

Cost of Public Service

Education



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This is one of eight bulletins supported by Title V of the Rural Development Act of 1972 on estimating costs of public services in Idaho communities of various sizes. Services covered in the series are:

- Education
- Fire Protection
- Police Protection
- Sewage Collection and Treatment
- Sheriff Protection
- Solid Waste Disposal
- Water Supply

A worksheet for estimating costs for each service area is designed to facilitate citizen use. Relationships are used to derive costs and are expressed in terms of state averages. You may use the standards as given to derive cost estimates for the services or change them to reflect the situation in your community.

Extension Bulletin 602, *Residential Growth: Its Benefits and Costs to the Local Community*, is used as a format for an overall look at what effects increases in the number of residential dwellings and people have on revenues for the public and private sector and on costs in the public sector. The estimation procedure is outlined for cities, counties and school districts.

This publication outlines a method of estimating your community's increased costs in education caused by population growth.

About the Authors

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Cost of Public Service: Education

N. R. Rimbey and N. L. Meyer

This publication presents a method of estimating expenditures for education. A method of estimating the impact of population growth on these expenditures is also detailed. The cost estimates derived through these processes are based on relationships that approximate the actual situation in communities and counties. The relationships are based on state or national averages and can be changed to reflect the situation in the community being considered. Worksheets are provided to assist in the estimation procedure.

Introduction

Idaho is currently one of the fastest growing states in the nation. This growth brings economic benefits such as increased tax revenue to the public sector, possibly more service-oriented jobs and increased spending in the private sector. This growth may also bring general social benefits such as meeting and interacting with people from different cultural backgrounds, more specialized health care and more cultural programs through schools and civic organizations.

However, this growth does not come without additional costs. Many communities and counties in Idaho are not prepared for this growth. The public sector (present residents) must handle the added costs of providing services to the new residents. For example, growth may create needs for a new sewage treatment plant, school buildings, fire and police facilities and equipment, water wells or reservoirs and garbage collection and disposal equipment. Sizable public expenditures may also be necessary for land acquisition and additional employees.

Areas can accommodate growth more easily if the public service infrastructure already exists. This means having excess capacity in the sewage treatment facility, school system and police department and other services in place so population increases can be absorbed without the need for major capital expenditures. Excess capacity in public services does not exist in many rural areas.

The increasing of service capability coupled with the movement toward government spending limitations poses a severe problem for many Idaho communities. "How can we accommodate the rapid population growth and additional service demands of residents and finance the services with reduced or 'frozen' revenues?" This is the most perplexing issue facing state and local government officials.

One possible alternative for local government officials is a program which would require new development to pay its "fair share" of the added service costs. Although this may seem a simple policy move, this action will require certain kinds of information. For example, information should be collected and analyzed to determine: the present costs of various services, the estimated costs for new residents, when expansion of which capital facilities will be needed (based on capacities of existing systems and projected growth rates), and what the existing policy of the unit of government is concerning who should pay the additional costs.

Present costs of services are available in the annual audit report or annual budget of the unit of government. The policy aspect may require investigation of zoning regulations, building permit procedures or conversations with a city or county administrator.

The cost estimates presented here are based on relationships or standards that typify state or national averages. Standards for each service are pre-

sented with the intention that you will change or modify them to fit the situation in your municipality. Worksheets, an abbreviated interest table and sources of information within the municipality are also given to help you in the estimation process.

A word of caution should be injected at this point. The cost figures presented here are **estimates** of actual costs and should be analyzed carefully before basing policies upon them. To help you critically evaluate costs, remember that the standards given should be changed when they prove inaccurate. Variations between actual and estimated costs may result from using average figures, the topography of the area, the time lag between estimation and construction and a variety of other circumstances.

Be advised, then, to use care in using the cost figures presented. This publication was designed to give you, as a concerned citizen or government official, a **framework** for estimating the current costs of a public service. A method to estimate the added costs of population growth is also given. The service covered is education.

Methods of Estimating Expenditures

You can estimate costs several ways. The procedure used most often in fiscal impact studies is known as the average cost method. This involves:

1. Using the existing budget or audit report to derive current costs of services.
2. Dividing these costs by number of people or households to determine a per capita or per household cost for each service.

3. Projecting this cost to new residents by multiplying the per capita or household costs by the number of new residents or houses.

This technique may be adequate for projecting the operation and maintenance costs of services but will severely underestimate the impact if capital expansion is needed. The problem lies in basing the estimates on past costs.

A more reliable method is using average cost figures and adding estimated capital costs. In other words, you can use average cost figures from the budgets as well as the estimated increases in capital costs to derive estimates of the impact on expenditures.

The most reliable (and costly) estimation method is conducting a detailed audit of each department within the municipality to determine the actual costs per household (or per capita) and determining the anticipated date and cost of needed expansion of facilities. This would involve a detailed study of each employee's duties, the anticipated equipment and personnel needs and the municipality's projected growth rates. This procedure is obviously very time consuming and expensive. However, it is the most reliable method to support local policies which require new development to pay for added service cost.

The following section gives standards and procedures for estimating education's existing costs and the added costs of development. This information should be used in conjunction with the publications on fire protection, sheriff protection, police protection, sewer, solid waste, water and Extension Bulletin 602, *Residential Growth: Its Benefits and Costs to the Local Community*.

Education

Nearly 200,000 students attend public schools (grades kindergarten through 12) in Idaho. The average expenditure was \$1,616 per pupil in 1978-79. The expenditures per pupil ranged from about \$1,200 to more than \$6,600 (3).

The standards or relationships given here can be used to estimate the current costs of local schools and the impact of population growth on these costs. The standards are based on state averages derived from literature or estimates (construction costs) and should be changed to reflect the situation in the community being studied.

The following standards are used to estimate education expenditures:

1. There are 254 students per 1,000 population (1 and 3).
2. The student/teacher ratio is 21 to 1 (1).
3. Secondary teachers receive an average annual salary of \$13,345. Elementary teachers receive an average annual salary of \$12,462 (1).
4. A secondary principal receives an average annual salary of \$20,731; an elementary principal earns \$19,405 (1). A student body of 300 or more students is required to support the principals' position. For student populations of less than 300 students, costs are allocated at \$47 per student (1 and 4).

As school population increases, there will be no change in the number of principals for each secondary school. Therefore, a school which has 1,800 students will have one principal. It is also assumed that a community with more than 2,000 students (populations of more than 15,750) at the secondary level will require two schools.

At the primary school levels, the largest school enrollment is in the range from 600 to 800 students. Therefore, as school population increases, new schools would be required on the basis of 600 students per primary school. For example, a community with 1,200 primary students would require two schools.

5. Assistant principals receive an average salary of \$19,238 and are employed only at the secondary level (1). A student body of 600 students is required to support this position (4). With larger school populations, assistant principals will be allocated based on this ratio of 600 to 1. For example, a school with 1,800 students will have three assistant principals.

6. A counselor receives an average annual salary of \$16,430 (1), and the position must be supported by a minimum of 300 students (4). If the student population is less than 300, counseling costs are allocated at \$44 per student (1). The counselor position is also assumed only for secondary schools.

7. The clerical staff receives an average annual salary of \$6,000 per person. A teacher/clerical staff ratio is 15 to 1 (1).

8. Total instructional salaries (TIS) includes teachers', principals', assistant principals', counselors' and clerical staff salaries. Total instructional salaries (TIS) account for 72.8 percent of total instructional cost (TIC). The other 27.2 percent is allocated to teaching supplies and other teaching needs (3).

9. Transportation costs are based on 180 days per year with an assumed 50 percent of the students being bussed an average of 20 miles per day at a cost of 2.5 cents/student/mile (4).

10. Construction costs of school buildings are based on an average of \$35 per square foot for construction and \$5 per square foot for furnishing (\$40 per square foot total). Each student requires 90 square feet of building space (4). Financing of the building is for 30 years at 10 percent. Table 1 presents other interest rates and time periods.

11. Maintenance and operation are estimated to be 12.8 percent of total instructional costs (TIC) (3).

12. Fixed charges (insurance, retirement and so on) are estimated to be 4 percent of TIC (3).

13. School population is divided into primary (grades K to 6) and secondary (grades 7 to 12). Using state figures for the 1978-79 school year, 51.4 percent of the students were in the primary level, and 48.6 percent were in the secondary level (1).

Estimating Education's Cost

With the standards listed, you can estimate the cost of education for a community of a given size. For example, consider a community with a population of 1,000 people.

- First, estimate the number of students by multiplying.

$$1,000 \text{ population} \times .254 \text{ (Standard 1)} = 254 \text{ students}$$

- Second, estimate the number of teachers necessary by dividing the number of students by the student/teacher ratio.

$$254 \text{ students} \div 21 \text{ (Standard 2)} = 12.1 \text{ teachers}$$

- Third, multiply the number of teachers by the average annual faculty salary.

$$12.1 \text{ teachers} \times \$12,462 \text{ (Standard 3)} = \$150,790$$

- Fourth, estimate the clerical staff necessary for the school by dividing the number of teachers by the teacher/clerical ratio.

$$12 \text{ teachers} \div 15 \text{ (Standard 7)} = .8$$

Derive the total clerical staff salary by multiplying the number of employees by the annual salary.

$$.8 \text{ employees} \times \$6,000 \text{ (Standard 7)} = \$4,800$$

Table 1. Amortization rates for different interest rates and loan periods.

Interest Rate	Years							
	3	5	10	15	20	30	40	50
7	.381052	.243891	.142378	.109795	.094393	.080586	.075009	.072460
8	.388034	.250456	.149029	.116830	.101852	.088827	.083860	.081743
9	.395055	.257092	.155820	.124059	.109546	.097336	.092960	.091227
10	.402115	.263797	.162745	.131474	.117460	.106079	.102259	.100859
11	.409213	.270570	.169801	.139065	.125576	.115025	.111719	.110599
12	.416349	.277410	.176984	.146824	.133879	.124144	.121304	.120417
13	.423522	.284315	.184290	.154742	.142354	.133411	.130986	.130289

*This table will help you calculate the annual payments on investments for community services. For example, the annual payments for a \$40,000 loan at 10 percent interest rate for 15 years can be calculated using the following equation:

$$\text{Loan amount} \times \text{amortization rate} = \text{annual payment}$$

$$(\$40,000) \quad (.131474) \quad (\$5,259)$$

An annual payment of \$5,259 would pay the principal and interest on this loan and retire the debt in 15 years. You can get interest rates and time repayment periods not listed here from your local bank.

- Fifth, estimate the cost of a principal.

$$254 \text{ students} \times \$47 \text{ per student (Standard 4)} = \$11,938$$

- Sixth, estimate counseling costs.

$$254 \text{ students} \times \$44 \text{ per student (Standard 6)} = \$11,176$$

By adding the salaries together (teachers, principal, counselor and clerical), you will get an amount for TIS. You can then derive an estimate for TIC.

$$\$178,704 \text{ (salaries)} \div .728 \text{ (Standard 8)} = \$245,473 \text{ TIC}$$

By subtracting TIS from TIC, you derive an amount for other instructional costs. In this example, the figure is \$66,769.

Estimate operation and maintenance costs by multiplying TIC by .128 (Standard 11).

$$\$245,473 \times .128 = \$31,421$$

Estimate fixed charges by multiplying TIC by .04 (Standard 12).

$$\$245,473 \times .04 = \$9,819$$

To estimate transportation costs, first multiply the number of students by .5 to get the number of students bussed. Multiply this number by the cost per mile (\$.025), the number of miles per trip (20) and then by the number of school days (180). You can thus derive an estimate of annual transportation cost (Standard 9).

$$254 \text{ students} \times .5 = 127 \text{ students bussed}$$

$$127 \text{ students bussed} \times \$0.025 \times 20 \text{ miles per trip} \times 180 \text{ days} = \$11,430$$

To estimate construction costs, use the following procedure. First, estimate the number of square feet of building space required and multiply the number of students by the required amount of square feet per student (Standard 10).

$$254 \text{ students} \times 90 \text{ sq. ft. per student} = 22,860 \text{ sq. ft. of building space}$$

Next, estimate construction cost by multiplying the number of new square feet by the construction cost per square foot (Standard 10).

$$22,860 \text{ sq. ft.} \times \$40 \text{ per sq. ft.} = \$914,400 \text{ construction cost}$$

To determine the annual cost of the building, you need to know the loan interest rate and the period of time the financing will encompass. For this example, assume the building can be financed with a 10 percent loan for a period of 30 years. To derive the annual capital cost, multiply the loan amount by the amortization rate.

$$\$914,400 \times .106079 \text{ amortization rate} = \$96,999 \text{ annual capital cost}$$

To derive an estimated total annual cost, add TIC, fixed charges, operation and maintenance, transportation and annual capital costs. In this case, the total annual cost of the school for a population of 1,000 people is \$395,142 or \$395 per capita (\$1,556 per student). These costs and others for various population sizes are given in Table 2.

Estimating Population Growth's Impact on Education's Costs

If our example community of 1,000 residents experiences a development expected to bring in 500 new residents, what will be the impact on education expenditures? The standards can be used to estimate this impact.

First, estimate the number of new students* expected to attend schools in the community (Standard 1).

$$500 \text{ new residents} \times .254 \text{ student/population ratio} = 127 \text{ new students}$$

Second, estimate the number of new teachers needed (Standard 2).

$$127 \text{ new students} \div 21 \text{ student/teacher ratio} = 6 \text{ new teachers.}$$

*Note: the number of new students will depend on the characteristics of the new residents. However, the existing student to population ratio may be used as a rough estimate.

Table 2. Education costs by community population.

Population	# of primary students	# of secondary students	Total instruction cost-primary	Total instruction cost-secondary	Total instruction cost	Fixed charges — primary	Fixed charges — secondary
500	—	127	—	—	121,880	—	—
1,000	—	254	—	—	245,473	—	—
1,500	196	185	177,492	189,273	366,765	7,100	7,571
2,000	261	247	235,929	253,665	489,594	9,437	10,147
2,500	326	309	300,856	328,777	629,633	12,034	13,151
5,000	653	617	576,036	654,766	1,230,802	23,041	26,191
10,000	1,306	1,234	1,152,066	1,283,614	2,435,680	46,083	51,345
15,000	1,958	1,852	1,734,277	1,914,448	3,648,725	69,371	76,578
30,000	3,917	3,703	3,469,437	3,876,372	7,345,809	138,777	155,055

Population	Total fixed charges	O & M* primary	O & M* secondary	Total O & M	Transportation primary	Transportation secondary	Total transportation	Construction costs-primary	Construction costs-secondary	Total constr. cost
500	4,875	—	—	15,601	—	—	5,760	—	—	457,200
1,000	9,819	—	—	31,421	—	—	11,430	—	—	914,400
1,500	14,671	22,719	24,227	46,946	8,820	8,370	17,190	705,600	666,000	1,371,600
2,000	19,584	30,199	32,469	62,668	11,790	11,160	22,950	939,600	889,200	1,828,800
2,500	25,185	38,510	42,083	80,593	14,670	14,040	28,710	1,173,600	1,112,400	2,286,000
5,000	49,232	73,733	83,810	157,543	29,430	27,810	57,240	2,350,800	2,221,200	4,572,000
10,000	97,428	147,464	164,303	311,767	58,770	55,530	114,300	4,701,600	4,442,400	9,144,000
15,000	145,949	221,987	245,049	467,036	88,110	83,340	171,450	7,048,800	6,667,200	13,716,000
30,000	293,832	444,088	496,176	940,264	176,310	166,680	342,990	14,101,200	13,330,800	27,432,000

Population	Ann. cap. costs-primary	Ann. cap. costs-sec.	Total ann. cap. costs	Total ann. costs — pri.	Total ann. Costs — sec.	Total ann. costs	Total ann. costs per cap.	Total ann. cost per student
500	—	—	48,499	—	—	196,570	393	1,548
1,000	—	—	96,999	—	—	395,142	395	1,556
1,500	74,849	70,649	145,498	290,980	300,090	591,070	394	1,551
2,000	99,672	94,325	193,997	387,027	401,766	788,793	394	1,553
2,500	124,494	118,002	242,496	490,564	516,053	1,006,617	403	1,585
5,000	249,371	235,623	484,994	951,611	1,028,200	1,979,811	396	1,559
10,000	498,741	471,245	969,986	1,903,124	2,026,037	3,929,161	393	1,547
15,000	747,730	707,250	1,454,980	2,861,475	3,026,665	5,888,140	393	1,545
30,000	1,495,841	1,414,118	2,909,959	5,724,453	6,108,401	11,832,854	394	1,553

*O & M = Operation and Maintenance

Next, calculate the cost of additional faculty salaries by multiplying the number of new teachers by the average salary figure (Standard 3).

$$6 \text{ teachers} \times \$12,462 \text{ average salary} = \\ \$74,772 \text{ new teachers' salaries}$$

Estimate the administrative, counseling and clerical salaries as follows:

Principal: $127 \text{ new students} \times \$47 \text{ per student (Standard 4)} =$
\$5,969 principal salary

Counselor: $127 \text{ new students} \times \$44 \text{ per student (Standard 6)} =$
\$5,588 counselor salary

Clerical: $6 \text{ new teachers} \div 15 \text{ teacher/staff ratio}$
(Standard 7) = .4 new clerical staff
.4 \times \$6,000 per staff member
= \$2,400 new clerical salaries

Next, estimate total instructional cost (TIC):

$$\begin{aligned} & \$74,772 \text{ teachers' salaries} \\ & + \$5,969 \text{ principal salary} \\ & + \$5,588 \text{ counselor salary} \\ & + \$2,400 \text{ clerical salary} \\ & = \$88,729 \text{ Total Instructional Salaries (TIS)} \\ & \text{TIC} = \text{TIS} \div .728 \text{ (Standard 8)} = \\ & \$88,729 \div .728 = \\ & \$121,880 \text{ Increased Total Instruction Cost (TIC)} \end{aligned}$$

Estimate transportation cost increases using Standard 9:

$$\begin{aligned} & 127 \text{ new students} \times .5 \text{ students bussed} \\ & \times 20 \text{ miles per day} \times \$0.025/\text{student/mile} \\ & \times 180 \text{ days/year} \\ & = \$5,715 \text{ increased transportation costs} \end{aligned}$$

More building space may be needed. Using Standard 10, determine the number of square feet and cost:

$$127 \text{ new students} \times 90 \text{ sq. ft./student} \times \$40/\text{sq. ft.} = \\ \$457,200 \text{ new construction cost}$$

The annual cost of this construction, if amortized at 10 percent for 30 years, is \$48,499. Calculate added maintenance and operation and fixed charges using Standards 11 and 12:

$$\$121,880 \text{ TIC} \times .128 = \$15,601 \\ \text{added maintenance and operation}$$

$$\$121,880 \text{ TIC} \times .04 = \$4,875 \text{ added fixed charges}$$

Estimate the increase in education expenditures by summing the total instructional cost (TIC), transportation cost, annual cost of new construction, maintenance and operation (M & O) and fixed charges:

$$\begin{aligned} & \$121,880 \text{ TIC} \\ & + \$5,715 \text{ transportation} \\ & + \$48,499 \text{ annual building cost} \\ & + \$15,601 \text{ M \& O} \\ & + \$4,875 \text{ fixed charges} \\ & = \$196,570 \text{ total added cost resulting from 500} \\ & \text{new residents coming into the community} \end{aligned}$$

$$\begin{aligned} & \$131.05 \text{ added cost per capita (1,500 population)} = \\ & \$515.93 \text{ added cost per student (381 students)} \end{aligned}$$

The population growth of 500 translates into an added education cost per capita of \$131.05 for the community now numbering 1,500 residents. For the 381 persons of school age expected in the population growth, the added cost per student for the total community is \$515.93.

Community Information Sources

- The school district office will be able to provide information concerning educational needs, standards, employees, salaries and transportation relating to the local school district. The superintendent may also "hypothesize" on the impact of different growth levels on the school system.

- The city or county administrators may be able to offer insights on the type of people moving into the area (if, for example, the growth is induced by a construction project), the growth patterns and planning process stages where the information you develop will have the greatest impact.

- Contractors should be able to provide estimates on building costs and possibly on building requirements.

- Local banks and financial institutions will be able to provide information on financial arrangements.

- The state statute relating to bonding and other educational policy will also be helpful.

Literature Cited

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2. City-County Data Book. 1977. Boise Center for Urban Research, Assn. of Idaho Cities, Idaho Assn. of Counties.
3. Financial Summaries: Idaho School Districts, July 1, 1978-June 30, 1979. State Supt. of Public Instruction, State of Idaho, Boise.
4. Mackey, R. Bruce. 1977. Costs for rural community services in Nevada: An economic-engineering approach. Ag. Exp. Sta., Univ. of Nevada-Reno.

WORKSHEET — Estimating Education's Cost

- A. _____ = (_____^{.254} × _____)
 Number of students Standard 1 School district population
- B. _____ = (_____ ÷ _____)
 Number of teachers (A) Number of students Standard 2

Education Costs

C. Instructional Costs

1. _____ = (_____ × _____)
 Teachers' salaries \$11,173 or actual salaries (B) Number of teachers
2. _____ = (_____^{\$47} × _____)
 Principals' salaries Standard 4 Number of students
- or
- _____ = (_____ × _____)
 Average salary (Standard 4) Number secondary schools
3. _____ = (_____ × _____)
 Assistant principals' salaries \$19,238 or actual salary Number assistant principals (Standard 5)
4. _____ = (_____ × _____)
 Counselors' salaries \$44 (Standard 6) Number secondary students
- or
- _____ = (_____ × _____)
 \$16,430 or actual salary Number of counselors (Standard 6)
5. _____ = (_____ × _____)
 Clerical salaries \$6,000 or actual salary Number clerical staff (Standard 7)
6. _____ = (_____ + _____)
 Total instructional salaries (1) Teachers' salaries (2) Principals' salaries
- + _____ + _____ + _____)
 (3) Asst. principals' salaries (4) Counselors' salaries (5) Clerical salaries
7. _____ = _____ ÷ _____
 Total instructional cost (6) Total instructional salaries Standard 8 .728
- D. _____ = (_____ × _____^{.04}) or = _____
 Fixed charges (7) Total instructional cost Standard 12 Actual amount
- E. _____ = (_____ × _____^{.128}) or = _____
 Maintenance and operation (7) Total instructional cost Standard 11 Actual amount
- F. _____ = (_____ × _____)
 Transportation cost Cost/mile/student (Standard 9) miles per day
- × _____ × _____)
 days bussed Number students bussed

Capital Costs

- G. _____ = _____
 Total construction costs Standard 10
- H. _____ = (_____ × _____)
 Annual capital cost (G) Total construction cost Amortization rate (Table 1)
- I. _____ = (_____ + _____)
 Total annual cost (7) Total instructional cost (D) Fixed charges
- + _____ + _____ + _____)
 (E) Maintenance and operation (F) Transportation cost (H) Annual capital cost
- J. _____ = _____ ÷ _____
 Total annual cost per capita (I) Total annual cost Population served

Cost of Public Service: Education is the second in a series of bulletins on estimating costs of public service in various size Idaho communities. Other bulletins in that series available from the University of Idaho Agricultural Information Department are as follows:

EXT 602 Residential Growth: Its Benefits and Costs to the Local Community	50 cents
EXT 605 Cost of Public Service: Fire Protection.....	25 cents
EXT 606 Cost of Public Service: Police Protection.....	25 cents
EXT 607 Cost of Public Service: Sewage Collection and Treatment	25 cents
EXT 608 Cost of Public Service: Sheriff Protection.....	25 cents
EXT 609 Cost of Public Service: Solid Waste Disposal.....	25 cents
EXT 610 Cost of Public Service: Water Supply	25 cents

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