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Effects of Banfield Transitway Expenditures on the Portland Metropolitan Economy

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EFFECTS OF BANFIELD TRANSITWAY EXPENDITURES ON THE PORTLAND METROPOLITAN ECONOMY

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An assessment of the construction related economic repercussions of the Banfield Transitway Project was performed. The effects of the project were derived using a 24-sector input-output model of the four county Portland SMSA economy. The input-output methodology is frequently employed for the purpose of impact assessment because it provides exceptionally detailed estimates of interindustry activity, employment and income that result from project-related expenditures.[1] The primary data and background information needed to perform this analysis were provided by the Banfield LRT Project office.

The major findings of this study include:

- Approximately 80 percent of the expenditures budgeted for the project will be made within the metropolitan area. Gross local outlays equaling $236 million were estimated.

- The direct local expenditures will generate a total of $385 million in direct, indirect and induced metropolitan production.

- The project will generate a direct increase in employment of 2,370 person-years. Total direct, indirect and induced employment increases are estimated to be 10,600 person-years.

- A direct, indirect and induced wage and salary income increase of $195 million in the metropolitan area is projected.

BACKGROUND

The Banfield Transitway Project was designed to accommodate the growing demands placed on the East Portland/East Multnomah County transportation system.[2] The project consists of a 14.9 mile light rail transit system connecting downtown Portland and the City of Gresham, and improvement along a 4.3 mile segment of the Banfield Freeway. Of the approximate $300 million budgeted for this project, one third will be devoted to freeway improvements, with the remainder devoted to the construction of the light rail system. The project was initiated in April, 1982 and is expected to be completed by mid 1986. Project planners project that in 1990 some 42,000 passengers will be carried daily on the light rail system.

ECONOMIC IMPACT OF PROJECT EXPENDITURES

An input-output model functions as a demand-driven interindustry accounting system, providing very disaggregated production, employment and income projections resulting from an initiating direct economic change. In this study the direct stimulus is defined to be the budgeted expenditures that will be made in the course of completing the Transitway project.

In satisfying the direct demands for goods and services required for the project, local producers must purchase additional inputs to produce their own products. The producers of these inputs, in turn, place similar demands on their suppliers. These secondary rounds of interindustry activity provide an added stimulus to the local economy, called indirect effects.

In addition to the secondary rounds of economic activity associated with the direct demands, an induced change in local production related to household spending may be estimated. This effect is attributable to the increase in consumption by a labor force employed to produce the goods and services needed to satisfy the direct and indirect requirements.

The magnitude of the combined direct, indirect and induced effects is highly influenced by the interindustry structure of the local economy in the sense that not all demands are met by local producers. Metropolitan economies are typically characterized by large volumes of imports and exports. To the extent that project-related demands are met by imported goods and services, a portion of the economic effect "leaks" out of the area to other regions. Wtih regard to the Transitway project these leakages may take several forms. First, a portion of the direct demands associated with the project will be satisfied by producers in other regions--LRT vehicles and steel rails, for example. In addition, imports may be required to satisfy some of the indirect economic activity--equipment used in the quarries supplying sand and gravel, for example. Finally, induced output may be reduced by the importation of the goods and services households consume, and by the fact that not everyone in the metropolitan labor force resides in and consumes the products of the four county region. The input-output model accounts for the indirect and induced leakages endogenously. Direct leakages have been dealt with in a manner that will be outlined below.

The approach typically used inassessing the economic effects of direct expenditures in an input-output model is to allocate an expenditure to the appropriate final demand sector. In the case of the Transitway project this would suggest that the $294 million budgeted expenditures represent a demand for output of the Contract Construction sector in the 24 sector I-O model. To follow such an approach, however, would raise the possibility of substantial error due to effects of what is known as aggregation bias. That is, the composition of the Contract Construction sector reflects an aggregated average of the interindustry transactions that are associated with a wide range of construction-oriented activities. Industrial, commercial, residential, public works and other types of construction are contained within this sector. Although the Transitway project is construction-oriented, its composition is hardly representative of the composition of the Contract

Construction sector in the I-O model. Thus, allocating the project budget to this sector would misspecify the product demands that are unique to the project.

An alternative approach--the one used in this study--breaks down the total budgeted expenditure into itemized purchases of the inputs that are required to complete the project. Using this approach, the project is defined by its purchases of labor, concrete, structural steel, design and consulting services, etc. In this way, the composition of the project is better matched to the composition of the input-output model. It further allows for the identification of expenditures for goods and services known to have been produced outside the region. These expenditures represent direct leakages that would not have been adequately captured under a "single sector" format.

The Banfield LRT Project office provided data consistent with the disaggregated format. This data is contained in Tables 1 and 2. The first column of figures in Table 1 gives the total budgeted expenditures by project category. These expenditures sum to $294 million. The second column of figures lists those purchases that are known to be satisfied by producers outside the region (i.e., the direct leakages). A total of $58 million--20 percent of the total project budget--was identified. These expenditures are primarily for LRT vehicles, track and signals, items accounting for 80 percent of the total direct leakage. The third and fourth columns give the expenditures for locally produced materials and services and labor respectively. Local material and service expenditures of $130 million account for 44 percent of the total project cost, while the $106 million outlay for labor accounts for 36 percent. Material purchases associated with civil, highway and operation building construction are provided in greater detail in Table 2. Materials required in these three categories account for 70 percent of all the locally supplied materials and services required in the project. As one would expect, these materials are heavily comprised of basic

TABLE 1

BANFIELD TRANSITWAY PROJECT
(In Millions)

CLASSIFICATION DESCRIPTION	BUDGET AMOUNT	CONTENT DESCRIPTION	OUTSIDE PORTLAND	INSIDE PORTLAND	
				Mat./Serv.	Labor
VEHICLES	30.822	Vehicles & Instruments	30.322	-	-
		Training & Tech. Support		-	.500
SUPPORT EQUIPMENT	3.238	Fare Collection	2.520	-	.398
		Communication	.270	-	.050
SERVICES/MAINTENANCE EQUIP.	3.250	Tools & Equipment Material	1.900	1.350	-
R.O.W. ACQUISITION	15.545	Acquisition & Relocation	-	14.655	-
		Expenses & Appraisals	-	-	.890
PROFESSIONAL & LEGAL SVC.	17.840	Interagency	-	3.740	-
		Consultants	3.600	10.500	-
WRAP-UP INSURANCE	4.429	Claims, Bonds, Expenses & Premiums	-	4.429	-
OPERATION BUILDING	8.445	Construction	.250	4.795[1]	2.600
CIVIL CONSTRUCTION	72.000	Procurment of Track (15 mi. double track = 30 miles)	8.500	-	-
		Construction	-	25.400[1]	28.600
HIGHWAY CONSTRUCTION	101.192	Construction (4 1/2 Miles)	-	60.722[1]	30.350
SYSTEMS MFG/INSTALLATION	18.392	Design, Fab/Mfg/Procurement	8.700	.460	-
		Installation	2.292	-	5.100
		Training	-	-	.140
SUPPORT SERVICES	15.262	LRT Staff	-	-	12.362
		Office Equip. & supplies	-	2.000	-
		Force Account	-	-	.900

TABLE 1
(Continued)

CLASSIFICATION DESCRIPTION	BUDGET AMOUNT	CONTENT DESCRIPTION	OUTSIDE PORTLAND	INSIDE PORTLAND	
				Mat./Serv.	Labor
PLANNING STUDIES	.878	Metro Services	-	-	.878
Contingency	Omitted	Undetermined	-	-	-
RESERVE FUNDS	Omitted	Undetermined Construction	-	-	-
LOCAL FUNDS	3.000	Construction (Sewer)	-	1.500	1.125
FRINGE BENEFITS (LOCAL DIRECT LABOR)	NA		NA	NA	22.495
TOTAL INDENTIFIED EXPENDITURES	294.293		58.354	129.551	106.388

Source: Data obtained from cost information provided by project contracts.

[1]A more detailed description of these material outlays is given in Table 2

TABLE 2

SELECTED BANFIELD TRANSITWAY PROJECT MATERIAL EXPENDITURES

	Operation Building	Civil Construction	Highway Construction	Total
• Textile Products	20,000	1,000,000	700,000	1,720,000
• Wood Products	361,000	-	-	361,000
• Chemical Products	22,000	5,000,000	4,300,000	9,322,000
• Stone, Clay, Glass	1,358,000	12,000,000	25,000,000	38,358,000
• Struct. Steel	2,403,000	2,400,000	25,700,000	30,503,000
• Electrical Products	631,000	5,000,000	5,000,000	10,631,000
Totals	4,795,000	25,400,000	60,700,000	90,895,000

Sources: PLTK Associates, "Capital Cost Estimates/Operations and Maintenance Costs," Technical Memorandum 10, Banfield Light Rail Project. July, 1980, and cost information provided by project contracts.

products used for construction, with concrete, aggregate, structural steel and related products representing 75 percent of the locally supplied materials.

To determine the effects of the local expenditures on the metropolitan economy the data in Tables 1 and 2 were allocated to their originating sectors in the input-output model. Table 3 provides the resulting expenditures across the model's 24 sectors. In the first column the payment for local labor of $106 million was distributed among the 24 sectors using the model's endogenous household consumption function. Note that only a portion of this total amount is actually converted into the direct consumption of goods and services by households. Fringe benefits and federal, state and local taxes are deducted from the gross outlays for labor, leaving $62 million for direct consumption. In the second column the full amount attributable to local material and service purchases--$130 million--is allocated across the 24 sectors. The third column gives the combined total purchases--$192 million consumed directly by the construction labor force and the project itself in locally provided goods and services. The combined demands are largely concentrated in five sectors, with Stone, Clay and Glass, Primary and Fabricated Metals, Wholesale and Retail Trade,[3] Finance, Insurance and Real Estate and Services accounting for 77 percent of the total direct demand.

The direct, indirect and induced production generated by labor force and project-related material and service expenditures is given in Table 4. The format used in Table 3 is employed here as well. Total regional production associated with the project is estimated to be $385 million. As with the direct demands this total is largely concentrated in a handful of sectors, with those noted previously and Transportation, Communications, and Utilities accounting for 74 percent of the total local output. Associated with this level of production are wage and salary payments to persons employed to satisfy the direct and subsequent indirect and induced demands equaling $111 million. When combined

TABLE 3
DIRECT LOCAL EXPENDITURES ASSOCIATED WITH
THE BANFIELD TRANSITWAY PROJECT

	Labor	Materials & Services	Total Final Demand
Agr. For., Fish	545,304	0	545,304
Mining	0	0	0
Con. Contr.	0	0	0
Food & Kindred	4,714,787	0	4,714,787
Text. & App.	847,319	1,720,000	2,567,319
Wood Product	520,137	361,000	881,137
Pulp & Paper	511,747	1,193,000	1,704,747
Chemical Product	897,655	9,322,000	10,219,655
Rubber & Leather	109,061	0	109,061
Stone, Clay, Glass	50,336	39,858,000	39,908,336
Prim. & Fab. Met.	151,007	30,773,000	30,924,007
Machinery	58,725	1,467,000	1,525,725
Electrical Equip. & instr.	511,747	11,091,000	11,602,747
Trans. Equipment	1,174,502	0	1,174,502
Misc. Mfg.	243,290	0	243,290
TCU	3,548,674	0	3,548,674
Electrical Services	1,333,899	0	1,333,899
Wholesale/Retail Trade	14,068,856	420,000	14,488,856
FIRE	15,260,137	19,084,000	34,344,137
Services	16,392,692	10,500,000	26,892,692
Gvt. Enterprises	899,266	3,740,000	4,639,266
Eletrical Utilities			
• Federal	58,725	0	58,725
• State & Local	192,954	0	192,954
Scrap	167,786	0	167,786
Total Direct Disposable	62,258,606	129,529,000	191,787,606
Total Direct	83,893,000	129,529,000	213,422,000
Gross Local Outlays[1]	106,388,000	129,529,000	235,917,000

[1]The gross local outlay of $106,388,000 in column one is the total budgeted local personnel cost. Eliminating fringe benefit costs of $22,495,000 gives direct labor income of $83,893,000. Of that total federal, state and local taxes account for an additional $21,634,394 leaving $62,258,606 as the amount directly expended in the area economy.

TABLE 4

DIRECT, INDIRECT AND INDUCED EFFECTS OF BANFIELD TRANSITWAY PROJECT PURCHASES ON THE PORTLAND SMSA ECONOMY

	Labor	Materials & Services	Combined Totals
Agr. For., Fish	2,031,639	1,662,837	3,694,476
Mining	20,155	1,177,277	1,197,432
Con. Constr.	2,366,601	4,602,377	6,968,977
Food & Kindred	8,009,074	4,585,081	12,594,966
Text. & App.	1,423,074	3,011,101	4,434,175
Wood Product	1,633,199	2,962,936	4,596,135
Pulp & Paper	2,776,873	6,079,556	8,856,429
Chemical Product	2,418,406	15,237,684	17,656,090
Rubber & Leather	374,520	806,852	1,181,372
Stone, Clay, Glass	414,120	46,054,960	46,469,080
Prim. & Fab. Met.	1,597,394	39,804,473	41,401,867
Machinery	362,752	3,004,311	3,367,063
Elect. Equip. & Instr.	1,218,850	13,577,000	14,795,850
Trans. Equipment	2,081,604	1,459,883	3,541,488
Misc. Mfg.	398,700	367,097	765,797
TCU	8,993,323	15,441,172	24,434,495
Electrical Services	2,981,641	4,355,915	7,337,556
Wholesale/Retail Trade	21,504,674	17,450,228	38,954,902
FIRE	27,571,731	41,837,505	69,409,236
Services	28,695,457	34,896,868	63,592,325
Gvt. Enterprises	1,842,955	5,556,775	7,399,730
Electrical Utilities			
• Federal	123,474	171,362	294,836
• State & Local	391,357	512,228	903,585
Scrap	291,862	1,243,160	1,535,022
Totals[1]	119,524,244	265,858,641	385,382,885

[1]Estimates of reginal production include wage and salary payments to employees residing within the Portland SMSA as follows:

- Labor-related: $35,412,703
- Material & Services-related: $75,630,365
- Combined Total: $111,043,068

with the $84 million paid directly to the project labor force an estimate of $195 million in wage and salary income is given.

In Table 5 the indirect and induced employment generated in each sector is provided. Of the total of 8,233 person-years estimated the six sectors noted above account for 79 percent, a slightly larger proportion due to the lower productivity of the Wholesale/ Retail Trade and Services sectors. When combined with the direct employment of 2,373 person-years[4] a total of 10,605 was determined.

A breakdown of the generated indirect and induced employment by occupation is given in Table 6. Larger than normal concentrations are found among Craft and Kindred workers and Operatives, which is not suprising given the composition of Products utilized directly in the project. Professional/Technical and Clerical show lower than normal concentrations, owing to the relative dependence on manufactured products over services.

Production, income and employment multipliers associated with the project are given in Table 7. A multiplier is typically defined as follows:

$$\text{Multiplier} = \frac{\text{Direct, Indirect and Induced Change}}{\text{Direct Change}}$$

With respect to the regional product multiplier the direct change may be defined in a number of ways. As indicated in Table 7 each definition will result in a different product multiplier. The first multiplier (1.3) defines direct change as the total expenditures budgeted for the project (294 million). The interpretation of this multiplier is as follows: for every dollar budgeted for the transitway project regional production will expand by 1.3 dollars. The definition of direct change for the subsequent product multipliers is:

- "Gross Local Outlays" - Direct change equals the total expenditures attributable to local sources ($236 million).

TABLE 5

INDIRECT AND INDUCED EMPLOYMENT, BY SECTOR, ASSOCIATED WITH BANFIELD TRANSITWAY PROJECT EXPENDITURES
(in person-years)

	Labor	Materials & Services	Combined Total
Agr. For.,Fish	37.69	30.85	68.54
Mining	.46	26.88	27.34
Con. Constr.	43.34	84.29	127.64
Food & Kindred	70.63	40.43	111.07
Text. & App.	42.10	89.09	131.19
Wood Product	23.98	43.51	67.49
Pulp & Paper	41.14	90.07	131.21
Chemical Product	16.63	104.80	121.43
Rubber & Leather	9.51	20.48	29.98
Stone, Clay, Glass	7.57	841.96	849.53
Prim. & Fab. Met.	23.02	573.55	596.57
Machinery	7.48	61.94	69.42
Electrical Equip. & Instr.	31.41	349.92	381.33
Trans. Equipment	27.90	19.57	47.47
Misc. Mfg.	10.58	9.74	20.31
TCU	168.73	289.70	458.43
Electrical Services	22.55	32.95	55.50
Wholesale/Retail Trade	716.82	581.67	1298.50
FIRE	294.26	446.50	740.76
Services	1161.76	1414.83	2574.59
Govt. Enterprises	78.42	236.46	314.88
Electrical Utilities			
• Federal	1.17	1.63	2.80
• State & LOcal	2.85	3.73	6.58
Scrap	0	0	0
Total	2840.02	5392.55	8232.57
Total Direct (On-Site)			2372.54
Total Direct, Indirect and Induced			10,605.11

TABLE 6

OCCUPATIONAL DISTRIBUTION OF INDIRECT AND INDUCED EMPLOYMENT EFFECTS

Occupational Category	Labor Related	Material Service Related	Combined Total
Professional/Technical	502.60	813.41	1316.01
Managers/Proprietors	328.11	517.00	845.11
Sales Workers	226.39	275.55	501.94
Clerical Workers	577.21	962.45	1539.66
Crafts & Kindred	259.81	735.66	995.47
Operatives	315.25	1180.04	1495.29
Service Workers	482.39	609.18	1091.57
Laborers	118.01	274.48	392.49
Farmers/Farm Workers	30.26	24.77	55.03
Totals	2840.02	5392.55	8232.57

TABLE 7

MULTIPLIERS ASSOCIATED WITH THE
BANFIELD TRANSITWAY PROJECT

Regional Production:	
Based on :	
• Total Budgeted Expenditures	1.310
• Gross Local Outlays	1.634
• Direct Local Outlays	1.806
• Direct Local Disposable Outlays	2.009
Regional Income;	2.249
Regional Employment:	4.470

- "Direct Local Outlays" - Direct change equals the wages and salaries paid to the project work force plus local material and service purchases ($213 million).

- "Direct Local Disposable Outlays" - Direct change equals the value of goods and services directly consumed by the project labor force plus local material and service purchases ($192 million).

In comparative terms, the multipliers associated with regional production, employment and income are quite large. This is attributable to a number of factors. Product multipliers associated with construction are typically higher because the affected industries are more localized (e.g., concrete, lumber, sand and gravel) and more labor-intensive. This is especially so in the Portland Metropolitan Area as compared with other areas.[5] The employment multiplier is quite high for two reasons. Persons directly employed in the project are very well paid in comparison with indirect and induced employees. Also, the direct leakage of material and service expenditures was relatively small, resulting ultimately in greater levels of regional production and thus greater levels of associated indirect and induced employment. The relatively high income multiplier is attributable to the composition of the material purchases, showing a large dependence on labor-intensive products (Stone, Clay and Glass) and on products with a relatively higher value added component (e.g. Chemical Products, Primary and Fabricated Metals).

MODEL DOCUMENTATION

The model employed in the analysis is a 24 sector input-output system covering the four county Portland SMSA. The interindustry transactions component is based on the IMPLAN model developed by the U.S. Forest Service.[6] The IMPLAN system is derived from the 1977 national input-output model developed by the U.S. Department of Commerce.

An endogenous household sector was constructed using established closure practices, with data provided by the 1980 Census and other U.S. Department of Commerce publications. The occupational component of the model was derived form industry-occupational data contained in Bureau of Labor Statistics publications.

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FOOTNOTES

1. For examples of the application of input-output analysis to impact assessment see:

   Isard, W. and R. Kuenne, "The Impact of Steel Upon the Greater New York-Philadelphia Industrial Region," The Review of Economics and Statistics, Vol. 35 (1953), pp. 289-301.

   Isard, W., T. Reiner, R. Van Zele, J. Strathman, Regional Economic Impacts of Nuclear Power Plants, University of Pennsylvania, Energy Policy Project, prepared for Brookhaven National Laboratory, Report No. BNL50562, August, 1976.

   Miller, R.E., "The Impact of the Aluminum Industry on the Pacific Northwest: A Regional Input-Output Analysis," The Review of Economics and Statistics, Vol. 39 (1957) pp. 200-209.

   Stieker, G. and J. Strathman, "Regional Economic Impact From Construction of a Nuclear Electric Generating Plant," Regional Science Research Institute, RSRI Discussion Paper No. 91, December, 1976.

2. A full description of this project can be found in:

   Banfield Transitway Project: Light Rail Transit Line and Banfield Freeway Improvements, Final Environmental Impact Statement. U.S. DOT, Federal Highway Administration and Urban Mass Transportation Administration, August, 1980.

3. The expenditures described in this study are defined in terms of producer prices. Within the input-output system this means that the value of demand by sector represents only that portion of the final sales price received by each sector. Following this convention, the figures for the wholesale/retail trade sector do not represent the value of sales. Rather, the levels of activity measured in this sector represent trade margins equal to the value of sales minus the cost of the items purchased for resale The cost of the item to this sector is then allocated to the original producer. This procedure has no effect on the value of the total economic activity.

4. This figure was determined using an average wage rate of $17.00/hr. and a 2,080 hour work year.

5. For example, see:

   SMSA Multipliers: RIMS Results for 61 SMSA's, U.S. Department of Commerce, Bureau of Economic Analysis, Jan. 1981.

6. See Alward, G.S. and C.J. Palmer, "IMPLAN: An Input-Output Analysis System for Forest Service Planning" (mimeo) U.S. Forest Service.