

CHAPTER 9 – RELOCATION

9.1 Introduction

Relocation involves lifting and placing a structure on a wheeled vehicle to transport it to the new site outside the SFHA (Figure 9-1). This method is one of the most effective mitigation measures. If space permits, it may be possible to move the structure to another location on the same piece of property.



Figure 9-1. Structure placed on a wheeled vehicle for relocation to a new site

Relocation is most appropriate in areas where the flood conditions are characterized by one or more of the following:

- Deep water
- Short warning time (flash flooding)
- High flow velocity
- Wave action
- Significant quantity of debris in floodwaters

Table 9-1 includes a summary of advantages and disadvantages for using relocation as a mitigation measure.

Table 9-1. Considerations for Using Relocation

Advantages	Disadvantages
<ul style="list-style-type: none"> ▪ Removes flood problem since the structure is relocated out of the floodprone area. ▪ Allows a substantially damaged or substantially improved structure to be brought into compliance with a community's floodplain management ordinance. ▪ May be fundable under FEMA mitigation grant programs. 	<ul style="list-style-type: none"> ▪ Cost may be prohibitive. ▪ Additional costs are likely if the structure must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.

For a detailed discussion of the relocation process, see FEMA 312, *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding*, Chapter 7 or FEMA 259, *Engineering Principles and Practices of Retrofitting Floodprone Residential Structures*, Chapter VI-R. Additional references are included in Section 9.5, Available Resources.

9.2 Technical Considerations

Technical considerations for a relocation project include structure type, condition, and size.

9.2.1 Structure Type

Structures that are easiest to elevate, such as a single-story wood-frame structure over a crawlspace or basement foundation with a simple rectangular shape, are also the easiest to relocate. Concrete, masonry, or brick faced structures require special attention to ensure that the structure is not damaged during the process. For a structure with wood-frame construction, with a brick veneer, the brick could be removed and then reapplied once the relocation process is complete.

9.2.2 Structure Condition

Structures best suited for relocation are those in good condition. All structural members and their connections must be able to withstand the stresses imposed when the structure is lifted and moved. A structure that is in poor condition, especially one that has been damaged by repeated or severe flooding, may need so much structural repair and bracing that relocation would not be practical.

Prior to beginning, a thorough analysis of both the existing site and structure and the new site must be made. The examination of the structure should be done by a licensed structural engineer, with particular attention given to the building's floor support system (i.e., joists, plates, and flooring) to ensure that it will remain intact. If these components are not in good structural condition, the structure may not be a good candidate for relocation.

9.2.3 Structure Size

Large rambling structures, buildings constructed of extremely heavy materials, and multi-story structures require special attention before they are relocated.

9.3 Relative Costs

The relative cost ranking is based on the combination of the estimated costs for the relocation project and a determination of cost-effectiveness.

9.3.1 Estimated Cost

Relocation is a relatively expensive mitigation measure. In order to determine the estimated cost of a relocation project, contact one or more house movers. Provide basic data on the structure, such as wall and foundation type and size, and information on the distance to the new site. The movers should be able to provide a general cost estimate.

Examples of cost estimating items that may need to be considered include the following:

- Analysis of existing site and structure
- Site selection and analysis and design of the new location (i.e., adequacy of the new location for the structure, utility connections, permits, etc.)
- Analysis and preparation of the moving route, including items such as the width of the road, obtaining approval and permits, and route preparation
- Preparation of the structure prior to the move, such as disconnecting utilities, preparing the structure for the lift, and separating the structure from its foundation
- Moving the structure to the new location
- Preparation of the new site
- Construction of the foundation at the new location
- Connection of the structure to the new foundation
- Restoration of the old site

To estimate the relative cost of a relocation project, examples of general cost estimates are included in FEMA 312, *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding* and FEMA 259, *Engineering Principles and Practices of Retrofitting Floodprone Residential Structures*.

Appendix C, Cost Estimating, provides guidance and references for conducting a more detailed cost estimate. Additional cost estimates can be obtained from R.S. Means' *Contractor's Pricing Guide*. A blank preliminary cost estimating worksheet (Worksheet D) is provided in Appendix B.

9.3.2 Determination of Cost-Effectiveness

A component of the relative cost scoring is to include a determination of cost-effectiveness. Table D-1 in Appendix D, Determining Cost-Effectiveness, provides a quick screening for the cost-effectiveness of a project. The attributes included in the table are frequency of flood, level of damage, project cost, project benefits, and criticality (impact or loss of function). For example, if the frequency is the 10-year flood, the project will have a very high likelihood of cost-effectiveness.

Based on the combination of the estimated cost of the project and the likelihood of cost-effectiveness, a relative cost ranking will be assigned on Worksheet B, Appropriate Mitigation Measures. If the likelihood of cost-effectiveness is low, the ranking of relative cost will be either moderate or high, based on the estimated cost of the project. However, if the estimated cost is low and the likelihood of cost-effectiveness is very high or high, the relative cost ranking will be low.

9.4 Additional Considerations

9.4.1 Annual Maintenance

The ownership of the original site may be transferred to the local community, which then has the maintenance and security responsibilities associated with the vacated site. If several relocation projects are undertaken within the same community, the result may create an undesirable patchwork of empty lots for the community to maintain.

9.4.2 Moving a Structure Between the Old and New Sites

Analysis and preparation of the moving route is accomplished by the contractor. Permits for a move and the new site will likely be required from the local government. If the move entails more than one community, a moving permit from each community will be required. On the day of the move, any obstructions need to be temporarily removed or positioned out of the way: power lines are either disconnected or simply lifted above the moving structure; fire hydrants close to the street may need to be disconnected and temporarily removed; and roads checked for possible obstructions to the passage of the structure. Narrow roads, restrictive load capacities on roads and bridges, and low clearances under bridges and power lines can make it necessary to find an alternative route. When no practical alternatives are available, the moving contractor may have to cut the structure into sections, move them separately, and reassemble the structure at the new site.

9.4.3 Access to Site

The Adequate Clearance box in the *Flood Risk and Mitigation Possibilities* tab in NT indicates whether there is sufficient clearance to permit equipment access to the site (Figure 9-2). The box should be checked if the structure is clear by approximately 20 feet on each side.

The screenshot shows the FEMA National Flood Mitigation Data Collection Tool interface. The title bar reads "FEMA NT Version 2.0 - [National Tool]". The main header displays the FEMA logo and the tool name. Below the header, the address "#7654321 - GRAY ROCK 456 GRE ROKC PL SANDPEAR, MD 40101" is shown, with "Prev Address" and "* Limited View *" buttons. The "Flood Risk and Mitigation Possibilities" tab is selected and circled in red. The interface is divided into several sections:

- Current FIRM Data:** Includes fields for FIRM Index Date, Flood Zone, Vertical Datum, Panel # and Date, and BFE/Depth, each with a "Notes" button.
- Mitigation Observations:** Contains radio buttons for "Possible mitigation measures observed" (selected) and "No possible mitigation measures observed", a "View" button, and a checked checkbox for "Adequate Clearance" (indicated by a red arrow). There is also an "Additional Notes" button.
- Potential Hydraulics Impacts:** A list box containing items like "Low Bridge", "Culvert(s)", "Storm Drainage System", "Planned Projects", "Pump Stations", "Dams", "Levees", "Run off from U/S dev.", "Retention Basins", and "Detention Basins". A note below the list says "(Use the Ctrl key to select all that apply)".

At the bottom, there are navigation buttons, "Limited View", "Search Criteria: All Records", and "Record 1 of 2".

Figure 9-2. Flood Risk and Mitigation Possibilities tab - Adequate Clearance

9.4.4 Housing of Occupants

Relocation is a disruptive mitigation method for the occupants of the structure. Before the structure can be lifted, all utility systems must be disconnected. The structure becomes uninhabitable at this point, and the property owner will not be able to move back in until the structure has been placed at the new site and all utility systems have been reconnected. Until then, the property owner will need to find temporary lodging and a place to store furniture and other belongings.

9.5 Available Resources

FEMA 85. *Manufactured Homes in Flood Hazard Areas: A Multi-Hazard Foundation and Installation Guide*. See Chapter 8, Methods for Mitigating Flood Hazards 8.3 Relocation.

FEMA 259. *Engineering Principles and Practices of Retrofitting Floodprone Residential Structures*. See Chapter VI-R, Relocation.

FEMA 312. *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding*. See Chapter 3, An Overview of the Retrofitting Methods and Chapter 7, Other Methods - Relocation.

FEMA 511. *Reducing Damage from Localized Flooding*. See Chapter 9, Redevelopment.

The Louisiana State University (LSU) Extension Center website (<http://www.louisianafloods.org>) lists many retrofitting publications, provides advice on floodproofing methods and flood insurance, and links to online shopping for retrofitting products and contractors.

R.S. Means' *Contractor's Pricing Guide*.