Chapter - 8
Construction Programme, Manpower and Plant Planning

8.1 Construction programme

It is programmed to construct the Damanganga-Pinjal link project over a period of 9 (nine)years from the start. It is expected that all the preliminaries such as residual survey works,preconstruction survey works,design studies including laboratory test,construction of access roads to facilitate further investigations of foundation of spillways, earthdams etc and detailed geological investigation works will be completed in first 2 (two) years. The land acquisition, rehabilitation and resettlement are proposed to be taken up from 2nd year onwards, construction of approach roads, colonies, excavation of tunnels and foundation for various purposes will be started from third year onwards.

The works comprise of the following items:

1) Excavation of inter linking tunnel of 16.85km length between Bhugad & Khargihill reservoirs and another tunnel of 25.70 km length between Khargihill & Pinjal reservoirs.
2) Construction of Bhugad and Khargihill dams

The various componments of the above works are proposed to be taken up for construction simultaneously so that these works can be completed in a stipulated period of 9 years. The yearwise construction programme is enunciated in subsequent paragraphs.

Year	Works
1st year	All preliminary works such as residual survey works, preconstruction survey work etc. in respect of Bhugad-Khargihill and Khargihill-Pinjal tunnels and procurement of T&P will be started and compeleted by the end of the year.
2nd year	All preliminaries pertaining to Bhugad and Khargihill dams will be started and completed by the end of the year. Land acquisition for Bhugad-Khargihill and Khargihill-Pinjal tunnels and construction of temporary building will be started and completed by the end of the year.
3rd year	Excavation foundations for various purposes and construction of approach road and colonies in respect of tunnels will be started in this year.
4th year	Afforestation work for Bhugad and Khargihill dams and concreting work for various structures will be taken up.
5th year	The lining work of tunnels will continue in this year. Construction of dams will be taken up. Afforestation in case of both the dams will be completed by the end of the year.
6th year	Excavation of Bhugad-Khargihill and Khargihill-Pinjal tunnels and lining of tunnels will continue in this year. Construction of dams will continue in this year.

7th year — Excavation of tunnels will be completed by the end of the year and lining of tunnels will continue. Construction of dams and various structures will be completed by the end of year.

8th year — Lining of tunnels will continue in this year. Erection of spillway gates and finishing work for Bhugad and Khargihill dams will be started.

9th year — Finishing works will be completed in all respect by the end of the year. Erection of spillway gates and adjustment of men, machineries and equipments will be completed in all respect by the end of the year.

8.2 Programme of yearwise expenditure

The construction costs of the main component of the works corresponding to the price level of 2002-2003 are given below.

a) Unit – I Head works	Rs. 875.40 crores
b) Unit-II Tunnels	Rs. 402.37 crores
Total	Rs. 1277.77 crores say **1278** crores

The yearwise expenditure for construction of the above works is planned as under :

Year	**Rs. in Crores**
First year	45
Second year	64
Third year	156
Fourth year	218
Fifth year	207
Sixth year	174
Seventh year	166
Eight year	144
Nineth year	104
Total	**1278**

8.3 Material planning

With regard to material planning, the stone is available locally while the cement and steel are to be procured from various agencies. These materials can be transported by goods train upto Vapi, Thane and Dahanu road. The cement can be procured from Narmada Cement Factory in Surat district, which is located at a distance of about 100 km and 144 km respectively from Vapi and Dahanu railway station. The carting distance of each dam site by road from respective railway stations are as given below :

Rail Head	**Site**	**Distance in km**
Vapi	Bhugad dam site	95 km
Dahanu road	Khargihill dam site	90 km
Vapi	Khargihill dam site	105 km
Vapi	Bhugad-Khargihill tunnel	100-110 km
Dahanu road	Khargihill-Pinjal tunnel	90-60 km
Thane	Khargihill-Pinjal tunnel	160-170 km

8.4 Quantum of work involved

The quantities of various items of works such as earth work, concreting, grouting, tunnel lining etc. are as follows :

Sr.No.	Item of work	Unit	Total quantity
1	Excavation in soft soil	M^3	204987
2	Excavation hard soil	M^3	102494
3	Excavation of soft rock	M^3	1702
4	Excavation in hard rock	M^3	1448704
5	Cement concrete M15	M^3	1478882
6	Cement concrete for road bridge M20	M^3	1197
7	Reinforcement	MT	26151 90
8	Grouting consolidated & Curtain	M^3	2944 1399
9	Structural steel	Sq.m.	1123
10	Rubble Masonary	M^3	64522

Based on the above quantities of work, the quantity of cement required works out to about 3.15 lakh metric tonnes.

8.5 Plant and Machinery

The requirement of plant and machinery has been worked out separately for earth work, structures, tunnel lining ect. The details are given in Table-8.1 and 8.2 respectively. Details of departmental vehicle are given in Table-8.3 under the special "Q-special Tools and Plants".

(a) Q-Special tools and plants estimate

Table-8.1
(a) Q-Special tools and plants estimate
I-Equipments for earthwork and excavation of rock

Sl. No.	Items	Total Qty.	Rate in lakh	Amount in Rs. lakhs
1.	3 cum hydraulic Excavators	2	75.00	150.00
2.	Tunnel excavators	10	85.00	850.00
3.	275 H.P.tractor dozzers	2	70.00	140.00
4.	11.5 cum Motorised scrapers	4	75.00	300.00
5.	O.H.D. Tractor pusher	1	60.00	60.00
6.	180 H.P. Tractor dozzers	1	45.00	45.00
7.	Water tanker	5	8.00	40.00
8.	Self propelled vibratory roller	3	40.00	120.00
9.	18.22 kg. jack hummers	15	0.2	3.00
10.	500 cuft mounted air compressor (Electric driven)	2	4.00	8.00
11.	20-22 T rang dumper L.S.	1	35.00	35.00
12.	3-10 T rang dumper L.S.	1	25.00	25.00
13.	4.5 front and wheel loader L.S.	1	40.00	40.00
14.	Wagon drills L.S.	10	1.00	10.00
15.	40-50 H.P. centrifugal pumps L.S. (Diesel driven)	2	1.00	2.00
16.	40-50 H.P. centrifugal pumps L.S. (Electric driven)	6	1.00	6.00
17.	Dumper of 35 tonne capacity L.S.	6	55.00	330.00
18.	Draug lines L.S.	1	55.00	55.00
19.	Pneumatic tyred roller	1	30.00	30.00
20.	Sheep foot roller of 10 tonne capacity L.S.	1	30.00	30.00
21.	Road roller (8 tonne) L.S.	1	7.00	7.00
22.	Cranes (10 tonne) L.S.	2	35.00	70.00
23.	Explosive van L.S.	2	7.5	15.00
24.	Grout pump L.S.	6	1.00	6.00
25.	Graders L.S.	2	25.00	50.00
26.	Misc. equipments including Machine tools, workshop, tools etc. L.S.	--	--	175.00
27.	Tunnel boring machine/Drift boring machine			1000.00
	Total (at 1999-2000 price level)			3597.00
	Total (escalated to 2002-2003)			4788.00
	Provision towards Unit – I Head Works			3031.00
	Provision towards Unit – II Tunnels			1757.00

Table 8.2
II – Equipment for tunnel lining

Sl. No.	Items	Total Qty.	Rate in Lakh	Amount in Rs. lakh
1.	3 Cum motorized transit mixer	6	10	60
2.	100 t/hr stone crushing plant	2	4	8
3.	100 t/hr screening and classification plant	2	3	6
4.	30 ton truck mounted telescopic boom	1	45	45
5.	25 tonne rough rerrain crane	1	35	35
6.	Bulk cement carrier	2	3	6
7.	Concrete vibrator (needle type)	10	0.30	3
	Total (at 1999-2000 price level)			163
	Total (escalated to 2002-2003)			217

Table 8.3
(b) Q-Special tools and plants estimate
Departmental vehicles (Inspection vehicles)

Sl. No.	Items	Total	Rate in Rs. lakh	Amount Rs. In lakhs
1.	Q-Special tools and plants estimate Departmental vehicles (Inspection vehicles)			
2.	Ambassador Cars	7	4.5	31.5
3.	Jeeps	26	3.5	91.0
4.	Jeeps trailors	14	0.75	10.5
5.	Pickup van/minibus	3	4.5	13.50
6.	Trucks	2	7.5	15.00
7.	Staff bus	3	7.5	22.50
	Ambulance vans	2	7.5	15.00
	Total (at 1999-2000 price level)			199.00
	Total (escalated to 2002-2003)			Say 200 266

8.6 Manpower planning

It is proposed to have 2 Chief Engineers headed by a General Manager for executing the project. Organisational set up for each Chief Engineer has separately been worked out. As large quantities of earthwork and rock excavation work are involved in the present projects, it is proposed that 25% of earth work will only be carried out manually and the rest 75% will be done by machinery. Exact number of skilled, semi skilled and unskilled labours have not been worked out. However, it is expected that large force of such labourers are available in the vicinity of the project areas.