USACE NATIONAL NONSTUCTURAL COMMITTEE
BEST PRACTICE GUIDE 2020-01_Rev2

Calculating Interest During Construction for Nonstructural Alternatives

1. Purpose. This Guide establishes a best practice method for calculating interest during construction (IDC) expenditures for proposed nonstructural alternatives. Unlike the construction period used to calculate the IDC for structural alternatives, the construction period for nonstructural alternatives can be based on the time to construct one increment of the alternative.

2. Applicability. This Guide applies to the planning process for all USACE flood risk management (FRM) and coastal storm risk management (CSRM) nonstructural studies.

3. References

a. USACE, 2019. ER 1105-2-100, Planning Guidance Notebook, Appendix D – Economic, Social and Regional Considerations.

b. USACE, 2019. Planning Bulletin 2019-03, U.S. Army Corps of Engineers, Washington, D.C. Subject: Further Clarification of Existing Policy for USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Damage Reduction Measures.

4. Background

a. Interest During Construction Defined. Reference 3.a. defines interest during construction as "…the opportunity cost of capital incurred during the construction period. These are not considered financial costs, but are NED costs. The cost of a project to be amortized is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of the construction and other initial cost plus interest during construction. Cost incurred during the construction period should be increased by adding compound interest at the applicable project discount rate from the date the expenditures are incurred to the beginning of the period of analysis."

b. Duration of Construction of Nonstructural Alternatives. Reference 3.b. identifies the duration of construction for nonstructural alternatives as "…the length of time funds are committed to an individual structure. This concept is straight forward when looking at a levee, for example. The time from start (no levee) to finish (finished feature) is identified and IDC calculated accordingly. The timing for nonstructural project implementation is less defined. For example, 100 structures may be elevated over the course of a year, but the time to implement a nonstructural measure at a single structure is only 3 months. Thus, the IDC should only be calculated for 3 months. Therefore, when calculating IDC for nonstructural measures or plans, the length of time will be based on construction duration for a specific measure and/or structure, and not the overall duration of construction for the entire project."

5. Best Practices

a. For the purposes of calculating IDC, nonstructural measures fall into two categories: acquisition/relocation and structural improvements. The duration assumption used to calculate interest during construction differs between these two categories, as follows.

i. Duration for Acquisition and Relocation of Properties in the Floodplain. Acquisition and relocation includes both administrative activities (title searches, property assessments and other legal requirements) and physical activities (demolition of the property, debris removal and the relocation of structures from one geographic location to another location). While administrative activities could take over a year to complete, physical activities could be completed in a much shorter time frame. Since the physical activities directly reduce flood risk, only the time duration associated with these activities is used in the calculation of IDC. According to recent interviews with FEMA Hazard Mitigation personnel, the demolition of a residential structure and the associated debris removal takes approximately one month to complete, while the demolition and cleanup of a non-residential structure requires a longer time frame. The time required to relocate a structure from one geographic location to another varies based on the configuration of the structure and the distance that it is being moved. It is recommended that interviews be conducted with experts such as FEMA Hazard Mitigation personnel and other engineers to obtain more specific time estimates for each evaluation. It should be noted that the time duration is based on the acquisition and relocation of an individual structure rather than for all of the structures in the recommended plan.

ii. Duration for Elevation and Floodproofing of Properties in the Floodplain. Elevation and floodproofing measures include physical activities such as raising the first floor elevation of a structure to a target elevation and implementing/constructing impermeable barriers to provide resistance to flooding. The time duration for the implementation and completion of these measures for an individual increment of the nonstructural alternative is used in the calculation of IDC. Since this time frame could vary based on the location, size and configuration of the structure, it is recommended that interviews be conducted with experts in the fields of elevation and floodproofing. An example of the calculation of IDC for the elevation of structures is shown in the case study below.

b. Use Current Federal Interest. The current Federal interest rate is used with the construction period duration and mid-period compounding/discounting to calculate the IDC component of the project costs. The IDC is then added to the construction cost, or first cost, to derive the total NED cost for the nonstructural alternative.

6. Case Study

a. Example. The following steps can be used in the calculation of interest during construction cost for the elevation of 100 residential structures. This example is consistent with the discussion in Paragraph 5 of Reference 3.b.

b. Elevation Costs. The table below shows the cost per square foot for the elevation of four residential structure types based on the square footage of the structure and the number of feet the structure is to be elevated. The cost per square foot also includes supervision and administrative (S&A) activities and the costs of connecting utilities. This information was obtained from interviews with operators of three shoring companies located in the New Orleans Metropolitan area following Hurricane Katrina. Please note that costs vary considerably regionally, and these costs are only applicable to the New Orleans area. The square foot costs were indexed to current (FY 2019) price levels using the 2019 RS Means Catalog. Finally, a 35 percent contingency cost was added by Engineering Division to account for the uncertainty surrounding the costs of applying nonstructural measures to structures.

Structure Raising Cost Calculation				
Structure Elevation Cost Schedule Cost Per Square Foot (FY19 Price Level; dollars)				
Ft. Raised	1STY-SLAB	2STY-SLAB	1STY-PIER	2STY-PIER
1	88	97	78	86
2	88	97	78	86
3	90	99	81	89
4	93	106	81	89
5	93	106	81	89
6	95	107	83	91
7	95	107	83	91
8	98	111	85	93
9	98	111	85	93
10	98	111	85	93
11	98	111	85	93
12	98	111	85	93
13	101	117	86	95

c. Structure Records. The table below contains four residential structure records used for a structure elevation alternative. Each structure record has an identification number (1-4), a damage category (residential), an occupancy type (1 or 2 stories; slab or pier foundation), square footage (living area of the structures to be elevated), number of structures (each structure record represents 25 structures), and feet raised (number of feet to reach a target elevation).

Structure Records					
Structure ID	Damage Category	Occupation Type	Square Footage	# of Structures	Feet Raised
1	Residential	1sty-Slab	1500	25	4
2	Residential	2sty-Slab	1800	25	5
3	Residential	1sty-Pier	1350	25	6
4	Residential	2sty-Pier	2000	25	7
Note: Each structure requires three months to complete the elevation process.					

d. Calculation of Total Elevation Construction or First Costs. The following table shows the cost of elevating the 25 structures for each of the four structure records. The elevation costs are based on the type of residential structure (number of stories and foundation type), the size of the structure (square footage), and the number of feet the structure must be raised to reach a target elevation. A total elevation cost was calculated for each of the four structure records. The elevation costs for the four records were totaled to derive the total elevation construction or first cost ($15,570,083).

Elevation First Cost Calculation								
Structure ID	Damage Category	Occupation Type	Square Footage	Number of Structures	Feet Raised	Cost per Square Foot	Cost per Structure	Cost per Record (x25)
1	Residential	1sty-Slab	1500	25	4	$ 93	$ 139,277	$ 3,481,924
2	Residential	2sty-Slab	1800	25	5	$ 106	$ 190,027	$ 4,750,680
3	Residential	1sty-Pier	1350	25	6	$ 83	$ 111,612	$ 2,790,309
4	Residential	2sty-Pier	2000	25	7	$ 91	$ 181,887	$ 4,547,170
				Total Elevation First Cost (Cost per record sum)				$ 15,570,083

e. Calculation of Interest During Construction (IDC). A mid-period quarterly basis is used to calculate IDC because it is not known exactly when the work orders will be paid during the 3-month construction period. The current discount rate (2.875 percent) is used with the construction period on a mid-period quarterly basis (three months is one quarter of a year; the middle of the quarter is one eighth of a year or 0.125) to calculate the compounding factor of 1.003549. The compounding factor minus one is then multiplied by the elevation first cost to calculate the IDC. The formula for this calculation is shown below the table. The IDC calculations were performed using Excel spreadsheets for this Best Practice Guide, but the calculations can also be performed using the Certified IWR Planning Suite Model to be in full compliance with USACE model certification protocols.

Interest During Construction Calculation (Mid-Period Quarterly Basis)	
Discount Rate	0.02875
Construction Period (4th Quarter)	0.125
Compounding Factor	1.003549
Compounding Factor -1	0.00355
Elevation First Cost	$ 15,570,083
IDC	$ 55,264

$$IDC = \sum_m P_m * [(1+i)^n\text{-}1]$$

Where:

IDC: interest during construction

Pm: elevation first cost

i: discount rate

n: construction period