

**WEST COAST MAJOR PORT DEVELOPMENT COMMITTEE'S
REPORT AND RECOMMENDATIONS**

REGARDING

**THE POSSIBILITY OF SITING A MAJOR PORT
ON THE COAST**

COVERED BY



KATHIAWAR AND CUTCH

RESOLUTION

New Delhi, the 17th February, 1948

No. 19-P(53)/47.—The Government of India are pleased to constitute an expert committee known as "The West Coast Major Port Development Committee" to carry out the following two investigations:—

I. (a) whether a deep-sea port on the stretch of coast covering Kathiawar and Cutch for the accommodation of ships of large size and tonnage at all seasons of the year is required;

(b) if so, where it should be sited, having regard to construction and maintenance costs, allied transport developments, possibilities of developing existing ports and the needs of the entire area to be served.

II. (a) whether a deep-sea port between Mormugao and Cochin for the accommodation of ships of large size and tonnage at all seasons of the year is required;

(b) if so, where it should be sited, having regard to economy of construction and maintenance of the port and allied transport developments required and having regard to the needs of the entire area: also what measures are necessary for establishing it;

(c) what improvements are necessary in communications to the existing ports; also what other measures should be taken for the development or provision of additional facilities in these ports as may be found necessary or desirable.

2. The composition of the Committee will be as follows:—

Mr. Kasturbhai Lalbhai—CHAIRMAN.

The General Manager, B. B. & C. I. Railway, Bombay, for the former investigation, and the General Manager, M. & S. M. Railway for the latter.

Mr. S. N. Haji, Scindia Steam Navigation Co., Ltd., Bombay.

Mr. K. Mitter, Docks Manager, Calcutta Port Commissioners, Calcutta.

Mr. J. B. Murray, Chief Engineer, Calcutta Port Commissioners, Calcutta.

Commander D. Shankar, Director of Naval Engineering, Naval Headquarters (I).

Mr. V. V. Bhide, Secretary to the General Manager, B. B. & C. I. Railway, Bombay—SECRETARY.

3. The committee is requested to submit its recommendations to Government before the end of April, 1948.

S. CHAKRAVARTI, Jt. Secy.

CORRIGENDUM

Delhi, the 12th April, 1948

No. 19-P(53)/47.—In the Resolution of the Government of India in the Ministry of Transport, No. 19-P(53)/47, dated the 17th February, 1948, published in the *Gazette of India Extraordinary* dated the 17th February, 1948, for the words "General Manager, M. & S. M. Railway" substitute "Chief Commercial Manager, M. & S. M. Railway"

S. CHAKRAVARTI, Jt. Secy.

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1. **First Term of Reference I (a).**—The first question referred to the Committee reads as follows:—

“Whether a deep-sea port on the stretch of coast covering Kathiawar and Cutch for the accommodation of ships of large size and tonnage at all seasons of the year is required”.

2. Our answer is—

Yes and without delay. The emphasis is on the time factor.

3. The immediate and imperative necessity of having a major port on the coast line of Kathiawar and Cutch is obvious, if the following points are borne in mind:—

- (1) **Hinterland.**—Vastness of hinterland, with millions of people *vide* Appendix ‘A’, which shows the hinterlands of the ports of Karachi, Bombay and Kathiawar.
- (2) **Length of Coast Line.**—Long coast line, about 1,000 miles between Karachi and Bombay and about 950 miles between Lakhpat (the most northern port on the coast of Cutch) and Bombay.
- (3) **Loss of Karachi.**—In spite of all friendliness, India must naturally see that her trade flows to and from her lands through her own ports.
- (4) **Congestion in Bombay.**—Congestion in the port of Bombay has been acute, although there has been only a partial diversion of traffic from the port of Karachi. Diversion could not have been but partial because of the essential fact that trade takes time to shift and that the trade of Punjab and Delhi has been almost at a standstill, due to the tremendous convulsion caused by communal frenzy and the mass migration of people. In the port of Bombay there have been times when six food ships were working in port and as many as fourteen food ships had to wait outside. Some of these ships had to wait for days, in extreme cases up to even a month, before getting berths to discharge.
- (5) **Relief to Rail Congestion.**—Relief to our over-burdened rail transport can be afforded by the opening of more ports and thereby substantially reducing rail leads to and from the hinterland. The country’s whole economy is vitally linked up with transport. More ports mean quicker turn-round of wagons enabling transport of more goods.
- (6) **Traffic Potential.**—Rise of India as a free country, taking her proper place in the world federation of free countries, and playing her legitimate part in her sphere of influence—the Indian Ocean and the adjoining regions, Australia, Asia and Africa—is bound to give rise to much more port traffic. Further we can definitely count on such factors as the rise in the standard of living, increased agricultural production, increased industrial activity, development of mineral resources of the country, growth of population and a co-ordinated transport policy. All these factors will add to the country’s seaborne traffic and without more ports progress is bound to be handicapped.

Sufficient has been said to justify a major port on the stretch of coast covering Kathiawar and Cutch and there is no time to lose in the construction of the port.

4. Significant Events.—Fortunately significant changes have taken place and are still rapidly taking place which render the construction and operation of a major port much easier than ever before. We refer to the tumbling down of age old customs barriers in the maritime States of Kathiawar and Cutch, with all their peculiarities and complexities, the integration of the numerous States into sizeable economic entities and the fusion of small State Railways—all motivated by the desire to serve the greater interests of the country.

5. Definition of Major Port.—For the terms 'ships of large size and tonnage', we accept the basis worked out by the Armstrong Committee viz., ships of 600 feet length and 30 feet draft. We accept also, the definition of a major port given by the Armstrong Committee, which reads as follows:—

"The distinction drawn between a major and minor port is not mathematical. . . . It is arbitrary. When a minor port, by reason of size or for other reasons is taken under the financial control of the Central Government, it is called a major port. . . . all the others are called minor ports . . . , even though the tonnage of cargo passing through a minor port may be greater than that passing through a major port.

For all practical purposes, however, the distinction between a major port and a minor port is generally understood. The sheltered nature of a port, the well-laid out approach channels, the provision of docks, jetties and moorings, the well-laid out transit sheds, the effective rail connections, the ability to serve a very large portion of the hinterland lying behind the port, the facilities for meeting the requirements of defence and strategy, the comparatively large volume of traffic and the possibilities of work for shipping, all the year around, usually distinguish a major from a minor port."

We, however, add one more point as an essential requirement in a major port, i.e. the port's ability to turn-round ships quickly.

6. Ship Turn-round.—This feature has come very much to the fore since the war, due primarily to the shortage of ships. The cost of ships and the operating costs have risen considerably and are not likely to come down substantially. The importance of this aspect in port economics is not generally realised. One of the reasons for the prevailing high shipping freight is the poor turn-round at ports. To achieve quick turn-round of ships, a port must have adequate cargo handling equipment, and must fulfil certain marine conditions which will be referred later.

7. First Term of Reference I (b).—Now we come to para I(b) of our terms of reference—

"If so, where it should be sited, having regard to construction and maintenance costs, allied transport developments, possibilities of developing existing ports and the needs of the entire area to be served."

A study of the data placed at our disposal by the Ministry of Transport, Government of India, left us in no doubt that finding the answer to this question would be difficult. The answer has been arrived at after a careful study of all available data, including admiralty charts, engineering reports, and local surveys, after visits to all existing ports and all likely sites, after a close scrutiny of the valuable mass of documents which have been furnished to the Committee by the various ports and chambers of trade and after the Committee has had the opportunity of meeting the Rulers and officials of various States,

Ministers of the Saurashtra Government, and representatives of various trade and commercial interests.

The original statements submitted to the Committee have also been forwarded to the Ministry of Transport, Government of India.

Method of Approach.—Our plan of approach in the matter of investigation and in the matter of arriving at a decision was made as follows:—

- (A) **Needs of Entire Area.**—The first essential was to bear in mind “the needs of the entire area to be served”. A map giving a rough idea of the hinterland of the major port was drawn up *vide* Appendix ‘B’.

Estimated Traffic.—The traffic of the major port in the immediate future was estimated to be 1·3 million tons *vide* Appendix ‘C’. A study of the map led us to make the following deductions.

- (i) **Railway connections.**—that to afford maximum rail facilities, and to avoid break of gauge transshipment, the port must be served both by broad gauge and metre gauge. The immediate area served by the port has a network of metre gauge railways, whereas the far hinterland is served mainly by broad gauge.
 - (ii) **Ability to meet Growth in Traffic.**—that the hinterland has great potentialities. Properly served by rail, on a conservative estimate, the immediate estimated traffic of the port may be expected to double itself in the course of the next decade.
 - (iii) **Area Reserved for Development.**—that there should be a sufficiently large area included within the port limits to admit of the siting of new industries, growth of warehouses, expansion of marshalling yards and workshops, accommodation for offices and quarters—all on a properly planned basis.
 - (iv) **Land Appreciation.**—that the benefits as a result of appreciation in land values due to the construction of a major port should accrue as far as possible to the port itself, and not to individuals or corporate bodies.
- (B) **Marine Conditions.**—We have laid down the following marine conditions for the new port:—
1. It must have natural shelter
 2. The tidal range should not be excessive.
 3. It should be capable of initial development without having to resort to enclosed docks.
 4. The ultimate possible development should be unlimited if impounded docks are constructed at a later stage.
- (C) **Information on Existing Ports.**—Information was then invited from existing ports, followed by a reconnaissance of the entire coast within our terms of reference. Contacts were made with the Government and State officials and port and railway officers. The data thus collected has been tabulated in Appendix ‘D’.
- (D) **Rail Distances to Hinterland.**—The next step was to take note of the existing communications with the hinterland by rail, road and sea, and the various proposed rail connections. Rail distances from some of the ports to main trade cities and important sites are shown in Appendices ‘E’ and ‘F’.

(E) **Visits to Ports.**—The Committee was then in possession of sufficient information to visit the likely ports, study the problem at site, meet representative bodies, and come to a final decision.

8. Investigation of Alternative Sites.—The coast line of Kathiawar and Cutch extends to a total length of 700 miles, and may be sub-divided into three sections, each containing a number of ports and possible sites for new ports:—

1. Gulf of Cutch.

Kandla, Navlakhi, Bedi, Sika, Salaya, Port Okha.

2. The Arabian Seacoast of Kathiawar, *i.e.* the west and south coasts—
Porbunder, Verawal, Nawabunder.

3. The Gulf of Cambay.

Port Albert Victor, Bhavnagar, Dholera, Cambay.

We shall deal first of all with the ports on the main coast line of Kathiawar.

9. Ports on the West and South Coasts of Kathiawar.—These ports all suffer from the same disadvantage, namely exposure to the south-west monsoon, and in consequence they have to close down for several months every year. The construction of an all weather port on this coast could be achieved by building breakwaters, but such massive engineering works take time to construct and are necessarily expensive. It has been estimated that an all-weather port at Verawal, consisting of two berths, a passenger jetty and other usual facilities would cost about Rs. 2½ crores, of which Rs. 1½ crores would be spent in dredging rock and constructing breakwaters. Junagadh has access to the sea only on the Arabian coast, and therefore the State had to contemplate this heavy expenditure for the establishment of even a small all-weather port. Fortunately this Committee is working under no such restrictions, and has the choice of several sheltered harbours which nature has already provided.

The above facts, alone, are sufficient to eliminate these ports from our choice, but in addition they are all badly placed geographically in relation to the hinterland, resulting in greatly increased railway leads. The fact that they are on the main sea routes cannot outweigh these disadvantages.

We have, therefore, no hesitation in recommending that the new major port should not be sited on the coast of Kathiawar facing the Arabian Sea.

10. The Gulf of Cambay.—Much time and thought has been devoted to the possibility of siting the new port in the Gulf of Cambay. The favourable geographical position, easy access to the hinterland, and the present advanced stage of development of at least one port in the gulf, namely Bhavnagar, are all factors which have been given much weight by this Committee.

A number of rivers, namely the Sabarmati, Mahi, Dhadar, Narbada and Tapti debouch into the Gulf of Cambay. Every year these rivers bring down large quantities of silt, and there is ample evidence that the gulf is slowly but surely silting up. If this is allowed to continue, in the course of time the present deep water channels may completely disappear.

Dredging cannot be considered as a remedy, as the quantities of material to be dredged are too great. Local dredging at port entrances, such as that adopted at Bhavnagar, is a big enough problem. To dredge a channel through the gulf would be a stupendous task, and cannot be contemplated.

The cost of dredging (excluding the capital cost of the dredgers) has been given as Rs. 3 lakhs per annum and on 300,000 tons of cargo this represents Re. 1 per ton of cargo handled. Based on the full capacity of the port the cost would work out at Re. -/8/- per ton still a very high figure. If the deep water basin were extended to provide more berths, the cost of dredging would also increase, although not *pro-rata*. Nevertheless the fact remains that the dredging of this basin is a major problem.

A method by which Bhavnagar could improve conditions inside the basin, and reduce the cost of dredging is by sluicing, taking advantage of the high tidal range and low lying land in the vicinity of the dock. If certain areas of this land are banded off so as to form large settling tanks which can be filled at high tide, huge quantities of clear water can be made available to sluice out the basin at low tide. It is easy to imagine how siltation takes place inside the basin. Silt-laden water enters with the tide, and lies dormant in the dock for several hours. At high tide the total depth of water is over 50 feet. While the water lies dormant, the silt gradually settles, and later, as the tide recedes, comparatively clear water runs out, the water left in the basin at low tide being heavily charged with silt. If this is sluiced out every day by the method described above, there should be a tremendous reduction in the amount of dredging required.

This suggestion has been made to the Bhavnagar authorities by the Committee.

The Bhavnagar authorities have suggested that the present limitations to the port could be overcome by the construction of an impounded dock, with a lock entrance, at the site of the present dock. This proposal is not favoured by the Committee for the following reasons:—

1. The cost of such a structure would be considerable; it has been estimated at Rs. 1½ crores, and could only be justified if the size of the port was likely to increase very materially.
2. The entrance would not give access to deep water, but to a shoaled channel, only 4 feet deep at low water, and 4 to 5 miles distant from the deep water anchorage.
3. This would restrict the movement of vessels through the lock to the period of high tide, and only two or at the most three vessels could be moved per tide—a serious restriction if the port were to expand.
4. Dredging would not be eliminated, except possibly inside the dock. Dredging the approach channel, at the entrance to the lock, would have to continue on the same scale, or even on a greater scale, as at present.
5. The grave uncertainty of the future of the Bhavnagar channel, and the Gulf of Cambay, make the construction of such a structure a doubtful venture.
6. This risk need not be taken as other sites are available which do not suffer from this great disadvantage, and yet have at least equal geographical advantages in respect of the main hinterland.

However, much capital has been invested in this port and trade is well established. The quays are served by rail and road, and there are adequate transit sheds, warehouses and open storage areas. Use should be made of the facilities to serve, as far as possible, the hinterland in Zone 'B' *vide* Appendix 'G'.

The first step required is to improve the output of the dredgers, so as to maintain 28 feet of water in front of the berths.

As soon as it has been demonstrated, that the local dredging problem at Bhavnagar can be overcome, it is recommended that one or at the most two new berths be constructed inside the dock. Work on these berths could be put on hand at an early date, and Bhavnagar could thus materially assist in meeting the present needs.

Even, however, after the completion of the new major port, these new berths at Bhavnagar could be put to good advantage. They could be used to supersede the working of steamers at the anchorage, and the long haul of 12 miles by lighter from the anchorage to the old bund. If Bhavnagar is to stand on its feet, as a self supporting port, the method adopted in the past of unloading ships 12 miles away from the port cannot continue. A large proportion of Bhavnagar's dredging costs is in dredging the old lighterage port and the creek leading to it. This could be discontinued and the old port used for country craft only.

12. Port Albert Victor.—Port Albert Victor has attracted attention for many years as a possible harbour for sea going traffic. It is at present only a port in name, situated at the south west corner of the Gulf of Cambay. A small timber jetty was constructed many years ago, and a metre gauge railway track has been laid to the site—a distance of about 120 miles from Bhavnagar.

A fairly extensive deep water anchorage lies inside the entrance channel, and from there Mota Pat Creek runs, in a north easterly direction, a distance of about 6 miles to the jetty. Both the anchorage and the creek are sheltered from the south-west monsoon. The creek is about 800 feet wide at low water mark and the depth of water at L. W. O. S. T. varies from 5' to 10'.

The deepening and widening of this creek would present a big dredging problem, and a very rough estimate of the amount of dredging is 10 million tons. Further it is unlikely that the creek once widened and deepened, would retain the required depth without considerable maintenance dredging, as the water which enters the creek is silt-laden.

Had Port Albert Victor been situated on a deep inlet which required little or no dredging, it would have merited greater consideration. As it is, it does not appear to possess the natural advantages which would justify its development. On the issue of rail distances from the hinterland also, the development of Port Albert Victor does not commend itself.

13. Cambay.—Situated at the extreme northern tip of the Gulf of Cambay, this was at one time a flourishing port. Water has receded from the port, however, and the present condition is but a further proof of the deterioration in the Gulf. It must also be borne in mind that when Cambay flourished as a port, it had not to cater for ships of deep draft. A modern port, as we know it, could only be constructed at great cost, and it is very doubtful if sufficient dredging capacity could ever be obtained to maintain a deep water channel. There are no natural features favouring the construction of a deep water port at this site, and it must therefore be discarded.

14. Dholera.—Here conditions are similar to Cambay, and the site must be discarded for the same reasons. The geographical position of both these ports is good, and would have been attractive had the marine conditions not been so unsatisfactory.

15. The Gulf of Cutch.—Having discarded the Gulf of Cambay, and the main coast line, we are not left with a number of possible sites in the Gulf of Cutch from which to make our choice.

16. **Navlakhi.**—Navlakhi is a well developed lighterage port, operated in the past by Morvi State, and which has attracted trade owing to its geographical position and other advantages. Ships lie at a small anchorage in Hansthal Creek, at the eastern end of the Gulf of Cutch, and cargo is transferred to lighters. The distance from the anchorage to the lighter quays is $1\frac{1}{2}$ miles. The construction of a deep water port at this site would present many difficulties and in fact such a step would never be contemplated unless no other possible site existed. Navlakhi cannot, therefore, be considered as a site for the new major port.

17. **Port Bedi.**—This also is a lighterage port, operated by the State of Nawagar. For the same reasons as given for Navlakhi, Bedi cannot be considered as a possible site for the new port.

18. **Port Okha.**—Port Okha lies at the entrance to the Gulf of Cutch on the southern shore. In spite of its close proximity to the Arabian Sea it is protected from the South West Monsoon, and can be worked all the year round. The harbour lies between Beyt Island and Okha Point; Samiani Island to the North of Okha Point affords protection to the anchorage and steamer berths. A pier has been constructed for berthing steamers upto 30 feet draught, and a quay of 800' long for lighters. Large steamers can also discharge into lighters, while lying in the harbour.

Okha fulfils many of marine conditions we have laid down. There is a sheltered harbour, the tidal range, maximum 13 feet, is not excessive, and there is easy access to dry land.

Unfortunately the harbour is small, and there is a limit to the possible expansion of the port. The bed of the harbour is very irregular, and steamers can only lie at anchor in a few places. Dredging is necessary but is not a serious problem at present.

Engineers have reported on the possibility of constructing another pier, similar in design to the existing pier. This would increase the capacity of the port, but a substantial increase in capacity could only be achieved if the harbour is considerably enlarged by dredging, and if many of the existing features are removed to make way for deep-water quays.

Port Okha will continue to serve its immediate hinterland and for this purpose it is a well laid out and efficient port. With the establishment of new and expanding industries in the vicinity there is no reason in fact why Port Okha should not continue to expand. It cannot, however, be considered as a site for the new major port because (a) the harbour, in its present state, is too small (b) it is badly placed geographically to serve North and Central India.

Our choice is now narrowed down to three possible sites namely, Sika, Salaya and Kandla.

19. **Sika.**—For a number of years the State of Nawagar has been exploring the possibility of developing Sika into a deep water port. A half tide reef, known as Goos Reef, splits up the harbour into two channels, the main channel, and the western channel.

There are a number of features which favour the selection of Sika as the major port:—

1. There is a fine natural harbour, providing over 30 feet of water at low tide.
2. The harbour is sheltered.

3. Industries exist, and trade facilities are already established.
4. A metre gauge railway connects Sika with the Kathiawar Railways and beyond. A broad gauge railway could be constructed to Viramgam.
5. Water supply would present no difficulty, and the climate compares favourably with other possible sites.

There are, however, three serious objections to the selection of Sika:—

1. The long distance between the harbour and the nearest dry land (dry at high water).
2. The cost of reclamation and the time required.
3. The comparatively longer rail lead to the main hinterland.

With regard to the first objection, the distance between the harbour and dry land is 5 miles, and thus every bit of land required within miles of the quays, would have to be reclaimed from the sea. Not only so, the maximum height of reclamation would be 90 feet, and the average height over 13 feet.

A small port, such as that envisaged by Nawanager State would work fairly efficiently by means of a narrow causeway connecting the quays with dry land, but to develop a major port, a vast reclamation scheme would be necessary, as such a port could not function properly without ample space immediately behind the quays. The separation of the quays from high land, by a causeway 5 miles long would place too serious a limitation on the working of a large port.

During the past year, attention has been diverted to the western channel, which covers a larger area, and has a wider entrance. Deep water approaches closer to dry land, and it is probable that by developing a port on the western channel, the approach to dry land would be shorter. Nevertheless, the distance is still great and the reclamation which would be required remains a major problem.

2. The local authorities have estimated that the cost of a causeway to Goos Reef, designed to carry only one railway track, would be 45 per cent of the total expenditure involved in constructing a two-berth port. As already stated, however, for a large port, a causeway alone would be insufficient and reclamation on a much larger scale and at much greater cost would be necessary. The time required for this reclamation would be considerable, and every subsequent stage of development of the port would be halted until further reclamation could be completed.

3. From the point of view of rail leads, Sika is at a disadvantage, *vide* Appendix 'E'.

Had we not found a site which fulfils the marine conditions, and at the same time does not suffer from the two serious handicaps of reclamation and longer rail lead, Sika might have been our choice.

20. **Salaya.**—The conditions at Salaya are very similar to those at Sika. There is a fine harbour which was, in fact, selected as a site for a naval base during the last Great War. It must be borne in mind, however, that there is a vast difference between the requirements of a naval base and a commercial port. In the former, naval vessels lie at anchor in the harbour, and only tie up at a quay to repair, replenish or refuel. There is no question of handling large quantities of cargo. Any objection to Sika and Salaya as commercial ports does not apply to the same extent, therefore, when considering either as a possible naval base.

As a possible commercial port, Salaya suffers from the same disadvantages as Sika. There is a large gap between the harbour and dry land. The rail leads to the hinterland are even longer than from Sika. Salaya therefore has no better a case than Sika.

21. **Kandla.**—Along the northern shore of the Gulf of Cutch there appears to be only one natural deep water harbour, namely Kandla Creek, situated at the eastern end of the gulf. This creek has maintained a depth of water of over 30 feet ever since records have been maintained (1851) although a bar has formed at the entrance in recent years (between 1926 and 1930). The creek forms a natural sheltered harbour, and is easily navigable. The land on the west bank is only two or three feet below high water and there is no serious reclamation problem. The Cutch State authorities have already, in a small way, developed Kandla as a port, and have constructed a pier which carries a narrow gauge railway.

The maximum tidal range is 22'-6", and this would not materially affect the working of ships. Currents are not excessive, and there is a period of slack water amounting to about half an hour. The channel is wide, 6 miles long, and could provide anchorage and turning space for many ships.

Kandla could be developed, in the first instance, to handle up to 2-3 million tons of cargo per annum, by the construction of berths facing the creek. There is a limit to the number of berths which could be constructed in this manner, however, as the port would become too long and scattered, and ultimately an impounded dock would probably be required, set at an angle to the creek. The site lends itself to the construction of such a dock.

As previously stated, a bar has formed at the entrance to Kandla Creek. This appeared, for the first time, in the 1930 charts and since then there has been no further deterioration. There is a depth of 14 feet of water over the bar, at low tide, and the minimum rise of tide on any day of the year is 17 feet. Thus, at high tide, the depth of water would be not less than 31 feet. This does not mean that ships could only cross the bar at high tide. Most ships using the port would be drawing 28 feet or less and it would be very seldom that the water available would be only 31 feet. There would normally be a period of at least 4 hours during each twelve hours when heavily laden ships could cross the bar, and this is quite a workable arrangement comparing favourably with other ports.

There is no reason to suppose, however, that this bar could not be removed by dredging. The water in the creek is only very slightly silt-laden, and the fact that the remainder of the creek has maintained a great depth of water for so many years is a further indication that the bar could be removed. Bars usually form where a fresh water river flows into a tidal estuary, and are caused by (a) the reduction in velocity owing to the widening out of the estuary, with consequent deposition of silt and (b) the mixing of silt-laden fresh water with salt water. Neither of these conditions apply to Kandla Creek. One reason given for the formation of the bar is the coastal erosion caused by indiscriminate cutting down of vegetable growth on the banks of the creek. This is a possible explanation.

The approach channel to the port would require to be buoyed and lighted. At present it is inadequately buoyed, and as there are no light buoys, navigation at night is not possible.

It has been stated by the Ports (Technical) Committee that Kandla has not developed as a port owing to the policy of isolation adopted in the past by the Cutch State authorities, and in fact the lack of industries, roads and railways in the hinterland is an objection to the selection of Kandla as a site for the new port. At present the water supply to the port is on a small scale, and the potential supply for a large port must be considered. The annual rainfall in Cutch State, averaging 11 inches per annum, is much less than the average in Kathiawar. However, there are vast catchment areas, and undoubtedly there is the potential for an adequate water supply to serve a port of the size contemplated.

At Kandla we have found a natural deep water harbour adjacent to high land, where a port can be constructed quickly, and developed to any extent which trade may justify. It has certain limitations, but taking all these into account, we have no hesitation in recommending Kandla as the site for the new major port. Adequate data exists for us to make this decision, but extensive borings and engineering surveys would necessarily have to be undertaken before the construction of the port could be commenced.

In Appendix 'H' we have shown the future port of Kandla as we envisage it. This, of course, is merely tentative.

The estimated traffic of 1.3 million tons (including petroleum and coastal traffic) justifies the construction of four deep water cargo berths, one oil berth, and one quay for lighters and country craft. The most convenient site for the construction of the cargo berths is north of the existing pier, adjacent to the salt works. Here deep water is obtained close to the bank, and there is room for the construction of at least six berths, each 600 feet long. The site for the oil berth is not shown on the plan, but there are various alternatives, either on the opposite bank of the creek, or south of the existing pier.

We have also shown how an impounded dock could be developed at a later stage. This may not be required for many years, but is important that the site selected should be capable of such development, and land should be reserved for this purpose.

The salt works will have to be removed to another site. At present they occupy most of the land which will be required for the first stage of development.

22. Other Possible Sites.—In addition to the ports which have already been described in detail, other sites have been inspected and, in fact, a survey of the entire coast has been made. Thus Jafrabad, Nawabundar and other ports have been visited, but all have been discarded, as they do not comply with the conditions we have laid down.

The various interested States were also invited to make suggestions regarding any possible sites for a new port, and such information as has been supplied has been fully taken into consideration.

23. Advantages and Disadvantages of Kandla.—Even at the cost of repetition, it will be best to sum up the advantages and disadvantages of Kandla.

Advantages.—1. Its geographical position is best suited to replace the port of Karachi in its service to the hinterland.

As between Kandla and Karachi, Delhi is 656 miles from Kandla as against 783 miles from Karachi. Similarly Hissar is 688 miles from Kandla as against 733 miles from Karachi.

2. The deep water sheltered harbour in close proximity to high land affords quick and economical development into a major port.
3. Economy of construction and maintenance—low cost of reclamation and comparatively little dredging.
4. Considerably shorter rail leads, *vide* Appendices 'E' and 'F'. Bhatinda and Hissar are closer to Kandla than to Sika by 59 miles, or by 77 miles depending on the route selected for the new metre gauge connection. Similarly, Delhi and Agra are 79 miles nearer. By the new broad gauge connection Ahmedabad will be 47 miles nearer to Kandla than to Sika by the present metre gauge line.

Moreover, the transport of over one million tons of estimated traffic in the immediate future and of much more in the near future over an extra distance of even seventy miles, if Sika were to be selected, is a very important factor, which would add to the cost of goods and would put an additional burden on the railway system.

5. The undeveloped and unexploited nature of the territory of Cutch, covering 1700 sq. miles, of which the two Ranns of Cutch comprise 900 sq. miles. Potentialities for development of industries, *e.g.* salt cement, glass and fishing. Development of vast mineral resources, *e.g.* Gypsum, Lignite, Bauxite, etc.
6. Unlimited availability of land for port area.

Disadvantages.—1. Bar at entrance.

2. Non-existence of trade facilities.
3. Inadequate water supply at present.
4. No existing rail communications. The cost of proposed rail connection and the time involved.

With regard to the disadvantages, the following comments are necessary:—

1. This disadvantage has been dwelt upon at length in para. (21).
2. There are many instances of trade facilities following new ports.
3. We are satisfied that there are resources for an adequate water supply both to the port and port town *vide* Appendix 'D'.
4. Two rail connections are proposed:—

Broad Gauge: Jhund to Kandla=137 miles plus bridge over the Little Rann of Cutch.

Cost=Approximately 6 crores of Rs.

Metre Gauge: Deesa Radhanpur, Piprala, Kandla=174 miles plus bridge over Banas river.

Cost=Approximately 4½ crores of Rs.

Both broad gauge and metre gauge railways can be constructed in three years time subject to materials being made available and the port would take just as long to construct.

Railway traffic surveys have been made for both connections. Immediate returns will be from two to three per cent. on the capital outlay, *vide* Appendices 'I' and 'J'. It must be stated also that the proposed railway lines would be running through vast virgin tracts of territory and will be of considerable

strategic importance. These lines will serve to connect up an extensive area which unfortunately has remained severed from the mainland and for so long.

24. Future of Minor Ports.—It is necessary here to dwell upon some of the common features of the Kathiawar ports. Each one has grown as a direct result of its respective State's activity, mainly prompted by economic considerations, arising out of customs privileges enjoyed by these States. It was in the State's interests to develop these ports up to a certain stage. Due to the favourable customs and income-tax arrangements, each port has a certain number of industries around it. The extent of such industries varies at each place according to the local conditions, availability of raw materials and power, etc., and according to the enterprise of the particular Ruler.

Each of these ports has gone a long way to attract traffic by levying low charges on ships and on cargo and by offering facilities of storage which would be the envy of merchants in other parts of India.

At times, even rail rates over the respective State-owned Railways have been adjusted to attract traffic.

What has been stated above merely emphasizes the need for co-ordination of operations in each of these ports under one Port Commission.

The procedure and charges at the various ports should be similar, storage charges should be reasonable, and the total available mobile port facilities should be utilised by all the ports to the best advantage.

Although we recommend the construction of a major port at Kandla, we believe it to be essential to maintain in efficient condition the existing ports in Kathiawar, e.g., Navlakhi, Bedi, Okha, Porbunder, Verawal and Bhavnagar. These ports are very necessary for the country's economic life. In one commodity alone, namely, salt, the Government's latest policy is to increase the annual output from 280,000 to 550,000 tons, so that India may in the course of the next 5 years be independent of salt imports. Practically, the entire increase will represent additional traffic in the ports of Kathiawar and Cutch. Again on the transport side, India cannot but encourage the movement of goods along the coast, both in ships and in country craft.

In the event of an emergency, traffic could be diverted to these ports, should the necessity arise, and their continued existence therefore is of considerable importance.

25. Summary of Recommendations.

1. The need for a major port is immediate and imperative.
2. The major port should be sited at Kandla.
3. All the existing ports of Kathiawar should be placed under one Port Commission.
4. A concentrated effort must be made to get better dredging results at Bhavnagar so as to maintain an adequate depth of water at the berths.
5. After satisfactory dredging results have been obtained, one extra berth should be constructed, so that Bhavnagar can, to some extent, serve the area marked as Zone 'B' in Appendix 'G'.

26. **Implementation.**—The first essential steps in order to implement the above recommendations are as follows:—

(A) **Major Port.**

1. Land must be acquired and reserved for the present and future needs of the port. In this connection the salt works must be removed to another site.
2. Accurate land and marine surveys must be prepared, and borings of the sub-strata obtained.
3. Arrangements made for an adequate water supply.
4. Broad Gauge and Metre Gauge railways must be laid from the port to the hinterland.

(B) **Development of Bhavnagar Port.**

1. Steps must be taken to improve the dredging so as to obtain at least 28 feet of water at the berths, and keep the entrance channel clear.
2. Surveys and plans should be prepared for the construction of one additional berth.

27. **Conclusion.**—The Committee wishes to place on record its grateful appreciation to the Rulers of the States visited, to the Saurashtra Government, the State of Cutch and the Government of Baroda, for the great kindness and courtesy which was extended to them wherever they went. They also desire to thank all the port and other officials and the various trade representatives for their untiring help and advice and for the large mass of information which they produced. Without this unstinted help, the Committee could not have hoped to complete its investigations within the brief period of two months.

KASTURBHAI LALBHAI,

(Chairman).

N. S. SEN.

S. N. HAJI,

K. MITTER,

J. B. MURRAY.

D. SHANKAR.

V. V. BHIDE, (Secretary).

30th April, 1948.

APPENDIX C

Estimated Traffic of the Major Port.—There are no available statistics on which a reasonably accurate assessment of traffic can be made. In the circumstances the following methods A and B have been adopted :—

METHOD 'A'

Total traffic of Port 'X': A plus B plus C plus D plus E.

where A=Diversion from Karachi.

B=Diversion from Bombay.

C=Diversion from Kathiawar and Cutch.

D=Local Traffic.

E=Petroleum and petroleum products.

Estimates of A, B and C have been worked out as follows :—

(A) Total Karachi traffic (excluding petroleum)	=	1.9 million tons.
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Deduct grain	=	0.6 m. tons
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Deduct local traffic	=	0.3 „
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Deduct cotton	=	0.15 „
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Deduct 60% of balance as traffic for Baluchistan, Afghanistan, N. W. F. P., West Punjab and Sind	=	0.51 „
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1.56 m. tons.		1.56 million tons.
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Balance	=	0.34 million tons=
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(B) Total Bombay traffic (excluding petroleum)	=	340,000 tons. 4.6 million tons.
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Deduct Bunder traffic	=	1.5 m. tons.
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Deduct coal	=	0.2 „
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Deduct city's own traffic	=	1.0 „
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Deduct 85% of balance as traffic for Bombay's eco- nomic hinterland.	=	1.62 „
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4.32 m. tons.		4.32 million tons.
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4.6 m. tons.		
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4.32 „		
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Balance	=	0.28 m. tons
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(C) 20% of total Kathiawar traffic	=	280,000 tons. 200,000 tons.
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Total of A, B and C	=	820,000 tons.
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(D) The volume of traffic under (D) will vary according to where Port 'X' is sited but the minimum immediate traffic under this head excluding petroleum may be taken as 180,000 tons per annum.

(E) Traffic in petroleum and petroleum products is estimated to be 300,000 tons

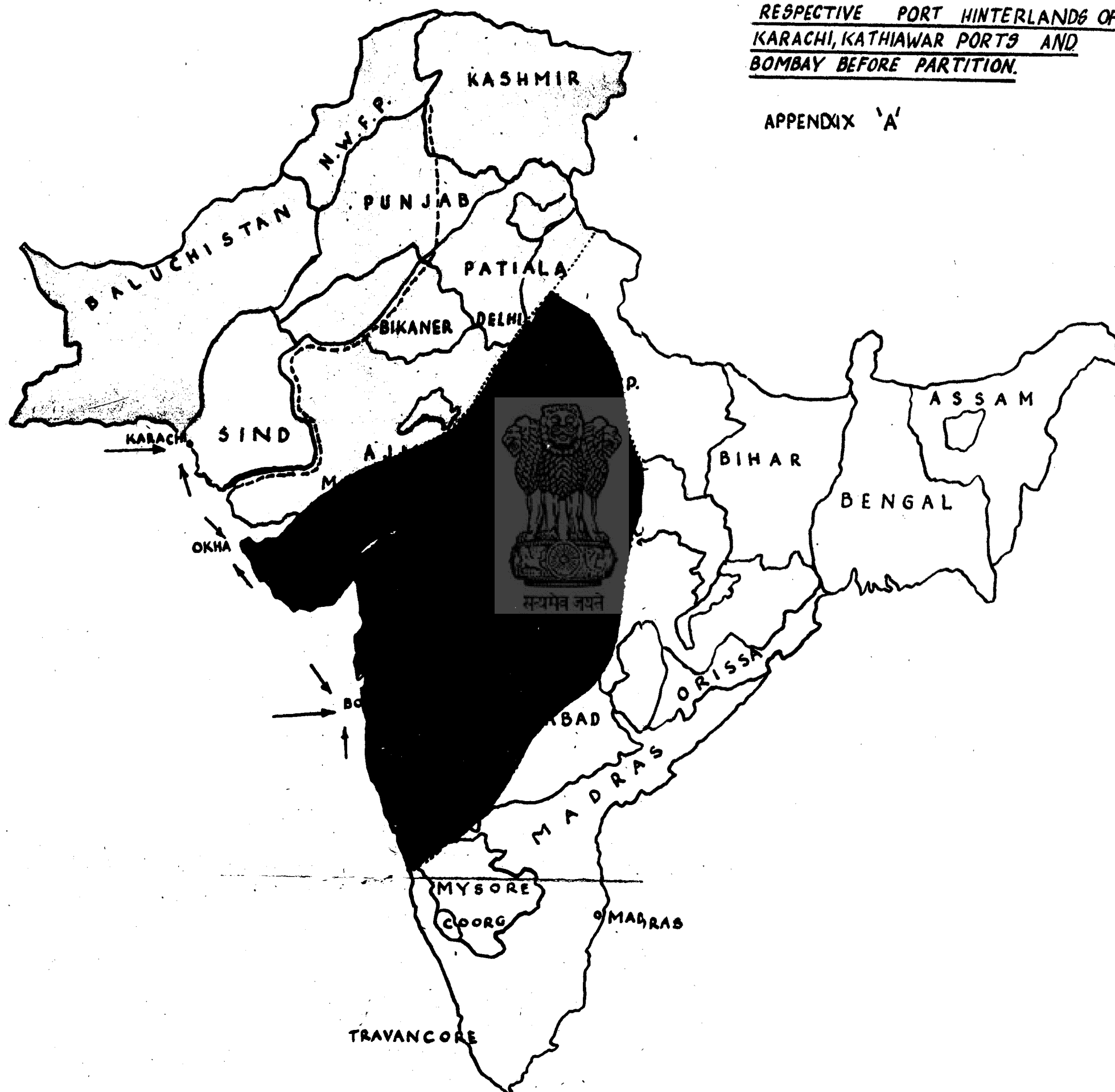
The estimated traffic of A plus B plus C plus D plus E=1.3 million tons.

METHOD 'B'

By the process of analysing rail despatch figures to and from various junctions and the ports of Bombay and Karachi, and by making due allowances for adjustment of traffic by sea or by sea-cum-rail route, the traffic estimate, according to a railway survey amounts to 1½ million tons, vide Traffic Survey Report compiled by Mr. Kevalramani, DTS (Survey) of the B. B. & C. I. Railway.

RESPECTIVE PORT HINTERLANDS OF
KARACHI, KATHIAWAR PORTS AND
BOMBAY BEFORE PARTITION.

APPENDIX 'A'



APPENDIX B

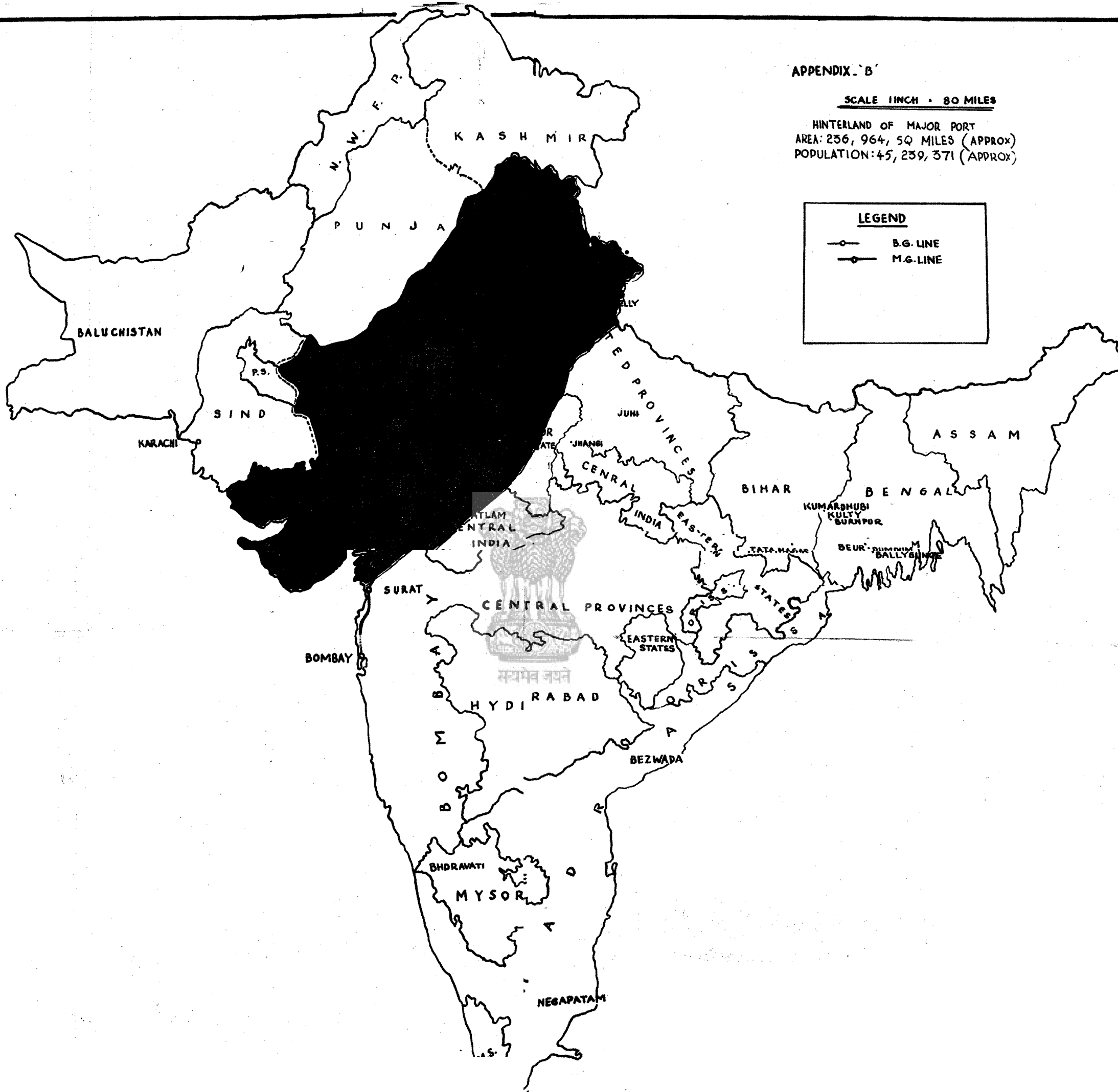
SCALE 1 INCH = 80 MILES

HINTERLAND OF MAJOR PORT
AREA: 236, 964, 50 MILES (APPROX)
POPULATION: 45, 239, 371 (APPROX)

LEGEND

 B.G. LINE

 M.G. LINE



APPENDIX D.
HARBOUR DATA—TRAFFIC AND COMMERCIAL

	Kandla				Navlakhi				Bedi				Okha				Porbandar				Veraval				Bhavnagar				All Kathiawar Ports (Approx.)							
	37-38	38-39	45-46	46-47	37-38	38-39	45-46	46-47	37-38	38-39	45-46	46-47	37-38	38-39	45-46	46-47					37-38	38-39	46-47	34-35	35-36	45-46	46-47	38-39	46-47							
1. Total tons	22,896	36,153	43,231	53,494	108,802	100,814	67,732	76,681	107,576	170,578	72,308	81,767	232,188	175,182	205,552	251,530	Figures in tons not available.				224,440	222,020	104,298	337,615	319,048	200,756	184,247	1,140,000	940,000							
Import	20,896	34,088	7,419	9,876	74,679	87,949	16,233	24,106	32,221	46,816	12,789	16,802	107,712	65,546	79,614	100,266	Figures in values only				110,000	75,377	280,910	232,317	107,598	113,239	625,000	420,000								
Export	2,000	2,065	36,818	48,618	34,123	12,165	51,499	52,485	75,357	123,086	59,519	64,965	124,476	109,636	125,938	151,314	Approx. 185,000 tons prewar.				112,020	28,921	66,705	96,731	93,158	70,988	515,000	520,000								
Steamer			28,120	45,736	95,808	87,640	39,768	51,778	Country craft figures not available				217,792	164,228	175,915	215,328							10,053	220,789	165,454	49,973	46,542	650,000	490,000							
Country craft			15,111	9,708	11,994	12,794	27,964	24,303					14,396	10,954	29,637	36,252							94,245	126,826	153,594	150,783	137,705	490,000	450,000							
Maximum	53,494 tons in 46-47				194,835 tons in 39-40				170,500 tons in 38-39				274,702 tons in 42-43				185,000 tons approx.				224,440 tons in 37-38				347,615 tons in 34-35											
2. Types of cargo	(a) Mainly foodstuffs				(a) Chemicals (13), Dates (14), Metals and Hardware (4), Paper and Starch (5), Grain (3), Coal (20), Cement (10).				(a) Cottonseeds (30%), Wheat (15%), Cottonseeds (30%), Oilseeds (15%), Wheat (16%), Cotton (5%).				(a) Petroleum, Coal, Grain, Machinery.				(a) Grain and Timber, Cottonseeds, Dates, Chemicals.				(a) Cottonseeds, Timber, Grain, Iron, Oil.				(a) Grain, Coal, Cotton, Timber, Chemicals, Metal, Ores.											
(b) Export	(b) Very largely salt				(b) Wool (8), Salt (40), Oilseeds (14), Seeds (20). Figures in brackets indicate 1,000 tons.				(b) G. Seeds (50%), Wool (20%), Oilseeds (10%), G. Oil (10%).				(b) Cement, Salt, Chemicals				(b) Limestone, Cement, Salt, G. Oilseeds, G. Oil, Cotton.				(b) G. Seed oil and Oilseeds, Onions, Limestone, Plantains				(b) Cotton, Groundnut oil and oilseeds											
3. Capacity	250,000 tons				500,000 tons				600,000 tons				300,000 tons				400,000 tons				350,000 tons				400,000 tons				600,000 tons				3,100,000 tons.			
4. Port facilities	(a) One R. C. Jetty				(a) NW				(a) NW				(a) R. C. Jetty				(a) Nil				(a) Nil				(a) Two berths.											
(b) Lighter berth	(b) Ample for present traffic				(b) Versuadi Creek—Steel and Masonry wall 800'. Sui Creek 10 wooden jetty 1000' long.				(b) Ample, Concrete tidal basin, dry at low water.				(b) Ample for present requirements.				(b) Ample. Entry and exit from lighter berths, possible at certain tides only.				(b) Extensive lighter berths				(b) Ample. Steel jetty. Also number of landing slopes.											
(c) Cranes	(c) 1 = 6 T				(c) 7 = 1 1/2 T 5 T 2 T				(c) 11 = 1 1 9 15 T 10 T (1 T—3 T)				(c) 6 = 1 1 2 5 T 2 T 12 T 2 Y.C.				(c) 9 = 1 1 1 6 8 T 6 T 3 T 2 T (H)				(c) 7 = 1 1 2 3 20 T 5 T 3 T 1 T				(c) 8 = 7 1 3 T 1 T											
(d) Lighters	(d) 33=1779 tons capacity				(d) 28=2800 tons capacity 3 L. C.=900 tons.				(d) 28=2800 tons capacity 3 L. C.=900 tons.				(d) 28=2800 tons capacity 3 L. C.=900 tons.				(d) 12=200 tons, 2 Z Craft=300 tons.				(d) 16 lighters=600 tons				(d) 5=37 T tons.											
(e) Tugs	(e) 4=3 deep-sea tug, 2=unicraft deep-sea tug.				(e) 4=3 deep-sea tug, 2=unicraft deep-sea tug.				(e) 2 tugs and 2 launches. On order 1 tug and 1 launch.				(e) 4 tugs.				(e) 2 tugs plus 1 launch 65 H.P.				(e) 6 tugs.															
(f) Covered area	(f) 3000 tons capacity				(f) 23,350 sq. ft. of which 171,350 sq. ft.				(f) 53,350 tons				(f) 149,454 sq. ft. plus 12,500 sq. ft. semi-covered.				(f) 50,000 sq. ft. plus godowns outside.				(f) 406,700 sq. ft. of which 11,700 sq. ft.				(f) 759,457 sq. ft. of which 168,322 sq. ft. transit.											
(g) Open area	(g) Extensive				(g) 225,000 sq. ft. near Quay				(g) 23,500 tons				(g) Ample				(g) No data				(g) 500,000 sq. ft.				(g) Extensive.											
5. Port charges (approximately).	(a) 1 anna per nett regd. ton plus berth hire at varying rate up to Rs. 20 per day for ships of 1000 tons or over.				(a) 1 anna per nett regd. ton for ships of 50 tons or over.				(a) 9 pies per nett regd. ton.				(a) 1 anna per nett regd. ton.				(a) 1 anna				(a) 1 anna per ton for ships taking over 100 tons of cargo. 3 annas per ton for ships carrying free cargo.				(a) 2 annas per nett regd. ton.											
(b) On Cargo	(b) 3 annas per ton				(b) Rs. 2 1/2/- per ton				(b) Re. 1 to Rs. Re. 1 per ton				(b) Re. 1 to Rs. 1 1/4/- per ton for import. Re. 1 per ton for export.				(b) 12 annas to 14 annas per ton				(b) Rs. 3/8/- per ton				(b) Rs. 1/13/- per ton (approx.)				(b) (i) Concrete jetty Re. 1 to Rs. 1/8/- per ton for import. Re. 1/15/- per ton for export (ii) For anchorage Rs. 1/8/- to Rs. 2 per ton (contractors charge).				} Plus 15% from—1-1-46.			
(c) Warehousing	(c) 1st week free. Thereafter 2 annas per ton per week.				(c) 3 months free. 6 annas per ton per month on bag cargo. 8 annas per ton per month on other cargo.				(c) Widely varying rates				(c) 1 month free for foreign cargo. 15 days free for coastal cargo. 25% of wharf dues per day.				(c) 5 1/2 annas per ton per week.				(c) Rs. 1/13/- per ton per month after free time of 10 days. Rs. 10 per 1000 sq. ft. per month.				(c) 3 weeks free time. Varying rates on the whole very low.											
6. Handling in port	Stevedoring—Agents responsible. Handling ashore ex ships—Ports function. Lighters and wagons loading and unloading—Party's function.				Stevedoring—Agents responsible. Handling in lighters and ashore—Ports contract.				Stevedoring and all handlings—Ports own contractual labour.				Stevedoring—Steamers representative. All handling except bulk cargo—Ports labour.				Stevedoring—Steamers representatives. Handling ashore—Parties. In lighters—Ports labour.				Stevedoring—Agents. All handling—Parties own labour.				Stevedoring—Agents. Handling at concrete jetty—Ports labour. All other handling—Party's labour.											
7. Availability of Labour	Fair				Good				Good. Short notice sufficient for additional supply for peak periods.				Fair				Good				Sufficient for normal requirements. Availability for extra labour from nearby villages.				Good.											
8. Prosser hinterland	State of Cutch only				Mainly the Morvi State. Wool and seeds from Rajputana and Central India. Dates right up to Delhi. Paper, Metal and cotton to Ahmedabad and certain portions of Northern India.				50% State of N. Kathiawar. 25% State of N. Kathiawar. 25% State of N. Kathiawar.				Bulk of traffic immediate port vicinity. Very small traffic (other than petroleum) to far hinterland.				State of Porbandar and contiguous parts of Kathiawar. Small despatches to and from main hinterland of India.				State of Junagadh, Jalore and Gondal.				130,500 sq. miles claimed by port authorities. No definite tonnage data of cargo movements to and from hinterland.											
9. Industries	Salt only. Capacity 70,000 tons (45).				Salt Works (160,000 T). Metal, Paint, Chemicals, Oilmills, Glass, yielding 10,000 tons of port traffic.				Salt 40,000 tons. Foundries, macerated, Fe = 30 Factories, port traffic.				Tata Chemical Works, Associated Cement Co's Cement Works and Hindustan Motor Assembly Works, yielding a total of 300,000 tons of port traffic and over.				Salt Works, ACC's Cement Factory, Maharani Textile Mills, Oilmills, Engg. Works, Vegetable Ghee, Limestone quarries, yielding a total of over 125,000 tons of port traffic.				Cotton Presses, Ghee, Match, Bone, Oil Presses and Lime. Port traffic figures not available.				Salt, Textile, Oil, Bone, Chemicals, Ghee, Rubber, Metals, and Saw Mills. Traffic to and from factory via port not available.											

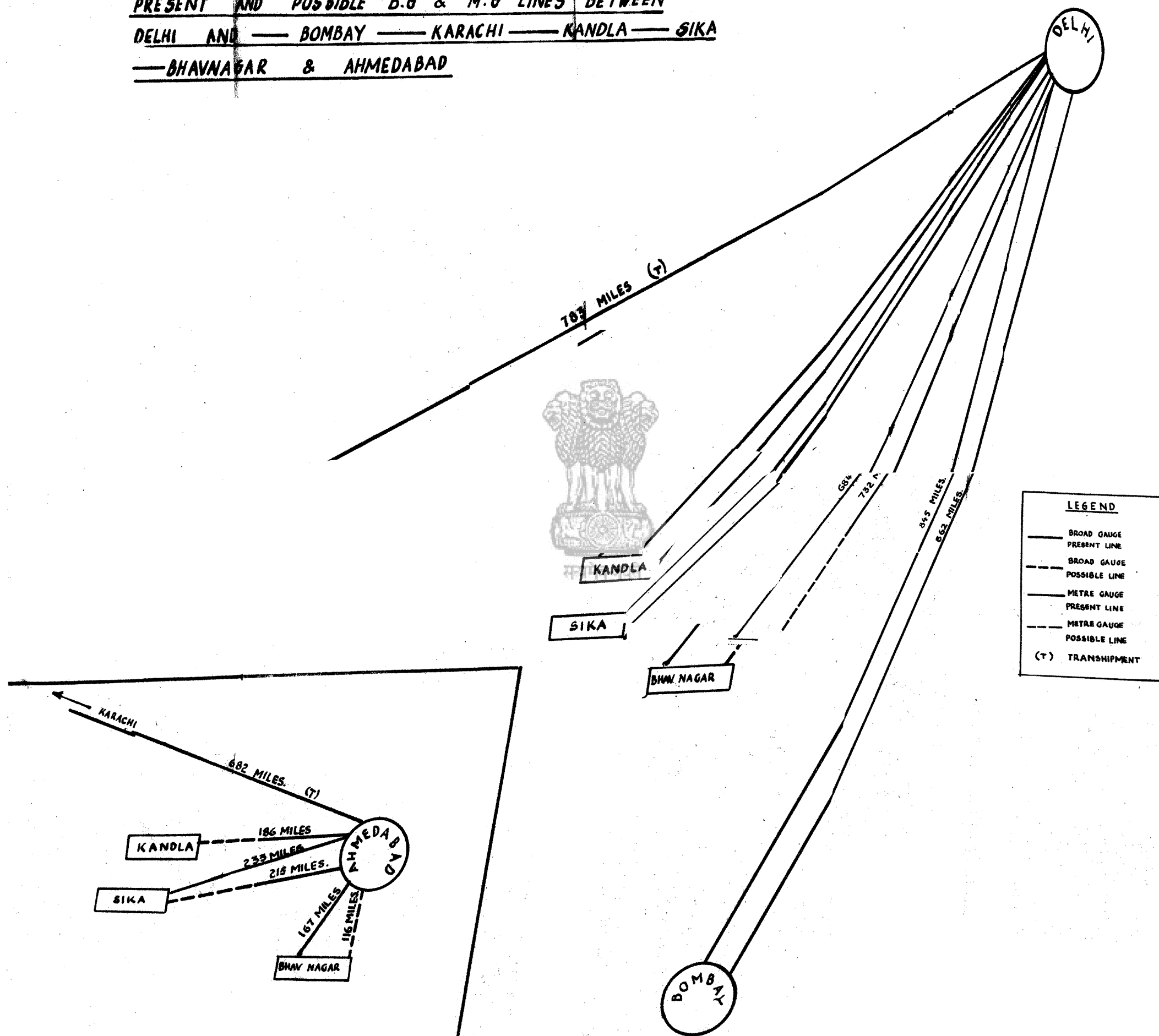
	Kandla	Navlakhi	Bedi	Okha	Porbandar	Veraval	Bhavnagar	All Kathiawar Ports
10. Potential industrial expansion in hinterland.	Great potentialities— (a) Mineral—Geological Report. (i) Gypsum—Vast deposits. (ii) Lignite extensive. (iii) Ochre and coloured clay—fair quantities. (iv) Limestone and Silica in abundance. (v) Bauxite—fair quantity. (b) Fisheries—The two Runns of Cutch. (c) Agricultural development considerable areas of the two Runns of Cutch is reported to have great agricultural potentialities in not distant future.	Resources of immediate hinterland already well-developed. Ports own estimate of possible ports traffic of 400,000 tons in the next five years appears optimistic.	Cement Factory nearing completion to consume 75,000 tons of coal and yield of 100,000 tons of cement. Woollen Mills, more textile and oil mills. Expected total traffic 250,000 tons.	No project for industries but present industries are expected to yield 40% more than port traffic estimated in 9 above.	Projected Alkali Factory? Intensive development of stone quarries. No traffic estimate.	Projected Alkali Factory.	Port's estimate of potential hinterland, vide their report.	
11. Administration	Running at a loss. 46-47 Income Rs. 57,000 approx. Expenditure Rs. 78,000 approx. Interest and Sinking Fund not taken into account.		No separate port account	No separate port account	No separate port account	Return of 34% on capital on traffic of 35-39.	No separate port account	
12. Advantages.	1. Deep natural protected all-weather harbour. 30' of water close to shore. 2. Nearest port to Rajputana, East Punjab and Delhi. 3. Great potentialities in mineral resources and for starting fish-industries. 4. Definite plans for siting of a city of 200,000 souls. 5. Little dredging.	1. Nearest port by existing M. T. rail to Rajputana, Delhi and north. 2. Proximity to Dhrangadhra Chemical Works. 3. Fair industrial growth in Morvi State itself. 4. Good layout of present port.	1. Good deep sea all-weather natural harbour. 2. No dredging. 3. Growing city of Jamnagar within easy distance. 4. Fairly established trade. 5. Rapid industrial growth.	(In preference to Bedi) 1. Practically on the direct route between Bombay and Karachi—yet an all-weather port. 2. Oil installations 3. Important cement and chemical factories, very close to the port.	1. On the main sea—on direct route between Bombay and Karachi. 2. Small city at port. 3. Good water supply potential 4. Large limestone quarries	1. On the main sea midway between Bombay and Karachi. 2. Facility of quick delivery of cargo from Bombay and Karachi into the heart of Kathiawar. 3. Rich agricultural belt with in short distance of port. 4. Growth of fishing industry.	1. Largest port city on the coast of Kathiawar—a growing one too. 2. Well-established trade facility, banking and insurance, etc. 3. Largest volume of traffic handled by any Kathiawar Port. 4. Closest port by rail distance to industrial centres like Ahmedabad, Baroda, etc. 5. Proximity by sea to very extensive well populated hinterland (N&W Gujarat). Potential Transhipment Traffic—Ship to countrycraft and vice versa. 6. Good water supply already existing. 7. Least difficulty in obtaining both skilled and unskilled labour.	
Disadvantages.	1. Bar at entrance. 2. Barren undeveloped country. 3. No existing connection—rail or road—with the hinterland of India. 4. Poor communications in State itself. 5. No established trade facility. 6. Present water supply meagre.	1. Anchorage 1½ miles from port. 2. Enormous cost of development into a major port. 3. No city within easy distance. 4. Water supply appears to be inadequate.	1. Cost of construction very heavy. 2. Does not compare favourably with some other ports re. rail mileage to main hinterland of India. 3. B. G. link up would involve crossing the existing M. G. System at more than one point.	1. Harbour too small. 2. Dredging. 3. Long distance from main hinterland.	1. Not an all-weather port. 2. Cost of conversion into a major port very heavy 3. Long distance from main hinterland.	1. Not an all-weather port. 2. Cost of conversion into an all-weather port very heavy. 3. Long distance from hinterland.	1. Tidal range of 34'. 2. Heavy dredging of silt. 3. Anchorage 4 miles from concrete jetty. 4. No B. G. Connection.	

APPENDIX D
HARBOUR DATA—ENGINEERING

S. No.	Jamnagar (Sika)	Cutch (Kandla)	Morvi (Navlakhi)	Baroda (Port Okha)	Porbandar	Bhavnagar	Bhavnagar (Port Albert Victor)	Junagadh (Veraval)
1 (a) Approach from sea	From Gulf of Cutch in S. E. direction. Two deep-water harbours, one on either side of a half-tide reef.	At eastern end of Gulf of Cutch, Kandla Creek runs in northerly direction. Port situated 5 miles up creek.	At eastern end of Gulf of Cutch, Hansh, Hanstlal Creek runs in easterly direction. Anchorage is 10½ miles from buoyed pilot station, and 1½ miles from shore on shore.	At entrance to Gulf of Cutch, between Okha Point and Beyt Island. Buoyed channel (from Samiani Island) 3500' long x 400' wide.	An oadstead about 1½ miles from shore where ships can anchor.	In the Gulf of Cambay, the approach being along a well-lighted coast. Ships anchor 4 miles from the port, and the latter distance can only be navigated at high water.	At S. W. corner of Gulf of Cambay, Mota Pat Creek runs in a NNE direction, the distance to railhead from deep water being about 6 miles.	An open roadstead, about 3/4 mile from shore.
(b) Depth of water and extent of harbour.	Good 30' of water in each harbour. Maximum depth = 78'. Main Channel Width of entrance 1600' Maximum Width 2500' Length 11000'	Depth of water in creek Width between 30' contours = 40' (Min.) = 2000' (Min.) = 3000' (Min.) Length of anchorage = 6 miles	Depth of water in anchorage = 30' = 30'	Depth in channel at L. W. = 24' Owing to irregular depths of water in harbour, only one buoyed berth and one berth where ships can anchor are available in addition to the pier.	Depth of water in anchorage = 36'	Depth of water at anchorage = over 30'. At berths = 28' (designed). Owing to lack of dredging capacity, it has not been possible to maintain this depth. At present the depth is approximately 20' with shallow patches. Entrance channel 2500' long, 100' bottom width. Turning basin 700' wide.	There is a protected anchorage inside the entrance channel, which is about 4000' long and 150' wide, 30' deep at low water. From the anchorage to the site of the present port the creek has a depth of not less than 8 feet at low water.	Depth of water in anchorage = 36'. Approach channel 13' deep at low water.
(c) Details of any bars or changes in regime.	No appreciable alteration since 1851	Bar formed at entrance to creek since 1926, but no subsequent deterioration. Min. depth of water at bar at L. W. = 14 feet. Min. rise in tide 17'.	There are two bars in the approach channel, with 17' and 13' depth of water at low tide.	High spots in approach channel with 20' of water at L. W. O. S. T.	Rock is between anchorage and shore 1 foot of water at L. W. T.	The approach to the port from the anchorage has depreciated from 3' depth to 4' since 1932. Channel Bank, north of the anchorage has moved slightly southward and westward.	The creek has more or less remained stable over a period of many years.	No bars. Minor and deposits.
2 (a) Range of tides	maximum 21' Average spring tides 20' Average neap tides 6'	Maximum 22' 6" At neap tides 17' 6"	Springs 24' Neaps 18'	Springs 24' Neaps 18'	Springs 24' Neaps 18'	Maximum 34.3 feet Average 23 feet	Maximum 14 feet N. H. W. S. T. 10 feet M. H. W. N. T. 7.9'	Maximum 10.33 ft. Average 8.5 ft.
(b) Currents	Channel Main West Maximum current 4K Average spring tide 3 Average neap tides 2	At Springs 3½K At Neaps 2½K	At Springs 5 Knot At Neaps 4 Knot	5 Knots Very little current in channel, but at sea entrance current at right angles to channel.	At Springs 3 Knots At Neaps 1 Knot	Springs 3 to 5 Knots Neaps 1 to 2½ Knots	At entrance 2 Knots In creek 1½ Knots	
(c) Direction of Currents	Longitudinal with Channel Slack water = Nil.	Longitudinal with channel. Slack water = ½ hour.	Not recorded	Not recorded	Not recorded	Parallel to coast	In direction of creek	East, ENE on flood. WSW in ebb.
3 (a) Maximum and Minimum temperatures.	Maximum 105° F. Minimum 42° F.	Maximum 105° F. Minimum 40° F.	Maximum 107° F. Minimum 54° F.	Maximum 98° F. Minimum 63° F.	Maximum 98° F. Minimum 56° F.	Maximum 100° F. (Peak 112° F) Minimum 47° F.		Maximum 100° F. (Peak 105°) Minimum 50° F. (Peak 45°)
(b) Humidity	100% during morning fogs. 18% Minimum.	Not recorded	Not recorded	Maximum 85% High	Maximum 85% High	Maximum monthly average = 82.7° Minimum monthly average = 41.6°		Maximum 100% Minimum 10%
(c) Rainfall	Average 17" per annum. In 1939 3.43" In 1937 28.74"	Average 11" per annum	Average 13" per annum	Average 6" per annum	Average 6" per annum	Average 24 inches	Average 22.6 inches	Average 20 inches.
(d) Prevalence of storms	Occur before monsoon, but with due warning. Sudden storms not prevalent.	Occasional storms during S. W. Monsoon period.	Not frequent	Strong S. W. winds, but harbour protected by mainland and Samiani Island.	Strong S. W. winds, but harbour protected by mainland and Samiani Island.	Occasional storms of moderate intensity.		Occur in May, October and November.
(e) Direction and Force of	Cold weather N. E. 8 m.p.h. Hot weather and monsoon, W. 15 m.p.h. Peak gust velocity W. 60 m.p.h. Peak gust velocity N. E. 40 m.p.h.	Prevailing wind from S. W., except during cold weather when wind is from N. E. Force not recorded.	Not recorded	April-September S. W. March Force 4-5 Rest of year N. E. Force 3-4	April-September S. W. March Force 4-5 Rest of year N. E. Force 3-4	Average for year 4 M. P. H. Peak velocity = not recorded.		Monsoon S. W. 15-25 M.P.H. Winter winds SW/W or N 10-15 M.P.H. 5-10 M.P.H.
(f) Prevalence of fog	Morning mist or fog only	Morning mist	Morning mist	Cold weather morning fog, but does not interfere with ship movements.	Cold weather morning fog, but does not interfere with ship movements.	in March, April and May. Nil	Nil	Slight fog—January and February. Occasionally December and March.
4 (a) Natural shelter	The tidal basin is land-locked on three sides, and sheltered to some extent by Goos Reef. Mainland to the west of main channel also affords protection.	Port situated about 5 miles from entrance of Kandla creek and sheltered from monsoon winds.	Anchorage is land-locked and well sheltered from storms.	Port situated at extreme end of Gulf of Cutch and in an exposed position. Shelter however is provided by Samiani Island and the port is worked all the year round.	Port situated at extreme end of Gulf of Cutch and in an exposed position. Shelter however is provided by Samiani Island and the port is worked all the year round.	The deep water berths are constructed in an artificial basin, land locked on three sides, and well sheltered.	The creek is completely sheltered from the S. W. monsoon.	Anchorage not sheltered from monsoon and port is closed May-October.
(b) Dredging	Nil	Port owns a self-propelling grab-hopper dredger	Nil	New dredger purchased and expected shortly.	New dredger purchased and expected shortly.	Port owns five dredgers, details of which are given elsewhere.	Nil	Port owns a Lobnitz Dipper Dredger with 2-50 T hopper barges.
5 Present port facilities	Nil	A reinforced concrete pier 302' long x 42' wide with 32' depth of water along-side. Mooring buoys fore and aft so as to berth longer steamers.	Lighter and country craft berths on Steamers have to anchor 1½ miles from the port, and cargo discharged into lighters.	A reinforced concrete pier 400' long with 30' depth of water alongside. Quay 800' long for lighters.	A reinforced concrete pier 400' long with 30' depth of water alongside. Quay 800' long for lighters.	One concrete jetty 832' long, capable of berthing two steamers 450' long. In addition, there is a lighterage port, 12 miles from the anchorage, with extensive accommodation for lighters and country craft.	A small timber jetty used by country craft.	Lighter and country craft berths protected by breakwater.
6 Water Supply:								
(a) Present	Two reservoirs with pipe lines under construction.	Piped supply from reservoir and springs available 6 lakhs gallons per day.	Piped supply from wells 11 miles distant.	Wells capable of yielding about 1 lakh gallons per day.	Wells capable of yielding about 1 lakh gallons per day.	Piped supply from well, through storage tank.	Piped supply from adjacent river.	Mains supply from R. Hiran, 2½ pipe lino in harbour area.
(b) Potential for increased	Sites exist for more reservoirs, and there is sufficient rainfall and catchment areas in the hinterland for a copious water supply.	State Irrigation Engineer reports that supply could be increased to 30 lakh gallons per day if required or more. A further report from the Cutch State has also been submitted.	Additional wells or reservoir in hinterland.	Additional wells or reservoir in the hinterland of Kathiawar, with long pipe line.	Additional wells or reservoir in the hinterland of Kathiawar, with long pipe line.	Over 5,000 million gallons reservoir capacity at present in Bhavnagar which can be piped to the docks.	There is adequate rainfall and catchment area to provide a larger water supply.	Scheme under preparation for harnessing rivers.
7 Power Supply	An A. C. Thermal Electrical Power Station is under construction.	Electricity generated at port on a small scale.	Small Diesel Power Station.	Small Diesel Power Station.	Small Diesel Power Station.	Small Diesel Station	Nil	Small thermal station meets present demands.
8 Building materials	Stone and Sand in abundance. Cement Factory under construction.	Stone, Sand, Lime, Gypsum available in large quantities.	Available in Morvi State but not locally	Stone available. Sand from Kambhali. Cement from Dwarka.	Stone available. Sand from Kambhali. Cement from Dwarka.	Stone gravel and sand available nearby.	Stone, gravel and sand available nearby.	Stone and sand in abundance.
						Metre Gauge Rly. on the jetty connects the port with Kathiawar Railways and beyond.	M. G. Rly. alongside creek connects the port with Kathiawar Railways and beyond.	Junagadh State Railways (Metre Gauge) link port with Kathiawar Railways and beyond.

S. No.	Jamnagar (Sika)	Cutch (Kandla)	Morvi (Navla)	Baroda (Port Okha)	Porbandar	Bhavnagar	Bhavnagar (Port Albert Victor)	Junagadh (Veraval)	
10	Distance by rail by short route to—						From Station	From Bunder	
	Virangam 192 present 174 B. G. proposed.	145 Proposed B. G.	134 via Wadhwan	271 via Rajkot and Wadhwan	272 via Dhasa and Wadhwan	146	197	200 230.	
	Wadhwan (Surendranagar) 152 (77 J & D Rly. and 75 M. Rly.)	122 Proposed B. G.	94	231	232	105	158	161 190.	
	Ahmedabad 233 Present 215 (Proposed B. G. via Virangam)	186 (Proposed 145+41)	175	312	294 via Dhasa and Dhandhuka	187 via Dhandhuka	221	224 271.	
	Delhi 730 Present M. G.	758 Proposed B. G. link and then via Virangam and Muttra.	672 via Wadhwan M. G.	809	810 via Dhasa and Wadhwan	684 via Wadhwan, Virangam and Mehsana.	733	736 768 via Wadhwan, Virangam and Mehsana.	
	787 Proposed all B. G. via Virangam and Muttra.	685 Raniwara link M. G.							
	805 Present M. G. to Virangam and then to Delhi all B. G.	656 Deesa link M. G. proposed.							
	Agra 729 Present M. G.	764 All B. G. proposed	671 via Wadhwan	808	813 via Dhasa and Wadhwan	683	735	738 769.	
		699 Raniwara M. G. proposed.							
	Amritsar 982 Present M. G. via Virangam	935 M. G. via Virangam, Mehsana and Hissar.							
	962 B. G. to Virangam and then M. G. to Amritsar.	903 Deesa link	924 via Wadhwan and His	1061 via Rajkot, Wadhwan and Hissar	1064 via Dhasa, Wadhwan and Hissar	936 via Wadhwan, Mehsana and Hissar	988	991 1020 via Virangam, Mehsana and Hissar.	
	1084 Present M. G. to Virangam and then via Nagda Muttra.	852 Raniwara link.							
	1066 via Virangam and then Anand, Muttra and all B. G. (Proposed).	1037 B. G. Proposed to Virangam (145)+892 via Virangam to all B. G. route.							
11	Road communications with hinterland.	Fair weather road to Jamnagar	Road connection with Bhuj	Road connection with Morvi	Local roads only, and tracks to hinterland.	Fair weather roads to Rajkot, Jamnagar and Junagadh.	Fair weather roads connecting Bhavnagar, with main centres of Kathiawar.	Fair weather roads to Rajula and Mahuva.	Fair weather roads from port to all main centres of Kathiawar.
12	Action already taken by local authorities to develop port.	Engineers Report and preliminary data obtained for constructing port in main channel. Proposed quay 1300' long. Also lighterage and country craft quays. Borings taken to determine sub-strata. During past year a hydrographical survey of the western channel has been made and this channel appears to open up better possibilities than the main channel.	Consulting Engineers have recently visited Kandla and their report is awaited. It is intended to extend the existing pier to provide two new berths, and dredge the bar at the entrance to the creek. New storage godowns are also envisaged. A new hydrographical survey of Kandla creek has been made.	Nil	Consulting Engineers have submitted a report suggesting the construction of another pier to berth one ship, the construction of the lighter wharf and dredging in front of the new pier and in the harbour.	Nil	Several Engineer Reports have been obtained with a view to developing the deep water port. No action has been taken to implement any of these ports.	Engineer Reports have been obtained for developing this port, the first in 1926. No action taken.	Many Engineering Reports have been obtained with the object of converting Veraval into an all-weather deep sea port. A new site at Deni Bara, about 1 mile from the present port is at present being investigated.
13	General Remarks	A very fine natural harbour in a sheltered position, and has remained stable for many years. The main objection is the distance between deep water and high ground. The site first considered for development was on the east side of Goos Reef, a distance of 5 miles from high water mark, thus necessitating a long high embankment. The western channel, however, offers better scope for the construction of a major port. The harbour is larger and the 30' contour penetrates much closer to the dry land, thus reducing the extent of embankments and reclamation which would be required. There are no borings to show the nature of the sub-strata in the western channel.	A natural deep water creek which has remained stable since observations were first taken in 1851. A bar formed at the entrance between 1926 and 1930, but there has been no subsequent deterioration. To the west of the creek the land is about 2 feet below H.W.O.S.T. and would therefore have to be raised about 4 feet for railway embankments, roads, buildings, etc. Deep water obtains in close proximity to this land, thus facilitating the construction of quays.	Navlakhi is purely a light is not suitable for conveyance of major port. The anchorage is small and is too far from to make any connection except at very great cost.	This is a natural harbour and although in an exposed position, shelter is obtained from Okha point and Samani Island. The depth of water in the harbour is very irregular, and trouble has already been experienced through movement of sand. The port has been developed in such a way as to limit its ultimate expansion to a few berths only, unless very extensive dredging is undertaken to increase the size of the harbour.	This port consists of an open roadstead where ships can anchor, and the construction of a major port at this site would necessitate extensive breakwaters to form a sheltered harbour. Rock outcrops exist between the anchorage and the shore and much of this would have to be excavated. Porbandar could only be developed into a major port at great cost and time.	Bhavnagar maintains an extensive lighterage port, with many warehouses, etc., about 12 miles from the ship anchorage. The deep water port was constructed in recent years by dredging an artificial basin and constructing two concrete berths with transit sheds, cranes etc. Difficulty has been experienced in maintaining the required depth of water owing to the rapid deposition of silt in the basin.	Port Albert Victor has been for many years considered as a likely site for a deep-sea port, and with this end in view, a metre gauge railway track was laid many years ago. Establishing a port would, however, necessitate very extensive dredging, apart from the construction of quays, etc.	Veraval is a well developed "Lighter" port, with substantial quays and a breakwater which afford protection to small craft. Ships, however, have to anchor in an open roadstead where there is no protection, and the port has to close down during the monsoon. The construction of a port where deep draught ships could berth all the year round would necessitate the construction of breakwaters, and other massive engineering works.

PRESENT AND POSSIBLE B.G & M.G LINES BETWEEN
DELHI AND — BOMBAY — KARACHI — KANDLA — SIKA
— BHAVNAGAR & AHMEDABAD



APPENDIX F.

Rail Distances

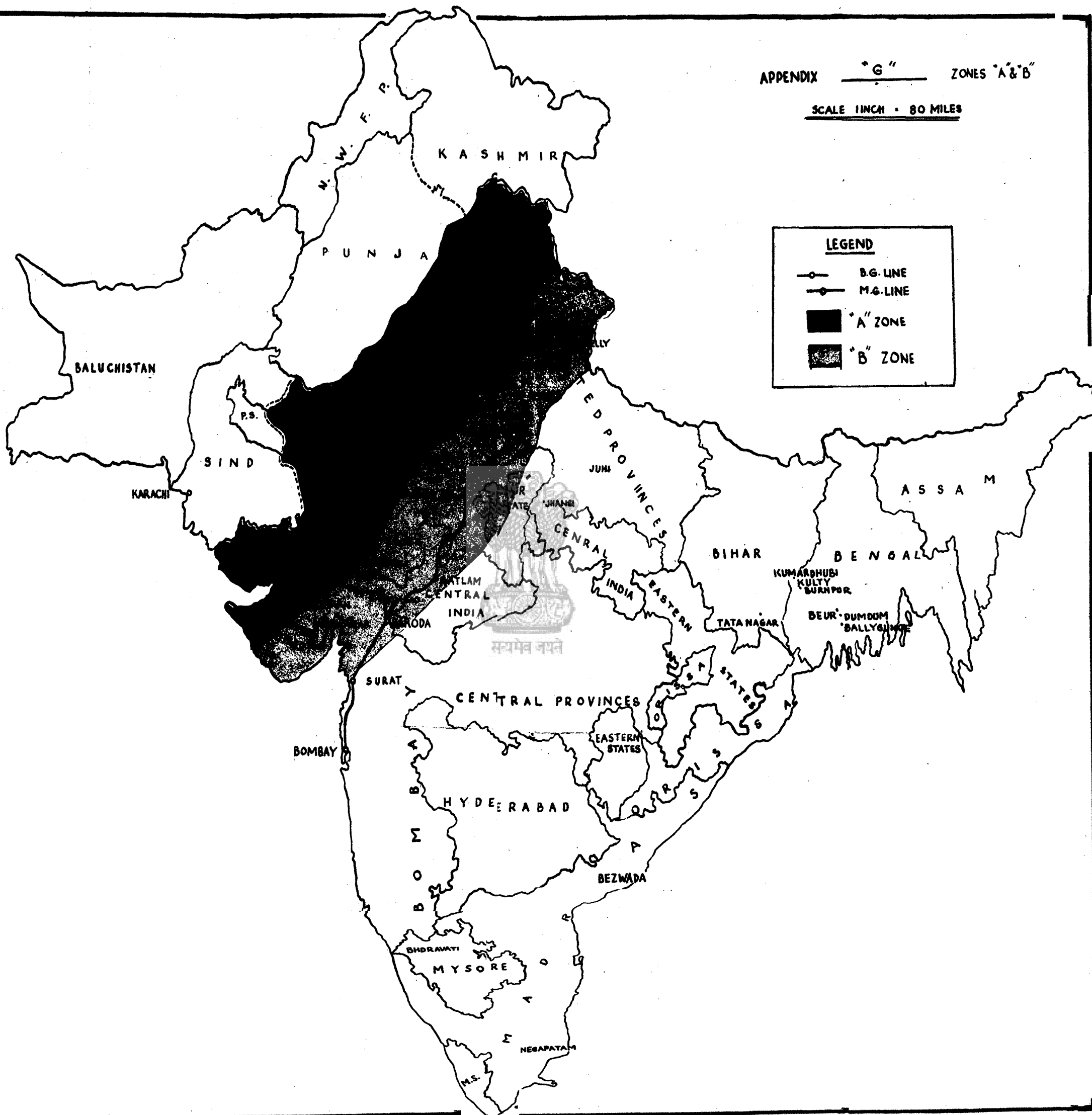
Rajputana			Eastern and Punjab North				United Provinces			Central Provinces																	
Central		Northern		Southern		Western	Southern	Northern	Eastern	North																	
Jodhpur	Ajmer	Bikaner	Bikaner	Delwara	Ellenabad	Dargi	Sawai	Chittorgarh	Udaipur	Bhatinda	Faridkot	Hissar	Amritsar	Ludhiana	Jullundur	Ambala	Cawnpore	Agra	Aligarh	Allahabad	Moradabad	Jhansi	Itarsi	Nagpur	Jubbulpore	Bilaspur	
Bombay	591	613	762	762	831	933	933	639	624	645	983	1069 MG	835	1141 B.G.	1057 BG	1049	991	992 BB&CI	730	842	860 GIP	930	702 GIP	484 GIP	528	616 GIP	777 GIP
Kanpur	440	561	611	611	762	762	762	714	693	693	725	693	733	792	810	809	831	937	730	819	1056	868	914	935	1141	1108	1344
Bharatpur	426	449	537	537	607	607	607	606	595	595	619	605	621	993	832	835	812	837	631 BYR	721	960	738	728	604	790	757	993
Yeral	510	533	661	661	761	761	761	700	539	539	660	903	979	1029	936	960	931 Cantt.	973	767	805	1044	872	900	707	803	860	1086
Nowakshi	414	437	535	535	647	647	647	604	493	493	573	807	833	924	940	873	791 Cantt.	877	671	709	948	776	804	611	797	764	1000
Present	472	495	643	643	763	763	763	662	551	551	631	844	920	940	940	896	833 Cantt.	935	729	767	1006	834	862	689 via VG.	854	822	1068
Proposed	454	477	625	625	746	746	746	644 M.G.	538	538	619	838	902	942	942	878	835 Cantt.	917 BG	793 BG	749	1081 BG	944	775	651	804	1040 via VG/	
								653 B.G.									840 City	851 via VG/	to Belangit	838 via VG/	ANND/ETS	BG via	BG via	UJN	UJN	UJN/KMW	MT
																	860 City	AEB.			ANND/AEB	ANND/AEB	UJN				
Kanals	344	455	515	515	661	661	661	618	507	507	587	716	792	832	788	801	791	843	684	723	902	790	818	859	1045	1012	1248
	393	416	564	564	616 M.G.	616	616	533	472	472	553	705	831	906	919	852	819	808	650	688	927	755	783	714	900	867	1103
Vinangam	425	448	596	596	737 B.G.	737	737	615 via VG/	504	504	584	707	873	935	851	884	811	840	764	809 via VG	959 via VG/	787	740	622	805	775	1011
								MSH/UP												ANND and	MSH/AEB.						
								624 via VG/												HTS	1002 via						
								ANND												720 via VG/	UJN/NTN						

APPENDIX "G" ZONES "A" & "B"

SCALE 1 INCH = 80 MILES

LEGEND

- B.G. LINE
- M.G. LINE
- "A" ZONE
- ▨ "B" ZONE



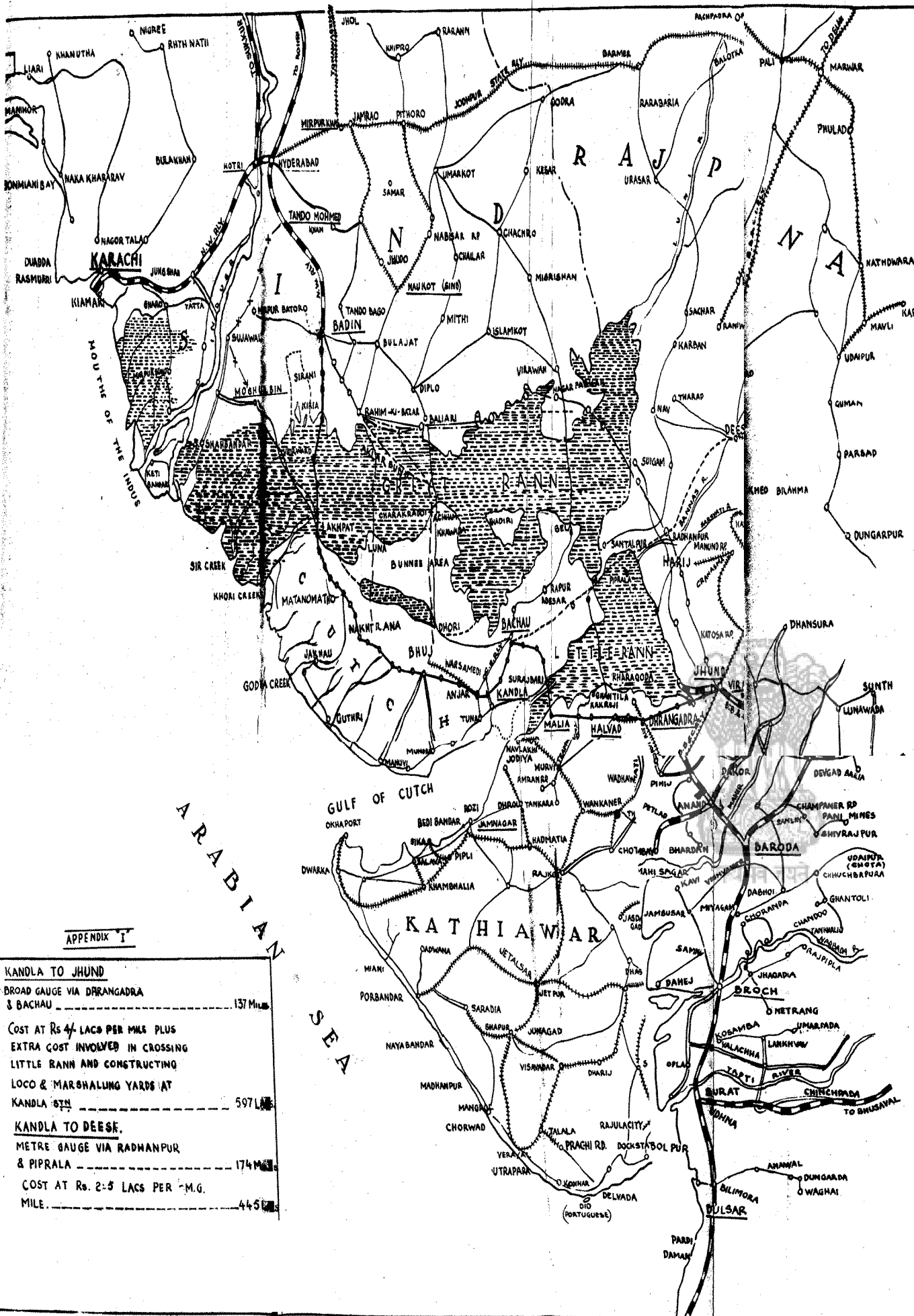
GENERAL MAP ACCOMPANYING REPORT

ON THE BOMBAY SIND CONNECTION RAILWAY SURVEY CUTCH ROUTE (SEASON 1946-47) GAUGE '5-6'

JHUND TO BADIN = 306.97 MILES

ALTERNATIVE (NORTHERN) ROUTE = 266.20 MILES

SCALE 32 MILES = 1 INCH



APPENDIX I

KANDLA TO JHUND BROAD GAUGE VIA DHRANGADRA & BACHAU	137 Miles
COST AT RS 4 LACS PER MILE PLUS EXTRA COST INVOLVED IN CROSSING LITTLE RANN AND CONSTRUCTING LOCO & MARSHALLING YARDS AT KANDLA STN	597 LACS
KANDLA TO DEESE. METRE GAUGE VIA RADHANPUR & PIPRALA	174 Miles
COST AT RS. 2.5 LACS PER M.G. MILE.	445 LACS

REFERENCES

PROPOSED RAILWAY LINE SHOWN	THUS	—○—
ALTERNATIVE (NORTHERN) ROUTE	DO	—○—
EXISTING BROAD GAUGE LINES	DO	—+—
DO METRE DO DO	DO	—+—
DO NARROW DO & TRAMWAYS DO	DO	—+—
ROADS	DO	—+—
RIVERS AND LAKES	DO	—+—
ALIGNMENT FROM MOGHULBINTO TANDO MOHD KHAN	DO	—X—
ALT ALIGNMENT FOR CROSSING GREAT RANN	DO	—X—
PROPOSED EARTH BUND BETWEEN LITTLE & GREAT RANN SHOWN THUS	DO	—+—