Independent Economic Analysis Board

Project Cost Escalation Standards

Task 115

Council document IEAB 2007-2 March 30, 2007

Summary

Project costs as described in project proposals sometimes turn out to be inaccurate. One source of error involves cost estimation in the presence of inflation and price changes. The purpose of this paper is to determine if some common cost reporting and cost escalating standards are advisable for all fish and wildlife projects, and if so, what the standards should be. Relevant cost standards are presented in the report and guidance is provided for using cost escalators and price indices to improve cost predictions and for estimating current costs. The IEAB recommends that information on cost escalating and expected inflation be updated regularly and made readily accessible for use in project proposal development, review and contracting.

Inflation and Cost Escalation Principles

Inflation refers to an increase in price levels over time. Prices paid by fish and wildlife projects for inputs such as labor and materials often increase over time, so costs often increase even though the level of fish and wildlife services may not. Cost inflation is important to the fish and wildlife program in several ways.

Nominal or **current** dollars refer to the expenses that are actually observed at any given point in time. **Constant** or **real** dollars remove the effect of inflation so that dollar amounts in different years can be compared without inflation. Constant or real dollars are expressed in terms of a given benchmark year (e.g., 2007).

First, a budget that is fixed over years in nominal dollar terms will often be able to accomplish less in the future years. Funding recommendations for 2007 to 2009 show that, for 299 projects with some funding recommended, 162 (more than half) were recommended for the same nominal dollar amount for each of the three years (NPCC, 2007). If input costs increase, project managers will have to change the way they manage their fixed budgets in this situation; additional investigations in 2009 may be useful to see how project managers actually accomplish this.

Second, managers must often base their cost estimates on past experience. Sometimes, estimated costs are based on bids or quotes for the expected time frame in the future. If so, no updating may be required. In other cases, costs may be estimated from past experience. If these estimates are more than 1 or 2 years old, then inflation from the past to the present should be accounted for. Managers need to know what future cost levels are reasonable given the past costs and recent and expected inflation.

Third, managers are often asked to forecast future costs, but these costs will depend on future inflation. In the previous case, recent inflation estimates may provide a useful basis for estimating current costs. In the third case, inflation must be predicted.

Fourth, the cost shares for land, energy, and labor vary substantially between projects. These costs escalate at different rates, so the costs of different projects escalate at different rates. Awareness of these cost escalation differentials could help plan for differences in expected cost increases between projects.

Past inflation is often tracked by price indices, which are weighted averages of many prices paid by aggregate groups. The consumer price index (CPI), producer price index or the gross national product deflators are examples. One drawback of these indices is that they represent a weighted average of a large group of goods. For example, the CPI-U is an index based on costs of many goods bought by urban consumers. Many more inflation measures are tied to more specific groups of goods and regions of the United States. Sometimes, average prices of individual types of goods are available and these data can be used to estimate price changes. But in some instances, estimates for the pertinent region are not available or the timing of publication may be inadequate. The availability, applicability and quality of future inflation forecasts are variable across the products and services actually used by specific projects. The question for managers is: which price indices and forecasts should be used and in what instances?

The practice of increasing costs to account for inflation is known as *cost escalation*. Normally, cost escalation will reference a year in which cost data were observed and a later year in which the cost will occur. For example, “cost data were escalated from 2000 to 2007 using the referenced price paid index” or “the referenced price paid index forecast was used to escalate 2005 costs to 2009.”

“Nominal” or “current” dollars are the actual dollars observed in a past year, or expected to be observed in the future. As an example, one might say “with inflation, nominal costs are expected to increase 10 percent by 2009.”

“Constant” or “real” dollars remove the effect of inflation so that dollar amounts in different years can be compared without the effect of inflation. Constant or real dollars should always be referenced to a base year such as “2007 dollars.” As an example, one might say “after accounting for inflation, real costs are expected to decline 2 percent by 2009 to $98 in 2007 dollars.”

Review of Past Proposals to Ascertain Potential for Improvement

A sample of past proposals (six habitat and five hatchery) which were selected for the IEAB project “Scoping Investigation of Available Project Information” (IEAB document 2006-2) were reviewed to identify key cost categories and to see how cost escalation issues were addressed.

Habitat proposals reviewed:

- ODFW Blue Mountain Oregon Fish Habitat Improvement
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=379
- Albeni Falls Wildlife Mitigation
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=171
- Trout Creek Fish Habitat Restoration Project
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=241
- Northeast Oregon Wildlife Project Precious Lands
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=200
- Pine Creek Conservation Area: Wildlife Habitat and Watershed Management on 33,557-acres to benefit grassland, shrub-steppe, riparian, and aquatic species.
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=109
- Libby Mitigation Program
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=500

Hatchery proposals:

- Johnson Creek Artificial Propagation Enhancement Project
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=188
- Hood R Prod O&M - Ws/ODFW
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=266
- Nez Perce Tribal Hatchery Operations & Maintenance
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=573
- Restoration and Conservation Aquaculture
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=152
- Sherman Creek Hatchery - O&M
  http://www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=151

For each of the chosen proposals, three questions were considered:

2. *If cost estimates are based on prior-year costs, were they adjusted for inflation?* No instances were found where the source of the cost estimates was provided in enough detail to answer this question.

3. *Are 2006 cost estimates provided in current dollars?* Yes, as far as we can tell., However, there does not appear to be a standard for reporting costs in proposals did not state if the costs were in current dollars or not.

4. *Are future costs escalated to be reported in future dollars?* Most of the eleven proposals appear to include inflation in their cost estimates. A few cost categories in a few proposals did not. Albeni Falls Wildlife Mitigation did not include inflation in land costs in their cost estimate, and Libby Mitigation did not inflate some costs. Otherwise, there was an obvious attempt by project managers to account for inflation.

While most proposals requested funding with inflation, most Council funding recommendations did not provide for inflation. Six out of 11 funding recommendations were flat-lined, i.e., FY07 funding was recommended at or below the requested level and FY08 and FY09 funding was the same amount as FY07. Only 4 of 11 projects were funded at or above the requested level. One was funded at a level lower than requested, but increasing over time. The implications of "flat-lining" budgets are beyond the scope of this project, but the practice could be detrimental to projects that are proposed at efficient funding levels.

Inflation and Price Indices

Here, we investigate the use of inflation and price indices to see if cost estimates might be improved. We report on a variety of price indices which might be useful for fish and wildlife projects. Potential usefulness is related to the types of goods and services that are indexed and the geographic location of the prices.

Indices for Recent Inflation

Few price indices specifically relate to the types of goods and services purchased by fish and wildlife projects, but some are available for similar goods and related industries.

The U.S. Department of Labor (DOL, 2007) prepares the producer price index (PPI), primarily for manufactured goods, by commodity or industry. The PPI measures the average change over time in the selling prices received by domestic producers for their output. These indices might be useful for some very specific components of projects such as lumber, farm products or gasoline. A sample is provided as Table 1.

Note that there is a large disparity between price increases for different commodity groups. In particular, the price of gasoline increased much faster than the other commodities.

The U.S. Department of Agriculture (USDA, 2007) provides price paid indices for agricultural production costs. Indices are published annually in July for a variety of types of production costs including farm machinery, building materials, and farm services. A sample is provided as Table 2. Average prices paid for some individual items of potential interest to project managers; types of herbicides for example, are also provided.

Table 1.
Producer Price Indices for Five Commodity Groups, 2001 to 2006, 2001 = 100

Year	All commodities	Lumber	Construction Machinery & Equip	Farm Products	Gasoline
2001	100	100	100	100	100
2002	98	99	101	95	92
2003	103	102	103	107	113
2004	109	119	106	119	142
2005	117	116	113	114	186
2006	123	110	118	113	218

Source: DOL, 2007. 2006 data are preliminary

Table 2.
USDA Agricultural Production Cost Indices, Annual, 2001 to 2005, 2001 = 100

Year	Agricultural Chemicals	Gasoline	Farm Machinery	Building Materials	Farm Services	Farm Services Custom Rates	Rent	Wage Rates
2001	100	100	100	100	100	100	100	100
2002	98	101	103	101	99	99	102	105
2003	100	125	106	102	102	103	103	108
2004	100	140	113	111	102	103	103	110
2005	101	180	121	117	106	103	107	113

Source: USDA, 2007

The USDA publishes data on agricultural land prices paid by state (USDA, 2004). From their documentation:

> "Estimates of agricultural real estate values are published annually using a variety of survey indications and check data. The agricultural census provides a benchmark for farm real estate values once every 5 years. After a census benchmark is established, the annual estimates for the current census year and the 4 previous non-census years are reevaluated and revised, if necessary."

A price index based on reported land values is provided as Table 3.

Table 3.
Crop Land Price Index Based on Land Values Reported by the USDA, 2001 = 100

	Idaho			Montana			Oregon			Washington		
Year	All	Irri-gated	Non-Irri-gated	All	Irri-gated	Non-Irri-gated	All	Irri-gated	Non-Irri-gated	All	Irri-gated	Non-Irri-gated
1999	92	92	94	95	93	97	93	95	91	99	103	94
2000	95	95	97	97	96	98	96	97	95	100	101	97
2001	100	100	100	100	100	100	100	100	100	100	100	100
2002	104	105	103	102	103	101	103	102	104	102	100	103
2003	109	111	105	105	107	104	104	105	104	103	100	106

Source: USDA, 2004

The State of Washington Department of Transportation (DOT) provides construction cost data and indices in graphical form for highways based on bid data (Washington DOT, 2007). Potentially useful data are provided for structural concrete and roadway excavation. The State of Oregon DOT (2007) provides similar information including indices for excavation, surfacing and structures. A sample indexed to 2001 is provided as Table 4.

Table 4.
Oregon DOT Price Indices for Highway Construction, 2001 = 100

	Excavation	Structures	Structural Concrete
2001	100	100	100
2002	146	133	150
2003	143	142	153
2004	135	129	128
2005	162	180	199
2006	215	200	221

Source: Oregon DOT, 2007

The Federal Highway Administration recently published a paper discussing the reasons why the States have been experiencing “unprecedented construction cost increases” (USDOT, 2007). Some of the stated reasons for these cost increases are:

- Local material shortages

- Consolidation in the highway construction industry
- Spot shortages of skilled labor,
- Increased non-highway construction demand following the 2005 hurricane season

The article reveals how national and even international events can shape prices and price indices observed.

> "During 2005 and early 2006, some construction material prices rose much faster than consumer or producer prices indices. The availability of portland cement, copper, gypsum and PVC pipe became an issue in many parts of the US. Of particular concern to the highway industry, the availability of portland cement became a major worry during Hurricane reconstruction efforts in late 2005. However, on March 6, 2006, the U.S. Commerce Department, the U.S. Trade Representative and Mexico's Secretary of Economy signed the U.S.-Mexico Agreement on Cement. This agreement resolves a sixteen-year dispute over the U.S. antidumping duty order on imports of gray portland cement from Mexico."

Construction cost indices are also provided by the Engineering News Record (McGraw-Hill, 2007). These data are available through the Engineering News Record publication or can be purchased on-line. A summary of their building cost index and construction cost index for Seattle is provided as Table 5. Table 5 suggests that building and construction costs have nor risen nearly as fast as excavation and highway construction costs.

Table 5.
Engineering News Record Building and Construction Cost Indices, December, Seattle, 2001 = 100

	Building Cost Index	Construction Cost Index
2001	100	100
2002	101	103
2003	105	107
2004	113	111
2005	118	115
2006	120	118

Source: McGraw-Hill 2007

Labor costs can be an important share of fish and wildlife project costs. Recent average wage rates per job by State or County can be obtained from the Bureau of Economic Analysis (USDC, 2007). A sample of data for Oregon and some local areas are shown in Table 6. Some of these data are not as current as one might desire.

Data on average compensation rate by industry can be derived from this source for any State county or metropolitan area by dividing compensation by industry (Bureau of Economic Affairs [BEA] code CA06) by total full and part-time jobs in that industry (BEA code CA25). The employment data are even less current, however. As of January 2007, average compensation per job by industry could be calculated only through 2004.

These data showed some interesting trends. Average compensation per public-sector job in Oregon increased 29 percent from 2001 to 2004. In the private sector, average compensation increased only 8 percent. Differences in compensation rates by type of work could be important to cost estimating for project managers. Possibly, the increase could reflect an increase in full time employment relative to part-time or a shift in the types of jobs within each sector.

Table 6.
Index of Average Wage Rate per Job, Selected States, CSAs and MSAs, 2001 = 100

	Oregon	Washington	Seattle-Tacoma-Olympia, WA (CSA)	Idaho	Portland-Vancouver-Beaverton, OR-WA (MSA)	Coos Bay, OR Micropolitan SA	Prineville, OR Micropolitan SA
2000	99	100	100	100	100	97	97
2001	100	100	100	100	100	100	100
2002	101	102	102	102	101	105	102
2003	103	104	104	104	102	102	106
2004	106	107	107	108	106	105	111
2005	110	110	110	112	110	108	116

Source: USDC, BEA, 2006

The data in Tables 1 to 6 shows that prices and price indices are available for goods and services similar to those used by fish and wildlife projects. The rates of price increase for different types of goods vary widely. The indices suggest that, over the 2001 to 2005 period, some prices, - farm services and agricultural chemicals, for example - increased at a relatively slow pace. The price of fuel, buildings and excavation increased relatively fast.

Some costs increased at a very fast pace compared to overall inflation rates. Table 7 shows the CPI-U, published by the Department of Commerce (USDC), for urban consumers in the western region of the United States and 2 metropolitan areas. From 2001 to 2006, consumer prices in the region increased ten to fifteen percent. During the same period, some types of construction costs and the price of gasoline approximately doubled.

Table 7
Consumer Price Index (CPI-U) for Western Region and Local Metropolitan Areas, 2001 = 100

Year	West Region	Portland-Salem	Seattle_Tacoma-Bremerton
2000	96	98	96
2001	100	100	100
2002	102	101	102
2003	104	102	104

2004	107	105	105
2005	110	107	108
2006	114	Not available	112

Source: USDC 2007a

Inflation Forecasts

Relative to the indices for recent inflation, there are fewer inflation forecasts publicly available. Many inflation forecasts are provided privately. This paper focuses on inflation forecasts that can be readily accessed without cost.

Inflation forecasting is an important problem for economics, and many economists conduct research to find better methods of forecasting. Some economists have found that complicated economic models have recently done no better in inflation forecasting than simple models (Fisher, Liu and Zhou, 2002).

Some forecasts available in the public domain are provided by the Congressional Budget Office (CBO, 2006). The CBO provides forecasts of these price indices:

- Gross Domestic Product (GDP) Price Index
- Personal Consumption Expenditures (PCE) Price Index
- Core PCE Price Index (like above, but excludes food and energy)
- Consumer Price Index (CPI) (for urban consumers)
- Core Consumer Price Index (for urban consumers, excludes food and energy)

A sample is provided as Table 8. These data suggest that overall inflation is expected to increase prices by about 10 percent from 2005 to 2009.

The State of Oregon Office of Economic Analysis provides quarterly economic forecasts which include the CPI for Portland, Oregon average wage rates, the national GDP price index and the PCE Price Index. The most recent forecast is provided in Table 9. Overall inflation in the Portland-Salem MSA is forecast to be similar to the national average, but wage rates were expected to increase 17 percent from 2005 to 2009.

Table 8.
Forecast Price Indices for GDP, PCE and Consumer Prices, 2005 = 100

	GDP	PCE	Core PCE	Consumer	Core Consumer
2005	100	100	100	100	100
2006	103	103	102	103	103
2007	105	105	104	105	105
2008	107	107	106	108	108
2009	109	109	109	110	110

Source: CBO, 2006

Table 9.
Economic Forecasts from the Oregon Office of Economic Analysis, 2005 = 100

	GDP implicit price deflator	Personal consumption deflator	CPI Urban Consumers Portland-Salem MSA	Oregon Average Wage Rate
2005	100	100	100	100
2006	103	103	103	105
2007	105	105	105	108
2008	107	107	108	112
2009	109	109	110	117

Source: Oregon Office of Economic Analysis, 2007.

The Financial Forecast Center (2007), an on-line service, provides forecasts of the producer price index, but only for six months ahead. The most recent data show no change over the period of March to August 2007.

The national Association of General Contractors of America (2006) provides general outlooks for construction costs and prices of specific materials as of September 2006. This information could be useful for projects with construction components, or that require specific materials. For example, as of August 2006, “contractors should expect the delivered cost of many inputs to rise faster than the producer price index.” Price trends for diesel, plastics, gypsum, asphalt, copper, steel, and concrete are discussed. “It appears price increases over the next 6 -12 months will be less severe than recently for copper and concrete products. Construction plastics and gypsum products should turn down in price. Steel, diesel fuel and asphalt prices could move in either direction.” This source also summarizes public data on recent price increases in construction and for construction materials.

Recommended Price Indices and Escalators

Updating recent costs to current dollars

To provide more accurate cost forecasts, Fish and Wildlife managers should update past cost data to current dollars. Absent any information that price changes will be different from average inflation, an inflation index such as the GDP price deflator can be used. Recent history reminds us, however, that some costs escalate much more rapidly than average. Managers should be aware of such price trends and, when identified, more detailed information for cost escalating and forecasting may be necessary.

A number of cost indices are potentially useful for updating recent cost information. However, the types of goods and services covered are somewhat different than those required by fish and wildlife projects. In general, local information about actual cost increases for specific goods and services are preferable to state or national price indices for similar goods and services, but the local information should be well-documented. Absent such sources, the following indices are recommended (links are provided in the reference list below):

- Purchase of specific commodities: use the producer price index.
- Purchase of agricultural services, custom operations or labor in rural areas: use USDC BEA local area information for labor where possible, use USDA agricultural production cost indices otherwise.
- Rural land prices: use USDA (2004) information. More detailed information might be obtained from State offices of the Association of Farm Managers and Rural Land Appraisers. Local realtors may be used to check on general trends.
- Road construction and excavation: Use State DOT data.
- Other construction: use Engineering News Record data (small cost required).
- Labor: use USDC BEA data. May want to consider county data on compensation per job by industry from same source. Two tables must be acquired: 1) total compensation (CA06), and 2) number of full and part-time jobs (CA25).

Example of updating recent costs to current dollars

Suppose that a project would include construction of small building and labor near Portland. It is known than an identical building was built in 2002 for $20,000, and the cost of labor was $20 an hour in 2004. What are the expected costs in 2006?

From Table 5, the expected cost of the building should be increased by a factor of 120/101 (the index in 2006 divided by the index in 2002), so the expected cost in 2006 is $23,762. Given the cost of this item it might be wise to also obtain a cost estimate from a building contractor. From Table 6, average wage rates near Portland increased by a factor of 110/102 up to 2005. From 2005 to 2006, wages were expected to increase by another 5 percent (Table 9). The wage rate in 2006 is expected to be $22.26 an hour [(1.05 x (110/102)) x $20].

Cost forecasting

For cost forecasting, most of the same principles apply. Recently, use of an overall inflation rate forecast would have understated cost increases for projects that were relatively dependent on excavation or energy. Managers should try to be aware of recent price trends, and local sources of information on expected costs may be useful. Information from trade associations such as the Association of General Contractors of America may be helpful. Absent information that costs will not follow inflation, overall inflation forecasts from State or federal offices (the CBO forecast, Table 8) should suffice. Those reviewing and making recommendations and decisions on project funding

should take this expected inflation into account. This should yield more accurate projections of future funding requirements.

Example of cost forecasting

Suppose that costs of a project were $100,000 in 2006, and about half of the costs were labor. What is the expected cost in 2007 and 2008?

From Table 9, general inflation was expected to increase costs by a factor of 105/103 in 2007 and 107/105 in 2008. The average wage rate was expected to increase faster; by factors of 108/105 and 112/108 in 2007 and 2008, respectively. Labor costs and other costs in 2006 were both about $50,000. Therefore, project costs are expected to be about $102,400 in 2007 and $105,275 in 2008. [In 2008, (107/103) x $50,000 + (112/105) x $50,000]

References

Association of General Contractors of America. 2006. AGC's Construction Inflation Alert. Reported by AGC's Chief Economist Ken Simonson. September.

Congressional Budget Office. 2006. http://www.cbo.gov/budget

Congressional Budget Office. 2006. Backup Data for Table C-1: CBO's Year-by-Year Forecast and Projections for Calendar Years 2006 Through 2016 (and Actual Data for Calendar Years 1950 Through 2005). The Budget and Economic Outlook: An Update, August 2006. http://mirror1.cbo.gov/ftpdocs/77xx/doc7731/01-24-BudgetOutlook.pdf

Financial Forecast Center. 2007.
http://www.forecasts.org/ppi.htm

Fisher, J.D.M., Chin Te Ziu, Ruilin Zhou, 2002. When Can We Forecast Inflation? Economic Perspectives. 1st Quarter 2002, Federal Reserve Bank of Chicago.

McGraw-Hill Construction. 2007. Engineering News Record. ENR.com.
https://www.enr.com/default.asp

Northwest Power and Conservation Council. 2007. Final Council Recommendations for FY 2007-09 Proposals. http://www.nwcouncil.org/fw/budget/2007/reviews.asp

Oregon, State of. State of Oregon Office of Economic Analysis. 2007. Economic Forecast. Appendix A. Economic Forecast Detail.
http://www.oregon.gov/DAS/OEA/economic.shtml

Oregon, State of. 2007. Department of Transportation. Construction Costs Trends.
http://www.oregon.gov/ODOT/HWY/ESTIMATING/cost_trends.shtml

U.S. Department of Agriculture. 2004. Statistical Bulletin Number 993. Agricultural Land Values and Cash Rents Final Estimates 1999-2003.National Agricultural Statistics Service. March 2004.
http://usda.mannlib.cornell.edu/usda/reports/general/sb/sb993.txt

U.S. Department of Agriculture. 2006. Agricultural Prices. 2005 Summary. Pr 1-3(06)b National Agricultural Statistics Service.
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003

U.S. Department of Commerce, Bureau of Economic Analysis. 2006. Local Area Personal Income. CA34 Wage and Salary Disbursemenets, Wage and Salary Employment, Average Wage per Job.
http://www.bea.gov/bea/regional/reis/default.cfm?catable=CA34&section=2

U.S. Department of Labor. 2007. Producer Price Indices.
http://www.bls.gov/ppi/home.htm

U.S. Department of Labor. Bureau of Labor Statistics. 2007a. Consumer Price Index. All Urban Consumers.
http://data.bls.gov/PDQ/servlet/SurveyOutputServlet?data_tool=dropmap&series_id=CUURA425SA0,CUUSA425SA0

U.S. Department of Transportation. Federal Highway Administration. 2007. Highway Construction Cost Increases and Competition Issues. Washington.
http://www.fhwa.dot.gov/programadmin/contracts/price.cfm

Washington, State of. 2007. Trends in Highway Material Costs.
http://www.wsdot.wa.gov/biz/construction/constructioncosts.cfm