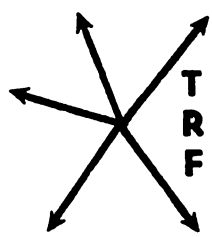
PROCEEDINGS —
Eighteenth Annual Meeting

Theme:
"Transportation in Transition"

October 17-18-19, 1977
Colony Square Hotel
Atlanta, Georgia

Volume XVIII • Number 1 1977



TRANSPORTATION RESEARCH FORUM

Rail System Investment Analysis

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EVERY YEAR, over one billion dollars[1] are invested in an industry which consistently earns one of the lowest rates of return on net invested capital of any U.S. industry, the railroad industry. Recently, the Federal government and the states have authorized the addition of billions of dollars of public money to the funds provided by private investors.

Because of the responsibility to make effective use of public funds, the Office of the Secretary of the U.S. Department of Transportation (DOT) is sponsoring a major study of railroad investments and the techniques used for their analysis. Through the study, DOT expected to learn how private sector investment decisions are made in the railroad industry and, more important, what financial results are expected from various classes of railroad investment. Railroad investment techniques and experience were believed to be a valuable guide for developing government standards for the investment of public funds. It was also believed that a comparison of investment evaluation practices on a number of railroads would be of interest to the industry and would enable railroad managements to benefit from a knowledge of one another's techniques attainable without disclosure of proprietary interests. The study is being undertaken by Ernst & Ernst with subcontract assistance from R. L. Banks & Associates, Inc. This paper presents its highlights.

The investigation consists of a series of tasks:

- A review of the literature relating to the evaluation of railroad investment projects.
- Discussions with analysts and senior officials of 13 different railroads about the way they make investment decisions.
- The financial evaluation of 63 diverse railroad investment projects from the point of view of the investing railroad. The projects are investment opportunities actually considered (and, in most cases, approved) by the 13 cooperating railroads. Four financial indices including the internal rate of return (IRR) were computed for each project following a standard procedure developed especially for this study.
- An investigation of how the financial attractiveness of projects changes depending on whether they are evaluated from standpoint of the investing railroad or that of the railroad industry as a whole.
- An investigation of how project attractiveness changes depending on whether projects are evaluated from the individual railroad's perspective or that of the national economy.

As of this writing, the first four of the above five tasks are substantially complete, and the principal conclusions from those tasks are presented below.

THE LITERATURE REVIEW

While perhaps the earliest quantitative writing on capital investment decisions is A. M. Wellington's **Economic Theory of the Location of Railways**, 1887, the abundant modern literature on railroads contains almost no reference to capital investment decisions, and the abundant modern writings on capital investment decisions make little or no reference to railroads. There is no modern textbook or manual published dealing specifically with the evaluation of railroad capital projects.

THE DISCUSSIONS WITH RAILROAD MANAGERS

All of the railroads cooperating with this study routinely undertake quantitative financial analyses of some types of investment projects. However, most railroad managers believe that such analyses are inappropriate for other types of capital expenditures, particularly the following:

- Necessary projects—projects which railroad managers feel they must accomplish regardless of computed financial indices if they are to stay in business. Many railroad managers believe that in practice they have little or no discretion over a large portion of their capital spending.
- Low cost projects — projects for which the cost of doing the analysis would be high and the cost of a bad decision low.

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- Projects in which assignment of dollar values to benefits is very difficult. Foremost among these are projects undertaken to improve service quality.
- Projects in which financial considerations are not paramount, such as safety and employee amenities.

In the absence of a financial analysis, railroads sometimes perform an engineering analysis as, for example, to determine how many locomotives are needed to meet certain performance objectives. In many other cases, decisions are made entirely on the basis of managerial judgment.

Railroad managers hold differing opinions regarding which types of investment decisions should be subjected to quantitative financial analysis. Most would agree that some projects are obviously necessary as long as the management has not resigned itself to immediate liquidation. As the Chief Executive Officer of one of the most highly regarded companies in the industry remarked, "When the Tye River bridge on our main line was washed out, we didn't make a study, we replaced it." On the other hand, most find financial analyses of projects which are clearly discretionary and which have easily estimated benefits, to be quite useful. The differences of opinion concern projects which some railroads regard as discretionary and others do not. Most notable among these are track rehabilitations and locomotive purchases.

We found that computation of an IRR is, by far, the most widely used approach to financial analysis in the industry today; it appears to be used for at least 85% of the projects subjected to any type of financial analysis. The fact that most railroad managers are already quite familiar with this technique is a strong argument in favor of requiring the calculation of IRR, rather than some other financial index, in the evaluation of projects for which railroads request Federal or state financial assistance. This is one reason the Federal Railroad Administration (FRA) selected IRR as the principal measure of financial attractiveness to be used in administering the Title V financial assistance programs created by the Railroad Revitalization and Regulatory Reform Act of 1976 (the 4R Act).

Although the term "rate of return" seems to be quite standard in the railroad industry, the approach used to compute that rate is not standard at all. Rates of return computed at different railroads may not be comparable for any of the following reasons:

- **Exclusion of tax impacts.** Some railroad analyses ignore the tax consequences of projects, perhaps quite properly for the railroad concerned. This sometimes produces IRR's which are what they would be if taxes were considered.
- **Short cut.** Some railroads arrive at the rate of return by simply dividing the benefits expected during the first year by the investment cost. This generally gives higher results than the discounted cash flow approach, and can be especially misleading if the benefits in the first year are substantially greater than those in later years. To correctly compare potential investments, it is necessary to use discounted cash flow computations rather than this short-cut.
- **Inclusion of financing.** Some railroad financial analyses do not show the investment as a lump sum cost at the beginning of the project, but rather as a series of payments on a loan used to finance the investment. This results in the IRR being several times what it would be if the effect of financing were excluded from the computations.
- **Use of inflated dollars.** While standard analyses are, in this study, expressed in units of constant purchasing power, some analyses done by railroads use inflated dollars. Using inflated dollars gives a higher IRR than would be found using constant dollars, with the difference depending on the assumed inflation rate. Of course, an investor seeks a high rate of return to compensate for inflation.

The quality of the financial analyses reviewed during the study varied from one railroad to another. This variation appeared to be due primarily to two factors:

- **Top Management Policy.** The quality of financial analyses is usually superior at railroads where top officials place great importance on the analyses, allocate adequate resources to producing them, and devote a significant amount of their own time to reviewing them.
- **Organizational Structure.** The quality of the analyses is usually superior where there is a staff officer responsible for reviewing the analyses to ensure their quality and comparability.

THE FINANCIAL EVALUATION OF SAMPLE PROJECTS

Characteristic Project Rates of Return

The standardized internal rates of return computed for the sample projects ranged from negative to well over 100%. The weighted average return on total sample investment was 17%. One-tenth of a percent of the investment dollars

had IRR's above 100% and 28% had IRR's above 15%, an after-tax hurdle rate quite commonly used in the industry. These measures of rate of return suggest, on the one hand, that railroads can afford outside financing for a substantial portion of their capital investment, assuming private investors are willing to supply the funds, and, on the other hand, that there is not a huge reservoir of potentially highly profitable investment opportunities unexploited for lack of capital.

The foregoing results raise two questions. The first is how the average 17% IRR for new railroad investment can be reconciled with the much lower return on invested capital for the industry as a whole. Even if the industry's entire net operating income were attributed to the gross capital expenditures of the previous 10 years alone, the industry's rate of return is in the neighborhood of 5%.[2] There is an explanation for the paradox:

- IRR and similar financial indices indicate only how efficient a project is in increasing profit, but say nothing about the overall profitability of the business area in which the investment is made. For example, a financial analysis of a terminal investment undertaken to lower the cost of handling existing traffic will usually indicate whether the cost savings are sufficient to justify the investment, given that the railroad will continue to handle the traffic in question. Such an analysis would provide no information about the profitability of the traffic itself, however. Thus, it is entirely possible for the traffic to be unprofitable even after an investment with a very high IRR is made. The same phenomenon occurs on a larger scale for the aggregate investment railroads make in their facilities and equipment; high rates of return on the individual projects are not sufficient to guarantee that the railroads' various business activities will be highly profitable.

The second question raised by our sample is why railroads invest so much of their money on projects with so little financial appeal. We identified three possible reasons for investment in projects with low IRR's:

- Some projects are undertaken for reasons other than profit, such as safety or legal requirements. Such projects, however, constitute a very small part (perhaps 4%) of all railroad spending.
- Many projects, like the replacement of the washed-out bridge mentioned above, must be completed to ensure continued operation, regardless of computed rate of return. Other projects are so viewed by railroad management because of inability to compute a credible rate of return.
- In some cases, as discussed later in this paper, railroads compute rates of return higher than those arrived at by the standardized method. Some such calculations may be appropriate in the specific situation, e.g., ignoring income tax effects when the railroad in fact earns no taxable income. Other calculations, however, appear to involve overstatement of benefits or understatement of costs.

IRR's OF DIFFERENT KINDS OF PROJECTS

The most striking feature of investment projects in our sample was the large dispersion among the IRR's. We tried grouping the projects by asset type, purpose, the financial strength of the investing railroad, the source of financing, project size, and whether the project would affect other railroads. For all the classification schemes tried, the differences within categories were far greater than the differences among the category averages, so that no categories were clearly superior to others. The very high dispersion of the IRR's around the average values for most categories suggests that funding decisions—whether made by railroad managers or Federal officials—must be made on the basis of project-by-project evaluations rather than simple funding categories if the return on the invested funds is to be maximized.

While the grouping of projects did not produce statistically significant results, the data did suggest some hypotheses which might be verified or proved false by more extensive data than was used in this study:

- The replacement of worn out assets and other cost reduction projects have higher IRR's than projects undertaken for other purposes. (This may reflect the fact that it is easier to quantify the benefits of replacements and other cost reduction projects than other types of projects.)
- Financially stronger roads tend to realize higher IRR's.
- Projects for which external funds are available have lower IRR's than those which must be paid for with internal funds. (Perhaps the shortage of internal funds has forced railroads to forego projects in which they would otherwise invest, while easily available funding for other kinds of projects has induced them to approve investments with only marginal IRR's. The difficulties in estimating IRR for cars and lo-

comotives make judgments in this area suspect.)

- Large projects are less profitable than small projects.
- Investments in maintenance-of-way equipment, maintenance facilities, and terminals have higher IRR's than other projects. Investments in locomotives, cars, and signals have lower IRR's than other projects. (We also found track rehabilitation projects to have high IRR's, but that finding was based on only two projects).

KEY BENEFIT TYPES

From our examination of the sample projects, it appears that a few types of benefits are the "driving factors" which determine the attractiveness of railroad investments. Foremost among these is labor savings, which is the primary motivation for many of the sample projects, and is involved in about half of them accounting for 35% of investment dollars. Contribution from traffic, improved car utilization, and other operating savings are less pervasive benefit categories, but each usually dominates the benefits of the projects with which it is associated. In contrast, the investment tax credit, salvage value at the end of a project's life, and the tax impact of depreciation are involved in almost every project, but make only a small contribution to the overall benefits. Salvage value is entirely negligible in most cases. This suggests that railroads and others doing financial analyses of railroad investment projects will usually need to be particularly careful in estimating benefits from labor savings, traffic, improved car utilization, and other operating savings. Rough estimates will generally suffice for salvage value, depreciation, and tax credits.

TECHNICAL PROBLEMS

Data limitations and conceptual difficulties caused problems in some railroad financial analyses. The following difficulties seemed to be the most important:

- **Project definition.** It is sometimes difficult to identify the full scope of investments necessary to a project. In other cases, independent investments which should be analyzed separately may be included in a single project. This sometimes hides the fact that a particular investment could not be justified if it were evaluated by itself.
- **Base case definition.** It is frequently difficult to make realistic, consistent assumptions regarding what would happen in the absence of the project (the "base case"). As a result, some investments may be given credit for helping the railroad avoid costs (or traffic losses) which would not actually be incurred in the absence of the project.
- **Exclusion of the value of assets already owned.** When an asset already owned by the railroad is involved in a project, it should not necessarily be treated as costless. The opportunity cost is either the price at which the asset could be sold or its value (however estimated) if used elsewhere on the railroad.
- **Double counting of benefits.** Particularly in the case of interrelated projects, there is a danger of counting the same benefit twice, thereby overstating the attractiveness of each project.

In addition to the above more general problems, there are technical problems associated with estimating the dollar value of particular benefits and costs. Some of the most troublesome are:

- The change in cost associated with a change in traffic volume.
- The change in traffic volume, and hence profit, resulting from a change in service quality.
- The dollar value of reducing accidents, such as derailments.

Unfortunately, these problem areas are associated with the kinds of projects which account for the bulk of railroad spending: locomotives, cars, and line rehabilitation.

In view of the government involvement in railroad investment matters discussed at the beginning of this paper, two major public policy implications emerge. First, to address the technical problems and to give railroads the opportunity to benefit from one another's experience, a manual of investment evaluation techniques would fill a real need. Such a manual is being produced as a part of this study. In addition, we developed some illustrative analyses demonstrating the recommended techniques.[3]

The second implication is that care must be exercised in comparing rates of return for different projects, especially when calculated by different railroads. In order to attain comparability, the Federal Railroad Administration has issued regulations for computing internal rate of return in connection with the Title V program.[4]

INSTITUTIONAL FACTORS

A final set of conclusions from our examination of the sample projects relates to institutional factors affecting the attractiveness of certain investments. We identified several such factors, the most important of which are summarized below:

● The accounting conventions followed by a railroad affect the impact a project will have on its taxable income, and hence on its taxes. Project expenditures can be divided into three general groups: those which are treated as current expense, those which are depreciated, and those which are neither expensed nor depreciated. Railroads using betterment accounting treat the cost of track rehabilitation (exclusive of betterments) as a maintenance expense. That reduces their taxable income in the year of the rehabilitation by the entire cost of the rehabilitation, with a corresponding reduction in income tax liability. Track abandonments also result in an immediate reduction in taxable income, equal to the book value of the track less its net salvage value. Expenditures for most other assets are depreciated so that their impact on taxable income is spread over several years. Purchases of land and the construction of new track, however, do not reduce taxable income at all, because they are neither expensed nor depreciated. If a railroad manager selects projects based on the after-tax IRR, the above conventions will lead him to prefer track rehabilitations and abandonments over investments in depreciable assets, while avoiding new track construction and land purchases. If, on the other hand, the manager is most concerned with reported profits, not IRR, then his priorities would be just the reverse.

● Labor rates and rules have an extremely widespread impact. There was little evidence that employee protection agreements have much effect on investment decisions. The rates and work rules, on the other hand, are often crucial in determining how attractive investment projects are.

● Rates regulated by the ICC, both for rail and its competitors, are also crucial to the financial attractiveness of many projects, although for fewer of the sample projects than are affected by labor agreements.

● In a few cases, apparently high equipment hire rates resulted in investments which otherwise would not have been made. However, in most cases, equipment hire rates appear to be reasonably close to the true cost of car ownership, and therefore do not distort investment decisions. And even in the referenced cases, there may have been special circumstances making equipment purchase more attractive to one railroad than to another.

● The availability of external financing for a project can increase that project's chances for approval in two ways. First, the railroad may include the impact of the financing in its IRR computation, thereby increasing the apparent rate of return on that portion of the investment which requires internal funds. Also, the external funding may enable a project to avoid stiff competition for internally generated funds.

Four of the above institutional factors — accounting conventions, rates, equipment hire rates, and availability of funds—are completely or partially susceptible to control by the Federal government, and therefore might theoretically be adjusted to encourage investment in certain kinds of projects at the expense of others.

AN EXAMINATION OF RAILROAD INVESTMENTS FROM THE INDUSTRY PERSPECTIVE

It has often been asserted that the organization of the railroad industry as a large number of independent companies results in investment decisions which are not in the best interest of the railroad industry as a whole.[5] Our investigation supports that view, and identified three general ways in which this organizational structure affects investment decisions:

● Fragmentation of the industry's profits

● Fragmentation of the industry's capital resources

● Fragmentation of the industry's administrative and decision-making structures.

Because industry profits are fragmented, economic self-interest sometimes induces railroads to undertake projects which are not desirable from the industry point-of-view, and sometimes discourages projects which are desirable from the industry viewpoint. One reason for this is that railroads tend to ignore a project's impacts on other railroads. From our sample, it appears that about one project in three has impacts, often but not always beneficial, on the profits of other railroads. We identified six major ways in which a project on one railroad affects other railroads:

● Securing interline traffic which would otherwise not move by rail

● Improving the reliability of train arrivals at interchange points

● Diverting traffic from competing railroads

● Changing the type of equipment used

● Changing the balance of equipment hire payments

● Reducing yard congestion on connecting railroads

Of these, the first two are the most

common. Of the various types of projects, those most likely to affect other railroads are those involving cars, trailers, containers, yards, terminals, track extensions for new business, and track upgrading. For some kinds of projects, particularly yard projects, a single project may involve several different impacts, some positive and some negative, on other railroads.

Another important way in which fragmented profits lead to suboptimal investments is by effectively blinding managers to alternative actions which are not profitable to their own railroad, even though they may be quite attractive from the industry point-of-view. In many cases, the alternative most attractive from the industry point-of-view, but not considered by an individual railroad, is the routing of traffic so as to use facilities belonging to another railroad, rather than the investor. It appears that yards and rolling stock are the types of assets for which the failure to consider traffic rerouting has probably led most frequently to overinvestment. To the extent that decisions made from the viewpoint of the firm are sub-optimal from the industry viewpoint, the loss in efficiency may be viewed as the price, perhaps fully justified, of competition.

Fragmentation of the industry's capital resources effectively prevents individual railroads from undertaking large scale, high cost projects. Such projects may be very attractive from the industry perspective, but are not considered at all by individual railroads because those railroads cannot afford them. The problem is compounded by the high risk associated with some high cost investments. A possible role for the Federal government in response to this is to fund studies of such projects, demonstrations, and perhaps even the improvements themselves.

Joint projects have the potential for overcoming the problems of fragmented profits and capital. In particular, they

- Ensure that the impacts of a project on more than one railroad are considered (although impacts on non-participating railroads are not considered)
- Permit consideration of a wider range of alternatives than a single railroad would consider, including some rerouting of traffic
- Provide, if necessary, larger amounts of capital for a project than any of the participants alone could afford.

Despite these benefits, and despite the fact that about 20% of railroad investment projects, encompassing virtually all types of projects, present an opportunity for joint action, it appears, based on the sample studied, that railroads actually take advantage of less than one-third of those opportunities. This is because there are numerous administrative impediments to joint action which often deter railroads from such projects despite their financial advantages. Among those impediments are:

- The time, energy, and expense required to get a number of independent parties to understand and agree on a course of action.
- Differences in corporate philosophy and market strategy.
- Differences of opinion regarding technical matters.
- The risk of revealing confidential information to a competitor in the course of planning a project.
- Reluctance of the management of one railroad to lose complete control of its operations and become more dependent on the actions of a competitor.
- Difficulties arising from differences in the labor agreements of the various participants.
- Restrictions in corporate charters or mortgages.

It may well be that the industry can find ways of alleviating, or even eliminating, some of these impediments. The Federal government can certainly encourage joint projects by giving them priority for Federal assistance, and by insisting that an applicant for Federal assistance explore the possibilities for joint action with one or more other railroads before its project will receive Federal assistance.

Finally, this investigation is relevant to Federal policy regarding mergers. Because investment decisions made from the corporate point-of-view are sometimes quite different from those which would be made from an industry perspective, the merger of extant railroad companies into a much smaller number of organizations would probably enhance the efficiency of the industry's capital spending by aligning the perspective of the individual company more closely with that of the industry. This finding alone, however, is certainly not a recommendation that the structure of the U.S. railroad industry should be changed. More efficient capital spending is only one of many changes, some good and some bad, which are likely to accompany such a consolidation.

This paper has only presented highlights of our investigation of railroad investment analysis. Additional findings and a detailed explanation of how the investigation was conducted are contained in a series of reports issued by the U.S. Department of Transportation.[6]

FOOTNOTES

1 Interstate Commerce Commission, **Transport Statistics in the United States.**

2 Task Force on Railroad Productivity, **Improving Railroad Productivity,** National Commission on Productivity and Council of Economic Advisors, Washington, D.C., 1973, p. 110.

3 See two reports prepared by Ernst & Ernst and R. L. Banks Associates, Inc., on **Rail System Investment Analysis.** These are: **Manual for Determining Rate of Return on Railroad Investment Projects,** and **Sample Evaluation of a Track Rehabilitation Project.** Both reports will be published shortly by the U.S. Department of Transportation.

4 These regulations for IRR computation were published by the Federal Railroad Administration in the **Federal Register,** Volume 42, No. 16, January 25, 1977, pp. 4652-4659.

5 See, for example, the Task Force on Railroad Productivity, op. cit., Chapter VIII, and Morton, Alexander L., "Balkanization in the Railroad Industry," in **Proceedings—Fifteenth Annual Meeting,** Transportation Research Forum, Chicago, 1974, pp. 14-17.

6 In addition to the reports referenced in note 3 above, the other reports in the **Rail System Investment Analysis** series are: "Literature Search," "Description of the Railroad Investment Process," "Financial Analysis of Sample Investment Projects," "Industry Perspective," "National Economy Perspective."