The Construction of the Williamstown Short Road and the use of Marram Grass as a Sand Stay.

BY H. V. CHAMPION.

INTRODUCTION.

This description is not given to illustrate any particular excellence in engineering design or construction in the work, but because there are certain novel features in the construction, and it is hoped that some particulars of the use of marram grass as a sand stay may be of special interest as it is the first time that this plant has been used on a large scale near Melbourne.

GEOGRAPHICAL POSITION OF WILLIAMSTOWN.

It is hardly necessary to describe the geographical position of Williamstown to residents of Victoria. It may be stated shortly, however, that it is situated on the peninsular forming the western side of Hobson's Bay, and is cut off from easy communication with the city of Melbourne, in the most direct line, by the waters of that port. The distance of the Williamstown Post Office from the Melbourne General Post Office as the crow flies is only about 4½ miles, but by the only route available for heavy traffic up to the end of 1896 it was 9 miles. The river Yarra for a long time presented a serious obstacle to the passage of traffic by the short route across Fishermen's Bend to the city and the road roughly followed the direction of the railway line and made a great detour to avoid crossing the river.

SHORT ROAD TO MELBOURNE.

Many years ago the residents recognised the disabilities under which they laboured in this respect, and in September, 1867, began to agitate for the construction of a short road along the head of Hobson's Bay and the establishment of a steam ferry to cross the river. This combination reduces the distance between Post Offices to six miles, and the movement culminated in the construction of a ferry for about £2000, which began to run across the river at the point indicated on plan in 1873. The road was then constructed on the line shown and was thrown open to traffic in 1874. "The road then remained a thoroughfare until in late years it had become so cut up as to be practically impassable for any but very light loads." This is the charitable view taken of the work by a local newspaper, but in 1890, in conjunction with the Town Surveyor of Port Melbourne, the writer examined this road and estimated that it would cost £2040 to put it into a reasonable state of repair. As a matter of fact a great deal of money formerly spent upon its construction had been practi-
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cally wasted through indifferent design and lack of proper supervision. Even in its earlier stages the road could not have been of value for heavy traffic. For a distance of 4000 ft. it had been formed up, but the metalled way simply consisted of loose stones in great quantity, of sand and detritus without any foundation.

BLOWN SAND.

For about 2000 feet near the old stone works the road had been overwhelmed by blown sand and completely obliterated. In some places when the new work was being constructed the old tar-paved roadway of this part was found buried under 3 or 4 feet of sand. This sand is not blown up from the sea but from the pits excavated further to the north near the river Yarra for the supply of the city of Melbourne with building sand. The prevailing northerly winds have brought the sand down in enormous quantities until about 300 acres have been converted into a desolate waste.

In 1894 with the advent of Councillor Hosking to the Williamstown Council there began an agitation for the reconstruction of the short road. As a matter of course widely divergent views prevailed. Many councillors considered it would be impossible to construct any permanent roadway through the sand drift, and were in favour of completing the unmade 54 chains of Lorimer-st., a road which runs along the south side of the river, and is already constructed from a point opposite the pumping station of the Board of Works to the Queen's Bridge.

REPORT BY THE TOWN SURVEYOR.

The matter was finally referred to the Town Surveyor, and after a careful investigation, the following report was submitted, which is included "in extenso" as dealing with all the points raised and as indicating the methods finally adopted with some modifications in detail:

REPORT ON THE RECONSTRUCTION AND MAINTENANCE OF THE WILLIAMSTOWN SHORT ROAD AND THE COMPLETION AND MAINTENANCE OF LORIMER-STREET BY THE TOWN SURVEYOR.

This report has been prepared with a view of determining by what means and at what cost a trafficable and permanently sound roadway can be established across Fisherman's Bend from the Steam Ferry to the Queen's Bridge.

ROUTES AVAILABLE.

In order to arrive at a reliable estimate the various routes available have been examined and surveys made where necessary. It is considered that selection of route narrows itself down to a choice between two, viz.,

SHORT ROAD.

1. The Williamstown Short Road, Graham-street, Ross-street, Normanby-street, and the Yarra Bank Road to Queen's Bridge. Length 315 chains or, say, 4 miles. This is practically the most direct route available but the short road, for a length of nearly 2 miles, is in very bad condition. Indeed, in one part for a length of 30 chains it is almost impassable being entirely disintegrated and destroyed by blown sand.
CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

Lorimer-Street.

2. Lorimer-street, Normanby-street and the Yarra Bank Road to Queen's Bridge. Length 361 chains or, say 4½ miles. This route is therefore 46 chains, or say half a mile longer than the Short Road. Lorimer-street is a substantial and well-constructed roadway, well drained and having a width of 30 feet of metal throughout. It stops short opposite the Glass Bottle Works, at Spottiswoode, and though surveyed is unmade for a length of about 54 chains.

Distances.

The total distance from Williamstown Post Office to the Melbourne Post Office, by the shortest route now available for traffic is nine (9) miles. The Short Road route would reduce this distance to 6½ miles and the Lorimer-street route to 6¼ miles.

1. The reports and plans on this subject furnished by the Inspector General of Public Works and Mr. W. Thwaites have been carefully inspected and perused, copies having been obtained from the Public Works Department.

W. THWAITES, M.A., C.E.

On the 19th August, 1887, Mr. Thwaites, then Engineer of Reclamation Works, estimated the cost of raising the road throughout to 8 feet above low water, and constructing a steel tramway and tarred metal road at £17,500.

W. DAVIDSON, M.I.C.E., INSPECTOR GENERAL OF PUBLIC WORKS.

On 10th October 1892, the Inspector General submitted a memorandum in which he proposed to raise the road to the 8 feet level, form a foundation through the sand with clay embankment, and cover the roadway throughout with 15 inches of metal for the sum of £8,000.

UNNECESSARY TO RAISE ROAD.

The policy of raising the road to the 8 feet level is not recommended as a desirable or necessary one for the Council to pursue; and the letter from the Public Works Department dated 11/12/95, covering the copies of reports aforesaid intimates that “the probability of any alteration to the surface levels of Fishesman’s Bend is now so very remote that any remarks made on the subject at the present time” would materially modify the reports.

JOINT REPORT BY SURVEYORS OF PORT MELBOURNE AND WILLIAMSTOWN.

On the 17th June 1890 the Borough Surveyor of Port Melbourne and the Town Surveyor of Williamstown made a joint report. “After considering the various methods available for rendering the Short Road a safe and serviceable route for heavy traffic,” and furnished an estimate of cost of £2,040. This estimate made no allowance for raising the road above existing levels, and provided for a pitched track only 9½ wide through the part affected by sand.

WORK NOW PROPOSED.

The road is now in very much worse condition than it was 5½ years ago, but it is estimated that it can be put in first class condition for heavy traffic with a tarred roadway 16½ wide on a rough pitched foundation through the sand for the sum of £2300. For this sum the entire road,
CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

from the centre of Ross-street to a point about 32 chains east of the Steam Ferry, can be reconstructed.

**Pitched Foundation.**

Where no pitched foundation exists it is recommended that the road be taken up and a layer of rough pitching laid for a width of 16'. It is useless to expect this road to carry heavy traffic unless the metal is separated from the bottom soil by a firm and regular foundation.

**Present Metal to be Re-used.**

The existing metal must be taken up and screened so that it does not contain more than 20 per cent of detritus, and it may be re-used with a proportion of new metal, the surface being formed to a proper cross section. The road should be covered with a good binding material and properly rolled throughout. For 32 chains from the Steam Ferry, only metal repairs will be required, as an excellent pitched foundation already exists.

**Tarmacked Road Through Sand.**

Provision has been made in the estimate for confining the tarmacked roadway through the sandblown area within solid timber kerbs, and experience on Beaconsfield Parade has demonstrated that tarmacked roadways, if properly constructed are very effective on sand foundations. If these recommendations be carried into effect a good and substantial roadway with a metal surface 16' wide will be provided from the Steam Ferry to the intersection of Ross and Graham-streets.

**Blown Sand. Effect of Blown Sand.**

It will, however, be inadvisable to go to this expense unless some means can be devised to protect the road from the disastrous effects of blown sand. Although it is believed that the construction recommended would offer a stout resistance to destruction, still much inconvenience and damage would result from the deposition of sand upon the surface, and labor would have to be constantly employed in clearing it and effecting repairs.

**Silt Covering.**

Silt has been used in former years with some benefit in thin layers over the sand; but the surface is easily broken by the carts engaging in the sand traffic. The removal of the ti-tree and the indiscriminate nature of the sand traffic have contributed very largely to the extension of the sand waste which now covers about 300 acres.

The silt covering is expensive, and it is unnecessary to raise the levels of the sandy area, which is already above the 8ft. level.

**Sand Stays.**

In older countries it has long been recognised that the most effective way of preventing inroads of blown sand is to create barriers of those plants which can flourish in sand.

The surface is thus held in check and gradually prepared for a greater fertility.

Along the Bay of Biscay the coast is in many places planted with the "Pinus Maritima," which acts as an admirable barrier. "Lathyrus Maritimus" or the "Sea Pea" is also used. It has excessively long flowing roots, which multiply indefinitely and hold the sand together.

**Marram Grass at Port Fairy.**

In Victoria experiments have been conducted in this direction since
1883, the "Arundo Arenaria" or "Marram Grass" having been grown with much success at Port Fairy since that date.

The seed was first introduced into Victoria by Baron Von Mueller, and practical evidence of its value can be seen in the miles of sand-hills now reclaimed at Port Fairy.

"So complete has been the reclamation that, where a few years ago not a sign of vegetation was to be seen, there now exists a succulent grass, eagerly devoured by cattle, and growing to a height of 4ft." "Marram grass is practically indestructible; burning, cutting, or eating off only makes it thrive, whilst in exposed shifting sand it propagates as surely as in the most sheltered position." The grass is supplied by the Port Fairy Council at the actual cost of digging, packing, etc., and it could be landed on the Williamstown piers for £2 5s. per ton. From the information courteously supplied by the Borough Surveyor, Mr. C. H. Neylon, C.E., it is estimated that an acre can be planted and fenced for about £10, including all labour and material; and it is recommended that, for the length of the Short Road through the drift sand (about 31 chains), a width of five chains be planted on each side of the road. The plantation will act as a barrier, and check the deposit of blown sand upon the road. By transplanting yearly, the good work can be economically continued until the whole of the sand area has been reclaimed; but this is work for the Government as the Crown Lands would be improved.

GOLDEN GATE PARK, SAN FRANCISCO.

In this connection it may be well to note the excellent results obtained by the Board of Park Commissioners of San Francisco. According to their report, the great work of reclaiming the drifting sand dunes of Golden Gate Park, an area of 1040 acres, was facilitated by planting Marram grass and wild Lupins. These take root, stay the sand, and soon prepare it to receive other trees of a hardy nature, to be followed by others as conditions allow, until the whole park is made as beautiful and attractive as its highly improved parts are at present. "The site was the most unpromising ever selected for such a purpose. It was largely a desert of shifting sand dunes, moving inwards by ocean winds. Long reaches of sand cliffs, the sand curling over like breakers, help principal possession. Behold the change! The sand waves over the whole area have been checked. . . . ." When mature the bunches of grass are separated and transplanted, each plant rooting, and in turn becoming a bunch. "By continual transplanting the whole mass of moving sand has been subdued, and now (1885) there are planted among the grass 250,000 trees of cypress and pine."

SHORT ROAD PLANTATION.

In the case of the Short Road, it is proposed to plant an area of 31 acres and to enclose it with a post and wire fence, the total cost being estimated at £310.

TOTAL COST OF WORK.

If this amount be added to the £2300 set down for construction, and allowance of about 7 per cent. be made for engineering and contingencies, the total cost of works for restoring the short Road is estimated at £2800.
CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

LORIMER STREET ROUTE.

2. This work was laid out by the Harbour Trust, and extends from the Steam Ferry to the Yarra Bank Road, and is parallel with the South bank of the River along the route of the Fishermen's Bend Canal. It is 46 chains longer than the Short Road route.

CONDITION OF ROAD.

Starting from the Melbourne end, from the Queen's Bridge to the mouth of the railway canal an excellent macadamized road exists. Thereafter to the timber jetties at Spottiswoode the road is in very fair order, having a good foundation, and being well drained at frequent intervals to the river. For a short distance it is slightly affected by blown sand when it passes the extreme N. limit of the sand area. There is too much clayey binding material on the surface but the road is in every respect superior to the Short Road, and having a solid pitched foundation, it is comfortably trafficable for heavy loads throughout. For a distance of about 25 chains from the timber jetties the construction is not quite complete. The formation is flat and requires raising; the metal is large and loose. This part of the road will require some small metal and binding material and must then be rolled.

PORTION NOT MADE.

From the end of the loose metal to the Short Road near the Steam Ferry, for a length of 54 chains, the road is unmade. A survey has been made and plan prepared for the purpose of estimating the cost of construction. The ground covering this route has all been reclaimed to a height of 8' above low water and there is little or no trouble to be expected from blown sand. The Short Road, from its junction with Lorimer St. to the Steam Ferry, must also be repaired with 2½' metal, and a proper binding material and rolled.

COST OF WORKS TO COMPLETE.

The estimated cost of works to complete the Lorimer St. route including all allowances for drainage, repairs to existing road, contingencies, &c. is £1,136.

MAINTENANCE.

It cannot be too strongly urged that, whichever route the Council decides to adopt, some definite and well arranged steps should be taken to ensure its proper maintenance. From past experience this appears impossible unless the Williamstown Council acquires the right to maintain the road. There is no doubt that, had the Short Road been only moderately well maintained, it would be a serviceable route at the present time. The Inspector General of Public Works in his 1892 report stated "In my opinion the present condition of the Williamstown Short Road is more attributable to neglect of maintenance than to the cause assigned." The maintenance of the road is vital to the interests of Williamstown alone, and it can scarcely be expected that the Port Melbourne Council will actively conduct the necessary operations to keep the road in good order when so little is obtained in rates from the area it traverses and so little benefit from its traffic.

SHORT ROAD.

In the case of the short road it is considered that the Williamstown
CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

Council should acquire the right to maintain that thoroughfare and Graham-street, from the Steam Ferry to the intersection of Graham Street and Ross-street, a distance of about 2 miles. It is estimated that this would require an annual outlay for labour and materials of £180.

LORIMER STREET.

With regard to Lorimer-street the road was constructed by the Harbor Trust and has been maintained by that body up to date.

It is now asserted, however, that no further maintenance will be done by the Trust on this road and that the Councils interested have been so informed. In that case it would be necessary for the Williamstown Council to maintain the Lorimer-street route from the Steam Ferry to Boundary Road South Melbourne, a distance of three miles, for there is even less inducement for the municipality of Port Melbourne to maintain Lorimer-street than to maintain the Short Road. That part of the route which traverses South Melbourne is now, and probably always will be, well kept. The estimated cost of maintaining the Lorimer-street route for three miles is £230 per annum.

SUMMARY.

The following then are the principal points to be considered in arriving at a decision as to the most desirable route for expenditure.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Short Road</th>
<th>Lorimer St.</th>
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<tbody>
<tr>
<td>1</td>
<td>Length from the Steam Ferry to</td>
<td>4 miles</td>
<td>4½ miles</td>
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<td></td>
<td>the centre of Queen's Bridge.</td>
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<td>2</td>
<td>Cost of construction.</td>
<td>£2800</td>
<td>£1136</td>
</tr>
<tr>
<td>3</td>
<td>Annual charges for maintenance.</td>
<td>£180</td>
<td>£230</td>
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(Signed) H. V. CHAMPION, M.C.E., Town Surveyor.

This report and the plan accompanying it will give some idea of the procedure in this matter before it was finally decided that plans and specifications should be prepared. At such a stage it is not advisable to expend too much labour in plans, as often the subject is entirely dropped in consequence of the estimate or through failure of the negotiations. Conferences then took place between the Councils of Port Melbourne and Williamstown and the Minister of Public Works on behalf of the Government, and ultimately it was decided that £3000 should be set apart for the purposes of construction, planting, etc., £1500 to be furnished by the Government and £750 by each Council interested. The Williamstown Council decided to raise £1000 by loan, £750 to be devoted to the construction of the road and the balance to be set apart for repairs to the Steam Ferry. In order to comply with the conditions of the local Government Act it is necessary for plans and specifications to be exhibited simultaneously with the advertisement for tenders for loan money. In this case the Councils were prepared to proceed with the financial arrangements at once, so the preliminary plan was used and a short general specification and estimate of the proposed works drawn up to comply with this Act.

PLANS AND SPECIFICATIONS.

The detailed plans and specifications were then drawn up by the surveyors of Port Melbourne and Williamstown in conjunction and are submitted herewith for the purposes of illustration. They were approved by
the department. The principal point in which they differ from the recommendations of the preceding report is in dispensing with the tar-paved track for the distance through the sand drift and substituting for it a paved chaussée similar to the famous roadway from Charleroi to Brussels through the field of Waterloo. It had been noticed that a paved approach to the wooden causeway leading to the old stoneworks remained always free from sand, although in a situation most exposed to be submerged. It was also thought advisable to adopt some hard surface not capable of being affected by the disintegrating action of sand for the earlier period during which the Marram grass was growing and not exerting its full effect in checking the movement of the drift. The pitchers can be very easily reset, and in the event of the paved road ultimately becoming very rough from wear it was considered that its life could be prolonged and a very smooth surface made by using a coat of tar and sand on top similar to that used by Mr. Mountain in the city of Melbourne. The timber kerbing and ties were adopted as enabling the road pitchers to be set in the sand without any special foundation. The bottom of the kerbs extends some distance below the stones on to solid ground and the ties prevent the kerb spreading. The adoption of this style of construction naturally increased the preliminary estimate.

**Description of Work.**

The following is a brief description of the work. The total length is about 2 miles, 130 yards, from the intersection of Clark and Graham-sts. to the river. From Clark-st. to the beginning of the sand the foundation of the old road had been made of rough pitching, and except in a few places was quite good enough to re-use. The old metal was taken up with the pick and fork and stacked for measurement on the side of the road and then re-used, with a proportion of new metal on top to bring the total depth up to 7 inches. The ground being sandy, the action of the forks was quite effective in cleaning the stones without using screens. The surplus detritus was used afterwards as binding material. The lifting and relaying of old metal was done by the contractors at 1s 6d per cu. yard. From the end of this part of the work for a length of 2000 feet the road is constructed of smooth faced pitchers, properly secured on each side by 12" x 6" red gum kerbs set on edge and bolted to 8" x 8" and 6 1/2 x 6 1/2 red gum posts alternately with 2 1/2 w.i. bolts to each post. These posts are sunk into the sand 8' apart centre to centre and are 4' 6" long. The 8" posts were adopted to give more room at the joints. Each pair of posts is tied together under the road with a 9" x 3" R.G. tie set on edge checked 3' on to posts and bolted to each post with two 3" w.i. bolts. The pitchers are 8' deep and about 12" x 9" on the top face, hammer dressed and laid so as to break joint throughout. They form a serviceable, if somewhat rough, roadway and carry heavy traffic without settling. This part of the road on each side is backed up with a 6' width of clay 1' 6" deep. From the western side of the sand for a distance of 3900 ft. the whole road was reconstructed. The existing metal was forked out, stacked and measured; the metal bed formed and pitched for a depth of 8 in. with what is locally known as rough pitching. This is similar to Telford pitching except that the latter's dimensions are not strictly adhered
to on account of the extra cost that would thereby be entailed. Upon the rough pitching a thin coat of sand was spread and then a layer of old and new metal 7 in. thick. Surplus material screened out of the old metal was used for a binding material. This brings us to O on the longitudinal section. Thence to the river a distance of 2000 feet the foundation of the old road was good, and a layer of metal 7 in. thick was spread with the necessary binding material. In all cases the road was rolled with the Prahran Steam Roller, weighing 11 tons when fully loaded. It was found much more effective to roll the metal first and put the binding material on after and then well roll again. For binding, in addition to the detritus from the old road, a very thin layer of sandy clay from the sewer excavation was placed on top of the finished work, and proved effective in binding the work together very quickly.

**TENDERS.**

Tenders were invited for the work and the lowest, that of Messrs. Rumpf Bros. and Ebeling for £2863 was accepted, the estimate of the joint surveys being £2832. The work was let on a schedule of rates contract principally because it was impossible to tell, except by actual measurement what quantity of old metal there was on the road. The Surveyors' estimate of this quantity was low, and designedly so, for an increase in lifting and relaying metal at 1s 6d per cub. yard would mean a corresponding decrease in supplying and spreading new metal at 6s 3d. Therefore the contract price was likely to be decreased if the Surveyor's estimate of old metal was exceeded. The estimated quantities of metal to be handled were 900 c. yd. of old metal and 2500 c. yd. of new, whereas in the contract the quantities actually used were 1500 c. yds. of old and 1900 c. yds. of new, the total quantity 3400 c. yds. of both kinds remaining the same. This alone represented a saving of £142 10s. on the contract price. The work was carried out very faithfully by the contractors who succeeded in making a very good roadway.

**MARRAM GRASS.**

On this subject the knowledge previously acquired was augmented by the following extract from page 431, "Select Extra Tropical Plants readily eligible for Industrial Culture" by Baron Von Mueller:—Psamma Litoralis or Arenaria (or Arundo Arenaria). The Morram, Marrum, Marrem or British Bent Grass., Sand coasts of Europe, North Africa, and Eastern North America. One of the most important of reedy grasses with long descending roots, to bind moving drift-sands on the sea shore, for consolidation of which this tall grass and "Elymus Arenarius" are chiefly employed in Europe. It delights in the worst of sand drift, and for its full development gradual accumulation of fresh sands around it becomes necessary; hence it never gets suffocated. It has great tenacity of life; even when long dislodged and looking withered or dead it may sprout again from the root. Not readily igniting. Easily started from portions of roots for new growth, but also often sown. Can also be grown in sandy saline inland localities. Mr. S. Avery found that cattle, one head per acre can be kept in Marram grass plantations in the frostless regions of Port Fairy during the cool moist season, when the growth of the plants is vigorous, and that the animals thrive well on
CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

This pasturage. In countries with severe winters this procedure could not likely be carried out as it would too much enfeeble the plants. This plant will by gradual upgrowth form stems and roots, sanded into a depth of fully 100 feet. Can be used to some extent for paper material, for tying and for mats." Information was also gained by personal interviews with the Baron and by communicating with any other people who were likely to know anything of the subject. There was also available for inspection a small triangular plot of Marram grass which had been planted on the sand near the stoneworks* by the Port Melbourne Council as a trial at the instance of Baron Von Mueller and although the plot was so small as to give but an imperfect idea of the powers of the grass there was no doubt that the plants were alive and vigorous. An example of the successful application of the plant had come under the writer's personal observation. The Government tramway which conveys stores from Queenscliff to the fort and depots at Swan Island runs very close to the shore and Marram grass had been used very effectively to prevent the sand from encroaching upon the permanent way. It was, however, felt by the Surveyors that before actually entering upon the proposed expenditure of £250 or so on the grass some opportunity of observing the effects produced on a large scale should be afforded them. In spite of the information already accumulated there were still many sceptics amongst the Councillors and it was felt that all doubts should as far as practicable be set at rest.

PORT FAIRY PLANTATIONS.

During the progress of the work, therefore, the Surveyor's visited Port Fairy to inspect for themselves the Marram grass paddocks, and, if satisfied, to make definite arrangements for the supply of this material. They were received by the Town Clerk and Park Ranger and shown over the plantations. These extended for a distance of nine miles, between Port Fairy and Warrnambool. The country in this district is amongst the most valuable in the colony, but the sand dunes from the sea-shore were extending inland with alarming rapidity and threatened to absorb great tracts of fertile land. The old road between these two places was completely destroyed. On the advice of the late Sir Ferdinand Von Mueller it was decided to try the effect of the Marram or British Bent Grass. Parcels of the plant were obtained from India, and were planted by Mr. S. T. Avery, the Park Ranger, who for some time despaired of success, but by a careful study of the habits of the plant and the direction of the prevailing winds, he ultimately achieved a result which profoundly impresses the visitor with the powers of the grass under careful handling. Mr. Avery's method is to plant it in parallel rows, 6 ft. apart, in lines at right angles to the direction of the prevailing winds. Each plant in a row is 2 ft. from its neighbour. It was roughly estimated that since 1883 about 3000 acres of pure sand-hills had not only been held in check but actually reclaimed, and rendered profitable grazing areas by this agency. Last year the Port Fairy Council took £200 in grazing fees and £424 for the sale of plants, and expended £384 in labour on the plantation at

* NOTE. The writer was not aware of this when making his original report to the Williamstown Council.
a time of the year when other work was slack in the district. The net profit for last year, therefore, amounts to £240. As an instance of what may be effected by this grass in protecting roadways, the surveyors were shown a road-cutting 12ft. deep through pure sand. The road itself was made with limestone (an excellent material for roads in sandy countries), and simultaneously with its construction the slopes of the cutting were covered with ordinary grass sods while the whole top of the hill and the ground in its immediate vicinity were planted with Marram. The road has been kept open without any difficulty from the start, though from an inspection of the locality it certainly seems that, but for the planting, the cutting would simply have filled up again in a few days. The action of the roots in matting the sand together was strikingly exhibited in one case at Port Fairy. The sea had advanced in and cut into a portion of the shore on which the grass had been firmly established. Some of the ground had been washed away, but a face was left standing about 8ft. high, and throughout the whole of this the Marram roots had penetrated, matting the ground together with a dense net-work from top to bottom.

**Planting at Port Melbourne.**

Arrangements were made for the supply of 40 tons of grass to be delivered at the River Yarra wharves, near the Steam Ferry, about one mile and a quarter from the Short Road plantation. The accompanying plan shows the position of the paddocks planted. About 60 acres were fenced in, although the grass ordered was enough to plant not more than 30. Some of the area fenced in is taken up by buildings and swamps, but there is still some room for extension of the grass planting. The fencing consists of post and three wires, with one barbed wire on top. It is 18ft panels, with a stiffening picket in the centre. It is very light, but strong enough for the purpose—which is to keep cattle off the first two years. In some parts old posts were used from an existing post-and-rail fence, and one side of the large plantation the existing fence was used for 19 chains. The fencing was let by tender, and done very cheaply. As soon as the fencing was completed the grass arrived from Port Fairy per s.s. *Casino*, and consisted of 644 bags, 16 of which are reputed to go to the ton, and are so charged for by the shipping Company. Steamer is recommended for transit in preference to rail, as giving more certainty of accurate delivery, being safer and less liable to allow injury of grass. Further, a large quantity may be delivered in one lot. The grass was carted up to the paddocks and stacked in convenient positions. By special request of the surveyors, Mr. Avery’s services were lent by the Port Fairy Council to supervise the preliminary operations of planting. After a study of the ground and the direction of prevailing winds, he started planting with a gang of 14 men. The operation is simple. A line is marked out on the sand by the Overseer with the foot and two men set to work on it. The leader digs the holes and the follower plants and stamps the filling round the plant, being careful not to injure the grass. The filling is thrown back by the leader from the hole he is excavating in front. The follower carries as much grass as he can conveniently under his left arm, the butts, or roots, having all been arranged so as to be at the same level when put in the ground. One plant consists of as much as can be with-
12. CONSTRUCTION OF THE WILLIAMSTOWN SHORT ROAD.

Drawn from the bundle by the right hand. Any number of men can be employed at once, but they must be worked in pairs. In planting the grass all sand filling or accumulation above the natural surface must be removed. If the plant straggles and leans over too much draw the ends together and tie a loose knot on the top. A long-handled spade is convenient to use in this work, and may be used as a gauge to verify the distance between rows. If it be discovered that the drift is coming along the lines of grass, breaks should be planted of not less than four rows at right angles to the direction of the drift. The method of planting adopted at Port Fairy is to begin at the outward extremity of the sand and work back gradually to the sea-shore, which is the source of evil in that case. A plan of the plantation shows that a very much larger quantity of grass was planted north of the road. Mr. Avery was of opinion that six rows on the south side would be able to stop the drift from that direction, but that the bulk of the grass ordered would be required to stop the drift from the north. In order to protect the road as fully as possible the fences were brought in close on each side of the pitching, and the grass planted close up to the fences. The clear width of roadway between fences through the sand is, therefore, only 42 ft. The quantity of grass planted at Port Melbourne covers about 27 acres, which is somewhat less than the Port Fairy directions given.

COST OF WORKS.
The whole of the road-work, planting, fencing, etc., was completed on the 17th May of this year, on which date final measurements were made, the result being as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract by Messrs. Rumpff Bros. &amp; Ebeling</td>
<td></td>
<td>2596</td>
<td>16</td>
</tr>
<tr>
<td>Steam roller and water cart</td>
<td></td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>Fencing.—Post and 3 wires and 1 barbed wire on top. When old posts were used at 5s 3d per chain. When new posts were used at 7s 3d per chain</td>
<td></td>
<td>45</td>
<td>19</td>
</tr>
<tr>
<td>MARRAM GRASS.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 tons on Port Fairy Wharf at £1 10s</td>
<td>£60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40 tons freight 10s</td>
<td></td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Agents’ charges</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Taking delivery, landing at wharf and carting to site</td>
<td></td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Planting by day labour. 14 men at 6s. One overseer at 8s</td>
<td></td>
<td>84</td>
<td>13</td>
</tr>
<tr>
<td>Expenses of Mr. Avery from Port Fairy</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Surveyors’ expenses to Port Fairy</td>
<td></td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Balance</td>
<td></td>
<td>139</td>
<td>5</td>
</tr>
<tr>
<td>Total amount provided</td>
<td></td>
<td>£2852</td>
<td>10</td>
</tr>
<tr>
<td>Balance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total amount provided</td>
<td></td>
<td>£3000</td>
<td>0</td>
</tr>
</tbody>
</table>
From an examination of these figures it will be found that the cost per acre of reclaiming 27 acres with Marram grass amounts to £6 14s 7d, not including fencing. If we add to this the cost of fencing we find the total cost per acre to be in this case about £7 10s per acre. But the fencing was done at an exceedingly low rate, and as we have seen part of the area was already fenced. Under ordinary circumstances, however, it is considered that this price should allow for the fencing as the price for planting at £3 7s 2d per acre was abnormally high compared with what is stated to be the case at Port Fairy, viz., £2 per acre. It will be at once admitted that this method of reclamation is much cheaper than the deposition of silt for that purpose. A large quantity of sandy ground in the vicinity was some years ago reclaimed by the Public Works Department which deposited silt in a thin layer 4 inches deep over the area to be dealt with. This is equivalent to about 540 c. yds. per acre, which at 1s per cu. yd. would cost about £27 per acre, or nearly four times as much as the Marram grass method. With regard to the care and nurture of the grass every precaution must be taken during the first two years that it is not interfered with or tampered in any way. New shoots will then appear between the rows and the grass be probably fit for transplanting, when it must be removed to about 6 inches below surface level, i.e., under the knots, with a sharp spade. After that is allowed to grow again and comes up uniformly distributed over the whole surface, and after arriving at maturity is fit for thinning out and grazing over. The fences may be removed, and the land becomes a good pasturing ground for cattle, who not only benefit the plants, but also fertilise the ground by depositing manure containing the seeds of other grass plants which quickly take root and thrive. Marram grass can be used for fodder, i.e., eaten "in situ" by cattle for 5 months per annum in the cool season, but only after 3 years' growth. The tops where seed grows can be cut and form very nutritious feed. Planting should be done in the cool season very soon after Easter. In cutting plants for transplanting they must be cut off below the knot from which the roots spring forth. The plants sold by the Port Fairy Council have been forwarded to many parts of the world, including South Australia, New South Wales, Dunedin, Brazil and California. From all these places testimony has come as to the value of the material, and in South Australia it has been found to flourish in inland districts with a very small rainfall. It is believed that Marram grass is the most economical and efficient way of subduing sand wastes, at all events in temperate climes, and he was further strengthened in the views then held by discovering the report of the Golden Gate Park Commissioners on the effects produced by Marram grass in San Francisco. There is no doubt that the introduction of this grass to Australia is one of the principal benefits conferred upon us by the late Sir F. Von Mueller, and it is gratifying to know that that gentleman lived to see the striking effect of his recommendations at Port Fairy and to express his appreciation in the liveliest terms of the enterprise of the Port Fairy Council and the skill and energy of its Ranger, Mr. Avery. In conclusion the writer desires to acknowledge the cordial co-operation of his confrere, Mr. A. V.
Heath, C.E., Surveyor to the town of Port Melbourne, as well as his appreciation of the courtesy extended to him on all occasions by Mr. G. C. Crockford, Town Clerk.
PLAN OF MARRAM GRASS PLANTATION

SCALE 5 CHAINS = 1 INCH
DISCUSSION ON THE WILLIAMSTOWN SHORT ROAD BY THE USE OF MARRAM GRASS AS A SAND STAY.

Prof. Kernot was sure the members of the Institute appreciated this paper very much. The use of Marram Grass was a very important thing indeed on the sand wastes of the colony. At Sorrento very great trouble was experienced from the sand; whilst in Western Australia there were terrible stretches of sand. He was pleased to hear of the merits of their excellent deceased friend, the late Baron Von Mueller, who was a most useful man in his life, and he was glad to see that in this direction his work had borne fruit of a valuable character. On the French coast he had heard of a whole village there having been submerged only the spire of a village church appearing above the ground for about 3 feet.

Mr. Anderson was glad the planting of this grass had been a success. Trouble was sometimes through want of proper instructions as to planting. Mr. Champion’s paper would supply this want.

Mr. Fyire mentioned that many years ago in Scotland he had seen a small brickworks near a fishing village which was covered up entirely in about three weeks. A little distance from this he had actually seen a church spire above the ground, the body of the church having been covered by the sand.
Author/s:
Champion, H. V.

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The construction of the Williamstown short road and the use of marram grass as a sand stay (Paper & Discussion)

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