This hopefully would be an evolutionary step toward the ultimate role -- that of rail planning, policy analysis, and policy advocate. Today, the rail agencies within the Conrail region range across a spectrum moving toward rail planning/policy/advocate role. I think this evoluation is desirable and will happen. My hope is that the evolution occurs rapidly enough to assist beneficially the evolution which the industry must undertake.

Conclusion:

The relationship between Conrail and the state rail planning agencies within Conrail's service region has been dynamic, vibrant and generally productive. Implementation of new federal programs has required extensive problem-solving, innovation, and patience. But collectively, the relationship has progressed to mutual respect and, I think, reciprocal needs among the industry and the State agencies.

Our hope is that the foundation created under difficult circumstances is firm, from which to launch an even more ambitious effort under equally crisis-like environments. Rail service can survive as a vital ingredient in the nation's economic revitalization, if industry and public policy makers work together. An environment must be created conducive to the industry's evolution towards its future, yet presently unknown, dimensions. State government can provide an essential contribution to this evolution.

## SOUTHERN PACIFIC'S VIEW OF THE STATES' RAILROAD PLANNING

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I strongly believe that the states will play a particularly important role in determining the future dimensions of the Nation's rail network. Certainly in the early era of railroad construction and development, the states were an important force shaping the rail network, and I am convinced this will be repeated before the twentieth century is ended.

The role of federal aid in encouraging the dedication of scarce, private capital to the risky proposition of constructing railroad lines throughout a largely undeveloped nation in the last century is well known. But what is often overlooked is that the states played a similar role, as did many cities and towns.

Some states constructed railroads. Pennsylvania, for instance, constructed the Allegheny Portage Railroad and the Philadelphia and Columbia Railroad. The state of Georgia constructed the Western and Atlantic and operated the road successfully until after the Civil War.

Other forms of aid were also provided by the states. In the early decades of railroad building, many railroads were granted monopoly privileges, which provided protection from competition for a limited period of time. Some states provided banking privileges to railroad corporations; the idea seemed to be that profits from banking operations were more assured than those from railroad operations, and thus could be used to entice the subscription of stock from otherwise reluctant investors in amounts equally divided between a jointly-controlled banking and railroad operation. The exemption from taxation for a limited number of years was also provided as an incentive to railroad development by at least nineteen states. North Carolina provided the most unusual form of aid as it turned over gangs of convicts on favorable terms to a number of railroads; for example, the Cape Fear & Yadkin Railroad was constructed entirely by convicts.

But the principal form of aid from the states was provided in the form of direct financial aid to encourage railroad development. The Federal Coordinator of Transportation estimated an amount in excess of $200 million was ultimately provided, including stock subscriptions of $40 million, loans of $80 million, railroad bond guarantees of $45 million, and land donations of 49 million acres valued at $48 million. 1/

My point in delving into this bit of history is simply to demonstrate how crucial were the states in developing the railroad system during the last century. Of course, there were sound economic and political reasons for doing so because there was no other feasible means of surface transportation for much of the country. Thus, to the extent a locality was unable to find itself linked into the rail system, it truly had no economic future. From this perspective, the eagerness of the people to obtain improved transportation facilities and their willingness to provide the direct financial aid and other assistance to do so are readily understood. For it is evident the people knew very well that the economic future of their communities and of their states depended on the availability of rail transportation facilities.

Although competing modes of transportation are more fully developed today, railroads still play an important role in the economic fabric of the states and, of course, of the nation. Although less crucial than our forefathers viewed them in earlier times, railroads still provide freight services which cannot be duplicated without incurring the penalties of higher transportation costs, reduced economic activity, increased highway deterioration, and greater fuel consumption and environmental damage.

But the government-sponsored development of the nation's multimodal transportation infrastructure has significantly changed the economic legitimacy of the existing railroad network. In point of fact, the ubiquitous highway system comprises approximately 3.5 million miles, more than 15 times the 200,000 mile route system of the nation's rail network. As that highway system was developed and expanded during the past half century, patterns of intercity freight transportation changed accordingly. The resulting shift of traffic from rail to highway and the declining rail share of the intercity freight market are well documented.

But the end result is that the rail network which was developed when railroads were the only feasible national transportation mode is far too extensive and over-developed given today's conditions.

The extensive debate which preceded the passage of the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) considered the extent to which restructuring of this rail network should occur. Strengthening the nation's private enterprise rail system through consolidation in order to permit the carriers to compete intermodally and intramodally with efficiency and economy so as to assure their financial solvency was determined by the Congress to be one important public policy objective to be pursued. In addition, the Congress recognized that portions of the rail network's light density lines constituted a financial burden on the rail carriers which they could no longer bear. As a result, a shift in public policy was provided so as to permit the abandonment of financially non-viable light density lines, unless their retention was deemed essential to meet either the social or political goals of the affected states. Broadly stated, the basic responsibility for determining the economic importance of each state's light density line has been placed jointly upon state rail planners and the rail carriers serving each state. Together, these two shifts in public policy which promote restructuring of the rail network will significantly reshape both the railroad industry and the rail network during the next twenty-five years.

The Existing Railroad Network

As required by Section 503 of the 4R Act, on January 19, 1977 the U.S. Department of Transportation issued a report entitled "Final Standards, Classification, and Designation of Lines of Class I Railroads in the United States." The purpose of this report was to develop framework for classifying the lines of Class I railroads into categories of main lines and branch lines, and to designate each line segment of the entire Class I rail system into its appropriate category within that framework. In its report, the Department of Transportation established the following categories for the designation of rail lines:

(1) A Main Lines: . 20 million or more gross tons per year and major Transportation Zone connectivity needed for through moves of defense related shipments.
(2) B Main Lines: . at least five, but less than 20 million, gross tons
(3) A Branch Lines: . at least one, but less than 5 million gross tons.
(4) B Branch Lines: . less than 1 million, gross tons

In addition to these categories, DOT also categorized 18,900 route miles as existing in a "corridor of consolidation potential." Such corridors were defined as those whose end points are major markets connected by three or more parallel through routes operated by three or more carriers, and in which the practical traffic handling capacity of the combined routes exceeds the actual traffic density by 50 percent or more; the route mileage in this category of lines is obviously expected to shrink by an unstated amount over time as the number of parallel, main line routes is reduced.

As a result of its classification of the U.S. rail system, the following table summarizes route mileage by DOT's line designations:

| | Route Mileage | Percent of Total Route Mileage |
|---|---|---|
| Main Lines: | | |
| Category A | 50,400 | 26.0% |
| Category B | 48,800 | 25.2 |
| Total | 99,200 | 51.1% |
| Branch Lines: | | |
| Category A | 41,300 | 21.3% |
| Category B | 53,500 | 27.6 |
| Total | 94,800 | 48.9% |
| Grand Total: | 194,000 | 100.0% |

As should be expected, distribution of traffic density over the existing railroad network is greatly skewed. At one end of the spectrum, about one-third of the rail mileage (65,000 miles) carries only one percent of total gross ton miles. At the other end, about 20 percent of the rail mileage (39,000 miles) carries about two-thirds of total rail traffic.

Financially Non-Viable Light Density Lines

The existing traffic density distribution implies that substantial portions of the lightly-used rail network will be eliminated in time, based on micro-economic analyses of the revenues to be lost and costs to be saved by eliminating specific line segments. Clearly, the 53,500 miles of Category B branch lines with traffic density less than one million gross tons annually are most likely to be eliminated as uneconomic during the next twenty-five years.

An earlier DOT report [2/] had predicted that 18.1 percent of the 141,000 miles--or 25,500 miles--located outside the Northeastern region were potentially uneconomic light density lines. Although this DOT study utilized as its generalized economic viability criterion the origination and/or termination of an average of 70 carloads per mile per year, it provides some estimate of the amount of rail mileage outside the Northeast likely to be financially non-viable.

In the Final System Plan [3/] more precise economic methodology was applied to light density lines located within the Northeast. As a result, the Final System Plan concluded that 6,918 miles of road were not financially viable.

Combined, the results of these two studies suggest that about 32,400 route miles of the existing rail network are already financially non-viable.

The most sophisticated analysis which has been applied to the entire rail network was performed by Dr. Robert G. Harris of the University of California. In his working paper No. SL-7705 [4/] which involved the application of several highly refined micro-economic models to the existing Class B branch line mileage, he selected as most appropriate two models which indicated that between 35,300 miles and 47,000 miles of light density line were not financially viable. The lower quantity of route mileage which Dr. Harris found to be not financially viable approximates the total derived from the combination of the Final System Plan's results and the U.S. DOT study of May 1976.

As Dr. Harris discusses for his 35,300 mile estimate, the dollar benefits of a large scale light density line abandonment program are not insignificant to the railroad industry. Using his model, he predicted that an immediate $1.5 billion would accrue from the sale of land and salvageable assets associated with these lines whereas the rehabilitation costs which would not be incurred due to the abandonment of these lines would approximate $2 billion; both estimates are stated in 1977 dollars. Compared to the total annual capital expenditures for roadway and structures by all Class I railroads of $350 and $550 million annually at present rates, it should be apparent the effects of these capital inflows and capital outflows not required are very substantial indeed. In addition, Harris points out that annual net operating cost savings would range between $138 and $303 million annually. Again, this is not insignificant compared to total annual net railway operating income for all Class I railroads which has ranged from $350 million to $650 million annually in recent years.

A Rationalized Railroad Network

As discussed, public policy has now shifted toward promoting a restructured rail industry. However, such a restructuring of the institutional components of the industry will also significantly reshape the U.S. railroad network.

As a member of the Federal Railroad Administration, I completed an unpublished study in 1971 entitled, "The Economic Potential of Rationalizing The Railroad Network." Although the primary objective of that analysis was to explore the economic potential of rationalizing the railroad network, achievement of that objective required that the possible size of as well as the traffic density distribution over such a rationalized railroad network first be estimated.

The primary research tool used in this study was a railroad network model which I created for the Federal Railroad Administration; that network model has been substantially refined by FRA in subsequent years. However, the railroad network model which I used was composed of approximately 2,600 separate rail route links and 490 traffic centroids. Forty-three major rail systems were identified separately. The network constituted 135,000 out of the then existing 207,000 route miles, including 78,500 of the 81,900 signalled route miles in the country; those signalled lines which were omitted were largely duplicate lines in urban areas. Each separate link of the rail network was coded to include:

(1) Railroad ownership;

(2) Capacity (expressed in net tons per day) based on the number of tracks and the signal system;

(3) Average link speed;

(4) Length in miles;

(5) State identification.

The traffic flows used to load the network were based on the 1965 One-Percent Waybill Sample. Total traffic loaded on the network model represented the total rail freight traffic flows handled by the "real world" railroad network. This traffic was concentrated into a nationwide zone system comprised of 490 discrete geographic areas, referred to as traffic centroids. Traffic data from the 1965 One-Percent Waybill Sample was aggregated into the 490-by-490 matrix. These zones, in turn, were linked to all railroads which pass through the geographic areas defined by the zones. Using a Fratar expansion process, the 1965 traffic levels were projected to 1980; 1980 traffic levels were used primarily in the network loadings which were performed. However, 1965 traffic was also assigned to the network to provide a base year for which the validity of the model could be tested by comparing its results to those of the "real world."

Railroad freight traffic was assigned to the railroad network model using the Urban Planning System 360 ogram Battery which had been developed by the U.S. Bureau of Public Roads. Use of this program battery permitted the assignment of traffic according to three alternative algorithms:

(1) Minimum time path;

(2) Minimum distance path;

(3) Some combination minimum time and minimum distance paths.

Neither of the three available algorithms was regarded as perfectly depicting existing rail service routes. Competitive carriers' service capabilities are simply too complex to be accurately presented with either of the available algorithms, encompassing intermediate terminals, plant maintenance condition, gradient and curvature conditions, and other factors as well as distance and speed capability. However, use of the minimum distance path seemed to give a more realistic result when defining the important lines of a rationalized railroad network.

Using 1980 traffic levels, the network model was loaded using minimum distance paths in four different cases, each of which concentrated traffic on the network somewhat differently. Recognizing the willingness of rail carriers to incur circuity in order to obtain maximum traffic concentration on a limited route structure, the case selected as best representing the rationalized railroad network provided the most highly concentrated traffic density on a limited number of route miles as well as the greatest number of route miles in the lowest density range.

For light density lines, results of the network model's best run showed rationalization of the network would downgrade 24,000 miles to the density range of less than one million gross-tons annually. These lines probably consist of duplicate feeder lines which permit competing carriers to reach the same traffic centers as well as other duplicate routes.

Combining the 35,300 to 47,000 mile range of estimated light density line mileage from the existing rail network which Dr. Harris found to be financially non-viable with the 24,000 miles of line which rationalization of the rail network would cause to be financially non-viable, present railroad route mileage seems likely to shrink by 60,000-70,000 miles.

However, neither Dr. Harris' estimates nor mine have considered that some route mileage carrying more than one million gross-tons is also probably not financially viable. In addition, it should be recognized that Dr. Harris utilized current revenue and cost levels. Given that traffic volume on light density lines is usually shrinking; given that the costs of rail operations on such lines continue to increase in concert with general rail inflationary trends without the opportunity for offsetting productivity improvements which can be applied to main line railroading; given the continuing inflation in rehabilitation costs; and given that the opportunity costs of retaining land and materials--which would not otherwise be required if light density line operations were terminated--will also increase with inflation; I conclude that additional light density line rail mileage will become financially non-viable during the next twenty-five years. Thus, by the year 2000, I anticipate that at least 75,000 miles of the current rail network will have been abandoned unless continued operations are subsidized to meet social or political goals.

For those heavy density lines carrying more than twenty million gross tons annually, results of the network model indicated the following traffic density distribution:

| Density | Route Miles | Percent of Total Traffic |
|---|---|---|
| Over 20 million gross tons | 36,000 | 81 |
| Over 30 million gross tons | 25,000 | 68 |
| Over 40 million gross tons | 17,000 | 54 |
| Over 50 million gross tons | 12,000 | 45 |

This contrasts with the 50,000 route miles in the existing rail network which carry 75 percent of total traffic today, with densities greater than 20 million gross tons annually. However, despite the increased concentration of traffic which rationalization will cause, the high-density, main line central core of railroad network would have an average capacity utilization ratio of less than 30 percent. Thus, substantial excess capacity to accommodate future demand beyond 1980 would remain in even the heaviest density portion of a rationalized rail network.

Such a rationalized railroad network would permit operating savings which were estimated in 1971 to range between $1.0 billion and $1.6 billion annually. Capital requirements would also be reduced while other capital now "frozen" in the rail network would be released.

Perhaps of greater importance, the increased concentration of traffic density on a more limited route structure would increase the economic justification for investments made on the 20,000 to 25,000-mile central core railroad network. Electrified locomotion and related technological applications such as electric or electro-pneumatic braking and coupling systems; complete rail/highway grade crossing separation; and automated train operations all become more achievable investment alternatives both if the magnitude of the required investment were reduced and if the flow of benefits generated by the investment were increased because of the rationalization of the railroad route structure.

## A Restructured Railroad Industry

As a result of the 4R Act, achieving the benefits of a rationalized rail network is now a public policy objective. To do so, however, first requires that the institutional structure of the railroad industry be simplified through consolidation. The formation of Conrail; DOT's continuing interest in restructuring the marginal Midwestern railroads; Burlington Northern's current proposal to acquire the Frisco; Southern Pacific's recent agreement to acquire Rock Island's Santa Rosa to St. Louis line; Union Pacific's current discussions toward the possible acquisition of Milwaukee's lines west of Butte, Montana; Southern Railway's study of possibly acquiring the Illinois Central Gulf; and Southern Pacific's discussions of a possible affiliation with Seaboard Coast Line are all actions which would modify the rail industry's existing institutional structure through consolidation; and therefore change the dimensions of the Nation's rail network. Similarly, actions by the individual carriers to eliminate those light density lines which do not contribute to their financial viability will shape the rationalized rail network.

## The Role of the States

Given this portrayal of the rationalized railroad network of the future as I envision it, and having considered the intent of Congress as expressed in the 4R Act, we in the railroad industry have defined specific goals and objectives which we seek to have the states adopt and achieve as their state rail planning efforts accelerate. On behalf of Southern Pacific Transportation Company, President D. K. McNear will describe these goals and objectives in his address on Friday, September 8; accordingly, I will not duplicate his effort.

However, I do hope Mr. McNear's discussion will clearly indicate the importance which Southern Pacific attaches to the states' rail planning activities. Since passage of the 4R Act, the Executive Department has assumed the responsibility for the state rail planning function at Southern Pacific. At the inception of this program, our Executive Department Vice President and I personally conducted orientation trips for the states' transportation planning personnel representing most of the states which we serve. Partly as a result of this personal contact, cooperation and coordination with the states as they are developing their plans has been easily accomplished.

From our viewpoint today, we would offer the following comments concerning the state rail planning process:

(1) Only Arizona of the 12 states which we serve has completed its State Rail Plan in final form.

(2) The affected states have thus far taken a most pragmatic position in their review of light density lines which we have shown to be not financially viable. Thus, although some have expressed concern that public funds would be wasted in pell-mell rush by the states to preserve each and every mile of railroad within their boundaries, we have not found this to be true. In fact, not a single light density line on Southern Pacific is now being operated under subsidy.

(3) The importance of continued land availability for railroad operating requirements and for industrial developments requiring rail access have both been well recognized by Oregon in the preparation of its draft state rail plan. We hope other states will give similar recognition to the often overlooked needs of railroads for land when land-use plans are prepared either at the state or at the local levels of government.

(4) We have been pleased that the individual states recognize the importance of efficient rail transportation to their economies. Equally important, the interrelationship of individual states' rail networks to the national rail network has not been overlooked.

(5) As Congress expressed in the 4R Act, continued private ownership and private operation of the railroads are also desired by those states which we serve. The states recognize the railroads' past financial returns are inadequate and must be improved if this objective is to be achieved.

(6) State attention has been focused on the need for increased and improved rail-highway grade crossing protection, extending to rail relocation projects in some urban areas. If the sort of automated, electrified, high volume rail system which I envision is to become reality, there is no question but that an exclusive rail right-of-way -- totally separated from highway vehicles and pedestrians -- is essential both for the safety and the efficiency of rail operations.

Because only one state rail plan has been completed in the 12 states we serve, I find it impossible to point to specific, concrete achievements which will be translated into improved service for the public and improved financial viability for the railroads. However, I do feel that the reservoir of railroad knowledge and railroad planning talent has now been filled at the state level, and I am optimistic toward the future achievement of those goals and objectives which we believe appropriate for states' rail planning activities.

Footnotes:

1/ Locklin, D. Philip. Economics of Transportation. Richard D. Irwin, Inc., Homewood, IL: 1960.

2/ U.S. Department of Transportation. Railroad Abandonments and Alternatives: A Report on Outside the Northeastern Region. Washington, D.C., May 1976.

3/ U. S. Railway Association. Final System Plan For Restructuring Railroads In The Northeast and Midwest Region. Washington, D.C.: July 26, 1975.

4/ Harris, Robert G. Rationalizing The Rail Freight Industry: A Case Study In Institutional Failure And Proposals For Reform. University of California at Berkeley, Dept. of Economics; September 1977.