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RESTORATION AND MODERNIZATION CAPITAL IMPROVEMENTS OF ARMY INFRASTRUCTURE UNDER HQ AMC AS A VIABLE REPLACEMENT FOR MILITARY CONSTRUCTION

June 2019

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ARMY INFRASTRUCTURE UNDER HQ AMC AS A VIABLE REPLACEMENT
FOR MILITARY CONSTRUCTION**

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Submitted in partial fulfillment of the
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ABSTRACT

This paper is intended to examine at a high level the U.S. Army Materiel Command's (HQAMC) use of restoration and modernization (R&M) capital improvements to existing facilities as a practical alternative to demolition and new construction through military construction (MILCON). The Army has been struggling over the past few years with the ever-declining mission readiness and quality of infrastructure. Lack of MILCON funds hinders efforts to demolish outdated facilities and replace them with newer buildings that are better suited to the needs of the Army. HQAMC has addressed this predicament by investing more of its overall operations and maintenance (OMA) funding into R&M projects to restore and modernize the current inventory. This paper looked at the background of Army real property funding in terms of capital improvements, discussed how funding flowed through the chain of command, and finally, addressed the benefits and risks involved in each type of effort. The conclusion was that, given the current state of the Army budget and the lack of any large financial investments on the horizon, the use of R&M for capital improvements is not only a viable option to MILCON but in many cases should be the first choice when seeking to restore facilities to the start of a useful lifecycle.

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TABLE OF CONTENTS

I.	BACKGROUND	1
A.	U.S. ARMY INFRASTRUCTURE.....	1
1.	Department of Defense Real Property	3
2.	Army Organizations Involved in Real Property	5
B.	ARMY GUIDANCE AND REGULATIONS ON INFRASTRUCTURE	7
1.	Army Real Property Guidance	7
2.	Planning, Programming, Budgeting, and Execution of Army Infrastructure.....	8
3.	Infrastructure Appropriations	9
4.	Military Construction.....	10
5.	Restoration and Modernization.....	11
6.	Responsibilities of Land Holding Commands and Army Commands.....	12
7.	Army Materiel Command.....	13
8.	HQAMC Guidance	13
9.	Infrastructure Planning.....	14
10.	Reduce the Footprint Guidance.....	15
11.	Project Prioritization, Funding, and Execution.....	16
12.	Military Construction.....	16
13.	Restoration and Modernization.....	18
II.	TWO APPROACHES TO PROJECT EXECUTION	21
A.	RESTORATION AND MODERNIZATION (R&M)	21
B.	MILITARY CONSTRUCTION (MILCON)	23
C.	CONSIDERATIONS IN SELECTING AN APPROACH.....	24
D.	EXAMPLE: REPROGRAMMING A PROJECT FROM MILCON TO R&M.....	28
III.	SUMMARY AND RECOMMENDATION	31
A.	SUMMARY	31
B.	RECOMMENDATION.....	31
	APPENDIX A. ORGANIZATIONAL CHARTS.....	33
	APPENDIX B. DEFINITIONS.....	37

LIST OF REFERENCES	39
INITIAL DISTRIBUTION LIST	43

LIST OF FIGURES

Figure 1.	DoD’s Appropriation Accounts as a Percentage of its Base Budget, 1980 to 2015. Source: Congressional Budget Office (2017).....	2
Figure 2.	AMC MILCON POM Schedule FY18-22. Source: Johnson (2015, p. 1).	17
Figure 3.	HQAMC MIMCON and R&M Project Numbers.....	25
Figure 4.	HQAMC MILCON and R&M Project Funding	25
Figure 5.	Notional Lifecycle Curve for Original and Renovated Construction	30
Figure 6.	ASA(IE&E). Source: Office of the Administrative Assistant to the Secretary of the Army (2017).	33
Figure 7.	OASCIM Organizational Chart. Source: Assistant Chief of Staff for Installation Management (ACSIM) (2016).....	34
Figure 8.	IMCOM and AMC within the Army Command Structure. Source: Department of the Army (n.d.).	35

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LIST OF TABLES

Table 1.	DoD Assets and Plant Replacement Values (PRV) by Service. Source: Department of Defense (n.d., p. 7).	4
Table 2.	Elements of the HQAMC MILCON Algorithm. Source: Johnson (2017a, p. 3).	18
Table 3.	Elements of the HQAMC R&M Algorithm. Source: Army Materiel Command G-3/4 (2017, p. 3).	19
Table 4.	Cost Saving Examples of HQAMC R&M vs MILCON. Source: Army Materiel Command G3/4 – Facilities Division (2016, p. 4).	22

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LIST OF ABBREVIATIONS

In an effort to achieve consistency of terminology, abbreviations have been taken from the following: Army Installations 2025 (U.S. Army Installations, Energy, and Environment, 2016); Army Regulation 420-1 (Department of the Army, 2012).

ACOM	Army Command
ACSIM	Assistant Chief of Staff for Installation Management
AMC	Army Materiel Command
APSL	Army Primary Standards Laboratory
ARNG	Army National Guard
AR	Army Regulation
ARSTAF	Army Staff
ASA	Assistant Secretary of the Army
ASA(IE&E)	Assistant Secretary of the Army for Installations, Energy and Environment
ASCC	Army Service Component Command
BASOPS	Base Operations
BEA	Business Enterprise Architecture
BMMP	Business Management Modernization Program
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CG	Commanding General
COCOM	Combatant Command
CONUS	Contiguous United States
DAIM	Department of the Army's Assistant Chief of Staff for Installation Management
DA PAM	Department of the Army Pamphlet
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities
DPW	Department of Public Works
DRU	Direct Reporting Unit

EA	Environmental Analysis, <i>also</i> Economic Analysis
EXORD	Execution Order
FIS	Facility Investment Strategy
FSM	Facility Sustainment Model
FY	Fiscal Year
FYDP	Fiscal Year Defense Program
GAO	U.S. Government Accountability Office
GFEBs	General Fund Enterprise Business System
GOGO	Government Owned, Government Operated
HQ	Headquarters
HQAMC	Headquarters Army Materiel Command
HQDA	Headquarters Department of the Army
HQIIS	Headquarters Installation Information System
IE&E	Installations, Energy and Environment
IMCOM	Installation Management Command
IPT	Integrated Programming Team
ISR	Installation Status Report
LHC	Land Holding Command
LHS	Life, Health, Safety
LRC	Logistics Readiness Center
MCA	Military Construction, Army
MILCON	Military Construction
MSC	Major Subordinate Command
NAF	Non-Appropriated Funds
NDAA	National Defense Authorization Act
IMCOM	Installation Management Command
O&M	Operations and Maintenance
OACSIM	Office of the Assistant Chief of Staff for Installation Management
OIB	Organic Industrial Base
OMA	Operations and Maintenance, Army
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense

POC	Point of Contact
POM	Program Objective Memorandum
PPBES	Planning, programming, budgeting, and execution system
PRV	Plant Replacement Value
QWE	Quality of the Work Environment
R&D	Research and Development
R&M	Restoration and Modernization
RA	Requirements Analysis
RDTE	Research, Development, Test and Evaluation
RPLANS	Real Property Planning and Analysis System
RPMP	Real Property Master Plan
RtF	Reduce the Installation Facility Footprint
SECDEF	Secretary of Defense
SRM	Sustainment, Restoration and Modernization
SSC	Service Component Commands
UFC	Unified Facilities Criteria
UMMCA	Unspecified Minor Military Construction, Army
US	United States
USAR	United States Army Reserve
USATA	U.S. Army Test, Measurement, and Diagnostic Equipment Activity
USC	United States Code

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EXECUTIVE SUMMARY

This paper explores the fact that restoration and modernization (R&M) capital improvements of Army infrastructure are a viable replacement for military construction (MILCON) in the long term. In this paper, I give an overview of the entire Army infrastructure process by describing the organizations, agencies, and commands that oversee Army infrastructure; explaining the process of planning, programming, budgeting, and execution in order to illustrate the difference between MILCON and R&M funding avenues; describing relevant guidance and regulations; looking at HQAMC's use of both funding avenues for infrastructure improvements; and finally providing a comparison of each.

I used Headquarters Army Materiel Command (HQAMC) because of my ability to coordinate with the program points of contact for access to pertinent information and because the command recently had a major project move from a MILCON approach to R&M. I evaluated past HQAMC project data, project considerations such as structural integrity, funding availability, and environmental considerations, and finally the ongoing project at the Army Primary Standards Lab at Redstone Arsenal in Huntsville, AL to explore whether R&M or MILCON would be the better execution avenue for any given project. By using this information, I illustrate that there are situations in which R&M is the better way to get needed infrastructure than immediately requesting a MILCON.

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I. BACKGROUND

A. U.S. ARMY INFRASTRUCTURE

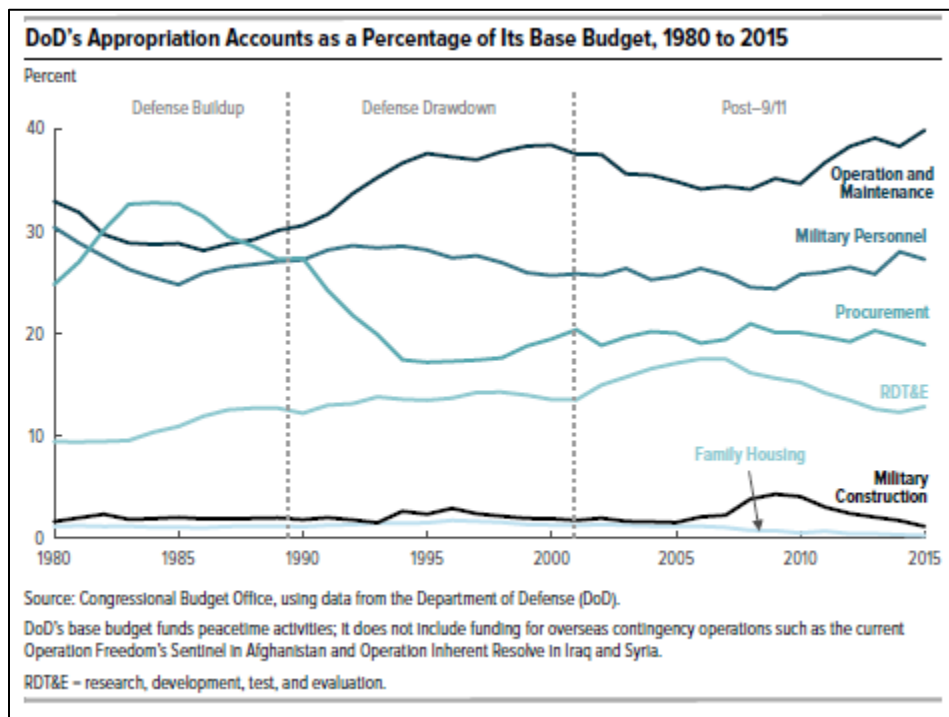
The Army is the largest military service and has the largest requirement for infrastructure to house everything from tanks to families, and from research and development (R&D) to weapon stockpiles. For this paper, the term *infrastructure* is considered synonymous with real property. Joint Publication 3-34, *Joint Engineer Operations*, defines real property as “Lands, buildings, structures, utilities systems, improvements, and appurtenances, thereto that includes equipment attached to and made part of buildings and structures, but not movable equipment” (Joint Staff, 2016, p. GL-9).

Over the years, the Army’s real property inventory has continually grown with little divestiture or significant investment in sustainment or modernization. Such growth has occurred primarily during and after times of conflict or of major mission change such as base realignment and closure (BRAC). The combined lack of infrastructure management and oversight, minimal sustainment/maintenance on these facilities, and ever-decreasing budgets has left the Army searching for an economical and effective way to maintain and invest in infrastructure capabilities.

Growth in the infrastructure footprint is a systemic problem in the Army. It is often left up to each Army command (ACOM) to determine the best way to manage their own inventory. The combination of a large footprint and dwindling resources has meant that much of the real property inventory has gone for years without any centrally funded major repairs or upgrades through military construction (MILCON) or dedicated restoration and modernization (R&M), and that even sustainment operations are extremely rare. The MILCON budget is one of the first areas where infrastructure takes cuts in order to preserve what little sustainment and maintenance funding is available. Because it has not made facilities a priority, the Army is retaining old and ill-configured buildings that often do not adequately serve current or future missions.

DoD budgets for MILCON have been relatively static over the years but hit a brief peak in the 2008 timeframe due to BRAC, overseas investments, and various initiatives to

improve the force. While the small uptick in construction helped to alleviate some of the problem of aging infrastructure, budgets have been slowly falling since approximately 2008 (Figure 1) (Congressional Budget Office, 2017, p. 9) and do not appear to be coming back up anytime soon. These dwindling MILCON budgets translate to lower rates of project authorization and appropriation for each of the services. However, Figure 1 shows that the operation and maintenance (O&M) funding line, which is where R&M falls, has increased. This is because O&M also includes many other programs across the DoD besides real property improvements, among which are procurement and sustainment of programs covering people, places, and things.



The figure shows funds for all DOD MILCON between 1980 and 2015, which includes not only major construction funding but minor construction funding, BRAC, and housing. While Army is not specifically broken out, the figure gives a good idea of the highs and lows of MILCON appropriations over the years.

Figure 1. DoD's Appropriation Accounts as a Percentage of its Base Budget, 1980 to 2015. Source: Congressional Budget Office (2017).

In 2015, HQDA responded to dwindling construction and sustainment budgets for facilities by issuing EXORD 164-15 to reduce the Army’s infrastructure footprint. EXORD 164-15 states, “In today’s fiscally constrained environment, we must optimize the use of existing facilities and reduce our real property portfolio to match our mission requirements” (Department of the Army, 2015, p. 2). While the EXORD focuses on reduction of the Army’s overall footprint, it also directs the Army commands to “where economically prudent convert (repurpose) facilities ... ensuring optimal allocation of the best available facilities to support Army missions” (Department of the Army, 2015, pp. 2–3).

The thinking behind the Army’s effort to reduce the footprint is that if there is less inventory to sustain and maintain then funding for the remaining infrastructure will go further. Just like all of the other services, the Army receives a set amount of money to sustain and maintain infrastructure. With a large inventory, many critical maintenance needs are going unaddressed. By doing away with outdated, inadequate, and sometimes unsalvageable facilities, the Army can better focus on maintaining the infrastructure that is critical to supporting core Army missions and ultimately national security.

1. Department of Defense Real Property

According to the U.S. Government Accountability Office’s *2017 DOD Support Infrastructure Management* report

DoD manages a global real property portfolio that consists of more than 562,000 facilities—including barracks, commissaries, data centers, office buildings, laboratories, and maintenance depots—located on about 4,800 sites worldwide and covering more than 25 million acres. With a DoD-estimated replacement value of about \$880 billion, this infrastructure is critical to maintaining military readiness, and the cost to build and maintain it represents a significant financial commitment. (U.S. Government Accountability Office, 2017, p. 311)

Within this massive real property footprint, the Army has the highest number of assets, followed by the Air Force, as shown in the table of DoD Assets and Plant Replacement Values (PRV) by Service (Table 1).

Table 1. DoD Assets and Plant Replacement Values (PRV) by Service. Source: Department of Defense (n.d., p. 7).

Service/WH	Number of Assets				PRV (\$B)			
	Buildings	Structures	Linear Structures	Total	Buildings	Structures	Linear Structures	Total
Army	138,545	78,902	55,363	272,810	\$216.20	\$35.85	\$49.75	\$301.80
Navy	61,109	34,788	15,474	111,371	\$136.74	\$50.33	\$36.31	\$223.38
Air Force	50,766	46,743	30,371	127,880	\$174.33	\$35.29	\$66.23	\$275.85
Marine Corps	26,156	17,253	5,719	49,128	\$51.04	\$9.60	\$10.73	\$71.37
WH	194	427	165	786	\$6.76	\$0.15	\$0.06	\$6.97
DoD Total	276,770	178,113	107,092	561,975	\$585.07	\$131.22	\$163.08	\$879.37

2. Army Organizations Involved in Real Property

To help manage the enormous Army footprint, specific commands and organizations are responsible for oversight, maintenance, and funding. Each one has specific responsibilities as set forth in Army Regulation (AR) 420-1 as well as other regulations ensuring that there is synchronized support. These players are the Assistant Secretary of the Army for Installations, Energy, and Environment (ASA(IE&E)), the Assistant Chief of Staff for Installation Management (ACSIM), and the Installation Management Command (IMCOM). Lower within the real property decision chain, the Army's major commands (ACOMs), service component commands (SCCs), direct reporting units (DRUs), and others oversee and influence their specific installations.

a. Assistant Secretary of the Army for Installations, Energy, and Environment

The ASA(IE&E) is responsible for the oversight of all of the Army's real estate and infrastructure assets and reports to the under the Secretary of the Army as shown on the organizational chart in Figure A1. The ASA(IE&E) sets strategic direction for the enterprise by determining applicable objectives, policies, and standards that affect the Army's installations, energy and environment (Department of the Army, 2012, p. 1). Per Army Regulation (AR) 420-1, ASA(IE&E) "has the principle responsibility for all Department of the Army matters related to all installations and environment, and safety and occupational health" (Department of the Army, 2012, p. 1).

b. Assistant Chief of Staff for Installation Management

Within the Army Staff (ARSTAF), responsibility for "development, integration, and interpretation of standards, policies, and doctrine for planning, execution, and administration of garrison operations" (Department of the Army, 2012, p. 2) belongs to the ACSIM. The ACSIM advises the ASA(IE&E) on installation management, portions of the Army program objective memorandum (POM) and Army planning, programming, budgeting, and execution system (PPBES), as well as public works policy and management. The office also represents HQDA at both private and interagency meetings,

has responsibility for infrastructure-related inquiries from Congress, and oversees safety and risk management. In regards to garrison infrastructure, ACSIM is also responsible for the oversight of “Installation Management Command (IMCOM) compliance with DoD-approved standards and methodology documented as part of the Business Enterprise Architecture (BEA) and Business Management Modernization Program (BMMP) to include adherence to OSD expenditure threshold approval and certification requirements” (Department of the Army, 2012, p. 2).

c. Installation Management Command

The Installation Management Command (IMCOM) is one of the Army’s direct reporting units and the largest land holding command. IMCOM is responsible for base operations (BASOPS) on Army installations world-wide. The command develops procedures for garrison public works departments’ operational plans, performance standards, and technical guidance for facility support. IMCOM integrates facilities-engineering services across Army installations to ensure consistency and quality, find efficiencies and best management practices, and ensure compliance with Army initiatives. Their offices review and approve infrastructure improvements such as military construction, sustainment, and modernization; family housing; utilities management; energy; environment; and emergency services projects. The command also ensures compliance with Federal, state, and local regulations governing the environment, safety, and health, as well as integrating risk management and safety considerations into garrison operations.

IMCOM is the Army’s proponent for any type of installation BASOPS construction projects while mission-related projects fall under one of the Army’s major land-holding commands. The responsibility for infrastructure is divided because BASOPS projects benefit the entire installation such as roads and utilities while mission projects typically support only a single tenant’s need and cannot be utilized by any other organization.

Through both the ACSIM and the IMCOM chains, the ASA(IE&E) ensures that the Army enterprise has the “critical infrastructure to organize, train, equip, deploy, and

conduct combat operations by land forces” (Assistant Chief of Staff for Installation Management [ACSIM], n.d., p. 1).

d. Land-Holding Commands

In addition to IMCOM, other Army land-holding commands include the U.S. Army Materiel Command (AMC), the Army National Guard Bureau (ARNG), and the U.S. Army Reserve Command (USAR). All the land-holding commands are responsible to manage both the MILCON and R&M programs on their installations. They provide installation services such as fire, emergency response, security, public works support, and infrastructure sustainment and maintenance. To manage the development, sustainment, and maintenance of infrastructure, the land-holding commands utilize the planning, programming, budgeting, and execution system (PPBES) process, ensuring that development and support plans are in line with the overall Army strategy.

B. ARMY GUIDANCE AND REGULATIONS ON INFRASTRUCTURE

When most people think of taking care of Army infrastructure they do not realize the entire scope of responsibility. From experience, most warfighters, civilians, and contractors only consider the condition of their buildings when either something fails or they are being moved into new space. The truth is that in order for the Army to repair, replace, maintain, construct, or demolish any infrastructure, requirements imposed by myriad laws (both state and federal), regulations, policies, and guidelines all must be complied with before work is authorized and funding is awarded. That is why the Army maintains not just one, but three levels of oversight: ASA(IE&E), OASCIM, and the land holding commands. Out of all of the programs in the Army, infrastructure is one of the most cut-and-dry when it comes to planning, funding, and executing any actions. There is little leeway when dealing with construction contracts or procurement of infrastructure related equipment.

1. Army Real Property Guidance

Army infrastructure investment guidance begins with Congress and the U.S. Code, specifically Title 10 for R&M and MILCON. From there, OSD will interpret the guidance

and issue direction to agencies and services, each of which in turn interprets and builds upon the guidance in order to prepare their own policies and directives.

Specific guidance for Army infrastructure is found in Army Regulation 420-1, Army Facilities Management. This AR describes the roles and responsibilities of every office within the infrastructure chain from ASA(IE&E) down to the department of public works (DPW) staff at Garrison level. AR 420-1 references a number of other regulations and pamphlets about such topics as master planning, MILCON and non-appropriated funds (NAF), and work classification.

In addition to AR 420-1, there are also a number of supplemental publications that the Army uses such as the DoD centric unified facilities criteria (UFC) and facilities investment strategy (FIS). The UFC gives the military departments, agencies, and activities criteria for planning, design, sustainment, restoration, and construction. The UFC is a whole-building design guide and serves to standardize construction across the departments. The FIS is the Army's guidance for balancing investments between sustainment, demolition, construction, and restoration and modernization. The FIS is specific to the Army and takes into consideration long-term strategy and mission readiness.

While Army guidance, the UFC, and the FIS do not guarantee compliance with environmental laws or funding instructions, they are very straightforward and assist planners in making decisions that benefit not only the installation but the surrounding community as well.

2. Planning, Programming, Budgeting, and Execution of Army Infrastructure

Understanding how military construction differs from restoration and modernization starts with a general understanding of how each approach is funded. Both funding streams are governed by the Army planning, programming, budgeting, and execution system (PPBES). MILCON projects are identified individually, and each has dedicated funding authorized and appropriated by Congress, while R&M projects generally come out of a command's overall OMA budget. Requests for funding priorities are developed by the garrisons in accordance with guidance published both by IMCOM and

the OACSIM, then they are reviewed and submitted to higher headquarters for funding consideration within the annual Army budget. Through OMA, R&M priorities are planned and executed in the current year of the future years defense program (FYDP) year while MILCON planning is shown in every FYDP year and will be executed when the FYDP reflects the planned FY.

Army Regulation 420-1 explains that the Army uses the PPBES to tie infrastructure in with capabilities and mission.

[The] Army Planning, Programming, Budgeting, and Execution System (PPBES) is the management process employed by the Army to ensure effective use of resources to establish and maintain the Army's capabilities to accomplish its roles and missions. Guided by policy and direction from the SECDEF, the Army PPBES responds to the DOD Planning, Programming, and Budget System and the Joint Strategic Planning System. The PPBES is the Army's primary management system that ties strategy, program, and budget together. It builds a comprehensive plan in which budget flows from programs, programs from requirements, requirements from missions, and missions from national security objectives. (Department of the Army, 2012, p. 154)

3. Infrastructure Appropriations

Infrastructure funding is subject to a stringent set of policies and it is rare that a project incorporates a combination of both R&M and MILCON appropriations. Infrastructure project appropriations are based on work classifications outlined in DA PAM 420-11 which gives determination guidance for construction, restoration, and maintenance. Project classifications that utilize MILCON and R&M appropriations are both expected to result in a building that will last 50 or more years, hopefully without any further major capital improvements to the structure (barring accidents or natural disasters).

PPBES requests for both MILCON and R&M are managed by the ACSIM, which gathers project requests from across the Army and builds the program in accordance with Army requirements, policy, and guidance. The ACSIM ensures that requested projects are classified correctly, are requesting the appropriate funding approach, and are in line with the Army's requirements and objectives, and applicable policies and procedures.

Regardless of the programming approach, all projects on Army installations must be done in coordination with the garrison department of public works (DPW), which reviews projects for such things as siting, environmental constraints, garrison mission impacts, and compatibility with surrounding infrastructure. The DPW also ensures that proposed projects comply with state and Federal laws, codes, and regulations, as well as established Army regulations and procedures. Before a project can be requested to the installation's major command, the DPW assists the requesting stakeholder in obtaining the garrison commander's signature on the requesting documentation giving his/her assurance that the garrison will support any funded improvements. This helps to certify that any construction, renovation, or other types of work are in sync with established and approved real property management initiatives and plans on the installation.

4. Military Construction

A military construction project is defined by Army regulation 420-1 as "All military construction work and any authorized contribution to that work necessary to produce a complete and usable facility or a complete and usable improvement to an existing facility (or to produce such portion of a complete and usable facility or improvement as is specifically authorized by law)" (Department of the Army, 2012, p. 445).

Army regulation 420-1 also specifies that for any MILCON "[the] undertaking must be specifically authorized and funded in MILCON legislation or performed under special statutory authority (for example, 10 USC 2803 or 10 USC 2854)." (Department of the Army, 2012, p. 153). Service component commands, ACOMs, DRUs, and IMCOM submit proposals for individual construction projects through ACSIM to the Assistant Secretary of the Army for Installations, Energy, and Environment (ASA(IE&E)) in support of established missions, workloads, and installation improvements. New construction under this appropriation must provide a complete and usable facility or complex and must be among the highest priorities as viewed by the Department of the Army.

As discussed in AR 420-1,

The MILCON program involves a sequence of reviews by the Office of the Secretary of the Army, the Office of the Secretary of Defense (OSD), Office

of Management and Budget (OMB), and the Congress. Program changes continue throughout the review until the MILCON program becomes law. The DOD Financial Management Regulation (DOD 7000.14-R) volume 2B, chapter 6, paragraph 060301.B.2 (www.dtic.mil/whs/directives/corres/html/700014r.htm) requires the design of all construction projects be at least 35 percent complete, or alternatively that a parametric cost estimate based on a 15 percent complete design be completed prior to submission to Congress. This allows for submission of an accurate budget estimate based on the project design. There is a deliberate one-year lag between the Army's normal biennial programming and budgeting system and the MILCON process. MILCON programming, unlike other Army programming, requires an additional year for project design effort. The IMCOM and ACOM, ASCC, and DRUs must identify projects for the first year of its POM a year before it is submitted to HQDA. (Department of the Army, 2012, p. 154)

5. Restoration and Modernization

In order to save money, instead of opting to demolish and replace existing buildings with new construction, the Army may choose to recapitalize existing facilities through restoration and modernization (R&M). According to DA PAM 420-11, recapitalization is

the major renovation or reconstruction activities (including facility replacements) needed to keep existing facilities modern and relevant in an environment of changing standards and missions. Recapitalization extends the service life of facilities or restores lost service life. It includes restoration and modernization of existing facilities. Recapitalization encompasses both renovation and replacement of existing facilities and essentially resets the Army's sixty-five year life-cycle period for the facility. (Department of the Army, 2010, p. 3)

DA PAM 420-11 defines facility restoration as "the restoration of real property to such a condition that it may be used for its designated purpose. Restoration includes repair or replacement work to restore facilities damaged by inadequate sustainment, excessive age, natural disaster, fire, accident, or other causes" and modernization of facilities as "the alteration or replacement of facilities solely to implement new or higher standards, to accommodate new functions, or to replace building components that typically last more than 50 years (such as, the framework or foundation)" (Department of the Army, 2010, p. 3).

AR 420-1 establishes a so-called 50% rule for funding with regard to R&M funding and approvals. It states that the

Commander, IMCOM may approve maintenance and repair projects when: (1) The funded project cost does not exceed \$3 million; and for a combined maintenance and repair project, the total of the maintenance cost and the repair cost does not exceed \$3 million. (2) *The repair cost (or repair plus construction project cost for a combined undertaking) does not exceed 50 percent of the replacement cost of the facility for projects whose funded costs are greater than \$750,000.* [emphasis added] (3) WWII temporary buildings that have total repair and construction costs in excess of \$40 per square foot in accordance with paragraph 2–13. (4) Environmental documentation has been completed in accordance with AR 200–1 and 32 CFR 651. (Department of the Army, 2012, p. 11)

In 2017 the so-called 50% rule referenced in AR 420-1 was increased to 75%, expanding the potential for more projects to fall under R&M instead of construction.

Regulation 420-1 also states “HQDA will approve or disapprove projects that exceed IMCOM approval authority. Requests for approval will be forwarded through the IMCOM to the Assistant Chief of Staff for Installation Management (DAIM–ODF)” (Department of the Army, 2012, p. 11).

Just as for MILCON projects, “Approving officials will ensure that all repair projects, regardless of costs, are consistent with force structure plans, more cost effective than replacement, and an appropriate use of operations and maintenance funds” (Department of the Army, 2012, p. 11). Both MILCON and R&M strive to provide the Army with a facility that meets current construction code and criteria while giving the tenants of that facility a space that strives to optimize their mission.

6. Responsibilities of Land Holding Commands and Army Commands

Initial determination of infrastructure appropriations rests with the land-holding command’s real property and infrastructure specialists. Each command tries to balance facility investment between MILCON and R&M in order to best support the larger Army mission. These installations work to prioritize BASOPS type projects in the IMCOM chain while submitting mission projects to their higher headquarters. In order to increase project coordination, IMCOM recently placed a contingent of personnel within each of the land-

holding commands G-3/4 offices which should help identify the most important infrastructure investments regardless of approval chain, mission or BASOPS focus.

7. Army Materiel Command

Army Materiel Command (AMC) “is the Army’s premier provider of materiel readiness—technology, acquisition support, material development, logistics power projection, and sustainment—to the total force, across the spectrum of joint military operations.” (Army Materiel Command, 2017) The Command “operates the research, development and engineering centers; Army Research Laboratory; depots, arsenals, and ammunition plants; and maintains the Army’s Prepositioned Stocks, both on land and afloat.” (Army Materiel Command, 2017) AMC also “leads, manages, and operates the Army’s Organic Industrial Base” (OIB), which “manufactures and resets our Army’s equipment, generating readiness in our formations” (Army Materiel Command, 2017). A frequently heard motto for the Command is, “If a Soldier shoots it, drives it, flies it, wears it, communicates with it, or eats it, AMC produces and provides it” (Army Materiel Command, 2017).

8. HQAMC Guidance

Like any of the other land holding commands, AMC develops their infrastructure guidance by building upon HQDA guidance. HQAMC uses the guidance found in ACSIM’s annual FIS that focuses on “1. Sustain Required Facilities; 2. Dispose of Excess Facilities; 3. Improve Existing Facility Quality/Functionality (to address recapitalization); and 4. Build-out Critical Facility Shortfalls” (Army Materiel Command G-3/4, 2017, p. 3). In order to ensure that the FIS objectives are accomplished HQAMC utilizes a combination of MILCON, R&M, demolition, and sustainment.

AMC meets the FIS objectives by using algorithms and metrics to evaluate their subordinate commands project submissions. For both MILCON and R&M, HQAMC has developed algorithms that consider multiple metrics with a maximum of 100 available points.

9. Infrastructure Planning

As of September 2018, AMC is the land holding command (LHC) for 23 installations and is responsible for approximately 30,000 facilities. These facilities are scattered over AMC's installations, IMCOM installations, and a number of Joint and DoD installations. AMC quantifies and qualifies these facilities through the Army's installation status report (ISR) database. The ISR database provides an Army-wide, consistent tool with which to assess infrastructure conditions against requirements and standards. Installations inspect between 30% and 50% of their real property each using ISR ratings to quantify facilities in terms of quality (Q) and mission (F). Accepted descriptions of the Q and F ratings are:

- Q1/F1 – minimal or no facility deficiencies/fully mission capable
- Q2/F2 – moderate facility deficiencies/partially mission capable (essential mission elements exist and are functional)
- Q3/F3 – significant facility deficiencies/essential mission elements are dysfunctional but can be repaired with proper funds
- Q4/F4 – major facility deficiencies/essential mission elements cannot be repaired (facility must be replaced)

The quality rating, more often referred to as the Q-rating, also estimates the cost to improve the facility to "green" status. A rating of Q1/green is given when the inspection calculation is between 90-100%, a rating of Q2/amber annotates a calculation of 80–90%, Q3/red annotates a calculation of 60-80%, and Q4/black is used for calculations between 0-60%. The ratings give real property managers and higher headquarters staff information to help inform rough funding estimates with which to make long-term infrastructure plans and decisions. Using this rating system, AMC reports that approximately 58% of assigned infrastructure has Installation Status Report (ISR) quality ratings ranging from well below standard (Q3) to unusable for the mission (Q4).

AMC's prioritization algorithms use ISR values along with command priorities, sub-command identified critical infrastructure shortfalls with which to support the mission,

quality of the work environment (QWE), life, health and safety conditions (LHS), funds availability, and the possibility of project execution within the fiscal year as metrics to rank projects in priority. AMC acquires most of the information needed for the algorithm from ISR and other infrastructure databases such as the general fund enterprise business system (GFEBS), the real property planning and analysis system (RPLANS), and the headquarters installation information system (HQIIS). AMC routinely asks their supporting command and reporting units to validate and supplement the information needed to request funding from higher headquarters.

Out of AMC's nearly 17,500 Q3/Q4 facilities, approximately 65% are programmed to be demolished. In order to ensure mission continuation, AMC believes that the remaining Q3/Q4 facilities should be recapitalized and restored. AMC's primary mission considerations include the organic industrial base (OIB), laboratories, and logistics readiness centers (LRCs). AMC considers facilities such as administrative buildings, storage buildings, ammo storage, and shipping/receiving as support infrastructure and only considers them for funding after primary mission facilities are addressed. For the facilities that AMC considers to be under their primary strategic mission of production and maintenance, the bill to restore them to a rating of Q2 is approximately \$1.33B.

10. Reduce the Footprint Guidance

In response to HQDA EXORD 164-15, HQAMC issued OPORD 15-215 to aggressively reduce its infrastructure footprint while maintaining readiness. AMC's major subordinate commands (MSCs) were told that "AMC will reduce installation's facility footprint through real property accountability improvements, facility utilization and elimination of under-used and unused excess facilities in order to gain operational efficiencies while simultaneously preparing for defense budget cuts" (Army Materiel Command, 2015, p. 1). OPORD 15-215 forced AMC to be more strategic in what facilities it kept and repaired, demolished, or scheduled for future construction.

Equipped with this new reduce-the-footprint guidance, HQAMC G-3/4 evaluated the MSCs 2016 requests for primary mission facility investment through R&M and MILCON. As a result of their evaluation, HQAMC G-4 increased the use of R&M for

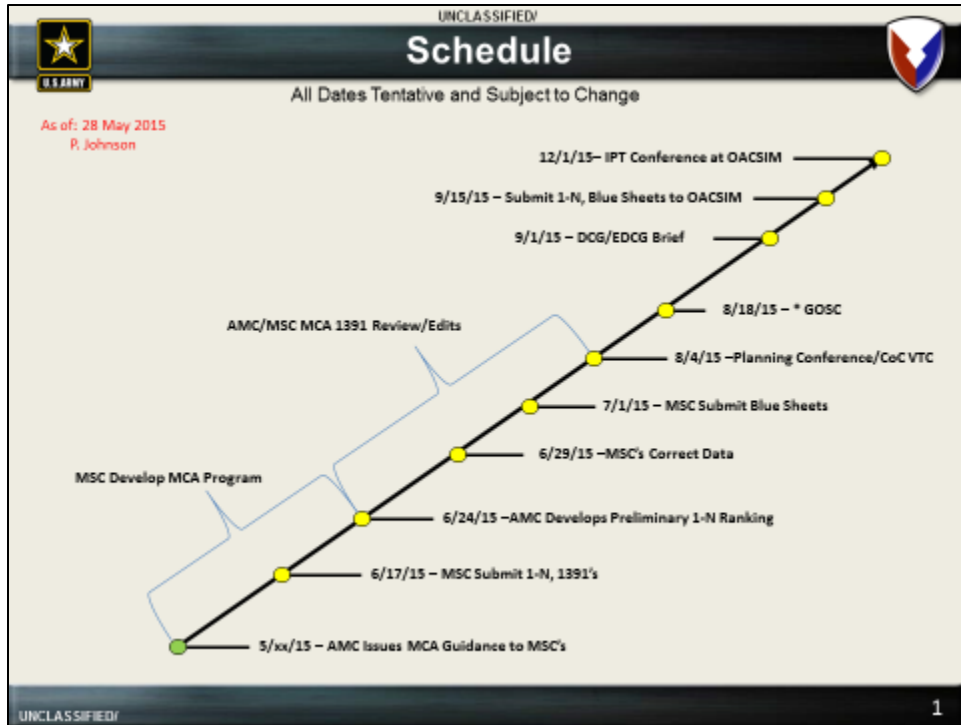
recapitalization of existing infrastructure instead of building new facilities using MILCON. AMC/CG and AMC G-3/4 believe that units can be provided with mission-capable, quality infrastructure under R&M and that this is a viable way not only to meet HQDA recapitalization requirements but to reduce the Army's bloated footprint.

11. Project Prioritization, Funding, and Execution

The approval chain for AMC's MILCON and R&M proposals works its way up from the command to ACSIM, then through ASA(IE&E) to be submitted to Congress. Competition for this funding is severe, with all of AMC's subcommands vying for a spot in the budget. Infrastructure funding across all of the Army has been so modest that for a few fiscal years the MILCON program included no AMC projects at all. R&M fared a little better because it is taken directly from AMC's overhead and maintenance budget at AMC's discretion, but even there only a few projects were executed in order to ensure that funding was available for other command requirements. AMC's prioritization for MILCON and R&M vary slightly.

12. Military Construction

The schedule AMC follows for its MILCON requirements submittal to ACSIM is illustrated in Figure 2. All Army reporting commands follow a similar process. ACSIM then ranks the projects based on criteria such as the completeness of the project request package, mission criticality to the Army and DoD, and command/garrison support before sending the prioritized list to ASA(IE&E) for final submittal to the POM.



Each year HQAMC publishes a tentative MILCON submission schedule that shows the MILCON planning process. The schedule is built on guidance from ACSIM.

Figure 2. AMC MILCON POM Schedule FY18-22. Source: Johnson (2015, p. 1).

Per the *AMC Guide for Military Construction*, “The MCA [Military Construction – Army (MCA)] program is intended to: 1) Recapitalize facilities in poor condition, (Recap Projects) 2) Correct critical shortfalls (New Footprint Projects)” (Johnson, 2017b, p. 6). HQAMC accepts only those projects that have the requisite documentation such as complete project request packages, requirements analyses (RAs), and economic analyses (EAs). Each project is measured using pre-determined metrics and only the top five are submitted to ACSIM. HQAMC developed the metric algorithm to remove perceived subjectivity and emotion from the ranking process. The algorithm addresses seven elements and associated point values with a potential for each project to score up to 100 as shown in Table 2.

Table 2. Elements of the HQAMC MILCON Algorithm. Source: Johnson (2017a, p. 3).

ELEMENT	NAME	POINTS (MAX)
1	Army Readiness Priority	25
2	MSC Priority	20
3	RPLANS/ISR (Q-ratings)	20
4	Life, Safety, Health, QWE	10
5	Recapitalization Potential	10
6	Project Documentation	10
7	AMC Staff Priority	5

Draft HQAMC MILCON algorithm elements and related point values as described for the FY20-24 POM build. Minor edits made for clarification purposes.

13. Restoration and Modernization

AMC’s focus on R&M projects as a separate approach from other OMA funding is a relatively new way of funding projects. Prior to FY12, AMC funded R&M on a case-by-case basis and not as its own program. Funding R&M projects in a similar fashion as MILCON is not Army policy, but rather it is a program that AMC heads up themselves in order to address failing infrastructure throughout its inventory. By using the command’s own OMA funding source, AMC is able to focus on infrastructure that it deems mission essential for its mission. In 2016, AMC developed a briefing called “HQAMC Sustainment, Restoration and Modernization (SRM) Solutions” that explains the need for R&M projects. Slide 3 of this briefing describes the command’s background and reasoning for the R&M approach as follows:

In 2011 HQAMC began an aggressive initiative to focus efforts on R&M as the “gap” filler for the long under funded needs of our deteriorating facilities. A stern mandate by the Vice Chief of Staff-Army to improve the conditions, after a 2010 visit to one of our 1939 era Ammunition Plants, opened the door of opportunity to get DA Secretariat and Commanding General level backing to develop an initiative, Quality Work Environment (QWE), to assess and articulate our needs. In 2013 HQAMC took back Installation Master Planning functions from IMCOM, resulting in the rapid

development of an award winning Program, recognized in 2016 by the American Planning Association for highest level quality and excellence in the field of Federal Government Master Planning. These projects are in direct support of the Army Facility Investment Strategy (FIS) and Reduce the Installation Facility Footprint (RtF). (Army Materiel Command G3/4 – Facilities Division, 2016, p. 3)

Potential R&M projects are scored in a similar manner to MILCON but with different metrics. As with the MILCON program, the largest weights are assigned to the subordinate command’s prioritization and to the facilities in the worst condition. The elements and their associated point ranges are shown in Table 3 from the 2017 R&M Project Request Memorandum.

Table 3. Elements of the HQAMC R&M Algorithm. Source: Army Materiel Command G-3/4 (2017, p. 3).

ELEMENT	NAME	POINTS (MAX)
1	MSC Priority Points	20
2	ISR Quality (Q) Rating	8
3	ISR Mission (F) Rating	7
4	ISR Quantity (C) Rating	5
5	Readiness Facility Drivers	15
6	LHS/QWE	15
7	Recapitalization	10
8	Project Documents [Master Plan 5pts, C-Project 5pts, 1391 5pts]	15
9	AMC Staff Priority	5

Draft HQAMC R&M algorithm elements and related point values as described in the 2017 R&M Project Request Memorandum. Minor edits made for clarification purposes.

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II. TWO APPROACHES TO PROJECT EXECUTION

Which of R&M and MILCON is the better option for a given project depends on the work associated with the project. Because MILCON is centrally funded (i.e., authorized and appropriated by Congress), it does not put a drain on an organization's overall operating budget. By contrast, R&M projects are funded as part of a command's overall OMA account, which leaves less available for the command's other initiatives.

Both approaches result in what the Army refers to as permanent facilities, which are described in Department of the Army Pamphlet 420-1-2 as

Facilities [that] are designed and constructed to serve a useful life of 25 years with expectation that recapitalization after that would allow the facility to last for a total of 50 years. Also, the facilities are designed and constructed to be energy efficient; and with finishes, materials, and systems selected for low maintenance and low life cycle cost (LCC). (Department of the Army, 2009, p. 4)

Both approaches will result in a facility that meets all current codes and requirements, and because R&M projects typically cost a fraction of what MILCON does, HQAMC has shifted projects to R&M whenever possible. In choosing between each approach, HQAMC weighs both the advantages and disadvantages to not only the infrastructure but how the facility will support the overall mission.

A. RESTORATION AND MODERNIZATION (R&M)

Many real property specialists consider R&M to be a great way to recapitalize existing infrastructure that has gone years without adequate sustainment and maintenance when there is little chance for MILCON appropriations. The Army has a huge inventory of infrastructure and by using R&M, no additional buildings are added to the inventory. Supporters of recapitalization claim that the work benefits not only the facility tenants but also the installation in saved maintenance costs. This is because the user gets a building that supports their mission and the installation does not have to add the cost of an additional building's sustainment and maintenance to the infrastructure inventory. The installation can also lower sustainment and maintenance requirements for the improved facility

because repairs should no longer needed to keep the building habitable. Addressing all of the needs at once in an R&M eliminates the continual drain on the DPW’s and/or the MACOM’s annual OMA budget for sustainment, maintenance, and repair.

The initial benefit of using R&M is, of course, the money saved. New construction not only requires the cost of excavation and foundation, tie-ins to utilities and additional drain on those systems, but also the time and effort for environmental analyses, economic analyses, personnel relocation, and demolition. R&M benefits from reuse of existing foundations; existing utilities (even though they may need upgrades) that are already attached to the installation grid, and in most cases, a structurally sound building shell. As the examples in Table 4 show, using R&M in major capital improvements can cut costs substantially.

Table 4. Cost Saving Examples of HQAMC R&M vs MILCON. Source: Army Materiel Command G3/4 – Facilities Division (2016, p. 4).

Project	Location	Scope	MCA		R&M		Savings
			Proj'd FY	PA	Estimated BOD	Cost (\$K)	%
Machine Shop – Ammo	Tooele Army Depot	Sustain/rest. 3 exist. bldgs. in lieu of 1 new	FY22	\$28M	FY15	\$9.9M	65%
Army Contracting Command (ACC)	Redstone Arsenal	New Headquarters in existing 1958 building	FY20	\$28.2M	FY16	\$10.7M	62%
Electronic Maint. Shop (1A)	Tobyhanna Army Depot	Sustain/restore exist. in lieu of new facility	FY22	\$56M	FY18	\$44.6	20%

Table shows three HQAMC projects comparing estimated cost to execute in MILCON and R&M.

Even though reusing existing infrastructure has significant benefits, there are also risks. A full study should be completed during the planning and design phase of work to allow for early discovery of unknown building conditions such as a failing slab, structural damage, environmental hazards, or inadequate utility support. Late discovery of such conditions can significantly raise the cost of the project and can delay the reconstruction work while contracts are redone.

There is also a chance that the only facility space available for reuse on the installation cannot suit the mission because of square footage limitations, location, environmental constraints, or utilities. Furthermore, changing available space to fit the mission can mean extensive and lengthy work during which personnel must be provided with alternative work locations such as flex space. If such flex space is not available in other, existing buildings, then the project must fund trailers or leased space for employees to work in. These costs reduce available funding for structural improvements.

B. MILITARY CONSTRUCTION (MILCON)

Because of HQDA's reduce-the-footprint guidance, MILCON brings with it the requirement for at least one-to-one demolition of existing structures: For every new square foot built, the same or larger area must be demolished. MILCON is a win for both the building tenants and the DPW since the space is ideal for mission execution and the DPW reduces their footprint and utility usages.

Both approaches completely ensure that the building has incorporated all of the current construction codes and regulations. However, new facilities can be specifically tailored to the mission without any structural constraints like load-bearing walls that might be found in existing infrastructure. New buildings also include the latest energy saving measures, which may not be possible when renovating an existing structure.

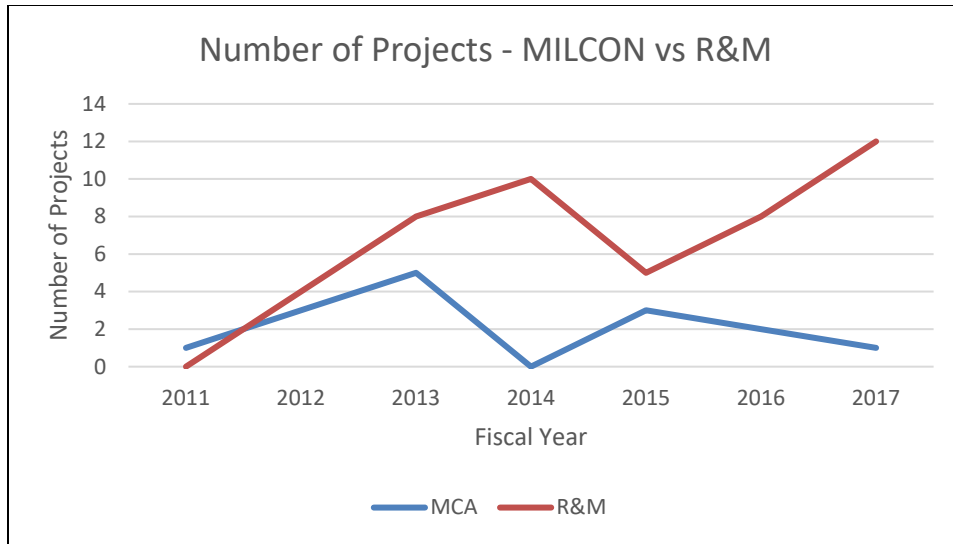
Other MILCON considerations potentially include flex space or leased space, and high costs of running utilities to the new site. With a new footprint, there is no guarantee that utilities are in the area and of adequate capacity for a new building. An environmental analysis of the site may delay the start of construction because those studies can take more than a year to complete. If the new building will encroach on any type of protected habitat, the project may have to incorporate mitigation measures. If mitigation cannot be accomplished then the project may have to be changed to a different location.

Coordination with the DPW early on in project planning will help to determine if R&M or MILCON is the best way to address mission needs. The DPW will assist in the coordination with IMCOM and/or the mission command to ensure that whatever approach is chosen, new or existing, it meets the needs of the Army.

C. CONSIDERATIONS IN SELECTING AN APPROACH

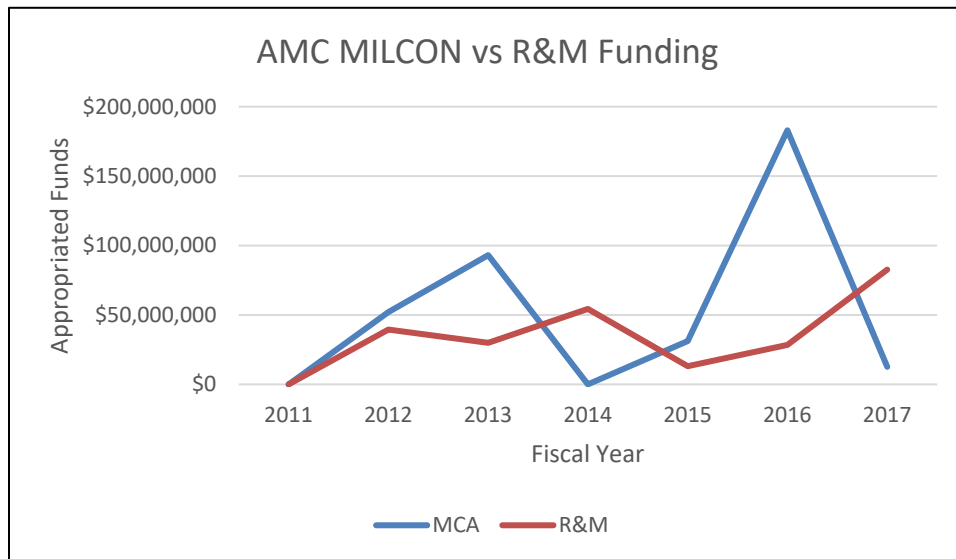
Due to the high demand and the limited funding available, HQAMC studiously evaluates potential R&M and MILCON projects. While some projects are clearly MILCON or clearly R&M, many are in the gray area. HQAMC uses tools such as economic analyses to compare options such as new construction, building reuse, or the “cost” of doing nothing at all to help determine the correct funding path. The command will also use the economic analyses to determine costs to sustain the buildings into the future, the utility loads, and potential impacts to space use across the installation.

An important piece of the decision for AMC is consideration of how either improvements or new construction would ultimately affect the mission and the overall installation infrastructure footprint. As stated before, reusing space can be a benefit because it improves upon existing infrastructure, lessening the demand on already limited sustainment and maintenance funds. MILCON will provide a structure low in sustainment and maintenance demand but, unless the project includes destruction of the facility currently in use by the mission, the new building will only add to the number of facilities the garrison is required to maintain. Figure 4 illustrates the increasing frequency in which HQAMC is using R&M for infrastructure projects. This has allowed the command to bring more infrastructure up to code while reducing sustainment and maintenance expenditures in the following years.



The figure only shows R&M and MILCON projects between FY11 and FY17. Prior to FY11 R&M was not a program for recapitalization execution at HQAMC. Based on HQAMC raw data as tracked by Program Managers.

Figure 3. HQAMC MIMCON and R&M Project Numbers



HQAMC project funding between FY11 and FY17 is shown with R&M slowly increasing over time. Based on HQAMC raw data as tracked by Program Managers.

Figure 4. HQAMC MILCON and R&M Project Funding

When looking at the specific facility in question, structural integrity may be a deciding factor in the execution approach. Both R&M and MILCON will provide a facility

that has a minimum 50-year life cycle or more, however, if the structural integrity of the building is bad then it should be demolished. In terms of R&M projects, reuse of the foundation, load bearing walls, and façade in an R&M project is important. This is because the Army considers complete facility replacement from the slab up to be construction, not renovation or repair. Repair will address failed or failing internal components of the building but will not significantly affect the footprint and façade.

Once the choice is made to use an R&M approach, the architect-engineer (A-E) doing the design and renovation must do a full building assessment to uncover any unseen issues with the building components, foundation and structure, or utility service. This is a critical piece of planning and design when developing an R&M project scope and cost. If the assessment determines that the original building is unsuitable for reuse then the project will move into the MILCON realm. If there is any concern about structural integrity then MILCON is the preferred alternative because it will guarantee a new foundation, frame, and interior that meets all current code and criteria.

Another installation-level consideration is the general aesthetic and appearance of the garrison's infrastructure as a whole. Many garrison master planners try to adhere to one consistent aesthetic type for continuity across the installation. In order to fall in line with the DPW's installation real property master plan (RPMP) and to blend with the buildings already in place, both new construction and major renovations typically follow an established color scheme or architecture. Keeping with a consistent theme may generally be easier with R&M than with MILCON. This is because R&M makes use of as much as possible of a building's structural components, potentially leaving the shell of a building intact, which retains the façade essentially unchanged. In many cases, a new building that is energy efficient and costs less to construct will not have many of the finishes and fixtures found in historical construction and trying to copy or emulate historical structures may quickly escalate overall cost.

The RPMP typically suggests fixtures and finishes that ensure new construction will blend with the surrounding area to the highest degree possible and that historic or period-specific architectural components be retained and maintained during the R&M recapitalization process. This can include matching construction materials to the original

structure, maintaining the architectural style, restoring the site and exterior to original condition, or rebuilding finishes that are similar to the type used during initial construction. Doing so ensures that the building fits in with the overall aesthetic of the installation, especially if the surrounding buildings have a period-specific look.

For many projects the “make or break” determination of the approach is not the cost of matching an installation’s aesthetic but environmental factors. Environmental considerations for infrastructure come with their own policy, guidance, state and federal laws, and requirements that installations are required to follow. Capital improvements to a building using R&M might have a small advantage over MILCON as long as no new footprint is included in the project because the facility was likely included in the installation’s last environmental analysis (EA). Since the footprint remains unchanged in the R&M approach, additional approvals beyond the last EA generally are not required. The addition of any new footprint on the installation would require a new EA to study the impacts new structures, utilities, and roads would have on the garrison’s mission and surrounding area. Similarly, a change in the facility use due to a new or transforming mission could alter water runoff, increase or decrease mission noise, or impact the amount of mission related air pollution, having a greater impact to the surrounding area’s habitats. Guidance on environmental considerations for construction can be found in AR 200-1, Environmental Protection and Enhancement.

New construction under MILCON requires a new EA during the design phase to gauge installation impacts if the project was not included in the installation’s last EA. If the EA finds any concerns for things like wildlife, noise, or quality of the work environment that might impede construction, the installation will coordinate with local authorities and HQDA to find an alternative solution that will still allow for mission accomplishment. An EA can add a year or more to the planning and design process, increasing already lengthy construction timelines, and if the chosen site cannot meet Federal and local requirements, a new site must be found, essentially restarting the design effort from scratch. From my experience, most real property planners generally consider R&M projects to be easier than MILCON with regard to environmental impacts and studies.

There are many other considerations besides financial, environmental, and structural that go into determining which of R&M and MILCON to pursue. There may be Congressional interest or a new mission at the installation that dictates construction of a new facility, thus forcing the project into the Army's MILCON budget. An installation's garrison or senior commander could be actively pursuing the HQDA reduce-the-footprint guidance by denying new construction at that location or the Army could reallocate funding that would otherwise be set aside for infrastructure projects, essentially stopping all new work. Finally, any number of unforeseen requirements could push planners toward one avenue over the other. It falls to the planners and programmers at both the installation and higher headquarters to determine what is the optimal use of both funding sources.

D. EXAMPLE: REPROGRAMMING A PROJECT FROM MILCON TO R&M

As an example of how HQAMC met mission requirements by using R&M, I explored the case of the Army Primary Standards Lab (APSL), a project that was successfully transitioned from a MILCON request to an R&M execution.

The APSL is overseen by the U.S. Army Aviation and Missile Command (AMCOM) at Redstone Arsenal in Huntsville, AL. According to Redstone Arsenal's PAO "The APSL is the Army's primary metrology and calibration laboratory [which provides] calibration and measurement services and traceability to national standards in at least 50 measurement parameters for most test, measurement, and diagnostic equipment in the Army and Department of Defense." (Redstone Public Affairs Officer (PAO), 2017).

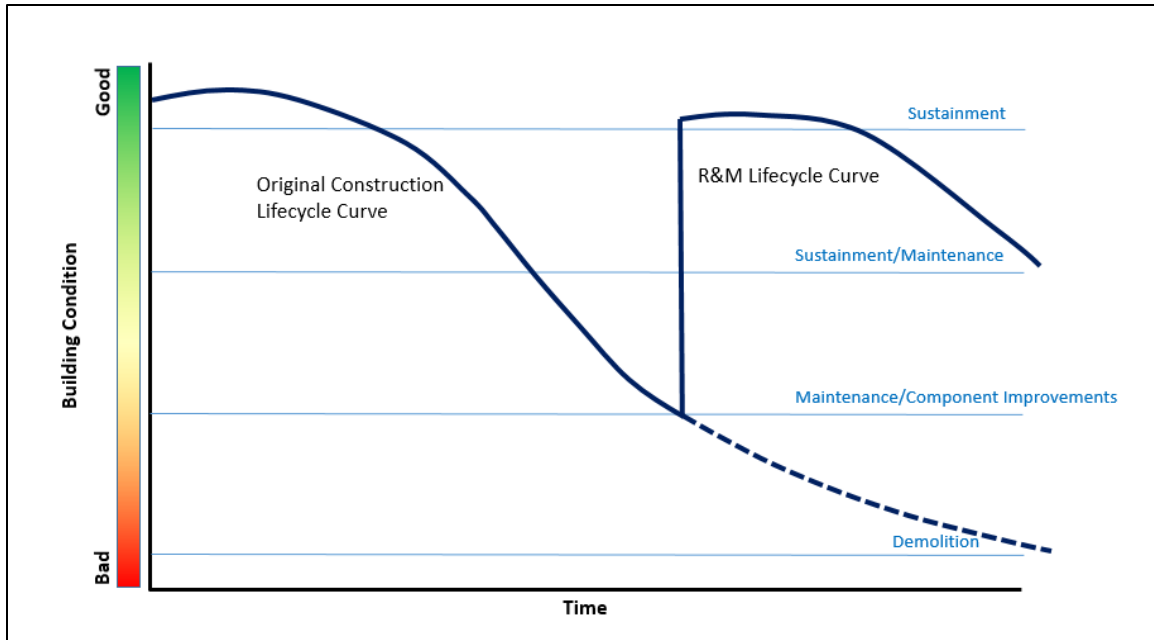
Between 2002 and 2014 the APSL requested that AMC advocate for a new facility. The MILCON project would augment the nearly 60-year-old building complex with a new \$30M facility. In 2014, HQAMC reviewed the project with help from both the tenant and the DPW and determined that the intent and requirements could be met using the existing lab spaces. The APSL did not have a mission requirement for additional space and so renovation and modernization of APSL's three existing facilities became the new path forward. In order to allow the APSL's mission to continue uninterrupted throughout the R&M process, AMCOM and HQAMC G-4 staffs have worked together to ensure that the

construction portion of the project will be phased and that the fully renovated facility will meet all of the APSL's mission needs. Currently, the renovation and modernization of the APSL is in design and is expected to meet or exceed all mission requirements without using MILCON.

If the APSL project had been executed as a MILCON, the facility would have remained on Redstone Arsenal's real property inventory due to lack of demolition funding across the Army. With an additional building to maintain and no reduction in older infrastructure to sustain, the lifecycle sustainment and maintenance costs for the APSL campus would have only gone up. Sustainment funding is determined not by age but by the category code of the facility. Due to funding reductions at the DoD level, installations are receiving only approximately 60–70% of the calculated sustainment cost for all of their infrastructure. By improving the APSL through R&M, it means that the garrison will have to spend less to maintain those structures over the next few years, freeing funding up for other projects on the installation.

Some planners and programmers believe that the newer, higher efficiency fixtures and finishes in the APSL will actually put more of a strain on the garrison's maintenance budget because they are more sensitive to changes and require a highly skilled team to service them, essentially negating the benefit of R&M over MILCON. However, both the tenant and the DPW have considered this in the building redesign and there is not any proof that higher efficiency equates to higher overall sustainment and maintenance costs.

Repurposing the existing facility will bring the building from a quality rating of Q3/Q4 to a rating of Q1. Figure 5 illustrates a building lifecycle curve based on my experience with R&M and MILCON projects. New construction starts out needing only sustainment such as cleaning and upkeep, moving through to sustainment/maintenance where roofs need to be repaired, then to maintenance/component replacement of entire building systems such as transformers and water lines, and finally moving into demolition when the building and its components can no longer be upgraded or replaced. By rehabilitating the building with a R&M project the lifecycle is once again brought up to a "good" status where only sustainment is required.



This is a notional overview of a typical facility lifecycle curve where major renovation is accomplished prior to the end of the original useful lifecycle. The comparison of the two curves is based on knowledge I've picked up over the years while working in the infrastructure field for both the US Air Force and US Army.

Figure 5. Notional Lifecycle Curve for Original and Renovated Construction

At the point in time when a facility's sustainment, maintenance and component replacement becomes prohibitively expensive and no longer cost effective, most installations vacate the facility and slate it for demolition. The Army does not anticipate an increase in MILCON funds within the next few POMs so new construction is highly unlikely for the majority of the garrisons. The APSL project is an example of commands working together to identify a true need versus a desired outcome and to address mission need through R&M rather than waiting indefinitely for MILCON to be funded. As the project moves toward completion and utilities are brought back on line, it will be interesting to note the difference in usage rates, quality of the work environment, and whether or not the building can efficiently and adequately meet mission needs.

III. SUMMARY AND RECOMMENDATION

A. SUMMARY

HQAMC's use of R&M to address critical infrastructure requirements is working out very well. Because of the success HQAMC has had with the initiative, I believe that other Army commands are likely to follow their example. R&M is being used to recapitalize the Army's vast infrastructure footprint without users' having to wait upwards of 10 years for authorization, appropriation, and execution of MILCON funding. Costs are generally much lower for R&M than MILCON, meaning that commands can make more of an impact on their inventories. The use of R&M also helps the installations themselves in reducing utility loads through improved and energy efficient infrastructure and gives them the means of meeting the DA reduce-the-footprint guidance.

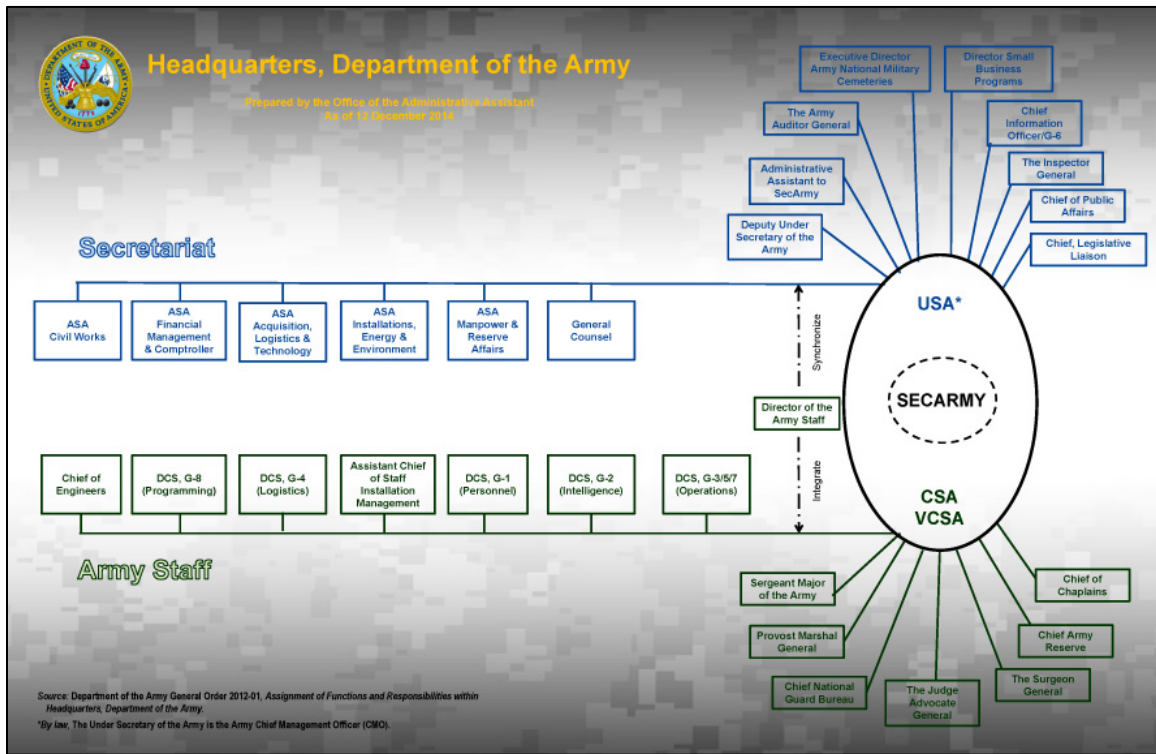
B. RECOMMENDATION

I recommend that the Army (1) establish a line of funding specific to R&M projects outside any command's OMA account and (2) ensure that the line of funding is large enough to address critical needs. A specific line of funding will allow commands to make capital improvements without shifting already reduced funds from other high-value investments. A potential line of funding that would not increase the Army's total request could be the reassignment of any expired, unobligated funds from procurement, RDT&E or O&M accounts to new infrastructure obligations.

Establishing an independent R&M funding line would likely take years, meanwhile HQAMC's consideration of R&M improvements out of its own OMA funding is a wise choice. The reuse of existing infrastructure allows HQAMC to work with installations to plan, program, budget for, and execute projects that meet mission needs much faster than in any MILCON approach.

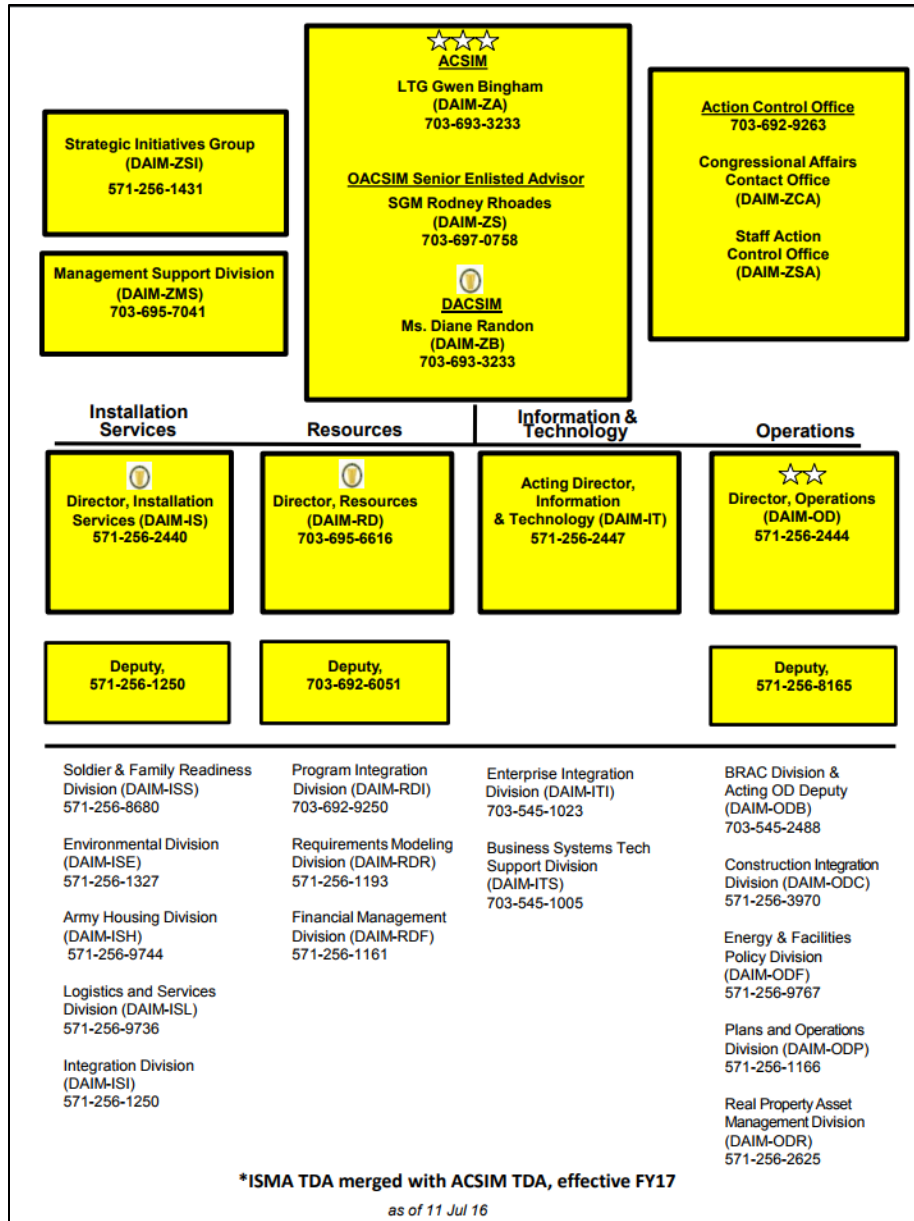
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APPENDIX A. ORGANIZATIONAL CHARTS



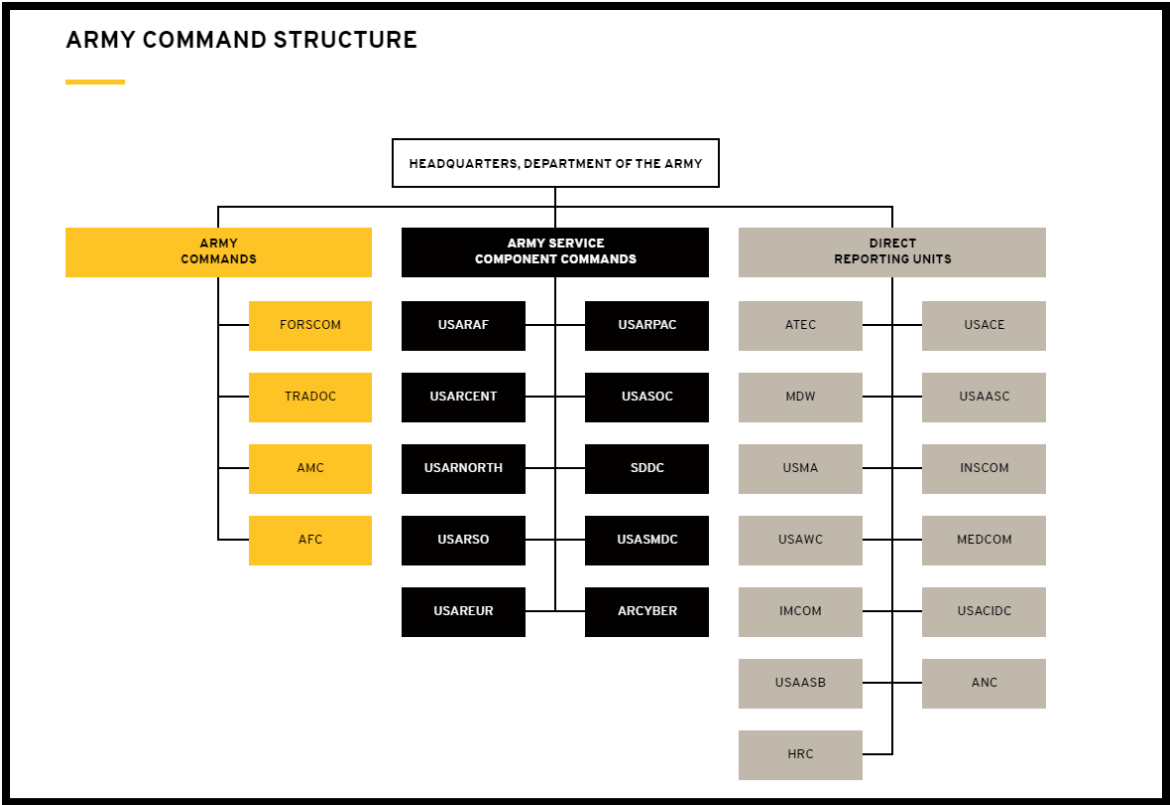
ASA(IE&E) falls under the Secretariat of the Army and is responsible for oversight of the Army footprint.

Figure 6. ASA(IE&E). Source: Office of the Administrative Assistant to the Secretary of the Army (2017).



The OASCIM reports infrastructure related information to ASA(IE&E) and compiles requests for both R&M and MILCON for annual POM builds.

Figure 7. OASCIM Organizational Chart. Source: Assistant Chief of Staff for Installation Management (ACSIM) (2016).



The Army Command Structure consists of Major Commands, Service Component Commands, and Direct Reporting Units

Figure 8. IMCOM and AMC within the Army Command Structure. Source: Department of the Army (n.d.).

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APPENDIX B. DEFINITIONS

[BASOPS]—Base Operations Support: Base operations are those common-service support functions listed in chapter 5, section XII, AR37–100–XX, Army Management Structure (AMS), regardless of the appropriation or fund account from which they are financed. (U.S. Army Installations, Energy, and Environment, 2016, p. 30)

BRAC—Base Realignment and Closure: BRAC is a process used within DoD to reorganize its installation infrastructure to more efficiently and effectively support its force structure. It utilizes an independent Commission established by Public Law 101-510 as amended, which evaluates DoD recommendations for realignment and closure of bases and whose final recommendations become law. (U.S. Army Installations, Energy, and Environment, 2016, p. 30)

FIS—Facility Investment Strategy: The Army’s effort to efficiently sustain, dispose of, improve the quality of, and buildout critical shortfall of facilities throughout the Army. FIS is the Army’s enterprise approach across the Active and Reserve components, and establishes guidelines to assist commanders and planners to “right size” installations’ facilities. (U.S. Army Installations, Energy, and Environment, 2016, p. 30)

FSM—Facility Sustainment Model. The Sustainment Model programs support for critical worldwide operations, activities and initiatives necessary to maintain (sustain) the Army’s facilities; to meet the full range of tasks necessary to provide relevant and ready land power for this Nation. (U.S. Army Installations, Energy, and Environment, 2016, p. 30)

Installations Strategy 2025—This provides a holistic strategy for the future by incorporating the Army’s Facility Investment Strategy (FIS) and other policies and programs to support the Army’s critical mission requirements. This strategy aligns to overarching National, Department of Defense, and Army strategies, and is intended to guide and shape current and future program actions at all levels within the Army. (U.S. Army Installations, Energy, and Environment, 2016, p. 30)

Military Construction—Any construction, development, conversion, or extension of any kind carried out with respect to a military installation under the provisions of the Military Construction Codification Act (see 10 USC 2801). (U.S. Army Installations, Energy, and Environment, 2016, p. 31)

Mission Project—Supports unique or single tenant needs, and typically serve a smaller population than BASOPS facility projects. AMC is the proponent for Industrial Base mission projects. See AR 4210-1 pg 204 for additional info and examples. (Johnson, 2017b, p. 22)

Modernization—The alteration or replacement of facilities solely to implement new or higher standards, to accommodate new functions, or to replace building components that

typically last more than 50 years (such as, the framework or foundation). (Department of the Army, 2010, p. 3)

New Footprint Project—Project that constructs a new facility, or adds to an existing facility, without demolishing equal SF of an existing facility. New footprint construction results in a SF growth of the installation’s real property inventory. (Johnson, 2017b, p. 22)

Optimize Infrastructure—The ability to assess an organization’s infrastructure across capabilities using various tools and models. The Army’s current Analytical Process includes: Capacity Analysis, Military/Economic Value Analysis, and Scenario Development. (U.S. Army Installations, Energy, and Environment, 2016, p. 31)

Recapitalization—The major renovation or reconstruction activities (including facility replacements) needed to keep existing facilities modern and relevant in an environment of changing standards and missions. Recapitalization extends the service life of facilities or restores lost service life. It includes restoration and modernization of existing facilities. Recapitalization encompasses both renovation and replacement of existing facilities and essentially resets the Army’s sixty-five year life-cycle period for the facility. (Department of the Army, 2010, p. 3)

Restoration—The restoration of real property to such a condition that it may be used for its designated purpose. Restoration includes repair or replacement work to restore facilities damaged by inadequate sustainment, excessive age, natural disaster, fire, accident, or other causes. (Department of the Army, 2010, p. 3)

RPMP—Real Property Master Plan: The installation blueprint for real property development and real estate actions. (U.S. Army Installations, Energy, and Environment, 2016, p. 31)

Strategy (IE&E) 2025—Office of the Assistant Secretary of the Army for Installations, Energy & Environment December 2016 document that provides the foundation and vision to pro-actively support the Army as it transitions, adapts, and improves to meet the demands of the future. (U.S. Army Installations, Energy, and Environment, 2016, p. 31)

LIST OF REFERENCES

- Army Materiel Command. (2015, June). *Reduce Installation Facility Footprint(OPERATIONS ORDER 15-215)*. Redstone Arsenal, AL: Author.
- Army Materiel Command. (2017, Jan). AMC fact sheet. Retrieved from <https://www.amc.army.mil/amc/Fact%20sheets/HQAMCFactSheet.pdf>
- Army Materiel Command G3/4 – Facilities Division. (2016). *HQAMC Sustainment, Restoration and Modernization (SRM) Solutions*. Redstone Arsenal, AL: Author.
- Army Materiel Command G-3/4. (2017, April 21). *Memorandum: RM Project Request. Request for Restoration and Modernization (R&M) OMA Projects and MSC I-n List*. Redstone Arsenal, AL: Publisher.
- Assistant Chief of Staff for Installation Management (ACSIM). (2016, July 11). Organization chart. Retrieved from <http://www.acsim.army.mil/assets/docs/ORGPHONEROSTER.pdf>
- Assistant Chief of Staff for Installation Management (ACSIM). (n.d.). ACSIM brochure. Retrieved February 16, 2018, from <http://www.acsim.army.mil/assets/docs/OACSMBrochureUpdatedV6.pdf>
- Assistant Secretary of the Army (Installations, Energy and Environment). (n.d.). ASA(IE&E) resources. Retrieved February 16, 2018, from <https://www.army.mil/asaiee#org-resources>
- Congressional Budget Office. (2017). *Trends in spending by the Department of Defense for operation and maintenance*. Retrieved from www.cbo.gov/publication/52156
- Department of Defense. (n.d.). *Base structure report - Fiscal year 2015 baseline: A summary of the real property inventory*. Retrieved February 16, 2018, from <http://www.acq.osd.mil/eie/Downloads/BSI/Base%20Structure%20Report%20FY15.pdf>
- Department of Defense. (2013, January 25). *The Planning, Programming, Budgeting, and Execution (PPBE) process* (DoD Directive 7045.14). Washington, DC: Author. Retrieved from <http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/704514p.pdf>
- Department of the Army. (2005, May 16). *Real property master planning for installations* (Army Regulation 210-20). Washington, DC: Author. Retrieved from http://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/r210_20.pdf

- Department of the Army. (2009, April 2). Army Military Construction and Nonappropriated - Funded construction program development and execution (Department of the Army Pamphlet 420-1-2). Retrieved from http://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/PAM%20420-1-2.pdf
- Department of the Army. (2010). Facilities Engineering Project definition and work classification (Department of the Army Pamphlet 420-11). Retrieved from http://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/p420_11.pdf
- Department of the Army. (2012, August 24). *Army Facilities Management* (Army Regulation 420-1). Retrieved from http://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/r420_1.pdf
- Department of the Army. (2015, March). *Reduce the installation facility footprint* (HQDA EXORD 164-15). Washington, DC: Author.
- Department of the Army. (n.d.). Organization - Who we are. Retrieved February 16, 2018, from <https://www.army.mil/info/organization/>
- Johnson, J. P. (2015, May 28). *AMC MCA POM 18-22 Schedule*. [Working paper]. Retrieved from Army Materiel Command G-3/4.
- Johnson, J. P. (2016, November). *AMC MCA POM 19-23 IPT Version 15 Nov 16. U.S. Army AMC*. [Working paper]. Retrieved from Army Materiel Command G-3/4.
- Johnson, J. P. (2017a). *AMC MCA Prioritization algorithm, 2017 Update V2 Draft Pre-Decisional*. [Working paper]. Retrieved from Army Materiel Command G-3/4.
- Johnson, J. P. (2017b, January). *U.S. Army Materiel Command Program Guide for Military Construction, Initial Guidance for POM 20-24 Using 2016 FIG*. [Working paper]. Retrieved from Army Materiel Command G-3/4.
- Joint Staff. (2016, January 06). *Joint engineer operations* (Joint Publication 3-34). Retrieved from http://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_34.pdf
- Little, A. (2018). Installation status report - Infrastructure, FY18 training. Retrieved from FY18 ISR-I Webinar Training Slides: https://isr.hqda.pentagon.mil/Download/Webfiles/isrdocs/2018/Training/FY18_ISR-I%20201%20Training%20Slides%20Oct17.pdf
- Office of the Administrative Assistant to the Secretary of the Army. (2017). Headquarters, Department of the Army organization chart. Retrieved from OAA: <http://www.oaa.army.mil/hqda.aspx>
- Redstone Public Affairs Officer (PAO). (2017). APSL. Retrieved from U.S. Army TMDE Activity (USATA): <https://tmdehome.redstone.army.mil/directorates.asp>

- Stewart, A. (2016, Nov 15). *AMC Implementation of Facility Investment Strategy, FY19-23 POM*. [Working paper]. Retrieved from Army Materiel Command G-3/4.
- U.S. Government Accountability Office. (2017). *High-risk series: Progress on many high-risk areas, while substantial efforts needed on others*. Retrieved from <http://www.gao.gov/assets/690/682765.pdf>
- U.S. Army Installations, Energy, and Environment. (2016). *Army installations 2025*. Retrieved from <https://www.army.mil/e2/c/downloads/454188.pdf>
- Yates, Laura. (2016, October). *Installation status report - FY18 ISR 101 introductory training*. Retrieved from <https://isr.hqda.pentagon.mil/Download/Webfiles/isrdocs/2017/Training/FY17%20ISR%20101%20Introductory%20Training%20Slides.pdf>

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