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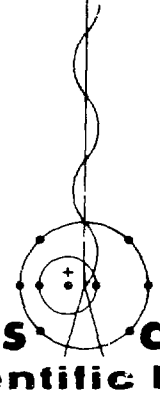

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LOS ALAMOS SCIENTIFIC LABORATORY BUILDING COST INDEX

by

Glenn D. Lemon, Donald W. Morris, and P. H. McConnell

ABSTRACT

The Controller's budget request for FY-1979 established guidance for escalation rates at 6 to 8% for construction projects beyond FY-1976. The Los Alamos Scientific Laboratory (LASL) has chosen to use an annual construction escalation rate of 10%. Results of this study should contribute toward the establishment of realistic construction cost estimate totals and estimates of annual construction funding requirements.

Many methods were used to arrive at the LASL escalation rate recommendation. First, a computer program was developed which greatly expanded the number of materials previously analyzed. The program calculated the 1970-76 weighted averages for labor, materials, and equipment for the base line project. It also plotted graphs for each category and composite indexes for labor and material/equipment.

Second, estimated increases for 1977 were obtained from several sources. The Zia Company provided labor cost estimates. Projected increases for material and equipment were obtained through conversations with vendors and analysis of trade publications. Third, economic forecast reports and the *Wall Street Journal* were used for source material, narrative, and forecast support. Finally, we compared LASL Building Cost Index with the effects of escalation associated with three recently developed projects at LASL.

I. INTRODUCTION

Approximately 2 yr ago, a Los Alamos Scientific Laboratory Building Cost Index (LASLBCI) was developed by the Los Alamos Scientific Laboratory (LASL). This year, a computer program was developed to replace and expand upon the manual calculations previously required. The new program permits inclusion of many more items in the LASLBCI study. Type of construction remains the same, a mixture of an office building and light and heavy laboratory structures, which is typical of much of our construction.

As a basis for the LASLBCI, labor and material/equipment cost histories were assembled for the previous 7 yr as they would have been used for a "typical" office—light and heavy laboratory construction project at LASL. A total of 12 field-labor crafts and 17 material/equipment categories were used and the data were compiled to reflect the relative costs of individual labor and material/equipment units as components of total project costs. The composite index indicates an annual escalation rate of almost 12% for the past 4 yr as shown in Fig. 1.

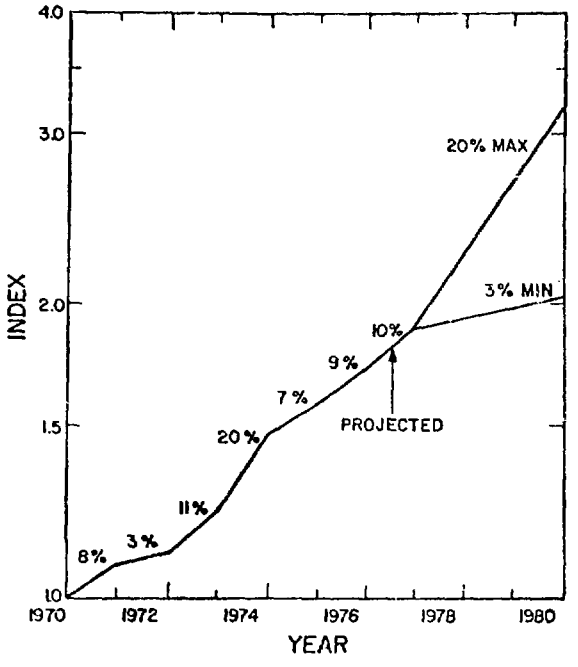

Fig. 1.
Los Alamos building cost index.

The recommendation for the LASL construction escalation rate is summarized below:

	1977	1978-82
Labor	11.83%	10%
Material/equipment	8.06%	10%
Weighted average	9.95%	10%

II. LABOR COST

National reports clearly show there were no wage explosions during 1976. Further, unless the rate of inflation accelerates unexpectedly, there will be no large increases during 1977. This is especially true for the construction industry. Nationally, more than 15% of construction workers are jobless. This is down from 30% 2 yr earlier, but is still the highest rate of any major industry group. High unemployment is probably the main reason construction unions settled for wage increases of about 6% for the first half of 1976, a rate well below the 8.4% national average of all wages for the same period. Also, during 1976, Federal Reserve statistics indicate the Consumer Price Index rate of increase steadily slowed, the rate of price inflation ran at 6.1% between June and August, but dropped to 4.3% in September, and to 3.6% in October and November. However, the Consumer and Wholesale Indexes showed an average of over 10% for the first three months of 1977. Hence, on a national basis, unions may be under more pressure to catch up with cost of living increases as settlements are renegotiated during 1977-79.

At LASL, labor costs increased by 10% on an annual basis for the base line project during the first half of 1976, a rate 67% higher than the national construction wage average for the same period. Based on signed union contracts, local construction wages for 1977 will increase by 11.83% (refer to Table I and Fig. 2), much higher than the expected national average. Further, the potential for increases on a national level could well be amplified locally, especially in view of the impact of the energy crisis on regional demand for construction crafts. Two factors are worth noting. First, the Albuquerque Chamber of Commerce is currently receiving more than one thousand inquiries a month, principally from people living in the northeastern United States, concerning living conditions and job opportunities in the Albuquerque area. Such a flood of correspondence, in all likelihood, eventually will result in an increase in the local (i.e., central and northern New Mexico) population growth rate and in the construction activities necessary to support such growth. Second, because of the high-energy resources inventory enjoyed by New Mexico, activities associated with construction of new and expanded mining, milling, and power plant facilities can only increase. Both factors cited above will result in a greater local demand for construction crafts than will be experienced nationally, thus maintaining greater than national upward pressure on construction wages.

III. BUILDING MATERIALS/EQUIPMENT COSTS

Nationally, the fast phase of the home building recovery is continuing essentially unabated. Housing starts during November and December rose to an annual rate of 1.8 million units, double the level

TABLE I

LASL CONSTRUCTION FIELD LABOR INDEX

Craft	f Man-Hour Distribution (%)	x 1977 Wage Increase (%)	fx
Electricians	18.3	13.84	253.27
Laborers	16.6	12.84	213.14
Carpenters	16.0	10.81	172.96
Plumbers	13.6	12.12	164.83
Ironworkers	8.6	11.06	95.12
Painters	7.5	10.64	79.80
Masons	6.4	11.00	70.40
Tinners	4.6	10.67	49.08
Operators	4.0	9.44	37.76
Roofers	2.3	9.72	22.36
Teamsters	2.0	11.57	23.14
Insulators	0.1	8.20	0.82
	N = 100		$\Sigma fx = 1182.68$

Weighted mean percentage increase during 1977 $= \frac{\Sigma fx}{N} = \frac{1182.68}{100} = 11.83\%$

of early 1975. Further increases in housing activities were forecast in the January 1977 issue of *Fortune*.

> "By the middle of 1978, housing starts should be near a two million rate for the first time since the summer of 1973. This time around that rate should be a sub-stainable level..."

This is reinforced by Norman Robertson, Senior Vice President of Pittsburgh's Mellon Bank, who foresees housing starts in 1978 at better than 2 million units. Results since January tend to confirm the *Fortune* forecast, at least for the near term. In March 1977, total starts were running at an annual rate of 2.1 million. According to a May 3, 1977, article in the *Wall Street Journal*, "the March figure in part reflected a catching-up after the severe cold weather of January and February. But the uptrend seems likely to continue. Building permits in March, an indication of future starts, rose 12 per cent from February."

Regionally, New Mexico is planning an additional stimulant of more than $40 million in residential construction based on mortgage guarantees during 1977. Twenty million dollars of this was issued in February. This comes on top of an already strong market as shown by the following article taken from the January 9, 1977, *Albuquerque Journal*.

> "Howard W. 'Peg' Parsons of the Albuquerque Homebuilders Association predicts continued momentum for the construction industry, both residential and commercial. In the last year, total permits increased 57.5 per cent and total value of all permits jumped 63.9 per cent over 1975, making last year a record year at the permit level."

Parsons goes on to forecast 1977 housing unit starts in the Albuquerque area at 8% higher than that for the record year of 1976.

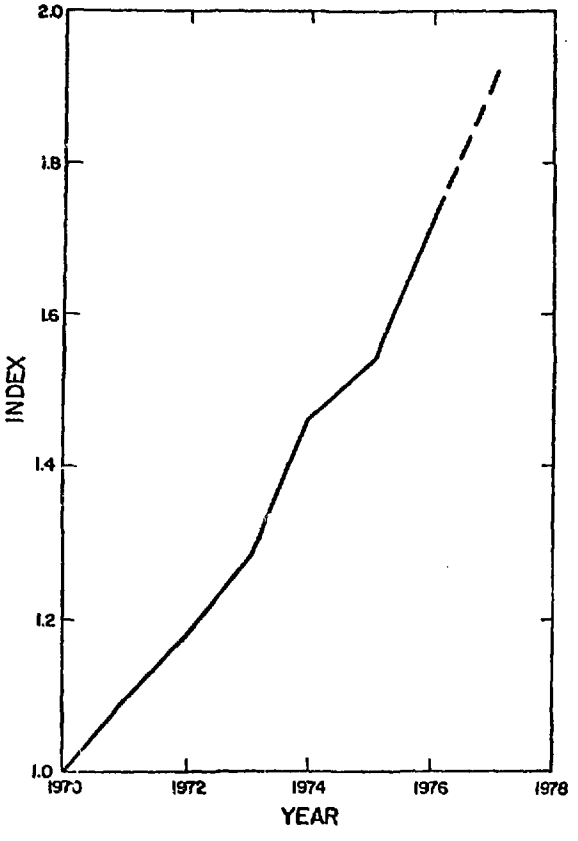

Fig. 2.
Labor.

President Carter emerges as a critical variable in determining housing prospects and the recently unveiled Carter Economic Plan did not specifically mention housing. The AFL-CIO has decided to push an $18 billion expansion of Federal housing programs that will create an estimated 325 000 jobs. However, Patricia Harris, the President's Secretary of Housing and Urban Development, did not indicate any aggressive policy to stimulate housing at her Senate confirmation hearing on January 10, 1977. Most economic analysts feel housing starts are running at a high rate and further stimulus is unsound. Because New Mexico ranks third in poor housing conditions, any newly established government support program can be expected to affect New Mexico more than the national average.

Contrary to 1973 when local construction costs increased more than 19%, residential construction is not expected to stimulate large price increases for building materials during 1977 because of large current excess capacity. However, after mid-1978, when combined with the expected business expansion efforts and a possible shortage of basic materials, building material costs should increase faster.

Business capital investment (includes plant and equipment expansion) should grow considerably this year. This expenditure will cause more inflation pressure on the type of materials/equipment that LASL uses than the residential expenditures. And with profits increasing rapidly, factory executives have already taken the first steps toward a faster rate of plant expansion. Yet the McGraw-Hill survey indicates the big increase in real spending is expected to show up in late 1977. This is in agreement with a recent survey conducted by the U.S. Department of Commerce, which found capital spending for the first half of 1977 is planned at $130.3 billion. That is 4.1% higher than in the second half of 1976 and 11.9% higher than in the first half of 1976. The Carter Economic Plan calls for an increased investment tax credit of two percentage points (10 to 12%). This small increase probably will lead to increased investment, more because of increased confidence than direct benefits to businesses. Even with this growth, the limits of plant capacity will be reached by 1978. This means the capital expenditure boom should continue through 1978. During 1977, these pressures are expected to cause some upward movement in overall building material and equipment costs and in 1978, rapid increases in selected materials that have supply constraints. The September Economic Report published by Manufacturer's Hanover Trust Bank states the basic materials industries such as metals, fiber, chemicals, and paper will have production bottlenecks.

Table II and Fig. 3 show the expected price increases for material/equipment determined by a telephone survey of several suppliers. Most opinions were based on recent past experience when inflation was lower than the current rate. Therefore, these are probably slightly underestimated for 1977. Figure 1 shows the weighted labor, material/equipment history, and 1977 projection.

The Sales Manager for Hamilton, a large corporation that makes laboratory furniture, indicated a

TABLE II

1977 MATERIAL/EQUIPMENT INDEX

Material	f Materials/ Equipment Cost Distribution (%)	x Expected Price Increases for 1977 (%)	fx
Wire, cable, conduit	08.2	10	82.00
Miscellaneous steel	27.5	6.3	173.25
Pipe, fitting, valves	07.8	9.4	73.32
Masonry products	08.3	8.0	66.40
Structural steel	04.0	11.6	46.40
Insulation	03.0	6	18.00
Lumber products	02.2	9.4	20.68
Cast iron pipe	03.0	8.0	24.00
Equipment			
Compressor	00.5	5	2.50
Electrical equipment	16.6	7	116.20
Fans and blowers	04.2	7	29.40
Heat exchangers	00.1	7	0.70
Instruments	01.0	8	8.00
Laboratory furniture	04.9	12	58.80
Tanks and vessel	03.5	10	35.00
Process equipment	03.1	11	34.10
Pumps	02.1	8	16.80
	N = 100		$\Sigma fx = 805.55$

Weighted mean percentage increase during 1977 $= \frac{\Sigma fx}{N} = \frac{805.55}{100} = 8.06\%$

10% per year increase for their products for 1978-82. Overall, this appears to be a reasonable planning figure for all construction materials and equipment for 1978-1982.

IV. ESCALATION SENSITIVITY ANALYSIS

We compared LASLBCI with the effects of escalation associated with three recently developed construction projects at LASL. The analysis was made to determine the magnitude of variation between escalation rates applicable to different types of construction activities in the local area. Figure 4 shows the results of this comparison.

LASLBCI A composite index consisting of light and heavy laboratory structures and an office building. Total project cost was $4.5 million.

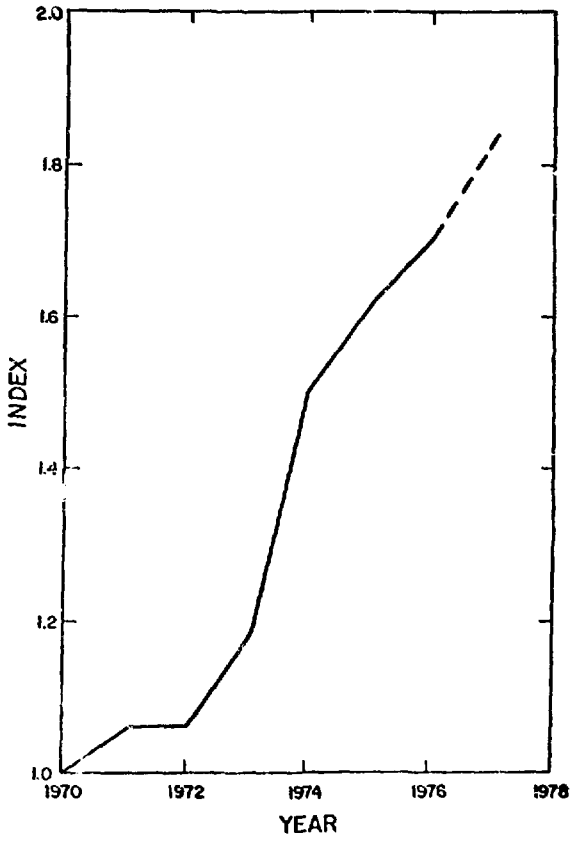

Fig. 3.
Material/equipment.

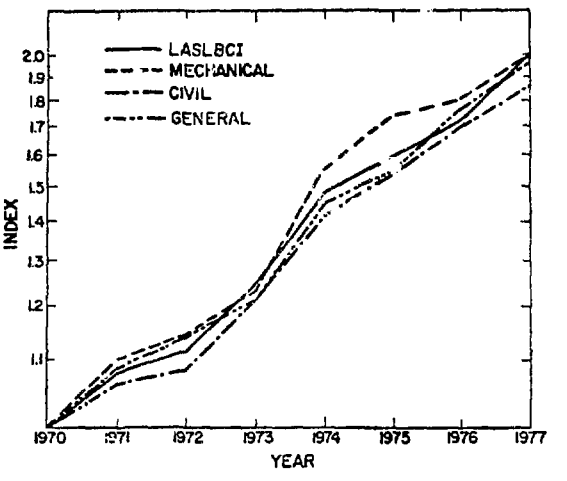

Fig. 4.
Escalation sensitivity analysis.

A — A mechanical project consisting of modifications and additions to a cooling water tystem. The project includes installation of an additional 500-ton cooling tower, distribution piping, electrical systems, and controls. Total project estimate is $2.2 million.

B — A civil project consisting of general airport improvements, including a runway extension, extensive earth work, roads, and utilities. Total project estimate is $2.5 million.

C — A small general construction project consisting of erecting and equipping a preengineered metal building. The project includes the building itself, a 2-ton bridge crane, heating, air conditioning, sprinkler, and communication systems. Total project estimate is $0.15 million.

Figure 4 shows the differences between escalation rates of specific projects and that of the composite index are relatively nominal, and probably within an acceptable uncertainty factor when projected beyond 1977. Therefore, we concluded that a single escalation rate could be used for estimating all FY-1979 construction projects to be proposed by LASL.