Update and Revise Cost Containment Benchmarks

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- Alaska Native Tribal Health Consortium (ANTHC);
- Alaska Housing Finance Corporation; and
- Alaska Village Electric Cooperative.

Executive Summary

While rural Alaska infrastructure costs have increased by roughly 60% over the past 5 years due to substantial increases in freight, fuel, the demand for materials and a decline in the value of the dollar, diligent managers have been able to reduce the rate of cost increase through a clear focus on efficient site selection, design, procurement and construction practices.

Cost containment remain possible in the future by supporting managers who have demonstrated a keen focus on cost issues and encouraging others to redouble their focus on efficient delivery of rural infrastructure.

Building construction cost studies for teacher housing, clinics and multi-use buildings have been updated, and studies for bulk fuel tank farms and rural power plant have been developed.

A comparison of 2004 and 2008 cost study data for remote rural clinics indicates a **60% increase** in total cost per square foot: **$625/sf to $1020/sf**. Similar cost escalation was noted in the other types of Commission projects.

Tables 1-3[1] highlight the regional benchmarks for teacher housing, multi-use facility, clinic, rural power system upgrade, and the bulk fuel program.

Table 1 Regional Benchmark Costs, 2008 ($ Per Square Foot)

Region	Teacher Housing (4 Units, 1040 Sf Each)	Multi-Use (2768 Sf)	Clinics (2572 Sf)
Aleutian/Pribilof Islands Association	$ 487	$ 394	$ 841
Arctic Slope Native Association	$ 597	$ 478	$ 1,018
Bristol Bay Area Health Corporation	$ 475	$ 391	$ 832
Maniilaq Association	$ 597	$ 475	$ 1,020
Metlakatla	$ 444	$ 371	$ 789
Norton Sound Health Corporation	$ 609	$ 466	$ 1,035
Southeast Regional Health Corporation	$ 438	$ 369	$ 779
Tanana Chiefs Conference	$ 465	$ 384	$ 816
Yukon-Kuskokwim Health Corporation	$ 561	$ 466	$ 967

Source: MAFA, Benchmark Costs, 2008

[1] Source: MAFA, Benchmark Costs, 2008

Table 2 Regional Benchmark Costs, Bulk Fuel Tank Farms, 2008 ($ per gallon)

Region	Large Tank Farms (594,000 gallons)	Small Tank Farms (168,000 gallons)
Aleutian/Pribilof Islands Association	$ 10.46	$ 18.03
Arctic Slope Native Association	$ 11.32	$ 19.12
Bristol Bay Area Health Corporation	$ 10.34	$ 18.01
Maniilaq Association	$ 11.46	$ 19.17
Metlakatla	$ 9.79	$ 17.33
Norton Sound Health Corporation	$ 11.68	$ 19.39
Southeast Regional Health Consortium	$ 9.80	$ 17.15
Tanana Chiefs Conference	$ 10.10	$ 17.61
Yukon-Kuskokwim Health Corporation	$ 10.81	$ 18.34

Source: MAFA, Benchmark Costs, 2008

Table 3 Regional Benchmark Costs, Rural Power System Upgrades, 2008 ($)

Region	Multiple Modules (1550kW - AVEC)	Three Bay Power Plant (920kW - AEA)
Aleutian/Pribilof Islands Association	$ 2,829,172	$ 2,929,743
Arctic Slope Native Association	$ 3,246,803	$ 3,158,029
Bristol Bay Area Health Corporation	$ 2,805,229	$ 2,921,496
Maniilaq Association	$ 3,262,926	$ 3,167,810
Metlakatla	$ 2,689,531	$ 2,797,980
Norton Sound Health Corporation	$ 3,314,022	$ 3,218,123
Southeast Regional Health Consortium	$ 2,688,508	$ 2,779,587
Tanana Chiefs Conference	$ 2,748,382	$ 2,850,166
Yukon-Kuskokwim Health Corporation	$ 3,132,582	$ 3,024,134

Source: MAFA, Benchmark Costs, 2008

Using a combination of benchmark costs *and* reinvigorating the use of performance measures to encourage partners to adopt project management best practices, including best value review of standard designs, aggressive management of variance from standard designs, bundling of procurement and construction contracts, and identification and sharing of best practices across the planning, design and construction process, we believe that the Denali Commission could minimize cost escalation compared to business as usual.

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1 Introduction

This report updates the information in the 2004 report, *Cost Containment Options For Selected Denali Commission Projects*[2]. The Denali Commission requested this new version, which reflects the significant changes in the construction industry of the intervening four years, including: an improved understanding among Commission project partner and other construction management professionals of increases in construction costs; and additional expertise in identifying appropriate cost containment opportunities.

1.1 Purpose and Use

This report:

- Presents an overall picture of recent rural construction costs in Alaska and a forecast for the short term to help the Commission estimate future infrastructure development costs.
- Highlights factors that drive increased construction costs in rural Alaska, which may help the Commission 's focus on alternative cost management approaches.
- Extends the Commission's understanding of cost containment and cost management opportunities within approved rural Alaska infrastructure projects, which will improve future cost estimates.

1.2 Organization

This report has three parts.

- A forecast for rural Alaska infrastructure construction.
- Summary results of extensive interviews with Denali Commission project partners and professionals about the reasons for the major cost increases projects have experienced recently.
- Expanded discussion of the benchmarking tools that were introduced in earlier cost containment reports (2002[3] and 2004), including: benchmarking methods for Commission-funded buildings, bulk fuel storage, and rural power system; integration of those benchmarks with other cost management approaches; and the spreadsheets, with instructions, for the benchmarks.

NANA Pacific prepared each section as an independent, freestanding report, with this document comprising a synthesized summary. To the extent practical, the structure and formatting from component reports have been retained to preserve logical flow.

[2] Cost Containment Analysis and Evaluation for Selected Denali Commission Projects, NANA Pacific, November 19, 2004.
[3] Final Denali Commission Project Cost Containment Assessment Projects in Various Alaskan Villages. ICRC (Koniag Regional Corporation) April 8, 2002

The cost benchmarking sections of this report were prepared as part of an assessment of opportunities to improve the cost effective delivery of constructed facilities in rural Alaska to ensure the sustainability of investments funded by the Denali Commission and its partners.

2 Rural Alaska Building Construction Cost Outlook: 2008[4]

2.1 Summary

In 2004, North American building construction costs began to escalate rapidly due to these converging factors: an increased demand in emerging world markets; the resurgence in US home building after the dot.com slump; and a decrease in US dollar value.

Concurrently, labor prices continued to escalate above inflation due to high demand, limited supply, and increased benefits costs, especially health care.

These basic inflation forces were further magnified in rural Alaska by large increases in freight rates, which were driven up by rising fuel costs and increased demand for the finite "supply" of mechanical and electrical contractors.

The net effects of these factors include a 50% increase in unit costs between 2004 and 2008, and certain building system enhancements and upgrades—especially mechanical, fire protection and electrical—experienced an additional 10% increase. For rural clinics, the total cost per square foot rose approximately 60% during those four years, which is equivalent to a 17% compound annual growth rate (CAGR) .

The outlook for 2008, however, suggests a moderation in unit cost growth as the North American housing market continues to slacken and the associated credit crunch is likely to expand to nonresidential markets. The Engineering News Record (ENR) Materials Cost Index is up approximately 2% (May 2008), and the ENR Building Cost Index is higher by 3% than the prior year. However, this moderation in upstream materials and labor markets may be offset by the cost of fuel—which affects mobilization, freight, and construction equipment costs—is experiencing a 50–60% increase, year-over-year.[5]

The 2008 net increase to overall unit costs (expressed in dollars/square foot) in the Alaska building construction market is anticipated at 8–12% over 2007, primarily due to the high fuel costs.

[4] Source: MAFA, Benchmark Costs, 2008 .

[5] BLS Producer Price Index (Diesel), Seattle and Anchorage Rack Prices for #2 Diesel Fuel (2007-2008).

2.2 North American Trend, Retrospective (1983–2008)

Over the past 25 years, the overall unit cost of building materials has approximately matched inflation at an annual average growth rate of ~2.5%.[6] While wages tend to reflect the consumer price index (CPI), the past 8 years have experienced a slight lag below the CPI. This has been offset, for the most part, by increases in benefit costs, especially health care.

Over the past 10 years, building construction cost indicia have tended to track the North American housing market: a slowdown after the dot.com crash in the early 2000s; and a subsequent increase as that market recovered, demand accelerated for construction materials in emerging markets, and the US dollar declined in value (see Figure 1).

Figure 1: Engineering News Record Construction Materials Price Index (Steel, Cement, Lumber) (Jan 1983- Jan 2008)

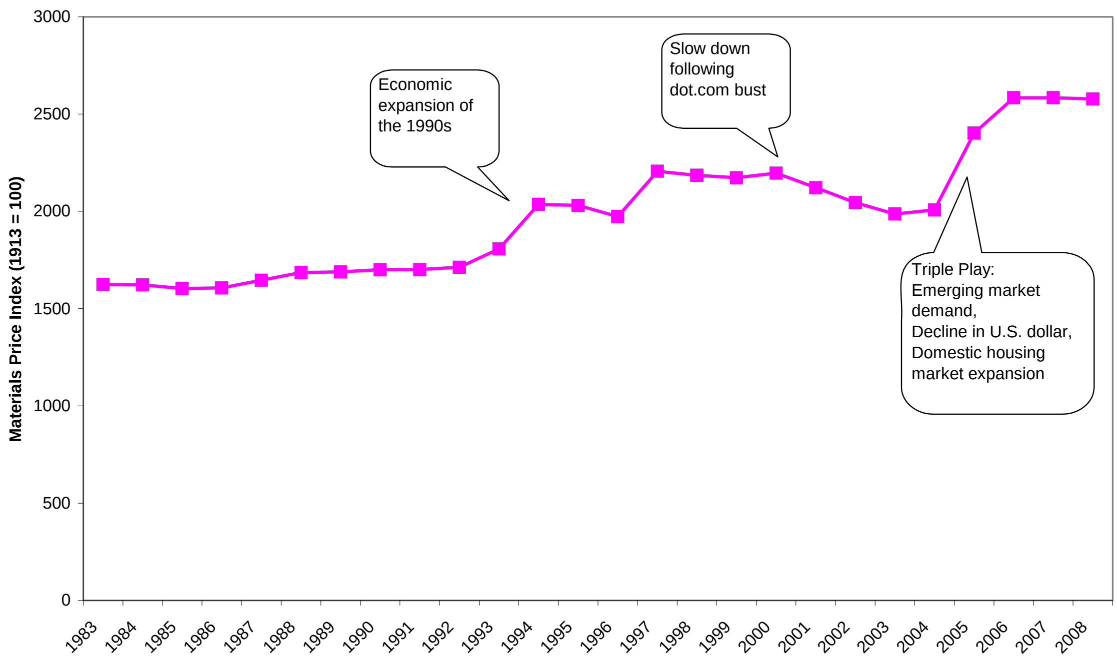

Figure 2 includes discrete information on components of the building materials markets, revealing divergent trends among lumber, plywood, steel, and ready-mix concrete.

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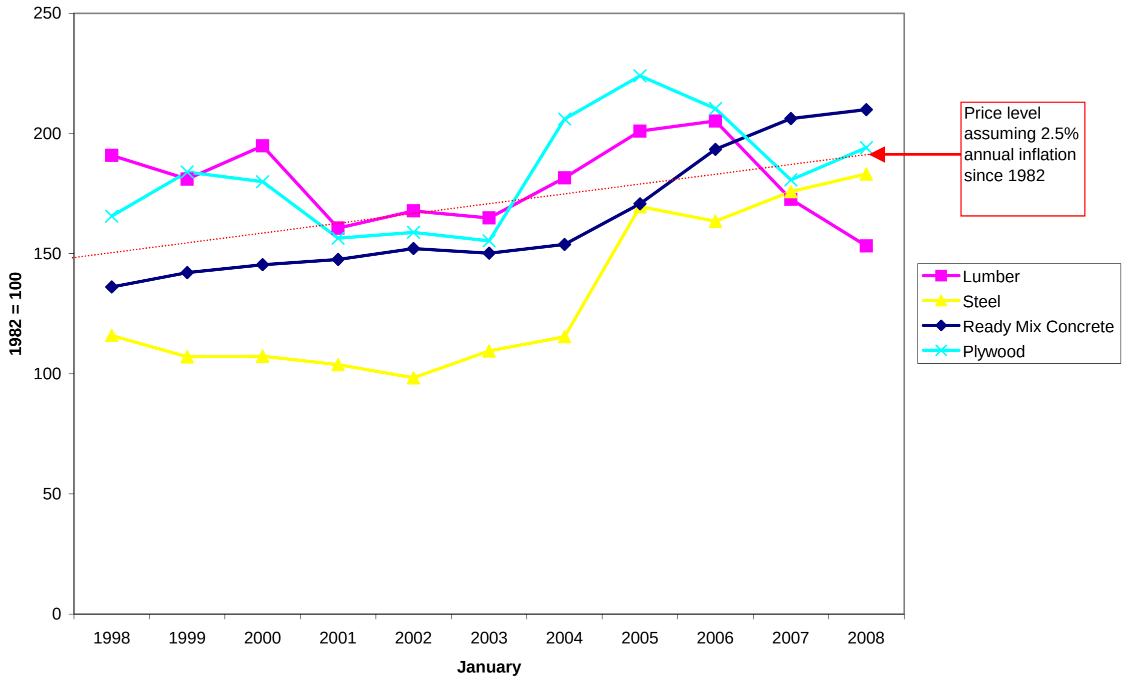
[6] MAFA analysis of 1) BLS Producer Price Indicia for Lumber, Steel, Cement, Ready-Mix Concrete, Plywood and other building materials (1982-January 2008), and 2) ENR Construction Economics, Building Cost Index (1983- February, 2008). The ENR Materials Cost Index (1983-2008) has increased an average 2% per year (see Figure 1 in this paper).

Figure 2: BLS Producer Price Indicia: Lumber, Steel, Ready Mix Concrete and Plywood



After running above long-term inflation, lumber and plywood prices fell after the dot com crash in 2000. In 2003 and 2004, factors including the US housing expansion and consequent increase in lumber imports; a rapid, expanding demand in emerging overseas markets; and a drop in US dollar value contributed to a rapid increase in lumber and plywood costs of 23 and 28%, respectively, in 2004. When the US housing expansion slowed and plywood and lumber orders began to decline, associated prices declined in the second half of 2006 and continued through 2007. February 2008 figures indicate a slight rebound in plywood, which is largely due to supply curtailments.[7]

Steel and ready-mix concrete prices, which tend to be more closely tied to commercial building and construction markets, have tracked the conditions that contributed to continued price increases through 2007.[8]

2.3 Rural Alaska Building Construction Benchmark Cost Studies: 2004 - 2008

In 2004, NANA Pacific conducted a series of building construction cost studies for teacher housing, clinics, and washeterias in rural Alaska for the Denali Commission.

Building construction cost studies for teacher housing, clinics and multi-use buildings have been updated, and studies for bulk fuel tank farms and rural power plant are in progress.

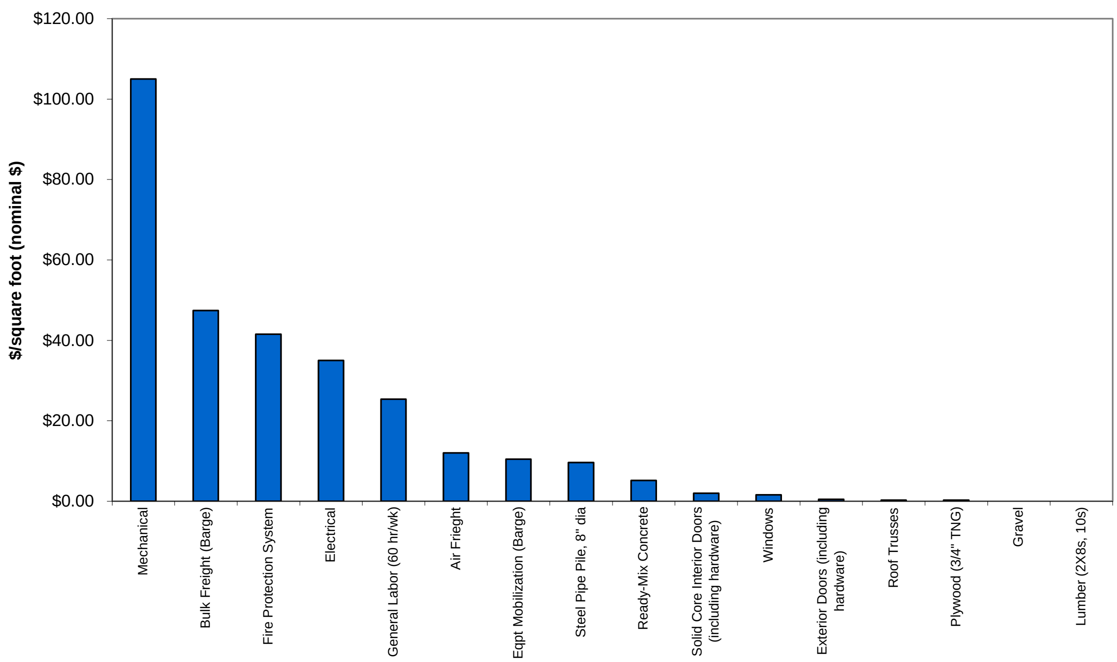
[7] Random Lengths Lumber and Panel Market Report, 29 February, 2008.
[8] MAFA Analysis of BLS Producer Price Indicia (1998-2008).

A comparison of 2004 and 2008 cost study data for remote rural clinics indicates a **60% increase** in total cost per square foot: **$625/sf to $1020/sf**.

Figure 3 includes specific details about the main contributors to this increase:

- Mechanical (materials, tight skilled labor market, limited pool of experienced contractors, high and freight and fuel costs)
- Electrical (materials, tight market for skilled labor, limited pool of experienced contractors, high mobilization and freight costs, a new fire sprinkler system code requirement, and general labor wage and benefit increases)

Figure 3: Increase in per square foot cost by category
2008 vs 2004 Benchmark Costs



2.4 2008 Outlook

While for many building materials cost growth has slowed from double-digit increases each of the past 4 years to less than 5%, in the first quarter of 2008 fuel costs experienced 50–60% year-over-year increases, which resulted in significantly increased freight costs. The net increase of total cost of building materials in 2008, including delivery to a remote rural construction site in Alaska, is estimated between 8 and 12%.

Mechanical and Electric subcontract work are also anticipated to increase between 8 and 12% due to continued material cost escalation, tight skilled labor markets, and high fuel costs.

3 Construction Costs in Rural Alaska: Contributing Factors[9]

The 2004 version of this report[10] identified factors that contributed to contemporaneous, increasing construction costs in rural Alaska. This update expands that information by adding material from experts and key informants about the management of rural construction projects and associated costs.[11]

The 2004 partner and expert questionnaires were modified slightly and re-used for this update to ensure consistency between report versions.

Substantial assistance was rendered by many organizations and individuals in the course of this study section. Interviewees helped to ensure that a wide variety of perspectives were portrayed, and reviewers of individual sections have contributed greatly to its accuracy and completeness

Five partners involved in the funding proposal review and construction management of projects funded by the Commission were interviewed between April 23 and May 1, 2008.

Partner agencies included:

- Alaska Department of commerce, Economic and Community Development Division of Community and Regional Affairs;
- Alaska Energy Authority;
- Alaska Native Tribal Health Consortium (ANTHC);
- Alaska Housing Finance Corporation;
- Alaska Village Electric Cooperative; and
- Three staff from the Denali Commission.

3.1 Summary of Respondents.

Most respondents were willing to respond to the interviewer's questions. In only a few instances did the respondents answer questions out of order. In these cases, the interviewer entered responses under the appropriate question. Therefore, this information is summarized according to the questions asked during the interviews.

3.1.1 What have been your organization's general experiences with cost containment for Denali Commission funded projects?

Respondents discussed the process of developing cost benchmarks and their use in project management. These topics will be discussed separately.

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[9] This section reflects the opinion of the Commission's partners, staff, and some peer reviewers. This does not necessarily reflect the opinion of NANA Pacific.

[10] 2004 Cost Containment Report, op cit, pp. 19-21.

[11] Brian Saylor, *Summary of Key Informant Cost Containment Interviews Partner Level,* May 3, 2008. Note: Information that is relevant but not directly responsive to an interview question, including partner concerns and out-of-scope comments, was gathered and may contribute to this summary.

- Involvement with the cost benchmark development process. Most partners with a long relationship with the Commission have at some point been involved in developing cost containment standards. Two partners have submitted cost data to a consultant who prepared the Project Cost Containment Assessment (April 8, 2002). While most find the cost benchmark data useful to verify project construction budgets, some partners were skeptical of its utility during the development process. One partner suggested that the consultant preparing the 2002 cost benchmarks was unclear about the project's intent or the extent to which partners could be involved.

- Evolution of the Cost Benchmarks. In general, partners have been pleased with the improvements in cost benchmarks with the publication of the 2004 report. One partner noted that the updated benchmarks were between 2 and 2 1/2 times higher than the 2002 cost benchmarks. He commended Mark Foster for his excellent work.

- Constructive Feedback of the Cost Benchmarks. There are still criticisms from partners that the cost benchmarks do not include important, but difficult to measure, construction costs like geographic and site-specific adjustments. Some partners are also concerned that design and management fees are not adequately addressed. One partner warned that not including these fees could reduce the number of designers and contractors willing to work on complex construction projects in rural Alaska[12].

- The use of cost benchmarks. The use of cost benchmark data in managing projects varies widely, with an apparent correlation to a partner's role in project review, award, and management.

  Granting agencies such as ANTHC use the size-related health-facility prototypes as their benchmark standard. Many times, an approved project is forwarded to ANTHC with the expectation that they will construct the project with the plans and budgets approved by others.

  The Commission reviews project applications and compares cost estimates included therein with estimates from similar proposals. Review staff make funding recommendations to the commission but lack the authority to direct an applicant to reduce specific budget expenditure lines.

  Agencies involved with project management review engineers' estimates against cost benchmark data during a project's design phase. The project management agency discusses the variance with applicants. If the applicant can justify the variance, a request for an exception to benchmarks is forwarded to the Commission for final review and approval. Other partners employ a less formal process, relying heavily on professional experience and comparable costs from similar projects. Approach-related differences in results have not been identified.

[12] Note: Design fees are included as a user defined input in the cost model.

In some cases, partners serve as pass-through agencies. In this role, they have little opportunity to apply rigorous cost benchmark data during early project phases. Applicants or the funding agency may, however, ask these agencies to intervene in a project and correct management or construction deficiencies.

- Effort related in Cost Benchmark Development. A few partners questioned allocating resources to develop cost containment benchmarks, arguing the efficacy of other cost containment activities, such as delegating increased management authority to operating partner agencies or revising the project award timetable to reduce costs through more diligent procurement and by avoiding lost construction.

3.1.2 How do you review project costs and expenditures for your program areas?

Similarly to their responses about applying cost containment benchmarks, partners' comments about processes to review project costs and expenditures varied widely.

- Review of Project Costs. Granting agencies send their review comments to the applicant, who can then act on or ignore their advice. After receiving Commission concurrence to a recommendation to fund a proposed project, the granting agency can negotiate a line-item expense budget that reflects cost benchmarks.

  Grant administrators monitor expenditures using routine administrative processes. Invoices that exceed the negotiated budget by more than a fixed percent are questioned. Applicants may present a justification for the variance between actual and projected costs and request a budget revision. The number of invoices that are rejected by grants administrators during this process is unknown. Clearly, however, reliable budget line-item expenditures are essential to reviews of ongoing expenditures.

  Some agencies send their personnel into the field to review construction project progress, and these periodic inspections help inform the routine reviews of contractor invoices.

- Professional Expertise. In other instances, ongoing review of grantee expenditures is less formal. One partner agency relies on the professional expertise of its accounting staff and uses an extensive historical record to verify expenditure appropriateness.

- Construction Experience. Partners who are also contractors or directly manage contractor activity appeared to have more efficient systems for reviewing project costs and expenditures. Experienced construction managers often have expenditure decision authority as they respond to problems in the field. This delegated authority for field positions requires a high level of trust between the administrative agency and the field personnel.

3.1.3 What have been the most significant factors driving costs for Denali Commission funded projects?

- Material/Input Price Increases. All partners identified increased building material cost as the most significant driver of project cost increases. Concrete, steel, copper, zinc, and wood costs continue to rise. While the predominant explanation for these increases is the increased cost of oil, partners were less uniform in their assessment of the relative impact of competition from China or India and reconstruction in the Gulf states following Hurricane Katrina. Both material costs *and* those of transportation to the work site are directly affected by higher petroleum-based products and services. These cost increases are not included in cost benchmarks, and they are not controllable by project managers.

- Project Delays. While project delays were occasionally weather-related, partners most often attribute them to delays in funding and notices of grant award. Delays caused by budget reviews and approvals for can cause a work-stoppage for a mobilized project field crew or cause a project delay of a full construction season—either can increase project costs. Costs associated with inappropriate timing of grant awards are controllable. When grants are awarded in late spring, it is difficult to start projects during the limited summer construction season. Partners strongly recommended making grant awards in January to allow adequate time for more cost-efficient procurement and mobilization activities.

- Project Coordination Obstacles. Lack of coordination among participating agencies can also increase overall project costs. One partner recounted an example where a partner was unable to properly size bulk fuel and power generation because the partner was unaware of other community construction projects that required extra power. The partner's project power generation and bulk fuel storage facilities had to be redesigned, which increased overall project cost. Increased coordination and communication among partners was uniformly supported.

- Program Policies. Commission policies that restrict construction projects from putting "any existing business out of business" can also increase project costs. Maintaining separate facilities for each fuel vendor in a community, for instance, may require subdivision of a tank farm using additional tanks and containment. Distribution systems must also be duplicated to accommodate vendors' product segregation needs, which also increases project costs.

- Project Funding Cycles. The way projects are funded eliminates the opportunity to contain costs using mass procurement. Standardization ensures that many of the components that are used during relevant infrastructure construction projects could be purchased in bulk. A mass procurement effort could reduce materials costs using a simple database of commonly used items like bulk fuel tanks and fuel dispensing systems. Many other commonly used items and building materials could probably be purchased in bulk for further project cost reduction. An administrative switch to single project funding would make this a viable cost containment practice.

3.1.4 In 2004, NANA Pacific recommended some improvements in cost management systems. Do you know if any of these recommendations have been implemented?

- Comprehensive Cost Management System. Implement a Comprehensive Management Information System to include detailed cost monitoring. Partners with construction management authority already have some system for monitoring costs in place. Partners fulfilling either a grant or pass-through role do not have detailed cost management systems, and they rely on administrative staff to routinely monitor costs and expenditures. All partners agreed that the Commission had no such system; however, language being added to MOUs and MOAs that requires partners to advise the Commission on cost issues may effectively force the adoption of an enhanced construction management information system.

- Cost Benchmark Implementation. Implement a cost benchmark for targeted program areas. Partner use of cost benchmark data varies between programs. Benchmark data developed by the Commission is used extensively by some agencies, while other agencies do not use it at all. Unit cost benchmarks, such as the cost per gallon of fuel stored, are more often used. Generally, costs for units used in frequently built, larger facilities, such as clinics of different prototypical sizes, are often known. Most partners want to be more involved in the development and implementation of cost benchmarking systems.

- Project Audits. Only one partner conducts audits of completed projects. Others rely on findings uncovered during audits conducted under the single state or federal audit procedures. These procedures involve one audit of an agency's multiple programs to uncover irregularities. When one project appears to have substantial fiscal or management problems, auditors may refocus the audit's scope to learn more about that program's particular challenges. Routine single-project audits are not typically done.

  Some partners were concerned about attempting to verify cost benchmarks without reliable fiscal data. While most financial information maintained by administering partners is accurate, independent verification thereof is impossible without an audit, and assessing the precision of benchmark project costs is also difficult. More general cost benchmarks may not require the precision of verified audited financial data.

- Build upon and improve standardized design principles. Partners were uniformly in favor of increasing standardization of construction designs in rural Alaska. Currently, health facilities base the use of three basic facility prototypes on the size of the community it will serve. Designs for bulk fuel storage, power distribution systems, and power generation plants can also be standardized. Clearly, standardization would lead to more mass procurement opportunities, easier training of on-site operations and maintenance personnel, and possibly to the development of regional repair facilities for large, standardized equipment such as commercial washing machines and power generators.

Multi-use facilities and teacher housing projects are less amenable to standardization. Implementation of standard facility designs was expected to noticeably reduce project design costs, which has not happened. One respondent commented on the ambitiousness of a 40% reduction in design costs. Reductions are impacted by requirements that designers guarantee the quality of their work product and also incorporate specific design elements for each facility's geographic location, electrical distribution system, foundation requirements, and sewer and water systems. Standardized designs may also enable more off-site modular construction. Assembling modular facility elements off-site and transporting them to the work site would reduce costs by performing higher-quality construction in a way that is not affected by the availability of skilled workers or inclement weather.

- Establish best value procurement and construction contracts. Most partners agreed that an open bidding procurement process could ensure realization of the greatest value. Moving to this type of project-specific funding, however, would probably reduce mass procurement opportunities.

- Improve interagency coordination. All partners agreed that the quality of interagency coordination can have a direct impact on costs. Remodeling and reuse of surplus facilities, shared use of large public spaces, and coordinated transportation of materials on the barges could reduce project costs. Agencies can also work together to find more efficient project implementation processes. Coordinated mobilization and construction administration can help reduce costs. Interagency coordination can also reduce costs through shared information about local infrastructure planning and design, which will help solve logistical problems, increase economies of scale at the work site, and improve infrastructure design to accommodate the needs of all new facilities.

3.1.5 How do you think that the Denali Commission and its partners can help grantees better manage project costs?

- Dialogue on policy issues. Partners reported having little opportunity to discuss policy issues with the Commission. They believe that such discussions could help avoid project delays that are caused by disagreements over project scope or funding timelines. Construction partners supported Commission initiatives to promote renovation and repair as a preferred alternative to new construction. The development and implementation of business plans could reduce the number of operation and maintenance issues faced by communities with new infrastructure funded by the Commission.

3.1.6 Other comments.

- Program Change. There was some concern that the Commission is too quick to embrace and move new ideas into operating policy. If a new idea is misguided, it may result in inappropriate policy.
- Planning and Design. More information about the realities of planning design and construction of facilities in rural Alaska would help Commission staff. Addition of more experienced and seasoned professional staff could improve project management and reduce costs.
- Training Programs. The Commission could sponsor local training programs on construction project management.
- Capital Reserve. Those vendors who wish to participate in a bulk fuel project could be required to make a substantial deposit in a capital reserve fund to help offset the costs of future renovation and repair. In addition, required contributions to a spill response fund would demonstrate good faith about their continued intent to operate *the facility*. Requiring vendors to agree not to sell their portion of bulk fuel storage and distribution systems could discourage vendors and grantees who do not have a long-term commitment to these systems.

3.2 Rural Alaskan Construction Costs and Management: Building Industry Professional Opinions

NANA Pacific interviewed construction professionals with extensive project experience in rural Alaska about their project management and cost containment experiences as it relates to Denali Commission projects. An experienced interviewer recorded and synthesized their comments into five topic areas. In many cases, respondents did not follow the interviewer's questions, but gave their opinions as they saw fit. Therefore, the interview schedule could not be used for the synthesis of their responses. However, to the extent possible, the overall categories used in the 2004 report are re-used where possible in this update for long-term consistency.

3.2.1 Strengthen planning and design activities

- Prevent over-building. Some communities' unrealistic expectations of commission funding may increase their construction costs. These expectations include over-building and misconceptions of downstream operating and maintenance costs.

  Communities do not want to reduce their buildings' size, even when cost estimates exceed benchmarks or initial budgets. For example, it is unlikely that a health clinic with a high cost estimate would subsequently choose to build the next smaller size. However, case-by-case introduction of improved designs, scope modifications, and more efficient construction management well help align facility costs with facility budget.

  To keep costs low and within benchmarks, communities may accept higher long-term operating and maintenance costs. Lifecycle engineering decisions like the choices of finishes, selection of building materials, and heating systems and their installation can be linked to a value.

Applicants should be required to file a 10–20-year expansion plan including service needs with their initial proposal. As a projection of future facility expansion, this plan could avoid instances of over-building.

- Enhance facility coordination among regional or neighboring communities. Most communities build infrastructure to accommodate projected needs of their individual community. This can lead to over building, which drives up construction costs. However, many communities are closely linked, both culturally and geographically, which could facilitate inter-community travel and support development of larger, more efficient centrally located service facilities. The latter would reduce both construction and operating and maintenance costs.

  Most regional facilities are larger than their single-community counterparts. Program planners, designers, and funding agencies should carefully evaluate project proposals and examine their conceptual design, site selection, and operational characteristics. Such a rigorous external review by skilled commission staff or contract designers will ensure that facilities are designed to accommodate projected growth.

- Improve facility designs. Flexible facilities can accommodate a variety of uses. Flexibility adds a capacity for different activities that can be used by different community services and organizations. The project team should be sure, however, that this very flexibility will not lead to uses that are incompatible with each other or with community interests.

  Public facility designs should minimize heat loss; they can also be redesigned to maximize the benefits of the sun and improve amenities. These design choices will result in improved energy efficiency and lower long-term operating costs. The benefits of some such "green solutions" must be weighed against the price, which can add 10% to facility cost, putting facility cost estimates outside cost of benchmarks.

- Promote the development and application of facility prototypes. Use of standardized facility prototypes is infrequent. Prototypes could be developed to accommodate the availability of local workers and to allow off-site modular construction. Standardized equipment that would reduce long-term operating costs and promote economic development could also be used.

  Facility prototypes using modular components would reduce project costs, because components can be prefabricated off-site and shipped to the project site. Use of these prototypes would also enable mass procurement processes that could reduce overall costs.

  The expected reduction in design costs following construction of prototype facilities was never actualized, which may be due to the requirements for projects using a design prototype. These requirements include accommodation of unique construction site characteristics, especially civil engineering costs of surveys, soil testing, utilities, and necessary site work. Together with a required 25% payment to the designer of the prototypical clinic, these costs typically comprise at least 20% of total design fees, which means that design costs will never go below 45% of “custom” design fees.

The Denali Commission could sponsor a competition among three or more prototype designers for designs to extend 5 feet beyond the exterior facility wall. These designs would then become Commission property.

- Encourage renovation and remodeling. Many more new construction projects have been funded than have renovation and remodeling projects. Renovation and remodeling projects should be encouraged to help reduce costs, perhaps building on the popular acceptance of material recycling of most rural Alaskan communities.

3.2.2 Revise procedures for project funding and executive sponsor management.

- Grant Award Schedule. Devise a grant award schedule that accommodates the realities of rural Alaskan construction timelines such as procurement and mobilization. Project funding is available in most cases, but it is often delayed by administrative issues, which can postpone project completion for a year. Project grant awards are easily delayed, potentially losing an entire construction season.

  Delays in funding or to delivering construction materials to the field combine with administrative interruptions to project schedules to drive up costs of rural Alaska construction projects. Deferred or delayed project starts also escalate cost and introduce the need to mobilize and demobilize a project while administrative processes are completed. Intermittent funding also increases costs.

- Promote mass procurement systems. Employing mass procurement could reduce total project costs by one-third. For example, when a standardized commercial washing machine is installed in every washeteria, machine repairs could be if these machines made by trained Alaska Native technicians at a Fairbanks repair facility operated by the Tanana Chiefs Conference. The technical crew that picks up the broken equipment for shipment and repair could bring a temporary replacement machine. The time the community lacks a functional machine is reduced, as are machine repair costs, and a new appliance repair industry is introduced. This scenario relies on standardized equipment, the benefits of which extend to different facility types.

- Encourage inter-agency coordination of construction projects. Construction agencies should coordinate their project schedules when projects will occur in the same community or region. Using the same construction management partner can reduce duplication of effort, improve resource sharing, and enhance administrative efficiency. Better coordination can reduce costs through economies of scale, bulk purchasing, more efficient use of a work force, improved construction management, and more efficient mobilization. These examples of inter-project coordination can reduce costs and limit the number of projects that fail.

3.2.3 Improve construction project management

- Select skilled construction managers. Construction management cost can be controlled by careful selection of is a construction manager, which will also increase the chances of a successful project outcome.

  Sponsors must develop and use selection criteria that measure construction manager candidates' ability to get a project on-site and make it happen. Ability to meet these criteria should be given more weight than associated fees.

- Procurement Procedures. Develop procurement procedures that allow contractors to work efficiently. Protocols currently used by the public sector are not dictated by statute or regulation, and they often prevent private sector contractors from working efficiently, delay projects, and increase cost. Many private-sector contract management firms find the current procedures frustrating.

- Reimbursement Requirements. Inform units of local government about reimbursement requirements. Communities are sometimes assigned the responsibility for building clinics without the technical knowledge or leadership continuity required to successfully complete a project. The Commission could identify and require a standard approach (including accounting and coding systems) that constituted "good management" and give it to each community as a part of the grant award. Such a system is currently lacking at the Commission and in most public-sector partner agencies.

  A consistent management model would help local government units maintain strict cost caps, potentially requiring a detailed and mission-relevant justification for each function or space within a proposed facility.

  Communities are unaware that contracts are cost-reimbursable and lack the information needed to anticipate market changes or other factors that increase costs. Further, some communities have limited cash reserves, which prevents them from managing a cost-reimbursable project budget.

  Occasionally, there are conflicts within a community that increase costs. These can and should be resolved prior to the grant award. Communities should demonstrate the desire to work cooperatively, and the Commission should require that the community demonstrate the administrative capacity necessary to manage a large construction project.

3.2.4 Improve the reliability of construction cost estimates.

- Underestimation of project costs and misapprehended impacts of inflation may result from a time-lag between completing the cost estimate and completing the project itself. Some projects take years to complete, while others are completed in a single season. A skilled cost estimator can more accurately predict increased construction costs over time, which results in more accurate cost estimates.

3.2.5 Strengthen project cost management systems.

- Overemphasis on Cost Benchmarking. There may be too much emphasis on cost benchmarking as the main way to contain construction costs.

  There are a few unsuccessful projects; projects that exceed their budgets are also few. Therefore, cost benchmarking and cost management efforts may not realize significant cost savings, and the Commission should reconsider the basis for their emphasized use. One respondent said "Nobody is stealing!" But material and labor costs continue to rise, and all construction projects are affected.

- Cost Management Systems. Improved cost management systems could help identify areas for better cost management. Cost control systems are an essential ingredient in efficient project management; they allow construction managers to quickly identify and resolve construction problems as they manifest in the cost accounting system.

  However, many firms use *ad hoc* administrative and management methods, which may impede effective and consistent project management decisions.

  The Commission could require the use of standardized cost accounting systems as a condition of grant award.

- Mobilization. Efficient project mobilization could help control project costs. In rural Alaska, project mobilization is a major factor in cost increases; it is itself driven by increases in the fuel costs required to get materials to the work site.

- Business Plans. Insist on the development and use of accurate business plans. Weak business plans lead to major design errors, and some communities do not follow their business plans closely. Business plans with inaccurate projections of operating and maintenance expenses can increase long-term failure rates.

3.2.6 Examine the choice of labor in local construction.

- Local Capacity. Local capacity for forced labor accounts has not been developed. Without local skilled labor, contractors bring in own outside workers at increased cost. Skilled workers need continuity (reasonably steady employment), tools, skills, technical competence, and administrative support. Some of this weak local capacity may be attributable to what one respondent called "The Bush Factor." By this, he meant that it's hard to get people to work in a community when community activities like subsistence require their attention. Some of these realities of construction in rural Alaska can be addressed by improvements in design and project management.

4 Cost Benchmarks

One way to control program costs is to set realistic benchmark costs for rural Alaska infrastructure construction and require project partners to meet them. These benchmark costs provide program-level managers with a cost containment tool that can improve cost-effective service delivery.

To that end, benchmark costs were developed that take into account cost variations among rural Alaska regions due to factors that are largely outside of management control, including: climate; weather; transportation needs; soil conditions that may necessitate pile foundations; and availability of highly specialized labor (e.g., electrical and mechanical subcontractors).

4.1 Selected Denali Commission Facility Types

2008 benchmark construction costs were developed for these types of infrastructure:

- Teacher Housing (4 units, 1040 square feet per unit "typical" development)
- Clinic (2572 square foot prototype)
- Multi-Use Facilities (2768 square foot "typical" development)
- Small Bulk Fuel Tank Farm Upgrades (BFU) (<200,000 gallon capacity)
- Large Bulk Fuel Tank Farm Upgrades (BFU) (500,000–600,000 gallon capacity)
- Rural Power System Upgrades (RPSU) (Three Gen-Set Bay Power Plant)
- Rural Power System Upgrades (RPSU) (Modular Gen-Set & Support Modules)

4.1.1 Buildings (Housing, Multi-Use, Clinics)

2008 benchmark costs for teacher housing, multi-use facilities and clinics are summarized in Table 4.

Table 4 Regional Benchmark Costs, 2008 ($ Per Square Foot)

Region	Teacher Housing (4 Units, 1040 Sf Each)	Multi-Use (2768 Sf)	Clinics (2572 Sf)
Aleutian/Pribilof Islands Association	$ 487	$ 394	$ 841
Arctic Slope Native Association	$ 597	$ 478	$ 1,018
Bristol Bay Area Health Corporation	$ 475	$ 391	$ 832
Maniilaq Association	$ 597	$ 475	$ 1,020
Metlakatla	$ 444	$ 371	$ 789
Norton Sound Health Corporation	$ 609	$ 466	$ 1,035
Southeast Regional Health Corporation	$ 438	$ 369	$ 779
Tanana Chiefs Conference	$ 465	$ 384	$ 816
Yukon-Kuskokwim Health Corporation	$ 561	$ 466	$ 967

Source: MAFA, Benchmark Costs, 2008

4.1.2 Bulk Fuel Tank Farms

2008 benchmark costs for bulk fuel tank farm upgrades are summarized in Table 5.

Table 5 Regional Benchmark Costs, Bulk Fuel Tank Farms, 2008 ($ per gallon)

Region	Large Tank Farms (594,000 gallons)	Small Tank Farms (168,000 gallons)
Aleutian/Pribilof Islands Association	$ 10.46	$ 18.03
Arctic Slope Native Association	$ 11.32	$ 19.12
Bristol Bay Area Health Corporation	$ 10.34	$ 18.01
Maniilaq Association	$ 11.46	$ 19.17
Metlakatla	$ 9.79	$ 17.33
Norton Sound Health Corporation	$ 11.68	$ 19.39
Southeast Regional Health Consortium	$ 9.80	$ 17.15
Tanana Chiefs Conference	$ 10.10	$ 17.61
Yukon-Kuskokwim Health Corporation	$ 10.81	$ 18.34

Source: MAFA, Benchmark Costs, 2008

4.1.3 Rural Power System Upgrades

2008 benchmark costs for bulk fuel tank farm upgrades are summarized in Table 6.

Table 6 Regional Benchmark Costs, Rural Power System Upgrades, 2008 ($)

Region	Multiple Modules (1550kW - AVEC)	Three Bay Power Plant (920kW - AEA)
Aleutian/Pribilof Islands Association	$ 2,829,172	$ 2,929,743
Arctic Slope Native Association	$ 3,246,803	$ 3,158,029
Bristol Bay Area Health Corporation	$ 2,805,229	$ 2,921,496
Maniilaq Association	$ 3,262,926	$ 3,167,810
Metlakatla	$ 2,689,531	$ 2,797,980
Norton Sound Health Corporation	$ 3,314,022	$ 3,218,123
Southeast Regional Health Consortium	$ 2,688,508	$ 2,779,587
Tanana Chiefs Conference	$ 2,748,382	$ 2,850,166
Yukon-Kuskokwim Health Corporation	$ 3,132,582	$ 3,024,134

Source: MAFA, Benchmark Costs, 2008

4.2 Program Management Best Practices: Leveraging the Benchmarks

With benchmark costs set, program managers can encourage partners to adopt a best-practices approach to conceptual planning and engineering/design. This approach considers practical alternative solutions using appropriate materials and methods to optimize project lifecycle costs while preserving basic value.

In addition, program managers can continue to strive to use standard designs that incorporate standard materials and methods. To leverage the value of standards, program managers should strongly encourage the bundling of procurement and construction contracts.

Further, program managers and partners should explore the use of best practices procurement and construction contracts that require performance and price competition.

Finally, to increase cost benchmarking effectiveness, program managers should require clear, consistent cost reporting from partners to enable accurate comparisons with benchmarks, variance analysis, and identification and implementation of corrective action to reduce costs. To further facilitate comparisons with the benchmarks and variance analysis, as well as significantly improve effective measurement and management of cost, the Commission should consider requiring use of a standard cost reporting format.[13]

4.3 Implementation Considerations

4.3.1 Denali Commission

At the Commissioner level, benchmark costs could be established for each region, and the difference between the regional average and the regional benchmark could be used to help monitor compliance with benchmark cost levels. Commissioners and partners would have a clear, concise scorecard that supports cost performance assessment.

4.3.2 Regional Implementation

A Denali Commission program manager could limit the average cost in a region to the regional average cost benchmark and allow regional partners to bundle unique local costs with other projects to meet or beat the benchmark cost.

This straightforward approach places the burden of containing closer to the project implementation level.

4.3.3 Project-Level Implementation

Alternatively, the program manager could require individual projects to meet or beat the benchmark cost and then assume responsibility for responding to potential individual project requests for exceptions to the benchmark cost.

This approach may place additional cost pressure on individual projects and reduce a region's ability to bundle high-cost projects with low-cost projects. It also adds new work to Denali Commission program managers.

4.3.4 Assumption Updates

Given cost volatility in many component parameters of 2008 baseline material costs and the rapidity with which benchmark costs become obsolete due to rapid construction cost escalation, annual updates should be made to the benchmarks, and where possible, site-specific information should be used to fine-tune the basic benchmark cost estimate.

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[13] Cost reporting between and among agencies and partners remains inconsistent. As a result, comparisons between benchmarks and cost estimates typically require line-by-line review to verify whether the comparisons fully capture the similar scopes of work, and to be able to identify the variances in instances where they are not. Because a uniform system of accounts has not been established, it is often necessary to use actual project invoices to verify what is included in which line in the various accounting systems. A uniform system of accounts in each program area would greatly improve cost and scope management throughout the project life cycle. In the absence of such a system, a year-end audit to review scope, schedule, and cost performance of selected projects contribute significantly to identifying variances and enabling more effective corrective action.

4.4 *Methodology*

4.4.1 Basic Development of Benchmark Costs

2008 benchmark costs were developed following these steps:

1. Solicit client and partners for identification of a sample of benchmark cost-effective projects of each infrastructure type.
2. Develop an independent construction cost estimate with a detailed breakdown by labor, material, equipment, and subcontractors for each infrastructure type.
3. Develop cost adjustments to account for reasonable variations in local conditions between a baseline (typically Anchorage) and rural Alaska regions. The regional cost adjustment factors include:
   a. Freight for materials and equipment to take into account loading, freight, delivery and unloading of materials and equipment to job site;
   b. Mobilization/demobilization to take into account set up and tear down of project office and associated support;
   c. Travel allowance to take into account the number of round trips required for imported supervision and imported labor;
   d. Billeting allowance to take into account the room and board required for imported supervision and imported labor;
   e. Weather allowance to take into account the reduced productivity of labor and equipment (i.e., waiting on weather to clear);
   f. Foundation (to compute, subtract foundation cost of baseline project and add typical foundation costs of particular region); and
   g. Insulation, heating, and ventilation system adjustment for buildings (i.e., teacher housing, clinics, and multi-use facilities) due different severity of regional climate.

4.4.2 Rural Power System Upgrades – Cost Variation Considerations

Review of rural power plant and rural modular power system upgrade costs indicates that three diesel generator sets are a very common rural power installation and that most cost variation between projects was related to location rather than to the installed capacity (kW) of the diesel generator sets. As a result, benchmark costs are reported in total dollars rather than in dollars/kW.

In both power system configurations reviewed (modular, three bay power plant), most rural power system construction costs were fixed, but a small percent of total cost did vary by generator size. A simple regression equation was developed and the cost of rural power system upgrades was modeled as a fixed cost plus a variable cost.Each rural power system upgrade cost model allows users to indicate the system's total installed capacity (kW) with a slider; the model then recalculates each region's benchmark cost in dollars.

5 Integration of Benchmark Cost into Cost Containment Strategy

To successfully control program costs, a containment strategy must include clear guidance and significant incentives to manage individual projects from conception to construction to operations.

Denali Commission program managers should encourage their partners to take advantage of program management and project management best practices by:

- Focusing on the key cost decision points in the project life cycle, and
- Implementing a common project management information system that supports adequate cost detail.

5.1 Project Life Cycle

5.1.1 Introduction

One major contribution to controlling cost made by a professional project management system is to influence the critical, early project development stages by taking <u>full</u> advantage of proven cost-effective local planning, local methods, and local construction expertise.

Focusing on cost effectiveness at these early stages helps program managers set realistic expectations and impose a discipline that will later help contain future cost escalation as it occurs.

5.1.2 Planning and Design

In early project planning and design phases, expenditures are low relative to the total cost of the project life cycle. Planning, engineering, and design fees often represent less than 15% of total construction costs. Similarly, capital costs are often a fraction of total operations and maintenance costs over the life of a well maintained facility. However, despite these relatively low dollar amounts associated with early project activity, decisions and commitments made during these phases can have a significant effect on future—more expensive—project expenditures.

- What program elements to include,
- Where the facility will be located, and
- How much capacity is required (square feet, gallons, number of diesel gen-sets).

5.1.3 Procurement and Construction

When construction begins, only approximately one-quarter of the original capacity to influence project costs may remain. This capacity must enable the construction manager to adjust productive use of labor, use innovative methods, and follow procurement policies. But even in these areas, the engineer and designer have already exerted a greater influence on construction while making decisions regarding the use of standard methods and materials[14], appropriate sizes, clearances to allow ample room for construction, and the need to import skilled labor.

5.1.4 Construction

Decisions made during construction can also greatly affect a facility's operation and maintenance and management costs.[15]

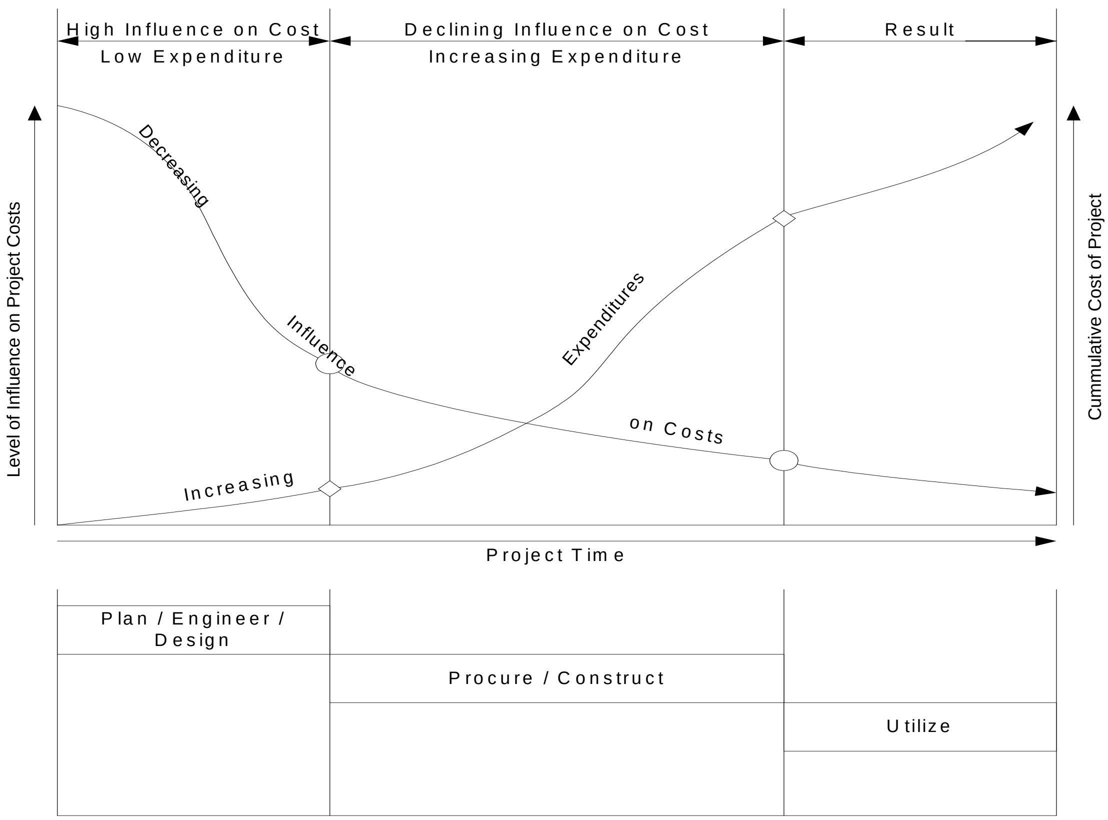
During each project development stage, there are opportunities to institute cost controls that will maintain value without threatening the cost-effective fulfillment of funding agency goals.

5.1.5 Best Opportunities for Cost Containment

The best opportunities for significant improvements in the cost effective delivery of rural infrastructure frequently occur during a project's initial planning stages (see Figure).

[14] For a recent example of non-standard designs, methods, and materials that lead to cost escalation and delay, see the University of Alaska Fairbanks Museum Expansion Project.
[15] For example, Tanana Power representatives report that the size of the piping between a barge unloading fuel system and a new bulk fuel tank farm was reduced during construction, which increased longer barge lightering time and consequently increased fuel delivery costs. Thus, while construction costs may have been saved, the resulting long-term operating costs may not have reflected the best value possible over the life of the facility.

Figure 4 Level of Infuence on Project Costs



Source: Boyd C. Paulson, Jr., "Desiging to Reduce Construction Costs," Journal of the Construction Division, ASCE, Vol. 102, No. CO4, December 1976, p. 588

5.2 Management Information Systems

5.2.1 Introduction

The most effective project managers adopt a comprehensive project cost control system early in project development to establish realistic expectations, project specific cost goals, and begin the project-long effort to control costs.

Similarly, the most effective *program* managers require project managers to actively manage their costs throughout the project life cycle by:

- Establishing accurate, reliable benchmark cost caps during early project planning;
- Requiring submission of a detailed, well organized cost report at each funding milestone, starting in the early planning stages and continuing throughout the project; and

- Requiring submission of a project close-out report that includes an overview of the benchmark cost, the initial project budgets, subsequent budget variances, and total project cost.

An effective project cost control system must include a clear, consistent, and comprehensive cost accounting system that supports inter-year cost comparisons within and between projects. Project cost reports should include, at a minimum, this basic information:[16]

- Budget,
- Actual and Obligated Costs,
- Forecasted At-Completion Costs,
- Cost Variances (Amount, %), and
- Cost Variance Explanation, corrective action, and responsible party.

5.2.2 Background

Most project partners appear to have a *basic* project cost control process in place in the project design phase. However, these elements may be missing from the current project development process:

- Cost Containment Culture. An effective cost discipline by partner program managers and project managers at the *very earliest project planning* stages.
    - Evidence: research uncovered reports that project engineers were deliberately excluded from early program planning in an effort to reduce agency overhead, which may have resulted in unrealistic scope and budget expectations.[17]
    - Evidence: research included an instance of a regional agency office simply added a contingency to the prior year's *highest-cost* project and carried the resulting number forward into the next funding cycle as the *benchmark* budget. This form of inflation indexing is likely to result in an upward cost spiral.

  A comprehensive project cost control system that is used at the individual project level to manage project cost and that consistently rolls up into a standard regional and statewide cost tracking report.

In summary, a comprehensive project cost management system is needed from the earliest stages and the management of project cost and quality should be throughout the project (see Table 7).

[16] See for example, Project Cost Estimate; Job Cost Status, Summary; Job Cost Status, Individual Divisions 01 – 16; provided by Summit Consulting Services, Inc., October 18, 2004.
[17] Interview with Steve Weaver, ANTHC, September 2004. This would reverse a prior policy that calls for the engineers (who have cost information) to absent themselves for these key early program development phases to reduce agency overhead.

Table 7 Measures to Improve Facility Cost Effectiveness

Project Life Cycle Stages	Cost Drivers	Measures to Improve Cost Effectiveness
Planning	Programming Site Selection Capacity of facility	Realistic expectations[18] Implementation of a detailed, organized project cost control system[19] Benchmark Cost Caps[20]
Conceptual Design	Foundation, site orientation, utilities	Best Practices Conceptual Design[21]
Engineering/Design	Choice of materials, methods, crafts	Best Practices Engineering/Design[22]
Procurement	Bundling Clear requirements	Best Practices Procurement[23] Bundle Clear, concise requirements
Construction	Location[24] Contract Method Construction Market Conditions	Best Practices Contracting[25]

[18] For an example of a program cost approach that sets realistic expectations from the earliest project development stages, see State of Alaska, Department of Education, Program Demand Cost Model for Alaskan Schools, 9th Edition. Available at http://www.eed.state.ak.us/Facilities/FacilitiesCIP.html

[19] See for example, State of Alaska, Department of Education, Standard Construction Cost Estimate Format, 2004 Edition.

[20] See Benchmark Costs and the Benchmark Cost Tool discussions in Section 2 of this report.

[21] Best Value Approach During Conceptual Design: If historical cost data are properly tabulated and the project engineer is acquainted with local conditions, alternative cost estimates can be prepared quickly for early identification of economical alternatives that preserve basic value.

[22] Best Practices Approach During Engineering/Design: A well organized construction manager, who is acquainted with local conditions, with an up-to-date cost tracking system, listing alternative materials and methods, together with cost information and comparisons from previous jobs can quickly identify opportunities to reduce cost and maintain or add value during the engineering and design stage.

[23] Best Practices Procurement: Procurement of resources based on *quality and price* to optimize life cycle cost of materials, equipment, and associated systems.

Project Life Cycle Stages	Cost Drivers	Measures to Improve Cost Effectiveness
Start-up/Warranty	Quality	Continued focus on best value
Operations and Maintenance	Quality	Continued focus on best value

Source: MAFA

[24] See Section 2.3.1 of this report.
[25] For a description of best value construction contracting, see http://construction.asu.edu/busdev/cmcp/cmcp_advconstrmgmt.htm.

Appendix: Using Benchmark Spreadsheets

This appendix includes instructions for using the benchmark spreadsheets for these facility types:

- Teacher Housing
- Clinics
- Multi-Use Facilities
- Bulk Fuel Tank Farm Upgrades
    - Small Capacity (<200,000 gallons)
    - Large Capacity (500,000–600,000 gallons)
- Rural Power System Upgrades
    - Three Gen-Set Bay Power Plant (AEA)
    - Modular Gen-Sets & Support Modules (AVEC)

System Requirements: You must have a copy of Microsoft Excel or an interoperable substitute software installed on your computer to use these spreadsheets.

Appendix I: Teacher Housing (4 units, 1040 sf each "prototype")

1. Open the "Housing Benchmark 2008" spreadsheet file

2. Select the "Project Cost Sum" tab

   2.1 Select a region from the pull-down menu

   2.2 With the program manager, determine the "negotiated costs" for

      2.2.1 Land acquisition

      2.2.2 Planning and design

      2.2.3 Project Owner's construction management

   2.3 Enter amounts of each "negotiated cost" in a blue-shaded cell

   2.4 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix II: Clinics (2572 sf prototype)

1. Open the "Clinic Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

    2.1 Select a region from the pull-down menu

    2.2 With the program manager, determine the "negotiated costs" for

        2.2.1 Land acquisition

        2.2.2 Planning and design

        2.2.3 Project Owner's construction management

    2.3 Enter amounts of each "negotiated cost" in a blue-shaded cell

    2.4 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix III: Multi-Use Facilities (2768 sf prototype)

1. Open the "Multi Use Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

    2.1 Select a region from the pull-down menu

    2.2 With the program manager, determine the "negotiated costs" for

        2.2.1 Land acquisition

        2.2.2 Planning and design

        2.2.3 Project Owner's construction management

    2.3 Enter amounts of each "negotiated cost" in a blue-shaded cell

    2.4 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix IV: Bulk Fuel Tank Farm Upgrades - Small Capacity (<200,000 gallons)

1. Open the "BFU Small Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

    2.1 Select a region from the pull-down menu

    2.2 With the program manager, determine the "negotiated costs" for

        2.2.1 Land acquisition

        2.2.2 Planning and design

    2.3 Enter amounts of each "negotiated cost" in a blue-shaded cell

    2.4 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix V: Bulk Fuel Tank Farm Upgrades - Large Capacity (500,000 – 600,000 gallons)

1. Open the "BFU Large Tank Capacity Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

    2.1 Select a region from the pull-down menu

    2.2 With the program manager, determine the "negotiated costs" for

        2.2.1 Land acquisition

        2.2.2 Planning and design

    2.3 Enter amounts of each "negotiated cost" in a blue-shaded cell

    2.4 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix VI: Rural Power System Upgrades - Three Gen-Set Bay Power Plant (AEA)

1. Open the "RPSU AEA Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

    2.1 Select a region from the pull-down menu

    2.2 Adjust slider to reflect the total installed capacity of the diesel generator sets (kW)

    2.3 With the program manager, determine the "negotiated costs" for

        2.3.1 Land acquisition

        2.3.2 Planning and design

    2.4 Enter amounts of each "negotiated cost" in a blue-shaded cell

    2.5 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)

Appendix VII: Rural Power System Upgrades - Modular Gen-Sets & Support Modules (AVEC)

1. Open the "RPSU AVEC Modular Benchmark 2008" spreadsheet file
2. Select the "Project Cost Sum" tab

   2.1 Select a region from the pull-down menu

   2.2 Adjust slider to reflect the total installed capacity of the diesel generator sets (kW)

   2.3 With the program manager, determine the "negotiated costs" for

      2.3.1 Land acquisition

      2.3.2 Planning and design

   2.4 Enter amounts of each "negotiated cost" in a blue-shaded cell

   2.5 Choose and apply appropriate benchmarks (available options: "total construction cost" and "total project cost")

3. (Optional) To adjust a specific benchmark cost, a program manager can use the "detailed cost estimate tabs" (for example, if part of a specific construction project is funded by a third party, the program manager could adjust the benchmark cost to reflect the difference in total scope of work)