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REPORT ON
STREAMLINE, LIGHT-WEIGHT,
HIGH-SPEED PASSENGER TRAINS

June 30, 1938



COVERDALE & COLPITTS
CONSULTING ENGINEERS
120 WALL STREET, NEW YORK

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REPORT ON STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

As of June 30, 1938

BY COVERDALE & COLPITTS

INTRODUCTION

ON January 15, 1935, we made a report on the performance of the first Zephyr type, streamline, stainless steel, light-weight, high-speed, 3-car passenger train, built by the Edward G. Budd Manufacturing Company for the Chicago, Burlington & Quincy Railroad Company, and placed in service on that company's line between Kansas City, Mo., and Omaha and Lincoln, Neb., on November 11, 1934.

In that report we drew attention to the marked decline in railroad passenger traffic in recent years and discussed the prospects for regaining a measure of that traffic through the adoption of modern light-weight high-speed equipment. We described the main features of the first Zephyr train, its new and unusual appointments and the superior structural characteristics resulting from the use of high tensile stainless steel and the shot-welding process. Various pertinent subjects were discussed in this report and, amongst other data, it included an estimate of the increase in traffic of the Kansas City-Omaha-Lincoln line since

the inauguration of service by the Zephyr and a statement comparing the cost of operation of the Zephyr with that of the trains it replaced.

On October 1, 1935, we made a further report on the three high-speed trains which had been placed in service earlier in that year between Chicago and the Twin Cities—the Twin Zephyrs of the Burlington, the Hiawathas of the Chicago, Milwaukee, St. Paul and Pacific, and the "400" of the Chicago and North Western. The report outlined in general terms the factors which are responsible for the low stage of passenger traffic on the railroads of the country and voiced the view that the marked and growing popularity of the new high-speed trains gave promise of greatly increased patronage following their more general adoption. The report included a brief description of the main characteristics of each of the three fast trains in the Chicago-Twin Cities service, with comparable statements of their respective revenues and expenses, and it indicated also in general terms the sources of the increased traffic.

In the past twenty years the travel habits of the people of the United States have expanded enormously. The remarkable growth in private automobile ownership has been almost wholly responsible for this greatly increased urge to travel. This new vehicle and, to a much lesser degree, the common carrier bus have now created an immense stream of highway passenger traffic which, in the course of its expansion, has absorbed about two-thirds of the movement that formerly was attached to the rails. It is in this new reservoir of highway travel, vast and continuing to expand, and susceptible in part of being restored to the railroads, that the hopes of railroad managements lie for regaining the patronage the roads once enjoyed.

It is necessary to point out that the situation in respect of the possibilities for retrieving passenger traffic is radically different from that pertaining to freight traffic. Only to a very limited extent can the railroads as a whole increase the freight traffic of the country. They now move a very large percentage of the total tonnage available for movement and the volume is dependent upon general business conditions and other factors entirely beyond the scope of railroad activity. It is true that one line, by more aggressive solicitation or improved service, may seize the freight traffic of another line, or another transportation agency, but it does so against strongly organized and constant resistance, and the total volume is not thereby increased.

On the other hand, the reservoir of highway passenger traffic waiting to be

tapped is twenty times larger than that which now flows toward the railroads, and the diversion of a portion of the automobile travel, however small in relation to the total volume, is prospectively of great importance in augmenting railroad revenues. And, to whatever extent automobile travel is diverted to the railroads, it will have the desirable effect of reducing highway congestion and, instead of generating resistance, will meet with favor on every hand.

Railroad officials for many years have given intensive study to this subject of the most practicable means for recovering passenger traffic, and have been keenly alive to the fact that, to the extent this purpose could be accomplished through the medium of the equipment, a vehicle must be presented to the public that would possess qualities of safety, speed, comfort and economy not possible in highway vehicles.

It would appear that the solution of the problem has been found in the streamline train.

Perhaps no other important new development in transportation has proceeded with greater rapidity than has the streamline train—not even the automobile or the airplane. It was only a few years ago that the Diesel-electric locomotive was made available for high-speed trains and that the materials suitable for light-weight train construction, such as aluminum alloy and high tensile stainless steel, could be obtained at prices within reach for large structures. Since then a whole new philosophy of light-weight car design and construction technic, of

decoration and comfort-affording facilities, has had to be formulated. Considering the consequences of accident at high speed, strength factors could not be sacrificed to light weight, so that designs along entirely new lines had to be perfected to withstand the rigorous stresses to which the new trains are subjected.

The leaders in this new field of light-weight streamline train construction have been the Pullman-Standard Car Manufacturing Company and the Edward G. Budd Manufacturing Company, in designing and perfecting construction methods for the building of light-weight cars, the former by the employment of aluminum alloy as the weight-saving medium, and the latter through the use of high tensile stainless steel and its shot-welding process; the Electro-Motive Corporation, in devising and adapting a Diesel two-cycle engine practicable for high-speed train service; the Union Pacific, with the cooperation of the Chicago and North Western and the Southern Pacific, the Chicago, Burlington & Quincy, and more recently the Atchison, Topeka and Santa Fe and the Chicago, Rock Island and Pacific, in reaching conclusions respecting the economic factors involved in fast train construction and operation and in establishing extensive streamline train services on their respective lines.

The early inauguration of high-speed services by the Hiawathas of the Chicago, Milwaukee, St. Paul and Pacific, the Flying Yankee of the Boston and Maine-Maine Central, the Comet of the

New York, New Haven and Hartford, the Royal Blue, Abraham Lincoln and Ann Rutledge of the Baltimore and Ohio-Alton, the Green Diamond of the Illinois Central, the Mercury of the New York Central, the Rebels of the Gulf, Mobile and Northern, and more recently by the Crusader of the Reading, has contributed greatly toward popularizing travel in high-speed streamline trains.

The fine new light-weight streamline trains, the Twentieth Century Limited and the Commodore Vanderbilt of the New York Central; and the Broadway Limited, the Liberty Limited, the General, and the Spirit of St. Louis of the Pennsylvania—all very recent installations—have received wide public approbation.

Heavy contributors to the comfort and safety of travel in the newer types of trains have been the designers and makers of air-conditioning equipment, high-speed brakes, light-weight sound and heat insulation, safety glass, roller-bearing trucks, and numerous other modern installations.

Perhaps no instrumentality not directly engaged in the construction or operation of railroad trains has done more to promote and encourage the introduction of the new types of passenger equipment on American railroads than has the Railway Age.

That much progress has been made in the establishment of fast passenger train service throughout the country is seen in the fact that, since the inauguration of the first 3-car Zephyr on the Burlington on November 11, 1934, and the

3-car City of Salina on the Union Pacific on January 31, 1935, some 76 high-speed trains with modern luxurious appointments have been introduced on different roads, a large number of which are of streamlined, light-weight construction.

These trains, however, have replaced or extended but a small fraction of the high-class passenger train service of the country. We believe the marked public appeal of the new types of trains, as evidenced by the financial success which has accompanied their operations which this report displays, fully confirms the opinion expressed in our 1935 reports with respect to them.

It is primarily the purpose of the present report to present in brief form such facts respecting the financial results of recent operations of the new streamline light-weight, high-speed passenger trains as are available to us for the information of those interested in the restoration of railroad passenger traffic. The financial statements and the data surrounding them pertaining to the individual trains and the lines on which they operate will, it is hoped, be of assistance to railroad officials in reaching conclusions as to the merits of high-speed service on their own roads.

We wish here to acknowledge the courtesies shown us by the gentlemen who are our sources of information for the facts given in this report:

- MR. S. T. BLEDSOE,
President: The Atchison, Topeka and Santa Fe Railway Company
- MR. RALPH BUDD,
President: Chicago, Burlington & Quincy Railroad Company
- MR. L. A. DOWNS,
President: Illinois Central Railroad Company
- MR. SAMUEL O. DUNN,
Editor: Railway Age
- MR. E. S. FRENCH,
President: Boston and Maine Railroad and Maine Central Railroad Company
- MR. JAMES E. GORMAN,
Trustee: The Chicago, Rock Island and Pacific Railway Company
- MR. W. M. JEFFERS,
President: Union Pacific Railroad Company
- MR. A. D. McDONALD,
President: Southern Pacific Company
- MR. HOWARD S. PALMER,
President: The New York, New Haven and Hartford Railroad Company
- MR. FRED W. SARGENT,
President: Chicago and North Western Railway Company
- MR. H. A. SCANDRETT,
Trustee: Chicago, Milwaukee, St. Paul and Pacific Railroad Company
- MR. EDWARD W. SCHEER,
President: Reading Company
- MR. I. B. TIGRETT,
President: Gulf, Mobile and Northern Railroad Company
- MR. DANIEL WILLARD,
President: The Baltimore and Ohio Railroad Company and Alton Railroad Company
- MR. F. E. WILLIAMSON,
President: The New York Central Railroad Company

PREFATORY REMARKS

The arrangement of the different sections of the report is partly chronological and partly geographical. The development of the streamline train was initiated and has been carried farther in the West than in the East, and it, therefore, seemed proper to begin the report with discussions of the trains of western lines and proceed eastward to the trains of roads in New England.

The report is based wholly on records compiled by the accounting staffs of the respective railroads, and the information given herein is, therefore, authoritative. The items in the statements are not, however, entirely comparable, one railroad with another, and care must be used in making comparisons of specific items, but it may be said that each statement presents an accurate record of the results of operation of the individual trains for the year ended June 30, 1938, or for a lesser period in the cases of trains installed within the year.

We have not included in the statements of REVENUES and EXPENSES of the trains the items of INTEREST, DEPRECIATION, TAXES and INSURANCE for the

reason that these are in the nature of fixed or overhead charges not directly attached to train operation. A further reason for not including the items of interest and depreciation is that the interest rates on one road may differ from those on another, while depreciation rates are still a matter of controversy and no uniform rate would be generally acceptable. Neither have we included TERMINAL RENTALS since they depend largely upon the local conditions of each route and are not informative in their application to other situations. The figures of NET REVENUE appearing in the statements are, therefore, subject to deductions for these items. All of the excluded items are susceptible of easy computation in any particular case.

The trains discussed in this report all have distinctive names. Many of them are run in duplicate, and to indicate that fact clearly and briefly in references to them we have taken the liberty of pluralizing their names. The two El Capitan trains, for example, we speak of as the El Capitans.

STREAMLINERS

UNION PACIFIC

GENERAL STATEMENT

The Union Pacific for long distance travel, in conjunction with the North Western and the Southern Pacific, and the Burlington for short distance services in its initial undertakings, were pioneers in the development of the streamline train and in introducing into them the modern conveniences and attractions which have completely transformed railroad travel.

Conscious of the growing necessity for faster and more comfortable railroad service on its long routes if it were to meet the competition of private automobiles, buses and airplanes and retain the position it had always held as a major passenger transportation agency between the East and the West, the Union Pacific began its investigations in 1932 with the purpose of effecting a substantial reduction in the time of transit between Chicago and the three Pacific Coast terminals—Los Angeles, San Francisco and Portland.

The conclusion was soon reached that to accomplish this purpose cars much lighter and with a lower center of gravity than the conventional types were necessary, and that a radically different type of motive power than the standard steam locomotive was also essential. The extensive studies and experiments of the Union Pacific, working in conjunction with the Pullman-Standard Car Manufacturing Company, the Electro-Motive Corporation, and others, were therefore directed toward producing equipment capable of meeting the new demands.

In this undertaking the Union Pacific was well equipped by experience and knowledge of the mechanical and economic problems involved. The McKeen car, gasoline driven, was the invention of a Union Pacific official. First placed in service in 1905, many are still in operation on the road. The gas-electric car, a later development, also found wide use on the Union Pacific.

It was a natural progression from these earlier types of internal combustion motive power to the Diesel-electric locomotive, which had been the subject of a vast amount of research and experimentation coincident with the development of the art of building light-weight cars. The combination of the two, the Diesel-electric locomotive, with its long range, and light-weight streamline cars, constituting a train of low center of gravity, seemed the answer to the problem of greater speed in passenger train movement. These advances, coupled with air-conditioning, better riding qualities, and greater travel conveniences and comforts than had hitherto been known in conventional trains, found expression in the first streamline train built in the United States.

The announcement by the Union Pacific on May 24, 1933, of the introduction to the transportation world of America's first "streamliner" created a sensation and captured the public imagination as perhaps nothing had done since the opening of the first transcontinental line in 1869. This train, built of aluminum alloy, as have been all subsequent

light-weight trains built by the Union Pacific, was completed early in 1934. It was immediately presented to the public in a widely publicized and astonishingly successful coast-to-coast tour and was later exhibited at the Century of Progress exposition. It was placed in regular service between Kansas City and Salina as the "City of Salina" on January 31, 1935, and is still operating on this route.

The Union Pacific was thus launched upon its extensive streamliner program. While its first streamliner was proceeding on its exhibition tour construction was begun of the second streamliner, the City of Portland, comprising six splendidly appointed cars, the first light-weight streamline train to carry sleepers. This train, completed in October, 1934, made a test run from Los Angeles to Chicago in 38 hours and 50 minutes, and to New York in 56 hours and 55 minutes. The run from Los Angeles to New York established a record which still stands. The train was placed in regular service on a 39¾-hour schedule between Chicago and Portland on May 5, 1935.

There followed in quick succession the magnificent streamliners, the City of Los Angeles, the City of San Francisco, the City of Denver and the Forty Niner, all of which are described herein.

Another step in the program of the Union Pacific to retrieve passenger traffic paralleling that of other lines was taken on July 1, 1935, when the Challenger, a conventional type train, planned to operate on a 60-hour schedule between Chicago and Los Angeles, was introduced. It was exclusively a coach and tourist sleeping car train and was the first train

to provide free stewardess service, low cost meals and many other innovations.

The first Challenger was an instant success and was soon operating in two sections. Almost immediately the service was extended to Portland and San Francisco. In 1937 five new light-weight streamline Challenger trains were placed in service, drawn by new high-speed steam locomotives especially designed for the purpose.

Note: The Challengers are operated on much slower schedules than the other Chicago-coast cities trains and are hauled by steam locomotives. The record of their performance is not, therefore, included in this discussion.

Thus, the fleet now comprises thirteen streamliners—City of Salina, City of Portland, City of Los Angeles (two), City of San Francisco, City of Denver (two), Forty Niner, and the Challengers (five). That the program as a whole has been remarkably successful, the statements which follow will show.

The streamline trains which now operate on the Union Pacific constitute a large fleet and are all, with one exception, long distance trains, reaching Chicago over the rails of the North Western; Portland, Los Angeles and Denver over its own lines, and San Francisco over the lines of the Southern Pacific.

The exception is the City of Salina, a Union Pacific train, to which reference has already been made.

Before proceeding to discuss the operations of the long distance streamline trains in which the three railroads participate, it seems advisable first to comment on the performance of the City of Salina.

CITY OF SALINA

UNION PACIFIC

The City of Salina was the first streamline light-weight train to be built in the United States. After a country-wide tour of exhibition, including a showing at the Century of Progress in Chicago in the latter part of 1934, it was placed in regular operation on January 31, 1935, following by about four months the inauguration in service of the first Zephyr.

It is a 3-car train, built of aluminum alloy by Pullman. The front car houses in the forward end a 600 H.P. oil-electric power unit. The train is fully articulated, weighs 124 tons, is 204'6" long, contains 108 coach seats and a buffet. The center of gravity of the forward car is 54 inches above the rail, and of the other two cars, 45 inches.

The train makes a daily round trip between Kansas City and Salina and between Kansas City and Topeka. The daily mileage of the train is 510 and its average speed about 56 miles per hour.

This train, a pioneer in light-weight streamline construction, retains the popularity it won when first introduced to the public.

PHYSICAL CHARACTERISTICS OF LINE

Kansas City-Salina, 187 Miles

About 36% of the line is double track.

RULING GRADES beyond the terminal are 0.6% in both directions.

MAXIMUM CURVES are generally 4°, ranging in a few cases up to 6°. About 81% of the line is straight track.

WEIGHT OF RAIL—90 to 110-pound.

TIES are all treated.

BALLAST—Sherman Hill granite.

RESULTS OF OPERATION OF
CITY OF SALINA

The revenues and expenses of the City of Salina for the year ended June 30, 1938, are given in the statement on the following page. They include the figures for substitute steam service and a relatively small amount of extra steam service.

The Net Revenue of the City of Salina for the year ended June 30, 1938, was 25.5 per cent of the Revenues.

GROWTH OF TRAFFIC

The revenues of the City of Salina (exclusive of dining car revenues) by six-months' periods were as follows:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$69,381	
Jan. 1 to June 30, 1936	73,540	\$142,921
July 1 to Dec. 31, 1936	71,175	
Jan. 1 to June 30, 1937	75,551	146,726
July 1 to Dec. 31, 1937	80,885	
Jan. 1 to June 30, 1938	74,624	155,509

This train is operated on comparatively short runs (Kansas City-Salina, 187 miles, and Kansas City-Topeka, 68 miles) in a section served by competing railroads and traversed by excellent highways.

REVENUES AND EXPENSES

Item	KANSAS CITY-TOPEKA-SALINA	
	1 Train, 3 Passenger Train Cars, a part of one car containing the power plant. One round trip Kansas City-Salina, and one round trip Kansas City-Topeka, daily.	
	Operation begun January 31, 1935	
	Amount	Per Train-Mile
REVENUES (Streamline and steam trains)	\$ 155,509	\$.828
TRAIN EXPENSES		
Wages of crew (Streamline trains)	42,841	.267
Fuel oil " "	9,640	.060
Lubricants " "	5,224	.033
Train supplies and expenses " "	6,839	.042
Repairs " "	21,645*	.135
Total " "	86,189	.537
Steam train substitute service	22,601	
Steam train extra sections	1,874	
Total (steam train)	24,475	.899
TOTAL Train Expenses	110,664	.589
Dining-Buffer loss	-5,119	-.027
TOTAL, Including D-B Loss	115,783	.616
NET REVENUE	39,726	
Per cent of Revenue	25.5	.212
Route-miles	255	
Train-miles:		
Streamline trains	160,637	
Steam trains	27,237	
Total train-miles	187,874	
Passenger-miles	7,013,840	

* Overhaul repairs which, between January 1, 1936, and June 30, 1938 (2½ years), totaled \$45,909, or \$0.131 per train-mile, are not included.

STREAMLINERS

NORTH WESTERN-UNION PACIFIC

The North Western-Union Pacific fleet of streamliners consists of five trains, the City of Portland, the first City of Los Angeles (an extra-fare train), the City of Denver (two trains), and the second City of Los Angeles (also an extra-fare train). They comprise in all 50 cars, of which 23 are sleeping cars. The cars are of aluminum alloy construction and were built by Pullman. The trains are hauled by Diesel-electric locomotives, in units of 1,200 and 1,800 H.P., built by the Electro-Motive Corporation.

The City of Portland is fully articulated. The cars of the first City of Los Angeles are fully articulated. Six cars in each of the two City of Denver trains are articulated in pairs. Ten cars in the second City of Los Angeles are articulated in pairs.

The center of gravity of the power cars in the City of Portland, the first City of Los Angeles and the City of Denver is 52 inches above the rail. That of the cars in the two first-mentioned trains is about 49 inches, and in the latter train about 52½ inches; that of the power cars of the second City of Los Angeles is 57 inches and of the cars 55 inches.

All of these trains and the City of San Francisco, but more particularly perhaps the City of Portland, can be said to have made streamline train history. As before stated, the City of Portland was the first streamline train to carry sleeping cars and the first to be operated in trans-continental service. It still holds the record for the run from Los Angeles to New York, made in October 1934.

The second City of Los Angeles and the City of San Francisco (to be described later) are the longest streamline trains yet built and are powered with the largest Diesel-electric locomotives.

These long distance sleeping car trains, more especially the newer City of Los Angeles, are the acme of travel luxury. They and the City of San Francisco and the trains of similar equipment of the Santa Fe and the Burlington are representative of the highest development of the art of streamline train construction, in beauty of line, in distinctive interior decorations and in the provision of features intended to add to the comfort of passengers. The statements of earnings which follow are indicative of their popularity.

CONSIST OF TRAINS

The makeup of the North Western-Union Pacific streamliners and the order of the cars in the trains are as follows.

The City of Portland is a 6-car train, composed of a power car of 1,200 H.P., a baggage-dormitory, a diner-lounge, 3 sleeping cars, and a coach-buffet car. The first City of Los Angeles is a 10-car train—2 power cars of 1,200 H.P. each, a mail-baggage car, a baggage-dormitory-kitchen car, a diner-lounge, 5 sleepers, a coach, and a coach-buffet car.

The two 10-car City of Denver trains each comprise 2 power cars of 1,200 H.P. each, a baggage car, a baggage and mail car, a tavern car decorated in early frontier style, with bar, 2 coaches, a diner with cocktail lounge, 3 sleeping cars, and a sleeper-observation car. The second City of Los Angeles is a 14-car train—3 power cars of 1,800 H.P. each, a baggage-dormitory car, 2 coaches, 2 diners, a dormitory-club car, 7 sleepers, and an observation-lounge car.

The City of Portland makes a round trip between Chicago and Portland every six days.

The two City of Los Angeles trains each make a round trip between Chicago and Los Angeles every six days.

The two City of Denver trains each make a one-way trip daily between Chicago and Denver.

WEIGHT, SEATING CAPACITY, ETC.

The weight, seating capacity, etc., of the North Western-Union Pacific streamliners, and the dates when placed in service, are given in the tables at the bottom of this page.

DAILY MILEAGE

The average daily mileage of these trains is as follows:

Name	Average Daily Mileage
City of Portland (1 train)	757*
City of Los Angeles (First) (1 train)	766*
City of Denver (2 trains)	2,096
City of Los Angeles (Second) (1 train)	766*
Total Daily Mileage	4,385

* Round trip mileage divided by 6.

The average speed of the City of Denver is 66 miles per hour and of each of the other three trains about 58 miles per hour.

PHYSICAL CHARACTERISTICS OF LINES

The five streamliners described above traverse North Western and Union Pacific lines. Two trains, the streamliner City of San Francisco and the Forty Niner, are operated over lines of the North Western, Union Pacific and Southern Pacific. These two trains will be discussed later in the report. Since the routes of the two latter trains partially overlap those of the former, it is advisable to describe here briefly the physical characteristics of the routes of the seven trains.

Run and Train		Date Placed in Service	Power Cars Exclusively Weight (Tons)	Trailing Cars Weight (Tons)	All Units	
					Weight (Tons)	Length
(1)	CITY OF PORTLAND Chicago-Portland 1 power car and 6 trailing cars	5/5/35	83	225	308	454'11"
(2)	CITY OF LOS ANGELES (First) Chicago-Los Angeles 2 power cars and 10 trailing cars	9 cars 5/15/36 1 car 2/21/38	185	353	538	778'5"
(3 and 4)	CITY OF DENVER Chicago-Denver 2 trains of 2 power cars and 10 trailing cars each Each train	6/18/36	215	452	667	864'0"
(5)	CITY OF LOS ANGELES (Second) Chicago-Los Angeles 3 power cars and 14 trailing cars	12/27/37	438	818	1,256	1,267'0"

	Salable Seats			Other Seats			Total All Seats
	Coach	Pullman	Total	Dining	Lounge	Total	
(1)	54	64	118	30	10	40	158
(2)	86	102	188	40	17	57	245
(3 and 4)	100	82	182	40	32	72	254
(5)	104	141	245	104	71	175	420

*North Western. Chicago-Council Bluffs,
485 Miles*

All of the line is double track.

RULING GRADES are about 0.70% in both directions, except between Chicago and West Chicago, 30 miles, where they are much lighter.

MAXIMUM CURVES are 3° except in a few instances, mostly at terminals. About 84% of the line is straight track.

WEIGHT OF RAIL—110 and 112-pound.

TIES are all treated.

BALLAST—Between Chicago and Boone, 340 miles, crushed rock; balance, gravel.

*Union Pacific. Council Bluffs-Portland,
1,787 Miles*

About 56% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Council Bluffs-Summit	5	1.25	
Summit-Cheyenne	50.5	0.70	0.70
Cheyenne-Laramie	56	1.55	0.82
Laramie-Granger	281	0.82	0.82
Granger-Pocatello	214	0.75	1.50
Pocatello-Huntington	336	1.45	1.45
Huntington-Rieth	177	2.21	2.00
Rieth-Portland	213	0.50	0.60
Average Distance	1,787		

MAXIMUM CURVES are 3° east of Huntington with a few 6° curves, mainly in Idaho. West of Huntington curves range up to 10° with much lighter curves predominating. About 79% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 100-pound predominating.

TIES are all treated.

BALLAST—Sherman Hill granite east of Granger and gravel west.

*Union Pacific. Council Bluffs-Los Angeles,
1,813 Miles*

About 63% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Council Bluffs-Summit	5	1.25	
Summit-Cheyenne	50.5	0.70	0.70
Cheyenne-Laramie	56	1.55	0.82
Laramie-Evanston	351	0.82	0.82
Evanston-Ogden	76	0.37	1.14
Ogden-Salt Lake City	36	0.50	0.50
Salt Lake City-Milford	207	0.80	0.80
Milford-Yermo	414	1.00	2.20
Yermo-Colton	99	1.60	2.20
Colton-Los Angeles	64	0.90	1.00
Average Distance	1,813		

MAXIMUM CURVES are 3° between Council Bluffs and Evanston, 917 miles; 3° between Ogden and the Utah-Nevada line, 321 miles, with occasional 4° curves; 7° between Evanston and Ogden, 76 miles, and up to 10° west of the Utah-Nevada line. Much lighter curves than the maximum predominate throughout the whole line. About 85% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, with 100-pound predominating east and 90-pound west of Salt Lake City.

TIES are all treated.

BALLAST—Sherman Hill granite east of Ogden and gravel and crushed rock elsewhere.

*Union Pacific. Council Bluffs-Denver,
563 Miles*

About 67% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Council Bluffs-Summit	5	1.25	
Summit-Julesburg	360	0.60	0.50
Julesburg-La Salle	151	0.30	0.30
La Salle-Denver	47	0.60	0.46
Average Distance	563		

MAXIMUM CURVES are 2° with lower rates predominating except at terminals. About 92% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 100-pound predominating east and 90-pound west of Julesburg.

TIES are all treated.

BALLAST—Sherman Hill granite.

STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS 17

Southern Pacific. Ogden-Oakland, 781 Miles

About 75% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Ogden-Lucin	103	0.40	0.37
Lucin-Alazon	77	1.35	1.40
Alazon-Weso	180	0.43	0.40
Weso-Sparks	177	0.42	0.40
Sparks-Roseville	138	1.91	2.42
Roseville-Elvas	15	0.25	0.40
Elvas-Sacramento	3	0.38	0.30
Sacramento-Benicia Jct.	51	0.43	0.41
Benicia Jct.-Martinez	6	0.45	1.00
Martinez-Oakland Pier	31	0.26	0.22
Average Distance	781		

MAXIMUM CURVES range up to 10°23' on mountainous subdivisions with lighter maximum curves ranging from 1°30' to 6° on other subdivisions. About 72% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 110 to 112-pound predominating.

TIES are all treated.

BALLAST—Crushed rock predominating with balance gravel, slag and cinders.

RESULTS OF OPERATION OF NORTH WESTERN-UNION PACIFIC STREAMLINERS

Following is a statement of the revenues and expenses of the North Western-Union Pacific streamliners, with the exception of the second City of Los Angeles, for the year ended June 30, 1938. For the latter train the statement covers the period from the beginning of operations (December 27, 1937) to June 30, 1938.

Note: The railroad companies' proportion of sleeping car revenues on these trains is necessarily an estimate. It is a relatively small amount and is included in the item of Revenues.

REVENUES AND EXPENSES

Item	Routes and Trains								TOTAL FIVE TRAINS	
	CITY OF PORTLAND		CITY OF LOS ANGELES* (First)		CITY OF DENVER		CITY OF LOS ANGELES (Second)			
	Chicago-Portland		Chicago-Los Angeles		Chicago-Denver		Chicago-Los Angeles			
	1 Train, 6 Pass. Tr. Cars. One round trip every 6 days.		1 Train, 10 Pass. Tr. Cars. One round trip every 6 days.		2 Trains, each 10 Pass. Tr. Cars. Each one-way trip daily.		1 Train, 14 Pass. Tr. Cars. One round trip every 6 days.			
	Operation Begun 5/5/35		Operation Begun 5/15/36		Operation Begun 6/18/36		Operation Begun 12/27/37			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.
REVENUES	\$ 373,032	\$ 1.368	\$ 550,567	\$ 2.335	\$ 1,717,833	\$ 2.229	\$ 512,906	\$ 3.535	\$ 3,154,338	\$ 2.215
TRAIN EXPENSES										
Wages of crew	110,925	.407	95,098	.404	239,931	.312	59,601	.411	505,555	.355
Fuel	12,205	.045	17,919	.076	73,475	.095	26,023	.179	129,622	.091
Lubricants, etc.	4,935	.018	8,978	.038	28,926	.038	9,344	.064	52,183	.037
Train supplies and expenses	13,036	.048	13,745	.058	56,297	.073	13,574	.094	96,652	.068
Repairs	91,811	.336	121,221	.514	420,346	.545	116,130	.800	749,508	.526
TOTAL Train Expenses	232,912	.854	256,961	1.090	818,975	1.063	224,672	1.548	1,533,520	1.077
Dining-Buffer loss	-19,580	-.072	-20,760	-.088	-34,196	-.044	-12,001	-.083	-86,537	-.061
TOTAL, Incl. D-B loss	252,492	.926	277,721	1.178	853,171	1.107	236,673	1.631	1,620,057	1.138
NET REVENUE	120,540	.442	272,846	1.157	864,662	1.122	276,233	1.904	1,534,281	1.077
Per cent of Revenue	32.3		49.6		50.3		53.9		48.6	
Route-miles	2,272		2,298		1,048		2,298			
Train-miles	272,640		235,828		770,280		145,073		1,423,821	
Passenger-miles (est.)	10,614,000		13,744,000		38,625,000		13,445,000		76,428,000	

* Out of service 12/26/37 to 2/21/38.

As will be seen from the foregoing statement, the Net Revenues range from 32.3 per cent of the Revenues in the case of the City of Portland to 53.9 per cent in the case of the second City of Los Angeles, an average for all trains of 48.6 per cent.

GROWTH OF TRAFFIC ON NORTH WESTERN-UNION PACIFIC STREAMLINERS

Following is a statement of the revenues of the North Western-Union Pacific streamliners (exclusive of dining car revenue) by six-months' periods from July 1, 1936, to June 30, 1938:

Period	6 Months	Year
<i>City of Portland</i>		
July 1 to Dec. 31, 1936	\$198,630	
Jan. 1 to June 30, 1937	142,464	\$341,094
July 1 to Dec. 31, 1937	188,377	
Jan. 1 to June 30, 1938	184,655	373,032
<i>City of Los Angeles (First)</i>		
July 1 to Dec. 31, 1936	358,504	
Jan. 1 to June 30, 1937	347,283	705,787
July 1 to Dec. 31, 1937	338,786	
Jan. 1 to June 30, 1938*	211,781	550,567
* Out of service Dec. 26, 1937, to Feb. 21, 1938.		
<i>City of Denver (2 Trains)</i>		
July 1 to Dec. 31, 1936	967,309	
Jan. 1 to June 30, 1937	754,037	1,721,346
July 1 to Dec. 31, 1937	953,403	
Jan. 1 to June 30, 1938	764,430	1,717,833
<i>City of Los Angeles (Second)</i>		
Dec. 27, 1937, to June 30, 1938	512,906	

It will be seen that the revenues of these trains for corresponding periods have remained substantially uniform. This is due to the fact that the trains have been extraordinarily popular and have been booked substantially to capacity throughout the whole period of their operation. The larger second City of Los Angeles, installed December 27, 1937, replacing the first City of Los Angeles for a period of about two months, after which both trains were operated, has also been heavily patronized.

The revenues (exclusive of dining car revenue) of the North Western-Union Pacific Chicago-Los Angeles streamline extra-fare trains have been approximately proportional to the number of cars in this service, which tends to confirm the statement that capacity has been a major factor in limiting the traffic on these trains.

These trains and the Challengers, whose operations are not recorded here for reasons before stated, have been remarkably successful, as the foregoing statements show, both in their public appeal and as business undertakings.

STREAMLINERS

NORTH WESTERN-UNION PACIFIC-SOUTHERN PACIFIC

In addition to the streamliners operated jointly by the North Western and the Union Pacific two important extra-fare trains, the City of San Francisco and the Forty Niner, are operated over a route embracing lines of the North Western, Union Pacific and Southern Pacific, each train making a round trip every six days between Chicago and San Francisco.

The City of San Francisco is a 14-car train built by Pullman, hauled by a Diesel-electric locomotive of three units of 1,800 H.P. each, built by the Electro-Motive Corporation. It is an aluminum alloy train, splendidly appointed and handsomely decorated, and is largely similar in type and consist to the second City of Los Angeles. Eight cars are articulated in pairs. The train consists of a baggage-dormitory car, a coach, 2 diners, a dormitory-club car, 8 sleeping cars, and an observation-lounge car.

The center of gravity of the power cars is 57 inches above the rail, and of the cars 55 inches.

The Forty Niner is an 8-car sleeping car train, hauled by a streamline steam locomotive. The first 6 cars are rebuilt and refurnished conventional cars, consisting of a baggage-dormitory-kitchen car, a diner-lounge and 4 sleeping cars. They are followed by 2 cars of light-weight construction, articulated, built by Pullman. They are both sleeping cars, the rear car containing also a buffet-lounge.

WEIGHT, SEATING CAPACITY, ETC.

The weight, seating capacity, etc., of the North Western-Union Pacific-Southern Pacific Chicago-San Francisco extra-fare trains, the City of San Francisco and the Forty Niner, and the dates when placed in service, are given in the following statements:

DAILY MILEAGE

The average daily mileage of each of these trains is 753 (round trip mileage divided by 6).

Run and Train		Date Placed in Service	Power Cars or Locomotives Exclusively Weight (Tons)	Trailing Cars Weight (Tons)	All Units	
					Weight (Tons)	Length
(1)	CITY OF SAN FRANCISCO Chicago-San Francisco 3 power cars and 14 trailing cars	1/2/38	441	832	1,273	1,292' 0"
(2)	FORTY NINER Chicago-San Francisco Steam locomotive and 8 trailing cars	7/8/37	N.W. 226 U.P. 284 U.P. 346 S.P. 330	661	887 945 1,007 991	644' 2" 649' 9" 659' 11" 664' 2"

	Salable Seats			Other Seats			All Seats
	Coach	Pullman	Total	Dining	Lounge	Total	
(1)	54	168	222	104	66	170	392
(2)		114	114	42	36	78	192

20 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

The average speed of the City of San Francisco is 57 miles per hour, and of the Forty Niner 46.

PHYSICAL CHARACTERISTICS OF LINE

This route partially overlaps those of the North Western-Union Pacific streamliners and its physical characteristics are briefly described in that section of the report.

RESULTS OF OPERATION OF CITY OF SAN FRANCISCO AND FORTY NINER

Following is a statement of the revenues and expenses of these trains for the respective periods of their operation to June 30, 1938.

Note: The railroad companies' proportion of sleeping car revenues on these trains is necessarily an estimate. It is a relatively small amount and is included in the item of Revenues.

The Net Revenue of the City of San Francisco from beginning of operation, January 2, 1938, to June 30, 1938 (six months), was 60.4 per cent, and of the Forty Niner from beginning of operation, July 8, 1937, to June 30, 1938 (one year), was 56.3 per cent. The average of the two was 58.5 per cent.

GROWTH OF TRAFFIC ON CITY OF SAN FRANCISCO AND FORTY NINER

The City of San Francisco described in this report replaced another streamline train of the same name which was placed in service on June 14, 1936. The first City of San Francisco consisted of 2 power cars and 9 trailing cars fully articulated; the present train, as noted on

REVENUES AND EXPENSES

Item	CHICAGO-SAN FRANCISCO				TOTAL TWO TRAINS	
	CITY OF SAN FRANCISCO		FORTY NINER			
	1 Train, 14 Passenger Train Cars. One round trip every 6 days.		1 Train, 8 Passenger Train Cars. One round trip every 6 days.			
	Operation Begun 1/2/38		Operation Begun 7/8/37			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.
REVENUES	\$ 568,964	\$ 4.188	\$ 500,242	\$ 1.883	\$ 1,069,206	\$ 2.662
TRAIN EXPENSES						
Wages of crew	61,231	.451	91,222	.343	152,453	.380
Fuel	25,351	.187	41,483	.156	66,834	.166
Lubricants, etc.	7,758	.057	4,778	.018	12,536	.031
Train supplies and expenses	13,181	.097	11,397	.043	24,578	.061
Repairs	105,300	.775	48,467	.183	153,767	.383
TOTAL Train Expenses	212,821	1.567	197,347	.743	410,168	1.021
Dining-Buffer loss	-12,552	-.092	-21,280	-.080	-33,832	-.084
TOTAL, Incl. D-B loss	225,373	1.659	218,627	.823	444,000	1.105
NET REVENUE	343,591	2.529	281,615	1.060	625,206	1.557
Per cent of Revenue	60.4		56.3		58.5	
Route-miles	2,259		2,259		4,518	
Train-miles	135,848		265,720		401,568	
Passenger-miles (est.)	18,249,000		17,313,000		35,562,000	

a preceding page, consists of 3 power cars and 14 trailing cars, 8 of which are articulated in pairs. The train provides unsurpassed travel luxuries and is booked to capacity, frequently with a long waiting list.

The Forty Niner, a well appointed and comfortable all-Pullman train, is scheduled about 10 hours faster than the regular daily train service and about 9 hours

slower than the City of San Francisco. The train is unusually popular.

The following statement showing the revenues of the City of San Francisco and the Forty Niner (exclusive of dining car revenues) by six-months' periods from July 1, 1936, to June 30, 1938, includes the period of operation of the first City of San Francisco as well as that of the second train which replaced it:

Period	*North Western-Union Pacific-Southern Pacific Extra-Fare Service—Chicago-San Francisco					
	CITY OF SAN FRANCISCO		FORTY NINER		TOTAL TWO TRAINS	
	6 Months	Year	6 Months	Year	6 Months	Year
July 1 to Dec. 31, 1936	\$ 360,723	\$	\$	\$	\$ 360,723	\$
Jan. 1 to June 30, 1937	346,568	707,291			346,568	707,291
July 1 to Dec. 31, 1937	337,421		243,592		581,013	
Jan. 1 to June 30, 1938	568,964	906,385	256,650	500,242	825,614	1,406,627

* June 14, 1936, to July 8, 1937— 9 Trailing cars, 1 train
 July 8, 1937, to Jan. 2, 1938—17 Trailing cars, 2 trains
 Jan. 2, 1938, to June 30, 1938—22 Trailing cars, 2 trains

The revenues of the City of San Francisco and the Forty Niner, shown in the above statement, like those of the City of Portland, the City of Los Angeles and the City of Denver, set forth in the foregoing, have been approximately proportional to the number of cars in the respective services in different periods, which is a confirmation of the statement that the trains are patronized

substantially to the full extent of their capacity.

These two trains, like the long distance streamliners previously discussed, have demonstrated in a striking manner the popularity of modern travel conveniences and comforts and high-speed schedules. The financial success which has attended their operation is clearly displayed in the foregoing statements.

STREAMLINERS

SOUTHERN PACIFIC

In addition to the streamliners operated by the Southern Pacific in conjunction with the Union Pacific and the North

Western, the Southern Pacific operates two important pairs of streamline trains, the Sunbeams and the Daylights.

SUNBEAMS

SOUTHERN PACIFIC

The two streamline 8-car trains, the Sunbeams, were placed in service between Houston and Dallas on September 19, 1937. The cars were built by Pullman and are drawn by oil-burning steam locomotives, also streamlined, built by the American Locomotive Company. The strength members of the car bodies are of Corten steel assembled by welding. The side sheathing is of stainless steel and the roof covering of Corten. The cars are so designed with respect to couplers, face plates and floor levels that they may be used with conventional equipment. Four cars are articulated in pairs. The center of gravity of the cars is 55 inches above the rail. The order of the cars in the train is—a baggage car, a coach exclusively for colored passengers, 2 articulated units of 2 coaches each, a parlor car, and a diner-observation car.

The weight of the locomotive is 281 tons, cars 394 tons, total 675 tons. The length of the train is 671'4".

The seating capacity of each train is as follows:

Salable Seats		
Coach for colored passengers	48	
4 Coaches articulated in pairs	200	
Parlor car	32	
Total Salable Seats		280
Non-Salable Seats		
Parlor car—card section	8	
Diner-lounge		
Dining section	32	
Lounge	14	
Total Non-Salable Seats		54
Grand Total		334

Each train makes a daily one-way non-stop trip between Houston and Dallas under the name Sunbeam, for which the results of operation are shown later in

this report. Since June 5, 1938, this equipment has made an additional daily one-way trip between Houston and Dallas under the name Hustler, on a slower schedule, making intermediate stops. Prior to that date, the Hustler was composed of conventional equipment and no detailed records were kept of its earnings and expenses.

Running as the Sunbeams, the two trains leave the terminals, traveling in opposite directions, at the close of the business day and cover the 264 miles without stops in 285 minutes, or at an average speed of 56 miles per hour. This fast schedule is maintained notwithstanding the necessity for complying with numerous speed restrictions through cities.

Passengers have been profuse in their praise of the conveniences, interior decorations, the excellent dining car service and the quiet, homelike atmosphere prevailing on the trains. The large rest rooms and their appointments, particularly in the coaches, have been the subject of much favorable comment.

PHYSICAL CHARACTERISTICS OF LINE

Houston-Dallas, 264 Miles

About 3% of the line is double track.

RULING GRADES are 1% in each direction.

MAXIMUM CURVES range up to 4°, with 2° curves prevailing. About 96% of the line is straight track.

WEIGHT OF RAIL—36.8% 90-pound; 22.5% 110-pound; and 40.7% 112-pound.

TIES—90% creosoted; remainder are cypress and zinc treated.

BALLAST—47.7% crushed rock; 33.2% coarse gravel; and 19.1% light gravel.

RESULTS OF OPERATION OF SUNBEAMS

Following is a statement of the revenues and expenses of the Sunbeams for the period of their operation to June 30, 1938:

REVENUES AND EXPENSES

Item	HOUSTON-DALLAS	
	2 Trains, each Steam Loco. and 8 Pass. Tr. Cars. Each one-way trip daily.	
	Operation begun 9/19/37	
	Amount	Per Train-Mile
REVENUES	\$ 152,705	\$ 1.015
TRAIN EXPENSES		
Wages of crew	43,726	.291
Fuel	17,844	.119
Lubricants, etc.	3,213	.021
Enginehouse expenses	7,525	.050
Train supplies and expenses	23,098	.154
Power plant maintenance	7,128	.047
Train maintenance	17,061	.113
TOTAL Train Expenses	119,595	.795
Dining-Buffer loss	-7,974	-.053
TOTAL, Incl. D-B Loss	127,569	.848
NET REVENUE	25,136	.167
Per cent of Revenue	16.5	
Route-miles	264	
Train-miles	150,480	
Passenger-miles (est.)	5,853,000	

The Net Revenue of the Sunbeams from the beginning of operation to June 30, 1938, was 16.5 per cent of Revenues.

GROWTH OF TRAFFIC ON SUNBEAMS

The following statement shows monthly revenues of the Sunbeams (exclusive of dining car revenues) from the beginning of operation to June 30, 1938:

MONTHLY REVENUES

(Exclusive of Dining Car Revenues)

Month	Revenues	Month	Revenues
1937—September	\$7,360	1938—January	\$16,654
October	19,831	February	14,251
November	16,887	March	15,433
December	19,845	April	14,912
		May	16,271
		June	16,356

Note: The sum of the monthly figures above does not agree with the figure of Revenues in the preceding statement because adjustments applicable to prior months are included in period figures to avoid distorting current month's results.

The Sunbeams have been in operation too short a time to furnish evidence of the probable future growth of traffic on them.

DAYLIGHTS

SOUTHERN PACIFIC

The Daylights were placed in service on March 21, 1937, between Los Angeles and San Francisco, 471 miles, replacing conventional trains of the same name. Each of the two trains consists of a specially designed steam locomotive built by the Lima Locomotive Works, to serve both on mountain grades and at high speeds on level grades, and 14 light-weight, attractively styled and splendidly appointed streamline cars built by Pullman, principally of Corten steel. Six cars in each train are articulated in pairs. The weight of each train is—locomotive, 417 tons; cars, 712 tons; total, 1,129 tons; the length—locomotive, 109'10"; cars, 1,028'9"; total, 1,138'7". The center of gravity of the cars is about 55 inches above top of rail.

Each train consists of a baggage-coach, 8 coaches, a parlor car, a parlor-observation car, a coffee shop car, a tavern car, and a diner. The salable seats total 497, of which 440 are coach and 57 parlor car seats. Other seats include 56 in the coffee shop, 56 in the tavern car, 40 in the diner, and 18 in lounges, a total of 170. The total of all seats is 667.

The trains each make a one-way trip daily, covering the 471 miles in 9 hours and 45 minutes, or at an average speed of 48.3 miles per hour. The entire trip is made in daylight along the scenic California coast route.

PHYSICAL CHARACTERISTICS OF LINE

Los Angeles-San Francisco, 471 Miles

About 19% of the line is double track.

RULING GRADES are 2.2% in the mountain section between Santa Margarita and Pismo, 27 miles, and 1% on the balance of the line.

MAXIMUM CURVES are 6°, with a few sharper curves on mountainous sections and at terminals. 72% of the line is straight track.

WEIGHT OF RAIL—110 to 131 pounds, with 110-112-pound predominating.

TIES are all treated.

BALLAST—Crushed rock.

RESULTS OF OPERATION OF DAYLIGHTS

Following is a statement of the revenues and expenses of the Daylights for the year ended June 30, 1938. The statement does not include the revenues and expenses of second sections.

REVENUES AND EXPENSES

Item	LOS ANGELES-SAN FRANCISCO	
	2 Trains, Each Steam Loco. and 14 Pass. Tr. Cars. Each one-way trip daily.	
	Operation begun 3/21/37	
	Amount	Per Train-Mile
REVENUES	\$ 1,580,871	\$ 4.631
TRAIN EXPENSES		
Wages of crew	140,158	.411
Fuel	86,748	.254
Lubricants, etc.	4,879	.014
Enginehouse expenses	16,980	.050
Train supplies and expenses	99,857	.293
Power plant maintenance	35,292	.103
Train maintenance	94,429	.277
TOTAL Train Expenses	478,343	1.402
Dining-Buffer-News Service loss	-6,335	-.018
TOTAL, Incl. D-B-N S Loss	484,678	1.420
NET REVENUE	1,096,193	3.211
Per cent of Revenue	69.3	
Route-miles	471	
Train-miles	341,337	
Passenger-miles (est.)	80,000,000	

The Revenues of the Daylights are not only extraordinarily large, but the proportion of the Net Revenue to the Revenues is also high.

GROWTH OF TRAFFIC OF DAYLIGHTS

The statement opposite shows monthly revenues of the Daylights (exclusive of dining, buffet, and news service revenues) from the beginning of operation to June 30, 1938:

The record of earnings of the Daylights since March 21, 1937, when conventional trains were replaced by the present splendid streamline light-weight equipment especially designed for the service and the schedules were shortened from 11 hours to 9 hours and 45 minutes, is outstanding. During the summer vacation season more particularly, as the foregoing statement shows, the earnings have been very large, reaching a figure of \$6.28 per train-mile in August 1937.

MONTHLY REVENUES

(Exclusive of Dining, Buffet, and News Service Revenues)

Month	Revenues	6 Months	Year
1937—March	\$50,367		
April	116,598		
May	128,450		
June	154,738		
July	175,403		
August	183,259		
September	156,311		
October	129,927		
November	100,407		
December	105,606	\$850,913	
1938—January	124,745		
February	100,881		
March	115,612		
April	113,287		
May	117,103		
June	158,330	729,958	\$1,580,871

ZEPHYRS

CHICAGO, BURLINGTON & QUINCY

GENERAL STATEMENT

The Burlington, along with the Union Pacific, was a pioneer in the development of the streamline train, the former in its earlier undertakings in the establishment of short distance services, working in conjunction with the Edward G. Budd Manufacturing Company and using stainless steel as the weight-saving medium; the latter for transcontinental runs in cooperation with the Pullman-Standard Car Manufacturing Company, using aluminum alloy. In finding solutions of the motive power problems of both roads the Electro-Motive Corporation has played a major part.

The Burlington, like the Union Pacific and a number of other roads, early realized the necessity for providing more attractive equipment, better service, and greater speed in its passenger train operations if it were to stem the tide of fast receding railroad passenger traffic. Its extensive studies of the subject led to the conclusion that to accomplish this object trains of a type entirely different from those in general use must be offered the traveling public. With a knowledge of the fact that the bulk of railroad passenger business is short distance travel, the Burlington's first efforts were devoted to the production of a train possessing qualities of speed, comfort and convenience, and beauty of design and decoration that would assure the diversion of a measure of the local traffic from the highway stream.

The wide experience of the company in the operation of gas- and oil-electric trains pointed to the Diesel-electric engine as the most desirable motive power to meet the new and more exacting requirements. In cooperation with the Budd Company a stainless steel car was produced in the first train built that has constantly stood the test of service under the most extreme conditions of high-speed operation.

So successful have been the short distance services thus far established that the company's more recent activities have been directed to the long distance field, and with equally or even more satisfactory results.

With these beginnings, in which the principles and philosophy underlying stainless steel light-weight high-speed streamline train construction were laid down, the company has rapidly extended its high-speed services to the point where it now possesses one of the largest fleets of streamline trains in the country.

The first Zephyr train, as soon as completed, made a nation-wide exhibition tour and attracted extraordinary interest in every direction. On May 26, 1934, it made a non-stop run from Denver to Chicago in 13 hours and 5 minutes, at an average speed of 77.6 miles per hour, breaking all previous records, entering the grounds of the Century of Progress exposition at the completion of the trip, where it remained on display for a short time prior to its placement in service. It was assigned to the line between Kansas City, Mo., and Omaha and Lincoln, Neb., on November 11, 1934, thus gaining the distinction of being the first streamline Diesel-electric train to be placed in regular service in the United States. The train has been in continuous operation on this route since that date.

Initially the train consisted of three cars, the forward car containing the power plant. On June 24, 1935, a 40-seat coach was added, which was removed from the train on June 28, 1938, and replaced by a dinette coach with 24 coach seats and 16 dinette seats. This train was the subject of our report of January 15, 1935.

The original Twin Zephyrs began operation between Chicago and the Twin Cities for single daily service on April 21, 1935. Favorable public reaction led to

the establishment of double daily service on June 2, 1935. Each of these trains comprised 3 cars, the forward car in each case containing the power plant. Following various reassignments of trains and cars, further public demand resulted in the introduction, on December 18, 1936, of the fifth and sixth Zephyrs—the larger Twin Zephyrs. These trains consist of 7 cars each, one of which is the power plant car. In September 1937, a dinette coach was added to each train containing 40 coach seats and 16 dinette seats.

The fourth Zephyr train to be built has been operating continuously (except for interruptions in reassignment of trains) between St. Louis, Mo., and Burlington, Ia., since October 28, 1935, and consists of 4 cars, with the power plant in the forward car. Shortly before it was placed in regular service this train, during a trial run, attained a speed of 122 miles per hour for a short distance.

The seventh and eighth Zephyr trains were assigned to service between Chicago and Denver on November 8, 1936. Two of the original 3-car Zephyr trains had been operated on this route between May 31, 1936, and November 8, 1936. The larger Denver Zephyrs originally comprised 12 cars each, of which 2 cars in each train were power cars. On May 27, 1938, a dinette coach was added to each train, containing 48 coach seats and 16 dinette seats. One of these trains, on October 23, 1936, captured the record from the first Zephyr in making a non-stop run of 1,017 miles from Chicago to Denver in 12 hours and 12 minutes, at the average speed of 83.4 miles per hour.

One of the original 3-car Twin Cities Zephyrs was placed in service between Fort Worth, Dallas and Houston on October 1, 1936. On July 8, 1938, a 40-seat coach was added to this train. The other original 3-car Twin Cities Zephyr was placed in service between St. Louis and Kansas City on December 20, 1936.

BRIEF DESCRIPTION OF BURLINGTON ZEPHYRS

The smaller Zephyr trains, and all cars in the larger trains, including the sleeping cars in the Denver Zephyrs, are of stainless steel and were built by the Edward G. Budd Manufacturing Company. All of the trains are propelled by Diesel-electric locomotives. The power plants in the smaller trains and the power cars and power plants in the larger trains were built by the Electro-Motive Corporation. Those of the smaller 3- and 4-car trains are 600 H.P., of the Twin Cities trains 1,800 H.P. (2 power plants of 900 H.P. each) and of the Denver trains 3,000 H.P. (2 power plants of 900 H.P. each and 1 of 1,200 H.P.). All trains are fully articulated with the exception of the Denver trains, which are partially articulated.

The center of gravity of the power cars in the case of the smaller trains is 52½ inches above the rail, and of the Twin Cities and Denver power cars about 57 inches. That of the cars in the smaller trains is about 48 inches above the rail, and in the larger trains about 52 inches.

The fundamental structural features of the newer Zephyr trains follow the description of the original Zephyr given in our report of January 15, 1935. Great thought and care have been devoted to the questions of structural strength and of beauty of exterior design and interior decoration. All known travel conveniences and comforts were embodied in these trains at the time they were built, but each new train surpasses the earlier ones in luxuriousness of appointments, in riding qualities and in passenger appeal.

CONSIST OF TRAINS

The Kansas City-Lincoln Zephyr consists of 4 cars—a power plant, mail compartment and baggage car, a baggage-boiler room car, a dinette-coach, and a coach-parlor-observation car.

28 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

The Fort Worth - Dallas - Houston Zephyr, the Sam Houston, and the St. Louis-Burlington Zephyr, the Mark Twain, are 4-car trains. The former consists of a power plant, baggage and express car, with space for colored passengers, a dinette coach, a coach and a coach-parlor-observation car. The latter is somewhat similar in car arrangement to the Kansas City-Lincoln Zephyr. The St. Louis-Kansas City Zephyr, the Ozark State, is a 3-car train.

The two Twin Cities Zephyrs are each composed of a power car and 7 passenger train cars, the latter comprising a bar and baggage car, a dinette coach, 2

coaches, a diner, a parlor car, and a parlor-observation car.

The two Denver Zephyrs are each composed of 2 power cars and 11 passenger train cars, the latter comprising a baggage and mail car, a cocktail lounge and bar car, a dinette coach, 2 coaches, a diner, 4 sleeping cars, and a lounge-parlor-buffet car.

WEIGHT, SEATING CAPACITY, ETC.

The weight, seating capacity, etc., of the Burlington Zephyrs, and the dates when placed in their present service, are given in the following tables:

Run and Train		Date Placed in Service	Power Cars Exclusively Weight (Tons)	Trailing Cars Weight (Tons)	All Units	
					Weight (Tons)	Length
(1)	ORIGINAL ZEPHYR Kansas City-Omaha-Lincoln 4-car train	11/11/34			151	261'2"
(2)	SAM HOUSTON Fort Worth-Dallas-Houston 4-car train	10/1/36			136	246'6"
(3)	OZARK STATE St. Louis-Kansas City 3-car train	12/20/36			112	196'10"
(4)	MARK TWAIN St. Louis-Burlington 4-car train	10/28/35			145	280'1"
(5 and 6)	TWIN CITIES ZEPHYRS Chicago-Twin Cities 2 trains of 1 power car and 7 trailing cars each Each train	12/18/36				
(7 and 8)	DENVER ZEPHYRS Chicago-Denver 2 trains of 2 power cars and 11 trailing cars each Each train	11/8/36	112	267	380	531'4"
			216	506	723	971'3"

	Salable Seats					Other Seats				Total All Seats
	Coach	Sleepers	Cocktail Annex	Parlor	Total	Dining	Cocktail Lounge	Parlor Lounge and Card Playing	Total	
(1)	64			12	76	16			16	92
(2)	88			22	110	16			16	126
(3)	48			22	70	16			16	86
(4)	60			16	76	16			16	92
(5 and 6)	160		16	46*	222	48	18	10	76	298
(7 and 8)	150	93	16	10	269	56	18	30	104	373

*43 Parlor. 3 Drawing room.

DAILY MILEAGE OF ZEPHYR TRAINS

The daily mileage of Zephyr trains on the Burlington has now reached imposing proportions.

The line to which the eight Zephyrs are assigned and the average daily mileage of each are given in the table below:

Name	Run	Average Daily Mileage
Original Zephyr	Kansas City-Omaha-Lincoln	500
Sam Houston	Fort Worth-Dallas-Houston	566
Ozark State	St. Louis-Kansas City	558
Mark Twain	St. Louis-Burlington	442
Twin Cities Zephyrs (2 trains)	Chicago-Twin Cities	1,764
Denver Zephyrs (2 trains)	Chicago-Denver	2,072
Total Daily Mileage		5,902

Since the beginning of Burlington Zephyr service, the accumulated mileage of the trains to June 30, 1938, totals over five million, with the high average availability over the whole period of 95.4 per cent.

The maximum speeds of the Burlington Zephyrs are limited by rules to the following:

	Miles Per Hour
On tangent track and 1 degree curves	90-100
On 2 degree curves	85
On 3 degree curves	65

The average scheduled speed of the Twin Cities and Denver Zephyrs is about 65 miles per hour.

PHYSICAL CHARACTERISTICS OF LINES

For a proper understanding of the conditions under which the trains operate a

brief description of the physical characteristics of the lines is given below:

Kansas City-Omaha-Lincoln, 250 Miles

About 44% of the line is double track.

RULING GRADES—There are no adverse grades except between Omaha and Lincoln, where the ruling grades are 1.25% in each direction.

MAXIMUM CURVES are 1° except in terminals and near ends of double track at Weston, Iatan and Armour. About 81% of the line is straight track.

WEIGHT OF RAIL—90 to 112 pounds, 90-pound predominating.

TIES are treated throughout.

BALLAST—Cinders, slag and chatts, cinders predominating.

Fort Worth-Dallas-Houston, 283 Miles

The line is practically all single track.

RULING GRADES range from 0.70% to 1.00%.

MAXIMUM CURVES are generally 1° between Fort Worth and Dallas, 34 miles, 2° between Dallas and Teague, 97 miles, and 3° between Teague and Houston, 152 miles. About 88% of the line is straight track.

WEIGHT OF RAIL—85 and 90-pound, the latter predominating.

TIES are all treated.

BALLAST—Crushed rock, gravel, burnt gumbo and shell, the latter predominating.

St. Louis-Kansas City, 279 Miles

About 12% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	Westbound %	Eastbound %
St. Louis-West Alton (C.B. & Q.)	20	0.5	0.5
West Alton-Old Monroe (C.B. & Q.)	32	None	None
Old Monroe-Mexico (C.B. & Q.)	65	0.5	0.5
Mexico-Slater (Alton)	67	1.0	0.8
Slater-Kansas City (Alton)	95	1.1	1.0

30 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

MAXIMUM CURVES except at terminals are 1° on the C. B. & Q. between St. Louis and Mexico, 117 miles, and 2° on the Alton between Mexico and Kansas City, 162 miles. About 78% of the line is straight track.

WEIGHT OF RAIL—85 to 112 pounds, 100-pound predominating, including the Alton.

TIES are 100% treated on the C. B. & Q. and largely untreated on the Alton.

BALLAST—Stone, crushed slag and chatts, stone and crushed slag predominating.

St. Louis-Burlington, 221 Miles

About 13% of the line is double track.

RULING GRADES range from 0.30% to 0.50%.

MAXIMUM CURVES are 2° except at terminals. About 77% of the line is straight track.

WEIGHT OF RAIL—85 to 112 pounds, 90-pound predominating.

TIES are treated throughout.

BALLAST—Principally chatts, gravel and slag; chatts predominating.

Chicago-Twin Cities, 441 Miles

About 75% of the line is double track.

RULING GRADES over the greater portion of the route are 0.30% in both directions. Between Aurora and Savanna, 107 miles, the ruling grades are 0.80% westbound and 0.88% eastbound. On the Great Northern between St. Paul and Minneapolis, 10 miles, which is used by the Burlington, the ruling grades are 1.65% westbound and 0.70% eastbound.

MAXIMUM CURVES—1° curves prevail except at terminals. About 76% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 100-pound largely predominating.

TIES are all treated.

BALLAST—Principally washed and crushed gravel and chatts.

Chicago-Denver, 1,036 Miles

About 46% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Chicago-Aurora	38	0.5	0.3
Aurora-Galesburg	124	0.87	0.4
Galesburg-Burlington	43	None	0.4
Burlington-Creston	188	0.66	0.66
Creston-Pacific Junction	82	0.66	0.66
Pacific Jct.-Lincoln via Plattsmouth	81	1.25	1.25
Pacific Jct.-Lincoln via Council Bluffs	76	1.25	1.25
Lincoln-Hastings	96	0.60	0.45
Hastings-McCook	132	0.5	0.5
McCook-Denver	254	0.7	0.7
Average Distance	1,036		

MAXIMUM CURVES—1° curves prevail except at terminals. About 81% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 100-pound largely predominating.

TIES are all treated.

BALLAST—Principally chatts, gravel and slag. Gravel predominates east, and slag west of the Missouri River.

RESULTS OF OPERATION OF ZEPHYRS

Following is a statement of the revenues and expenses of the Zephyrs for the year ended June 30, 1938.

Attention should be drawn to the fact that the revenues and expenses shown in this statement are for the particular equipment unit regardless of the route on which it may have been operated. The route shown, in each case, is that to which the equipment unit is now regularly assigned.

Note: The railroad company's proportion of sleeping car revenues on the Denver Zephyrs is necessarily an estimate. It is relatively a small amount and is included in the item of Revenues.

REVENUES AND EXPENSES

Item	Routes and Trains												TOTAL EIGHT TRAINS	
	KANSAS CITY-OMAHA-LINCOLN		FORT WORTH-DALLAS-HOUSTON		ST. LOUIS-KANSAS CITY		ST. LOUIS-BURLINGTON		CHICAGO-TWIN CITIES		CHICAGO-DENVER			
	1 Train, 4 Pass. Tr. Cars. One round trip daily.		1 Train, 4 Pass. Tr. Cars. One round trip daily.		1 Train, 3 Pass. Tr. Cars. One round trip daily.		1 Train, 4 Pass. Tr. Cars. One round trip daily.		2 Trains, each 7 Pass. Tr. Cars. Each one round trip daily.		2 Trains, each 11 Pass. Tr. Cars. Each one-way trip daily.			
	Operation Begun 11/11/34		Operation Begun 10/1/36		Operation Begun 12/20/36		Operation Begun 10/28/35		Operation Begun* 12/18/36		Operation Begun** 11/8/36			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.		
REVENUES	\$ 221,072	\$ 1.221	\$ 199,619	\$.982	\$ 158,285	\$.814	\$ 144,270	\$.944	\$ 1,220,569	\$ 1.902	\$ 1,088,938	\$ 2.759	\$ 4,032,763	\$ 1.893
TRAIN EXPENSES														
Wages of crew	46,535	.257	50,431	.248	50,636	.260	37,902	.248	167,874	.262	201,992	.269	557,370	.262
Fuel	4,054	.022	3,965	.020	4,182	.022	3,620	.024	30,599	.048	58,900	.078	105,420	.049
Lubricants	579	.003	1,180	.006	759	.004	703	.005	6,769	.010	13,211	.018	23,201	.011
Train supplies and expenses	5,973	.033	9,659	.047	8,832	.045	5,576	.036	33,878	.053	38,497	.051	102,415	.048
Power plant maintenance	9,159	.051	23,426	.115	13,909	.072	12,130	.079	64,597	.101	103,908	.137	227,129	.107
Train maintenance	11,729	.065	22,267	.110	14,064	.072	13,108	.086	49,520	.077	52,087	.069	162,775	.076
TOTAL Train Expenses	78,029	.431	110,928	.546	92,382	.475	73,039	.478	353,337	.551	470,595	.622	1,178,310	.553
Dining-Buffer loss	-4,362	-.024	-6,792	-.033	-8,656	-.045	-7,883	-.052	-43,810	-.068	-49,112	-.065	-121,015	-.057
TOTAL, Incl. D-B Loss	82,391	.455	117,730	.579	101,038	.520	80,922	.530	397,147	.619	520,107	.687	1,299,325	.610
NET REVENUE	138,681	.766	81,909	.403	57,247	.294	63,348	.414	823,422	1.283	1,168,831	2.072	2,733,438	1.283
Per cent of Revenue	62.7		41.0		36.2		43.9		67.5		75.1		67.8	
Route-miles	250		283		279		221		441		1,036		2,510	
Train-miles	181,000		203,352		194,529		152,769		641,608		757,068		2,130,326	
Passenger-miles	8,234,506		9,709,959		7,303,243		5,438,027		64,760,743		93,174,868		188,621,346	

* Operation begun with 3-car trains 4/31/35.

** Operation begun with 3-car trains 5/31/36.

The above statement shows that the total Net Revenue for the eight trains for the year ended June 30, 1938, was 67.8 per cent of the Revenues. From this standpoint the most profitable trains during the year were the two large Chicago-Denver trains, 75.1 per cent; and the least profitable, the St. Louis-Kansas City train, 36.2 per cent.

GROWTH OF TRAFFIC ON ZEPHYRS

Following is a statement of the revenues (exclusive of dining car revenues) of the Zephyrs by six-months' periods from January 1, 1935, to June 30, 1938.

These figures for the last two six-months' periods agree with those given in the foregoing statement of Revenues and Expenses for the year ended June 30, 1938, only in the cases of the Kansas City-Omaha-Lincoln Zephyr and the Fort Worth-Dallas-Houston Zephyr. This seeming discrepancy is due to the fact that reassignment of trains has taken place on several occasions and the figures of revenues and expenses are so kept by the company as to apply to the equipment as units, while the revenues by six-months' periods attach to the route. The totals for the year for all trains and routes are in agreement.

32 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

	6 Months	Year
Jan. 1 to June 30, 1935		
Kansas City-Omaha-Lincoln (Operation begun 11/11/34)	\$110,271	\$110,271 (6 months)
July 1 to Dec. 31, 1935		
Kansas City-Omaha-Lincoln	102,271	
Chicago-Twin Cities	316,012	
TOTAL	418,283	
Jan. 1 to June 30, 1936		
Kansas City-Omaha-Lincoln (On other runs 4/27 to 11/7/36)	69,596	
St. Louis-Burlington (On other runs 5/17 to 12/31/36)	58,110	
Chicago-Twin Cities	303,327	
TOTAL	431,033	849,316
July 1 to Dec. 31, 1936		
Kansas City-Omaha-Lincoln (On other runs 4/27 to 11/7/36)	29,609	
Chicago-Twin Cities	423,972	
Chicago-Denver	536,237	
TOTAL	989,818	
Jan. 1 to June 30, 1937		
Kansas City-Omaha-Lincoln	107,741	
Fort Worth-Dallas-Houston	95,072	
St. Louis-Kansas City	76,747	
St. Louis-Burlington (On other runs 6/17 to 9/8/37)	67,435	
Chicago-Twin Cities	524,258	
Chicago-Denver	916,795	
Chicago-Burlington (2nd Section Denver Zephyr— 6/18 to 6/30/37)	4,225	
TOTAL	1,792,273	2,782,091
July 1 to Dec. 31, 1937		
Kansas City-Omaha-Lincoln	111,267	
Fort Worth-Dallas-Houston	109,496	
St. Louis-Kansas City	88,090	
St. Louis-Burlington (On other runs 6/17 to 9/8/37, 12/8 to 12/15 and 12/27 to 12/31/37)	42,071	
Chicago-Twin Cities	648,356	
Chicago-Denver	1,144,003	
Chicago-Burlington (2nd Sec- tion Denver Zephyr—7/1 to 9/7/37)	23,471	
TOTAL	2,166,754	
Jan. 1 to June 30, 1938		
Kansas City-Omaha-Lincoln	109,805	
Fort Worth-Dallas-Houston	90,132	
St. Louis-Kansas City	79,827	
St. Louis-Burlington (On other runs 4/3 to 4/8/38)	65,681	
Chicago-Twin Cities	563,450	
Chicago-Denver	957,114	
TOTAL	1,866,009	4,032,763
GRAND TOTAL		\$7,774,441

The Zephyr trains have been filled substantially to capacity from the beginning which is illustrated by the fact that the growth of traffic on them has been closely related to the increase in the number of cars in the service.

The Zephyrs in the Chicago-Twin Cities service have in three years grown from twin three-car trains, each making a one-way trip daily, to twin seven-car trains, each making a round trip daily. This expansion of the service by successive steps is evidence of the growth in demand for accommodations on the trains.

As bearing on the question of how passengers would have traveled had Zephyr trains not been available to them, the following statement shows composite results of passengers' answers to periodical questionnaires:

	Total Passengers	Number who would have used Auto, Bus or Plane	Per Cent of Total
Pioneer Zephyr	18,610	2,906	15.6
Twin Zephyrs	4,700	1,077	22.9
Sam Houston Zephyr	2,733	1,244	45.5
Ozark State Zephyr	2,352	960	40.8
Total	28,395	6,187	21.8

While these data do not give complete answers to the question of the extent of traffic growth due to the introduction of the Zephyrs, they, and other similar statistics not included herein, prove conclusively that the new trains have induced a large number of persons to travel

by rail who would not otherwise have done so. In the opinion of the officials also the benefits derived in added freight traffic have been quite important.

The record of the Burlington in the operation of its Zephyr trains has been one of continuous and rapid growth, both in the number and size of trains and in

the replacement of smaller trains with larger ones.

The foregoing statements clearly display the extent to which these developments have won the approval of the traveling public. The financial success attained in the operation of the Zephyrs is outstanding.

HIAWATHAS

CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC

GENERAL STATEMENT AND BRIEF
DESCRIPTION OF NEW HIAWATHAS

In our report of October 1, 1935, we described and commented upon the great popularity of the original Hiawathas of the Milwaukee operating between Chicago and the Twin Cities and gave the operating results of these trains for the two months, June and July, 1935. Since then new cars of the same general design, built in the company's shops in 1936 and 1937, have replaced the original cars. The new cars are similar to the older cars in their structural features in that they are of light-weight construction, but Corten steel has been substituted for plain carbon steel, the vestibules are of a new closed type, and the center of gravity has been lowered to 50 inches above the rail. Since the date of this report new and finer Hiawathas have replaced the trains discussed herein.

The average daily mileage of each train is 422.

The following statement gives the consist, weight, etc., of each unit of the two

new 9-car Milwaukee Hiawathas. They are hauled by oil-burning Atlantic type streamline steam locomotives especially designed for the purpose and built by the American Locomotive Company. The cars are not articulated.

PHYSICAL CHARACTERISTICS OF LINE

Chicago-Twin Cities, 422 Miles

The line is double track throughout.

RULING GRADES between Chicago and Portage, 178 miles, are about 0.50% in both directions; between Portage and La Crosse, 104 miles, 0.66%; between La Crosse and St. Paul, 128 miles, 0.30%.

MAXIMUM CURVES are 1° between Chicago and Milwaukee, 85 miles, and 2° on balance of line. About 80% of line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 100-pound largely predominating.

TIES are all treated.

BALLAST—Gravel.

RESULTS OF OPERATION OF HIAWATHAS

The statement on the opposite page of the revenues and expenses of the regular

9-Car Train	Length Over All	Weight (Tons)	Seating Capacity	Total
1 Locomotive	88'8"	274		
1 Tap-Express	82'3"	48		
4 Coaches	329'0"	301	Main Room 208, Lounges 56	40
1 Diner	82'3"	51		264
1 Parlor Car	82'3"	48	Main Room 28, Lounges 8	48
1 Drawing Room				36
1 Parlor Car	82'3"	48	Main Room 22, Lounges 9, Drawing Room 7	38
1 Beaver Tail				
1 Parlor Car	82'3"	46	Main Room 26, Lounge 12	38
Total	828'11"	716		464

Hiawathas (i.e., exclusive of extra sections) for the year ended June 30, 1938:

REVENUES AND EXPENSES

Item	CHICAGO-TWIN CITIES	
	2 Trains, Steam Loco. and 9 Pass. Tr. Cars. Each a one-way trip daily.	
	Operation begun May 29, 1935	
	Amount	Per Train-Mile
REVENUES	\$	\$
	1,337,898	4.343
TRAIN EXPENSES		
Wages of crew	100,630	.326
Locomotive fuel (oil and coal)	54,213	.176
Water for locomotives	2,043	.007
Lubricants for locomotives	3,038	.010
Other supplies for locomotives	731	.002
Train supplies and expenses	30,482	.099
Locomotive repairs	71,689	.233
Passenger car repairs	83,575	.271
Enginehouse expenses	12,120	.039
TOTAL Train Expenses	358,521	1.163
Dining-Buffer gain	11,557	.037
TOTAL, Incl. D-B Gain	346,964	1.126
NET REVENUE	990,934	3.217
Per cent of Revenue	74.1	
Route-miles	422	
Train-miles	308,060	
Passenger-miles	64,089,349	

The Net Revenue of the Hiawathas for the year ended June 30, 1938, as shown in the foregoing statement, was 74.1 per cent of the Revenues.

GROWTH OF TRAFFIC ON HIAWATHAS

The original Hiawathas were placed in service on May 29, 1935, as 7-car trains. They were later extended to 8 cars and recently to 9 cars.

A statement of the revenues of these trains (exclusive of extra sections and dining car revenue) by six-months' periods follows:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$534,396	
Jan. 1 to June 30, 1936	540,404	\$1,074,800
July 1 to Dec. 31, 1936	631,057	
Jan. 1 to June 30, 1937	643,078	1,274,135
July 1 to Dec. 31, 1937	684,940	
Jan. 1 to June 30, 1938	652,958	1,337,898

The remarkable success of the Hiawathas and their growing popularity are demonstrated clearly by the figures in the two foregoing statements.

THE "400"'S

CHICAGO AND NORTH WESTERN

GENERAL STATEMENT AND BRIEF
DESCRIPTION OF "400"'S

The two "400"'s of the North Western were placed in operation on January 2, 1935. The cars, of which there are 6 in each train, are of conventional type. They are not new but were reconditioned, redecorated and refurnished for their present service and are described in our October 1, 1935, report. The trains are hauled by oil-burning steam locomotives reconditioned to meet the demands of high speed. While the "400"'s are not light-weight trains, their schedules equal those of the Burlington Twin Zephyrs and the Milwaukee Hiawathas. The appointments are excellent and the trains are popular with the traveling public.

The average daily mileage of each train is 419.

The consist of each of the "400"'s, and other data concerning them, are given in the table below:

PHYSICAL CHARACTERISTICS OF LINE

Chicago-Twin Cities, 419 Miles

About 75% of the line is double track.

RULING GRADES between Chicago and Eau Claire, 322 miles, and between Wilson and North Line, 25 miles, range from 0.50% to 0.75%. Except for 6 miles of 1.30% ruling grades, those of the balance of the line vary from 0.50% to 1.17%.

MAXIMUM CURVES are 3° except in a few instances. About 88% of the line is straight track.

WEIGHT OF RAIL—100 to 112 pounds, 100-pound largely predominating.

TIES are all treated.

BALLAST—Between Chicago and Milwaukee, 85 miles, crushed rock; balance of line, gravel.

6-Car Train	Length Over All	Weight (Tons)	Seating Capacity	Total
1 Locomotive	88'8"	296		
1 Baggage & Passenger	76'7"	77	Main Room 42, Men's Lounge 20	62
1 Lounge Coach	81'9"	77	Main Room 38, Lounges 12	50
1 Diner	83'10"	88		36
1 Lounge Car	78'8"	76	Lounge 27, Parlor 13	40
1 Parlor Car	78'5"	71	Lounge 13, Parlor 31	44
1 Parlor Car	84'1"	87	Parlor 23, Solarium 8, Drawing Room 5	36
Total	572'0"	772		268

RESULTS OF OPERATION OF "400"s

Following is a statement of the revenues and expenses of the "400"s for the year ended June 30, 1938:

REVENUES AND EXPENSES

Item	CHICAGO-TWIN CITIES	
	2 Trains, Steam Loco. and 6 Pass. Tr. Cars. Each a one-way trip daily.	
	Operation begun January 2, 1935	
	Amount	Per Train-Mile
REVENUES	\$ 665,472	\$ 2.052
TRAIN EXPENSES		
Wages of crew	96,664	.298
Fuel	87,257	.269
Lubricants, water, etc.	6,488	.020
Train supplies and expenses	26,274	.081
Repairs	114,505	.353
TOTAL Train Expenses	331,188	1.021
Dining-Buffer loss	-19,463	-.060
TOTAL, Incl. D-B Loss	350,651	1.081
NET REVENUE	314,821	.971
Per cent of Revenue	47.3	
Route-miles	419	
Train-miles	324,376	
Passenger-miles (est.)	33,273,000	

As shown in the foregoing statement the Net Revenue for the year ended June 30, 1938, was 47.3 per cent of the Revenues.

GROWTH OF TRAFFIC ON "400"s

Following is a statement of the revenues of the "400"s (exclusive of dining car revenue), by six-months' periods from July 1, 1935, to June 30, 1938:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$274,401	
Jan. 1 to June 30, 1936	277,934	\$552,335
July 1 to Dec. 31, 1936	388,294	
Jan. 1 to June 30, 1937	345,048	733,342
July 1 to Dec. 31, 1937	371,862	
Jan. 1 to June 30, 1938	293,610	665,472

It will be noted that traffic on the "400"s has not increased during the past year. This is accounted for in part by the fact that the Minnesota "400", operated during a portion of the past year and then withdrawn, diverted a certain amount of patronage from the "400"s.

The trains, as the statements indicate, have been a successful operation from the beginning.

STREAMLINE TRAINS

ATCHISON, TOPEKA AND SANTA FE

GENERAL STATEMENT

The Atchison, Topeka and Santa Fe now possesses and operates a larger fleet of streamline light-weight trains than any other railroad. Its experience in this field is, therefore, of especial interest.

On May 12, 1936, the Santa Fe introduced its Super Chief, the first 39¾-hour extra-fare train between Chicago and Los Angeles, followed quickly by the Union Pacific's City of Los Angeles. The Super Chief was unique only in its Diesel-electric locomotive and its great speed. Otherwise, it consisted of ordinary high-type, heavy conventional Pullman equipment.

When first placed in service there was a definite question in the minds of many Santa Fe officials as to the need and probable success of the new train. At that time the Santa Fe Chief, an extra-fare train, was running light. It was felt by many that the day of extra-fare luxury travel had largely passed, and that the patronage of the once-a-week Super Chief would be mainly drawn from the Chief itself.

Experience quickly demonstrated the fallacy of this view. The original Super Chief proved instantly and strikingly successful, being booked to capacity on practically every east and westbound trip as long as it remained in service. It was significant too that from the day the fast Super Chief was inaugurated there was an immediate and heavy increase in the patronage of the slower Chief. In fact for a number of months the Chief itself has been carrying more passengers than in any previous corresponding period in its 12-year life.

On May 17, 1937, the Santa Fe's first

new stainless steel streamline Super Chief completed a record run from Los Angeles to Chicago in 36 hours and 49 minutes. On the following day it was placed in regular service. Its capacity was somewhat greater than that of the original conventional train, but it too continued to be booked to capacity, regardless of season, and normally with a long waiting list.

Prior to 1938 this new Super Chief was the only streamline train in operation on the Santa Fe. A major program for extensive streamline train operation, however, had been under careful consideration and development for many months. It came to full fruition early in 1938. On February 20, 1938, a second streamline Super Chief was placed in service, thus doubling the de luxe service; and on February 22nd two new light-weight high-speed coach trains, the El Capitans, were introduced, running twice weekly between Chicago and Los Angeles on the same fast 39¾-hour schedule.

On March 23, 1938, another 6-car streamliner, the San Diegan, was put in service between San Diego and Los Angeles, making two round trips daily on a 2½-hour schedule.

The new 7-car streamliners, the Chicagoan and the Kansas Cityan, were installed on April 17, 1938, each train making one trip daily, in reverse directions, between Chicago, Kansas City and Wichita, Kan.

On July 1, 1938, two 5-car streamliners, the Golden Gates, went into service between Bakersfield and San Francisco, Cal., each train making one round trip daily.

During the period of construction of

these new trains and their Diesel-electric locomotives, the six trains required for the daily Chief were completely re-equipped with new light-weight equipment of the same high type of workmanship and completeness of appointments as had been provided for the Super Chief.

Thus, in a period of a few months in the early part of 1938 the number of Santa Fe streamline trains had grown from one to fifteen.

The experience with the Super Chief has been outlined. The first once-a-week conventional train was sold out to capacity from the beginning. Its operation undoubtedly increased the patronage on the daily Chief, then also conventional in form. When the first Super Chief was replaced by a stainless steel streamliner of greater capacity, it too continued to be sold out. The same condition continued to obtain when the second Super Chief was built and its operation placed on a twice-a-week basis. Even at the present time, under conditions highly unfavorable to luxury spending, the Super Chiefs are filled nearly to capacity, while the now streamlined Chief, steam-drawn, continues to hold its patronage.

It is significant that there are now in weekly operation eleven extra-fare first-class trains each way between Chicago and Los Angeles, and that these trains in the aggregate are today carrying many more extra-fare first-class passengers than in any other corresponding period in the history of western travel.

Perhaps the Santa Fe's most interesting experiment in transcontinental streamline service was in the introduction of the El Capitans. These are 5-car stainless steel streamline trains, drawn by Diesel-electric locomotives, and operated twice a week in each direction between Chicago and Los Angeles on the same days and on the same 39¼-hour schedule as the Super Chiefs. The latter

carry only extra-fare first-class passengers. The El Capitans, however, cater entirely to coach travel, at the lowest existing coach fares plus a small extra fare. So far as our knowledge goes, the El Capitans are the only transcontinental all-coach streamliners in the world.

Prior to the introduction of the El Capitans, splendid economy service in coaches was already being given on such trains as the 60-hour Challengers (North Western-Union Pacific-Southern Pacific), the 60-hour Santa Fe Scout and others. The North Western-Union Pacific high-speed streamliners City of Los Angeles also carried coach equipment, charging a small extra fare. The question to be solved by the Santa Fe officials was whether sufficient transcontinental coach business existed or could be created to justify new trains entirely devoted to such travel and at the Super Chief's speed and with an extra fare. It was their feeling that there was potential business for such trains and that the economy traveler would welcome the service afforded by fast, luxurious and highly comfortable coach streamliners, in which he would have the run of the train, and on which all would pay the same fare; and that the saving in time and the low basic fares would overbalance the slight extra charge.

The El Capitans were designed to permit of extremely economical operation. Having no definite measure of the degree of acceptance the train would receive from the public, a rate of mileage revenue only slightly in excess of a generous figure for operating costs was set up as a preliminary acceptable rate.

The operation of the El Capitans has been surprisingly successful. Introduced on February 22, 1938, patronage increased rapidly from the beginning. Week after week, in recent months, the train has been completely sold out. In

June, capacity operation in both directions was attained, with mileage revenues approaching three times the preliminary estimate.

The introduction of the San Diegan on March 23, 1938, made good a promise for such service of long standing. It is a relatively local operation between two major points where a highly competitive situation exists as between rail and highway travel. No definite estimate of prospective revenue was made under the circumstances, but it can be said that this train, averaging nearly 4,000 passengers per week, has been extremely successful both from an actual revenue standpoint and because of its success in recapturing automobile and other highway travel.

The two Golden Gates, placed in service on July 1, 1938, between Bakersfield and San Francisco, also represented the fulfillment of a promise made several years ago. In this case also no definite estimate of probable revenues could be made. The results, however, parallel those of the San Diegan. Here again, in excess of 4,000 passengers have been carried weekly, and the results currently exceed expectations by wide margins.

The streamliners Chicagoan and Kansas Cityan, operating daily between Chicago, Kansas City and Kansas points west to Wichita, are proving another successful operation. Traffic has increased steadily since the inauguration of the trains and is now about 25 per cent above the preliminary estimates.

In summation it may be said that the experience of the Santa Fe has paralleled that of the Burlington and the Union Pacific. These two roads first and the Santa Fe later had each reached the conclusion that the high speeds, comfort and luxuriousness possible in modern streamline trains have extraordinary public appeal, and that the new trains are not only

an effective means of recapturing traffic previously lost to the highways and airways, but of developing much new traffic that otherwise would not move at all.

We have dwelt at some length on the Santa Fe's experience in the operation of streamline trains, particularly the fast coach trains, because of the fact that, as a whole, the developments have been more recent, more rapid and more extensive on this line than on any other and, as will be seen from the statements which follow, the program has been a highly successful one from the beginning.

BRIEF DESCRIPTION OF SANTA FE STREAMLINE TRAINS

Note: The six Santa Fe Chiefs are largely streamline light-weight trains, but carry conventional type non-passenger cars, and are operated on much slower schedules than the Super Chiefs and El Capitans and are hauled by steam locomotives. The performance record of these trains is not, therefore, included in this discussion.

The Santa Fe's fleet of streamline light-weight high-speed trains consists of the Super Chiefs, the El Capitans, the San Diegan, the Chicagoan, the Kansas Cityan and the Golden Gates. They comprise a total of 58 cars, of which 51 (including 5 sleeping cars) were built of stainless steel by Budd, and 7 sleeping cars of Corten steel, sheathed with stainless steel, by Pullman. All of the trains are hauled by Diesel-electric locomotives in units of 1,800 H.P., built by the Electro-Motive Corporation.

The cars in all trains are non-articulated.

The center of gravity of the cars averages about 55 inches above the rail, and that of the locomotives about 57 inches.

These trains, like the larger Burlington Zephyrs, the Rock Island Rockets, the North Western-Union Pacific-Southern Pacific Streamliners, the Reading Crusader and others, represent the highest

and most recent developments in railroad passenger car construction. Each of the Santa Fe streamline trains has been designed to provide the maximum degree of comfort in travel consistent with the type of service required of it. While the structural characteristics are alike in all, each possesses distinctive interior decorative features that have won pronounced public admiration.

CONSIST OF TRAINS

The first Super Chief is exclusively a sleeping car train, composed of 2 power cars and 9 light-weight passenger train cars, 8 of which are of stainless steel built by Budd and 1 by Pullman. The order of the train is—a club-baggage car, 3 sleeping cars, a club-lounge, a diner, and 3 sleeping cars, the rear car containing an observation end. The second Super Chief is similar in makeup to the first Super Chief and consists of 9 light-weight cars, 3 of which are of stainless steel built by Budd, and 6 by Pullman.

The locomotives of the Super Chiefs are Diesel-electric, in two units of 1,800 H.P. each, built by the Electro-Motive Corporation.

The two El Capitans are exclusively coach trains, each composed of a Diesel-electric locomotive and 5 light-weight stainless steel passenger train cars—a baggage-dormitory, a coach, a lunch-diner, a coach for women and children, and a coach-observation car. The cars were built by Budd and the locomotive (1,800 H.P.) by the Electro-Motive Corporation.

The Super Chiefs and El Capitans make a round trip weekly between Chi-

cago and Los Angeles, leaving Chicago on Tuesdays and Saturdays, and Los Angeles on Tuesdays and Fridays.

The San Diegan is composed of a Diesel-electric locomotive and 6 light-weight stainless steel passenger train cars—a baggage and mail car, 3 coaches, a tavern-lunch counter car, and a parlor-observation car. In August an additional coach was added. The cars were built by Budd, and the locomotive (1,800 H.P.) by the Electro-Motive Corporation. The San Diegan makes two round trips daily between Los Angeles and San Diego.

The Chicagoan and Kansas Cityan are companion trains, each consisting of a Diesel-electric locomotive and 7 light-weight stainless steel passenger train cars—a baggage and mail car, 3 coaches, a club-coach car, a diner, and a parlor-observation car. The cars were built by Budd, and the locomotives (1,800 H.P.) by the Electro-Motive Corporation and St. Louis Car Company.

The Chicagoan and Kansas Cityan each make a one-way trip daily between Chicago and Wichita.

The two Golden Gates are each composed of a Diesel-electric locomotive and 5 light-weight stainless steel passenger train cars—a baggage-coach car, 2 coaches, a lunch-tavern car, and a parlor-observation car. An additional coach was added to each train in August. The cars were built by Budd, and the locomotives (1,800 H.P.) by the Electro-Motive Corporation.

The Golden Gates each make a round trip daily between Bakersfield and San Francisco.

42 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

WEIGHT, SEATING CAPACITY, ETC.

The weight, seating capacity, etc., of the Santa Fe streamline light-weight trains, and the dates when placed in service, are given in the following tables:

The average speed of the Super Chiefs and El Capitans is 56 miles per hour, of the San Diegan 50, of the Chicagoan and Kansas Cityan 58, and of the Golden Gates 54.

Run and Train	Date Placed in Service	Power Cars Exclusively Weight (Tons)	Trailing Cars Weight (Tons)	All Units	
				Weight (Tons)	Length
(1 and 2) SUPER CHIEFS Chicago-Los Angeles 2 trains of 2 power cars and 9 trailing cars each One train One train	5/18/37	287	482	769	890'11"
	2/20/38	287	520	807	890'11"
(3 and 4) EL CAPITANS Chicago-Los Angeles 2 trains of 1 power car and 5 trailing cars each Each train	2/22/38	147	248	395	473'11"
(5) SAN DIEGAN Los Angeles-San Diego 1 train of 1 power car and 6 trailing cars	3/23/38	145	285	430	547'9"
(6 and 7) CHICAGOAN AND KANSAS CITYAN Chicago-Wichita 2 trains of 1 power car and 7 trailing cars each Each train	4/17/38	145	340	485	627'7"
(8 and 9) GOLDEN GATES Bakersfield-San Francisco 2 trains of 1 power car and 5 trailing cars each Each train	7/1/38	145	248	393	474'3"

	Salable Seats				Other Seats			Total All Seats
	Coach	Sleeper	Parlor	Total	Dining	Lounge	Total	
(1 and 2)		121		121	36	77	113	234
(3 and 4)	156			156	38	32	70	226
(5)	156		34	190	37	8	45	235
(6 and 7)	182		34	216	48	37	85	301
(8 and 9)	140		34	174	37	8	45	219

DAILY MILEAGE

The average daily mileage of these trains is as follows:

Name	Average Daily Mileage
Super Chiefs (2 trains)	1,274*
El Capitans (2 trains)	1,274*
San Diegan (1 train)	504
Chicagoan and Kansas Cityan (2 trains)	1,358
Golden Gates (2 trains)	1,264
Total Daily Mileage	5,674

* Round trip mileage divided by 7.

PHYSICAL CHARACTERISTICS OF LINES

The physical characteristics of the lines on which the Santa Fe streamline light-weight trains operate are briefly described below:

Chicago-Los Angeles, 2,229 Miles

The line between Chicago and Los Angeles, over which the Super Chiefs and El Capitans operate, traverses prairie, semi-mountainous and mountainous

country. The ruling grades and maximum curves vary accordingly, covering the whole range up to 3.5 per cent and 11 degrees, respectively.

About 65% of the line is double track.

RULING GRADES are as follows:

Section	Distance Miles	West- bound %	East- bound %
Chicago-Fort Madison	233	1.5	1.5
Fort Madison-Kansas City	218	0.8	0.9
Kansas City-Newton (via Ottawa Jct.)	186	0.6	0.9
Kansas City-Newton (via Topeka)	201	1.1	1.0
Newton-La Junta	356	0.6	0.6
La Junta-Isleta	359	3.5	3.3
Isleta-Gallup	147	1.0	0.6
Gallup-Winslow	128	0.6	0.3
Winslow-Needles	293	1.4	1.8
Needles-Barstow	167	1.5	1.0
Barstow-San Bernardino	82	1.6	2.2
San Bernardino-Los Angeles	60	1.5	2.2
Average Distance (via Ottawa Jct.)	2,229		

MAXIMUM CURVES between Chicago and La Junta, 992 miles, range from 4° to 6°. In the mountain sections west of La Junta, they are 11°. On the balance of the line, they vary from 4° to 6°. Throughout the whole line, the predominating curvature is much lighter than the maximum, being generally 1° to 1½° on the low grade sections and 1½° to 4° in the mountain territory. About 82% of the line is straight track.

WEIGHT OF RAIL—90 to 131 pounds, 110-pound largely predominating.

TIES are all treated.

BALLAST—About 40% gravel, 37% crushed rock, 17% volcanic cinders, the remainder slag and screenings.

Los Angeles-San Diego, 126 Miles

The line is single track.

RULING GRADES are 2.2% in both directions.

MAXIMUM CURVES are 10°20', with 1° to 4° predominating except in heavy grade sections. About 78% of the line is straight track.

WEIGHT OF RAIL—Practically all 90-pound.

TIES are all treated.

BALLAST—About 74% of the line is ballasted with gravel, 19% with crushed rock and the remainder with cinders and screenings.

Newton-Wichita, 27 Miles

The line is single track.

RULING GRADES are about 0.80% in both directions.

MAXIMUM CURVES are 3°13', with 1½° and 2° predominating. About 88% of the line is straight track.

WEIGHT OF RAIL—90 to 112 pounds, 90-pound largely predominating.

TIES are all treated.

BALLAST—All crushed rock.

Bakersfield-Oakland, 316 Miles

About 2% of the line is double track.

RULING GRADES are 1.2% against west-bound and 1.5% against eastbound traffic.

MAXIMUM CURVES are 6°, with 1° to 3° predominating except on heavy grade sections. About 90% of the line is straight track.

WEIGHT OF RAIL—90-pound.

TIES are all treated.

BALLAST—All crushed rock.

44 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

RESULTS OF OPERATION OF SANTA FE STREAMLINE TRAINS

Following is a statement of the revenues and expenses of the Super Chiefs for the year ended June 30, 1938, (one train from July 1, 1937, to February 19, 1938, and two trains from February 20, 1938, to June 30, 1938), and for the other Santa Fe streamline trains for the respective periods since they were installed to June 30, 1938:

Note: The railroad company's proportion of sleeping car revenues on the Super Chiefs is necessarily an estimate. It is relatively a small amount and is included in the item of Revenues.

From this statement it will be seen that the Net Revenue of all seven trains for the respective periods of operation as stated in the foregoing was 61.3 per cent of the Revenues. From this standpoint the most profitable trains have been the Super Chiefs, 64.9 per cent; and the least profitable the San Diegan, 44.3 per cent.

GROWTH OF TRAFFIC ON SANTA FE STREAMLINE TRAINS

The first Super Chief was placed in service on May 12, 1936. From that

REVENUES AND EXPENSES

Item	Routes and Trains								TOTAL SEVEN TRAINS	
	SUPER CHIEFS Chicago-Los Angeles		EL CAPITANS Chicago-Los Angeles		SAN DIEGAN Los Angeles-San Diego		CHICAGOAN AND KANSAS CITYAN Chicago-K.C.-Wichita			
	1 Tr., 7/1/37-2/19/38 2 Tr., 2/20/38-6/30/38, 9 Pass. Tr. Cars. Each one round trip weekly.		2 Trains, 5 Pass. Tr. Cars. Each one round trip weekly.		1 Train, 6 Pass. Tr. Cars. Two round trips daily.		2 Trains, 7 Pass. Tr. Cars. Each one-way trip daily.			
	Operation Begun 5/12/36		Operation Begun 2/22/38		Operation Begun 3/23/38		Operation Begun 4/17/38			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.		
REVENUES	\$ 794,358	\$ 2.514	\$ 279,655	\$ 1.701	\$ 70,003	\$ 1.447	\$ 162,912	\$ 1.600	\$ 1,306,928	\$ 2.072
TRAIN EXPENSES										
Wages of crew	97,210	.308	45,750	.278	13,348	.276	24,636	.242	180,944	.287
Fuel oil	32,078	.102	9,679	.058	4,147	.086	6,980	.068	52,884	.084
Lubricants, etc.	8,995	.028	2,598	.016	390	.008	2,032	.020	14,015	.022
Train supplies and expenses	33,042	.104	12,927	.079	5,582	.115	10,691	.105	62,242	.098
Power plant maintenance	70,538	.223	14,596	.089	5,284	.109	12,826	.126	103,244	.164
Train maintenance	26,214	.083	19,388	.118	7,386	.153	16,811	.165	69,799	.111
TOTAL Train Expenses	268,077	.848	104,938	.638	36,137	.747	73,976	.726	483,128	.766
Dining-Buffer loss	-10,944	-.035	-6,332	-.039	-2,855	-.059	-2,091	-.021	-22,222	-.035
TOTAL, Incl. D-B Loss	279,021	.883	111,270	.677	38,992	.806	76,067	.747	505,350	.801
NET REVENUE	515,337	1.631	168,385	1.024	31,011	.641	86,845	.853	801,578	1.271
Per cent of Revenue	64.9		60.2		44.3		53.3		61.3	
Route-miles	2,229		2,229		126		679		630,640	
Train-miles	316,028		164,378		48,384		101,850		55,216,168	
Passenger-miles	26,424,162		15,739,789		5,494,068		7,558,149			

date to May 18, 1937, it consisted of a Diesel-electric locomotive and conventional high-type heavy Pullman cars. On the latter date the cars were replaced by stainless steel streamline equipment of greater capacity, and on February 20, 1938, a second Super Chief with a Diesel-electric locomotive and light-weight streamline cars was placed in this service. The two Super Chiefs each make a weekly round trip between Chicago and Los Angeles.

The rapid growth of traffic on the Super Chiefs is indicated by the following statement of revenues (exclusive of dining car revenue) by six-months' periods:

Period	6 Months	Year
July 1 to Dec. 31, 1936	\$199,246	
Jan. 1 to June 30, 1937	238,581	\$437,827
July 1 to Dec. 31, 1937	306,286	
Jan. 1 to June 30, 1938	488,072	794,358

The remarkable increase in the revenues of the Super Chiefs which the above statement discloses is a measure of their popularity, especially when considered in the light of the fact that the Chiefs have continued to retain their patronage.

The El Capitans, the San Diegan, and the Chicagoan and Kansas Cityan were inaugurated since the first of the year. The statement below shows the date each train or pair of trains was placed in service and the monthly revenues (exclusive of dining car revenues) from the beginning of operation to June 30, 1938:

Train	Date Placed in Service	(Dollar Figures in Thousands)					
		1938					Total
		February	March	April	May	June	
EL CAPITANS Chicago-Los Angeles 2 trains	2/22/38	\$	\$	\$	\$	\$	\$
		8,	38,	49,	83,	101,	279,
SAN DIEGAN Los Angeles-San Diego 1 train	3/23/38		3,	22,	22,	23,	70,
CHICAGOAN AND KANSAS CITYAN Chicago-Kansas City- Wichita 2 trains	4/17/38			26,	62,	75,	163,
Total		8,	41,	97,	167,	199,	512,

As the above statement shows, the growth of traffic on the El Capitans and the Chicagoan and Kansas Cityan is outstanding.

May and June are the only full months of operation of all five trains. The increase in the traffic in June over May is indicative of the growing favor with which the public has received these new

splendidly appointed trains and high-speed service.

The whole Santa Fe streamline train program has been attended with remarkable success, both in the manner in which the trains have been received by the public and in the financial results of their operation.

ROCKETS

CHICAGO, ROCK ISLAND AND PACIFIC

GENERAL STATEMENT

As in the case of other western roads, the adoption of streamline train service on the Rock Island was the result of a very careful study of ways and means for stemming the decline in passenger traffic on its lines and for recovering to whatever extent might be possible the large amount which had been diverted to other agencies of transportation—the automobile, the bus and the airplane. These studies, directed to specific routes, coupled with a knowledge of the satisfactory experience of other roads, led to the conclusion that the streamline fast train, with its great popular appeal, its high availability in service and economy of operation, was capable of reversing the downward trend. Immediately upon reaching this conclusion, six trains, which were named Rockets, were purchased.

The routes selected for streamline service were:

CHICAGO-PEORIA (161 miles), where the travel is normally heavy and where by the use of one Rocket, making two round trips daily, satisfactory schedules would be furnished.

CHICAGO-DES MOINES (358 miles), where one daily round trip would serve besides the terminal cities the important centers of Moline, Rock Island, Davenport and a number of other large intermediate points.

KANSAS CITY-MINNEAPOLIS (489 miles), where two trains, each making a one-way trip daily, would serve a number of important centers.

KANSAS CITY-OKLAHOMA CITY (408 miles), where one train making a daily round trip would serve the terminal cities and a large number of important centers.

FORT WORTH-DALLAS-HOUSTON (283 miles), a joint division of the Rock Island and Burlington, where the traffic is relatively light and where double daily service each way would be provided by a Rocket and a Burlington Zephyr.

The Rockets were placed in operation on the jointly operated Fort Worth-Dallas-Houston route on August 25, 1937, on the Chicago-Peoria, Chicago-Des Moines and Kansas City-Minneapolis routes during the latter part of September 1937, and on the Kansas City-Oklaoma City route on February 13, 1938.

As the statements which follow show, the trains have been given a highly favorable reception by the traveling public.

BRIEF DESCRIPTION OF ROCK ISLAND ROCKETS

The fleet of Rock Island Rockets, including the jointly operated train, comprises two 4-car trains and four 3-car trains, a total of 20 cars, all of which were built by Budd. The trains are hauled by Diesel-electric streamline locomotives of 1,200 H.P. each, built by the Electro-Motive Corporation.

Three cars in each of the 4-car trains and two cars in each of the 3-car trains are articulated.

The center of gravity of the cars averages about 58 inches above the rail, and that of the locomotives about 57 inches.

The Rock Island Rockets are representative of the high type of workmanship, beauty of line, excellence of interior decoration, completeness of appointments and travel comforts and smooth riding qualities that characterize the newer high-speed streamline trains.

CONSIST OF ROCKETS

The Rockets are all day trains. The 4-car trains are each made up of a dinette coach (with space in the forward end for baggage) a 60-seat coach, a 76-seat coach, and a 41-seat parlor car with bar. The 3-car trains each consist of a dinette coach with baggage compartment, a 76-seat coach, and a combination car of 28 coach seats and 24 parlor car seats, with bar.

WEIGHT, SEATING CAPACITY, ETC.

The weight, seating capacity, etc., of the Rock Island Rockets, and the dates when placed in service, are given in the following tables:

DAILY MILEAGE

The average daily mileage of the Rockets is as follows:

Run	Average Daily Mileage
Chicago-Peoria (1 train)	644
Chicago-Des Moines (1 train)	716
Kansas City-Minneapolis (2 trains)	978
Kansas City-Oklahoma City (1 train)	816
Fort Worth-Dallas-Houston (1 train)	566
Total Daily Mileage	3,720

Through the inauguration of Rocket service the Rock Island has effected a net reduction in train mileage of other trains of 1,374 per day.

The average speed of the Rockets ranges from 53 in the case of the Kansas City-Minneapolis trains to 60 in the case of the Chicago-Peoria and Chicago-Des Moines trains.

Run and Train		Date Placed in Service	Power Cars Exclusively Weight (Tons)	Trailing Cars Weight (Tons)	All Units	
					Weight (Tons)	Length
(1)	CHICAGO-PEORIA 1 train of 1 power car and 4 trailing cars	9/19/37	110	176	286	356'10"
(2)	CHICAGO-DES MOINES 1 train of 1 power car and 4 trailing cars	9/26/37	110	176	286	356'10"
(3 and 4)	KANSAS CITY-MINNEAPOLIS 2 trains of 1 power car and 3 trailing cars each Each train	9/29/37	110	140	250	292'10"
(5)	KANSAS CITY-OKLAHOMA CITY 1 train of 1 power car and 3 trailing cars	2/13/38	110	140	250	292'10"
(6)	FT. WORTH-DALLAS-HOUSTON 1 train of 1 power car and 3 trailing cars (Operated jointly by Rock Island and Burlington)	8/25/37	110	140	250	292'10"

	Salable Seats			Other Seats		Total All Seats
	Coach	Parlor	Total	Dinette	Total	
(1)	136	41	177	32	32	209
(2)		Same as (1)				
(3 and 4)	104	24	128	32	32	160
(5)		Same as (3)				
(6)		Same as (3)				

PHYSICAL CHARACTERISTICS OF LINES

Before proceeding to display the statements of revenues and expenses of the Rockets, brief descriptions of the physical characteristics of the lines on which they operate will be given, as follows:

Chicago-Peoria, 161 Miles

About 70% of the line is double track.

RULING GRADES are approximately 0.50% in both directions.

MAXIMUM CURVES of 1° predominate except at terminals. About 80% of the line is straight track.

WEIGHT OF RAIL—90, 100 and 112-pound.

TIES are all treated.

BALLAST—Crushed rock and gravel, the latter predominating.

Chicago-Des Moines, 358 Miles

About 70% of the line is double track.

RULING GRADES are 1.00% westbound and 0.77% eastbound.

MAXIMUM CURVES of 1° predominate except at terminals. About 82% of the line is straight track.

WEIGHT OF RAIL—100, 110 and 112-pound.

TIES are all treated.

BALLAST—Crushed rock and gravel, the latter predominating.

Kansas City-Minneapolis, 489 Miles

About 17% of the line is double track.

RULING GRADES are 1.00% in each direction.

MAXIMUM CURVES of 2° predominate except at terminals. About 80% of the line is straight track.

WEIGHT OF RAIL—85 to 112-pound.

TIES are all treated.

BALLAST—Gravel, shale, burnt gumbo and chatts.

Kansas City-Oklahoma City, 408 Miles

About 37% of the line is double track.

RULING GRADES are 0.80% westbound and 0.70% eastbound.

MAXIMUM CURVES of 2° predominate except at terminals. About 89% of the line is straight track.

WEIGHT OF RAIL—90 to 112-pound.

TIES are all treated.

BALLAST—Crushed rock, gravel, burnt gumbo and chatts.

Fort Worth-Dallas-Houston, 283 Miles

The line is practically all single track.

RULING GRADES range from 0.70% to 1.00%.

MAXIMUM CURVES are generally 1° between Fort Worth and Dallas, 34 miles, 2° between Dallas and Teague, 97 miles, and 3° between Teague and Houston, 152 miles. About 88% of the line is straight track.

WEIGHT OF RAIL—85 and 90-pound, the latter predominating.

TIES are all treated.

BALLAST—Crushed rock, gravel, burnt gumbo and shell, the latter predominating.

RESULTS OF OPERATION OF ROCKETS

Following is a statement of the revenues and expenses of the Rockets for the respective periods of their operation to June 30, 1938:

REVENUES AND EXPENSES

Item	Routes and Trains										TOTAL SIX TRAINS	
	CHICAGO- PEORIA		CHICAGO- DES MOINES		KANSAS CITY- MINNEAPOLIS		KANSAS CITY- OKLAHOMA CITY		FORT WORTH- DALLAS-HOUSTON*			
	1 Train, 4 Pass. Tr. Cars. Two round trips daily.		1 Train, 4 Pass. Tr. Cars. One round trip daily.		2 Trains, each 3 Pass. Tr. Cars. Each a one-way trip daily.		1 Train, 3 Pass. Tr. Cars. One round trip daily.		1 Train, 3 Pass. Tr. Cars. One round trip daily.			
	Operation Begun 9/19/37		Operation Begun 9/26/37		Operation Begun 9/29/37		Operation Begun 2/13/38		Operation Begun 8/25/37			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.
REVENUES	\$ 314,688	\$ 1.714	\$ 353,956	\$ 1.785	\$ 310,530	\$ 1.155	\$ 94,626	\$.850	\$ 168,814	\$ 1.034	\$ 1,242,614	\$ 1.343
TRAIN EXPENSES												
Wages of crew	47,041	.256	49,661	.251	66,815	.248	27,098	.243	41,978	.257	232,593	.251
Fuel oil	9,154	.050	9,696	.049	12,901	.048	4,576	.041	5,941	.036	42,268	.046
Lubricants, etc.	4,255	.023	5,284	.027	5,935	.022	2,042	.018	4,637	.028	22,153	.024
Train supplies and expenses	9,831	.054	9,995	.050	12,532	.047	5,057	.046	8,087	.050	45,502	.049
Power plant maintenance	13,143	.072	15,727	.079	16,205	.060	5,944	.054	21,447	.131	72,466	.078
Train maintenance	10,390	.056	8,765	.044	12,848	.048	2,796	.025	12,370	.076	47,169	.051
TOTAL Train Expenses	93,814	.511	99,128	.500	127,236	.473	47,513	.427	94,460	.578	462,151	.499
Dining-Buffer gain or loss	139	.001	3,996	.020	1,869	.007	-1,018	-.009	-6,620	-.041	-1,634	-.002
TOTAL, Incl. D-B Gain or Loss	93,675	.510	95,132	.480	125,367	.466	46,531	.436	101,080	.619	463,785	.501
NET REVENUE Per cent of Revenue	221,013 70.2	1.204	258,824 73.1	1.305	185,163 59.6	.689	46,095 48.7	.414	67,734 40.1	.415	778,829 62.7	.842
Route-miles	161		358		489		408		283		1,699	
Train-miles	183,540		198,346		268,950		111,320		163,331		925,487	
Passenger-miles (est.)	15,734,000		17,698,000		15,527,000		4,731,000		8,204,000		61,894,000	

* Jointly operated by Rock Island and Burlington.

It will be seen from the foregoing statement that the Net Revenue of all six trains from the beginning of operations to June 30, 1938, was 62.7 per cent of the Revenues. From this standpoint the most profitable train is the Chicago-Des Moines train, 73.1 per cent; the least profitable, the Fort Worth-Dallas-Houston train, 40.1 per cent.

GROWTH OF TRAFFIC ON ROCKETS

As has been shown in a foregoing statement, the Rock Island Rockets have been in service a comparatively short time. The first to be inaugurated was the Fort Worth-Dallas-Houston train (a joint operation of the Rock Island and Burlington) which was placed in service on August 25, 1937.

50 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

The statement which follows shows the monthly revenues (exclusive of dining car revenues) of each train or pair of trains since the beginning of operation:

during the fall and early winter. The current business depression has undoubtedly adversely affected the revenues but to what extent cannot, of course, be ascertained.

Rocket Routes	Date Placed in Service	(Dollar Figures in Thousands)										Total
		1937				1938						
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
Chicago-Peoria	9/19/37	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
Chicago-Des Moines	9/26/37	9,	34,	36,	41,	39,	35,	32,	31,	30,	27,	314,
Kansas City-Minneapolis		4,	36,	38,	47,	44,	37,	35,	38,	35,	40,	354,
2 Trains	9/29/37	1,	27,	29,	41,	40,	34,	34,	34,	31,	38,	309,
Kansas City-Oklahoma City	2/13/38						13,	20,	22,	19,	21,	95,
Fort Worth-Dallas-Houston	8/25/37	20,	18,	17,	19,	17,	14,	16,	16,	16,	17,	170,
Total		34,	115,	120,	148,	140,	133,	137,	141,	131,	143,	1,242,

Because the Rockets have been so recently installed, the above statement gives little indication of the probable growth of traffic on them in future months. The figures must also be read in the light of the fact that on most of the routes passenger travel is normally heaviest

It is the opinion of the officials that a substantial portion of the travel on the Rockets is newly induced traffic.

The Rock Island streamline train program as a whole, as the foregoing statements clearly indicate, has been highly successful.

GREEN DIAMOND

ILLINOIS CENTRAL

GENERAL STATEMENT AND BRIEF
DESCRIPTION OF GREEN DIAMOND

The Green Diamond was placed in service on the Illinois Central between Chicago and St. Louis, 294 miles, on May 17, 1936, supplanting two steam trains. It consists of 5 fully articulated light-weight streamline cars, with dimensions generally corresponding to standard steam train practice. The forward car is a 1,200 H.P. Diesel-electric locomotive, followed by a mail-baggage car, a 56-seat coach, a coach-diner with 44 coach seats and 16 diner seats, and a diner-lounge car with 22 parlor car and 8 diner seats. The seating capacity is—100 coach, 22 parlor and 24 diner seats, a total for the train of 146. Its weight is 248 tons and its length 328'6". The train was built by Pullman. The principal structural material is Corten steel assembled by riveting. Aluminum is used for interior finish and decorative features. The power plant was built by the Electro-Motive Corporation.

The center of gravity of the power car is 61 inches, and of the trailing cars 57 inches, above top of rail.

The Green Diamond makes a round trip daily and traverses the distance between Chicago and St. Louis, 294 miles, in 4 hours and 55 minutes, or at an average speed of 60 miles per hour.

The train possesses many unusual and attractive features. The effective air conditioning, smooth riding qualities at high speed, absence of shock in starting and stopping and its fast schedule are most favorably commented on by passengers.

PHYSICAL CHARACTERISTICS OF LINE

The physical characteristics of the line on which the Green Diamond operates are as follows:

Chicago-St. Louis, 294 Miles

About 32% of the line is double track.

RULING GRADES are 0.76% in both directions, except between Gilman and Clinton, 68 miles, where the southbound ruling grade is 1%.

MAXIMUM CURVES are 6°, with a few sharper curves at terminals. About 94% of the line is straight track.

WEIGHT OF RAIL—15% 112-pound; 24% 110-pound; and 61% 90-pound.

TIES are all treated.

BALLAST—50% chatts; 17% broken stone; 13% slag; 12% cinder; 6% gravel; and 2% screenings.

52 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

RESULTS OF OPERATION OF THE GREEN DIAMOND

Opposite is a statement of the revenues and expenses of the Green Diamond for the year ended June 30, 1938:

The percentage of Net Revenue to total Revenues for the year's operation was 39.6.

GROWTH OF TRAFFIC ON GREEN DIAMOND

The revenues of the Green Diamond (exclusive of dining car revenues) by six-months' periods are shown in the following statement:

Period	6 Months	Year
July 1 to Dec. 31, 1936	(est.) \$164,000	
Jan. 1 to June 30, 1937	149,032	\$313,032
July 1 to Dec. 31, 1937	155,346	
Jan. 1 to June 30, 1938	122,628	277,974

REVENUES AND EXPENSES

Item	CHICAGO-ST. LOUIS	
	1 Train, 4 Pass. Tr. Cars. One round trip daily.	
	Operation begun May 17, 1936	
	Amount	Per Train-Mile
REVENUES	\$ 277,974	\$ 1.486
TRAIN EXPENSES		
Wages of crew	51,053	.273
Fuel	8,957	.048
Lubricants, etc.	2,583	.014
Train supplies and expenses	14,864	.079
Power plant maintenance	32,548	.174
Train maintenance	37,621	.201
TOTAL Train Expenses	147,626	.789
Dining car loss	-20,137	-.108
TOTAL, Incl. Dining Car Loss	167,763	.897
NET REVENUE	110,211	.589
Per cent of Revenue	39.6	
Route-miles	294	
Train-miles	187,109	
Passenger-miles	11,683,493	

REBELS

GULF, MOBILE AND NORTHERN

GENERAL STATEMENT AND BRIEF DESCRIPTION OF REBELS

The two original Rebels are streamline Diesel-electric 3-car trains, designed and built by the American Car & Foundry Company. They were placed in service on the Gulf, Mobile and Northern between New Orleans, La., and Jackson, Tenn., in July 1935, replacing conventional steam trains. They are run on night schedules of approximately 14 hours for the 488 miles between terminals, making 47 stops. The average speed is about 35 miles per hour.

The principal material of construction in the trains is Corten steel. The cars are not articulated. Each train consists of a power car with compartments for mail and baggage, a buffet-passenger coach, and an observation-sleeping car. An additional coach is provided for use interchangeably in the two trains.

The motive power is a 660 H.P., 4-cycle McIntosh & Seymour Alco type Diesel engine, with cylinders of 12½-inch bore and 13-inch stroke, directly connected to a Westinghouse generator.

The center of gravity of the power car is 49 inches, and of the coaches and sleeping cars 51 inches, above top of rail.

The buffet-passenger coach seats 38 in the white compartment and 24 in the colored compartment. The buffet is equipped to serve meals throughout the

train and is operated by the Interstate News Company at a small loss to the railway company.

The observation-sleeping car contains 6 sections and 1 stateroom, together with spacious dressing rooms for men and women. The lounge-observation compartment seats 18 persons. The sleeping cars are operated by the railway company.

The extra car is a coach of 71 seats, 47 in the white compartment and 24 in the colored compartment. It is attached to the Rebels for the run between Jackson, Miss., and New Orleans, a distance of 186 miles, where the population is relatively dense.

The total weight of the 4-car train is 234 tons, and its length 302 feet. The total weight of the 3-car train is 187 tons, its length 226 feet.

In January 1938, a third Rebel was placed in service between Mobile, Ala., and Union, Miss., 181 miles. This train consists of a power car (of the same type as those of the New Orleans-Jackson, Tenn., Rebels) and a combination coach-sleeping car which it delivers to and receives from the New Orleans-Jackson, Tenn., Rebels. These combination cars contain 40 coach seats and 6 sleeping car sections, are 81 feet in length and weigh 53 tons. Thus, the New Orleans-Jackson, Tenn., Rebels are 4-car trains between New Orleans and Jackson, Miss., 186

miles; 3-car trains between Jackson, Miss., and Union, Miss., 74 miles; and 4-car trains between Union, Miss., and Jackson, Tenn., 228 miles.

The Rebel trains were designed to meet the particular needs of Gulf, Mobile and Northern passenger travel. They were an evolution rather than an innovation, as the company has operated motor trains since 1924, and gas-electric trains since 1930. The inauguration of the Diesel-electric trains marked the complete replacement of steam motive power in passenger train service with self-propelled internal combustion equipment.

The Rebels are the only streamline trains operated in the South. They are air-conditioned, ride smoothly and possess many features designed to add to the comfort and convenience of passengers. A hostess is in attendance on all trains. Because of their attractiveness and the completeness of their appointments, the enthusiasm with which they were first received has been fully sustained throughout the whole period of their operation.

PHYSICAL CHARACTERISTICS OF LINE

New Orleans, La.-Jackson, Tenn., 488 Miles

About 16 miles of the line is double track, the balance single track.

RULING GRADES are 1%.

MAXIMUM CURVES are 4°. Lower rates predominate, except at terminals. About 84% of the line is straight track.

WEIGHT OF RAIL—2% 80-pound; 47% 85-pound; and 51% 90-pound.

TIES—85% of the ties in the main track are treated.

BALLAST—The entire line is ballasted: 39% gravel, 57% slag and 4% cinders.

RESULTS OF OPERATION OF THE REBELS

Following is a statement of the revenues and expenses of the New Orleans-Jackson, Tenn., Rebels for the year ended June 30, 1938:

REVENUES AND EXPENSES

Item	NEW ORLEANS-JACKSON, TENN.	
	2 Trains, 4 cars New Orleans-Jackson, Miss. 3 cars Jackson, Miss.-Union 3 cars to 1/16/38, 4 thereafter, Union-Jackson, Tenn. Each a one-way trip daily.	
	Operation begun 7/29/35	
	Amount	Per Train-Mile
REVENUES	\$ 238,292	\$.679
TRAIN EXPENSES		
Wages of crews	79,027	.225
Fuel oil	9,977	.028
Lubricants, etc.	2,449	.007
Train supplies and expenses	18,316	.052
Power plant maintenance	19,525	.056
Train maintenance	21,543	.061
TOTAL Train Expenses	150,837	.429
NET REVENUE	87,455	.250
Per cent of Revenue	36.7	
Route-miles	488	
Train-miles	350,955	
Passenger-miles (est.)	7,800,000	

As the statement shows, the Net Revenue for the year was 36.7 per cent of the Revenues.

GROWTH OF TRAFFIC ON THE REBELS

The revenues of the New Orleans-Jackson, Tenn., Rebels (exclusive of buffet revenues) by six-months' periods are given in the following statement:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$80,693	
Jan. 1 to June 30, 1936	75,847	\$156,540
July 1 to Dec. 31, 1936	121,772	
Jan. 1 to June 30, 1937	104,598	226,370
July 1 to Dec. 31, 1937	124,995	
Jan. 1 to June 30, 1938	113,297	238,292

As this statement shows, the increase from the first year to the third was 52 per cent.

It is the opinion of the officials that approximately 40 per cent of the traffic of the Rebels is drawn from the highways, a view which is confirmed by the fact that the number of passengers declines about that amount when the Rebels are withdrawn from service for any reason and conventional steam trains substituted.

MERCURY

NEW YORK CENTRAL

GENERAL STATEMENT AND BRIEF DESCRIPTION OF MERCURY

The Mercury was placed in service on July 15, 1936, between Cleveland and Detroit, 164 miles. It was at first a 7-car train consisting of a baggage-coach, a coach, a coach-kitchen, a diner, a lounge car with bar, a parlor car and an observation-parlor car. In December 1936, 2 additional coaches were added to meet the growing demand for space on the train.

The cars which constitute the Mercury are semi-light-weight. They were originally built for suburban service and were completely rebuilt and redecorated for their present service, the work being done in the company's shops. The train is attractively streamlined throughout.

This train represents a complete departure from conventional design and decorative treatment in that the corridor-like appearance of the interiors of long passenger cars is largely overcome. The dining facilities are exceptionally commodious, permitting of serving 56 persons at one time.

The seating capacity is as follows: in coaches 194, in parlor cars 57, total 251; in dining car 56, in lounges 95, total 151; a total for the train of 402.

The train is drawn by a high-speed streamline Pacific-type steam locomotive. A unique feature is the illumination at night of the driving wheels by hidden floodlights.

The center of gravity of the locomotive is 77 inches above top of rail, and of the cars, 60 to 63 inches.

The weight of the train is—locomotive 305 tons, cars 573 tons; total 878 tons. The length of the locomotive is 91'6", cars 708'1"; total 799'7".

The train makes a round trip daily, traversing the distance of 164 miles between Cleveland and Detroit in 2 $\frac{3}{4}$ hours, or at an average speed of 60 miles per hour.

RESULTS OF OPERATION OF MERCURY

The operating costs of individual trains are not prepared by the company and that information is not, therefore, available for the Mercury.

The growth of traffic on the train is shown by the following statement:

Period	Revenue	Revenue per Train-Mile	Number of Passengers Handled	
			Westbound	Eastbound
July 15 to Dec. 31, 1936	\$161,462	\$2.89	20,167	28,447
Jan. 1 to June 30, 1937	189,503	3.19	23,272	34,444
July 1 to Dec. 31, 1937	214,582	3.55	27,041	39,079
Jan. 1 to June 30, 1938	184,095	3.10	22,239	34,486

The popularity of the train because of its luxurious appointments, beauty of decoration, high speed and smooth riding qualities has been such as practically to double the volume of rail travel be-

tween Cleveland, Toledo and Detroit and, as the above statement shows, its patronage continued to increase steadily until the beginning of the current business recession.

TWENTIETH CENTURY LIMITED
COMMODORE VANDERBILT
OF THE
NEW YORK CENTRAL
AND
BROADWAY LIMITED
LIBERTY LIMITED
GENERAL
SPIRIT OF ST. LOUIS
OF THE
PENNSYLVANIA

These new trains were inaugurated on June 15, 1938, replacing standard equipment. They are completely and beautifully appointed streamline light-weight high-speed trains, built by Pullman.

This report is as of June 30, 1938, and it is not thought that the record of operations of these trains for a 15-day period would be enlightening in respect of the subjects discussed herein.

ROYAL BLUE

BALTIMORE AND OHIO

The Royal Blue was installed in service on the Baltimore and Ohio between Jersey City, N. J., and Washington, D. C., 224 miles, on July 2, 1935. It was re-equipped on September 26, 1937, for the third time. The equipment of the train now consists of a fully streamlined steam locomotive, rebuilt in the railroad company's shops, and eight cars converted from conventional body construction into an attractive and pleasingly decorated streamline train with all modern conveniences. The work of reconstruction was done in the railroad company's shops.

The cars consist of a baggage-coach, 3 coaches, a lunch counter-coach, a dining car, a parlor car, and a cocktail lounge-observation car. The seating capacity is: coach, 240; parlor car, 32; total salable seats, 272; dining-lunch, 58; lounge, 42; total non-salable seats, 100—a total of all seats of 372.

The Royal Blue makes one round trip daily between Jersey City and Washington, a total daily mileage of 448. Its average speed is about 56 miles per hour.

The revenues and expenses of the Royal Blue are not available for this report.

ABRAHAM LINCOLN ANN RUTLEDGE

BALTIMORE AND OHIO-ALTON

The Abraham Lincoln and the Ann Rutledge are operated between Chicago and St. Louis, 282 miles, each train making a round trip daily, on about five-hour one-way schedules, at an average speed of 56 miles per hour.

The Abraham Lincoln was placed in service on June 24, 1935. It is an 8-car streamline train, built of aluminum alloy by the American Car and Foundry Company. It is handsome in appearance, well appointed, and with attractive interior decorations. It is hauled by an 1,800 H.P. Diesel-electric locomotive built by the Electro-Motive Corporation. The train consists of a baggage-coach car, 2 coaches, a diner-lunch car, a buffet-lounge, 2 parlor cars, and a parlor-observation car. The weight of the locomotive is 129 tons; cars, 361 tons; total 490 tons. The length of the locomotive is 65'10", cars, 560'0"; total, 625'10". The cars are non-articulated. The center of gravity is 46½ inches above the rail. The seating capacity is: coach, 164; parlor car, 76; total salable seats, 240; dining-lunch-buffet, 58; lounge, 35; total non-salable seats, 93—a total of all seats of 333.

The Ann Rutledge was installed under that name on the Alton for service between Chicago and St. Louis on July 26, 1937. From July 2, 1935, to July 25, 1937, the train had been operated as the Royal Blue by the Baltimore and Ohio

between Jersey City, N. J., and Washington, D. C. It is an 8-car Corten steel, beautifully styled and completely appointed, streamline train, built by the American Car and Foundry Company. It is hauled by a steam locomotive built in the railroad company's shops. The train is composed of a baggage-coach car, 2 coaches, a diner-lunch car, a buffet-lounge, 2 parlor cars, and a parlor-observation car. The weight of the locomotive is 266 tons; cars, 393 tons; total, 659 tons. The length of the locomotive is 97'5"; of the cars, 560'0"; total, 657'5". The cars are non-articulated. The center of gravity of the cars is 46½ inches above the rail. The seating capacity is: coach, 172; parlor, 76; total salable seats, 248; dining-lunch-buffet, 58; lounge, 35; total non-salable seats, 93—a total of all seats of 341.

PHYSICAL CHARACTERISTICS OF LINE

Chicago-St. Louis, 282 Miles

About 98% of the line is double track.

RULING GRADES are 0.78% northbound, 0.70% southbound.

MAXIMUM CURVES are 2°, except at terminals. About 90% of the line is straight track.

WEIGHT OF RAIL—85 to 130 pounds, 90-pound predominating.

TIES—About 15% treated, balance untreated.

BALLAST—About 95% crushed stone or crushed slag, balance cinder.

RESULTS OF OPERATION OF ABRAHAM LINCOLN AND ANN RUTLEDGE

Complete information concerning the revenues and expenses of the Abraham Lincoln and the Ann Rutledge is not

available for the period prior to December 1, 1937.

Following is a statement of the revenues and expenses of the two trains for the seven months ended June 30, 1938:

REVENUES AND EXPENSES
(7 Months)

Item	CHICAGO-ST. LOUIS				TOTAL TWO TRAINS	
	ABRAHAM LINCOLN		ANN RUTLEDGE			
	1 Train, Diesel-electric locomotive, 8 Pass. Tr. Cars, One round trip daily.		1 Train, Steam locomotive, 8 Pass. Tr. Cars, One round trip daily.			
	Operation Begun 6/24/35		Operation Begun 7/26/37			
	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.	Amount	Per Tr.-Mi.
REVENUES	\$ 361,083	\$ 3.020	\$ 309,123	\$ 2.585	\$ 670,206	\$ 2.803
TRAIN EXPENSES						
Wages of crew	34,250	.286	31,571	.264	65,821	.275
Fuel	9,767	.082	14,107	.118	23,874	.100
Lubricants, etc.	4,156	.035	1,883	.016	6,039	.025
Enginehouse expense	2,283	.019	4,485	.037	6,768	.028
Train supplies and expenses	19,206	.161	17,672	.148	36,878	.154
Steam locomotive maintenance	3,320	.027	28,661	.240	31,981	.134
Diesel locomotive maintenance	21,669	.181			21,669	.091
Train maintenance	17,562	.147	17,648	.147	35,210	.147
TOTAL Train Expenses	112,213	.938	116,027	.970	228,240	.954
Dining-Buffer loss	-11,942	-.100	-11,333	-.095	-23,275	-.098
TOTAL, Incl. D-B Loss	124,155	1.038	127,360	1.065	251,515	1.052
NET REVENUE	236,928	1.982	181,763	1.520	418,691	1.751
Per cent of Revenue	65.6		58.8		62.5	
Route-miles	282		282		282	
Train-miles	119,568		119,568		239,136	
Passenger-miles	15,118,496		13,010,833		28,129,329	

The percentage of Net Revenue to total Revenues for the seven months in the case of the Abraham Lincoln was 65.6, of the Ann Rutledge 58.8, an average for the two trains of 62.5.

As the foregoing statement shows, the trains have been well patronized and the financial results of their operation have been highly satisfactory.

CRUSADER

READING COMPANY

GENERAL STATEMENT AND BRIEF DESCRIPTION OF CRUSADER

The Crusader is the first streamline light-weight train to be installed on the Reading System. It was placed in regular service on December 13, 1937, between Philadelphia and Jersey City. It consists of five cars hauled by streamline locomotives, of which two are assigned to it. The cars are of stainless steel built by Budd.

The arrangement of the cars in the train is such that it may be run in either direction. The center car is a diner-tavern, preceded and followed by two coaches with smoking lounges.

The weight of the train is—locomotive 248 tons, cars 272 tons: total 520 tons. Its length is 490'8". It is non-articulated.

The coach compartments seat 224, the lounges 52, the diner-tavern 51: total 327.

The train makes two round trips daily (except Sundays) and is operated on schedules in the morning and evening to meet the needs of commuters to and from Philadelphia and New York.

The average mileage for the days run

is 361. The average speed is 55 miles per hour.

The train is splendidly appointed throughout, is strikingly handsome, and because of its many unusual features for providing day train comforts and conveniences it has received wide publicity and is exceptionally popular with the patrons of the road. No extra fare is charged. A coach ticket entitles the passenger to any seat in the train.

PHYSICAL CHARACTERISTICS OF LINE

Philadelphia-Jersey City, 90 Miles

About 70% of the line is 4-track and 30% double track.

RULING GRADES are 1.20% eastbound and 0.73% westbound between Philadelphia and Bound Brook Junction, 58 miles, and 0.42% eastbound and 0.60% westbound on balance of line.

MAXIMUM CURVES are 2°. About 86% of the line is straight track.

WEIGHT OF RAIL—130-pound.

TIES are all treated.

BALLAST—Crushed rock.

RESULTS OF OPERATION OF CRUSADER

No separate statistics of operation of the individual express trains between Philadelphia and Jersey City are kept by the Reading Company and consequently

the revenues and expenses of the Crusader are unavailable.

GROWTH OF TRAFFIC ON CRUSADER

The Crusader makes a round trip mornings and afternoons (weekdays only) between Philadelphia and New York. Its morning trip, leaving Philadelphia at 7:40 A.M. and arriving at New York (Liberty Street) at 9:25 A.M., is the most popular. The increase in the number of passengers on the train, as compared with the number carried on the conventional type train previously operated, is about 175 per cent. This increase does not entirely represent new patronage

since a certain indeterminate number of passengers have been drawn from two other trains leaving Philadelphia at 7:00 A.M. and 8:00 A.M., respectively.

That the Crusader has drawn traffic from new sources, however, is shown by the fact that since its inauguration the combined business of the three trains has increased about 28 per cent. Further evidence of induced new traffic is found in the increase of 21 per cent in the patronage of all Philadelphia-New York trains since the Crusader was installed, during which period passenger traffic generally declined as a result of depressed business conditions.

THE COMET

NEW YORK, NEW HAVEN AND HARTFORD

GENERAL STATEMENT AND BRIEF
DESCRIPTION OF THE COMET

The 3-car Comet was placed in service between Boston (South Station) and Providence on June 5, 1935. The original schedules provided for five round trips daily, except Sundays, between these points, with one intermediate stop at Back Bay Station (Boston). Between September 29, 1935, and September 27, 1936, the runs were increased to six round trips, reverting to five on the latter date. On September 29, 1935, a stop at Pawtucket (a suburb of Providence) was added.

All of the above represented new service as no steam trains were replaced by the Comet. At about the time the Comet was installed a one-day round trip rate of 2 cents per mile was inaugurated in New England. Commutation tickets, however, which are available in this section, were not accepted on the Comet.

On September 26, 1937, the entire Boston-Providence service was revised, so that the Comet replaced three local steam trains, and it now makes five round trips on weekdays and four on Sundays. On four of these trips on weekdays and three on Sundays the train makes from 3 to 5 local stops, consuming from 48 to 55 minutes, while one train each way daily makes the run in 44 minutes with 2 stops. Commutation tickets are accepted on all of these trains.

During the first two years of operation the capacity of the train was not completely utilized, but since the addition of local stops and the acceptance of commutation tickets it has been necessary on occasion to substitute steam trains to

relieve the growing over-capacity travel on the Comet.

The Comet is a 3-car articulated streamline unit, the car at either end housing a 400 H.P. Diesel-electric power plant and containing an operating compartment. The cars are of aluminum alloy and were built by the Goodyear-Zeppelin Corporation. The power plants and electrical equipment were furnished by the Westinghouse Electric & Manufacturing Company. The center of gravity of the train is 50.3 inches above top of rail.

The total weight of the train is 127 tons, its length 207 feet. It seats 160 coach passengers and has no head end or dining accommodations.

The average speed is 60 miles per hour between terminals with two intermediate stops and somewhat less with additional stops. The daily mileage is 440 on weekdays and 352 on Sundays.

The train presents a handsome appearance, contains many unique features and its appointments and riding qualities have been most favorably commented upon.

PHYSICAL CHARACTERISTICS OF LINE

Providence-Boston, 44 Miles

A four-track line extends from Providence eastward for 5 miles and from Boston westward 10 miles. The balance is double track with a 5-mile section of third track.

RULING GRADES—0.6% westbound, 0.4% eastbound (4.7 miles).

MAXIMUM CURVES—2°, except in terminals. About 79% of the route is straight track.

64 STREAMLINE, LIGHT-WEIGHT, HIGH-SPEED PASSENGER TRAINS

WEIGHT OF RAIL—About 69% is 107-pound; 12% 112-pound; and 19% 130-pound.

TIES are all treated.

BALLAST—Stone with the exception of about 2 miles of gravel.

RESULTS OF OPERATION OF COMET

Following is a statement of the revenues and expenses of the Comet for the year ended June 30, 1938:

REVENUES AND EXPENSES

Item	BOSTON-PROVIDENCE	
	1 Train, 3 cars, 2 containing power units. 5 Round trips weekdays and 4 Sundays.	
	Operation begun June 5, 1935	
	Amount	Per Train-Mile
REVENUES	\$ 149,997	\$ 1.101
TRAIN EXPENSES		
Wages of crew	32,315	.237
Fuel oil	5,080	.037
Lubricants	2,116	.016
Train supplies and expenses	7,774	.057
Power plant maintenance	19,846	.146
Train maintenance	9,006	.066
*General overhauling	6,810	.050
TOTAL Train Expenses	82,947	.609
NET REVENUE	67,050	.492
Per cent of Revenue	44.7	
Route-miles	44	
Train-miles	136,302	
Passenger-miles (est.)	8,086,000	

* Train did not receive general repairs during the year and this item is therefore estimated.

Note: The above figures are for the Comet only and do not include substitute steam operations, which represented 11.9 per cent of the service.

It will be seen from the statement that for the year the Net Revenue was 44.7 per cent of the Revenues.

GROWTH OF TRAFFIC ON COMET

The revenues of the Comet (exclusive of those from excursions) by six-months' periods, were as follows:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$53,265	
Jan. 1 to June 30, 1936	48,461	\$101,726
July 1 to Dec. 31, 1936	49,871	
Jan. 1 to June 30, 1937	52,465	102,336
July 1 to Dec. 31, 1937	73,472	
Jan. 1 to June 30, 1938	76,525	149,997

During the first four periods the train was out of service at different times for annual overhauling or other mechanical attention and the variations in earnings were due principally to this fact.

It is estimated that during the first six months of operation about 60 per cent of the Comet's passengers represented new business. The increase in the last two periods was due in part to added local stops and the acceptance of commutation tickets. As in the case of the Flying Yankee, it is probable that, but for the depressed business conditions, particularly in the two latter periods, the earnings would have been larger.

In the opinion of the officials of the road the Comet has attracted a considerable number of passengers who would otherwise have traveled by highway.

FLYING YANKEE

BOSTON AND MAINE—MAINE CENTRAL

GENERAL STATEMENT AND BRIEF
DESCRIPTION OF FLYING YANKEE

The 3-car Flying Yankee was placed in service on the Boston and Maine and Maine Central railroads between Boston and Bangor on April 1, 1935. The new train did not replace an existing steam train; nevertheless, during the past two years its limited seating capacity has been a distinct handicap.

For the period from April 1, 1935, to June 1, 1936, the seating capacity of the train was adequate, except at times of holiday weekends. With the advent of reduced coach fares, however, its capacity was insufficient in the periods of peak travel, such as on holidays and during the summer months, and it was necessary to supplement it with steam sections on so many occasions that a companion Diesel-powered train of conventional equipment, the Mate, was placed in service paralleling the Flying Yankee schedules. It was found, however, that the net profits were not sufficient to justify the operation of both trains, and the companion train operation was discontinued on September 30, 1937. The Flying Yankee is run normally only on weekdays, and because of its inadequate seating capacity it has been taken out of service on Mondays and Saturdays of the current summer and a larger steam train substituted. On occasion the train is used for Sunday excursions.

When the Flying Yankee was first introduced, the occasional substitution of a steam train was unpopular with passengers, so much so that it was necessary for a diplomatic passenger representative to be present to make explanations; and when the train was out of service for any considerable period as, for instance, during the annual shopping season, the business of the substituted trains declined more than that of other steam trains operating over the same route.

The Flying Yankee is a 3-car train, the forward car housing a 600 H.P. Diesel-electric power unit. The train was built by the Edward G. Budd Manufacturing Company, the power plant by the Electro-Motive Corporation. It is of stainless steel construction, streamlined, light-weight, and similar in its main features to the first Zephyr of the Burlington. The center of gravity of the train is about 52 inches above top of rail.

The total weight of the train is 123 tons, its length 199 feet. It contains 120 coach seats and 12 parlor seats in the observation end. The buffet on the train is rented to a concessionaire at a small percentage of the gross receipts.

The train operates at an average speed of about 62 miles per hour between Boston and Portland, and about 43 miles per hour between Portland and Bangor. The daily mileage is 734 for the days run.

The appointments and speed of the train have been favorably commented upon throughout New England. At the time it was built its appointments were the most modern and attractive then evolved for trains of its type.

PHYSICAL CHARACTERISTICS OF LINES

The physical characteristics of the lines on which the Flying Yankee operates are as follows:

Boston and Maine. Boston-Portland, 114 Miles

The line is double track throughout practically the whole route of the Flying Yankee.

RULING GRADES are about 0.80%.

MAXIMUM CURVES are 2° except at terminals. About 80% of the line is straight track.

WEIGHT OF RAIL—About 70% of the rail is 100-pound; 5% 112-pound; and 25% 130-pound.

TIES are practically all treated.

BALLAST—The entire line is rock ballasted principally with trap rock.

Maine Central. Portland-Bangor, 139 Miles

About 41% of the line is double track.

RULING GRADES are about 0.90% eastbound and 0.85% westbound.

MAXIMUM CURVES are 6° with curves of 2° and under largely predominating. About 71% of the line is straight track.

WEIGHT OF RAIL varies from 100-pound to 112-pound, with a small proportion of 85-pound.

TIES—54% treated hard pine; 16% untreated hard pine; and 30% untreated cedar and other soft woods.

BALLAST—2% crushed rock; 13% washed gravel; 85% bank run gravel.

RESULTS OF OPERATION OF FLYING YANKEE

Following is a statement of the revenues and expenses of the Flying Yankee for the year ended June 30, 1938:

REVENUES AND EXPENSES

Item	BOSTON-PORTLAND-BANGOR	
	1 Train, 3 cars, 1 containing power unit. Round trip Boston-Bangor and round trip Boston-Portland daily except Sunday.* Operation begun April 1, 1935	
	Amount	Per Train-Mile
REVENUES	\$ 270,188	\$ 1.427
TRAIN EXPENSES		
Wages of crew	45,769	.242
Fuel oil	3,845	.020
Lubricants, etc.	1,550	.008
Train supplies and expenses	5,362	.028
Power plant maintenance	14,115	.075
Train maintenance	21,406	.113
TOTAL Train Expenses	92,047	.486
NET REVENUE	178,141	.941
Per cent of Revenue	65.9	
Route-miles	367	
Train-miles	189,310	
Passenger-miles (est.)	13,120,000	

* Because of lack of capacity train was run only on Tuesdays, Wednesdays, Thursdays and Fridays of current summer.

Although inadequate for the service, as before stated, the percentage of Net Revenue to Revenues for the year's operation was 65.9.

GROWTH OF TRAFFIC ON FLYING YANKEE

The revenues of the Flying Yankee (exclusive of buffet revenues) by six-months' periods are shown in the following statement:

Period	6 Months	Year
July 1 to Dec. 31, 1935	\$132,066	
Jan. 1 to June 30, 1936	102,982*	\$235,048
July 1 to Dec. 31, 1936	145,367	
Jan. 1 to June 30, 1937	104,555**	249,922
July 1 to Dec. 31, 1937	(est.) 153,501	
Jan. 1 to June 30, 1938	(est.) 116,687***	270,188

* Out of service 7 weeks. Was shopped for annual inspection and shops marooned in flood.

** Out of service 7 weeks. Annual inspection and heavy repairs to car and power plant after 400,000 miles.

*** Out of service 3½ weeks for annual inspection and light repairs.

While the revenues of the Flying Yankee have grown moderately, as the above statement shows, it is probable that the rate of increase would have

been considerably greater had its capacity been adequate for full-time service. No doubt also the depressed business conditions have adversely affected the earnings.

It is the belief of the officials that the train possesses a dramatic appeal that has been an important factor in attracting traffic. Questionnaires returned by passengers on the Flying Yankee during the early period of its operation indicate that about half of its patronage was either newly created or recaptured from the highways.

The Flying Yankee, as the statements show, has been a highly successful train from the beginning of its operation notwithstanding its inadequate capacity.

CONCLUSION

This report is not as complete as would be desirable. Unfortunately, there are few actual data available from which accurate determinations can be made of the sources of traffic on the new trains, the extent to which travel is diverted from other slower and less luxurious trains, recovered from the highways, or is newly created. In many cases we have stated the opinions of the officials of the respective lines on this subject and, although necessarily expressed in general terms, they may be taken as authoritative. It is clear from these opinions that a large proportion of the traffic on these trains has been newly created or retrieved from the highways.

The outstanding facts, however, which the statements in the report reveal in a striking manner, are the great popularity and the high degree of financial success attained in the operation of light-weight high-speed streamline trains.

