MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

a. Installation Static Factor #9 – Officer Basic Allowance for Housing (BAH)

b. Installation Static Factor #10 – Enlisted BAH

2. DESCRIPTION: BAH at the installation for an O-3 with dependents and BAH at the installation for E-5 with dependents.

3. CERTIFIED VALUE: See each attached table with BAH rates for each Military Housing Area (MHA). The MHA is the defined housing area surrounding an installation or activity.

4. DATA SOURCE: Per Diem, Travel, and Transportation Allowance Committee Web page.

a. DATE LAST UPDATED: 4 January 2004

b. DATE OF NEXT UPDATE: January 2005

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Installation Static Factor #11 – Locality Pay Rate

2. DESCRIPTION: The percent increase in the GS schedule pay at specific localities to compensate for high cost of living expenses.

3. CERTIFIED VALUE: See each attached table from the Office of Personnel Management (OPM) home page.

4. DATA SOURCE: OPM 2004 Locality-Based Comparability Payments.

a. DATE LAST UPDATED: January 2004

b. DATE OF NEXT UPDATE: January 2005

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Installation Static Factor #12 – Area Cost Factor (ACF)

2. DESCRIPTION: The published ACF for construction, facility rehabilitation, and facility sustainment costs at an installation. The ACF accounts for local factors including labor, material, and climate.

3. CERTIFIED VALUE: See each attached table from the DoD Facilities Pricing Guide (FPG).

4. DATA SOURCE: DoD FPG, Table B.

a. DATE LAST UPDATED: March 2003

b. DATE OF NEXT UPDATE: March 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Installation Static Factor #13 – Installation Per Diem Rate

2. DESCRIPTION: The per diem rate at the base in dollars per person per day. If seasonal rates apply use the higher value.

3. CERTIFIED VALUE: See each attached table from the Joint Federal Travel Regulation (JFTR).

4. DATA SOURCE: JFTR, Appendix D.

a. DATE LAST UPDATED: 17 October 2003

b. DATE OF NEXT UPDATE: October 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
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ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

   a. Standard Factor #6 – Average Unemployment Cost

   b. Standard Factor #7 – Unemployment Duration

2. DESCRIPTION:

   a. Average Unemployment Cost is the average weekly benefit amount in dollars per week

   b. Unemployment Duration is the average number of weeks a worker is drawing unemployment benefits.

3. CERTIFIED VALUE:

   a. Average Unemployment Cost – 261.40 $/week

   b. Unemployment Duration – 16.31 weeks

4. DATA SOURCE: Department of Labor Unemployment Insurance Homepage.

   a. DATE LAST UPDATED: 30 November 2003

   b. DATE OF NEXT UPDATE: February 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

David A Smith

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

   a. Standard Factor #15 – Home Sale Reimbursement Rate

   b. Standard Factor #16 – Maximum Home Sale Reimbursement

   c. Standard Factor #17 – Home Purchase Reimbursement Rate

   d. Standard Factor #18 – Maximum Home Purchase Reimbursement

   e. Standard Factor #43 – Maximum Civilian Household Goods

   f. Standard Factor #47 – POV Reimbursement

   g. Standard Factor #50 – Miscellaneous

2. DESCRIPTION:

   a. The average percent of the median home price that civilians will receive as a reimbursement for selling a home.

   b. The maximum reimbursement to civilians for home sales.

   c. The average percent of the median home price that civilians will receive for purchasing a home.

   d. The maximum reimbursement to civilians for purchasing a home.

   e. The maximum amount of household goods a civilian may claim for a permanent change of station move.

   f. The rate for using a privately owned vehicle (POV) for official travel (e.g. PCS move).

   g. Moving cost per direct employee, not covered by other moving costs.

3. CERTIFIED VALUE:

   a. Home Sale Reimbursement Rate – 10%

   b. Maximum Home Sale Reimbursement - $50000

c. Home Purchase Reimbursement Rate – 5%

d. Maximum Home Purchase Reimbursement - $25000

e. Maximum Civilian Household Goods – 18,000 lbs.

f. POV Reimbursement – 0.20 $/mile

g. Miscellaneous - $1000

4. DATA SOURCE: The Joint Travel Regulations, Volume 2

a. DATE LAST UPDATED: 1 December 2003

b. DATE OF NEXT UPDATE: December 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Standard Factor #19 – Home Ownership Rate

2. DESCRIPTION: The average percent of military personnel and government civilian employees who own their homes.

3. CERTIFIED VALUE: Home Ownership Rate – 68.4%

4. DATA SOURCE: Census Bureau Reports on Residential Vacancies and Homeownership

a. DATE LAST UPDATED: 28 October 2003

b. DATE OF NEXT UPDATE: October 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

   a. Standard Factor #27 – Mothball Cost (closing)

   b. Standard Factor #28 – Mothball Cost (deact/realgn)

2. DESCRIPTION:

   a. The average cost to mothball a facility that is designated to be turned over to a reuse authority.

   b. The average cost to mothball a facility in preparation for future use.

3. CERTIFIED VALUE:

   a. Mothball Cost (closing) – 0.17 $/sq. ft.

   b. Mothball Cost (deact/realgn) – 0.43 $/sq. ft.

4. DATA SOURCE: Construction Engineer Research Lab (CERL) report dated 1994 (attached).

   a. DATE LAST UPDATED: N/A

   b. DATE OF NEXT UPDATE: N/A

5. METHODOLOGY: See attached report.

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

David A. Smith

DAVID A. SMITH
MAJ, AR
ORSA Analyst

SUBJECT: Derivation of Building Mothball Factor

PURPOSE: To provide a multiplier/cost factor for COBRA to estimate a macro-level approximation of facility mothball casts.

DISCUSSION:

1. A literature search for the costs of mothballing excess buildings produced analyses conducted by The United States Army Construction Research Laboratories (USACERL) in connection with the 1995 Base Realignment and Closure (BRAC 95) actions during the 1995-1996 timeframe. Two USACERL reports specifically addressed the mothballing of facilities:

   a. Technical Review of the Economic Development Conveyance Application for Sacramento Army Depot Activity by the City of Sacramento, CA Vol. 1 Executive Summary, Special Report TA-95/01/ADA 299550, February 1995

   b. Facility Layaway Economic Analysis, Technical Report 96/81, August 1996

No more recent information was found.

2. The two USACERL reports provided exactly the type of costing information and data needed for COBRA. The reports addressed buildings being mothballed on a military installation either for disposal or future re-use. Two cost elements were addressed. The first cost element covered the layaway cost for the building. This covered the costs of utilities shutdown, climate control (depending on whether the building was to be demolished or reused0, sealing, and securing the building. The second cost element covered the maintenance and repair cost of the building until its eventual demolition or re-use. Only the layaway costs were required for COBRA as the maintenance and repair costs for shutdown buildings are covered in another COBRA cost element.

3. Layaway costs were determined for ten different types of buildings for three different layaway levels: eventual disposal, reactivate in less than a year, and reactivate in more than a year. Within each level a low and a high cost were determined. The low option covered the absolute minimum actions and/or material necessary while the high option included additional actions and/or materials that would be desirable. Figure 1. shows all of the possible options.

4. Joint Process Action Team (JPAT) discussion resulted in the decision to include two mothball costs in COBRA; one for buildings being disposed, and one for buildings being reactivated. The low value of the average cost per square foot for disposals ($0.17) was selected for those buildings to be disposed. The high value of the average cost per square foot for buildings to be reactivated in more than a year ($0.43) was selected for buildings to be re-used.

		LAYAWAY COSTS PER SQUARE FOOT				
	Layaway Level One		Layaway Level Two		Layaway Level Three	
	(Reactivate < 1 year)		(Reactivate > 1 year)		(Eventual Disposal)	
Building type	Low	High	Low	High	Low	High
Training	$0.01	$0.01	$0.01	$0.02	$0.01	$0.02
Maintenance/Production	$0.05	$0.09	$0.12	$0.21	$0.08	$0.16
RDTE	$0.03	$0.05	$0.07	$0.11	$0.05	$0.09
Storage	$0.01	$0.01	$0.01	$0.02	$0.01	$0.02
Hospital and Medical	$0.40	$0.79	$1.04	$1.81	$0.71	$1.43
Administration	$0.05	$0.10	$0.13	$0.23	$0.09	$0.18
UEPH	$0.20	$0.39	$0.51	$0.90	$0.35	$0.70
Community	$0.03	$0.05	$0.07	$0.11	$0.05	$0.09
Family Housing	$0.20	$0.39	$0.51	$0.90	$0.35	$0.70
Other	$0.01	$0.01	$0.01	$0.02	$0.01	$0.02
AVG COSTS PER SF	$0.09	$0.19	$0.25	$0.43	$0.17	$0.34

Figure 1. Layaway Costs per Square Foot (of building size)

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Standard Factor #29 – Net Present Value (NPV) Discount Rate

2. DESCRIPTION: The discount rate to be used for the NPV and Return On Investment (ROI) calculations.

3. CERTIFIED VALUE: NPV Discount Rate – 3.15%

4. DATA SOURCE: Office of Manpower and Budget (OMB) Circular A-94, Appendix C

a. DATE LAST UPDATED: February 2004

b. DATE OF NEXT UPDATE: February 2005

5. METHODOLOGY: Appendix C only lists a 10-year rate and a 30-year rate. OMB guidance states that analyses of programs with terms different from those presented above may use a linear interpolation. Therefore, to determine the 20-year discount rate, find the average of the10-year real discount rate and the 30-year real discount rate.

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS: Standard Factor #30 – Site Preparation Cost

2. DESCRIPTION: The cost per square foot of construction to prepare a site for new building construction. Value is for an average, unimproved site with no demolition required.

3. CERTIFIED VALUE: 0.71 $/sq. ft.

4. DATA SOURCE: R&K Engineering Report, dated 3 November 2003 (attached).

   a. DATE LAST UPDATED: N/A

   b. DATE OF NEXT UPDATE: N/A

5. METHODOLOGY: See attached report.

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

SUBJECT: Derivation of Site Preparation Multiplier

PURPOSE: To provide a multiplier/cost factor for use with COBRA initiated stationing drills to predict a macro-level approximation of site preparation costs.

DISCUSSION:

1. The Department of Defense defines Site Preparation as:

> "the clearing and grubbing, demolition, and layout of a construction site. This includes the removal of surface vegetation and debris (clearing), such as the cutting down of trees and brush and the removal of subsurface vegetation (grubbing), such as the digging out of roots and stumps."[1]

This definition is consistent with commercial construction definitions and specifications up to a point, in that most commercial definitions also include provisions for the supporting utilities and other facilities, and generally treat "clearing and grubbing", "demolition" and "layout of a construction site" as just three of many sub-tasks to Site Preparation.

The DoD treats supporting utilities and other associated facilities as necessary work, that is captured by different and unique category codes separate from the primary facility. They are generally referred to under the heading of supporting facilities. The assumption of this effort is that the COBRA model will be costing facilities along established Facility Analysis Category (FAC) groupings, and not on an integrated project basis.

It should also be noted that there are numerous variables (water level, core drillings, soil analysis, etc.) that would affect the site preparation costs for a specific individual project. For purposes of this proposed methodology, an average (i.e. medium density, no water) site is considered. Seismic considerations are accounted for in the TriService Area cost factor and thus would not impact the site preparation calculation. Likewise, environmental remediation is outside what DoD considers applicable costs and is not considered in either the case of a demolition or a "green grass" project. Nor is the ultimate use of the site a consideration, i.e. are we building a low-tech warehouse or a high-tech lab. The removal of a 12-inch diameter tree would cost the same in either case.

2. The definition above indicates that two possible scenarios are possible. The first is a site that had not previously been utilized as a facility location. This "green grass" location would require the tasks of clearing and grubbing and layout. The second scenario is where there is currently a facility in place and demolition and layout would be applicable. This is an important distinction as cost may differ significantly. In fact, "one of the most expensive parts of clearing and grubbing is the disposal of tree stumps."[2]

3. <u>Existing Facility Replacement:</u>
A demolition cost factor has been developed for use with the USMC Commanding Officer's Readiness Reporting System (CORRS) and the Navy's Installation Readiness Reporting System (IRRS). The cost factor was derived from data published by the Air Force Civil Engineer Support Agency (AFCESA), and in FY 2003 dollars equals $11.07/SF of building to be demolished. If the scenarios envisioned by COBRA are to footprint all proposed construction, then the recommendation would be to use the $11.07 as an addition to the construction project cost factor. (Additive after all multipliers applied)

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[1] Final Report of the PRV Panel, Defense Strategic Plan Working Group, page iii, September 2002.
[2] Means Estimating Handbook, RS Means Company, p. 132, 2002.

4. Original Facility – "Green Grass" Construction:

For "green grass" scenarios, there are multiple options.

- Use of the current RPLANS multiplier
- Use of a parametric estimation methodology
- Use of a calculated factor from RS Means data
- Use of a historic based factor derived from USACE data
- Use of a combination factor based on RS Means and USACE data

Based on the time available, research was conducted on publications from RS Means, Marshall & Swift, BNI, Whitestone Research and other commercial agencies. There does not appear to be any single multiplier or cost factor in current publications, i.e. no simple "rule of thumb". Costs are available for individual components, but this would require an exhaustive calculation of varied options. An internet search produced thousands of examples of completed projects, but almost none with any costing data. Thus, the simple way was out.

4a. RPLANS: Currently RPLANS has a multiplier (1.2) that it uses as a project factor, but in discussion with the RPLANS Project Manager, it was determined that site preparation is just one of the components of this multiplier and that it cannot be split out as no documentation exists (an audit trail) of the original work done over 10 years ago to derive this factor. Based on the age of the data, and lack of an audit trail, use of the RPLANS multiplier is not recommended.

4b. Parametric estimation methodology: PACES could provide an approximation of a site preparation cost with the following drawbacks. A building must be defined, by type and size, and the resultant calculation would include other category codes in addition to the primary facility. This methodology would essentially produce a different factor for each of the 400 FACs currently used by DoD.

A similar process was described by Koenigseker[3] as a series of base costs and multipliers. In his example a base cost for material used in site preparation was derived, the multiplier was regionally driven (similar to area cost factors) and a total amount calculated. This process was continued with each of the labor types necessary and other variables (overtime, bad weather) as might be applicable. It is not recommended that this process be used. While auditable and repeatable, it would require maintenance of an outside data base to derive the regional factors and base costs or use of individual FAC runs by PACES.

4c. RS Means based calculation. The RS Means Square Foot Costs 2003 provides data that could be used to derive a universal multiplier/cost factor. For each of their 70 building templates, data is provided for the uniformat group of "Substructure". Substructure is further divided into four (4) sub-elements: Standard Foundation; Slab on Grade; Basement excavation; and Basement walls. Basement excavation is further defined as "site preparation".
There are two possibilities with this methodology.

4c1. Using the data provided for the 70 templates in the reference above, the costs for site preparation per SF of ground range from $0.12 to $7.20, with the median cost being $0.19/SF, and the average being $0.43/SF. Both the median and average cost equate to less than 1% of the total facility cost.

4c2. Data is also provided in terms of $/SF of building, the same unit of measure the prime facility unit cost is calculated in. Costs range from $0.01 to $0.68 per SF of building, with the average being $0.09/SF. For this analysis, 3 building types were eliminated as being way out of normal range. These 3 were: Underground garage ($3.60/SF); Movie Theater ($2.53/SF); and Swimming Pool ($7.20/SF). Again, the average cost equates to less than 1% of the total facility cost.

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[3] Koenigseker, Norman A., "Parametric Estimating of Buildings" Cost Engineering, Vol. 24/No. 6 December 1982.

By way of comparison, three projects were found on the internet with sufficient cost data to make a preliminary analysis.

1. A tire plant, comparable to FAC 2241 – Tank/Automotive Production Plant was constructed with the site work costing an amount equal to 1% of the FAC CCF.
2. A retail store, comparable to FAC 7346 – Exchange Sales Facility was constructed with the site work costing an amount equal to 1.17% of the FAC CCF.
3. A medical office building, comparable to FAC 6100 – General Purpose Admin Facility was constructed with the site work costing an amount equal to 0.56% of the FAC CCF.

This equals an average of 0.91% of the FAC unit cost. However, the actual cost per building SF would be even lower, as each example included the placement of site utilities and/or paved areas in the cost of the overall site preparation amount. Again, available data is pointing to a multiplier less than 1%.

4d. Use of a historical based factor derived from USACE data. A review of recent projects (DD 1391's and 1354's) done by the Army Corps of Engineers would provide historical data of actual project costs. Theoretically this has already been done in the preparation of the USACE cost data as published in the PAX newsletter (March 2003).
In that publication, the cost of clearing and grubbing is listed as $4,056/AC (FY05 dollars). Converting to SF and deflating to FY03 dollars the resulting value is $0.09/SF. However, this value is for ground SF and not building SF.

4e. Use of a combination factor based on RS Means and USACE data. A review of the calculation in paragraph 4c2 and paragraph 4d provide a slice of the cost that we are trying to capture. However each, taken separately or together, do not capture the necessary components that would constitute the bare essential site preparation of the "green grass" scenario.

Returning to the USACE data from the PAX newsletter, a reasonable amount of grading, after the clearing and grubbing in preparation for a slab on grade would be $0.32/SF. According to RS Means[4] a basic conventional survey and building layout would add an additional $0.06/SF.

While normally considered as "Engineering services" a certain amount of boring, augur holes, reports and drawings would be required. The amount (based on RS Means data) to meet a minimum level of "due diligence" would add an additional $0.15/SF.

Combining the different pieces together:

Paragraph 4c2 – RS Means – site prep of the slab area	$0.09
Paragraph 4d – USACE cost of clearing & grubbing	$0.09
Paragraph 4e – USACE cost of grading the site	$0.32
Paragraph 4e – RS Means – survey & layout	$0.06
Paragraph 4e – RS Means – "due diligence"	$0.15
Total	$0.71/SF

CAUTIONS/CAVEATS:

- The calculation costs only represent that portion of the project attributable to the prime facility, NO supporting facilities (parking, utilities, etc.) are included.
- Taken separately, each was based on the derivation of the cost for a portion of a larger area (per AC) and would not represent actual contract costs. You could not get a contractor to come in and clear 500 SF at Xcents/SF. You could get the work done for Xcents/SF if the area was an acre or more.

[4] Building Construction Cost Data 2003, RS Means

RECOMMENDATION:

1. For purposes of stationing drills in COBRA, a "green grass" approach be considered the norm, and the value of $0.71/SF be utilized (paragraph 4e). The formula below would represent the project cost.

{(FAC CCF + $0.71) * (Inventory amount)] * (design) * (contingency) * (SIOH) * .....

For facilities with a UM other than SF, the cost of site prep be disregarded. For utility FACs, ranges, roads, runways, etc. site prep is an unavoidable component of the current CCF. Conversion of the $0.71/SF to a percentage of the average SF FAC CCF ($156.83) results in a multiplier of 0.45% (1.0045) or $4,500 per $1,000,000 of construction.

2. A detailed study be done to revise the site preparation portion of the supporting facilities factor currently used in RPLANS.
3. A detailed study be done to confirm or refine the work presented above.

Keating 11.6.03

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

   a. Standard Factor #31 – Rehab vs. New MILCON (default)

   b. Standard Factor #32 – Rehab vs. New MILCON (red)

   c. Standard Factor #33 – Rehab vs. New MILCON (amber)

2. DESCRIPTION:

   a. The average percentage of new construction costs required to rehabilitate a space of equal size when the condition of the facility is unknown.

   b. The average percentage of new construction costs required to rehabilitate a space of equal size when the condition of the facility is coded red. A "red" facility has adequate substructure, superstructure, and exterior closure. All other parts of the building need to be replaced.

   c. The average percentage of new construction costs required to rehabilitate a space of equal size when the condition of the facility is coded amber. An "amber" facility has adequate substructure, superstructure, exterior closure, roofing, plumbing, HVAC, and basic electrical systems.

3. CERTIFIED VALUE:

   a. Rehab vs. New MILCON (default) – 47%

   b. Rehab vs. New MILCON (red) – 64%

   c. Rehab vs. New MILCON (amber) – 29%

4. DATA SOURCE: Determining a Rehabilitation Construction Factor Standard Factor for COBRA (attached).

   a. DATE LAST UPDATED: N/A

   b. DATE OF NEXT UPDATE: N/A

5. METHODOLOGY: See attached report.

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

DETERMINING A REHABILITATION CONSTRUCTION STANDARD FACTOR FOR COBRA

MAJ David A. Smith

FIND: At present to determine the cost to rehabilitate existing military construction in the Cost of Base Realignment Actions (COBRA), the algorithm determines the cost for the a building's new construction and then multiplies it by a factor of 0.75. This value is used because the legislative cap on rehabilitation of an existing structure is 75% of the cost of new military construction of that same building. Intuitively this number seems too high and would not accurately reflect the possible savings from using rehabilitated buildings. The purpose of this report is to find a new factor. I recommend that factor to be 0.47.

GIVEN:

1. The following references were used:

    a. The report will use Appendix F, Building Systems Work Breakdown Structure (WBS), from TM 5-800-4, Programming Cost Estimates for Military Construction and the

    b. Army Installation Status Report from FY 2002.

2. The following definitions were used:

    a. Substructure – The systems includes all work below floor construction (usually slab on grade) and the enclosing horizontal and vertical elements required to form a basement, together with the necessary mass excavation and backfill
    b. Superstructure – This system includes all structural slabs, decks, and supports within the basements and above grade. Structural work includes both horizontal items and vertical structure components. Exterior load bearing walls are not included in the system.
    c. Roofing – This system includes all waterproof roof coverings and insulation, together with skylights, hatches, ventilators, and all required trim. In addition to roof coverings, the system includes all waterproof membrane and traffic toppings over below grade enclosed areas, balconies, and the like.
    d. Exterior Closure – This system consists of the exterior facing of the facility that includes all vertical and horizontal exterior closure features excluding roof.
    e. Interior Closure – Construction that takes place inside the exterior wall or exterior skin. This system does not include interior structural walls.
    f. Interior Finishes – Finishes that are applied to interior surfaces, including the interior skin of exterior walls.

g. Specialties – Specialty items that are permanently fixed in place.
h. Plumbing – This system includes all water supply and waste items within the building.
i. HVAC – This system includes all equipment, distribution systems, controls, and energy supply systems required by heating, ventilating, and air conditioning systems.
j. Special Mechanical – This system includes standard fire protection and suppression systems.
k. Electrical – This system includes electric power and lighting.
l. Special Electrical – This system includes provisions for communications, security, and alarm systems.
m. Equipment – This system refers to fixed and moveable equipment.
n. Conveying Systems - This system includes elevators, escalators, pneumatic tube systems, conveyors, chutes, and others.
o. Amber Building – Army definition for a building that will impair mission performance.
p. Red Building – Army definition for a building that will significantly impair mission performance.

ASSUMPTIONS:

1. Since the analysis uses data from the Army, I assume that installations in the other Services have buildings with similar Building System Work Breakdown Structure.

2. I also assumed that the overall status of the other Services is similar to the overall status of all buildings in the Army.

3. I assumed that a building in a "red" condition only has an adequate substructure, superstructure, and exterior closure. All other parts of the structure need to be replaced.

4. I assumed that a building in an "amber" condition has the same adequate systems as a "red" building, but it also has adequate roofing, plumbing, HVAC, and electrical.

SOLUTION:

The Building Work Breakdown Structure (WBS) divides the parts of a building into 14 different "systems". Each different type of building has a different set of ratios of WBS system cost to facility cost. For example, the substructure of an administrative building has a ratio of 11.00, which means the substructure is 11% of the buildings total cost. The WBS in TM 5-800-4 contains 32 different building types. I matched 13 of the 32 facility types with the list of facilities that will be hard-wired into the COBRA model. This list of COBRA hard-wired facility types is found in Appendix 1. Appendix 1 also lists the percentage of DoD Plant Replacement Value (PRV). These 13 facility types make up 23.79% of the total DoD PRV. There are 398 other facility types that make up

the other 76.21 % of PRV, so these 13 facilities chosen for analysis make up a large part of the total. The only facility not included in the WBS that has a significant PRV percentage is family housing with a PRV percentage of 7.41%.

To determine a building rehabilitation factor, I first determined a factor to rehabilitate a "red" building and a factor to rehabilitate an "amber" building for each of the facility types. Since I assumed that all red buildings had an adequate substructure, superstructure, and exterior closure, then the cost factor to rehabilitate is found by adding the other 11 system ratios together. This produces a percentage of facility cost required to repair or replace the remaining systems. A copy of the spreadsheet used to calculate the factors can be found in Appendix 1. The red factors can be found in Table 1.

Facility Type	Red Factor (%)
Administration Facility	59.28
Applied Instruction Building	67.87
Enlisted Barracks	72.10
Brigade Headquarters	59.24
Battalion Headquarters	59.08
General Instruction Building	63.65
General Purpose Warehouse	54.82
Physical Fitness Center	60.22
Aircraft Maintenance Hanger	60.80
Dining Facility	80.01
Health Clinic	87.28
Reserve Center	65.86
GS Vehicle Maintenance Shop	47.35

Table 1

I used a similar method to find a factor for amber buildings. In addition to the adequate systems in a red building, an amber building also included adequate roofing, plumbing, HVAC, and electrical systems. To determine a factor I added the remaining seven systems together. The amber factors can be found in Table 2.

Facility Type	Amber Factor (%)
Administration Facility	28.80
Applied Instruction Building	27.08
Enlisted Barracks	39.30
Brigade Headquarters	26.19
Battalion Headquarters	24.07
General Instruction Building	29.48
General Purpose Warehouse	13.12
Physical Fitness Center	29.90
Aircraft Maintenance Hanger	27.93
Dining Facility	16.73
Health Clinic	12.41
Reserve Center	32.79
GS Vehicle Maintenance Shop	18.47

Table 2.

COBRA only uses one factor to determine the costs to rehabilitate a building. The first step in reducing 26 different values down to 1 is to find an overall red factor for all facilities and an overall amber factor for all buildings. Appendix 1 has the percent DoD PRV for all of the facilities hard coded into COBRA. Earlier I found that the total percent DoD PRV of the 13 building chosen for analysis was 23.79. So I found a weighted average red factors by summing the products of the individual building red factor and the individual building percent DoD PRV. I then divided that sum by 23.79. I used the same method to find the amber factor. The results can be found in Appendix 1 under the weighted average heading. The red factor is 64.31 while the amber factor is 29.46.

The second step in finding the rehab standard factor is to find a single factor for rehab construction. COBRA does not delineate between red and amber buildings. If I knew the percentage of red and amber buildings, I could find a weighted average of the two numbers. To find these percentages I referred to the Army's Installation Status Report (ISR). The report can be found in Appendix 2. The ISR will report the total square footage of Army facilities that are considered red and amber. I made the assumption that the condition of buildings in the other Services is about the same. I added up all of the possible square footage of buildings classified as red and divided it by the total square footage of buildings in the Army. I used the same method to find the percentage of amber buildings. I determined that 24% of the Army's square footage is red while 43% of it is amber. All of the rest is green and does not require rehab.

A few issues must be highlighted about the ISR data. First of all it is data from 2002. I don't think this is a serious issue, because I doubt much has changed in a year. The second issue is that I only included buildings that were reported in units of square feet. The barracks and family housing were I units of design capacity and family unit respectively. To take these issues in account I will adjust the estimate of the percentage of red buildings and amber buildings to a one to one ratio. This will produce a higher standard factor that would be a more conservative estimate. It also simplifies the

calculation. Now to find the final factor I will just take the average of the two factors. This gives a value of 46.885, which I will round off to 47.

RECOMMENDATION:

I recommend that the JPAT should agree to change the rehab standard factor from 0.75 to 0.47. The 0.75 value was based on a statutory requirement with no structural analysis behind it. The 0.75 value is too conservative. If we use it, then the COBRA model could lose the potential savings involved in rehabbing buildings. The 0.47 value has been determined using the most up to date technical manual published by the Army Corps of Engineers. The ISR data shows that using a on to one ratio is a conservative estimate. Finally the 0.47 value is close to the 0.4 value that R&K presented using an intuitive argument.

Appendix 1

WBS	Description	ADMIN	AIB	BARRCK	BRDGHQ	BTTNHQ	CLSRM	GPWH
	FAC	6100	1712	7210	6102	6101	1711	4411
	% DoD PRV	4.9	0.99	6.26	0.76	1.41	0.97	0.88
	Cat. Code	61050	17130	722111	61011	61012	17120	44110
1	Substructure	11.00	6.73	4.5	7.13	5.97	7.89	9.5
2	Superstructure	17.94	12.1	12.7	14.37	11.62	12.91	19.22
3	Roofing	4.06	5.23	2.3	3.2	7.49	5.56	12.1
4	Exterior closure	11.78	13.3	10.7	19.26	23.33	15.55	16.46
5	Interior construction	13.10	11.18	18.1	7.36	9.02	12.94	6.05
6	Interior finishes	9.73	10.73	18.6	10.83	9.09	8.98	1.82
7	Specialties	0.89	0.38	0	1.03	2.45	4.06	1.81
8	Plumbing	3.10	3.3	17.3	5.41	6.29	3.43	1.52
9	HVAC	13.86	8.28	5.2	17.71	12.15	15.45	16
10	Special mechanical	0.00	1.5	2.1	0	0	1.57	2.33
11	Electrical	9.46	23.98	8	6.73	9.08	9.73	12.08
12	Special electrical	3.48	3.29	0.5	6.97	2.03	1.93	1.11
13	Equipment	1.60	0	0	0	1.48	0	0
14	Conveying system	0.00	0	0	0	0	0	0
		100	100	100	100	100	100	100
	RED	59.28	67.87	72.10	59.24	59.08	63.65	54.82
	AMBER	28.80	27.08	39.30	26.19	24.07	29.48	13.1

WBS	Description	GYM	HANGR	KIT/DN	MEDCL	RESREV	SHOPGS
	FAC	7421	2111	7220	5500	1714	2141
	% DoD PRV	0.68	2.21	0.89	0.46	1.94	1.44
	Cat. Code	740034	21110	72210	55030	17140	21420
1	Substructure	5.22	7.2	11.06	4.59	10.39	8.45
2	Superstructure	13.36	16.16	3.34	3.17	9.85	24.18
3	Roofing	5.49	13.88	3.63	2.28	10.19	5.06
4	Exterior closure	21.2	15.84	5.59	4.96	13.9	20.02
5	Interior construction	2.28	12.06	2.29	3.61	19.02	6.21
6	Interior finishes	12.9	7.86	12.84	3.57	11.32	3.47
7	Specialties	3.9	1.44	0.61	1.13	1.14	5.57
8	Plumbing	3.57	3.64	22.15	5.59	10.98	3.45
9	HVAC	11.42	6.59	21.12	4.7	1.76	8.48
10	Special mechanical	0	2.5	0	0	0	1.29
11	Electrical	9.84	8.76	16.38	62.3	10.14	11.89
12	Special electrical	0.93	2.32	0.99	2.4	1.31	1.93
13	Equipment	9.89	1.75	0	1.7	0	0
14	Conveying system	0	0	0	0	0	0
		100	100	100	100	100	100
		60.22	60.80	80.01	87.28	65.86	47.3[illegible]
		29.90	27.93	16.73	12.41	32.79	18.[illegible]

Weighted Average

64.31

29.46

nformation Sys Fac	F13115	Square Feet	5788569.84	1044584	18	2870951.54	50
Air Nav Aids Buildings	F13300	Square Feet	228784	42775	19	94807	4
Airfield Opns Buildings	F14110	Square Feet	631044	80408	13	284679	45
Aviation Unit Opns Bldgs	F14112	Square Feet	544180	150825	28	274207	50
CIDC Facilities	F14114	Square Feet	540312	120628	22	230862	4
Training Aids Spt Cntr	F14129	Square Feet	1367829	268802	20	735287	54
Storage Spt Facilities	F14133	Square Feet	4357338.02	494950.02	11	1950664	45
EOC / SCIF Facilities	F14161	Square Feet	1201805.54	159096	13	566641.54	47
Production Plt Spt Facs	F14169	Square Feet	22912	1890	8	843	4
Brigade HQ Bldgs	F14182	Square Feet	3294656.5	468890	14	1760674.5	53
Battalion HQ Buildings	F14183	Square Feet	7434357.3	1657938.3	22	3561500	48
Company HQ Buildings	F14185	Square Feet	19421984.08	4002069.5	21	9897604.58	5
Ship Opns Bldgs	F14310	Square Feet	199569.69	24105.38	12	65753	33
Band Training Facilities	F17115	Square Feet	491765	187789	38	244255	50
Organizational Classroom	F17119	Square Feet	2826122	466467	17	1263331	45
Gen Instruct Buildings	F17120	Square Feet	13779188.66	2878402	21	6149747.66	45
Indoor Firing Ranges	F17121	Square Feet	508839	283805	56	89239	18
Physical Educ Trng Bldgs	F17125	Square Feet	583222	514234	88	11888	2
Compact Item Rpr Instruct	F17131	Square Feet	770560	12419	2	187070	63
Item Repair Instruction	F17132	Square Feet	777994	214645	28	418862	54
Vehicle Maint Instruction	F17133	Square Feet	1904861	384884	20	770474	40
Aircraft Maint Instruction	F17134	Square Feet	874910	6762	1	818282	94
Lab Instruction	F17135	Square Feet	388990	226680	58	124348	32
Information Aided Instruct	F17136	Square Feet	1185786	218170	18	593673	50
Material Handling Instruct	F17137	Square Feet	62719	0	0	53945	86
Limited Use Instruction	F17138	Square Feet	2058339	582030	28	694998	34
ITAR Center	F17140	Square Feet	22342328.02	5335724.34	24	11736304.15	5
Training Centers - NG/AR	F17142	Square Feet	1791363	222997	12	793849	44
Training Centers - ARNG	F17180	Square Feet	60436931.88	29015541.02	48	23227670.9	38
Simulator Facilities	F17200	Square Feet	3323421.9	377916	11	1552652	47
Aircraft Maint Facilities	F21110	Square Feet	14616429.39	4598087.96	31	6481369.21	44
Guided Missile Maint Bldg	F21210	Square Feet	636139	39029	6	95174	15
Ship Maint Facilities	F21310	Square Feet	170392	23483	14	63709	37
National Guard Maint Fac	F21407	Square Feet	7182865.84	2561208.94	36	2697493	38
Army Reserve Maint Fac	F21409	Square Feet	5388008.29	1713574.2	32	2288067.09	42
Vehicle Maint Shops	F21410	Square Feet	20745647.57	5869218.76	28	9919243.81	48
Depot Maint / Rebld Shops	F21440	Square Feet	4002726.5	337940.5	8	1327510	33
Depot Wpns Maint Shops	F21500	Square Feet	424667	8936	2	196575	46
Depot Ammo Maint Fac	F21600	Square Feet	1120754	223434	20	510329	46
Ammunition Repair/Inst	F21670	Square Feet	21871	17071	78	0	0
Depot Comm - Elect Shops	F21700	Square Feet	2771633	112101	4	1166517	42
DOL/Proc Item & Equip Maint	F21800	Square Feet	1465784	351525	24	417484	28
Vehicle Main DOL/ DEH DPW	F21885	Square Feet	10495513.88	2285203.88	22	4220976	40
Install Maint/Repair Facs	F21900	Square Feet	5384130.77	865636	16	2948921.77	55
Aircraft Prod Facilities	F22100	Square Feet	1626	1626	100	0	0
Guided Missile Prod Fac	F22200	Square Feet	137495	6439	5	76367	56
Tank / Automotive Prod Fac	F22400	Square Feet	189199	95940	51	10048	5
Wpns Prod Facilities	F22500	Square Feet	2951641	356660	12	2491251	34
Ammunition Prod Fac	F22600	Square Feet	2259408	681501	30	422898	19
Misc Prod Facilities	F22800	Square Feet	92254	7255	8	74469	81
Install Support Prod Bldg	F22960	Square Feet	3786	3281	87	0	0
RDT&E Laboratories	F31000	Square Feet	3712376.23	953279.23	26	1030049	28
Aircraft RDT&E Facilities	F31100	Square Feet	432858	34483	8	380403	88

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

    a. Standard Factor #34 – Contingency Rate

    b. Standard Factor #35 – Design Rate (Medical)

    c. Standard Factor #36 – Design Rate (Other)

    d. Standard Factor #37 – Supervision, Inspection, and Overhead (SIOH) Rate

2. DESCRIPTION:

    a. The average percent of construction costs which must be added to cover unforeseen (contingency) requirements.

    b. The average percent of construction costs which must be added to accomplish planning and design for medical facilities (identified by FAC).

    c. The average percent of construction costs which must be added to accomplish planning and design.

    d. The average percent of construction costs which must be added to cover SIOH (Supervision, Inspection, Overhead).

3. CERTIFIED VALUE:

    a. Contingency Rate – 1.05

    b. Design Rate (Medical) – 1.13

    c. Design Rate (Other) – 1.09

    d. SIOH Rate – 1.06

4. DATA SOURCE: DoD Facilities Pricing Guide (FPG)

    a. DATE LAST UPDATED: March 2003

    b. DATE OF NEXT UPDATE: March 2004

5. METHODOLOGY: N/A

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

MEMORANDUM FOR RECORD

SUBJECT: COBRA Data Certification

1. FACTORS:

   a. Standard Factor #39 – Officer Household Goods (HHG) Accompanied

   b. Standard Factor #40 – Enlisted HHG Accompanied

   c. Standard Factor #41 – Officer HHG Unaccompanied

   d. Standard Factor #42 – Enlisted HHG Unaccompanied

2. DESCRIPTION:

   a. The average pounds of household goods per officer family, accompanied.

   b. The average pounds of household goods per enlisted family, accompanied.

   c. The average pounds of household goods per officer, unaccompanied

   d. The average pounds of household goods per enlisted service member, unaccompanied.

3. CERTIFIED VALUE:

   a. Officer HHG Accompanied – 15290 lbs.

   b. Enlisted HHG Accompanied – 9204 lbs.

   c. Officer HHG Unaccompanied – 13712 lbs.

   d. Enlisted HHG Unaccompanied – 6960 lbs.

4. DATA SOURCE: Joint Federal Travel Regulation (JFTR) and DoD Active Duty Military Personnel by Rank / Grade

   a. DATE LAST UPDATED: 1 November 2003

   b. DATE OF NEXT UPDATE: November 2004

5. METHODOLOGY: The JFTR provided the maximum PCS weight allotments by rank for a PCS. I then took a weighted average of the allotments using the data form the

Active Duty Military Personnel as the weights. This allowed us to find officer and enlisted values. See the attached report.

6. I certify that the information supplied is accurate and complete to the best of my knowledge and belief.

DAVID A. SMITH
MAJ, AR
ORSA Analyst

CHAPTER 5 - PERMANENT DUTY TRAVEL
PART D: HOUSEHOLD GOODS (HHG) TRANSPORTATION AND NONTEMPORARY STORAGE (NTS)
U5310 BASIC ENTITLEMENT
B. Prescribed Weight Allowances.

B. Prescribed Weight Allowances.

Except as provided in pars. U5315 and U5330-A, authorized PCS weight allowances are: ***NOTE:*** ***The Secretary concerned may authorize a higher weight allowance (NTE 18,000 pounds) of a member below pay grade O-6, but only on a case-by-case basis. The Secretary may increase the member's PCS weight allowance if the Secretary determines that failure to increase the member's weight allowance would create a significant hardship to the member or the member's dependents.***

PCS & NTS Weight Allowances (Pounds)		
Grade 1/ & 3/	**With Dependents 2/**	**Without Dependents**
Officer Personnel		
0-10 to 0-6	18,000	18,000
0-5/W-5	17,500	16,000
0-4/W-4	17,000	14,000
0-3/W-3	14,500	13,000
0-2/W-2	13,500	12,500
0-1/W-1/Service Academy Graduates	12,000	10,000
Enlisted Personnel		
E-9	14,500 4/	12,000 4/
E-8	13,500	11,000
E-7	12,500	10,500
E-6	11,000	8,000
E-5	9,000	7,000
E-4	8,000	7,000
E-3 to E1	8,000	5,000
Aviation Cadets	8,000	7,000
Service Academy Cadets/Midshipmen		350

1/ Includes regular members, members of a Uniformed Service reserve component, and officers holding a temporary commission in the Army/Air Force of the United States.

2/ For this table, members "with dependents" are members who have dependents eligible to

Department of Defense
Active Duty Military Personnel by Rank/Grade
October 31, 2003

Rank/Grade - All	Services				Total
	Army	Navy	Marine Corps	Air Force	Services
GENERAL -ADMIRAL	9	10	4	13	36
LT GENERAL -VICE ADMIRAL	40	30	16	38	124
MAJ GENERAL -REAR ADMIRAL(U)	105	69	20	84	278
BRIG GENERAL -REAR ADMIRAL(L)	148	108	40	139	435
COLONEL -CAPTAIN	3,642	3,486	646	3,742	11,516
LIEUTENANT COL-COMMANDER	8,909	7,036	1,791	10,665	28,401
MAJOR -LT COMMANDER	14,169	10,470	3,484	15,928	44,051
CAPTAIN -LIEUTENANT	24,982	17,079	5,243	22,426	69,730
Ist LIEUTENANT-LIEUTENANT(JG)	7,139	7,895	3,119	9,622	27,775
2nd LIEUTENANT-ENSIGN	8,953	7,195	2,307	10,853	29,308
CHIEF WARRANT OFFICER W-5	401	1	91		493
CHIEF WARRANT OFFICER W-4	1,543	347	229		2,119
CHIEF WARRANT OFFICER W-3	3,505	429	592		4,526
CHIEF WARRANT OFFICER W-2	4,554	866	817		6,237
WARRANT OFFICER W-1	2,206		219		2,425
TOTAL OFFICER	80,305	55,021	18,618	73,510	227,454
E-9	3,328	3,149	1,415	2,868	10,760
E-8	11,373	7,055	3,478	5,733	27,639
E-7	37,872	24,511	8,599	30,161	101,143
E-6	57,009	53,271	14,791	46,005	171,076
E-5	74,260	76,119	23,503	75,927	249,809
E-4	122,082	62,885	28,926	52,749	266,642
E-3	63,278	58,471	44,824	58,529	225,102
E-2	30,639	23,318	18,865	11,857	84,679
E-1	18,435	12,823	13,712	13,832	58,802
TOTAL ENLISTED	418,276	321,602	158,113	297,661	1,195,652
CADETS-MIDSHIPMEN	4,198	4,293	0	4,061	12,552
GRAND TOTAL	502,779	380,916	176,731	375,232	1,435,658

	W/D	WO/D	Total		
0-10 to 0-6	18,000	18,000	12389	223002000	223002000
0-5/W-5	17,500	16,000	28894	505645000	462304000
0-4/W-4	17,000	14,000	46170	784890000	646380000
0-3/W-3	14,500	13,000	74256	1076712000	965328000
0-2/W-2	13,500	12,500	65745	887557500	821812500
			227454	**15290**	**13712**

E-9	14,500	12,000	10760	156020000	129120000
E-8	13,500	11,000	27639	373126500	304029000
E-7	12,500	10,500	101143	1264287500	1062001500
E-6	11,000	8000	171076	1881836000	1368608000
E-5	9,000	7000	249809	2248281000	1748663000
E-4	8,000	7000	266642	2133136000	1866494000
E-3 to E1	8,000	5000	368583	2948664000	1842915000
			1195652	**9204**	**6960**

HHG Accompanied Officer 15290 lbs
HHG Unaccompanied Officer 13712 lbs
HHG Accompanied Enlisted 9204 lbs
HHG Unaccompanied Enlisted 6960 lbs