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THE RISE OF RAIL-POWER

IN WAR AND CONQUEST

1833—1914

WITH A BIBLIOGRAPHY

BY

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PREFATORY NOTE.

THE extent to which railways are being used in the present War of the Nations has taken quite by surprise a world whose military historians, in their accounts of what armies have done or have failed to do on the battle-field in the past, have too often disregarded such matters of detail as to how the armies got there and the possible effect of good or defective transport conditions, including the maintenance of supplies and communications, on the whole course of a campaign.

In the gigantic struggle now proceeding, these matters of detail are found to be of transcendent importance. The part which railways are playing in the struggle has, indeed—in keeping with the magnitude of the struggle itself—assumed proportions unexampled in history. Whilst this is so it is, nevertheless, a remarkable fact that although much has been said as to the conditions of military unpreparedness in which the outbreak of hostilities in August, 1914, found the Allies, there has, so far as I am aware, been no suggestion of any inability on the part of the railways to meet, at once, from the very moment war was declared, all the requirements of military transport. In this respect, indeed, the organisation, the preparedness, and the efficiency throughout alike of the British and of the French railways have been fully equal to those of the German railways themselves.

As regards British conditions, especially, much interest attaches to some remarks made by Sir Charles Owens, formerly General Manager of the London and South Western Railway Company, in the course of an address delivered by him to students of the London School of Economics on

October 12, 1914. He told how, some five or six years ago, he had met at a social function the Secretary of State for War, who, after dinner, took him aside and asked, "Do you think in any emergency which might arise in this country the railways would be able to cope with it adequately?" To this question Sir Charles replied, "I will stake my reputation as a railway man that the country could not concentrate men and materials half so fast as the railways could deal with them; but the management of the railways must be left in the hands of railway men." We have here an affirmation and a proviso. That the affirmation was warranted has been abundantly proved by what the British railways have accomplished in the emergency that has arisen. The special significance of the proviso will be understood in the light of what I record in the present work concerning the control of railways in war.

Taking the railways of all the countries, whether friends or foes, concerned in the present World-War, and assuming, for the sake of argument, that all, without exception, have accomplished marvels in the way of military transport, one must, nevertheless, bear in mind two important considerations:—

(1) That, apart from the huge proportions of the scale upon which, in the aggregate, the railways are being required to serve military purposes, the present conflict, in spite of its magnitude, has thus far produced no absolutely new factor in the employment of railways for war except as regards the use of air-craft for their destruction.

(2) That when hostilities were declared in August, 1914, the subject of the employment of railways for the purposes of war had already been under the consideration of railway and military experts in different countries for no fewer than eighty years, during which period, and as the result of vast study, much experience, and many blunders in or between wars in various parts of the world, there had been slowly evolved certain fixed principles and, also, subject to constant amendments, a recognised and comprehensive organisation which, accepted more or less completely by the leading nations, with modifications to suit their national

circumstances and conditions, was designed to meet all contingencies, to provide, as far as human foresight could suggest, for all possible difficulties, and be capable of application instantly the need for it might arise.

The time has not yet come for telling all that the railways have thus far done during the war which has still to be fought out. That story, in the words of a railway man concerned therein, is at present "a sealed book." Meanwhile, however, it is desirable that the position as defined in the second of the two considerations given above should be fully realised, in order that what the railways and, so far as they have been aided by them, the combatants, have accomplished or are likely to accomplish may be better understood when the sealed book becomes an open one.

If, as suggested at the outset, the world has already been taken by surprise even by what the railways are known to have done, it may be still more surprised to learn (as the present work will show) that the construction of railways for strategical purposes was advocated in Germany as early as 1833; that in 1842 a scheme was elaborated for covering Germany with a network of strategical railways which, while serving the entire country, would more especially allow of war being conducted on two fronts—France and Russia—at the same time; and that in the same year (1842) attention was already being called in the French Chamber to the "aggressive lines" which Germany was building in the direction of France, while predictions were also being made that any new invasion of France by Germany would be between Metz and Strasburg.

If, again, it is found that a good deal of space is devoted in the present work to the War of Secession, criticism may, perhaps, be disarmed by the explanation that the American Civil War was practically the beginning of things as regards the scientific use of railways for war, and that many of the problems connected therewith were either started in the United States or were actually worked out there, precedents being established and examples being set which the rest of the world had simply to follow, adapt or perfect. The possibility of carrying on warfare at a great distance from

the base of supplies by means of even a single line of single-track railway; the creation of an organised corps for the restoration, operation or destruction of railways; the control of railways in war by the railway or the military interests independently or jointly; the question as to when the railway could be used to advantage and when it would be better for the troops to march; the use of armoured trains; the evolution of the ambulance or the hospital train—all these, and many other matters besides, are to be traced back to the American Civil War of 1861-65, and are dealt with herein at what, it is hoped, will be found not undue length.

As for the building up of the subsequent organisation in Europe—Germany, France and England being the countries selected for special treatment in relation thereto—this, also, has had to be described with some regard for detail; and, incidentally, it is shown (1) that the alleged perfection of Germany's arrangements when she went to war with France in 1870-71 is merely one of the fictions of history, so far as her military rail-transport was concerned; (2) that France learned the bitter lesson taught her by the deplorable and undeniable imperfections of her own transport system—or no-system—on that occasion, and at once set about the creation of what was to become an organisation of the most complete and comprehensive character; and (3) that the "beginning of things" in England, in the way of employing railways for the purposes of war, was the direct outcome of the conditions of semi-panic created here in 1859 by what was regarded as the prospect of an early invasion of this country by France, coupled with the then recognised deficiencies of our means of national defence.

Military railways, as employed in the Crimean War, the Abyssinian Campaign, the Franco-German War, the Russo-Turkish War and the Sudan are described; a detailed account is given of the use of railways in the Boer War and the Russo-Japanese War; and this is followed by a description of the strategical railways constructed in Germany for the purpose of facilitating war on the possessions of her neighbours.

Chapters XIX and XX deal with the building of railways which, whether avowedly strategical or what I have described as "economic-political-strategical," are intended to effect the purposes of conquest, with or without the accompaniment of war. The former of these two chapters, which shows how, with the help of railways, Germany proposed to transform the African continent into an African Empire of her own, should be found deserving of notice, and especially so in view of the statements quoted (p. 311) as having been made by German officers in what was then German South-West Africa, to the effect that the main objective of Germany in going to war would be the conquest of Africa, "the smashing up of France and Great Britain" being regarded only as "incidents" which, followed by seizure of the possessions of the smaller Powers, would make Germany the supreme Power in Africa, and lead to the whole African continent becoming a German possession.

From Chapter XX the reader will learn how Germany proposed to employ railways for the furthering of her aims against, not only Asiatic Turkey, but Egypt and India, as well.

The subsidiary articles on "Indian Frontier Railways" and "The Defence of Australia" have no direct bearing on that *evolution* of rail-power in warfare with which it is the special purpose of the present volume to deal; but in the belief that they are of interest and importance in themselves, from the point of view of the general question, they have been given in an Appendix. The difficulties and other conditions under which the Sind-Pishin State Railway, designed to serve strategical purposes, was built to the frontiers of Afghanistan are unexampled in the history either of railways or of war. As regards Australia, the gravity of the position there was well indicated by Lord Kitchener when he wrote of the lines running inland that they were "of little use for defence, although possibly of considerable value to an enemy who would have temporary command of the sea."

At the end of the volume there is a Bibliography of books, pamphlets and review or other articles relating to

the use of railways for the purposes of war. In the first instance this compilation was based on a "List of References" prepared by the American Bureau of Railway Economics; but, while many items on that list have here been omitted, a considerable number of others have been inserted from other sources. The Bibliography is not offered as being in any way complete, but it may, nevertheless, be of advantage to students desirous of making further researches into the matters of history here specially treated.

The assistance rendered in other ways by the American Bureau of Railway Economics in the preparation of the present work has been most helpful. In the writing of the chapters concerning German designs on Africa, Asia Minor, etc., the resources of the well-arranged and admirably-indexed library of the Royal Colonial Institute have been of great service. I have, also, to express cordial acknowledgments to the General Managers and other officers of various leading railway companies for information given respecting the organisation of railways in this country for military purposes.

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Appendix

INDIAN FRONTIER RAILWAYS

ON the north-west frontier of India the plains of the Punjab are separated from the great central valley of Afghanistan, from the deserts of Baluchistan, and from the Russian Empire on the north thereof, by ranges of mountains, otherwise "a gridiron of stupendous ridges and furrows," intersected by passes which have always been regarded as the most vulnerable points of the Indian Empire. Through these passes from the earliest days of recorded history there has come a long succession of invasions instigated by that incalculable wealth of India which may well have inspired the envy of dwellers in less favoured lands.¹

* These considerations would alone suffice to establish the need for an effective control of the more important of the said passes by the Power which exercises supremacy in India ; but the obligation thus devolving upon the British people as the present holders of that supremacy has been increased in recent times by two further factors—(1) troubles with frontier tribes ; and (2) the development of that Central Asian Question which, though now no longer acute, was, not so many years ago, a source of great anxiety in England and India. Frontier troubles gave rise to a number of expeditions to Afghanistan from time to time, while the gravity of the general situation was increased by the once steady advance of Russia towards India—whether for the purposes of actual conquest thereof or, alternatively, for the attainment of the aim cherished by Russia during three centuries for an outlet to a southern sea, such outlet being sought via the Persian Gulf on her disappointment in regard to the Dardanelles ; though British interests were concerned in either case.

This combination of circumstances, with the possibility, at one time, that Afghanistan might become the theatre of war

¹ Altogether there have been twenty-six invasions of India, dating back to about 2,000 years B.C., and of this number no fewer than twenty-one have ended in conquest.

in a conflict between two great European Powers, invested with special interest and importance the provision on the north-west frontier of India of railway lines which, whether constructed to the more important passes or going actually through them, would form a ready means of concentrating Anglo-Indian troops at such places on the frontier, or beyond, as occasion might require.

From this point of view the Bolan and Khyber passes—the former leading to Quetta and Kandahar and the latter to Kabul—have more especially had importance attached to them as “the two gates of India.”

Proposals for constructing railways through them were advanced as early as 1857, when Mr. (afterwards Sir) W. P. Andrew, chairman of the Sind, Punjab and Delhi Railway, acted as spokesman of a deputation which waited on Lord Palmerston in order to urge the construction of (1) a railway down the valley of the Euphrates, improving our communications with India by connecting the Mediterranean and the Persian Gulf; and (2) railways through the Bolan and Khyber passes, not only, as he urged, facilitating the movement of troops to the frontier, but offering alternative routes by means of which the flank or the rear of an enemy operating beyond or between the limits of the two lines might be threatened. Mr. Andrew followed up with great earnestness and perseverance for many years his advocacy of these views, publishing a succession of books and pamphlets, and writing many letters to the Press on the subject.

Such advocacy had, however, no practical issue, and, though the arguments originally advanced in favour of the Euphrates railway lost most of their force on the opening of the Suez Canal, the consequences of the neglect to provide better means of communication with the north-west frontier were well manifested in the troubles of 1878–79–80.

The refusal of the Ameer of Afghanistan—who had already accorded an ostentatious welcome to a Russian Embassy at Kabul—to receive a British mission led, in 1878, to an order being given for the advance of three columns of British forces upon Afghan territory, the routes selected for this purpose being (1) the Khyber Pass, (2) the Kuram Pass, and (3) the Bolan Pass. At this time, however, the system of frontier railways which had been advocated so long scarcely existed except on paper. The nearest point of railway communication with Afghanistan was then at Sukkur, on the Indus. An extension across the Sind desert to the entrance to the Bolan Pass had been surveyed, and a very short section had been laid; but in their advance on Kandahar Sir Donald Stewart and his force had to march all the way from the Indus, experiencing great trials in crossing the intervening desert, where many of the men lost their lives. The

work of constructing this desert railway—which presented no engineering difficulty—was now taken actively in hand, and the line was available for the troops on their return.

Success attended the expedition of 1878 so far as it led to the flight of Shere Ali, the occupation of Kandahar by Sir Donald Stewart, the control by the British of the three main highways between India and Afghanistan, and the signing of the treaty of Gandamak; but the murder of Sir Louis Cavagnari and his staff at Kabul, in September, 1879, rendered necessary the sending of a further expedition, General Sir Frederick (afterwards Lord) Roberts being directed to proceed with a British force by the Kuram route to Kabul.

Thereupon the whole question of transport facilities was revived afresh, and, although the expedition itself was a conspicuous success, delays and commissariat difficulties arose which might have been avoided had better railway facilities been available. The terminus, at that time, of the Punjab State Railway was at Jhelum, seventy miles from Rawal Pindi, 180 from Peshawar, and 260 from Thal, the frontier post of the Kuram pass; and in spite of the vigorous efforts made, between 1878 and 1880, to extend the line, Jhelum remained the actual railway base throughout, no material assistance being gained from the twenty miles of extension which, owing to the great engineering difficulties presented by innumerable ravines, could alone be carried out during that period. Commenting on the "painfully slow" progress being made by the Khyber column, *The Times* of October 13, 1879, remarked:—

It is now upwards of a quarter of a century since the chairman of the Sind railway commenced to broach the idea of connecting the Khyber and Bolan passes with the railway system of India. For more than a quarter of a century he has unsparingly advocated these views. . . . Had the views so persistently advocated by Mr. Andrew, and so repeatedly brought forward by us, been adopted at the commencement of the struggle last October, as we then ventured to insist upon, vast sums would have been spared in the hire of transport, and we should have been spared the ignominy of feeling that a British army, nominally on active service, has occupied five weeks in covering less than seventy miles.

Rawal Pindi—one of the most important strategical points in India—was not reached by the railway until October, 1880,

¹ It has been stated that the number of camels employed during the expeditions of 1878–80 for transport purposes, in default of better rail communication, was so great as almost to exhaust the supply of the frontier provinces of Sind and Punjab, while from 30,000 to 40,000 of them died owing to the excessive toils and trials of the work they were required to perform, the financial loss resulting therefrom to the Treasury being estimated at £200,000

by which time the Afghan War of 1878-80 had been brought to a close ; and the further extension of the Indian railway system to Peshawar,—another position of the utmost strategic importance, situate ten miles from the entrance to the Khyber Pass, and 190 from Kabul—was effected by May, 1883.

From a military point of view, however, still greater importance was attached, at that time, to the securing of rail communication through the Bolan Pass to Quetta and Pishin in the direction of Kandahar, this being the route by which, it was thought, the Russians would be certain to attempt their invasion of India,—if they should undertake one at all.

Surveys for an extension of the Sukkur-Sibi desert line to Pishin were made whilst that line was under construction, and early in 1880 the Government gave directions that the extension was to be proceeded with ; though they decided that the route to be taken from Sibi should be through the Hurnai Pass in preference to the Bolan route, the former being regarded as preferable for the broad-gauge line (5 ft. 6 in.) with which the "Kandahar State Railway," as it was to be called, would be provided.

Arrangements were at once made for collecting the necessary materials and for carrying through the work with the least possible delay ; but further progress was checked, in July, 1880, by the disaster at Maiwand. In the following October the Gladstone Government, who had succeeded the Beaconsfield Administration and had, apparently, resolved upon a complete reversal of the Indian policy of their predecessors, followed up an earlier announcement of their intention to withdraw from Kandahar by giving orders for the cessation of the work on the Sind-Pishin railway. Maiwand having been avenged, and some refractory tribes subdued, Afghanistan was completely evacuated by the British at the end of April, 1881, and the construction of frontier railways in India was dropped, for the time being.

In the middle of 1883 came a reconsideration of the position. Russia was then showing increased activity in the direction of Merv, and the British Government concluded, apparently, that they had been too hasty in ordering the abandonment of the Kandahar State Railway scheme nearly three years before. So they gave orders that the work should be resumed ; though, in order to render this *volle face* on their part less conspicuous, they directed that the undertaking should now be known only as the "Hurnai Road Improvement Scheme" ; that it should be proceeded with quietly, in order that it might not attract too much attention, and that the suggestion of a "road improvement scheme," instead of a railway, should be kept up by the engineers not being allowed to have even a temporary line of rails for conveying stores, materials for bridges, etc., from the

base to the passes. This last-mentioned stipulation meant that the stores and materials had to be either transported on the backs of camels or dragged on wheels up stream; and it was estimated that, in addition to the great loss of time, a sum of not less than £1,000,000 was wasted in this way before the order prohibiting the use of temporary rails was rescinded.

A start was made with the work in October, 1883, and the fact that the Russians were then actually approaching Merv, and that a sudden advance by them in force was regarded as probable, led to the laying of great emphasis on the need for construction being pushed on with the utmost vigour. When, in February, 1884, the Russians did occupy Merv, the pressure brought to bear on the Engineer-in-chief became still more acute. Then, in May, the British Government formally announced that, owing to the encroachments of Russia, the line *would* be built. The fiction of a "Hurnai Road Improvement Scheme" was now abandoned. Henceforth the line under construction was to be known as "The Sind-Pishin State Railway."

From the very outset, however, the difficulties which crowded upon Colonel (afterwards Sir James) Browne, R.E., an officer well experienced in railway and engineering work who was entrusted with the carrying out of the scheme, were unfavourable to the prospects of speed in construction. The surveys which had already been made were found not only worthless but misleading. The first members of his staff were unacquainted with railway work and had to be succeeded by men brought from England. The plant and materials previously collected, but disposed of at scrap-iron prices when the line was abandoned in 1880, had now to be replaced at an almost fabulous cost, owing to the urgency of the need for them.

All these were, nevertheless, minor troubles as compared with the physical conditions to be overcome.

Starting from an elevation, at Sibi, of 300 ft., the line was to rise 6,200 ft. in the 120 miles between Sibi and the summit level at Kach.

Then, for the greater part of the 224 miles to which the line was to extend, the country was a wilderness of rocks and stones—a land of barrenness and desolation, where there was no timber, no fuel, scarcely a blade of grass, and, in places, for stretches of several miles, no water. It was a land, too, almost devoid of inhabitants, while those who did dwell there were described as "a savage and blood-thirsty race of robbers," continually engaged in plunder and inter-tribal warfare, and not growing sufficient food even for their own consumption. Almost everything that was wanted—including supplies for from 15,000 to 30,000 workers and materials for the line—had to be imported from a distance.

Still less inviting was this inhospitable region by reason of its range of climatic conditions. The lowlands have the reputation of being one of the hottest corners of the earth's surface. A temperature of 124 deg. Fahr. has been registered in the Nari valley. The highlands, in turn, offer the alternative of Arctic cold, the temperature there falling in winter to 18 deg. below zero. Between the lowlands and the highlands there is a temperate zone; but here the constant pestilence was dreaded no less than the extremes of heat and cold elsewhere.

As the result of these conditions, the work of construction could be carried on in certain districts for part of the year only, and the workers had to be transferred from one section of the line to another according to the season. Such a movement of front involved the transport of everything,—stores, tools, offices and some thousands of men. "The management of this vast exodus," says Captain Scott-Moncrieff, R.E., in his paper on "The Frontier Railways of India,"¹ "was a work of considerable anxiety and difficulty. A sudden influx of people, such as this, into a desolate and barren land naturally caused a famine. Everything was eaten up, and for some days the question of supplies was the burning question of the hour. . . . Nine hundred camel loads of food were consumed daily on the works." The customary load for a camel was 400 lbs., but some of the camels carried loads of 800 lbs. up the pass.

The engineering difficulties fell into four principal groups,—(1) the Nari Gorge; (2) the Gundakin Defile; (3) the Chuppur Rift, and (4) the Mud Gorge.²

The Nari Gorge, about fourteen miles in length, beginning just beyond Sibi, has been described as "one of the most weird tracks through which a railway has ever been carried. The hills, absolutely bare, rise above the valley for many thousands of feet in fantastic pinnacles and cliffs. It is a scene of the wildest desolation." The Nari river, running through the gorge, is formed by a combination of three streams having but little water on ordinary occasions, but becoming, in time of flood, a raging torrent which fills up the whole gorge for miles, attains a depth of ten feet, and has a velocity of five feet per second. Over this river the railway had to be carried in five different places. Not alone bridges, but heavy embankments, cuttings and tunnels were needed. At one point there was an especially dangerous tunnel in which so many accidents occurred, owing to roof or sides falling in, that at last no workmen would enter it except at a wage five-fold that of the high rate already being paid. The

¹ "Professional Papers of the Corps of Royal Engineers," Vol xi, 1885.

² "Life and Times of General Sir James Browne, R.E., K.C.B., K.C.S.I." by General J. J. McLeod Innes, London, 1905.

whole work was liable to be stopped for months together, owing to the washing away of half-completed embankments or bridges ; though until this portion of the line had been completed no materials could be sent to the sections beyond.

In the Gundakin Defile, eight miles long, two tunnels had to be made through some most treacherous material, and four bridges had to be provided.

The Chuppur Rift is a chasm three miles long in the spurs of a rocky mountain forming an apparently insuperable barrier. In time of floods the river attains a height of from 30 to 40 ft. The running of the railway on a ledge along the side of the mountain being impracticable, owing to the nature of the rock, the engineers cut a line of continuous tunnels partly on one side of the rift and partly on the other, connecting the two series by an iron girder bridge ; but, instead of constructing the tunnels in the usual way, from each end—a procedure which would have taken much time—they adopted the expedient of driving openings (adits) into the side of the cliff at various points, and then cutting the tunnel right and left of each of these openings until the various sections met. The only way in which the openings could be made was by lowering men down by ropes several hundred feet from the top of the cliff until they reached the point where the work for an opening was to be started. They then drove crowbars into the perpendicular sides of the cliff in order to gain the necessary support for a platform from which the blasting operations could be carried on. Six of these openings were made on one side of the cliff and six on the other. As a separate gang of men could operate at each it was possible to complete the whole work in the course of a few months. Altogether there is a collective length of 6,400 ft. of tunnels in the rift, in addition to a viaduct 75 ft. high, with seven spans of 40 ft. each, and a bridge having an elevation over the river of 250 ft., and consisting of a central span of 150 ft. and eight spans of 40 ft.

On the summit level, twenty-five miles in length, came the five-mile long Mud Gorge,—a narrow valley, between precipitous mountains, filled with a soil little better than dried mud, and of such a character that several bad slips of road-bed, carrying away the whole of the line, occurred.

One would think that with all these difficulties—physical, climatic and engineering—to face, the constructors of the railway might have been excused any more ; but there were others besides.

In August and September, 1884, the troops and native labourers employed on the work on the lower part of the line were visited by an outbreak of fever and scurvy of a virulence almost unprecedented in Indian experience. Large numbers of the men died. In one gang of 200 the average number of deaths was ten a day.

Of those who survived the majority were so prostrated as to be scarcely capable of doing anything. Sixty per cent. of the Sappers were in hospital.

Fresh troops, to the extent of three Battalions of Pioneers, were brought on to the work; but they had scarcely arrived before—in November—there was a severe outbreak of cholera. The Afghans thereupon “bolted to a man”; and they were followed by many skilled artisans who had been collected from various parts of India. Additional labour had to be obtained from the Eastern Punjab, but much time was lost.

Whilst the engineers were struggling to overcome these manifold difficulties, the political situation was steadily becoming still more acute. The climax seemed to be reached by the Penj-deh incident of March 30, 1885, when a Russian force under General Komaroff seized this important strategical position, situate near the junction of the Khushk and Murghab rivers. On April 27, 1885, Mr. Gladstone proposed in the House of Commons a vote of £11,000,000 for the purposes of what then seemed to be an inevitable war with Russia. The money was voted the same night.

So the urgency for completing the line which would now, probably, have been available for use had it not been stopped in 1880, was greater than ever. Orders were sent to India that the work must be continued along all parts of the line regardless of seasons. Within a week or two, however, of the war vote at Westminster, cholera broke out afresh among the construction party in India. By the end of May it was spreading among them “like a raging fire”; while to the cholera itself there was added a heat so intense that even the most willing of workers found it almost unendurable.

Under this combination of cholera and excessive heat, work on the lower sections of the line was stopped altogether for a time—Government orders and Russians notwithstanding. All possible measures were taken to mitigate the severity of the epidemic; but the death-rate increased with frightful rapidity. Some of the best workers, European and Asiatic—men who could least be spared, on account of the responsible positions they held—were carried off. During the month of June no fewer than 2,000 died out of 10,000. Of the remainder large numbers sought safety in flight. Many of the minor Government officials, such as telegraph and Post Office clerks, went off in a body.

Whilst sickness and disease had thus been afflicting the camps, fresh troubles had arisen in another direction. Early in 1885 the district was visited by a succession of floods exceeding in severity anything known there for sixty years. In the course of three months the rainfall amounted to 19.27 inches,—a total six times in excess of the average. Several bridges and many

miles of temporary roads were washed away ; numerous accidents were caused ; camping grounds were destroyed ; communications were interrupted ; food supplies became scarcely obtainable, and great delay resulted in the prosecution of a work for which urgency was being so persistently demanded. The floods did not finally subside until the end of May.

Nature having done so much to impede the progress of the undertaking, it only remained for politicians and officials to do what they could to follow her example.

Mention has already been made of the initial prohibition of temporary lines of rails for the conveyance of stores and materials, and the loss of time and waste of money involved in the use of camels instead ; but to this one fact may be added another, namely, that after the Engineer-in-Chief had made his arrangements to obtain sleepers from the juniper forests on the north of the line—this being the only timber available in the whole district—the Government vetoed the arrangement on the ground that it might, possibly, lead to quarrels among the Afghan tribes. The timber had to be procured from India, instead. Hence more delay.

Then the original arrangement with the Engineer-in-Chief, that the work was to be carried out under the Military Department of the Indian Government, and that, in the interests of urgency, he should have a free hand, was changed into one which required that the work should be controlled by a new member of the Public Works Department, who, it is alleged, interfered with many of the working details which should have been left to an Engineer-in-Chief, and, by his " unskilled and unqualified control," caused still further delay, together with much expense and confusion. A good deal of time was lost, for instance, before Col. Browne could get even some indispensable instruments and survey appliances. Especially persistent, also, was Col. Browne's immediate superior in demanding from him " detailed estimates " which, on account of the uncertainties of the engineering work and of the other factors in the situation, it was impossible to prepare whilst the construction of the line was in progress.

Such, however, was the energy which had been shown, in spite of all these difficulties and drawbacks, that the work was completed within the two years and a half fixed by the Engineer-in-Chief at the start as the period in which—" with money freely granted"—it could be done. On March 27, 1887, an engine ran over the line all the way from Sibi to Quetta, and the Hurnai Railway was formally declared open for traffic.

In the meantime the apparent certainty of war with Russia, following, especially, on her seizure of Penj-deh, had led, in April, 1885, to an order being given for the construction of a light rail-

way from Sibi through the Bolan Pass to Quetta, as an alternative, more direct and more quickly constructed route, of which use could be made for a movement of troops to the frontier on the anticipated partial mobilisation of the Indian Army.

The laying of this light railway constituted another notable engineering achievement.

Running through the heart of what has been described as "some of the boldest mountain scenery in India," the Bolan Pass has a length of about sixty miles and a breadth ranging from one mile to a space, in places, of only about twenty yards between the rugged mountain walls which here convert the pass into a mere defile. The pass is, in fact, practically the bed of the Bolan River, and is dry for the greater part of the year, but liable to floods. The temporary narrow-gauge line was to be laid along the river bed without interfering with the military road constructed in 1882-84 as far as Quetta.

For the first forty miles there was a fairly good gradient; but beyond that came a very heavy rise to the top of the pass; and here, at least, anything more than a metre-gauge line would have been impracticable. The possibility of constructing a line of railway through the pass at all had long been the despair of engineers, and this was the reason why the Hurnai route had been decided on in preference to the Bolan for the broad-gauge line to Quetta. Unfortunately, too, the climatic were even greater than the engineering difficulties. The heat in the lower parts of the pass was "beyond all description," and cholera or other diseases carried off thousands of the workers.

With these two lines at their disposal, the Government were, in the spring of 1887, quite prepared for a concentration of British and Indian forces in Afghanistan, had the political condition rendered such a course necessary; but the situation had by then greatly improved, thanks to the negotiations which had been proceeding with Russia for the demarcation of frontiers. In April, 1877, the British and Russian commissioners met at St. Petersburg, and, as the result of still further negotiations, the questions at issue were settled without the appeal to arms which had at one time appeared inevitable.

In 1892 some fifty miles of the Bolan light railway were abandoned in favour of another route which, avoiding the first part of the pass, allowed of a broad-gauge line being laid from Sibi through Quetta to Bostan Junction, where it connects with what is now known as the Hurnai-Pishin Loop. A branch ninety miles in length, from Quetta to Mushki, on the Seistan trade route, was opened in 1905.

To-day the Sind-Pishin railway, with its two sections, via the Bolan and the Hurnai respectively, has its terminus at New Chaman, on the actual frontier of Afghanistan, and within seventy

miles of Kandahar. A broad-gauge line throughout, it forms part of the railway system of India, linking up at Ruk junction with the line running thence along the north bank of the Indus to Karachi, and, by means of a bridge across the Indus, with a line on the south of the river which, in one direction provides an alternative route to Karachi, and in the other connects with Calcutta and other leading cities. The Sind-Pishin line affords, in fact, a most valuable means for concentrating on the Afghan frontier, within a short distance of Kandahar, and in the shortest possible time a considerable body of troops collected from all parts of India, together with reinforcements from Europe, landed at Karachi. As a strategical line, therefore, the railway is of exceptional importance to India and to British interests in general; though there can be no suggestion that it would be used otherwise than for purely defensive purposes.

Then, in what, since 1901, has constituted the North-West Frontier Province of India, there has been a considerable extension of frontier railways in recent years,—all serving important strategical purposes. From Peshawar—1,520 miles from Calcutta—there is a broad-gauge extension, twelve miles in length, to Fort Jamrud, at the mouth of the Khyber Pass; from Nausahra, a cantonment twenty-seven miles due east of Peshawar, there is a narrow-gauge line to Dargai, at the foot of the Malakand Pass; while among other lines is one to Thal, a military outpost on the extreme limit of British territory which serves also as a depôt for the trade with Northern Afghanistan passing through the Kurram valley; and one to Banu, a garrison town, seventy-nine miles south of Kohat, built on a site chosen for political reasons by Sir Herbert Edwards in 1848.

A number of other railways on the north-west frontiers of India have been proposed. Whatever may or may not be ultimately done in regard to these further schemes, it is obvious that those already constructed have made an enormous difference in our strategical position in regard to Afghanistan and the lands beyond as compared with the military transport conditions of 1878.

THE DEFENCE OF AUSTRALIA

With a total area of 2,948,000 square miles, a population of less than four and a half million, and a coast line of 11,300 miles, the continent of Australia is peculiarly open to attack, and the possibilities of invasion, or of attempts at invasion, have not only been much discussed there of late years, but they have given rise to schemes of land defence in which the building of strategical railways and the adapting of existing lines to strategical purposes form important factors.

Under present conditions Western Australia and the Northern Territory are isolated from the remaining States of the Commonwealth so far as regards rail communication, and are at the mercy of any invader who might be able to land a force there unchallenged by the British Fleet.

Since the autumn of 1912, however, there has been under construction a railway which, starting from Kalgoorlie, the eastern terminus of the Western Australian system, will proceed in a direct line for 1,063 miles to Port Augusta, on the South Australian system, thus establishing through rail connection between Perth (Western Australia) and the farthest limit of the Queensland railway system, a total distance, that is, of about 4,000 miles. When this, the first of Australia's proposed trans-continental lines, is completed, it will be possible to send troops from the Central or the Eastern States to Western Australia, not only by rail, but by a railway laid so far inland that they will be safe from attack from the sea. There would thus be a reasonable certainty of the troops arriving at their destination; whereas if they had to go by water there might be the risk of the vessels in which they were making the journey being captured by the enemy. While, therefore, the Kalgoorlie-Port Augusta line is expected to serve other than purely strategical purposes, it is, in effect, the latter which claim first consideration.

Referring to the Northern Territory, in an article contributed by him to *The Empire Review* for May, 1910, Mr. F. A. W. Gisborne, an authority on Australian questions, wrote:—

This vast region embraces 523,620 square miles of land, and lies close to Asia, the most populous of the continents. At present it contains, exclusive of the aborigines, barely one thousand white people and about twice as many Chinese. It lacks railway communication with the settled parts of Australia, and is completely isolated from them. Its magnificent harbour, accessible to the largest vessels afloat, and constituting the natural gateway to tropical Australia, lies, save for the British Fleet, absolutely defenceless. Behind it extend millions of acres of fertile plains never yet tilled, and never likely to be cultivated by white hands. Practically no industry

flourishes in a region which could support myriads of agriculturists and operatives.

That some of the peoples of crowded Asia may, sooner or later, seek a settlement for their surplus millions on what, for them, would be so desirable a land as the Northern Territory, with its magnificent opportunities for those capable of working in a tropical climate, is a contingency that has been fully realised in Australia, and the questions have arisen (1) as to whether the presence of a thousand whites in a region half a million square miles in extent constitutes such "effective occupation" thereof as gives them a right to its exclusive possession; and (2) whether it would be possible either to prevent Asiatics from invading the Northern Territory, if they sought so to do, or to eject them therefrom if they did.

The latter question raises in an especially interesting form the problem as to the respective merits and possibilities of sea-power and rail-power.

Sea-power would, assuredly, have to be relied upon for safeguarding the Northern Territory against invasion, since it would be impossible for the Commonwealth Government to station troops at every prospective landing point along 1,200 miles of a tropical coast-line in sufficient force to keep off any invader who might appear there at some unexpected moment. For the checking, therefore, of such invasion, dependence would have to be placed on the power of the British Fleet (1) to stop the invader, (2) to cut off his connections if he should effect a landing, or (3) to carry war into the invader's own country.

Nor, if any large Asiatic settlement—as distinct from an "invasion" in the ordinary acceptation of that term—did take place in the Northern Territory under conditions that might not call for the intervention of the British Fleet, is it certain that the ejection of the settlers could be ensured with the help even of a trans-continental line of railway. Here the question is not that of the carrying power of a single line of railway. The examples offered by the War of Secession, the South African War and the Russo-Japanese War have well established the great advantages that even single lines, extending for great distances, can confer in the effecting of military transport. The considerations that would arise in Australia are, rather, (1) the fact that troops arriving at Pine Creek or Port Darwin from the south might have to make some very long and very trying marches across the 523,000 square miles comprising the Northern Territory before they reached the settlement of the Asiatics whom they were to eject, while they would be dependent for their supplies on a far-distant railway base; and (2) the doubt as to whether Australia could spare a sufficiently large body of troops to undertake such an expedition, having regard to the defence require-

ments of her south-eastern States, the integrity of which would count as of more vital importance than an Asiatic settlement in her Far North. So there are those who think that if such a settlement were eventually effected in the Northern Territory, under conditions not constituting a *casus belli*, Australia would simply have to accept the situation, and reconcile herself to it as best she could.

All these things may seem to reflect on the precise value, from the rail-power point of view, of that direct communication which, more especially for strategical reasons, Australia has hoped eventually to obtain between north and south as well as between west and east. It is, nevertheless, desirable to see what has already been done in this direction.

The construction of a north-to-south trans-continental line, passing through the very centre of the Australian mainland, and linking up the Northern Territory with the southern and eastern States, has been under discussion for a period of about forty years. Progress seemed to be assured by the Acceptance Act of 1910, under which the Government of the Commonwealth, in taking over the Northern Territory from South Australia, agreed to build a trans-continental line connecting Oodnadatta, the northern terminus of the South Australian railway system, and 688 miles from Adelaide, with Pine Creek, the southern terminus of the Northern Territory system, and 145 miles distant from Port Darwin. This connecting link would have a length of 1,063 miles,—the same, by a singular coincidence, as that of the Kalgoorlie-Port Augusta line.

Since this "bargain" between the South Australia and the Commonwealth Governments was made, there have been many advocates of an alternative, or, otherwise, a supplementary route which, instead of going direct from South Australia to the Northern Territory, (passing through the central Australian desert,) would link up—on their west—with the railway systems of Victoria, New South Wales and Queensland, connections with the new line being made by these States where necessary. This "eastern deviation route" would, it is argued, offer a greater strategical advantage, as compared with the other route, because if troops had to be despatched to the north, they could more readily be supplied from Melbourne and Sydney—which, between them, contain over one-fourth of the entire population of Australia—than from Adelaide; while to send troops from Queensland, New South Wales and Victoria to South Australia in order that they might start on their journey to the Northern Territory from Oodnadatta, would involve a material delay under, possibly, urgent conditions. Thus it is estimated that if the eastern route were adopted, troops and travellers from Brisbane to Port Darwin would only travel about 2,234 miles as against 3,691

miles via Sydney, Melbourne, Adelaide and the central Australian route from Oodnadatta.

How these rival claims and contentions will be eventually settled remains to be seen ; but there has now been added to them a project for the building of other avowedly strategical lines, establishing a more direct connection between the Kalgoorlie-Port Augusta trans-continental line, when it is finished, and the capitals of Victoria, New South Wales and Queensland respectively, facilitating the mutual defence of the eastern, southern and western States in a time of crisis. This further scheme is, however, designed only to supplement the trans-continental lines already mentioned.

As regards the eastern States and the " central " State of South Australia, the question of an Asiatic invasion may be assumed not to arise. It has, however, long been regarded as possible that if Great Britain were at war with some non-Asiatic Power able to challenge her supremacy on the seas, the enemy might make an attack, not on the admittedly vulnerable Northern Territory—which he would not want either as a colony for Europeans or as a " jumping-off " place from which to conquer the remainder of Australia—but on some point along the coast-line of nearly 2,000 miles which, stretching from Rockhampton, in Queensland, to Adelaide, in South Australia, comprises (with a Hinterland of some 200 miles) the most populous, the most wealthy and (for non-Asiatics) the most desirable section of the whole Australian continent.

It is true that Germany—the Power which claims first attention from this point of view—has shown far greater desire to convert Africa into a German Empire than she has to effect the annexation of Australia. Yet that she has recognized the weakness of the Australian situation is suggested by the fact that, in dealing with the defensive power of the Commonwealth, Dr. Rohrbach, one of the exponents of German World-Policy, and author of " Deutschland unter den Weltvölkern," among other works, has declared that Australia could not resist if her four chief towns, all of them near the coast, were occupied by an invader.¹

Which of these four towns, or which particular point along the said 2,000 miles of coast-line, an invader would select for his main attack—apart from feints elsewhere—must needs be uncertain ; but this very fact only adds to the imperative importance of those responsible for the defence of Australia being able to move troops freely, and within the shortest possible period, either from one State to another or from any place to another within one and the same State, as the defence conditions might require.

¹ See " The Origins of the War " ; by J. Holland Rose, Litt.D. Cambridge, 1914.

When we thus pass on to consider the question as to the use of existing lines of railway in Australia for strategical purposes, we find that the most noteworthy expression of opinion on this branch of the subject is contained in the following extract from the "Memorandum" which Lord Kitchener wrote in 1910, as the result of an investigation made by him, at the request of the Commonwealth Government, into the "Defence of Australia":—

Railway construction has, while developing the country, resulted in lines that would appear to be more favourable to an enemy invading Australia than to the defence of the country. Different gauges in most of the States isolate each system, and the want of systematic interior connection makes the present lines running inland of little use for defence, although possibly of considerable value to an enemy who would have temporary command of the sea.

The "different gauges" undoubtedly constitute one of the most serious shortcomings of the existing railways in Australia in regard to those military movements with which we are here alone concerned.

Strategical considerations as applied to rail transport require, not only that troops shall be readily conveyed, when necessary, from one part of a country or one part of a continent to another, but that a mobilisation of the forces shall be followed by a mobilisation of railway rolling stock. Locomotives, carriages and trucks on lines which are not themselves likely to be wanted for military transport should be available for use on the lines that will be so wanted, in order that all the rolling stock of all the railways in all parts of the country or of the States concerned can, at a time of possibly the gravest emergency, be concentrated or employed on whatever lines, or in whatever direction, additional transport facilities may be needed.

The importance of this principle was first recognised by von Moltke; but when the railways of Australia were originally planned, each State took a more or less parochial view of its own requirements, its own geographical conditions, or its own resources, and adopted the gauge which accorded best therewith, regardless of any future need for a co-ordinated system of rail-transport serving the requirements of the Australian continent as a whole.

So we find that the 3 ft. 6 in. gauge has been adopted in Queensland, South Australia (with a further 600 miles of 5 ft. 3 in. gauge), Western Australia, and the Northern Territory; the 4 ft. 8½ in. gauge (the standard gauge in Great Britain and, also, of over 65 per cent. of the world's railway mileage,) in New South Wales; and the 5 ft. 3 in. gauge in Victoria. This means, in most cases, that when the frontier of a State is reached, passen-

gers, mails, baggage and merchandise must change or be transferred from the trains on the one system to those of the other.

Assuming that the west-to-east trans-continental railway (which is being built with the 4 ft. 8½ in. gauge) were now available for use, a traveller by it from Perth, Western Australia, through South Australia, Victoria, New South Wales, and Queensland would require, on account of the differences in gauge, to change trains at least five times. This may be regarded as an extreme case; but the evils of the existing conditions are presented to us in a concrete form by an estimate which the Defence Department of the Commonwealth recently made as to the time it would take to move a force of 30,000 mounted troops from Melbourne to Brisbane. It was shown that, with the present break of gauge, this operation would occupy no less a time than sixty-three days; whereas if there were no break of gauge twenty-three days would suffice. Thus the differences of gauge would mean a loss of forty days in effecting transfers at the frontier. In this time much might happen if the enemy had obtained temporary control of the sea. Under these conditions, in fact, he would be able to move his own forces by sea for the still longer distance from Adelaide to Brisbane in five days. Brisbane might thus be captured by the enemy while the reinforcements it wanted were still changing trains at the State boundaries.

It may be of interest here to recall the fact that at one time there were still greater differences of gauge on the railways in the United States; that in 1885 the American railway companies resolved upon establishing uniformity as a means of overcoming the great inconveniences due to these conditions; and that in 1886, after adequate preparation, the conversion of practically the entire system of railways in the United States to the 4 ft. 8½ in. gauge was effected in two days. Strategically, therefore, the United States Federal Government could now, not only send troops by rail from any one part of their vast territory to another, but utilise almost the whole of the available rolling stock for military purposes.¹

Unification of gauge forms, however, a serious proposition for Australia on account of the prodigious outlay which, owing to the short-sighted policy of the past, it would now involve.²

The estimated cost of converting all the 4 ft. 8½ in. gauge in New South Wales and all the 3 ft. 6½ in. gauge in Queensland, South Australia, Western Australia and the Northern Territory

¹ In the *New York Sun* of June 18, 1911, there was published an article which had for its heading, "If Troops had to be Rushed, the Railroads in this Country could move 250,000 Men a Day."

² The mileage of lines open, under construction, or authorised, in the three gauges, is as follows:—5 ft. 3 in. gauge, 4,979 miles; 4 ft. 8½ in. gauge, 6,160 miles; 3 ft. 6 in. gauge, 11,727 miles.

to the 5 ft. 3½ in. gauge of Victoria is no less than £51,659,000. To convert all the 3 ft. 6 in. and 5 ft. 3 in. railways to the 4 ft. 8½ in. gauge of the New South Wales lines would cost £37,164,000. To convert to the 4 ft. 8½ in. gauge all the trunk lines connecting the capitals—and this without shortening the present circuitous routes or modifying the heavy grades—would alone cost about £12,000,000.

In addition to this still undecided "battle of the gauges" there are in Australia other disadvantages, from a strategical standpoint, in the existing railway system, included therein being (1) an undue preponderance of single over double track, so that any exceptional amount of traffic causes a congestion which is likely only to be aggravated by new lines constructed, or extensions made, before the carrying capacity of the trunk lines has been increased; and (2) the building of lines which either lead nowhere or have been expressly stopped short of the boundaries of a State in order to retain, for the railways of that State, traffic from outlying districts which would pass, by a much shorter journey, to the port of a neighbouring State if, by means of through railway connexion, the residents in the districts concerned were free to avail themselves of their geographical advantage in respect to their nearness to such port.

In addition to the efforts she has already made, or is proposing to make, to effect such improvement both in her railway system and in her military transport facilities as may be practicable, Australia has sought to provide for that effective organisation without which, as experience elsewhere has fully shown, great and even disastrous confusion may arise at a critical moment owing to conflicts of authority and other troubles or difficulties in the working of such railways as may be utilised for military movements.

The action taken in this direction is based on a further recommendation made by Lord Kitchener, who, in the course of his Memorandum to the Commonwealth Government in 1910 said (paragraph 85):—

Preparation for mobilisation is primarily the work of the General Staff, who recommend the lines to be followed and advise where, and in what quantities, the munitions of war of the various units should be stored. Concentration can only be satisfactorily effected when the railway and military authorities are in the closest touch, and work in absolute harmony. To secure this co-operation, I advise that a War Railway Council be formed, as is the case in the United Kingdom, composed of the Chief Railway Commissioner from each State, under the presidency of the Quartermaster-General of the Citizen Forces, and with an officer of the Headquarters Staff as secretary.

A War Railway Council for the Commonwealth was duly

constituted in 1911. The Council, which forms an adjunct of the Commonwealth Defence Department, consists of the Quarter-master-General, (president,) the senior officer of the Engineer and Railway Staff Corps also created for the railway system alike of the Commonwealth and of each State (such senior officer being the Chief or the Deputy Commissioner of Railways); the Consulting Military Engineer of the Commonwealth, and two representatives of the naval and military forces, with a military officer as secretary. The duties of the Council in time of peace are, generally, to furnish advice to the Minister of Defence on railway matters, and, particularly (*a*) to determine the method of supplying information to, and obtaining it from, the different railway departments; (*b*) to suggest regulations and instructions for carrying out movement of troops; (*c*) to suggest the method of organising railway staff officers in time of war to act as intermediaries between the various railway authorities and the troops; (*d*) to consider the question of extra sidings, loading platforms, etc.; and proposals for unification of gauges; and (*e*) to suggest the organisation and system of training of railway troops. In time of war the Council further advises the Minister of defence on questions of mobilisation. The organisation for military rail-transport in the several States follows on the lines of the system already adopted in the United Kingdom, as laid down in the Field Service Regulations.

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Much valuable help has been derived from the American list; but a large number of its references, and especially those relating to the World-War itself, have not here been reproduced, while so many additions have been gathered in from other sources among which might be mentioned the published catalogue of the War Office Library; the libraries of the British Museum, the Royal Colonial Institute, and the Patent Office; the *Journal* of the Royal United Service Institution, the publications of the Royal Engineers' Institute, and official or other publications in Great Britain, France, etc.), that the Bibliography here presented may, perhaps, be regarded as practically a new compilation, supplementing the excellent purpose which the list of the American Bureau of Railway Economics will undoubtedly serve.

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