet. If the height is to be reduced by the use of a dark material in the base, as it would be by using trachyte, it would at the same time reduce its importance and appearance. The building is rather too long for its height. With a granite base and facings it would not be an ineffective building. I have treated it so as to avoid that disadvantage by getting variations of texture of surface from the top moulding to the ground level. I propose to have a series of courses of rock faced and tooled work in

such a way that the long series on the basement will have shades on them which will have the effect of suggesting weight and support. I do not seriously object to trachyte, but I think that more can be made of a granite base. I believe that the red granite used on the Government Savings Bank in Sydney is imported from Sweden. I propose to have the columns of the administrative building at Canberra made of the same granite as is used in the base. I am quite against the use of terra cotta or synthetic granite. A 3-in. granite facing will be quite sufficient. In some buildings a 2-in. facing is used, but I think it is much too fine. The veneer is cramped and wired to the reinforcement. The present generation will not be in a position to say whether there is any danger of its becoming detached from the wall. Every precaution is taken to prevent corrosion, but it is impossible for any human being to say that the facing will not become detached. History so far has shown that it will not. There is a way of bonding it and making it absolutely certain without the use of wiring, but it costs about 50 per cent. more to do it. I would not recommend the use of Fairy Meadow limestone without a series of tests. I do not know of any building in which it has been used. There is nothing like the practical test of time to indicate the varying effect of climatic conditions on building materials. A practical test would be to erect a small building, but that would take a long time. If the administrative building were to be ten stories high I would recommend steel frame construction, because it would mean a saving in cost, but for a building with two principal stories and an intervening mezzanine floor, reinforced concrete will be found to work out cheaper than steel. A steel frame construction would cost one-third more than reinforced work. My estimate is for the building as planned, omitting each end of the second floor. The extra cost of putting up the building as originally designed with the full floor space would be about £48,000. I prefer to omit the two ends of the second floor to obtain a more aesthetic effect. If the whole building were completed I would not suggest any other design for the purpose of giving it a more aesthetic effect, but as it would then lose the central feature that might, if so desired, be built up again to produce the effect. I have not given further thought to the idea of having a dome. My advice is to omit it altogether. An administrative building in the Government group does not demand any dominating dome or tower. The central feature I propose would be sufficiently dominant for a building of this character. I am not in favour of a wholly rounded end to the building. I think a reasonable compromise is the use of an apse which would be concentric with the circles of the layout of the grounds in the immediate vicinity. I do not think it would add very much to the beautification of the building, but it would harmonize very well with the layout of the avenue better than would a square end to the building. A square building is more economical and equally effective from the point of view of working space. I have fixed 65 degrees Fahr. as the temperature I would supply for the heating of the building, but that figure may have to be carefully gone into. I think it would be advisable to leave the choice of the marbles to the Commission and their advisory officers and myself. I could not give any evidence on that matter just now except that I think that marbles from all the States should be used as far as possible. This building should be made a Commonwealth building, and no leaning should be exhibited to any particular State. Wherever possible woods, marbles, or any other material that may be obtainable from various States should be used. It would take me six months to complete the drawings after Parliament gave me authority to proceed. That is assuming that a decision was arrived at on certain points within that period. The six months would include the preparation of bills of quantities. It would take another month to obtain tenders. The construc-

tion should occupy four years. In all it should take four years and seven months to complete the building from the time it was authorized by Parliament. I am estimating on lump sum contracts. I would not be able to estimate with reasonable accuracy on day labour.

116. *To Mr. Cook.*—Before I would express any opinion on the Fairy Meadow limestone deposit, I should like to see some of the stone subjected to a year's exposure. If there is a satisfactory granite at Canberra, it should be used. I would not be interested in getting granite from each State. A quarry at Canberra could be opened up in six months, and then a decision as to the possibility of using it could be arrived at, but it should be tested as to how the stone will turn out on the face and what class of face it had, and that would take another six months, making twelve months in all. In my opinion the Tharwa granite is a bit too dark, but I would not object to using it in the base. Quite possibly it may alter as it goes down. I compared the price of Uralla granite with Harcourt. In making my estimates I consulted granite and other stone merchants, terra cotta merchants, and merchants in plaster. I obtained their prices for undressed stone f.o.r. Canberra. The terra cotta manufacturers quoted £100,000 for terra cotta f.o.r. Rosehill. Those are the Wunderlich people. For other matters I consulted experts, and I think my estimate is reasonably accurate.

117. *To the Chairman.*—The item "Other Items, £30,150" in my schedule refers to marble for the corridors and lavatories, sanitary apparatus, drains, and plumbing matters of that description chiefly. My original estimate for electric lighting and power points was £10,800, but I find on going into the matter more closely with the engineer that they would probably cost £14,837. A heavy plant will be required for heating the building. It will be on the lower ground floor. There must be two systems in that length of building. It would be impossible to heat it effectively by a low pressure system from one boiler. I do not think the upkeep of the plant would be serious. In any case, that cost would not be a capital cost. I think that £1,500 should cover the cost of refectory apparatus. It will include steamers, grillers, pastry ovens, a large range, hot plates, &c.—all the necessary equipment of a kitchen to serve meals to 600 or 700 people. I do not think the officers will want elaborate dinners there. I take it that a great many of them will be satisfied with light meals. I do not consider that the apsidal end will add materially to the cost of the building as compared with the square end. There will have to be a number of columns there in the square. Instead of being arranged concentrically they will be arranged on the square. The actual cost of the columns will be small. It will run into about £10,000. I have included that amount in my estimate.

118. *To Mr. Cook.*—Before commencing with construction I would have to be instructed to prepare working drawings. All the materials I have referred to-day are available and could be obtained at once.

(Taken at Sydney.)

SATURDAY, 24TH APRIL, 1926.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Lacey
Senator Reid	Mr. McGrath
Mr. Cook	Mr. Seabrook.

Thomas Campbell, Works Manager, Wunderlich Limited, Sydney, sworn and examined.

119. *To the Chairman.*—I have been works manager for Wunderlich Limited for twenty years, and I wish to ask the Committee to consider the advisability of

using architectural terra cotta in the administrative building at Canberra. The manufacture of Wunderlich architectural terra cotta was commenced after a realization of the fact that this material offered the architect a medium as near the ideal as possible for the facing of buildings. As a first step, the works manager of the company visited America, inspected various establishments devoted to the manufacture of terra cotta, and collected essential data. Subsequently he engaged two of the most highly talented experts available, who were in the employ of firms famous for the extent and quality of the terra cotta they had produced. These men are now holding important positions at the Wunderlich Architectural Terra Cotta Works, Rosehill, near Sydney. The works are in full swing, and several substantial contracts have been completed, while various others are in course of execution. We feel that there is little need to emphasize the quality of Wunderlich architectural terra cotta. Apart from the fact that the Wunderlich organization has been engaged for many years in the production of terra cotta roofing tiles and accessories of unchallenged merit, and that experts are watching every process in the manufacture of architectural terra cotta, there is the final evidence of the finished product itself, which has been accepted everywhere with nothing but favourable comment. Wunderlich architectural terra cotta is as truly Australian as bricks, stone, or granite. It is made from Australian clays, grog, &c., by Australian workmen, and is financed throughout its entire processes by Australian capital. Unlike the carving of stone or similar materials, the manufacture of architectural terra cotta is an exceedingly healthy occupation. It is only mildly laborious. Both in the process of manufacture and subsequent operations on the building site, the average terra cotta block can be handled by an adult without exertion. The proper support and encouragement of the terra cotta industry will undoubtedly lead to the establishment of other important industries dependent on the ceramist's skill. An enormous amount of high grade ceramic ware that is indispensable to modern structures, is now imported. Acquisition of highly technical knowledge relating to ceramic ware will in due course encourage Australians to branch out in the directions indicated. Just as our tile works are operating in practically every State in Australia, so we plan to establish a terra cotta plant in each capital as the need arises. We now have our first branch factory for the manufacture of architectural terra cotta in course of completion at Sunshine, Victoria. Architectural terra cotta is to-day accepted in the United States of America, England, and the continent as the most available building material with which to clothe or embellish a permanent building, because of definite structural, aesthetic, and economical advantages. It is employed to an extraordinary extent in the United States. During the year 1925 the production amounted to 160,000 tons. It is an undoubted fact that more than half of the building material of New York's stupendous downtown skyline is architectural terra cotta. This skyline includes such terra cotta structures as the Woolworth building, *New York Sun* building, the *World* building, Underwood building, Produce Exchange Equitable building, Federal Reserve Bank, and the Hudson Terminal building. Architectural terra cotta is used throughout the United Kingdom, and works are in operation throughout the country. Notable examples are the treatments to the Natural History Museum at South Kensington, and the Victoria Law Courts, Birmingham. A publication issued by the Terra Cotta Publicity Bureau, of London, illustrates some of the numerous treatments carried out in the United Kingdom. The Japanese think so highly of architectural terra cotta as to go to the expense of importing it from America. A publication entitled *Atlantic Terra Cotta*, vol. 8, No. 5, illustrates some of the recent Japanese terra cotta structures. Architectural terra cotta is the most durable building material known.

This statement will be supported by our exhibiting for your inspection the following publications:—

- (a) Terra Cotta, B.C. and A.D.—(*Atlantic Terra Cotta*, vol. 6, No. 10), which provides numerous photographic reproductions of terra cotta of the fourth and fifth centuries, B.C. It shown no signs of gradual erosion which eventually obliterates many materials.
- (b) English Tudor Terra Cotta, A.D. 1522 (*Atlantic Terra Cotta*, vol. 7, No. 7), which shows the perfectly preserved terra cotta treatment to Layer Marney Towers, Essex, erected in 1522 A.D.
- (c) Terra Cotta of the Italian Renaissance (National Terra Cotta Society), wherein are shown a profusion of examples of well preserved terra cotta treatments of the fifteenth century.

Glazed and slip furnaces render terra cotta impervious to moisture, and dust and dirt may be removed at trifling expense with dry brushes or plain water. To substantiate this, we will show you the following publication:—Spring Cleaning—(*Atlantic Terra Cotta*, vol. 3, No. 8), which illustrates how readily terra cotta can be restored to its original freshness by cleaning down with soap and water. Having been carried during the process of manufacture to a temperature exceeding 2,000 degrees Fahrenheit, it is untouched by the heat of a conflagration. Proof of this will be shown by our exhibiting the following:—Atlantic Terra Cotta in the Disasters of Augusta and Paris—(*Atlantic Terra Cotta*, vol. 3, No. 7), wherein it is stated and demonstrated that in the fire which gutted the Empire Building of Augusta, Georgia, "the limestone face of the first and mezzanine stories and the granite columns are spalled, chipped, and calcined; but the facade of terra cotta is fundamentally intact. Even the smoke stains can be removed." It is on record that in the Baltimore, Buffalo, and San Francisco fires salvage of terra cotta was not only very high and certainly much greater than in the case of any other exterior building material, but such damage as did occur was from mechanical cause and not from heat. Terra cotta is economical in structural weight. Its plasticity during manufacture makes it economically adjustable to any form of structure—concrete, steel, or brick—and very simply anchored and tied thereto. This has become most apparent in the reinforced concrete structures of to-day. The light weight of terra cotta calls for only a minimum of structural support, and means consequent cost-saving in frame and anchorage. Terra cotta is therefore a light, physically strong material; imperishable and unflammable; capable of withstanding the structural demand imposed. In terra cotta architects have a peculiarly versatile and broad medium of aesthetic expression. In no other material does the architect find the manufacturer so alive to colour, mass and salient line; to scale of block and unit; to colour scale, relation and harmony; and, above all, to appreciation, feeling and sympathetic understanding and execution of modelling—so important an element in the individuality of any architectural composition. In illustration of this, the following literature will be exhibited for inspection:—

- (a) Atlantic Terra Cotta Modelling—(*Atlantic Terra Cotta*, vol. 7, No. 9), which shows how terra cotta responds to every demand of decorative art, and points out that many decorative features would be prohibitive in a non-plastic material.
- (b) Better Banks (National Terra Cotta Society, Brochure Series, vol. 4), showing how terra cotta modelling adapts itself to the massive forms of columns and classic enrichments typical of such buildings.
- (c) Standard Construction (National Terra Cotta Society, 1914) exhibiting details in full size of column treatments (plate 56).

A very important advantage of terra cotta lies in the fact that ornament and modelling may be used freely, because with the model once made, the material duplicates at practically no increase in cost over plain work. In colour, terra cotta affords the means of achieving distinctive and striking results unattainable in any other high-class material; for there are available not only the normal colours common to burned clay, such as greys, buffs, reds and browns, but also the variety of shades produced by imparting a glazed surface to the exposed portions of each block. Such glazes may be lustrous, like polished glass, or dull matt, simulating the appearance of egg shell, and may partake of almost any desired colour, ranging from white through shades of cream to deep ivory; various degrees of buff, grey, red, bright blues, green, purple, lavender, yellow, and even gold and vermilion. Terra cotta thus provides an almost unbounded palette for the richest effects in colour design. Accurate execution of colour schemes is assured, with only those variations of shade in the individual pieces which enhance the interest of colour expression. In texture and surface treatment there is no limit. The range extends from the natural clay finish, made impervious with a slip, through matt or dull to lustrous and brilliant glazes; and from the smooth or honed finish, through different degrees of toding, dragging and stippling, to any extent of roughness desired. Any terra cotta treatment may consist of one colour only, or any combination of colours, even in the individual pieces. A review of the process of manufacture reveals the source of its economy—its plasticity and the facility with which it may be produced. Repetition is the keynote of terra cotta economy. The difference in cost between reproducing a number of identical pieces of terra cotta from the one mould, and the methods necessary for non-plastic material where the initial cost is constant for every piece, can be readily appreciated. The saving is particularly great where the pieces are ornamental. Apart from this, it is not possible to quote definite figures relative to the cost of terra cotta. It is, perhaps, sufficient to say that it will always be considerably less expensive than other materials of equal dignity. In the bulletin of the Atlantic Terra Cotta Company (vol. 3, No. 3), entitled "What Will it Cost?" will be found a presentation of the facts bearing on the cost of terra cotta as follows:—

[Extract from *Atlantic Terra Cotta*, vol. III., No. 3, January, 1916.]

#### WHAT WILL IT COST?

When an architect is considering a certain material for work on hand, very naturally he wants to know what the cost will be. He is annoyed, sometimes to the point of exasperation, by the salesman, who says, "I must see my house about that." Sometimes the architect gets the impression that the salesman could give the cost if he would, but that he must refer to the house, so his superior can put on "what the traffic will bear." It is impossible for our own representatives to give an immediate estimate of the price of Atlantic terra cotta. Aside from the fact that it will be considerably less expensive than other materials of equal dignity there is little that can be said. Atlantic terra cotta can not be sold by the square foot nor by the ton; it is not a stock material; every piece is made especially for the building in which it is to be used, and many factors enter into a determination of the cost. The only way of arriving at the cost is to have our estimating department figure the architect's drawings.

A feature often of great importance is the speed with which a terra cotta treatment can be prepared. Once the initial models are made, repetition of units is a simple matter, and even an entire "facing" for a building can be made available quickly, thus obviating the costly delay which hand-carved materials usually involve. In structures of certain types, it is possible

to commence the fixing of the terra cotta at practically any floor level on the building. In very many of the greatest modern buildings in the United States—Government and administrative buildings, court houses, post office, County Court houses, State capitols, State service buildings, city halls, libraries, railroad stations, &c.—terra cotta has been successfully used by the most prominent American architects. Unusual freedom in the use of ornament has been possible in many instances where, with stone or granite, the cost would have been prohibitive. In this respect we exhibit for inspection, vol. 8, No. 4, of *Atlantic Terra Cotta*. The frontispiece of this publication illustrates the new Miami City Hall, which is treated from base to roof with conglomerate terra cotta. The portico ceiling and arcade walls are also of terra cotta. Plate 30 towards the end of this book is interesting as demonstrating how a towering facade of terra cotta dominates its locality. Another publication (*Terra Cotta Publicity Bureau's Book on Terra Cotta*) displays, on page 8, an illustration of the terra cotta facing to the Natural History Museum, South Kensington, England. Architectural terra cotta treatments undertaken by Wunderlich Limited are as follows:—

#### Sydney.

- Modelled heads for Sydney University—Modelled by Raynor Hoff.
- Archivolt, columns, windows, &c., to Christian Brothers' Chapel, Strathfield.
- Matched blocks, about 70 altogether, for Bank of New South Wales, Macquarie-place, Sydney.
- Facade to Manufacturers' Mutual Insurance Limited Building, O'Connell-street.
- Facing to ground and first floors, Sun Insurance Company's Office, Bridge-street.
- Facing to Government Savings Bank premises, Martin-place.
- Terra cotta arches, Liverpool-street station (city railway).

#### Melbourne.

- Terra cotta trim to entrances, Duerdin and Sainsbury's premises.
- Facade to Temple Court Building, Collins-street.
- Facade to Royal Exchange Assurance Company's premises, Queen-street.
- Facades of Nicholas Building, Swanston-street and Flinders-lane.
- Ground floor facing, Pauline et Cie, Collins-street.

#### Hobart.

- Facade to Bursaries Board Building.

#### Adelaide.

- Facade to Wunderlich House.

Owing to the nature of the clays we have discovered here, we are burning to 2,260 deg. Fahr. to bring them to their best maturity. It is surprising the number of men who week by week bring us samples of clays from all over the place, and many of them are quite suitable for our work. "Grog" is a technical term, meaning "once-fired clay." It is ground in with the fresh clay to control shrinkage and warpage. When we make a piece of the green clay, we make it actually 1 inch to the foot larger than we require. Our shrinkage rule is 13 inches divided into twelve parts. After burning the ordinary rule is put on, and it measures 12 inches. To get that shrinkage as regular as possible we incorporate a portion of already burnt clay. In the drying process we also make provision to allow the water in the clay to find its way out to the atmosphere. In Sydney we are using four different clays, and it is likely we shall be using three in Victoria as the result of tests already made. In Sydney we control two of the deposits—one is on our own property, and the other is held under lease from the New South Wales Government. We buy two others from clay miners. Terra cotta stands on its own as a building

stone. It is just as monumental as granite. We prefer to bond our terra cotta to a back of brickwork. Terra cotta and bricks are both burnt clay. They can be bonded together expeditiously. The man laying the bricks can set the terra cotta. The latter is part and parcel of the wall. There is no difficulty in attaching it to concrete, but we believe that it gives a better job when it has brick for the backing. It is also more economical. If terra cotta were used in the administrative building at Canberra I should like to see a granite base to give strength and massiveness and to get larger sized blocks. Terra cotta has one limitation in respect to the size of blocks to be made. Occasionally large blocks are used, but you cannot do your best work with very large quantities of very large blocks. It makes it a costly operation. For base work, however, one likes to see large scale blocks massive in character. I should like to see all of the columns and all of the wall treatment above the base done in terra cotta. I submit to the Committee samples of terra cotta used on columns. Many methods are adopted for secreting joints. On Temple Court building in Melbourne there are eight plain columns done in terra cotta. It gives an idea of what can be done in one block without vertical jointing. The columns are 2 feet in diameter, yet the National Terra Cotta Society, which is the national technical association of the United States manufacturers, say that they cannot be made larger than 20 inches. We claim to have gone to the limit of 24 inches in one piece in a plain column without vertical joints. I believe that terra cotta facings on a granite base and with granite columns would look all right and could actually be made to harmonize. Some columns are round and plain; others are round and fluted. The plain would show the vertical jointing to a greater extent than the fluted. There is nothing alarming in showing vertical jointing when you know you are telling the truth about the material. On the other hand, it is possible, but only at great expense, to turn out these large polished granite columns such as those in front of the General Post Office, Sydney. They must have cost a great deal of money even in the days when they were placed in position. With terra cotta facings there is always some variation in the shades of some individual blocks. If there was not you would produce something like a painted job. There is always variation in colour in every kind of stone quarried. The *Sydney Morning Herald* office, which is built of Sydney sandstone, probably shows more colours than a rainbow. I believe that the streaks on the face of the terra cotta work on the Bank of New South Wales, Macquarie-place, are due to excess oil in the putty, which was used for jointing in one or two portions of the job. At the present time my firm is actually producing for the Nicholas building, Melbourne, between 450 and 500 tons of terra cotta. It has promised to deliver everything by October next, and I think we shall be able to keep that promise subject to immunity from strikes and that sort of thing interfering with our work. At the same time, we are carrying out work for the Government Savings Bank which is undoubtedly a big job for any country. We are now extending our factory. It is the second extension we have undertaken. We have no competition in Australia in the regular manufacture of terra cotta. We are only prepared to give prices on plans submitted to us. Mr. Jones simply asked me for a price for so many columns of certain dimensions and I gave him an approximate estimate. I have not had plans of the building on which I could submit a tender. I understand that Mr. Jones says that there is a difference of £25,000 in favour of granite as compared with terra cotta for this building, but one way to check that would be to get exact quotations to do the job. I could put in an approximate estimate, but being a Scotchman and being a little cautious, I would not like to do anything which would cause heartburnings later on. We must have a plan to work on. Every block of terra cotta has to be made for its place in the building. Of

course if it is a job requiring hundreds and hundreds of the same sized block out of the same shape mould, only one model would be required for it. Each mould will survive 30 to 50 pressings. Last year we sent our sales manager and draughtsman to America to make themselves familiar with the manufacture of architectural terra cotta, and they happened to be in Chicago when the North-West Terra Cotta Company secured a contract for the Jewellers' Building. But they had had two draughtsmen in the architect's office for a year assisting in the preparation of the drawings before the contract was let to them. You must have plans before you can submit any tender for terra cotta work. I should say definitely that terra cotta blocks would be cheaper than granite for facing purposes. No one sells granite to any extent. There is not a wholly granite building in Australia. Our price for the Temple Court building in Melbourne was about £70 lower than the price of imported terra cotta, but in the case of the Royal Exchange Insurance Building our price was a little higher. I fancy at that time the importers were trying to cut the price in order to get in. However, the architects were so satisfied that they gave us a slight preference and entrusted us with the job. I do not think that they asked for prices from the importers for the Nicholas building in Melbourne. Tenders were called for the Sunshine Hotel, Melbourne, and our price was just about the same as the importers' would be, but it was submitted a month earlier than theirs was. In transporting our product we do not have many breakages. In the case of the Nicholas building we packed in cases at Rosehill on to trucks at our siding, we loaded the cases into small craft on the river, we unloaded from the small craft into a steamer, we discharged them from the steamer at the wharf in Melbourne and carted them to the job. The percentage of breakages was very small. In the case of Canberra we should pack in trucks on our siding at Rosehill and those trucks would be hauled, I take it, on a spur line to the job itself. Frost would have no effect on terra cotta work if the joints were made perfectly sound and weatherproof, and if from time to time they were kept in good condition and not allowed to perish. The surface of the terra cotta itself can be made impervious to all moisture. The blocks are all fitted before leaving the works and the joints are ground. Every piece thus fitted is marked before leaving the works, and when it arrives on the job is placed in the position the marking indicates.

120. *To Mr. Seabrook.*—I prefer brickwork as a backing to terra cotta. Concrete is built separate with fastenings in it with which to tie the terra cotta to the wall. Thus, the latter does not become part of the structure. In the case of brickwork, however, it can be taken as being part of the wall, and, in the ordinances of many of the cities of the world, it is allowed to be regarded as being part of the wall. Brickwork gives a better key for terra cotta than does concrete. The latter is a different material from the terra cotta. It has a different coefficient of expansion. Nevertheless, terra cotta can be attached to either concrete or brickwork. Even on a plain job there might not be the same number of blocks between one window and the next, and that makes a big difference in terra cotta, whereas it does not make much difference in stone. If you deal broadly in averages you may be very far astray in estimating for individual jobs. I cannot say how a square yard of terra cotta would compare with a square yard of granite. We do not supply stone, and I know of no granite job in Australia. It is true that as a business man I should ascertain which is the cheapest—granite, freestone or terra cotta—but the only way that can be ascertained is by actual competition. I cannot go to the stone man and get him to tell me his price. During this week an architect supplied me with the figures in reference to one contract in which the stone men said that they wanted 17s. 6d. per foot fixed for sandstone, and 50s. per foot fixed for granite. In that particular case our price was about 13s. per foot without

fixing. In one job in Sydney the cost of fitting terra cotta has come out at about 10d. per square foot, including the brick backing for labour only. Speaking broadly, the cost of sandstone and terra cotta, in Sydney, would be probably about the same, because since the advent of terra cotta on the Union House the sandstone man has learnt his business over again. Prior to that, sandstone was only used as monolithic material. To-day, it is being used as a veneer. In lieu of the deeper reveals of the monolithic construction, straight joints are being made in the reveals and vertical slabs at the window jambs. It does not follow that because you have a freestone front it shows a vertical joint right up. You have one joint on the face and one on the side. I point this out to illustrate the new development in the use of sandstone. I saw a job being erected in Pitt-street where a stone was being set which was false jointed into apparently four courses. That is all new, and very little is known about it outside those few people who have done this class of work. There is nothing special about the samples I have submitted to the committee. They are out of stock; many of them are already old. The column pieces are picked up from a job we are sending away at the present time. It is impossible to get a terra cotta block perfectly true on the face in moulding and burning it. The blocks are all more or less slightly warped. That is one of the characteristics of terra cotta, as it is with all burnt-clay materials, but the variation is so slight as rarely to matter, and it is frequently taken up by various methods of design. The large block I exhibit is one of our earliest samples. We have not made a real white job yet, or anything just as white as this. It is not possible to entirely overcome the warpage. Our ceramic engineer, Mr. Williams, is a university man. He carried out his studies under a very famous English ceramic professor, and he himself was afterwards a professor in New Jersey. Architectural terra cotta is a science as well as an art. It has been co-ordinated in the light of the knowledge of the methods of the past, and that knowledge has been brought into definite arrangement. We have a mixture for putting on our glaze. Every glaze differs in its application and combination according to the required finish. The Temple Court terra cotta work is a good job, but it is not perfect—no human work is ever perfect. The first production of a group of men who were all taught their work while they were doing it necessarily cannot be perfect. Nevertheless, it was a good job. The bad joints may have been the result of setting. It is possible to overcome this. Great care is taken in that direction, and we shall even do better as we proceed. During the last two years we have taken 60 men into our works, and worked painstakingly to teach them. Some of the work on Temple Court shows all the peculiarities of terra cotta which cannot wholly be overcome, but it can be handled and corrected to a great extent. As I have already claimed for the material, while it has certain excellencies it will have certain defects. The Della Robbia family noticed these defects and did not seek to hide them, and, of course, modern architects know what they are handling. The man who does not ask for unduly large blocks is wise. I am not endeavouring to mislead the Committee. It would be injurious to our business to do so. When we are endeavouring to develop something entirely new to Australia, although not new to the world, one thing will serve us best throughout, and that is to tell the truth about it, and seek for a proper and not an improper use of the material. It is difficult to get similarity as regards colour, but it all depends upon the standpoint from which one regards it in respect to similarity. You can get an absolutely regular tone with variations within that tone. Individual blocks are, of course, subject to the manipulations of the person working the spray of glaze. The man may spray one a little finer than another. One block may get into the

top of the kiln, and another into the bottom. Variations may be brought about in that way, but the blocks are all of the same class and the same body, and they have the same amount of firing. If it were stock material, the terra cotta manufacturer would do the same as the tile man does. He would have automatic machines, and as the material passed along it would be sorted. Even then there would be some variation. It must be remembered that we are dealing with a natural product made by the forces of nature, under fire. It is certainly not a painted surface, but even the painter gets different shades according to how he moves his brush.

121. *To Mr. Cook.*—I do not believe a terra cotta facing would be more expensive than a granite. I think that a terra cotta front could be put on a monumental building just as well as granite, but I would not bring it down to the ground level. I would go down to the base line only. I believe that you would get the greatest beauty and art in this building by using terra cotta. As a building material its lasting qualities are superior to those of granite. This can be proved by historical records. No more skill is required to work in terra cotta than would be required to work in granite. Masons or bricklayers would do the work in both cases.

122. *To Senator Reid.*—The surface on the Christian Brothers building, Sydney, is particularly suitable. It is a vitreous surface. On the samples exhibited to the Committee slight reflections can be seen, but that is merely due to the angle of light. Various devices are adopted to overcome the difficulty that attaches to the use of terra cotta, namely, that the joints and shadows may be too prominent. One method is to have a spotted surface on the glaze. We overcome the jointing difficulty by rustications. The joints on Temple Court are mostly plain straight joints, but part is rusticated. To overcome the unevenness of the surface recessed joints might be used. This characteristic of terra cotta is one to which people must become accustomed by familiarity. It will not be noticeable in the Nicholas building, because of the broken surface of the terra cotta throughout. Speaking generally, you get an even surface from top to bottom with sandstone or granite, but, even in the Commonwealth Bank building, in Sydney, the trachyte base is overlapping another portion by one-eighth of an inch in the centre wall.

*The witness withdrew.*

George Andrew Williams, Works Manager of Wunderlich's Terra Cotta Factory, at Rosehill, sworn and examined.

123. *To the Chairman.*—I received a university education at Alfred in 1913 and gained the degree of Bachelor of Science in ceramics. I spent 3½ years with the Department of Ceramics at Rutgers College in New Jersey. In regard to knowledge of ceramic problems I had perhaps a unique opportunity among the younger men of America, and furthermore I was taken on the staff of the Atlantic Terra Cotta Company, the largest of the type in the world. It operated four plants, two of which were close to New York; a third was situated in the centre of New Jersey, and a fourth plant was in Georgia. It is difficult to quote any big monumental building in the East of America in which terra cotta has been used, but in the west and south where more recent developments have taken place it has been employed in that very type of building which the committee is now investigating, particularly in public institutions and State Parliament Houses. In New York there is a very good selection of building stones close at hand. There is good water transport for the granites of Maine. Consequently the stone used in the large government buildings in that section of the country is either marble or granite. But the same does not apply to the more recently developed portions of America. While I was in the University at Alfred, a fire entirely destroyed the State Library at Albany.

New York State. It was replaced by another structure which had a large colonnade with marble columns of the Corinthian order. The Atlantic Terra Cotta Company took a contract to make the capitals of these columns to match the marble and to architecturally harmonize with it in all respects. The price of the marbleman for these column capitals was 250 per cent. higher than ours. The Terra Cotta Company received about 800 dollars each for these capitals. The price of the marbleman was 2,600 dollars each. The difference was due to the fact that we could dissolve the thing into small units. Each leaf of the capital could be made as a separate unit and with solid jointing it made a very satisfactory capital indeed, matching the marble in which it was employed. In regard to the cheapness of terra cotta, we are not living in the cheapest country in the world, but the cheapness of terra cotta becomes more evident the more elaborate architectural features there are in a building. Even in the United States where the business is done on a more substantial basis than here, because of the longer development of the country, we found that plain ashlar work would run terra cotta a very fine race in regard to price. Terra cotta cannot reduce its price on the plainer work to compete with any margin of profit for us. It we get a plain job it is simply because of the lightness of our material, but we claim that terra cotta is superior to granite or sandstone in a monumental building. It depends to a certain extent upon the quality of the building itself. The Federal Reserve Bank at Cleveland—an enormous structure—went to the expense of procuring beautiful red marbles from Tennessee for all the lower portion of the building except the dark granite base, but this red marble superstructure was crowned by a cornice of terra cotta. It was an elaborate feature above the column lines. I am very much in favour of having terra cotta in certain buildings. I have seen universities in America of the ecclesiastic type in which terra cotta has been introduced with pleasing effect. It shows up best in an ornamental building. The advantage of using terra cotta increases as the ornamental character of the building increases. In some of the recently erected American factories the development is to have four square walls with square windows in them. In such cases terra cotta has the least attractive results, but as the building becomes more detailed in its ornamentation the terra cotta becomes correspondingly cheaper and correspondingly more desirable in its effect. I understand that the administrative building at Canberra will be severely plain, but there will be capitals on the columns, and we can handle them as well as the mason who is working granite. I have seen columns in terra cotta which it seemed impossible to get in stone. Where it is impossible to transport and manufacture huge sawn blocks for use in columns, we overcame the difficulty by using small blocks of terra cotta. There are cases in which terra cotta would give better results on drum columns without flutes, but where the jointing may be horizontal terra cotta will not handle the proposition satisfactorily. However, if the column becomes greater than the ordinary tackle of the stone-man the terra cotta steps in and takes its rightful place again. I should like to see terra cotta used in an important building in the official group at Canberra. No doubt the committee recognizes its peculiar position. In recent times no one has had an opportunity such as is presented in Australia to-day of building a new capital without the pace having already been set by others. Ottawa is perhaps the only parallel example, but in that case terra cotta had not been developed to any extent. With a granite base to indicate stability which large blocks of a stone such as granite will frequently give, this building at Canberra could become light, airy, modern and clean if a terra cotta facing were used for the superstructure, and these advantages would well outweigh any disadvantages that might be due to the alinement of the terra cotta blocks.

124. *To Senator Reid.*—The people of Washington would not have a terra cotta building because Washington is almost entirely built of marble. It would be equally foolish to put up a granite, trachyte, or sandstone building in Washington. If the people of America were setting out to build a new Washington it is difficult to say whether they would use terra cotta instead of marble. It is difficult to say what any group of architects or town planners would do in such a case. For the Washington Chamber of Commerce the Atlantic Terra Cotta Company did certain huge medallion panellings to introduce colour into one plain white building.

125. *To Mr. Seabrook.*—In Temple Court we put round drums on columns up to 2 feet in diameter, and I believe that there is ridge showing, and that there is a slight variation in the colouring, but the result is very satisfactory from the point of view of straightness. I have seen Temple Court lately, and I cannot say that I noticed any of the features which have been criticized, although I am perhaps the most harsh critic that that building would have. On a round column the effect of shrinkage and binding would be uniform throughout. The column permits of the least tendency to distortion as compared with the plain face on a plain backing. Square or fluted columns give a better opportunity to make adjustments than can be got in a round single drum column.

(Taken at Melbourne.)

WEDNESDAY, 28TH APRIL, 1926.

*Present:*

Mr. MACKAY, Chairman,	
Senator Barnes	Mr. Lacey
Senator Reid	Mr. McGrath
Mr. Cook	Mr. Seabrook.
Mr. Gregory	

Daniel James Mahony, Government Petrologist, Geological Department of Victoria, sworn and examined.

126. *To the Chairman.*—I have made a general study of stones for building purposes. Sandstones are composed of grains of quartz cemented together by various materials. The quartz grains are practically indestructible, but the cementing materials vary in character and lasting properties. Because of this, it is impossible to make a general statement regarding the durability of sandstones. If a sandstone is composed mainly of quartz grains and has a good cementing body, it should have great durability. The actions that tend to disintegrate sandstones are of two kinds—chemical and mechanical. A porous sandstone admits water; in periods of heavy frost the water in the interstices freezes, and the resultant expansion causes disintegration. Rain and other water include a certain amount of gases in solution, and these gases act chemically on some of the cementing materials. If that material is principally silicate, the chemical action is negligible, but with other materials it may be very great. Often samples of sandstone taken from the same quarry differ very much in colour and texture. Sandstone is usually in beds which vary in thickness, and often are not uniform in quality. In using bedded rocks for structural purposes—this applies particularly to sandstone—it is considered important that the stone should lie in the building in a position similar to that which it occupied in the quarry. All these sandstones have been deposited by particles sinking in water, and in the position they naturally take up their longer axis lies parallel to the surface on which they rest. There is, therefore, a general tendency for

the sandstone to split parallel to the surface. If slabs of stone are cut from these beds and set on edge the tendency will be for any weathering that takes place to cause the stone to fall away in flakes. If, however, they are set in the building on their natural base, the longer axis of the particles will be parallel to the ground, and the tendency to flake will be absent. In England there are many well-known illustrations of that. In the Geological Museum in Jermyn-street the stone was laid on its natural quarry base, and the building has worn particular well. Other buildings in London which were constructed from the same material have weathered badly. That is usually attributed to lack of supervision in the quarry, with the result that the stones are set on an unnatural base. The twelve months' test that is being conducted by Mr. Butters, at Canberra, with Sydney freestone, may or may not give useful information. If during that period the stone commences to flake or fret, that will be an indication that it is not sufficiently durable for the permanent monumental buildings, but if the stone should show no wear in one year that will not constitute reliable evidence that it is likely to wear for a long time. Opinions differ as to the value of artificial tests, and I think that the most reliable information regarding the Sydney freestone will be obtained from an examination of a building of that material that has been erected for many years. A twelve months' test might conclusively condemn the stone, but will certainly not establish its lasting qualities. I recently visited the limestone deposit at Fairy Meadow. Generally speaking, the lasting qualities of crystalline limestones of that character are good; they wear uniformly and even with great age do not fret into irregular surfaces. Any weathering that takes place is usually even. The decay of limestone is mainly due to chemicals in solution. In large cities, where considerable quantities of coal are used, large volumes of gas containing sulphur go into the atmosphere, and in a manufacturing district the air includes also nitric and sulphuric acid. All of these are injurious to limestone buildings, yet even in London, which, I suppose, has a more polluted atmosphere than any other city in the world, there are stone buildings that have lasted for centuries, although subjected to these gases. Portion of the walls of the Tower of London is made of one of the softer limestones, so are parts of St. Paul's Cathedral, but both these structures have withstood chemical action for several centuries. In a city like Canberra, which will include many open spaces, and in which manufacture on a large scale is not probable, and the consumption of coal for household purposes will be comparatively small and confined to a few months of the year, there will not be much risk of stone deteriorating through the action of gases. A few years ago I made a conservative estimate that the deposit at Fairy Meadow contains about 3,000,000 tons of utilizable stone. That computation includes allowances for waste and caverns and other faults that are usually found in limestone. I think it probable, therefore, that actual quarrying would produce double the quantity of stone I estimated. I investigated the possibility of quarrying the stone in sizes suitable for building. Reliable information on that point can be obtained only by quarrying for 15 or 20 feet into the solid rock. From such information as one is able to obtain without that test, I think suitable building blocks could be obtained, and I have no doubt that the stone would wear well. I produce a small sample that was taken from Fairy Meadow when I was there. It has been partly dressed, and the committee will see that the colour is a dark grey, and a lighter grey where the stone has been axed. I do not think that the colour would alter very considerably as a result of exposure to sun and weather, but probably after a long period of years the axed face would tend to return to the original dark grey. My own opinion as a geologist is that this stone is good enough for any ordinary building, but I recognize that the most reliable data will be obtained by testing the stone in

actual use. I have inspected the granite deposits at Tharwa. There is sufficient stone there to supply the building requirements of the Capital city for centuries ahead, but I do not think it is a suitable building stone. The granite is too irregular in texture. Veins traverse almost every face, and instead of the stone having an even texture, all sorts of disfigurements run through it. It is unlikely that these defects would disappear at depth. The rock is exposed in many places, and practically everywhere veins and dykes are seen running through it. The stone is of varying shades of grey. I do not regard it as suitable for facing a monumental building. I have no experience of synthetic granite, but I should think it would be almost as uneven in colour and quality as the natural stone. In order to determine the value of the Fairy Meadow deposit of limestone I recommend the opening up of one quarry to a depth of 15 or 20 feet from the weathered surface, and if the results justified it, further quarrying at various points in order to determine the nature of the deposit. The site is about  $1\frac{1}{2}$  miles from the Fairy Meadow railway station, and the fact that at one time the proposed railway to the Naval Base was to be laid along Sandy Creek in which the deposit is situated indicates that that route must have been considered practicable for a railway. I am not very well acquainted with the New South Wales granite, but the Geological Museum includes prepared blocks of Victorian granite and other building stones. Whilst I am not able to supply you with actual figures regarding the relative costs of working limestone and granite, we have found that the cost of preparing 1-ft. granite cubes for exhibition is about three times the cost of preparing similar limestone cubes. That is an indication that limestone is very much easier to work. Granite usually occurs in large masses, and an established quarry is likely to supply a uniform quality of stone for a long period. The same cannot be said of sandstone quarries. I understand that the best type of Pyrmont stone which has been used extensively in Sydney is practically unobtainable, the bed in which it was found having been worked out. As a rule, the white sandstones are softer and more crumbly than the yellow ones.

127. *To Mr. Cook.*—A large scale map of the limestone deposits at Fairy Meadow was prepared by Mr. Scrivener, a former Surveyor-General of the Commonwealth, and contour lines were drawn in. That map showed the shape of the mass in plan, and also in the third dimension, and from that data I calculated the volume of the deposit above the creek. I think my estimate of 3,000,000 tons errs on the safe side. I assumed that the deposit would be worked only above the creek level in order to avoid water difficulties. As a rule the quality of limestones remains very much the same throughout the deposit, except near the surface, where the stone is weathered. The quality 20 feet below the surface would be practically the same as at a depth of 100 feet. I should liken the Fairy Meadow limestone to Buchan marble, and I think it might well be classified as a first-grade stone. Without further testing it, I have faith in it as a building material, and I prefer it to the Tharwa granite. Both crystalline limestone and granite are excellent building materials, and I do not think that either has any very great advantage over the other, but there is no granite in the Federal Territory that I would recommend for use at Canberra. In Victoria the largest granite quarries which are open at the present time are those at Harcourt and Elphinstone. They produce an excellent stone, which has been used extensively in the new *Herald* office, and Victorian State Savings Bank buildings, in Elizabeth-street, and the Flinders-street railway station. One objection to it is that it is disfigured by dark patches. The Fairy Meadow limestone is a thoroughly good building material, the deposit is the property of the Commonwealth, and practically an unlimited quantity of it is available. I think there is no doubt that the Government could obtain there large quantities of stone,

uniform in texture and colour, and suitable for use in the buildings at Canberra. As to the price at which the stone can be made available, the cost of quarrying it would be about the same as the cost of quarrying similar stone elsewhere. The other important cost, that of delivery, would of course be governed by the distance over which the stone had to be carried and the transport facilities available. Because of its nearness to Canberra the Fairy Meadow stone would probably have an advantage over any competing stone. Crystalline limestone and marble may be bracketed together. In a good climate granite is practically imperishable. Cleopatra's Needle, which was hewn from the earth thousands of years ago is still in a state of perfect preservation. A good limestone has not the actual wearing capacity of good granite, but Europe has many cathedrals and other large buildings, erected as early as 1100 A.D. which are still in good order. For all practical purposes a stone that will last for 1,000 years is as good as one that may last for 3,000 years.

128. *To Mr. Gregory.*—So far as it goes trachyte is as good a stone as granite, but statistics show that the crushing strength of Bowral trachyte is considerably less than that of granite. In regard to the use of trachyte in the base of a building, the crushing strength of a stone of that type is so great that it would support any weight of walls that is likely to be put upon it. I mention the comparative crushing strengths of granite and trachyte merely because some authorities consider that information an index to wearing properties. The atmosphere at Canberra would be much less contaminated than the atmosphere at Sydney or Melbourne, and rain in the country absorbs from the atmosphere very little deleterious gases; therefore stone buildings at Canberra would not be likely to suffer much from the gases in the atmosphere, but they would be subject to mechanical action, such as the expansion due to the heat of the sun, and contraction due to the extreme cold. Both these influences would produce in the stone very fine cracks which would admit the weather. I have already mentioned how stones that absorb water may be affected by frosts. I have not had much experience of Sydney freestone, but I know that many buildings in Sydney show considerable signs of weathering, especially near the base. That may be due to dampness of the atmosphere, or moisture rising from the ground through defective damp courses. Another cause is dust and grit blown against the buildings by wind. Stawell stone is generally considered to be the best of the Victorian sandstones, but it is very doubtful whether it would last for a long period. In appearance it is not unlike the Sydney sandstone. Judging by the experience in Sydney, I doubt whether freestone would have a reasonable life at Canberra. It is difficult to express an opinion as to which of the Australian granites is the best, because tastes in regard to colour and texture differ widely. When I was at Fairy Meadow I examined the tunnels which had been driven about 14 years ago in order to test the quality of the limestone for making Portland cement. Those tunnels were driven with the aid of high explosives, and as that meant the shattering of the rock for some distance, it was impossible to judge from the face of the tunnels the actual structure of the rock. I suggest that before this stone is used in the permanent buildings at Canberra a small quarry should be opened up. If that test showed that the stone was uniform and obtainable in blocks of suitable sizes it could be employed with safety in the construction of the first monumental building, but until the exploratory quarrying has been done I am not prepared to say that it should be used. Crevices and cleavages in the stone will be found at all depths. If these faults occur at short intervals it will not be possible to quarry good blocks of stone, but if they are far apart and occur regularly they will facilitate quarrying. Limestone deposits are worked to great depths, but I do not think that the quality improves with depth. Twenty feet below the surface

the stone would probably be entirely free from weathering, and as good as it is likely to be at 100 feet. If this deposit opened up well the committee would be justified in recommending that the Canberra buildings should be faced with Fairy Meadow limestone. It could be used for the foundations also, but that is a matter to be determined by the architect. I do not suggest that a tram line should be built to the Fairy Meadow quarry before its value has been proved. In regard to the cost of quarrying limestone, it is well to remember that most of the waste material can be burned for lime, for which there will be a big demand at Canberra. I assume that this stone will be sawn out of the quarry.

129. *To Senator Reid.*—Stone laid in a building on its natural base would not escape the effects of extremes of heat and cold. The cementing material varies in different types of sandstone. The Bacchus Marsh sandstone which is employed in the Victorian Government Printing Office evidently has a cementing material which includes a good deal of clay, and some of the stones are almost decomposed. Other sandstones which have a good binding material will last for very long periods. I have already emphasized my opinion that owing to the purer air at Canberra the chemical action upon stone buildings is not likely to be so great as in cities like London, Sydney, and big manufacturing centres. Sandstones are subject to the influences of heat and cold, but each must be judged on its own merits; some sandstone buildings in Europe have lasted for many centuries. The best sandstone used in Australia is the Sydney freestone, but as I understand that it frets and disintegrates, I am inclined to recommend for Canberra one of the more permanent stones. The weathering of limestones is exceedingly slow and uniform, and does not produce broken surfaces. Experiments were made in order to determine the rate at which limestone weathers, and the result was expressed in a second place decimal of a millimetre per annum; that means that many centuries would be required for a stone to lose half an inch by weathering. The greatest damage to limestone buildings in cities is caused by the coal gases from fires and factories; the sulphur from the coal becomes oxidized and converted into sulphuric acid. Wood fires have a much less effect upon the stone. Crystalline limestones do not harden with exposure, but many of the soft shelly limestones which can be cut with a hand saw in the quarry develop a hard surface after exposure.

130. *To Mr. Seabrook.*—If the committee desires information regarding the probable wear of good quality freestone at Canberra, its best policy would be to examine structures in the neighbourhood of Sydney, but away from the contaminated city atmosphere. I have no doubt that there are many old bridges and culverts built of freestone in outlying parts which have been in use for 80 or 100 years. As sandstone is found in beds its quality varies in different layers. It is often possible to declare that a freestone will not last, because its binding material is inferior; another stone may appear all right, but only use and age will determine its value for building purposes. Canberra has a typical inland climate, but its occasional heavy frosts are not to be compared with those in England and Scotland. The amount of expansion and contraction due to heat and cold is very small, but it tends to cause the surface of the stone to flake or disintegrate, just as sand glued to a piece of indiarubber would break off if the rubber were bent or stretched. The light veins that are found in limestone do not affect its wearing qualities. They are calcite veins, and are of the same composition as the rock itself. They are likely to be found throughout the deposit, but not necessarily uniformly. It is improbable that these veins will weather more rapidly than the other part of the stone.

131. *To Mr. Lacey.*—A certain amount of waste is unavoidable in quarrying any stone, but if the structure is suitable and the stone can be sawn from the beds the waste is comparatively small. I do not recommend experimental building with limestone in connexion

with this particular inquiry, but for future guidance it might be advisable to erect at Canberra a building in which various kinds of stone were employed, in order to test their wearing properties. To be conclusive, such a test would require to extend over 50 years. I could not offhand recommend a granite for the facing of the administrative offices at Canberra, but I could offer an opinion if I had time to look up data and think over the problem. Generally speaking, all granites of suitable texture and free of irregularities are suitable for permanent buildings, but the architect's ideas in regard to colour and the cost of transport are important considerations. The Committee would be safe in recommending a trachyte base and a granite superstructure, because the crushing strength of all the igneous rocks is so great that although one may be twice as strong as another, even the weakest is sufficiently strong to support any structure that may be placed upon it.

132. *To Senator Barnes.*—The laying of the stone on its natural base is not so important with crystalline limestone as with sandstone. It would not be necessary for a geologist to direct quarrying operations; but there should be supervision by an experienced quarryman accustomed to dealing with that class of stone. Fairy Meadow limestone would be affected more quickly than granite by atmospheric changes and gases, but the effects would be so slight and so slow in their development as to be negligible. Bowral trachyte has not been sufficiently long in use to enable one to form a reliable opinion of it, but stone of that type has a long life. The coralline limestone of Mount Gambier would not be suitable for permanent buildings at Canberra. It is soft, porous, and uneven. It is made up of particles of shell with fine material in between, and might weather badly. Limestone is usually quarried with the aid of a channelling machine. This cuts into the bed and then a charge of black powder is used to shift the block without shattering it.

133. *To Mr. Lacey.*—I am influenced to recommend Fairy Meadow limestone by the fact that practically unlimited quantities of this good building material are obtainable in close proximity to Canberra. The extent of the deposit is an important factor, because if this stone proves suitable it can be used in the development of the city for very many years ahead. If you choose a stone of which there is only a limited quantity the deposit may be exhausted in half a century or less, and uniformity in the permanent monumental buildings will be impossible.

134. *To Senator Reid.*—A lot of experimental work with stone has been done in Germany, to ascertain the reactions under varying chemical conditions, but there is a difference of opinion as to whether laboratory results are an index to results in practice.

(Taken at Melbourne.)

THURSDAY, 29th APRIL, 1926.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Gregory
Senator Reid	Mr. McGrath
Mr. Cook	Mr. Seabrook

Thomas Hill, Chief Engineer Department of Works and Railways, sworn and examined.

135. *To the Chairman.*—I have been furnished with a copy of notes made by Mr. G. Sydney Jones on his accepted design for the first permanent administrative building at Canberra. I have also had an opportunity to study the plans and familiarize myself with the proposed engineering services. It must be understood, however, that I have not seen details or plans of the engineering services. Any comment which I

may make is based on information obtained from Mr. Jones' notes. With regard to heating services he proposes two systems with boilers in the basement and what is known as the overhead drop system, necessitating vertical risers to second floor, and mains completely round the top and bottom floors. This will mean the installation of at least 80 drop pipes extending from the ceiling of the second floor to the lower ground floor. It is a good system, but in my opinion the pipes will be unsightly if left exposed and, on the other hand, if concealed, will be difficult to get at for repair work. If we were designing the building we would adopt the system provided for Parliament House, namely, horizontal hot water pipes, connected with two or more vertical risers. The largest riser, where exposed to view outside the lower ground floor, would not exceed 2½ inches and the minimum would be 1½ inches, and the largest horizontal loop serving the radiators would be 1½ inches diameter, and the minimum 1 inch. All the circuits would be connected to a battery of four cast iron water boilers with the necessary valves to permit the isolation of any one circuit for repairs or other purposes. We would suggest that the system be split up into eight circuits, four on the main walls and four around the light courts. The cost of this system would not be any greater, but it would have the advantage that in the event of anything happening we could carry out the repair work in any particular part of the building without interfering with the heating of other portions of the administration block. Under the overhead drop system proposed by Mr. Jones it would be exceedingly difficult to deal with leakages in the main pipes without interfering somewhat with the heating of the building. I notice also that Mr. Jones has provided for what is known as the two-column radiator. We always use the wall type. It does not project as far into a room and provides a slightly better radiation service per square foot, the ratio being about 200 to 180. I concur with his provision for 12 square feet of radiation surface to 1,000 cubic feet. This conforms to the provision for other buildings in Canberra. We think that his estimate of £13,800 is rather low. He estimates labour on site at work erecting piping systems, boiler equipment, &c., at £1,240. We consider it will cost more. On the other hand we are of the opinion that £5,600 for cast iron radiators is somewhat high. We import all our radiators direct and believe that those required for this building would not cost more than £3,800. We have endeavoured to encourage Australian firms to manufacture these radiators, but as they are of a special type of casting we have not been able, up to the present, to obtain them at a reasonable cost in Australia. We believe that Mr. Jones's estimate for these services should be increased by £1,800, making it £15,600 which would include everything. Possibly Mr. Jones has included the duty on the cast iron radiators. Generally, when we import these requirements for Commonwealth buildings, we arrange not to pay duty. What is known as the "Ideal" type of boilers will be used. They are not manufactured in Australia. The plans do not indicate the location of the boiler house, but we may take it that it will be in the basement and that provision will be made for a chimney, which should be 6 square feet in area with an 8-ft. rise from the boilers. I should like it to be clearly understood that I am not suggesting that the system proposed by Mr. Jones is not a good one. I am chiefly concerned about the 80 vertical drop pipes, which will be unsightly. I worked out the power consumption of the pumps will be approximately seven units per hour. We may take it that the cost of the two systems will be approximately the same; but I claim for my proposal that it will get rid of the vertical drop pipes, give a better distribution and ensure less disturbance to occupants of the building whenever repair work may be necessary. The installation proposed by Mr. Jones for vacuum cleaning is considered satisfactory, and no amendment is suggested except in regard to the discharge of sweepings into the sewer. This is not advised.

Mr. Jones proposes to use wet centrifugal separators, and discharge all dust into the sewer. I am sure that the sewerage authorities will not permit this because of the danger of causing a block. Certainly it would not be allowed, except with a silt trap, which would require constant attention to prevent dust and fluff entering the sewer. Dry centrifugal separators should be used. The machines should be located in or adjacent to the boiler house, where they could be looked after by the boiler attendant. The amount allowed in the estimate for labour and sundries is considered somewhat low for Canberra. We think that the estimate should be increased from £2,700 to £3,000. Again, this is only an opinion, and I do not necessarily press it against the estimate submitted by Mr. Jones. I should like the committee to consider the adoption of portable electric vacuum cleaners instead of the pipe system. This would effect a considerable economy, because Mr. Jones has provided 500 power plugs in connexion with his electric lighting system, and these could be used for electric vacuum cleaners of a portable type so that the only cost would be the purchase of machines, representing not more than £1,000. Mr. Jones proposes to use six centrifugal machines. In my opinion that provision is not sufficient for a building of the size contemplated. The portable vacuum cleaners at present being used in the Commonwealth offices, Melbourne, are working very satisfactorily, and our experience favours their use for a building of the type proposed at Canberra. An entirely different problem is met with in buildings like the General Post Office, for which we recommend the piping system. The adoption of portable vacuum cleaners would reduce Mr. Jones's estimate of £2,700 to, say, £1,000, for the purchase of the necessary vacuum cleaning machines and the installation of additional power plugs in the building. I notice also that the architect has made no provision for the supply of hot water to the lavatory basins. In my opinion this is necessary in a climate like that of Canberra for almost six months of the year. The estimated cost of an installation consisting of a cast iron water boiler, copper-lined cylinder, and copper pipe reticulation to serve the basins in the eight lavatory blocks is £2,500. Mr. Jones suggests the adoption of the Reichel fire alarm system, 1,020 points at a cost of £3,650. In the present Commonwealth offices we have no Reichel fire alarm or sprinklers. We depend upon the watchmen for the protection of valuable books and documents in the buildings generally. The watchmen have to punch clocks in various portions of the building. If they fail to do so at regular intervals the clocks, being connected with the fire brigade station, give an alarm and the brigade turns out to ascertain the reason. I am advised that it is proposed to adopt this system in Canberra. In any case watchmen would be employed on the building, and besides punching time-clocks they would have other duties to attend to, such as cleaning and attending to the hot water system. For the administrative building the adoption of this system would involve the installation of about 50 points at an estimated cost of £750, as against £3,650 for thermostats. There would be ten points on each floor all connected with the fire station in Canberra. The system would be in every respect similar to that adopted in Melbourne. Mr. H. B. Lee, Chief Officer of the Metropolitan Fire Brigade, Melbourne, and Commonwealth Consultant, has authorized me to say that the watching system is preferable to thermostats, which are liable to get out of order. As a member of the Commonwealth Fire Board I may state that he regards thermostats as being in the third line of defence. Watchmen and clocks are placed first, sprinklers second, and thermostats third. Mr. Lee has already given evidence before the committee in connexion with the provisional Parliament House. He included in his evidence reference to the administrative buildings and advised that the provision for outside mains is ample. He does not require any internal mains for fire-fighting services or any other provision

except the ordinary CO<sub>2</sub> fire extinguisher. Mr. Jones provides £1,500 for electric cooking apparatus. This is ample. Generally speaking the demand will be for light luncheons. Even if midday dinners had to be provided it would be sufficient. The present cost of power for bulk supplies varies with the nature of the demand from 1d. to 1½d. a unit. The ordinary charge for domestic supply is from 6d. to 1s., but present prices should only be regarded as tentative. Based on Sydney rates the cost of power for the administrative building should be about ¾d. a meal for each person. This is what it costs the Commonwealth Bank authorities in Sydney and Melbourne, where three-course meals are provided. The next item in Mr. Jones's notes relates to lifts. He proposes six lifts, dual control, 3,000 lbs. load, equivalent to 20 persons, with a speed of 250 feet a minute, to cost approximately £12,000. That is about the average cost. I notice, however, that certain other lifts, which appear to be provided for, are not included in the estimate. Apparently these lifts are to be installed in future if required for the purpose of sending papers or documents from one floor to another. In all there will be twelve of these smaller lifts within the various rooms. For electric lighting and power Mr. Jones estimates the cost will be £14,837. I had a check estimate made of these items, and the cost worked out at £14,975. Our estimate, however, provides for 800 power plugs as against 500 in Mr. Jones's estimate. We base our figures on the provision made in other large buildings, and we also have in mind the possibility of the adoption of portable vacuum cleaners. The wiring has to pass the several points in any case, so the only additional cost will be for porcelain plugs which cost about 5s. each and the labour in fixing, a total of about £150. It costs a considerable amount to fix power points after the completion of a building, but very little extra while the work is being done in the first place. There are ample water mains in the streets around the building, and fire hydrants are fixed at 120 yards apart in accordance with Mr. Lee's recommendation. There is no mention in the architect's notes of the cost of water services and sewerage, but I understand that the estimated cost of the building per cubic feet covers all internal water and sewerage fittings, so they are not enumerated. The proposal for a 6-ft. by 6-ft. conduit under the building is an excellent idea. It will carry all sewerage, water, and storm water mains.

136. *To Senator Reid.*—I am not in favour of the vertical drop pipe system of heating for the reasons given. It is very difficult to conceal the drop pipes and, if they are covered, exceedingly difficult to effect repairs. The piping system which we suggest would go round the walls on the top of the skirting and might actually take the place of moulding. I should like to emphasize that one system is as satisfactory as the other, but in my opinion the use of smaller pipes, distributed as suggested, will make for more effective control. With the drop pipe system it will be necessary to cut out one-half of the building to effect repairs to the main pipe, whereas under our proposal it will be necessary only to cut out about one-fortieth of the building to do repair work. I doubt if the sewerage authorities will permit the dust and fluff, gathered during the cleaning of the building, to be turned into the sewers. Certainly silt traps will have to be provided and attended to frequently. If portable vacuum cleaners are used the dust can be dropped into the dust shoots and taken away in bins.

137. *To Mr. Seabrook.*—The piping used for the hot water services will be valved, so that it will be possible to attend to leaks without causing serious inconvenience. If anything happened to the main pipes on the top or bottom floors it would be necessary to shut off the whole of the heating system for portion of the building to effect repairs, but this would not take long, and therefore I do not stress that objection. I prefer the smaller pipes placed round the rooms on the top of the skirting. Only the water for cooking will be heated electrically. Mr. Jones provides for two cast iron boilers

with a capacity of transmitting 1,350,000 British thermal units per hour at 65 degree Fahr., for the heating of the building. This is much cheaper than heating by electricity. The amount of thermal units per ton of coal delivered electrically at the point of use is about only 1 per cent.; the other 99 per cent. is either lost in the boilers or in transmission. Heating with steam gives about 30 per cent. We heat the present Commonwealth offices in Melbourne for about £120 a year, using Ideal boilers, which are very efficient. I doubt if it would be possible to cleanse the building with the  $7\frac{1}{2}$  h.p. electric motors provided in Mr. Jones's estimate, even working eight hours a day. There would, of course, be no difficulty in adding to the number of machines, but if, as I suggest, portable vacuum cleaners are used it will be possible to save £2,700 in the installation of the machinery and piping for the system favoured by Mr. Jones. The architect's estimate for the electric lighting services is about right. He provides for 2,000 electric lights, including distribution boards, £2 15s., and fittings, 2,000 100-watt lamps at £2 15s. each. This estimate appears to be low. With present cost of labour and materials, we estimate the cost at £3 each, exclusive of fittings. I suggest that there be 800 power points instead of 500. All the electric wires will be laid in steel conduits in accordance with the fire underwriters' regulations.

138. *To Mr. McGrath.*—Apart from the suggestions which I have made, I am satisfied with the estimate furnished by Mr. Jones, but I cannot offer any opinion as to the probable total cost of the building, £690,096 with granite facings. I can speak only of the engineering side. The main portion of the provisional Parliament House was built by day labour, but there has been a lot of contract work in it as well. I may explain that, as there was an earnest desire to push on with the erection of the building, work was put in hand without waiting many months for the preparation of all the drawings and specifications, which would have taken at least six months. Subsequently contracts were let for many of the fittings and appliances. Probably half the work has been done by day labour and half by contract. I do not care to express any opinion as to the amount of commission to be paid to the architect whose design has been accepted. That is the rate laid down by the Institute of Architects, and represents a percentage on the actual cost of the work.

139. *To Mr. Gregory.*—I should say that it will cost £750 a year in labour and material for the upkeep of the heating system. Steam heating is cleaner and very much cheaper than the old system of fire-places. There should be no difficulty whatever in extending the ac-

commodation to suit the requirements of the several departments. It will be possible to cut out the heating of some of the floors altogether if they are not needed, whereas if the vertical drop pipe system were adopted all the floors will have to be heated. Both systems are good, but I think the method of distribution under my proposal is the better. The boilers will not require much attention. The fuel supply is coke, with soft coal to brighten up the fires in the morning. They require very little attention throughout the day, and no attention at night. Once the building is heated it retains the heat. In Melbourne the usual practice in the cleansing of a building, is to send the dust away in the ordinary dust bins. I approve of a hot water service for the lavatory basin, because electric water heaters would be too costly. In a climate like that of Canberra a hot water service is essential. Draughtsmen and other officers cannot give good service with cold hands. The Cotter river water gets down to 40 degrees Fahr. in the winter time, but the building will be maintained at a temperature of 62 degrees. In my opinion electric cooking appliances will be the more economical for the character of the proposed service in this building. Electric power costs about  $2\frac{1}{2}$ d. at present, but I think the price will be reduced in the near future.

140. *To Mr. Cook.*—Personally I favour contract work, but if tenders are not reasonable then the work should be done by day labour. This course was followed in the construction of the sewers at Canberra. The lowest tender was £132,000. We thought it too high and did the work by day labour, absolutely to specifications, for £100,000. It is as well to have a tender to work against, because it cannot be said, afterwards, that if a certain work had been done by contract it would not have cost so much. Our day labour costs are taken out by independent men, so that we know at any time what is the actual cost of a particular work. As departmental officers we would naturally prefer work to be done by contract, because it would save a considerable amount of trouble, but if we advise the Government that a tender price is too high, then it is our duty to do the work by day labour.

141. *To Mr. Seabrook.*—Whenever tenders are to be called for a particular work we prepare a departmental tender which is initialed by the responsible Minister and sealed a week before tenders are received from outside contractors. If we find that private contractors' prices are too high we advise the Minister and carry out the work by day labour.

*The witness withdrew.*

*The Committee adjourned.*