Royal United Services Institution. Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rusi19

Land Transportation in the Late War

Colonel M. G. Taylor Assistant Director of Movements C.M.G., D.S.O.

Published online: 12 Nov 2009.

To cite this article: Colonel M. G. Taylor Assistant Director of Movements C.M.G., D.S.O. (1921) Land Transportation in the Late War, Royal United Services Institution. Journal, 66:464, 699-722, DOI: 10.1080/03071842109434650

To link to this article: http://dx.doi.org/10.1080/03071842109434650

LAND TRANSPORTATION IN THE LATE WAR.

By Colonel M. G. Taylor, C.M.G., D.S.O., Assistant Director of Movements.

On Wednesday, 5th October, 1921.

Sir T. E. Clarke, K.C.B., K.C.M.G., Q.M.G. to the Forces, in the Chair.

The Chairman: Ladies and Gentlemen. The title of the lecture which we are to be privileged to hear this afternoon is "Land Transportation in the Late War." I have been connected with the new term "transportation" for a long time. I thought possibly I might be asked what the term "transportation" meant, for I do not think that at any of the lectures given in this building the term "transportation" has ever been used, so I thought before I came here I had better acquaint myself with its exact definition. I therefore called for a dictionary and looked to see what the word "transportation" meant. It was given, first of all, as "The act of transporting," which did not seem to me to help much. The next definition was "Transmission," which did not seem to me to help either. The next definition was "Banishment for crime," which also did not seem to fit, and the last definition was "Conveyance." So I came to the conclusion that perhaps the words "Land Transportation in the Late War" meant conveyance by land in war. I then came to the conclusion that that definition would not be any good, because, after all, in the late War we carried men and material by inland waterways. I eventually arrived at the conclusion that for the moment there was no specific definition of the term. It is a term that came, I think, from the other side of the Atlantic. It is used by the Americans and in the Dominion of Canada to represent the transportation warrant which took their men across, I believe, the whole of America, the whole of Canada, and the ocean. It is a term we have never used. No doubt, however, the lecturer will be able so to explain matters that we can picture in our own minds what the exact definition of the term is. Colonel Taylor controlled in France a section of the Quartermaster-General's Staff dealing with what is called in the War Office "Movements." I can give no better definition of that term than to say that he was responsible to a very large extent for—to use another word which has come into use since the War began—implementing the orders issued by the Quartermaster-General. His experience therefore has been great. His experience taught him the difference between movements in stationary warfare, movements when you are hurriedly going away from a foe who is pressing you backward faster than you want to go, and movements when you are pressing a foe back quicker than he wants to go. In introducing him to you I think I can say that his experience, if equalled, certainly has not been excelled.

LECTURE.

GENTLEMEN: At the outset of this lecture I must apologize to you if it appears that in dealing with the subject of "Land Transportation in the late War" my remarks are coloured chiefly by experience in France and Flanders. No one is more appreciative than I am of the many problems affecting land transportation which arose during the course of the Great War in the United Kingdom and in theatres of war other than France and Flanders, and of the skill with which they were attacked and difficulties surmounted. Nevertheless, land transportation is a many-sided subject, and each theatre of war had its own peculiar problems to deal with. Consequently to attempt to deal with all of them is manifestly impracticable, and I think it preferable, therefore, to confine myself to one theatre, where at one time or another practically all aspects of the transportation problem assumed importance, and to review what happened in that theatre alone. I trust that this course will commend itself to you.

Before tracing the course of events in France, however, and at the risk of repeating what must be to many of my audience axiomatic, I should like to remind you that while one may consider transportation problems as they arose in any particular theatre, the fact must never be ignored that these problems were, as a rule, merely manifestations of causes which arose at places possibly remote from the theatre in question. Transportation in any area is, in other words, merely a link in a chain, or rather a small area in a network, of processes which proceed simultaneously in many widely separated parts of the world. Any disturbing cause in one part of this network is bound to have its repercussion in the particular locality under consideration, and the delicacy of the machinery involved is such that a slight maladjustment in one process may have a considerable and even a disproportionate effect for evil in the supply of an army. Perhaps you may incline to the view that I labour this point unduly, but I cannot help feeling that when it is possible to study the Great War as a whole, and as a matter of history, it will be found that many of our earlier troubles in the struggle were due to an imperfect grasp of this truth. Transportation was the cause of our greater difficulties—not fighting power, leadership, or the more active side of military training.

However that may be, the melancholy truth is that in 1914 our ideas were rudimentary. Our small force of six Divisions went to France on their great adventure with no more than a rudimentary organization for transportation. We had an efficient organization for "transport" in the form of road transport, and for sea transport, but we had only a small staff of officers—thirty-one all told—to ensure that our interests were adequately safeguarded in that most important link of all transport services in war—the railways. Co-ordination between the three—sea, rail, and road—was not provided for beyond the provision made in the normal staff organization of the Army, under which the Quartermaster-General's branch of the staff is responsible for movement as a whole, and no provision whatever was made for

controlling the technical operation of such important points as overseas ports.

What appears now to be a want of foresight cannot be laid to the account of those responsible for directing affairs at the time. The whole of this country was organized, and had been so organized for many years, in separate watertight compartments in regard to transportation. Ports, railways, canals, roads, each undertaking formed an independent organization, the dependency of one upon the others being sufficiently assured by commercial usage. The necessity for any special co-ordination of the functions of each with those of the others had never arisen because the capabilities of each were equal to the strain imposed by civil movement in peace. It remained for the unprecedented strain imposed by the Great War to bring out clearly that something more was needed if chaos were to be avoided, and that something was the application of the science of transportation. In 1914, military opinion was moulded upon civil practice, although the organization put into operation for the movement of our six Divisions to France was in effect a fine example of co-ordinated movement.

Our French allies, as a result of their experience of forty years before, realized that in any future struggle with Germany the French railways would play a predominating part. The French War Office had, therefore, given the railway problem anxious thought and had evolved a method of military control which, tested out in manœuvres, seemed to assume satisfactory operation in war. I need not go into details, but in general the plan was to establish a military hierarchy at all points where the technical control of railways was exercised, and to utilize the civil railway administration to the fullest possible extent under the general control of this military hierarchy. The two together formed combined committees exercising absolute power over railway operation, and were represented throughout the systems at railway companies' headquarters, important district headquarters, regulating stations, depôts, railheads, and even wayside stations at which quite insignificant military movement was contemplated. The organization was only imposed in what was called the "Zone des Armées." In the interior of France the control of railways remained independent of the military hierarchy.

A similar organization, but developed to a lesser degree, was created for the ports. It is probable that in preparing for a future war France did not have in mind quite so stupendous an affair as that which actually took place, and so for her the ports would not have appeared of so vital a concern as her railways, since most of her supplies would have been drawn from internal resources. But the point I would like to indicate is that with all her experience of Continental war, with all the study she had made of probable requirements of modern armies, even France had not realized the need for complete co-ordination of her transport services, and thus had created a port organization quite independent of her railway control.

It was arranged with the French War Office that the French railway organization for war would carry out for our Army the whole of the railway transport services for which it was designed as for the

French Army. In the light of our then knowledge this offer was all that appeared desirable, and ensured the supply of our Army *pari passu* with that of the French. We had no reason to think that anything more was wanted, and so the British Expeditionary Force contained thirty-one officers for railway transport services, and none for transportation proper.

Experience showed almost at once the immense difficulty of arranging the movement, both of personnel and material, by rail of a force whose system of supply differed fundamentally from that for which the railway control system had been designed. All that need be said is, that by the continuous use of expedients our force was moved and was supplied somehow during that first month. None of the arrangements made were really satisfactory, and this despite the utmost willingness shown by our Allies in meeting our demands. The difficulties arose from a matter entirely beyond our power or that of the French to remedy, namely, a fundamental difference of organization. Matters went smoothly enough at our overseas base ports, and our road transport organization worked marvellously well. It was the railway factor which caused anxiety.

The arrival of reinforcements, heavy artillery, Territorial Divisions and, close on their heels, the new army formations caused rapidly increasing demands for transportation; and very early, actually in October, 1914, it became clearly evident that our arrangements for rail transportation would need a drastic revision. The history of these early days of war is not one of failure; on the contrary, it is a history of success under adverse circumstances, of a never-ceasing struggle on the part both of the French and of ourselves to make an unsuitable machine carry out vital work, and it is impossible not to look back to that period without a very lively appreciation of the resources shown by those whose daily work it was to secure somehow that the troops got what they needed. I would not like to assert that they got *all* they needed, but at least our operations did not become disastrous by reason of any complete failure to get supplies up to the troops.

As already stated, the first arrangement for the use of railways was that the French Military Railway Organization should operate for us exactly as it did for the French Army. This arrangement made it necessary for us to have a service, the Railway Transport Establishment, capable merely of telling the French authorities what we wanted and leaving the rest to them. Our duty was confined to loading and unloading stations, and we were to have no concern with what happened during the time in which our men and material were in transit. But our men had to be fed, watered, and looked after generally while *en route*, and in this respect the arrangements made for the French troops did not suit our men. Sometimes the arrangements were lacking or insufficient, for we travelled by routes differing from those in use by the French. As regards material, difficulties cropped up in connection with lost trucks—vital supplies perhaps cut off a train and left at some unknown wayside siding because of a hot-box. Late arrivals at railhead, alteration of route on account of some traffic block of which we knew nothing, and similar mishaps created a feeling of uncertainty at

the front in regard to the arrival of necessities. It was inevitable that there should be a period during which the French and ourselves could shake down and get used to each other and understand requirements, and for this reason, as well as on account of the many small instances of miscarriage, it became evident that we must keep touch with trains in transit and that we could not work on a principle which confined our control of rail movement to terminal points.

The first remedial step was to create Railway Traffic Offices. These worked in touch with the Commissions Regulatrices, a higher grade of the French Military Control than the Commissions de Gare, with which the Railway Transport Offices worked. We were thus enabled to keep in touch with our railway traffic in transit. At once we were able to warn forward arrivals, to regulate changes of route, and to bring pressure to bear on the lower French military organization where difficulties arose in the case of specially important movements.

Traffic Offices were a great step forward, and remained to the end of the War, developing as the force developed, and able to the end to keep a most efficient control on our railway movements. But Traffic Offices by no means solved our difficulties: they were only the first step.

Up to the date of the re-establishment of our bases at the northern ports and the move of our force from the Aisne front to Flanders, the responsibility for movement between the base ports and the front had been divided between the I.G.C. and the Q.M.G. at G.H.Q. The former was responsible for rail movement to railhead and also for the road movement to rendezvous, the latter for the onward transportation by all and any method to the troops. Thus the railways, as a whole, were a Line-of-Communications Service. The circumstances of the Mons retreat, the advance to the Marne, and the battles of the Marne and Aisne clearly showed that the I.G.C. could not keep in touch with a rapidly changing situation, and that the control of road movement in front of railhead could not be exercised effectively from any organization to the rear of G.H.Q. Transfer of the control of road movement to G.H.Q. brought with it the power to select railheads, for the situation of the latter could not be fixed without reference to the road routes leading forward from them. On the other hand, selection of railhead could not be made without reference to the rail routes leading to them. The latter, in their turn, depended on matters of railway operation, affected constantly by questions of local congestion and causes of interference arising in the railway system to the rear. The only remedy, and one which was adopted definitely about the same time as the establishment of the Traffic Offices, was to withdraw the control of railway movement from the I.G.C. and place it under the Q.M.G. at G.H.Q. This step necessitated the creation of a railway office at G.H.Q., which logically became the headquarters of the Traffic and Railway Transport Offices, and thus came into being the Railway Directorate with its headquarters at G.H.Q. The Director of Railways, on a plane one above that of the Traffic Offices, could

deal in railway matters with a still higher grade in the French organization, and this brought us into intimate official touch with the French Commission de Reseau, which was in absolute control of the whole of the railway system serving our force. The benefit drawn from this liaison was incalculable, for at least we were able to represent in an expert technical manner our needs in railway transport to the technical authority capable of satisfying them. Two facts are worthy of note. One is that it took us nearly three months to build up what after all was only a very rudimentary railway organization of control, and that during all this critical time we were open to serious disaster since the main link in our chain of communications was imperfect. The second is that the control of the ports still remained in the hands of the I.G.C., an authority independent of that which controlled the means of onward movement from the ports to the troops.

During the long phase of stationary warfare which followed the first battle of Ypres up to the Somme offensive in 1916, matters went smoothly enough under the control of the Q.M.G. The increased demands due to the expansion of the force were met satisfactorily by the mutual good will and co-operation which was a characteristic of the relations between ourselves and our Allies, and the gradual development of the Railway Directorate commensurate with the requirements of circumstances ensured an adequate flow of men and materials to our armies. It remained for the strain imposed by active operations to come to show up the weak points in our organization. This came in 1916, and the cause, as I shall attempt to point out, was primarily a non-appreciation of the real meaning of the service of transportation.

The expansion of the French Armies reached its maximum in 1916. Coincident with it both ourselves and our Allies reached a high degree of production in munitions of war. Consequently, it was judged that the psychological moment had come when offensive action on a large scale might be attempted. Hence—for us—the Battle of the Somme. It was this battle which imposed such a strain on the railways of France that they were unable to cope with it, and which was the cause of the reorganization of the whole service of transportation. Had we known as much about transportation in the spring of 1916 as we know now, we might have appreciated the situation somewhat as follows: "We may blow the enemy clean out of sight, but if we do we won't be able to follow up our success by an advance which would give us any material advantage. We can gain a moral advantage, and that alone." No one, however, had the experience, and even had experience been available it would have taken considerable courage to appreciate matters thus, and so 1st July, 1916, came with high hopes.

The first evil symptom experienced was the lack of trucks at loading points. Following this we were notified that even when trucks were available trains would have to be strictly limited in number below what we knew the carrying capacity of trunk lines, because of lack of engine power, lack of drivers, lack of coal. Then came a reduction in the capacity of the lines themselves because the shortage of maintenance labour and material made it impossible to keep them in condition.

These, and a number of lesser symptoms which in the aggregate became serious, soon indicated that our railways were breaking down. Repercussive effects began to be felt for the first time. The ports were under the I.G.C. and independent of railways: the latter failed to clear away imports, yet imports came in in ever-increasing quantities in satisfaction of the I.G.C's. demands which themselves were based on the requirements of the troops for operations planned on a generous scale. Consequently, ports, transit sheds, quays, and wharfs became congested with material of all sorts. Ships arriving loaded could not unload. Stores wanted urgently at the front could not be moved because they became buried beneath mountains of other stores not yet required forward. Gradually movement as a whole slowed down, and complete cessation was threatened.

At the same time our Allies became seriously alarmed at the state of affairs developing behind their own armies in a manner exactly similar to what we were experiencing. They were dependent upon imports to a far greater extent than they had originally contemplated owing to the great excess of demand over the productive capacity of the country made by modern methods of warfare. Consequently the imminent breakdown of the railways of France was not a local affair threatening one army alone, it was universal—a matter of miscalculation of capacity or of faulty organization. For the French it was the former, for us, as we began to think, the latter.

Whatever the cause, we and our Allies were face to face with a most serious danger. Our Allies turned to us for help, asking for trucks, engines, railwaymen, and fuel to be brought from England, and the C.-in-C., while demanding all these things from home, called also for a man of experience and reputation to come over and set our organization to rights—to connect up ships, ports, railways, and roads, and to put the whole affair on a working basis. I would like to remind you that all this happened during the battle of the Somme, up to then the greatest battle ever fought—it happened at a time when we were committed to action, when we could only carry on and could not back out without a confession of weakness which must have had the most serious consequences. And one cannot evade the truth that we could have foreseen it and taken measures to meet it *before* the battle, had we only studied earlier the science of transportation and its practicable application to war.

The events which followed are a matter of history well known to all students of the Great War. Sir Eric Geddes came over and saw what was wrong and devised the full organization for transportation which was required. He linked up ports to railways, railways to roads, inland waterways to both. He secured the regulation of sea transport with direct reference to port capacities and to the possibilities of clearance from the ports inland. He developed ports, railways, and roads by construction until they could reasonably be expected to carry out the work required of them, and he brought the whole under one unified control responsible for co-ordination of effort. He showed what *transportation* meant, and how each variation in one process of movement must inevitably have its effect on the others, and he secured

from home men and plant in sufficient quantities and of the right type to relieve the situation entirely both for us and for our Allies. Finally, he, as Director-General of Transportation, took command of our new organization, got it into running order, and controlled its operations until it found its own feet.

By Christmas, 1916, the railway problem was well in hand, and we knew, in theory at least, how to meet future transportation troubles. But the creation of the transportation organization did not put an end to all transportation difficulties, and we experienced many crises between 1916 and 1918 in connection with transportation which though not comparable in gravity with that of the autumn of 1916 yet caused many anxious periods.

Perhaps the most instructive of these is that connected with mechanical transport. Throughout the period 1914-1916 the M.T. services of our army worked to perfection.

Perhaps we in the Army have made a more specialized study of this form of transport than we had in the case of the railways. However that may be, the scale of M.T. provided and maintained in the French theatre by the Director of Transport G.H.Q. was amply sufficient for our needs, so long as it was not called upon to undertake undue proportion of long distance work to relieve railways. As a natural result, however, of our experience of railways, M.T. began to be regarded as the most reliable form of transport in the field, even for really long distances, except in such forward country as obviously could be negotiated only by horsed transport. As a consequence, we gradually adopted a policy of forward reserves in large quantities located where they could be loaded to road transport (or, later, to road or light railway transport at choice), and thus became to a certain extent independent of the regularity of flow which we had come to regard as beyond the powers of standard gauge railways under war conditions.

The natural result of such a policy was that the mechanical transport of the force gradually deteriorated due to overwork. Deterioration was not very marked in the early stages, and in 1916 and the earlier part of 1917 the course of events was not very obvious to the troops, however clearly it may have been appreciated by the directorate of transport responsible for the provision and upkeep of the vehicles. The result, which *was* clearly obvious, was the effect on the roads of the heavy use of M.T. So great was the deterioration of the roads, and so numerous were the bye-ways which had to be strengthened to carry M.T.—many of which were merely country lanes on a mud foundation before the war—that the provision of stone for repair became a serious factor of rail transportation. To a certain degree the increased use of road transport due to lack of railway facilities was thus responsible for an increased use of railways; it therefore partially defeated its own object of relieving railways.

The alarm caused by the deterioration of vehicles and roads had its effect in promoting the use of light railways. The latter saved the wear and tear on M.T. vehicles, and even though ballasted demanded less tonnage for that purpose than road repairs required in their

absence. Hence, in 1917, about the time of the Passchendaale offensive, the policy was to utilize light railways to the greatest possible extent in order to extend the standard gauge railways and to act as a distributing agency to points as near the troops as the enemy would permit. The Passchendaale offensive opened, one might say, almost on a light railway basis. Reliance was not, of course, exclusively placed on light railways, but they were highly organized in the battle area and were regarded as a most important factor of the supply system between forward reserves and unit transport. The work of the light railways, though under a directorate (D.L.R.) separate from that controlling the standard gauge traffic (D.R.T.), was co-ordinated with it both at G.H.G. and locally in Army Areas through the D.G.T. and his representatives on Army Headquarters.

Unfortunately, at Passchendaale we met with a concentration of hostile artillery on a scale more intense than we had hitherto experienced. This enemy artillery was apparently chiefly used against our forward communications—light railways in particular—rather than against our advancing troops. In certain sections it appeared to be the aim of the German command to paralyse our advance by denying the supplies requisite to enable it to be continued rather than by overwhelming the troops themselves. Light railways under these circumstances suffered heavily. Many a train load of ammunition or other vital supply was locked up by breakages on the line in front and behind, and shot to pieces before the lines could be repaired. It was found that lorries, on the other hand, could usually get round craters or other obstructions on the roads, and unless actually hit managed somehow or other to get through in the large majority of cases.

The deduction may safely be drawn from these operations that reliance cannot be placed upon light railways in the face of intelligently directed enemy artillery fire, and until the latter is subdued reliance must be placed largely on road transport as the medium of supply for the troops.

The value of light railways under such circumstances is largely a matter of opinion, but the fact is that the pendulum swung rather heavily against light railways in shelled areas after the experience of Passchendaale. During the winter 1917-18, therefore, the policy turned again in the direction of standard gauge, plus road transport, as the normal method of supply in battle areas. Light railways were to be used as much as possible in quiet localities so as to save wear and tear on roads and road vehicles.

About this time it became a matter of knowledge that our armies were going to be called upon to face the culminating enemy effort in the spring of 1918. Standard gauge railway communications were once more in really good condition owing to the work of the Roads Directorate, and to efforts of the home authorities in supplying men and materials to make good French deficiencies. But our road transport was going from bad to worse, and there was trouble in our overseas communications due to the unrestricted submarine policy of the enemy, which made economy of petrol a matter of necessity. It was therefore decided:—

(1) To withdraw into G.H.Q. reserve every M.T. vehicle which could be spared from units, and to recondition them as quickly as possible.
(2) To make the fullest possible use of light railways during the quiescent winter period, and thus to save the roads against the time when they would be vital to us. Meanwhile to carry out the fullest possible programme of road repair.
(3) To take standard gauge railheads as far forward as practicable, so that troops could draw supplies directly from as many as possible with their unit horsed transport.
(4) To form general purpose M.T. companies in G.H.Q. reserve from the reconditioned lorries withdrawn from formation.

The necessary measures to give effect to this policy were put into force with the greatest energy, and by March, 1918, when the enemy opened operations with the great attack on our Fifth Army, the necessary work of reconditioning was perhaps sixty per cent. completed; we had available six M.T. companies in G.H.Q. reserve in good condition and ready for immediate employment, more in process of formation, and we had made a saving of something like 4,000 M.T. drivers who could thus be released for fighting purposes. At this time, too, the roads, as a result of winter repair work and careful nursing, were better than they had been for a long time back. On the other hand, broad-gauge railheads were very far forward, and light railways, where they existed, went almost into battle positions. Consequently the enemy attack, meeting with success, overwhelmed light railways and broad-gauge railheads very early—necessitating rapid railhead changes.

These happenings, combined with the effect produced by a policy of sustained enemy attack from the air on all important railway junctions and defiles, resulted in an increasing dislocation of railway traffic operations, and we were soon forced to rely heavily on our road transport. Thanks to the policy adopted during the preceding winter, we were able to draw the fullest advantage from the latter while at the same time securing the greatest possible economy in its use by allotting the G.H.Q. reserve companies to formations which required them most, but only for so long as they were actually required. Meanwhile, we continued the reconditioning of the vehicles withdrawn from units, and the formation of additional G.H.Q. reserve companies with the greatest possible speed. In addition, at our urgent request, the War Office formed two additional G.H.Q. reserve M.T. companies and sent them overseas.

During March and April, 1918, the railway situation became increasingly difficult as a direct result of enemy action. The culmination was reached in May, 1918, when the great lateral line from St. Just, via Amiens, to Hazebrouck had to be abandoned as a railway route owing to enemy shell fire. Our armies were then penned into a narrow strip of country, possessing only one lateral railway communication, through Abbeville and Boulogne. Most of the forward engine depôts had been lost, and several of the important engine depôts remaining were so close to the enemy as to be practically useless, and our one lateral, along which all reserves and reinforce-

ments drawn from one part of the front to be thrown in at another had to be moved, was threatened daily and nightly by persistent air attacks on the bridge over the Canche at Etaples. At this period the situation might be described, without exaggeration, as most serious, and the railways were so disorganized as to be rapidly approaching a state in which they could be disregarded as a factor in the military situation for large movements. It was only the work of the road transport service which enabled the force to be maintained.

This period of the war must always be a source of great interest to military students of transportation. It shows so clearly the powers and limitations of railways when faced by a resolute enemy. It shows also so clearly the elasticity and adaptability of road transport, and the need to hold as much of the latter in reserve as possible. It shows, also the power of aerial attack when directed against railways, of which our experience is an example, and when directed against roads, of which the Germans had a very disagreeable experience during the latter half of March on the Albert—Bapaume—Cambrai road. It shows the danger of *over*-advanced railheads, which cause the creation of over-advanced dumps, and of the undesirability of frequent railhead changes. Also, it brings out very clearly the advantages of a generous scheme of railway construction of duplicating routes, making avoiding lines, alternate bridges and other defiles, and of providing temporary engine depôts well sprinkled about and not too far forward.

The advance following the final enemy defeat and signature of the Armistice is also prolific of lessons to the student of military transportation. It affords a good example of limitation in the rate of railway reconstruction, even when undeterred by enemy action, excepting, of course, the delayed mine, and as a result of this limitation the impossibility of moving a strong force forward at the rate it can march for any length of time and of keeping it supplied while in movement. Where the enemy have had time to destroy railway works, even though this destruction be confined to cutting the bridges, and demolishing signal equipment, electrical communications, and engine water supply installations, the possible rate of advance is very slow indeed.

You will probably have remarked the omission in this lecture of a very important factor in the transportation problem, namely, the Inland Water Transport Service. At the beginning, I mentioned that each theatre of war had its own peculiar problems of transportation, but that for obvious reasons one could not consider all the theatres concerned in the recent War. Inland water transport is one of those transportation services which is better considered when studying the Mesopotamian Campaign, for in Mesopotamia the I.W.T. was the mainstay of military transportation, and it is there that the problems which arose and the solutions adopted offer the best medium for study. In France and Flanders the I.W.T. was really a secondary service, and important though the service undoubtedly was, it did not rank with the railway and road services in its bearing on military operations. I am, of course, disregarding the Cross-Channel Services both by barge and train ferry which, though operated by I.W.T. and of the first importance, hardly came within the definition of land transportation.

France is a country well laid out for inland water transport, and Belgium also. A very considerable canal and river traffic proceeds normally in peace, and probably had the War continued of a stationary character for longer than it actually did fuller military use would have been made of the available navigable waterways. As it was, the fact that our armies grew from small beginnings, and that with their growth the railways developed sufficiently for all needs, caused less attention to be given to organizing an Inland Water Transport Service during the earlier stages than might perhaps have been the case under different circumstances. It was only in 1916, when serious doubts arose as to the railway capacity that relief was sought by a more extensive use of inland water transport. The latter service was thus only incorporated in the official transportation scheme as an effective agency on the reorganization of 1916, when the Directorate of Inland Water Transport was co-ordinated with the remaining transportation services under the Director-General of Transportation.

From its nature, canal and river transport is more suited to bulk carriage than to detailed distribution. From a military point of view, too, it is slow, albeit reliable, and thus it is not easily adapted to a rapidly changing military demand. Its chief utility lies rather in the relief it can afford to the overtaxed railway system by carrying material in bulk for which there is a steady demand, such as road repair stone, timber, engineer material for installation works, or coal, to points inland from which distribution can be made by road transport or light railway. In carrying out this sort of work the I.W.T. rendered most valuable service in France, and the tonnage transported increased progressively from 1916 onwards. The main limitation from which it suffered lay in the fact that so far as the area of the British armies was concerned, the navigable portions of the canals did not go very far forward. Canals require a good deal of maintenance, which must be applied continuously if they are to be kept in a condition of utility, and they are easily damaged by an intelligent enemy. The years of neglect between 1914 and 1916, when we tried to make real use of the canals for the first time, had the natural result that a considerable portion of the existing waterways had deteriorated to such an extent that their repair was more than we had either time or labour to undertake. Later on, when the I.W.T. organization had developed sufficiently to undertake this repair work, it had grown to present such a formidable task, especially in the forward areas within enemy artillery range, that the service never really overtook arrears. We were never able, for these reasons, to draw the advantage which under more favourable circumstances the inland water system of the country would have afforded. The lesson to be learnt from what we actually were able to do is that even in a country possessing a highly organized road and railway system the use of inland waterways for military purposes should be encouraged to the fullest practicable extent from the outset.

Before leaving the subject, mention should be made of one or two of the uses we made of canals which were of particular value.

We found that where they could be used for this purpose, canal barges afforded the best possible means of evacuation of sick and

wounded, both men and animals. The lack of jolting and jarring inseparable from road or rail transport proved an inestimable boon to badly wounded cases, and there is no corresponding disadvantage for the length of time spent on a voyage to a base hospital by canal did not militate against the cases. The barges—well decked, cool, and airy—made beautiful hospital wards, and space was ample for nursing staff and all medical necessaries required to ensure the care of the cases, and, a matter of great importance, ample provision could be made for plenty of water. Similar considerations apply, of course, to veterinary cases.

Another useful purpose served by the I.W.T. was in connection with forward water supply to troops. Barges, which we called "Infiltration" Barges, were fitted up with power pumps and water pumping appliances and were well supplied with delivery hose. Such a barge, complete with trained crew, would be sent as far forward as it could get, and lying there moored to the canal bank it was capable of taking canal water, pumping it until fit for drinking purposes, and pumping it into storage ashore, or direct to unit water carts. A mobile water-supply installation of this sort can prove of the greatest use, especially in cases where troops are concentrated prior to some operation in numbers exceeding the capacity of the normal water supply of the area—these barges being unloaded and therefore of light draft, and not being required to move frequently, can penetrate into canals quite unfit for normal transport work; they can therefore be taken by horse-towage, poling, or some other expedient, comparatively far forward.

Even these services do not end the useful purposes to which the I.W.T can be put. I.W.T. plant by its nature is most useful for the construction of temporary bridges and similar military works required in the tactical employment of the troops. The maintenance personnel of the service, being skilled in the practice of water retaining works, are of use in the design and construction of drains and similar works to create inundations, and to put the matter shortly, the I.W.T. provides a body of men and class of material which may come in very handily indeed during the course of operations.

The last point to be dealt with is that of the ports. The control of port operation, independent up to 1916, was brought into the scheme of transportation on the creation of the Directorate General of Transportation. While port operations inevitably recall thoughts of ships and sea transport generally, we had found that important though the seaward side of them may be, the landward side is, as a matter of fact, of equal importance. It is of no use to send more ships in a given time to a port than can be unloaded in that time at the berths available, but it is equally useless to unload more cargo in a given time at the quays of a port than can be cleared away in that time from the port by the transport agencies working inland from it. This, of course, is a most evident truth when the matter is given reasonable consideration. Yet it would almost seem to be of universal practice, even in peace time, to construct and develop port facilities with an eye to the seaward side, and almost to neglect the landward aspect.

In France, it needed the railway crisis of 1916 to open our eyes to the matter. The creation of a Docks Directorate, linked up to the Directorate of Railway Traffic by the general control exercised by the D.G.T., was the solution of 1916. The Director of Docks had only one duty, namely, to speed up transit through the ports, but in doing so he had to avoid congestion. He carried out this duty firstly by improving the methods of working at the ports and the plant used for loading and discharging shipping, by keeping the Director of Railway Traffic fully informed of his needs, present or future, for clearance by rail from port areas, and finally by regulating the flow of imports so that each port dealt with what it could best handle, both on the seaward and landward sides, in quantities which lay within its capacity. Under this organization system replaced the haphazard lack of method in force prior to 1916, and the justification for the additional officials and expensive plant rendered necessary by its creation will be found in the immensely increased movement made possible by its operations. The result was to remove all anxiety in connection with the supply and maintenance of our armies, at any rate so far as the working of the base was concerned.

One important deduction can be drawn from our experience of port working in France. It is that a port must constitute a reserved area, and that in the port area no warehouses of any sort can be permitted nor can any material be allowed to be stored in the open. The whole of a port area must be reserved for movement, and everything inside the area must be in a state of transit, not allowed to stand still for an instant longer than cannot be avoided. This means that continued pressure must be brought to bear on consignees to remove their consignments either by charging a heavy demurrage rate or by a similar process, or else that the port authorities must remove consignments themselves to temporary warehouses situated outside the zone of movement. The military practice, the latter, is the principle we shall expect to adopt as being the more suitable, and we did adopt it and work it successfully in France.

So long as the base port areas were sufficiently large to absorb our imports into dumps and warehouses situated therein there was no difficulty in operating the ports, but immediately the imports increased to an extent which taxed the railway clearance facilities, congestion made its appearance and warehouse accommodation inside port areas was no longer able to meet our requirements. One of the steps we took to remedy matters was to create inland depôts of all sorts outside the congested port areas, though within reasonable distances of them, and to convert every scrap of warehouse—dump accommodation inside the port areas into transit sheds and spaces. Bulk movement coming in by sea was transferred at once, in bulk, through the transit sheds to depôts, specific demands being met from these inland depôts instead of from the base ports as heretofore.

The improvement effected was very marked. Congestion largely disappeared, though constant care was still needed to prevent its reappearance owing to clearance delays from transit areas. The turnround of ships was accelerated, and demands from the front were

satisfied with far less delay. There was little or no difficulty in supplying emergency material at short notice, and the total tonnage passing through the ports was enormously increased. Such advantages are not to be gained without accepting some disadvantages, and perhaps the greatest of these was the lack of check on arriving consignments. To the end of the war we were not able to devise a method which, while not reducing the rate of flow through a port, would yet enable losses on stores to be definitely traced and the responsibility fixed on ship, port, or depôt. Consignees, who were in most cases the administrative services and departments, could make no effective check on their consignments until arrival at inland depôts. By that time the consignments had passed through so many hands, checked in bulk only if at all, that losses could not be brought home. In this case, however, the end justified the means under the particular circumstances prevailing, and if in future we have to face a similar problem we shall probably have to adopt the same solution.

Men, animals, and stores were all treated separately as regards transportation. In the ports men and animals were dealt with by the Embarkation Staff in conjunction with Base Commandants and the local remount and veterinary organizations. Stores were dealt with exclusively by the Directorate of Docks in consultation with the officers in charge of depôts of the services concerned.

On the railways the Traffic Officers dealt with the whole, but at important stations a special staff of Railway Transport Officers dealt, as a rule, with movements of men and animals separate from that concerned with store movement. At railheads and unimportant stations they were, of course, dealt with by one railway transport office. In front of railheads the movements were again largely separated. Men passed through the hands of special staffs at reinforcement depôts, leave camps, and rest camps until they reached their units. Animals were moved by the Remount and Veterinary Departments through their own organization of advanced depôts, staying at camps and veterinary hospitals in direct consultation with units. Stores were taken over and delivered to railheads through the media of Divisional M.T. companies and trains and M.T. companies allotted for Corps and Army troops or by light railways supplying transport at Divisional, Corps, and Army demand, for the stores destined for the troops of those formations. But, while our organization was arranged in this manner to deal with different classes of conveyance, in the matter of theoretical transportation everything was dealt with on a common basis, consignor and consignee services being kept in continuous touch with the progress of movements in which they were interested through the liaison work of the various Transportation Directorates.

A matter of the greatest importance when transportation facilities were strained was to settle the order of priority under which the acceptance of traffic offered by various consignors was to be regulated. This was a matter which had so intimate a bearing upon operations, contemplated or in progress, that the decision could not be left to local authorities at the consignors' end. It was a matter of high staff policy. An order of priority was laid down for general use under which food

supplies came first and other materials in the order in which they could best be arranged on the principle that anything which the troops could manage best to do without had the lower priority. But a general order would not meet the case, and daily decisions were given as regards special consignments—or even ordinary consignments where special transportation difficulties arose—at a Railway Conference held daily by the Deputy to the Quartermaster-General at G.H.Q. At this conference the interests of the troops were represented by competent staff officers, and the consignor services and transportation directorates each sent representatives to present their views. By this means it was possible to take a clear view of the necessities in each case and to give an impartial decision to the best interests of the force as a whole.

DISCUSSION.

THE CHAIRMAN: Ladies and Gentlemen. In my introductory remarks I asked the lecturer to be good enough to try and define the term transportation. I am afraid I did that entirely out of sheer laziness, because I was told it was my duty as Chairman not only to invite discussion but to see that whatever speeches were made were relevant to the subject. I therefore thought I would like to know what the boundaries of the subject were so that I should not have much trouble. The lecturer in his final remarks said there were no boundaries to the subject, but nevertheless I hope that those who take part in the discussion will not cover too wide a ground but will confine their remarks to the points made by the lecturer.

LIEUT.-COL. H. OSBORNE MANCE, C.B., C.M.G., D.S.O., R.E.: Mr. Chairman, Ladies and Gentlemen.—As regards the scope of the discussion perhaps it is just as well that the Chairman has limited us a little in the range of our remarks, because the lecturer might possibly reply to the Chairman's query as to what is transportation by quoting Kipling, who said that "Transportation is civilization." I think we should all congratulate the lecturer on his very valuable paper. It has been of particular interest to me because for a great length of time I was looking upon the subject from the back end of it, while Colonel Taylor has given us his impressions from the front end of it. It was particularly interesting to me to hear how he developed the subject of transportation in France, in a very accurate manner, but looking at the question always from a slightly different point of view from that of the people at the War Office or at Headquarters. I can add nothing to the substance of the lecture, which I think is a very complete one, but I should like to be able to supplement it with a little information from the other end. Colonel Taylor referred to the lack of senior railway traffic officers in France at the beginning of the War. It must be remembered, however, that it was absolutely and explicitly stated in writing by the French military staff—it is no longer a secret—that the French would be entirely responsible for everything to do with railways connected with the British Army. On the strength of that it had been suggested by our General Staff to cut out the three senior officers of our very modest railway establishment, namely, the Director, the Deputy-Director and the Assistant Director, which is the Staff to which the lecturer refers as not having gone out at the beginning. But the Quartermaster-General put his foot down and said: "You must send one man out there, if only to ask for the others; because he will very soon find it necessary to do so." The then Quartermaster-General, Sir John Cowans, clearly foresaw that there would be demands made on us very quickly, so that as soon as mobilization was ordered he mobilized the Director and Deputy-Director of Railways, and instead of sending them to France

he sent one to organize railway troops and the other to organize railway stores; and I think it was largely due to that foresight that we were able to keep going in the comfortable way referred to by the lecturer during 1915. We were always able just to keep ahead of requirements, and it was only when the great and unexpected demands from the French came in 1916 that these measures failed to meet the case. In December, 1914, when the Director of Railways, who also ran the Inland Waterways at that time, was transferred to General Headquarters, there was a considerable improvement. But the great disadvantage we suffered from until Sir Eric Geddes came was that the ports continued under the Inspector-General of Communications, and, more than that, these ports were not run by technical people. However good the railwaymen and inland water men were, there were no technical men out there to run the ports. It was considered that they could be run by purely staff work in the Army. That was a very grave mistake, and the lecturer would be the first to admit it. It was not cured until Sir Eric Geddes' organization came and took over the ports as well as the waterways, railways, roads and light railways. In 1916, when Sir Eric Geddes went out to France I had the good luck to go with him. As the lecturer said it was right in the middle of the Somme offensive in 1916. Colonel Taylor has referred to the fact that at that time the railways and the ports showed signs of cracking, chiefly due to the lack of practical control. One point that Colonel Taylor did not allude to, to which I might draw your particular attention, is that the immediate reason why we could not carry on the 1916 offensive, in so far as transport was concerned, was the lack of roads. Colonel Taylor alluded to it later on but not in connection with this particular period. During this offensive, when the weather was fine the horse transport was able to go along the more or less open ground on the side of the roads, and with the horse transport going along the side and the mechanical transport going along the road they just managed to carry on. But as soon as wet weather came, the operations were practically stopped, because everything immediately had to go on to the roads, and the roads could not take all the necessary traffic. There were not enough of them; they did not hold good and they could not be maintained near enough up to the front. That was the main fact that led to the introduction of light railways, simply to take the traffic off the roads. To give you some indication of the traffic that had to come forward at the time, I will quote some figures from memory, but I think they are approximately accurate. It was found that during an offensive the quantity of stores which arrived at railhead and had to be moved forward was 2,200 tons a day per mile of offensive front. Of that I might mention that about 1,500 tons consisted of ammunition, 400 tons of road material for maintaining the roads, and the other 300 tons consisted of stores and rations. That gives you some idea of the magnitude of the problems to be solved and why the railways were strained. In the new technical organization which coordinated all the existing forms of transportation—it was a great pity that it was not done earlier—one of the principal changes made was that each branch was manned by specialists. For example, before that time the roads in the British Army were run under the control of the Chief Engineers. The men composing the working parties came from the Army or were German prisoners, or anybody that could be got hold of. As a result the work that those men did was insignificant compared with the work that the same number of skilled road personnel could do. One of the great features of the reorganization which was carried out by that very eminent road engineer, General Maybury, was that he ransacked England and took away all the skilled men and rollers and everything else connected with the roads and quarries that he could lay his hands on. Having been on the Road Board he knew where to go for them in England, and that is the reason why, towards the

end of the War, our roads in England began to suffer. But he saved the road situation in France. Colonel Taylor has paid a tribute to the wonderful roads that existed there after we took charge of them, and I myself have always been most impressed by that part of the organization. There is one other point that I should like to say a few words upon, and that is the canals. One very important use of the canals which was not mentioned by the lecturer was the part they played in helping to save the ports. The use of a port is measured, generally speaking, by the work done at the quays, in fact our efficiency figures were expressed in tons per hour per yard of quay. If you can load off the other side into barges, which can then go to a depot inland, you will readily appreciate how much you can help the ports in that way.

MAJOR-GENERAL W. H. ANDERSON, C.B. (Staff College): I should like, if I may, to ask a question with the object of eliciting some information as regards the future. I think many of us have had brought back to our minds the problems we had to deal with during the War through the very realistic way in which the subject of transportation has been described to us by the lecturer. I think the memory that comes back more than anything to those of us who remember the conditions in France at the end of 1916 is that old bit of road between Fricourt and Mametz. That road was occupied by a stream of traffic day and night. The road never had a bottom to it before the War, and as the lorries went along the road in an endless stream, parties of men threw some stones down between each lorry as they came along. Those who remember that will certainly appreciate the importance of transportation. As regards the future, I think we should like to get some help from the Quartermaster-General and from the lecturer with regard to what is likely to happen. Having in view the great difficulty of taking a broad gauge railway forward on account of its being seen from the air by day and night, and the possibility of bombing; having also in view the difficulty of using light railways, except for purely static operations, for the same reason; having also in view the increased effect of bombing by day and night from the air on main roads occupied by transport, I should like to know if there is any airman who will give us his ideas as regards the bombing of transport in the future. I should like him to express an opinion as to how far we shall be able to get our broad gauge up in future to a point from which presumably the cross country tractors are to branch off. The prospect of cross country tractors going across country in every direction at night without lights is not a pleasant one or one which the Quartermaster-General will look at favourably. I should like to know what the views of officers are with regard to the future, particularly on these questions.

PAYMASTER LIEUT.-COMMANDER H. B. TUFFILL, R.N.R.: When I heard of this lecture on "Land Transportation in the War," I thought the lecturer would probably start off by saying that in operations of war there are three armies—the Army of Production, the Army of Transport, and the Army in the Field. Perhaps the wish was father to the thought, because it was with the second of those three armies that I was interested, having been closely associated during the greater part of the War with the organization of the Ports. I had the honour to serve on the Committee which was charged to maintain the flow of traffic through the Ports (of England), and when the lecturer concluded his interesting discourse, saying that he was not able to tell us what he had intended to say with regard to Ports, I must confess to a feeling of disappointment. Nevertheless, I would thank him, if I may, for what he has told us. Many were our troubles, caused by factors arising elsewhere than in the immediate sphere of the Ports. If I may say so, in view of what we in Whitehall could see of the working and the troubles

that were arising out on his side, I can only express surprise that the lecturer took all so well. In the Ports of the United Kingdom we were meeting not only the requirements of the several Armies in the Field, in so far as their transit through the ports was affected, but endeavouring to meet all those of the various Departments of State, not the least of which was the discharge and storage of Prize Cargoes, and, later, the immense quantities of food stuffs imported by the Ministry of Food, etc., it being found that the bulk of the available storage space of the country existed in the ports, indeed Cold Storage was scarcely to be found except in port areas. Huge stocks of timber also accumulated in the ports, occupying almost every piece of open ground that could be found, thereby hampering the free movement of many commodities. The import of all the raw materials required for the manufacture and preparation of the immensely varied articles that were needed for the prosecution of war, and the feeding of the population of England and the Armies in the Field each necessitated most careful and economic usage of port facilities, so that our problems in the home ports were very great, and we saw that to a great extent all these problems were arising and proving equally troublesome to those in charge on the other side of the Channel. The lecturer mentioned the question of congestion at the ports. Our experience was that a ship can always discharge on to the quay at least twice, and probably five times more quickly than the quay itself can be cleared; and similarly the quay can be cleared three times, and even five times more quickly than the shed can be cleared. Hence we endeavour to use the utmost persuasion to keep the transit sheds cleared in order to deal with the immediate requirements for cargoes urgently needed. This point of quicker discharge of the ship, etc., means that the facilities for removing the goods on the near or receiving side must be altered and broadened out. The goods have to go through a "bottle-neck," and experience showed us that rail and road transport was to a great extent failing under the strain of war. We were also faced with the railway problem of the severe lack of railway trucks in the ports. Our Committee endeavoured, with the Railway Executive Committee, to effect measures to meet that difficult position. The pooling of railway trucks was the first thing suggested, and after considerable difficulty, that was arranged for. But all the time we were losing our trucks because the army in France needed them equally, or perhaps more than we did, but it made our problems the more heavy. One point that the first speaker mentioned was the off-loading from a ship into lighter and barge. If I may add my testimony in connection with that subject, that is a very valuable factor in the clearance of a ship and the clearance of urgent goods previously referred to, particularly if a special Transit Quay be maintained for the handling of such urgent goods ex lighter, and thus avoid their going through the quays and sheds used for less urgent goods. With these few remarks, I would like to add that if any opportunity arises to go further into this great question of Transport, I hope the question of labour will be dealt with.

MAJOR-GENERAL SIR GERALD ELLISON, K.C.M.G., C.B.: I desire to say only a very few words. What we have heard to-day has dealt almost entirely with the important operations in France. Operations on that scale are exceptional; they are not what you might call normal so far as we are concerned. Personally I was concerned with operations which I think were much more normal for us, namely, those connected with Gallipoli. I was Deputy Quartermaster-General to Sir Ian Hamilton in Gallipoli, and I saw the conditions that existed there. There the whole problem of transportation, or whatever else we call it, was absolutely and entirely different from what it was in France. There was hardly any connection between the two. The whole problem there was one of sea transport, and

it was extraordinarily interesting and difficult. Colonel Mance mentioned that the port was the weakest link in the chain. We had no ports, at any rate in the sense in which there were ports in France. We had only that great Mudros Bay, but no piers, no jetties, no store houses, nothing at all; simply ships coming in with their contents which had to be got somehow to the front. The stores had to be changed from one ship to another; they had to be transferred from the big ships into small ships because the big ships could not go up to the Peninsula. From Mudros onwards our means of transport were small ships, somewhat limited in number. It was a prodigious problem, and I do not suppose any system in the world would ever have made it an easy problem or have made the transportation perfect. We experienced at that time many of the same things that we read about in connection with the Crimea. Boots when wanted were at the bottom of the ship, and all the same things happened again—I do not say to the same extent, but they did happen. They will happen under any system that can possibly be devised. This question of sea transportation is one of the great problems, perhaps the greatest problem, that has to be dealt with under our normal conditions. I only want to mention one or two of the factors that appear to me to be of great importance. One of the factors was exactly the same as occurred in France and elsewhere, namely, the absolute necessity for one control in all matters of transportation, whatever they may be—big ships, small ships, railways, canals and roads, and especially docks. You will never get intelligent use of transportation in any shape or form unless there is someone looking forward and having in some degree control over every form of transportation. We tried divided control in matters of organization. We had divided control between the Quartermaster-General, who was the man at the front, and the Inspector-General of Communications, and practically in every campaign during the late War that system had to be abandoned. Ultimately the control over administration came to be vested in one head, and that is the first thing we get to. It is absolutely essential to have one head of administration—it does not matter what you call him (we now call him Quartermaster-General). That one head of administration must, if he is intelligently to use transportation of all sorts, be in close touch with the Commander-in-Chief and with the Chief of the General Staff, who is all the time attending to operations and looking forward to what is going to happen. The Quartermaster-General must be in close touch with him, and if he is kept in close touch with operations he is in a position to frame his plans for the future. No human being will ever be able to make the organization perfect, but if such a system is carried out it gives a chance of making some sensible plan for co-ordination of all means of transport. I am perfectly certain that unless sea transport can be brought properly into a co-ordinated scheme of transportation you will never get the thing right on land. You begin in the home country with production, and thence onward there must be some well-thought-out plan, right on from the main bases in the home country, in despatching things overseas. You cannot have everything thrown in indiscriminately, as it was at Mudros, without adequate means of getting rid of the various stores. You must have the same sort of control over sea transport as we have on the railways in war. On the railways we now have regulating stations, and you must have some similar kind of scientific control over shipping at various stages. Such control must be exercised as one of the normal functions of the Quartermaster-General. Exactly how such control ought to be exercised I will not enter into now, but I am quite certain it is a factor connected with transportation which is of enormous importance.

COLONEL M. G. TAYLOR (in reply): Mr. Chairman and Gentlemen. Most of the speakers referred in their remarks to the question of ports. I said during the

course of my lecture that I had taken up so much time that it was impossible for me to deal with that question. I am very sorry indeed that it was necessary for me to omit any reference to that part of the subject, because the question of ports is, I know, most interesting to many of those who are present. My own view is that ports are an integral portion of the machinery; in fact, they are so much an integral portion that any variation of the port capacity will have a very serious effect on the ships on the one side and the railways on the other. All ports conjure up in one's mind visions of ships, adventurers, and all sorts of things, but I think one is apt to forget that the landward side of a port is just as important as its seaward side. While you can sum up a port, quite broadly, in its capacity of tons per hour per yard of berth, that is not the real capacity but only the paper capacity of a port. The real capacity is the tons per hour that can be passed completely through it at the other end. One of the speakers mentioned that it is easier to discharge from a ship to a wharf than it is from a wharf to a shed. Similarly it is easier to discharge from a wharf to a shed than it is to discharge from a shed to a railway truck, simply because all our ports are organized on those lines. Everybody has had their eye to the sea side. The opening of a new dock is a very great event, but is the addition of an extra line of railway to the port of equal importance in the public eye? Of course it is not. The truth is that an extra outlet to the port from its landward side would probably be a great deal more valuable than any number of extra berths. Most ports have too many berths and too few railways, and our ports in France suffered very much indeed from that defect. All the damage that occurs from month to month in the stores at the ports is purely a matter of the construction of the ports and nothing else. So much for ports. If we accept as a principle for working that clearance facilities should always be slightly greater than import facilities we should have an ideal port, and I am convinced that that must be the port of the future. General Anderson mentioned the Fricourt-Mametz road. There were many roads just as bad. Perhaps the worst road in France at any time from the beginning to the end of the War was the Albert-Bapaume road after the German retreat to the Hindenburg line in 1916. That was terrible. One sent out one's lorry drivers for a trip of nine miles out and nine miles back with thirty-six hours' rations on them, because you could never be sure that they would get back in less than that time. Modern intensive traffic on a road must be well organized. General Anderson also asked me a question, in connection with which the Quartermaster-General said that I might make a prophecy. I am not a prophet. I only wish I knew the answer to the question. It would simplify our army organization in the future if we could tell what the power of the air arm is going to be five or ten years hence. We suffered very much from bombing in France, even while we had command of the air. I do not know what it would have been like if we had not had command of the air. I only mentioned the Canche Bridge as an example. But, really, bombing, so far as we have experience of it, is of little effect because the damage caused is so quickly repaired. In France it did not happen as a rule in the daytime, and by the time the night had passed in which the damage had been done it was usually repaired. I would not like to hazard an opinion of any sort as to what may happen in the future. We must simply take the risk, and that is all one can say about it. With regard to General Ellison's remarks, he must bear in mind that I was asked to deal only with land transportation. I should have liked to deal with the sea side of the problem because I am very interested in it. General Ellison mentioned the Gallipoli campaign from the point of view of the sea side part of the problem. I said at the beginning of my lecture that I could not deal with anything but France, because the subject was too big a one to allow me to deal with any other field of operations. The

Gallipoli campaign is full of sea transportation lessons. I happened to be in charge of certain of the transport work at Mudros during its worst time, and my experience was certainly interesting. There was congestion of the very worst type ashore; the clearance facilities were always less than the incoming facilities for dealing with transports. I might almost say that every sin of transportation that could be committed was committed in that country. I would like to have dealt with that matter, but I do not think you would have sufficient patience with me if I endeavoured to do so.

THE CHAIRMAN (SIR T. E. CLARKE, K.C.B., K.C.M.G., Q.M.G. to the Forces): Ladies and Gentlemen. I believe it is the province of the Chairman to sum up the points of the discussion. Colonel Mance said that transportation was civilization. If that is the case I am perfectly certain that you will not desire me to make any attempt to sum up such a subject, because I could not possibly sum up the subject of civilization! However, I will deal with a few aspects of the problem. The Commandant of the Staff College, General Anderson, endeavoured to draw a prophecy from the lecturer and from me of what is going to happen in the future. It is always a dangerous thing to prophesy because you are nearly always wrong. I had very much hoped that the distinguished Air Commodore who was present at the commencement of the meeting, Air Commodore Brooke-Popham, would have taken part in the discussion and given us the benefit of his views on the subject, but unfortunately he has gone. Personally, however, I do not believe that, until a very great development is made in the power of air bombing, it will affect the general principle of pushing the standard gauge railhead as far forward as you possibly can. Only the normal (if I can describe it as such) fluctuations of war in regard to the forward line should be taken into account when fixing that particular railhead. I cannot give any further definition of how far forward it ought to go, but it should go so far forward that there will be only the shortest possible run from the railhead to the troop areas. I was glad to hear the lecturer mention that bombing will not hinder the advance of the railway line. What the future is going to disclose in regard to aircraft I had hoped that Air Commodore Brooke-Popham would have told us. Whether the Air Ministry will provide us with an air cargo boat I do not know. If they do, then these horrible difficulties that Colonel Taylor has presented to you of tons and tons of road metal for the roads will disappear to a large extent. I do not want to say much about the question of ports, because I rather led the lecturer to believe that as the lecture was on land transportation in war, the port side of the question should be cut out as the hour was getting late. I agree with the representative of the Navy, who has spoken to-day, with regard to the necessity of keeping the port areas clear of stores; that is to say, the dock warehouses should be used as transit warehouses and not as warehouses for storage. The lecturer and I are fully in accord on that point. But I would like to point out that there are other factors which must be taken into consideration. It seems very simple to write an order to the effect that stores are not to be kept in a certain definite port area; General Ellison pointed out how very essential it is that all methods of transportation shall be co-ordinated, and he illustrated his meaning by referring to sea transportation. So long as you have so many interests involved in the same particular series of movements so long will you have difficulty in getting complete co-ordination. One of the speakers said that ports can be filled up quicker than the goods can be taken away from the ports. That is perfectly true, and Colonel Taylor also agrees that it is correct. I had a lot of experience in connection with the matter in two theatres of war, and I desire to point out that so long as the ships are run by one set of people, the railways

by another and the ports by another you will have these difficulties, because although those various people do turn the machine they do not turn it as easily as might otherwise be the case. One of the points that was impressed upon me as Quartermaster-General in France was the necessity of getting a quick turn round for the ships. I asked: "What are the ships going to France for?" and was told "With stores for the troops there." I replied: "Then it is my duty to get the stores to the places at which they are wanted. You say that the chief element in that is to get the stores out on the dockside or put them into a barge, or get rid of them somehow, so that the ships may turn round quickly. Very well, if this is the main object it must be carried out, but the stores may not get to the troops." It is not business simply to throw the stuff out on the quays in order to turn your ships round quickly. There is no place in which to put the stores; loss and peculation is rife. Although one set of interests, the shipping side, is satisfied and happy because you have got the ship there and turned it round quickly, we are not so happy on the land side. Therefore, before you can lay it down as a principle that the ports and the port areas must not be filled up with goods, you must see whether the principle can be carried out. Undoubtedly experience in many theatres during the late war proved that the necessary co-ordination was not attained, and I am doubtful whether it is ever likely to be attained under the existing system. It seems to me that if you say that goods are not to be brought into a theatre of war at a speed quicker than you can get them away from the port area you have probably done a great deal towards finding a solution, but in a large number of cases in the late war ships had to come into the ports in large numbers because they were in convoys, and it was necessary to clear them as soon as possible. There are so many factors that it is very difficult to arrive at a practicable solution, but the whole question is so important that it should be subjected to the closest inquiry and investigation. I think from the discussion that has taken place we may establish one rule, namely, that if you are going to get the greatest efficiency out of all your methods of movement or your methods of transportation you must have efficient and effective co-ordinated control, not only generally, but from the point of origin to the areas of distribution. I could elaborate that principle, but I think the words I have used explained what I am driving at, and in addition the lecture has made the point fairly clear. There is one point which I should like to mention, which is really a corollary of what I said about ports, namely, that the forwarding of traffic should be controlled from the destination end, so that delivery will be in accordance with the relative requirements of the situation. There is also one other point to which I should like to refer. I think these discussions very often become obscured by too much weight being attached to the periods of static warfare. The greater portion of the War in France was what you might call reasonably stationary. In the earlier stages of 1914 that condition of affairs did not exist, and in 1918 we made very rapid advances. I think we rather obscure the lessons of 1914 and 1918, owing to the shorter period of the operations then, by the experience we gained in the intervening years. I would like to utter a note of warning in that connection. We must not obscure the main issue. I would have liked the Commandant of the Staff College to prophesy what form the next large war will take. I will not venture to do so, although he asked me to express an opinion on the subject. I think the lecture has been most extraordinarily interesting, and I would like to see Colonel Taylor at some future time take up the subject, which I know he has a great deal at heart, of ports and sea-going traffic. Whether he will do so I think it is for the Council of the Institution to ascertain, but I am quite sure that if he were able to deal with the subject it would prove of extreme interest to us. I will not detain you any longer, although it would be possible to make

remarks of an almost indefinite length on this subject. The lecturer has devoted a great deal of time and thought to the lecture he has prepared, and I am quite certain I am voicing your opinion when I ask him to accept a very hearty vote of thanks for the lecture he has been good enough to deliver to us this afternoon.

The resolution of thanks was carried by acclamation.

MAJOR-GENERAL W. H. ANDERSON: I have been asked to propose a hearty vote of thanks to the Quartermaster-General for his kindness in presiding over the meeting this afternoon. I am sure we are all disappointed that there are so few serving soldiers here, not only to hear this lecture on a subject which is of vital importance, but also to listen to the Quartermaster-General, who has given up so much of his valuable time in order to preside on this occasion. It affords me the greatest possible pleasure to move a vote of thanks to him.

The resolution of thanks was carried by acclamation, and the meeting terminated.