

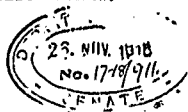
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*W. B. Henderson*

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

P A P E R S

Clerk of the Senate.  
13<sup>th</sup>/1/8. to be laid on the Table of the Senate.



R E P O R T

together with Minutes of Evidence  
relating to the proposed  
A R S E N A L   R A I L W A Y .

1918.

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

ARSENAL RAILWAY.

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# MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

## Second Committee.

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

### Senate.

Senator George Henderson.

Senator Edward Needham.

Senator John Newland, Vice-Chairman.

### House of Representatives.

William George Mahony, Esquire, M.P.

James Mathews, Esquire, M.P.

Sydney Sampson, Esquire, M.P.

Hugh Sinclair, Esquire, M.P.

The Honorable William Henry Laird Smith, M.P.

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# PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

## ARSENAL RAILWAY.

### R E P O R T.

EXTRACT FROM No. 78, VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES

20th September, 1918.

7. PUBLIC WORKS COMMITTEE.—REFERENCE OF ARSENAL SITE RAILWAY.—SITTINGS ON COMMITTEE.—Mr. Groom moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act* 1913-1914, the following work be referred to the Parliamentary Standing Committee on Public Works for their report:—“Railway to connect the Arsenal Site, Tuggeranong, Federal Capital Territory, with the New South Wales Government Railway between Nimmitabel and Goulburn”; also, that leave be given to the Committee to hold meetings and transact business in connexion with this reference whilst either or both Houses of Parliament is or are actually sitting.

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

Debate ensued.

Question—put.

The House divided—

Ayes, 27.

Noes, 13.

Mr. Archibald	Mr. Mackay
Mr. Bamford	Mr. Mahony
Sir Robert Best	Mr. W. Maloney
Mr. Chantler	Mr. Pigott
Mr. Chapman	Mr. Paynton
Mr. Corner	Mr. Riley
Mr. Falkiner	Mr. Sinclair
Mr. Fenton	Mr. Laird Smith
Mr. Greene	Mr. Watt
Mr. Gregory	Mr. Webster
Mr. Groom	
Mr. Jensen	
Mr. Lamond	Tellers:
Mr. Lister	Mr. Mathews
Mr. Lynch	Mr. John Thomson

Mr. Brennan	Mr. Page
Mr. Bruce	Mr. Tudor
Mr. Considine	Mr. West
Mr. Finlayson	
Mr. H. W. Foster	Tellers:
Mr. Kelly	Mr. Charlton
Mr. Maxwell	Mr. McWilliams
Mr. Nicholls	

And so it was resolved in the affirmative.

THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS, to which the House of Representatives referred for investigation and report the question of the proposed construction of a railway to connect the Arsenal site, Tuggeranong, Federal Capital Territory, with the New South Wales Government railway between Nimmitabel and Goulburn, has the honour to report as follows:

#### INTRODUCTORY.

In pursuance of the decision of the Federal Government to establish an Arsenal within the Federal Territory, and in view of the fact that the site selected at Tuggeranong for such Arsenal is at some distance from the existing railway line, the necessity arises for considering the advisability of constructing a railway, for it is obvious that in the matter of the erection of large factories, the carriage of raw material and the distribution of the finished product, it is essential that railway connexion should be provided.

#### PRESENT PROPOSAL.

2. The proposal now under consideration is to construct a line of railway to link up the site of the proposed Arsenal with the New South Wales railway from Goulburn to Nimmitabel at a point about 5 miles south of Queanbeyan.

#### DESCRIPTION OF PROPOSED WORK.

3. After leaving the New South Wales system the proposed line would run for some three miles almost parallel to the main line and then in a westerly direction until the Arsenal site is reached, a distance of about 8½ miles from the starting point.

It is proposed to construct a single track only, with a ruling grade of 1 in 60, with sharpest curves of 20 chains radius. The gauge would be the New South Wales standard 4 feet 8½ inches, the formation in cuttings and banks being 17 feet wide. It is proposed to use 80 lb. rails, 40 feet in length, with 2,244 sleepers 8 feet by 9 inches by 4½ inches, and 1,640 yards of ballast to the mile.

Three bridges are considered necessary, namely:—One at Jerrabomberra Creek of three openings, 40 feet; one near the 4 miles 48 chains point of two openings, 10 feet; and one at Tuggeranong Creek, four openings, 40 feet.

It is proposed to construct these bridges of concrete and steel, while any necessary culverts will be of concrete.

4. For the whole of its length the branch line would run through Federal Territory, and as it is pastoral country it is proposed that the line shall be fenced.

5. No station yard or siding accommodation is provided for excepting a siding at the connexion with the New South Wales railway main line, the terminal point of the branch line being at the Arsenal site in connexion with which numerous branch lines and sidings will be constructed.

#### ESTIMATED COST.

6. The Departmental estimate of the cost of the line is £62,613 12s. 6d., or about £7,590 per mile, and it is stated that its maintenance will amount to approximately £800 per annum.

The time set down for completion of the work is about eight months from date of commencement.

7. It is intended that the branch line shall be worked either with the New South Wales locomotives or with shunting locomotives which will form part of the Arsenal equipment; no provision has therefore been included in the estimate for rolling stock, as the inwards and outwards loading will be conveyed by the New South Wales rolling stock, and any carriages for the conveyance of workmen and trucks for the carriage of goods within the Arsenal will be included as portion of the plant for the operation of the Arsenal.

#### ESTIMATED REVENUE.

8. The traffic for the main branch line will consist in the first instance of material required in connexion with the construction of the Arsenal and eventually the township, and after operations shall have been commenced at the Arsenal the inwards freight will comprise the raw material, together with stores, &c., for the requirements of the employees, while the outwards freight will consist of the manufactured product. It was stated that no reliable estimate can, therefore, be given of the revenue, the amount of which will depend upon the extent of the operations of the Arsenal.

#### COMMITTEE'S INVESTIGATIONS.

9. At the outset of the inquiry it was decided that while individual members of the Committee might hold various opinions as to the advisability or otherwise of establishing the Arsenal in the position indicated, it was realized that the establishment of such Arsenal had been approved by the Government and was outside the scope of the present reference. It was consequently agreed to regard the establishment of the Arsenal as a fact in process of accomplishment and members devoted themselves entirely to the consideration of the best means of providing access to the Arsenal site.

10. The Committee visited the sites selected for the Arsenal and town, inspected the route suggested for the branch line, and by its own observation, the scrutiny of plans and the examination of witnesses from the Commonwealth and New South Wales Railway Departments, as well as the Federal Capital Director of Design and Construction, endeavoured to ascertain whether any other alternative and equally suitable route could be discovered for the purpose of establishing railway connexion with the proposed Arsenal.

#### POINT OF DEPARTURE.

11. Careful inquiries were made as to whether a more direct route from the Goulburn-Nimmitabel railway to the Arsenal site could not have been obtained, or whether a point a little further south could not have been selected and so avoid the construction of a bridge over the Jerrahombera Creek, but the evidence obtained showed that this matter had formed the subject of discussion between officers of the Commonwealth and a representative of the New South Wales railways, and the conclusion arrived at was that, owing to the steepness of the grades on the New South Wales line skirting the Territory, the point of departure selected at about the 200 miles 30 chains point from Sydney was the only practicable place for an off-take outside Queanbeyan.

#### ALTERNATIVE ROUTE.

12. Realizing that in dealing with any project for railway construction such as now proposed, it is wise to keep in view the ultimate railway development of the Federal Territory, as well as the advisability of providing at some future period for rapid transit from the Arsenal to various parts of the Commonwealth, consideration was given to a proposal put forward by Mr. Griffin, Federal Capital Director of Design and Construction, that railway communication with the Arsenal should be obtained by constructing a line on a 1 in 100 grade from the terminus of the present Queanbeyan-Canberra line in a south-easterly and then south-westerly direction to Tuggeranong. This, however, involved a longer line, a greater capital expenditure, and a higher cost for carriage of freight, and did not therefore commend itself to the Committee.

13. Attention was given to a modification of this proposal which involved the construction of about 7½ miles of the Arsenal end of the railway on Mr. Griffin's suggested route and grade, and then a length of about 1½ miles on a 1 in 60 grade to connect his proposed line with the New South Wales railway system at the 200 mile 30 chain point from Sydney already fixed upon by the Commonwealth Railways, the idea being that at some future date the contemplated Yass to Canberra line could be extended to connect with this 1½ miles of line running into the Arsenal.

This modified route was, however, shown to be more expensive than the departmental proposal and to involve a slightly longer haul for freight, while the advantage sought to be gained by the adoption of a 1 in 100 grade could not be realized by reason of the steeper grades on the long sections of the New South Wales system which would of necessity have to be traversed in transporting material to or from the Arsenal to the Capital cities of the various States.

A line constructed to a grade of 1 in 50 on this route offered no advantages over the proposed Departmental line, which, it was stated, has also been located with a view to connecting with Canberra at any future time when thought necessary.

#### ACQUISITION OF LAND.

14. Although the whole of the proposed railway will lie within the Federal Territory, the Committee ascertained in the course of its inquiries that prior to commencing construction it will be necessary to acquire certain privately owned lands through which the proposed line would pass. This acquisition may involve the expenditure of possibly £5,000 or £6,000, still such acquisition would only be anticipatory action which would have to be taken sooner or later, as it has long been decided that all privately owned land within the Federal Territory must eventually be acquired by the Commonwealth.

The amount of land to be actually set aside for railway purposes is however not large, and its value may be estimated roughly at about £500.

#### AGREEMENT WITH NEW SOUTH WALES RAILWAYS.

15. As it is the intention that the branch line to the Arsenal shall be worked by the New South Wales authorities with its own rolling stock with the exception perhaps of a couple of shunting engines at the Arsenal—it follows that some agreement should be arrived at with the State Government under which the Commonwealth Government, which bears the cost of the construction of the line, will be treated equitably in the matter of passenger fares, freight charges, &c. During the course of its inquiries the Committee learned that no such agreement had yet been made and at its suggestion action was immediately taken to arrive at an understanding in the matter.

16. At the instance of the Committee communications were addressed to the New South Wales Railway Department and two officials of the Commonwealth Railways were despatched to Sydney for the purpose of conferring on the matter, with the result that the New South Wales Railways Commissioners have undertaken to work and maintain the line on payment of the Department's published rates.

The Committee considers that this offer would form the basis of an equitable working agreement provided that such agreement be subject to review at stated intervals, so that when traffic increases the Commonwealth would be allowed some proportion of the revenue earned to liquidate the interest on its capital expenditure.

#### SUPPLY OF BRICKS.

17. In the course of the inquiry mention was made of the fact that approximately 20,000,000 bricks will be needed for Arsenal and Arsenal Town purposes, and that it was the intention to manufacture such bricks at the Yarrolumla brickworks within the Canberra City area.

Though somewhat outside the scope of the reference, the Committee deemed itself justified in inquiring into the means to be adopted to transport the bricks to the Arsenal Site.

Two methods were considered by the Committee:—

The Resident Engineer, Commonwealth Railways, recommended the construction of a length of about three miles of light line of railway at a cost of about £12,000 to connect the Yarrolumla brickworks with the Canberra Railway Station and thus enable the bricks to be carried by rail, via Canberra and Queanbeyan, to the Arsenal a distance of approximately 21 miles.

The Director-General of Works recommended as an alternative that the existing traction plant at Canberra be utilized and the bricks transported by road. He stated that by an expenditure on crossings, difficult portions of the track, &c., of an amount of £1,000 spread over four years and an additional expenditure of £420 per annum for maintenance during the construction period, it would be possible to use the natural surface of the ground and avoid any large amount of road-making. The road would be located in the position suggested in the Federal Capital design for one of the developmental roads, so that any small amount of road-making done would be to the good when the future road is constructed.

The figures quoted by the Director-General of Works and Mr. Hill, who strongly favoured the carriage of bricks by road traction on the ground that a traction plant is already available, tended to show that the transportation and handling would be done more economically by this method, while in addition the special expenditure of £12,000 involved in the construction of the light railway would be saved.

The Committee therefore did not further pursue this portion of the inquiry.

## COMMITTEE'S DECISIONS.

18. After careful consideration of all the evidence received, the Committee is of opinion that the line suggested by the Commonwealth Railway Department is the best proposition for providing railway connexion with the Arsenal at the present time, and the whole of it, with the exception of about  $\frac{1}{2}$  miles, could be utilized for connecting to Canberra and thence to Yass at any future time when thought desirable.

The decision arrived at by the Committee is shown in the following extracts from the Minutes of Proceedings:—

Senator Newland moved.—That in view of the expressed intention of the Government to establish an Arsenal at Tuggeranong, the Committee considers that the construction of a railway to the site of such Arsenal is advisable and recommends that the route suggested by the Commonwealth Railway Department be adopted.

Seconded by Senator Needham. Carried unanimously.

19. In carrying out the construction it is thought possible that some advantage might result from the work being carried out by the New South Wales Railway Department, who will eventually work the line; moreover, it is advisable that every effort be made to carry out the work as quickly and as economically as possible. With this end in view the Committee recommends that the New South Wales Railway Department and the Commonwealth Railway Department both be asked to submit a price for the construction of the line, and that the lower quotation be accepted.

The decision arrived at by the Committee in connexion with this matter is shown in the following extract from its Minutes of Proceedings:—

Mr. Laird Smith moved.—That the Commonwealth Railway Department and the New South Wales Railway Construction Branch be asked to submit quotes for the construction of the line and that the lowest quotation be accepted.

Seconded by Mr. Sinclair. Carried unanimously.

*H. Gregory*  
Chairman.

Office of the Parliamentary Standing Committee on Public Works,

31 Queen-street,

Melbourne, 29th October, 1918.

## MINUTES OF EVIDENCE.

(Taken at Melbourne.)

WEDNESDAY, 25th SEPTEMBER, 1918.

Present:

Mr. GAZDOFF, Chairman;	
Senator Henderson,	Mr. Sampson,
Senator Needham,	Mr. Sinclair,
Senator Newland,	Mr. Laird Smith.
Mr. Mathews,	

John Irwin Darbyshire, Resident Engineer, Commonwealth Railways, sworn and examined.

1. To the Chairman.—I have been placed in charge of the work. No survey has yet been made. There has been only a location from the contours supplied by the Lands and Survey Branch, which will give a very close approximation. The Lands and Survey Branch made a survey over portion of the line some time ago, but it does not suit this proposal. It follows the line as shown on drawing No. 505, practically for  $4\frac{1}{2}$  miles, and then goes off almost due south. The grades on it are 1 in 65, and the curves 12-chains radius. The line shown on the plan has curves of 20-chains radius, and compensating grades of 1 in 60. With those grades and curves we could not get down in the southerly direction taken by the survey of the Lands and Survey Branch. The line shown on the plan has been drawn there without a survey, but I have sections and everything necessary made from the contours of the Lands and Survey Branch. I have proper sections right through. I have made my estimates from those data. They will give a very close approximation to what the actual figures would be after a survey. Practically, the whole Federal Territory has been contoured. I am satisfied from the contour survey made by the Lands and Survey Branch that no better line could be obtained using the grades and curves we have adopted. This is the first time I have ever heard of a Lands Department making contour surveys. In railway locations we always make contour surveys and locate from them. Instead of doing that on this occasion, we have adopted theirs, which are obtained on the same basis that we would obtain ours. Before any work is started it is absolutely essential that the most complete survey should be made. We would not attempt to build the line on the information we now have. A proper working survey would take from six weeks to two months. A flying survey to obtain practically the same information as we have now would take a fortnight. Whether the working survey will be made depends on the decision the Committee arrive at. If it is decided to construct the railway, that survey will certainly be made. We would not dream of doing anything else. I produce plans showing the sections of the proposed line. The first sheet shows the section up to  $3\frac{1}{2}$  miles. The second shows the section up to  $8\frac{1}{2}$  miles. The worst grade is 1 in 60. The take off from the State railway from Goulburn to Cooma is at a point 20 $\frac{1}{2}$  miles from Sydney, from which the new line would run southerly, and then westerly. The formation in cutting and banks is 17 feet wide; 80-lb. rails, 40 feet long; gauge, 4 ft. 8 $\frac{1}{2}$  in.; sleepers, 8 feet x 9 inches by 4 $\frac{1}{2}$  inches; the ballast, 1,540 yards to the mile, which is our standard for a 4 ft. 8 $\frac{1}{2}$  in. railway, ballast material gravel, of which we shall

be able to get plenty from the river and Jerrabomberra Creek. There are three bridges, one over the Jerrabomberra Creek, with three openings of 40 feet, another small bridge with two openings of 10 feet near the 4 $\frac{1}{2}$ -mile, and another bridge with four openings of 40 feet at the Tuggeranong Creek. There are ten small culverts, ranging from 2 feet to 4 ft. 6 in. in diameter. The cost of the steel and concrete bridges will run into about £8,000. We have had to go a good way north to get a connexion with the State railway, because from the 200 mile 60 chains right to the 204 miles is a rising grade of 1 in 40 which makes it impossible to connect there. The spot chosen is the only suitable place outside of Queanbeyan. The New South Wales Government would not permit connexion on a 1 in 40 grade. The matter was discussed in June, 1916, by a Board, consisting of Colonel Owen, Mr. Hohler, Mr. Griffin, and the New South Wales District Engineer. In their report to Mr. Bell, the Board recommended the spot chosen as the only possible place for a take-off. I went over the ground myself to try to find a place, but could find no other suitable. The sleepers on the trans-continental line are 9 feet x 10 inches x 6 inches in some cases, and 8 ft. 6 in. x 9 inches x 6 inches in others. This will be a different class of traffic. It will always be slow, and the trains comparatively light on account of the grade. When I say light, I mean light as against the grades. A 1 in 60 grade limits your load considerably as against a grade of 1 in 100. The axle load would not be light. Another reason why we have decided on the 8-ft. sleeper is that that is the type that has been used by the State authorities in that district. If we introduced another type we should have to pay considerably more for them, seeing that our requirements are so small. Eight-ft. sleepers are best for this work. The terminal site has not been marked out, but I have the proposed position shown on a plan. There is no doubt that we will be able to get the railway into that site without any trouble. Only the general area of the township has been marked out for us on the plan. I am satisfied that, with a branch off the line, as marked on the plan, we will be able to give railway connexion to the township. I understand that the line is to be worked by the New South Wales Railway Department. New South Wales Government stock is to run over the line, and do all the carrying. As the place is developed, this line will be able to be connected with the railway extending from the Capital to Yass. I went into that question, and the connexion is quite feasible judging from the contour surveys. The present terminal of the railway to the Capital is at a point at the south-east corner of the Capital City site, near the power-house. One way to join that up with the proposed line to the arsenal would be to go west along the Uriarra-road to Western Creek, then turn south along Western Creek to the Divide, then southerly down Villago Creek to the arsenal township. That would mean going westerly 4 miles from the power-house, and southerly 8 miles. That distance is necessary to get a 1 in 60 grade. We could save a mile by adopting the 1 in 60 grade. The total of 12 miles would be to the arsenal town site. It would require another  $\frac{1}{2}$  mile of line to the arsenal. Another route would be to go from the power-house, following the Jerrabomberra Creek in, a direction slightly east of south, and joining the line now under

consideration at a point about 1 mile from the proposed connexion with the State line. The distance of that route would be about 4½ miles. The 12-mile route goes through country of decomposed granite, mostly poor land. The easterly route goes through better country, and would open up fairly good agricultural land. That is a consideration, as the township will want feeding. The area east of the arsenal site and the Tuggeranong Creek is fairly good agricultural land. There will be no difficulty in the future in connecting up from the arsenal site with Jervis Bay and Sydney, and with Melbourne through Yass. To reach Melbourne, I would make the connexion through Yass, and would recommend the Jerrabomberra Creek route. This country is easier, and the work would be £2,000 a mile cheaper. I am quite satisfied that connexion can be made with all the Capitals, as we looked into that question. The estimate of cost for clearing is based on my own observation of the country and my knowledge of what the work is worth. The amount of £250 for clearing represents 100 acres at 50s. an acre. For fencing, I estimate 1,200 chains at £1 per chain. The earthworks comprise 78,232 yards of cut and 25,444 yards for about 20 chains of extra load at 1s. For sleepers, I believe we can get ironbark, as there is ironbark country about 50 miles south. The best sleepers we ever had were of Murray red gum, but we cannot get them now. The gravel from the river will make very good ballast. It is proposed to construct the line by day labour. That is as efficient as the contract system. Day labour under the buttressing system is most expeditious. You do not require the same men supervising as you have under contract. But a small job like this I would not consider it worth while to call for tenders. We can give the Committee all the details, and the drawings of the bridges and culverts. They are our standard types. The only trade we know of for the line will be in connexion with the arsenal, and the requirements of the people employed there. I have not been asked to consider whether the freight on the line will pay interest and sinking fund on the cost of construction. The only people who could give us any information are the Defence authorities, and their estimate is a daily working of 250 to 300 tons. From the time the railway is approved it will take us about eight months to construct. The work has to be rushed.

2. To Mr. Mathews.—The nearest point of the line would be within a mile of the township site, but it is intended to carry it into the centre of the township. That is not in this proposal, but is part of the arsenal proposal. I should say the creeks to be crossed are subject to flood. The bridges we are going to put in will be quite capable of carrying off any flood, for they are well above flood level. The existing bridge on the State line over the Jerrabomberra Creek has been there over 25 years. I am providing the same accommodation over that creek as on the State line. I had the drainage area on the map to go in designing the bridges. It would not be possible, owing to the rough nature of the country, to start the railway to Jervis Bay from the most southern point of this line. This line cannot be made the main line to Jervis Bay. The Jervis Bay line will start a good distance north of where we cross, somewhere about Queanbeyan, and go along the Molonglo Valley.

3. To Mr. Sinclair.—The proposal now before the Committee is more economical than to extend the line from Yass to Canberra on to the arsenal. This line will not form part of the Yass-Canberra line.

4. To Senator Newham.—I am sure we can make the permanent survey in two months. I am quite satisfied with the contour survey of the Lands Department for the purposes we are using it for. The

proposed line will carry the heaviest locomotive that can be put on the road. It is built for a 17-ton axle load—the Commonwealth standard. The New South Wales standard is 15½ tons. As regards clearing, there is no heavy timber, but a good deal of box scrub, some of which is very thick. I estimate the cost of ironbark sleepers at 6s. each in the road. In connexion with the first arsenal proposal, sleepers were offered to be delivered from Sydney in trucks at Queanbeyan at 4s. 11d. each. I have taken that as a basis, and added 1s. 10d. for extra handling, &c. I think I can get ironbark sleepers for 6s. right on the job, from where the timber grows. We will have the line ready for traffic eight months after authorization.

5. To Mr. Laird Smith.—By the nearest route along Jerrabomberra Creek, the distance from Yass to the terminus of the proposed railway would be about 57 miles. There is no nearer route off the main Sydney to Melbourne line to take off from the State line now. The proposed line is to take off from the State line now at 1 in 88 and 1 in 132. The grade where the actual connexion will be made is 1 in 132. In making my estimate I have made allowance for contingencies, and am not likely to increase it. It is the custom to allow a margin of 10 per cent. on estimates. A man putting in a tender allows 10 per cent. for contingencies. I am making provision for the bridges and culverts to carry the full load carried on the State railways.

6. To the Chairman.—I have not allowed "10 per cent. and a little more" for contingencies in making my estimate. I have allowed only 10 per cent. It would be a stupid thing to add "a little more" in these jobs. The line is to be a single track, which will be sufficient for a long time. No sidings are required on it. The line as surveyed will be suitable if a double track is needed at any time. It is advisable to fence the line. The State railway is fenced. The arsenal output may have to run night and day, and the country is all stocked. Even from a maintenance point of view, it is better to have the line fenced, to keep cattle out. The railway from Queanbeyan to beyond the powerhouse is being extended towards Yass at the present time in the shape of earthworks and bridges over the Molonglo River, the Jerrabomberra Creek, and another creek, but the rails have not been put down.

7. To Mr. Laird Smith.—In making an estimate on a flying survey, the only things not definite are the quantities. The rates will be the same. If the actual quantities are less than the estimated, it will be possible, when the permanent survey is made, to reduce the cost. I believe the earthwork quantities will be reduced, and that is the biggest item in the whole thing. After the flying survey is made we shall be able to locate the line more closely to the ground.

(Taken at Melbourne.)

THURSDAY, 26TH SEPTEMBER, 1913.

Present:

Mr. GREIG, Chairman;  
Senator Henderson, Mr. Mathews,  
Senator Newham, Mr. Sinclair,  
Senator Newland, Mr. Laird Smith.  
Mr. Mahony.

Alexander James Gibson, Temporary Chief Engineer and Acting General Manager of the Commonwealth Arsenal, sworn and examined.

8. To the Chairman.—I have been consulted in regard to the site of the arsenal railway, and I have seen the plan of the proposed route, plotted on a contour map. The sites of the main entrance line to the factory, and

of the factory line running off it to afford communication with the various groups of factories at the arsenal, have been fixed. The location of the arsenal itself has also been fixed, and I believe gazetted. There have been one or two Commissions which have inquired into the question of whether the site chosen for the arsenal is a suitable one, but the location of the actual buildings on that site has, of course, been my responsibility. I am quite satisfied with the terminal point of the projected railway, which has been fixed to suit my requirements. The route which will be traversed by the line will be equally satisfactory from the standpoint of the township that it is proposed to establish for the purpose of housing the workmen. These matters have all been taken into consideration, and the way of the country practically determines the line of its approach to the township. A railway connexion between the arsenal and all the capitals of Australia is of very great importance. It is essential that we should have railway communication with them in connexion with the supply of all sorts of raw material, and also in connexion with the output of the arsenal, especially in war time. Whether any other undertaking will be necessary to provide this outlet is dependent upon our strategic requirements, not only in connexion with the supply of the Forces generally, but also in connexion with economic strategy in relation to supplies to the arsenal. This aspect of the matter has been considered, and there are possibilities—future possibilities, of course,—of linking up our chief sources for the supply of material with the arsenal site. My chief requirement is railway connexion, as soon as possible, with the nearest existing railway. The proposed line will provide that connexion by the shortest possible route. I have been to Canberra recently, and I know the railway which runs from Queanbeyan to the Capital Site. I am also aware that in the near future it is proposed to construct a line from Queanbeyan to Yass. As a future requirement, I have ascertained that it is possible to get a connexion between the arsenal and the railway which at present ends at Canberra. The route which that connexion will traverse has been laid down. Of course, the connexion with Yass is a matter for the distant future. Such a line would be 40 miles long, and from my standpoint it does not enter into present consideration at all. But it will, nevertheless, be possible to get on to the Yass line from the arsenal when it is built. In any case, we can reach the line from Queanbeyan to Canberra by a railway running due south from the latter place, and joining the line to connect with the arsenal about a mile from where the proposed arsenal line leaves the New South Wales railway. The proposed arsenal railway will be about 5½ miles long as the crow flies, and the route round the foothills will probably cover a distance of 7 miles. A connexion between the lines leading to the Capital Site has been considered, and the project is quite a feasible one. No survey has been made, but the undertaking has been run out on a contour plan which is quite good enough to determine the location of the line. Although my estimate must necessarily be somewhat crude, I calculate that when our programme is under way the inward freight to the arsenal will approximate 30,000 tons annually. That is when the arsenal is completed. Until its completion a great deal of the freight carried over the line will not come within the scope of my functions. It will be dealt with by the constructing authorities. I am unable to give the Committee any idea of the tonnage that is likely to go to the arsenal in connexion with building operations. Of course, this railway will constitute an ordinary feeder to the arsenal, which will be required to pay freights, which presumably will be fixed by the authorities on such a scale as will provide for a return on the capital cost of the line. I have

made no computation of the quantity of outward freight that will be handled after we get going. The question of whether the railway will pay has never entered into my calculations. I do not regard either the arsenal or the railway as a paying proposition. I cannot do so. But this line is absolutely essential for the running of the arsenal. Briefly, the position which I, as the responsible officer for the arsenal, take up is that I must have the projected railway, that I want it to follow the shortest possible route, and that I want it built as soon as possible. It is a matter of absolute urgency. It is the very first work that should be undertaken in connexion with the establishment of the arsenal. To attempt the handling of plant and material, with all the risk and delay that would be inevitable in the absence of the proposed railway, is, to my mind, unthinkable. The establishment of an arsenal at Canberra is such a large undertaking that my first requirement is handling facilities, and those facilities can be supplied only by a railway. I estimate that the all-round tonnage required for both township and arsenal, when the arsenal is in full operation, will approximate 100,000 tons yearly. The sooner the railway is started and completed the better it will be for all concerned, as the work is an absolute essential. I am anxious to begin certain operations at the arsenal, if possible, within eighteen months from the present time. For that reason I must have this railway, and I must have the complete commencement of production. In addition to the essentials which I have enumerated, water supply and power will have to be provided. The proposal is that, at the outset, the requisite power shall be obtained from the Canberra power-house.

9. To Senator Newland.—I have been over the country which will be traversed by the projected railway, and I have seen the estimated cost of the work. The estimate has been made by the railway authorities, and I am content to accept it. Speaking as an outsider who has been all over this country and who has viewed it from an engineering standpoint, I know that a route can be obtained through the Western Creek country. But that country is of a very poor character, and consequently I pass it right out. From the arsenal town site there will be railway connexion with the Federal Capital when the latter has been established. There is a good route available there for a tramway, which would serve for the transport of light material. There is no station at the point at which the projected railway will join the State line. A junction will have to be established there, and a signalman will require to be located at that junction. I anticipate that the railway authorities have taken these matters into consideration in framing their estimate of the cost of working the line. It is very difficult to obtain statistics which will enable one to form an idea of what a township similar to that which will be established for the purpose of housing the workmen at the arsenal will require annually in the way of freight. But as the basis of my calculation I have assumed that its requirements will amount to 20 lbs. per head per day, including fuel and all commodities. I have also considered the requirements of the arsenal itself, and, after rounding up the whole thing, I estimate that the inward freight will represent about 100,000 tons annually. Probably Colonel Owen or Mr. Bell may be able to give the Committee closer figures, so far as the requirements of the township are concerned. It will be to my interest to see that the proposed line is constructed along the shortest and most economical route, because I anticipate that the arsenal will be loaded with a certain sum annually on account of freight and other charges. I may mention that in discussing this project with the Railways Commissioner, the question of a ruling grade arose, and I agreed with

him to a maximum ruling grade, solely from the standpoint of cheapness of construction.

10. *To Mr. Sinclair.*—When operations at the arsenal are in full swing the distribution of its products would take place from Goulburn. Of course, when we have railway connexion with Jervis Bay we shall be able to get to that port very promptly. But at the present time our sole means of communication with the various capital cities is through Goulburn. The possibility of a line being constructed to Jervis Bay has been kept well in view. I am not concerned with naval requirements, save in the matter of smaller material, and cannot say whether Jervis Bay will be the principal outlet for marine supplies. If at the Flinders Naval Base the authorities have laid down macadamized roads for distribution purposes within the area covered by the factories, that is the concern of the naval authorities. Inside the arsenal area I shall use railways, tramways, tracks, and macadamized roads, as circumstances dictate. If the projected railway were to enter a break down during war-time we should have to immediately repair it at any cost, because the arsenal could not carry on operations without it. It would be absolutely impossible to dispense with this railway, even if the Commonwealth incurred the expense of laying down good macadamized roads within the area I have indicated. Tuggeranong would be my nearest point for handling material, and the shifting of material from that point by road, together with the cost of maintenance of plant, would involve a charge of at least 10s. per ton.

11. *To the Chairman.*—I am quite satisfied that a single track line would suffice for our requirements for the time being. No provision has been made for the laying down of a double track, because we are convinced that we can carry all our requirements over a single line by arranging for suitable trains. I may explain that at the turn-out of the junction line to the arsenal township, and the line to the arsenal factories, is situated a marshalling yard, and at that point the arsenal will take charge of supplies intended for it with its own locomotives. The New South Wales Government, with running rights, will bring material to the marshalling yards just outside the arsenal. Then we shall take control of it, and do our own handling. We could not allow an outside authority running rights over our arsenal tracks.

12. *To Mr. Mahony.*—I consider that the distance between the arsenal site and the site of the arsenal township is quite consistent with safety, assuming that an explosion occurred at the arsenal. God has been very good to us in connexion with that site. He has placed a hill between the township site and that of the arsenal, as a result of which the whole town area is protected. In the lay-out of the various sections I have shown what one may call the "danger" zone. In any case, the risk will be relatively small, 1 mile from the danger zone. There is a good big hill between the township site and the explosive section of the arsenal, and this circumstance practically eliminates risk so far as the township is concerned.

(Taken at Yarralumla.)

SATURDAY, 28th SEPTEMBER, 1918.

Present:

Mr. GREGORY, Chairman;

Senator Henderson,	Mr. Mathews,
Senator Needham,	Mr. Sampson,
Senator Newland,	Mr. Sinclair,
Mr. Mahony,	Mr. Laird Smith,

John Thomas Hill Goodwin, Commonwealth Surveyor-General, sworn and examined.

13. *To the Chairman.*—I have no accurate knowledge of where the railway connexion between the Goulburn-Cooma line and the Arsenal site at Tuggeranong is to be located. I have not been over the route, neither do I know whether it is altogether on Commonwealth land. A contour survey has been made of the country between the Arsenal site and the Federal Capital, and the country through which the proposed line would be taken is embraced by this survey. A contour survey does not necessarily involve the survey of improvements on the land. There has been a rough detail survey of very much of the country between Murrumbidgee and Moolooloo Rivers. The surveys which have been made are quite sufficient to locate the position of the railway. I have not yet had an opportunity of examining the plan of the proposed route. From the plan before me, showing the proposed point of junction with the New South Wales railway, I am not in a position to say whether the proposed line passes altogether through lands acquired by the Commonwealth, but it is within the boundaries of the Federal Capital Territory. I will supply an approximate estimate of what the acquisition of the land required would amount to. A most accurate contour survey has been made of the proposed Arsenal site, and also in respect to the township site. I am a member of the Design Committee for the town. I see no difficulty in getting the railway into the town site, as well as to the Arsenal. I do not think there would be any difficulty in making a connexion between the Federal Capital site and the proposed Arsenal railway. With respect to the route which might be adopted for that connexion, I have consulted with Mr. Darbyshire, and two possible routes were discussed. That which was most favoured was one which, after leaving the proposed station on the town site is taken up the western branch of Village Creek, and then down the valley of Western Creek, going north; thence, with an easterly swing, it could be taken into the Federal Capital city or join the line already surveyed to Yass from the Federal Capital outside of the city boundary. That would provide a connexion through to Yass, and thence to the various capitals of Australia. If such a railway from the Arsenal township was taken, with its eastern swing, to join the other line inside of the Federal city, it would entail some amendment of Mr. Griffin's design; but I do not see any reason why it could not, if desired, be kept without the Federal city. There is, I understand, a proposal to take the line direct from the Federal Capital up the Jerrabomberra Creek valley, but I do not know where it would join Mr. Darbyshire's line, but probably it would be somewhere between 1 and 2 miles from Mr. Darbyshire's starting point. The effect of this proposal would be to make the station at Tuggeranong a terminal station. I see no objection to the town site being made a terminal station for the present, but provision should be made to allow of an extension. A trial survey has been made of the proposed line from the Federal Capital to Yass. There are no engineering difficulties of which I am aware. It is a very generous line. A trial survey has also been made for rail connexion from the Capital city to Jervis Bay. That line presents no insuperable difficulties, although there would be expensive engineering problems.

14. *To Mr. Laird Smith.*—None of the land here is regarded as first class agricultural land. Generally, it is looked upon as second class agricultural land, but most of it is first class grazing land. There is actually a certain amount of first class agricultural soil, but not much.

(Taken at Yarralumla.)

MONDAY, 30th SEPTEMBER, 1918.

Present:

Mr. GREGORY, Chairman;

Senator Henderson,	Mr. Mathews,
Senator Needham,	Mr. Sampson,
Senator Newland,	Mr. Sinclair,
Mr. Mahony,	Mr. Laird Smith.

John Irwin Darbyshire, Resident Engineer, Commonwealth Railways, re-called and further examined.

15. *To the Chairman.*—I have given consideration to the project for the conveyance of bricks from the works in the Federal Territory to the proposed Arsenal site, either by means of a railway linking up the works with the present Canberra station, and thence through Queanbeyan along the proposed spur line into the Arsenal site, or by the construction of a macadamized road from the brickworks to the Arsenal, whereon the bricks would be conveyed by traction cars. What I suggest is the construction of a light railway from Canberra railway station to the brickyards, and to transport the bricks by rail from Canberra to the Arsenal branch line. I think a cheap line could be constructed, using the grade of one in forty, with fifteen chains radius curves, and, if possible, to use 60-lb. rails. Another idea would be that the location for this light railway would possibly be placed along the same route as a line that might be required later for the development of the Territory out towards the Murrumbidgee, to the west. The length of the connexion between the brickworks and the Canberra station would be 3 miles, and I estimate that the cost would be about £12,000, allowing for necessary siding accommodation both at the brickworks and at the present Canberra station. To estimate the cost over a period of five years, which is the time required to place the necessary number of bricks upon the Arsenal and township site, I have allowed upon that sum of £12,000 5 per cent, making, for the five years, a total of £13,000 as a full charge. Carriage by rail from the brickworks around to the Arsenal site—a distance of 2½ miles—at the rate of 11d. per mile, would be, upon a total of 62,500 tons, £3,875. Handling and transport from the railway terminus at the Arsenal to the various building sites, of that 62,500 tons, at the rate of 1s. 6d. per ton, amounts to £4,087. That makes a total cost, including interest on the road and transport from the brickworks to the Arsenal site, and then handling and transport to the various buildings, of £14,562 upon the total of 20,000,000 bricks. Altogether, that appears to be the cheapest, as well as the quickest, proposition. It would be quicker to run the 2½ miles by rail than to cover some 7 or 8 miles along the suggested macadamized road by traction engine. The 60-lb. rails would be satisfactory for running the New South Wales locomotives over the line; that is, at the speed at which the locomotives would be required to go. A line built with 60-lb. rails would be sufficiently heavy. The track over which a good macadamized road could be constructed between the Arsenal and the brickworks would be about 8 miles in length as the crow flies. It would be necessary to add about another mile, in view of the winding nature of the road. I am of opinion that a heavy macadamized road would need to be put down. I do not think it possible to make a satisfactory road through that country, to carry the traffic proposed, at less than £1,000 per mile. A 15-ft. road would be wide enough, with provision for the motor lorries to pass at certain spots, or else to provide so that the traffic should be all one way. Of course, the maintenance of a road of that kind would be a heavy item. That cost alone would run into £200 per annum. It would approximate

£30 per mile—say, about £270 per annum—for maintenance. I have not gone fully into the question of cost for a macadamized road. My estimate is only a rough one. If it were my responsibility to construct what I considered the best transport proposition, I would certainly go for a railway. Even remembering that a road direct from the brickworks to the Arsenal site would be valuable later as a means of communication between the Arsenal town and the Federal city, I would look upon the proposed railway as the better proposition. I think you would save the price of the road in one year.

16. *To Mr. Mathews.*—Investigation has been made at and about the Arsenal and town sites, but nothing has been found which suggests that there would be suitable material for brickmaking on the spot. It is practically all decomposed granite. I realize that to convey the bricks by motor lorry over a macadamized road would permit the bricks to be delivered right to the spot at which building was going on; but I have allowed for that item of handling and transport at the Arsenal and town sites in my estimate. Although 2½ miles by a roundabout route may, perhaps, seem an inordinate distance, it is not so serious a matter as the distance of 9 miles by road.

17. *To Senator Newland.*—In addition to the proposed connexion from a point on the New South Wales railway near Queanbeyan to the Arsenal site, there is also a suggestion for the construction of a western route. That would be the more direct connexion with the Arsenal. As for the wisdom, before constructing further temporary lines, of going into the question of a permanent line between the Arsenal and the Capital city, I have already, in my proposition to the Committee, advised that the extension from the Canberra railway station to the brickworks be constructed in such a manner that it could be utilized for the permanent purpose of linking up the Arsenal if required, and so that it would be the first instalment of a direct line anywhere to the west. As for the question of the New South Wales authorities working the railway, I have calculated upon their charges for haulage. That is all we would pay them. Regarding the point whether New South Wales would require extra allowance for engines and men, I point out that New South Wales would not station men at Canberra for this proposed run. Queanbeyan would be their station. There would need to be an agreement with the State authorities, of course, and it would all hinge upon that. The bricks constructed at the works on the Federal Territory are all of very fine quality. I have not yet seen them in any building.

18. *To Mr. Sinclair.*—With respect to an agreement between the New South Wales Railway Department and the Commonwealth concerning the take-off from the New South Wales line, there was a Conference between a number of officers in 1916, when it was agreed upon and decided that the point of take-off should be down near the Jerrabomberra Creek. That was looked upon as the one and only suitable spot. New South Wales was represented at that Conference, and the whole matter has been placed before the Commissioners of that State. The take-off is about ½ mile from Queanbeyan. As to the question whether it would mean keeping a man at that point, there would certainly have to be signals there. Upon the point as to whether it would be possible to elevate a stretch of the present New South Wales line in order to take off from the other side of the Jerrabomberra Creek, and so avoid the construction of a bridge, I think it would certainly be possible to elevate the bank. I am asked whether it would be cheaper to do that rather than to build a bridge. If the present line were altered, there is a bridge there now, and a new bridge will have to be constructed for the State railway. If that were to be done the State authorities would probably want us to make



the bridge wide enough to carry our line also, and that would necessitate the construction of a double bridge. The present bridge on the State line could not be raised without spoiling its strength. We would have to make a new bridge for them. It would not be much use unless the bank was raised, say, 15 feet in order to get off on the southern side, and that would mean the banking of a tremendous amount of earth. The question of raising the bank has not been considered by myself, but can be examined closer, in order to test the feasibility of constructing a new bridge, so that the junction may be made lower down and avoid the building of a bridge for the line to the Arsenal. I am not aware of the cost of shunting at Canberra, but the usual charge is 1s. per pair of wheels. I have not considered the advisability, if a macadamized road is put down from the brickworks to the Arsenal site, of utilizing electric trams. In the matter of a train line, as against the more expensive railway line, the former could be worked from steeper grades and sharper curves; but I do not think the proposition is worth considering, for the reason that the traffic on the tramline would be purely in connection with the construction of the Arsenal. After the completion of that work there would not be much doing on the line. The country itself is not much good. There would be no closer settlement between the two points to feed the tramline. I suppose there would be some amount of traffic developing eventually, year by year between the Capital city and the Arsenal.

10. To Senator Needham.—I have based my cost for getting the bricks to the Arsenal over the proposed railway of 21 miles on the basis of about 14d. per ton per mile. I am now informed that the usual charge for that class of carriage is 1d. per ton per mile. I would consider that that is, perhaps, under the ordinary rate. I was not aware that the Western Australian Railways Commissioner had promised to haul stone from Wungah to Henderson Naval Base at the rate of 3d. per what I have indicated, it would make the proposal for the construction of a railway all the better. I calculated upon a figure which I know is safe. The usual charge for firewood and stone and bricks is 1d. per ton per mile in all the States. I based it upon 14d., so as to be on the safe side.

20. To Mr. Laird Smith.—I suggest that about £50 per mile should be allowed as the cost of maintenance per annum for the proposed line. I do not expect that it would be necessary to construct any big culverts. There will be no creek of any size to be crossed. I am not aware of what it costs to run material per mile by traction engine to the Cotter River. I have heard it stated that goods can be carried upon a traction car for 6d. per ton per mile. I am satisfied that no better route can be secured to the Arsenal site than that indicated upon the plan before the Committee.

21. To Mr. Sampson.—The additional cost for constructing a permanent line from the present terminus to the brickworks would be, I should say, another £8,000, making in all £20,000. The question of not merely looking into the proposed railway connexion from the stand-point of serving the Arsenal alone, but of taking the Federal Capital as the focal point, has been considered, and was one of the reasons for our connexion by the western route and into the eastern route by way of the Jerrabomberra Creek valley. Direct communication can be secured by the Jerrabomberra Creek route to the Arsenal. It would be a mile longer. The easterly connexion to the Arsenal site would be about 14 miles—that is, from Canberra—while the western connexion, via Western Creek to the Arsenal, would be about 13 miles. The proposed line junctioning with the New South Wales line is 24 miles. The line which I would favour if I were asked to construct a railway to connect with the Arsenal from the Federal

Capital, having in view all the while the future development of the Federal Capital itself, would be the round line. That is, the present proposal, connected up with the western project. I am aware that if a line was to be built from the present terminus in Canberra to the brickworks at a distance of 2 miles, the difference in the distance from that point to the Arsenal would be little greater than the present proposal from the State line. As a matter of fact, it would be 10 miles as against 24. There would be little difference in the cost of construction in either case. It would amount to about the same per mile. The objection to carrying on the railway via the western route, after having constructed a line from the present terminus to the brickworks, is that we would be adding the extra haulage of 4 miles to the Arsenal for everything that had to go there—that is, besides the bricks. In connexion with carrying the whole of the traffic required from Queanbeyan via Canberra to the Arsenal, I have some interesting figures. The estimated cost of the connexion from Canberra via the brickworks and Western Creek to the Arsenal is £90,000. The estimated cost of the connexion from the Jerrabomberra Creek, off the State railway, is £22,515—a difference of £67,485. To get at the total extra annual charge during the period of construction, I have taken 5 per cent. per annum upon £33,357. That amounts to £1,668. The additional maintenance would be £300. Freight on 15,000 tons of bricks per annum, at 1s. 8d. per ton, for 9 miles, would be £1,000. Cost of distribution from the railway terminus to the various building sites, 12,000 tons at 1s. 6d., would be £200. The freight on the extra distance from Queanbeyan via Canberra to the Arsenal upon all Arsenal and general stores—that is, outside of the bricks—is, according to figures given me by the Defence authorities, 62,000 tons per annum. For the extra 4 miles the estimated charge on that would be £2,087 per annum. That makes a total extra annual charge during the period of construction of £2,955 per annum. Following on that, again, there is another charge. That is, the perpetual charge. After the five years, on everything going into or out of the Arsenal 5 per cent. interest still goes on, and would amount to £1,609. Maintenance still goes on, and there is an extra charge on all inwards and outwards material, stores, and other requirements, estimated at 100,000 tons per annum, which runs out at £3,334, making the total perpetual annual charge, after the construction period, of £2,503. I have not considered the factor that some deduction by way of saving would need to be allowed for in bringing the bricks over 9 miles instead of 21 miles. That question had not originated at the time I was compiling my estimates.

22. To Mr. Mathews.—I have not given consideration to the proposition of constructing the 3 miles from the terminus at the power-house to the brickworks, and over our own Territory.

23. To the Chairman.—Viewing the whole proposition, and having in mind the eventual question of the most direct means of communication from the Arsenal to the capital cities of Australia, I still consider that the proposed connexion with the State railway, as indicated on the plan, would be the best. Eighty per cent. or more of the requirements for the Arsenal during the next few years will be inwards from Sydney. That is my chief reason. When the line is constructed from the Federal Capital to Yass it will provide direct communication right through with all the capitals. For the most direct communication with Sydney it would be advisable always to retain the connexion between the Arsenal and the State line, irrespective altogether of the linking up, either east or west, with the Capital city. The proposed line, as shown upon the plan, appears to me as the quickest and cheapest from the view point of distributing the product of the Arsenal

for all time. There is only the difference of a mile, and the route, as shown on the plan, goes over better country. The western line would probably cost about £2,000 per mile to construct, while the eastern work can be done for about £3,000. Altogether, the eastern line would cost about £7,000 less than the other proposal.

(Taken at Sydney.)

TUESDAY, 1st OCTOBER, 1918.

Present:

Mr. Guessey, Chairman;

Senator Henderson,

Senator Needham,

Senator Newland,

Mr. Mathews,

Mr. Sampson,

Mr. Sinclair,

Mr. Mahony,

Mr. Mathews,

Mr. Sampson,

Mr. Sinclair,

Mr. Laird Smith.

Robert Limond Ranken, Chief Assistant Engineer Existing Lines, New South Wales Railways, sworn and examined.

24. To the Chairman.—I have not been consulted in connexion with the proposed deviation from the Goulburn-Cooma line to provide a railway into the Arsenal site at Tuggeranong, on the Federal Territory. I have only seen the plan of the route for a few minutes prior to the present. As to the matter of taking in a deviation from our own railways, and with respect to the question of grading from which it can be made, the junction of a new line would naturally be a depot; and our practice always has been to get out from such a junction as nearly level as possible. I am not familiar with the line near the Tuggeranong siding, and can only judge of the nature of the country, and of the grades, by the map now before me. I should say, looking at the map, and providing that the country was suitable, that the line to the Arsenal might have been taken from the Tuggeranong siding, south of the spot shown on the plan, and that it would thus have saved a good deal of construction. However, I am in no position to offer an opinion. I understand that the Committee has been informed that the grading at the Tuggeranong siding would not permit of the proposed new line being taken out of there. If it is to be a siding where trains have to be disconnected or trucks allowed to stand for any time, there is rather an element of danger in case of the air leaking off while the rolling-stock is on a grade. That possibility would apply to the investigations of the Committee at this point. The method of service over the proposed line is a matter which could be arranged between the Commonwealth and State railway authorities. We have heavy locomotives running on the Goulburn-Cooma line. The present line, as originally laid, had 7½-lb. rails, but wherever renewals are necessary we are laying 60-lb. rails. The proposed line to the Arsenal, if there is to be heavy traffic for a limited period only, might not be affected with respect to its permanent way as much as would be the case if a fairly continuous and fairly heavy traffic were to go over it for a lengthy period. Altogether, I should say that the 60-lb. rail would be a suitable rail to put in. It really depends on the volume of traffic. The ruling grade that we generally try to adopt is one in 70. I should think, however, that for the traffic over the proposed line a ruling grade of one in 60 would be suitable. What we desire is to get as big a train as possible, in order to work our trains to maximum capacity. I understand that long trains would not be going over the proposed line, except during the construction period for the Arsenal. We are using 8-ft. sleepers now, and putting in extra sleepers in a length of rail. We put in nineteen to the 40-ft. rail, which amounts to about 2,500 to the mile. Some-

of our railways have been laid with 8-ft. sleepers. We save in the ballast with the 8-ft. sleepers, of course, and get quite a stable road. We get equally as good a road as if 6-ft. sleepers were down. I understand that the project here is to provide a railway to freight the requirements for building the Arsenal, but that ultimately it will be essential that the outlet from the Arsenal should be by the most direct route available to every capital city in Australia. Keeping those considerations in mind, if I were asked to advise on the best route, I should say, at any rate at present, that that marked on the plan was the best. I am given to understand that there is not good material for brick-making at the Arsenal site, and that the bricks will have to be transported from the brickyards near Canberra. It is possible, I believe, that some 400,000 tons of bricks may be conveyed from the brickworks to the Arsenal and town site. From what information I have, that would, roughly, work out at 900 trains to convey those bricks to the Arsenal. Take 500 tons to a train, and if one train a day is run it would occupy nearly three years in transporting the 400,000 tons of bricks. I should say that it would pay, therefore, to put in a connexion with the terminus of the railway at Canberra. I am informed that such a line from the brickworks to the present terminus, covering a distance of 3 miles, could be constructed for £12,000. I should judge that that would be about a fair thing. The alternative suggestion for constructing a macadamized road from the brickworks to the Arsenal would mean a distance of 9 miles against 31 miles around by rail. You would spend three times as much as would be the case upon the railway if you built a good macadamized road. And then your maintenance, in the light of having to carry 400,000 tons of bricks, would be rather excessive. I should say that this would also provide a very heavy task upon traction engines, and you would want a great number of them. A new macadamized road would have to be laid, which would be about three times the length of the proposed 3 miles railway from the brickworks to Canberra terminus. I should judge that the railway is certainly the better proposition, both from the view point of first cost and in regard to maintenance.

25. To Senator Newland.—In the event of our main line being broken at the taking-off point shown on the plan, and the new line laid to the Arsenal, it would be necessary to provide a station at that point which would be in conformity with the working of the section. I think the section now works a staff and ticket system. Any station put in there would be under that system, with the necessary signalling gear and all safeguarding appliances. The Annetts lock system is employed upon unimportant sidings on our New South Wales lines. The risk to our main line traffic, of course, is equally as great, no matter how unimportant the traffic may be at a siding. If one or two trains a day were required over the proposed Arsenal line, I do not think our management would favour such a connexion at the junction. We have unimportant sidings, such as small brickyards, where three or four trucks are put off every day. The key is on the staff, and the guard unlocks the points, and lets the train in. But it all depends on the volume of business that would be required at your junction, and from the figures supplied I should say that it would require to be a fairly big depot there. We have no junction, of which I am aware, that is worked upon the Annetts system, and I do not think that it would be permissible at a junction of this importance. The class of engine that would be employed on the branch line would be dependent on the volume of traffic. Supposing you had enough material coming along regularly to make up a full train, the engine dealing with it would run right into the Arsenal. But if your material is coming along in small lots, and can be put on a pick-up train, your

traffic, then, would be dealt with as by arrangement with the Commissioners. In regard to whether you would have your own locomotive, or construct an electrical railway, or whatever it might be developed into, unless there was a fall at the siding, and would remain there until we sent an engine to do the work for you. The engine would come from Cooma or Queanbeyan. Queanbeyan is not a depot for locomotives now; but stabling a locomotive is not a very big matter. Of course, all that would add to the cost of working. As for the proposal to lay down a macadamized road fairly wide, although, I suppose you would want a road worked so that there would not have to be any crossing on the part of the traction engines. If the road was 10 feet wide, I should say that the forming of it would cost about £2,000 a mile. It appears to me that it would be rather difficult country to put down a road of the calibre required. To cope with the amount of traffic indicated, a good many motor vehicles would be required to deliver the bricks within three years. As I have indicated, if the quantity of bricks is conveyed by train that would represent about 900 trains of 500 tons each. Those trains would represent about 45 trucks each, and a truck would equal two motor lorries easily. Looking upon the macadamized road question from that aspect, therefore, there would be required a very considerable number of motor trips, and that would necessitate a very large number of vehicles. Traction engines nowadays are by no means easily procurable, and there is also the question of petrol always to be considered. I feel satisfied that there is no comparison between the laying of a road and the construction of a railway, both from the view point of economy and of getting the work done.

20. To Mr. Sinclair.—I think the one in 40 grade is, broadly, the grade right through, along the Goulburn lines as quickly as practicable. We are reducing the grades on the Cooma line; but, of course, when the traffic justifies it the Commissioners, no doubt, will want to take on that work. If we were putting in the new line in 40. We improve our grades as the traffic calls for improvement. I am asked if it would be possible to lift the present New South Wales line in that neighbourhood, say, about 4 feet, so that the take-off for the proposed Aresenal branch might be made at another bridging of the Jerrahomberra Creek. Of course, that might be done, but it would be expensive to lift the bridge also, which would be a very heavy item. Cooma State authorities to this question of improving the grades on the existing line, while at the same time raising the railway in the neighbourhood so as to save the bridging of the creek on the branch line. The one in 40 grade is against the down traffic. On this line the down traffic would probably be fairly light. With regard to converting the proposed branch line into an electric railway, that opens up a big question. If there were to be only a few trucks conveyed each day, as representing the permanent traffic after the building of the Aresenal is finished, something in the way of a small electric scheme might be feasible. I understand that there is also a suggestion for the running of an electric tram between the brickworks and the Aresenal town. That would provide connexion between the Capital city and the Aresenal. If it is necessary to have a permanent present the whole question in another light altogether. Despite all considerations, however, I can see nothing so practicable as the proposed railway.

27. To Senator Needham.—The 8-ft sleeper was our standard, but we found that by reducing it to 8 feet we got a better supply of sleepers, and by putting an extra sleeper into the length of rail we got quite as good a road. I cannot say that it has meant a saving on sleepers. We put just as much superficial area of sleeper into a road as we did before, but there is certainly less ballast. There would be roughly a lineal foot of ballast saved—say, 15 inches by 1 foot—over a length of 5,280 feet per mile. It means that we save a cubic foot per lineal foot. Two hundred yards of ballast is saved per mile, and that, at the rate of 6s, means £50 per mile saved in ballast alone. Then there is 1 foot less in cuttings; and, in fact, there is a saving throughout.

28. To Mr. Laird Smith.—A one in 40 grade is most expensive to work. The grades directly control the load. Our heaviest engine is over 20 tons to the axle. We work our railways with the staff and ticket. We have an absolute block system. When your branch line is opened, a man would have to be stationed at the junction. It has been pointed out to me that a temporary railway to haul the bricks might be made with 60-lb. rails, and I am asked if my Department would allow our trains to run over 60-lb. rails, and on a comparatively light line. You would have to reduce speed with an engine running over 60-lb. rails. We have any amount of 60-lb. rails upon our pioneer lines. As for the suggestion of raising the present line in the neighbourhood of Tiggeranong siding, we could not raise the existing bridge. We would have to construct a new one, and while that was being done a temporary bridge would have to be made to carry existing traffic. I am not acquainted with the country between the Federal Territory and Jervis Bay. As to the macadamized road project, I am sure that traction engines could not pass each other upon a 13-ft. road with any degree of safety. The minimum width should be about 20 feet.

29. To Mr. Mathews.—To place a 9-foot sleeper along the permanent way is actually a waste of material. We find that the extra 6 inches overhanging the rail on each side of the 9-foot sleeper is never packed. It is needless, and therefore wasteful, and adds to the trouble of keeping the road stiff and carrying on necessary maintenance. I think that, in spite of all the considerations favouring a road connexion between the brickworks and the Aresenal, the proposed railway would be the best. A macadamized road only 33 feet wide would be impracticable.

30. To Mr. Laird Smith.—The maintenance cost for a railway would be more like £100 than £50 per mile. If the connexion from our railway is made with the Aresenal site three men would be required for maintenance.

31. To the Chairman.—Taking into consideration the short length of the proposed construction and the appliances that the New South Wales Department has available for doing the work, I think it would be wise to recommend that the State Government be asked to construct the line. I cannot say whether we could do it more economically than the Commonwealth engineers, but it must be remembered that they would have to bring in their own plant. I do not think there will be any difficulty in arranging with the New South Wales Government to construct that small section.

Witness withdrew.

Charles Austen Hudgson, Chief Traffic Manager, New South Wales railways, sworn and examined.

32. To the Chairman.—I am acquainted with the project of the Federal Government to construct a branch line from the Goulburn-Cooma system to the proposed Federal Aresenal. I do not recall that there was a conference between Federal and our own officials. I remember a Federal officer seeing me and informing me

of this proposal, and inquiring also what, in our opinion, might be the best way to construct and work it. In regard to the take-off a few miles south of Queanbeyan I have a sketch plan of the proposed line. As to whether it would be possible to have the take-off further south, the difficulty is the grade. The grade of 1 in 40, which runs almost without intermission for many miles along that line, is not at all a good place to have a junction. It depends, of course, how it is going to be worked. It would be a very bad place to have a junction if worked by passing trains, but it would not be quite so bad if it were to be worked by an independent service. The proposed site is suitable for either. The proposed take-off is suitable in every sense, so far as grades are concerned. That is the best place to provide railway communication with the Aresenal site, from our line. As to whether we would have marshalling yards at Queanbeyan and through trains running to the Aresenal, I would first want to know who is going to work the branch line. That has not been dealt with, so far as I know. If the Commonwealth are going to work it the point of exchange would be at the junction, unless the Commonwealth engine run over our line. But if we are going to work the whole thing for the Commonwealth we would undoubtedly work it from Queanbeyan. We have room enough there to deal with the business. We already deal with the Canberra line business there, and there would be through trains running from Queanbeyan to the Aresenal and its township site as desired. If there was sufficient through traffic to warrant it we might run from Goulburn to the Aresenal, Goulburn being our locomotive depot. So far no special representations by the Commonwealth to determine some contract to get connexion with the Aresenal have been made, beyond the conversation to which I have just referred. It was not exactly an official conference. I have no particulars before me with respect to the probable amount of traffic. I am asked, assuming that the traffic to the Aresenal and town site the traffic would be fairly heavy, in many instances necessitating train loads, what system would be the most economic; that is, whether to have the State Railway Commissioners having running rights over the line and conveying the goods to their destination, or for a siding to be put in at the take-off from our line, from which the Commonwealth could pick up their goods and run them into the Aresenal for themselves. The most economic system would be for the New South Wales railways to work the line. I do not see any reason why our Department should not consider this as part of our whole system in the matter of freight charges—that is, if there was anything like a fair amount of haulage. If despatching goods from Sydney they would be carried at the same rate of haulage as though the proposed 81 miles of new construction were actually part of our own system. As to whether any special demand is made by my Department regarding the class of line which would need to be constructed, the chief consideration would be that it must be so laid out as to take our engines. It would have to be a standard line in that respect. It need not be standard in other respects, unless you are going to carry heavy locomotives. There are two ways in which a line is equipped. A line is made of a certain strength to carry heavy locomotives. That may be a mineral line, and the matter ends there; but if you carry passengers all kinds of safe working appliances are required, which we do not demand on a purely goods line. With respect to the actual permanent way, of course, it would not make any difference. I understand that the proposed line is to be on a 1 in 60 grade. Coming from our line you would have to climb a 1 in 60 grade. Our goods engine will haul 480 tons gross. In that case, about 334 tons of bricks will make a train load. I do not see any reason why the bricks could not be conveyed by rail at our ordinary minimum rates, in the quantities which have been indicated to me. For the 21 miles

the rate on bricks would be 2s. 6d. a ton. That is a very low rate, and it would only be a short haul. I am not prepared to say whether the rate might be reduced if regular loads were guaranteed.

33. To the Chairman.—I understand that a rate of 3d. was secured by the Commonwealth in Western Australia for the carriage of stone from the Wangueo quarries to the Henderson Naval Base. That was all down grade. In this case, it must be realized that this is not a direct run. I am not going to say that some arrangements cannot be made with our Commissioners are going to be. In order to work that traffic we would have to bring an engine from Goulburn and station it at Queanbeyan, and there it would have to stop; it would work the 21 miles and back again. The engine would be no use to us for any other purpose. The engine could probably do the two services—that is, to the Aresenal and from Queanbeyan to the Capital Site. I have not been to Canberra. I understand, however, that there are two suggestions: First, to take the bricks by a macadamized road, running the bricks directly to whatever point on the Aresenal or town site may be desired; and, secondly, for a temporary line from the brickworks to the capital city station, and thence by train around. As to which proposal would be the more economical, judging from what I know of road transport, I would go for the railway every time. It is estimated that the line from the brickworks to the capital station would cost £3,000 per mile. Against that there would be a fairly heavy expenditure in motor lorries if you are going to haul that great tonnage of bricks to the Aresenal over the road. Those vehicles are generally reckoned to cost more than 1s. per mile for running. It would even pay to lay down a siding at the Aresenal and the town site, and run the do that and save handling. I think the railway right around to the site would be the most economical. You would not have to go into the capital cost of the engines and trucks, and that would be a saving. You would not get a great number of motor lorries for the price of the proposed railway line. You would want an army of them, and they are very expensive. If they are only going to take 5 tons each, and also in view of the fact that they are almost unobtainable, I would certainly not recommend them. From a traffic point of view I see nothing whatever against the proposition of running a line into the Aresenal, with a derivation to the town site. I would recommend the proposed plan, assuming that the two sites are fixed. I do not know of any difficulties in the way of constructing a railway from Canberra to Yass, thus linking up the Aresenal directly with all the capital cities. That would give more direct communication with Melbourne. The line would probably go to Bowdoin, through the town of Yass. Bowdoin is the next station to Yass Junction. That would then provide a more economical method and more direct route of getting your goods to Melbourne. I do not know the country between Canberra and Jervis Bay. I am very doubtful about a line to Jervis Bay. It would have to traverse very rough country. A 1 in 40 grade is not a grade that we like, nor do we put it in where we can avoid it. If you look at the map and look at Goulburn, as compared with Sydney, you will notice that it is not so far from the way to run your stuff direct to the sea at Sydney, rather than to make for the seaboard at Jervis Bay. With regard to the traffic on the Goulburn-Cooma line that section, unfortunately, is a white elephant. From Numbul, the junction near Goulburn, to the terminus at Numbul, the distance is 161 miles 51½ chains. It cost £1,019,882 to construct, 1916—the 1917 figures are not yet quite ready—we received £51,486 from coaching and £35,031 from goods, a total of £86,517. The

Interest on the line was £201,180, and the working expenses were £200,000, a total of £122,080. That is the total cost for interest and working expenses, and if you deduct the revenue you will note that the loss was £24,073 for the year. It is a very old line. The extension from Cooma to Nimbinabel is modern, but the construction, as far as Cooma, is many years older. The line traverses poor country. It is practically only grazing. Nothing is grown there. That territory certainly comes to the rescue occasionally in times of drought when stock has to be transferred from other parts of the State. I am given to understand, in connection with the arsenal, marshalling yards will be constructed at the arsenal site, and thence goods will be conveyed to wherever they are required within the arsenal site. In my quotation of 2s. 6d. for handling bricks from Canberra there would be no additional charges for shunting or excess. We would look upon the arsenal line as our station for all intents and purposes. The same would apply to the brick-yard end.

24. To Senator Newland.—Whether or not a signal cabin was built at the take-off would depend on the volume of business. We might put the ground frame in, but if the volume of business was too heavy we would have to put a cabin there, but it would not necessarily have to be manned. It could be worked by the guard. Under our system it would be permissible for the man in charge to operate the points at the take-off and let his train in on the branch. Of course, he would have to have possession of the staff for the section. It would all depend whether that would mean that our traffic would be delayed while the train ran to the arsenal site and back again to Queanbeyan. Naturally, if we could arrange the trip when we did not want the line, there would be nothing in it, but if we could not do so we would have to establish a staff station at the junction. We have staff stations at which nobody is in charge. We call them automatic staff stations. We could do without a signal box and signaller. The man who is going off the main line on to the branch carries a through staff. When he gets to the junction he uses the through staff to open the points, lets himself on to the branch, replaces the points for the main line, takes the staff out and puts it in an instrument; and that at once releases the staff at both ends of the long section and a train could then come from anywhere. The siding is thus locked away from the main line. The main line is made secure, and the staff is put in the intermediate instrument by the guard, and at once that restores staff working. Upon his return the guard goes to the instrument and asks permission to draw the staff out, from the man at both ends. Both men have to give permission before he can take the staff out. As to whether circumstances to run their own locomotive in all the branch line and take the goods in as required, rather than for us to put an engine in at Queanbeyan, I point out that we would have to put an engine in at Queanbeyan in any case if the traffic is of any magnitude, because we would have to work it from the junction. I dare say we would do that if the traffic amounted to, say, more than ten or twenty trucks a day. Of course, we would need to arrange a proper and continuous service. You would not want your traffic hanging up just to load in the case of small lots of goods, but that would lead to the cost of the whole work. I am asked if it would not be safer for the Commonwealth to have their own locomotives running over the line and taking the goods from the site to the junction and off again as required. That would apply in the same way to the Commonwealth as it would to us. Of course, it would mean that sidings would have to be laid in at the junction. It is not correct to hold the view that sidings would have to be laid in at the junction in any case. As to whether the cost of the extra yard and of the

engine would be heavier upon the Commonwealth than our extra charges to haul in a small load, that is a matter that could easily be reviewed while the material is going to the arsenal. Altogether, it would be very much cheaper for the Commonwealth to let us work it. If, after the arsenal is built, and all the material has gone in, and you are starting your business of manufacturing munitions, and the traffic is found to be very light, then, if you have locomotives that are capable, and you found it better to terminate the arrangement with the New South Wales Commissioners, there would be nothing to prevent that. After that you could start working the traffic with your own engine. All it would mean, probably, would be that you would have to put a yard in at the junction.

25. To Mr. Sinclair.—I would undoubtedly be prepared to say that 50,000 tons per week for eight years would be sufficient tonnage to warrant our running the business on the mileage basis, but I do not think the line would carry 50,000 tons a week. If the traffic was 1,000 tons a day that would be quite enough; and, in that case, I am asked if we would pay the cost of maintenance of that line. As a rule we do not. We have to maintain our own lines. We would have to consider the question of maintenance. I am not quite familiar with what the present arrangement is with regard to our running trains into the Federal Capital City. We used to run a regular service, but now trains are despatched only as required.

26. To Mr. Laird Smith.—So far as I know there is very little competition between our system and a traction engine service at any point in the State. We do not give special rates to compete against that sort of thing. We have had some competition with regard to passengers where the railway is rather roundabout, and the motor lorries are able to convey people by a direct route. There is one such instance at Grenfell. The reason why the motor cars were able to compete with us in respect to passenger traffic there was that they were able to convey travellers more quickly than we could. The motors had to traverse one side of the triangle while we had to go over the other two. Throughout our lines we work the absolute block system. Sometimes on goods lines we work on the permissive system. We are working with the ordinary staff and ticket on the Goulburn-Cooma line. If a train were sent into the arsenal line, that would close our line for the whole of the period that the train was on the branch. That would be the case on the staff and ticket system, unless we broke the section at the siding. It would be necessary to open a staff station at the junction if there is going to be traffic amounting to some thousands of tons per day. That would involve two or three daily trips. If it was opened with a staff station we would not necessarily want any man placed there. We work some staff stations without any employee being placed there at all. We have never had any smashes through the staff being forgotten or disregarded. An electric staff could be put in from Queanbeyan. The risk with the electric staff is very remote. I do not anticipate any great cost in working the proposed take-off as a junction. I am asked whether, as a traffic man, we would run our engines over a temporary line built of 60-lb. rails for goods traffic. We have any amount of engines running over a 60-lb. rail, but we have other engines that do not. It would depend in a great measure upon how it was sleepered. We have run our heaviest goods engine over 60-lb. rails, but the sleepers were fairly close.

27. To Mr. Sampson.—I cannot pass any opinion upon an alternative proposal for the arsenal site, since I do not know of the necessary particulars; but I do not see how a better proposition could be presented. Of course, we could get rid of the junction by running the branch line right into Queanbeyan, parallel with the present railway, but the distance would be too far to

be practicable. I know nothing of the contour of the country covered by the suggestion to link up the arsenal site with the existing terminus at Canberra, by a route other than that shown on the plan. As to the proposal for putting a line along the western side, if the traffic were going to Sydney it would all have to go via Queanbeyan. That would mean a distance of 18 miles from north to Queanbeyan, and, for all traffic going travelled an additional 6 miles. With respect to traffic going south, if Canberra is connected with Yass that would mean 13 miles from the arsenal to Canberra, as against 17 from the Tuggeranong route into Canberra. Taking the two directions together, it would mean that you would save 4 miles on the southern traffic and lose 6 on the northern. I am not aware that the proposal for the Servia Bay line is to cross the Queanbeyan line rather a long distance further north than at Queanbeyan itself. Without knowing the cost of construction, and the contour of the country, it would be impossible for me to express an opinion upon that project.

28. To Mr. Mathews.—I am informed that there is another proposal to bring the line a distance of 44 miles along the Jerrabomberra Creek valley to the Capital terminus, and then, the remaining 3 miles, to the brickworks. The construction of that 71 miles would keep the brick traffic within Federal territory. To make that connexion would mean spending a lot of money if it were Federal territory. It is a very difficult question, especially since I have no data. But I cannot see how the Jerrabomberra Creek project can be of any value, compared with the western route. The line that it, to the line shown would be supplementary. I take saving in cost upon the junction line from our present that construction. It would be in addition to in connexion with working isolated lines, and it has been to our sorrow. We have had two thrusts on us. One of them is from South Grafton to Glouceburgh, and the other from Coff's Harbour to Raleigh. They are little pieces of what will be the main line to Brisbane some day, and there are very expensive to work. They require to have their own locomotives. And that means 23 miles long. The trucks had to be taken by ship, and that took there, and it is not making ash-grease. The have small business. It is not only one going to you are using, but the capital cost of the engines which not using. You must have your mechanics to look after them, and repair shops. There is no end to the cost, where you have only one or two it does not. It does not pay to attempt to do that sort of thing on a small scale.

29. To Mr. Seapin.—I would not suggest that you should build the line from the brickworks to the arsenal. As for the project of continuing the line from the Capital city terminus to the brickworks, and then on to the arsenal by way of the western route, I do not see any reason for that until you get your line through to Yass. Until then your traffic must go through Goulburn. As for building the western line instead of that indicated on the plan, although it would be nearer for a matter of 10 miles as against 21, it would be much worse in regard to all the traffic coming from Sydney than it is I say, until you build the line from the Capital to Yass.

30. To the Chairman. I point out that the length of line from the brick factory to the Canberra station is merely temporary. When all those bricks have been

conveyed from the works to the arsenal you will have the value of the material as against the cost of construction of your 3 miles of temporary railway. Therefore the item of £12,000 is not a fair capital charge to be charged against that line.

31. To Mr. Laird Smith.—I do not think we would object to the Commonwealth having running rights over our line. We would make a proviso that the men actually doing the running would have to pass our test. That test would apply, of course, to the locomotives as well as to the men.

(Taken at Melbourne.)

FRIDAY, 4TH OCTOBER, 1918.

Present:

Mr. GHEOWAY, Chairman;  
Senator Henderson, Mr. Mathews,  
Senator Needham, Mr. Sinclair,  
Senator Newland, Mr. Laird Smith,  
Mr. Mahony.

Perry Thomas Owen, Director-General of Works and Railways, sworn and examined.

32. To Senator Newland.—I am aware of the nature of the inquiry being conducted by the Committee, and I am acquainted with the location of route for the proposed railway to the Arsenal. The location survey was made about two years ago by Mr. Surveyor Reid. The location of this proposed railway is practically the same. It crosses through the same road, and the Tharwa-road, and, for the rest of the location, I think it coincides with Mr. Reid's survey. I could not say with accuracy if the survey has been sufficient for the purpose of the Committee, who has had his railway engineer on the survey, and who, I understand, has been over the route himself. Particulars have been furnished to the railway authorities as to the entrance of the railway into the factory compound. The Commissioner was given the location of the internal factory railway, and I understand, was also given the point at which it would take off from the Cooma line. The location of the way within the factory compound was settled by the Acting Manager of the Arsenal and myself. All details in connection with the linking up of this proposed railway with the New South Wales system will be furnished by Mr. Bell or his officers. About two years ago I was asked by the Minister, at the instance of the Minister for Defence, to make a suggestion as to railway communication, and the New South Wales Railways Commissioners, who were communicated with, deputed Mr. Menzies, District Railway Engineer at Goulburn, to meet Mr. J. J. P. and myself. Mr. Menzies agreed with Mr. Bell that the take-off should be a few hundred feet to the north of the Jerrabomberra Creek. That is the take-off, as shown on the plan submitted by Mr. Bell to the Committee. I have made an estimate of the quantity of material likely to be carried over the line during the period of the construction of the Arsenal and a.c.w. During the first five years there will be heavy traffic. I think 5,000 tons of constructional material per annum would be a conservative estimate. I cannot give the Committee anything more definite, because the working drawings of the factories and buildings for the town have not yet been prepared, and the question as to the extent to which timber will enter into construction, as against bricks or concrete, has not yet been finally decided, but I have

come to the conclusion that there will be a large number of brick buildings if bricks can be obtained cheaply, and also that in the Arsenal factories timber, as a slow-burning proposition, will be used to a great extent instead of steel. My estimate does not include bricks, foodstuffs, or general merchandise for the working population. This would be a difficult tonnage to estimate, because it would depend on how far the construction of portion of the town to be occupied by the constructional workmen could be advanced from year to year, it being the proposition of the Department to erect huts for the workmen as soon as the town plan will admit of this being done. My suggestion is that, at first, the men engaged on the general preparation of the site shall be accommodated in tents, to be followed as soon as feasible by huts close to the constructional work, and finally to erect dwellings, which would principally be occupied by constructional workmen, and subsequently be taken over by employees of the Arsenal. Some consideration has been given to the number of bricks likely to be required in the construction of the Arsenal. So far as it is possible, and in the absence of working drawings for the factory buildings, I anticipate that 4,000,000 bricks per annum will be used for the Arsenal and houses in the town. At present, we are not contemplating the manufacture of bricks at the Arsenal site, because we now have a very fine plant at Canberra, and a unique deposit of mudstone, which makes excellent bricks. I am not at all sure that we will get anything approaching the quality of shale at the Arsenal as is obtainable on the brickworks site, and for this reason we contemplate using bricks from the existing brickworks establishment. The extent to which they will be used will depend, of course, on the price charged but, on the basis of figures at which we consider bricks should be turned out for us, we would use them to a considerable extent from the existing works. Consideration has been given to alternative transport proposals, and I have come to the conclusion that the best method would be road traction. An alternative proposal was considered by Mr. Bell, not at my instance, but, I believe, at the suggestion of one of his officers, that the main line should cut through Canberra. I told Mr. Bell I could not give any opinion as to the feasibility of this project, but, owing to the extra length of railway, it could not be an economical proposition to bring the main line right past the brickworks instead of a direct connection with the Cooma line. In anticipation of some questions on this subject I have got out some figures which will, I think, make the position clear. One proposal is to bring bricks across by a small 2 ft. gauge steam locomotive railway, or alternatively by electric traction over a 2-ft. gauge, and, thirdly, a 4-ft. 8½-in. gauge line to be diverted temporarily to pick up bricks from the brickworks site. I think the capital outlay of any proposal of this nature must be a dominant factor, and I estimate that, in round figures, it would cost £19,000 to run a 2-ft. railway across from the brickworks to the central location between the Arsenal factory compound and the town. This would not be linking up with the proposed railway at all, but would be the western route; and, in addition to that, it would be necessary to buy three locomotives, costing about £3,000, thus bringing the total capital expenditure up to £21,000 for a 2-ft. gauge railway. The alternative scheme to work this line electrically would cost somewhat more, because of the necessary rail connections and the need for a more carefully prepared road bed, which, added to the cost of three locomotives, would cost about £35,000. There would also be contingencies for transformers and other items, so we might place the amount at £37,000. Dealing now with the scheme to deliver the material by road traction, I point out that we already have a plant at

Canberra in the form of seven traction engines, and that four traction engines would be able to cope with the loading required. Three of these would be in commission, and one held in reserve as a spare, and, working five days a week, there is no doubt that they would be able to handle the traffic. If the Government accepted the timber proposition, it would be necessary to increase the plant by three extra traction engines, costing about £1,000 each; and, with additional trailers costing about £2,000, the capital outlay on new plant would be about £5,000. But that would not be all charged against brick delivery. The charge on account of bricks would be in respect of the plant we already possess, so that actually no capital outlay would be involved at all. All the traction engines would be held on suspense account, chargeable against construction during the period assigned by the Department for this work. If we accepted the timber proposition, and purchased the additional traction engines, we would have a plant of ten traction locomotives with the necessary trailers. By road traction we would be able to transport 4,000 bricks per traction train load, representing a dead weight of about 12 tons, and, working five days a week, each traction engine would do seven and a half trips per week, giving a total haulage capacity of 30,000 bricks per week, or 4,000,000 bricks per year—roughly speaking, about 13,000 tons. What I suggest for the consideration of the Committee regarding capital cost is this: Assuming that all this enabling work is done under Suspense Account, it will be necessary in the four years to wipe off a proportion of plant covered by depreciation, and only to retain under Suspense Account the actual value of the plant then existing. If we have to wipe off half or one-third of the £21,000 in one case, and of £37,000 in the other, and add to that the operative charges for locomotives and for running trains, the question of wiping off the cost of plant in the time is going to be a serious factor. If this were a proposition for an ordinary brickyard to be carried on for twenty years or longer, the railway proposal might be more seriously considered; but it is not an economic one for a four or five years' scheme. Then there is another point. If by any chance this work is stopped, then, instead of having a large capital outlay upon which interest must be paid, the loss will not be appreciable if we started with a small capital outlay, such as I suggest, by adopting road traction, because a tractor has always a market value, and may be used elsewhere. It appears to me preferable that we should spend as little as possible on the capital outlay in the event of the whole project being stopped at any time for some, at present, unforeseen reason. This, I think, is a factor worthy of consideration. In addition to the outlay for the extra traction engines and plant, assuming that the timber proposition is accepted, there is, of course, the cost of road construction and maintenance. The engineer has investigated the road location which would follow the course of one of the city extension roads; so any work done on the road would really be to the good in the future. Then, instead of making an expensive road, the engineer, who has a full knowledge of the country, proposes to spend only £1,000 to make good the track. It will be done under Suspense Account, thus distributing the cost over four years; and he will spend £870 per annum on maintenance with a gang permanently employed, so as to keep the road in good condition for the traction plant. I believe this will meet the requirements. On the other hand, supposing it were considered necessary to make a more permanent road, I think, under the Suspense Account principle, it would not be necessary to debit the whole of the cost against brick delivery, because the road connection would then have been established according to the plan between the Capital city site and the Arsenal. The

proposed route goes by the Western Creek, and would break away south from somewhere near Yarralumla House, and go in a direct line across to the Arsenal site. This proposed expenditure and main road maintenance charges represent about 3s. per 1,000 bricks. In addition, there would be the cost of traction haulage—15s. per 1,000—and with contingencies and allowances for bad weather (about another 3s.) the total cost is brought up to 21s. per 1,000 delivered from the yard to the buildings. I have not given serious consideration to a proposal to link up the brickworks with the Cooma line, because this would entail railway construction from the brickworks to the siding, and mean extra handling of bricks, so this proposal presents a difficulty. If we had a light railway to deliver at the siding, or at the Arsenal end, the bricks would then have to be delivered by drays to the buildings, which would mean additional handling, and would cost about 8s. per 1,000. As against that, if the trailers were taken to the buildings by road traction, there would still be a charge of 3s. per 1,000 for taking the bricks off the trucks to the buildings, so that the extra cost would be about 5s. per 1,000 if the bricks were brought by train. I think the road would be sufficiently strong to carry the traction traffic. We would start off by making crossings and filling up the bad places. The engineer thinks, and I am prepared to support the view, that an expenditure of £1,000, with an annual maintenance charge of £370, would keep the road in good condition. The estimate is based on our experience in the transport of heavy material for constructional work in the Territory. I have not taken out the probable cost of a 4-ft. 8½-in. electric railway, but that is a big proposition, and at the end of four or five years the capital expenditure would represent a heavy item in interest charges, until such time as the Federal Capital was developed sufficiently to warrant passenger communication between the Federal Capital and the Arsenal town, and that might be many years hence. We have had a considerable experience in the transport of heavy material by road for the Capital site, and the gradients for the last 2 miles were steeper than on the proposed road to the Arsenal site. I estimate that we would use, from 1,500,000 super. feet to 2,000,000 super. feet of timber per annum for the Arsenal factories and town. We should deliver this by traction trains at the rate of 133 tons per week. I have already said in a report concerning the internment huts on the Canberra site. If these buildings are not going to be used in the near future, they could be transferred for use as huts or hostels on the Arsenal site. About half of them are bolted together, and this should facilitate the work of removal.

43. *To Mr. Sinclair.*—When I said that there was a difficulty in connexion with the construction of a temporary railway from the brickworks to the Arsenal site, I really meant there were the disabilities attendant on that course. The principal disability, I think, is the amount of capital outlay involved, and the objection I had in mind to any proposal to link up with the western route was that the railway would traverse the Federal Capital city area; and, if it were a 2-ft. gauge line, it would mean extra handling of the bricks out of the truck; and if it were a 4-ft. 8½-in. line, the gradient would be fairly heavy, the construction expensive, and it would run through the Federal Capital plan along a route where no railway has been proposed, so it would have to come up afterwards. There would be some surrender value for the material, but I do not think this is the time to purchase rails or copper, or incur unnecessary capital expenditure in the hope of being recompensed to some extent by surrender value, because, at present, prices for all materials are fairly high, and, if the war should end shortly, we do not know that values will not come down considerably. I

am aware that the New South Wales Government are discarding some 50-lb. rails, and these, of course, will be good enough for any railway intended for the handling of bricks. The decision regarding the take-off on the north side of the Jerrabomberra Creek was the outcome of a discussion at the Conference to which I have referred. As to whether the take-off should be made somewhere south of the Jerrabomberra, between the creek and the Tuggeranong railway, the objection raised by the New South Wales resident engineer was that it would be a 1 in 40 gradient for the whole distance, and that his Commissioners would not allow either a railway station or a siding on such a gradient. The only place at which he would allow the take-off between the Tuggeranong Station and Queanbeyan was at a particular point a few hundred yards north of the Jerrabomberra, where the grade is 1 in 60, and where there would be no danger of any trucks that might break away going right through Queanbeyan, as might happen in the alternative scheme. We did not consider the possibility of lifting the line. Even if that were done, I do not know how we could save the cost of the bridge, because there is a pretty big discharge of storm water from the hills. If the take-off were on the other side of the creek, and the gradient flattened out at the bottom, there would be a considerable expenditure on the bridge work. I think, however, that the Railway Commissioner would be able to give more definite information as to this cost. I have not estimated the cost per 1,000 for delivering bricks over the railway by linking up the brickworks with the present railway system. I do not apprehend any delay in the delivery of bricks by road traction.

44. *To Senator Yerrall.* I prefer the road traction proposition for the delivery of bricks to the Arsenal as against any railway proposal. The figures I have given cover traction haulage, replacement, and maintenance of plant, and all other charges. The cost per ton for delivery by road traction would be about 6s. 3d. I have not worked out a comparison of this cost with rail freight charges, because I have not seriously considered the railway proposition for the reasons already given. An outlay of £6,000 would cover the total capital expenditure required for road traction delivery. We would convey by traction trains 30,000 bricks per week per engine, or 4,000,000 per year. It is estimated that the work will take five years, and if it extended over a longer period, the delivery charge on account of bricks will be greater, because capital costs will still have to be provided for.

45. *To Mr. Laird Smith.*—I based my remarks with regard to road traction on the actual experience we have had in the transport of heavy material for the Capital city work, over what were not first class macadamized roads. We would locate the proposed road from the Capital site to the Arsenal on the route as laid down in the city plan for one of the developmental roads, so that any small amount of road making which we might do would stand for many years. I understand it has been suggested in evidence already given that bricks could be distributed from the station site at the proposed Arsenal works at 1s. 6d. per ton, but departmentally we have found this to be impossible. It was allowing 3s. per 1,000 for taking the bricks off the trailers to the building sites, and 8s. per 1,000 for picking them up from the end of the railway and taking them to the building. If it became necessary to construct a thoroughly sound macadamized road, it would be possible for two traction engines to pass each other on a road 15 feet wide. A thoroughly battered road would cost from £700 to £1,000 per mile, but I do not think that would be justified if it were charged against brick delivery, when bricks can be delivered, as I have shown, for a lower capital expenditure. Even if we take up

the timber proposition, and purchase three more traction engines, no additional capital charges should be made against brick delivery. I have not been in charge of the plant, so I cannot say what amount has been set aside as a sinking fund, but I presume that something has been allowed for depreciation of plant. The engines were purchased in 1912, but they have not been much in use during the last two years. I am afraid I cannot say what would be the life of one of these engines, but it is fairly long. My estimate of 21s. for the delivery of bricks covers operative charges, depreciation, maintenance, and other items.

46. To Mr. Mathews.—My estimate for the cost of transport is based on present charges. The tractors are coal or wood fuel engines, and so would not be affected by any decrease in the price of petrol in the event of the war ceasing.

47. To the Chairman.—No arrangement has been made with the New South Wales Government for running the proposed line into the Arsenal beyond what I have already stated, namely, that a couple of years ago there was a conference between the District Engineer at Goulburn, Mr. Hobler, and myself. It would be the duty of the Railways Commissioner to make any such arrangements, but I do not think this matter has been referred to him yet. I have always assumed that the freights would be on the basis of the Queensland rates, but I could not say what they would be over the short length of line. I do not know whether the position was sufficiently advanced at the time of the visit by the Committee to Sydney to negotiate with the New South Wales Railways Commissioners. An estimate of £4,000 per mile for a railway to deliver material is, I think, conservative, but before giving a definite opinion I would like to examine the evidence. It is always an advantage not to handle bricks too much, and if it is possible to take them from the kiln to the building site in one loading, that is a much better proposition than handling them a couple of times. I do not think it is feasible to have light railways for the delivery of bricks on the building site, because the proposed buildings are too small. If we had any monumental buildings, such as there will be at Canberra, either a railway or a wire ropeway would be suitable. If the Committee recommended the construction of the 3 miles of railway suggested for the purpose of delivering the material, I could not say if it would interfere with the Canberra plan until I saw the location of the proposed railway; but I think the gradients will be very heavy. The manufacture of bricks at Canberra was taken out of our hands some time ago, so we can only give an estimate of what they should cost us now. When the Arsenal site was selected, I was aware that the take-off would be 4 or 5 miles from Queanbeyan. The estimate for the railway is now £23,000. I do not remember giving an estimate of £25,000. If I did, it must have been for the shorter connexion, which I suggested, but was objected to by the engineer of the Railways Commissioners of New South Wales.

48. To Mr. Sinclair.—My estimate for the cost of delivering bricks by traction engine covered everything, and did not make any allowance for surrender value of the plant. The plant is under a different item, and I presume depreciation is allowed for.

(Taken at Melbourne.)

MONDAY, 7TH OCTOBER, 1918.

Present:

Mr. Guesbory, Chairman;	Mr. Sampson,
Sensor Henderson,	Mr. Sinclair,
Sensor Needham,	Mr. Laird Smith.
Mr. Mathews,	

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

49. To the Chairman.—I have given some consideration to the question of transporting bricks from the brickworks at Canberra to the Arsenal site by rail and by traction engine. I have prepared three tables for your information, setting out the various costs of these proposals for the purpose. The Director-General of Works was to have been present to present these tables to you officially, but as he has unfortunately been detained by the Minister, I present them for him. I should like to say that he has seen all the estimates of costs with the exception of those connected with the proposal for a temporary railway of 2½ miles, and the Committee will be good enough to take the estimates for that proposal as subject to any alteration he might find fit, upon consideration, desirable to make. The first table I submit deals with the estimated cost of delivering 18,000,000 bricks in four years at the Arsenal from the brickworks at Yarralumla by the existing traction plant and road via Yarralumla Creek. The distance would be 0 miles each way, and it is proposed that there should be seven and a half trips per week per engine, and that the load should be 4,000 bricks, or equal to 13 tons. That is to say, that each traction engine shall take 13 tons per week. With four traction engines three would be kept continuously in work. It is assumed that, on the average, one engine would be always under repair or standing by for overhaul. The cost of running is estimated at £3 per day per engine, or £16 10s. per week per engine. For five days per week each engine would be running hauling the bricks, and the Saturday is given over to washing out the boiler and generally attending to the engine. That is in accordance with the usual practice in the handling of a traction plant. The estimate includes a charge of 30s. for the Saturday morning for each engine, which is at the full rate per day, although the engine would not be running, and would not, therefore, be burning any coal. The week's cost for four engines would be £200. Everything is charged up against the four engines, although one of them would not be actually running and using coal. The bricks carried would be 90,000 per week, so that the cost per 1,000 would be 18s. I estimate the cost for improving the track for the traction engines at £1,000, which sum would be spread over the four years, at £250 per year. Provision is made for a maintenance gang of two men, with horse and dray, at a cost of £120 per annum, so that the cost of keeping the track in order would amount to £370 per annum, representing a cost of 5s. per 1,000 on the bricks. Provision is made for wet weather, breakdown, contingencies, &c., to the extent of 10 per cent. on the cost of 18s. per 1,000 bricks, which adds another 2s. to the cost of transport per 1,000, making the total cost 21s. per 1,000 bricks for taking them from the brick kiln at Canberra to any works right on the Arsenal site. If the total number of bricks required during the four years—18,000,000—be run out at a cost for transport of 21s. per 1,000, it will be seen that this proposal represents a total expenditure of £18,000. This total includes all depreciation, interest, repairs, maintenance on plant, &c. It includes amortization—that is, a certain loss on plant—representing for engines and trailers £428 per annum. It should be borne in mind that all the plant proposed to be used is at present available at Canberra. The cost of the Burrell engine is shown at £500, the cost of the Fowler engine at £371, and of the two McLaren engines at, respectively, £350 and £307, or a total of £1,518. The total cost of running each traction train per day is estimated at £3. This is based on the following items:—Four traction engines, present value, £1,913; fitting and tuning up, £83; twelve engine trailers, present value, £365; and five water trailers, £90. Amortization is allowed for to the extent of £333 on the engines and £25 on the trailers,

or a total of £128 per annum for four trains, equal to a charge of 7d. per train per day. To this must be added, to make up the cost per day for each train:—Coal consumption per engine per day, 13s.; repairs and maintenance per train per day, 10s.; oil and waste per train per day, 2s.; and wages per train per day, 28s.; making the total cost of running £3 per train per day. The second table presented shows the estimated cost of delivering 18,000,000 bricks in four years at the Arsenal from the brickworks at Yarralumla by a temporary railway, 4½ miles, gauge from Canberra to the brickworks, and thence by rail to the Arsenal and by dray to the building site. I have measured the distance by road from the end of the railway to the brickworks, and it is 3½ miles. There would, however, be difficulties in getting the trucks to the kilns. It would be necessary to make a detour for the purpose, and, consequently, in view of the sidings that would be necessary, I estimate that before this proposal were completed we should have constructed about 4½ miles of railway. The suggested route has, I understand, a grade of 1 in 40. Three hundred tons of bricks per week would require to be delivered, and this would represent two trains per week. With 30 trucks, you have to consider how they should be handled if you had 150-ton trains. Fifteen trucks would be loading at the brickworks and fifteen unloading at the other end. Unless you are prepared to lose a day at each end, you should have another fifteen trucks in transmission empty between the terminal, or else pay for demurrage. In transporting gravel, we have made arrangements with the railways to have one lot of trucks loading, another unloading, and a third in transmission. If you have 45 trucks, reckoning the rate for the distance for "M" class at 2s. 9d. per ton, they would earn in freight £41 5s. per week, so that each truck would be earning less than £1 per week. Their running cost, estimated at 10 per cent. would be £40 per week, and they would, under these conditions, be earning only interest and depreciation, leaving nothing for coal or other expenses. I have taken the distance at 4½ miles, and at £4,000 per mile this would cost £18,000. A fair amount of sidings would be necessary to enable the trucks to be properly handled for loading at the kilns. The plan will show you that they are not very easy of access, as they are just on the brow of the ridge, and a fair detour would be necessary. I estimate the cost of the sidings at £2,000. This gives a total construction cost of £20,000. The Director-General considers £4,000 per mile a low estimate for the construction of the line, and it might cost a little more. The freight charge would be for 21 miles "M" class, 2s. 9d. per ton, which would represent 0s. per 1,000 bricks. Handling and delivering from the Arsenal terminus on to the job would represent another 8s. per 1,000 bricks. This is a very low estimate. It covers three trips of horse and dray over a distance of 1 mile. The interest charge on £20,000, of 5 per cent. for four years, represents £4,000, and this would represent 4s. 4d. per 1,000 bricks. Depreciation on £20,000 in four years—that is, earthworks not recoverable, deterioration in sleepers and rails, laying, and freight on sleepers and rails, cost of taking up—all estimated at £12,000, which would leave £8,000 recoverable value at the end of the four years, and the £12,000 would represent 13s. 4d. per 1,000 bricks. Then you have to consider maintenance of 4½ miles of line, which would amount to, say, £400 per annum, representing 1s. 9d. per 1,000 bricks. These figures give a total cost of freight of 36s. 9d. per 1,000 bricks. This rate represents an expenditure of £22,850 to deliver the 18,000,000 bricks within the four years by this method from the brickworks to the building site of the Arsenal. At present two trains per week are sufficient to cope with all the traffic on the Canberra line. I am assuming that these two trains would go to the brickworks and handle the bricks, and to keep your men regularly employed

loading and unloading you would need 45 trucks—fifteen being loaded, fifteen being unloaded, and fifteen in transit, and there would earn £41 5s. per week at the freight charge of 2s. 9d. per ton. The third table shows the estimated cost of delivering 18,000,000 bricks in four years at the Arsenal from the brickworks at Yarralumla by a temporary railway of 2½ miles, gauge from the brickworks to the Arsenal district, and Yarralumla Creek. The data connected with this proposal are: Distance, 9 miles; ruling grade, 1 in 40. Two engines and one in reserve, and a train load of 20 tons. The cost of the line would be 9 miles at £2,000 per mile, or £18,000, and engines, sidings, &c., at a cost of £3,000, giving a total capital cost of £21,000. The freight charges would be 0 miles at 2s. 9d. per ton, which would represent 8s. per 1,000 bricks. Interest on £21,000 at 5 per cent. for four years—£4,200—equal to 4s. 8d. per 1,000 bricks. Depreciation on £21,000 in four years—that is, earthworks not recoverable, deterioration of sleepers and rails, laying, freight, and taking up—estimated at £12,000, which would represent 13s. 4d. per 1,000 bricks. Maintenance, 9 miles of line at, say, £400 per annum, representing 2s. 8d. per 1,000 bricks. These figures give a total freight charge of 28s. 8d. per 1,000 bricks, and at this rate per 1,000 the expenditure involved on the transport of the 18,000,000 bricks in the four years would amount to £25,500. Referring again to the first proposal, I might say that the existing traction engines proposed to be used are steam engines, using coal. You will have noticed that provision is made for the initial cost of the road to the extent of £1,000. This matter came up about two years ago, and I looked into it personally, and later, also, in company with my assistant engineer. The suggestion then, and still, submitted was that it is not necessary to make any macadamized road for this purpose. It is good ground, and it would be quite easy to make a track across this country to take this traffic, with the maintenance provided for in the estimate of two men and horse and dray at £420 per annum. I may inform the Committee that for some years all the material taken down to the Cotter was taken over the natural surface. The material for the pipe track was transported in this way, and with the same loads of pipes as provided for in the first of these proposals—13 tons to the load. These loads were delivered over miles across these plains on a similar track without any attempt at road making. Only recently, in connexion with the Molonglo Defence Camp, over 4,000 tons of material delivered at the railway siding there were taken along one track and delivered on to the job in the space of a few weeks, with very little appreciable damage to the surface of the road. Almost all the carting of material in the Federal Capital was done over the natural surface of the country. As a matter of fact, we prefer this to having a mado road, because, as soon as you put expenditure into the making of a good road, you find that you have to handle motor and light vehicle traffic upon it, and have to keep it in order for such traffic. That is not at all necessary for the carting of bricks. I should prefer not to attract motor and light vehicle traffic to this road, as such traffic would be in the way. It would delay the transport of the bricks, as the drivers of the traction engines would have to be stopping occasionally to help some one with a retative horse. If it were desired to turn the track into a road, it would require expenditure of about £1,000 per mile, and that would also increase the maintenance charge. To make a road at £1,000 per mile would involve a capital outlay of £9,000, which, at 5 per cent., represents £450 a year, and the maintenance would require four men, with two drays and horses, at £250 a year. This would mean a total annual cost of £1,300, which would represent an additional freight charge on the transport of the bricks of 2s. 9d. per 1,000 bricks,

and would so bring the total cost of the cartage of the bricks up to 23s. 6d. per 1,000.

20. To Mr. Mathews.—The width of tire of one of the traction engines is 18 inches, and of all the rest 3 feet. The width of tire of the trailers is from 8 to 10 inches.

21. To the Chairman.—If all the traction engines we have been available for the cartage of bricks, and some were likely to be utilized for carting timber, two more engines would be required. There is no other purpose connected with the Arsenal construction for which I think these engines would be required. On the score of cost, and also on the ground of efficiency, I consider that the proposal for the cartage of the bricks by traction engines is the one that should be adopted. If building was started in the Federal Capital there would be a considerable demand for bricks there also, but I personally consider that it would be better to deliver all bricks by traction engine from the brickworks on to the particular jobs in which they are being used. This system avoids unnecessary handling. Were it not for the fact that we already have the traction plant, and need not incur further capital expenditure to give effect to that proposal, the proposal to transport the bricks by a temporary light railway or tramway, with a 2-ft. gauge, would deserve more careful consideration. I have seen the plan of the proposed new railway line to the Arsenal site. I have not been consulted in regard to it, as the matter is taken in hand by the Department of the Commissioner for Railways. The estimated cost was, I think, calculated at the time when it was hoped that a connexion station, which would be about due east of the Arsenal site, and about 5 miles from that site. It has, however, been found necessary to go some miles to the north of that point. It has to be remembered that a cost of £5,000 per mile at that time would be equivalent to a cost of £8,500 or £7,000 per mile today. Having the plant available for the traction engine proposal, and in view of the convenience of delivering the bricks from the brickworks on to the Arsenal site, I think the traction plan is the best of the proposals. It should be remembered that the traction plant was obtained some years ago, and at good prices; and if we had not the traction plant, and it was necessary to purchase it at the present time at present prices, the 2-ft. tramway proposal would present some features for favorable consideration, especially if the period for delivery was extended beyond the four years. For the tramway you would have to spend £21,000 in capital expenditure right away, and under existing conditions the tramway proposal does not appear to me to be the best proposition. No considerable expenditure on bridges or culverts would be required for the traction engine track. Yarrolmulla and Western Creeks are crossed on the present Thiarra-road, lower down, without any cutting. There is simply metal placed or formed in the bed at the Creeks.

22. To Mr. Mathews.—It is not proposed that the traction plant should be used in flood time. You will notice that, in the data supplied in connexion with the traction proposal, 10 per cent. is allowed for detentions and loss in that way, and the freight charge is based on a week of five working days. You do not use a traction plant in wet weather. It does not pay to do so. It injures the plant as well as the track. An allowance on this account is made equivalent to 3s. per 1,000 bricks.

23. To the Chairman.—I am unable at the moment to say what was the cost per ton per mile of taking goods and material from the Canberra station to the Cotter River. We do not usually estimate the cost in

that way, as it gives such variable figures. It is obvious that, for a short journey, the rate per ton per mile is very much higher than it would be for a long journey. Some three years ago we discontinued the practice of estimating the cost per ton per mile as misleading, and we work out the cost now in the terms of the cost per day of working of the traction engines. I am satisfied, from past experience, that the estimate of cost for the traction engine proposal is based upon what has been done in the past and may be done in the future. It is an honest estimate, based on knowledge of the country, of the plant, and of what may be done in the cartage of bricks by traction.

24. To Mr. Sinclair.—We do not think that there is any clay or shale within a few miles of the Arsenal site. The country there is all decomposed granite. It was proposed to have a brick kiln and machinery erected on the Arsenal site, but the haulage cost being only about 21s. per 1,000 bricks, it was considered preferable to use the original plant, and just as economical as to establish new brickworks near the Arsenal. I do not think that the number of bricks required for the Arsenal would justify the capital cost of a high-class plant at the Arsenal site, and if a plant were established it would only be a second-grade plant, with open kilns. We have estimated that there should be an output from the brickworks of 4,500,000 bricks per year. They could be turned out at 60s. per 1,000 delivered in the stack at the brickworks, and this would make the cost of the bricks delivered at the Arsenal by the traction proposal 80s. per 1,000. The only bricks available at Queanbeyan would be some hand-made bricks burned in open kilns. We used to be charged £3, £3 5s., and £3 10s. per 1,000 for them. Only a limited number could be obtained, and they were not too good. I have taken the freight charge of 2s. 6d. per ton for a distance of 21 miles from the New South Wales Freight Book. That is the charge quoted for that distance for "M" class traffic. The minimum charge for "X" class traffic starts with 1s. 5d. for 10 miles. I think that if you propose to take 300 tons per week by two trains per week, the Railways Department would not be prepared to reduce their rates. I think they would lose money if they did so. Minimum rates are at present charged on the line from Queanbeyan to Canberra, as that is treated as a Commonwealth siding. It has been proposed that, if suitable timber at a payable price and in sufficient quantity can be obtained, it should be substituted for bricks in many instances for building at the Arsenal site. If that were found possible, the quantity of bricks required would, of course, be less. In my view, the existing plant would be quite sufficient to cope with the transport of the whole of the material required.

25. To Mr. Laird Smith.—If the temporary line from Canberra to the brickworks were constructed, it could not be maintained at a cost of £50 a year, because it would not be ballasted. I know the country on the route proposed for the line from the Cooma line to the Arsenal site. Some of it is fairly densely timbered, but I think it could be cleared at a cost of £250 per acre. A good deal of assistance would probably be given by persons requiring firewood. It has to be remembered that the timber would have to be grubbed, and not merely felled, and that would increase the expense. I think that a cost of 3s. per cubic yard for side cutting in that country is high. It should be done for less. I take it that the estimated cost of 3s. 4d. per cubic yard for centre cutting is an average cost taken over the whole length of the line, but I should not care to express an opinion upon that estimate of cost without seeing the sections. The traction engines now available to give effect to the traction proposal would last for the four years. You will find that in the data I have given them an amortization of six years. The traction engines would be able to carry a 15-ton girder over the same

track. Such girders were taken to the Cotter over a natural track along between two trailers on bearings in loads of 15 tons.

25. To Mr. Sampson.—I know the proposal to link up the Arsenal by rail with the existing New South Wales Railway at a point some distance below Queanbeyan. Two years ago I was with the Director-General of Works when he looked into the different methods of communication with the Arsenal. One considered was by Jerrabomberra Creek to near the power-house, but in view of the increased length and the necessity for making a sort of detour from Queanbeyan to Canberra, and then from Canberra almost to the suggested starting point, it did not seem to be justified. In view of the fact that the Federal Capital is gone on with there will have to be a railway through the Capital to Yass, and another to Jerrabomberra, I do not consider that that will establish the Federal Capital as a distributing centre for rail traffic. The construction of a line from the present terminus at the Federal Capital past the brickworks and round the western route can very well wait, in my opinion, until the connexion between Canberra and Yass is being considered. If you want communication from Canberra, it can easily be given via Jerrabomberra Creek. At present I connect very strongly with the proposal to connect with the existing Cooma line as quickly as possible. I have noticed that Major Gibson has estimated that the inward freight to the Arsenal will approximate 30,000 tons annually, but I do not know whether he includes in that estimate material for the construction of buildings. The Director-General of Works has stated in evidence that construction will represent about 8,000 tons per annum for five years. I believe that Major Gibson has given his estimate of 30,000 tons speaking as Director of the Arsenal, and of material required for Arsenal purposes. Colonel Owen's estimate is the estimate of freight for construction. Concrete, bricks, and timber will enter into the construction at the Arsenal. I consider, in connexion with these proposals, that we are dealing with a special demand for bricks which will cease after a few years, or will be so small afterwards as not to justify railway communication. If I were called upon to make a single proposal for communication between the Federal Capital and the Arsenal site, I should say that the route along Jerrabomberra Creek would be a satisfactory route for railway purposes. I think that passenger traffic between Canberra and the Arsenal will be dealt with by electric tramway, and by what is known as the Yarrolmulla Creek route.

26. To Senator Henderson.—I am of opinion that, if the proposed temporary railway were constructed, it would serve no useful future purpose after all the bricks required had been supplied to the Arsenal. In the total expenditure involved there is a difference between the traction proposal and the small-gauge railway proposal of £7,000, and between the traction proposal and the proposal for a temporary railway with a 4-ft. 8½-in. gauge there is a difference of nearly £14,000. As compared with the latter proposal, the adoption of the traction proposal represents the saving of £14,000. It has to be borne in mind that, if the temporary 4-ft. 8½-in. line were adopted, we should be left at the end of the four years with rails and sleepers to the value of £8,000, which we might not then have any use for.

27. To Mr. Mathews.—We shall require to use only four of the seven traction engines we have at present for the cartage of bricks under the traction proposal. One great advantage of that proposal is that, by adopting that means of transport, the bricks can be taken right alongside the wall in the construction of the power-house. The bricks used in the construction of the power-house were obtained from an open kiln. The power-house is constructed of concrete, and bricks were used only in building in the boilers. With the exception of the fire-

bricks, all the bricks used in connection with the power-house were obtained from the brickworks and transported by traction. The brickworks are big enough to supply all the bricks required for the Arsenal, and whether they are also big enough to supply at the same time all required in the construction of the Federal Capital must depend upon the rate at which it is proposed the Capital should be built. The present kiln has a capacity for 4,500,000 bricks a year, and a small addition to the plant would make it possible to increase the output to 15,000,000 bricks per year.

28. To Senator Neelham.—We have not made fire bricks at our brickworks because we have not suitable clay for the purpose.

29. To the Chairman.—It is estimated that 18,000,000 bricks will be required for the Arsenal and so forth, and 18,000,000 bricks represents 60,000 tons.

(Taken at Melbourne.)

TUESDAY, 8TH OCTOBER, 1918.

Present:

Mr. Guxon, Chairman;

Senator Henderson, Mr. Mathews,  
Senator Neelham, Mr. Sampson,  
Senator Newland, Mr. Laird Smith.  
Norris Garbutt Bell, Commonwealth Railway  
Commissioner, sworn and examined.

30. To the Chairman.—The point of departure from the Goulburn-Nimmitabel line, which has been selected, was originally selected by a meeting of officers representing the New South Wales Railways Department and the Commonwealth, at which there were present Colonel Owen, Mr. Menzies, the Divisional Engineer—who represented the New South Wales Railways Department—and Mr. Griffith, representing the Commonwealth Railway Department, and also, I think, Mr. Griffin. When the question of the erection of the Arsenal was first submitted to the Committee, there was an estimate of £25,000 for the cost of this line, and the assumption that it would join up some 4 or 5 miles further south. That scheme would have been impracticable for the reasons that the grades leading down to the Arsenal would have been too steep, and that the New South Wales Railways Department would not have agreed to a connexion on a steep grade. In my opinion, the route now before the Committee is the only practicable one, and the best to bring the Arsenal into touch with the railway service. An alternative route by Western Creek was proposed, but it would be several miles longer. I look upon the route now suggested as the only practicable one for the purposes required. For the purposes of the general development of the Federal Territory, and with a view to providing an outlet for the output of the Factory to all the State Capitals, it would be quite feasible to construct from the proposed branch line to the Arsenal, at about 1 mile south of its junction with the New South Wales State railway at Queanbeyan, a line connecting up with Canberra. Upon completion of the Yass-Canberra line, that would give the necessary outlet. The New South Wales Railways Department are building the majority of their trunk lines with 80-lb. rails. I have recommended the use of 80-lb. rails for this branch line, since I regard them as essential. We propose to fence the line. It is not absolutely necessary to do so, but it is much safer, especially where passenger traffic may be carried, and where we may run night trains with passenger traffic. The cost of the fencing is estimated at £1,200. The whole of that amount would not be saved if the fencing were done away with, because fencing would still be required where we put



in cattle pits. We might save £1,000 by doing away with the fencing. I have no personal assurance from the New South Wales authorities that every assistance will be given us in connexion with the running of trains and the carriage of goods on this line, but I believe it will be extended to us. I had a conversation with Mr. Hodgson on the subject when I was last in Sydney, but it was quite unofficial. I have no doubt that such assistance will be given us. We are largely in the hands of the New South Wales Railways Department in this regard, and it might have been better had negotiations been opened up before, and some arrangement arrived at. In any case, we should have been compelled to go on with the operations, whether we could arrive at an arrangement or not. I imagine that the loading will come largely from Sydney, and, perhaps, Newcastle. The greater part of it will consist of coal and steel. If operations are to be pushed on, as I understand they will be, the material, I think, will be consigned through. The loading will be brought through to Goulburn by the ordinary trains of the New South Wales Railways Department, and full train loads will be made up at Goulburn and worked right through to the Arsenal. If the work is to be prosecuted with any vigour, that will be necessary. There will probably be one or more trains a day, and since Goulburn is the traffic centre, the train-loads are likely to be made up there. I am sure that the New South Wales Government will do everything to assist us and to expedite our work. We shall naturally endeavour to secure the best possible terms, but we are entirely in their hands. It would not be economic or feasible for us to run any of these lines within the Territory ourselves. That would involve the purchasing of locomotives and the erection of workshops for their repair and maintenance. It will also mean the employment of locomotive hands, whose time would not be fully occupied. When the Arsenal develops, and shunting engines are employed in the Arsenal yards, those engines might be used to make trips to Queanbeyan with passengers and loading. I would not recommend that we should provide ourselves with rolling-stock for this line; I merely say that it might be possible for engines to make trips with loading and passengers to Queanbeyan if rolling stock were found to be necessary in the working of the Arsenal. I would not otherwise suggest that we provide our own rolling-stock. It would be more economical to make arrangements with the State Government. I estimate the cost of maintaining this line at £100 per mile. Where we construct a siding for a private individual or company, we charge the owner of the siding the actual cost of materials. There will be little or no public traffic. I regard the expenditure in constructing the line as merely an outlay in connexion with the erection of the Arsenal. The only public revenue that will be derived from it will be in respect of those who live in the Arsenal city. The railway will be a direct capital charge against the Arsenal itself. In this year's Estimates provision is made for expenditure in connexion with the Arsenal, and the cost of this line is to be a charge against that provision. We cannot look for much public revenue from the line; it must simply be charged as a siding for the purpose of bringing and taking goods to and from the Arsenal. I propose that the work of building the

line shall be carried out, by day labour, by our own Department. Mr. Darbyshire's estimate of the cost of earthwork is 3s. 4d. per yard. The actual cost may not be so high, but we have to make some allowance for the possibility of striking granite in some of the larger cuttings. The work may be done for a little less. We shall not use steam navvies in making the necessary excavations. The quantity is not sufficient to justify putting in a steam navvy and laying down special roads to provide for shifting it. As to the estimated cost of building the line, the permanent way material alone will run into a considerable sum. The ballast is easily obtainable. The river ballast should prove quite satisfactory. The larger stone will not have to be cracked; it can be thrown out. The rest will make good ballast. We are going to use 8 feet by 6 feet by 4½ inch sleepers. They will be quite large enough for this line. Sleepers of that size are used on the local line. The cost of any longer sleeper would be considerably more, for the gagers are accustomed to cutting that length of sleeper. For many years the Construction Branch of the New South Wales Department used 9-ft. sleepers, but that branch has recently been taken over by the Commissioners, who use 8-ft. sleepers. You ask what steps have been taken to secure an accurate estimate of the cost of this work. A complete survey has not been made, but a section has been prepared from a contour plan. I have standard drawings of bridges which are suitable for use on any line. The survey, when completed, may alter the quantities to a slight extent, but the alteration will not be material. The contour survey enables us to make fairly exact estimates. The estimate supplied to the Committee is not in the nature of guess work, but is a fairly accurate one. I think the estimate for the cost of earthwork is a liberal one. It is wise not to try to cut the preliminary estimates too fine. The Supervising Engineer, when he commences this work, will be supplied with a working estimate, and the provision in that working estimate will probably be slightly below the preliminary estimate. We can commence operations as soon as the complete survey is finished. The survey is not yet in hand. We are awaiting the result of the inquiry by your Committee. The making of the survey should not occupy more than six weeks, and once we commence the building of the line we should be able to complete it within six or eight months.

61. To Senator Newland.—If the operations are sufficient to warrant full train-loads, the proper way to work the traffic will be to make up full train-loads from Goulburn. If there is not sufficient loading to make up full train-loads, the trucks will be brought up to Queanbeyan and work out from Queanbeyan by shunting engines. There is an engine on the Canberra line which is used for shunting purposes, and there is not much work on that line at present. It might be necessary to run an engine from Goulburn to do our work if we had not full train-loads, unless the traffic were sufficient to warrant a shunting engine being stationed at Queanbeyan. At the present time an arrangement exists between the Commonwealth railways and the New South Wales authorities in connexion with the working of the traffic on the Queanbeyan-Canberra branch. Special shunting rates over this line, if charged, would be higher than the through rates. I have not made any arrangements with the New South Wales Railways Department as to the stationing of a man at the junction, and the provision of a cabin for him, because I do not yet know how many trains will be run on the line. I cannot say yet whether it will not be possible to work the traffic with a staff lock. If there is only an occasional train, it will not be necessary to station a man there, but if there are several trains a day we shall have to do so. One man would be sufficient for the purpose. Our Department would have

to pay the cost of erecting a cabin and dwelling house for him; but a single man would require only small cabin quarters. The rates charged by the New South Wales Government for haulage over this line will vary according to the class of material carried. One penny per ton per mile would be too much to charge for the haulage of coal, for instance, and not enough for explosives and such like material. The loading that would go through would probably come from a considerable distance—largely from Sydney and Newcastle. Material coming from Newcastle would have been hauled 300 miles, and the additional haulage over our line would not affect the rate to any extent. The New South Wales Department would require to make some slight deduction from their through rates to compensate for the fact that this line belonged to the Commonwealth. They should charge a lower rate over our line than they would for haulage over their own lines, since we shall own and maintain this section, and they will not have to earn interest upon it, or provide for its maintenance. I do not think £50 a mile per annum would be sufficient to allow for maintenance. I would have only one gang of three men and a ganger on this 8-mile section. The men would receive about 70s. per day, and the ganger a higher rate, and that would mean nearly £700 per annum for wages alone, leaving £100 for odds and ends in the way of ballast renewals and material of different kinds. I think that £100 per mile will cover maintenance.

62. To Senator Needham.—If I were to go to Sydney, I could probably arrive within a week at an official understanding with the New South Wales Railways Department as to the working arrangement of this line. I could go over at any time. I shall endeavour to arrive at an official understanding as soon as possible. I have discussed with several officers the question of the transport of bricks from the brickworks at Canberra to the Arsenal site. I am not quite satisfied that the cheapest way to convey the bricks to the site would be, as has been suggested, to construct a temporary 4-ft. 8½-in. railway from the brickworks at Canberra to the present termination of the Queanbeyan-Canberra line. I understand that at the most only some 200 tons of bricks per week would be handled. That would mean between 4,000,000 and 5,000,000 bricks a year. I am informed that Colonel Owen has seven steam tractors at Canberra, and by using a traction engine and making a cheap direct road, not necessarily metalled, I think we could land the bricks at the sites of the buildings as cheaply as by any other method. I am not committed to the proposal to construct a temporary 4-ft. 8½-in. line. On that question I have an open mind.

63. To Mr. Laird Smith.—It would be quite possible for the New South Wales Department to have running rights over our line, and for us, at the same time, to have equal running rights over it, so that if we could not make up a load at Goulburn, a truck could be attached to an ordinary train, kicked off at our junction, and taken to the Arsenal by one of our own engines.

64. To Mr. Sampson.—Any agreement arrived at with the New South Wales Department would provide for running rates and freights, and for everything relating to expenditure on the line. I have not been over the route of the proposed line, but as Commissioner I am satisfied that the proposed off-take is at the most suitable point to connect up with the New South Wales railway.

65. To Mr. Mathews.—The New South Wales Department should not charge full passenger fares over our section. A deduction should be made from their rates in respect of both passenger and goods traffic. In making arrangements with the New South Wales Department, I would stress that point, since we own this 8 miles of line, and would have to maintain it. The question of whether or not an automatic staff station

would be sufficient at the junction would, as I have said, depend upon the traffic. With much traffic it would not be a good arrangement, but with, say, only one train a day it would be quite sufficient.

66. To Mr. Gregory.—The New South Wales Commissioners have certain rules with regard to the working of branch sidings, and, so far as this line is concerned, it is merely a question of our securing better terms than the ordinary public obtain from them.

67. To Senator Newland.—As to the question of whether or not we should hand over to the New South Wales Department the work of constructing this line, I may say that my experience of the New South Wales construction methods in connexion with the line from Queanbeyan to Canberra was not very satisfactory, and that I am rather unwilling to give the State authorities another chance. There is at Canberra a considerable quantity of plant that we can use, and I am quite satisfied that we can construct this section as cheaply as the State Department could do.

68. To Mr. Sampson.—As to whether, in the event of tenders being called, and the successful contractor being given the use of the plant now at Canberra, the work could be carried out in that way for less than it would cost under the day labour system, I would point out that before a contract could be let a survey would have to be completed and proper plans, sections, and specifications prepared. That would occupy considerable time, and there would be a further loss of time in advertising for tenders. In this way three or four months would be occupied. I am fairly well satisfied that, with Mr. Darbyshire in charge, we shall be able to carry out this work as reasonably as any other contractor could. I have been associated with the question of day labour versus contract work for a good many years, and have considered it from every point of view. A recent example of the advantage of day labour against contract work in the building of railways was furnished in connexion with the trans-Australian line. We called for tenders for the construction of about 200 miles of road, including earthwork, culverts, and bridges, but did not accept a tender, and we actually carried out the work for £37,000 less than the lowest tender received. If all the earthworks and culverts throughout had been constructed at the lowest contract rate, the line would have cost £300,000 more than it did. The competition amongst contractors for the 200 miles of line was very keen; we received only four or five tenders. My experience on the trans-Australian railway satisfies me that we shall be able to construct this line on the day-labour system just as cheaply as if a contract were let for it. I unhesitatingly recommend the day-labour system for the construction of this line. I base that recommendation upon my experience.

(Taken at Melbourne.)

WEDNESDAY, 9th OCTOBER, 1915.

Present:

Mr. GREGORY, Chairman;	
Senator Henderson,	Mr. Sampson,
Senator Needham,	Mr. Shirair,
Senator Newland,	Mr. Laird Smith,
Mr. Mathews,	

Walter Barley Griffin, Federal Capital Director of Design and Construction, sworn and examined.

69. To the Chairman.—I was not a member of the conference that decided on the point of departure of the proposed branch line. I was not consulted about it, nor

I was consulted about the construction of the line. I have a minute from my Minister, dated the 29th ult., given to one of the officers that came to see me, and stating that the matter would be discussed between myself and Mr. Bell, but I have heard nothing further about it. I have not been supplied by the Railway Department with a tracing of the proposed line. I have seen nothing about it except what appeared in *Hansard* in regard to the reference of the question to the Committee. I have decided opinions on the question, which as affecting larger matters should have been discussed with me as Director of Design and Construction, and have caused them to be referred to the Minister on previous occasions. I see the proposed route of the line on the plan on the wall, starting at a point about 4 miles south of Queanbeyan. I remember some time ago there was a previous proposal to take off from the State line across the Jerrabomberra creek, then run parallel with the State line for a considerable distance, and divert into the Tuggeranong Valley. The proposed route does not meet with my approval, as it is an impediment for the Arsenal, but as part of a comprehensive railway system for the Federal Territory, which, no doubt, will have to be developed by railway at some time or other. From that point of view this line might be taken as quite a different route, that would accomplish the purpose intended as well, if not better. It would then be a link in the chain which would be a function of the Federal Capital, and would primarily bring in supplies for the construction of the Capital, and also serve permanently for its maintenance. This point of departure was not decided upon in 1916 at a conference between Colonel Owen, Mr. Hlobler, Mr. Macleay (State Engineer), and myself. No decision was made at all. We visited the site, and made our individual recommendations. There was no conference and no agreement on the point of departure. Mr. Hlobler and I traveled the route together. I do not remember having met Mr. Macleay at that time. I do not recall whether Colonel Owen was present at that time or not. At no time did I incur in the proposed point of deviation. In considering railway connexion with the Arsenal, I would emphasize that the first point of departure should be towards Yass, away from the direction of the Dividing Range, so that we could connect first to Canberra from Tuggeranong, then we could connect to Canberra from Jerrabomberra-Queanbeyan line to Sydney. That would be constructing the line in the direction of Yass by the direct and the easiest grade route to Sydney, as well as to the rest of the capitals in Australia. I produce a relief map of Australia to show my meaning. I show only a plan a line of 1 in 100 grade, compensated, starting from near the power-house on the Queanbeyan to Canberra line, running south, and then going right down the Jerrabomberra valley to the Arsenal. The country south of Canberra is a level plain. It would take off in the form of a Y practically at the terminus of the present line to Canberra. Thus, instead of having two spurs in the Capital Territory, we should have only one. Operating costs would be materially reduced by serving both places with one line instead of with two separate lines. My line would run parallel with the existing railway for a short distance, and then diverge immediately after passing the gap. The summit of the line is the highest point between Canberra and Tuggeranong, that is, at the lowest point in the range. Any railway connecting with Tuggeranong must go over that gap. My line would provide for curves of minimum radius of 20 chains, with the exception of one curve of 15 chains radius right at the summit. It would be 12 miles 43 chains 24

links long from the Arsenal to the junction at Canberrra. There are no engineering difficulties whatever. There is not even a waterway of any size to cross. The Tuggeranong Creek is sunk deep in a flat valley, and only a short bridge would be required. I have just built a line at Canberrra for about £6,000 a mile, including a long overpass over the Molonglo, considerable trestling, and some permanent works. The cost of the line, at the price of materials for that line, the line I now suggest should cost about £3,000 a mile, but prices now are very ambiguous. The question of getting rails is the first consideration. I have assumed in my estimate £12 10s. per ton for rails at Newcastle. My actual price is £4,468 per mile, working it out on the same basis as for the line now constructed at Canberrra, but the earthworks will be considerable. At half the rate per mile than they are on that little 31 miles of line at Canberrra. There are no considerable crossings, so that that margin will make up for a good deal of increase in the cost of labour and materials. Coming off the line near the power-house, I make the distance about 25 miles. I have assumed that it will be 25 chains more than that would be, which I have put down from the main line as put before the Committee, and the railway authorities. This is portion of a memorandum which I sent to the Minister on the 15th March, 1917:

**ARSENAL TOWNSHIP.**

Railway—Length, 12 miles 40 chains 24 links.

[illegible]

I arrive at the 2 miles 25 chains by reckoning, along the route of the permanent line when Camborne is properly connected with Queanbeany, because the present line is only temporary and runs across the flood bottom. The permanent line will go through the flood bottom as the maximum depth of the flood is 10 to 12 feet. When that work is completed a grade of the distance over which goods will have to be carried to the Arsenal, as compared with the present proposal, will be 2 miles 25 chains. I have under consideration a scheme for a line from the Arsenal to the Federal Territory generally, but I have gone no further than that which is implied by the physiographical reconnaissance of Mr. G. Griffith Taylor. It would take more detailed surveys to establish such a line on a route following as nearly as possible the line of the flood, and involving more bridge construction, but much less climbing up and down the work. My proposal would enable the Arsenal to be connected with all the capitals in Australia. That is why I emphasize direct connection with the interior, where the present line is only a branch line. The main proposal is advantageous to all the capitals there. My proposal is advantageous to all the capitals, because it is for a better transport of heavy material, because it is for a better transport of heavy goods. The route to Yass is surveyed for a line in 100 maximum

gradient consumed. The route from Sydney via the present Goulburn-Cooma line has a maximum gradient of 1 in 37, which shows a vast difference in favour of the route via Yass. I think the maximum grade of the present line from Yass to Sydney is only about 1 in 50. If the Arsenal is proceeded with it will be essential to have railway connection between it and Canberra, and the dividing point will be situated at Queanbeyan. This will be very different to Federal Capital development, as Queanbeyan will be of no advantage for any commercial house to set up, instead of at Canberra, which is the property of the Commonwealth. Even if the main object of the scheme before the Committee is to get enormous quantities of heavy material required to build the Arsenal at Tuggerah, it would not be advisable to make the deviation suggested by the Committee, as the vast quantities of the stores required are already at Canberra. The material, &c., will have to be taken straight from Canberra. If there were direct connection between Canberra and the Arsenal the stores centre might remain at Canberra, where railway facilities, such as sidings, platforms, and trains are all provided. I do not agree with Major Gibson's contention that he would still assist the Government with the main Sydney line so as to be able to get his supplies from the line from Canberra were they extended down to the Arsenal. Instead of it would be just the other way about, because the main train service would serve the two places instead of having two separate train services diverging from Queanbeyan. We already have goods trains running continuously from Queanbeyan to Canberra. They could be much more expeditiously sent on direct to the Arsenal. At present activity at Canberra is at the minimum owing to the war. I do not think it should be considered that the Arsenal will be constructed in a minute, or that the Federal Capital will be constructed in its present condition for ever. The question of haulage of heavy goods will always be a factor in the Arsenal operations, and heavy goods demand not the shortest line but the best-graded line. In time all the lines in the States will be devoted to make them much longer than they are now, in order to enable them to handle the heavy goods. I propose a much better graded line on which the trains carrying the heavy goods with the same crew and less coal. Queanbeyan would be the junction point until the Yass line is built, and then the marshalling yards will be somewhere on the Yass line. To facilitate the work and cheapen the original cost, I would propose that the line I have now put before the Committee should be executed first on a maximum grade of 1 in 50. This would serve for the connection of the Yass line, and it would be possible to be upgraded on exactly the same scale of 1 in 100. That will make a considerable difference in the cost of earthworks to start with. I am convinced that 1 in 100 is the best grade that the country will economically stand, and, in considering the Arsenal, nothing but the best grade will do. There will be pretty well a constant grade of 1 in 100 right from Canberra to the summit. The earthworks would cost £20,000 at the rate of 2s. per yard, except the summit, which would be taken from the summit, would be available for railings. This I would distribute by gravitation both ways. There is no rise and fall in both directions except straight to and from the summit. My estimate of 2s. per yard for cuttings and fillings right through. My estimate for small Canberra line just constructed was only 1s. and the small initial cost of construction has come down to the estimate of 10s. for earthworks on that line were twice as heavy as they would be on this line on a 1 in 50 grade.

69. *To Mr. Laird Smith.*—I do not say we did the earthworks for less than 1s. per yard, but our original estimate was 1s., 1s. 4d., and 1s. 6d. for the different classes of earthworks. I am confident we could do this line for 2s. per yard, as it is largely side cutting, seeing that we are following the side of the hill right round.

70 *To the Chairman*—The brickworks at Canberra are under my control. Doubtless a large quantity of bricks will be required at the Arenal site. We could supply them from Canberra. I could not estimate the present at what price. The only prices we have had, applying to our own brickwork, have been very high, owing to the initial cost of the brickworks. We have not distributed the cost of opening up the kiln except on our present work. The brickwork plant has been idle since 1910. Its capacity is 5,000,000 bricks per order which we were just got the plant in fair working order when it was opened, and, as a result, the cost to us of the production of bricks is considerable. We had a lot of trouble in drying out the kiln. We have charged ourselves 84s. per 1,000. That includes the cost of opening up the plant, &c. We have produced about half a million burnt bricks, and perhaps 250,000 machine-pressed, at that rate. I have not gone into the question of cost or method of delivery of bricks from Canberra to the Arenal, but I would hazard the opinion that if we had a railway line it would be best done by rail, as the bricks could be handled as they are at the State brickworks. I have had a great deal of experience of the handling of goods in traction engines at Canberra, but possibly not under favorable conditions. We brought back an enormous amount of plants from the Catter Dam and the sewerage works by means of traction engines. A temporary line from the brickworks to the railway at Canberra will not interfere with the lay-out of the capital if it were merely a surface line. I have not considered the question of the best method of sending bricks for the Arenal. Probably there would be no objection to the traction engines were they used for the purpose of conveying the bricks to the traction service of that kind. The trains pulled by traction engines are relatively small in relation to the crew, compared with the railway.

71 To Mr. J. Sinclair. The contour surveys that have been made of the country are quite good enough to make an estimate of the cost of either of the proposed railways. I have taken the proposed railway to Jervis Bay into consideration in relation to future distribution from the Arsenal. The only surveys I have known anything about make a difference of only 20 odd miles between the proposed line to Sydney and the line constructed from Brisbane. I think that my proposed line would work in with that to secure the economical distribution of material from the Arsenal, because the purpose of the proposed railway to Jervis Bay is to connect Canberra and the coast. If Canberra is made a main point on that route it will be a much better distribution than if not. That is supposed to be a distribution line from Jervis Bay, passing through Canberra, and if Canberra is a main point, which it was originally intended to be, the trains for Canberra can just as well handle Tuggeranong on this route, but that would not be so if they had to spur off at Queanbeyan. The total cost of my proposal on the line from the Arsenal to Jervis Bay is £65,310. I estimate the total cost of completing the line in 10 grades, following exactly the same track and in the same main tainment works, at £80,320. The Commonwealth Railway Engineer tells me that he can supply only estimates as to unit costs, because he has been unable to get quotations from New South Wales. I gave him my estimated prices over the telephone, and he said they were about what he would expect. These prices are: 10 lbs rails, £12 10s. per ton; sleepers, £18 6s.; fish-bolts, £40; dog spikes, £30; spring rails, £25. The freight from Newcastle to Canberra, £3 6s. 1d. The railway engineer said the freight from Newcastle to Canberra was only 18s. 6d., so that my estimate is much higher. His figure must be a special rate on rails, as he said he got the rate for the fish-bolts. My proposed route will go through Tuggeranong, Queanbeyan, and there will be no resumption charge. The stock-works plant is capable of turning out a limited quantity of very good bricks. Those that have been turned out



have varied greatly in the burning they get. The well-burnt bricks are good, but there are a good many lightly burnt. A great many have had to be re-burnt. Another item of expense is the cost of getting out the shale. The deposit is very poor and limited. It has been necessary to get material from two or three sides of the cut to make a truck-load, so as to mix them and get a uniform quality. From the geological reports there is a very small chance of getting any large deposits of clay on any site near the Arsenal. The shale deposit to the south end at about the south boundary of the City site, Canberra and on the west side of the boundary. They extend north of the Mount Ainslie and the Black Mountain. There is an endless quantity of very fine shale in that direction. If the Committee decided on two railway routes put before it by the Railway Department, I do not think it would be possible to take off from the State line on the south side of the Jerrabomberra Creek, in order to save the construction of another bridge. The line runs for miles there on a 1 in 40 gradient, on which the State railway authorities would not allow a siding to be put. It would be a difficult matter to lift the main line sufficiently to allow a take-off on the south side of Jerrabomberra Creek, because it is a very long grade, though it might be cheaper to raise the existing bridge over the Jerrabomberra than to construct a new bridge.

72 To Mr. Lord Smith.—I have not gone into the question of the difference in cost, per the line I propose, of carrying material from Queanbeyan. That would be rather difficult. If the trains are made up at Queanbeyan, the extra loads that could be carried over my proposed route could be set off against the extra distance, but if the trains are made up at Goulburn that difference would not apply. At present, we are operating from Queanbeyan, and the trains are made up there, at the rate of 18.4d. per yard for earth in cuttings, and 2s. 6d. a yard in side cuttings, seems high to me; but it might possibly be made up in not charging it again in the ballast. I have explained that in my proposal most of the rock taken from the mountain can be run down on either side by gravity. I would use such rails. I have used rails of that weight on the line just constructed at Canberra.

73 To Mr. Simpson.—To connect my line at the nearest point direct to the State line on a grade of 1 in 60 would be a distance of about 4 miles. I strongly recommend making one line instead of two. There will be a very slight difference, if any, in the cost of construction as against the line now before the Committee, and there will be great savings in operating one line instead of two. Moreover, my line will open up new country, comprising the best fruit-growing district we have examined. I could construct a portion of my line from the Arsenal to the point nearest to the State railway, leaving the other part, to Canberra, to be constructed afterwards. The two routes must converge to the highest point. Although my line would be about 12½ miles, as against the departmental proposal for a line of about 8 miles, it gives a great advantage in grade, and also in the cost of earthworks.

74 To Mr. Mathew.—I am not necessarily basing my proposal on the belief that the construction of the Arsenal and the Capital will go on concurrently. That is one of the factors, but I do not say it is the most important. The ultimate factor is the permanent railway development of the Federal Territory. With my proposed route, it would be necessary to have a loop running north again to reach the township site to the north, but the question of the township site may be a new one altogether. I put before the Minister alternative sites for the township, one to the north and one to the south. I do not know anything about the present design for the township. The factory for high explosives would have to be kept away from the township. I would prefer the plan for putting the township on the south side, because it is better pro-

vided from the site of the Arsenal proper by intervening hills, and because it would be on the route of the railway which would ultimately lead south through it, Federal Territory, thus avoiding another loop and spur. My railway route, however, would serve the town on either side of the valley. The distance would be the same for either side of the valley. My proposed line would be more direct, ultimately, for the whole of the Federal Territory; but the chief consideration guiding me has not been directness so much as gradient. My estimate that the line from Queanbeyan through Canberra to the Arsenal would give a route only 2 miles 25 chains longer than the Goulburn-Comma line, and the proposed direct connection with it, is correct, so far as I know the projected direct line. The distances were worked out carefully on the map a year or two ago. I can go over them again if the Committee so desires. In spite of what Major Gibson contends, I would oppose the construction of the projected direct line in all circumstances, because it would be something of which we cannot foresee the consequences. As soon as we establish traffic lines, we establish vested interests and business conditions, which I would like to see established right, and not have to rectify them afterwards. If my proposal is adopted, it will not be necessary for the Commonwealth to run a complete railway system of its own in the Territory, with its own rolling-stock. At present, the New South Wales Railway Department is operating the Queanbeyan to Canberra line. My proposal would make that only another 12 miles longer. If the whole railway system in the Federal Territory were 40 or 50 miles long, it might be another matter; but this short line could still be treated as a spur from the New South Wales railway system. It would be better to have one system than several detached ones. The line to Yass will pass through rich shale country, containing an inexhaustible supply of the best material for brick-making. That is the main developmental railway route I propose, running from north to south of the Territory.

75 To Senator Newland.—The last I had to do with any railway proposal to connect with the Arsenal was when it was actively under consideration about two years ago. I went over the line that I proposed then, and discussed it with the officers, and they understood my position, but we came to no conclusion. The projected direct connection from the State line would give the shortest route between Sydney and the Arsenal, and my proposal is to consider grade. If I were engineer in charge of the construction of the Arsenal, I would not necessarily ask for the shortest route for ease of freight. This is a matter of Federal Capital railway construction, and the Federal Parliament should have the right to fix the rate, which should be based on capital cost and cost of hauling. As this would be a national work, the Commonwealth could dictate reasonable haulage rates over the line in the Capital Territory. The Commonwealth would have to agree to the New South Wales terms for haulage over the State line; but I take it that rates are not arbitrary, and certainly for a national work they could not be maintained at an arbitrary figure. The grades on the proposed direct line are not as steep as those on the Goulburn-Comma line. I do not think Major Gibson's contention that he must have the shortest route to the works, without considering the future railway development of the Federal Territory, is correct. He is assuming that rates are arbitrary, and not fixed by grade as it is of distance. If the trains are made up at Queanbeyan, and this is as much a matter of much cheaper to haul goods over a well-graded road than over a steeply-graded road. If the trains are to be made up at Goulburn, there would be no logic in making the grade on the line to the Arsenal any better than 1 in 37. If the shortest route is the only consideration, probably a grade of 1 in 37 would give Major Gibson a still shorter route. If he says that the

construction of a railway from Canberra to the Arsenal would make him pay a considerably longer mileage for his freight, he is basing his argument on the assumption that rates will be fixed arbitrarily, and not taking into consideration the cost of haulage. This is a public work, and it should be chargeable only with the expense of haulage. It should be remembered, also, that the greater the distance the more traffic is developed, and the more new country is opened up. The projected direct connection is outside of the Capital site, but the Federal City must be planned to be connected with its tributary country as directly as possible. A direct line to connect with the country on the south of the Territory should run south, and not east, whereas the projected line from the Arsenal to Queanbeyan throws the railway communication with the south towards the east. The proper plan is a railway running south from the city site through the Jerrabomberra Valley. That was contemplated at the very inception of the city plan. That route will continue right through the city to Yass. Eventually if the city plan were carried out, the projected direct connection from Tuggeranong to the Goulburn-Comma line would mean a duplication of line. The price at which we could sell bricks, with an output of 5,000,000 per annum, has been variously estimated by numbers of experts. I should think we could supply bricks for 6s. per 1,000. I do not say how many we could supply at that price, because of the restrictions on the quantity of material economically available. We sank a shaft at the bottom of the pit where the shale has been excavated, the pit being now 15 feet deep, and struck limestone at a depth of 15 feet. We went into the limestone 10 feet. There had never been a trial shaft put down until just before we closed the brickworks. We put a series of shafts down on the direct railway line to Yass for 2 miles. We carried them down 20 feet, and carried the terminals down to 60 feet, and found all the same quality of pure shale from top to bottom. That deposit begins about the centre of the Capital site, just at the end of the line we have recently constructed. The material, except in the open cut through the city, is useless for brickmaking. The Government physiographer could find no material for brickmaking to the south, or west, or north.

76 To the Chairman.—The land along my proposed route is all in Federal Territory. I believe it has all been taken over, and paid for. I do not know if that is the case or not on the projected direct route.

76A To Mr. Sinclair.—The loop from the Arsenal on my plan is to supply the township. It is not included in the estimated distance of 12 miles 49 chains.

77 To Mr. Ramsden.—I supply the Committee with an estimate of the cost of making the shortest possible connection between my line beyond the Capital and the Goulburn-Comma line, which is as follows:

The shortest connection between the proposed permanent Federal Territory railway system of the Commonwealth to the point of take-off from the State railway nearest to the Arsenal site is 1 mile 53 chains in length for a 1 in 60 gradient and 20 chains radius minimum curvature as requested.

In accordance therewith I have checked, as asked by Mr. Mathew, the difference in distance of such combination route, and the all-Commonwealth route through the Federal Capital, which, accordingly, is 2 miles 50 chains.

Itemized preliminary estimate of cost and particulars of distances are as follows:—

COST FOR PROPOSED LINE FROM ARSENAL STATION TO QUEANBEYAN.

The Federal Territory railway system route (for maximum gradient 1 in 100 compensated) and short connection to Goulburn-Nimmitabel line (1 mile 53 chains)—

7 miles 53 chains of proposed main line at 1 in 100 ruling grade .. .. .	£40,000
1 mile 53 chains of proposed connecting line at 1 in 60 ruling grade .. .. .	£14,000
Total .. .. .	£50,000
7 miles 33 chains of proposed main line at 1 in 60 ruling grade .. .. .	£38,000
1 mile 53 chains of proposed connecting line at 1 in 50 ruling grade .. .. .	£11,000
Total .. .. .	£49,000

#### LENSHIRE.

Railway Access to Arsenal from Queanbeyan via All-Commonwealth Route (maximum gradient 1 in 100 compensated for curvature).

Line Q.A.T.—	Already Constructed.		To be Destroyed or Constructed.		Total Length.	
	Miles.	Chains.	Miles.	Chains.	Miles.	Chains.
via Queanbeyan-Canberra existing temporary line through suburban stations of "Riverbourn" and "Lake Park" and permanent city route via "Lakelbourne" and "Southbourn" suburban stations and the Jerrabomberra and the Tuggeranong Valley line .. .. .	3	10	12	65	15	75
Line Q.B.T.—						
via Queanbeyan-Canberra existing temporary line through suburban stations of "Riverbourn" and "Lake Park" and permanent city route via "Lakelbourne" and "Southbourn" suburban stations and the Jerrabomberra and Tuggeranong Valley line .. .. .	4	56½	12	70	17	10½
Railway Access to Arsenal from Queanbeyan via New South Wales Railway (ruling gradient 1 in 37) and separate temporary Federal Spur Line (ruling gradient 1 in 60) to disconnected portion of Federal Territory System.						
Line Q.C.T.—						
via Goulburn-Nimmitabel Railway to point north of Jerrabomberra Creek, thence via temporary cut-off (1 mile 53 chains, gradient 1 in 60) thence via Jerrabomberra and Tuggeranong Valley line of Federal Territory system .. .. .	4	10	9	6	13	16

#### SUMMARY.

All Commonwealth System.		Part Commonwealth and Part State System.		Difference.
Route Q.A.T.	Length.	Route Q.C.T.	Length.	
15 miles.	75 chains.	13 miles.	16 chains.	2 miles 59 chains.
Route Q.B.T.	17 miles.	13 miles.	16 chains.	3 miles 73 chains.

(Taken at Melbourne.)

WEDNESDAY, 10th OCTOBER, 1916.

Present:

Mr. GRIMDY, Chairman;

Senator Henderson, Mr. Sampson,  
Senator Needham, Mr. Sinclair,  
Senator Newland, Mr. Laird Smith,  
Mr. Mathews.

John Irvin Darbyshire, Resident Engineer, Commonwealth Railways, recalled and further examined.

78. To the Chairman.—Since I was last before the Committee, I have had an opportunity of studying the proposal submitted by Mr. Griffin to connect the Arsenal site with the Goulburn-Cooma railway. I have gone through the papers relating to this matter, and I have here a section showing his proposal and also the proposal of the Commonwealth Railways Department, drawn to the same scale. I have also featured Mr. Griffin's proposed line and the line proposed by the Department upon a plan drawn to the same scale. The red line on the map shows the projected departmental railway and the blue line represents the route that would be followed by Mr. Griffin. The proposal of the Department shown in red on drawing No. 595, is for a line running almost due south for 3 miles from the take-off of the Goulburn-Cooma railway, and thence travelling west to the Arsenal site, a total of 8½ miles. Mr. Griffin's projected line shows in blue on the same drawing leaves the Goulburn-Cooma railway at the same point as does the departmental line, runs westerly for about a mile; then south-westerly for about 1½ miles; then westerly for about 3 miles; then almost due south for 4 miles; and then west for 3 miles, to the terminus at the proposed station on the Arsenal site—a distance of 9½ miles. The first of the two sections which I have had prepared show the departmental line upon a 1 in 60 compensating grade, and the second features Mr. Griffin's proposal for a 1 in 100 compensating grade, with a connecting grade of 1 in 60 compensating at the junction with the Queanbeyan-Cooma railway. In the first place, I desire to point out that the Arsenal site shown on the departmental plan, and also the proposed town site near the Arsenal, have already been approved; and Mr. Griffin's terminal station would, as a matter of fact, be on the site of the Arsenal store and the filling shed. Consequently, it would not fit in with the sites which have already been determined by the military authorities. In the second place, if Mr. Griffin's proposal were adopted, the distance from the junction of the Queanbeyan-Cooma railway to the accepted town site would be 10½ miles, whereas by the route proposed by the Department, it would be only 8½ miles. I have made an estimate of the cost of the line projected by Mr. Griffin. Of course, it is quite possible to construct a railway with a grade of 1 in 100 between the junction of the Goulburn-Cooma railway and the Arsenal site, but it would not be economical to do so. Consideration of Mr. Griffin's proposal has not altered my view in favour of the route recommended by the Department. In the first place, all the State railways connected with the line to Canberra have grades of 1 in 40, so that there would be no advantage gained by having a short length of line with a gauge of 1 in 100, isolated as it would be. The ruling grade between Goulburn and Queanbeyan would be 1 in 47 if it were compensated, and 1 in 40 if it were not. If full trains were run to the Arsenal site, and the grade from the take-off was 1 in 100, that circumstance would prove of very little value from a commercial stand-point. At the present time, Goulburn is the marshalling station for all the traffic on the Goulburn-Cooma railway, and trains running

to Queanbeyan have to run over grades of 1 in 40. Mixed trains would take their loads over these gradients to Queanbeyan, between which place and the junction-point of the proposed line to the Arsenal the grade is 1 in 55. Additional loading could therefore be placed upon trains at Queanbeyan and run direct to the Arsenal. I understand that the Commissioner of Railways is now pressing to have the line between Yass and Canberra constructed on a grade of 1 in 60, so as to make it harmonize with the grade of the railway from Canberra to Jervis Bay. I do not think any material advantage would be derived from having a grade of 1 in 100 upon the proposed line to the Arsenal while there are surrounding grades of 1 in 40. My estimate of the cost of the line proposed by Mr. Griffin is set out in the following table:—

## COMMONWEALTH RAILWAYS.

CONNECTION ARSENAL SITE WITH GOULBURN-COOMA RAILWAY. Mr. Griffin's proposal 1 in 60 grade for 1 mile 40 chains, then 1 in 100 to terminus at 9 miles 11 chains.

ESTIMATED COST.	
Works.	Total Amount.
1. Clearing 110 acres, at 50s. per acre	£ 275
2. Fencing, Gates and Folds	1,810
3. Earthworks	29,774
4. Grades and Mile Posts	20
5. All drains, complete with excavation, outlets and inlets, &c.	913
6. Bridge Work, Steel and Concrete	6,000
7. Sleepers and Ballast	6,620
8. Road Laying	1,000
	50,024
9. Plant and Supervision, 12½ per cent.	7,499
Contingencies, 10 per cent.	6,002
	73,400
80-lb. Rails and Fastenings	20,604
	£93,910

Say, £10,292 per mile.

I have also seen Mr. Griffin's proposal for linking up the Arsenal site with the capital. Regarding the proposed connexion with the Canberra city site, our main object is to get a railway for the purpose of transporting the material necessary for the establishment of the Arsenal. At present, there is no connexion between the Canberra city site and Yass. When that connexion is about to be made, I think it would be a good thing to link up with Canberra and Yass by what is known as the eastern route. But no advantage would be gained by doing this at present. The work would cost over £30,000, and probably that money would be lying idle for many years. I notice, too, that Mr. Griffin suggests that the traffic to the Arsenal could be brought round through Canberra up to Jerrabomberra Valley. To do that by the route which he recommends would necessitate an increased haulage of 6 miles. In other words, we should have to pay to the New South Wales Government haulage over that 6 miles for all time. This would be obtained by putting in the proposed connexion at the 200 miles 30 chains point. All traffic to and from Sydney will have to be carried at the New South Wales railway rates on a mileage basis, and even if that State reduced those rates to a point at which they failed to be remunerative, it would look to the Commonwealth to make up the deficiency. Consequently, the shorter we can make the proposed line, the better for the Commonwealth. My estimate for Mr. Griffin's line from Canberra to the Arsenal site, with a grade of 1 in 100, is £117,000. That, of course, is an approximate estimate. With a grade of 1 in 60,

I estimate that its cost would be £31,000. It would prove very expensive at a later stage to alter the grade of the railway which is now recommended by the Department from 1 in 60 to 1 in 100. The line, therefore, should be regarded as one which, for all time, will have a grade of 1 in 60. Even if the marshalling of Arsenal goods took place at Queanbeyan, Mr. Griffin's proposed line would be of no value, because the trains would still have to run over a grade of 1 in 55 in order to reach the 200 miles 30 chains point. I know that there is a great divergence between my estimate and that of Mr. Griffin, but I still consider that the construction of earthworks will cost as much as I have allowed for that work. Of course, my estimate must be regarded as merely a preliminary one. It is not the estimate upon which the line would be built. The railway would be constructed only after a proper survey had been undertaken, under existing conditions. I have been obliged to guess at the quality or class of material contained in the cuttings. My estimate is based upon my having to deal with the hardest material, namely, rock, so that it is a maximum estimate. If we encountered softer material, the price would be correspondingly reduced. I am not aware that two years ago my estimate was given to the Committee of the cost of constructing a railway into the Arsenal site. The first I heard about plans in this connexion was on the 12th August last. It would have been possible, with the time at our disposal, to have had a more complete estimate of the probable cost of the line available, but it would not have been in accordance with the practice that is ordinarily followed. My own experience is that the information which the Department has supplied is that which is always required in cases of this kind. The intention of the Department, if its proposed line be approved, is to carry out the work on the day-labour system. Everybody else, in making an estimate of the cost of the line under existing conditions, would have to rely upon the same data that we have relied on. I know that Mr. Griffin estimates the cost of the side cuttings on his projected line at 2s. per yard, but I know that the Victorian Railway Department, which is always very keen upon keeping down costs, has recently had to pay 1s. 8½d. per yard for side cuttings, through almost similar country on the Upper Murray; and 2s. 6½d. per yard for centre cuttings. In the one case, they have handled 250,000 cubic yards, and in the other 600,000 cubic yards, as compared with the small quantity that we should have to handle. The prices I have given are the costs of work that has been carried out by means of day labour on the Cudgewa line.

79. To Mr. Sinclair.—I do not know whether Mr. Griffin really knows what a side cutting is. Judging from his statements in evidence, he appears to think that a side-long cutting is a side cutting. As a matter of fact, a side cutting consists of the material which is taken from the side of the line to fill up banks. You might have to shift this material only a few feet, but sometimes it is necessary to go into cuttings and to widen them out.

80. To the Chairman.—I estimate that in connexion with the line proposed by the Department, there would be 93,915 yards of cutting, and 110,837 yards of bank, as against 156,475 yards of cutting and 293,735 yards of bank in connexion with Mr. Griffin's line. There would thus be a difference in favour of the former project in the matter of earthworks of 62,560 yards of cutting and 187,898 yards of bank. If the material obtained from excavating operations were suitable for the purpose, it would be utilized for ballasting the line. I cannot say whether suitable material is likely to be found until it has been opened up. You cannot ballast the road until your cuttings have been got out.

81. To Mr. Sinclair.—I stated in my previous evidence that if this place were developed it would be possible to connect it with a railway extending from the Capital to Yass. That would mean its connexion by means of what is known as the eastern route. Mr. Griffin's proposal would not cut out the bridge over the Jerrabomberra Creek. The grade of 1 in 60 under his proposal would apply only to the connexion between his scheme and the New South Wales line. I take it that he means to cut that out, and to have all the traffic passing through Canberra. When I was asked to go into this matter, I was instructed to find the shortest and cheapest route for connecting the State railway system of New South Wales with the Arsenal site. I was not requested to consult Mr. Griffin in the matter at all. The only people whom I consulted were Major Gibson, Colonel Owen, and Mr. Morrell, who is the town-planner. I have previously said that a decision in regard to the take-off was arrived at in 1916. I know that Mr. Griffin says that no decision was arrived at. I have not seen any report by that gentleman, but I have seen a report by Mr. Hobler, in which he says that, after conferring in connexion with the junction, they decided on the particular spot recommended as the only suitable one at which to make the connexion. The following is a letter from Mr. King O'Malley, the then Minister for Home Affairs, the Engineer-in-Chief of the Commonwealth Railways, dated 19th May, 1916:—

Cairns has approved of conference on various matters arising out of questions of town-planning and railway connexion in reference to the Arsenal site at Yuggenong. The conference to consist of Colonel Owen, representing the Arsenal Commission; Mr. W. B. Griffin, Federal Capital Engineer-in-Chief; Mr. George Hobler, representing Commonwealth Railways; and Mr. Morrell, representing the New South Wales Railways. Kindly arrange for Mr. Hobler's attendance.

That letter was received by the Engineer-in-Chief on 19th May, 1916. Following upon it, Mr. Hobler went to Canberra and Queanbeyan, and subsequently supplied a report for Mr. Bell. The following are copies of reports, dated 14th April, 1916, and 6th June, 1916, submitted by Mr. Hobler to the Department on the subject:—

Melbourne, 14th April, 1916.  
Engineer-in-Chief, and Acting Commissioner,  
SWAY FOR LINE TO COMMONWEALTH SMALL ARMS FACTORY  
AND ARSENAL—FEDERAL CAPITAL TERRITORY.

As instructed by you, I conferred with Mr. T. Hill, Engineer, Director-General of Works Branch, and left with him by the Sydney express at 5 p.m. on Friday, 7th instant, arriving at Canberra at 8.30 a.m. on Saturday.

On Saturday, in company with Colonel Owen, Director-General of Works, Mr. T. Hill, Engineer, Director-General of Works Branch, Mr. A. B. Menzies, Acting Divisional Engineer, Goulburn District, and Mr. P. Percival, Surveyor, an inspection was made to ascertain the most suitable point for a junction on the Goulburn-Cooma line between Queanbeyan and Yuggenong. The most economical point for junction of Arsenal line with State line would be about 200 miles 30 chains on that line (see section of existing line, drawing S/645); but, owing to the grade from 200 miles 35 chains 1 in 44, the point of junction is forced back to the 1 in 54 suitable position nearer to Queanbeyan. This was selected at about 200 miles 30 chains on State line (see drawing S/646). Colonel Owen stated that it is in my report, the necessity to get material to the Arsenal site to commence construction of these works before it is possible to complete the line may arise.

After discussion it was agreed to ask for a temporary siding to be put in as shown in red on Drawing S/646. This would be used for unloading material for construction of Arsenal, pending completion of line to same point in my report, required for construction of line. Drawing S/646 also shows that portion of proposed line to Arsenal is dotted red running parallel to the State line until it crosses Jerrabomberra Creek and flood channel of same at 200 miles 25 chains. Recent heavy floods have done some damage to the two 10-foot openings at 200 miles 25 chains, and it appears to me that these openings are not sufficient to deal with heavy floods.

Subject to the Defence authorities deciding to proceed with construction of the Departmental line, and requiring, in connection with same, I recommend that copies of Drawings S/645 and S/646 be forwarded to the New South Wales Railways Commissioners and they be asked—

1. To approve the permanent junction of the Ardenal and State line as of about the 200 miles 30 chains.
2. To approve of temporary siding and dead end as shown on Drawing S/645, and to give the Commonwealth Public Works Department road access to that siding.
3. To furnish plan and estimate of the permanent junction and portion of line to Ardenal as far as the 200 miles 60 chains, giving separately estimated cost of proposed temporary crossover as per No. 3 above.

The New South Wales Railways Commissioners will probably desire to themselves construct that portion of the line to Ardenal from junction of same with State line until it leaves the boundary of their railway land.

With reference to the line to Ardenal from opposite about 200 miles 60 chains on State line, I attach Drawing S/644, showing in red the approximate proposed route.

As the grades on the existing State line from Queanbeyan to 200 miles 30 chains (the proposed point of junction) are 1 in 65 on straight, subject to your approval I have adopted this grade on line to Ardenal, compensating same for curvature, the minimum of curvature to be radius 12 chains, and have arranged for the trial survey to be proceeded with on this basis.

The probable length of line from junction of State line to Ardenal is approximately 8 miles, and the branch to site of Ardenal township about 2 miles.

As soon as the trial survey has been made and cross-sectioned, I shall be able to submit the permanent location for your approval.

There is a through siding at 107 miles 70 chains on the Queanbeyan-Canberra line which is not required, and I propose to take this siding up and use it for the temporary siding at junction of State and Ardenal lines.

The weight of rail used on Goulburn-Cooma line at proposed junction with Ardenal line is 73 lbs. per yard.

I understand Colonel Owen is communicating his recommendations to the Honorable the Minister for Defence to regard to the construction of the Ardenal.

Geo. A. Housen,

Construction and Maintenance Engineer.

C.P. 3201. Melbourne, 6th June, 1916.  
Eng. in Chief and Acting Commissioner.

#### LINE TO ARDENAL—FEDERAL CAPITAL TERRITORY.

Referring to your memo of the 22nd ultimo regarding Cabinet approval for the conference of various officers on matters arising out of the question of township location and railway connection, in reference to the Ardenal site near Tuggeranong, in the Federal Capital Territory, as arranged, I proceeded to Canberra on Monday last, 20th ultimo, and met Colonel Owen and Mr. Griffin there. After conferring with these gentlemen, I found that a question had arisen with regard to the site for the Ardenal township and site for the Corliffe Factory, also that it was not possible to finally determine the sites for these two places at present, as further consideration would have to be given the matter.

Under these circumstances, it was impossible to consider the railway question of connection between Canberra and the Ardenal Factories and town sites as a whole. In the meantime, however, I conferred with these two officers as to the railway proposition between Canberra and a point called Gap. This point, Gap, is a fixed position of the railway system which will lead either from Canberra direct or from the State line to the Ardenal, as it is the lowest point on this route where the line passes through the hills leading to the Ardenal site.

Mr. Griffin is strongly desirous of connecting the Ardenal Factories and township sites direct with Canberra. This is a matter that requires very full consideration. It may not be advisable to carry it out at present, pending further development of the railway question, policy regarding connection of Canberra with Yass and Jervis Bay. In the meantime, railway connection will be required as quickly as possible to enable materials for the building of the Ardenal Corliffe Factory, and Ardenal township to be brought to the ground.

The quickest and most direct method of doing this would, no doubt, be to make connection with the Goulburn-Cooma line, and this could be done either as shown by Drawing S/645 accompanying my memo to you dated 14th April last, or as shown in Drawing S/645. To determine which is most suitable it will be necessary to confer with the New South Wales Railways authorities.

I attach herewith lithograph showing the railway proposition between Gap and the Federal Capital. The lithograph shows the connection between Gap and junction with the Cooma line, the length being 31 miles of line, which would cost, approximately, £18,000. Also, in blue, a suitable route which would connect Gap with the line with the Canberra Railway Station, and which would give direct communication

between the Capital and the Ardenal Factories and township. The estimated total cost of a direct line from Gap to Canberra Railway Station is £40,000.

Should it be decided to build the connexion with the State line, and it was decided later on to make the direct communication with the Federal Capital, the 2 miles of line from "B" to "C" connecting with the State line could be taken up and the rails and fastenings and sleepers used for building portion of line on the direct route. The lost entailed in this would only be a small cost for earthworks, part cost of a bridge over the Jerrabomberra Creek 150 feet long, which would cost about £1,500, loss of ballast put on road, and labour of putting down rails, say, about £4,000.

The following are the summarized particulars regarding the direct route from Gap to Federal Capital railway station, and route from Gap to Federal Capital railway station, and State line and Queanbeyan-Canberra railway.

#### Direct Route—Gap to Canberra Railway Station.

Length of line—A to D, 71 miles. Cost of construction, £40,000.

#### Route via State Line and Queanbeyan—Gap to Canberra Railway Station.

Total length, 121 miles: distance from Gap to Queanbeyan, 71 miles; distance from Queanbeyan to Canberra 50 miles; Queanbeyan Station, 43 miles; length of line to be built, 31 miles. Estimated cost of construction, £18,000.

If the direct line was built the full benefit of the line already built from Queanbeyan to Canberra would be lost and 121 miles of road would require to be maintained at a cost of 41 miles of additional line to be maintained—say, £350 per year.

The interest per annum on the additional cost of the direct route at 5 per cent. would be £1,100, to which should be added the cost of 41 miles of additional line to be maintained—say, £350 per year.

Taking everything into consideration, it appears to me at present that it would be advisable to build the connexion with the State line until the whole matter of the construction of Federal Capital and railway connexion of same with Yass and Jervis Bay is more forward.

In connexion with this matter the material for construction of Ardenal township, which is required to be brought from Sydney, will be sent to Queanbeyan, even if the Yass line was built.

Distance—Sydney to Canberra, 215 miles, 235 miles.

Distance—Sydney to Canberra, via Queanbeyan, 201 miles.

This material could be sent cheaper from Queanbeyan by the Ardenal line, connecting with the Goulburn-Cooma line, than if sent from Queanbeyan to Ardenal by the direct route from Canberra Station to the Ardenal.

Queanbeyan to Gap by State line route, distance, 71 miles. Queanbeyan to Gap by route via Canberra Railway Station, 121 miles.

So soon as the sites of Ardenal town and Corliffe Factory are settled the railway proposition as a whole can be considered and finalized.

(Signed)

Geo. A. Housen,  
Construction and Maintenance Engineer.

I know that Mr. Rankin, Chief Assistant Engineer of Existing Lines, New South Wales, has said:—

I should say, looking at the map, and provided that the country is suitable, that the line from the Ardenal might have been taken off from the Tuggeranong siding south of the point shown on the plan.

But the country is not suitable. Undoubtedly that would shorten the length of the line, but it would add to its cost considerably by reason of the heavy nature of the earthworks. With a 1 in 60 grade there would be half-a-million yards of earthworks to the mile, and subsequently the trains would have to haul loads over a grade of 1 in 40. That scheme, therefore, is not a practicable one. It would add the cost of constructing about three additional miles of line on account of the difficult nature of the country to be traversed, and there would be banks from 60 to 80 feet high. The bridge over the Tuggeranong Creek would not be cut out. In my previous evidence, I stated that the usual shunting charge at Canberra was 1s. per yard per pair of wheels. That is to say, a four-wheeled vehicle would cost 2s. and an eight-wheeled vehicle 4s. each shunt. The cost of a connexion between Canberra and the proposed line to the Ardenal would be cheaper than would the cost of a line from the junction into the Ardenal, because of

the easier character of the country to be traversed. I have already said that my estimate for the construction of the line recommended by Mr. Griffin on a grade of 1 in 100 is £117,000, and on a grade of 1 in 60 £201,000. I have also stated that it should not be built until the connexion has been made with Yass, otherwise there would be a sum of £30,000 lying idle. The township at the Ardenal site is 81 miles distant from the take-off of the Goulburn-Cooma railway if the route of the proposed departmental line be followed, and 104 miles if the line proposed by Mr. Griffin be adopted. Our proposal represents a fork into the township, and not a loop.

82. To Senator Needham.—On the 11th October the Department wrote to the New South Wales Government with a view to arriving at an official agreement with it in connexion with the working of both railways to the Ardenal. So far, however, no agreement has been arrived at. But I have here a copy of an agreement under which the traffic between Queanbeyan and Canberra is at present being worked, and we expect the other agreement which we hope to conclude will be of a similar character. I know that Mr. Bell has not been to Sydney for the purpose of arriving at an arrangement with the New South Wales Railway Department regarding the working of this line, but I cannot say that an officer has not been despatched to Sydney for that purpose. The thing may have been done without my knowledge. I will get Mr. Bell to inform the Committee whether any officer has visited Sydney with that end in view, and whether he can supply the Committee with a copy of the working agreement.

83. To Mr. Laird Smith.—I am acquainted with the country which the proposed railway will traverse. I have not seen any gravel there which would be suitable for ballasting purposes. If any of the material excavated were used for these purposes it would not necessarily have to be stone that would require to be crushed. Sometimes, in decomposed granite country, you can across beds of good, clean stuff, which are almost gravel and which can be used for ballasting.

But usually there is too much mud mixed with this material. I do not think that we would be likely to strike any clay beds in that particular country. At the present time Goulburn is the marshalling yard for all the traffic on the Goulburn-Cooma railway. It is also an engine depot. It is not good railway practice to haul a number of empty trucks through the country. This load hauled between Goulburn and Queanbeyan would not exceed 200 tons per train, and it would not require much traffic to secure that quantity. Goulburn has always been a marshalling station. It has been the practice to split up trains there for the purpose of enabling them to traverse heavier grades. If a lower grade were adopted between Queanbeyan and the route proposed by Mr. Griffin to the Ardenal, I do not think any great saving would be made in the matter of haulage. The estimated full traffic requirements for the Ardenal, in and out, represent about 300 tons per day. That would be equivalent to only one train load daily on a grade of 1 in 60. Consequently we do not require a line which will carry double volume of the maximum traffic over it.

84. To Mr. Mathews.—The agreement with the New South Wales Government at present is that the amount representing the cost of wages, material, and stores shall be recovered by the Commonwealth, with the cost of supervision and a proper proportion for plant added. For the use of rolling-stock and repairs and renewals thereof an amount representing 20 per cent. of the revenue in respect of the railway is deducted by the Deputy Chief Commissioner. In other words, the New South Wales Railway Department takes 20 per cent. of the gross receipts for the

maintenance and renewal of rolling-stock. The passenger fares are on the New South Wales mileage basis. Goods in truck loads for the Commonwealth Works Branch, or for Commonwealth contractors, are conveyed at a through mileage rate, other goods and parcels at the minimum rates prescribed in the New South Wales merchandise rate book and coaching rate book, subject to a maximum rate of 2s. 6d. per ton in respect of goods, with a minimum rate for small consignments of 6d. for a weight not exceeding one-quarter, and of 1s. for a weight in excess of one-quarter. The New South Wales Government charges the Commonwealth the usual mileage rates over the Commonwealth 84 miles of railway, but it subsequently returns that money to the Commonwealth. All the revenue for freights and fares is collected by the New South Wales Government. They retain 20 per cent. of it for maintenance and renewal of rolling-stock, and the balance is returned to the Commonwealth. No advantage would be derived from having a small section of a line constructed on a gradient of 1 in 100 when the greater portion of the line was built on a grade of 1 in 60. Even after the construction of the line to the Ardenal, the trains will continue to be made up in Goulburn. Mr. Griffin's line is really six miles longer than that proposed by the Department. If his line were built, another bridge would be required over the Jerrabomberra Creek. If the trains were made up in Queanbeyan and run up in the line proposed by Mr. Griffin on a grade of 1 in 100, that project would not be worth considering, by reason of the short length of the line. Under the departmental scheme, all the trains will be made up at Goulburn, and will run right through. Instead of having an engine stationed at Queanbeyan to do the work, the Commonwealth could bring that engine from Goulburn to Queanbeyan, from which place it could haul an additional load of 41 per cent. The locomotive would thus be working full time, as it is only a short day's run from Goulburn to the Ardenal site. I cannot say whether any land would have to be purchased under Mr. Griffin's proposal.

85. To Senator Needham.—A train travelling on a straight run has not the resistance to overcome that it has to encounter when rounding a curve. Consequently, when putting in curves, it is necessary to flatten the grade. To overcome this, the grade on curves is flattened. For instance, with a grade of 1 in 60 on a straight line, it would be necessary, in the event of a 20-chain curve being encountered, to make the grade 1 in 67. Mr. Griffin's line contains 400 degrees more of curvature than the departmental line, and every degree of curvature means the addition of £7 10s. to the capital cost of the project for all time. I have not included that factor in my estimate. The Commonwealth Railway Department has not consulted Mr. Griffin since I have been connected with it. I have not been instructed to recognise that gentleman at all in connexion with Federal Territory work. The Department has considered the ultimate railway designs for connecting the Capital City with the railways to the north and south. That is why I went into the question of the eastern connexion as against the western connexion. The proposed railway is purely an Ardenal line, but it will occupy such a position that it can be connected with Canberra direct. My estimate of £117,000 is intended to cover the cost of a connexion between Canberra and the Ardenal site with a grade of 1 in 100, as proposed by Mr. Griffin. That gentleman's estimate for the work is £27,000, and for the same line with a grade of 1 in 50 it is £265,310. I do not know what data he had to go upon in preparing his estimate, but my own estimate was based upon the quantities taken from Mr. Griffin's section between 1 mile 40 chains,

and the terminal point of the blue line shown on that section. I estimated the cost of the portion between the take-off and the connexion at Canberra without quantities. I know that that will be easier to construct than will the other portion. My estimate of the cost of the proposed departmental line works out at £7,500 per mile. I know that the earthworks upon the line which Mr. Griffin has built at Canberra for £6,500 per mile are not comparable with the earthworks which would be required on this line, although the bridge over the Molonglo River which he had to construct would naturally be a big item. But the earthworks themselves would be of a very light character. The cost of rails has been included in my estimate. I have estimated the cost of those rails on trucks at Queanbeyan, inclusive of freight, at £15 5s. 6d. per ton, that of fishplates at £18 16s. 6d. per ton, that of fishbolts at £39 15s. 6d. per ton, and that of dog spikes at £3 15s. 6d. per ton. The freight from Newcastle is £3 15s. 6d. per ton. I have no knowledge of the quantity of brick-making materials that is available at the kilns at Canberra. That is a matter which does not come within my purview.

86. To Mr. Sampson.—On the line from Albury to Sydney the ruling grade is 1 in 40. The Railway Department of New South Wales has been regarding that line for the past thirty years. It has not yet completed the work between Goulburn and Sydney, a distance of 136 miles. I have already said that even if the whole of the traffic were worked from Queanbeyan it would not make any difference to the view which I have already expressed in regard to Mr. Griffin's proposal. I would still hold that it would be preferable to adhere to the departmental proposal. There will not be sufficient traffic over the line to the Arsenal to warrant the adoption of a grade of 1 in 100. With the existing railway at Canberra connected with the Arsenal the Commonwealth would have to pay for 214 miles of freight if the departmental proposal be adopted. With the connexion at the 200 miles 20 chains on the Goulburn-Cooma line, it would have to pay for 204 miles of haulage, irrespective of whether the grade be 1 in 60 or 1 in 100. The cost of altering a grade from 1 in 60 to 1 in 100 would be very heavy. It would more than make up the difference between my estimate and that of Mr. Griffin. It would double the cost. Tuggeranong siding, at about 205 miles on the Goulburn-Cooma railway, is the closest point to the Arsenal site.

87. To Mr. Laird Smith.—It is owing to the nature of the country that Mr. Griffin has put in the extreme curve that is apparent in his line. The evidence that I have shown in respect of that line represents the distance direct from the junction with the Goulburn-Cooma railway to the terminal station at the Arsenal site.

88. To Mr. Sinclair.—The contour surveys upon which we have worked show every 5 feet in vertical height. I have previously said that a saving of £2,000 per mile would be effected upon the connexion between the Canberra railway station and the proposed Commonwealth line to the Arsenal. My estimate of the cost of Mr. Griffin's direct line to the Arsenal works out at £10,299 per mile. With a grade of 1 in 100 from Canberra to the Arsenal site, I have estimated the cost of construction at £9,000 per mile. In other words, I have recognised that the cost of construction would be reduced somewhat on account of the easier nature of the country that would be traversed between Canberra and the junction along the Jerrabomberra Creek. When I stated that a reduction of £2,000 per mile could be made in the cost of construction, I had in my mind a grade of 1 in 60.

THURSDAY, 17th OCTOBER, 1918.

Present:

Mr. GREGORY, Chairman;

Senator Henderson,  
Senator Needham,  
Senator Newland,  
Mr. Mahony,

Mr. Mathews,  
Mr. Sinclair,  
Mr. Laird Smith.

Thomas Hill, Engineer, Department of Works and Railways, recalled and further examined.

89. To the Chairman.—I have seen a copy of the evidence by Mr. Griffin, which was made available to me in anticipation that I would be recalled by the Committee, and I have examined his proposal for a railway on the 1 in 100 grade. From my knowledge of the country, I think it would be feasible to construct such a railway from along the Jerrabomberra Valley to block 168, but I would like to look into the levels further south, because I do not think it is feasible to maintain the 1 in 100 grade, although I would not like to say definitely now. I have examined the contours. I expect, however, that the route would be very circuitous, as there is a quick drop from block 168 down to the Tuggeranong Creek, though I think it would be practicable with an increased length of line, to get that grade. The plan does not show the railway to finish at the point desired for Arsenal purposes. Bearing in mind that the output of the Arsenal will have to be conveyed to every capital in the Commonwealth, I would insist upon a loop connecting the line with the New South Wales railway system, and I would construct that portion of it from the Arsenal to the Cooma line first, leaving the other extension up the Jerrabomberra Valley to Canberra for construction later. At the present time, I do not think we would be justified in the latter expenditure, but I would give direct connexion from the Arsenal to the Cooma line as quickly as possible. Looking at Mr. Griffin's plan, it does not appear to me that the line dotted in red could be constructed on the 1 in 100 grade, but that it would be 1 in 40 or 1 in 50, as it has to traverse some broken country. I would reduce the grade from 1 in 100, and get the connexion in some cheaper form, as suggested in Mr. Bell's route, from the top of the ridge. In other words, assuming that Mr. Griffin's line was followed from the Arsenal site to the top of the ridge at block 168, I would then deviate from Mr. Griffin's line, and see if I could not get a cheaper route, as suggested by Mr. Bell's railway, on to the Cooma line. I have not seen the figures, so I could not speak authoritatively in regard to Mr. Griffin's estimate, which I observe is less than that of the Railway Department.

90. The Chairman.—You need not answer this question unless you wish to do so, but unfortunately certain statements have been made in evidence which perhaps you may desire to refute. When we started this inquiry it was thought that we should also consider the best method of conveying bricks from Canberra to the Arsenal site, and the advisability of making a recommendation for a light line of railway. Mr. Griffin's evidence concerning the transport of bricks opened up the larger question of the possibilities of brick manufacture, and he made certain statements with regard to the shale deposit on the brick kiln site. He said that the deposit is very poor and limited, and added—"I should think we could supply bricks for 61s. per 1,000. I do not say how many we could supply at that price, because of the restrictions on the quantity of material economically available. We sank a shaft at the bottom of the pit where the shale has been excavated, the pit being now 15 feet deep, and

struck limestone at a depth of 13 feet. We went into the limestone 10 feet. There had never been a trial shaft put down ~~before~~ until just before we closed the brickworks."

91. Do you wish to make any statement in regard to this portion of Mr. Griffin's evidence?—Yes. This question of the shale deposits was gone into very thoroughly in evidence before Mr. Blackett, K.C., as a Royal Commissioner on 18th September, 1910, Mr. Edward Fisher Pittman, the Government Geologist of New South Wales, being examined by Mr. Blackett at Canberra. At that time the shale pit was open, and bricks were being made, the condition of the works being much the same as at the present time. Mr. Pittman produced a plan—unfortunately I have not it available at the moment, but I have prepared a duplicate from memory as closely as possible—showing the actual site of the brickworks, and the deposits proposed to be worked, namely, from the crown of the ridge, roughly at about the 1,940-ft. level, down to the 1,905-ft. level, which is the level of the present entrance to the crushing plant, where the stone is taken from the quarry into the brickworks. This area was selected on the advice of Mr. Pittman, who made a geological survey of the city site, and furnished all the information required for the Capital city plans that were submitted for competition. Mr. Pittman recommended this site as being the most suitable for the establishment of brickworks. The area extends from the crown of the ridge at the trig. station to the Uranyarra-road, and about three years ago, as the result of Ministerial instruction, the area to the east of the ridge was eliminated, the shale deposits available being limited to the area west of the ridge only and to the 1,905 level. In his evidence before Mr. Blackett, Mr. Pittman took this fact into account, and stated that he estimated the quantities of material available within the restricted area, between the 1,905 contour line and the top of the ridge, at about 600,000 cubic yards, representing, on the basis of 360 bricks to the cubic yard, about 180,000,000 bricks. It is known that there are small bands of limestone in that country, and as these are met with in the shale deposit itself to a small extent, the machinery was particularly designed to obviate completely any possibility of inferior bricks being turned out owing to the presence of a small percentage of limestone in the shale. It is not a large percentage, and, as I have said, it is common to the whole of the shale in that country. I notice that Mr. Griffin said that at 13 feet he discovered limestone, but this would be below the 1,905 level in the brickworks area. I am satisfied that the quantity of bricks estimated by Mr. Pittman will be available. A number of trial holes were put down in positions indicated by the geologists, Mr. Griffith Taylor and Mr. Mahony, who specially reported on this matter. Speaking from memory, I should say that altogether forty or fifty holes were sunk to depths varying from 6 feet to 24 feet, and one in an area adjacent to the brickworks east and south of the Uranyarra-road was put down to 60 feet. All the holes were sunk on positions indicated by the geologists, and to the depths asked for. I think it is probable that some of the trial shafts may still be seen. The deposit in the area where the 60-ft. shaft was sunk would be about half-a-mile from the brickworks. I do not regard this distance as excessive. In our estimate we reckoned we could deliver the material for 3s. per cubic yard, and assuming that we were working continuously for a year, we estimated the bricks would cost 59s. a thousand.

92. To Mr. Laird Smith.—Mr. Griffin has suggested in his evidence that some of the excavations along the route proposed by him could be used as ballasting

material, but the only place where I think doubt might be obtained would be from near block 168, but the quantity would not be large, and certainly not enough to ballast the line. Ballasting material could also be brought from the Molonglo River. I think that an alteration of the grade from 1 in 60 to 1 in 100 after the construction of the line would cost a considerable sum of money, and that it would necessitate some deviations.

93. To Senator Henderson.—This suggested alteration of the grade subsequently could not be made on the same track.

94. To Mr. Sinclair.—In my previous evidence, I referred to two possible routes. At that time I did not have in mind the proposition now submitted by Mr. Griffin. I was referring to that portion of the line from the Cooma railway into the Capital site along the Jerrabomberra Creek, that is a connexion across from the Arsenal line near the Cooma line to the Federal Capital line near the power-house. This would not traverse Mr. Griffin's proposed route, but would run parallel with it, about a quarter of a mile distant, for three or four miles between the Cooma line, where the suggested take-off is, and the Capital site near the power-house. Mr. Griffin gives 1 in 60 grade for a little over a mile and a half, and the rest is 1 in 100. But instead of doing that, I would suggest following Mr. Bell's route from the summit. I think it would be cheaper, and in view of the grades on existing railways, it is quite as serviceable. I do not see any advantage in having 1 in 100 grade when the grades all around are 1 in 40 or 1 in 50. I do not think it an advantage to have the 1 in 100 grade for the purpose of future marshalling yards in the Territory, because the line would deliver at a certain point near the Arsenal on a 1 in 50 grade, and sufficient area for marshalling purposes can be obtained on the flat. It would be no advantage to have a 1 in 100 grade from the summit down to the marshalling yards. A grade of 1 in 50 is just as good. Near Canberra we can get large areas for marshalling yards all over the Jerrabomberra flats without any trouble. The area is somewhat restricted for marshalling yards until near the Arsenal, and it is proposed to have the yards near the junction of the town railway with the Arsenal railway. There would be no engineering difficulties about the terminal point of Mr. Griffin's proposed route, as it would on the 1,900 level, which is about the level of the Arsenal; but the terminal point which is inconvenient as regards the lay-out and marshalling yards. I would like to consider this point before I give a definite answer, but it does not seem to be suitable. Mr. Griffin could not have had in his mind a different location for the Arsenal, as it has been fixed definitely; but he may have had in view some alteration of the location by the Defence authorities, who want that site for the townships. I understand the south site is objectionable to the Defence authorities, who want that area for explosives, and from what I have seen of the north site, I think it would mean putting the township ultimately where the lay-out is fixed for shell filling and storage, so that the town would then encroach on the activities of the Arsenal. I understand from Mr. Griffin's sketch that he is suggesting a deviation to the south of the existing railway near the power-house at Canberra. If that were constructed, it would reduce the distance, but it does not seem to be necessary. I think there has been the freest collaboration between the various Departments interested in the Capital city proposals. Mr. Bell, for instance, was given the points to which to run his railway by Major Gibson and the Director-General of Works, and he designed the route accordingly.

94. *To the Chairman.*—I remember the interview mentioned in the letter written by Mr. Hobler, dated the 14th April, 1910, in which he speaks of a conference which he had with the Director-General of Works, and Mr. J. B. Menzies, the Acting Divisional Engineer for the Goulburn district on the site of the proposed take-off, at which I was present. In my opinion, the most suitable place for the take-off is at the point suggested.

*The witness withdrew.*

John Thomas Hill Goodwin, Commonwealth Surveyor-General, recalled and further examined.

95. *To the Chairman.*—I submit a plan showing the land that would need to be acquired in the event of the construction of a railway to the Arsenal. I think the total cost would be about £7,000, but the exact amount cannot be ascertained until negotiations have been entered into with the owners. I do not think the railway should be charged for more land than is required for railway purposes, because the Commonwealth

own the adjoining land, and in the ultimate subdivision it would not be necessary to pay attention to the original Crown boundaries. I have hurriedly looked through Mr. Griffin's proposal, in order to ascertain through what land it would pass, and in my opinion the total acquisition necessary would not exceed £1,600.

95A. *To Mr. Mathews.*—It would be advisable to purchase the land right out, because we could use it in connexion with other land. It could be acquired for Federal Capital purposes, and the railway charged with the land required.

96. *To Mr. Sinclair.*—If the land required for the railway represents 110 acres, I should not think that, at the outside, more than £500 should be debited against the work.

97. *To the Chairman.*—The loop from the Cooma line, suggested by Mr. Griffin, passes through less un-acquired land than that proposed by Mr. Darbyshire.

*The witness withdrew.*

*The Committee adjourned.*