EWC 461: River Engineering and Flood Management

3 Credit Hour

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Lecturer

Department of EWCE

Lecture-11

Flood Damage Assessment

Syllabus of Sec-A: 2.0 Credit

- Behavior of alluvial rivers
- River channel pattern and fluvial processes
- Aggradations and degradation
- Local scours
- River training and bank protection works
- Navigation and dredging of sediment movement in river channels
- Bed form and flow regimes
- Case studies

Syllabus of Sec-B: 1.0 Credit

- Flood and its causes
- Flood process in urban and urban area
- Flood management measures: structural and non-structural measures such as dams, reservoirs
- Diversion channels and floodways
- Improvement of channel capacity by dredging
- Land management, Flood proofing, Flood zoning, Flood hazard mapping
- Flood forecasting and warning, Flood damage assessment

Course Outcome (CO)

CO1	Be able to explain the relationships of river planforms with the river Morphological parameters
CO2	Be proficient in calculating and estimating sediment distribution and sediment load of a river
CO3	Be able to apply different engineering perceptions to estimating the scour depth.
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes
CO5	Apply knowledge of flood processes and management strategies to analyze and assess flood risk.

Reference Books

- Any book on Flood Management and Mitigation
- **Water Resources Engineering by R. K. Linsley, J. B. Franzini, D. L. Freyberg and G. Techobanojlous**
- Fluvial Processes in River Engineering (1992) by H. H. Chang
- **Flood Control and Drainage Engineering, Fourth Edition, S.N. Ghosh**
- Urban Flood Management; by Chris Zevenbergen (Author), Adrian Cashman (Author), Niki Evelpidou (Author), Erik Pasche (Author), Stephen Garvin (Author), Richard Ashley (Author)
- Flood Risk: Planning, Design and Management of Flood Defence Infrastructure, By: Paul Sayers
- Vulnerability and Adaptation to Climate Change in Bangladesh: Processes, Assessment and Effects by MD Aboul Fazal Younus
- **Flood Action Plan**

Types of Damage

Types of Damage:

- Tangible Damage
  - Direct Damage
  - Indirect Damage
- Intangible Damage

Types of Damage

Direct Damages:

- All damages which results form physical contact to goods, property and/or structures with flood water, including damages from sediment, debris and other floating objects
- Direct urban damages are those occurring to structures, contents and other appurtenances of buildings (residences, commercial and industrial enterprises having plants, equipment etc.)

Types of Damage

Direct Damages:

- Direct rural damages includes:
  - losses of agricultural production
  - losses of livestock
  - losses of lives
  - losses of capital equipment like fences, plant, equipment, levees, roads, and buildings

Types of Damage

Indirect Damages:

- This covers all damages which result indirectly from the flood and may occur either during the flood or in the weeks or months following.
- indirect damages include loss of sales and production for flood affected commercial and industrial enterprises, lost wages, disrupted transport and communication systems, the cost of removing goods and services etc.

Types of Damage

Indirect Damages:

- Expenses for cleaning up, constructing or establishing temporary facilities, or erecting temporary levees etc.
- Indirect rural damages include the cost of disrupted transport, moving plant, equipment and stock to a higher ground.

Types of Damage

Intangible Damages:

- Intangible damages cover those which might be classes more as social than economical and which can be evaluated in financial terms only with some difficulty.
- Includes disruption to personal activities
- loss of health both physical and psychological
- Risk to life
- Inconvenience

Damage Assessment

Economical evaluation of flood mitigation projects:

Two major question to be in mind

What level of protection is appropriate and
what is the optimal combination of measures

1. Cost/Benefit Approach
2. Fixed Cost Approach
3. Multi objective Approach
4. Cost Effective Approach
5. Non economic Approach

Damage Assessment

Level of Protection:

- It is not feasible to prohibit development from all land liable to flooding
- it is not possible to protect individuals and communities against the most extreme flood events
- Therefore, the choice of a specific level of acceptable risk should reflect the interest and values of the total community.
- These aspects would include desirable standards of health, safety and convenience as well as attitude to the use of land resources and economic issues.

Damage Assessment

Cost Benefit Approach:

- In this approach the level of protection for each project would be determined by a cost/benefit appraisal.
- This approach does give the ultimate choice of measures, but provides a ranking of different measures.

Damage Assessment

Fixed Cost Approach:

- In this approach, the maximum amount of capital is specified.
- Level of protection is determined from the budget.
- Not the best approach, but sometimes is needed.
- Not very useful when multipurpose project is applied.

Damage Assessment

Cost Effective Approach:

- In this approach, a goal or level of protection is specified.
- Then the budget is determined from by studying all combinations of measures to achieve the goal.
- Useful for multipurpose projects.

Damage Assessment

Multi-objective Approach:

- In this approach, multiple level of objectives are specified.
- Sometimes, only economic considerations do not justify a project. In that case, social and environmental benefits play a significant roll.
- May combine with other projects, i.e., navigation, fisheries, irrigation etc.

Damage Assessment

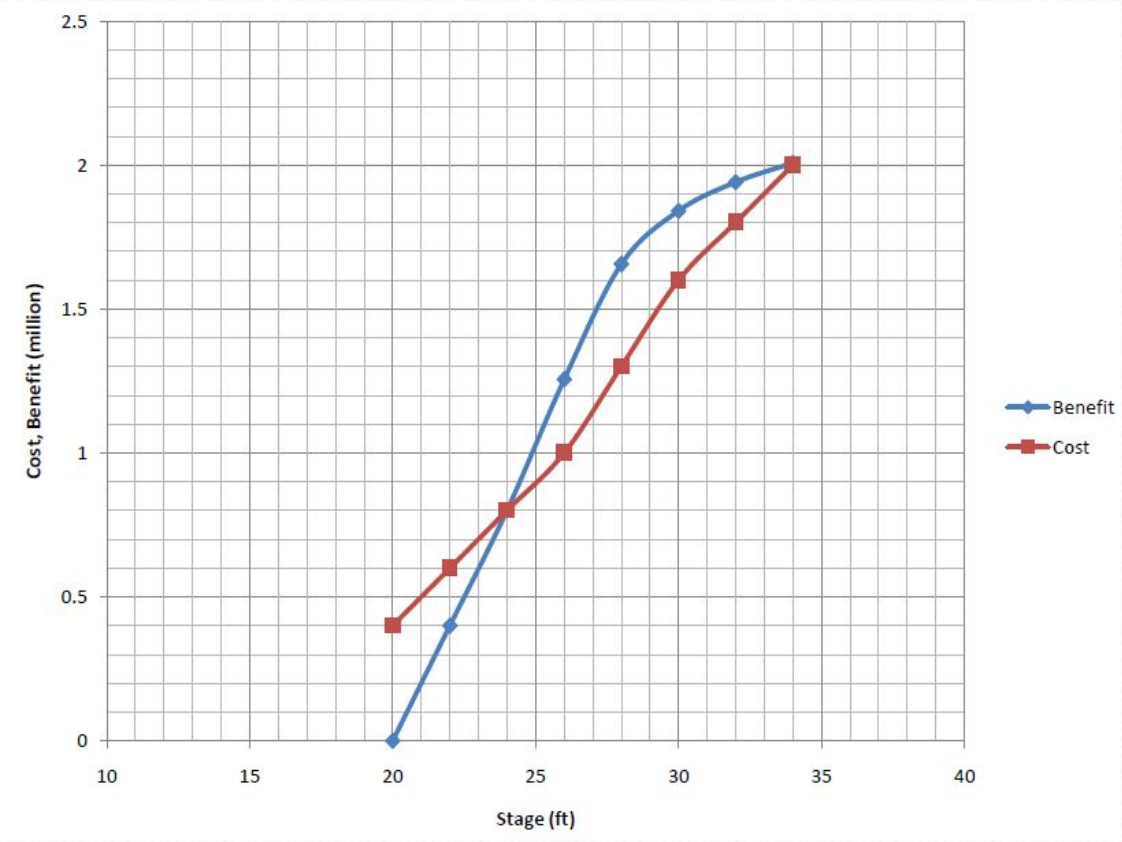
Non economic Approach:

- In this approach restrictions comes from technical considerations, political considerations, social considerations, and environmental considerations.
- For example, protecting a city, areas, bridges, roads etc.

Damage Assessment

Peak stage (ft)	Total damage below indicated stage	Increment of loss	Return Period	Annual benefit for protection increment	Total benefits	Project cost	Ratio benefit to cost
20	0	0			0	0.4	0.00
22	4	4	10	0.40	0.4	0.6	0.67
24	10	6	15	0.40	0.8	0.8	1.00
26	20	10	22	0.45	1.25	1	1.25
28	32	12	30	0.40	1.65	1.3	1.27
30	45	13	70	0.19	1.84	1.6	1.15
32	60	15	150	0.10	1.94	1.8	1.08
34	80	20	300	0.07	2.01	2	1.00

Damage Assessment



Damage Assessment

Disaster Relief:

Emergency assistance embraces two functions:

1. Planning and developing the system for the emergency
2. putting the plans into action when the flood comes

- it includes grants to develop: flood warning systems, evacuation plans and training programs for emergency services
- It also includes assistance for recovery program. Recovery falls into two categories:
  - i. short term recovery and
  - ii. long term recovery.

Damage Assessment

Disaster Relief:

- Short term recovery program includes:

Emergency shelter, food medical services, unemployment benefits, restoration of essential services such as communications, hospitals, water supply, electricity and transportations.

- Long-term recovery consists:

assistance in the form of low interest loans to business and individuals, assistance for the reconstruction and rehabilitation of public facilities, relocation of flood victims and some form of tax relief.