Facilities Reduction Program
Best Practices Toolbox

United Stated Army Corps of Engineers

Facility Reduction Program

Best Practices Toolbox

(Library Document)

Estimate Methodology

June 30, 2005

TABLE OF CONTENTS

1.0 INTRODUCTION TO TOOLBOX ESTIMATING 3

2.0 BASIC PRINCIPLES OF TOOLBOX ESTIMATING 4

3.0 TOOLBOX ESTIMATING TOOLS 5

3.1 Quick Estimate Overview 5

3.2 Advanced Estimate Overview 5

3.2.1 Facility Location 6
3.2.2 Facility Use 6
3.2.3 Construction 6
3.2.4 Local Disposal Costs 7
3.2.5 Environmental Issues 7

4.0 Toolbox Estimating Categories 8

4.1 Facility Use 8

4.2 Construction Type 8

1.0 INTRODUCTION TO TOOLBOX ESTIMATING

A primary goal of the United States Army Corps of Engineers (USACE) Facility Reduction Program (FRP) Best Practices Toolbox (Toolbox) is to provide installations with a method to obtain budgetary estimate values for use in funding requests for facility removal efforts. In most instances, the Toolbox is not intended to provide an exact value and should not be used in place of an independent government estimate (IGE). A basic premise of Toolbox estimating is to provide a procedure that is relatively simple and requires a minimal amount of user input. Toolbox estimate values are based on an algorithm driven by historical data that has been normalized to account for project variances. The estimate algorithm must make assumptions to specify what items have been included in the estimate (i.e. disconnect and cap utilities). Assumptions used by the Toolbox are provided to the user during the estimate process and the user has the ability to adjust or “override” a given value if project variances from the Toolbox scenario are anticipated. Also, the user has the ability to include additional funding items that may be allowed as part of the facility removal process. Common environmental/HAZMAT related issues that are commonly addressed during the facility removal process (i.e. Abestos Containing Material (ACM)) are also captured as part of the estimating process.

2.0 BASIC PRINCIPLES OF TOOLBOX ESTIMATING

The estimating methodology of the Best Practices Toolbox relies on a few simple principles:

- The Real Property Inventory of the U.S. Army is comprised of many buildings with similar physical characteristics when considering Facility Removal Program (FRP) candidates;
- With the exception of “exotic” environmental contamination, environmental issues surrounding FRP projects are often similar in nature including methodology and costs when developing budgetary estimates;
- Factors resulting in the greatest variance of costs for a similar project in different regions includes labor and disposal;
- A Quick Estimate tool can provide a cost range ($ per square foot) that should be expected based on regional labor and disposal cost variances; and
- An Advanced Estimate tool can provide a total cost estimate based on user input of project size and adjust the estimate based on labor costs (related to location), disposal costs (user input), and environmental issues (user input).

3.0 TOOLBOX ESTIMATING TOOLS

The Toolbox provides the user with two general options to obtain budgetary estimate data: 1) Quick Estimate and 2) Advanced Estimate.

1. *Quick Estimate*. The quick estimate provides the user with a RANGE of anticipated costs associated with removal of an indicated facility. The quick estimate requires minimal user input and knowledge, but provides only a range of values per square foot that the user should expect for removing a similar facility.

2. *Advanced Estimate*. The advanced estimate provides a refined facility removal cost. The advanced estimate requires additional user input than the quick estimate, but provides a specific budgetary value for normal cost of facility removal. The advanced estimate provides the user with the ability to add multiple facilities to build a complete facility removal project.

3.1 Quick Estimate Overview

The Quick Estimate is a three (3) step process:

1. User selection of facility “use”
2. User selection of facility “construction-type”
3. Output summary

The quick estimate relies on basic unit costs derived for each category of facilities/structures within the Toolbox. Since the quick estimate does not require input regarding size of each facility, the output value is provided in unit costs (i.e. dollar per square foot ($/SF)). In addition to providing an estimate for unit costs required to remove an indicated facility/structure, the Quick Estimate will also provide the user with anticipated quantities of materials that should be considered as part of overall waste stream diversion goals. Diversion quantities will also be provided on a per unit basis in the Quick Estimate output summary.

3.2 Advanced Estimate Overview

The Toolbox "Advanced Estimate" tool has identified the following key factors to encompass a significant variance in facility removal efforts/costs:

- Facility Location (i.e. Ft. Carson, Ft. Gordon, etc.)
- Facility Use (i.e. Barracks, Warehouse, etc.)
- Construction (i.e. Wood, concrete, steel, etc.)
- Local Disposal Costs (i.e. Landfill tipping fees)
- Environmental Issues (i.e. Asbestos, lead, mercury, etc.)

Each of the variables and their effect on the outcome of the budgetary estimate are discussed below.

3.2.1 Facility Location

The location of a facility is used to adjust the estimate for labor variance. Approximately 30-40% of the total weighted costs associated with facility removal typically involve labor. Labor costs have currently been derived for 91 locations. The labor costs are based on U.S. Department of Labor data and comply with Davis Bacon Act (DBA) wage rate determinations. The wage rates were compiled and assigned a relative coefficient. The current labor coefficients have been estimated to range from 0.35 to 1.72 (Includes OCONUS for Puerto Rico). This equates to almost 500% variance in labor rates, which can result in significant variances in project costs. For example, a typical $100,000 project could vary by almost $50,000 when the labor coefficients are applied at a rate of 35% of the total project weight (assuming all other variables are equal). However, all other variables are typically not equal. For example, increased labor typically correlates to increased disposal fees in high-density population areas. Therefore, based on average estimates, the location of facility can be expected to vary overall project cost by an estimated 30-40% when all other factors are equal.

3.2.2 Facility Use

The Toolbox inquires about the original intended use of the facility in order to draw upon common statistics identified throughout the Army inventory. These groupings (i.e. barracks, warehouse, etc.) are used to apply commonly observed construction techniques for estimating purposes and to associate known recommended best practices. Otherwise, the "use" category has no direct effect on the estimating formula.

3.2.3 Construction

The Toolbox estimating process requires the user to select the building description that best describes the STRUCTURAL components of the removal target. In general, variances in veneers, wallboards, and other “cosmetic” items do not have a significant effect on the overall removal cost. The structural components have the greatest impact on removal procedures and waste stream quantities. Additionally, structural components generally comprise the bulk of construction materials that are amenable to cost-effective salvage, recycle, or other diversion. The most common diversion candidates include structural steel components and concrete that may be diverted for reduced disposal fees at recycling centers. Due to the potential for waste diversion, tipping fees can sometimes be reduced by percentages that exceed 70%. This number can vary significantly as would be most predominately noted between removing a steel building versus a wood building.

3.2.4 Local Disposal Costs

For a typical project with non-environmental removal issues, landfill "tipping fees" typically represent the most significant portion of the disposal cost. It is not uncommon for disposal costs to vary by more than 500% based on location. With a fixed disposal cost and varying construction-types, variances ranging from 2-34% of total project costs are not uncommon.

3.2.5 Environmental Issues

Environmental issues perhaps introduce the single greatest variable with potential to affect the overall project cost. Therefore, the Toolbox inquires about known environmental issues and assigns cost estimates based on a universal rate. The most common environmental issues typically encountered are included in the Toolbox. Exotic contamination could cause a project to exceed anticipated estimates by orders of magnitude due to special considerations. However, contamination to such extents is considered rare. For this reason, the Toolbox has included a feature that allows "override" of an estimate value to include adjusted costs associated with demolition, environmental, or other considerations. When a user has elected to modify a Toolbox estimate, a space for "explanation" is provided and the final report includes both the original and overridden value along with the explanation provided by the installation.

4.0 TOOLBOX ESTIMATING CATEGORIES

The Best Practices Toolbox estimating tools focus on “traditional” building construction methods, but also include a select number of “special” structures such as telephone poles, pilings, railroad tracks, and other structures commonly associated with facility removal projects. All Toolbox categories are based on buildings/structures anticipated to be prevalent at a wide range of installation locations. Identification of a removal candidate generally involves identification of the common use group and the corresponding identifying construction characteristics of the building/structure.

4.1 Facility Use

Facilities and Structures have been classified into general groups based on the original use of the facility unless extensive remodeling has occurred. The general concept behind using the original use is that for a given set of structural components, facilities of different use types would require different cost components for removal and disposal. For example, consider a similarly constructed barracks and warehouse where both have wood frame construction on a concrete slab floor. It is generally anticipated that the barracks will have more internal wall partitions and Construction & Demolition (C&D) debris than a warehouse if all other structural components were similar. The current categories are:

- ⊕ Barracks
- ⊕ Warehouses
- ⊕ Shop Buildings
- ⊕ Administrative Facilities
- ⊕ Medical Facilities
- ⊕ Sheds/Garages
- ⊕ Family Housing
- ⊕ Small Buildings
- ⊕ Special Structures

4.2 Primary Construction Elements

Identification of a facility within a given use category is based upon major construction elements of the building/structure. For various reasons, the construction type has considerable impact on costs and procedures associated with its removal and disposal. Depending on the construction type, volume and weight of materials can vary considerably as well as labor and machinery required for completing the removal process.

For ease of use, the Toolbox considers only the four main structural elements of a traditional building:

- Foundation
- Floor
- Walls
- Roof

Each structural element has multiple variables, as described below:

4.2.1 Foundation

- **CMU/Concrete** – CMU/Concrete foundations generally consist of steel reinforced concrete footings and Concrete Masonry Unit (CMU) stem walls or piers that support the structure. The CMU walls may or may not be filled with concrete. Commonly, a CMU/Concrete foundation may support a wood frame floor with a crawl space of up to approximately 3 feet. Cost for removal/backfill can increase significantly as the depth of the crawl space increases and in some buildings, considerations for a basement are required.

- **Concrete** – For purposes of Toolbox estimating, concrete foundations generally include steel reinforced concrete footings that often support concrete slab floors. Depending on the size and layout of the building, the concrete foundation may by bordered by a small CMU stem wall (1-2 courses) or by a solid poured wall. Also, a facility/structure may have internal footings to support load bearing points that are central to the external walls. It is common that gravel or other engineered fill material may be encountered as part of the footings/foundation stem walls, especially under a concrete slab floor.

- **Pilings** – The Traditional Building categories of the Toolbox currently include wood pilings due to a few encounters noted in the Army inventory. Wood pilings are generally considered to be inert (due to age) when creosote is present. This does not preclude the need for proper verification and handling and is noted here so that cost adjustments can be made as required. It is generally considered that it will be appropriate to break the pilings at a depth of 4 feet below the surface for removal and other considerations may require a cost adjustment.

Walls

- **Wood frame** – Unit costs to remove wood frame walls generally include up to 2x6 dimension lumber with studs 16 inches on-center (OC). Tipping fees may be slightly reduced for 2x4 dimension lumber and when 24 inch OC spacing is used. The overall cost for removal is generally not affected

significantly when wall coverings and veneers vary with tipping fees being the most affected cost component.

- **CMU/Brick** – CMU/Brick walls are typically built with stacked CMU that is commonly reinforced with steel reinforcement bar (rebar) and filled with concrete. Externally, the CMU may be painted or covered with a brick veneer. Internally, the wall may be painted or may be covered with wall coverings such as gypsum board that is attached to furring strips attached to the CMU wall. The CMU and brick used in construction can be recycled into concrete aggregate during demolition, resulting in a higher diversion rate for the project. This construction element generally has a higher cost associated with it than CMU/Concrete walls due to the Brick veneer.

- **Steel Frame/Metal** – This category includes steel members that are used to form the structural wall components . Generally, the outside of a steel frame wall is covered with corrugated sheet metal, however sometimes light wood framing and external lap siding can be present. Internally, the wall can sometimes be covered by gypsum or other wall board, much like a wood frame wall. In other cases, such as a warehouse, internal steel members are exposed with no wall covering.

- **CMU/Concrete** – This category typically includes walls constructed from stacked CMU or poured concrete. The CMU may be filled with steel and concrete. The walls may or may not include internal/external coverings or veneers.

Floor

- **Wood Frame** – In smaller structures, generally small dimension lumber is used for the flooring. The flooring is built on a crawl space, which is generally 3-feet high.

- **Concrete Slab** – One of the most common methods of flooring is a concrete slab. A slab is a section of concrete that is poured to a certain thickness, generally 4 inches thick.

- **Timber/Wood** - Larger wood frame structures commonly use larger dimension lumber (timbers) for the floor supports. These materials are often recyclable and can lead to a higher diversion rate for the project.

- **Earth** – Dirt floors are common in some sheds/garages. Typically these structures have some type of concrete foundation to support the walls, however the floor consists of only Earthen material.

Roof

- **Wood frame** – Wood material used to construct a roof varies depending on the size of the structure. In smaller structures, generally smaller dimension wood is used. Whereas in large roof truss systems, larger dimension timber and wood is used. Sometimes the large dimension timber and wood is composed of smaller wood materials bolted together. Roofing is typically composed of asphalt shingles or other common types of roofing materials.

- **Steel Frame/Metal** – Steel frame roofs are common in larger facilities with long span truss systems. The exterior sheathing of a steel frame roof is generally corrugated sheet metal

- **Concrete** – Concrete roofs are created using poured concrete. During construction, steel reinforcement such as rebar is inserted in the concrete for stability.

Each facility use type may have multiple construction types. For example, a Barracks building may be built on one Installation using mainly concrete for the four structural elements; however on another Installation the same Barracks may be built using wood only.

In order to maintain simplicity for Toolbox users, the Toolbox currently includes 33 typical examples of construction types for the nine facility use categories. You can find out detailed information about each construction type by viewing the Toolbox Library Construction Type document. This document can be downloaded from the Toolbox library, under the FRP/Toolbox section, or you may click directly on the link below.

https://eko.usace.army.mil/frptoolbox/library/docs/47.pdf