A Report by a Panel of the
NATIONAL ACADEMY OF PUBLIC ADMINISTRATION
for the National Park Service

Assessment and Analysis of the National Park Service Construction Program

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Assessment and Analysis of the National Park Service Construction Program

PANEL

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The views expressed in this report are those of the panel. They do not necessarily reflect the views of the Academy as an institution.

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Foreword

For over a century, the National Park Service (NPS) has built, operated, and maintained the Nation's National Park System, including the myriad rich trove of natural, historical, and cultural resources to be discovered within them. Over that same time, the Service's approach to constructing and renovating the multitude of physical assets has varied. Today, major NPS design and construction planning and management tasks are the focus of a team located in its Denver Service Center.

The NPS contracted with the National Academy of Public Administration (the Academy) to perform an assessment of the Denver Service Center Design and Construction Program pertaining to its largest projects appropriated by Congress. This assessment by an Academy Panel, serves to enhance program performance by identifying opportunities to improve efficiency and better utilize modern management practices.

As a congressionally chartered, independent, non-partisan, and non-profit organization with over 900 distinguished Fellows, the Academy has a unique ability to bring nationally-recognized public administration experts together to help government agencies address challenges. We greatly appreciate the constructive engagement of NPS employees as well as many other individuals who provided important observations and context to inform this report.

I am deeply appreciative of the work of five Academy Fellows and one additional subject matter expert in the design and construction industry who served on this Panel. I also commend the Academy Study Team that contributed valuable insights and expertise throughout the project.

Given both the importance and complexity of the National Park System, I trust that this report will be useful to the NPS as it considers how to shape and implement changes needed to accomplish a vital design and construction mission.

Teresa W. Gerton
President and Chief Executive Officer
National Academy of Public Administration

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Acronyms and Abbreviations

A/E	Architecture & Engineering
ABAAS	Architectural Barriers Act Accessibility Standard
Academy	National Academy of Public Administration
ADA	Americans with Disabilities Act
ADAB	Automated Development Advisory Board
Caltrans	California Department of Transportation
CAP	Capital Asset Plan
CIBL	Capital Improvement Business Line
CM/GC	Construction Manager/ General Contractor
CMAR	Construction-Manager-at-Risk
CPMD	Construction Program Management Division
D&C	Design and Construction
DAB	Development Advisory Board
DB	Design-Build
DBB	Design-Bid-Build
DOI	Department of the Interior
DSC	Denver Service Center
ECI	Early Contractor Involvement
eCPIC	Electronic Capital Planning Investment Control
FAR	Federal Acquisition Regulation
FTE	Full Time Employment
GAO	Government Accountability Office
GMP	Guaranteed Maximum Price
GSA	General Services Administration
HR	Human Resources
HVAC	Heating, Ventilation, and Air Conditioning
IDIQ	Indefinite Delivery Indefinite Quantity
IGE	Independent Government Estimate
IPD	Integrated Project Delivery
IRB	Investment Review Board
IT	Information Technology
LIC	Line-Item Construction
MATOC	Multiple Award Task Order Contract
MS Project	Microsoft Project
NAVFAC	Naval Facilities Engineering Command
NPS	National Park Service
O&M	Operating and Maintenance
PDC	Park Direct Charge
PDCA	Plan-Do-Check-Adjust
PM	Project Manager
PMIS/FMSS	Project Management Information System / Facility Management Software System
PSA	Project Scoping Assessment
QA/QC	Quality Assurance/Quality Control
RFQ/RFP	Request for Qualifications/Request for Proposals
S/CVR	Scope and Cost Validation Report

SME	Subject Matter Expert
SOW	Statement of Work
SP	Spending Plan
USACE	United States Army Corps of Engineers
VRF	Variable Refrigerant Flow
WASO	Washington D.C. Area Support Office

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Executive Summary

The National Park Service (NPS, or "the Service") administers a widely diverse and geographically distributed network of 419 sites, ranging from urban parks to the vast parks of the West, to numerous historic dwellings, museums, battlefields, and monuments. This expansive system has experienced sustained growth in holdings and visitation since its founding. Continuing increases in the number of sites and visitors has required expansion of the NPS facilities and infrastructure for both park visitors and NPS staff members. In addition, NPS's deferred maintenance backlog has increased to $11.92 billion as of September 30, 2018, and continues to grow as existing infrastructure continues to age. Congressional interest is currently directed at both increasing NPS design and construction (D&C) appropriations and ensuring the most effective use of funding. At the time of writing, S.3422 "Great American Outdoors Act" has passed the Senate and been transmitted to the House. The bill, among other things, would direct over $1 billion, annually, over the course of five years for NPS deferred maintenance and construction.

The NPS contracted with the National Academy of Public Administration (the Academy) to conduct an independent assessment of the Denver Service Center (DSC) and its execution of the Line-Item Construction (LIC) program. The Academy appointed an expert Panel of five Academy Fellows and one subject matter expert to oversee a professional study team while conducting the review.

This Academy review of the NPS construction program builds on previous Academy reports in 1998[1] and 2002.[2] Unlike the previous Academy reviews, this review was not driven by significant cost overruns nor sought to fundamentally restructure DSC operations. In this report, the Panel urges NPS to take further important steps toward the future, implementing and building on the practices and behaviors consistent with modern construction programs. To that end, the Panel identified several opportunities to streamline burdensome processes, build missing capabilities, and strengthen accountability and ownership for outcomes. The Panel believes that this is an important opportunity for NPS to refresh its construction program for the next decade. To that end, the Panel recommends thirteen actions, addressed to both DSC and NPS, to improve overall project delivery. The recommendations in this report represent good practice and should be considered across all projects delivered by DSC and NPS. The Panel also notes that there are potentially significant issues related to NPS priority-setting and management of non-LIC projects, but emphasizes that these issues are outside of this project's scope, as agreed with NPS staff members.

This report's recommendations and accompanying analysis reflect the following five good practice themes.

1. A qualified construction professional is accountable for the development and delivery of a project.

[1] "*Strengthening the National Park Service Construction Program*," National Academy of Public Administration, (1998).

[2] "*A Review of the National Park Service Implementation of the Reforms Recommended in a 1998 Academy Report,"* National Academy of Public Administration, (2002).

2. The program builds the internal expertise needed to effectively manage and deliver projects.
3. The program proactively identifies, gathers, validates, and uses data to make informed decisions about cost and schedule.
4. The program strikes a balance between competition in bidding and the early injection of expertise into the project lifecycle.
5. The program pursues continuous improvement in all areas of operations.

The following 13 recommendations are connected with ten findings from the assessment of the LIC program, and are numbered consistent with the chapters in which they appear. Thus Recommendation 3.1 is discussed in Chapter 3, and is the first recommendation in the chapter.

Finding 1. There is diffuse ownership and accountability for line-item construction projects. Ownership and accountability for the development and delivery of LIC projects is hindered by the lack of clear responsibility and authority for LIC projects. Responsibility and authority is fragmented between the park superintendent, DSC, regional offices, Construction Program Management Division (CPMD), and Washington D.C. Area Support Office (WASO). In addition, obligation rates are an important performance measure for the LIC program, but have little to do with the success of LIC project delivery. The Panel finds that a narrow focus on obligation rates can inhibit successful project outcomes by prioritizing rapid awards, instead of alignment and agreement on scope, cost, budget, and schedule.

Recommendation 3.1: To strengthen ownership and accountability within the LIC program, NPS should clearly assign responsibility and corresponding authority for project development and delivery to appropriate individuals in order to enhance the accountability framework. Specifically:

- The park superintendent should be assigned responsibility for defining the initial need, in collaboration with regional LIC coordinators and informed by planning documents such as the General Management Plan and the Strategic Facility Investment Plans (SFIP).
- An NPS design and construction professional, either from DSC or elsewhere in NPS, should be assigned responsibility for assessing the scope and cost of the need defined by the park superintendent, before the project is funded.
- A DSC design and construction professional should be assigned responsibility for effective and efficient project delivery on behalf of the park and region, once the scope, cost, and schedule baseline is established. This role is ideally held by a single individual, but in the event of a change, the owner (likely the superintendent) is responsible for promptly reassigning the stewardship role and assuring continuity.

In this process, the Panel urges the Service to operate in an accountability framework that establishes a "steward" to enhance project delivery and work with the project "owner," typically the Superintendent. Specifically, DSC should combine its current customer-orientation with clear responsibility and authority to serve as a "steward" of project resources during project delivery.

A steward is not the "owner" of the resources, but has been given authority to manage them for the pre-approved, defined outcome. While the steward has the responsibility to deliver the promise and purpose of the resources that have been given, this individual is not empowered to change the defined outcome without express approval of the "owner" of the resources. The steward is

responsible for the execution and outcome of the expressed purpose of these resources. The steward's responsibilities should be aimed at the three common project metrics of cost, quality, and schedule. Achieving these metrics should be the primary measure of success for NPS, rather than the simple measure of obligation rate.

It is best if this steward can be engaged from the earliest concept stage through completion of a project to maintain consistency of knowledge. In reality, it is likely this role will change as the project moves from the pre-funding phase to post-funding phase. The steward role is in contrast with the roles of consultants or technical advisors who primarily focuses on their area of expertise, instead of the big picture of project delivery. The steward role supports the project owner, who retains the responsibility for resource decisions. The steward is the key advocate for the "Project," not for any individual stakeholder. It is critical that the steward articulate the agreed upon outcomes for the specific allocated resources and defend those even to the highest authority in the "owner" organization.

Finding 2. NPS has insufficient professional project development and cost estimating capacity. NPS has insufficient and varied professional project development and cost estimating expertise at all levels of the organization (i.e. parks, regions, and DSC). Other federal construction programs have entire teams or offices dedicated to cost estimating for construction. The entire Service has fewer than ten employees with professional cost estimating expertise. None of these employees are full-time cost estimators for NPS.

Recommendation 4.1: NPS should build a professional cost estimating unit at DSC with a primary focus on LIC projects, but not limited to LIC, and take steps to ensure close integration between this unit, regional staff, and CPMD's project development and analytics efforts.

Professional cost estimators who are NPS employees should be involved throughout a project's lifecycle, including project development, design, and construction. A central cadre of estimators at DSC provides an opportunity to improve Service-wide consistency of estimating efforts, to build deep expertise in the unique aspects of NPS projects, and better consolidation, management, and utilization of NPS cost data. A key function of this cost estimating unit should be the management, gathering, and preservation of data for cost estimation.

Finding 3. Several NPS and DSC processes constrain efficient and effective project execution. There are many opportunities to streamline processes within DSC and NPS that constrain efficient and effective project execution. Three key processes of particular concern are: construction modification and fund request process; Service-wide Development Advisory Board (DAB) review; and DSC quality assurance review process.

Recommendation 4.2: DSC should review its processes using collaborative process improvement methodologies to identify opportunities to improve project delivery. This review should focus on three processes in particular—construction modification and fund request process; Service-wide DAB review; and quality assurance review process. Each of these processes is addressed in the following three, more specific, recommendations:

Recommendation 4.3: DSC and CPMD should follow a two-part solution to the construction modification and fund request process. The Panel notes that this solution is not entirely within DSC's control and that NPS leadership must also agree to act in order to achieve the intended outcomes of this recommendation.

1) NPS should continue process improvement efforts started with Project Revamp by establishing a team to improve the post-award contract processes, specifically the construction modification and fund request process. The Panel identifies the construction modification process as an "anchor" process, that if resolved, will demonstrably increase the efficiency of DSC project teams and can expedite project timelines.
2) NPS should make available some portion of LIC project construction contingency funds for immediate access by DSC, so that the warranted contracting officer can rapidly execute change orders and construction modifications within certain parameters.

Recommendation 4.4: The Service-wide DAB should continue its efforts to take a more strategic approach by focusing on its investment review role. As part of these reform efforts, the review by the Service-wide DAB should be moved to occur earlier in the process so that the DAB can take a more meaningful strategic investment and prioritization approach.

Recommendation 4.5: DSC should adopt Recommendation #4 in the Wheeler Report to improve integration between the Quality Assurance (QA) group and the project teams. As part of implementing Recommendation #4 from the Wheeler Report[3] and more fully engaging the QA group, DSC should expand the role of QA's technical experts. The current 13 technical experts in the QA group should be integrated into the project team and involved early in the project so that they can play a more constructive role, identifying innovations in design across the LIC project portfolio, and championing improvements to resolve process deficiencies.

Finding 4. Duplicative and siloed information technology (IT) systems constrain effective and efficient LIC project execution.

DSC project teams deliver projects within a patchwork of duplicative and siloed IT systems, including Microsoft (MS) Project, Panorama, Automated DAB (ADAB), Electronic Capital Planning Investment Control (eCPIC), and Project Management Information System / Facility Management Software System (PMIS / FMSS). These many systems constrain management line of sight into precise details of project performance, hamper the project team's ability to manage and control project costs, and waste valuable project management time.

Recommendation 4.6: DSC and NPS should follow a two-stage approach to reduce administrative burden caused by a disparate set of technology tools and siloed data, and improve the use of technology in the LIC program by DSC and others.

[3] *A Review of the Denver Service Center Design and Construction Program,* by Matthew J. Wheeler.

- **Phase 1**: DSC, CPMD, and NPS should review existing systems, submittals, and reporting requirements for DSC project teams. The review, for each data field and requirement, should ask, "*How is this field or requirement used? Is it still useful or serving its intended purpose?*"
    - For fields or requirements that are still useful and serving their intended purpose, the field and requirement should be clearly defined and understood by those responsible for completing and fulfilling it.
    - As part of these reviews, NPS and DSC should assess what additional data should be collected and analyzed in order to support cost estimating capabilities.
- **Phase 2**: DSC, CPMD, and NPS should identify opportunities to consolidate systems, submittals, and reporting requirements.
    - As part of consolidating, NPS should identify and exploit opportunities to eliminate data siloes across the LIC program and organization.
    - NPS should use the services of GSA's 18F for digitizing processes, substantially streamlining existing IT infrastructure, and procuring or building new IT infrastructure.

As part of these reviews, NPS and DSC should assess what additional data should be collected and analyzed in order to support cost estimating capabilities and other programmatic decision-making. In addition, NPS should reduce duplicative data entry, striving toward a goal of one-time data entry that is shared among systems.

Finding 5. DSC could enhance use of standardized designs in their design process.
NPS has developed models for some asset types that predict total square footage based on different inputs. It is also considering the use of pre-engineered products for frequent project components such as garages and comfort stations; and it has used modular, prefabricated units for employee housing. But, the majority of NPS projects do not involve the first three layers of standardization mentioned above.

The appropriate level of standardization is determined on the basis of a number of factors. The most important factors are the applicability of standardization for the category of facilities under consideration, the costs to achieve and maintain the level of standardization, and the benefits that can be expected from the level of standardization being considered. Using the above factors, the Panel finds that the application of standardized design approaches is constrained by the fact that most projects are rehabilitation and restoration of existing assets, instead of replacement or new construction.

Recommendation 4.7: NPS should pursue greater standardization of design where they have a critical mass of replacement or new construction projects on suitable specific asset types.

Finding 6. DSC rarely uses collaborative delivery methods, relying predominantly on Design-Bid-Build.

DSC rarely uses collaborative project delivery methods, but primarily relies on the Design-Bid-Build approach. The overriding goal for DSC should be to increase collaboration by the early use of external expertise (designer, contractors, and sub-contractors) in the delivery process, in order to improve predictability and enhance cost-based decisions.

Recommendation 5.1: DSC should begin with piloting the use of collaborative project delivery methods with a subset of projects, for which they have robust historical data to compare performance to and measure improvements in delivery.

Finding 7. DSC needs to strengthen fundamental project management skills.

Many DSC project managers lack robust training and experience in fundamental construction project management skills, such as cost estimating, negotiating, scheduling, change management (both technical and philosophical change), collaborative problem-solving, and team leadership.

Recommendation 6.1: DSC should strengthen fundamental project management skills, to include cost estimating, scheduling, negotiating, collaborative problem solving, change management, and team leadership.

Finding 8. DSC provides very limited flexibility for DSC project teams to use their professional discretion in project execution.

DSC follows a rigid and prescriptive process for LIC projects that can impose a significant overhead burden. As processes are streamlined and project management skills enhanced, there will be the opportunity to accelerate projects by providing flexibilities to DSC project teams.

Recommendation 6.2: DSC should incorporate greater flexibility into the DSC process for LIC and empower project teams to make greater use of their professional decision-making throughout project execution.

Finding 9. DSC reliance on third-party construction management firms may not be appropriate for all projects.

The 1998 Academy report recommended that DSC transition away from using DSC employees for on-site construction management (CM) and supervision services and instead contract with the private sector for construction management services. DSC has fully embraced this approach and no longer performs any on-site construction management with DSC employees. DSC's reliance on third-party CM firms for on-site construction management may not be appropriate for all projects, such as projects that are unusually complex and where a familiarity with park circumstances is especially important. That said, on-site construction management is needed in some form, regardless of approach for procuring or providing CM services.

Recommendation 6.3: DSC should review its approach and methodology for on-site construction management and consider alternate approaches. The review should also consider different thresholds for providing on-site construction management related to the complexity of the project and the importance of familiarity with park circumstances.

Finding 10. DSC's business model contributes to a mismatch between workload and funding to support project management.

DSC's responsibilities and workload have fluctuated over time, but its Operations appropriation, which supports project management for LIC, has remained relatively constant. In fact, there is minimal connection between base funding and fluctuations in workload, and DSC staff members do not track project management costs for each LIC project. This mismatch is largely driven by DSC's business model, which differs from other government construction programs by using base funding to fund project management activities for LIC.

Recommendation 6.4: In order to improve their resourcing, DSC should follow a three-part solution:

1) The DSC Operations appropriation request should be clearly connected to the LIC appropriation request, assuming improved tracking of real project management costs for LIC.
2) In order for NPS, Department of the Interior (DOI), Office of Management and Budget (OMB), and Congress to accurately adjust the DSC Operations appropriation, DSC needs to improve their tracking and analysis of real project management costs for LIC to inform and predict staffing and associated cost per project.
3) In order to improve project analytics at DSC and NPS, DSC will need to invest in their IT infrastructure. DSC does not have dedicated funding for this purpose. IT funding should be made available to implement Recommendation 4.6, in particular Stage 2 of that recommendation.

Conclusion

Successful implementation of these 13 recommendations requires concerted leadership by NPS and DSC. In addition, the DSC will need to further embrace an organizational culture of continuous improvement. Sustained leadership and a diligent focus on improvement will be necessary to implement the report's recommendations, foster successful program performance in the future, and provide the basis for any future expansion in capital investment.

Chapter 1: Background and Overview

Since its creation in 1916, NPS has successfully carried out its primary role of preserving and enhancing the Nation's historic treasures and natural wonders for the enjoyment of the American people and visitors from around the world. The Service administers a widely diverse system, composed of 419 sites ranging from urban parks to the vast wildland parks of the West, to numerous historic dwellings, museums, battlefields, and monuments. This system has experienced sustained growth in holdings and visitation since its founding.[4] The continuing increase in the number of sites and visitors has required expansion of the NPS facilities and infrastructure for both park visitors and NPS staff. The amount of deferred maintenance on NPS assets[5] has risen to $11.92 billion as of September 30, 2018[6] and continues to grow as existing infrastructure continues to age. Congressional interest is now directed at both increasing NPS D&C appropriations and ensuring the most effective use of funding. At the time of writing, S.3422 "Great American Outdoors Act" has passed the Senate and been transmitted to the House. The bill, among other things, would direct over $1 billion, annually, over the course of five years for NPS deferred maintenance and construction.[7]

At the request of NPS, the Academy prepared this assessment of the DSC D&C program. The NPS requested an independent assessment of its D&C program with the goal to enhance its efforts to optimize efficiency and to use best management practices. The Academy appointed a Panel of six members (composed of five Academy Fellows and one highly experienced non-Fellow) to oversee the work of a professional study team to provide guidance on key issues, and review and approve study team products (see Appendix A for Panel and project study team biographical information).

This report is designed to support NPS efforts to adopt industry standards in its D&C program. The initiative underscores NPS's goal to employ industry best practices to deliver high-quality projects, appropriate to the NPS mission as cost-effectively as possible, such that the Department of the Interior, Congress, and the nation can be confident that the NPS D&C program accomplishes its mission as efficiently and effectively as possible. For this report, NPS directed the Panel to focus specifically on DSC's execution of the LIC program. The Panel notes that there may be potentially significant issues related to NPS priority-setting and non-LIC projects, but emphasizes that these issues were outside of this project's scope as agreed to with NPS staff. For that reason, this report does not address other projects executed by DSC, including transportation, philanthropic, and park-

[4] "Visitation Numbers", U.S. National Park Service, Accessed March 26, 2020 https://www.nps.gov/aboutus/visitation-numbers.htm

[5] "An asset is real property that the NPS tracks and manages as a distinct, identifiable entity. These entities may be physical structures or groupings of structures; landscapes; or other tangible properties that have a specific service or function, such as a farm, cemetery, campground, marina, or sewage treatment plant." "Infrastructure", Accessed March 26, https://www.nps.gov/subjects/infrastructure/identifying-reporting-deferred-maintenance.htm

[6] "What is Deferred Maintenance?", NPS, Accessed February 24, 2020 https://www.nps.gov/subjects/infrastructure/deferred-maintenance.htm

[7] "S.3422 Great American Outdoors Act", Congress, Accessed March 25, 2020, https://www.congress.gov/bill/116th-congress/senate-bill/3422

funded projects. Despite this report's specific focus on LIC, the Panel advises DSC to consider how this report's recommendations might apply to all DSC projects.

The Academy's assessment has four main scope questions:

1. Are D&C costs in line with those of comparable projects undertaken by private and public sector companies or agencies?
2. Is DSC appropriately resourced to carry out its mission?
3. Are DSC D&C processes and contracting methods aligned with industry standards and processes used by other government agencies?
4. Is DSC employing the best management practices to deliver high-quality projects, appropriate to the NPS mission, as cost effectively as possible?

Previous Academy Reports on the NPS Construction Program

The Academy previously conducted two studies of the NPS D&C program. The first of these studies, in 1998, set forth 11 findings and recommendations to improve the efficiency of the program. The second study, in 2002, assessed NPS progress in implementing the recommendations from the 1998 report and found that substantial progress had been made. The findings from 1998 and 2002 are aggregated in Appendix B.

Study Approach and Methodology

The study team performed primary and secondary data collection and conducted structured interviews with federal and state officials, as well as stakeholders. It conducted interviews with over 100 stakeholders (see Appendix C for a full list of interviewees), including the following groups:

- Congress
- U.S. Office of Management and Budget
- Denver Service Center
- National Park Service Regions, Parks, and Headquarters
- U.S. Department of the Interior
- Architecture and Engineering Firms
- Benchmark Agencies: Government Accountability Office (GAO), General Services Administration (GSA), Naval Facilities Engineering Command (NAVFAC), United States Army Corps of Engineers (USACE), Parks Canada
- Industry Experts

The study team also reviewed NPS policy and program documents, analyzed line-item construction project data, and performed comparisons of NPS cost data to other benchmark sources.

Organization of the Report

In addition to this chapter, the report contains the following chapters:

- **Chapter 2: The National Park Service's Line-Item Construction Program –** describes the LIC project life cycle and the roles played by the parks, regions, DSC, and CPMD.
- **Chapter 3: Factors Affecting Line-Item Construction Costs at NPS** – highlights constraints on controlling LIC costs by discussing factors affecting project costs at NPS, addresses ownership and accountability of LIC project development and delivery, and closes with a review of organizational factors that are within the control of DSC or NPS to address.
- **Chapter 4: Building Estimating Capability, Streamlining Processes, Using Modern Enterprise Management Systems, and Opportunities to Use Standardized Designs** – evaluates three systemic, organizational issues impacting project outcomes at DSC and NPS and assesses opportunities to use standardized designs.
- **Chapter 5: Understanding and Implementing Alternative Project Delivery Methods** – provides a general framework for understanding project delivery and the different methods; a current-state assessment of project delivery at DSC and the related challenges.
- **Chapter 6: Building Capacity and Capability at DSC for Improved Project Management** – explores ways to enhance the expertise and project management skillsets at DSC, expand flexibility for project teams to use their professional discretion, and assess whether DSC is resourced appropriately to fund its project management efforts.

Chapter 2: The National Park Service's Line-Item Construction Program

This chapter provides important context and background information for this report. The following sections summarize the LIC program, the various funding models related to the program, the LIC project portfolio, and the related budget/construction sequence. The chapter also provides a high-level overview of the LIC program including DSC and CPMD, and their roles and responsibilities throughout the project lifecycle. Finally, the chapter briefly discusses ongoing changes to NPS operations.

The NPS LIC appropriation supports major facility and infrastructure development within the NPS, including new construction and rehabilitation/renovation of existing assets. A construction project estimated to cost more than $1.5 million net construction[8] is usually approved as a line-item, by the Congress, and is funded by the line-item appropriation. This line-item account is the primary funding source for these major projects, which include utilities, visitor centers, waste water treatment facilities, historical monuments and other infrastructure. The planning and design that support the LIC program is funded by the Construction Planning account, which is described in the following section. The focus of this study, as previously noted, is on DSC's execution of the LIC program. However, we also briefly address DSC's responsibilities for executing projects in other NPS construction programs (e.g., Park-Direct Charge projects) in this chapter.

Decentralized Organizational Structure and Centralized Project Execution

Execution of the Service-wide construction program reflects the highly decentralized structure of NPS. Parks are responsible for developing the business case for potential LIC projects, scoping and estimating the cost of those projects and preparing the project documentation for review and approval by the Regional Investment Review Board (RIRB). The regions are responsible for submitting a record of RIRB-approved projects into the Service-wide PMIS. Regions also assist parks in business case development, scoping and cost estimation, and the review of PMIS submissions to ensure they are consistent with Park Service guidance and are responsive to Service-wide investment priorities. DSC provides technical planning, project management and project tracking and reporting to CPMD. CPMD is responsible for preparing and providing guidance on investment priorities and requirements for project scope, cost estimation and justification. CPMD also is responsible for validating and prioritizing project proposals included in the Service-wide LIC program and for determining the appropriate allocation of funds appropriated for the construction program. Figure 1 below provides a high-level overview of the LIC project life cycle. Appendix D provides additional detail on the respective roles of parks, regions, DSC, and CPMD across the project life cycle.

[8] At DSC, "net construction" = gross construction cost minus (construction contingency + construction supervision).

Figure 1, *Overview of LIC Project Lifecycle*

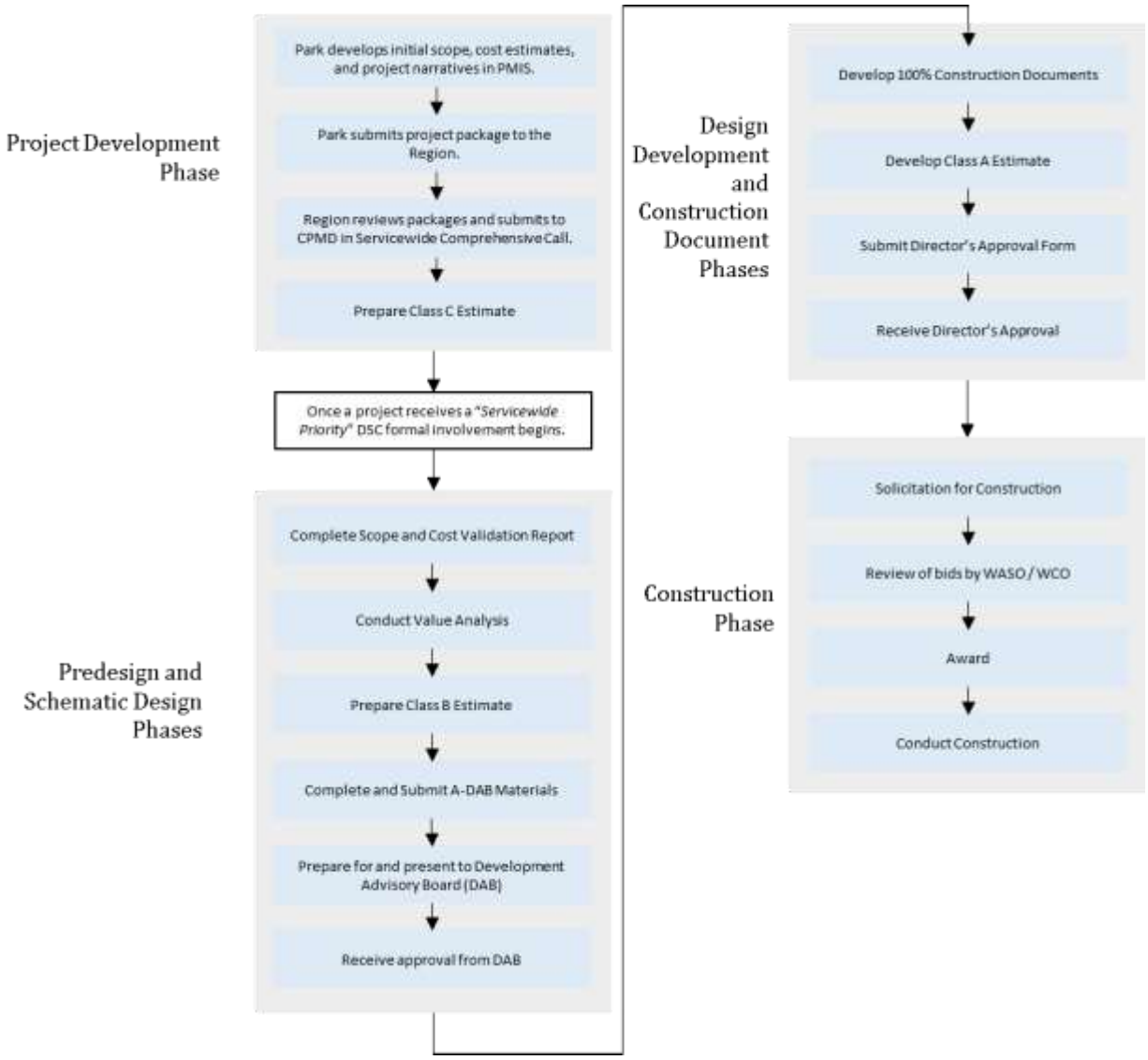

Figure 1. Overview of LIC Project Lifecycle (Source: National Academy of Public Administration)

Construction Program Funding

The construction program is funded through a distinct appropriation in the NPS budget. The appropriation contains five major activity accounts:

1) *Line-Item Construction*. As the largest account in the overall construction appropriation, it identifies specific projects by park and provides funds for construction, supervision, and contingency. This is a no-year appropriation, remaining available until expended. Over the last five years, this FY appropriation for the account has risen to nearly $300 million, after steadily declining since the early 2000s. In recent years, a substantial portion (over $100 million) of the line-item amount was added by Congress and was not requested by the Administration. Appropriations significantly departed from the requested budget beginning in 2018. After decreasing slightly in 2019, appropriations increased again into 2020. The

funding increase is, in part, an effort by Congress to help NPS begin working down its $11 billion maintenance backlog.

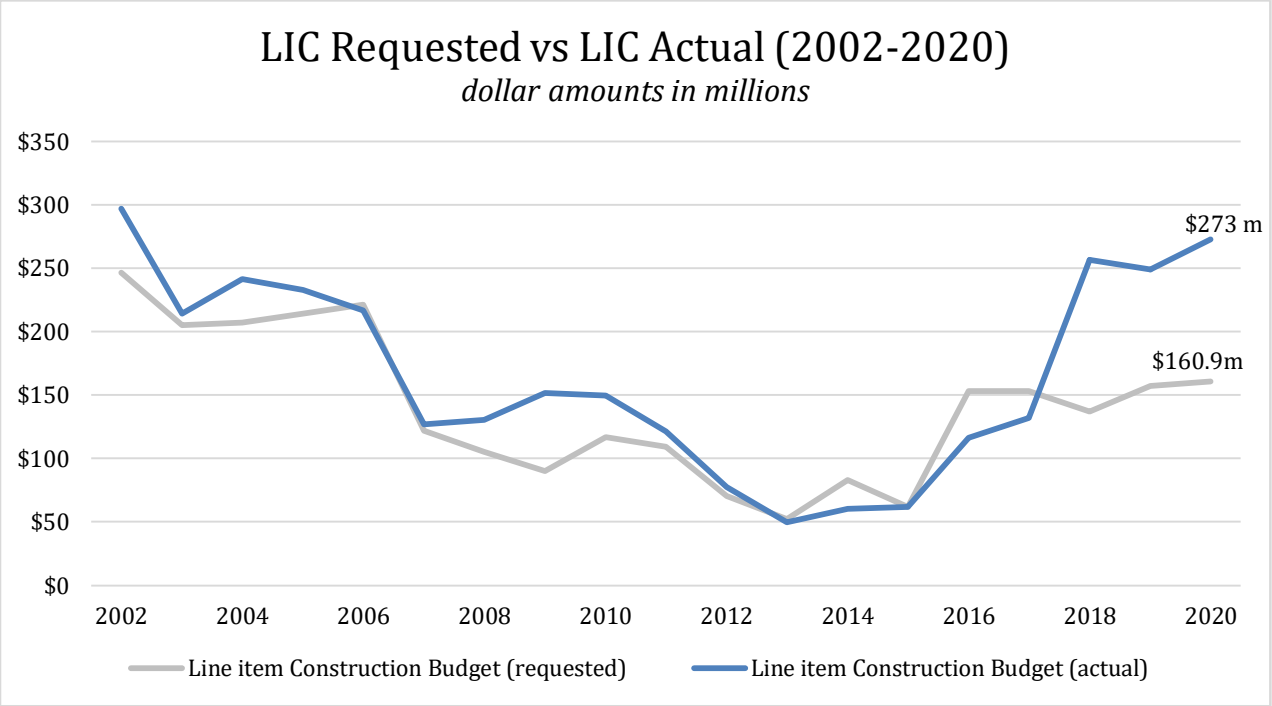

Figure 2. LIC Requested Budget vs. LIC Appropriations from 2002-2020 (Source: National Academy of Public Administration)

2) *Construction Planning*. This account funds planning, pre-design, and design activities connected with line-item projects, including special studies, compliance, concept plans, schematic and final construction documents, and post-construction reports.

3) *Construction Program Management and Operations*. This account funds the component providing centralized design and engineering management services, as well as contracting services for park construction projects. One of the key activities is a Service-wide project management control system to validate the cost and scope of each requirement and monitor status throughout all phases of the effort.

4) *Management Planning*. This activity prepares and maintains up-to-date plans to guide management decisions on the use, development, and management of each park.

5) *Special Programs*. Funds in this account cover minor, unscheduled, and emergency construction projects; inspection, repair or replacement of equipment and infrastructure.

In 1998, the Academy recommended that DSC's operations be base-funded (funded separately from the appropriation for LIC), which aligned with general congressional sentiment at that time. The recommendation intended to provide incentives to control costs and outsource D&C supervision. Since the early 2000s, DSC's base-funding has largely remained flat, despite fluctuations in workload (this topic is addressed more fully in Chapter 6, in the analysis of DSC's resourcing).

In addition to LIC projects, DSC manages projects that are funded by parks (called, Park Direct Charge), by philanthropic donations, and supplemental funding in response to emergencies. While this study does not address the DSC's role in execution of those projects, the Panel recognizes that DSC is called on to execute these other projects and doing so impacts DSC staff members' ability to complete LIC program work. A key underlying issue is the lack of clarity in how to set priorities among different programs, especially in response to large increases in program funding. One example includes large increases in LIC funding at the same time NPS received a large supplemental appropriation to address hurricanes Harvey, Irma and Maria disaster recovery.

The NPS budget sequence and planning process shapes the construction process and timelines. Figure 3, below, shows the connections between the budget sequence and the construction sequence for LIC, and is further described in the following pages.

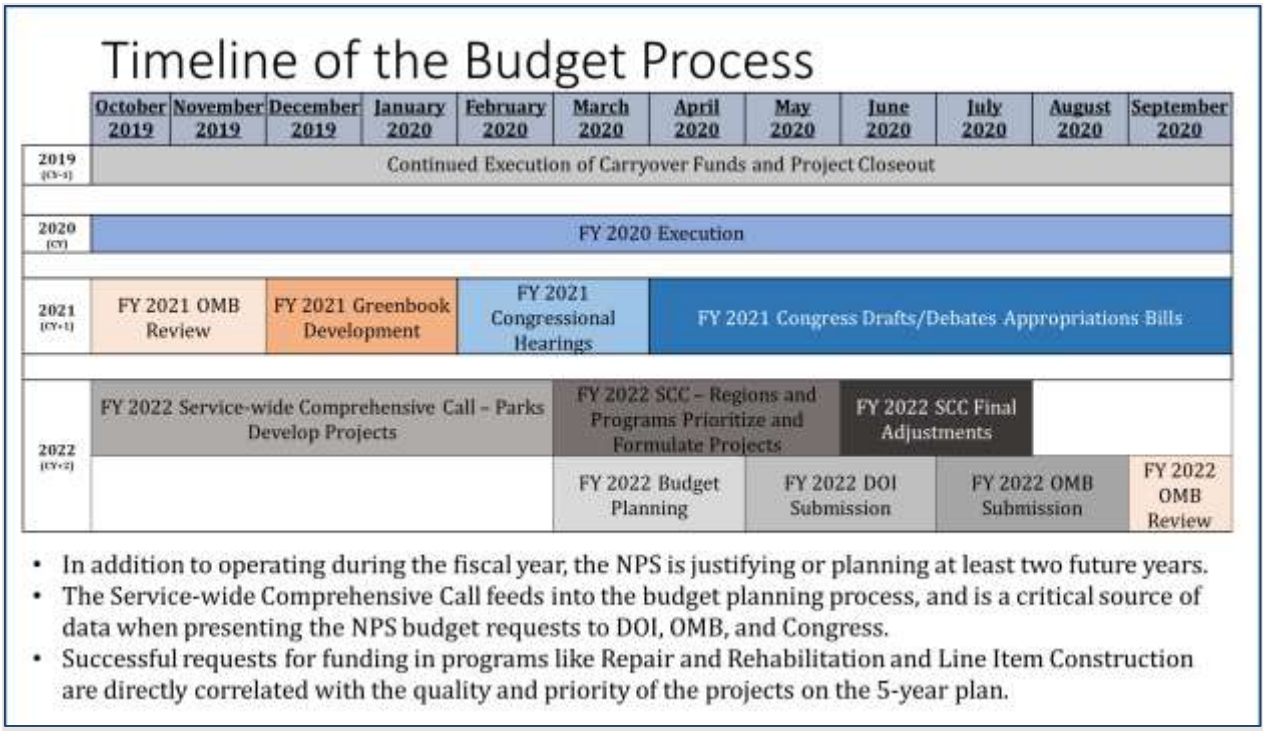

Figure 3. Budget Sequence as of FY20 (Source: National Park Service)

Construction Program Management Division

CPMD is the policy office for the NPS D&C program. The office was created in the early 2000s at the recommendation of the 1998 NAPA report recommended establishing a project management control system to provide visibility into project status. The report recommended establishing a small staff of project management professionals at NPS headquarters.

Today, CPMD has six full-time equivalents (FTE) and performs a variety of functions, including:

- LIC Program Fund Management, which includes:

- Regional LIC staff funding;
- LIC regional project planning funding; and
- LIC five-year plan formulation.

- Serves as the eCPIC interface with the DOI; and
- Supports the Service-wide Investment Review Board (IRB) and Development Advisory Board.

The Role of Denver Service Center

DSC is a centralized office of professional planners, project managers (PMs), subject matter experts (e.g. QA and Compliance), and contracting officers who assist all parks and regions with construction pre-planning, design, contracting, and project management of all major NPS line-item projects. DSC also provides other transportation, general management planning, and technical services outside of this study's scope. These latter mentioned services are not addressed in this report's evaluation of DSC operations as they are not part of the study scope.

Staffing

DSC staff currently number 217 FTE, and are supported by 50 contractor FTE. The chart below illustrates the FTE breakdown at DSC and in greater detail for the D&C division.

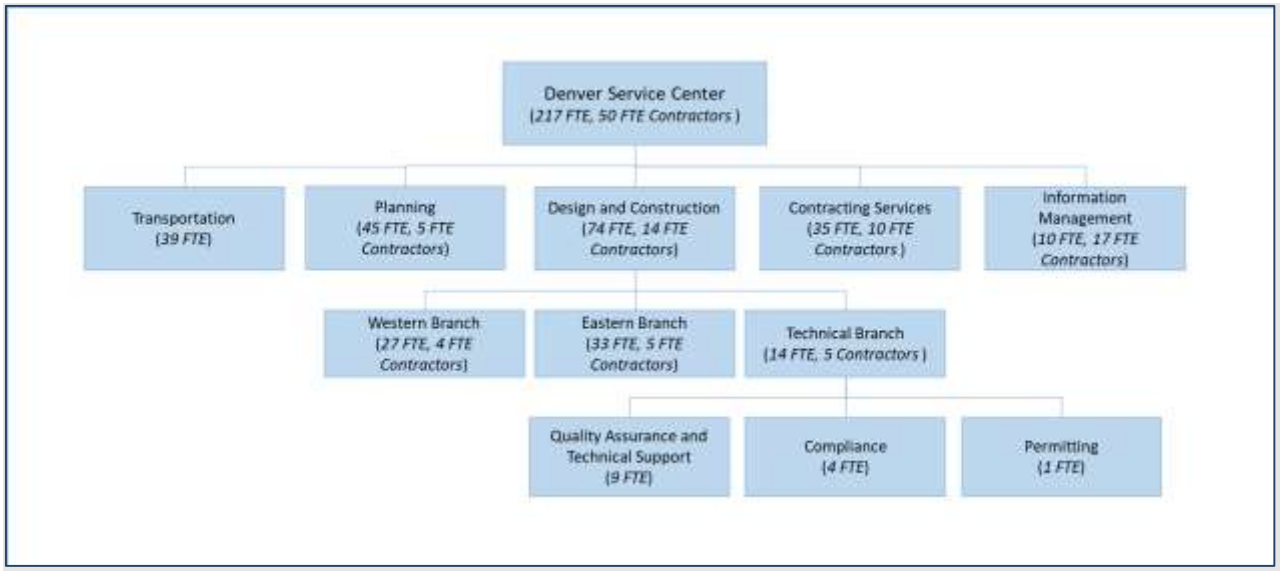

Figure 4. Denver Service Center Organizational Chart, chart does not display the Administration or Budget division, but total FTE count reflects their FTE count. (Source: National Academy of Public Administration, based on DSC data)

Project management staffing

DSC PMs and project specialists, supported by multi-disciplinary internal teams, manage contracted external teams from architecture and engineering (A/E) and construction firms to ensure that projects are completed on time and within budget while effectively meeting the client's (park and region) expectations.

- The **internal team** consists of NPS staff, including: contracting, natural and cultural resources, PMs, project specialists, and the various specialists from the Technical Branch Quality Assurance Group. The contracting team consists of the contracting officer and the contract specialists. The DSC model is to have four people on each project to manage the design and construction process.
- The **external team** consists of staff from contracted A/E and construction firms including architects, engineers, contractors, surveyors, natural and cultural resource specialists, AutoCAD technicians, and editors.

PMs and project specialists have a major role in each project phase including design, construction, and project close-out. The typical roles and responsibilities for a DSC PM can be found in Appendix E, titled *Project Manager Roles and Responsibilities*.

Funding

DSC operations, including civil service salaries, are largely base-funded with a *Denver Service Center Operations* line-item. This line-item funds project management for LIC, the Technical Information Center, and other activities (i.e. IT and professional development).

Recent and Ongoing Internal Operational Reviews

In the last several years, NPS and DSC have reviewed their processes and initiated process improvement initiatives to address DSC internal operations, the NPS asset management lifecycle, the NPS asset investment strategy, and the NPS project execution lifecycle. The Panel's assessment is just one part of these Service-wide efforts.

At the end of FY 2018, NPS started Project Revamp, a process improvement project. The project charter had three guiding areas of inquiry which mapped out into a number of process improvement work streams. The three general areas of inquiry were:

1) The asset improvement lifecycle;
2) The Service-wide asset investment strategy; and
3) The project execution lifecycle.

Some of the key processes for improvement include condition assessments, asset prioritization, portfolio-wide asset management planning, and improvement of project execution lifecycle.

In 2019, an internal report to DSC, titled, *A Review of the Denver Service Center Design and Construction Program*[9] was prepared. This report, informally known as the *Wheeler Report* made nine recommendations intended to "enable DSC to tackle the challenges of the coming decade." The recommendations sought to "streamline the design process, increase collaboration and stakeholder engagement, empower employees and managers, and deploy assets and expertise strategically to maximize DSC's return on investment" (see Appendix F for an abbreviated list of findings and recommendations in the Wheeler Report).

[9] *A Review of the Denver Service Center Design and Construction Program,* by Matthew J. Wheeler

Chapter 3: Factors Affecting Line-Item Construction Costs at NPS

This chapter highlights constraints on controlling LIC costs by discussing factors affecting project costs at NPS. These factors include the distinctive circumstances and requirements of the NPS mission and constraints operating on federal government agencies generally. The chapter also addresses ownership and accountability of LIC project development and delivery, about which the Panel makes one recommendation. The chapter closes with a review of factors that are within the control of DSC or NPS to address. These factors will be the focus of analysis and recommendations for change in subsequent chapters.

The Panel's analysis of factors affecting LIC costs is multi-faceted, consisting of:

- Analysis of DSC LIC project data on cost, quality, and schedule;
- Analysis of DSC data on change orders and construction modifications;
- Structured interviews with DSC project teams, regions, parks, WASO, and senior executives at federal construction programs and Parks Canada; and
- Analysis of cost and schedule data from other federal D&C programs and Parks Canada.

In addition to the above analysis, this report leverages external subject matter expertise, including Panel members' individual experience, to identify cost drivers and opportunities for improvement.

Cost Drivers Typical of NPS Projects

A discussion of NPS cost drivers can benefit from an appreciation of the variety of projects in the NPS LIC portfolio. To give the reader a sense of the challenges that are connected with the many types of construction projects, Figure 5 below provides a selection of the LIC projects funded by the $256 million appropriation for FY 2018.

Project Title	Project Description
Restore Jefferson Roof and Portico	This project restores the portico roof and portico ceiling, replaces roof systems along the colonnade and upper roof, and repairs stone sections of the architrave above the individual columns along the colonnade. (National Mall and Memorial Parks)
Replace Unsafe and Inefficient Windows of Boott Mill Museum	This project replaces deteriorated wooden windows installed in 1980. These windows are not similar to the original 1871 windows. Replacement windows typical of late 19th century textile mills more closely match the operation, configuration, and historical appearance of original windows. (Lowell National Historical Park)
Upgrade Visitor Access at Herring Cove Beach	The project addresses accessibility and erosion at Herring Cove. Work includes relocation of parking lot and limited demolition of structures. The project reestablishes a natural shoreline and public beach access and replaces existing North parking lot with a new lot farther inland from the current location. (Cape Cod National Seashore)
Rehabilitate and Seismic Retrofit of Mammoth Hotel Guest Room Wings	The project renovates the 1913 Guest Wing of the building; preserves, repairs, or replaces the character-defining features of the wing; replaces obsolete life, safety, mechanical, and electrical systems; and addresses Architectural Barriers Act Accessibility Standard (ABAAS) entry and egress deficiencies in guest rooms, and public areas. (Yellowstone National Park)
Repair Leaks in North Barbette Tier and Repoint Brick Masonry at Fort Point	This project removes concrete paving from the barbette (roof) tier, installs a new waterproof membrane, and reinstalls a portion of concrete paving. (Fort Point National Historic Site)
Replace Anacapa Stiff-Leg Derrick Crane with Two-Crane System	This project replaces an eighty year old, non-functioning, obsolete, stiff-leg derrick crane located on Anacapa Island, and performs required modifications to the concrete landing it is mounted on. (Channel Islands National Park)
Construct Electrical Intertie to Falls Creek Hydro Project	This project constructs a 15 kilovolt, three phase electrical intertie with a communication link between the Falls Creek hydroelectric plant in Gustavus and the park's Bartlett Cove power generation plant. (Glacier Bay National Park & Preserve)
Rehabilitate Elkmont Waste Water System	This project replaces components of the Elkmont waste water system with eco-friendly and energy efficient parts and components that meet current codes. (Great Smoky Mountains National Park)
Replace North Rim Potable Water Distribution System	The project replaces all of the water mains, sub-mains, and service laterals located in the two lower water distribution system areas of the North Rim complex, the Employee Dining Room and Lodge area. (Grand Canyon National Park)
Rehabilitate Visitor Center for Access, Safety, and Energy Efficiency	This project rehabilitates the Visitor Center by updating the structure to provide better operational and energy efficiency, environmental controls, and fire protection. Project includes replacement of critical systems (roof, exterior windows, electrical system, HVAC) and other major systems (elevator) nearing or beyond their design life. (Valley Forge National Historical Park)
Replace Failing Visitor Center to Correct Serious Safety Issues	The existing deteriorated and unsafe Visitor Center is replaced with a facility approximately 63% smaller to serve visitors more effectively and exemplify both financial and environmental sustainability. The project deconstructs the existing 3,834 square foot building and mitigates environmental contamination known to be on site and in the soil beneath the structure. (Apostle Islands National Lakeshore)
Rehabilitate Exterior Envelope, Historic Elements, and Seismic Retrofit	This project addresses severe deficiencies present in the exterior envelope and surrounding historic features of the Old Santa Fe Trail Building. (Intermountain Region)
Replace Water Intake Barge with Shoreline Wells at Katherine Landing to Ensure Reliable Water Supply	This project replaces the floating, water intake barge serving Katherine Landing (KL) developed area with two new shoreline production wells for all of the water supply. (Lake Mead National Recreation Area)
Restore Flood-Damaged Historic Scotty's Castle Visitor Center	This project restores the Scotty's Castle Visitor Center, interpretive exhibits, accessible parking, and pedestrian walkways which have been closed to the public since a massive flash flood in 2015 damaged them extensively. (Death Valley National Park)

Figure 5. Selection of LIC Projects Funded in FY18 (Source: National Academy of Public Administration)

Three factors driving project costs highlighted below reflect the distinctive circumstances and requirements of the NPS mission. On their own, each factor is not distinctive to NPS. But, NPS projects generally involve a mix of all three factors and each of them have a cost impact. This interaction of the three factors often means NPS projects and their constraints are dissimilar from projects conducted by other agencies. Interviews with A/E firms and other industry experts confirmed that very few of their projects for other agencies were similar.

Factor #1: Remoteness

A majority of NPS parks and park facilities are not located in one of the nearly 700 cities listed in the R.S. Means City Cost Index[10] (Cost Index), which is one of the cost estimating tools used by NPS.[11] It is clear that NPS facilities are located in remote areas, typically a large distance away from significant sources of labor, material, and equipment. Interviewees estimated that 40 percent of DSC projects are in hard-to-access locations. If labor, equipment, and materials can be delivered to the project site via over-the-road transportation, NPS cost estimating guidance recommends using a remoteness factor of 1% for each 10 miles that the project is located away from the city used in determining the location factor. Thus, if a project site is 100 miles from the closest commercial center, the remoteness factor would be 10%.

The Academy analyzed 88 park units, including National Parks, National Historical Parks, National Preserves, National Monuments, National Memorials, and National Battlefields.[12] The analysis measured the distance between the NPS asset and the nearest city listed in the Cost Index. The Academy performed the same analysis for 59 assets owned or operated by the GSA, as a reference point.

54 of the park units sampled (55 percent) are more than 50 miles away from the nearest city listed in the Cost Index. Of those 54, 30 (34 percent of total sample) are more than 100 miles away from the nearest city listed in the Cost Index. In summary, 54 (55 percent of total) of the NPS park units sampled would have a remoteness cost factor over 5 percent and 30 of those 54 projects would have a cost factor of more than 10 percent.

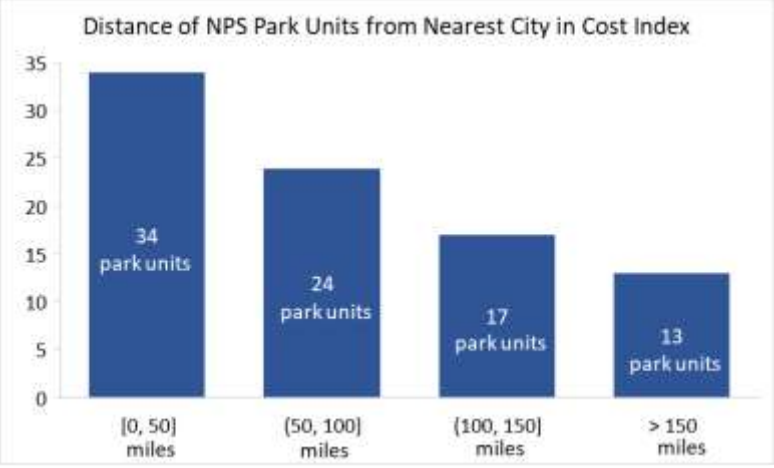

Figure 6. (Source: Academy analysis of 88 park units and RS Means City Cost Index.)

[10] "RSMeans City Cost Index", Gordian, Accessed June 17, 2020, https://www.rsmeans.com/rsmeans-city-cost-index.aspx

[11] "Cost Estimating Requirements, NPS, Accessed June 17, 2020, https://www.nps.gov/dscw/upload/CostEstimatingHandbook_2-3-11_111417_AF.pdf

[12] The sample did not include outliers with a distance further than 1,000 miles. In addition, the sample included nine park units where air or water transportation was needed to complete the journey to the park unit. The Academy measured the distance up to the point where air or water transportation was needed.

Of the 59 GSA assets analyzed, only seven were outside of a city in the Cost Index. Three were less than 30 miles away, three were less 100 miles away, and one was 120 miles away. Thus, only four (8 percent of total) of the GSA assets would have a remoteness cost factor over 5 percent, compared to 55 percent of NPS park units in this sample.

Such distance from populated areas drives project costs in two ways – limited availability and challenging logistics. Projects in remote locations are distant from pools of skilled labor, such as specialty mechanics and tradespersons, needed to both build and renovate even relatively simple structures, such as employee housing.

Remoteness also complicates logistics. Supplies often must be brought in from great distances. Temporary lodging and per diem provisions may be required for non-local workforces.

A recent extreme example is the Kennecott Concentration Mill Stabilization Project in Wrangell – St. Elias National Park and Preserve, located in Alaska. The Park is a seven-hour drive from Anchorage, with the last two hours of the drive on a very rough road. This challenges the ability of construction contractors to transport materials, access to temporary lodging for works, per diem costs, etc.

In extreme cases, remoteness-related logistics challenges have increased project cost by as much as 100 percent.

Factor #2: Historic, Natural, Cultural Resource Protection

NPS projects often involve historic preservation and natural/cultural resource protection requirements. These include both federal requirements, state-level requirements from the State Historic Preservation Office, and Secretary of the Interior requirements, such as "adaptive use"[13] of historic structures. These requirements can increase costs, and can often as much as double costs for individual elements of the work, and extend timelines.

While this factor is not unique to NPS within the federal construction space, the majority of NPS projects regularly interact with historic, natural, and cultural resource protection issues. For example, GSA construction costs are also regularly impacted by this issue. In fact, a 2005 GAO study highlighted historic preservation requirements as a key factor causing scope changes.[14] In two GSA construction projects studied by GAO, one project's total cost increased by $1.3 million and the other project's design costs increased by 14 percent.[15]

One NPS example is the ongoing project to restore the Jefferson Memorial Roof and Portico located in Washington, D.C. The Jefferson Memorial is a famous culture resource within NPS and is on the

[13] "Revising Preservation Brief 14", NPS, Accessed June 17, 2020, https://www.nps.gov/tps/how-to-preserve/revisingPB14.htm

[14] "Courthouse Construction: Information on Project Cost and Size Changes Would Help to Enhance Oversight," U.S. Government Accountability Office, 2005.

[15] Ibid.

National Register of Historic Places. Recent failures in the roofing and flashing systems created life, health, and safety hazards for visitors and NPS personnel. The work aimed to prevent further deterioration of this historical resource. Part of the work includes cleaning the structure's exterior stone cladding, which has a "highly visible bio-film growing on the dome."[16] The cleaning work is being performed with a specialized laser-cleaning technique, gentle detergents, and biological growth inhibitors.

Windows in historic buildings offer another example of historic preservation requirements driving up costs. Following DOI standards of historic preservation, DSC projects often preserve, rehabilitate, restore, or reconstruct historic windows rather than install modern windows for historic, period buildings, such as the Wright Brothers Visitor Center in Kill Devil Hills, North Carolina.

Natural resource protection requirements can prohibit construction work during preferred construction seasons due to overlap with breeding season for endangered or otherwise protected animal species.

Factor #3: Performance Standards

NPS infrastructure and facility projects are typically designed to meet high performance standards to facilitate longer service life[17], reduce lifecycle costs, and comply with policy mandates. There are several sources of design standards for DSC LIC projects, which include building codes and industry standards, laws, regulations, Executive Orders, DOI, NPS, and DSC. At the NPS level, there is a 3-tiered directives system to communicate policy and provide instruction for implementation:

- NPS Management Policies – The Guide to Managing the National Park System
- Director's Orders
- Handbooks, reference manuals, and other professional materials

In addition to NPS policies, as well as other design and performance standard information from other sources, DSC provides more specific requirements for each of the 14 design areas, specified on the DSC Workflows website. The primary driver of these standards is that NPS must operate and maintain their assets over long periods of time with limited, uncertain budgets for operating and maintenance (O&M). Performance and design standards are a common factor that can contribute to higher federal construction costs, compared to private sector projects. For example, a 2016 internal construction-cost study prepared for GSA by the National Institute of Building Sciences indicated that costs for repair and alteration projects at GSA were roughly 15 to 25 percent higher than repair and alternation projects in comparable private sector buildings. The study's staff suggested that GSA's

[16] Detail Schematic Review Report for Project *Restore Jefferson Roof and Portico,* PMIS #: 216036A. U.S. National Park Service.

[17] Unlike most private sector counterparts, NPS maintains and operates many of their assets in perpetuity. Although this is generally unique in the federal space, other federal agencies, like GSA, build for a 100-year service life, choosing to use more durable construction materials. Forty percent of GSA's occupied inventory is over 50 years old, and many federal buildings are over 100 years old.

recent adoption of performance-based design standards, instead of previously prescriptive standards, would likely lower the federal construction cost's premium relative to the private sector.[18] The new performance-based design standards at GSA provide contractors more discretion in selecting construction materials, which can impact costs.[19]

Examples of high performance standards and their impact on NPS projects include:

- NPS requires that all electrical and telecommunications wiring use conduit, which in the future will allow the wire to be pulled for replacement, rather than removing walls to replace wiring.[20] Other aspects of NPS assets that have higher performance standards include windows, doors, and Heating, Ventilation, and Air Conditioning (HVAC) units. NPS often uses corrosive resistant materials in marine environments.
- Federal sustainability mandates can contribute to higher initial costs for procurement and installation. For example, the Energy Independence and Security Act of 2007 generally authorizes agencies to consider and implement energy and water-system efficiency measures.[21] These systems may be more efficient to operate over the life of the building. The systems and requirements typically equate to Leadership in Energy and Environmental Design (LEED) GOLD performance. A private sector owner, in contrast, may choose to pursue a lower certification or none at all, which can result in lower construction costs.[22]
- In order to be more efficient and sustainable in the long-term, NPS tends to use the latest HVAC equipment available in the market rather than less expensive, but less efficient alternatives. One example is the use of Variable Refrigerant Flow (VRF) systems on heat pumps and air conditioning units. In addition to the compressors, the system often includes technology like metering devices on each coil unit, which can increase costs across the HVAC system. On a residential size HVAC unit, VRF will generally cost 30 percent more than a standard compressor. It is important to note that although this increases the cost of construction, VRF pays those costs back through increased efficiency and reduced O&M costs.[23]

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[18] "GSA Can Improve Its Communication about and Assessment of Major Construction Projects," U.S. Government Accountability Office, 2019.

[19] Ibid.

[20] "Denver Service Center Requirements", DSC, Accessed March 26, 2020, https://www.nps.gov/dscw/ds-electrical.htm#dsc

[21] Pub. L. No.110-140, § 432 (2007).

[22] "GSA Can Improve Its Communication about and Assessment of Major Construction Projects," U.S. Government Accountability Office, 2019.

[23] In 2012, the Pacific Northwest National Laboratory prepared a study on VRF for GSA. That report concluded that VRF HVAC systems were a mature technology that could achieve 30% and higher HVAC energy cost savings relative to minimally code conventional compliant systems, or older inefficient systems across a broad range of climates. Additionally, the report identified older and historical buildings (listed or eligible for listing in the National Register of Historic Places), as a best opportunity for VRF usage. "GPG

Cost Drivers Related to Federal Procurement Practices and Policies

Federal procurement practices and public policy initiatives can drive higher costs, compared to the private sector.

Due to the federal budget calendar and backlog of LIC projects in the design phase, most NPS project solicitations occur in mid-summer to early-fall; a point in the year, when many contractor work backlogs are full, the construction season is in full swing and most quality contractors, subcontractors, and vendors are not in need of additional work. Contractors are also aware or believe that federal contracts must be awarded by the end of the fiscal year, even though LIC funding is "no-year" money. This can have an inflationary effect on construction contracts. This reality, combined with projects involving the three aforementioned factors, can limit the market capability and interest, and reduce competitive solicitation or bidding.

Small to medium-sized NPS projects are frequently targeted toward set-aside procurement processes.[24] For general construction set-aside contracts the contractor is only required to perform 15 percent of the total contract cost with its own employees. In some cases, this translates to the set-aside contractor merely acting in the capacity of a broker who then hires a general contractor to administer and perform the actual construction, with the set-aside contractor providing a redundant layer of general administration functions and costs. The impact of this extra layer is most visible in the project schedule, because each communication has an extra handoff. For construction modifications and other responses to emerging conditions, this extra layer can add another day or week to the transaction.

Other public agencies, especially at the state level, deal with this by increasing the percentage of required work completed by the set-aside contractor to 25 percent or even 40 to 50 percent. This increases the set-aside contractors stake in project success and improves the alignment of incentives. Other agencies, like the Federal Lands Highways Program, sometimes adjust the percentage of required work by SBPC's for particularly complex work.

Ownership and Accountability for Line-Item Construction Projects

Interviews with NPS staff indicate that there is a lack of clarity with respect to ownership and accountability for LIC projects. Specifically, unclear ownership and accountability for LIC from project definition at the park-level through the regional office and CPMD to project delivery by DSC. The Panel finds that ownership and accountability for the project requirement and project delivery is divided and spread across several different offices and positions across NPS. Although several factors contribute to this dynamic within NPS, the Panel highlights three factors.

- **The park initiates project development based on a perceived need, but lacks the expertise to fully develop, own, and deliver the requirement.** Park superintendents are

Variable Refrigerant Flow", GSA, Accessed June 17, 2020
https://www.gsa.gov/cdnstatic/GPG_Variable_Refrigerant_Flow_12-2012.pdf

[24] DSC set-asides are generally capped at $4 million in gross construction cost, which translates to approximately $3.39 million in actual construction cost with the contractor.

formally responsible and accountable for line-item construction projects in their parks, and responsible for their cost effective execution. The 1998 Academy report recommended this approach. However, based on interviews, many superintendents do not have the expertise, resources, or incentives to effectively manage LIC project costs. Thus, parks often rely on some combination of technical staff in the regions, CPMD, and DSC.

In addition, a core issue with project development is that NPS uses a work order management system to define the project instead of scoping a project and incorporating it into a park-wide asset management plan. NPS is currently piloting a program to assist parks in developing a SFIP to foster a more strategic approach to investment across the Service.

- **DSC functions as technical advisor to parks and regions, with customer service orientation**. DSC has a customer-service orientation, serving a consultant and technical advisor to park and regional customers, that are not required to use DSC's services for design and construction projects. DSC officials do not feel consistently empowered to assume primary responsibility for projects. In practice, DSC should assume responsibility for project management, in consultation with the region and park, once the LIC project is published in a Greenbook.[25] The publication of projects in the Greenbook serves as the official notification from CPMD to DSC that the listed projects are now the responsibility of DSC to track and execute.
- **Obligation rates serve as primary measurement of LIC program success**. NPS uses obligation rates (amount of LIC appropriation obligated in current fiscal year), as the primary measurement of LIC program success. The Panel finds that measuring obligation rates is an important performance measure for the Agency, but has little to do with the success of LIC project delivery. The Panel also finds that a narrow focus on obligation rates can inhibit successful project outcomes by prioritizing rapid awards, instead of alignment and agreement on scope, cost, budget, and schedule.

Recommendation #3.1

To strengthen ownership and accountability within the LIC program, NPS should clearly assign responsibility and corresponding authority for project development and delivery to various individuals in order to enhance the accountability framework. Specifically:

- The park superintendent should be assigned responsibility for defining the initial need, in collaboration with regional LIC coordinators and informed by planning documents such as the General Management Plan and the SFIP.
- An NPS design and construction professional should be assigned responsibility for assessing the scope and cost of the need defined by the park superintendent, before the project is funded.
- A DSC design and construction professional should be assigned responsibility for effective and efficient project delivery on behalf of the park and region, once the scope, cost, and

[25] The DOI Budget Request is referred to as the Greenbook.

schedule baseline is established. This role is ideally held by a single individual, but in the event of a change, the owner is responsible for promptly reassigning the stewardship role and assuring continuity.

In this accountability framework, the Panel urges the Service to operate in an accountability framework that establishes a "steward" to enhance project delivery and who will work with the project "owner," typically the Superintendent. Specifically, DSC should combine its current customer-orientation with clear responsibility and authority to serve as a "steward" of project resources during project delivery. This relationship is further explained in the following paragraphs.

A steward is not the "owner" of the resources, but has been given authority to manage them for the pre-approved, defined outcome. While the steward has the responsibility to deliver the promise and purpose of the resources that have been given, this individual is not empowered to change the defined outcome without express approval of the "owner" of the resources. The steward is responsible for the execution and outcome of the expressed purpose of these resources.

The steward's responsibilities can be categorized under the three common project metrics of cost, quality, and schedule.

It is best if this steward can be engaged from the earliest concept stage through completion of a project to maintain consistency of knowledge. In reality, it is likely this role is changed from the pre-funding phase to post-funding phase. The steward role is in contrast with the role of a consultant or technical advisor who primarily focuses on their area of expertise, instead of the big picture of project delivery. The steward is the key advocate for the "project," not for any individual stakeholder. It is critical that the steward articulate the agreed upon outcomes for the specific allocated resources and defend those even to the highest authority in the "owner" organization.

Systemic, Organizational Issues that Impact Project Costs

The Panel identified several issues at DSC and NPS that can increase project costs through things like schedule delays and negative relationships with stakeholders. These issues will be addressed in upcoming chapters, but the primary issues impacting project costs are aggregated and summarized below:

- Significant deficiencies in general estimating expertise and capacity in DSC and NPS prevents the consistent development of high-quality project scopes and cost estimates.
- Complex, rigid, or requirement-heavy internal processes that drive large volumes of administrative work and paper work for project teams, without commensurate return on investment.
- An isolated team of technical experts that execute a rigid QA process disconnected from project team and design team, which has historically negatively impacted relationships between the QA group, DSC project team, and A/E firms.
- Duplicative and often siloed data systems and reporting requirements that require project teams to manually enter information multiple times.

- Reliance on a single method of project delivery (Design-Bid-Build), driven in part by a desire to own design and control delivery at DSC.
- Lack of clear flexibilities for project teams to use professional decision-making in project execution.

Conclusion

This chapter frames opportunities for controlling the cost of LIC projects through a discussion of factors that significantly affect costs, but that are generally beyond the control of DSC or NPS. These factors include the distinctive circumstances and requirements of the NPS mission and constraints operating on federal government agencies generally. This chapter highlights diffuse ownership and accountability for LIC projects and the Panel recommends an approach for solving this issue. Finally, this chapter identifies several systemic, organizational issues that can be impacted by DSC or NPS actions. The analysis and recommendations in the following chapters lever the context provided here to address these issues.

Chapter 4: Building Estimating Capacity, Streamlining Processes, Using Enterprise Management Systems, and Opportunities to Use Standardized Designs

In this chapter, the Panel evaluates three systemic, organizational issues impacting project outcomes at DSC and NPS. The three issues are: 1) estimating capability at DSC and NPS; 2) streamlining processes; and 3) the use of enterprise management systems. The report addresses them together in this chapter because of the interplay between them. Finally, this chapter assesses opportunities to use standardized designs at NPS.

Issue #1: Building Estimating Capability

Cost estimating is a vital and fundamental capability in construction. Many federal construction programs, at agencies like GSA, USACE, and NAVFAC, have entire teams and/or offices dedicated to creating cost estimates, vetting the estimates, and developing agency-wide guidance on best practices for cost estimating.

At GSA, project scoping and cost estimation is first performed at the regional level, with input from local offices, in accordance with pre-defined evaluation criteria. Once this initial scope and estimate is developed, it moves up the process chain to the cost estimating and schedule management group within the national office of the Public Buildings Service. The national cost estimating group is led by GSA's Chief Estimator and is staffed by three other professional cost estimators who oversee the efforts of each region. Each region has between 1 to 5 FTE of professional cost estimators.

USACE has a variety of cost estimating expertise built into its design and construction capabilities. At the regional level, USACE has professional cost estimators in each of their 43 regional offices (district command centers). One of these district command centers (Walla Walla MCX) is a center of expertise focused solely on cost estimating capability. District commands can use the cost estimating center, or cost engineering MCX, for technical assistance when creating project estimates. Cost estimating capability is also supported by the Cost Engineering Community of Practice (COP)[26] which formulates cost engineering regulations and policies for the agency as a whole.

The responsibilities of the Walla Walla MCX include:

- Providing technical cost estimating expertise to district commands as well as HQ
- Training executive staff, project managers, and project delivery teams in the factors that are considered in estimates
- Mentor other cost estimators in the organization
- Implement cost engineering guidance from COP
- Research and updates procedures in response to new emerging conditions.

[26] The Community of Practice includes cost estimators across the three service branches to include: USACE, NAVFAC, and the Air Force.

The responsibilities of the COP include:

- Formulating cost engineering regulations and policies
- Providing guidance and direction for all construction types (military programs, civil works, Environment and construction)
- Maintenance and operation support for cost engineering tools
- Developing guidance in the tri service cost engineering community.

NAVFAC has local command units responsible for cost estimation and the initial planning of the project. Above the local command level, the Chief Engineer is the final technical authority in the Navy, and provides the highest level of interdisciplinary engineering consultation. The Capital Improvement Business Line (CIBL) sits under the Chief Engineer and is where cost engineering (estimating) expertise is housed. Estimators who sit in CIBL provide estimating expertise to assist in initial project formulation, as well as other services (value engineering and risk analysis) on projects over $30 million. Project cost estimates that are above $500,000 are first developed at the local command units, and then reviewed for accuracy and adherence to NAVFAC procedure at CBIL. Projects less than $500,000 are handled by cost estimators in local command units.

Challenges with NPS Cost Estimating

The Panel finds that NPS has inadequate and varied professional project development and cost estimating expertise at all levels of the organization (i.e. parks, regions, and DSC). NPS employees estimate that between DSC, CPMD, and the regions there are approximately six individuals with professional cost estimating expertise and approximately three to four Parks with professional cost estimating expertise. Note that none of these individuals are full-time cost estimators, but rather have formerly been professionally trained in cost estimating and now perform other jobs at NPS. Additionally, none of these NPS cost estimators are fully versed in the cost variability associated with the different types of NPS work. For example, general-building versus heavy-civil infrastructure projects. Finally, many park and regional estimators believe that off-the-shelf databases, such as RS Means or Richardson, reflect actual costs of NPS projects. This is magnified by the lack of consolidated NPS construction cost history, which would otherwise be available for comparison and reference.

The Panel identifies several factors related to poor estimating capability within NPS:

- **Deficiencies in planning process hinders the success of DSC project execution**. The bottom-up NPS planning and investment process does not facilitate the development of predictable estimates and scopes. The current process begins at the development of projects at the park level for submission in response to the Service-wide Comprehensive Call[27]. Park employees, with varying levels of experience, develop the project scope, cost estimate, and project narratives. Once the estimate and scope is developed, it is broken into work orders to

[27] The Service-wide Comprehensive Call is the formal beginning of a new round of planning for future NPS budgets. The budget call includes policies and procedures set by NPS and DOI leadership, as well as target funding levels identified by OMB. Since the NPS budget cycle takes nearly two years to complete, the SCC is announced at the beginning of each new FY for planning two years in advance. The park prioritization is completed on an annual basis per the SCC.

be uploaded into the FMSS. Then the work orders are bundled back into a project and uploaded into PMIS minus the initial cost granularity, before finally connecting the PMIS financial information with the project narratives. These projects are vetted by regional professional staff, sometimes in consultation with A/E support, and passed along by the region to CPMD. The projects are then prioritized by a Service-wide assessment panel, based on criteria developed in consultation with the Investment Review Board. CPMD next formulates the Five-Year Plan for LIC based on the assessment findings, review by the IRB, and input from the NPS Budget office. As DSC's LIC portfolio has grown in the last few years, more projects are pulled up into the design phase. In recent years, several of these poorly scoped projects have received a construction appropriation before the project scope is properly validated. Recent large increases in LIC appropriations have exacerbated the underlying issues discussed previously and throughout this report. One result of accelerated construction funding based on preliminary planning funds is an increased likelihood for future scope reduction and can often lead to team frustration (Region, Park, and DSC), as the team is held accountable to inaccurate budgets.

- **Deficiencies in general estimating capacity have, historically, led to large variances in estimates.** Interviewees indicated that the variance, on average, was between 17 to 20 percent, but that for historical renovation projects, it could be closer to a 50 percent variance. To many observers, this looks like scope creep or the "gold-plating" of designs. Historically, the real cost issues were often not identified until the Schematic Design or Design Development phases. At that point, the PM would need to try to salvage the project by finding new funding sources or scaling back the project scope.
- **DSC lacks general estimating expertise on project teams**. The study team's research identified a lack of general estimating capacity at the PM level at DSC.[28] Interviewees suggested that approximately three PMs have formal estimating expertise (primarily in general-building estimating). DSC staff said this lack of formal training and expertise can impact estimating work in both the design phase and in the construction phase for construction modifications. Interviewees highlighted the need for standard, professional cost estimating Service-wide.

Ongoing NPS Efforts to Enhance Estimating Capacity

NPS and DSC recently started a pilot program to develop professional project scopes and cost estimates, in preparation for an influx of funding associated with pending Senate Bill 3422, titled the "Great American Outdoors Act".[29] The pilot program, called the PSA program was started in 2018. As of this year, DSC leaders believe that they have developed high-quality project scopes and cost estimates for $3.5 billion in projects. In 2018, they estimated approximately 140 projects, and in 2019 they targeted approximately 120 projects.

[28] The study team did not assess scoping expertise on DSC project teams.

[29] "S.3422 Great American Outdoors Act", Congress, Accessed March 25, 2020, https://www.congress.gov/bill/116th-congress/senate-bill/3422

The Panel commends this pilot program and urges that NPS and DSC treat this as an initial step toward building a permanent cost-estimating capacity at DSC.

In addition to the PSA program, the new Project Development and Analytics team at CPMD, in collaboration with DSC, is working to build long-term estimating capacity and capability within NPS. Its efforts include:

1) Implementing a standardized data structure that can be used to index estimates regardless of the source. This will enable NPS to build-out variance monitoring and management at the individual project level. Ultimately, this should allow NPS to build an as-built cost database that is created using NPS real-project data. As part of this effort, NPS will need to standardize estimates for easy indexing and uploading into the project analytic database.

2) Developing a scalable solution to use for all but the largest, most complex projects, because PSA's are too expensive for everyday project work. The Project Development team will pursue a blended approach with NPS team leads and estimators, with contracted Subject Matter Experts (SMEs), as needed, to assist with defining Statement of Work (SOW). In the short term or alternatively, NPS will supplement NPS team leads and SMEs with contract estimating support.

3) Finding a better way to initiate and load projects into PMIS/FMSS. The current process involves first building a comprehensive, fully scoped, project estimate. The next steps involve breaking it into work order-sized pieces, feeding the work order pieces into FMSS, bundling the pieces back into a complete project, importing that project into PMIS minus the cost granularity, and finally merging the PMIS financial information with the project narratives. The current process requires significant handling of various information pieces and parts, which creates significant risk of inadvertent mishandling or mistakenly omitting some parts.

Recommendation #4.1

NPS should build a professional cost estimating unit at DSC primarily focused on LIC projects, and take steps to ensure close integration between this unit, regional staff, and CPMD's project development and analytics efforts.

Professional cost estimators who are NPS employees should be involved throughout a project's lifecycle, including project development, design, and construction. A central cadre of estimators at DSC provides an opportunity to improve Service-wide consistency of estimating efforts, to build deep expertise in the unique aspects of NPS projects, and better consolidation, management, and utilization of NPS cost data.

Issue #2: Streamlining Processes

The second major issue addressed in this chapter examines streamlining processes. As previously noted, DSC runs only part of the construction program. Other parts of the construction program controlled at the Service and Department level impact the success of DSC projects. The study team's research identifies several processes that constrain or subtract from the execution of DSC line-item construction. Several interviewees describe DSC as a process-driven organization, instead of an

organization focused on project performance. Another interviewee said that DSC project teams are burdened by "so much busywork that does not actually impact project outcomes." Although this can seem like a project team problem, the unintended consequences of a distracted LIC project team can negatively impact the entire Service.

Recommendation #4.2

DSC should review its processes, using collaborative process improvement methodologies[30] to identify opportunities to improve project delivery. The analysis should focus on three key processes that interviewees highlighted as having the most negative impact on project performance. The three processes are:

1) Construction modifications and fund requests within NPS;
2) Development Advisory Board reviews; and
3) Quality assurance review at DSC.

Specific recommendations for improving each of these three processes are outlined in the following sections.

Construction Modification and Fund Request Processes

Throughout the course of a construction project, small and large changes can be expected after the contract is awarded. These changes require modifications to be made to the original contract. DSC follows a documented process for contract modifications during construction.[31]

The current contract modification process is quite lengthy, taking a substantial amount of a DSC PM's time. The study team's analysis indicates that each construction modification requires an estimated 20 to 40 hours of the DSC PM's time. Given that projects often include five to 10 construction modifications, the modification processes alone can take a total of 100 to 400 hours.

Figure 7. Potential PM Time Investment in Construction Modification Per Project (Source: National Academy of Public Administration Analysis)

[30] Collaborative improvement is a structured improvement approach that organizes a large number of teams or sites (i.e., "collaboratives") to work together for a period of time to achieve significant improvements in a specific area. The collaborative approach combines traditional quality improvement methods of teamwork, process analysis, introduction of standards, measurement of quality indicators, training, job aids, and coaching with techniques based on social learning and diffusion of innovation theories.

[31] Part 43, Section 103 of the Federal Acquisition Regulations governs contract modifications.

The current process is incredibly lengthy (over 50 documented process steps) and requires various tiers of approval and review (see Figure 8 for key participants).

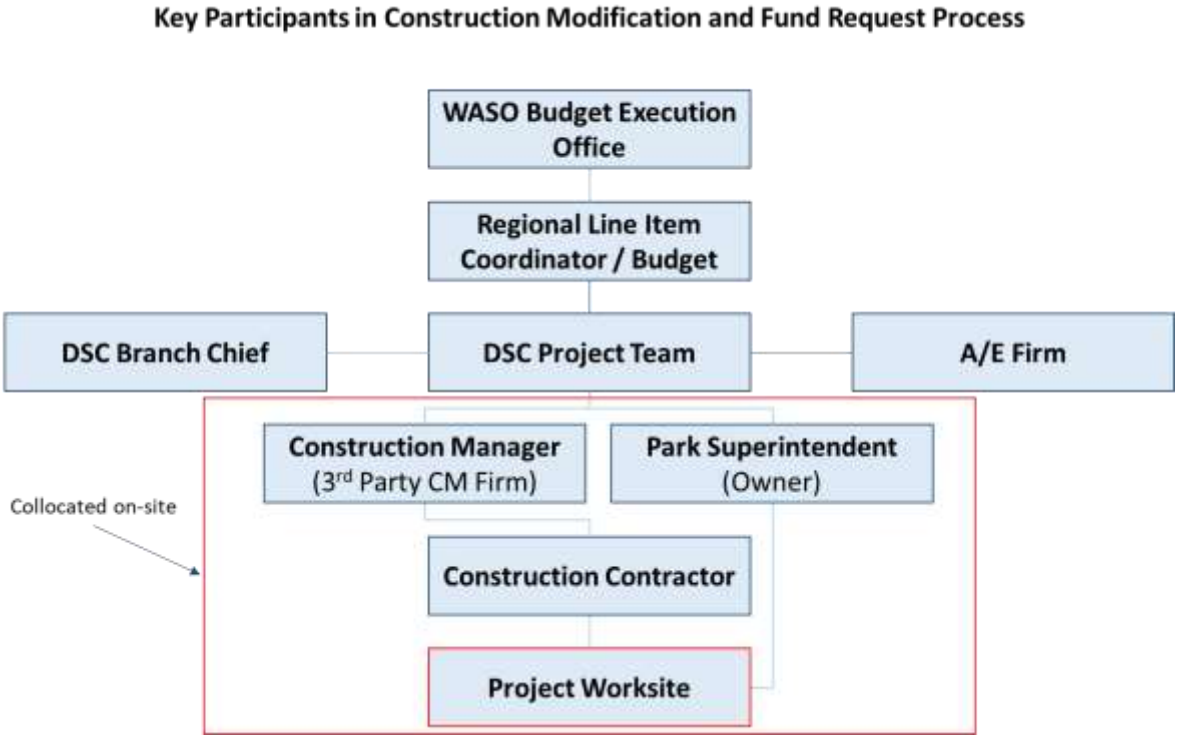

Figure 8. Parties involved in construction modification (Source: National Academy of Public Administration)

In addition to the length and general complexity of the process, the study team identified several other complicating factors.

- **Each region has a different fund request process, which complicates preparation by DSC PMs**. Once a construction modification has been negotiated and the terms agreed upon, the project team submits a fund request to the Regional Line-Item Coordinator or Budget Officer, who then submits it to the WASO Budget Execution office for review and approval. However, each region has their own process for fund requests, which can create unnecessary confusion for project teams.
- **Process is manually executed, tracked, and approved using a spreadsheet emailed between parties.** The entire process is manually tracked and executed by emailing ever-growing spreadsheets between all involved parties at DSC, the Region, and WASO. The study team received one of these spreadsheets for a project with 18 construction modifications. The spreadsheet had 77 separate sheets. Interviewees said that the use of a spreadsheet made it very difficult to follow the changes over time, and meant that only the project team could really understand what was happening. In addition, different steps of the process are documented in different spreadsheets in different places. There is not a single record of the entire process, from beginning to end.

- **Once submitted, interviewees report long approval timelines**. Once the request has been submitted to the Regional Line-item coordinator, interviewees estimate that it can take between three to four weeks[32] for the request to be reviewed and approved by the region and WASO[33]. During this three to four-week period, contractors often continue construction at-risk of non-payment, if the modification is not approved (modifications are almost always approved). One big blocker for DSC project teams is that the work priorities are not aligned between the construction contractors, project teams, and the reviewers at the regional and WASO level. At the regional and WASO level, the reviewers primary job is not reviewing DSC fund requests. Yet the impact for project teams and construction contractors is often felt immediately.
- **Multiple interpretations of project scope and multiple approval steps compound delays.** DSC project teams, parks, and regions typically refer to the PMIS statement for project scope decisions. However, WASO Budget uses the Project Data Sheet, included in the Greenbook, for project scope decisions. These two different sources of project scope can differ and are not integrated. Thus, WASO Budget and DSC project teams can sometimes be looking at different descriptions of the project scope.
- **Tight reprogramming guidelines may force WASO Budget to closely track and approve changes in scope and cost.** NPS' current reprogramming guidelines, as specified by the FY20 Appropriations bill, states that a reprogramming must be submitted to the Committees in writing prior to implementation if it exceeds $1m annually or results in an increase or decrease of more than 10 percent annually in affected programs or projects, whichever amount is less.[34] The restrictiveness of these guidelines is compounded by the recent doubling of the LIC program and the acceleration of projects with early, un-vetted estimates.

In the Academy's analysis of 37 recently completed LIC projects (with construction funds appropriated between 2015-2017) none had a fund request rejected, when within the existing contingency amount. In addition, interviewees could identify no instances when fund requests within the existing contingency amount were rejected. This raises the question of what value is added by the process. Interviewees suggested that an original intention of the process was to ensure all involved parties are informed of construction modifications and the use of construction contingency funds. Another function of the process is to document the event to show that the request was reviewed and found to be within the original project scope.[35] The Panel notes that there are less burdensome ways to achieve the original intent that are outlined in the recommendation below.

[32] Although many have been approved during the same day, if identified as urgent.

[33] In addition, fund requests may be reviewed and approved by CPMD, Compliance, the Budget office, and the Associate Director for PPFL.

[34] FY20 Appropriations Bill

[35] WASO staff noted that they have received many such requests for information about random projects, some directed at projects executed more than 20 years previously.

The primary driver of the entire process is that all requests for contingency funds must be approved by the region and WASO. For major[36] construction modifications, this review and approval structure, perhaps, has some merit. However, it is not clear what value there is in requiring approval for minor[37] or small modifications that do not materially change the project scope. WASO staff and DSC PM's emphasize that projects with multiple fund sources for different scope elements can significantly complicate the fund request process.

The Panel finds that other federal agencies, like the Federal Highways Administration, use a tiered approach for accessing construction contingency funds. For example, any change under $250,000 is approved by the warranted contracting officer (WCO), changes less than $1 million are reviewed by the WCO's supervisor, and any change more than $1 million is reviewed by a more senior construction program official. At DSC, a tiered system could consist of the DSC project team, the DSC branch chief, and the Regional Line-Item Coordinator and the WASO Budget Execution Office.

Recommendation #4.3

DSC and CPMD should follow a two-part solution to the construction modification and fund request process. The Panel notes that this solution is not entirely within DSC's control and that NPS leadership must also agree to act in order to achieve the intended outcomes of this recommendation.

3) NPS should continue process improvement efforts started with Project Revamp by establishing a team to improve the post-award contract processes, specifically the construction modification and fund request process. The Panel identifies the construction modification process as an "anchor" process, that if resolved, will demonstrably increase the efficiency of DSC project teams and can expedite project timelines. The process improvement project should consider:
    - The extent to which regions and parks should, or should not, be involved in the workflow for construction modifications and fund requests; and
    - Whether there are opportunities to improve communication and automate data-sharing between WASO and DSC project teams.
4) NPS should make available some portion of LIC project construction contingency funds for immediate access by DSC, so that the warranted contracting officer can rapidly execute change orders and construction modifications within certain parameters.

Development Advisory Board Project Review

The Service-wide DAB was created by the NPS National Leadership Council (NLC) in May 1996 in response to OMB Circular A-11 and associated guidance, which required a Bureau Investment Review Board. NPS has recently reorganized the DAB and Investment Review Board into a single body of members with the same goals, serving two distinct but complementary functions.

[36] This report defines a major construction modification as a modification that materially changes the scope of a project.

[37] This report defines a minor construction modification as a modification that does not materially change the scope of a project

- The IRB function is focused on ensuring parks are making sound investment decisions and effectively.
- The DAB function has primarily focused on ensuring construction projects are of high-quality, incorporate sustainable practices, are appropriate to their settings, and demonstrate defensible cost-conscious decisions utilizing a value-based decision process. This function will continue but under the name of the IRB.

The Investment Review Board (IRB) provides leadership, direction, and accountability and makes recommendations to the Director to implement the Administration's goals and DOI / NPS strategic plans. It ensures that investment decisions are aligned with mission priorities, to provide documented guidance for investment decisions, to oversee the development and implementation of the FIS, and to comply with the intent of the CPIC guidance.

LIC projects can move through three levels of review: first through a smaller, Regional DAB, second through a review from DAB staff in CPMD, and a third, if a project is more than $1 million net construction. In the latter case, a meeting with participants physically present by the DAB is typically required. CPMD staff have been delegated the authority to recommend approval on projects under $5m net construction, if a project is within boundaries of scope, cost, and schedule. These meetings presentations with the DAB are held three times in a fiscal year. The DAB, as it functions now, is a required checkpoint for projects after completion of the schematic design (SD) phase and before the start of the design development (DD) phase. Starting in 2003, the DAB began serving as the NPS IRB, assessing how well investments address the business needs as defined in the multi-year construction plan.[38] In its investment review capacity, the DAB manages investments, provides explanations and justifications for investment decisions, and plans the strategy for using NPS assets (for a more detailed description of DAB roles, see Figure 9).

The DAB has performed these two roles, project development advisory and investment review, in the spirit of having an external review. NPS staff involved in the review provide valuable unbiased judgment because they are knowledgeable about Service-wide priorities yet are disconnected enough from the daily management of projects. Recently, there is a growing interest and need within NPS to expand the investment review functions of the DAB and perform the DAB project review earlier in the project design phase.

[38] DAB and IRB Role and Function Internal Document, DSC, U.S. National Park Service.

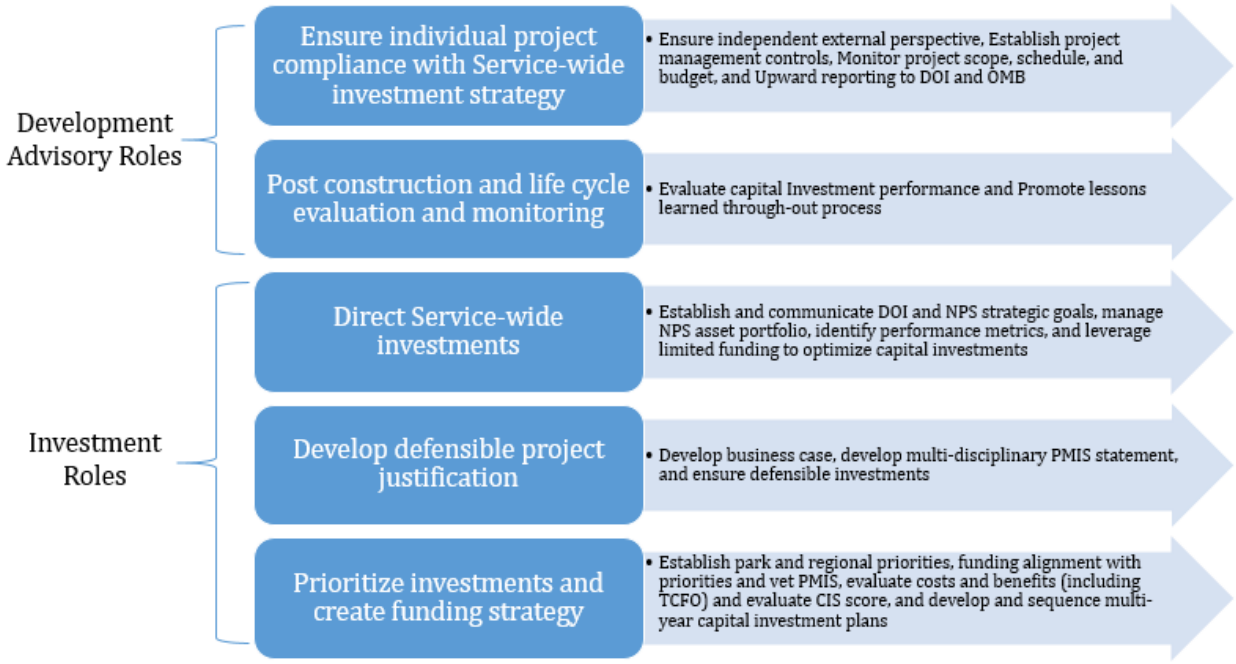

Figure 9. The roles of the DAB (Source: Recreated by the National Academy of Public Administration)

The Academy's 1998 and 2002 reports made several recommendations with respect to the DAB and the manner in which it operated. The 1998 recommendation was centered around the problem of a missing public perspective from the review of projects. It reinforced the need for the DAB. The 2002 report confirmed that the 1998 recommendation was fully implemented because the DAB shifted from a policy-orientation to a project review board. That report also noted NPS should find the appropriate balance of DAB or NPS staff control over facility projects. This decision was left open to be decided according to the Service's overall managerial philosophy and principles. As the environment has changed since 2002, NPS should reevaluate the balance between DAB and NPS staff control over facility projects. This is addressed in the following pages.

The Panel identifies two main inefficiencies related to the current DAB structure and process.

- **The project review by the Service-wide DAB functions as a "rubber-stamp" due to timing of review in project evolution**. The review by the Service-wide DAB occurs at the end of the Schematic Design phase, once significant investment has already been made in the project. Because of this, the DAB rarely rejects projects. The study team's interviews with past and present members of the DAB indicate that the DAB approves approximately 99 percent of projects that it reviews. Past and present members of the DAB, senior-level executives in the organization, interviewed by the study team said that this "project review function" did not effectively use their expertise.
- **The preparation process for the DAB is time-intensive, often burdensome, but useful for some stakeholders**. The preparation process for the DAB review is extensive, involving

the Park, the Region, the Regional DAB, and the DSC project team. Interviews with some participants engaged in this process indicate that there are significant hidden costs related to preparation for the DAB review. Although some interviewees note that this preparation process can serve a useful purpose to align view of different stakeholders, there is consensus that the investment of effort is not commensurate with the actual impact of DAB review. In addition, ADAB submission requirements for DSC project teams is highlighted as a significant time investment with little pay-off, since the DAB does not require that level of detail for their review.

The Panel notes that the collaborative preparation process can be valuable to ensure communication between all parties. However, the Panel finds that the impact of the Service-wide DAB review is not commensurate with the Service-wide investment of time required to prepare for the DAB review.

At the time of writing, NPS is considering how to refocus the DAB on its responsibilities as an IRB, reviewing projects at an earlier stage in their development. These changes would address the issues raised with the current version of the DAB mentioned above. An earlier DAB would be able to exert more influence on the direction of projects. This would also better utilize the experience of the DAB's members and allow the DAB to take a more strategic role within the Service. A shift in this direction, would be supported by improvements in NPS's project development and cost estimating capabilities, strengthening the DAB's ability to make well-informed decisions earlier in the project development lifecycle.

Recommendation #4.4

The Service-wide DAB should continue its efforts to take a more strategic approach by focusing on its investment review role (described in figure 9). As part of these reform efforts at NPS, the review by the Service-wide DAB should be moved to occur earlier in the process so that the DAB can take a strategic investment and prioritization approach.

Quality Assurance Process

Because DSC is responsible for assuring the quality of all design documents, DSC developed a documented QA process,[39] in accordance with Section 46.102 of the Federal Acquisition Regulation (FAR). The QA process is intended to ensure that delivered design products meet the established programmatic, performance, and technical goals of the project,[40] DSC QA reviews are conducted at major project submission milestones: 100 percent Draft Predesign, 100 percent Draft Schematic Design, Design Development, 100 percent Draft Construction Documents, and 100 percent Complete

[39] In accordance with Section 52.236-23 of the FAR, the A/E contractor is responsible for conducting Quality Control of the design deliverables prior to submission to DSC. DSC then performs QA of the supposedly finished product.

[40] The technical branch reviews are intended to ensure that the design meets code, is buildable and biddable, and does not raise any health, life, or safety concerns.

Construction Documents. Standard operating procedure at DSC is that each QA review be completed within 10 days,[41] but in practice can take closer to 25 days.

Measure	DSC	USACE	NAVFAC	Parks Canada
How many reviews?	5 reviews	4 reviews[1]	2 reviews[2]	Scaled by project complexity
Where is review performed?	DSC	Regional HQ / District[3]	Regional / Field	Central PM group
Who performs review?	QA discipline specialists	Project Delivery Team	Project Delivery Team	Peer group of PM staff
Is design deficiency tracking system used?	No	Yes[4]	Yes	Yes

[1] The number of reviews can be variable based on project complexity and scale. In addition, USACE asks PMs to set aside three calendar weeks for QA review. USACE interviewees felt that two calendar weeks was the minimum time frame. [2] Pre-final and Final are the two required reviews. [3] For projects designed by the owning district or activity, QA is performed by the Regional HQ. QA responsibility can also be delegated to the district for designs prepared by another district, government agency, or A/E contractor. [4] USACE, NAVFAC, GSA, VA, and many other federal construction programs use the Design Review Checking System (DrChecks) to enable actionable collaboration between reviewers and the design team.

Figure 10 - Comparison of QA Programs (Source: Research by National Academy of Public Administration)

In an ideal QA review, quality control and coordination is performed in-house by the A/E firm, and DSC should receive a package that is designed correctly and to the requirements found on the Workflows Website and in the Scopes of Service. In this ideal QA review, the comments are minimal, and the QA group is able to function in more of a technical expert role, collaborating with the PM/PS and Design team about what has worked and not worked on previous designs. One key role of the QA group, not documented in this analysis, is that of risk mitigation. In other words, preventing and resolving design issues before they turn into costly construction issues.

[41] The 10-day turnaround time for the QA group was established when the group performed fewer reviews each year, and did more QA than QC. The group has maintained its 10-day turnaround target as workload has increased and the complexity of reviews has increased. This has made it very difficult for the group to meet the 10-day turnaround target. In other words, it has created a false expectation that each review will be completed within 10 days, when realistically the group knows how unlikely the deadline is. Some DSC project teams have learned this and added more time to their schedules for the length of reviews, which has improved the relationship between the two groups on those projects.

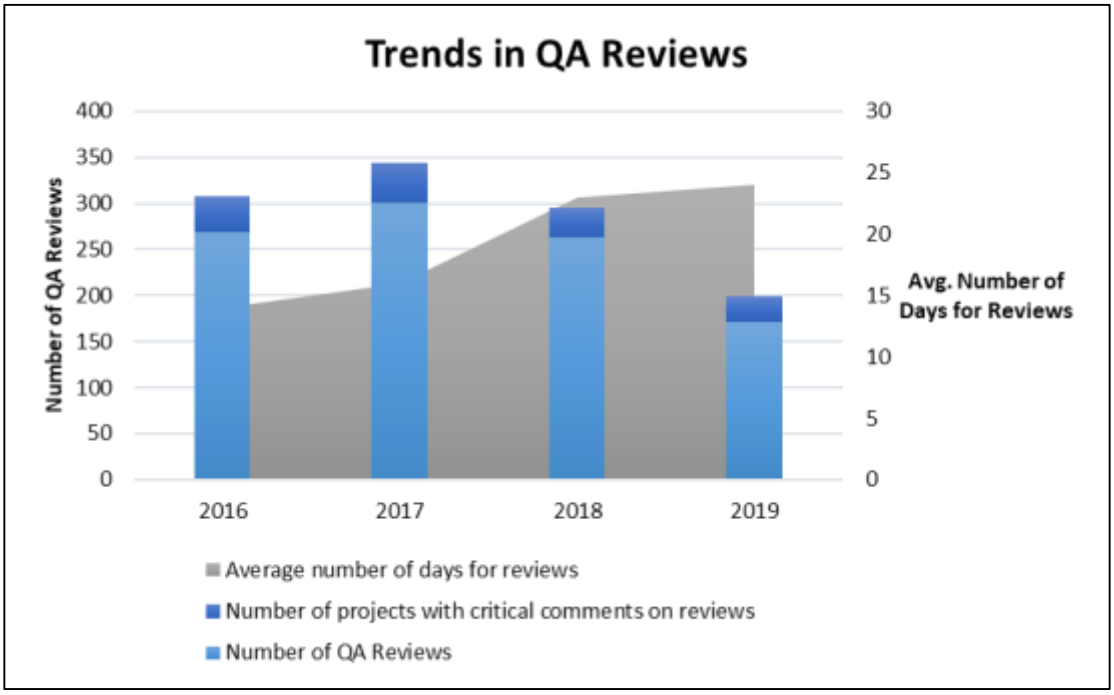

Figure 11. Trends in QA Reviews (Source: Recreated by the National Academy of Public Administration, Data provided by DSC as of 10/11/2019.)

In 2019, the *Wheeler Report* identified several issues related to the QA process at DSC that are driving long review times, including:

- A lack of integration between the QA review process and the design process managed by the DSC PM and conducted by the A/E firm (Finding #4);
- DSC acceptance of subpar designs from A/E firms[42], which forces the QA group to perform quality control (QC), a much lengthier process than QA[43] (Finding #7); and
- A breakdown in the working relationship between the Technical Branch's QA Group and DSC's Project Teams (Finding #9).[44]

The above factors, in addition to the increased volume of LIC construction, has significantly impacted the ability of the QA group to perform timely reviews. The Wheeler Report comprehensively documents this process and the impact it can have on projects. The Panel's research supports the conclusions made by the Wheeler Report and the Panel finds that the problems experienced at DSC are not unique when technical experts in the QA group are stove-piped by PM and construction-related discipline. The Panel notes that primarily using the technical experts in the QA group for review of technical documents from A/E firms leads to an underutilization of QA group's expertise. Currently, the QA group format can turn QA review into a "look at what's wrong, gotcha!" exercise.

[42] DSC and other agencies indicate that the quality of design deliverables has declined.
[43] Largely a product of trying to meet obligation deadlines and project milestones.
[44] See Appendix F for a full list of the findings and recommendations in the Wheeler report.

The study team's interviews indicate that these issues negatively impact DSC's relationship with its customers and A/E firms. But, these concerns are largely directed at the manner in which the process is managed and administered by DSC. Interviews with A/E firms highlighted three process improvements that, from their perspective, would improve alignment between their firm, the QA group, and the overall project design team.

- Improving coordination and integration of the QA reviewers with the project design team would lessen the surprises identified during the scheduled QA reviews.
- Fostering interim (between scheduled reviews) communications between A/E design team and the QA group regarding specific questions or concerns would reduce the number of comments received from a scheduled QA review.
- For new A/E's and following IDIQ re-competes, conducting face-to-face meetings between the A/E key staff and the QA group to review the DSC Workflows and QA group expectations.

Customers appreciated the work by DSC to ensure the design is accurate and meets their needs, but are often frustrated by the process.

Recommendation #4.5

DSC should adopt a two-part solution to refocusing the QA group's efforts to enhance project delivery.

1) The Panel endorses and encourages DSC adoption of Recommendation #4 in the Wheeler Report to improve integration between the QA group and the project teams; and
2) As part of implementing Recommendation #4 from the Wheeler Report and more fully engaging the QA group and regional QA staff,[45] DSC should expand the role of QA's technical experts. The current 13 technical experts in the QA group should be integrated into the project team and involved early in the project so that they can play a more constructive role, identifying innovations in design across the LIC project portfolio, and championing improvements to resolving process deficiencies.

Issue #3: Using Modern Enterprise Management Systems

The third major issue addressed in this chapter is Information management and the many systems that facilitate the collection, analysis, and reporting of information are vital for any modern organization. For the LIC program, information management means collecting, tracking, analyzing, and reporting of data on the schedule, cost, and quality of LIC projects.

Currently, DSC project teams must deliver projects working within a patchwork of duplicative and siloed IT systems that constrain efficient and effective D&C project execution. They sap valuable project management time, constrain NPS management line of sight into precise details of project performance, and hamper the project team's ability to manage and control project costs.

[45] Interviewees noted opportunities for greater involvement by regional subject matter experts during pre-planning, schematic design, value analysis, and design development. It was posited that this would improve the quality of project treatment development and reduce conflicts of treatment issues in final construction documents.

DSC project teams regularly use and enter information into five information management and reporting systems. These include MS Project, eCPIC, ADAB, and PMIS.

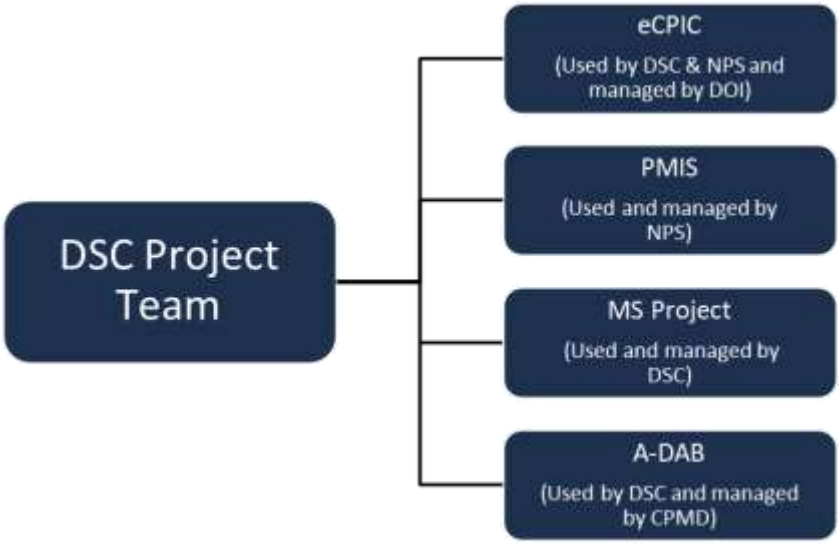

Figure 12. Graphic depicting information management and reporting systems used by DSC Project Team (Source: National Academy of Public Administration)

Interviews with DSC project teams and other staff highlighted several inefficiencies.

- **MS Project, ADAB, PMIS, and eCPIC are not integrated**. Information is not synced or otherwise automatically integrated across these five systems. The milestones in each of these five systems do not align. Finally, because information is not integrated across these systems, DSC project teams enter the same or similar information into multiple systems. The lack of integration also impacts other parts of NPS. For example, WASO Budget staff note that they check three separate systems to determine if a LIC project has a Class B estimate.
- **The ADAB submissions process is burdensome and value is unclear**. The ADAB system is administered by CPMD and was developed to allow NPS users to electronically prepare submissions for the DAB and other CPMD submissions. DSC project teams highlighted that the system required significant amounts of data entry, including detailed cost breakdowns. The study team notes that concerns with ADAB seem to be closely connected with the efficacy of the DAB review itself. For many, the effort put into ADAB submissions was not commensurate with the effectiveness of the DAB review or feedback.
- **The purpose and value of quarterly eCPIC submissions is unclear to project teams**. The eCPIC system[46] tracks the project budget on a cost curve, and any changes plus or minus five percent require the PM to complete and submit a Corrective Action Report. At the point the

[46] A process for CPIC is required by the U.S. Office of Management and Budget and DOI. DOI uses eCPIC as the reporting system for their CPIC process. eCPIC also functions as an intermediate step to the statutory requirement for scope changes plus or minus ten percent to be formally requested and approved by Congress.

report is submitted and approved, it is too late to be corrective, but rather is a justification of what's already been done. Project teams said that they believed the system was designed for IT projects, which generally have a flatter cost curve. Because construction projects generally have a growing or rising cost curve through construction, PM's must submit Corrective Action Reports every quarter. PM's estimate the quarterly report takes four to five hours to complete. For a PM with five projects, this could be two to three days of work every three months.

A problem with this system and quarterly reporting process is that the reporting seems to go into a "bureaucratic black hole." The PM's interviewed by the study team said they had never received any feedback on their entries into eCPIC, though this was not true of all eCPIC entries by DSC. PM's said that if the reported information is used to test the health of the budget and schedule every three months, then it is failing because the real cost control needs to occur daily and weekly.

From an agency-wide perspective, eCPIC is one tool to ensure there is transparency and accountability for LIC projects, which are both a major investment of taxpayer dollars and subject to strict reprogramming guidelines. The disconnect between this perspective and the PM's perspective seems to be a matter of implementation and coordination between disparate NPS systems.

- **DSC lacks a construction management system**. The former system was dependent on an external facing SharePoint service provided by DOI. In September 2019, DOI did not update their servers and stopped supporting the software. Currently, the construction management process occurs via email. Some PMs said that the volume and size of files being sent via email during construction regularly crashed their email client. Unfortunately, purchase of a commercial cloud-based service is not possible at this time since there are no FedRAMP approved construction management services.

DSC's ability to integrate and simplify systems and processes is complicated by the fact that only two systems are within DSC's direct control. The others are run by CPMD, NPS, and DOI.

Recommendation #4.6

DSC should follow a two-stage approach to reduce administrative burden caused by a disparate set of technology tools and siloed data, and improve the use of technology in the LIC program by DSC and others. This approach should begin with a review focused on what the project team needs to plan and manage the execution of the project, and then use that information to feed other systems and dashboards. There should not be anything needed by upper management that the project team is not already looking at during project execution.[47] The needs of the project team should be the guiding star for a Service-wide conversation on what is needed to meet the CPIC and other requirements.

[47] The Panel is not saying that DSC project teams are presently looking at all the information that they should be to ensure successful project execution.

- **Phase 1**: DSC, CPMD, and NPS should review existing systems, submittals, and reporting requirements for DSC project teams. The review, for each data field and requirement, should ask, "*How is this field or requirement used? Is it still useful or serving its intended purpose?*"
    - For fields or requirements that are still useful and serving their intended purpose, the field and requirement should be clearly defined and understood by those responsible for completing and fulfilling it.
- **Phase 2**: DSC, CPMD, and NPS should identify opportunities to consolidate systems, submittals, and reporting requirements.
    - As part of consolidating, NPS should identify and exploit opportunities to eliminate data siloes across the LIC program and organization.
    - NPS should use the services of GSA's 18F[48] for digitizing processes, substantially streamlining existing IT infrastructure, and procuring or building new IT infrastructure.

As part of these reviews, NPS and DSC should assess what additional data should be collected and analyzed in order to support cost estimating capabilities and other programmatic decision-making. In addition, NPS should reduce duplicative data entry, striving toward a goal of one-time data entry.

Opportunities to develop standardized designs for LIC

It is also important to identify and assess opportunities for the application of standardized designs for LIC. In order to identify opportunities for applying standardized approaches, it is essential to distinguish between levels of standardization, and to understand the costs and benefits of standardization. In a report for DOD, the Logistics Management Institute identified four levels of design standardization.[49]

1. **Standard designs** – Complete construction drawings that cover every aspect of construction, which provide the greatest degree of design standardization.
2. **Definitive drawings** – A lesser degree of design standardization, which shows space allocation, functional layouts, special features and requirements, and configurations for a complete facility, but do not include enough detail to be used for the construction of the facility.
3. **Functional modules** – Drawings that delineate functional elements, such as room types.
4. **Design criteria** – The least degree of standardization, which include written and graphic guidance describing the standards and requirements necessary to meet regulations and directives.

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[48] The Panel notes that 18F does not have its own appropriated budget, but rather is cost-recoverable, meaning they charge partner agencies for their work. The Panel believes this properly aligns the incentives between NPS and 18F, which is an alignment often missing in the procurement of IT services. The Panel notes that the three projects highlighted in 18F's recent update closely resemble NPS's needs. (Read more)

[49] "Better Facilities Through Design Standardization", DoD, Accessed June 17, 2020 https://apps.dtic.mil/dtic/tr/fulltext/u2/a193203.pdf

Standard designs, as defined above, are not generally used by the public or private sector for two reasons. First, is the diversity of factors to which design must be adapted in different locations. These include environmental factors such as rain and snow loads; temperature differentials and humidity; seismic conditions; and site characteristics. These factors often require very different design solutions and costly redesign. Second, is liability concerns. Even when location conditions conform to the standard design, concern about liability for facility problems may lead A/E firms to insist on validating the design. The time and cost of this validation may be as great or greater than that entailed by the original design.

Functional modules and the associated use of prefabricated building systems have become increasingly common in industry. This has been aided by the adoption of Building Information Modeling (BIM).[50]

NPS has developed models for some asset types that predict total square footage based on different inputs. It is also considering the use of pre-engineered products for project components such as garages and comfort stations; and it has used modular, prefabricated units for employee housing. But, the majority of NPS projects do not involve the first three layers of standardization mentioned above.

Potential Costs and Benefits of Standardization

The appropriate level of standardization is determined on the basis of a number of factors. The most important factors are the applicability of standardization for the category of facilities under consideration, the costs to achieve and maintain the level of standardization, and the benefits that can be expected from the level of standardization being considered.

Applicability of standardization for facilities under consideration

The selection of the facilities to standardize is a critical part of any standardization policy. The resource requirements to maintain the standards can quickly become burdensome, and as a result the standards are not maintained and, thus, do not address current needs. The standards then fall into disuse. The facility types to be standardized will be limited by the number of facilities expected to be built over the next one to five years.

Using the above factors, the Panel found that the application of standardized design approaches is constrained by the fact that most projects are rehabilitation and restoration of existing assets, instead of replacement or new construction.[51] Based on the study team's review of the LIC 5-year plan, the

[50] The adoption of BIM systems also has the potential to enable much more efficient and effective interaction among stakeholders in the design process. This can not only reduce design time, but yield better designs that anticipate issues in construction and reduce errors that might otherwise lead to delays in construction and costly change orders. However, it is important to note that the adoption of BIM systems requires a significant investment in standardization of processes and practices.

[51] To categorize LIC projects, the Academy study team used the following methodology. First, the study team identified all projects described in the title as "replace." Second, the study team screened out from this group

number and percentage of projects in each FY involving replacement versus rehabilitation or restoration is as follows:

- FY 2021 – 4/13 or 30.8 percent
- FY 2022 – 1/8 or 12.5 percent
- FY 2023 – 7/12 or 58.3 percent[52]
- FY 2024 – 3/13 or 23.1 percent[53]
- FY 2025 – 5/14 or 35.7 percent

Most (12 out of 20, or 60 percent) LIC "replacement" projects involved water or wastewater treatment systems. In addition, the study team's research suggests a significant number of planned LIC projects to replace employee housing.[54] Thus, the published LIC plan for FY 22 – FY 25 suggests that water/wastewater treatment systems and employee housing may offer a potential focus for design standardization, if the necessary scale can be achieved to offset upfront investment in development.

Costs to achieve and maintain the level of standardization

The costs to develop and maintain standardized designs, at any level, is a key consideration.[55] Establishing and maintaining any type of standard is expensive and requires significant collaboration and engagement across an organization. The greater the degree of standardization (i.e., the higher the level), the greater the investment of time and money. It is not prudent to establish a standard unless there is a reasonable expectation that significant benefits can be obtained by standardizing at the level under consideration. Even if costs and benefits cannot be precisely quantified, an analysis of their potential impacts should be part of the decision process for determining the appropriate level of standardization for any facility type.

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projects that only included replacing components of a larger system. Third, the study screened out projects involving asset types not called out in the contracted Statement of Work (visitors centers, water/water treatment and utilities, and employee housing) or identified in expert interviews (e.g., docks). It is important to note also, that components of larger projects, such as comfort stations and garages generally can only be identified in the more detailed "project data sheets" accompanying budget requests. Projects planned for the out-years are not accompanied by data sheets.

[52] This accounting does not include a project to "upgrade utilities project F" at the White House. The study team did not have detailed project description to determine is this was primarily defined by replacement.

[53] This accounting does not include a projects to "relocate NPS administrative structures from sensitive resource." This project title suggests "replacement," but the study team did not have detailed project description to confirm.

[54] The FY 21 – FY 24 LIC plan listed 4 employee housing projects for FY 21, but these projects did not appear in the FY 21 Presidential Budget Request.

[55] "A Report on the Benefits and Disadvantages of Prototypical School Design and Construction in Alaska," NIVSION Architecture and Dejong-Richter, 2015.

Potential benefits and cost efficiencies of standardization

Literature indicates two primary cost efficiencies related to the standardization of designs:

1) Minimizing design phase timeline can save dollars by reducing inflation in construction costs; and
2) Reduction of A/E design costs.[56]

Minimizing design phase timelines reduces impact of inflation on construction costs: Delays or lengthy timelines for the design phases do not, by themselves, adversely impact project costs. However, when construction inflation is factored in, long design timelines can equate to additional project costs. See Figure 13 below for a breakdown of design phase timelines (Predesign to 100% Construction Documents) for a subset of DSC projects between FY16 and FY19.

Time from PD to 100% CD (FY16-FY19)

	0-6 months	7-12 months	13-18 months	19-24 months	25-30 months	31+ months
Projects[4] $20m +	0 projects	0 projects	1 projects	1 projects	1 projects	4 projects
Projects[3] $5-20m	3 projects	15 projects	12 projects	19 projects	21 projects	19 projects
Projects[2] $2-5m	26 projects	55 projects	44 projects	26 projects	21 projects	29 projects

Figure 13. (Source: DSC project data)

The below analysis examines potential cost savings resulting from backing up the construction start date by one year and factoring in the construction inflation for that year. Although these projects have either just begun construction or are in the FY21 Greenbook (pre-construction), this analysis uses construction cost inflation data from 2019 and 2018, by way of example. In Figure 14, below, it is evident that shortening the design timeline, for even a small subset of projects, could save NPS significant capital dollars. However, no matter the level of design standardization, there will still be some delay between design and award, because the NPS budget process requires completion of schematic designs two years prior to the year of appropriation. Because of the budget process, the savings indicated by the following analysis might be overstated. The following projects are

[56] "The Facility Management Handbook, Second Edition," David Cotts.

illustrative of the potential cost efficiencies that might result from standardized designs, but not meant to suggest which projects with which NPS should implement design standardization.

Project Name	Construction Cost	Cost Adjusted for Inflation Minus 1 Yr.	Dollar Cost Difference
Replace Utilities Along Lake McDonald	$ 16,874,000.00	$ 16,198,167.96	$ 675,832.04
Rehabilitate Sugarlands Water and Wastewater Systems	$ 8,614,000.00	$ 8,268,994.83	$ 345,005.17
Rehabilitate Unsafe and Failing Electrical System for Settlement	$ 16,030,000.00	$ 15,387,971.58	$ 642,028.42
Rehabilitate Unsafe and Inadequate Primary Electrical System at Fort Mason	$ 19,406,000.00	$ 18,628,757.11	$ 777,242.89
Expand Utility Infrastructure for Stehekin Wildland Fire Facility and Dorm	$ 6,189,000.00	$ 5,941,120.16	$ 247,879.84
Repair Sewer System, Mammoth Cave National Park	$ 6,040,000.00	$ 5,798,087.86	$ 241,912.14
Replace Non-Compliant Lodgepole Water Treatment System	$ 4,731,000.00	$ 4,541,515.50	$ 189,484.50
Rehabilitate Big Spring Utilities	$ 9,706,000.00	$ 9,317,258.40	$ 388,741.60
Total	**$ 87,590,000.00**	**$ 84,081,873.39**	**$ 3,508,126.61**

Figure 14. Construction cost adjusted for inflation (Source: Construction cost inflation factor sourced from the RSMeans historical cost index)

Reduction of A/E Design Costs – A common application of standardized designs is school design and construction. One analysis of the feasibility of standardized design, quoted a former staff architect for a large metropolitan school system as saying, "Once the prototype design is developed, subsequent facilities can be constructed at a reduced rate for design fees. While there will always be site adaptation considerations and site specific civil engineering requirements, the basic design,

floor-plan, dimensions, and elevations remain the same. Based on that assumption it is conceivable that design fees could be reduced as much as 2 to 3 percent."[57] The aforementioned study performed an analysis of potential costs savings, assuming a 2% reduction in design fees, as a percentage of total construction cost. Figure 15 below applies the same analysis to NPS LIC utility and water/wastewater projects included in the FY20 and FY21 DOI Budget. The below illustrative analysis assumes very generous cost efficiencies for the A/E design fee, resulting from design standardization. It is important to note that the Panel is not suggesting these eight projects are candidates for standardization. In fact, a close examination of these projects highlights the significant variance in size, capacity, need, state regulatory standards, and seasonal use. This variance is typical of the majority of DSC projects in the LIC 5-year plan and significantly complicates standardization efforts.

Project Name	Design Cost	Original Design Cost as % of Construction	Less 2%	Original Design Cost % Less 2%	Reduced Design Cost As % of Construction	Design Cost Difference
Replace Utilities Along Lake McDonald	$ 500,000.00	2.96%	2%	0.96%	$ 162,520.00	$ 337,480.00
Rehabilitate Sugarlands Water and Wastewater Systems	$ 850,000.00	9.87%	2%	7.87%	$ 677,720.00	$ 172,280.00
Rehabilitate Unsafe and Failing Electrical System for Settlement	$ 889,000.00	5.55%	2%	3.55%	$ 568,400.00	$ 320,600.00
Rehabilitate Unsafe and Inadequate Primary Electrical System at Fort Mason	$ 1,347,000.00	6.94%	2%	4.94%	$ 958,880.00	$ 388,120.00
Expand Utility Infrastructure for Stehekin Wildland Fire Facility and Dorm	$ 710,000.00	11.47%	2%	9.47%	$ 586,220.00	$ 123,780.00
Repair Sewer System, Mammoth Cave National Park	$ 884,000.00	14.64%	2%	12.64%	$ 763,200.00	$ 120,800.00
Replace Non-Compliant Lodgepole Water Treatment System	$ 415,000.00	8.77%	2%	6.77%	$ 320,380.00	$ 94,620.00
Rehabilitate Big Spring Utilities	$ 775,000.00	7.98%	2%	5.98%	$ 580,880.00	$ 194,120.00
Total	**$ 6,370,000.00**	**N/A**	**N/A**	**N/A**	**$ 4,618,200.00**	**$ 1,751,800.00**

Figure 15. Academy Analysis of LIC Utility and Water/Wastewater Project Design Costs (Source: DOI Budget Requests from FY20/21)

[57] "Standardized Design Process and Capital Planning for Salvation Army Corps Community Centers", Georgia Institute of Technology, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.546.5459&rep=rep1&type=pdf

When the cost savings from these two analyses are combined, in Figure 16 below, the cost savings become significant.

Project Name	Construction Cost Savings	Design Cost Difference	Combined Design / Construction $ Savings	Combined Design / Construction % Savings
Replace Utilities Along Lake McDonald	$ 675,832.04	$ 337,480.00	$ 1,013,312.04	5.83%
Rehabilitate Sugarlands Water and Wastewater Systems	$ 345,005.17	$ 172,280.00	$ 517,285.17	5.47%
Rehabilitate Unsafe and Failing Electrical System for Settlement	$ 642,028.42	$ 320,600.00	$ 962,628.42	5.69%
Rehabilitate Unsafe and Inadequate Primary Electrical System at Fort Mason	$ 777,242.89	$ 388,120.00	$ 1,165,362.89	5.62%
Expand Utility Infrastructure for Stehekin Wildland Fire Facility and Dorm	$ 247,879.84	$ 123,780.00	$ 371,659.84	5.39%
Repair Sewer System, Mammoth Cave National Park	$ 241,912.14	$ 120,800.00	$ 362,712.14	5.24%
Replace Non-Compliant Lodgepole Water Treatment System	$ 189,484.50	$ 94,620.00	$ 284,104.50	5.52%
Rehabilitate Big Spring Utilities	$ 388,741.60	$ 194,120.00	$ 582,861.60	5.56%
Total	**$ 3,508,126.61**	**$ 1,751,800.00**	**$ 5,259,926.61**	**5.60%**

Figure 16. Combined Cost Savings

The above data suggest positive financial benefits can be derived from standardized design, should NPS be able to identify a significant subset of replacement or new construction projects that can be standardized, either within the LIC program or across the entire construction portfolio.

Recommendation 4.7

NPS should pursue greater standardization of design where they have a critical mass of replacement or new construction projects on suitable specific asset types.

Critical Success Factors for Facility Design Standardization of Capital Projects

If NPS does more fully develop and implement some level of standardized designs, a 2020 publication by the American Society of Civil Engineers in the Journal of Management in Engineering[58] identified fifteen critical success factors for facility design standardization to promote improved cost-effectiveness, agility, and predictability of standardized capital projects.

No.	Critical Success Factors	Description
1	*Alignment and approval-prior to basic design*	Project stakeholders must be aligned vertically and horizontally on the standardization approach and the project drivers (e.g., costs, benefits)
2	*Standardization early identification*	Owner should identify the need/opportunity for standardization
3	*Discipline to maintain standardization*	Owners must be disciplined, consistent, and committed (rigorous project oversight) across the lifecycle of the project, including making decisions/changes that fit the standardization approach and applying learnings from completed projects into future projects
4	*Operations & maintenance consideration*	Operations is a stakeholder throughout the lifecycle of the project, including lessons learned, and needs to be involved early
5	*Basic Engineering Design Data (BEDD)*	Select and commit to company and industry-standard procedures (detailed), specifications, and design decisions that support the standardization approach
6	*Define the standardization approach*	Owner should define the level of standardization for the project
7	*Applied knowledge*	After the first of multiple projects have been completed, the lessons learned should be reviewed and considered for incorporation into the standardization approach
8	*Constructability of standardization*	Owner should have an early constructability review to maximize the standardized design in order to gain constructability benefits
9	*Experience and capability of project team*	Project leadership should have experience or capability to implement a standardized project
10	*Benefits and tradeoff recognition/ evaluation*	Owner should understand the schedule, cost, and total cost of ownership [Capital Expenditures (CAPEX) and Operational Expenditures (OPEX)], as well as the capability benefits and tradeoffs of standardization through benchmarking, and quantifying available data
11	*Procurement development*	Align all contracting strategies to the standardization strategy across the entire supply chain
12	*Technology maturity*	Owner should select technology for the standardization efforts that is proven and mature in order to enable future, repeatable implementation
13	*Recognition of risk of standardization*	Owner must be aware that standardization can be subject to changes [e.g., environmental regulations, safety, Process Hazard Analysis (PHA)]. These changes should be deliberately quantified where possible
14	*Suppliers/vendors involvement*	Owner may create long-term partnerships with suppliers to further optimize or leverage standardized equipment and processes
15	*Feasibility analysis of standardization*	Owner should complete an early, timely, and thorough feasibility analysis that incorporates all of the benefits (e.g., NPV) of standardization. This may require third party involvement

Figure 17. Critical success factors and descriptions (Source: Study in ASCE's Journal of Management in Engineering)

[58] "Critical Success Factors", ASCE, Accessed on June 17, 2020 https://doi.org/10.1061/(ASCE)ME.1943-5479.0000788

Chapter 5: Understanding and Implementing Alternative Project Delivery Methods

The statement of work for this review directed the Panel to consider whether NPS and DSC are using "the optimal mix of contracting approaches." The Panel is tasked with identifying opportunities for greater reliance on methods like Design-Build (DB) or Construction-Manager-at-Risk (CMAR). This chapter on alternative project delivery methods has three major sections: 1) a general framework for understanding project delivery and the different methods; 2) a current-state assessment of project delivery at DSC and the related challenges; and 3) the Panel's recommendation on project delivery at DSC. The Panel notes that the defining characteristic of the alternative delivery methods discussed in this chapter is that they are more collaborative that Design-Bid-Build. For that reason, this chapter will use the term "collaborative delivery methods."

A General Framework for Project Delivery

Choosing a project delivery method, or how the project will be designed and constructed, is one of the most important decisions made by the owner of a construction project. Today, it is possible to choose a delivery method that is tailored to the unique needs of the owner and the project. For reference, see the chart below that illustrates the typical delivery roles within NPS.

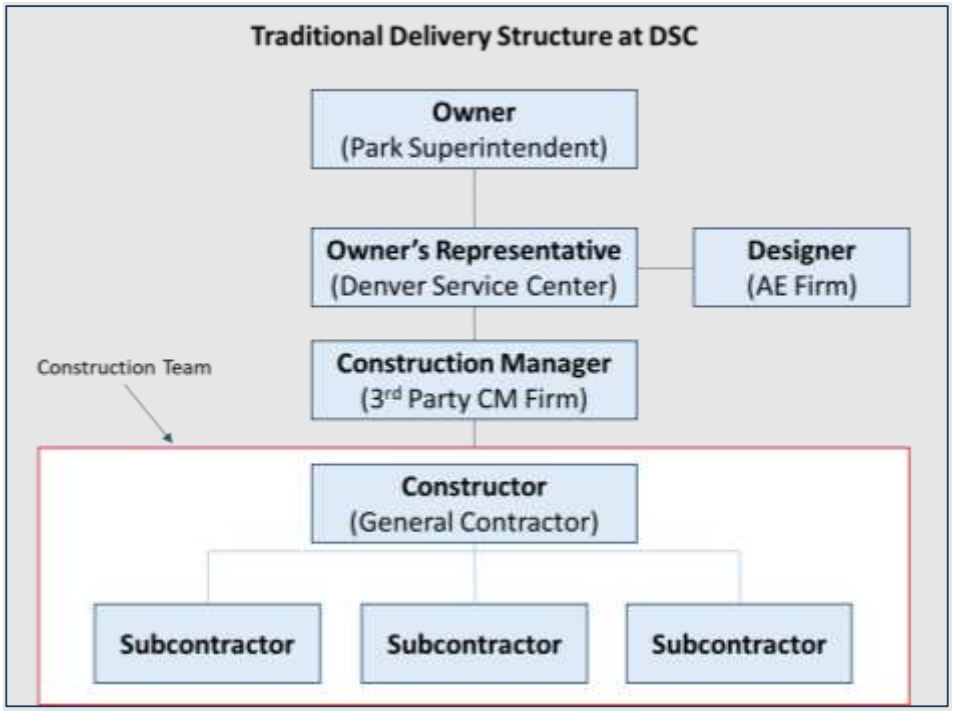

Figure 18. Traditional NPS Delivery Roles for Design-Bid-Build (Source: National Academy of Public Administration)

Several fundamental considerations are impacted by the delivery method, including:

- The need to adhere to a realistic budget and schedule;
- A schedule that accurately presents the performance period;

- A responsive and efficient design process that leads to a quality set of documents;
- A thorough risk assessment followed by the proper allocation of risk by the owner; and
- A recognition of the level of expertise within the owner's organization or available to it.[59]

In addition to the project delivery method, the owner will need to decide on the contracting, compensation, and procurement methods.

Contracting and compensation methods for professional and construction services will generally fall into one of three categories: Fixed Price, Guaranteed Maximum Price (GMP), or Reimbursable. These methods are not specific to any project delivery method. Procurement of professional and construction services will generally be accomplished in one of three methods: price-based, qualifications-based, or a combination of both.[60]

This report will frame the different delivery methods in the context of perceived owner risk, actual owner risk, and ability of the delivery team to mitigate risk.

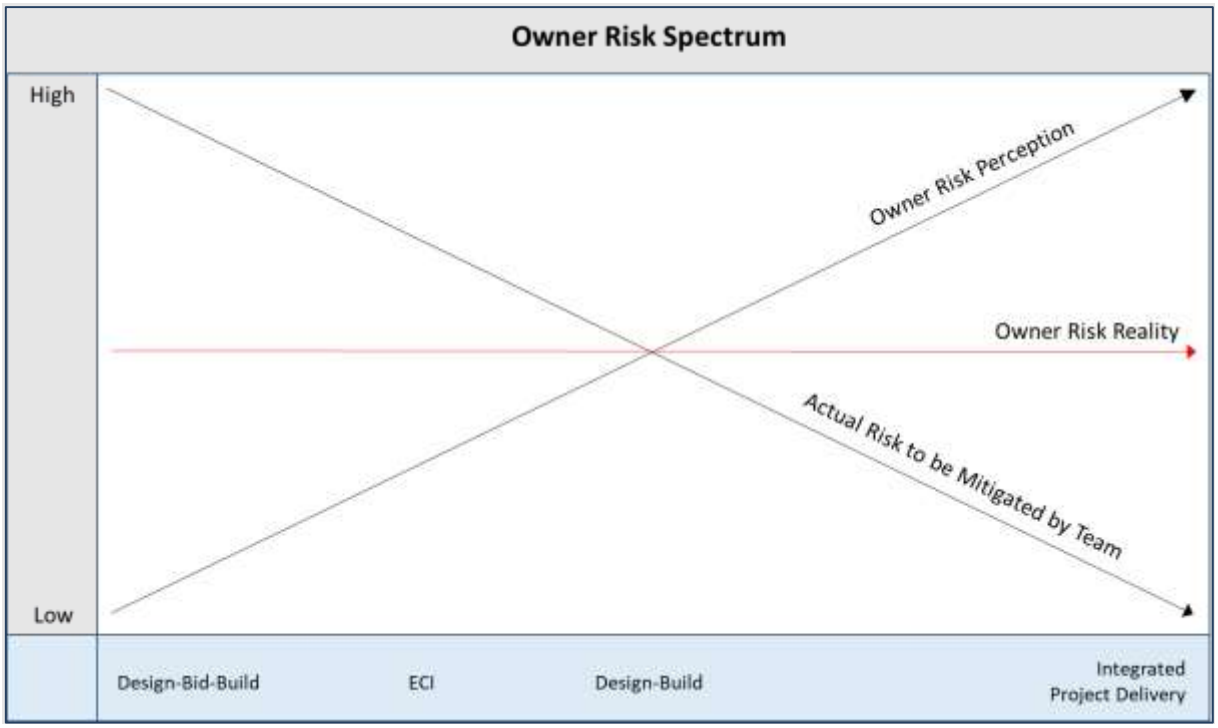

Figure 19. Owner Risk Spectrum (Chart created by the National Academy of Public Administration, based on expert input)

On one end of the spectrum is the Design-Bid-Build delivery method. For 30 to 40 years, owners believed that Design-Bid-Build (DBB) minimized their risk to the greatest extent and created the most competition for the cost at which construction was executed. Over time, DBB in practice has

[59] An Owners Guide to Project Delivery Methods, CMAA, pg. 1
[60] Ibid., pg. 2

resulted in the owner negating their risk by forcing it on contractors and subcontractors. The owner then pays for this loss of risk through higher rates, court fees, or re-designs. Many experts believe that the perceived risk shift in DBB is illusory.[61]

On the other end of the spectrum is the Integrated Project Delivery (IPD) method, in which all parties are fully integrated and aligned with a single multi-party contract. Rather than each member focusing solely on their aspect of the project, IPD forces them to consider the implications on the overall project. This model is based on the principle of shared risks and rewards, which can incentivize participants to mitigate risk as a team. The Design-Build method, Early Contractor Involvement (ECI) method, and other similar methods fall in between the two extremes of DBB and IPD.

Over the last two decades, industry has migrated away from the sole use of DBB and into other, more collaborative delivery methods. A 2018 forward-looking review of industry delivery method utilization indicated that between 2018 and 2021 only 19 percent of projects were delivered with the DBB approach. Both the CMGC/CMAR and DB delivery methods were used more often.

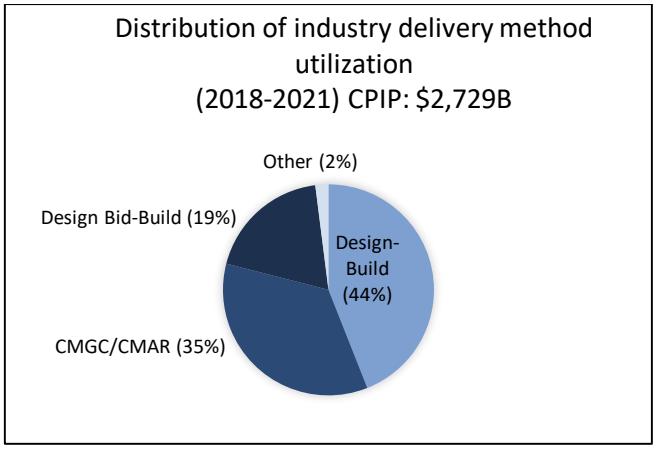

Figure 20. (Source(s): FMI Corporation analysis of multiple sources, 2018)

One reason for the gradual industry transition to collaborative delivery methods is the opportunity to reduce schedule, increase quality, and lower costs. A key driver inherent to these delivery methods is bringing the entire team[62] together earlier in the process, when changes have a lesser impact on cost. This changing impact of costs throughout the delivery process is illustrated by the MacLeamy Curve (below), which shows that the ability of the project team to impact cost and functional capabilities is inversely related to the cost of those design changes.

[61] In a more than 100-year old case (U.S. v. Spearin, 248 U.S. 132), the U.S. Supreme Court ruled that by providing detailed plans and specifications to the construction contractor, the owner also provided an implied warranty to the plans' accuracy and adequacy. The Court held that the contractor would not be responsible for the consequences of defects in the plans and specifications, and the owner would be responsible for increased costs resulting from defective plans and specifications.

[62] This includes the A/E firm, the owner, the constructor, subcontractors, specialty vendors, and sometimes the construction manager.

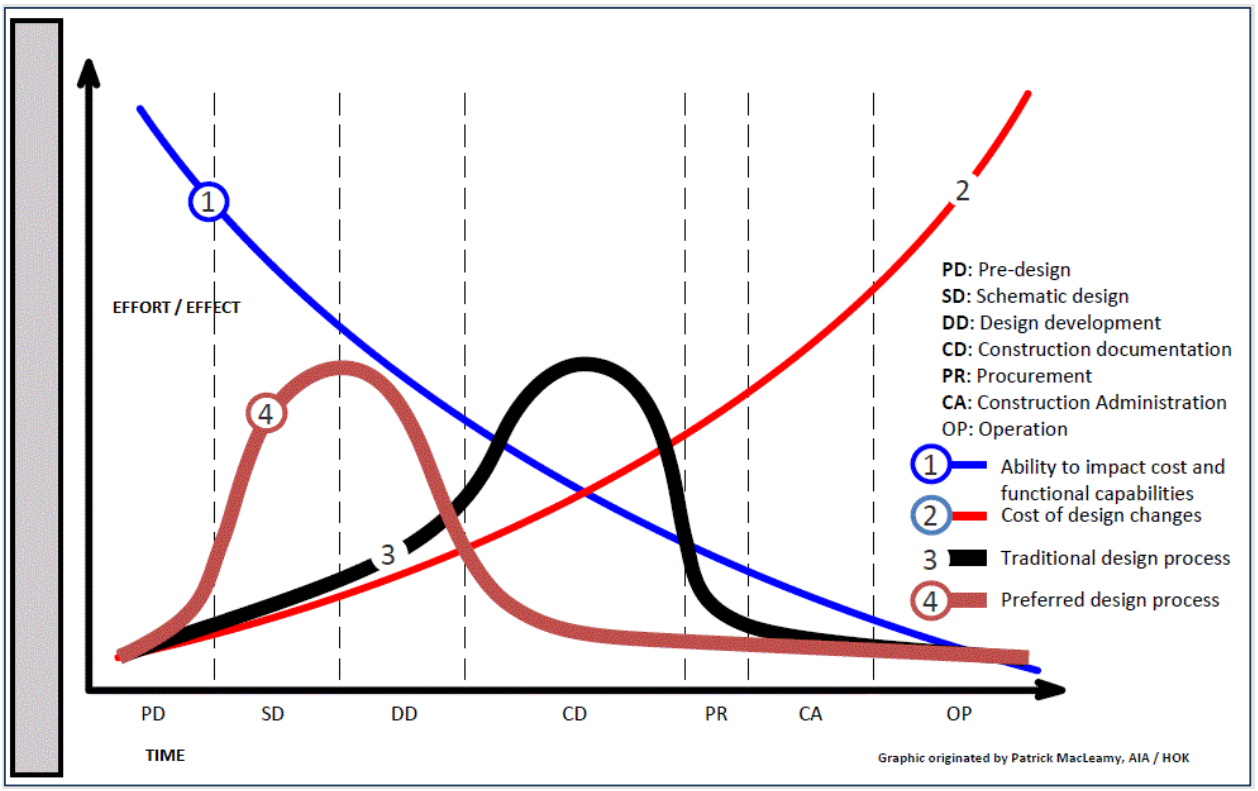

Figure 21. The MacLeamy Curve (Source: Patrick MacLeamy, AIA)

When using a traditional delivery method, like DBB, subcontractors and specialty vendors typically join the project at a fixed cost during or after the procurement phase. Any change to the project at that point is extremely costly. The intent of collaborative delivery methods is to use specialty expertise to inform both cost and technical acceptability at a time when their knowledge can be effectively and efficiently utilized, which is generally during the schematic design and design development phases. Line #4 in Figure 21 shows that expertise is more cost-effectively deployed earlier in a project. Involvement of constructors early in design efforts provides the owner with better ability to identify issues and develop cost-effective solutions when working within a fixed price project environment as DSC often does.

DSC's Use of Project Delivery Methods

The Panel finds that approximately 95 percent of DSC projects use the DBB project delivery method, contrary to industry practice and, to a lesser extent, contrary to the practices of other federal agencies.[63]

The chart below, Figure 22, captures the four major delivery methods and DSC's use of, rationale for, and legal authority to use each method.

[63] Interviewees at GSA, USACE, and NAVFAC said that somewhere between 25-50 percent of their projects use collaborative delivery methods. USACE said that overall, their DB projects experience one to two percent less cost growth.

Current State – Delivery Methods at DSC			
Delivery Method	**DSC Use**	**DSC Rationale**	**Legal Authority**
Design-Bid-Build	Preferred method at DSC. Used for approx. 95 percent of projects.	Provides ample control of the design and ensures it's done "right".	Yes
Design-Build	Rarely used. DSC process turns this into Design-Build Bridging. Has been used to increase award / obligation timeline.	Because DSC maintains responsibility for the design intent, it does not provide efficiencies in cost and schedule.	Yes
CMGC / CMAR	Does not use.	DSC has said they do not have the authority to use this method.	DOI Regional Solicitor has informally discouraged the use of CMAR/CMGC, and other agencies, like GSA have encountered legal trouble when using CMGC/CMAR.
IPD	Does not use.	--	Unclear.

Figure 22. Current State Assessment of Delivery Method Utilization at DSC (Source: National Academy of Public Administration)

As noted in the chart above, DSC has the authority to use the Design-Build method, and has a documented workflow for DB projects at DSC, but rarely chooses to use it in practice. DSC project teams said their DB process turns it into Design-Build-Bridging, which seems to minimize the efficiencies gained with DB.

A Path Toward an Optimal Mix of Delivery Methods

DSC's LIC portfolio is diverse. The majority of projects have a historic component. More than 90 percent of the portfolio is major rehabilitation and renovation projects. The projects involve many different groups of stakeholders. The projects are often in remote locations. In other words, NPS LIC projects often involve significant uncertainty and differing stakeholder perspectives. DSC PMs affirm that many important discoveries are not made until late into the design process or after construction starts.

The study team's research suggests that DSC LIC projects have a high number of change orders. Projects with a significant historic component often have 20-30 construction modifications, with multiple change orders bundled within a single construction modification. Even so, the cost growth related to change orders on LIC projects rarely exceeds the available contingency funds (10 percent

of net construction cost). In the Academy's analysis of 37 recently completed LIC projects (with construction funds appropriated between 2015-2017) none exceeded the available contingency funds.

Once a single construction modification has been developed and signed off on, it triggers the fund request process, which goes from DSC through the region to WASO, where construction contingency funds are held. Interviewees estimated that the timeline for the construction modification and fund request process was an average of three to four weeks from the initial purchase request within DSC to disbursement of funds. The Academy team was unable to obtain data to track the entire process from the creation of the purchase request to release of funds for use.

One purpose of collaborative delivery methods like DB, ECI[64], or CMGC is to front-load the discovery of triggers for change orders, so that they can be resolved collaboratively early in the project, when the impact on cost and schedule can be minimized (in accordance with the MacLeamy curve.) Numerous studies have validated this outcome.[65]

Today, DSC is under pressure to reduce costs, accelerate schedules, and maintain or improve the quality of their projects. The Panel identified a number of improvements to the current process for delivering projects. These improvements are necessary, but not sufficient in the pursuit of program improvement. Many of the challenges that DSC is facing, like a high volume of changes orders, are emblematic of the DBB method, and are a reason why other government construction programs (USACE and NAVFAC) and industry have embraced other delivery methods.

Impediments within NPS to Adopting Collaborative Delivery Methods

The study team's interviews and analysis identified several impediments to the adoption of collaborative delivery methods at DSC.

Perception of Risk and a Conservative Culture at NPS

DSC employees, and many parks, believe the DBB delivery method allows NPS to ensure that all stakeholders are heard and enable them to best mitigate risk. They say that the DSC process prevents project teams from using DB as it is intended to work, which introduces significant risk for NPS and creates scope creep. DSC employees say DBB is a better fit because NPS has its own unique standards and historic structures, a park has its own needs and constraints, and many other stakeholders have their own needs. The conclusion is that all of these factors enhanced the need for significant

[64] Note that USACE and NAVFAC developed a method called Early Contractor Involvement (ECI), that resembles CMGC / CMAR. The general structure resembles DBB, but a constructor is engaged during the design phase to provide input. (More information)

[65] Kulkarni, A., Rybkowski, Z.K. and Smith, J. (2012). Cost Comparison of Collaborative and IDP-like Project Delivery Methods Versus Competitive Non-Collaborative Project Delivery Methods. International Group for Lean Construction. And Konchar, M. & Sanvido, V. (1998). Comparison of U.S Project Delivery Systems. Journal of Construction Engineering and Management, Vol. 124, No. 6, November/December, 1998, 435-444. And Hale, D.R. (2005). An Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods. Austin, Texas: The University of Texas at Austin.

coordination, which is more easily conducted with the DBB method. Several interviewees said that they "would never use DB for historic structures."

The reliance on DBB, and hesitance to use other methods, is regularly attributed to a conservative culture within NPS and DSC.

Desire to own the design, and make it perfect

Another challenge identified was a strong desire by both DSC and some parks to own the design and "make it perfect." Our research indicated that superintendents and cultural resource managers were hesitant to use DB for their unique assets. The perception was that they give up control of the designs when using DB. One interviewee said that because many parks only construct a large project once every ten years, their perception is that they (the park) get the most control of the result by using DBB. A Park performing major construction once every ten years may not be best suited to dictate the choice of project delivery method to expert project management teams at DSC.

However, interviewees said that DSC project teams also prefer to own the design, which is what DBB provides. The impact of the desire to own the design and "make it perfect" is likely far-reaching, but can quickly be observed in the dysfunctional QA review process and interviewees concern of losing control of the design when using other methods. The Panel notes that this could also be attributable to the narrow focus of designers reviewing designs versus builders reviewing designs for constructability. The Panel notes that designers, as a general group, tend to think of themselves as the experts, and under-value the impact of builders' constructability expertise. This distinction is made sharper by DSC project teams largely being staffed by former landscape architects and engineers (this is discussed in greater detail in Chapter 6).

In the words of several external interviewees (all of whom are construction professionals), "the design will never be perfect, but A/E's always want to do a 'pure design.'" No matter the quality of the design, there will always be change orders and new discoveries during construction that change and impact the project design. Getting everyone involved early helps narrow these things down.

Interviewees, at other federal agencies, experienced with alternative project delivery methods emphasized that it was "wrong-headed" to think DSC would have less control. Instead, it's about 1) Better capturing the requirements up front; and 2) the PM remaining involved throughout the process, supervising and engaging with the design-builder.

PM's not in field and on multiple projects limited time to truly be PM's

The above point about PM's remaining closely involved throughout the project conflicts with practice at DSC. DSC PM's are staffed on many projects, in different locations, all at different phases. In addition to this challenge, project teams are weighed down by significant administrative burdens including duplicative data entry and duplicative reporting requirements. Finally, PM's do not perform onsite construction management, which minimizes their ability to manage, supervise, and facilitate collaborative delivery methods. Other federal construction program executives emphasized that the

biggest determinant of success with methods like DB was "the application of the approach on the ground by the project team."

Lack of experience with other delivery methods

Quite obviously, because DSC primarily uses DBB, it's project teams and contracting officers are not familiar with alternative delivery methods. In addition, the broader NPS legal and contracting communities are not familiar with the methods. Other agencies highlighted alignment between legal, contracting, and the PMs as the most important piece of implementing other delivery methods like DB, CMGC, ECI.

In addition to lack of understanding of other delivery methods at DSC and NPS headquarters, our analysis identified a widespread lack of understanding at the park and regional levels, where projects are formulated and executed. The impact is unclear, but it certainly factors into potential solutions.

In addition to these general impediments, project teams highlighted a number of process constraints to collaborative delivery methods. These include:

- The timing and process for project review by the Service-wide Development Advisory Board.
- The QA group expectations for level of design in 100 percent CD's does not align with typical execution of collaborative delivery methods.
- Funding requirements and processes run by WASO can constrain funding of collaborative delivery methods.
- Compliance requirements and timelines for review by the SHPO can be a major roadblock. The review is typically completed before construction starts, once well-developed design documents are produced.
- The high performance standards for NPS' assets can create misalignment between the contractor's incentives to control costs in construction and the performance standards that NPS typically specifies in the contract.

Recommendation #5.1

The overriding goal for DSC should be to increase collaboration by the early use of expertise (designer, contractors, and sub-contractors) in the delivery process, in order to improve predictability and enhanced cost-based decisions, in accordance with the principles depicted in the MacLeamy Curve. Collaborative delivery methods are one of the tools for DSC to increase collaboration in the delivery process.

DSC should begin with piloting the use of collaborative project delivery methods with a subset of projects, for which they have robust historical data to compare performance to and measure improvements in delivery. The pilot projects should use a Plan-Do-Check-Adjust (PDCA) methodology[66] to quickly determine the best practices for use at NPS. The pilot approach is important because DSC will need to develop practices, build consensus across functions, and establish the infrastructure to maximize the impact of collaborative delivery methods. Other federal construction

[66] Plan-Do-Check-Adjust, Accessed March 26, 2020, https://asq.org/quality-resources/pdca-cycle

program executives emphasized that the biggest determinant of success with collaborative delivery methods was "the application of the approach on the ground by the project team." In other words, the capacity and capability for execution by the DSC project team, the contractor, the designer, and the construction management consultant.

Once this pilot process has been completed, DSC should institutionalize the use of collaborative delivery methods as a standard option of methodology.

The DSC project team, park, and regional stakeholders will need to receive some level of training in the collaborative method. There are coaches and training programs available for collaborative delivery methods, which DSC should make full use of.

The Panel notes that this is an opportunity to begin moving from a siloed, constrictive approach toward a more integrated and collaborative approach for construction, which is increasingly the industry standard. The Panel's other recommendations are connected to this concept and will enable DSC to more effectively make the pivot.

Chapter 6: Building Capacity and Capability at DSC for Improved Project Management

In the late 1990s and early 2000s, DSC made a dramatic transition from operating an over 700-person D&C management organization within NPS, to a less than 200-person project management office that contracts out most of its D&C construction management work. The 1998 and 2002 Academy reports recommended this transition, and later reviewed whether DSC had made that transition. The 2002 Academy report also urged DSC to continue to improve the implementation of its project management mission as an on-going effort.

Now, almost 20 years later, the Panel finds that there are opportunities for improvement related to DSC's role as a project management office. These opportunities include enhancing the expertise and project management skillsets at DSC, expanding flexibility for project teams to use their professional discretion, and ensuring that DSC is resourced appropriately to fund its project management efforts.

Enhancing the Use of Expertise and Project Management Skills at DSC

As previously discussed, DSC has transitioned to its current role as a project management and contract administration office. But, the skillsets of the PMs did not necessarily adapt accordingly. It is important to note here that the study team's analysis does not indicate that DSC PMs are challenged in their individual performance. In fact, the opposite is true. Parks and regions which used DSC for LIC or other projects, with few exceptions, spoke very highly of DSC project teams. However, the Panel finds that many PM's lack robust training and experience in fundamental construction project management skills common to this complex and intricate field of work, such as cost estimating, negotiating, scheduling, construction program management, communication, change management (both technical and philosophical change), collaborative problem-solving, and team leadership. DSC follows best practice of other government construction agencies by providing various certificates including Federal Acquisition, Project Management Institute, and Energy and Environmental Design training. While certificate training is beneficial, there are more methods to improve project management skills as discussed in recommendation #6.1.

Managing the Process

A major function of DSC project teams is to manage and shepherd projects through the complex LIC process. On one hand, managing the process is an essential role of the PM or owner's representative,[67] both in the public or private sector. However, an overly burdensome or misguided process can crowd out attention to the proactive management of cost, schedule, and quality. At DSC, interviewees said that the process requirements are so demanding that project teams are primarily focused on funneling information up and through the NPS system. Some interviewees suggested that project teams can sometimes get so bogged down in the process management that project execution begins to slip out of their control. Much of this process management, detailed in depth in Appendix E, is dictated by contracting and budget processes and requirements. Two factors compound this emphasis on process management: 1) lack of integration and alignment between the project

[67] The park, specifically the superintendent, is considered the owner.

manager, contracting staff, and budget office; and 2) project teams are generally two layers removed from construction management (as noted in Chapter 2), in addition to being physically removed from the construction site due to their centralized location in Denver. [68]

The Panel notes that the combination of limited construction project management skills and a burdensome, time-consuming set of process requirements can constrain effective project management in various ways including:

- Hesitance to aggressively negotiate construction modifications, on the part of some PMs. Interviewees suggest that this is driven by a hesitant contracting department and the two layers of separation between DSC PM's and construction contractors on-site.
- When focused on process management, process execution can begin to get away from project teams. Then the project team is in catch-up mode and are generally not nimble enough to manage change in the field. Once in catch-up mode, project teams are reacting instead of anticipating two weeks in advance.

Another facet of improving the project management model at DSC is implementing a better approach to succession planning for its project teams. The Panel finds that DSC currently lacks an approach to succession planning for its project teams.

Recommendation #6.1

DSC should strengthen fundamental project management skills, to include cost estimating, scheduling, negotiating, collaborative problem solving, change management, communication, and team leadership.

Toward the end of strengthening the project management skills, the Panel further recommends that NPS and DSC consider options including:

- Develop an internal mentorship program to enhance project management skills throughout the project lifecycle.
- Expanding hiring and promotion requirements to include candidates with construction management expertise; and
- Hire and develop a contingent of lower grade, professional series employees (GS-7, 9, 11) that could potentially fill PM and project specialist positions.
    - These lower grade employees could be used on a rotational basis across project teams, performing tasks such as:
        - Project budgeting and accounting;
        - Writing task orders;
        - Assisting with quality assurance;

[68] Other major federal construction programs, at agencies like GSA, USACE, and NAVFAC, typically have a project manager / engineer and contracting officer on-site during construction. This is partly a byproduct of existing large installations or locations that have work volume to support this expertise, along with a centralized agency-wide office.

- Assisting in the development of Independent Government Estimates (IGEs) and SOW's; and
- Preparing modifications for construction.

Expanding Flexibility for DSC Project Teams

As previously discussed in detail, DSC follows a rigid and prescriptive process for LIC projects that can impose significant overhead burden. But, as processes are streamlined and project management skills enhanced, the Panel notes that there will be the opportunity to accelerate projects by providing flexibilities to DSC project teams.

Currently, project teams interviewed by the study team said they lacked clarity on what flexibility in the process was available to them and were unsure of their ability to use any existing flexibilities. However, the Academy heard several examples of flexibility mentioned in interviews, suggesting there is inconsistent communication and direction regarding the availability and the use of flexibility. Senior management, when interviewed, seemed to agree that flexibility exists, but was rarely observed in practice. Senior management also agreed that hypothetically for nine out of 10 cases, a project team would be able to use flexibilities without needing approval.

Project teams identified three flexibilities that have been used.

- On a case-by-case basis, the project team and QA group will modulate the number of QA reviews for certain projects, in consultation with DSC management.
- The Service-wide DAB has dedicated staff in CPMD responsible for reviewing projects. Some projects, based on money value or urgency just receive staff review versus review by the entire DAB.
- Generally, DSC contracts with an A/E in their Indefinite Delivery Indefinite Quantity (IDIQ) pool for design services from pre-design through schematic design. Then they negotiate and issue a new task order for design development and construction documents, generally with the same A/E firm. It can take up to one month to negotiate and finalize each task order. Some PM's suggested that on some projects they have used a single task order for the entire design process.

In addition to these ad hoc flexibilities, project teams identified four considerations for identifying and using greater flexibility:

- Project size and/or scale
- Project money value
- Project complexity
    - Projects with minimal options to be evaluated
    - Projects with minimal stakeholder impact
- Political initiative with high visibility

Recommendation #6.2

DSC should incorporate greater flexibility into the DSC process for LIC projects and empower project teams to more fully use their professional decision-making throughout project execution.

In conjunction with the preceding recommendations to streamline processes, improve use of IT systems, and enhance DSC's project management skillsets, DSC should empower project teams to more fully use their professional discretion by clarifying the flexibilities available and the conditions of their use.

DSC should collaboratively develop and implement its own solution, which captures the spirit of the Panel recommendation. The Panel believes that the solution should incorporate the following good practices:

- A risk-informed approach to assessing opportunities to use flexibilities;
- Identification of the key events that have major impact on project success and then organize the use of flexibilities around those key events;
- Management should improve communication and guidance on flexibilities available for project teams to use at their discretion, without establishing a new review and approval process; and
- Quantification of the benefits of potential flexibilities and ensure communication of those benefits to NPS leadership, DSC management, DSC project teams, and customers.

Reassessing DSC's Approach for Construction Management Services

The 1998 Academy report recommended that DSC transition away from using in-house DSC civil servants for onsite construction management and supervision services. Instead, the 1998 Academy Panel recommended that DSC contract with the private sector for construction management services. The 1998 Academy report urged DSC to maintain a core contract management and construction management capability to perform effective oversight and be "smart buyers". DSC has fully embraced this approach and no longer performs any onsite construction management with DSC full-time employees.

Reliance on third-party construction management firms for on-site construction management may not be appropriate for all projects. In some cases, such as projects that are unusually complex and where a familiarity with park circumstances especially important, the use of the A/E firm or NPS staff may be warranted.

Another problem related to the lack of onsite construction management by NPS staff is connected to managing emergent conditions, given requirements of the federal procurement system. Since the warranted Contracting Officer is the only one that can legally obligate the government to spend money, even minor latent changed conditions in the field can lead to costly delays for processing contract modifications; and it may take several days, or weeks to analyze, negotiate, and process them. In contrast, similar issues on private sector projects can be frequently resolved in the field in real-time with little delay. During project delays caused by emerging conditions, idle construction

crews must be paid even when work stops, because key personnel typically stay on the contractor's payroll until the delay is resolved.

Other federal agencies with large projects (like USACE or the Bureau of Reclamations) often have a dedicated contracting office and warranted contracting officer on-site, to provide real-time resolution to emergent issues. This set-up ensures that contractors know they will not get delayed for weeks if something changes. Generally, these government contracting professionals working onsite are construction focused, and in tune with the rhythms of construction.

Recommendation 6.3

DSC should review their approach and methodology for on-site construction management. The review should assess the current approach and alternate approaches, including construction management services performed by the design A/E, 3rd party A/E, or NPS staff. The review of alternate approaches should include an examination of funding approaches for CM services, including providing parks the ability to fund NPS staff with LIC funds, to perform CM services. The review should identify different thresholds for providing on-site construction management related to the complexity of the project and the importance of familiarity of with park circumstances.

Appropriate Resources Analysis

Finding and Recommendation #9 in the 1998 Academy report recommended that Congress base-fund the DSC civil service activities that support the general management planning and line-item pre-design and project management activities. The 1998 Panel justified base funding by indicating that it would align incentives of DSC civil servants around reducing costs and outsourcing work. The 1998 Panel also said that this would "divorce the civil service staff from the fluctuations of annual line-item appropriations and provide a stable basis for staffing technical support at Denver."[69] They estimated that the workload associated with project planning and management, general management planning, and provision of specialized professional services would require approximately 250-300 FTEs.[70] Since 2002, when DSC's service delivery model changed, LIC funding has varied. The following figure (Figure 23) shows variance in LIC funding since 2002.

[69] "*Strengthening the National Park Service Construction Program*", Panel of the Academy, National Academy of Public Administration, June 1998, p. 15

[70] Ibid.

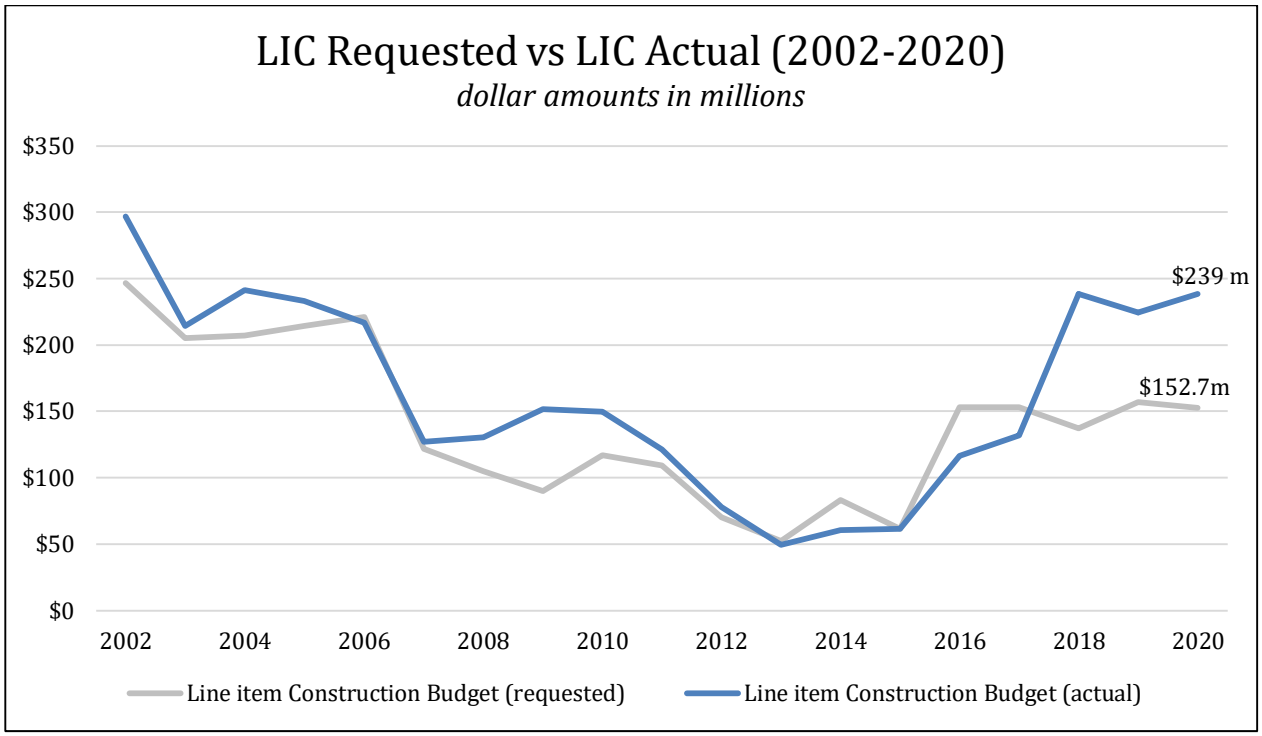

Figure 23. LIC Budget vs. LIC Appropriated from 2002-2020 (Source: National Academy of Public Administration)

In FY 2019, DSC managed 127 LIC projects and 167 park-funded, partnership, and hurricane recovery projects. Since FY16, DSC's entire D&C program has grown from $1.43 billion in gross construction dollars to $2.02 billion. In that same time, DSC's piece of the annual LIC appropriation has grown from about $116 million to $239 million in FY20.

Over the same period of time, DSC's base funding has remained mostly flat. In FY 18 and FY19, DSC received $20m in base funding, an increase of $2.2m from FY16 and FY17. Although DSC's base funding is no-year money, there is no guarantee that they will receive any balances in the next fiscal year.

Base Funding Disconnected from Workload

The Panel finds that DSC's responsibilities and workload have fluctuated over time, but base funding has remained relatively constant. There is minimal connection between base funding and fluctuations in workload.

Ideally, DSC would use the 5-year plan to determine future staffing needs, and then develop their operational budget based on staffing needs commensurate with the 5-year plan. The actual process occurs in reverse. The NPS formulates and requests appropriations from Congress for DSC operations based on the size of the requested amount for the line-item construction program; Congress typically appropriates that figure for DSC but may provide a different amount for the line-item program, typically in the form of an increase. DSC then figures out how to staff the appropriated workload with the Operations appropriation. In other words, DSC is given their workload to execute (LIC program)

and the budget with which to execute it, regardless of if that aligns with the operational realities of execution.

For example, in FY20, the NPS's congressional budget justification requested $153 million for LIC, and $20 million for DSC operations—an approximately 13 percent ratio. When the FY20 budget was passed into law, Congress appropriated $273 million to the NPS LIC program (of which DSC is responsible for managing roughly $238.5 million) and $20 million for DSC operations—this leaves an approximately 8.4 percent ratio for projects DSC is managing. Interviewees have suggested that the working assumption at NPS is that the DSC Operations appropriation should be approximately eight percent of the LIC appropriation. However, like all Executive Branch agencies, the NPS does not have direct control over the final appropriations amounts.

The logic of this rule-of-thumb appropriation ratio is not clear to the Panel or study team, but seems to be largely driven by political pressures rather than operational realities. The process for determining DSC's base funding also means that their project management costs always equal the funds available.[71]

DSC does not track LIC project management costs by project, so it is difficult to segment project delivery costs to understand cost drivers. However, DSC's budget office estimates that current project management costs range from five to 9 percent of total project cost.

DSC Base Funding in FY20

DSC's operations and scope of services goes beyond pure project management for LIC projects. They also staff and maintain the Technical Information Center, fund centralized Human Resources (HR) services, and fund their own IT investments, upgrades, and maintenance.

In FY20, DSC will use approximately $17m to deliver a LIC budget of $238.5m projects, approximately a 7.1 percent actual rate for project management costs. The other $34.5m in LIC funding is being managed and performed by the regional offices or park units.

[71] An analogy for this is the difference between giving an individual $100 per week to buy groceries vs. asking what it costs to eat healthy for one week. In the first example, the individual will buy $100 worth of groceries. The second example requires the individual to perform an analysis of options and meal planning.

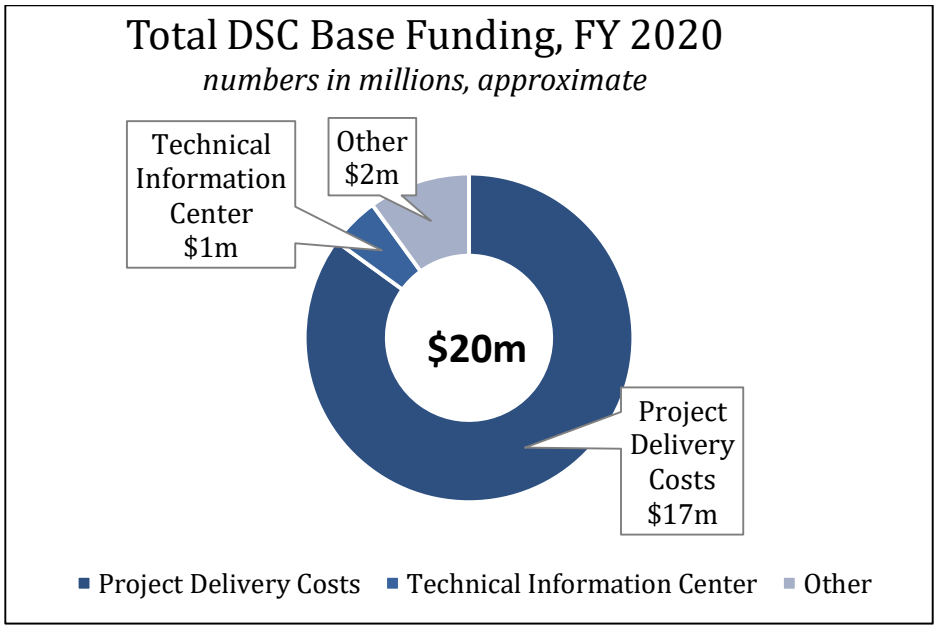

Figure 24. DSC Base Funding FY 2020 (Source: National Academy of Public Administration)

The $17m in project delivery costs can be divided up into three categories:

1) Direct labor for project teams (95 percent of costs)
2) Travel for project-related work (2-3 percent of costs)
3) Incidentals (1-2 percent of costs)

DSC leadership suggests that each year, for the last several years, approximately $300-400k is eaten up by steadily increasing administrative and maintenance costs, without requisite increases in base funding. However, over the same period, project team FTE's have declined approximately 9 percent.

The effect of this is two-fold. First, there are less staff to perform the work. This means that existing project teams manage more LIC projects. Finally, DSC often performs additional Park Direct Charge work to compensate.[72] Currently, interviews with DSC staff suggest that PM time is informally split 80/20 between LIC and Park Direct Charge (PDC) projects to fill workloads for existing staff. These factors can impact DSC's ability to maintain a high obligation rate and efficiently deliver projects.

DSC Staffing

In the Design and Construction division, DSC currently has 47 employees serving as Project Managers across both LIC, PDC, and other fund sources. The average PM at DSC is managing about six projects across both LIC and other fund sources. Only three PM's manage a single project, and there are more than five PM's that manage more than 10 projects. In fact, across all 73 employees that perform PM and PS roles, 77 percent manage more than 4 projects, as visualized by Figure 25 below.

[72] These projects are charged to separate project fund sources, other than LIC, like FLREA or Repair & Rehabilitation.

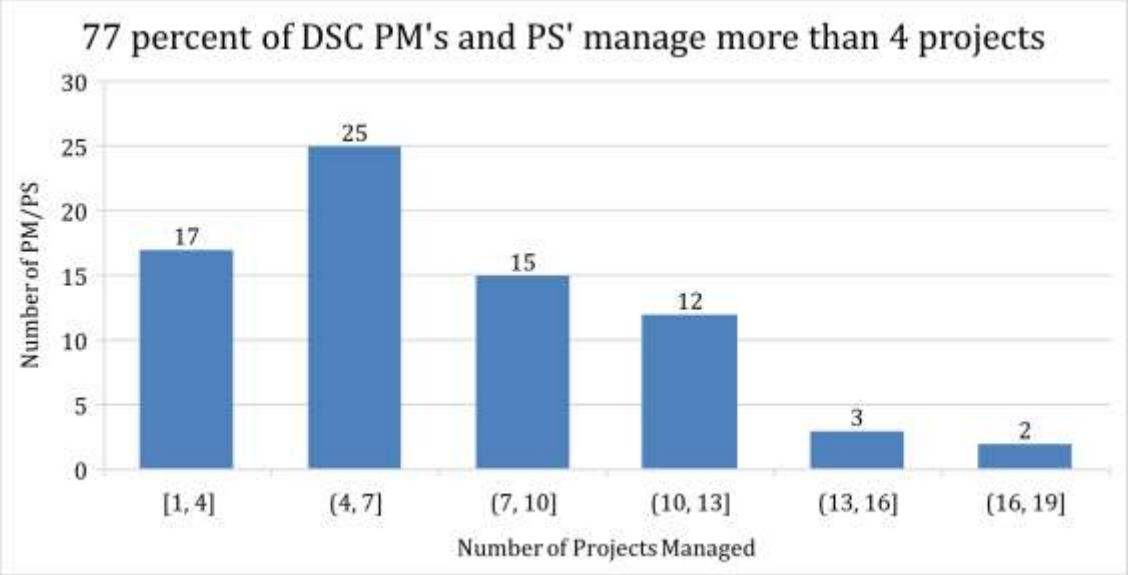

Figure 24. (Source: National Academy of Public Administration using DSC Data)

In comparison, an Academy review of GSA staffing data indicated that in FY19 GSA's Public Building Service retained 386 employees with the title of Project Manager. In FY19, the Public Building Service finished the fiscal year with 77 projects, at the prospectus-level, valued at $3.4 billion in construction. In FY19, DSC finished the fiscal year with 209 projects in design and construction, valued at $1.6 billion in construction.

DSC's Business Model Different than other Construction Programs

The study team benchmarked project management costs at other agencies including Parks Canada, USACE, and NAVFAC. A key difficulty with this benchmark analysis is variance in definitions. Every agency that was interviewed defined and categorized their "project management" costs differently.

In addition, every agency funded their project management costs differently than DSC. The other agencies interviewed funded their project management by adding a certain percentage to the total project cost. The cost percentage breakdown from DSC and other construction programs is below. These costs specifically focus on the project execution phases, design and construction.

- **DSC** – Total = ~7.1 percent:
    - Design and construction project management: 7.1 percent
- **USACE** – Total = ~15 percent:
    - Construction Supervision and Administration (S&A): 5.7 or 6.5 percent, depending on project;
    - Planning: 1 to 2 percent;
    - Design: 8.5 percent (six percent Brooks Act + other costs); and
    - Contracting: Flat $10k charge, for all projects.

- **NAVFAC** – Total = ~12 percent:
    - Design and A/E management: 4 to 6 percent; and
    - Construction supervision: 4 to 6 percent.
- **Parks Canada** – Total = ~ 6 percent:
    - An average range of 3 to 6 percent for large to mid-size projects; and
    - But, for their smallest projects ($100-500k) it can be as high as 10-25 percent.
- **Federal Lands Highways Program** – Total = ~25 percent budgeted, but in FY19 the program-wide actual was 19 percent.
    - Design[73] and project management costs: ~ 12 percent
    - Construction administration and supervision: ~ 12 percent

Recommendation #6.4

In order to improve their resourcing, DSC should follow a three-part solution:

1. The DSC Operations appropriation should be clearly connected to the LIC appropriation, given improved tracking of real project management costs for LIC.
2. In order for NPS, DOI, OMB, and Congress to accurately adjust the DSC Operations appropriation, DSC needs to improve their tracking and analysis of real project management costs for LIC to inform and predict staffing and associated cost per project.
3. In order to improve project analytics at DSC and NPS, DSC will need to invest in their IT infrastructure. The Panel finds that DSC does not have dedicated funding for this purpose. IT funding should be made available to implement Recommendation 4.6, in particular Phase 2 of that recommendation.

[73] For in-house or A/E design work.

Appendix A: Panel Members and Study Team Biographies

Panel Members

Mortimer Downey*, *Chair:* President, Mort Downey Consulting LLC. Former Principal Director and Former Chairman, Washington Metropolitan Area Transit Authority; Senior Advisor, Parsons Brinckerhoff; Chairman, Pb Consult, Inc.; Deputy Secretary, U.S. Department of Transportation. Former positions with Metropolitan Transportation Authority (New York): Assistant Executive Director for Management and Budget; Deputy Executive Director for Capital Programs; Executive Director; Chief Financial Officer. Former Assistant Secretary for Budget and Programs, U.S. Department of Transportation; Budget Priorities Analyst, Committee on the Budget, U.S. House of Representatives; increasingly responsible positions with the Port Authority of New York and New Jersey.

Donald Bathurst*: Former Executive Director for Emergency Preparedness, Management Directorate, Department of Homeland Security; Senior Advisor to the Under Secretary, Management Directorate, Department of Homeland Security; Director & Chair, Board of Directors, Senior Executives Association; Chief Administrative Officer, Management Directorate, Department of Homeland Security; Director, Asset Management, Management Directorate, Department of Homeland Security; Director, Facilities Management and Services Division, Federal Emergency Management Agency; Deputy Associate Director, Operations Support Directorate, Federal Emergency Management Agency; Acting Director, Program Assessment and Outreach, Mitigation Directorate, Federal Emergency Management Agency; Director, National Dam Safety Program, Federal Emergency Management Agency; Deputy US Fire Administrator, US Fire Administration, Federal Emergency Management Agency; Adjunct Lecturer, Fire Protection Engineering, University of Maryland; Director & Chair, Board of Directors, GSA Federal Credit Union; Chief Fire Protection Engineer, Public Buildings Service, General Services Administration; Fire Protection Engineer, National Capital Region, General Services Administration; Firefighter, Volunteer, Prince William and Prince Georges Counties.

Denis Galvin*: Former Associate Director for Planning and Development, National Park Service; Deputy Director, National Park Service; Manager, Denver Service Center; Associate Regional Director for Operations, National Park Service.

Greg Giddens*: Partner, Potomac Ridge Consulting, LLC; Executive Director, Office of VA Modernization, Office of Enterprise Integration, Department of Veterans Affairs; Chief Acquisition Officer, Office of Acquisition, Logistics, and Construction, Department of Veterans Affairs; Executive Director, Enterprise Program Modernization Office, Office of Policy and Planning, Department of Veterans Affairs; Executive Director, Facilities Management and Engineering, Customs and Border Protection, Department of Homeland Security; Executive Director, Secure Border Initiative, Customs and Border Protection, Department of Homeland Security; Executive Director, Secure Border Initiative, Department of Homeland Security; Deputy Assistant Commandant for Acquisition, United States Coast Guard, Department of Transportation; Deputy System Program Director, E-3, Air Force Materiel Command, Department of Defense; Program Manager, Air Force Weather Weapon System,

Air Force Material Command, Department of Defense; Program Manager, DoD Personnel Demonstration Project, Office of Acquisition Reform, Office of Secretary of Defense; Various, Air Force Logistics Command, Department of Defense.

Deborah Lucas*: Director, Golub Center for Finance and Policy, Massachusetts Institute of Technology; Sloan Distinguished Professor of Finance, Sloan School of Management, Massachusetts Institute of Technology; Assistant Director, Financial Analysis Division, Congressional Budget Office; Associate Director of Financial Studies, Congressional Budget Office; Professor of Finance, Sloan School of Management, Massachusetts Institute of Technology; Donald C. Clark HSBC Professor of Consumer Finance Department of Finance, Kellogg School of Management, Northwestern University; Member, Social Security Technical Advisory Panel; Chief Economist, Congressional Budget Office; Member, Social Security Technical Advisory Panel; Chairman, Department of Finance, Kellogg School of Management, Northwestern University; John L. and Helen Kellogg Distinguished Associate Professor, Department of Finance, Kellogg School of Management, Northwestern University; Research Associate, The National Bureau of Economic Research; Faculty Research Fellow, The National Bureau of Economic Research; Senior Staff Economist, Council of Economic Advisers; Assistant Professor, Department of Finance, Kellogg School of Management, Northwestern University; Visiting Assistant Professor, Department of Finance, Sloan School of Management, Massachusetts Institute of Technology.

William Seed: Senior Vice President, Facility Design & Construction at Jackson Health System in Miami, FL. In that position he provides leadership for a $1.5 Billion capital program delivering 6 Signature Projects in 4 years including 2 new full service specialty hospitals renovating 4 existing hospitals to enhance service as the Miami-Dade County safety net health care provider. From 2014 to 2017, he was Executive Project Integration with Walt Disney Imagineering leading a program delivery transformation employing Lean Integrated Project Delivery methodologies. Mr. Seed has published 2 books and 2 white papers on transformational change in the construction industry each centered on Lean principles and Integrated Project Delivery. In 2014 he was inducted into the National Academy of Construction recognizing this effort. He has been member of the board of directors and past chairman for the Lean Construction institute for 7 years and was awarded the Pioneer award in 2012. Along with his BS in Mechanical Engineering, Commercial General Contractor license, Master Electrical license, Mr. Seed has functioned in numerous roles from physical plant operations to capital and real estate development for 2 national healthcare systems with over 250 combined campuses.

Academy Study Team

Brenna Isman, *Director of Academy Studies.* Ms. Isman has worked at the Academy since 2008 and oversees the Academy studies, providing strategic leadership, project oversight, and subject matter expertise to the project study teams. Prior to this, Ms. Isman was a Project Director managing projects focused on organizational governance and management, strategic planning, and change management. Her research engagements have included working with the National Aeronautics and Space Administration, the Environmental Protection Agency, the Social Security Administration, the

Department of Veterans Affairs, as well as multiple regulatory and Inspector General offices. She is an experienced facilitator and her expertise focuses on development of communication and business strategy frameworks, analysis of ongoing transformation initiatives, and strengthening stakeholder engagement. Brenna's consulting experience includes both public and private sector clients in the areas of communication strategy, performance management, and organizational development. Prior to joining the Academy, she was a Senior Consultant for the Ambit Group and a Consultant with Mercer Human Resource Consulting facilitating effective organizational change and process improvement. As the Assistant Director for Executive Education for the Kogod School of Business at American University, she developed curriculum for business certificate programs and managed program delivery. She holds a Masters of Business Administration from American University and a Bachelor of Science in Human Resource Management from the University of Delaware.

Roger Kodat, *Senior Project Director.* Mr. Kodat has led more than 25 projects for the Academy. He brings twenty years of commercial and investment banking experience with JPMorgan Chase, and six years of senior level federal government experience at the Department of the Treasury. Appointed by President George W. Bush in 2001 to serve as Deputy Assistant Secretary of Treasury, he was responsible for Federal Financial Policy. Some of his tasks at Treasury included policy formulation for the 2006 Postal Accountability and Enhancement Act; rule making and oversight of Federal loan and loan guarantee programs; and management of the Federal Financing Bank (a $32 billion bank at that time). Mr. Kodat holds a BS in Education from Northwestern University and both an MBA in Finance and Masters of Arts (MA) in Political Science from Indiana University.

Jonathan Tucker, *Senior Analyst.* Dr. Tucker is a senior analyst and project director at the Academy. His areas of expertise include strategic planning/foresight, organizational design, change management, and S&T/innovation policy. His public management consulting experience includes projects with twenty federal agencies. Recent projects include assessment of research coordination function at the U.S. Department of Transportation; developing a strategic plan for the Office of Urban Indian Health Programs (U.S. Indian Health Service); developing options for the establishment of a new Under Secretary at USDA focused on international trade; developing a white paper for the Project Management Institute on institutionalizing project and program management in the federal government; assessing Census transformation initiatives; developing a long-term strategic plan for operational transformation at the Social Security Administration. In addition to his consulting activities, Dr. Tucker contributes to the work of the Academy's Strategic Foresight Panel (part of the broader Academy Transition 2016 initiative). Dr. Tucker also has experience assessing science and technology policies and programs, with a focus on supporting innovation. He has worked for organizations including Battelle; the National Research Council; the National Institute of Standards and Technology; and the New York State Department of Economic Development. He holds a Ph.D. in Public Policy (with a concentration in Science and Technology Policy) from George Mason University, an MS in Science and Technology Studies from Rensselaer Polytechnic Institute, and a Bachelor of Arts (BA) from New College of Florida.

Elijah Evans, *Research Analyst.* Mr. Evans joined the Academy in February 2017. He is currently supporting an assessment of R&D management at the Agricultural Research Service. He recently

supported an assessment of strategies for enhancing the technology policy resources available to the U.S. Congress. Prior to this, he supported strategic planning and performance improvement projects at DNFSB and a financial oversight corporation. He also served on congressionally directed engagements that examined the U.S. Environmental Protection Agency's guidelines for affordability of infrastructure investments and National Aeronautics and Space Administration's use of its Advisory Council. Mr. Evans received a BS in Convergence Journalism and Political Science from Abilene Christian University in December 2016.

Allen Harris, *Research Associate*. Mr. Harris joined the Academy in October 2019 as a Research Associate. Prior to joining the Academy, he had numerous internships including working at the Brookings Institute and the U.S.–Japan Bridging Foundation. Most recently he was working for an Impact Investor on projects including affordable housing in U.S. National Parks and bio-herbicide development in Kenya. Mr. Harris graduated from the University of St. Andrews, Scotland, in 2018 earning an MA, Honors in International Relations and Modern History.

Appendix B: Past Academy Report Recommendations

Chart 1: Summary of 1998 Academy Study Findings and Recommendations		
1998 Finding	**1998 Recommendation**	**2002 Assessment**
1. In-House Design and Construction Supervision/Inspection Too Costly	Contract out about 90% of design work. Retain core design capability in-house to handle the remaining 10% of design work	Fully implemented
2. Underutilization of Architectural/ Engineering (A/E) Firms' Skills	Improve DSC's management of A/E firms. Establish a process that promotes close communication and full utilization of DSC and A/E firms' capabilities	Fully implemented
3. Knowledge of Local Construction Conditions and Requirements Important	Use A/E firms with experience in the general local and have solid reputations.	Fully implemented
4. Savings Possible Through Standardized Designs and Construction Practices	Adopt standardized design and construction practices.	Significant progress but not fully implemented
5. Construction Management Practices Inadequate	Make planning and management of contracts a critical and major function of DSC.	Fully implemented
6. Responsibility and Accountability for Construction Projects Unclear	Assign responsibility for line-item construction projects to park superintendents.	Fully implemented
7. Project Management Control System Fragmented	Establish an NPS Project Management Control System to provide visibility of project status. Establish a small staff of project management professionals in the Office of Associate Director of Professional Services at NPS headquarters.	Partially implemented
8. Public Perspective Missing from Review of Construction Projects	Establish an external review group to assess line-item construction projects for functional suitability and cost-effectiveness.	Fully implemented
9. DSC Base Funding Needed	Base fund the DSC civil service activities that support general management planning and line-item pre-design and project management.	Fully implemented
10. Cost-Estimating Factors Too High	Use cost-estimating factors (as percentages of actual net construction costs) similar to other agencies for design (10%), construction supervision (8%), and contingency (10%).	Fully implemented
11. Economies in Housing Construction Overlooked	Compare estimated costs with the Tri- Services Military Family Housing Cost Model before budget submission and construction. Require NPS Director approval where estimates exceed 110% of the model's estimate.	Fully implemented

Chart 2: Additional Recommendations in 2002 Academy Assessment
1. Streamline the approval process for line item construction projects.
2. Provide the contracting organization two to three percent of project net construction costs as a contingency to accommodate necessary changes after a project's award.
3. Continue to refine the NPS housing cost model for unique conditions in some parks.
4. Recognize that the cost estimating factors recommended previously are program-wide factors and that available funds should be used to correct troubled projects.

Appendix C: Interviewee List

(Titles and positions listed are accurate as of the time of the Academy's initial contact)

National Park Service

Jessica Bowron, Comptroller, National Park Service
John Spernoga, Chief, Budget Execution Division, Washington DC Area Support Office, National Park Service
Karen Bergsma, Project Manager, Park Planning, Facilities and Lands Division, National Park Service
Linda Neal, Partnership Construction Program Coordinator, Park Planning, Facilities, and Lands Division, National Park Service
Mike Caldwell, Acting Associate Director of Park Planning, Facilities, and Lands Division, National Park Service
Shawn Benge, Acting Deputy Director, Operations, National Park Service
Theresa Hensley, Budget Analyst, Budget Execution Division, Washington DC Area Support Office National Park Service
William Thompson, Chief of Facility Planning, Park Planning, Facilities and Lands Division, National Park Service

Denver Service Center

Andrea Lind, Project Manager, Design & Construction Division, Denver Service Center
Brian Olson, Technical Branch, Denver Service Center
Carol Simpson, Chief, Information Management, Denver Service Center
Christopher Lewis, Branch Chief, Design & Construction Division, Denver Service Center
Chris Osgood, Cost Estimator, Denver Service Center
Darin Knapp, Branch Chief, Contracting Services, Denver Service Center
Daryl Lindeman, Project Manager, Design & Construction Division, Denver Service Center
Eric Thuerk, Project Manager, Design & Construction Division, Denver Service Center
Jared Kaber, Chief, Technical Branch, Denver Service Center
Jason Longshore, Branch Chief, Contracting Services, Denver Service Center
Jodie Petersen, Chief (West), Design & Construction Division, Denver Service Center
Joel Siderius, Budget Officer, Denver Service Center
Jordan Hoaglund, Branch Chief, Planning, Denver Service Center
Kate Randall, Project Manager, Design & Construction Division, Denver Service Center
Lori Irish, Chief, Contracting Services, Denver Service Center
Marie Fitzpatrick, Technical Branch, Denver Service Center
Michael Morelli, Project Manager, Design & Construction Division, Denver Service Center
Pamela Mault, Branch Chief, Contracting Services, Denver Service Center
Paul Rothgery, Branch Chief, Design & Construction Division, Denver Service Center
Paula Aldrich, Branch Chief, Design & Construction Division, Denver Service Center
Ray Todd, DSC Director, Denver Service Center
Rich Kagiyama, Project Manager, Design & Construction Division, Denver Service Center
Ron Shields Branch Chief, Design & Construction Division, Denver Service Center

Sharon Miner, Branch Chief, Contracting Services, Denver Service Center
Todd Alexander, Chief (East), Design & Construction Division, Denver Service Center

Construction Program Management Division

Bethany Barron, Chief, Construction Program Management Division, Park Planning, Facilities, and Lands
Katie Lunsford, Program Analyst, Construction Program Management Division, Park Planning, Facilities, and Lands
Michael Balin, Engineer, Construction Program Management Division, Park Planning, Facilities, and Lands
Rick Turk, Architect, Construction Program Management Division, Park Planning, Facilities, and Lands
Steve Bimm, Engineer, Construction Program Management Division, Park Planning, Facilities, and Lands

Regional Offices

Aaron Dowe, Regional Comptroller, Interior Regions 8, 9, 10, & 12
Aaron Roth, Associate Regional Director, Facilities & Lands, Regions 6, 7, 8
Brad Shattuck, Chief, Facility Management, Region 2
Brian Bergsma, Division Chief, Facility Management, Regions 6, 7, 8
Brian Strack, Associate Regional Director, Interior Region 1
Colleen Burnidge, Attorney-Advisor, Office of the Solicitor, Rocky Mountain Region
David Kruse, Chief, Facility Management, Regions 8, 9, 10, & 12
Dennis McCarthy, Branch Chief, Facility Investment, Region 2
Doug Jacobs, Associate Regional Director, National Capital Area
Gary Krysl, Regional Chief of Facility Management, Regions 3, 4, 5
Gay Vietzke, Regional Director, Interior Region 1
Hao Lam, Line-item Program Manager, Regions 8, 9, 10, & 12
Herbert Frost, Regional Director, Regions 3, 4, 5
Joel Hard, Deputy Regional Director, Region 11
John Chekan, Chief, Facility Management, Region 11
Kimberly Benson, Chief of Design and Construction, National Capital Area
Lisa Haddox, Division Chief, Facility Management, Regions 6, 7, 8
Sena Wiley, Branch Chief, Transportation, Regions 6, 7, 8

National Parks

Ben Bobowski, Superintendent, Wrangell-St. Elias National Park & Preserve
Cam Sholly, Superintendent, Yellowstone National Park
Charles Cuvelier, Superintendent, George Washington Memorial Parkway
Chip Jenkins, Superintendent, Mt Rainier National Park
David Davis, Facility Manager, Mount Rushmore National Memorial
David Hallac, Superintendent, National Parks of Eastern North Carolina
Elexis Fredy, Superintendent, San Juan Island National Historical Park

Garrett Chun, Design & Construction Branch Chief, Yosemite National Park
James Foster, Chief of Facilities Management, Glacier National Park
Jared Infanger, Historical Architect, Mt. Rainier National Park
Laura Joss, Superintendent, Golden Gate National Recreation Area
Mark Sturm, Superintendent, Katmai National Park
Peter Swisher, Superintendent, Herbert Hoover National Historic Site
Rusty Mizelle, Chief, Project Management, Grand Teton and Rockefeller Memorial Parkway
Sean Kennealy, Acting Deputy Superintendent, National Mall and Memorial Parks
Steve Byrd, Asset Manager, Glacier National Park
Tracy Swartout, Deputy Superintendent, Mount Rainier National Park

Department of the Interior

Aron Reif, Senior Transportation Analyst, Office of Acquisition & Property Management, Department of the Interior
Craig Lasser, Chief, Asset Management Division, Department of the Interior
Jeffrey Lang, Budget Analyst, Office of the Secretary of the Interior, Department of the Interior
Ryan Hambleton, Deputy Assistant Secretary, Office of the Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior
Scott Cameron, Principal Deputy Assistant Secretary for Policy, Management, and Budget, Department of the Interior
Susan Combs, Assistant Secretary for Policy, Management, and Budget, Department of the Interior

Architecture and Engineering Firms

Elizabeth Hallas, Principal, Anderson Hallas Architects
Jon Holbrook, Associate Vice President, HDR Inc.
Mark Lapointe, Principal, GWWO Architects

United States Army Corps of Engineers

Carl A. Penski, Chief, Army Programs Integration, Directorate of Military Programs, HQ, U.S. Army Corps of Engineers
Drew White, Chief, Construction, U.S. Army Corps of Engineers
Edward Belk, Chief, Program Integration Division, U.S. Army Corps of Engineers
Kathleen O'Neill, Chief, Military Design Branch, U.S. Army Corps of Engineers
Rick Calloway, Chief, Contracts Administration Branch, U.S. Army Corps of Engineers

Navy Facilities Engineering Command

Peter Marshall, Academy Fellow, Retired NAVFAC
Rex Fitch, III, Director, CI4-Engineering & Design, Capital Improvements, NAVFAC HQ
Robert Curfman, Chief Engineer and Assistant Commander, Capital Improvements, NAVFAC

General Services Administration

Cy Houston, Director, Facilities Management Division, Public Buildings Service, GSA
William Hunt, Chief Estimator, Program Risk Management Division, GSA

William Sonenberg, Acting Deputy Assistant Commissioner, Office of Design and Construction, GSA

Government Accountability Office

Anne-Marie Fennell, Director, Natural Resources and Environment, GAO
Elizabeth Erdmann, Assistant Director, Natural Resources and Environment, GAO
John Bauckman, Physical Infrastructure, GAO

Federal Highway Administration

Brent Coe, Project Management Engineer, Western Federal Lands Highway Division
Curtis Scott, Chief, Engineering, Central Federal Lands Highway Division
Laurin Lineman, Chief, Engineering, Eastern Federal Lands Highway Division

Other Interviews

Briana Bergstrom, Senior Associate, Campaign to Restore America's Parks, Pew Charitable Trusts
David Stutzman, President, Conspectus, Inc.
Karl Knapp, Chief, Facilities Management Division, California State Parks
Louis Medcalf, Senior Specifier, Conspectus Inc.
Marcia Argust, Project Director, Campaign to Restore America's Parks, Pew Charitable Trusts
Mary Fischietto, Senior Program Examiner and Policy Advisor, OMB
Matthew Wheeler, Acting Assistant Regional Director, Fish and Wildlife Service, DOI
Michelle Lane, Professional Staff, Senate Energy and Natural Resources Committee
Peter O'Connor, Chief Engineer, Project Delivery Services, Parks Canada
Richard Formella, Consultant, Design-Build Institute of America
Terry Camp, Professional Staff, House Subcommittee on National Parks, Forest, & Public Lands

Appendix D: Capital Planning and Investment Control Process for NPS LIC Program

Capital Planning and Investment Control Process for NPS LIC Program

For All LIC Projects Regardless of Cost (Includes Design, Construction, & Closeout)

Project Phase	Requirements Phase CY-4[1]	Info Source[2]	Requirements Phase CY-3	Info Source[2]	Planning/ Programming CY-2	Info Source[2]	Design CY-1	Info Source[2]	Construction & Occupancy	Info Source[2]	O&M
Project Development Elements per Phase	Project Concept Documents	1, 2, 3, 15	Concept Sketches, Site Planning, Massing	7, 8	Programming Study	1, 2, 3, 4, 7, 8	Class A Estimate for Construction	4, 7, 8, 9, 10	Contract Award	10, 11, 12	Post Occupancy Evaluation
	Business Case Analysis, Project Justification & Performance Gap Analysis	1, 2, 3, 7, 15	Design and Implementation Options Analysis	4, 7, 8, 9	Economic Analysis and Real estate Options	1, 2, 3, 4, 7, 8	Final Design Documents	10	Construction	10, 12	Condition Assessment
	Project Risk Assessment & Alternatives Analysis	7, 14	NEPA / NHPA Related Compliance Begins	4, 7, 8, 9	Acquisition Strategy	11, 12	Construction Documents	10	Furnishing Design	10, 12	Commissioning
	Project Scope (PSA process**)	7, 8, 14, 15	Project Scope Adjustment	4, 7, 8, 9	NEPA Continues	9	Contracting Package	10	Construction Management	10, 12	AUC Closeout
	Class C Estimate for Construction (PSA process**)	7, 8, 14, 15	Project Schedule, Milestones & Implementation Plan	4, 5, 7, 8, 9	NHPA Continues	9	Establish AUC		Post Award Services & QA/QC Monitoring	10, 12	Contract Performance Evaluation
	Project Schedule, Milestones & Implementation Plan	7, 8, 15	Schematic design		Spend Plan Completed	11, 12	Spend Plan		AUC Transfers		Building Certification (LEED, WELL, &c.)
	Initiate PEPC record and enviro screening form		Class B Estimate for Construction	4, 7, 8, 9	Class A or B Estimate for Construction	4, 7, 8, 9, 10	Construction Schedule	10	O&M Plan		
	Schematic design begins following RIRB-approved concept docs.						NEPA/NHPA complete		Project Closeout	10, 11, 12, 13	
Management Responsibility	Primary → Park & Region Secondary → CPMD & DSC PM		Equal responsibility → Park & Region, CPMD & DSC PM		Primary → DSC PM Secondary → Park & Region, CPMD		Primary → DSC PM Secondary → Park & Region, CPMD		Equal responsibility → Park & Region, CPMD & DSC PM		Primary → Park & Region
Park Role	Develop Sound Project Business Case, Scope, Cost Est, Analyze O&M impacts, Acquire RIRB Concurrence for Project Feasibility, Create PMIS Project Record w RIRB Approval		Coordinate with Regional LIC Coordinator to monitor project development progress		Coordinate with Regional LIC Coordinator to monitor project development progress		Coordinate with Regional LIC Coordinator to monitor project development progress				
Region Role	Regional IRB (RIRB) Review and Approval Concept, Scope, Cost, and Business Case. Submit Region-Approved Projects via in PMIS after RIRB Approval . Regions also assist parks with project scoping, cost estimating, business case development, and asset management in FMSS to ensure PMIS submittals meet SCC guidance and are responsive to BIRB/RIRB investment priorities &/or critical mission goals & objectives as stated in park foundational documents.		Coordinate with DSC PM re changes, adjustments, and schedule to assure project cost, scope, and schedule are being implemented as planned.		Coordinate with DSC PM re changes, adjustments, and schedule to assure project cost, scope, and schedule are being implemented as planned. Review and approve DAB submissions.		Coordinate with DSC PM re changes, adjustments, and schedule to assure project cost, scope, and schedule are being implemented as planned. Review and approve DAF and Spending Plan submissions.		Review funds allocation requsts, release of contingency funds, and/or reprogramming and submit concurrance to WASO.		
CPMD Role	Prepare SCC Guidance & Transmit to Regions to Convey Investment Priorities and Criteria, and Requirements for Adequacy of Scope, Cost, and Project Justification. Validate and Prioritize New LIC Proposals and Formulate the Next 5-yr Plan		Monitor DSC progress regarding changes, adjustments, and schedule status and document progress as required by CPIC policy		Monitor DSC progress regarding changes, adjustments, and schedule status and document progress as required by CPIC policy		Monitor DSC progress regarding changes, adjustments, and schedule status and document progress as required by CPIC policy		Review/approve requests for contingency funds, and/or reprogramming.		
DSC Role	Incorporate Newly-formulated Projects into Project Management Process and Develop a MS Project Schedule for Tracking, Monitoring, and CPMD Reporting. Begin Design Phase.		Achieve all scheduled project schedule milestones. Maintian accurate schedule information. Coordinate with CPMD and project proponents re changes in status, cost, or scope.		Achieve all scheduled project schedule milestones. Maintian accurate schedule information. Coordinate with CPMD and project proponents re changes in status, cost, or scope.		Achieve all scheduled project schedule milestones. Maintian accurate schedule information. Coordinate with CPMD and project proponents re changes in status, cost, or scope.		Prepare allocation requsts, release of contingency funds, and/or reprogramming and submit to region.		
Budget Role			Approve allocation requests made by CPMD		Approve allocation requests made by CPMD		Approve allocation requests made by CPMD		Approve allocation requests made by CPMD		
Bureau Role	BIRB et. al. Develop/Revise and Transmit Service-wide LIC Investment Priorities to Stakeholders. Review and approve new recommended projects. Approve LIC 5-year plan.				BIRB Approves Project Plan/ Estimate/ Schedule		BIRB Approves Final Plan/ Estimate/ Schedule		BIRB Reviews Quarterly Status of Construction Cost/ Schedule		Maintain Asset to Ensure Acceptable Condition
DOI Role	AMC ESC and Chair Briefed on Scope of 5-Year Program (For Projects >$20M)		ESC Chair Briefed on Program Plan/ Estimate/ Schedule; May Require ESC Concurrence or Elevate		ESC Chair Briefed on Final Program Plan/ Estimate/ Schedule; May Require ESC Concurrence or Elevate		ESC Briefed on Projects at Substantial Variance in Cost/ Schedule and Completion				Monitor Portfolio to Ensure Acceptable Condition
AMC ESC Chair Decision Needed	NA		Approval of Project Prioritization and 5-Year Plans		Approval to Move into Design Phase		Approval to Move into Construction Phase		NA		NA
Schedule	Construction Year - 4		Construction Year - 3		Construction Year - 2		Construction Year - 1		Construction Year		Construction Year +

Decision Point 1: RIRB review and approve CPMD recommendations for new iteration of the LIC 5-year Capital Investment Plan

Decision Point 2: BIRB and CPMD review to affirm project remains valid and feasible. CPMD to notify RIRB and LIC Coordinator if project will not advance to CY-3 due to changes in scope, cost or schedule status

Decision Point 3: BIRB and CPMD review to affirm project remains valid and feasible. CPMD to notify RIRB and LIC Coordinator if project will not advance to CY-2 due to changes in priority, scope, cost or schedule status. DAB review and approval.

Decision Point 4: BIRB and CPMD review to affirm project remains valid and feasible. CPMD to notify RIRB and LIC Coordinator if project will not advance to CY-1 due to changes in priority, scope, cost or schedule status. DAB review and approval.

[1] **This work is required for project entry into a LIC 5-year plan and accounts as to the plan with a project listed in year 5.**

[2] **Sources of information: 1) GMP (or equivalent); 2) FIS (or equivalent); 3) SFIP (or equivalent); 4) PMIS; 5) Panorama and/or MS Project; 6) Decision Lens; 7) Project Concept Documents; 8) Project Scoping Assessment; 9) Compliance Documents; 10) DSC; 11) Budget; 12) Contracting; 13) CPMD ; 14) OMB Capital Programming Guide; 15) SCC Guidance**

** **PSA process is a designated procedure defined by CPMD that results in development of adequate scope and cost estimates for projects proposed for inclusing in the LIC program**

Appendix E: Project Manager Roles and Responsibilities

Project managers (PM) develop, manage, and lead multi-disciplinary teams of in-house; A/E and construction staffs to ensure the project is completed on time and within budget while effectively meeting the client's (park and region) expectations.

The internal team consists of NPS staff from contracting; natural and cultural resources, the PM, a project specialist, and the various specialists from the NPS Quality Assurance Department (civil, mechanical, electrical, structural, landscape architecture, architecture, lighting, safety, constructability, estimating, accessibility, sustainability, and permitting). The contracting team consists of the Contracting Officer and the Contract Specialists. It is the DSC model to have four people on every project to manage the construction process.

The external team consists of architects, engineers (mechanical, civil, electrical), contractors, surveyors, natural and cultural resource specialists, AutoCAD technicians, and editors.

DSC PM's have many customers that they report to or need to keep happy, these include the Washington Office (WASO), regions, parks, Contracting, Quality Assurance, and Budget Offices. They report to and adhere to the processes in all of these departments. It is important that they have critical thinking skills; construction and design management expertise; be able to write well; understand highly technical construction and engineering issues; be good accountants and understand budgeting; be good estimators and schedulers; and be able to negotiate difficult topics and costs. Effective PM's must be able to communicate effectively and "read" people. They must be well-spoken and comfortable with public speaking.

PM's must maintain and track professional certifications. At one time DSC required all PM's to be PMP Certified. They are also Expert COR III certified, FAC P/PM certified, and many are LEED certified. Many PM's also hold professional licenses. These certifications and licenses require yearly training and maintenance.

Specific Roles and Responsibilities

Design

Major deliverables include a number of procurement deliverables, including Compliance, Supplementary Services(SS), Architect/Engineer(AE)Design, Construction, Title III, and Construction Management Representative(CMR).

- Compliance includes contracting with a firm to conduct some or all of the following: animal surveys, plant surveys, identify wetlands, environmental hazards, archaeology, natural and cultural studies, and State Historic Preservation Office (SHPO) approval.
- Supplementary Services can include contracting with a firm to assemble IGEs for construction, land surveys (either topography or boundary), and subsurface investigation, such as geotechnical analysis and Ground Penetrating Radar (GPR).

- Design Deliverables almost always include awards to an A/E for four phases, Preliminary Design, Supplemental Design, Design Development, and Final Design. PM's review each of these design submittals and provide written comments.
    - PM's set the design schedule and make sure that the A/E adheres to it, track deadlines for deliverables, and review each round of drawings during the design phase.
- Title III is awarded to the Designer of Record to respond to questions and issues that come up during the design and to complete the As-Built Drawings when the project is complete.
- CMR Services are awarded to an A/E firm to be the PM's eyes and ears on the construction site. They oversee construction work, test results, provide daily reports and photographs, and evaluate contractor invoices for accuracy, prior to submission to NPS.

Construction

- Review and comment on the Division One documents, including: Baseline Schedule, Schedule of Values, Health and Safety Plan, Accident Prevention Plan, List of Subcontractors, Liability Insurance, Labor Law Compliance, Waste Management Plan, Quality Control Plan (QCP), Storm Water Pollution Prevention Plan (SWPPP), Indoor Air Quality (IAQ) Management Plan, Contractor's (building) Commissioning Plan, Historic Preservation Treatment Plan.
- Review product submittals and Requests for Information. When all of these are "Accepted," PM's issue the Notice to Proceed.
- Periodic Quality Control inspection of the construction project work. This includes rejecting work that is subpar.
- Final inspection of construction work when the contractor is ready. Provide punch list of remaining work at that time.

Overall Project

- Negotiate Project Agreement with the park and the region, detailing responsibilities and expectations with stakeholders in the course of the project life.
- Write Scope & Cost Validation Report, comparing current needs of the project with what was originally anticipated in the Project Management Information System (PMIS) statement.
- Develop a Capital Asset Plan (CAP) early in the project. PM's must present a successful business case to the Development Advisory Board (DAB) for the project to move forward. PM's then manage and evaluate NPS acquisition investment performance by developing and managing a project budget, documenting project goals, identifying project risks and mitigation strategies, and developing an acquisition plan. Project results are measured and reported on a quarterly basis for comparison against the original baseline using Earned-Value principles. This is done until the project is completed.
- Provide monthly scope, schedule, and cost updates to management at DSC.
- Check and process submittals when the Project Specialist is out.
- Communicate frequently with the CMR and the park POC.
- Conduct weekly meetings with all appropriate parties to keep the project moving forward.

Accounting

- Fund Requests:
    - Write and issue RFP for A/E or contractor;
    - Develop a cost estimate;
    - Negotiate final pricing with A/E or contractor;
    - Develop the Spending plan (SP) for accounting;
    - Issue allocation request within the SP, i.e. or the Pacific West Region: Send to RLIC in Region; Regional budget person reviews and approves, sends to Regional comptroller; Comptroller reviews and sends to WASO budget to ensure that funds are available; Account numbers are assigned by WASO budget; WASO budget updates and signs the AR in the SP and sends to Comptroller for approval, approval sent to Regional Budget and RLIC who send this back to the PM with account numbers for preparation of PR;
    - PR developed with account numbers with scope of work and estimate;
    - Make sure the account numbers are agreed to and accurate;
    - Find out who the certifying funds approver is; and
    - Request and issue the PR for additional approval, upon PR approval, can obligate the funds, Track and prod people during the approval process.

Contracts

- Develop and write selection criteria for contracting;
- Develop and write the scopes of work for contracting;
- Write the RFP for solicitation and develop an IGE;
- Review the proposals;
- Write the pre-negotiation memo and develop the strategy for negotiation;
- Lead the negotiation for the CO and negotiate;
- Write the record of negotiation for the CO and make recommendation;
- Get the funding for the contract with the PR and request for funds; and
- Write up sole source justifications.

Solicitation

- Conduct market research to identify the appropriate pool of contractors.
- Request Qualification Statements from multiple firms, review them to select the "best value" firm.
- The selected firm then provides a proposal that PM's analyze and negotiate.
- Secure funding with SPs and Purchase Requests (PRs) and all supporting documentation, including Justification.
- Write Scope of Work (SOW).

- Assemble Independent Government Estimates(IGEs).
- Evaluate risks and develop strategy to mitigate risks.
- Schedule the work, including phasing when necessary.
- Manage communications with all stakeholders.
- Work with key stakeholders to specify project goals and plan the activities to achieve them.
- Negotiate and award modifications to contracts that include time extensions, price increases, and administrative changes.
- Write a Record of Negotiation.
- Manage scope of work, project schedule, quality, risks, and work completed vs. the project budget.
- Draft letters when the project is not going well and when Substantial Completion is achieved.

QA/QC

- Receive and deliver the design documents to the QA group filling out the review request forms and making sure that the package is complete for review from the AEs.
- Monitor and try to maintain the design process and try to get the review comments completed within the time frame of the design schedule.
- Get drawings to the parks and the regions and manage their review time period.
- Address review comment questions from the A/E and set up meetings for clarification and try to improve the quality of the design documents.
- Make ready the final solicitation package for contracting by going through the Construction Procurement Checklist and get final sign-offs.

WASO

- Work with Regional Line Item Coordinators and WASO on funding requests during the initial design process and report project progress to both offices.
- Manage and submit information within ADAB (Automated Design Advisory Board) system, which acts a repository for all needed documents and costs for DAB approval of projects.
- Provide the S/CVR to WASO for review and comment
- Develop and manage eCPIC (Electronic Capital Planning and Investment Control) for DOI reporting through WASO.
- Quarterly reporting updates and maintenance of eCPIC.
- Develop and make formal presentations for quarterly DAB meetings. PM's follow very strict criteria for these presentations; includes review of the presentations with regions and DSC prior to final presentation to the DAB.
- Upon DAB approval, request funding for the next step to DD/CD progression.
- Develop and submit the Director's Approval Form within ADAB.

Regions

- For LIC projects, work with the Regional Line Item Coordinators (RLIC).
- Daily/weekly meetings with the RLIC to discuss status of ongoing projects.
- Review upcoming Work Session Presentations prior to the DAB presentation for comment and approval.
- Request funding through the RLIC and the regions.
- Each region has different procedures to adhere to and PM's need to remember or learn how each region conducts business.
- Each fund source has a different process, i.e. LIC is different from Cyclic Maintenance and is different for 20 percent rec fee or Repair /rehab fund sources and each fund source has a different budget manager in the region.

Tasks outside of projects

- Annual Training
- FAC P/PM and COR Training
- PMP and LEED Training
- Professional License maintenance
- Maintain and track all training requirements and certificates
- Schedule travel
- Phone bills
- Credit card statements
- Timesheets

DSC related tasks

- Monthly Reviews with Branch Chiefs
- Update Project Schedules – Maintaining Panorama Through MS Project
- PM/PS Meetings

Appendix F: Recommendations from Wheeler Report

Finding No. 1: In 1998, the Department of the Interior commissioned the National Academy of Public Administration (NAPA) to review and recommend changes to NPS's design and construction program. To implement NAPA's recommendations, DSC developed its project management and contracting processes based on then-current industry standards. But those practices have not been reviewed or updated in more than 20 years. DSC would benefit from reexamining NAPAs recommendations, including whether DSC takes full advantage of the range of services that industry has to offer, whether DSC is effectively utilizing standardized designs to control costs, and whether DSC is adequately resourced to accomplish its mission. Finally, DSC continues to receive questions from the Department, Congress, and the public about whether its design and construction costs match the return. But neither NPS nor DSC have the resources to benchmark NPS's design and construction costs against comparable projects.

Recommendation No. 1: Because of the longevity of NAPA's recommendations, and the symmetry between those recommendations and the challenges confronting NPS today, NPS should recommission NAPA to conduct a follow-up review of NPS's design and construction program. NAPA's review should focus on, but not be limited to: (1) whether NPS's design and construction costs are in in line with comparable projects; (2) whether DSC is appropriately resourced to carry out its mission; (3) whether DSC's design and construction process and contracting methods are in line with industry standards and the processes used by other government agencies, and; (4) whether DSC is employing the best management practices to deliver high-quality projects, appropriate to the NPS mission, as cost-effectively as possible.

Finding No. 2: The Washington Contracting Office (WCO) conducts a clearance review of all DSC procurement actions that exceed $3 million. On average the review delays the obligation of funds by 36 days. The clearance review is redundant because DSC's procurement actions are thoroughly reviewed for procurement and legal risk by the contracting officer, the branch chief, the division chief, and the Solicitor's Office before WCO conducts its review. WCO's clearance review also creates legal risk where none should exist because WCO's edits and comments are made after the Solicitor's Office has determined that the action is legally sufficient.

Recommendation No. 2: NPS should reconfigure the procurement review process so that WCO conducts its review before the Solicitor's Office reviews the action for legal sufficiency. NPS should also raise WCO's clearance review threshold for DSC projects from $3 million to $10 million. This will reduce the number of DSC projects subject to WCO review by 62 percent, and maintain WCO's oversight role on the most sensitive projects. Finally, the purpose of the WCO review - to ensure consistency and identify areas for policy development - could be accomplished through retroactive audits, which would not burden or delay DSC's push to obligate funds. Thus, NPS should authorize WCO to audit DSC's procurement actions, templates, and internal controls to identify gaps and areas for policy development.

Finding No. 3: DSC's design and construction division consists of four branch chiefs. The branch chiefs oversee all design and construction projects in their assigned NPS regions and supervise a regional team of project managers and project specialists. But the regional teams often work on projects in multiple regions, supervised by different branch chiefs. This undermines the branch chiefs' ability to manage their projects and their people. It is difficult for the branch chiefs to manage their projects because they do not supervise the employees working on them. It is also difficult for the branch chiefs to manage their employees because their team is often working on projects in different regions. This misalignment can prevent the branch chiefs from carrying out basic managerial responsibilities, including providing feedback to employees, standardizing practices, holding team meetings, and managing the relationships between their team, the region, and the parks. It also makes it challenging for the branch chiefs to evaluate employee performance.

Recommendation No. 3: Within 1 calendar year, division chiefs and branch chiefs should reassign all projects so that each branch chief supervises a regional team that manages all of the projects in the region(s). Moving forward branch chiefs should assign all projects in their region(s) to their regional team. If necessary, division chiefs and branch chiefs should realign the regional teams to diversify subject matter expertise, which could ease the transition of the project reassignment. To maintain organizational flexibility, project managers should be allowed to work on one project outside of their assigned region, subject to the approval of the division chiefs and branch chiefs. And the division chiefs should deploy contractors to different regions, as needed, to address workload surges.

Finding No. 4: DSC delivers high-quality designs, on schedule, when DSC collaborates internally, engages stakeholders early and often, and values different ideas and perspectives. But this collaborative approach to design is now the exception instead of the rule. Because of a growing breakdown between project management and the technical branch, too many projects are passed from group to group with no meaningful collaboration or engagement. As a result, stakeholders and staff feel disengaged and underutilized, design-quality deteriorates, projects become stuck in quality assurance review, deadlines are missed, and poor-quality designs are pushed through and fixed in construction.

Recommendation No. 4: DSC should adopt a new project management model that formulates and empowers a Project Team at the outset of each project. The Project Team should consist of the project manager, contracting officer, relevant subject matter experts from the technical branch, CPMD, the park, the region, a cultural and natural resource specialist, the A/E firm, and other critical stakeholders. The Project Team will reconvene at specific project milestones to select the best A/E firm for the project, review designs, and make process and design decisions. Engineering a simple but repeatable process that engages all of the relevant stakeholders in the same room, at the same time, with different responsibilities, will reinvigorate the collaboration that is essential to managing the design process successfully. It will also improve communication and decision-making, dismantle the backlog of QA reviews by shaving 120-days off of the QA process, and improve relationships within DSC and between DSC and the parks, regions, and A/E firms.

Finding No. 5: DSC does not require staff to tailor the design process to meet the needs of the project. Every design flows through the same three design phases, the same workflows, and the same five QA reviews, regardless of cost or the complexity of the project. DSC also conducts Value Analyses (VAs) to select the design, even when only one design option is within budget and meets the operational needs of the park.

Recommendation No. 5: DSC should require the Project Team to customize the design process to fit each project. At the outset of each project, the Project Team should develop a project-specific work flow that addresses, at a minimum: (1) whether all three design phases are necessary, or whether a project can jump from schematic design to construction documents; (2) whether a VA is necessary, or whether the Project Team can document reasoned design decisions in a design log, and; (3) whether multiple QA reviews are necessary, or whether a single QA review would suffice. The Project Team should sign off on the customized work flow. This will empower employees, leverage expertise, and save time and costs without sacrificing the quality of the design or the integrity of the design process.

Finding No. 6: NPS developed cost-estimating factors for design activities (17% of net construction) and construction supervision (8% of net construction). The factors are targets across the portfolio of projects. CPMD will raise the threshold on a project-by-project basis provided that the project manager prepares a written justification for the override. But in practice, nearly all projects are managed to the thresholds. For smaller projects ($2-$5 million), 17% is often not sufficient to procure a high-quality design. Such projects typically require 20%-21% for design. For larger projects ($10 million or more), 17% may overpay for design work. Such projects typically require 14%-15% of net construction. Similarly, the 8% cap on construction supervision is not always sufficient to procure a full-time construction management representative (CMR), particularly on smaller projects that may need a full-time CMR.

Recommendation No. 6: NPS should implement a design range of 14% to 20% of net construction, with an aggregate target of 17% across the portfolio. NPS should also implement a construction supervision range of 5% to 11% of net construction, with an aggregate target of 8%. At the outset of the project, the Project Team should customize design and construction supervision costs by selecting a percentage within the applicable range to meet the demands of the project, subject to CPMD approval. CPMD and DSC should track the data on each project and periodically review the data to determine whether adjustments to the design and construction supervision ranges are warranted, or whether new benchmarks should be established.

Finding No. 7: DSC rarely forces the firms to fix flawed designs before advancing them the next design phase. Instead, DSC sends the flawed design to QA review, and the technical branch fixes the design. As a result, underperforming A/E firms rely on DSC to review the design for basic quality control. This practice not only adds to the already unmanageable backlog of QA reviews, but also potentially shifts the A/E firm's legal liability to DSC. And DSC executives cannot get ahead of such problems early in the process because they do not have a designated executive at the A/E firm to contact.

Recommendation No. 7: DSC can reverse the incentive to submit substandard designs by becoming a more demanding customer. DSC should require the Project Team to reject any design that the Project Team determines does not reasonably meet the minimum standards for that design phase. DSC should require the A/E firm to submit the corrected design without changing the deadline for the next design phase, unless the Project Team determines that an extension is warranted. DSC should also require each A/E firm in an IDIQ pool to designate a partner or executive officer as a point of contact for all projects in the region. DSC should likewise designate the division chief or branch chief as the corresponding DSC contact.

Finding No. 8: DSC has not adopted a repeatable system of project management practices. Nor has DSC developed a consistent onboarding process to educate new hires. As a result, project management practices vary greatly, and there is no written manual or searchable database of past projects for staff to consult.

Recommendation No. 8: Using the Project Team model as a starting point, DSC should contract with a third-party to develop a written project management manual. The branch chiefs should regularly update the manual to incorporate best practices and make revisions as needed. Branch chiefs should also develop a consistent onboarding process that combines the manual with mentoring or coaching. DSC should also contract with a third-party, as needed, to reorganize their digital warehouse of projects by project type (e.g., visitor centers, employee housing, waste water treatment facilities) to provide a searchable database that new-hires, contractors, and existing DSC employees can consult as a resource.

Finding No. 9: The tension between project management and the technical branch has devolved to the point that only a reset will reverse the breakdown. Collaboration is almost non-existent and communication is done almost exclusively through email. The tension is compounded by the "staircase effect," where DSC employees separated by a staircase collaborate even less effectively than those that are located on the same floor.

Recommendation No. 9: Before implementing the Project Team model, DSC should contract for an off-site teambuilding and leadership training to restore relationships and rebuild teamwork across design and construction and contracting services. After the training, DSC should relocate the entire design and construction division to the same floor to eliminate geographical barriers and encourage more effective collaboration and communication.

Appendix G: Alternative Project Delivery Methods Background

Design-Bid-Build

What is it?
Design-bid-build (D-B-B) is the traditional and most commonly used method of delivery at DSC. When using D-B-B, a sequential process begins with DSC contracting with an A/E firm to furnish complete design services, and then advertising and awarding a separate construction contract based on the completed construction documents. In D-B-B, DSC "owns" the details of design during construction and as a result, is responsible for the cost of any errors or omissions encountered in construction.

Why use it?
Some of its advantages are:

- Owner controls design and construction;
- Design changes can be easily accommodated before start of construction;
- Design is complete before construction award'
- Allows for a fixed cost at contract award (firm-fixed price); and
- Low bid costs allow for maximum competition among contractors.

What does it do?
The main characteristic of this delivery method is that the design and construction phases of a project are completely sequential to one another and do not overlap. The DSC goes out for the bid only when the design is fully or nearly completed and detailed. The underlying assumption behind D-B-B is that any qualified construction firm will produce the same product from a given set of plans and specifications, especially when plans and specifications are complete and properly written.

How to use it?
D-B-B is a sequential process to deliver a project. First, the DSC and A/E firm completes the project design to 100 percent or near 100 percent complete. Once the design is completed, the bidding stage begins where the design is released to interested firms. After the bids are received and the lowest priced and responsive bidder is awarded the project, the construction or build portion begins.

When to use it?
D-B-B is useful for projects that can be designed to or near 100 percent complete. Typical and common projects will benefit the most from the use of D-B-B as the delivery method. Projects that involve high risk and many unknowns as well as projects that have a limited amount of time to complete the project will not achieve the benefits of D-B-B and another delivery method might be a better choice.

Limitations
Some of the identified risks and disadvantages of D-B-B are:

- Requires significant owner expertise and resources;

- DSC bears the risks for design errors;
- Sequential design and construction results in longer schedules than with other methods;
- Construction costs unknown until contract award; and
- No contractor input in design or planning.

Design-Build

What is it?
Design build (D-B) is the second most commonly used delivery method at DSC (but still very rare). Ideally, the owner contracts with one single entity to design and construct the project based on very limited design details and selection criteria developed by the owner. This delivery method combines the design and construction phases of a project into a single contract for the to manage. D-B allows for greater private sector involvement, but does not allocate any of the risks of financing, operating and/or maintaining a facility to the design-builder.

Why use it?
The D-B method is the most used alternative to the traditional design-bid-build (D-B-B) method. Its main benefit is that it allows overlapping of the design and construction phases often reducing project completion time. Other advantages of this method are that it:

- Allows for greater innovation in selecting design, materials, and construction methods;
- Reduces claims due to design errors;
- Accelerates response time and dispute resolution through a team effort;
- Single contract that addresses quality, costs, and schedule from design through construction;
- Shortened project delivery time can reduce user costs;
- Risks are transferred to the design-builder;
- Can use various procurement options (i.e. short-listing, low bid, best value selections, Fixed Price Variable Scope, etc.);
- Offers price certainty as construction cost is known and fixed during design; and
- Requires less owner expertise and resources.

What does it do?
Under the D-B delivery method, the DSC develops detailed procurement documents that communicate the expectations about the project's physical components, basic configuration, operational requirements, and performance. Upon completion of these documents, the DSC procures and awards the project to a design-builder firm, which then bases the design and construction of the project on the procurement documents (e.g. Request for Proposals). During design and construction, the DSC acts in an oversight role. It performs "over-the-shoulder" design reviews, and oversees the construction process. It should be noted that while the DSC can enforce the D-B contract requirements, the DSC should refrain from directing, completing, or actively controlling the design-builder's engineering and design efforts.

How to use it?

The California Department of Transportation (Caltrans) *Alternative Procurement Guide (1)* provides a process chart for D-B procurement. The following are the steps included on this chart:

1. **Define Project Scope –** Things to consider are project size and complexity as well as type and location. In addition, any unique or special conditions, schedule requirements, and traffic maintenance requirements should be identified. The purpose of this stage is to develop a preliminary project scope definition.
2. **Identify Project Goals/Objectives –** Here, some of the principal project goals and objectives should be identified such as cost control, public relations, accelerated delivery, promote innovation, or enhance quality. These should be goals and objectives essential to project success.
3. **Preliminary Project Development –** During this stage, some things to consider are the level of design and development required for a D-B project, permitting requirements, right of way acquisition, environmental clearance, utility relocation, and any other third party project-related issues. Some of the data to be collected and investigated should be geotechnical conditions, drainage conditions, and traffic studies.
4. **Identify and Allocate Project Risks –** Some of these risks are usually related to environmental clearance, right-of-way acquisition, third party issues, construction phase risks (i.e. differing site conditions, traffic maintenance, and schedule), public questions, security, and the procurement method (low-bid or best-value).
5. **Preliminary Project Design -** During this stage, the purpose is select the best design option available. Different tasks for STAs to perform are design alternative identification and evaluation, cost/benefit analysis, and the alternative selection process. The factor to consider should be traffic, alignment, geotechnical, survey and mapping, and drainage.
6. **Finalize Project Scope Criteria –** Tasks to complete by the STA are to determine design criteria and the extent to which performance-based specification can be used, to select a request for qualifications/request for proposals (RFQ/RFP) evaluation system, and to develop and outline of the RFQ/RFP package. The STA should ensure here that the level of design is appropriate to maximize the benefit of the D-B method.
7. **Develop RFQ/RFP Package –** During this step, the STA develops the contract language including the scope of work, any special provisions, and the technical specifications and finalizes the RFQ/RFP package. Some things to consider are the risk allocation, procurement approach, stipends, and whether this D-B will be combined with other procurement methods such as alternative technical concepts.
8. **Advertise, Select, and Award –** This is the final step of the D-B procurement process and includes advertising the RFQ, evaluating the statements of qualifications, publishing the RFP to selected proposers, evaluating proposals, and selecting design-builder.

When to use it?

The D-B method is not suited for every project. This method works best for project that require acceleration, projects that have unique opportunities to appropriately transfer risk to the design-build team, and on projects with opportunities for innovation. This method has been used successfully on projects for which:

- A compressed schedule was needed;
- Schedule certainty was needed;
- Early costs certainty was required;
- Project scope could be adequately defined without 100 percent complete plans, specifications, and estimates;
- Project quality could be defined through minimum design; and
- Where minimal third party risks existed or could be mitigated.

Limitations

Although the D-B delivery method is a good alternative to the traditional D-B-B method, it also has some risks and disadvantages. For instance, D-B:

- Shifts additional control and responsibility to the design-builder;
- Makes bidding process more expensive for D-B teams;
- Makes coordination more challenging due to faster pace;
- Parties are more familiar with traditional methods;
- Requires a comprehensive and carefully prepared performance specification;
- There is potential for conflict of interests between design and construction; and
- DSC/NPS interests may be underrepresented throughout the process.

Construction Manager / General Contractor (CM/GC)

What is it?

Construction manager / general contractor (CM/GC) is a project delivery method in which the owner holds contracts with two parties: the design consultant and the Construction Manager/General Contractor firm. However, unlike the typical design-bid-build system, here, the CMGC's services are retained early on the design phase. As a result, the CMGC has an input during design and controls the entire construction phase. Under this method, the CMGC is said to be "at Risk" because the project is delivered under a GMP that is negotiated during the design phase.

Why use it?

The CM/GC delivery method provides the following advantages:

- Allows fast-tracking of design and construction activities resulting in potential time savings;
- Allows for innovation and constructability recommendations during design, but the owner retains significant control over design;
- Once GMP is established the CM/GC invests more in cost engineering and constructability reviews in order to minimize risks;
- Fixes project costs and completion responsibility; and
- CM/GC services provided during preconstruction reduce design costs by reducing the amount of detail that is required and by focusing the early design effort on constructible solutions.

What does it do?

Under the CM/GC delivery method, the owner selects a CMGC firm to perform preconstruction and construction management services. During the design phase, the CMGC firm acts in an advisory/management role. It provides constructability reviews, value engineering suggestions, construction estimates, and other construction-related recommendations. At some point on or before design reaches 100 percent completion, the owner and CMGC firm negotiate a GMP, which is based on a partially completed design and includes the CMGC estimate of the cost for the remaining design elements. Once the GMP is established, the CMGC firm starts the construction phase, thus allowing an overlap of the design and construction phases. During construction, the CMGC firm acts as a general contractor and performs contractually obligated work. The contractor holds the construction contract and risk for any construction costs that exceed the GMP.

How to use it?

Upon selection of the CM/GC method as a project's delivery method, the process can be divided into three parts:

1. **Project development and CMGC selection** – As a first step in the project development phase, the owner identifies and allocates the risks associated with the project. The second step is to develop preliminary documents. The third step is to develop preliminary design documentation, which should be minimal in order to maximize the effectiveness of the CM/GC method but enough to conduct effective procurement of a CM/GC firm. The project goals and objectives should guide the owner through these steps. In case of the CM/GC selection, the procurement is generally made using a qualifications-based selection. Here, the owner negotiates a fee for the pre-construction services with the highest ranked proposer awarded the project.
2. **Pre-construction services and GMP negotiation** – The pre-construction services include almost anything the service requires from the CMGC firm. Typical CM/GC packages include costs estimates, schedule analysis, work sequence, risk identification, mitigation and pricing, constructability reviews, development of work packages for bid, and development of a GMP that meets owner requirements and budget restraints *(2)*. During this stage of the project delivery process, the owner and CMGC should begin negotiations for the GMP. The GMP is a maximum price to which the CM/GC firm will commit to deliver the project for a quantified scope of work expressed in the design documents. It includes project direct costs, indirect costs, a profit, and the project contingency. The GMP can be negotiated any time during the design phase. It should be taken into account that when the GMP is negotiated closer to the design completion it will include less contingency. Conversely, when the GMP is negotiated earlier in the design, the overall costs may be higher due to a larger contingency; however, it allows construction to start earlier. Some special aspects to consider in the GMP are the CMGC self-performance limits which is regulated by laws in some states, subcontract competition and selection constraints, and the use of a shared savings clause which allows sharing a percentage of any GMP savings with the CM/GC firm upon project completion.
3. **Construction services** – During the construction phase of the project, the owner should provide a method to review and respond to construction issues compatible with the GMP contract requirements, and maintain an accounting system that supports the review of

contractor invoices and justifications, and make timely payments to the CM/GC firm. Key aspects to consider are strong communication between the owner and the CMGC, subcontractor control, quality control, contract changes procedures, and invoicing system.

When to use it?

The CM/GC delivery method is most advantageous:

- On projects where the owner has limited management resources;
- On projects where there is limited time or funding;
- When there is a need for immediate improvements;
- On projects where the design is complex, difficult to define, subject to change and there are several design options; and
- When the project is sequence or schedule sensitive.

The CM/GC method is less suitable for straight-forward projects, projects with easily defined scope and low risk, and projects that lack schedule sensitivity.

Limitations

Some of the major risks and disadvantages of a CM/GC delivery method are:

- Project price is negotiated with a CM and not competitively bid;
- CMGC input may not be included by designer;
- Use of GMP may lead to a large contingency to cover uncertainties and incomplete design elements;
- Use of GMP can lead to disputes over the completeness of the design and contract changes; and
- CMGC design input does not necessarily translates into better design quality.

Appendix H: Selected Bibliography

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