The Seymour-Bendigo Pole Route

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Summary:

A fascinating paper from 1952 describing the construction of an aerial trunk route and the problems associated with organisation of staff, equipment and materials.

Introduction

Wooden poles were the mainstay of the telephone network in the early days; however in the USA numerous people including elected officials and newspapers ferociously opposed the erection of telephone poles. They argued that telephone poles were ugly and characterised telephones as playthings of the rich. (Bliss 2008)

By 1901 however, Australians had accepted the importance of communications and Section 51 Sub-section (v) of the Constitution of Australia gives Parliament the power to legislate on "postal, telegraphic, telephonic, and other like services". These powers were used to merge the colonial mail systems into the Postmaster-General's Department (PMG). This body was responsible for telegraph and domestic telephone operations, as well as postal mail.

The historic paper (Quirk 1952) features the construction of the Seymour to Bendigo pole route by the PMG and the problems associated with organisation of staff, equipment and materials. This route was part of a plan to provide additional circuits between Bathurst and Seymour as back up to the main Melbourne to Sydney trunk route, which follows the main railway through Albury, Wagga, Yass and Goulburn.

The paper details the physical pole configurations to support 12 channels and the selection process to decide the best route. A survey party accurately measures the path and decides the optimum pole positions and transitions to limit cross-talk, once the route is fixed and cleared. These are documented in field books which lines personnel use to plan the construction work.

This project is typical of large scale trunk works at the time which were undertaken by camping parties due to the difficulties of obtaining suitable accommodation in towns. A typical camp would cover approximately 50 kilometres of the pole route and house approximately 40 men in tents. The paper provides details of the amenities in camp including water and electricity, reticulation, cooking and eating facilities, as well as drainage and waste disposal.

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The historical paper

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CONSTRUCTION ASPECTS OF THE SEYMOUR-BENDIGO POLE ROUTE

V. Quirk

Introduction

The existing telephone traffic between Melbourne and Sydney is carried by an open wire pole route of approximately 575 miles in length, generally following the main railway line through Albury, Wagga, Yass and Goulburn. At present there are operating on the route nine 12-channel systems (eight Sydney-Melbourne, one Sydney-Canberra and one Melbourne-Canberra) and a maximum of twenty-four 3-channel systems, mainly used for intra-state traffic. This represents the maximum carrying capacity for through circuits.

In anticipation of this stage, plans had been prepared for the provision of additional circuits by means of a new pole route between Seymour, in Victoria, and Bathurst, in New South Wales, pending the installation of a direct Sydney-Melbourne underground cable. The pole route, which is now nearing completion, passes through the large country country centres of Bendigo and Echuca in Victoria and Deniliquin, Jerilderie, Narrandera, Wagga, Temora, Young and Cowra in New South Wales, and, in addition to providing interstate circuits, enables substantial traffic relief to be given to these and other centres in northern Victoria and mid-western New South Wales. The open-wire route connects to existing 24 pair 40 lb. star quad carrier cables at Bathurst and Seymour, from which points the open-wire circuits are extended to Sydney and Melbourne respectively by cable carrier systems.

Because of the long distances involved the pole route was designed on the basis of maximum 12-channel carrier system capacity, a typical pole plan being shown in Fig. 1.

Accommodation of the twelve 12-channel systems on the three major trunk arms required intensive transposing of the pairs, and at the same time it was necessary for the pole spacing and wire sags to be maintained within close tolerances. In the present paper a description is given of the construction of the Seymour-Bendigo section, which is typical of the route as a whole.

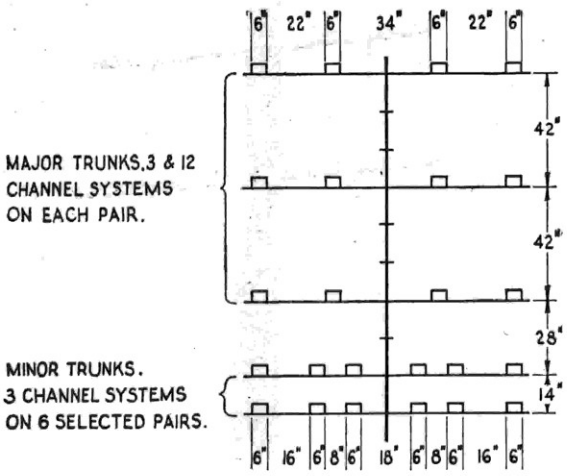

Fig. 1.—Pole Plan, showing ultimate number of pairs.

As shown in Fig. 2, the pole line, which is 56 miles in length, crosses the Goulburn River at Seymour, proceeds across country to Heathcote, and then follows the Kilmore-Bendigo highway, via Axedale, to Bendigo. Except through the Heathcote forest, where bush fires are a danger and steel H-beams are used, the poles are wood. For the steel beam construction 6″ x 5″ H girders are used for the normal pole height of 28 feet with 8″ x 6″ H girders where higher poles are required at road crossings, etc. Initial requirements were for four pairs of wires and as an additional four pairs were planned within two years, two pairs have been erected on each two arms in one and four positions on the pole, thus simplifying the subsequent erection of the additional pairs. In order to confirm the suitability of the transposition design for the route, a test E-section 6.4 miles in length, and including the twelve pairs of wires on the three 12-channel arms, was erected at the Bendigo end of the route. A general view of this test section is shown in Fig. 3, a close up view of a typical transposition pole being shown in Fig. 4. The following worst values in db of far-end and near-end crosstalk to 143 kc/s were obtained from all combinations of the twelve 12-channel pairs.

	Far-end	Near-end
Minimum	64	45
Average	74	57

Preliminary Work

Construction of new aerial trunk routes suitable for the operation of multi-channel carrier circuits involves consideration of the following:—

(a) choice of route,
(b) layout of route and preparation of field books,
(c) procurement and storage of material.

These matters must be attended to well in advance of commencement of the actual construction work.

Choice of Route: In the selection of a new route, three possible alternative locations need to be considered, namely:—

(a) along a public road,
(b) in a railway reserve,
(c) in private property and Crown land.

The railway reserve has the advantage of enabling shorter poles to be used because the minimum clearance of the lowest wires above ground for routes erected in a railway property is 8 feet, compared with 12 feet on public roads. This results in a lower capital cost and in greater ease in procurement of poles. Also, there is usually a

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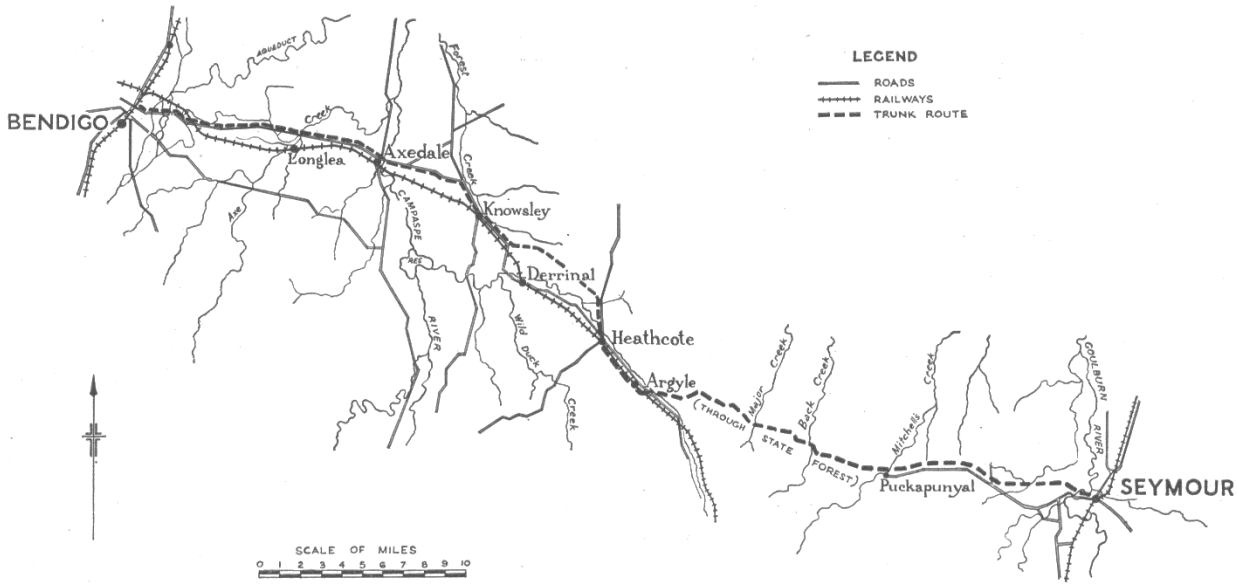

Fig. 2.—Location of aerial route between Seymour and Bendigo.

minimum of clearing. A disadvantage is that there is often difficulty of access both for construction and subsequent maintenance, in that a railway line is often some distance from good roads. The reserve itself is seldom suitable for motor traffic, particularly in the wet season, and it is often necessary to use pole trains and railway trolleys for transport.

Construction on public highways has the advantage of easy access, but often has a number of serious drawbacks. Chief of these is generally the necessity for extensive clearing. Many roads have trees growing over the full width between the carriageway and the fence line. Apart from any aesthetic considerations the cost of clearing is a major item, the felling, cutting up and stacking of timber and the burning of debris accounting for an appreciable proportion of the labour costs. The possibility of alterations to road alignment must also be taken into consideration. The presence of power lines restricts the selection of road routes, and often results in costly alterations to power construction to maintain adequate clearances between trunk and power lines, particularly at vehicular crossings.

Fig. 3.—General view of test section on Seymour-Bendigo route, near Bendigo.

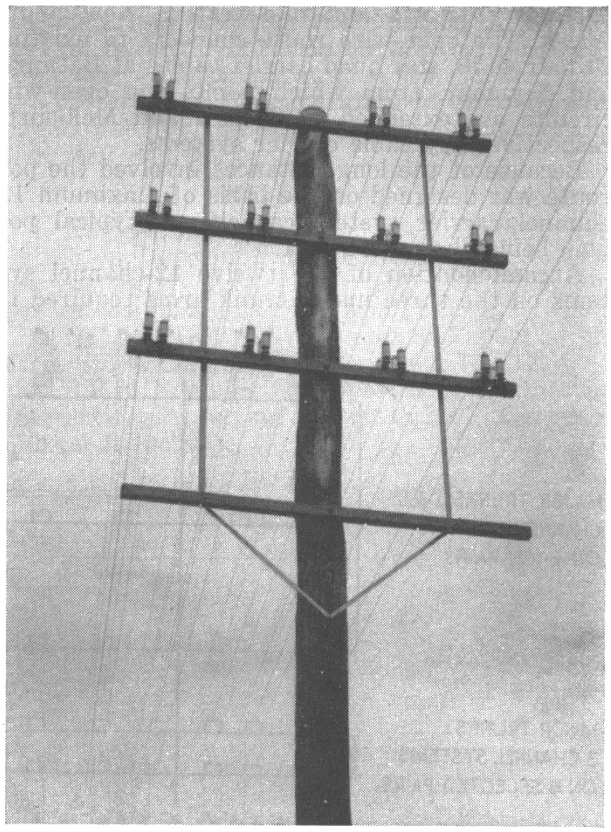

Fig. 4.—Transposition pole on test section on Seymour-Bendigo route, near Bendigo.

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The route on private property combines some of the advantages and disadvantages of the roadway and railway routes. The private property route is generally more accessible than the railway route, but less accessible than the roadway route. On the whole clearing in private property is much less of a problem, but difficulties arise from possible damage, and from interference with the rights and activities of the owner. This is particularly so where the land is cultivated, as poles and stays present an obstacle to the cultivation and harvesting of crops. In addition, in wet weather private property often involves serious problems of access for construction and maintenance work, due to the bogging of pole hole borers and trucks.

The Seymour-Bendigo route provides examples of all the various route locations, including Crown land. The latter includes a military reserve at Puckapunyal, but consists mostly of the State Forest at Heathcote, where steel beam poles were used because of the fire risk. The standard clearing of 40 feet on each side of the pole line was provided, as shown in Fig. 5, but fortunately the

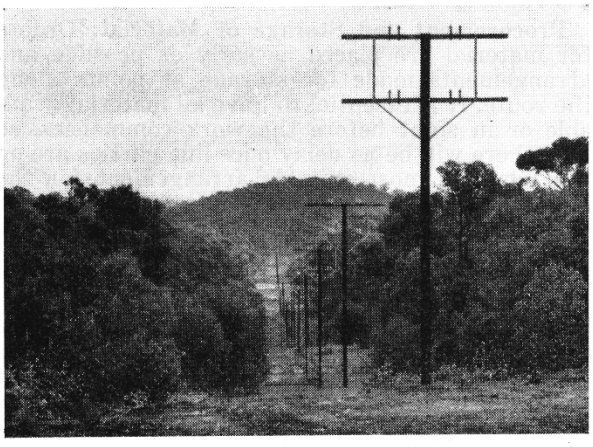

Fig. 5.—Seymour-Bendigo route, showing extent of clearing.

forest is of red ironbark, which is not a particularly tall tree and the amount of clearing was not excessive. Due to the unsuitability of much of the land for cultivation in the sections where it was necessary to construct the line on private property, it was practicable to construct most of the pole line 40 feet inside the fence line, resulting in a considerable saving in clearing costs and the avoidance of public criticism which might result from the cutting of trees along the roadway.

Where a route parallels a fence line, the separation from the latter is governed mainly by the clearing necessary and the overall width of the road reserve. Other factors which need consideration are the location of all ground stays and the presence of any power parallels. The usual margin on public roads is 5 to 10 feet, on private property 20 to 40 feet, whilst the location on railway reserve is affected by the height of the pole line, because of possible damage to the railway rolling stock should a pole fall over. The extent to which clearing was reduced by erecting the route on

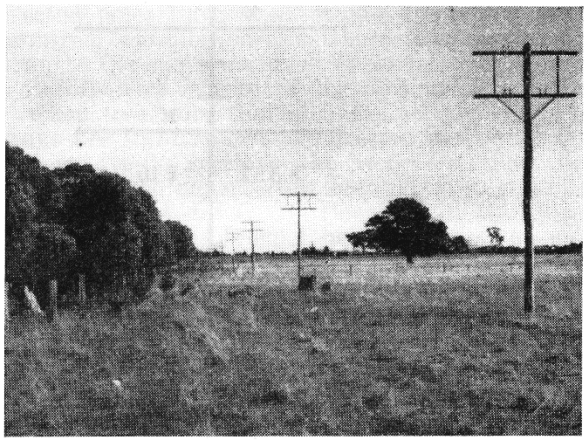

Fig. 6.—Seymour-Bendigo route on private property.

private property instead of along the road is shown in Fig. 6. A view of the route crossing the Campaspe River is shown in Fig. 7.

When the general location of the route has been decided upon, consultation is necessary with all public bodies and private citizens affected, and wayleaves and other matters determining the exact location and the construction of the route must be attended to.

Layout of Route and Preparation of Field Books: As soon as the final location of the route is fixed, any necessary clearing is done using a bulldozer where possible. This simplifies the work of the survey party, which makes an accurate measurement of the route, locates pole positions with wooden pegs, and takes levels for grading purposes. During the survey field notes are prepared, which, with the pole sizes as determined later from grading sheets prepared in the office, staying data, and any special provisions decided

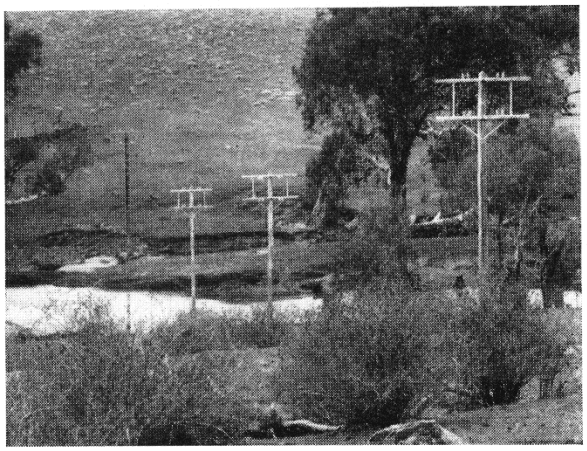

Fig. 7.—Campaspe River crossing at Axedale.

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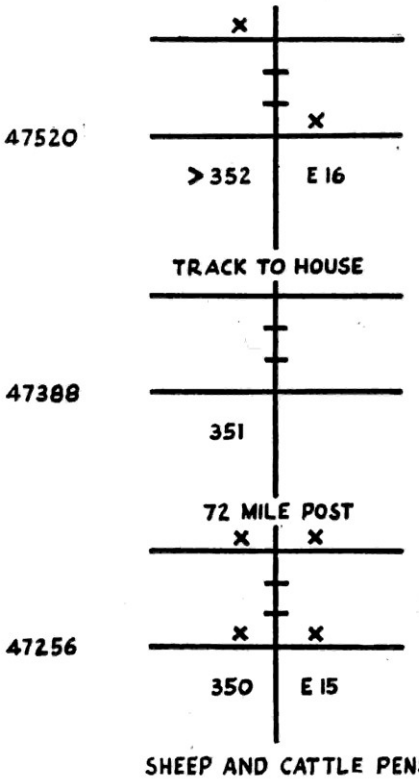
upon by the Engineer in charge of the work, are used to prepare the field book. See Fig. 8. As several copies are required and the time taken to



LEGEND :- > ANGLE POLE
350 CONSECUTIVE POLE NUMBER
E 15 TRANSPOSITION POLE
× TRANSPOSED PAIR
42756 CONTINUOUS CHAINAGE IN FEET

Fig. 8.—Field Book—typical sheet.

NOTE.—A covering sheet would be prepared for each field book, indicating generally the work to be carried out. In this case the work consisted of erecting 4 pairs of 200 H.D.C. wires in pin positions 1.3-1.6 and 4.3-4.6. Where only the basic pole layout is shown as for pole 351, the wires would be erected in the correct pin positions, but would not be transposed.

prepare them by hand is considerable, a trial was made of photostat copies printed and bound by the Drafting Section to form field books similar to the standard book. These have been successful, but a further improvement has been effected in in the Trunk Planning Division by use of the Fordigraph process. This is a duplicating process in which various coloured inks can be used. The latest field books are cheaper and faster to produce, and have the great advantage of being printed in colour. They are similar in size and quality of paper to the standard field book, and have strong manilla covers. The usual number of copies prepared for a job is six.

In the field books the poles are numbered consecutively, as well as in accordance with the transposition scheme, to correspond with the numbered pegs set up in the field by the survey party. The pegs are made of jarrah or red gum, and are approximately ten inches long. Angle pegs are made of 3″ x 3″ timber and painted red. Pegs for straight line poles are of 2″ x 2″ timber, painted yellow for transposition poles and white for other poles. Where transpositions occur at angle poles a yellow peg is placed alongside the red peg. Identification of the survey pegs in this manner and indication in the field books of all prominent land marks, and features including mileposts, gates, houses, dams, etc., as well as pole chainage, simplifies the task of the line parties when work commences, and minimises the possibilities of mistakes in laying out poles and subsequent fitting of transpositions. In addition to pole and transposition identification numbering, pole heights, pole plans, description of work to be done, and the geographical identifications, power crossings are included in the field books. The last item is of assistance in ensuring that standard clearances are effected, and in taking safety measures during the running of wire.

Procurement and Storage of Material: Orders for material are placed as early as possible and arrangements made for storage at points along the route. It is essential to have all material available or in sight before the work commences, so that there will be no delay once line parties are on the job. The most suitable arrangement for the storage of material is to have huts erected at line depots along the route so that material can be accepted and stored as it becomes available. Poles are delivered to pegmarks, or to dumps along the route and laid out from there. Huts have recently been obtained which are particularly suitable for the storage of material on large jobs. They are made of angle-iron frames bolted together, and covered with corrugated iron sheets attached to the frames with metal screws and clips. The roof is of the gable type. The whole unit is simple and speedy to erect and dismantle, and presents no difficulties in transport. Two sizes are in use, 20′ x 10′ and 8′ x 10′.

Construction Work

When the preliminary work has been completed the route pegged, field books prepared, material including poles procured, and accommodation arranged for staff, the actual work of construction commences. The first consideration is the laying out of poles to pegmarks. On the Seymour-Bendigo job the wooden poles were tank creosoted at Rushworth, and delivered straight to peg marks by Departmental pole trailers, the officer in charge at the creosote plant being provided with a field book showing peg numbers and corresponding lengths of poles, so that poles could be loaded for economical laying out along the route. Where poles are delivered by rail to sidings, a mobile crane has proved most useful in loading the poles to pole trailers for delivery to peg marks. Imme-

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diately the laying out is proceeding satisfactorily, parties are put on to the work of arming the poles and fitting transposition plates. As far as practicable all fittings are placed on the pole whilst it is on the ground.

With the modern post-hole borer poles can usually be erected complete with arms and plates, thus effecting a saving in time. This type of borer lifts the pole as well as boring the pole hole, and has a long boom enabling it to grip the average pole well above its centre point, to allow for the shift of the centre of gravity towards the head due to the weight of the arms and plates. Another type of borer, which has no lifting mechanism, has been used on the Seymour-Bendigo route for boring stay holes. When used for poles it has been worked in conjunction with a winch truck fitted with sheer legs. One party follows behind the borer uprighting the poles and filling in and ramming. A separate party attends to the stays. One man follows the pole erecting party stencilling the poles. The work is so organised that the erected poles have been fitted with stays when required, and allowed to settle as long as possible prior to the commencement of wiring work.

Before wire is erected the section of route is checked to ensure that all poles are upright and stays are tight. Wires are erected and tensioned in ½ to 1 mile sections, the weight method, described in the paper "New Method of Regulating Aerial Wires," by C. H. Hosking, in the June, 1951, issue of this Journal, being used for tensioning. Eight wires are strained at the one time. Where practicable, the wires are laid out in groups of four from wire reels mounted on a wire trailer or on the tray of a motor truck. A wire reel hav-

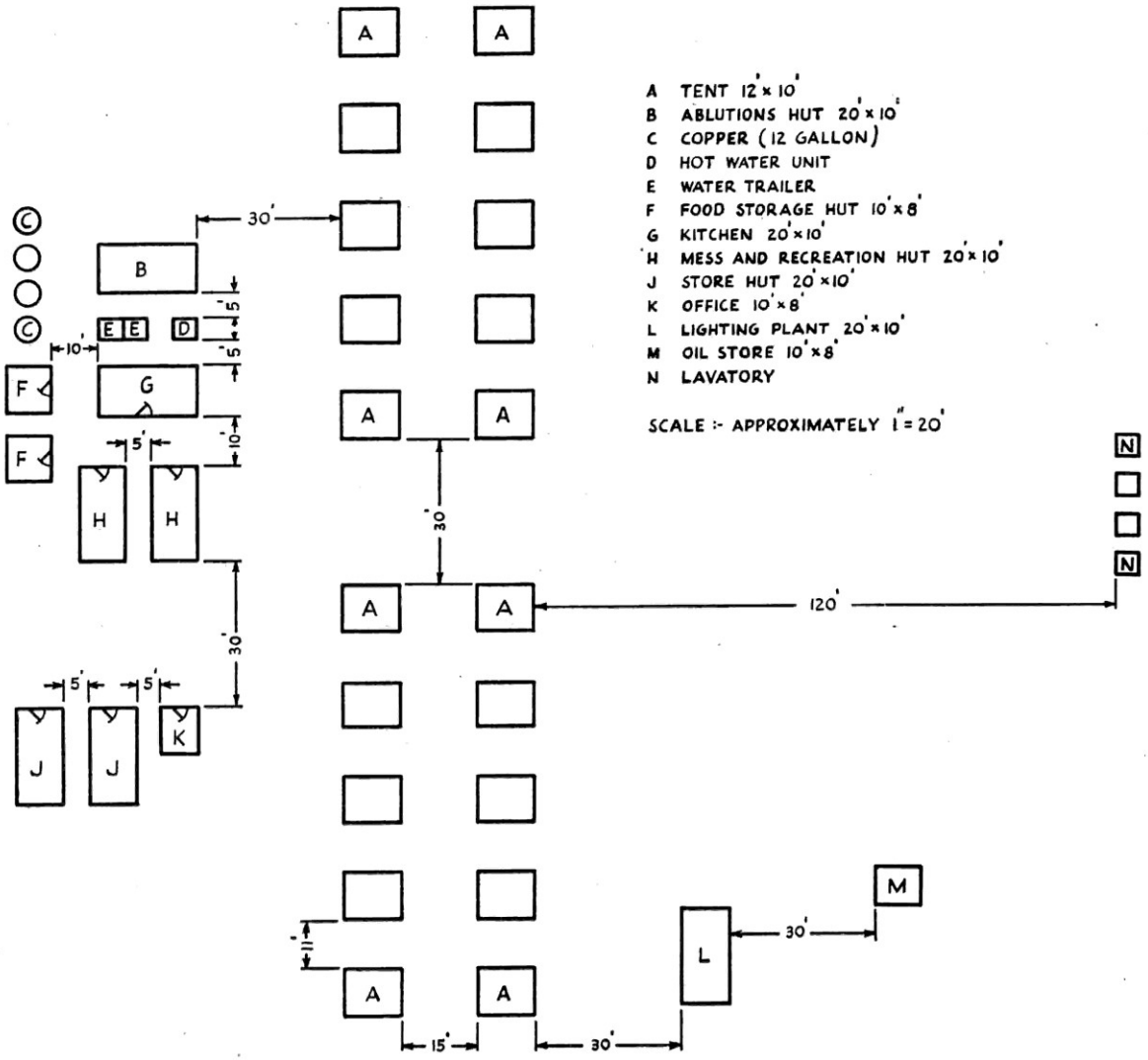

Fig. 9.—Large Line Camp—Layout.

ing an automatic braking device has recently been developed and simplifies the work, provided care is exercised at angles in the route. In this type of reel, the wire running off in a straight line holds a spring-loaded brake off the rim of the wire reel by means of the tension in the wire. Should slack develop, the tension is released and the brake operates until the wire is again under tension. An equal number of wires are strained on each side of the pole in the one operation, in order to maintain an even pull on the pole and arms.

Camps for Large Construction Parties:

Many large trunk works are now carried out by camping parties because of the difficulty of obtaining suitable accommodation in towns near the work. Camps should be located as near as possible to the route, and so that the maximum distance of travel in any one direction is approximately 15 miles. A camp would then cover 30 miles of route. Other considerations, such as proximity to water and power, fuel supply and drainage will affect the final location of camps. Sleeping accommodation is provided by 10′ x 12′ tents with wooden flooring. The tent is fitted up for two men, and has two steel stretchers, mosquito nets where required, one table and two camp chairs. A large portable hut approximately 20′ x 10′ is provided for messing and recreation. The hut is furnished with tables and camp chairs, a heating stove and wireless.

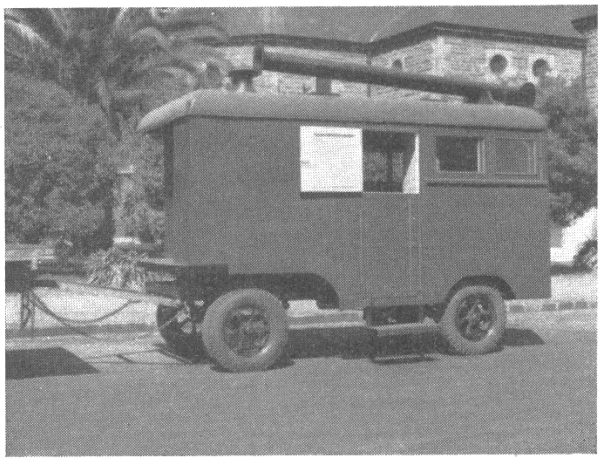

Fig. 10a.—Portable Kitchen—General View.

Kitchen arrangements consist of a trailer kitchen, and a small fly-proof hut to act as a pantry and to accommodate refrigerators. The kitchens are four-wheeled trailers with steel panelled bodies converted from surplus army "Wiles Cooker" vans. A wood fire or oil-burning stove is installed at one end, and the kitchen has both a solid and fly-wire door, a sliding panel in the roof, and fixed and sliding windows along the sides. All such openings are protected by fly-wire screens. Cupboards, shelves and drawers are fitted around three sides of the kitchen. The tops of the cupboards act as benches and also carry a stainless steel tank. A water tank is fitted between the stove and the sink. The oil-burning stove is the

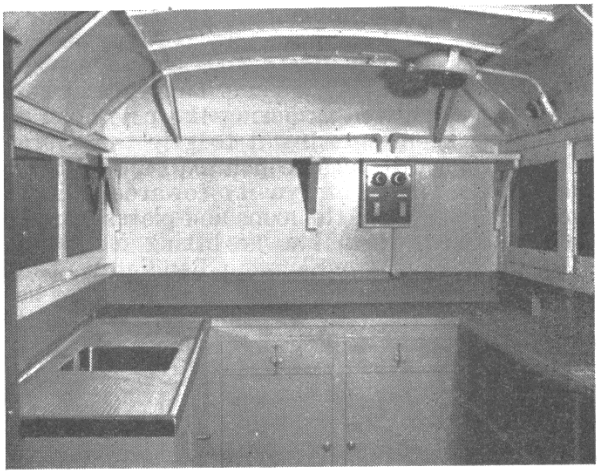

Fig. 10b.—Interior, showing steel sink, cupboards and bench, and electric light and power points.

type in which oil and water drip from separate tanks on to a hot plate, the preliminary heating of the plate being effected by allowing the oil to drip at a fast rate on to burning paper or wood chips. When the plate is heated, the oil rate is reduced and the water tap turned on. Oil and water taps are adjusted to give a clear, intense heat. The portable kitchen is a prefabricated wooden hut with similar fittings to the trailer kitchen. However, as it is not on wheels it is necessary to erect and dismantle it each time a camp is moved.

Lighting is normally provided by means of a 55 volt step down transformer where power is available. Where commercial power is not available eight six-volt car batteries are used, these being charged from a petrol generator set. Washing and bathing are catered for by means of a hot water service, wood or coke fired, and an ablutions hut, containing showers, baths and wash troughs.

Where a town water supply is not available the camp is pitched if possible near a river, and the water is pumped into a large water tank for distribution around the camp. Kitchen, ablutions hut and hot water service are grouped together to economise in piping, and for convenience. The mess hut is placed close to the kitchen. The camp office, a portable hut, is also included in this group. Beyond these buildings the tents are placed in rows, and beyond these again is the lavatory block. Earth drains are dug where necessary to dispose of surface water. Cleanliness is essential in a camp, particularly in hot weather, and all kitchen refuse is disposed of without delay. In some cases local farmers are prepared to cart away kitchen refuse, otherwise it is buried, use being made of the post-hole borer.

To reduce the number of flies present during the summer months, blow-fly traps are placed in suitable locations around the camp. Catering, re-

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creation and general camp matters are placed in the hands of a camp committee usually consisting of five members of the staff, including the Line Inspector and the cook. The Department provides the services of a cook for camps of ten or more men, with one or more assistants for camps of twenty men and over. Members of the camping party make their own arrangements regarding catering.

Fig. 10c.—Interior, showing oil stove and water storage tank.

A large camp of approximately forty men requires a regular staff of four, one to assist the Line Inspector on clerical duties and camp organisation, a cook, cook's assistant, and one on general duties around the camp. During weekends and on holidays a member of the camping party is rostered for a 24-hour period for camp protection duties. Such a camp covers an average area of half to one acre, and comprises twenty 12 feet x 10 feet tents, mess hut, trailer kitchen, store huts, ablution hut, hot water unit and portable lavatories. There are 94 distinct items of equipment, the total number of items being in the vicinity of 1400. A typical large camp layout is shown in Fig. 9 and three views of the portable kitchen are given in Figs. 10a, 10b, 10c.

Conclusion:

Trunk aerial construction using large parties has created a number of problems in organisation of staff, equipment and material to carry out the work speedily and without waste effort, and the experience gained on the Seymour-Bendigo route has been invaluable in meeting similar problems on other large works.

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