Preparation of Cost Estimate for Irrigation, Flood Management and Multipurpose Projects

Cost estimate of River Valley Projects is a prerequisite for the investment clearance of the project proposal. It is one vital aspect of Detailed Project Report (DPR). Further, cost estimate for the ongoing projects become essential when the total cost of the project exceeds 15% of the earlier approved cost, excluding the price escalation or there is some change in scope in the project. This estimate is technically termed as Revised Cost Estimate (RCE). After the completion of the project i.e., commissioning of the project, completion cost of the project is also prepared. The above three stages are applicable in case of a public sector projects. The estimated cost is tagged with a year and no escalation is considered. However, for private sector project, cost estimate at the DPR stage is prepared and total cost of the project is projected and finalized with reasonable interest during construction (IDC) and financing.

For the preparation of cost estimate of a river valley project at DPR stage, many an approximations are considered based on the past experiences and experiences from the nearby projects. Cost estimation of a DPR involves many a technological considerations like design, quantity estimation, equipment planning etc. At the DPR stage detailed design and quantity estimation are not done and some tentative calculations are only made. Based on the site conditions there may be many a variations. Still, cost estimate gives a standard idea about the technical viability of the project and helps to plan the implementation of the project with reasonability and means.

The preparation of cost estimate of a DPR is a lengthy work and involves many a calculations and specifications for wide variety of items of works and machinery. Basic inputs are quantity estimation and equipment planning besides the unit cost of material and manpower (skilled/semiskilled/unskilled). For detailed calculation the following references are very much important.

(1) Report of Committee of Cost Control of River Valley Projects, Vol-II, 1981
(2) CWC Guidelines for Preparation of Project Estimates for River Valley Projects, 1997
(3) CWC Guide Book on use rate, Hire charges and transfer value of Equipment and spare parts, Dec.1988
(4) Guidelines for Formulation of Detailed Project Reports for Hydro Electric Schemes, their Acceptance and Examination for concurrence, CEA, 2012(Revision-3)
(5) Indian Standard IS: 4877 “Guide for Preparation of Estimate for River Valley Projects”.

UNITS

According to the BIS Standard mentioned above, the project works have to be grouped into
the following units:

a) Unit-I - Headworks including main dam and auxiliary dam, dykes, spillway, outlet works, energy dissipation devices, barrages, weirs, regulators including intake structures and diversion works.
b) *Unit II*-Main canals, branches, and distribution system inclusive of all pucca works.
c) *Unit III*-Hydro-electric installation
1) Power Plant and appurtenant works:
i) Civil works, and
ii) Power equipment.
2) Transmission lines.
3) Sub-stations.
d) *Unit IV* - Navigation works.
e) *Unit V* - Water supply works.

HEADS

Each unit should be covered under the following minor heads classified as *direct* and *indirect*
charges.

Direct Charges

These shall include the following:
I. Works.
II. Establishment,
III.Tools and Plant.
IV. Suspense.
V. Receipts and recoveries on capital account.

Indirect Charges

These shall include the following:
a) Capitalized value of abatement of land revenue,and
b) Audit and account charges.

The provisions under the Minor head I-Works will be sub-divided under the following detailed sub-heads:
A- Preliminary
B- Land
i) Acquisition & Compensation
ii) Rehabilitation and resettlement

C- Works
D- Regulators and measuring devices (for canals only)
E- Falls (for canals only)
F- Cross drainage works (for canals only).
G- Bridges (for canals only)
H- Escapes (for canals only)
I- Navigation works.
J- Power Plant Civil Works.
K- Buildings.
L- (for canals only)
i) Earthwork;
ii) Lining and
iii) Service Road.

M- Plantation.
N- Tanks and reservoirs.
O- Miscellaneous.
P- Maintenance.
Q- Special T & P.
R- Communications.
S- Power Plant and electrical Mechanical System.
T- Water Supply Works.
U- Distributaries minors and subminors.
V- Water courses.
W- Drainage (to be clubbed with Environment & Ecology)
X- Environment and ecology.
Y- Losses on stock.

ABSTRACT OF COST

Detailed Abstract of cost

TO work out the total cost of the project in detail the cost of various units mentioned above should be compiled in a tabular form according to the accounts heads.

General Abstract of cost

On the basis of the detailed abstract of cost as above, general abstract of cost for the whole project tabulating all the units together may be compiled by minor and detailed heads.

EXAMINATION OF PROJECT ESTIMATES IN CWC

Under the procedure laid down by the Planning Commission, all major irrigation & multipurpose project reports including cost estimates received from the State Govts. /Union Territories have to be examined in detail by CWC and put up to the Advisory Committee of the Ministry of Water Resources for acceptance. After these schemes are accepted by the Advisory Committee, the investment clearance is issued. Thereafter, during implementation of the projects, if the cost exceeds 15% of the original approved cost including escalation due to price rise or where there is change in scope i.e. change in project parameters resulting in changes in nature and benefits such as CCA, installed capacity, energy generation etc., then a revised estimate for the project has to be submitted by the State and the estimate examined afresh for necessary clearance by CWC/Advisory Committee etc.

Feasibility estimates generally known as project estimates provide the basis for authorization of the project for construction and for the appropriation of construction funds. These estimates should be in enough detail to show the quantity, unit cost and total costs of various works and supply items.

Engineering surveys, geological explorations and similar works accomplished during the feasibility investigations are usually carried out to the extent needed to enable at least, a tentative layout to be prepared for the purpose of sound cost estimate and to prove the feasibility of the project. CWC has laid down guidelines for the minimum investigations to be done for formulation and submission of Irrigation and H.E.Projects. It is necessary that these guidelines are followed and the prescribed investigations are done to arrive at realistic estimates.

In the feasibility estimates, cost of major items is best worked out in detail on the basis of preliminary layouts and designs and unit rates which should be analyzed for the project in question. Smaller items may be computed from cost graphs and parametric rates.

PREPARATION OF ESTIMATE

The capital cost of a project includes all cost associated with investigations, design, construction and maintenance during construction period of the project. For preparation of cost estimates of civil works, the unit costs of labour, materials and equipment necessary to perform the work designated in the various pay-items for the proposed construction shall be determined. Current unit cost shall be used in all estimates and price level of the project estimate shall be mentioned.

The analysis of rates for various items shall be worked out taking into consideration the cost of materials, carriage-handling-storing, labour and share of machines involved in executing various items of the work and overhead charges.

The quantitative assessment of material requirement shall be adopted from authoritative books/publications or through independent calculations based on the data available at site or other projects. The unit cost of various materials may be taken as those prevalent in the State/ region. The appropriate cost for freight, unloading, cartage, storage, inspection and testing should also be included.

The wages of workers are periodically revised by the State under the statutory labour laws. Daily wage rates, therefore, shall be taken as those prevalent in the State at the time of formulation of the project.

For working out the use rates of machinery, the norms for life, depreciation, repair provision etc. shall be adopted as recommended by the latest CWC Guide Book on use rate, hire charges and transfer value of equipment and spare parts. Price of various equipments should be taken on the basis of recent quotations/ price list of such equipment. All taxes and freight charges should be taken into consideration while arriving at the cost of equipment at site.

Provision for contingencies and work-charged establishment is generally considered up to 3% and 2% respectively of the works' cost and provided in the detailed works estimates prepared on the heads of items rates and quantities of works to be executed. These percentage provisions should not be considered on lump-sum items.

Mention shall also be made regarding communication facilities available, terrain through which the roads are passing (hilly, plain etc.), type of road (Black top, water bound macadam, murum, kacha etc.). Suitable provisions for overhead charges and profit of the contractor has to be kept in the estimate. Since it is difficult to identify overheads and profits precisely, both these together may be provided @ 20% of the prime cost/or as per State Govt. norms in the analysis of rates. In the case of departmental works it is expected that additional departmental charges would also be about 20%. Any location specific incentives given for developing projects by States/ Union Govts should be considered in the estimate. Specific mention in this regard may also be made in the abstract of the estimate. In case of works let out on contract, the provision for II-establishment including leave and pensionary charges is generally of the order of 8 to 10 % for concentrated works and 10 to 12 % for scattered works like canals. For works to be executed departmentally the provisions could be higher than those given above say 12 to 15 %. For Hydro Electric

projects, the provisions for II-Establishment may be considered as per the latest CEA guidelines.

Project estimates are to be prepared on the basis of current costs without making any provision for future increase in price during the period of execution of the project. No allowance on future price escalation is to be considered as per government policy. However, in the case of private sector power projects, total completed project cost, including interest during construction (IDC) and financing costs, has to be arrived at before considering the project for execution.

INFORMATION TO BE GIVEN IN THE ESTIMATE

The following information is generally covered in the report of an estimate

1. Scope
2. Method of construction
3. Construction plant
4. Establishment
5. Land and resettlement of oustees
6. Time
7. Construction materials
8. Communications
9. Other public facilities
10. Labour
11. Diversion arrangement

The following documents are to be accompanied with the estimate.

1. Index map of the project, general layout and preliminary Drawings of important structures.
2. Single line diagram and layout drawings of Power House and Switchyard (applicable for Power Project only).
3. Brief specifications of work.
4. Details of micro planning for distributries, minors, water courses and drainage for 10% of the total area of the command in the case of Irrigation scheme.
5. A schedule of prevailing basic labour wages.
6. A schedule of prevailing basic cost of materials supported by analysis wherever necessary.
7. A schedule of prevailing transport rates supported by analysis wherever necessary.
8. Basic out-puts of men and machines assumed for estimating the cost.
9. Use rates of equipment supported by their analysis.
10. Analysis of unit rates of various works.
11. Copy of the latest schedule of rates of the district in which the project is located.
12. Relevant certificates from concerned Authorities/Departments.

The list is not exhaustive. Necessary supporting documents which differ from project to project may have to be attached with the estimate for transparency and future reference.

REVISED COST ESTIMATE (RCE)

In the case of major and multipurpose projects which have been approved by the Planning Commission and where the revised estimates of the project have increased by more than 15% of the original estimates, excluding escalation due to price rise or where there is

change in scope, be required to be furnished to CWC for examination in the same way as-new major and multi-purpose schemes irrespective of the fact whether the revision is due to change in scope or not. The procedure for scrutiny for such revised project estimates shall be same as for the new projects

In respect of revised project estimates where there is no change in the scope and where the cost excluding escalation due to price rise has not changed by more than 15%, the State Government need not forward a detailed estimate for examination at Centre. For such projects the State Government should send to CWC an excess note after obtaining the concurrence of the State Finance Department giving the abstract of cost under major sub head indicating the excess cost over the sanctioned cost and giving reasons thereof. The note will include the salient features of the project as originally proposed and as being executed at site. The CWC will examine such estimates broadly and send its views to the Advisory Committee for consideration and recommendation of the Planning Commission.

In the case of projects which undergo modification and revision subsequent to their pproval, the information required to be submitted to Planning Commission should be submitted in good time so that approval for the revised scheme is received from the Planning commission before any additional commitments over and above the sanctioned project estimate are made in respect of them.

The revised estimate should also include variation statement showing the variation in cost of different sub heads. Quantities and rates of important items should be furnished. Other items should be included as miscellaneous in the total cost. The revised estimate should also include an analysis of the reasons for the increase in cost of different sub heads as detailed below:

1. Rise in prices including variation due to exchange rate.
2. Rise due to change in scope.
3. Rise due to inadequate provisions in earlier estimate.
4. rise due to change in design
5. Additional requirements/new items.
6. Rise due to other causes such as inadequate plan allocation, arbitration, legal cases, poor performance of equipment, procurement problems etc.

When revised estimates are prepared during construction, the quantities of items completed should be indicated separately and the cost thereof assessed on the basis if actual expenditure. Any liability arising out of the contract for completed work and affecting the cost should also be considered in the estimate. For works in progress the estimates should be based in contract rates. If the contract document contains any clause for escalation on the prices of materials and labour wages subsequent to the award of contract, the amount involved should be assessed and included in the estimate. For the balance work to be done, the cost should be estimated on the basis of rates prevalent at the time of the preparation of the revised estimates.

ECONOMIC EVALUATION OF IRRIGATION, FLOOD MANAGEMENT AND MULTIPURPOSE PROJECTS

1. Introduction:

Economic evaluation of the project is basically an investment decision guided by cost estimate of the project on one side and the benefits expected to flow by such investments on the other. Different policy decisions adopted by various countries / agencies govern criteria to be used for assessing the economic viability of the projects.

Though the irrigation projects were earlier evaluated on the basis of rate of return criteria, a need was however felt that irrigation project in an area should not only be viewed as source of income to the Govt. but as a means for increased agricultural produce and economic development of that area and in the process, of the country as a whole.

2. Evolution of Criteria for Economic Evaluation

2.1 Pre-Independence- Development of financial policy

Systematic irrigation development took place during British era. However, at that time irrigation systems were considered as commercial ventures like any other infrastructure projects. The feasibility of irrigation projects essentially evolved from the concept of financial soundness of public investment. The beginning of financial policy can be traced to the period of rapid expansion of irrigation towards the close of last century with the acceptance of the proposal for construction of irrigation works through loan funds. The Select Committee on Indian Public Works reporting to the House of Commons in 1879 said:

" The financial results of works of irrigation are in the opinion of your committee, the best test of their utility. A rail road may traverse between its termini certain districts which it does not materially improve, yet the work may on the whole, be beneficial, to the country. Unless, however, an irrigation work benefits the immediate locality in which it is placed, it can be of no use to outside districts."

The committee further observed that:

"the construction of new works from borrowed money for the future be limited to those schemes alone which upon the responsibility of the Government are estimated to be productive by yielding an annual income equal to the interest in the capital expended on their construction including in such capital interest during construction."

This recommendation of the Committee then formed the basis for selection of irrigation projects.

First Indian Irrigation Commission (1901-1903) at the turn of the century also gave full consideration to the financial aspects of irrigation works. The Commission in its report made a brief mention of the selection criteria in vogue at that time which reads as

"An irrigation work is classed as productive and sanctioned against loan funds when it has shown to the satisfaction of the Secretary of state that it is likely to fulfil the conditions of productive public work, that is to yield a net revenue 10 years after completion, sufficient to cover interest charges on the sum at charge at that date. By sum at charge is meant the total direct and indirect capital cost plus the excess, if any, of interest charges to date over the net revenue."

2.2 Productivity rate:

The productivity of a scheme was judged with reference to the rate of return earned by it on full development. The criterion for the sanction of irrigation projects was based on financial results which were estimated as follows:

i) The capital cost of any work was taken as the sum actually spent on its construction;
ii) The revenue on account of direct receipt and indirect receipt was estimated;
iii) The revenue account was debited yearly with
  (a) the simple interest on the capital cost of the works at the commencement of the year; and
  (b) The working expenses of the year.
iv) The revenue account was credited yearly with
  (a) the direct receipts
  (b) the indirect receipts.

The difference between (iv) and (iii) above for any year gives the profit or loss for that year.

The acceptable value of 'productivity rate' was linked to prevailing Rate of interest and thus varied from time to time. The productivity rate varied between 4 to 6 percent on works sanctioned during the period 1919 to 1937. Government of India Act., was introduced in 1935. After April, 1937, Government of India prescribed Rate of Return as 6 percent as acceptable limit for sanction of projects. However, recognising the importance of irrigation to meet the food and fibre requirement of the public at large, most of the

Provinces reduced the productivity rate to 4 percent though the rate prescribed by the Government of India continued to be higher at 6 percent. This inter-alia helped in taking up more number of projects which otherwise would have failed to satisfy the prevailing financial criterion.

Schemes were sanctioned only if they satisfied the test of financial viability defined in terms of the rate of return. The financial viability test was rigidly applied to all irrigation projects Earlier large irrigation schemes were mostly diversion works and were relatively inexpensive. When new schemes were taken up, it was felt that the development of irrigation was being held up by the rigid application of the financial criterion, namely 6 percent between 1921 and 1949. Noting that apart from direct irrigation revenues, other benefits accrued to the Government in the shape of increased revenue from excise duties, income tax, sales tax, transport etc., The Central Board of Irrigation thus passed a resolution at its annual meeting held in 1936 stating that "as the expansion of irrigation is seriously handicapped by the restricted view taken of the value of irrigation, an economic survey should be carried out with a view to estimate the direct and indirect financial benefits accruing to the Central and Local Governments from Irrigation Projects". Even if studies showed that the indirect benefits of irrigation projects were substantial, criteria for selection of projects has to be acceptable value of rate of return. However, a view was taken that if a project did not fulfil the financial criterion, but was still considered necessary in the public interest, it could be sanctioned as a protective work.

Number of irrigation projects which failed to satisfy the financial criterion were accordingly taken up as protective works.

2.3 Plan era

After independence there was a change in the approach to the irrigation projects and these projects were viewed as investment in the development and social benefit where profit was not the sole motive. Sanction criteria was thus relaxed so that large number of projects could be taken up in order to meet the food and fibre requirements of ever growing population.

Rate of return on the capital outlay for classifying a capital work as productive was accordingly reduced to 3.75 percent. This rate continued upto the year 1954 and was applied to all projects financed by the Central Government as also for determining productivity of State irrigation works for which loans were obtained from the Centre. Subsequently, the rate was raised to 4.5 per cent and this rate continued up to March, 1960.

3. B.C.Ratio:

During First and Second Five Year Plans a large number of irrigation projects were taken up. It was observed that these projects could not satisfy the prevailing criterion of direct financial returns to the Government. However, it was felt that irrigation project in an area should not only be viewed as source of income to the Govt. but as a means for increased agricultural produce and economic development of that area and in the process, of the country as a whole. A need was therefore, felt to have full understanding of the various aspects of an irrigation project. Accordingly, in 1958, the Planning Commission initiated studies of some of the major projects to assess the overall benefits of the irrigation projects and to find a more appropriate criterion for deciding whether various irrigation projects should be undertaken. These studies were carried out under the Committee of Direction headed by Prof. D.R.Gadgil. These studies showed that large benefits accrued from irrigation in terms of double cropping, diversification and better quality crops, higher yields, larger income and greater opportunities of employment. Indirect benefits that accrued were the establishment of processing industries, expansion of consumer industries, retail trade, transport and communications. The Committee was of the view that total benefits from irrigation were far larger that the direct financial returns accruing to Government from water rates and betterment levy. The Committee, therefore, recommended that in future the concept of benefit cost ratio should be used for assessing the feasibility of new projects instead of the traditional criterion of the direct financial return to the Government. During the cause of whole exercise, the Committee studied the issue of direct i.e. primary benefits and primary cost and indirect i.e. secondary/ tertiary benefits and indirect cost separately. The committee was of the view that whereas it may be easy to work out the direct benefit i.e. increase in agricultural produce due to irrigation, it may not be so in case of indirect benefits. Secondary benefits are complementary in nature and are linked to overall developments of the area and as such it is difficult to quantify benefits exclusively attributable to irrigation. For simplicity, therefore, it was considered that the indirect or secondary benefits and cost need not be taken into account. The net annual benefit was to be worked out as the difference between the monetary value of the net agricultural production (total value of produce-cost of cultivation) 'before' and 'after' the introduction of irrigation. The annual cost should be taken to comprise the annual interest on capital, depreciation and expenditure on maintenance and operation.

Gadgil Committee report was submitted in 1964 wherein it was recommended that the economic benefit criterion should be adopted for sanctioning irrigation projects instead of the financial criterion. The Government accepted this recommendations and benefit cost ratio criterion has been adopted. Benefit-Cost Ratio criterion for judging the economic soundness of irrigation projects is in practice till date.

B.C. ratio is obtained by dividing the annual benefits by the annual cost. Net annual benefit is estimated as the difference in the net value of agricultural produce "before" and "after" irrigation. The annual cost in the denominator comprise (a) interest on capital cost of the project at the rate of ten percent per annum (b) depreciation charges at the rate of 1 percent in case of projects having 100 years life say storage scheme and 2% in case life of the project is considered as 50 years and (c) operation and maintenance expenses. Irrigation projects with B.C. ratio greater than 1.5 are considered acceptable from economic point of view. Benefit Cost ratio of 1.5 instead of 1.0 was suggested as a prudent precaution against likely increase in cost of the project. Subsequently acceptable value (B.C. ratio) was reduced to 1.0 for irrigation projects in drought prone areas. Further, for following categories of projects, B. C. ratio for acceptability of the project will be 1.0 instead of 1.5.

(a) For major and medium irrigation projects in special category states i. e.North eastern states, Sikkim, Uttranchal, Jammu & Kashmir and HimachalPradesh.

(b) Major and medium irrigation projects benefitting areas where 100% of the beneficiaries belong to SC/ST category or 75% of the beneficiaries belong to ST category.

The methodology for computing B.C. ratio shown in the format enclosed at Annexure I.

ESTIMATION OF B.C. RATIO FOR IRRIGATION PROJECTS

► B.C. ratio is obtained by dividing the annual benefits by the annual cost.

► Estimation of Irrigation Benefits

The net annual benefit is worked out as the difference between the monetary value of the net agricultural production (total value of produce- cost of cultivation) 'after' and 'before' the introduction of irrigation.

- Value of produce comprises of gross value of both farm produce and byproducts.
- Cost of cultivation includes expenditure on seeds, manure/fertilizers, pesticides, hired labour/equipments, depreciation, cash and share rent, Government taxes/ levies etc.

Estimation of Benefits other than Irrigation

(i) Drinking / Industrial water supply

If there is a specific reservation in storage of the reservoir, the proportionate cost of the dam be allocated to drinking/industrial water supply & the cost be excluded from the cost of the project for irrigation. Alternatively, the quantum of water supplied to the municipalities /industries be charged at the rates fixed by the Government or agreed to with the parties concerned & amount be considered as benefit.

iii) Pisciculture

The reservoir can be used for pisciculture. The output per ha of the reservoir area (average of the area at FRL and MDDL can be considered) can be estimated & its value after deducting the expenditure at the prevalent market rate is to be considered as a benefit due to the project. In this case there is no specific water allocation for it and it is an incidental benefit. However, if pisciculture is to be practiced in ponds fed by canals, water requirement can be estimated and provided for. Benefit may be considered in the similar way as from the reservoir.

iv) Animal husbandry

If any major farms are proposed in the project & water is to be supplied from the project, the net income may be considered as benefit. Augmentation of income of the farmers as a result of introduction of irrigation is difficult to estimate and need not be considered.

v) Hydro power

Generally, if power generation is proposed from the project, proportionate cost of the common works is allocated to power sector & B.C. Ratio for irrigation is calculated with remaining cost of the project.

vi) Catchment area treatment

This helps in restricting the soil erosion and augment water availability in the catchment area. This results in improvement in productivity of land. Increased yield from direct draining area may be estimated and included in the benefits. Its cost is already included in the project cost. Presently, however, this benefit is not being reflected in the DPRs.

vii) Canal bank plantation/reservoir territory afforestation

The benefits are easy to estimate and must be included in the benefits. Presently, however, this benefit is not being reflected in the DPRs.

Note:- Yield/ha and the prices to be used for converting the benefits into monetary terms shall be obtained from the State Department of Agriculture, Pisciculture & Forests. They would also furnish the basis for recommending the yields/ha under pre and post project conditions and prices to be used.

► The annual cost in the denominator comprise (a) interest on capital cost of the project at the prevailing rate. Cost of the project include Cost of land development (b) depreciation charges at the rate of 1 percent assuming 100 years as life of project (c) maintenance of Head Works @ 1% of the cost (d) operation and maintenance expenses

For lift schemes annual cost shall also include:

(i) Depreciation of the pumping system @ 8.33% of the estimated cost, assuming life of the system as 12 years.
(ii) Depreciation of the raising mains @ 3.33 % of the estimated cost, assuming life as 30 years.
(iii) Charges of the power.

ESTIMATION OF B.C. RATIO FOR FLOOD MANAGEMENT PROJECTS

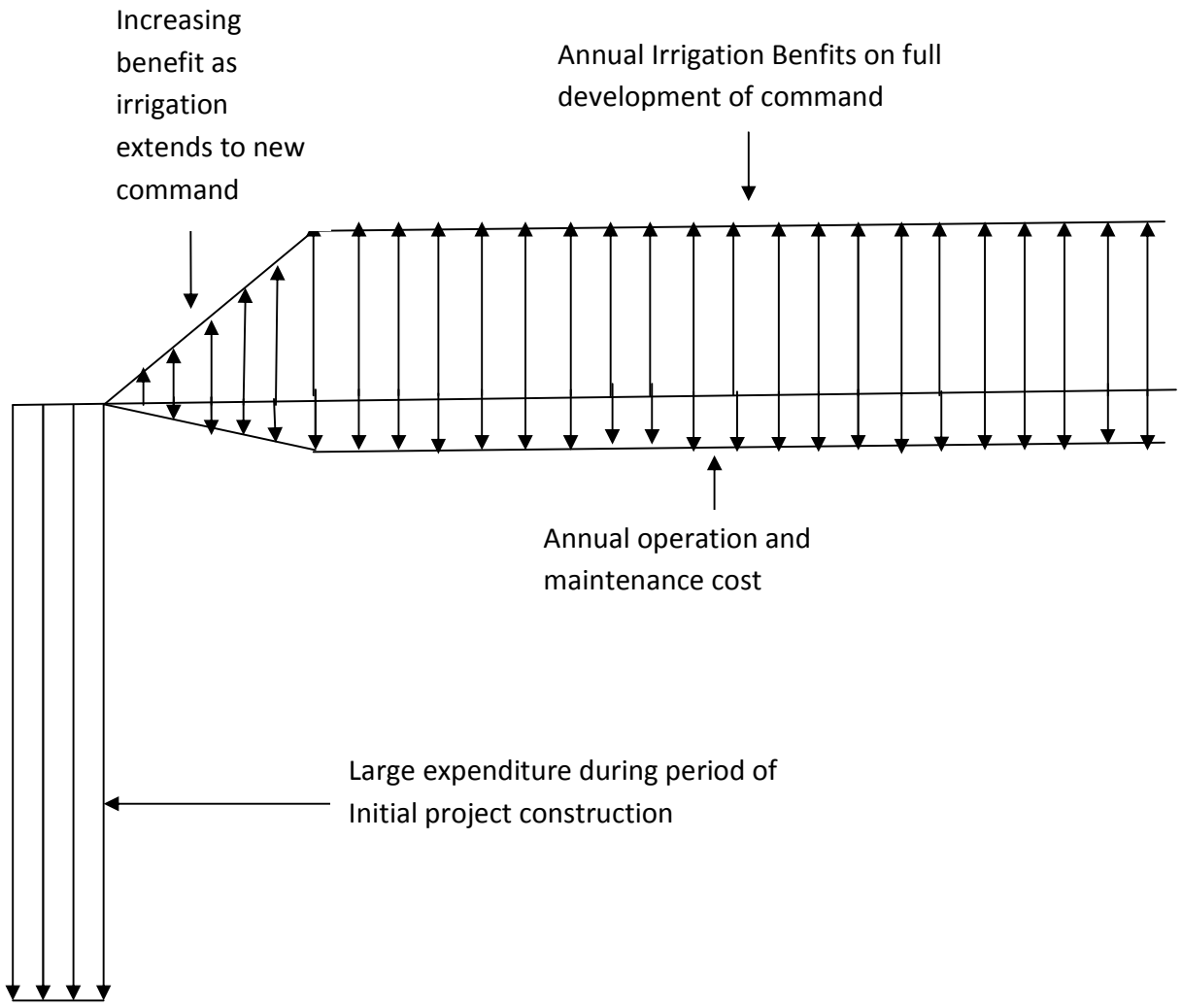
B.C. ratio should be worked out on prescribed standard and annual loss supported by documents from the revenue department of the State. Average annual damage should be computed on the basis of at least last 10 years data. B.C. Ratio calculation for flood management component of the project is worked out as under.

(i) Average annual damage computed on the basis of at least last 10 years data.
(ii) Average annual damage anticipated after the execution of the project.
(iii) Saving in annual damage {Item (i) and item (ii)}.
(iv) Annual cost of flood management component.
  (a) 12% of allocate cost of dam
  (b) 16% of allocated cost of embankment
  (c) 17% allocated cost for anti-erosion schemes
  (d) Total annual cost a+ b +c).

$$\text{B.C.Ratio} = \frac{\text{Item (iii)}}{\text{Item (iv)}}$$

4. Internal Rate of Return:

For World Bank aided project it is obligatory to work out Internal Rate of Return also beside B.C. ratio. Calculation of IRR is undertaken to reflect the further cost involved in long gestation that takes place during the construction. Cash flow diagram for a hypothetical irrigation project is indicated below. Irrigation development over large area is a slow process and projections of progress to assess flow of benefits and the stream of realisable benefits finds place in the I.R.R. analysis. The IRR is calculated as per profroma enclosed at Annexure II.



Cash Flow Diagram for Hypothetical Irrigation Project

B.C.Ratio **(Rs. In Lacs)**

			PRE PROJECT	POST PROJECT
A		**GROSS RECEIPTS**		
	1	**GROSS VALUE OF FARM PRODUCE**		
	2	**DUNG RECIEPT(30% OF B6)**		
	3	**TOTAL (A) GROSS RECEIPTS**		
B		**EXPENSES**		
	1	**EXPENDITURE ON SEEDS**		
	2	**EXPENDITURE ON MANURE**		
	3	**EXPENDITURE ON FERTILISERS**		
	4	**EXPENDITURE ON PESTICIDES**		
	5	**EXPENDITURE ON HIRED LABOUR**		
	6	**FODDER EXPENSES (15% FOR PRE AND 10% FOR POST PROJECT OF A1)**		
	7	**DEPRECIATION (2.7% OF A1)**		
	8	**SHARE AND CASH RENT(5% FOR PRE AND 3% FOR POST PROJECT OF A1)**		
	9	**LAND REVENUE (2% OF A1)**		
		TOTAL (B) EXPENSES		

C		**NET VALUE OF FARM PRODUCE**
	1	**TOTAL GROSS RECEIPTS**
	2	**TOTAL EXPENSES**
		NET VALUE (1-2)
D		**ANNUAL BENEFITS**
	1	**NET VALUE OF PRODUCE AFTER PROJECT**
	2	**NET VALUE OF PRODUCE BEFORE PROJECT**
	3	**ANNUAL BENEFIT (1-2)**
		COST OF THE PROJECT
	(a)	**CAPITAL COST (After apportionment)**
	(b)	**COST OF LAND DEVELOPMENT @ Rs 2000/- per ha of CCA - ha**
		Total
E		**ANNUAL COST**
	1	**INTEREST ON TOTAL COST**
	2	**DEPRRICIATION OF THE PROJECT @ 1 % OF THE CAPITAL COST**
	3	**O & M CHARGES @ Rs 600/- PER HA ON ha**
	4	**MAINTENANCE OF HEAD WORKS @ 1% OF THE COST OF Head Works of lac Rs.**
	5	**TOTAL ANNUAL COST**

B. C. RATIO (D3/E5)

Estimated value of Produce and cost of inputs before Irrigation

Cost of inputs

S. No.	Crops	Area (ha)	Cost of inputs per hectare						Total cost in lakh Rs.
			Seed	Manure	Fertilisers	Pesticides	Labour	Total	
	Kharif								
1									
2									
3									
4									
5									
6									
	Rabi								
1									
2									
3									
4									
5									
6									
	Total								

Estimated value of Produce before Irrigation

S.No.	Crops	Area (ha)	Yield (Qtls./ha)	Rate Rs./Qtl.		Receipt (lac Rs.)		Total Value of Produce (lac Rs.)
				Levy	Market	Levy	Market	
	Kharif							
1								
2								
3								
4								
5								
6								
	Rabi							
1								
2								
3								
4								
5								
6								
	Total							

Estimated value of Produce and cost of inputs after Irrigation

Cost of inputs

S. No.	Crops	Area (ha)	Cost of inputs per hectare						Total cost in lakh Rs.
			Seed	Manure	Fertilisers	Pesticides	Labour	Total	
	Kharif								
1									
2									
3									
4									
5									
6									
7									
	Rabi								
1									
2									
3									
4									
5									

Total

Estimated value of Produce after Irrigation

S.No.	Crops	Area (ha)	Yield (Qtls./ha)	Rate Rs./Qtl.		Receipt (lac Rs.)		Total Value of Produce (lac Rs.)
				Levy	Market	Levy	Market	
	Kharif							
1								
2								
3								
4								
5								
6								
7								
	Rabi							
1								
2								
3								
4								
5								

Total

Internal Rate of return

Sl.No.	Year (at the end of)	Project Cost Incured during the year	CCA Developed		O&M Cost per ha	Total Cost (Col.3 + Col.6)	Benefit	Net Cash Flow (Col.8-Col.7)	Discount Factor		Net Present Benefit	
			%age	Area in ha					With A% rate	With B% rate	With A% rate	With B% rate
1	2	3	4	5	6	7	8	9	10	11	12	13
1	1											
2	2											
3	3											
4	4											
5	5											
6	6											
7	7											
8	8											
9	9											
10	10											

Upto 50 (For Medium Projecs)
Upto 100(For Major Projecs)

I.R.R = Discount rate(A) = (Total of Col.12) / (Arithmetic sum of Col.12 & Col13) X (Difference of rate of Col.11-Col.10)