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MILITARY ROUTES

TO THE

INDO-AFGHAN FRONTIER,

BY

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INTRODUCTION.

THE occupation of Merv was met both by the English Government and by the English Press with a greater reserve than any other Russian success in Central Asia. Not that this tranquil bearing was a symptom of indifference to the accomplished fact; on the contrary, it is most probable that the reserve in the tone of the notes and articles was actually a consequence of the acknowledgment of its gravity. Now after the lapse of several years, while studying the measures which England has of late adopted in the East, we may judge of the impression produced in that country by the Russian establishment at the lower course of the Murghab and by the events which have followed. The Liberals and Conservatives have forgotten their differences on the platform of the defence of India. The Ministry of Mr. Gladstone hastened to admit the error it committed in stopping the construction of the road from the Indus to Quetta, which had been begun by Lord Lytton, and issued orders for the immediate prosecution of the work with all possible haste. The general plan of action was afterwards developed by the Conservatives, and it is being carried into execution up to the present time. Although the attempt to shake the Russian prestige, which was made at the time of the Afghan delimitation, turned to the injury of England, yet that failure had not the effect of slackening the energies of the Indian Government. The activity of that Government expressed itself in a determined course in Cashmere to extend its influence to the head waters of the Oxus, in a more active policy in (*sic*) Afghanistan and Persia, and more particularly in the strengthening of the north-west frontier of India. As regards the latter, there is an endeavour to maintain secrecy, yet the works which have been accomplished enable us, at the present time, to form a certain opinion as to the objects which are pursued. As regards action in the event of a rupture with Russia, not only is there nothing

determined upon, but on the contrary, there exist two diametrically opposite views; the majority of Indian Generals hold to the opinion that it is necessary to advance through Afghanistan to meet Russia, calculating upon England for support and reinforcement, and for the maintenance of communications with the base. In England, on the other hand, there is a prevalent conviction of the impossibility of operating with a large Anglo-Indian force at any considerable distance from the base. English strategists would leave to Russia the difficulty of advancing through Afghanistan, and with Lord Wolseley at their head, they anticipate great advantages from an attack on Russia in Armenia, in co-operation with Turkey, or in conjunction with other powers in some other quarter. It will in all probability depend upon circumstances for the one or the other opinion to carry the day at the critical moment, but, for the present, the India party has prevailed, insomuch as the previously adopted view of the Indus as a first line of defence has been totally abandoned.

In the south the entire system of defence has for its object the affording of the means to the Anglo-Indian Army to meet an advancing power at a bifurcation of the roads leading from Southern Afghanistan to the Indus, *i.e.*, at Candahar. As regards the north the matter is not yet clear, but even in that direction there is evidently an inclination to fortify some one point as far to the west as may be possible. The occupation of Candahar would signify a complete rupture with Afghanistan, and seeing that it is most important to England to avoid this, all attention at present is directed to Quetta, in the south, as the most convenient point on the line of route to Candahar. More or less important works are being everywhere conducted along the other stretches of the Anglo-Indian frontier.

The following accounts (of these sections of the frontier) are drawn up from official reports and from articles in Anglo-Indian papers for the period 1884 to 1889. Some of these articles appeared over the names of recognised authorities on Indian affairs, and those which appeared anonymously are also of importance, because the correspondents are nearly always officers who take part in expeditions, and in the construction of roads and fortifications.

The communications of the brothers Yate (Lieutenant-Colonel and Lieutenant), written during the Afghan delimitation are very well known; Captain Drummond, who likewise took part in that delimitation, acted as correspondent for the Civil and Military Gazette at the same time. The reliability of those communications is established by a comparison with the official reports which they serve to amplify and elucidate.

PART I.

THE SIND-PISHIN RAILWAY.

History of the Construction of the Road.

The construction of the road from the Indus to Quetta affords a striking example of the effect produced on the whole of the Government of India by the struggle between Parliamentary parties in England, and of the consequent waverings and inconsistencies.

The first decision as to laying a line of rails from Ruk (Rohri) to Sibi was arrived at on the 11th September, 1879, under the influence of a panic produced in England by the murder of Cavagnari. A gauge of 5 feet 6 inches was adopted, and the sleepers were to be laid on the surface without ballast. Nine days later a fresh order was issued "to cut a wheel road from the terminal point of the broad gauge line over the Bolan Pass to Quetta and Pishin, if possible, and on this road to lay a 2-foot railway to be worked by steam." 5,000,000 rupees were to be devoted to the section from Ruk to Sibi, and Lord Lytton hastened to order out from England, sleepers, rails, and rolling stock to the value of £570,000. In the month of December of the same year, Sir Richard Temple, superintending the construction of the railway, proposed to conduct the road northwards from Sibi, not over the Bolan, but through Harnai, because of the greater facilities in the latter direction. This was approved, and in June, 1880, traffic was commenced over the section from the Indus to the Mari hills, north of Sibi. The works in the Nari River valley were actively proceeded with; 100 miles of road to the Quetta plateau were almost ready, and a survey was pushed 50 miles towards Khwaja-Amran. At this time the Conservative Ministry fell in England, and Gladstone came again into power. Lord Hartington, as Secretary of State for India, sanctioned the continuation of the survey towards Khwaja-Amran and Candahar, but on the understanding that no work was to be undertaken in those directions without orders from London.

In October, 1880, the Viceroy, Lord Ripon, telegraphed: "We have determined to lay down a railway only as far as Gulistan-Karez, continuing a broad gauge all the way. Order 50 miles rails, binders (?) and sleepers of ordinary broad gauge type and 20 light locomotives." In reply, an enquiry from Lord Hartington as to the state of the works, the Viceroy said, "The line may be considered as completed, with temporary

bridges to the foot of the Bolan and the Nari Gorge, total length, 165 miles. Permanent bridges and ballasting of the line is being proceeded with. From the Nari Gorge to Spintanghi for 30 miles, the earthworks are more or less finished, the bridges are not begun, but the supports (?) have been taken to Sibi. The labourers' cart road from Spintanghi is complete all the way, excepting two miles through Chappar Defile. Railway work over this extent is only planned out. Further, in the direction of Gulistan, nothing is yet done, but it is known that work in that direction is easy. Up to the close of 1879-80 the expenditure has been nine millions of rupees; the estimate for 1880-81 is 16 millions, most of which has already been spent. The probable requirement is 15 millions, or altogether from the Indus to Gulistan about 40 millions of rupees. This amount includes orders from England; £600,000 must also be deducted as paid for narrow gauge material, which, at the present time, may be used in some other place."

The continuation of the work was not sanctioned, and during the course of nearly four years, from October 1880 to the Russian occupation of Merv, nothing was done, either in continuing the line northwards from Nari or in improving the road over the Bolan. A portion of the material was used for other lines, the work which had been completed was abandoned.

It is difficult to determine with accuracy the cost of this cessation of the work, seeing that no detailed report was published; but in the estimates of 1881, among items of military expenditure a sum of five and a half millions of rupees was placed against the account of the unfinished work of the Candahar Railway.

The occupation of Merv by the Russian troops induced the Liberal Cabinet to alter their views, and on the 24th April, 1884, Lord Kimberley telegraphed to the Viceroy that the Government had determined to go on with the construction of the railway from Sibi to Quetta, and he requested that necessary measures should accordingly be forthwith adopted. The Viceroy replied that everything would be done to finish the line so soon as conditions of climate and local circumstances permitted, and he at the same time asked for approval for laying a branch line from Bostan to Shebo, which was at once granted. Materials for bridges and for surface works were ordered from England by telegraph.

The estimated cost of the Sind-Pishin Railway (through Harnai) was Rupees 26,525,000, distributed as follows:—

1883-4	..	..	..	1,250,000
1884-5	..	..	..	7,400,000
1885-6	..	..	..	8,500,000
1886-7	..	..	..	7,500,000
1887-8	..	..	..	1,875,000
			Total	26,525,000

It was contemplated that the line to Shebo would be finished by 1887-8. In view of the political complications towards the close of 1884 and in the beginning of 1885, this was held to be too long a period, and it was therefore determined to improve the communications with Quetta, also over the Bolan Pass, while proceeding with the work through Harnai. The Viceroy proposed in this direction to continue the line to Mach, from that point to make a light road of seven miles to the summit of the Pass and finally from there to continue the broad gauge to Quetta. This suggestion was made immediately after the action at Dash-Kepri, and Gladstone's Cabinet hastened to sanction the entire project. The requisite material was sent from England without delay. Notwithstanding the hurry the work proceeded slowly, principally owing to the insalubrious climate of the locality in which the labourers died by thousands of fevers and cholera. This was accompanied by frequent stoppages of the work, and by destructions of completed works by deluges.

On the 14th of March, 1887, the laying of the main line (through Harnai), which was simultaneously commenced from Sibi and Quetta, was completed, and the first train passed over the whole line. With breaks of long intervals, in consequence of damage by floods, this communication goes on to the present time, albeit it is attended with great difficulties owing to the abrupt curves allowed on the line.

With a view to removing this drawback, surveys were made in 1889 to reduce these curves from 1 in 40 to 1 in 60 between Sibi and Kach, with the exception of the Chappar Defile. These surveys have been completed, but it has not yet been determined whether the necessary works are to be undertaken.

On the Bolan Line the broad gauge was laid as far as Hirok, on the 19th November, 1885; the line was opened for goods traffic as far as Mach, on the 24th April, 1886. The narrow gauge line of one metre from Hirok to Darwaza-Kotal was finished on the 7th March, 1886, and on the 6th August of the same year the broad gauge was completed to Quetta.

The Bolan branch was laid mostly along the bed of the river, and was consequently of a temporary kind. In January, 1886, and again in 1887, two surveys were made in search of permanent direction; as a result of the last of these surveys the narrow gauge line was reconstructed in that year. As regards the section south of Hirok no resolution has yet been arrived at. The surveys of 1887 have shown that instead of improving the line through the Bolan Valley and the Khundilani Defile, it will be more advantageous, commencing from Mach, to proceed along the Escheru margin of the Lolachi plain and thence by tunnel under the Rindu Pass entering Mashkof Valley and emerging on the Nari River, within four miles of Sibi. This makes a circuit of 45 miles, with curves of not more than 1 to 40, and with a minimum of 815 feet radius. The cost is estimated at six and a half millions of rupees.

In 1888 surveys were made with a view to straightening the line between Kirta and Pir-Chauki ; this straightening, besides shortening the line by several miles, would have the advantage of placing the Bolan River at a greater distance, thus safeguarding the new line against the effects of floods.

Up to the present time, however, no work has been undertaken in any one of these surveyed directions.

Surveys for a continuation of the main line towards Candahar were sanctioned in May, 1885. Instructions were given for a survey of the whole of the Khwaja-Amran Range, from the Kojak Pass to Gwaja, with a view to the discovery of the best direction for crossing it or for a détour towards Nushki. The Commission which was appointed to enquire into the preliminaries of this survey resolved upon fresh surveys in three directions:—

1. From Kila-Abdulla over the Kojak to some point below Chaman, from which the line might be continued to Candahar without abrupt curves.

2. Between the same terminal points through the Sunzal Ravine.

3. From Gulistan over the Gwaja Pass to a point on the western declivity at an elevation of about 4,500 feet above sea-level.

The unsuitableness of Sunzal became at once apparent, and on the conclusion of the survey the Kojak Pass was pronounced to be the most practicable; the length of the tunnel was calculated to be 12,400 feet, the curves on the line not more than 1 to 40, and the radius not less than 819 feet.

This last direction was approved on the 23rd November, 1887, by telegraph, and on the 8th of December of the same year, it was determined to make a temporary road over the Pass against the time of the construction (of the line).

This determination was one of very great importance, in as much as it put an end for once and for ever to all hesitations in respect of the selection of the further direction of the Sind-Pishin Road.

The direction to Candahar has been thus finally adopted and at the same time the direction to Herat through Nushki Rudbar, and along the bank of the Fara-Rud, which had formerly not a few advocates, has been finally abandoned, Tunnelling was commenced immediately on the receipt of this resolution, and it was expected that the tunnel would be open at the close of the year 1890.

The Amir Abdur Rahman was very hostile to the projects for the construction of a railway, and more particularly to that of its continuation over the Khwaja-Amran to Chaman; he long insisted that the water parting constituted the frontier of Afghanistan, and it was only owing to internal complications that he gave his consent to a continuation of the line to New Chaman. The English were not successful in their repeated efforts to obtain the Amir's consent to a railway to Candahar,

and they had to satisfy themselves with accumulating all the material necessary for such a continuation at the terminal point of their line. They have calculated that when the necessity arises, the remaining 65 miles to Candahar can be constructed in a couple of months.

Besides the above-mentioned works, at the instance of the Military Authorities in September, 1887, surveys were conducted for a railway from Quettah to a point between Kach and Fuller's Camp beyond the Takatu Ridge. The locality there is full of difficulties and the construction of a railway would be very costly.

The cost of the line from Sibi to Quetta by the Bolan Pass was included in the expenses of the Afghan war, and the cost of the road from Sibi through Harnai to Kila-Abdulla and of the branch line from Bostan to Quetta as shewn in the Official Report on Indian Railways for 1888-89, was Rupees 45,300,000. Considering local conditions, this might not be regarded as a very extravagant amount, supposing the railway had been soundly laid with gradual inclines and curves; but, notwithstanding abundance of time, it was laid upon unsatisfactory surveys; the gradients over a considerable extent are steep, the radius of the curves is too small. All this renders the working difficult; notwithstanding many reconstructions floods still continue to hinder the traffic. Had the work been more regularly conducted from the beginning without waverings, changes, and reconstructions, a more durable double line and a much shorter one through the Bolan, with graduating curves and deflections, might have been completed for a sum incomparably smaller than that which was actually expended.

Description of the Main Line of the Sind-Pishin Railway.

The Sind-Pishin Railway runs partly through British territory and partly through that of Kelat. At Jacobabad it passes out of the first into the last named where England exercises a police surveillance over a zone extending 200 feet on each side of the railway. Not far from Sibi it enters the territory ceded by Afghanistan under the Treaty of Gandamak, and known but a short time ago as the "ceded districts" of Sibi and Pishin, but included now within the British possessions under the name of British Baluchistan. At Quetta the road is again in the dominions of the Khan of Kelat, but this locality is under the immediate authority of the British Governor of British Baluchistan. Another Khan is in receipt of a certain stipend from the English Government in return for waiving his rights.

The road from the Indus to Quetta, as at first named the "Candahar State Railway," but now, in order probably not to irritate the Amir, the name is changed. In April, 1887, a

resolution was passed to call the line through Harnai and Bolan, with the extension to Kila-Abdulla, the Sind-Pishin section of the North Western State Railways. The main line is held to be that which begins at the Ruk Station of the railway from Karachi to Lahore, and passing through Jacobabad, Sibi, Harnai, Bostan, Kila-Abdulla, goes on to Chaman on the western side of the Khwaja-Amran Range. The line from Sibi through the Bolan and through Quetta to Bostan, 122 miles in length, is called the Quetta Loop.

Owing to the nature of the locality traversed, the railway from the Indus to Quetta was one of the most difficult undertakings. It suffices to say that, starting from the Indus at an elevation of about 160 feet above sea-level, and passing through Sibi, which is only 700 feet, it traverses the Chappar Defile over an elevation of 3,500 feet, whilst the highest point from the Harnai Valley to the Plain of Pishin is equal to 6,500 feet. The significance of these figures becomes more apparent from a comparison with the data of other lines. The highest point on the way over the Brenner is 4,600, that of the Mont Cenis Tunnel is 4,270, and St. Gothard is 3,800 feet above the sea. In these circumstances the connection of Quetta with the Indus was not so easy a matter, and we cannot be surprised at the hesitation of the English Government which postponed the construction of such an important and difficult line of rail until the last critical moment when the sense of the natural obstacles was emphasised by the call for promptness.

Climatic conditions and the lack of labourers served likewise to impede the work. The terrible summer heats in the low lands, and the excessive cold on the highlands limit the period of labour in those localities to six months in the year, but in the construction of the Sind-Pishin Railway it was necessary to work all the year round. There were no labouring people of the localities who were accustomed to the climate. Labourers had to be brought from India and even miners from England, for in all-round work, even if they cost five times as much, English workmen are to be preferred to natives. In avoidance of the heat in the summer, work which could be done by night was carried on by electric light, yet the labourers and employés suffered dreadfully; gangs of platelayers were substituted every month by fresh men from India as the others died off from fever, scurvy, or dysentery. The bridge builders were twice relieved in the course of four months. In 1885 cholera raged in the Bolan Pass to such an extent, that, notwithstanding the urgency of the case, the works had to be stopped for two months, the labourers having fled. At Mangi and Kach the locality is so unhealthy, notwithstanding the elevation, that the same epidemics broke out there which prevailed in the lowlands. Nor was it better in the winter; water froze in the reservoirs and in the tenders of the locomotives, the workmen suffered from the winds and snowstorms. Regardless of this, 3,500 men worked throughout the winter of 1885-6 in the tunnels of the Chappar

Defile, and in the winter of 1886-7 the laying of the road and the erection of bridges went on at an elevation of 5,500 feet above sea-level with breaks of only a few days at a time when the violence of the wind and of the snow storms rendered work quite impossible.

So soon as the works were commenced sappers were placed on the line for its protection as well as for tunnelling. Four companies of Bengal and one of Bombay Sappers were stationed at Mangi, one at Gharkai, and one company of Madras Pioneers at Kach. In Shahrig there was a permanent post of infantry and cavalry, and, therefore, military labourers were not employed there.

The final surveys of the line in 1884 led to great alterations of the original project drawn up during the war of 1879-80.

Owing to urgency a very unsatisfactory system of bridge building had been adopted. Previous to the elaboration of the project, supports had been ordered from England for spans of 20, 40, 100, and 150 feet, which the builders had to adapt to their uses. As it could not be forseen how many of these supports would be needed, the spans of the bridges were not considered with reference to the character of the rivers, but they were distributed in consideration of the material available. This is one of the main reasons why the bridges broke down and why they continue to break down up to the present.

The buttresses and piers of the bridges were built up with blocks of cement, in those parts where quarrying was impossible.

Owing to an absence of lateral cart roads the laying of the rails could be carried on only from one end. No bulky or heavy materials could be transported in advance, and the bridge supports could be set up only when the rails were laid up to the spot where they were needed. In order to obviate prolonged stoppages of the works, temporary bridges were thrown over the rivers, but these were constantly being washed away as well as the scaffolding made for the erection of the spans for the permanent bridges.

In consequence of all these difficulties the railway was opened only in the autumn of 1887, but in an incomplete form. The progress of the work may be judged from the following leading dates: on the 1st April, 1886, the rails reached the 159th mile, with only one deflection at the Babar-Kach Tunnel; on the 8th of May the 175th mile, with one deflection at the Gurmai Bridge; on the 1st of July the 191st mile without any deflections, and on the 1st of August the 201st mile; on the 1st of November the rails were laid on the 224th mile but with many deflections in the valley of the Mangi River near the building bridges. By the 15th of December a permanent way was laid over the whole extent from Sibi to Chappar Valley and the rails reached the large bridge at the 227th mile. Here it was impossible to make a détour or a temporary road and the locomotive passed further only after the setting up of the

framework of the permanent bridge, viz.: on the 16th February, 1887. On the 10th of March, the locomotive was on the western side of the bridge at Mangi, the 229th mile. On the night of the 14th of March at the 231st mile the rails joined those which had been laid from the Quetta End and the first train passed over the entire line.

On the Bostan-Gulistan Loop the work was commenced in April, 1886, and the first train reached Kila-Abdulla on the 10th February, 1887.

The main line of the Sind-Pishin Railway, over its entire extent from Ruk to Gulistan is a single line; the smallest radius allowed is 600 feet and the extreme curvature 1 to 45.

For the protection of the stations approached at a curvature of 1 to 45 there are catch sidings.

For the first 37 miles from Ruk Station to Jacobabad the line runs through cultivated fields; farther, as far as Sibi, 133rd mile, it traverses a desert, although at no great distance to the west there are well cultivated lands with abundant irrigation; but the rivers there frequently rise above their banks and the irrigation canals would have necessitated so many bridges that, in view of the urgency to complete this section in 1879, the direction across the desert was considered preferable, seeing at the same time that the desert offered no difficulties; here the track was laid at the rate of two miles per diem, and once it reached three miles; it was laid over a slight embankment, averaging about two feet high.

In the valley of the Mangi from Sunerai to Dirgi and in the Pishin Valley the line again runs through cultivated lands.

Commencing at Ruk, which is 315 miles from Kurrachee, the distances between the stations on the Main Sind-Pishin Line are as follows:—

	Miles.		Miles.
Ruk	0	Sunerai	184
Shikapur	11	Harnai	191
Sultan Kot	19	Nakis	198
Humaon	24	Shahrig	207
Jacobabad	37	Khash	215
Jutput	45	Dirgi	224
Templedera	59	Mangi	229
Nuttal	75	Mudgorge	236
Bell Put	92	Kach	247
Lindsay	109	Fuller's Camp	251
Mitri	121	Khanai	258
Sibi	133	Bostan	267
Nari	141	Yaru-Karez	275
Tanduri	148	Sirinan	282
Babar-Kach	155	Said-Hamid	290
Kuchali	162	Gulistan-Karez	298
Daludjal	170	Kila-Abdulla	306
Spintanghi	175		

The difficult parts of the line begin from Sibi, or more correctly from Nari.

Nari Section, from Sibi to Baber-Kach (from the 133rd to the 155th mile).

From Nari Station the line runs along the bank of the river at the foot of high precipitous cliffs; as a safeguard against frequent floods it was found necessary to shore, with a wall 25 to 30 feet high, laying deeply into the clay. Penetrating by a tunnel through the nearest ridge the line passes from side to side of the river Nari, and along its bank, crossing it six times. The six bridges on this section constitute four spans of 40 feet, six of 100 feet and 23 of 150 feet. One of these is at Tandri, two are at Kelat-i-Kila and three between this (later) point and Babar-Kach Station. The tunnel at the last named place is faced (plastered, tiled) throughout its length because of the friable nature of the conglomerate. The exit from this tunnel was at first too close to the river, it was therefore widened in order to bring the line nearer to the hill side; nevertheless the river current presses so strongly against the bank at this part that it was found impossible to lay the line over a dam, therefore a viaduct was raised on three spans of 40 feet; the viaduct is not a high one, but the laying of the foundations was a very difficult matter, the depth of water being very considerable, 22 feet. A temporary by-road was made along the bed of the river while the tunnel and viaduct were in progress.

Gandakin-daf Section, from Babar-Kach to Zindagi-Ab (from 155th to 165th mile).

The tunnel at Gandakin is 540 feet long, passing through very soft formation; it is also faced throughout; during the work of tunnelling there were constant slips which several times broke down the strong wooden props.

The bridge to the south of the Gandakin tunnel has two spans of 150 feet each and three of 40 feet; the buttresses are about 70 feet high. The bridge north of the tunnel is of one span of 150 feet and one of 100 feet.

The earthworks between Gandakin and Kuchali are very considerable.

On approaching Kuchali Station the line again enters a tunnel. This was one of the most difficult works on the line. The formation is of such a decomposed nature that it constantly slipped, forming an arch over the tunnel 50 to 60 feet in height, gigantic masses of stone, several tons in weight, falling and breaking away the strongest facings. The labourers refused to go on with the work. It was found necessary to bring down the top with dynamite; the loose earth was removed with the cavity thus produced to erect the arches and to cover them with earth. This work was done in extreme haste because the earth crumbled down the slopes of the piles. Rubble at the same time came tumbling down the slopes before the mouth of the tunnel and these likewise had to be covered. In con-

sequence of this the length of the tunnel grew to 600 feet, *i.e.*, twice its original length. During these works it was necessary to make a by-way here of 2½ miles circuit.

On emerging from the tunnel, at the Kuchali Station, the line runs across the Gandakin River over a bridge of three spans of 100 feet each.

Spintangi Section, from Zindaghi-Ab to a point near Sunerai (from 165th to 180th mile).

At Zindaghi-Ab, there are two bridges. The second is of 5 spans of 20 feet each. The laying of the road was delayed by the erection of the supports of these bridges, because there was no possibility of making a by-road in that part.

At the Daludjal Station there is a deep gulley of 1,600 feet.

At Gurmai, another bridge of two spans of 150 feet each.

Northwards from the tunnel at Spintanghi the line is subject to damage by floods for many miles. The embankments of the rivers and the shoring of the bed of the road entailed much stone and fascine work. In places it was found requisite to build up wire towers filled with stones.

Harnai Section, from a point near Sunerai to Nakis (from 180th to 198th mile).

At Sunerai, very extensive drainage operations had to be undertaken for supporting the slopes of the raised way on marshy ground.

The main bridges are at Sunerai and Harnai, but there is one other bridge (with one span of 150 feet) and many small bridges over irrigation canals.

Shahrig Section, from Nakis to Dirgi (from the 198th to the 224th mile).

At only a little distance from Nakis, the line enters the valley of a very rapid stream, and, ascending this, it emerges on the Shahrig Plateau at the little village of Pungi. In order to reduce the curvatures the line is developed over the whole breadth of the valley, and passes several times from one bank of the stream to the other; by this means the curvature has been kept within 1 to 45. The earth works are very considerable; here also are the most difficult bridges of the section, two of a single span each of 100 feet, and two of two spans of 40 feet each, 60 feet above the river bed. They are all in a curve of 1 to 45. A zigzag by-way, with a curve of 1 to 25, was constructed during the works here for the supply of materials.

A little below Shahrig, the line traverses a low-lying swamp; originally the line was laid through a hollow, but, owing to difficulties with regard to drainage, the profile was altered, and it was laid on an embankment.

Between a point 5 miles above Shahrig and Dirgi, there are a great many little and several large bridges, one at Khash of four spans of 100 feet each, and one of a single span of 100 feet. The laying of the foundations for the bridge at Khash was attended by great difficulties, consequent upon the unreliable bottom of the river bed.

Chappar Rift Section, from a point 6 miles west of Mangi (from the 224th to the 235th mile).

Chappar Rift (Chappar Defile) is a mountain defile about 2½ miles in length. A torrent sweeps through it, bounding over big stones, and at the lower defile turns almost at a right angle, rushing to Shahrig. At both ends of the defile, this torrent breaks through narrow gorges, in some places only a few feet wide, with precipitous overhanging cliffs to 200 feet high. The central defile between these clefts is an oval, walled in by blocks of stone and schist. The natural curve of the torrent bed is 1 to 20, and, since the extreme bend of the road is 1 to 45, it was necessary to mount to a considerable elevation on approaching the lower end. In view of the abrupt sides of the Chappar Mountains, this was a matter of great difficulty; the formation is soft clay. In order to reach the required elevation at the lower gorge or cleft, the line mounts at the limital curve on the opposite slope of the valley, the direction of which, as already observed, is at right angles with the defile.

Reaching the margin, the line turns, and approaches the defile through a tunnel in the soft formation of the mountains; it then crosses the lower gorge over a high bridge and through a tunnel enters the oval, which it traverses in hollows and on embankments. The most difficult work was experienced at the upper end of the defile; first is a tunnel 1,251 feet in length, then a very difficult excavation in the rocks, and finally another tunnel 437 feet long, after which the line emerges into the upper valley at Mangi Post.

Besides very considerable excavations and embankments on the approach to the valley from Dirgi, there are a high viaduct and two tunnels of very small depth (underground), and therefore called Karez No. 1 and Karez No. 2. In an excavation of 82 feet near the lower Karez, the slopes are continually giving way, and this requires constant attention. In Karez No. 1, length 817 feet, the work was performed by means of eight shafts, sunk to a depth, taken altogether, of 66 feet; in Karez No. 2, length 1,400 feet, there were twelve shafts of a total depth of 127 feet.

After this (at the 227th mile), there is a high bridge across the lower gorge, the "Louise Margaret Bridge." It is of two spans, each 150 feet, with a central space, closed *with forty pound ribs* (?). The highest of the buttresses is 80 feet, although the bottom of the cleft, through which the torrent rushes, is about 300 feet below the road bed.

The tunnel at the exit from the lower gorge is 542 feet long; it was commenced from both sides with the aid of two side-ways, measuring together 160 feet in length.

The excavations in the oval were renewed several times, because of the sliding pieces of detached rock; they were finally turned into tunnels, and covered with earth.

The first of the two tunnels (1,251 feet long), at the point of emergence on Mangi Pul, was constructed with the aid of seven side-ways, measuring altogether 302 feet in length.

Between this and the next tunnel is a short but very difficult excavation.

The last tunnel of this section (437 feet long) had to be worked from both sides (without side-ways).

At Mangi (229½th mile) the bridge is of two spans of 150 feet each.

Over the 6 miles from Mangi to the west there are no difficult works.

Kach Section, from Mangi Point 6 miles west from Gharkai (from the 235th to the 254½th mile).

In consequence of the impossibility of laying down side-ways and of the absence of all roads for the transport of material, the line over this section, as in the Chappar Rift Section, was constructed from only one end; the girders (? joists) and even scaffolding could only be put up when the rails were laid up to the sites for the bridges.

Midway between Mangi and Kach is a narrow valley with a marshy bottom of liquid clay, called for that reason Mud Gorge. Although, upon final examination, it was found possible to dispense with bridges, according to the original projects, yet a great deal of difficult labour was involved; there is an embankment 120 feet high, and an excavation 75 feet deep, the latter is in such a swamp that it was found necessary to convert it into a tunnel, covering it with earth. This was the most troublesome piece of work on the whole line.

Within 3 miles of Kach the line passes over a bridge of a single span of 150 feet, and three spans of 40 feet, standing 100 feet above the level of the river.

Beyond Kach the line ascends a pass of 6,500 feet above sea-level, and then descends to the Pishin Plateau to Gharkai. The descent is very steep, and the development of the line for the lessening of the gradients* was carried out under great difficulties. In some parts it was found necessary to adopt spiral tunnels (the first of the kind in India, we believe), *i.e.*, such of which the axis in the plan describes a complete circle. The gradients in the descent are almost uninterruptedly 1 to 45 and the radii of the *curves* 600 feet.

The work of laying the rails there was considerably delayed by the construction of numerous 40-foot bridges on these steep gradients.

Bostan Section, from Gharkai to Bostan, where the loop line leaves for Quetta (from the 254½th mile to the 267th mile).

Nearly over the whole of this section the line is laid without a break on an embankment of 5-6 feet; it presents no technical difficulties.

Gulistan Section, from Bostan to Gulistan-Karez (from the 267th to the 298th mile).

Originally this section was 3½ miles longer, but that length

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* I presume it should be gradient throughout where I have written curve or curvature.—P.M.L.

has been abandoned, and at the 298th mile the line turns to Kila-Abdulla.

The works here were commenced only in April, 1886.

For the first two miles from Bostan the line runs on considerable embankments, reaching a height of 35 feet; farther on the earthworks are easier.

The line crosses the Kakar-Lora River over a high bridge of one span of 150 feet and two of 40 feet.

The bridge across the Pishin-Lora River has three central spans of 100 feet and two end spans of 40 feet. The buttresses rest on foundations of stone. The work was commenced on the 20th June, 1887, and finished in November of the same year. The bridge is made available for wheel traffic. During its construction a side way was made in a deep excavation, for temporary use.

Kila-Abdulla Section, from Gulistan to Kila-Abdulla (from the 296th to the 306th mile).

Originally this section terminated on the plain short of the hills, within two miles of Kila-Abdulla Post. When the construction of the Kojak Tunnel was authorised it was determined to relay the line from the fourth mile from Gulistan and to conduct it up to the Post (Kila-Abdulla).

Here there are no works of significance.

Chaman Section, from Kila-Abdulla to New Chaman (within six miles west of Fort Chaman).

On the 23rd of November, 1887, a telegram was received sanctioning the construction of the Chaman Section, and the work was immediately begun. But miners and electro-technologists for the tunnel work arrived from England only in March of the following year.

The Kojak Tunnel is the most difficult work on the whole line; it is 12,400 feet in length, and lies at an elevation of 6,200 feet above sea-level. The Khwaja-Amran Range, which separates the Pishin plateau from the Plain of Candahar, consists of a narrow chain of mountains with very abrupt declivities. Quetta lies at a height of 5,604 feet, Kila-Abdulla 5,618 feet. The highest point of the Kojak Pass is 7,208 feet, Chaman 5,500 feet, and Candahar 3,350 feet. The ascent is 2,000 feet over $9\frac{1}{2}$ miles from Pishin, and the descent to Chaman is 1,700 feet over $2\frac{1}{2}$ miles; the former military road here ran in zigzags. In laying the line it was not possible to dispense with a long tunnel, notwithstanding the steepness of the allowed gradients.

From Gulistan to Kila-Abdulla the line ascends very gradually at the foot of the mountains. At Kila-Abdulla it was necessary to build several bridges across the arms of the Sanzal river, and from these begins an ascent which grows gradually steeper, and for the most part attains the maximum adopted here of 1 to 40; the extreme radius is 819 feet. The opening of the tunnel is at the 9th mile from Kila-Abdulla, at

a point which formerly had no significance, which is now called Shelabagh.

From Kila-Abdulla it is a double line. The tunnel is also adapted for a double line, with very inconsiderable gradients most of the way; it is cut through solid clay, slate, and schist. It was begun at both ends, and from three intermediate shafts: No. 1 (east), 63 feet deep; No. 2 (west), 318 feet; and No. 3 (nearest to western exit), 281 feet.

During the summer months the mountain springs ran dry, so that water had to be brought to the eastern extremity of the works from Kila-Abdulla. Pumping was a source of great trouble in shaft No. 3 on the western side. On the 2nd March the labourers struck a very copious spring which rapidly flooded the gallery, the water rising 156 feet in the shaft. The labourers were removed to the western exit, from which to shaft No. 3 it was only 2,400 feet, of these a length of 2,000 feet was already complete at that time; on excavating the remaining 400 feet the water drained itself away down the natural slope of the tunnel westwards.

During these tunnel works materials were supplied to the western side by means of a "cable road" over the Kojak Pass and along the mountain slopes, laid at an angle of 45°. Trains were raised by means of a steam engine placed on the summit of the Pass. Besides fuel and material for the tunnel more than 16 miles of railway heading (?) for the Chaman Line was carried over this "cable road" in the beginning of 1889.

The western declivity of the Khwaja-Amran is more abrupt than the eastern side, therefore on emerging from the tunnel there are very considerable works; besides numerous, although not large bridges, there are three more tunnels, two of which are 750 feet each, and one 350 feet. But the gradient of 1 to 40 is nowhere exceeded. In projecting the passage over the Khwaja-Amran, it was determined to terminate it at a point from which the line might be laid farther without steep gradients to Candahar. Fort Chaman, situated on the slope of the mountain, did not meet this requirement, therefore the Commission, which was appointed to select the terminus, chose a site within seven miles to the north-west of the fort.

Looking down from the Kojak the locality beyond Chaman does not appear an attractive spectacle. Southwards as far as the eye can see, extends a sandy desert; the gravel plain between Chaman and Candahar is here and there broken by isolated limestone rocks. On the horizon are visible the mountains at the base of which lies Candahar. The distance to Candahar from the terminal station—New Chaman—is only 65 miles; over the whole of this extent there would be no work of any significance, and the line, in case of necessity, might be laid in a couple of months. As already observed, it is proposed to keep ready in store at the terminal station material for 100 miles of surface way.

Description of the Quetta Loop.

The entire length of this line is 122 miles.
The distances between the stations are as follows:—

	Miles.		Miles.
Sibi	0	Hirok	66
Brahim Baran	10	Dozan	69
Rindli	14	Darwaza Kotal ..	76
Pirchauki	19	Spezad	86
Khundalani	26	Siri-ab	95
Kirta	34	Quetta	101
Bibi Nani	46	Baleli	109
Ab-i-Gum	53	Kachlan	115
Mach	60	Bostan	122

When the construction of the line over the Bolan was authorized in March, 1885, the political situation required its speedy completion. At the same time it was absolutely necessary to keep the existing road open for traffic ; this line was for this reason laid a considerable way along the bed of the Bolan river, which, excepting where it runs through the defiles at Khundalani, Bibi-Nani and Mach, occupies very little of its bed, swelling only after a deluge of rain.

The limit of the gradient between Rindli and the 32nd mile was fixed at 1 to 50, and it is seldom reached. Farther, to Ab-i-Gum, there are short sections of 1 to 36. From Ab-i-Gum to Hirok there are two miles with 1 to 26 and about 11 miles of 1 to 30. The limit of the radius between Pirchauki and Hirok is equal to 800 feet.

On the 19th November, 1885, the broad gauge line reached Hirok, and 10 miles beyond, on the so-called Ghat Section, there was at first a line of 1 metre laid with a limited gradient of 1 to 24 and a radius of 200 feet. Besides the inconvenience of unloading and reloading, the traffic on this line was extremely difficult, and it was found necessary to reconstruct it. After a few fresh surveys in 1887 and 1888 it was substituted by a broad gauge laid on a high level above the bottom of the hollow, with limited gradients of 1 in 25 and a radius of 819 feet over the three miles where the limited gradient was adopted is laid a *notched* rail in the centre ; the Abt locomotives which travel over such a line can also pass on two rails over easier gradients. Over the remaining extent from Hirok to Darwaza-Kotal the gradients are from 1 in 30 to 1 in 40. The cost of this construction, inclusive of the central notched rail, was Rupees 1,550,000.

From Darwaza-Kotal to Quetta the line was from the first as a permanent road ; it passes over a smooth ground with inconsiderable works.

From Quetta to Bostan the locality is a plain surface, with small isolated hills bordered by mountains more or less distant.

Here, as also farther on to Gharkai, the line runs on an embankment of 5 to 6 feet. At Baleli the line passes through a tunnel of 125 feet in length in a calcareous spur, and the approach to the tunnel is through excavations in calcareous formations. The largest bridge over the Quetta-Lora River is of one span 120 feet and two spans of 40 feet.

The Working of the Line.

Although the laying of the rails in the Bolan Line was finished up to Quetta by the beginning of August, 1886, yet it was opened for goods traffic only on the 20th March of the following year, and for passenger traffic on the 1st April. In the month of August the line was damaged by floods so that it became necessary to push forward the opening of the main direction through Harnai, although there was not a little to be done on it. Since then, with the exception of stoppages from damages, traffic has been conducted on both the lines; but, seeing that on the main line from Sibi to Quetta the train takes a longer time than through Balin (*sic*), the post, passengers, and troops, when practicable, avail themselves of the latter line in preference.

On the main line one passenger train runs daily each way. According to the time table of November, 1889, the train leaves Ruk at 8.20 p.m., reaching Sibi at 5 o'clock in the morning, and Kila-Abdulla at 7.38 p.m., *i.e.*, taking 23 hours 18 minutes. From Kila-Abdulla the train starts at 6.30 a.m., reaching Sibi at 7.2 p.m., and Ruk at 5.22 a.m., *i.e.*, being 22 hours 52 minutes on the way. The distance from Ruk to Kila-Abdulla is 306 miles, therefore the average rate of speed of the passenger trains is about 13 miles or about 20 versts in the hour.

The cost of the journey from Ruk to Kila-Abdulla is, 1st class, 24 rupees, 2nd class, 12 rupees.

Another local train runs between Quetta and Bostan.

The goods traffic is very difficult in consequence of the steep gradients allowed.

As already observed, surveys were made in 1889 with a view to a reduction of the gradients of 1 in 40 to 1 in 60 between Sibi and Kach, excluding the Chappar Defile.

Traders and natives of all parts of India avail themselves readily of the road to Quetta, but the local Brahui nomads have not yet accustomed themselves to it and prefer their own old methods of locomotion. There are constant complaints in the papers of the high passenger and goods tariff on the Sind-Pishin Line, which is twice as high as that on the other portion of the North-Western system. Independently of the inconvenience experienced by the Quetta garrison, this circumstance injuriously affects the revenue of the railway, seeing that many caravans from Candahar avoid the line and proceed to Karachi through Kelat.

The capability of the Bolan Line may be judged from the

Freight Returns for 1885 and 1887, when the daily transport exceeded 600 and sometimes reached 700 tons. By running night trains this might be increased to 960 tons for the 24 hours. Over the narrow gauge section 300 tons of goods per day was transported, and with night trains 550 tons in 24 hours.

As regards its working the Sind-Pishin Railway labours under very unfavourable circumstances. The surveys for the line were very superficial, and in the undertaking of the construction very little was at first done to counteract the unfavourable local influences. In consequence of this, and notwithstanding the constant improvements, damages are perpetually occurring, and stoppages occur for weeks and even for months.

The Bolan Loop Line, where it is laid along the bed of the river, suffers serious injury on every occasion of a flood. When rains occur simultaneously in the basins of the several affluents of the Bolan the water sometimes rises 12 feet, washes away or damages the line over the whole of this extent, and demolishes the supports of the temporary bridges. Serious damages were occasioned in the autumn of 1887, when a length of 150 feet of roadway was washed clean away. Repairs are not very costly but they take a great deal of time, generally three or four weeks and even more, for they cannot be begun until the waters subside, and then there is the drawback of want of local labourers. Less extensive floods occurred in 1888. Very extensive damages were suffered again in the year 1889. In the beginning of July, although there had been no rain below Mach, the water coming from the Upper Bolan rose 12 feet at Khundalani, carrying everything before it. It became evident that the reconstruction of the section between Hirok and Darwaza-Kotál had been unsatisfactorily performed. The removal of the line to a higher level here did not save it from the effects of high water; several dams and a wall were injured in consequence of the defective protections to the foundations.

Nor is the main branch of the Sind-Pishin Line in a better condition, although it is considered to be a permanent line. The bridges, with small spans, suffer in particular. The width of the spans is not in dependance on the character of the rivers, but on the dimensions of the stays (girders), sent ready made from England, and the distribution of these has been prejudicial to the soundness of the railway. The large span bridges hold very well, whilst the floods are constantly destroying the supports of the smaller spans which block the rivers. Every year there are several such occurrences. In the beginning of July, 1889, the local downpours occasioned a flood between Shahrig and Spintanghi, which swept away seven bridges and damaged about 20 miles of the railway. As this happened simultaneously with the damages in the Bolan Pass, Quetta was completely cut off from India ; even the mails were delayed several days. Damages were done also near Kojak, where the station was flooded, and where the buttress of the bridge (of five spans of 20 feet) was destroyed by the high water. There

was a flood even in the desert between the Indus and Sibi, where such occurrences are very rare, which washed away the line between Nuttal Station and Bell Put.

No little trouble does it cost, too, to contend against the subsidences in Mud Gorge, and in many other places where some of the excavations had to be converted into tunnels and then covered.

Near Kojak earthquakes are very frequent; there were two in the course of a single month in the autumn of 1888 of such severity that fissures were produced in some of the buildings. In March, 1889, there were several shocks, but not very severe ones.

Judging by the damages to which the railway is subject, it might be imagined that there is an abundance of water along the line. But this is not actually the case. Most of these torrents, so formidable after heavy rains, run dry, and the supply of water to the stations on the main line, as well as those of the Quetta Loop, is attended with great difficulties. From Jacobabad to Sibi, *i.e.*, over an extent of 96 miles, there is no water whatever. At Bell Put an experiment was made with an Artesean well, but the water, which came in abundance, was salt and unfit for any use. At the stations on the main line there are reservoirs for 12,000 gallons (about 2,000 cubic feet) of water. The daily requirements at Harnai, Shahrig, and Bostan are calculated to be 100,000 gallons, and for each of the other stations 30,000 gallons. These works are not yet completed.

Between Bostan and Gulistan-Karez there is good water only at the last-named point, and at Yaru-Karez; at the other places it is of bad quality, and difficulties have been experienced in conducting it to stations.

The supply of water on the Bolan branch was also a matter of great difficulty; for example, throughout the whole of the Ghat Section water is found only in the Dozan Springs which lie two miles away from the line in a side valley.

The question of fuel is not fully decided at the present time, notwithstanding the energetic measures which have been adopted in the matter. A local supply of mineral fuel in place of expensive English coal would in the first place be a great economy, in the next place it would tend to the preservation of the forests, the destruction of which is one of the evils which accompany the European into whatever part of Asia he may penetrate.

At present the comparative cost of various kinds of fuel for 100 miles of labour is illustrated as follows:—

Patent fuel	54·23	Rupees.
Coal	51·14 to 57·4	„
Naphtha	36·8	„
Wood	15·8 to 30·	„

Production of steam power to 1 lb. of fuel:—

Patent fuel	7·71 lbs. water.
Coal	6·91 „
Naphtha	9·82 „

We find from this that naphtha is more profitable than coal but is more expensive than wood; but as regards the latter consideration the difference becomes smaller as wood rises in price from the destruction of the forests. This refers to other sections of the north-western lines; on the Sind-Pishin Section there is no wood at all at present.

In view of this costliness of imported fuel, it was determined, when the construction of railway was resolved upon, to institute a search for suitable local material and it has been already ascertained that there is coal and naphtha in the vicinity of the line. Coal has been discovered near the Khash Station, on the right bank of the Mangi River at a distance of from ½ to 1½ mile of the Sind-Pishin Railway. Five seams of from some inches to seven feet of coal at a great inclination have been discovered; but of these only one, the Khash seam, is workable, its average thickness is two feet. This seam has been traced eight miles from Kila Ali-Khan on the east, to Kila-Hakim-Khan on the west, situated on the 213½th and 221½th miles from Ruk.

Where the seam is regular its angle of inclination southwards is 43° to 52°, it has an intermediate layer of clay, 2 to 16 inches in thickness, the upper coal seam being 10 inches, and the lower one 16 inches.

The deposits between Kila Ali-Khan and Khash are worked by native contractors, and the coal is carried on asses to the stations. In 1888, 2,800 tons of coal were obtained, and during the first three months of 1889, 1,720 tons. About 100,000 tons can be easily obtained near Khash without engines, but it is at present proposed to draw only half that quantity from the ridge which lies half a mile from the station, where the seam is exposed for half a mile at an elevation of 4,502 feet above the sea and 405 feet above the level of the river.

At the present time the cost of the coals in the trucks is 11 rupees per ton, but with improved working this might be reduced to 9 rupees. At the nearest station (Shahrig) English coal brought by way of Kurrachee comes to 32 rupees.

Experiments have shown that the coal now obtained is suitable for locomotives on *horizontal portions of the line.* But seeing that nearly the entire line is one of ascents, and of great steepness, we can understand why up to the present the utilization of this coal has not become general, and this will be the case only in the event of a negative result of the exploration of the naphtha springs.

The existence of naphtha in many parts of Baluchistan is not open to doubt, but so far none of the explorations has given any favourable results. The best springs and those which afford the best prospect of success, are found to be those near Kathan in Baluchistan, about 40 miles direct east from Sibi Station. The first experiments were made in 1884–85, when *heavy* naphtha was found in very large quantities at various depths. The boring was exceedingly difficult, not only by reason of the numerous fissures near the surface, but also because of the glutinous nature

of the oil filling the cavities. Dense (heavy) naphtha is found in large quantities at a depth of 28 feet and farther at intervals of some tens of feet; it rises about 15 feet below the edge of the openings. The openings have now reached a depth of 600 to 800 feet.

Each of the openings made up to this time yield from 500 to 600 casks (of 35 gallons) per diem, *i.e.*, about 4,000 poods, so that one of the fissures alone is ample for the requirements of the Sind-Pishin Railway, which are estimated at 50,000 casks per annum.

The naphtha procured is very thick and glutinous: one gallon of it weighs 8½ lbs. English. It has a large admixture of earth, sulphuric acid and water; it has to undergo a process of straining to get rid of the earth, and of boiling to get out the sulphuric acid and the water; for the latter purpose the locomotives are provided with respective pipes through which the steam passes out of the engine, under these conditions naphtha can be advantageously utilised as fuel. In experiments with this new fuel no difficulties were experienced, notwithstanding the novelty of it to the engine drivers. The average consumption per mile of speed is 28 lbs. English. The adaptation of the engine to naphtha fuel costs, according to the system, from 500 to 860 rupees.

The earth saturated with naphtha, which is obtained after straining the oil, forms a mass impervious to water and serves for roofing, the same being done on the Trans-Caspian Railway with the "Kir," which is the upper layer of the naphtha hill near Bala-Ishem.

At *Kathan* there was at first a great lack of fresh water; this is at present met by a supply laid on by means of a 1½-inch pipe from the Vazi springs within 11 miles above Kathan in the Garh Valley. Owing to the distance of the springs (naphtha?) from the railway the drawing of the supply is attended with great difficulties. Kathan is from 1,400 to 1,500 above Sibi, therefore it was at first imagined that a conduit would serve; but experiments showed that the oil was too glutinous to run and that it could not be made to move without pumps. On the other hand a survey for a railway gave no satisfactory results, the locality being very broken and difficult and the construction would cost not less than 2,500,000 of rupees. A very convenient cart road has for these reasons been made from Babar-Kach Station to the springs and by means of 4½-inch piping and Wartington pumps a naphtha conduit will be laid from Kathan through the Chakar Defile to Kura-Daf over an extent of 10 miles. The laying of the pipes is, however, postponed until it shall have been ascertained that the supply of the naphtha will last some time. This question will be settled by the constant pumping now going on to obtain 3,000,000 of gallons for the works in the Kojak Tunnel; this supply is taken to Babar-Kach on camels. Finally, the amount of the outlay, which will be required for the connection of the springs with the railway, is

contingent on the discovery of a more liquid oil at Kathan. The superintendents of the works are in expectation of finding it at a depth of from 1,000 to 1,200 feet; the boring instruments were brought from Canada in 1877; up to this time, however, nothing positive is known, the first four openings at Kathan were made, one near the other and a fifth at a distance of 1 mile from the others; it was intended to sink one to 2,500 if liquid oil were not found sooner.

At the very commencement of the works at Kathan many of the engineers dwelt on the necessity of ascertaining whether naphtha was not to be found nearer the railway; three years' labour having led to no positive results respecting the Kathan springs, the advisability of prosecuting the proposed search became evident, and in the autumn of 1888 the fissure for deep boring was abandoned (at a depth of 736 feet) and orders were given to send the instruments to Shoran, in the territories of the Khan of Kelat, where a preliminary survey had raised some expectations.

But at this time gratifying information was received concerning the locality near the Kirta Station in the Bolan Pass. In place of works at Shoran, an opening was made on the first mile from the railway at the foot of the hills on the western side of the valley. The first 18 feet were through gravel, then 180 feet of eocene clay schist. At a depth of about 180 feet below the surface a sulphur spring was struck which welled up with a quantity of gas and clots of thick glutinous oil of the same kind as that at Kathan. In the end of March, 1889, at a depth of 360 feet, under a thin crust of limestone, were found good signs of naphtha. There is no further information concerning the progress of this work.

Searches for naphtha in Northern India are not only undertaken near the Sind-Pishin Railway, but in other places as well. Thus, in the spring of 1888, an American Company (Mr. Noble), with a capital of 250,000 rupees, received a concession for the exclusive right of boring for naphtha in Northern Punjab; in places where naphtha is discovered the concessionaires will be granted five plots of 10,000 acres each of naphtha producing land, to be selected by themselves in return for which they will give up to the Government five per cent. of the raw product obtained. The Government accords to them special privileges in the transport of naphtha and kerosine over State railways, binds itself to purchase of them a portion of those products as well as lubricating oils at the price paid for castor oil which is at present used for lubrication. The first opening was made 30 miles west of Rawal Pindi, at Fatehjang, where the oil now, through pressure from below, oozes out to the surface.

The hardships of life on the railway are very great and for the English in India to be sent there is equivalent to transporation for crime, although under altered conditions, the effects of the bad climate are somewhat modified. The stations

are all of the ordinary splendid Indian type. The stations at Yaru-Karez, Sirinan, Said-Hamid, and Gulistan-Karez in the Pishin Valley, the most unhealthy localities, as well as the barracks for troops are particularly grand. At many of the stations there is still a great want of good water. At Quetta itself the aqueduct has only recently been completed. The greatest sufferers are the new comers, among whom the mortality is very great. Among the lower class of employés and among the soldiers drunkenness is very prevalent. All complain of the cost of living, which is mainly owing to the high railway tariff. In the Quetta bazar the price of wood is as high as 50 copecks per pud.

As regards the fortifications in the Quetta and Pishin Valleys, and on the Kojak Pass very little is known. In the year 1887 a notice appeared in the *Times* concerning a projected fortified camp at Said-Hamid, and the following information was given :—

"The position chosen is a strong one; the Pishin-Lora flows along its western front while the Surkhab and Kaker-Lora with excessively high and abrupt banks and muddy beds protect it in the rear. In the direction of the Khwaja-Amran the immediate neighbourhood affords no cover for the position against attack, and beyond, although it appears smooth, the ground is really broken so that cavalry could not operate over it. To the south the country is practically impassable. An advancing enemy crossing the mountains would concentrate his forces at either Kila-Abdulla or Gulistan, *i.e.*, not nearer than 12 miles from Said-Hamid. At each of the points there will be strong forts connected by a railway with a central position at Said-Hamid, by which reinforcements could always be sent forward." Whether this was carried into effect is not known, but later on there was a great deal said about the unhealthiness of the climate at Said-Hamid.

In July, 1889, the following notice appeared in the same paper respecting the protection of the termination of the line:—

"The defences of the pass over the Khwaja-Amran will not be great. The railway station will be seven miles to the west of Chaman, and a clay built fort will be erected near it for a small garrison, with a view to its protection against the neighbouring tribes of Achakzais; generally speaking they are not warlike, they are now employed to work on the line and are therefore in good relations with the authorities. The entrance into the tunnel from the Chaman side will be protected by small 'block houses'; this will be the *tête-de-pont* under cover of rifles and *mitrailleuses*."

From the reports of the latest manœuvres it is apparent that at Baleli, ten miles from Quetta, there are forts which defend the two only passes over which an advancing army could march to India from this side. The elevations facing the passes are escarped and fortified at every point, and the open plain between both lines of hills is defended for two or three

miles by a row of low redoubts which are barely visible to the eye at one mile distance. On an elevation of 7,000 feet there is a heliographic station in correspondence with the station at the summit of the Kojak Pass. The Quetta arsenal is in the old fort of the Khan of Kelat on the top of an artificial mound; on a somewhat smaller mound is the redoubt Baleli which gives its name to the entire line of defence. All the fortifications are of clay which hardens to stone in the sun. Forts of this construction gave great trouble to the English artillery during the Afghan war. Nature has made Quetta a very strong position, but in its natural aspect, it would require an entire corps to hold it; the fortifications admit of protection to three quarters of such a force, and the position has been rendered impregnable. It affords on the other hand, an excellent base for an offensive-defensive flanking attack on an advancing enemy. The works have been performed very rapidly and cheaply, all the fortifications and roads in the neighbouring valleys (not including the road to Dera-Ghazi-Khan) were completed in 18 months and cost only £120,000. The guns will be of a somewhat larger calibre than those which may be brought against them.

PART II.

MILITARY ROUTES FROM THE INDUS INTO AFGHANISTAN.

THE information concerning the great portion of the routes from the Indus into Afghanistan is very scanty. The roads over the Bolan, through the Khaibar and through Kuram are very well known; as regards the rest, only those portions of them have been studied which are close to the Indus. Those sections which lie to the east of the Suliman Range were only very recently deemed inaccessible to exploring parties owing to the hostile feelings of the native inhabitants towards the English. Attempts to conciliate the bordering tribes were made only a short time ago, when, in connection with the defence of the north-west frontier of India attention was directed to all the routes from India to Candahar, Ghazni and Kabul; and these attempts have partially succeeded.

Without repetition of the foregoing we will proceed to give the following information concerning the explorations and works undertaken by the English for the improvement of the routes which they resolved upon in 1885. Up to the present time these works have been and are being performed only along the road from the Pishin Valley to Dera-Ghazi-Khan, and in the Khaibar Pass; in all other directions it is a question only of explorations and speculation.

THE PISHIN MILITARY ROUTE.

This is the appellation of the Dera-Gazi-Khan route into the Pishin Valley. As a portion of the road from the Indus to Candahar it has long been known. More than once it has been traversed by armies marching to the conquest of India, and by rulers of Hindustan and Khorasan. An inscription near Vitakri in Khetran refers to the time of Firoz-Shah; another points out that the Masjid, near the road, was built by Jehangir on his march to Candahar. Baber passed through Sakhi-Sarwar and Chotiali. On the downfall of the Durani dynasty the road was abandoned because of the predatory character of the neighbouring tribes; it was made secure only in recent times, and now it is free from danger.

In projecting the road in 1885, it was proposed to conduct it through Gwal, Kavas, Thal, Anambar, over the Gan Chawala Pass, through Churuki-Munh, by Fort Munro to Dera-Ghazi-

Khan. Ultimately this direction was altered, and now the road passes from Harnai through Loralai, near Anambar, Mekhtar, Kingri, turns sharp to the south to Rankan, Rakhni, Khur and Dera-Ghazi-Khan. The western portion to Rakhni runs through wide valleys and broad mountain ridges which do not present difficulties even for camels. The pass over the Suliman Range alone involved some great work, and the pass chosen near Fort Munro is very high. There are two forts (at Kot-Mahomed-Khan and Murga) now building for the protection of the road against an attack from the north, and after a pacification of the locality the road will probably be taken to Mangrotha; the distance from Kingri to the Indus will then be 60 miles instead of 100 through Fort Munro. But this latter route will still retain its importance, seeing that the floating bridge over the Indus is at Dera-Ghazi-Khan, and will not be removed northwards.

It is necessary to observe that the Pishin military route is, by its profile and gradients, perfectly suitable to heavy wheel traffic and to artillery, but it is not macadamised, and, after heavy showers, in many places it is insufferably muddy. Wheel traffic is very much impeded also by the sands between Ranghar and Sakhi-Sarwar. Macadamisation is absolutely necessary, if even over this last section, but as yet this has not been undertaken.

There is at the present time no wheel traffic along the whole line; it exists only over 20 miles to the east of Loralai, and over 10 miles west of Dera-Ghazi-Khan. Wheeled carts are very little in vogue, and are unwillingly adopted along the whole of the north-west frontier of India.

Sir Charles Dilke gives some information about the section from Harnai to Loralai and to Rakhni in his account of his journey along the north-west frontier of India. From Harnai the road passes through the Mehrab-tangi Defile to Dilkhana, which is situated at an elevation of 5,400 feet above the level of the sea, and from this place it ascends to the pass 6,000 feet. The road is not wide and is even dangerous at the the turns when two wagons happen to encounter each other. From the pass the road descends to Fort Sinjawi, lying at the mouth of a wide valley traversed by this road as well as by others. A fort has been erected at Loralai. It is 18½ miles distant from Sinjawi and 56 miles from Harnai, at an elevation of 4,500 feet above the sea. In the tents the temperature never exceeds 30° R. The fierce cold winds are very trying in the winter. The road passes close to the fort and is connected with it by a side road. The fort is occupied by native troops only: one regiment of infantry, one of cavalry, and a mountain battery. The site of the fort is closed in by hills on three sides, which rise about 100 feet above the plain. There is a passage in the north-west corner, through which Arabashin is in connection with the Bori Valley. A karez runs through this aperture, which passes in a south-westerly direction through the settlement, and supplies excellent water, and there are two streams

skirting the northern and eastern sides of the camp. The ground is more or less a sandy clay with gravel in parts. All the barracks and officers' quarters are built of clay roofed with waved iron with a smearing of clay.

For a distance of 20 miles from Loralai the road passes through a wide valley margined on the north by a line of heights constituting the water parting between the valleys of Bori and Zhob. There are passes over this near Loralai and 20 miles to the east. The valley of Bori is tolerably fertile; one-third of it is annually irrigated and cultivated. A considerable quantity of corn and other necessaries of life can be raised in that valley for men and horses. The village of Anambar lies a little way off the road, which farther east passes between farms which have been fortified for protection against the Mari tribe, whose attacks only a short time ago were frequent with those of the Musa-Khel and of the inhabitants of the Zhob Valley. Even now this section of the road (through Mekhtar and Zhob) is not free from danger. It is not a rich country and on pacification will, in all probability, be densely populated.

From Mekhtar to Kingri the road runs direct east, but from the last-named place turns abruptly to the south to Rankan and Rakhni. Beyond Mekhtar the road runs 30 miles over a perfect desert with only one settlement, that of Zhob, which consists of two fortified farms. The locality is not very fertile, but the total absence of any population is attributable to insecurity of life. Within five miles of Kingri a stream is crossed which runs to the Indus through the Suleiman Mountains through a pass about 800 feet high. The locality about Kingri and farther south is fertile, and water is everywhere in abundance, but neither here is there any population at the present time; there is fuel and fodder in abundance over the whole extent between Mekhtar and Rakhni.

The pass over the Suliman Range begins from Rakhni; it presents an obstruction in the construction of a road; the descent to the Indus is steep and precipitous, and the road crosses the Mountains at a height of 5,500 feet above the sea. This was originally a foot-path, made 18 years ago by Sir R. Sandeman, and beginning at Sakhi-Sarwar ran along the Siri torrent, over the small plains of Gazan-tal and Chattamari, formed by deposits, to Khar. Khar is a small, fertile and well cultivated plain, at an elevation of 5,400 feet above sea-level; it belongs to Hadioni Baluchis, and is the converging point of all the practicable routes, which at this part traverse the Suliman Mountains. A triple peak of the Anari-Mal Mountain rises above the Khar plain. The Anari-Mal is now better known as Fort Munro, called after Colonel Munro, who was at one time Governor of Derajat. On the smooth plateau of the central peak are several houses, and 900 feet lower, on the Khar plain, are the barracks of a company of the 4th Sikh regiment under the command of a native officer, which occupies them.

The surrounding hills are perfectly bared, for the Baluchis destroy the forests most mercilessly.

The above-mentioned pathway was soon abandoned, and in 1875 a road was laid, passing through Chote, Choti-Bal, and Zaradan, which was used until lately. The inconvenience of this road is a steep ascent above Zaradan, where the road mounts 3,000 feet in three miles.

The circumstances are very different on the new Pishin road; this is the first regularly laid passage over the Suliman Range, with gradual slopes. Khar is as before the point of convergence of the roads. The road from Dera-Ghazi-Khan runs almost direct west to Sakhi-Sarwar for about 30 miles. The first part, as far a Gadai village, intersects several canals and tolerably well-cultivated ground; the two large canals, Shora and Manka, which the road crosses, contain water only in the summer; in cold weather, wells are resorted to. It is necessary to observe that for several miles from the Indus there is a fall until the ground is several feet below the level of the river. In consequence of this, there is great danger of floods, and very large sums are expended on the management of the irrigation works and on the maintenance of the large dams. From Gadai village the ground rises, and the road passes into a locality called Pashad, which is intersected by numerous gulleys, and by a network of dams, controlling the course and stemming the force of the water from the mountain streams. The place is not fertile, and the inhabitants do not rely upon more than one good harvest in three years. Within 15 miles of Dera-Ghazi-Khan, where at the present time there is no village, a bungalow has been built for travellers; the place is called Ramghar. A deep well has been dug near this house, as there are no streams here. Beyond Ramghar, the road passes over shifting sands, which extend almost as far as Sakhi-Sarwar, and short of that place the road intersects the Makam hollow and a small chain of hills. Traffic over this portion of the road is exceedingly difficult; in June, 1888, a detachment of 55 men of the 4th Sikh Regiment lost eight men here.*

Sakhi-Sarwar is a small town, with a population of about 1,500 individuals, located on a stony incline devoid of all vegetation. At a height of about 300 feet above the town is the tomb of a saint, of which the white cupola is visible 40 miles. This is esteemed both by Hindus and Mahommedans as one of the holiest places in India, and in the month of March thousands of worshippers flock to the place.

At Sakhi-Sarwar, the road enters the hills; for about seven miles it runs in a southerly direction over the rock-strewn slope of the

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* Whatever may be the difficulties of the road, such a loss in time of peace over some 20 miles shows great mismanagement on the part of the officer in command of the detachment, and leads one to form a low opinion of English affairs as conducted on the north-west frontier of India.

marginal range, crossing the Mitawan torrent at the fourth mile. Turning again to the west, it follows the Rakhi torrent to Rakhi-Munh, where there is a perpetual spring of fresh water. Here is a military encampment with a bungalow. Beyond Rakhi-Munh, the road continues to ascend as far as the Rakhi Gorge, traversing and passing round the numerous spurs of mountains. At Rakhi Gorge, the road makes an almost perpendicular ascent of about 700 feet above the bed of the stream. About two miles above Rakhi Gorge, there is a warm spring, giving rise to a stream running to Rakhi-Munh. Above this spring, the road passes through a gorge, now crossing the torrent, now rising several hundred feet above it, till it reaches the camp at Girdokh. To this point, water is conducted in pipes from Dawak spring, situated four miles above the road. Girdokh, as the camp is called, is, in fact, the name of the narrow gorge about 400 feet above, to which the road ascends in long zigzags, called the Limond Zigzags; at the present time, the Girdokh Gorge is frequently called Limond Gap.

From Limond Gap the ascent is a gradual one, and comparatively little labour was required in the construction of the road, except at Dawak, where the upper end of the gorge is closed by a semi-circle of perpendicular mountain sides, through which penetrates the water which collects at the base. The road mounts these precipices in very steep zigzags. Farther on, it passes over rounded and undulating heights of the Suliman Range. The Khar plain is reached after one mile of this almost horizontal road.

From Khar to Rakhni (3,500 feet above sea-level), there is a descent of 2,000 feet. On this extent, there were some difficult works; three long zigzags had to be made. The plain of Rakhni is eight miles wide, and about 40 miles long. Good water is in abundance.

Routes Leading over the Gomal Pass.

Now that the most urgent requirements for the defence of the north-west frontier have been satisfied by the measures adopted in the Bolan and Khaibar Passes, the Military Authorities and the Press are persistently demanding attention to two of the principal middle passes, leading from India into the centre of Afghanistan. A greater importance is attributed to the Gomal Pass, over which communication lies between Dera-Ismail-Khan and Ghazni, Candahar, and Pishin.

"In forming a plan of resistance against an enemy advancing on Afghanistan from the west," General Gordon says, "the practicability of concentrating troops at Ghazni is a matter of the greatest importance. This is the strongest strategical position between Candahar and Kabul; it is the most advantageous point from which it is possible to operate as well against an enemy marching upon Kabul from either

Balkh or Herat: from that place English troops could easily penetrate into the Hazara country, stir up the warlike tribes, seize the passes, and threaten the communications of the enemy. The enemy will, of course, likewise endeavour to obtain possession of Ghazni, in order to cut off Kabul from Candahar; it follows then that it is absolutely necessary for England to secure a direct road to anticipate an invader."

Almost the same thing is said by Sir Richard Temple; he points out that if the Khaibar and the Bolan were made perfectly unassailable an advancing force would not march that way; if it advanced through Kabul or Candahar it would from those points march to Ghazni and thence to the Indus. He advises the construction of a railway from Pishin to the Gomal Pass, through the Zhob Valley, in order to facilitate the speedy concentration of troops to meet the enemy. This line would be about 180 miles long; there is no reason to believe that the natural difficulties would be excessively great, but it is certain that for a great number of years the line would have only a strategical importance and would not be profitable.

The road from Dera-Ismail-Khan to Ghazni is one of the largest and is perhaps the easiest on the north-west frontier. For centuries past it has been the high road of the Pawindahs* passing between India and Afghan-Khorasan.

From 20 to 30 thousand of these people—warriors, merchants, drovers—make their way through the lands of the predatory tribes, coming to Dera-Ismail-Khan, and spread from there over all India. Immense quantities of sheep and goats move along with them, and as many as 60,000 camels, laden with the products of Khorassan, dried fruits, grapes, dyes, wool, silk, &c. In the spring they again assemble at Dera-Ismail-Khan, and pass in separate detachments of camps and tribes to their summer quarters over the Gomal Pass. The *Pawindahs* state that this is an easier road than those through the Bolan and the Khaibar. It abounds with fuel, forage, and water. As regards the neighbouring tribes, the first 24 miles at Gomal, from the point where the road leaves British territory, lies through a tract occupied by Mahsud Waziris. Over this extent of 24 miles the Pawindahs lose every year a great number of camels and bales, as large bodies of Mahsuds always gather together to intercept the migrators, driving off the worn camels and attacking the weak camps. The strongest camp, however, does not ordinarily possess more than 300 or 400 armed men, who have to protect a large number of women and children and a large transport, so that a struggle with the robbers is a hazardous matter.

Passing the Gwalari-Kotal and leaving the Zhob stream,

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* This name is applied by Persians, Hindus, and English to those Gilzais who are constantly transmigrating between India and Khorasan. The literal meaning of the word is fast-trotter. They call themselves Portani, *i.e.*, mountaineers. Their neighbours, who talk Pushtu, call them also Kochi, which is the same as *Pawindah*.

which unite with the Gomulan two miles above the Pass, the road enters the Wano Valley. This is a small but rich locality, occupied by the Zali-Khel tribe—one of the sections of the Darwesh-Khel-Waziris. One corner of the Wano is occupied by a settlement of Pawindahs. Westwards of Wano lies a country occupied by various tribes of Ghilzais, to which the Pawindahs belong. These latter are likewise of many sub-divisions, of which the best known are the Suliman-Khel and the Nasaris. They were formerly hostile one towards the other, but Abdur Rahman-Khan has recently made them cease quarrelling.

During the first Afghan war in 1839 Lieut. Broadfoot, of the Engineers, traversed this route, corroborating the description of it given by the Pawindahs, *i.e.*, that in respect of climate, as of abundance of water, fuel and forage, it is an incomparably better route than the one through the Bolan. One of its great advantages is that in many places it branches off into several détours. Broadfoot's particulars of this route were published in *Supplementary Papers*, vol. 1, part 3, 1885, of the London Geographical Society. Since then this route has not been followed by anyone.

Two other roads to Ghazni diverge from the confluence of the Gomal and Zhob Rivers; a western road leading to Candahar and an eastern to Pishin. A minute survey has been made up to the confluence of those rivers, and the further extent of the road leading through the Zhob Valley to Pishin is also tolerably well known. From the Indus there are several other passes to it, south of the Gomal Pass, but very much more difficult. The upper portion of the western road (to Candahar) is less known. For a certain distance it intersects the Zhob Valley, whence it runs to Kundil, follows it to its upper course, and, crossing the water parting of the Gomal and Helmund Basins, abuts on Maruf, a large village within 40 miles of Kelat-i-Ghilzai.

As will have been observed from the foregoing, the roads abutting on the Gomal Pass, have, up to the present, been very little explored; nor has it been possible, in view of the hostile bearing of the neighbouring tribes, to undertake any work up to recent times. Serious attention was given to this in 1889. An attempt was made in 1881 to establish better relations with the Mahsud-Waziris after the expedition into their country. Hostages from among that tribe were settled at Dera-Ismail-Khan and a subsidy of roubles 1,000 was granted to the Elders, from which were made deductions of fines for disturbance of the peace. Order was not secured, the fines grew in amount, and frequently out-balanced the subsidy. In 1888 the Waziris did not allow a surveying party to enter their country, and the subsidy was entirely stopped. In 1889 it was determined to try the method which yielded excellent results in the Khaibar, namely, that of forming a well-paid militia from among the native tribes, and setting it to protect the road. Barracks for 25 horsemen are to be built at Tank, Kot, Navaza, and Gomal.

Sir Robert Sandeman marched out with a large detachment

in 1889 in order to produce an impression on the tribes situated to the west of the Waziris; he is in communication with the more formidable head tribe, viz., the Suliman-Khel, relative to the performance of police duties over the extent from the country of the Mahsud-Waziris to the borders of Afghanistan.

The regulations concerning the crossing of the Punjab frontier were altered in 1889 with a view to the promotion of a better acquaintance with the bordering tribes and their country. Up to that time British subjects were not allowed to cross the frontier without special leave from the centre of Government; this leave may now be granted by the local authorities; leave is very readily granted to travel south of the Vihowa Pass.

It is only when the above measures lead to the desired results, viz., a sufficient pacification of the country that there will be a possibility of beginning the construction of roads to Ghazni, Candahar, and Pishin. Indian military writers oppose the fortification of the Gomal Pass, or the occupation and fortification of any advanced point in the direction of Ghazni, insisting that in a war with Russia over the possession of Afghanistan the English should occupy Ghazni, and that the only requirement is a good military road along which a strong force from Derajat could appear rapidly on the Kabul-Candahar Road.

Route over the Tochi Pass.

The most direct way of communication between the Indus and Ghazni is over the Tochi Pass; from Banu to Ghazni the distance is only 130 miles, or 71 miles shorter than from Dera-Ismail-Khan to the same place. The immense importance attaching to this last road is attributable to the significance of the Gomal Pass as regards Candahar and Pishin. In consideration of this nothing is done at Tochi; even explorations are suspended for fear of causing an agitation among the hill tribes by a simultaneous display of activity along the whole of the frontier.

But in the future this Pass will probably be of great importance, more particularly if Banu* is to be connected with a network of railways; investigations for the connection of this point with Dera-Ismail-Khan have already been begun, and it is proposed to commence the construction of a line in a short time. Although the routes through Tochi have not been explored, and nothing positive can therefore be said, yet according to the information which is possessed this is not alone the shortest but also the easiest direction for the continuation of a railway to Ghazni.

The main pass from *Banu* passes along the river called the Gambela within British territories; here the road runs over a tolerably smooth ground across a range not more than 9 miles wide, and then enters a large well-cultivated locality, known by the name of the Upper and Lower Dawar Valleys separated one

* "Baku" in original.

from the other by a small narrowing. These valleys are covered with forests and irrigated by a copious stream only occasionally unfordable. The upper valley extends to Sherania, nearly to the base of the eastern declivity of the Djardan Mountains.* Beyond this all that is known is from native explorers; according to their statements the easiest route lies through Orgun or Wargin and over the passes Kotani and Sarfsa, from where the road to Ghazni through Shilgar presents no difficulties. At all events the well-known section near the British territories is much easier than the Gomal Pass (*sic*) and the pass is lower than the Shutar-Gardan on the Kurama Line. The tribes along it are Dawaris, Waziri and Ghilzais. The first of these are now pacific, and for the opening of the route an understanding with the Waziris is alone necessary.

"Military Route from Kohat to Banu"† and Dera-Ismail-Khan.

The Kuram Pass is very well known; its insurmountable difficulty is the height of the Shutar-Gardan Pass, which is covered with snow all the winter. The so-called Kohat Pass on the road from Kohat to Peshawar is even now insecure in that portion which lies through the country of the independent Afridis. Its importance, however, has very much decreased since the opening of the railway from Rawal-Pindi to Kushalghar on the banks of the Indus, and since the making of the military route from that point through Kohat and Banu† to Dera-Ismail-Khan. In the matter of the defence of the north-west frontier this road is held to be of great importance; running parallel with the frontier it commands several very important passes into Afghanistan. It connects two systems of railways, brings into connection two such important bases as Rawal-Pindi and Multan and all the posts from Kohat to Dera-Ismail-Khan.

The length of the road is 202½ miles; it was laid as a first class road with permanent bridges; it is macadamised through the whole of its length and is practicable for military purposes at all times of the year. It was 3½ years in course of construction; the greatest difficulties experienced were the lack of labourers, and the prevalence of sickness in the summer; cholera raged in the summer along the whole line for two consecutive years, the cost of the road was 39 lakhs of rupees.

The Kushalghar Railway Station is on the left bank of the Indus, whose steep banks are composed of grey sandstone, the road descends in zigzags to the low water level and a bridge of boats. At high water the bridge is usually removed on account of the rapid current and depth which is some times 135 feet; but during the last Afghan war the bridge was kept up all the year round. At that time the steepness of the inclines

* "Town" in Russian.

† "Baku" in Russian. There appear to be a great many misprints in this part of the paper.

rendered communications difficult, but these have been facilitated by new plans.

From here the road passes through an undulating country of low hills of sandstone, and in all directions it is intersected by hollows and torrents. Passing through Shaikh-Ali Defile it enters a valley at the upper end of which is the large military post of Kohat. The principal artificial works on this section are five large bridges of two to three arches of 50-feet span. From Kohat the road turns to the south, crosses the Kohat River four miles farther, over a stone bridge of eight arches of 50-feet span, and passing through a gap in the limestone Djarwa hills, enters the valley of that name and crosses the Barakar and Chichona Rivers over two large bridges. The Lachi Valley is reached after traversing the Manduri hills; here, besides other inconsiderable works are two large bridges, one of a single arch and the other of five arches, of 50-feet span. The population of Lachi is about 3,000; a military post is established there; traversing another limestone ridge the Karuppa-Ghat, the road winds for some distance between low hills as far as the rich and wide Teri Valley. Again there are a great many bridges here, at first small ones over numerous torrents. Another one of six arches over the Tiri River of 50-feet span. Farther on the road winds along the southern slope of the Mirandi Ridge and passing through a cavity along its crest, runs down an abrupt declivity, descends into a narrow valley and then trends across the Totakhi and so into the Bahadur-Khel Valley. Leaving Bahadur-Khel Fort on the west, the road descends to the river of that name, crossing it over a bridge of eleven arches of 24-feet span, and ascends, winding up a range of hills, which it finally pierces, through a tunnel. Beyond this comes a spring of salt water, then the Kushad torrent, spanned by six arches of 50 feet each and through the Surdagh Pass the road emerges on a plain at a distance of two miles from the Latamar military post. From the tunnel to Latamar the road runs along the borders of a Waziri settlement; the desolate character of the whole of this locality being most favourable to plunderers. The Surdagh Pass is very narrow and precipices on both sides are very high. Passing another line of hills the road follows the frontier of the settlements through the Banu Valley. Up to the extreme limits of irrigation from the Kuram River, the locality is a sandy plain broken by numerous wide hollows. At a distance of 1½ mile from Banu (Edwardesabad post) the River Kuram is crossed; here this river is very wide. The bed of the river is shingle and pebble; the depth is very considerable and the rapidity of the Indus is 13 feet per second; the river swells unexpectedly and does not soon subside; there have been occasions when troops have had to wait for weeks before they could cross. The bridge across the Kuram is constructed of 15 iron girders (?) with 100 feet openings, it was built with a view to the possibility of laying a railway over it.

Banu is a very important military post and in the centre of

a well-watered and cultivated district. From Banu the road turns to the south, and trending a distance of 25 miles across a level plain, intersects the Gumbela River, passing over an iron bridge of nine spans of 100 feet. This bridge is built like a railway bridge against the event of the construction of a railway from Dera-Ismail-Khan to Banu.

From the Gumbela to Pisu for 21 miles the road passes over a hilly, sandy ground, intersected by small gulleys, but without any considerable works, until it reaches the Pesu Pass (at the point of abutment of the Bistani and Maidani chains of mountains) near the small village of Shaikh-Budin. The Pesu torrent has a stone bridge thrown across it of three spans of 40 feet.

For the remaining 36 miles up to Dera-Ismail-Khan the road passes over a plain here and there intersected by hollows and streams; in this part there are two iron bridges of 45 feet span and many small ones.

The Khaibar Pass.

Although after the occupation of Merv and Sarakhs, there appeared a greater probability of a Russian advance along the Herat and Candahar Line in the event of an Anglo-Russian conflict in Central Asia, yet many military writers in India still expect the advance to be made by way of Balkh and Kabul. In support of that view the *Pioneer Mail* expressed the following opinion:—

"The stragetical position created by recent events gives Russia a triple advantage. Basing herself on the Caspian she can operate rapidly against northern Persia and particularly against Meshed. From the same base Herat may be seized and Maimanah occupied. Balkh will not be able to resist a Turkestan force marching from Bokhara. There is no doubt, that in the event of a war with England, these three projects will be carried out by Russia without delay, and the entire country north of the Hindu-Kush will be in her hands at the very commencement of the campaign. This will be the first step of the invader. The second step will be more difficult, and in order to settle upon the best system of the defence of the north-west frontier of India, it is of great importance to ascertain what that step may be. If, after occupying Herat, the Russians should march to Candahar they would have an additional 370 miles to march to that point, whilst from the extremity of the English line of railway it is only 65 miles distant. The Russians would have to advance through a very poor country occupied by fanatical tribes, and open to a flanking attack from the side of Persia, Baluchistan, and Cabul. After a tedious march, far removed from their railway base at Merv, they would have to encounter a fresh English army in a fortified position at Candahar, which would by that time be in direct

railway communication with Karachi and the network of Indian railways. All the advantages would lie on the side of the defenders, whose way of retreat to the Pishin plateau would be secured, whilst, in case of necessity, there would be a second and a stronger position at Quetta. In view of this it is probable that only a diversion will be made in the direction of Candahar, but not an advance in full force.

"With an advance from the north the position of affairs will be different. Kabul is only 170 miles from Peshawar. The appearance of the Russians in that place would inflict an irremediable blow on English prestige in India. The bordering mountain tribes, as well as the Afghans, would probably pass over to their side. The most direct effect could be produced upon India from this side; there the occupation of Kabul would be of greater importance to Russia than the occupation of Herat. It would not be difficult to effect this. In 1879 General Roberts took Kabul with 6,000 men, and, of course, the Amir would not be able to stop a Russian advance without the help of England. This at once shows the importance of a good road from Peshawar to Kabul affording the means of reaching that place rapidly in case of necessity."

With reference to this opinion expressed by the military correspondent of the *Pioneer Mail* it may be remarked that the few hundred miles from Herat to Candahar, of which he speaks, are incomparably easier than the route from Balkh to Kabul, which is closed during the winter months. Besides, the correspondent, like all the English in India, does not admit even the thought that Herat can be seized by Russia previous to a great war with England, and turned in good time into a base for further operations in advance; under these conditions all the above quoted arguments will evidently have no value for the direct road from Herat to Kabul, through Daulat-yar and Chel-burj, although only 268 miles in length, offers too many impediments for the march of a large force.

A determination to meet an invader in Afghanistan renders unnecessary some of the strong fortifications first projected.

"The suggestion of fortifying Peshawar, adopted by Sir Donald Stewart," Sir Charles Dilke* writes, "is an extreme one. It is true that if an enemy should pass the Khaibar an English army would not be able to offer any opposition in the Peshawer Valley, and there are not sufficient troops in India to waste in garrisoning forts like Metz and Strassburg. It is to be hoped that the fortification of Multan will meet the same fate as that of Peshawar, and that if anything is done on the completion of the works at Attock and Rawal-Pindi, it will be to the west of the passes in some position which will play the part of a

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* In 1888 Sir Charles Dilke accompanied Sir Frederick Roberts, who, at the head of a Commission of the highest military authorities of India, made a tour of inspection along the north-west frontier to settle the question of the defences. Sir Charles Dilke expresses the opinion of that Commission.

northern Quetta. The plan which has been adopted meets with general approval in India; the railway will be carried to the entrance into the Khaibar Pass, which to a certain extent will be fortified. The Attock position will be made impregnable, and the base at Rawal-Pindi defended. The strengthening of Attock is indispensable, for the bridge at that place will probably for some time to come remain as one of the bridges across the Indus. This will, however, be attended with great difficulties, for on the western side the mountains rise abruptly in consecutive rows of detached elevations, of which each one is higher than the row in front nearer the river.

It is to be observed from this that the view of the Anglo-Indian Government, as regards the Khaibar Pass, has of late undergone a change, and is not the same as that held ten years ago. This is borne out by the progress of events in this quarter since the Afghan war.

When Sher Ali occupied Ali Masjid in prospect of a rupture with the English, the Afridis ranged themselves on his side. The attack on Ali Masjid (21st November, 1878) was repulsed, but the English occupied the position of Katta Kushtia in the rear of the fort, and Fez-Mahomed, the Afghan general, fled to Jalalabad through the Bazar Valley and the Sisobai Pass. Major Cavagnari was instructed to come to terms with the Afridis and Shinwaris who actually held the Pass. He offered them a subsidy larger than that which was paid by Sher-Ali; this produced a split among the tribes, the strongest party remained true to their allegiance, but the weaker accepted the English offer. A militia, jezailchi (from jezail, a matchlock), was organised of men of this party, who were placed to guard the Pass. But the hostile tribesmen continued their harassing operations.

On the conclusion of the war, Beaconsfield's "scientific frontier" was drawn at Lundi-Khana, and by the advice of Yakub-Khan, those of the hill tribes who occupied positions of that frontier line made their peace with England. This, however, was achieved with great difficulty in consequence of the intrigues of the tribal Maliks, each of whom sought to get into his own hands the English subsidy. After protracted negotiations the matter was arranged and a force of 597 jezelchis was organised. In making this arrangement the English forgot their first allies and the subsidy fell, not to those who had been first in siding with them, but to those who had held out longest for Sher-Ali.

A fresh war broke out after the murder of Cavagnari, and upon its conclusion the Liberal Government decided upon the evacuation of the Khaibar, being bent, as it was said by the Conservatives, upon discrediting all that had been done by Beaconsfield. In the end of 1889, the Authorities of the Punjab once more summoned the "jirga" (Council of Elders) of the Afridis and Shinwaris to Peshawar, and terms were arranged which form the basis of the relations with them at the present time.

The principal points of their obligations are :—

1. On the condition that the British Government maintain political relations with us, whilst our independence is fully recognised. We engage to prevent the exercise of any other influence of whatsoever power between ourselves and the British Government.

2. In recognition of certain subsidies, we undertake the responsibility of preserving order and guarantee safety of life and property in the Khaibar Pass.

3. All matters regarding the Pass, and particularly that of the security of the road shall be discussed in general council of all the Afridi tribes who are under obligation to be solicitous about the lives and property of persons of all tribes and races who may use the Khaibar Pass, whilst local trade will enjoy the same protection as that extended to foreign trade, and no inter-tribal feuds or quarrels and encounters of individuals shall take place near the road or posts.

4. The responsibility of the tribes for the security of the road shall not be in dependence on them from the British Government in the form of troops.

5. So long as the tribes receive a subsidy the right of levying toll in the Pass shall belong to the British Government. The tribes shall not demand payment from merchants or travellers.

7. The tribes shall be held responsible for the safety of the Political Agent or other officials visiting the Khaibar Pass on the condition of their receiving timely warning.

8. The tribes shall be responsible for the control of the Khaibar; the British Government does not charge itself with any responsibility under this head.

The number of *jezailchis* was increased to 636 ; later in 1887, two more companies were formed of 100 men each out of the total number of 836 men 30 were mounted ; they were at the same time converted from Government troops into a tribal Militia. Shortly after the signing of this treaty the British troops cleared out of the Pass. These *jezailchis* or Khaibar riflemen, as they were afterwards named, are under the command of Subadar Major Mahomed Aslam-Khan, who was attached in 1885–6 to the English section of the Frontier Commission. Major Warburton has been Political Agent in the Khaibar since the year 1882.*

On the council of the tribes controlling the Government of the Khaibar, the tribes are represented as follows :—Sipahs, 1 Malik ; Malikdin-Khel, 2 ; Kambar-Khel, 2 ; Kamrai, 2 ; Kuki-Khel, 1 ; Zakka-Khel, 2 ; the Shinwaris have nine representatives. Each of these chosen Maliks receives from the English Government his salary and the amount of subsidy falling to the share of his tribe, which he distributes as he knows best. They aim principally at satisfying the more influential members of

* He is a "half-caste" ; his father was in the first Afghan war.

their tribes, because these mountaineers being a very independent people, the Malik has very little influence and can do nothing without the Elders who constitute the Council ("jirgah") of the tribes.

At present there are altogether seven companies of Khaibar Rifles; the headquarters of five of these are at Jamrud from which place a garrison is supplied to Ali-Masjid of a single company relieved once a month. The two other companies are stationed at Lundi-Kotal.

The militiamen belong to various tribes; sometimes they are ordered out by the Maliks and sometimes chosen for service by the tribesmen, but generally speaking they answer the call very willingly, and it depends upon the commanding officer to accept their services. They are in physique the same kind of men as those in the regular service raised from among the bordering clans; they are powerful, well-built men, of proud bearing, and with all the determination of the mountaineer; they have a keen glance and a somewhat ferocious appearance and are of that type which prevails among the Pathans and gives them a resemblance to Jews. Each militiaman must bring his own rifle and provide his own ammunition; this condition is not burthensome, for Martini-Henry, Snider and Enfield rifles are to be found in large numbers among the hill tribes who pay any price for them. It is not so easy to say where they get the cartridges, but in all probability they buy them of the Afghans. The majority possess bayonets issued by the Government. Their pay is nine rupees per mensem, but from this sum is deducted the cost of their accoutrement which is made up to them in kind; it is very similar to the Khaki of the regular sepoys. The commanding officer is held responsible for their instruction, discipline and keep; he has, as in regular regiments, a staff of native officers. At Jamrud the men behave admirably; at Lundi-Kotal they are under the influence of their Maliks, and, although better armed than others, they cannot in other respects compare with those within British territories. From Jamrud to Lundi-Khana, where the Amir's territory begins, there is a series of posts of from four to eight and more men. In consequence of these measures the Pass is as secure as any road in India; strange to say robberies occur in proximity to the Indian frontier between Jamrud and the entrance into the mountains where the thieves and robbers of all the neighbouring regions find refuge. They know that if caught they cannot escape hanging and therefore are careless of a future.

One of the duties of the Khaibar Rifles is to escort kafilas and transports, this is done as follows: the Peshawar Caravan assembles at Jamrud on Mondays and Thursdays, evening; on these days the Kabul Caravan passes into Lundi-Khana where it leaves the Amir's escort, and halts for the night at Lundi-Kotal. On Tuesdays and Fridays caravans leave simultaneously from Jamrud and Lundi-Kotal meeting at Ali-Masjid, where there is an exchange of convoy. On Wednesdays

and Saturdays the Kabul Caravan proceeds to Peshawar, and the Peshawar Caravan to Lundi-Khana, where it is given over to the Khasadars of the Amir from Dakka. All this transpires without any delays.

For the last seven years acts of robbery have been very much less frequent than they were when the Pass was guarded by regular British troops. In the summer of 1888, three hundred Khaibar Riflemen took part, and with great distinction, in a campaign into the Black Mountains. Generally speaking the results are so satisfactory that the relations with the Afridis and Shinwaris are taken as patterns in the conduct of relations with other frontier tribes.

As regards the political side of the question it is to be observed that on the evacuation of the Khaibar in 1881 it was held as a desideratum to have as little to do with the hill tribes as possible. But in 1882 Colonel Warburton, returning from the country of the Mullagori, visited Lundi-Kotal and Ali-Masjid. He was well received by the tribesmen, and since then the visits of English officials have been more frequent.

The mountaineers became gradually accustomed to them; so that when the work of the defence of the Khaibar were begun no opposition was shown by the local population. One of the first steps taken was the re-occupation of Lundi-Kotal by English troops; then followed the improvement of the road, and its supply with water, and finally surveys for a continuation of a line of railway from Jamrud to Kabul. The construction of the 9 mile section from Peshawar to Jamrud has been determined upon, but the work is to commence only after the termination of the surveys for a continuation of the line.

The road from Peshawar to Lundi-Kotal is maintained in good order; it is always repaired after damage from heavy rains and can be driven over with ease in a carriage and pair; but carriages are driven only as far as Jamrud, farther the journey is made on horse-back.

There is an excellent macadamised road with strong bridges and (water) pipes across the stony plain between the camp at Peshawar and the entrance to the Khaibar heights. At Jamrud are stationed two companies of native infantry and a small body of cavalry under British officers. Although the fort has been considerably improved since the war, yet it has not been rendered proof against siege artillery. In its vicinity on the left side of the road are the barracks of the Khaibar Rifles, enclosed within high walls. The villages of Kuki-Khel lie on the left and right sides of the road immediately across the frontier; these are fortified, because internecine feuds are as prevalent here as in the depths of the mountains. The militia sets posts on the mountains. Lundi-Kotal is connected with Peshawar by telegraph.

The long descent from Lundi-Kotel is maintained in full order.

On this line there is fresh water only at Ali-Masjid and Lundi-Khana and an artificial water supply at Lundi-Kotal.

All the other points along the line are without water during the summer. A project has been approved according to which water will be conducted from the Shipola Spring to a point midway between Ali-Masjid and Lundi-Kotal. The spring is within five miles of the latter point and yields an abundant supply even in summer.

As stated above, the Indian Government, in concluding a treaty with the hill tribes, reserved to itself the right of occupying the Pass when it desired to do so. Although the security of the road has been guaranteed, and England has acquired a mastering influence over the local jirgas, yet it is not to be relied upon that circumstances may not change in the event of Afghanistan becoming the theatre of a war between Russia and England or even between Afghanistan and England. In such an event 20,000 hostile armed mountaineers could appear on the line of English communications. In anticipation of this it was of great importance, while circumstances allowed, to strengthen an influence over the Afridis and Shinwaris, and to accustom them to constant presence of Englishmen in their midst. This object could be best served by the occupation of a position at Lundi-Kotal (or Laorgai) where there had only been a few cabins. The fortification erected here, called Lundi-Kotal Serai, was not built to withstand artillery; this would have been superfluous, for the Khaibar Pass can be avoided by roads north and south, which, however, an European invader would hardly venture over. On this account the heights commanding the situation from which artillery might be brought to bear were not taken into consideration when the site for the Serai was selected. All that was done was to erect a fort at the south-eastern corner of the plateau, perfectly secure against attack without artillery and capable of serving as a depôt for stores and provisions for the troops operating in advance or for a force located on the plateau. In order to secure the Pass against an European enemy it would have been necessary to take up a position in advance of Lundi-Kotal, *i.e.*, the rocky heights above Lundi Khana. The first project of the Serai was drawn up in 1887, but the first steps to carry it out were taken only two years later. At first the Shinwari, at the instigation of the Afghan frontier authorities, created some difficulties; but matters were arranged and those people were not only reconciled but even engaged themselves for hire to assist in the work.

The fortification is quadrangular; the south side has a length of 1,020 feet facing the road; the breadth is 320 feet. The regularity of the quadrangle is spoiled by a cemetery, so that for 350 feet the breadth is only 225 feet. There are two gates; one on the south side, another on the north. The average height of the walls is 15 feet, but in some parts it reaches 26 feet, the thickness is 18 inches; the walls are built of unburned brick and adapted for rifle fire; internally they are strengthened by an earthwork forming a banquette. The highest parts of the wall are on the south side, and here, in

order to economise space, no earth was thrown up; another wall is 4½ feet up to the point where the parapet commences There are three bastions of hewn stone for field guns and two high towers, each one fitted with a machine gun which commands all the neighbourhood. Within the Serai are stone houses roofed with corrugated iron, and barracks for two companies of infantry; also quarters for four or five English officers. There is room within the Serai for the largest kafilas, although these generally camp outside the walls. The kafilas that pass now are not numerous, for, owing to the heavy transit dues imposed by the Amir, trade has decreased very considerably; one seldom hears now of a kafila of 1,000 to 1,500 camels as before.

Water is obtained from the Ullus Well, 2½ miles from the fort; it is conducted through iron pipes, filling 10 iron tanks, made to contain 4,000 gallons, placed near the Serai walls, and one within the Serai, made for 60,000 gallons. In the event of a disturbance, this water supply might be cut off there, for a well is being sunk inside the fort. Should a larger supply of water be required, it could be drawn from the Kam-Shilmian River, which flows below.

All the above-mentioned works are of a purely local character, and the Indian Government does not stop at these; the road for wheeled traffic, and the fort at Lundi-Kotal, are the first steps to the achievement of a greater object. Mention has already been made of the importance which is attached in India to Cabul, and to the matter of its quick occupation in the event of a war with Russia. Of course, an entire corps would have to be advanced for such a purpose; but the march of such a body of troops with transport and camp followers along the ordinary road would be attended with immense difficulties; the connection with the base must here be also taken into consideration. A railway could alone meet all requirements. A continuation of the line to Lundi-Khana, or in another direction as far as the Afghan frontier, would, of course, not meet with any opposition from the local population; but, for its prolongation through his territories, the Amir gives his assent only in case of emergency. When intelligence was received by him of the success of Ishak-Khan in his rebellion, Abdurrahman applied for a contingent of English troops to be sent to him to Jalalabad. So soon, however, as it appeared that the report was false, he recalled his application. In these circumstances, however great the natural difficulties may be, the political difficulty may be the greatest impediment to the laying of a railway west of the Indian frontier.

In November, 1889, surveys for such a line were made in two directions: (1) From Jamrud, directly through the Khaibar; and (2) by the valley of the Kabul River (north of the Khaibar) to Dakka. In the first-mentioned direction, difficulty occurs only in the locality between Ali-Masjid and Lundi-Khana, and over the short section between Barikab and Aliboghan. From Jalalabad to Kabul, on the

section through Darunja Defile, and Katsi-Azis to Adrak-Badrak-Kotal (near Jagdalak), there would have to be blasting operations, but these works are practicable. It may, however, prove that from Jalalabad to Kabul it is easier to pass through the Laghman Valley and along the Kabul River. According to the latest information the direction through the Khaibar has been found to be impossible, and that there is more hope of the practicability of the direction by the Kabul River. Surveys of the routes turning the Khaibar have been postponed so as not to arouse the susceptibilities of the hill tribes by simultaneous efforts in several places.

The Road turning the Khaibar Pass.

The construction of a railway through the Khaibar is contemplated with a view to an event of world-wide importance —an Anglo-Russian War. But the Indian Government very properly bears in mind that there is a more probable and approximate danger, although a danger of less magnitude,—namely, that of a fresh war with Afghanistan. There is no reason to expect that in such a case the existing amicable relations with the Afridis and Shinwaris will remain unchanged. On the contrary, it is most likely that this will be the very reverse, and that the hill tribes will, as before, obstruct the English communications. In unfavourable circumstances, the Khaibar can be completely closed. In view of this, the English are occupying themselves with the question of opening a road turning the Khaibar, a very difficult one truly, yet advantageous in that it is in the hands of the Mullagori tribe, which is less powerful than those of the Afridis and Shinwaris, and is inimical to them. The Mullagori can bring out only 500 fighting men, while the mountaineers of the Khaibar muster 20,000. But this alternative road has a special significance, even with good relations subsisting between the English and the last-mentioned tribes. The Khaibar road is not broad, and a simultaneous movement along it of large camel transports in various directions was one of the chief difficulties in the communications during the campaign of 1878-80. The possession of an alternative route for returning transports would obviate such difficulties.

A considerable portion of the routes turning the Khaibar is in the hands of the Mullagori. Nothing is known of the origin of this tribe; nobody knows where they came from, or what they are; they belong neither to the Afridis, Shinwari, nor to the Mohmand tribes, and it appears strange that they were not expelled from the country they occupy by their more powerful neighbours. Notwithstanding their inferiority, they hold, not alone the Sissobai Pass, but likewise the eastern portion of the route through the Tartara Mountains, and in 1878, notwithstanding the opposition of the Afridis, they

continued to keep this route open for traffic, while the Khaibar route was not available.

The Mullagori are divided by the Khaibar Pass into two sections, those living to the south of it, at Sissobai, viz.: the Kassaba and Petra-Mena are sub-divided into Para-Kel, Tar-Khel, and Kamal-Khel; they are neither strong nor numerous; they are chiefly occupied in making inroads, together with the Zakkas and Shinwaris, into Afghan territories at Dakka and Basawal.

North of the Khaibar, Mullagoris are found on the slopes of the Tartara Range. On the north, the limit of their settlements is the Kabul River; on the east, the Peshawar district; on the south-east and south, the range of mountains stretching from Sheghia-Sar to the south, and then extending to Lakka-Sar, and, dividing the valley of the Kambela from Sapri; on the west, a mountain spur, extending from the Kabul River and gradually rising to its merging with the Dubrai-Kotal. On the west, lie the valleys of the Kash and Loi-Shilman. In the southern part, towards Lakka-Sar, are fearful precipices and gorges, which lower down terminate in valleys; one of these stretches to Djavaramiana, another to Bar-Tartara. Lakkasar is the highest point of the Tartara Range; its slopes do not belong to the Mullagori, but to the Shinwaris and Afridis. On the summit is a level, seven paces by five, upon which stands a Ziarat. On the south and east sides, this mountain is inaccessible. This precipitous range extends 300 feet northwards, and another about two miles westwards; lower down, the slopes are more gentle.

Here, the Shinwaris, dwelling at Lundi-Kotal, have dug numerous wells (pits), in which they store snow; this is well preserved under coverings of grass, and is taken on mules in the summer for sale to Peshawar. The northern portion of the country of the Mullagoris is more undulating; there are not so many precipices, and there is more plain country as the Kabul River is approached. The right bank of this river is very steep and rocky, with the exception of one place; the Shahidmaina Ravine slopes down to the very water-side. The Mullagoris north of the Khaibar are divided into three main sections: the Ahmed-Khel, at Painda-Lalmakwa-Znakabar; the Ismail-Khel, at Lwaramaina, Shahidmaina, Murdarband, Srakala, Tartara, and Tandavba; and the Danlat-Khel, at Djkazamiana and Lwaramaina (together with the Ismail-Khel).

The largest villages are located to the south of the former caravan route. For three months in the summer these three sections of the tribe migrate with their families to Kambela, where there is a sufficient supply of water.

The following information is possessed concerning the roads passing through the country of the Mullagoris:—

The road turning the Khaibar on the south trends over the Sissobai Pass and through the Bazar and Jamrud valleys; this road is very well known, having been traversed by Nadir

Shah with 100,000 men, on his way to Peshawar, who chose this route after six weeks fruitless struggle with the Afridis and Orakzais, who defended Lundi-Khana and Lundi-Kotal.

The Tartara route north of the Khaibar has been used by kafilas for many centuries, seeing that the easier route from Dakka to Jamrud through the Khaibar was insecure even after payment of dues, and that it was often closed in consequence of tribal feuds. Since the pacification of the region in 1880 the other routes have fallen into disuse, and a resumption of traffic over the Tartarra route may be expected only after its improvement. In compensation for the loss of caravan dues which the Mullagoris and Mohmands of the Kambela and Shilman Valleys used to receive, the English Government pays 2,000 rupees per annum to each of those tribes.

From Peshawar the Tartara route passes through Shahgai; this is a good road for 10 miles. Farther, over a dry, smooth, undulating country, it is a track which trends over a series of hills near Srakala, running westwards, and leaving Makabar on the right, and reaches Lwaramaina, situated on one of the off-shoots of the Tartara, where there is a level plateau with cultivated fields and a spring of fresh water; this place is 1,000 feet above Shahgai, and consequently 2,600 feet above the sea. From Lvaramiana there is a series of very difficult descents and ascents over several spurs. From the left side of the plateau the road descends (600 feet descent) to Djvaramiana, ascends 2,600 feet to the Dabar plateau, and descends 1,800 feet to Shahidmaina, which lies in a ravine descending to the Kabul River. From this point there is a great ascent of 3,000 feet, and a descent of 2,000 feet into the valley of Kam-Shilman. Leaving the Kam-Shilman villages far to the left the road mounts and descends over the Prang-dara into the valley of Loi-Shilman, traverses the entire valley, then the Kam-Dakka Defile, first by a gentle ascent and then with a descent of 2,000 feet in two miles, avoids Kam-Dakka and Loi-Dakka, and at last, running over the spurs which fall to the Kabul River, approaches the fort on the banks of that river which was raised by Sher-Ali in 1875.

The greatest difficulties occur between Lwaramaina and the Loi-Shilman River; the length of the road here is about 12 miles, although as the crow flies the distance is not more than six. Kafilas usually crossed all the spurs in a single day because of the want of water over that section; at Lwaramaina there is not enough water for a large kafila of camels, and at Djvaramiana there is no suitable spot for an encampment. At Kam-Shilman there is a small stream, and at Prang-dara six wells; caravans therefore halted at either one of these places. The construction of a road over this locality would cost a great deal. A road along the Kabul River, which rushes below, could be made only by means of trenches in the hard limestone; they would have to be 10 miles in length because the river for the most part runs between high walls which in places are not more

than 180 feet apart; owing to which fact the water is often 100 feet above its ordinary level. In all probability it will be found necessary to do no more than improve the existing routes, selecting easier ascents and descents, and as the mountain spurs are of a soft formation the work will not be very difficult. A new direction will have to be chosen for a descent to Kam-Dakka and for an approach to Dakka Fort.

The Engineer, Baker, who surveyed this direction, is of opinion that a light railway might be laid there.

Even when the Khaibar was closed, kafilas took the Tartara route only when the Kabul River was in flood. When this river was fordable, or could be crossed in boats, they did not generally follow the Tartara track, when passing through Shilman, but descended straight to the ford at Gatta-Gudar (stony ford) at a height of 1,200 feet above the sea. The descent of 1,500 feet is about 3 miles long by a rough track running across the saddle between Fatteh-Kala and Shilman. Below and above the ford the river is only 200 to 250 feet wide, and steep rocks overhang the water; but at the ford there are sandy ledges, and the river expands there to 350 feet. There is always a boat or two at the ford. 4 annas are charged for each camel. Beyond the ford (ferry) there is an ascent of 2,300 feet to Haidar-Khan, a small hamlet, at a height of 3,500 feet above the sea; it covers about 200 acres of cultivated land. Passing the night at Haidar-Khan, caravans used to descend to Michni. Although two of the six miles of this descent are steep and rough, yet the difficulties are not so great as on the Tartara route. There is a ferry at Michni, and farther on to Peshawar the road is smoother. This is shorter than the Tartara route, but in order to secure a constant use of it it is necessary to obtain a footing in the country of the Mohmand tribe, and to construct at least suspension bridges at Gatta-Gudar and Michni. The bridges would not be large; one of only 210 feet and another of 450 feet, and the improvement of this route would probably be the least costly.

There is one more track from Michni to Shilman through Zankai; the ascent to Zankai is easier than that to Haidar-Khan, but the descent to the river, where there is also a ferry boat, is very steep, and the ascent to Shilman is longer than that from Gatta-Gudar.

PART III.

THE RIVER INDUS AND ROUTES EAST FROM IT.

THE great drawbacks of the Indus with reference to communications between India and Afghanistan are well known.* In the upper part it is the rapidity of the current which is compressed between high rocky banks; in the lower part it is the extreme width of the bed and the shifting bottom.

The whirlpools and rapids north of Kalabagh render the navigation dangerous for the awkward Indian craft. At Gova-Trap (horse's leap) above Kushalghar the river is not more than 135 feet wide; in consequence of this the difference between high and low water, as at Attock, is sometimes 90 feet. But at that part the banks are rocky-firm, so that as regards the building of bridges the conditions are more favourable than in the southern reaches. Below Kalabagh, on emerging from the hills on the plain, the river divides into numerous arms which constantly change their course, wash away their banks and occasion sand banks and islands, and these are so changeable that no permanent works can be raised upon them. The crossings are exceedingly difficult. At Isa-Khel Ferry the breadth is $13\frac{1}{2}$ miles, at Til-Kafir-Kot 9 miles, at Bil-Kafir-Kot $7\frac{3}{4}$ miles. At Dera-Ismail-Khan matters are still worse. The distance from that post to Daria-Khan is 12 miles in a direct line, the détours, which it is necessary to make during high water, are frequently twice as long.

When the river is in flood many miles of country are submerged, and much destruction of crops and of irrigation works ensues.

Sometimes the inundations are quite exceptional in consequence, it is presumed, of accumulation of water under the snow in the upper reaches, and of its affluents in North Kashmir and Little Thibet. Portions of glaciers slide and obstruct the mouths of the valleys until they give way to pressure of water.

The shifting of the channel occurs at low as well as at high water. Entire villages are swept away from its banks every year. Dera-Ismail-Khan sprang up in 1823, when a Baluchi settlement, Malik-Sohrab, four miles farther east, was carried away by the current. Considerable works have to be done now to protect the barracks in the new settlement. The river passed within 12 miles of Dera-Ghazi-Khan not so very long

* They are stated in detail by General R. Macgahan in his paper on "The Rivers of the Punjab." ("Proceedings of the Royal Geographical Society," November, 1885.)

ago; in the year 1884, it ran within two miles of the place; at present it is close up to it, and the question has been raised whether the barracks should not be moved elsewhere. The question of keeping the river within bounds is of course one which more particularly concerns agricultural interests, so that measures of precaution against inundations are adopted only when danger threatens military sites or railway work.

In these circumstances, following upon the construction of the bridge at Attock in 1882, a second bridge at Sukkur was built only in 1889. The want of a third bridge at some point between there is very great, but the difficulties in the way of meeting that want are enormous. The substitution of a floating bridge of boats at Dera-Ghazi-Khan by a permanent bridge is specially called for, but the conditions at that point are so unfavourable that some other point has to be found. Mianwali offers no advantages, Kalabagh is not in the line of the Gomal; it were easier to build a bridge at Til-Kafir-Kot or at Bil-Kafir-Kot, but then on the eastern side either the Khasor Range must be crossed or it must be turned.

Bridge across the Indus at Sukkur.

The necessity for a bridge at Sukkur was recognised when the railway from Karachi to Multan was begun—in 1871. It was, however, long before the building could be begun, and it is owing only to the advance of technical science that great difficulties were overcome, and that the bridge at Sukkur exists in its present form. There were many projects drawn up, but the difficulties were so great that they were many times put aside. A steam ferry was established in 1879 which carried over eight waggons at a time. At length, in 1881, it was determined to build a bridge a little below Sukkur; it was raised on buttresses with spans of 250 feet, but the floods of 1882 washed away the bed of the river. In February, 1883, a plan of a bridge of one span was finally adopted, and the bridge was completed in the beginning of the year 1889. The situation chosen for the bridge was between Sukkur and Rohri (Khadji-Moto) where the Indus is divided into two channels by the island of Bukkur. It was found practicable to throw a bridge of three small spans (278 feet, 238 feet, and 94½ feet) over the arm of the river nearest to Sukkur. . . . . * These spans are formed by ordinary girders resting on stone piers The bridge across the Sukkur arm was opened in March, 1885.

The bridge over the left or eastern arm at Rohri is a work of grander proportions. It is a single span of 790 feet, with 820 feet between the axis of the vertical pillars. It is built on the cantilever principle, the most striking example of which is the bridge across the Firth of Forth. The bridge at Rohri (better known as the Sukkur Bridge) is the second in the world

* Technical description here omitted.

in width of span. Two colossal cantilevers project each 310 feet over the river, the space of 200 feet between them is closed by a girder borne on the extremities of the cantilevers. Each cantilever has a vertical height of 170 feet above the abutment. The bridge is of steel, and the total weight of that metal used is 3,300 tons. The rails are laid on two horizontal girders passing over the whole bridge and 18 feet apart. The roadway is covered with a strong iron floor, the object of which is to strengthen the structure and increase the stiffness; this is of great importance since the oscillation of the bridge is very considerable. The vertical and lateral displacements are not great when locomotives pass, but with the motion of men marching the displacement is visible to the eye. The effect of temperature on so large a span is of course considerable; the expansion between the buttresses amounts to 8 inches. The extremity of the cantilever rises and falls 6 inches; the horizontal swaying extends 2 inches and depends on the difference of temperature between the sunny and shady side.

The work was commenced in the winter of 1883-84 simultaneously with the construction of the bridge on the eastern arm. The piers were completed in March, 1885, when all work was suspended pending the arrival from England of the steel parts of the cantilever and superstructure. Some of these parts were received in May, 1887, and all the material was to hand in November, after which work was resumed. The superstructure was completed between the 5th and 9th February, 1889, and on the 27th March of the same year the bridge was declared to be open by order of the Viceroy, Lord Lansdowne, after whom it was named "Lansdowne Bridge."

The whole of the construction of the bridges across both the arms cost Rupees 4,310,755, inclusive of the block houses on the buttresses which cost Rupees 90,316.

Communications East from the Indus.

An entire series of works has been performed east of the Indus in connection with the general plan of defence of the north-west frontier of India.

The narrow gauge lines near the frontier have been reconstructed, and east of Lahore all the railways have an uniform gauge of 5 feet 6 inches.

The Sind-Sagar Railway is a continuation of the section running along the Indus from Karachi to Multan; its length from Shershah to Kundian is 186 miles; from Kundian, where the line leaves the Indus and turns eastwards as far as Garanpore, the distance is 107 miles. From Garanpore to Lala-Musa Station (on the road from Peshawar to Lahore) the previous narrow gauge has been replaced by a broad gauge (1886).

The works on the main line were begun in 1885 and the line

was opened in 1887, 75 lb. steel rails are laid on steel sleepers. The principal works are two large bridges at each end of the line. The first (Victoria Bridge) is across the Jhelum River and consists of 17 spans of 150 feet each, each resting on a single caisson, sunk 82 feet below low water; the bridge was opened in May, 1887. The second bridge across the Chenab is also of 17 spans of 200 feet each on caissons sunk 75 feet below low water; it was begun in September, 1888, and it is expected that it will be finished in the autumn of 1890.

From the Sind-Sagar Line there are the following loops or branches:—

a. From Daria-Khan to the ferry at Dera-Ismail-Khan; length 5 miles.

b. From Mahmud-Kot to Ghazi-Ghat, 10 miles.

Surveys have likewise been executed for the connection of Kundian with Kushalghar; the first section (27 miles long) was begun in January, 1890 (from Kundian to Mari).

The abrupt curves between Jhelum and Rawal-Pindi have been reduced to 1 in 100; this involved a cost of Rupees 4,900,000.

Surveys have been executed for the connection of Banu with the Sind-Sagar Railway,—between Dera-Ismail-Khan or Kala-Bagh.

Great importance is attached to the building of a permanent bridge at Ferozepore across the Sutlej (Kaiser-i-Hind Bridge); it was begun in 1885, and opened in 1887.

Although there is a difference of gauge at Ferozepore (the North-West lines are all 5 feet 6 inches, but the Rajputana-Malwa road, running to Bombay, is 1 metre) involving a change of wagons and reloading, yet the construction of one of the largest bridges in India was dictated by a desire to overcome the difficulty of crossing at that part during inundations.

The length of the bridge is 4,250 feet; it has 27 spans of 150 feet each, on buttresses sunk to an average depth of 80 feet below the bed of the river. The rails are laid 26½ feet above low water. The girders are partly steel and partly iron. The rails are laid along the lower *lie* of the girders, and a carriage road runs over head. The abutments are protected by strong blockhouses with iron gates. Considerable work was done for the purpose of regulating the bed of the river, which frequently shifted from one side to another. The lateral and cross dams of very strong profile extend nearly three miles up the river from the bridge.

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