

NATIONAL TRANSPORT RESEARCH CENTRE

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1988
07310

INLAND WATER TRANSPORT
(REVIEW)

NTRC-114

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August, 1988

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ANNEX

Map showing inland navigation routes on various Rivers and Canals in Pakistan.

REVIEW OF STUDIES ON INLAND WATER TRANSPORT

I. PAST STUDIES

Information on studies carried out upto 1986 in government departments, autonomous bodies or professional bodies is as follows :-

- R-1) Navigation in the Indus : Navigation Directorate, Chief Engineering Adviser, Government of Pakistan, Mr. Bukhteyar Hussain, 1958.
- R-2) Navigational Facilities for Link Canals : Tipton and Kalmbach; 1962.
- R-3) Inland Navigation in West Pakistan : Engineering Congress; Mr. Mohiuddin Khan, 1963.
- R-4) Six reports by the Sukkur Zone, Irrigation Department, Government of West Pakistan (1967).
 - a) Feasibility of a Feeder-cum-navigation channel from Sukkur to Kotri via Nara Canal (1967).
 - b) Navigation along river Indus and from Kashmore to Kotri Barrage (1967).
 - c) Feasibility of navigation along Rohri Canal cum New Link to Hala (1967).
 - d) Feasibility of navigation along Nara Canal cum New Link to Hala (1967).
 - e) Feasibility of Navigable Link from Indus Upstream of Sukkur Barrage (1967) to Nara Canal and Rohri Canal and Navigability of gorges upstream Sukkur.
 - f) Feasibility of navigation in Indus river from Hala to Kotri Barrage (1967).

- R-5) Navigability of Indus River from Sukkur to Guddu :
Navigation Directorate : Communications Division
Mr. Bukhteyar Hussain, 1970.
- R-6) IWT Route from Sukkur Barrage to Port Qasim,
Planning Division, NESPAK, 1975.
- R-7) Navigation of Indus river from Sukkur to Kalabagh :
Ministry of Communications, WAPDA, 1976.
- R-8) Inland Water ways in Pakistan : CIT services
Bukhtayar Hussain, 1978.
- R-9) Of Bulk Loads on Inland Waterways : Mohiuddin
Khan, 1979.
- R-10) Inland Navigation in Pakistan with Special
reference to Link Canals : Abdul Majeed, 1979.
- R-11) Inland Water Transport in Pakistan : NTRC
M. A. Farouk, 1981.
- R-12) ESCAP : IWT Economist J. M. Deplaix, 1981.
- R-13) Feasibility Study of Inland Navigation in
Pakistan : Alluvial Channel Observation
Programme (ACOP), WAPDA, 1983.
- R-14) Prospects of Inland Navigation in Pakistan :
Irrigation, Drainage and Flood Control Research
Council of Pakistan (IDFCRC) - Development
Workshop Consultant Ltd., 1984.
- R-15) Un-Expert L.E. Van Houten, WAPDA 1984.
- R-16) IWT in Pakistan, DGP&S, Ministry of Communications,
1985.
- R-17) Minutes of Planning Commission, NTRC meeting
dated the 15th September, 1985.
- R-18) Minutes of meeting on Selection of a Pilot Project
for IWT Development by Ministry of Water and Power
and Directorate of Power Department, Government of
Sind, January, 1986..

II. MAIN RIVER CHANNELS AND LINK CANALS

The main river channels of Pakistan can be indexed as follows :-

1) Indus River

- Reach :
- a) Sea Coast to Kotri
 - b) Kotri to Sukkur
 - c) Sukkur to Kalabagh
 - d) Kalabagh to Attock
 - e) Attock to Tarbela
 - f) Tarbela Reservoir

2) Jhelum River

- Reach :
- a) Trimmu to Rasool
 - b) Rasool to Mangla Dam
 - c) Mangla Reservoir

3) Chenab River

- Reach :
- a) Mithankot to Panjnad Head Works(HW)
 - b) Punjnad to Taunsa Punjnad Link (TPL)
 - c) TPL Outfall to Trimmu
 - d) Trimmu to Qadirabad
 - e) Qadirabad to marala
 - f) Marala Upstream

4) Ravi River

- Reach :
- a) TPL Outfall to Sidhnai
 - b) Sidhnai to Balloki
 - c) Balloki to Border

5) Sutlej River

- Reach :
- a) Panjnad to Islam
 - b) Islam to Sulemanki

The inter-river link canal (1-2) between the Indus River (1) and the Jhelum River (2) is the Chashma-Jhelum Link Canal. The complete details are as follows :-

Link Canals :

L (1-2)	Chashma - Jhelum Link
L (1-3)	Taunsa Panjnad Link
L (2-3)	Rasul - Qadirabad Link
L (3-4)	- Trimmu - Sidhnai - Qadirabad - Balloki
L (4-5)	- Sidhnai - Mailsi - Balloki - Sulaimanki

Map showing inland navigation routes on various Rivers and Canals in Pakistan may be seen at Annex-I.

III. AN ABRIDGED REVIEW OF VARIOUS REPORTS

R-1 Navigation on the Indus : Bakhteyar Hussain, 1958. In this departmental report it was pleaded that in addition to irrigation and power generation, flood control and navigation should also be included in our water resources planning. Indus river had been used for navigation before and with modern multi purpose planning, in the interest of economy, defence requirements and better conservation of the river channel, it should be immediately opened to navigation from Sukkur to Kalabagh Barrage (Jinnah Barrage). Efforts should then be made to correct this waterway to the port of Karachi and other large towns. Possibility of navigation in Nara Canal and huge drains was suggested for investigation.

R-2 Tipton and Kalmbach (1962) calculated the cost of locks and modification of cross structures on inter river Link Canals to make them suitable for navigation. They also pointed out the limitations :-

- (a) Main river channels between which the links would operate, should also be made navigable.
- (b) Non perennial links would impose time limits on navigation.
- (c) The system could be vulnerable in times of war.

R-3 Mohiuddin Khan (1963) made the following proposals regarding inland navigation in Pakistan :-

- (a) Using Indus river Channel from Sukkur to Kalabagh
- (b) Investigation of a navigation route from Karachi to Kotri either through a link canal from Karachi to Kalri Baghar via Gharo creek and then use Kalri Baghar canal to Kotri. Alternatively, use 80 miles of Indus Channel from Keti Bandar to a point opposite mile 75 on Pinyari Canal near Thatta and then along Pinyari Canal upto Kotri.
- (c) Using Nara Canal from Sukkur to Jamroa weir and then 70 miles long irrigation-cum-navigation link from Jamroa to Indus 8 miles upstream of Kotri.

R-4 Irrigation Department, Sukkur Zone investigated Mohiuddin Khan's (MK) proposals and made some suggestions of their own :-

- (a) They concluded that alignment for link canal suggested by MK for an irrigation-cum-navigation link canal from Jamroa canal to Kotri on river Indus was not feasible and suggested a still water navigation link between Jamrao and Kotri.
- (b) They considered Nara Canal also unsuitable for navigation.
- (c) Suggested investigation of two routes via Rohri Canal or use of Indus river when sukkur discharge was above 20,000 cusecs (570 cubic metres/second).

- R-5 Navigation Directorate, Ministry of Communications Dacca prepared a report on navigability of Indus river from Sukkur to Guddu Barrage (1970). Recommended pilot barge service in this reach. Further surveys upto Kalabagh and investigation of possible route between Sukkur and Port Qasim via Kalri Baghar canal, Kalri Lake and navigation canal to Gharo Creek were proposed.
- R-6 Planning Division assigned study to NESPAK in 1975. They recommended further investigation of the Gharo, Kalri Lake and Kalri Baghar route for 1(a) reach (Sea Coast to Kotri) as proposed in R-3 and a navigation link from Sukkur through Nara Canal upto Jamroa weir and a new link along Jamroa to Kotri route for 1(b) reach i.e. Sukkur to Kotri.
- R-7 Study assigned by the Ministry of Communications to WAPDA in 1976 found the Indus reach 1(c) i.e. Sukkur to Kalabagh) being navigable for 2.5m drafts for 2/3rd of the year and a minimum draft of 1.5m during the low water period for 1/3rd of the remaining time.
- R-8 Bakhteyar Hussain in his 1978 paper suggested formation of a Ministry of Transport to plan and develop all modes of transport in a balanced manner. He suggested starting a pilot barge service project on Indus River in reach 1(c) (i.e. Sukkur to Kalabagh). Routes 1(a) (Sea Coast to Kotri) and 1(b) (Kotri to Sukkur) should be further studied for feasible IWT routes.
- R-9 'Of Bulk loads on Inland Waterways, 1979', M. Khan pleaded in the interest of fuel economy to open Indus river for navigation and provide containerised transportation.

- : 7 :
- R-10 Abdul Majeed developed criteria by 1979 for suitable dimensions of vessels and drafts which could be operated on link canals constructed under Indus Basin Treaty for irrigation purpose only. According to him Link Canals L(1-2) (Chashma-Jhelum Link), L(2-3)-Taunsa-Punjad Link, L(4-5) (ii)-Balloki-Sulaimanki Link were navigable and others were not.
- R-11 M. A. Farouk 1981 reviewed previous work and recommended that WAPDA be made responsible for providing navigation conservancy services on Indus from Sukkur to Kalabagh. Introduce mechanized pilot project for tug and barge operation.
- R-12 J. M. Deplaix, ESCAP Economist of Ports, Shipping and IWT Division studied IWT problem in Pakistan (1981). He recommended development of waterway from Sukkur to Kalabagh, worked out details about sizes of craft, locks, type of towing, etc. He considered a series of barrages below sukkur a preferred way of making Indus navigable in reach 1(b) i.e. Kotri - Sukkur. For the reach 1(a) i.e. Sea Coast to Kotri, he endorsed the proposal contained in R-3 and R-6.
- R-13 Was a review of previous reports and suggested that hydraulic, hydrological and structural features of canals and rivers be studied further.
- R-14 IDFCRC assigned (1984) this work to Development Workshop Ltd. for a review of studies on inland navigation and recommend future coarse of action. They suggested immediate start of IWT barge services on Indus from Kotri to Kalabagh (1263 Km) and Mithankot to Lahore on Chenab - Ravi (760 Km). A public authority be established to handle this work.

- R-15 Van Houten, a UN expert studied the Indus River Navigation problem with WAPDA and suggested the novel idea of an inflatable barrage in reach 1(a) i.e. Sea Coast to Kotri for increasing available draft for navigation between Kotri and Thatta.
- R-16 The DG P&S, Ministry of Communications also tried a review of work on IWT for conceptual clearance and came out with a phased plan in which first priority be given to reach 1(c) i.e. Sukkur to Kalabagh and second to 1(a)- Sea Coast to Kotri and 1(b) - Kotri to Sukkur for development.
- R-17 Meeting chaired by Secretary General (Planning) on 15th September, 1985 and convened by NTRC decided that a pilot project should be started and Secretary Water and Power should select the reach suitable for this.
- R-18 Secretary, Water and Power held a meeting of the Committee of Experts of Karachi on 23rd January, 1986 and decided that as no feasible navigable route was available between Port Qasim and Kotri Barrage, the idea of inland navigation in Pakistan should be shelved.

IV. ROUTE WISE ASSESSMENT OF VARIOUS PROPOSALS

The various proposals made in the aforementioned Reports (Section-II) are discussed on a route-wise basis as detailed in the following paragraphs :-

• Reach 1(a) - Indus : Seacoast to Kotri Barrage

Alternative-I : Indus river channel - 195 Km.

The reach has been known to be not navigable perennially but seasonal utilization can be done.

Just how long each year it may be possible and in what lengths of the river, is however not fully known.

Van Houten suggested an inflatable barrage on Indus River at Thatta (R-12) to make the channel above Thatta navigable. This was rejected by R-16 and R-17 as impractical.

Alternative - II : Pinyari Canal on left bank and Indus Channel.

Mohiuddin Khan made a suggestion (R-3) for connecting Kotri to Karachi via Pinyari Canal and Indus channel for 128 Km (80 miles) from Thatta to Keti Bandar but the proposal was not found feasible on detailed examination as mentioned in R-4(a) and R-6. It may be pointed out that in the nineteenth century when much navigation was done on Indus, Thatta served as the terminus for steamers and barges. Outfall of delta channels had sand bars which made navigation very difficult.

Alternative - III : Port Qasim - Gharo Creek (26 Km) — Khui Gharo Drain (50 Km) Kalri Lake (30 Km) — Kalri Baghar Feeds (60 Km). (Total 166 Km).

This route first mentioned in R-3 as a possibility was examined in detail by R-6 and declared feasible. However government panels decided in their meetings (R-16 and R-17) that it was not feasible at all.

• Reach 1(b) — Indus : Kotri to Sukkur

Alternative - I : River Indus Channel : Following the main channel of the river, the distance between Kotri and Sukkur is 480 Km. It has never been surveyed for navigation work but is presumed

to be navigable when discharges in excess of (15,000 cusecs i.e. 427 cu.m/sec.) are released downstream of Sukkur. This occurs about 7½ months a year. Nobody had suggested this reach as a regular waterway but it has been suggested that a lock through Sukkur Barrage could enable a seasonal extension of navigation services for about 7½ months down to Kotri. Sehwan barrage if it materialises would improve the navigability of this reach considerably.

J.M. Deplaix suggested a series of barrages (R-12) to make this reach navigable but this would incur heavy cost.

Alternative - II : Feeder cum navigation canal from Kotri to Jamrao and Nara Canal from Jamrao to Sukkur.

First proposed in R-3, it was examined in detail in R-4(a) and some changes in the alignment and levels of link canal were suggested in R-4(b) which was later incorporated in R-5. It was supported by all subsequent studies with minor variations as a feasible route.

Alternative - III : Kotri to Sukkur via Rohri Canal suggested as an alternative to Nara route in R-4(d) and on further study of R-4(c) it was judged as uneconomical and non-feasible.

Alternative - IV : Nara Jamrao - Feeder cum navigation link to Sakrand proposed in R-12 was not followed up further. Likely to be expensive as it goes too much in cutting.

● Reach 1(c) - Indus : Sukkur to Kalabagh

This reach 835 Km in length has been known to be navigable from the beginning and recommended for pilot projects by all in R-1 to R-16 but disregarded by R-17 and R-18 as it could not be connected, in their assessment, to a seaport.

This reach of river is about 835 Km long along the river main channel. Sukkur Barrage has no lock in it, but Guddu Barrage 160 Km upstream has a navigation lock of fair size (80 x 18 m). Taunsa barrage 346 kilometers upstream also has a lock but of a smaller size (70 x 7 m). Chashma Barrage 250 Km upstream also has a lock 70 x 7 m in size. Kalabagh Barrage 67 Km further upstream also has a 70 x 7m lock.

Kalabagh Dam is proposed to be constructed 26 Km upstream of Jinnah Barrage (Kalabagh Barrage) and would, at full reservoir, form a lake 166 Km along Indus and Kabul and at low reservoir 120 Km along Indus. The Soan area would have 56 km length at full and 32 Km at minimum level. The high dam is not provided with any locks but may provide for cargo transfer by road across the dam.

● Reach 1(d) - Indus : Kalabagh to Attock

This 160 Km length is navigable in low water season and after construction of Kalabagh Dam, the reservoir would be navigable year round.

● Reach 1(e) - Indus : Attock to Tarbela

Condition of river from Attock to Tarbela, a distance of 37 Km is not known. Steeper bed slopes would however make it difficult due to fast currents.

• Reach 1(f) - Indus : Tarbela Reservoir

The Indus arm of the reservoir is 40 miles Km in length and Siran arm is approximately 20 miles. Boat and launch services already operate between Haripur and Darband a distance of 32 Km.

• Reach 2(a) - Jhelum : Trimmu to Result

ACOP suggested (R-13) that Trimmu to Chashma - Jhelum (CJ) Link outfall and Jhelum town to Rasul can be utilized for navigation.

• Reach 2(b) - Jhelum : Rasul to Mangla

Rasul to Mangla is also navigable as per R-14.

• Reach 2(c) - Jhelum : Mangla Reservoir

Is presently in limited use by launches and boats, particularly between Mirpur and Dhudial approximately 12 miles.

• Reach 3 - Chenab River

Investigation of Mithankot - Multan reach was proposed in R-14 but no survey has been done on this river.

The river between Panjnad and Marala has a length of 534 Km through well populated area. R-14 suggests there is enough flow in the channel from May to September to make it navigable. Barages at Panjnad, Trimmu, Qadirabad, Khanki and Marala have small boat locks which may be enlarged if the river traffic develops. Detailed examination of river section and clearness under bridges is still to be done.

• Reach 4 - Ravi River

Although not mentioned in any one of the Reports mentioned in Section I, recently WAPDA have suggested using Balloki-Sulemanki link from Changa Manga upto Balloki and then Ravi upto Lahore for carriage of wood from Changa Manga Forest as a pilot project.

Development Consultant have proposed (R-14) using Ravi from Shahdara to Balloki (97 Km) in combination with upper Chenab Canal, Deg Nallah and lower Qadirabad Balloki link. Balloki to Sidnai to Cherat Below Balloki and Sidnai there is little water in the river.

• Reach 5 - Sutlej River

This river has no prospects of navigation in its 411 Km length within Pakistan. Indus Water Treaty gave its waters to India.

• Link Canals

Tipton and Kalmbach (R-2) suggested that sufficient waterway was available but cost of extra vertical clearance required for navigation was too high. The idea was dropped. The same conclusion was also reached in R-14.

V. CONCLUDING REMARKS

Seeing the results of government operated transport system on sea, rail and road transport, one hesitates to suggest the start of experimental inland water transportation under government auspices. Yet it is impossible for the private sector to develop conservancy services on government controlled waterways. Canal and

rivers within a province are under the control of Provincial Governments. The only inter-provincial river is the Indus in Pakistan and central government can initiate some work on it. Provincial governments hesitate to undertake work where they find the beneficiary will be some other province also.

Suitability of the Indus reach 1(c) from Sukkur upstream to Kalabagh as a perennial waterway has been repeated by all commentators from R-1 to R-16. The last mentioned Committee of experts concentrated on selecting a pilot project to be investigated by a UN-DTCD group for feasibility. It, however concluded the non-feasibility of the Port Qasim - Kotri alignment of waterway proposed in R-6 and decided that no pilot project was available. The reach from Port Qasim to Kotri is the most important as it connects the Indus to the sea at Port Qasim. Detailed feasibility study for this reach is immediately needed. The report of US Trade and Development Programme technical mission of January, 1987 has suggested study of alternatives of this reach as previous studies were mainly desk studies. In fact they have suggested three alternatives for this reach as below :-

"Alignment Alternatives - Waterway alignment alternatives between Port Qasim and Kotri Barrage and between Kotri and Sukkur Barrage are as follows :-

- (1) Gharo Creek (9 miles), dredge Gharo Creek (7 miles), Upgrade existing drain from Gharo Creek to Kalri Lake (21 miles), Kalri Lake (31 miles) and upgrade KB feeder canal from Kalri Lake into Kotri pondage, (35 miles).
- (2) Same as Alignment 1, except new canals between Gharo Creek and Kalri Lake and between Kalri Lake and Kotri pondage for a total of 103 miles.
- (3) Dredge Gharo Creek, new crossover canal from Gharo Creek to the Indus River and follow the Indus River to Kotri Barrage.

Port Qasim to Kotri, alignment 1, best reflects desk study concepts. However, alignment 2 appears to be the most compatible with anticipated water availability and water supply needs and was, therefore, adopted for the Appraisal Concept Plan. Alignment 3 would warrant consideration during feasibility level studies."

VI. ACTION PROPOSED

For a viable navigation system a link with the sea is absolutely necessary and for that it would be of utmost importance to carry out a detailed technical feasibility of the reach between the Port Qasim and Kotri as mentioned earlier in Section-V. This should serve as the starting point for an integrated IWT System in the country and the network may be enlarged upstream with lesser problems regarding at least the availability of water.

