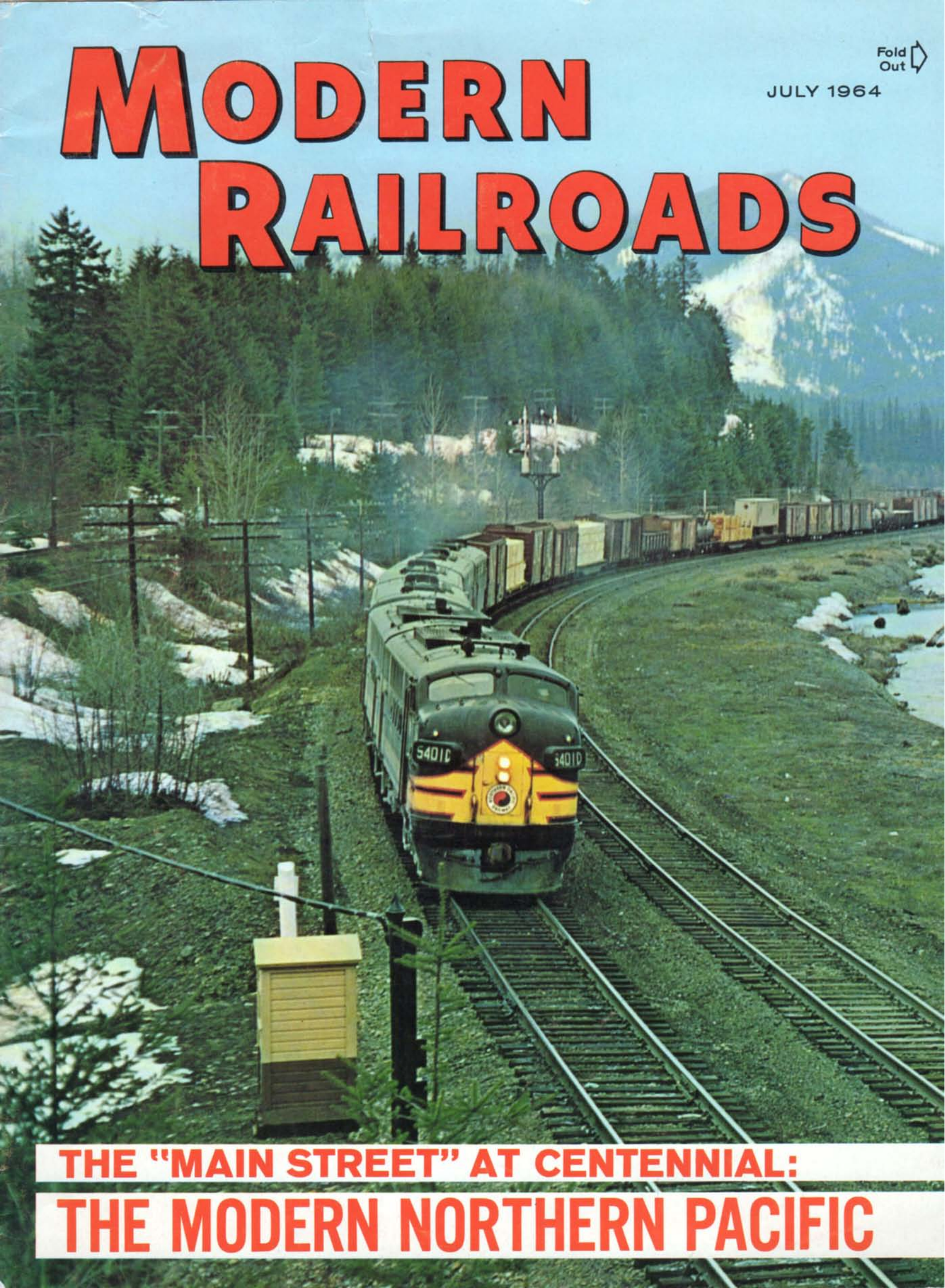
MODERN RAILROADS

Fold Out

JULY 1964



THE "MAIN STREET" AT CENTENNIAL:

THE MODERN NORTHERN PACIFIC

28th in Modern Railroads' series... Private Enterprise at Work

Along scenic Yakima River, fast freight rolls east

AFTER 100 YEARS

still the railroad with young ideas

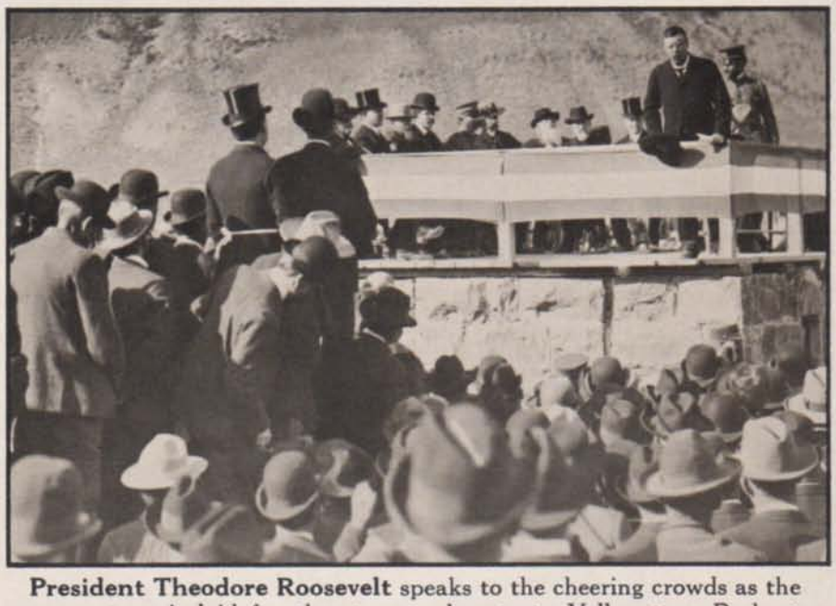
Railroaders find it particularly pleasant to stroll along memory lane, and no wonder. The history of American railroading is a story filled with adventure, courage and drama. That's why Northern Pacific is pausing a moment to look back on some of the happenings since July 2, 1864, when President Lincoln signed the bill that ultimately brought our road into being.

But Northern Pacific has never been a railroad to live in the past. Things are moving too fast nowadays to allow more than a quick appraisal of what has gone before; we're more interested in finding out — and preparing for — what lies ahead.

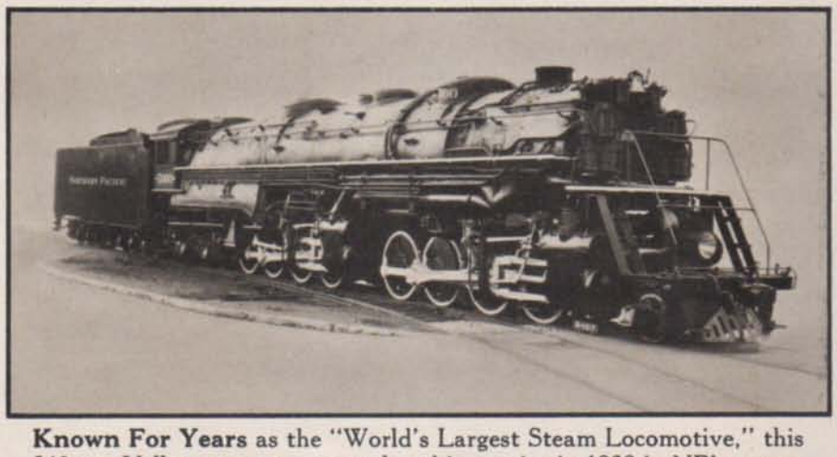
We think that's the way to run a railroad. It's the way we run Northern Pacific Railway, route of the Vista-Dome North Coast Limited.

NORTHERN PACIFIC RAILWAY

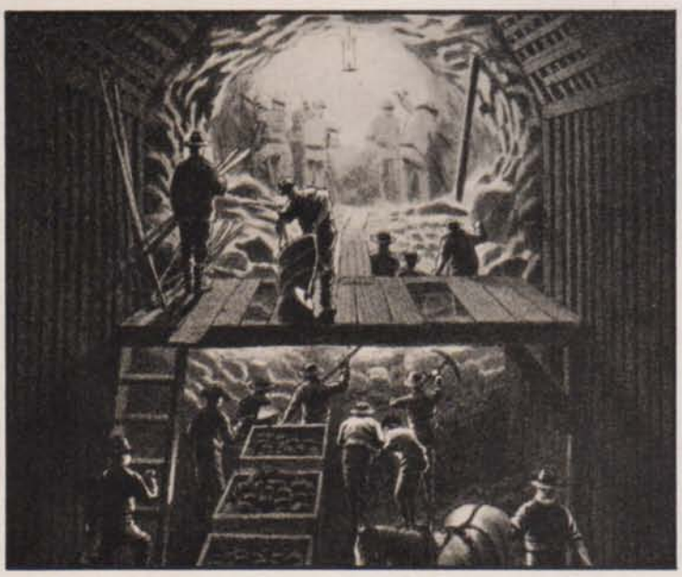
This Gaily Festooned Locomotive was one of four which pulled trains carrying celebrities to Gold Creek, Montana, for the driving of the last spike on the first northern transcontinental railway. Ulysses S. Grant was one of the notables who participated with Northern Pacific president Henry Villard in the ceremonies on September 8, 1883.



President Theodore Roosevelt speaks to the cheering crowds as the cornerstone is laid for the stone arch gate to Yellowstone Park at Gardiner, Wyoming, in 1903. Northern Pacific has carried thousands of people from all over the world to visit the Yellowstone wonderland, America's first national park.

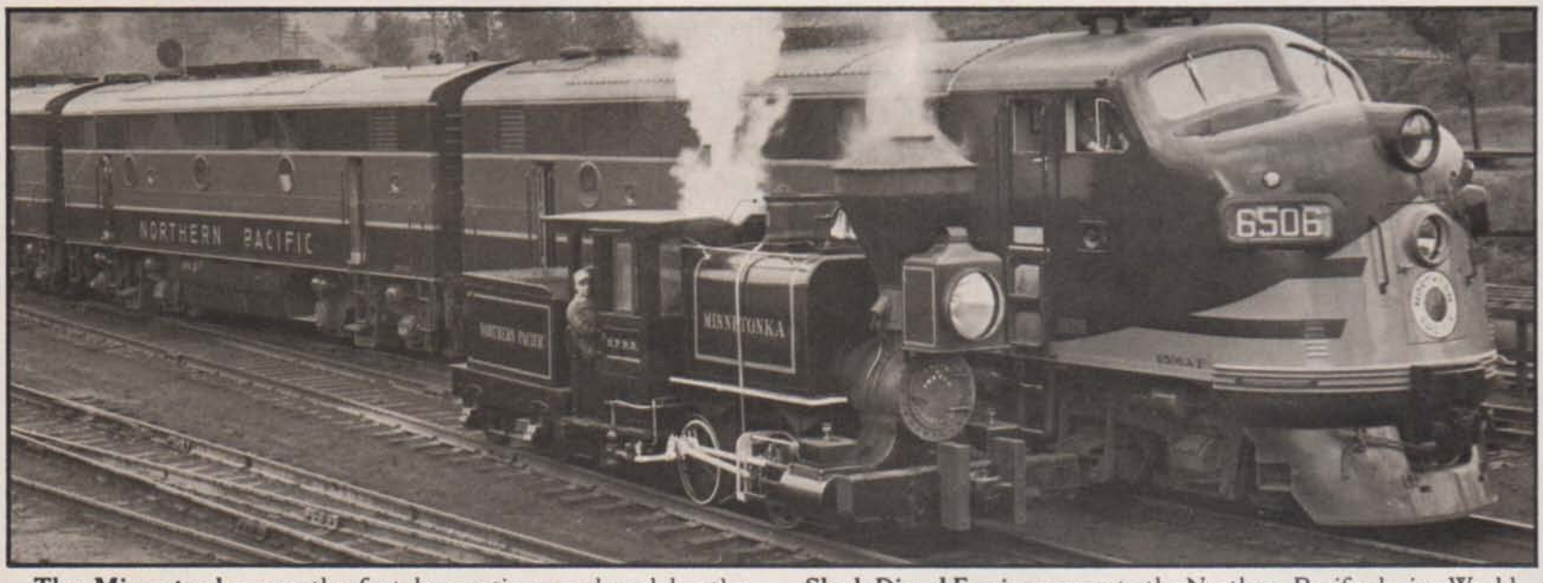


Known For Years as the "World's Largest Steam Locomotive," this 563-ton Yellowstone type was placed in service in 1929 in NP's mountain divisions. 125 feet long and over 17 feet high, it had twice the hauling capacity of locomotives used previously over this rugged terrain.



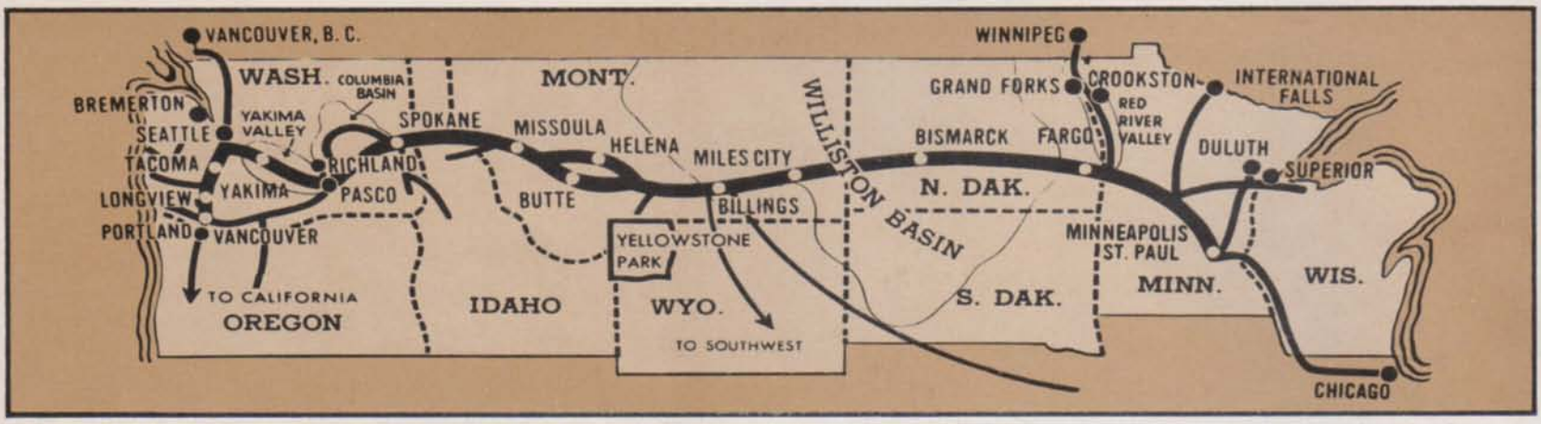
A Two-mile Tunnel At Stampede Pass in the Cascades was necessary to link Seattle directly with the east. The rough, tough Bennett brothers took on the job and on May 3, 1888, a final blast linked the two ends of the tunnel; the centers were within an inch of meeting perfectly.

The First North Coast Limited left passengers gasping with amazement in 1900, with its electric lights, library, barbershop and bathtub. Today the modern Vista-Dome North Coast Limited is the senior "name train" west of the Mississippi and its standards of service and elegance continue to delight and amaze travelers.



The Minnetonka was the first locomotive purchased by the Northern Pacific. The little wood burner was used for construction work as the first tracks pushed westward from Carlton, Minnesota, in 1870. When the tracks and the engine reached the Red River, the first town to the west was Bozeman, 780 miles away.

Sleek Diesel Engines came to the Northern Pacific during World War II and by January, 1958 had replaced the colorful steam locomotives. Shortly after the coming of the diesel, Northern Pacific became one of the first railroads to introduce radio communication between locomotive, caboose and station.



The Northern Pacific Today is a 6,800-mile network of track in seven states and Canada. More than 600 powerful diesel-electric locomotive units haul fleets of freight cars laden with the products of the farms and forests, ranches and mines of the Northwest, plus a steady stream of manufactured articles required by the growing population and expanding economy of this area.

PRIVATE ENTERPRISE AT WORK

The Modern Northern Pacific

"Main Street of the Northwest" at Centennial

by Nancy Ford and Edward T. Myers

This month marks the 100th birthday of the Northern Pacific Railway—the "Main Street of the Northwest."

Yet, as Northern Pacific passes "milepost 100," it is pausing only briefly to look backward. For this aggressive railroad is busy writing still another chapter of the many that have made it a dynamic part of the growing Upper Middle West and Pacific Northwest.

NP is involved in one of the most far-reaching of the many current merger proposals—the four-way union of the Northern Pacific, Great Northern, Chicago Burlington & Quincy and Spokane, Portland & Seattle railroads.

Despite the uncertainties this brings, NP is driving ahead with the 14th year of intensive self-improvement under the leadership of President Robert S. Macfarlane. The $34.5 million budgeted for physical improvements this year will bring the total spent for improvements to $332.6 million since Mr. Macfarlane became president in 1951.

The story of the Northern Pacific at centennial is yet another reminder of the vitality of America's free-enterprise railroads. Its highlights are sketched on the pages that follow.

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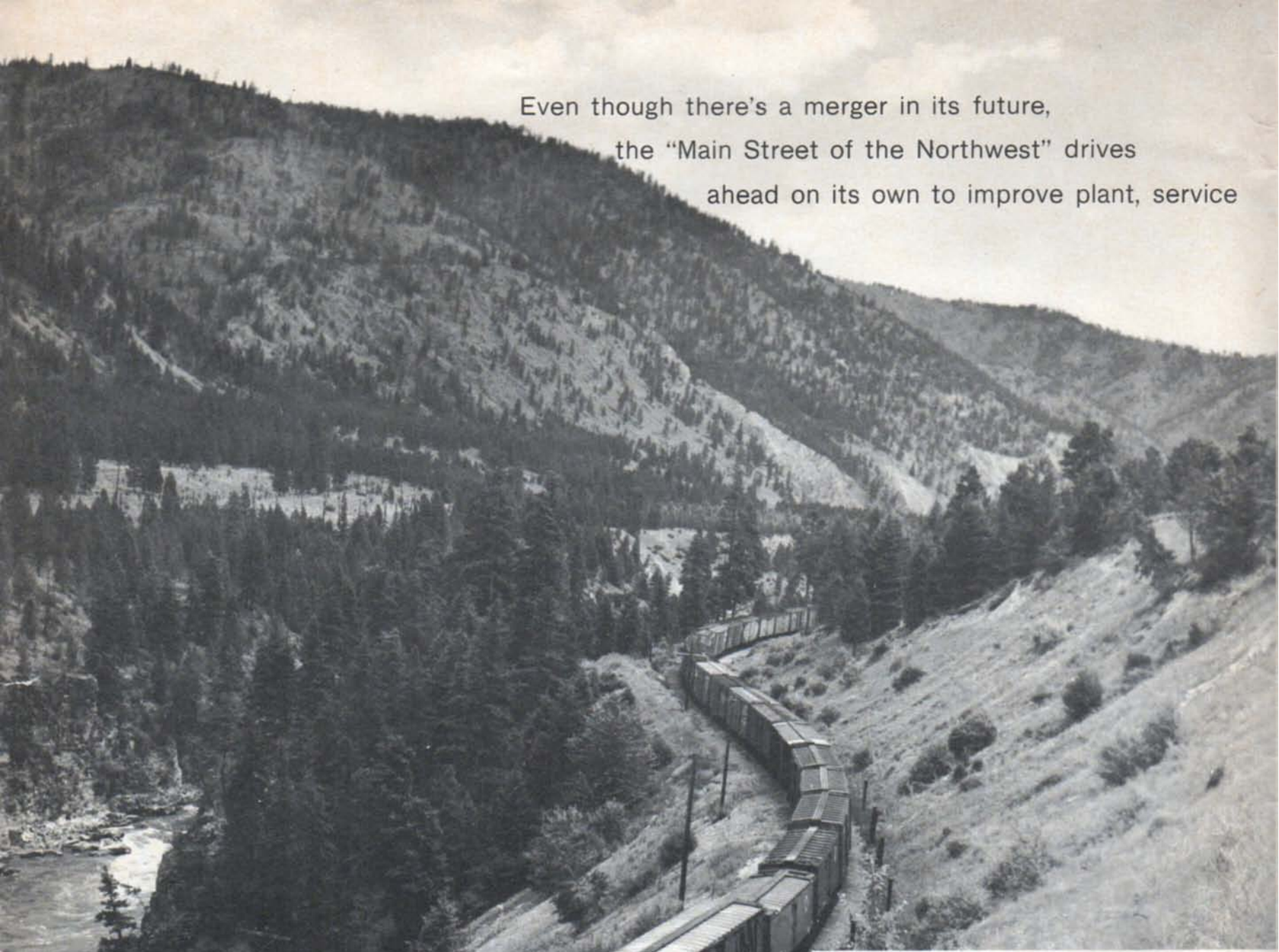

Even though there's a merger in its future, the "Main Street of the Northwest" drives ahead on its own to improve plant, service

July 2, 1964, has special significance for the Northern Pacific Railway. It is the 100th anniversary of the signing by President Lincoln of a special Act of Congress.

The Act chartered the Northern Pacific Railroad Company and authorized a land grant. In September, 1870, construction of the transcontinental railroad which is now the NP began at Carlton, Minn.

On Sept. 8, 1883, there was a ceremony at Gold Creek, Mont. President U. S. Grant, the colorful Henry Villard, then president of the Northern Pacific, and other notables marked the driving of the last iron spike in a right-of-way hacked out of a wilderness of mountains and plains. Its route generally followed that of the explorers, Lewis and Clark, from the Missouri River to the Pacific Northwest.

But on July 2, 1964, Northern Pacific will take only a short backward look.

The eyes of its present management, under the leadership of Robert S. Macfarlane, president, are firmly fixed on the future. "Northern Pacific's history is a proud one, and we honor it," says Mr.

At Centennial, NP Looks Ahead

At the throttle ...
"A Brilliant Administrator"

ROBERT S. MACFARLANE, president of NP.

At the throttle of the Northern Pacific Railway since Jan. 1, 1951, is Robert S. Macfarlane, a brilliant administrator, who, by his own account and that of his staff, likes to "run a tight ship, with a straight line of command and authority."

His officers call him exacting but fair, and a hard man with a dollar as befits his Scottish ancestry. An outstanding characteristic is an extremely retentive memory. "You could call it a gift of almost total recall," says one associate. **"You** *may forget a report you made to him a couple of years ago, but* **he** *doesn't."*

An early development in his administration was the discovery of oil on NP's Williston Basin lands. Mr. Macfarlane immediately formed a separate department to expand and manage oil interests. It reports directly to the executive department, is staffed largely by men from the oil industry.

Mr. Macfarlane set up a personnel department to recruit trainees from colleges for the operating, traffic, and accounting departments. Traffic courses were developed and offered to qualified employees. Mail courses in accounting were also made available. Men were sent to various colleges for management training.

While he never backs away from a decision which he alone must make, Bob Macfarlane rarely "second guesses" his officers. He feels that the main organizational change he effected was to place full responsibility on vice presidents to run their own departments. "I have a fine team," says he. "And the success of this or any other big company is really dependent on the work of a lot of people. We don't have just two or three stars."

Mr. Macfarlane speeded up freight and passenger schedules, also pushed multi-million dollar plant improvements for more efficiency, including: Complete dieselization by 1958; installation of continuous welded rail in open track; introduction of centralized traffic control and train radio; initiation of service over one of the longest privately owned direct dial phone networks in the world; and construction of the Pacific Northwest's first electronic freight classification yard.

Born in Minneapolis, the NP president grew up in Seattle, attended Brown University, and was graduated magna cum laude with an LLB degree from the University of Washington. In that same year, 1922, he became chief deputy prosecuting attorney for King County (Seattle), Washington. Eight years later, at 31, he was elected a superior court judge, youngest ever to hold that post in the county. In 1934 he left the bench to become assistant western counsel for NP. A series of promotions carried him to the post of executive vice president before he was elected president.

He rarely plays golf, doesn't dabble in amateur photography, or sail a boat. "I guess you could say work is my hobby," he confesses.

Macfarlane, "but we must move toward tomorrow and the day after tomorrow."

Hopefully, NP's future includes a multiple marriage with the Great Northern Railway, the Chicago, Burlington & Quincy Railroad, and the Spokane, Portland and Seattle Railway. With the Great Northern, NP owns all of the stock and bonds of SP&S. GN and NP also own all but a handful of shares of the "Q."

"The proposed merger is desirable and, we believe, in the public interest," declares Mr. Macfarlane, "but whether or not it is consummated, NP is dedicated to a continuing, solid program of physical improvements and managerial policies designed to increase efficiency and profits."

(In the 13-year period 1951-1963, NP plowed $140.7 million into roadway and structures, $206.8 million into equipment. Programmed for 1964 are $14.8 million for roadway and structures and $19.6 million for equipment.)

NP operates a network of approximately 6800 miles extending from Ashland, Wis., the Twin Cities, and the Lake Superior ports of Duluth and Superior to Seattle and Tacoma, Wash., and Portland, Ore., and other ports on Puget Sound and the Columbia River. Its operations in Manitoba are conducted by the Midland Railway of Manitoba, which is owned jointly with Great Northern. It reaches Chicago over lines of the Burlington.

NP's route from Chicago to the Pacific Northwest is somewhat longer than that of its chief competitors, GN, Union Pacific, and The Milwaukee Road. Yet, last fall, NP made a 24-hour reduction (to 60½ hours) in its schedule between Chicago and West Coast terminals, to keep competitive. Also reflecting NP's consciousness of customers' needs is its substantial fleet of specialized freight cars, and its willingness to make competitive pricing adjustments.

NP's management also believes there is a future for good passenger services and aggressively goes after business. It has speeded up transcontinental schedules in recent years, and spent several millions of dollars on new equipment.

NP rails serve the Cuyuna Iron Range in Minnesota, the grain and potato areas of Minnesota and North Dakota, the grain-growing, lumber and mining industries of Montana, Idaho, and Washington, the fruit and berry-growing areas, including the irrigated Yakima Valley in Washington, as well as the fish and lumber industries of the Pacific Coast areas. The company also serves the large Columbia Basin irrigation project.

Although a granger railroad, the development of food processing and other industries in its territory is diversifying and strengthening NP's traffic "mix." Piggyback and auto rack traffic are also on the increase.

Here are some of the ways NP continues to improve: A five-year program starts this year for replacement of diesel locomotives with units of higher horsepower. On this year's purchase of 15 2500-hp locomotives, the savings are estimated at about 6 percent on net investment (before federal income taxes).

NP officials say it is difficult to estimate total savings from elimination of outmoded work rules, including the elimination of firemen on diesels, but they would be "substantial." (On the less than 1900-mile run from the Twin Cities to

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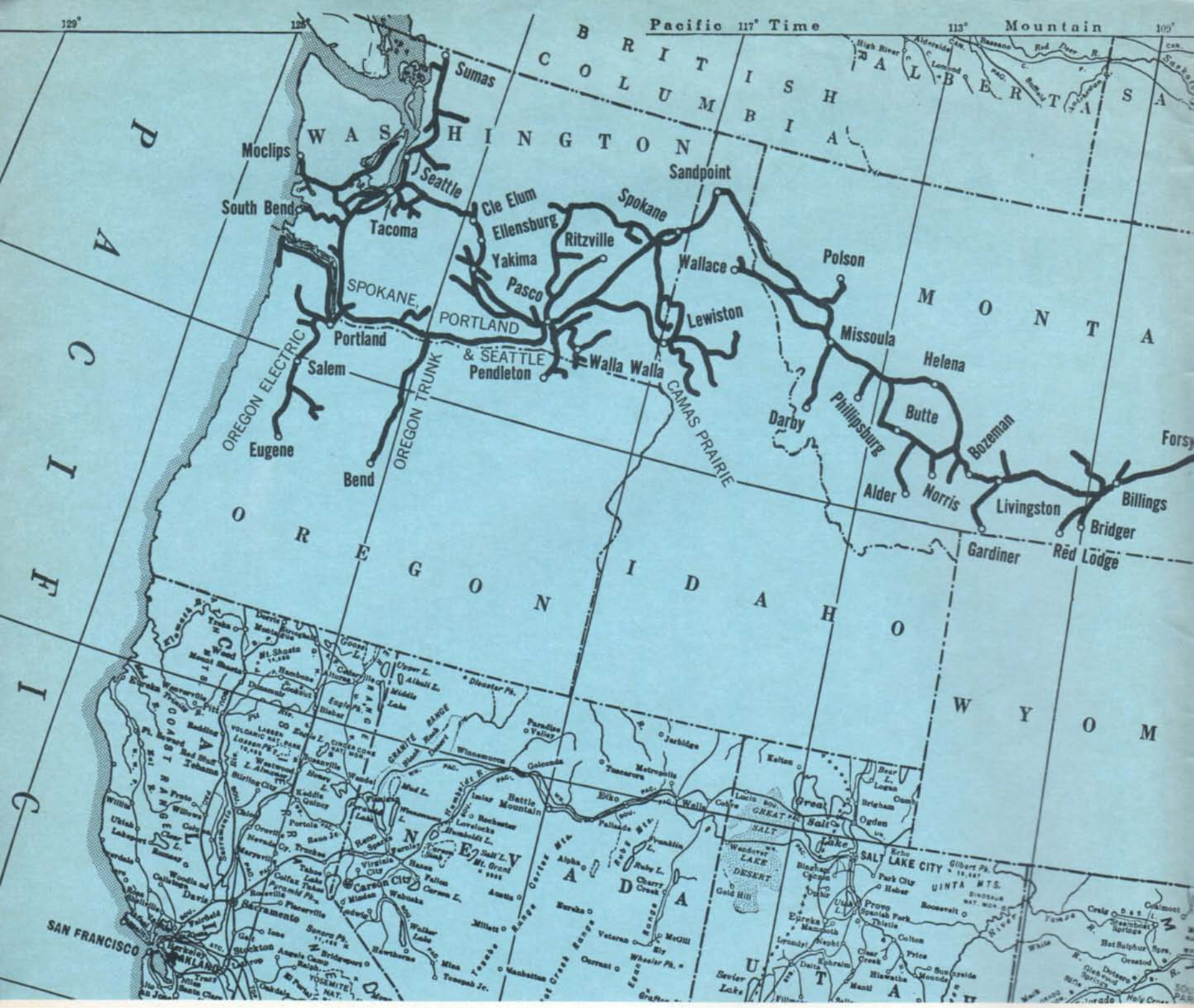


F. L. Steinbright
Vice President-
Operating

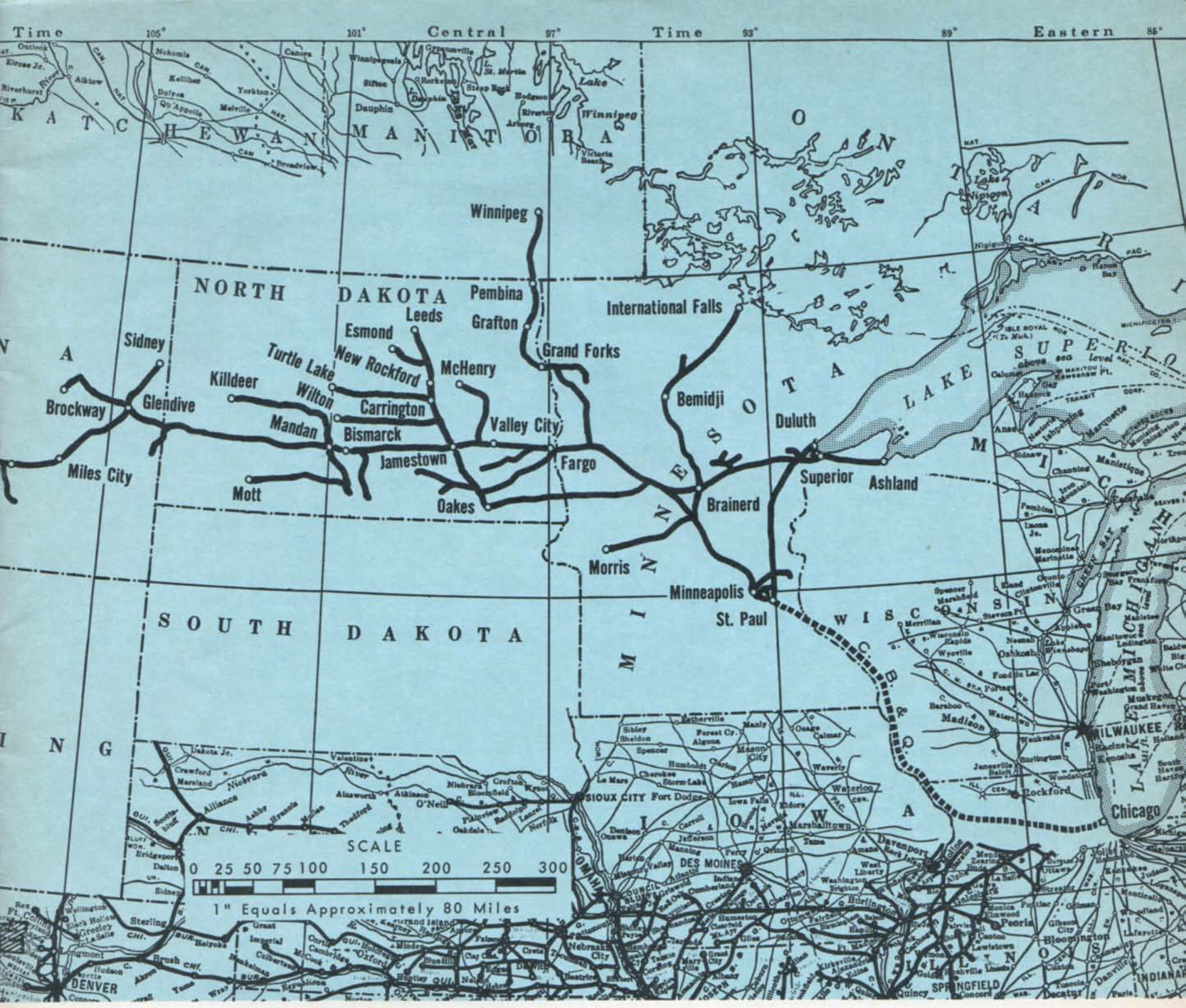
W. J. Luchsinger
Vice President-Traffic

Edward B. Stanton
Vice President
Executive Department

George M. Washington
Vice President
Oil Development

Earl F. Requa
Vice President and
General Counsel

Dean H. Eastman
Vice President and
Western Counsel



SYSTEM MAP OF THE NORTHERN PACIFIC

With 6795 miles of road, the Northern Pacific was the first northern transcontinental line. It serves seven states and one Canadian provinces, reaching Chicago via the Burlington Railroad and Portland via the Spokane, Portland & Seattle Railway.

How Northern Pacific Got Its Trademark — the Monad

A mystic symbol, the Monad, lies in the center of Northern Pacific's trademark. This symbol dates back nearly 1000 years, and traces of it can be found at least 4000 years before that. The design is called the great Chinese Monad or the Diagram of the Great Extreme. Traces of this design appear in the bead work of the American Plains Indians. Modified versions of the design are used as good luck tokens in Japan. Northern Pacific sees it not merely as a symbol of good luck but as a symbol of good transportation.

In 1893, E. H McHenry, chief engineer of the Northern Pacific, was visiting the Columbian Exposition in Chicago. He chanced to visit the Korean exhibit. Seeing the Korean flag which bore the Monad in red and blue, he was impressed by the simple but striking design. At that time, NP was searching for a suitable trademark. When he returned to St. Paul, he submitted his idea to Charles Fee, then general passenger agent, and together they worked out the emblem which is today so familiar to Americans.

The symbol has deep philosophical meaning. The two comma shaped halves represent the Dual Powers of the universe . . . Two Principles called Yang and Yin. Their primitive meanings were: Yang, Light; Yin, Darkness. Philosophically, they stood for the positive and the negative.

Many interpretations are assigned to these: male and female, Heaven and Earth, motion and rest. To the Chinese, the colors of the two elements were apparently unimportant.

the West Coast—now made in less than 48 hours—16 crew changes are now required.)

A pioneer in the use of welded rail, NP now has 16 percent of its main line track in these long lengths, a proportion that will increase with completion of this year's rail program.

New machines are coming for track work, already as well mechanized as on any railroad in the country, for surfacing, rail relay, tie replacement, and brush spraying. (NP does not use "system" gangs. Machines are sent to division and district roadmasters, who supervise the work.)

Although opportunities to apply Centralized Traffic Control with a **large** return on investment are fewer now, CTC installations are continuing. The goal is eventually to bring the entire main line under CTC.

"More automatic retarder yards are planned to supplement the one at Pasco," says F. L. Steinbright, vice president-operations. "If there's no merger, we'll go ahead on our own."

NP is also a pioneer in end-to-end train radio and in dispatcher-to-train radio. All main-line trains are now radio-equipped. Passenger train conductors recently were furnished with portable radios for contact with the head end and with wayside stations.

"We were one of the first railroads to use carrier-telephone facilities on our own wires," comments Mr. Steinbright. "We thereby expanded the number of circuits without putting up more wires. In recent years we have speeded our communications through a direct dial system between all phones at general headquarters, division headquarters, and major terminals."

NP's principal freight car shops at Brainerd, Minn., operate continuously rather than seasonally, largely for the building of boxcars on a production line basis and for heavy repair work. Como shops at St. Paul handle the principal repairing and rebuilding of passenger cars. All through freight and passenger locomotive repairs (heavy and running) are made at Livingston, Mont., where engine wheels can be trued without demounting and where there are also facilities for maintaining M/W equipment.

For more efficient control of materials and supplies, stocks have been centralized in fewer stores, and inventories reduced —by some $3.6 million in the 1960-64 period. Currently, a team from the accounting and stores departments is engaged in a study of inventories. The object is to set up new procedures for mechanizing stores material accounting, and providing a perpetual inventory of materials and supplies. Further reductions in inventory are expected.

In a move to make its owned automobile and truck fleet more efficient, NP turned administration of these vehicles over to a fleet supervisor in the personnel department, which reports directly to the executive department. The fleet represents an investment of nearly $2 million. (Truck units involved are separate from those of NP's wholly owned subsidiary, Northern Pacific Transport Co.)

Under this management system, NP has pared its per-mile costs to a level that's below the cost of leasing vehicles.

To deal with the traditional mountain of railroad paperwork, NP makes wide use of business machines for data processing. It recently replaced an IBM 1401 computer with a 1410. The accounting department is currently programming several new chores for the computer, to give management better decision-making tools.

Although NP went through a major reorganization at the turn of the century as a result of earlier financial difficulties, including the manipulations and failure in 1873 of Jay Cooke, who was fiscal agent of the railroad, NP has never been through another bankruptcy. Except for deficits in the depression years of 1932 and 1938, NP—aided by substantial non-operating income—has shown net income over a long period of years, although the profit figures have fluctuated widely. Also the road has consistently paid dividends since 1943, split its stock two for one in 1956, and declared a 20 percent stock dividend in 1958.

NP has no near-term mortgage debt, its earliest maturity being $1 million of St. Paul & Duluth First Consolidated 4s in 1968. Except for the collateral trust 4s of 1984, which have the benefit of a full pay-out sinking fund, the company's five

FINANCIAL TRENDS, 1954-64

Northern Pacific Ten-Year Summary

	3 Months 1964	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954
RAILWAY OPERATING REVENUES											
Freight	$ 40,328,857	$160,837,146	$153,638,050	$145,451,552	$155,556,632	$164,100,679	$160,207,155	$164,648,540	$167,777,992	$162,427,348	$150,833,126
Passenger	1,152,807	6,461,383	7,840,480	7,038,846	6,243,172	6,140,443	6,119,988	6,950,248	6,944,605	7,452,973	7,308,913
Mail	1,218,139	5,179,296	5,405,014	5,461,776	5,293,954	5,253,882	4,852,204	4,743,913	4,393,681	4,393,811	4,900,825
Other	1,696,649	7,126,686	7,379,390	7,460,279	7,821,734	8,113,778	7,928,384	8,060,289	9,053,534	8,759,198	8,558,979
Total railway operating revenues	44,396,452	179,604,511	174,262,934	165,412,453	174,915,492	183,608,782	179,107,731	184,402,990	188,169,812	183,033,330	171,601,843
Net railway operating income	3,179,616	14,154,478	13,820,180	8,585,776	10,115,540	14,568,518	18,225,319	17,401,669	17,875,223	19,223,760	15,459,345
OTHER INCOME	4,885,813	23,004,864	20,148,003	21,005,444	21,512,618	21,713,457	17,672,263	16,748,834	15,239,509	11,476,971	11,047,454
Income available for fixed charges	7,676,330	35,666,554	31,583,818	27,693,310	29,980,945	34,947,306	33,119,615	31,892,995	31,336,056	29,254,473	24,808,625
TOTAL FIXED CHARGES	2,763,348	11,074,084	11,283,283	11,379,988	11,433,751	11,166,141	11,107,639	10,766,945	10,352,611	10,110,855	10,450,580
NET INCOME—In conformity with I.C.C. accounting rules	$ 4,912,982	$ 24,592,470	$ 20,300,535	$ 16,313,322	$ 18,547,194	$ 23,781,165	$ 22,011,976	$ 21,126,050	$ 20,983,445	$ 19,143,618	$ 14,358,045
NET INCOME—In conformity with generally accepted accounting principles	$ 3,212,982	$ 18,067,470	$ 13,624,535	$ 14,916,322	$ 16,201,194	$ 21,507,165	$ 19,273,976	$ 16,902,050	$ 17,612,445	$ 15,763,618	$ 12,950,045
RATIOS:											
Operating	84.72	84.98	86.02	86.60	84.54	79.75	79.88	82.79	80.53	78.68	83.14
Transportation	41.53	39.62	40.95	41.80	41.11	38.73	39.12	39.65	39.61	39.29	40.86
M/W & S	13.99	16.65	15.25	15.47	15.56	15.01	13.40	15.44	14.86	13.95	15.55
M/E	19.89	19.75	20.17	19.42	18.61	17.27	18.48	18.90	17.88	17.76	18.94
TIMES FIXED CHARGES EARNED											
Before federal income tax	2.84	3.25	2.69	2.49	2.88	3.86	3.44	3.05	3.50	3.71	2.53
After federal income tax	2.78	3.22	2.80	2.43	2.62	3.13	2.98	2.96	3.03	2.89	2.37
EARNINGS PER SHARE OF STOCK	$ .82	$ 4.09	$ 3.39	$ 2.72	$ 3.10	$ 3.97	$ 3.68	$ 3.54	$ 3.52	$ 3.21	$ 2.41
DIVIDENDS PAID PER SHARE OF STOCK (Revised to reflect 2 for 1 stock split in 1956 and a 1 for 5 stock dividend in 1958)	$ .70	$ 2.35	$ 2.20	$ 2.20	$ 2.20	$ 2.00	$ 1.67	$ 1.63	$ 1.50	$ 1.25	$ 1.25
AVERAGE NUMBER OF EMPLOYEES	15,357	15,852	15,931	16,043	17,188	17,884	18,016	21,041	21,923	22,641	23,309

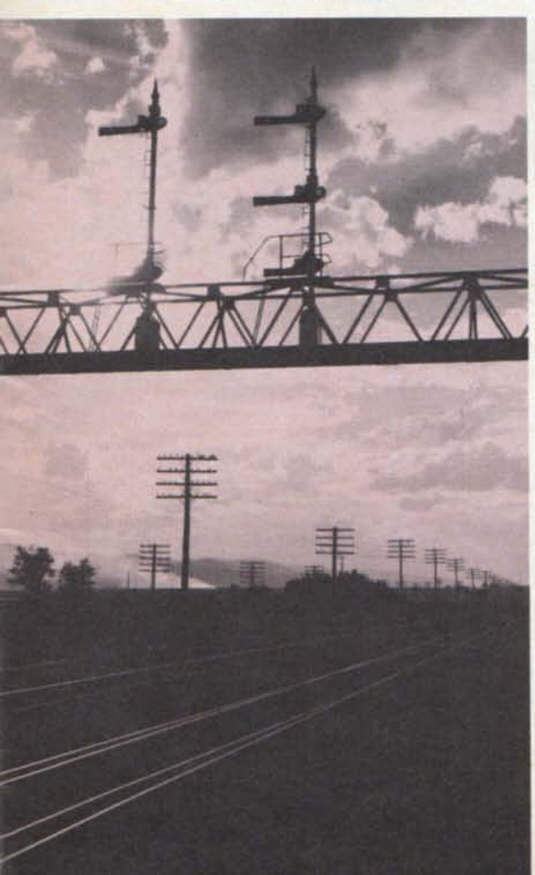
other mortgage issues mature variously some 30 years hence.

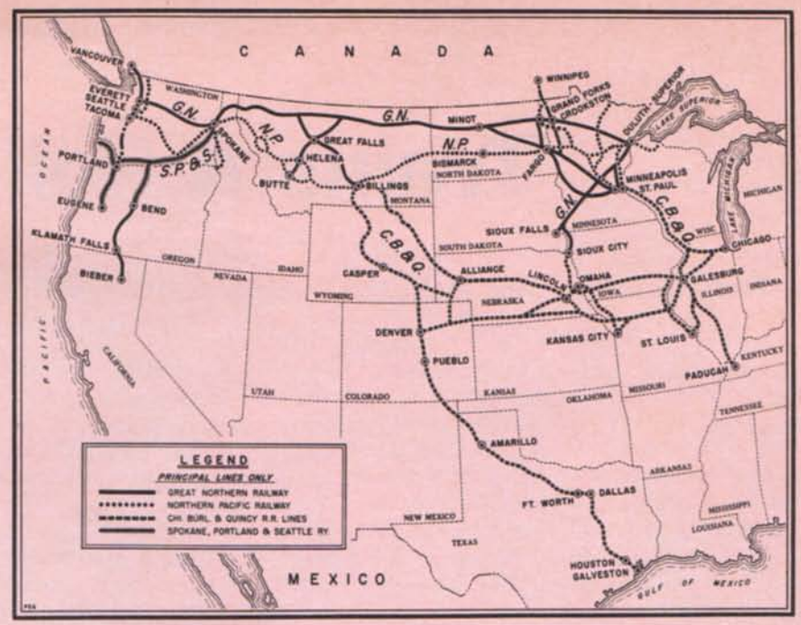
Fixed charges are rather high in relation to revenues, and net operating income from rail operations hasn't always covered them. But NP's handsome "other income" from non-operating sources has greatly minimized this hazard.

In recent years, oil and gas gross income has exceeded dividends from NP's 48.6 percent interest in the "Q," which up to then had formed the bulk of revenue from non-operating sources. Last year, for example, oil and gas gross income was reported at $8.3 million under a new accrual accounting system ordered by ICC. On a direct-comparison basis, this income was $7.7 million against $7.9 million in 1962. It still exceeded the Burlington dividend of $6.2 million. Other large items of non-operating revenue included timber sales of $4.2 million; real estate rentals, $2.4 million; interest, $3.7 million. With mineral and other miscellaneous income, the aggregate of NP's non-operating income came to $27.5 million, and compared with $25.5 million in 1962.

NP's Macfarlane, a canny Scotsman, is not given to overly optimistic, long-range predictions. But he's reasonably certain that for 1964, NP's centennial year, the railroad will again turn in a good profit. In the first quarter, he points out, net income at $4.9 million was the highest for many years and was attributable almost entirely to a sharp rise in rail earnings. ■

INTERLOCKING signals near DeSmet control traffic on main line through Rockies.





MAP SHOWS PRINCIPAL LINES ONLY of the GN, NP, CB&Q and SP&S railways.

The Merger in NP's Future

The proposed consolidation of four railroads—Northern Pacific, Great Northern, Chicago, Burlington & Quincy, and Spokane, Portland & Seattle—would create a rail network of 24,500 miles with 56,800 employees, and total assets of nearly $3 billion, based on figures at the end of 1963. Combined revenues of these four roads last year were $718.1 million.

(At presstime, an examiner's report and recommendations to the Interstate Commerce Commission was expected. Conversations looking toward the merger began in 1955. Hearings were completed in July, 1962, and briefs were filed in January of 1963.)

Four major benefits are seen as accruing to the public:

1. **Faster freight service,** both for transcontinental and local movements. The best routes, grades, and terminal facilities of each road would be combined, and utilize the most favorably located terminals. For example, the proposed transcontinental route between Seattle and the Twin Cities will be 17 miles shorter than the present GN line and 139 miles shorter than the present NP line.

More electronic freight yards would be among the various physical improvements planned under consolidation. In the Twin Cities, for illustration, where classification and switching is now done by the individual lines at nine separate yards, a new $14-million facility would be constructed.

2. **A better car supply.** Car days will be saved by using new, shorter routes and by use of most efficient and improved terminal facilities. Also, a single system transportation officer can distribute more efficiently different types of cars for special shipper needs.

3. **Wider routing, with more valuable transit and diversion privileges.** Shippers can use present routes, but will also have available shorter and more economical routes via the unified system. Still other routes will open as new patterns of trade develop. Expanded transit privileges will apply.

4. **More capital** will be available for modernization and improvements that are now beyond the financial reach of any one railroad.

Estimates are that eventually the economies from unification will approximate $40 million annually.

It is expected that integration of operations, once the merger is approved, will require five years to complete. Normal attrition—about 4000 job openings per year—is expected to create almost as many jobs as will be vacated gradually over the five years of integration. But beyond the assurance of continued employment, all employees have specific guarantees under federal law or by agreement.

The management of the new company —to be known as "Great Northern Pacific & Burlington"—would be shared equally by NP President Macfarlane as chairman of the board, and GN President John M. Budd as president. H. C. Murphy, president of the Burlington, would become vice chairman of the board. Each of four operating districts would be in charge of an executive vice president, with administrative autonomy, and a full complement of departmental heads. ■

Trains A'Rollin'

New methods ... new attitudes ... new tools like CTC, train radio keep NP trains moving

Rolling across the heart-land of America's mighty Northwest are the fast freight and passenger trains of Northern Pacific . . . trains like manifest freight No. 601 and the Vista-Dome North Coast Limited. NP calls this route the "Main Street of the Northwest," and indeed, it is just that. Lying on either side of its tracks are vast grain farms, fields of sugar beets, endless forests, and fertile orchards.

Northern Pacific sweeps across this fabulous country about 300 miles south of the Canadian border. Here it passes through such prosperous cities as St. Paul, Minneapolis, Minn., Fargo, Bismarck, N.D., Billings, Butte, Helena, Missoula, Mont., Spokane, Yakima, Tacoma, Seattle, Wash., Portland, Ore., and many others both on and off its main line.

For many miles in North Dakota, Montana, and Idaho, the route of the Northern Pacific follows the trail blazed by the Lewis and Clark Expedition in 1805.

Startling changes in transportation to the Pacific Northwest began on June 8, 1952, when NP first reduced running time of its fast freights.

In fact F. L. Steinbright, vice president operation says, "The speeding up of transcontinental freight schedules in the past few years is the most noteworthy and significant change that has taken place since the advent of the diesel."

Currently the fastest freight train timing is 45 hr 30 min from Minneapolis (Northtown) to Seattle. Road time is 41 hours and 40 minutes for the 1907 miles. This is a big change from the 108 hours scheduled until June 8, 1952, when the fastest schedule became 87 hr 15 min. Then on January 28, 1955, running time was further cut to 60 hr 30 min. The present schedule became effective November 13, 1963. NP offers third morning delivery in Seattle, though No. 601, its fast merchandise train, actually arrives the night before, thus giving forwarders ample time to sort their freight and load their delivery trucks before morning.

This speed has been achieved by the adoption of special operating practices. Fast trains are assembled to eliminate switching enroute. Thus, No. 601, the fast westbound freight, has only two blocks of cars. One block includes only cars for Spokane, Wash.; the other, cars for Pasco, Wash., and beyond.

Westbound No. 601 is limited in tonnage to 3000 tons, maximum. Short fast trains are NP's method of getting these hot shot freights to the coast on time.

To the casual outsider, the race to the coast appears as intense competition among the three railroads: the Northern Pacific, the Milwaukee Road, and the Great Northern. Actually, the speed-up was a necessary step in obtaining and holding business that might otherwise move over the highways.

Although the pressure for faster westward transportation came from eastern shippers of merchandise, all three railroads ultimately added super-fast eastbound trains.

NP's eastbound train is known as No. 600. Operation of this train follows much the same practices as that of No. 601, but the tonnage limit is somewhat higher, being a maximum of 4800 tons. Heavy movements of forest products causes tonnage of eastward trains to be generally higher than that of westbound trains.

Four groups or blocks of cars make up No. 600. One block is for a perishable connection with the Burlington's Kansas City train at Laurel, Mont. The other three blocks are destined to the Twin Cities, insuring prompt delivery to connections there.

Pasco is a central point for blocking and assembling trains to the East. It is a major connecting point for cars from NP's many branches as well as for the Camas Prairie Railroad and the Spokane, Portland & Seattle Railway. (Cars from both of these railroads also connect with NP's main line at Spokane.) The Spokane, Portland & Seattle with lines both to the east and to the west of Pasco uses the Pasco classification yard jointly with NP.

TYPICAL of "NP Country" is this mountainous area along the Clark Fork River west of Missoula, Mont. The train is eastbound time freight No. 602 bound for Minneapolis.

Somewhat secondary to Pasco is the yard at Auburn, Wash., 228 miles farther west. Into Auburn feeds traffic from points in all of western Washington . . . from points on the Olympic Peninsula . . . from Tacoma and Longview . . . from points north of Seattle and Everett all the way to the Canadian border.

Typically, eastward trains are "jumble-packed" at Auburn, the cars being coupled together as they arrive. These trains are then run to Pasco. Here the cars are blocked according to destination and reassembled in the train for the convenience of eastern yards. This blocking minimizes switching needed along the way east. An exception to the jumble-pack procedure is granted No. 600. This fast freight is blocked to some extent at Auburn. Then at Pasco, the blocking is completed by partially humping it.

High-speed schedules are maintained by minimizing work enroute. Each train serves only a portion of the intermediate line. Thus, westbound No. 601 makes no setouts east of Spokane. The regular section of No. 603 makes no setouts east of Billings, Mont., but handles loads for Billings and west only, operating to Seattle and Portland. An extra section of No. 603, operating westbound daily out of Laurel, Mont., in advance of the Twin Cities section runs to Pasco. This section handles intermediate work between Laurel-Billings and Pasco.

Service eastbound is paced by the relatively new No. 600. This leaves Auburn (Seattle-Tacoma) at 1:00 am on the first day and reaches Minneapolis 8:30 am on the third day with delivery to connections at 11:00 am. Today this train handles most of the eastbound fruit; however, the former Fruit Train, now No. 602, which is the next fastest schedule, makes fourth morning delivery in St. Paul-Minneapolis. It supplements No. 600 and handles some intermediate business.

Because of heavy movements of perishables and forest products, extra sections of Trains 600, 602, and 606 are run as required, in advance of regular schedules.

There is a fast train, No 604, originating in the evening at Laurel, Mont., which operates to the Twin Cities. This train handles livestock, especially out of Billings, Mont., and other important freight.

No development has been more important to the Pacific Northwest and, hence, to Northern Pacific than the big irrigation projects. These have brought agricultural prosperity to vast semi-arid areas of fertile land.

CONTINUED

PASSENGERS don't like to look at majestic scenery through dirty windows. To assure that they don't, the NP services tthe North Coast Limited en route during its brief stops.

TRAINS A'ROLLIN' CONTINUED

Well-placed branch lines have put NP in an enviable position in these new farming areas. These branches, many of which radiate from Pasco, feed a substantial volume of business to the main line and serve the growers and industrialists admirably.

An indication of the rapid development of the Columbia Basin since irrigation began can be found in NP figures for carloads shipped. Thus at Warden, Wash., in 1957, NP forwarded 1004 cars and received 60. Last year, NP forwarded 10,421 and received 316 cars!

Busier than NP's east-west main line is its track from Seattle to Portland—the only rail line between those points. NP operates two fast freight trains over the line each way daily, and several locals. Great Northern has had tenant rights on this line since 1909. Union Pacific operates over it from Tacoma to Portland; the Milwaukee Road uses it from Chehalis Junction to Longview Junction. With trains of these four railroads using it, this double track line is indeed a busy one.

The Camas Prairie Railroad, a 258-mile railroad in Northern Idaho, connects with an NP branch near Lewiston, Idaho, and also at Riparia, Wash. It is a joint operation with the Union Pacific dating back many years. It serves an important part of northern Idaho. On NP's Lewiston, Ida., branch, a tremendous lumber and pulp industry supplies substantial traffic. This whole branch is very productive, handling quantities of grain and considerable canned goods in addition to other products.

Beside important branches in the Northwest, NP has many branches in the southern part of North Dakota. Some of these extend northward touching Great Northern territory. One branch reaches from Manitoba Junction, Minn., northward to Winnipeg, Manitoba. Another branch sweeps northward from Little Falls, and Brainerd, Minn., to Bemidji and International Falls, Minn., on the border.

The high level of performance which NP obtains from its trains would not be possible without the aid of such technical innovations as diesel locomotives, train radio, centralized traffic control, improved wire and microwave communications, electronic classification yards, and modern freight cars equipped with such devices as lubricating pads and roller bearings.

NP operating people estimate that on single track the time saved a freight train taking a siding at a meeting point in CTC territory versus the time taken in manually operated switch territory is, conservatively, 20 minutes.

Asked if point-to-train radio was useful in conjunction with CTC, Mr. Steinbright replied affirmatively. "In our CTC territory direct dispatcher-to-train radio is extremely valuable in keeping the dispatcher informed. For example, a dispatcher can quickly ascertain why a train has stopped, or what a train is doing at a given moment.

"Within the past two years, we have put radio on passenger trains," he continued. "This year, we are giving passenger conductors portable radios . . . All in all radio adds up to better on-time performance."

LCL Is Important

NP's approach to less-than-carload freight differs drastically from that of many other railroads. NP enjoys an increasing volume of LCL and is ready, willing, and able to handle more. In the face of much apathy in the railroad industry, Northern Pacific has been able to increase its LCL business. With some railroads actually getting out of the LCL business, there has been some loss of through LCL business which has been more than offset by expansion in short haul traffic, particularly on the west end of the NP.

"LCL is an important part of the transportation of freight both for the Northern Pacific and for our customers who make small lot shipments," states Mr. Steinbright firmly. "Many of our carload patrons use our distributive service to get their merchandise to its final destination."

Use of coordinated truck service has been one of the keys to increasing LCL volume. The Northern Pacific Transport Company, a subsidiary of the Northern Pacific Railway, performs a substitute service on rail LCL in the states of Montana, Idaho, Washington, and Oregon, to and from points on NP's line.

NP operates LCL piggyback service daily, Monday through Friday, between the Twin Cities and Duluth. It expects to handle more LCL in this manner on its east-to-west service. It also handles volume LCL shipments to all points where it has TOFC service.

NP operates its piggyback service all the way to the Coast through seven states beginning at Superior, Wis., and ending at Portland, Ore. It interchanges TOFC traffic with connecting carriers at a number of points. Piggyback ramps are located at principal cities such as St. Paul, Minneapolis, Duluth, Superior, Brainerd, Cloquet, Little Falls, Camp Ripley-Topeka, Fergus Falls, Detroit Lakes, and similar places.

For operational purposes, the Northern Pacific is divided into two districts: Lines East of Livingston, Mont., and Lines West of Livingston. Each district is under the supervision of a general manager; one is headquartered in St. Paul; the other, in Seattle.

For operating convenience, the railroad is further divided into seven operating divisions: Lake Superior, St. Paul, Fargo, Yellowstone, Rocky Mountain, Idaho, and Tacoma. Each division is under the direct supervision of a superintendent who has a staff including assistant superintendents, trainmasters, a B&B supervisor, a division roadmaster, and others. The four eastern divisions comprise Lines East, and the three western divisions, the Lines West.

By having few levels of authority above the division superintendents, NP feels that it brings its top men closer to the railroad and achieves the most efficiency.

Contributing much to the economy and safety of its operations is Northern Pacific's aggressive safety program. This is in the charge of R. C. Lindquist, superintendent of rules, safety and fire prevention—the three faces of safety on the NP. On-the-road inspections, rules examinations, and frequent safety meetings enabled NP to substantially improve its employee safety record in 1963.

Consolidation and centralization of certain activities have taken place. However, some improvements must await the pending ICC decision on merger proceedings.

"We are not holding up any idea or project that will lead to better service for our customers," explains Mr. Steinbright in speaking of the merger situation. "We are keeping abreast of developments in the industry and are going to take advantage of anything that's good for the Northern Pacific." ■

ONE of the top trains in the country, the Vista-Dome North Coast Limited, crosses the Continental Divide high in the Rockies. NP's main line crosses the Divide about 10 miles east of Butte, Montana at an elevation of 6300 feet.

NP woos passengers with broad advertising, attractive rates; it pampers them with top-flight trains and service. A look into a North Coast Limited dining car reveals some of the latter; a stewardess-nurse, always available when needed, lends a hand with meat cutting in diner.

Passenger Service: NP's "Show Window"

Northern Pacific is one railroad that continues to woo passengers avidly, and to give them tender loving care while they're aboard. "We will not run anything less than a first-class service," declares NP's President Macfarlane, "and we will continue to run trains as long as there is demand for them."

NP traditionally allots a substantial chunk of its advertising budget to the passenger service. It moves quickly to adjust fares to meet highway competition, now pays 5 percent commission to authorized travel agents for one-way tickets, 10 percent on round trips, sold for any points on NP lines, and 7 percent on tickets involving trans-Pacific or trans-Atlantic travel.

NP passenger men beat the proverbial bushes for all types of passenger business –individual, family, tour package, convention, excursion, and other group movements.

The road keeps its equipment modern, clean, and well maintained; serves tempting meals in its diners. Employees give patrons courteous service on and off trains.

NP honors American Express as well as Rail Credit cards, pushes car rental services, and generally tries to make passenger travel via NP a comfortable, memorable experience. One bit of passenger-pampering is the mailing of tickets with a statement to patrons ("we've never lost a penny"); another is free parking lots at numerous stations, many of which have been modernized or are brand-new.

"There's no question about it—these parking facilities have brought us business," says F. G. Scott, passenger traffic manager. "Out in the wide open spaces, folks think nothing of driving 50 miles to a railroad station. We've had automobiles in these lots for as long as 90 days. We also note a growing trend among business travelers to take a plane one way, a train the other."

NP's all-out effort to promote passenger travel pays off. For example, increases in passengers and revenues were chalked up in each of the five years preceding 1963 (see financial summary, page 94).

Mr. Scott attributes last year's decrease to $6.4 million from $7.8 million in 1962 to the cancellation of numerous meetings following the assassination of President Kennedy; an open winter with little snow for skiing; and the several threats of a nationwide railroad strike. Also, the Seattle World's Fair was a big stimulant to 1962 travel.

He looks for 1964 to be a good passenger year. Inquiries were good, both on- and off-line for recreational travel in the West during the summer, which is NP's biggest season. Less dedicated passenger officials than "Scotty" and his men might have written off as hopeless the sale of any rail tickets from the West to New York City for the World's Fair. But NP ran ads in Seattle, Portland and Spokane plugging train travel to the Fair. This advertising produced several hundred inquiries, and NP looks for a good volume of this eastbound travel.

Typical of NP's moves to fight highway competition is this example:

The road is one of three operators (with Union Pacific and Great Northern) of a pool service between Seattle and Portland, a 186-mile run. The service paid its way, but a few years ago, the trains began to lose passengers. A round-trip coach fare advertised as "less than a tank of gasoline," reversed the trend. "In the face of all the highway competition between Tacoma and Seattle, and the building of a freeway between Tacoma and Portland, we're still holding our own," says Mr. Scott, "although we had to get 41 percent more passengers to stay even on dollars."

NP's blue ribbon train is its transcontinental "North Coast Limited," a crack streamliner that operates from Chicago via the Burlington to St. Paul, and to Seattle via NP, Portland via SP&S. The "North Coast" carrying only limited head-end traffic, features vista-dome coaches, a slumbercoach, as well as day-nite coaches, a Traveller's Rest buffet-lounge car, dining car, vista-dome Pullmans, as well as other type all-room cars, and a club-observation car. Stewardess-nurses are a feature on the "North Coast."

A second transcontinental name train, "The Mainstreeter," is primarily a head-end "workhorse," but does carry modern through equipment from Chicago and St. Paul to Seattle.

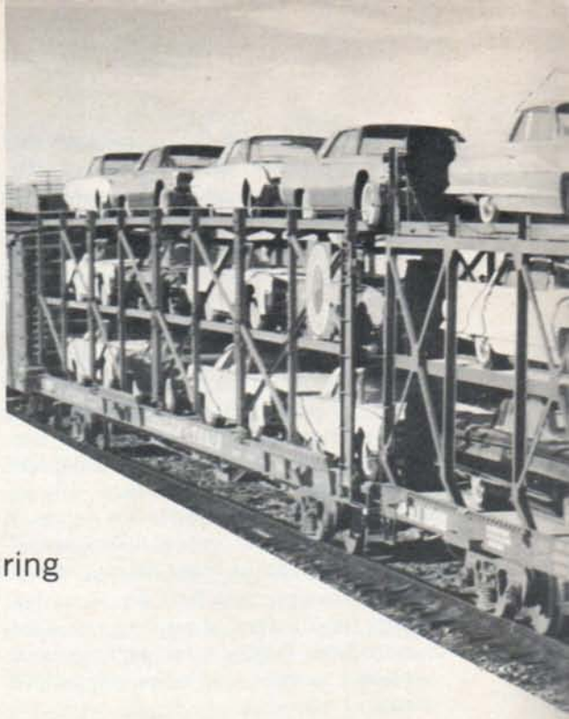
In addition to the Portland-Seattle pool service NP's other passenger services include Budd Rail Diesel Cars or trains between Spokane and Pullman, Wash.-Moscow-Lewiston, Idaho; Staples and Duluth, Minn.; Hawley, Minn., and Winnipeg, Man.; Minneapolis-St. Paul and Duluth-Superior, and Minneapolis-St. Paul and International Falls, Minn.

Since 1959, NP, through elimination of unprofitable branch lines, has reduced passenger train-miles by 833,106. The "North Coast Limited" and the "Mainstreeter" pay their out-of-pocket costs; and Slumbercoaches "almost break even." (Incidentally, NP, which is the only line in the Norhwest using this kind of equipment, now has eight of them.)

Does NP's passenger service make a profit? The answer is "no." The road's loss ratio on this operation last year, under the ICC formula of fully allocated costs, was 180.7 percent.

Despite the gloomy loss ratio, NP officials feel that their passenger business more than pays off as the "show window" of the railroad. Says Mr. Scott: "Actually, it is through a good passenger department that a railroad can present an image to the territory it serves, as well as to its off-line patrons, that can't be accomplished any other way." ■

Aggressive Selling Along the "Main Street of the Northwest"



NP's up-to-date service, equipment and prices surmount tough competition and boost freight revenues ... growth of manufacturing and processing in Pacific Northwest alters "granger" image

New and improved services, specialized equipment to meet shipper needs, and creative pricing policies are the tools used by the freight traffic department to make the "Main Street of the Northwest" more than a line of advertising copy.

NP's long-term revenue and ton-mile trends have been better than those for the Northwest region and for Class I railroads as a whole.

Symbolic of NP's aggressive selling techniques was the recent announcement of a new unit train service to handle 20,000 tons of lignite coal weekly from Zap, N.D., to a new steam generating power plant under construction for the United Power Association (a group of private cooperatives) on the Missouri River at Stanton, N.D. Under a long-term, three-way contract between North American Coal Corp., United Power and NP, the railroad will haul a million tons of coal annually to the plant starting Apr. 1, 1967.

Keeping and boosting freight volume and revenues takes some doing in a territory stretching from the western ports of the Great Lakes to Puget Sound and Columbia River ports on the Pacific, where the largest population centers are at the ends of the line—St. Paul, Minneapolis and head-of-the-Lakes communities on the east, and Portland, Tacoma, and Seattle in the Far West. "And we have tough competition from every kind of transport known to man," notes W. J. Luchsinger, vice president traffic.

Overhead or bridge traffic on NP is not a large portion of its total business, although it has increased in tons from 10.7 percent of total in 1955 to 14.4 percent in 1963. A considerable amount of this is lumber, plywood, paper and paper products originating in Oregon on the SP&S or SP and in British Columbia on the BCE Route, which is received at Portland, Pasco, Spokane and Sumas and is delivered by NP to connecting lines at the Twin Cities and Laurel, Mont.

Traffic originated by NP accounted for 68 percent of its total tonnage in 1955, but slipped slightly to 66.5 percent of total in 1963.

Traffic terminated in 1955 was 62.7 percent; 60 percent in 1963. There is some duplication of this tonnage and "originated" tonnage, to the extent that local traffic is both originated and terminated.

Of freight revenue, the products of agriculture normally contribute 22 to 25 percent; products of mines, 8 percent, forest products, almost 30 percent; and miscellaneous and manufactures and LCL the remaining 35 to 40 percent.

Important revenue items include forest products (29 cents of every dollar), wheat, gasoline and petroleum products, bituminous coal, food products, manufactured iron and steel, automobiles, barley and rye and woodpulp.

Develop Manufacturing and Processing

While NP is classed as a granger railroad, there is marked development of manufacturing and processing in the Yakima Valley, Tri-City area, Columbia Basin, Walla Walla, and Spokane regions in the state of Washington; Lewiston, Moscow, and the Coeur d'Alenes in northern Idaho; Missoula, Butte, Helena, and Billings in Montana; Bismarck, Jamestown and Valley City in mid-North Dakota; and Fargo and Grand Forks, N.D. in the rich Red River Valley. This development is creating a healthy diversification of freight haulage.

Over-all, NP's service territory holds the promise of further substantial growth. For example:

Competent authorities estimate that by 1974, shipments from the Yakima Valley of apples and soft fruits, now running at 9000-15,000 carloads a year, will be doubled. (NP handles about 60 percent of these perishable movements.) A stabilizing factor in grower's marketing is the new method of storing fruit in "controlled atmosphere," to prevent deterioration. The entire Columbia Basin has a big traffic potential. One million acres of land will be eventually brought under irrigation; about one-half the project is now complete.

Food processing is growing. An illustration is potatoes, an increasing volume of which is going into cans or packages in the form of chips, frozen French fries and the like. This is more of a change in traffic composition, although NP traffic men believe that, over-all, volume will increase.

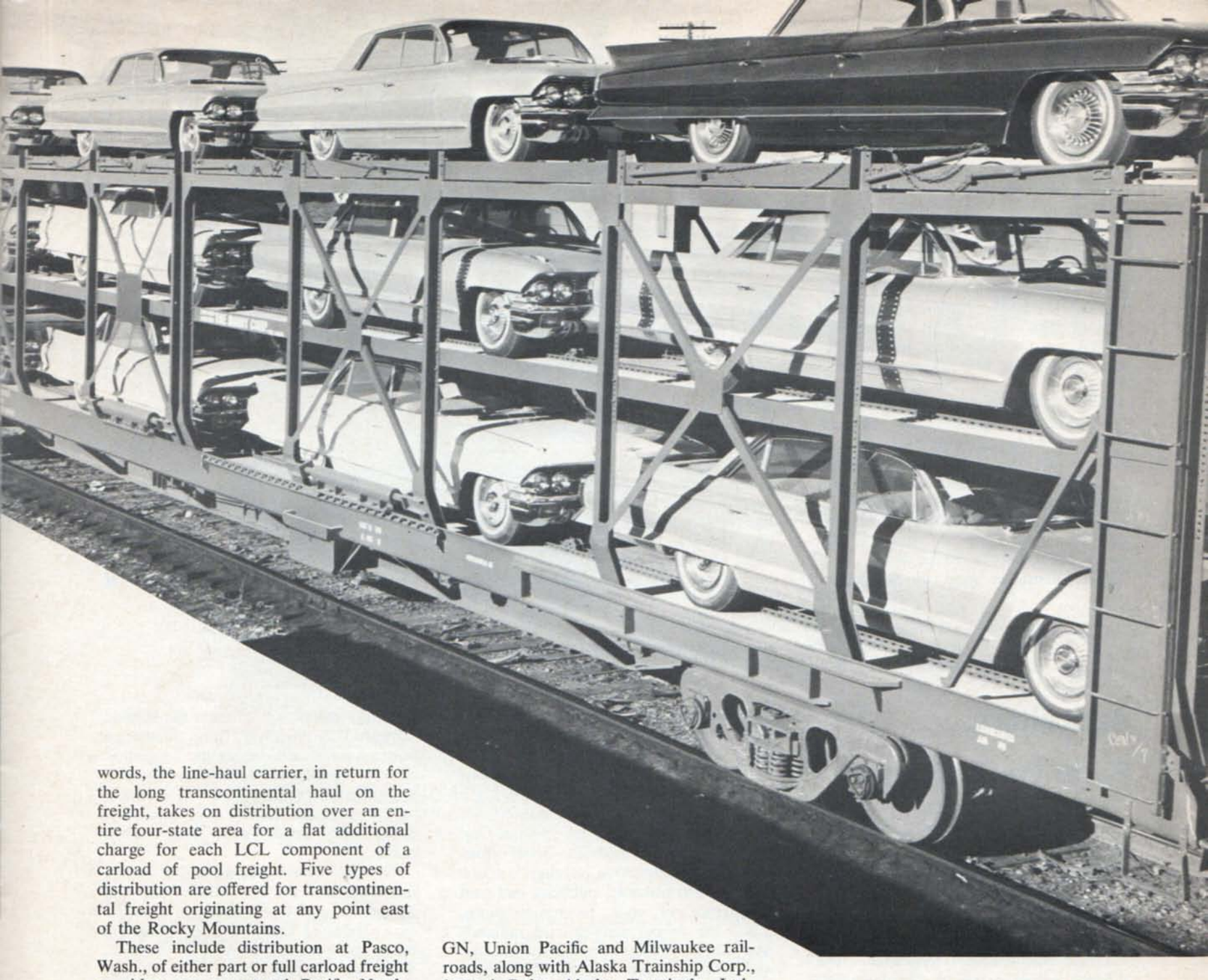
In the forest products category, Mr. Luchsinger notes the development of the pulpboard industry for making cartons to supply packaging needs for new manufacturers. A new tissue paper plant was recently opened at Lewiston, Ida. And the chemical industry is expanding to supply the paper, pulp and plywood manufacturers.

A new phosphate processing plant, opened this year at Elephant, Mont., will double NP's movement of this commodity. A new beet sugar factory will go into production in 1965 at Drayton, N.D. Each of these installations will add more than $1 million annually to NP's revenues. "A lot more beets could be grown and many more sugar plants could be built, but sugar production is, of course, tied to government quotas," said Mr. Luchsinger.

Role in Establishing Pasco Center

NP officials are credited with an important role in establishing Pasco, Wash., as a distribution center for the market area that includes western Montana, northern Idaho, Washington, Oregon, and Alaska. The railroad and its motor vehicle subsidiary, Northern Pacific Transport Co., have set up a "package distribution plan" for the Pacific Northwest, with single-carrier responsibility.

This plan, hailed as "revolutionary" when it was initiated last year, places on NP full responsibility from the shipper's plant to the several customers' doors at drastically reduced total cost. In other



ALTHOUGH still classed as a granger road, NP carries substantial tonnages of manufactured goods including automobiles in tri-level cars. 35-40 percent of freight revenues comes from miscellaneous, manufactures and LCL traffic.

words, the line-haul carrier, in return for the long transcontinental haul on the freight, takes on distribution over an entire four-state area for a flat additional charge for each LCL component of a carload of pool freight. Five types of distribution are offered for transcontinental freight originating at any point east of the Rocky Mountains.

These include distribution at Pasco, Wash., of either part or full carload freight to either one or several Pacific Northwest customers; re-shipment of freight warehoused at big Pasco warehouses within a year to several PNW destinations (on a consolidated bill of lading); or a combination of shipments from current and stored freight.

Beyond the CL break-bulk point, NP Transport Co. takes LCL lots to store-doors in substituted service. The fact that Pasco is the terminal point for all transcontinental trains of NP, speeds up service to PNW points at least a day.

New through freight rail-water service will be substantially faster and cheaper than present rail-water schedules to and from Alaska. A modern, streamlined train-ship, the "Alaska" recently went into service for Alaska Trainship Corp. The 18-knot vessel can transport up to 56 loaded cars in fully enclosed decks, providing weather and water protection to cars and lading.

The ship plies between Westminster, B.C., and Whittier, Alaska, for connection with the Alaska Railroad. NP, GN, Union Pacific and Milwaukee railroads, along with Alaska Trainship Corp., formed Delta Alaska Terminals, Ltd., a Canadian corporation, to handle interchange of rail traffic through new terminal facilities at New Westminster.

NP's time freights are No. 600 eastbound; No. 601 westbound. The secondary transcontinental trains are No. 602 eastbound and No. 603 westbound (see Trains A'Rollin', p. 12).

The eastbound schedule is now 53 hr. 20 min. from Auburn (Seattle) to Chicago, or third morning to Twin Cities and fourth morning Chicago. This compares to 110 hours Auburn to Minneapolis in 1951. Westbound, the Minneapolis-Seattle schedule is 45½ hours or third morning compared to 108 hours and sixth morning in 1951. These faster schedules resulted from faster interchanges, reduced terminal time, and faster time over the road.

"We feel this has earned us additional business through equalling or improving upon motor carrier schedules," says Mr. Luchsinger. "Also we've stayed competitive with other rail lines serving our area."

NP, through Northern Pacific Trans-

CONTINUED

NPT trailers at dock of Pasco Public Warehouse, terminal point for all NP transcontinental trains. NP Transport Co. takes LCL lots to store-doors beyond CL break-bulk points.

port Co., is authorized to perform substitute service on LCL at all points west of Glendive, Mont., and has an application before the Interstate Commerce Commission to perform such service over the remainder of the railroad.

NP offers all five plans of piggyback service, but Plan II is used most. In each of the last five years, NP's piggyback revenues have increased 25 percent.

"Our freight equipment," notes Mr. Luchsinger, "is being built to latest designs, in keeping with customer requirements."

All of NP's boxcars of recent vintage are 50-footers, single sheathed, with nailable steel floors, and wide door openings to permit mechanical loading.

RBL and XML special box and insulated or mechanically refrigerated equipment has DF or Compartmentizer load restrainers, and many are equipped with cushioning devices to reduce shock.

Bill Luchsinger sums up his department's alert pricing techniques this way: "We appraise the worth of our service in the light of that of competitors, potential or actual. We make a judgment as to the price we will charge that will return us a profit—after careful cost research. A new position of transportation analyst has been added to the traffic department staff to assist in the research effort."

He adds that "we have not only headed off diversion to private carriage but have regained traffic so moving."

NP frequently makes single-factor, through rates that include truck delivery of cement to construction sites within approximately 50 miles of the railhead This is a useful weapon in heading off proprietary trucking from plant to building site.

Not so long ago, NP's management hired a firm of traffic specialists to investigate the feasibility of building a pipeline for petroleum products between Pasco and Yakima. It turned out there wasn't sufficient volume to justify a pipeline, but it was attractive enough to justify a proposal to move the products in jumbo tank cars at reduced rates. (Later NP learned a side effect was the heading off of a pipeline between Puget Sound and Ellensburg.)

In another case, NP traffic men learned of a truck movement of aluminate sulphate from the Puget Sound area to Lewiston, Idaho. After study, a competitive rail rate proposal was made that not only got the business, but stopped the proposed construction of a chemical plant to make this commodity at Lewiston, Ida.

The road's aggressive selling, service, and pricing policies appear to be paying off—last year's freight revenues of $160.8 million topped those of 1962 by $7.2 million. And that's after deducting and earmarking in a reserve fund $1.6 million, as ordered by ICC, for possible retroactive payment to eastern and mid-western carriers after final disposition of the transcontinental divisions case. (The $1.6 million is for the last half of 1963—future accruals will be at the rate of $3.2 million annually.) ■

Agriculture: Basic Traffic Source

Since the days of immigrant trains, the agricultural department of Northern Pacific has been deeply involved in the development of its service territory.

The department has a director, assistant director and development agents assigned to specific territories. The director is responsible to the vice president-traffic.

In addition to the headquarters office at St. Paul, field offices are located at Fargo, Billings, Spokane and Seattle. At present, 11 persons are occupied in agricultural development, including six with technical training in agriculture.

NP continues to have a vital interest in the prosperity and purchasing power of the territory it serves. As a granger railroad, it is interested in the kinds of crops farmers grow; the kind of livestock they keep; the condition and fertility of the soil they till; the machinery and power they use; their markets, and the prices they receive for commodities. All have a direct bearing on the transportation facilities farmers need and use. A healthy farm community ships out substantial volumes, conversely creates volume movements inbound of chemical fertilizers, machinery, TV sets, automobiles, food, clothing, and other consumer goods.

"It's a fact that some types of promotional activities in agricultural development necessarily are best carried on by private commercial agencies rather than by public institutions," comments L. S. MacDonald, director.

"Colleges and experiment stations, for example, are equipped to originate and test new cultural methods, better crops and improved livestock, but they're not so well fitted to promote, publicize and gain acceptance of such recommendations. These are proper activities for railroads and others directly responsible for sales and service. Traffic volume can be built by undertaking this type of promotion."

Chemical fertilizers are a good illustration. Farmers had to be encouraged to use them. In one state alone, an annual movement of 165,000 tons of chemical fertilizer was generated that meant 3000 cars of new railroad business.

NP agricultural men aided in the introduction of a new crop in eastern Montana and western North Dakota in the late 1950's. This was safflower that thrives in arid country. The oil from safflower seeds was first used in paint—as a quick drying, non-yellowing ingredient. More recently, safflower has come into favor as a cooking oil; it is low in unsaturated fat, which makes it appealing to persons with a high cholesterol count. The seed pods are ground into meal for livestock. Some 70,000 acres are now planted in safflower in these areas.

Idaho's lush "Camas Prairie" is only about 18 miles long and eight miles wide. When it turns to gold in July and August, its ripe seed crop is ready to harvest. These seeds are so tiny that one farmer couldn't raise enough to make the volume commercially attractive. But a number of farmers could and did, at the suggestion of NP's agricultural agents, and there is a substantial movement of this seed out of this mountain-rimmed valley annually, along with lentils, peas and malting grains.

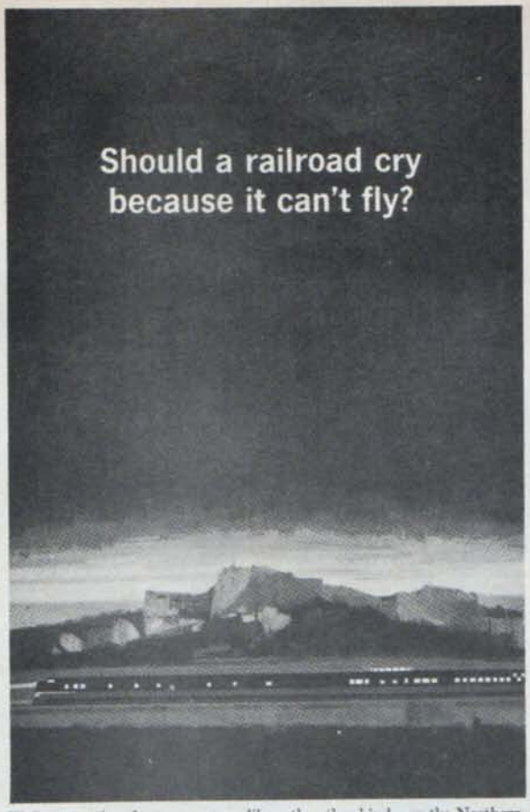
Or take sugar beets, which NP helped introduce into the Red River Valley of Minnesota and North Dakota, in Montana's irrigated valleys and the Columbia basin and Yakima Valley in Washington. When an NP man looks at an acre of beets, say in North Dakota, he's looking at $65 to $75 an acre in transportation—chemical fertilizer and seed shipped in; beets to a sugar mill being constructed in Drayton; other inbound movements such as lime rock, sulphur, coal, machinery and packaging materials. Sugar moves out; so does livestock feed made from beet pulp; as well as commercial molasses and amino acids used to make seasonings.

Walter Hunt, assistant director, notes that "in planning and executing our development program, conferences, advertising, publications, reports and speeches at strategic points, and at the right time all are resorted to."

One of the agricultural department's most valuable services since the 1880's is the publication of a general development magazine called "Northwest," which is currently edited by Mr. Hunt. Its emphasis has changed from time to time, but its basic purpose has always been to aid development activity in NP territory. The ultimate objective is to broaden the economic base of the area. ■

"PR"—Everybody Plays a Part

Wide-ranging public relations, advertising program tells story of a progressive railroad



ADVERTISING stresses advantages of traveling and shipping by rail, and flexibility of service. NP has the fourth largest railroad advertising budget in the country, $800,000 to $1 million per year.

Northern Pacific has had a long and continuous public relations program. Currently, even more emphasis is being placed on this activity.

Advertising and public relations are combined in one department with a staff of seven. But on NP, everybody is considered to have a part in public relations.

"As a department," comments Walter Gustafson, manager of advertising and publicity, "PR can function effectively with shippers and travelers only to the extent of the attitude of our employees toward the public. We try to keep them aware of the vital importance of helpful attitudes.

"Through advertising, we can inform shippers and travelers of our desire to serve, of our facilities and equipment, but the 'moment of truth,' so to speak, is the all-important personal contact between employee and public."

In its press relations, NP avoids turning out a steady stream of "puffs," feels that as a result, its news releases receive more favorable treatment.

NP publishes three magazines—"The Telltale," the "North Coaster," and "The Northwest." The first two are published by the advertising department, the third by the railroad's agricultural department.

"Telltale" has a circulation of about 14,000, goes to all NP employees. "North Coaster" is distributed bi-monthly to approximately 13,500, including railroad passenger people, tour bureaus and travel agencies. "The Northwest" carries news about industrial and agricultural activities all along NP lines, is distributed to leaders in industry and agriculture.

NP public relations activities cover other areas as well. Included are special programs in the legislative field; stockholder relations, including preparation of the annual report; and community relations. The latter are handled mostly by local NP personnel. Most of these employees are members of civic and social organizations and are active in community affairs.

In many on-line communities, old steam locomotives contributed by NP are on permanent display. And NP's proud little "Minnetonka"—the road's first power unit—is mounted on a flatcar, for convenient travel to communities requesting it for local civic events and celebrations.

NP has the fourth largest railroad advertising budget in the country—it usually runs from $800,000 to $1 million a year.

Its advertising objectives are two-fold—to help sell freight and passenger services and to tell the story, through institutional copy, on-line and nationally, of NP as a progressive railroad. Both printed media and TV are used.

NP recently received the "OLAF" award (Outstanding Leadership in Advertising Formation) for a 60-second, live action TV commercial "Watchful Eyes," a freight oriented film produced last year.

Where Most of NP's Advertising Is Placed

The bulk of NP's freight advertising appears in Traffic Management, Traffic World, Handling and Shipping, Business Week and Wall Street Journal. These publications also carry industrial development ads.

Says Mr. Gustafson: "The over-riding theme of all our advertising can be summed up in one line—'This is the way to run a railroad . . . this is the way we run Northern Pacific.' "

Even the institutional advertising stirs response. Typical is this comment to Mr. Macfarlane from a Seattle businessman:

"This note is to let you know how much I enjoyed your current TV series of ads showing 'how to run a railroad' I believe these scenes depicting actual operating of the freight trains, the modern electronic switching yards and the men doing their job is a thrilling and impressive way to advertise how all types of commodities should be moved across the nation." ■

ROAD-RAIL crane for laying continuous welded rail typifies NP's modern rail-laying techniques. NP first used welded rail in 1936 and thus ranks as a pioneer in the use of this type of rail.

Better, more economical track, matched to today's fast trains and heavy freight cars, is the aim of Northern Pacific's engineering staff. In searching for ways of improving track quality while holding the cost line, NP engineers are continually exploring new work methods, more efficient gang organization, mechanized equipment, and new types of rail.

Like several progressive railroads, NP has been exploring ways to make rail last longer, especially on curves, and be free of shelling.

Beginning in 1955, NP laid its first high-silicon rail as an experiment. Fifteen hundred tons of CF&I Hi-Si rail were laid on 6.5 miles of curved track, mostly in the mountainous areas of Montana. Comparative tests, while yet inconclusive, indicate that this rail will outlast carbon steel rail under the same conditions by a ratio of 2 to 1.

While a premium of about $10 per ton is paid for the Hi-Si rail, this compares very favorably with the $25 to $60 premium on other types of hardened rail.

Speaking of the Hi-Si rail, NP's Chief Engineer, D. H. Shoemaker, states, "In my opinion, we are realizing an attractive return on the additional investment."

Pacific is to lay 115 lb continuous welded

Current rail practice on the Northern rail of standard carbon steel on main line tangents and curves up to 1 deg 59 min. Curves from 2 deg up to 5 deg 30 min are usually laid with continuous welded Hi-Si rail. For curves in excess of 5 deg 30 min, Hi-Si 132 lb rail is used in standard 39-ft lengths.

Gleaming Tracks Typify NP

Over 9795 miles of track challenge NP engineers in utilizing new methods and new materials

Since 1950 the Northern Pacific has laid 1270 track miles of new rail. Of this 402.09 were continuous welded. During 1964 NP will add 90.42 additional track miles of continuous welded rail to this. Only 1.25 miles of conventional jointed rail (new) will be laid, and 12.00 miles of new rail will be held as emergency stock. This makes a new rail program of 103.67 track miles.

Standard rail for main track is 115 and 132 lb RE rail. This generally replaces 90, 100, 112, some 130, and some 131 lb rail. The rail recovered from the main track, if not scrapped, is placed in branch lines and secondary track. During the 1950 to 1964 period, NP laid 1339 miles of secondhand rail in branch lines and on secondary track.

Consist of NP's main line is largely 115 and 112 lb RE section rail. Specifically, NP has 1118 miles of 115 lb RE; 1267 miles of 112 lb RE; 346 miles of 132 lb RE; 165 miles of 100 lb RE; 135 miles of 131 lb RE; 52 miles of 90 lb RB; 7 miles of 130 lb RE; 2 miles of 119 lb CF&I; 2 miles of 140 lb RE; and 0.7 miles of 85 lb ASCE.

Northern Pacific was one of the pioneer users of continuous welded rail. The year was 1936 when NP installed welded rail in the Bozeman Tunnel in central Montana and in the Mullan Tunnel west of Helena. Welding was done on cars at Livingston and Helena respectively, using the Thermit process. This rail remained in the track for seven years at each tunnel. Since that time, Northern Pacific has used oxyacetylene pressure welding and now uses the electric flash butt welding.

Other types of welding aid the NP in maintaining rail joints, switches, and frogs. NP employs four rail end welding gangs that weld approximately 36,000 joints annually. In addition a system chamfering crew will chamfer approximately 300,000 joints annually.

Welding of engine burns is done on a division basis and is only on continuous welded rail. "We have, as of this date, no record of failure from welded engine burns in continuous welded rails," states S. H. Barlow, system engineer of track. NP has a frog and switch shop at Brainerd, Minn. This shop makes guard rails from the short lengths of new rail, left after rail laying operations. Five manganese welders repair approximately 715 frogs and switch points annually in the field. NP uses solid manganese frogs in secondary tracks. Heat-treated switch points and

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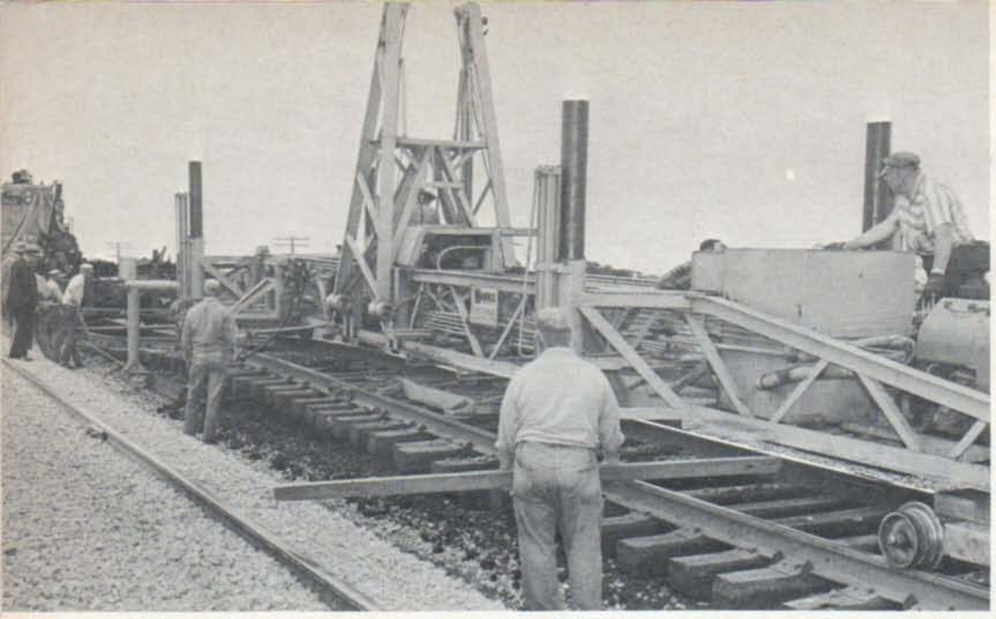
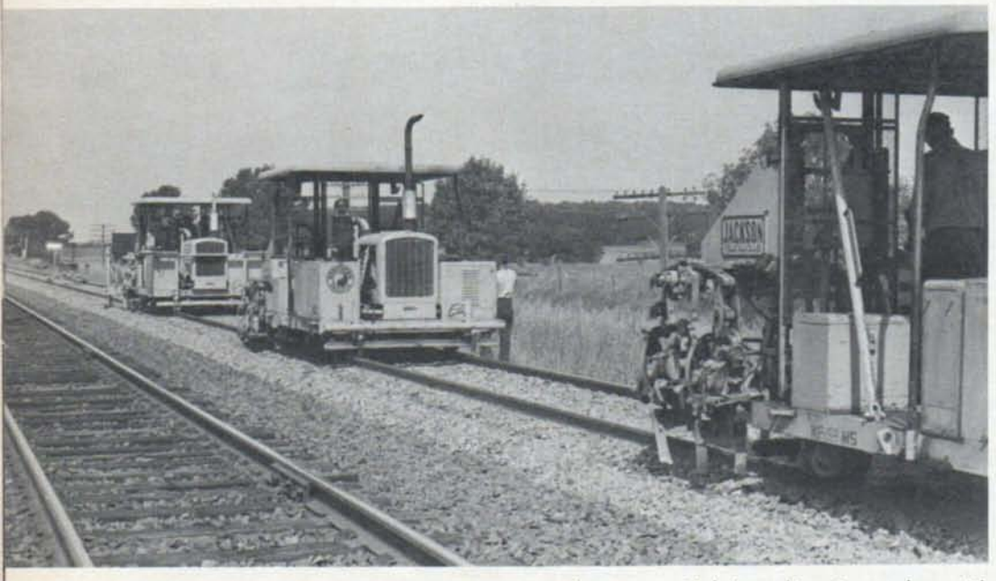


MODERN track equipment includes this multi-purpose machine that, when used with a ballast sled, picks up rails — ties and all — scoops out and levels old ballast, knocks out old ties that are to be replaced, lines the track and prepares roadbed for new ballast.



NORTHERN PACIFIC uses two conventional tampers (right) working in tandem with an automatic tamper at left. This technique increases production of surfacing gang.

RAIL-GRINDING TRAIN removes vibration-causing irregularities from surface of rail thereby reducing maintenance costs. Train is composed of eight cars that remove corrugations and other minor imperfections from rail surface.

GLEAMING TRACKS CONTINUED

stockrails are used in some main tracks.

To insure the safety of its rails, Northern Pacific carries out a three-point testing program. Sperry Rail Service tests its 112 and 131-lb rail. In 1963, Sperry tested 1399 track miles. NP also uses two AAR-type magnetic detector cars. One works on the Western District, and one, on the Eastern District, testing both main and branch line tracks. In 1963 these two cars tested a total of 4950 track miles. The test schedule will be about the same for 1964. In the third type of testing, NP employs Branson Audigage and Teleweld Soni-rail joint testing equipment to test joints; 154,000 were tested in 1963. An equal number are scheduled for test in 1964.

Punched card tabulation of rail failures is a special feature of NP's testing program. This involves a new form (Jan. 1, 1964) for reporting rail failures. The section foreman writes in all the essential information on a rail failure at the time that it occurs. After having been reviewed by the roadmaster, the form is sent to the chief engineer in St. Paul for coding. From this, one punched card is made for each rail failure.

"We expect that this method of maintaining rail failure information will produce more prompt, complete annual rail failure statistics," explains W. R. Bjorklund, assistant chief engineer.

The new system permits the ready classification of failures as to location, mill, weight, type of failure, the year rail was installed, and other data. Special studies may readily be made, and programming of future relays may well be based on information extracted from the punched cards.

In some main line areas where the rail is over 20 years old, NP has experienced corrugations.

"We have been using the Speno rail grinding train with great success for over five years," explains Mr. Shoemaker. "Where we caught the condition soon enough, we were also able to eliminate joint welding usually through grinding."

On the NP, track maintenance is the responsibility of the general managers, and like most progressive railroads, Northern Pacific is constantly replanning and reorganizing its gangs to utilize best the potentials of modern M/W equipment. The old section crews which covered 10 miles of track have been replaced with small gangs covering 20 miles on the main track and twice that on branch lines. These small gangs consist of a foreman and two men. Terminal crews usually have a few extra men.

All sections on the main line have small tampers and usually one compressor with rail saw and drill for every third section. All sections are equipped with motor cars, but trucks are used where possible. Branch line section crews have small portable air compressors for operating spot

tampers in areas where ballast warrants such equipment.

Section work is programmed so that work such as fence repairing, bolt tightening, and other miscellaneous jobs can be done during the winter months. Machines and work for all gangs are programmed jointly by the division roadmaster and the engineer of track. Programming makes the most effective use of the men and machines available.

"It would be impossible to complete the work now scheduled with the forces available without proper programming," states Mr. Shoemaker.

Use of highway vehicles for track maintenance forces has been increasing for the past 10 years. Buses and other passenger vehicles are used at times to transport the men. NP believes that the effective use of highway transportation may increase the range of a single crew. It also permits moving one crew around another crew which is using on-track machines.

NP uses two types of surfacing gangs. The newer gangs with fully automatic tampers such as the Jacksomatic requires only seven men (see Modern Railroads, Nov. 1963, p. 86). Such a gang is estimated to speed work 90 percent over comparable non-mechanized gangs. The other type of surfacing gangs consists of 12 men using mechanized equipment including a power tamping jack, one track liner, and two power ballasters. Such a gang is considered to have reduced surfacing costs by 50 percent over the 60-man non-mechanized gang.

Mechanization Improves Surfacing

"The track surfacing job is now done much better under mechanization due to controlled uniformity of work," states Mr. Shoemaker. "For the past five years, we have averaged 780 miles of track surfacing. For 1964, the goal is 830 miles."

Surfacing is scheduled by the general managers for locations requiring it.

NP engineers anticipate that the main line can be scheduled for track surfacing at some regular interval, such as three to five years which is common practice. But even such a schedule would have to be flexible in order to allow for changes and to handle areas requiring immediate work.

For example, surfacing is required in conjunction with track relaying. In some cases, spot surfacing is done immediately ahead of the rail relay gang. In addition, surfacing will also follow the relay gang.

Contributing significantly to track quality is the ballast. NP's main line track is ballasted with crushed rock, 3/4 to 2½ in. maximum size. Plants at several locations provide ballast for the system.

Since 1950 the Northern Pacific has installed over 3.6 million cu yd of ballast in main line tracks and over 2.25 million cu yd of pitrun and processed gravel in branch lines at a total cost of $24.2 million. It has averaged in excess of 100 miles of ballast over each of the past five years. This ballasting consists of a raise of eight inches on new material, using about 2520 cu yd crushed rock per mile on main lines and a 6-in. raise using 2200 cu yd pitrun or processed gravel per mile on branch lines. The program for 1964 calls for 147 miles of reballasting.

Typical Reballasting Operation

A typical NP reballasting operation includes two work trains, a Mannix sled, the Mannix Auto-Track, and power tampers. Exclusive of the trains, 48 men handle the equipment. Work performed includes tie removal by the Mannix Auto-Track and tie replacement. Ties are spaced and straightened; track is aligned. The first work train with a five-man crew pulls the Mannix sled and Auto-Track. The second work train with a five-man crew and four laborers unloads ballast under the direction of the roadmaster.

Tie renewals are programmed on a five-year cycle by divisions. Four tie gangs cover NP's seven divisions. Since Jan. 1, 1951, NP has installed over 6.3 million ties, averaging 49 ties per mile or an annual rate of renewal of 1.67 percent. NP has been an advocate of preservative treatment of timber since 1907. In that year, tie treating plants, equipped with the Lowrey process, were constructed at Brainerd, Minn., and Paradise, Mont. Since 1926 additional treating facilities have been contracted at Seattle.

The ties after aging and seasoning are installed at NP by four mechanized tie gangs. Besides a hydraulic spike puller, these gangs include a Kershaw dual tie saw with a hydraulic butt remover, a Kershaw scarifier and tie setter, a Jackson Maintainer, a Fairmont rail lifter, and two spike hammers. The crew totals 25 men including the foreman and eight machine operators. Railway Trackwork Tie Handlers also aid in NP tie renewals.

In preparing used rail for relay, NP crops a certain amount at its Brainerd cropping mill. Last year it cropped 13,536 linear feet. This year it plans to crop 12,899 linear feet of 112-lb rail. None of the cropped rail is welded.

Because of heavier cars and heavier diesel locomotives, NP engineers felt some concern for the track structure—especially the 56 and 66-lb rail used on some branch lines. GP-9 and similar diesel units have much heavier axle loads than the steam locomotives formerly used. However, experience has shown that their operation can be tolerated. The 100-ton cars have axle loads as high as a GP-9 diesel, with closer spacing. Occasional usage is being allowed with no known detrimental effect. Bridges and some culverts have required minor strengthening.

NP's rail relay gangs are made up on each division from men available. A gang usually averages about 0.82 track miles per day. These gangs work during summer and early fall on all lines east of the Cascade Mountains; during any season west.

"Our general policy is to have an annual inspection on each division to determine the most likely locations for relaying main and branch lines," explains Mr. Shoemaker. "Factors considered in determining location are the traffic, condition of the rail, age of rail, and the failure record of the rail plus the need for relay rail to lay on branches and secondary lines."

To keep brush along the right-of-way and weeds in the track under control, Northern Pacific carries out an extensive spray program. Each fall engineering and division officials make a complete survey to determine the location of annuals and perennials to be sprayed.

NP built four weed spray cars. These together with one leased spray unit make up five spray trains. They start work on May 4 and continue weed spraying until July 8. On the two western divisions, NP can get a head start on its weed spray program. Otherwise, it would require seven spray trains. Telvar and Karmex are the two most widely used spray components. Karmex, being less soluble, is used on the Coast lines where there is a lot of rain. NP uses some aromatic oils mixed with the chemical and water.

Brush spraying is a separate program carried out later in the year. Unlike the weed program, this is not a system project, but it is done where needed. Usually these areas lie in Montana, Washington, and Minnesota. For this work, NP rents special equipment from Nalco. NP finds it desirable to use Dow's B-K, which is a combination of 2,4-D and 2,4,5-T to kill woody species. These two chemicals are sprayed in diesel oil. Dry chemicals are used around yard areas, bridges, pole lines, and flammable structures. Usually this is Telvar Karmex or Hyvar granular. One of the biggest values from brush spraying lies in the protection given communication wires. Line losses get high when brush grows into the wires. NP maintains test plots in which it evaluates the new chemicals that become available.

With around 1500 units of both on- and off-track M/W equipment, Northern Pacific finds that careful planning for the repair of these machines is essential. Included in this group of machines are 32 production tampers, 7 Koehring Rail Aid shovels, 8 truck cranes with flanged wheels, 8 diesel-electric combination crane and pile drivers, and a recently built truss-type pile driver.

All this equipment gets heavy repairs in a M/W shop located at Livingston, Mont. A comprehensive field inspection of equipment, made each year, determines what equipment is sent to Livingston for off-season repair.

Eight traveling mechanics, more than one per division, provide routine maintenance and light repair to the M/W equipment. Each mechanic is equipped with a panel truck. This carries portable welding gear, tools, and vital maintenance parts. ■

Mileposts Along the Way:

Highlights of Northern Pacific's First 100 Years

1864—On July 2, President Lincoln signs act of Congress creating Northern Pacific Railroad and authorizing construction of the first of the northern transcontinental railroad and telegraph lines between Lake Superior and Puget Sound. Act provides for right of way and land grant. First board meeting is held; Josiah Perham is elected president.

1866—J. Gregory Smith succeeds Perham. Congress extends time required for commencing and completing construction.

1867—Construction begins on Lake Superior & Mississippi Railroad (incorporated in 1857 as Nebraska & Lake Superior; now part of NP). Gen. G. W. Cass and William G. Fargo are elected to board. Edwin F. Johnson is named chief engineer, begins surveys of line.

1868—Congress again extends time to begin construction.

1869—Congress consents to give NP authority to "issue its bonds and secure the same by mortgage." Jay Cooke becomes NP's fiscal agent.

1870—Groundbreaking ceremonies are held at planned junction of NP and LS&M lines 25 miles west of Duluth, on February 15. Grading and tracklaying are begun at both ends of system in June. LS&M drives last spike on 155-mile line between St. Paul and Duluth. NP buys first locomotive (Minnetonka, Itaska, Ottertail and St. Cloud) and rolling stock.

1871—NP completes 230 miles of line between LS&M junction and Moorhead, Minn., on the Red River, plus 25 miles of line on North Pacific Coast. Maj. Gen. W. S. Hancock orders out 600 troops to protect survey parties in hostile Indian country. Brainerd, Minn., shops are established.

1872—Freight contract is signed with Hudson's Bay Company. Chief engineer reports completion of 164 miles of main line into Dakota Territory and 45 additional miles on coastal line. Colonization offices are opened in Europe. Frederick Billings is named managing director of land department. NP President Smith warns President U. S. Grant that hostile Indians are impeding construction. Gen. Cass succeeds Smith as president. NP leases LS&M.

1873—NP line is completed to the Missouri River. Coastal line from Kalama to Tacoma—110 miles—is completed. Jay Cooke's firm collapses; NP slides into bankruptcy, and further construction is virtually halted for five years.

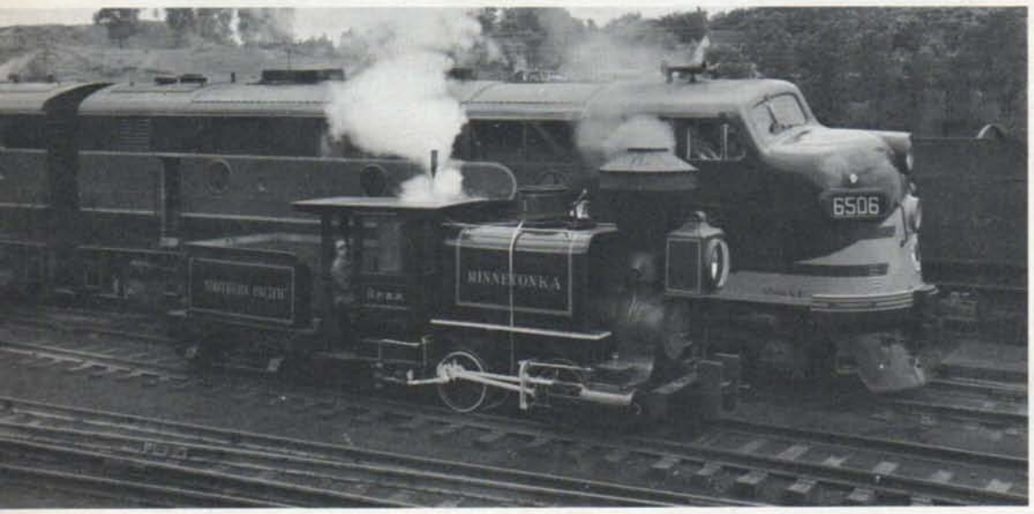
1875—Charles B. Wright is elected president as Gen. Cass resigns to become receiver of the company. Reorganization plan, formulated by Frederick Billings, is put into effect. Gen. Custer is assigned to Fort Rice, Dakota, and provides protection for NP survey and construction crews.

1877—NP employs mining engineer to open company's coal fields in Washington Territory—beginning of geology division. Shops are established near Tacoma.

1879—Contract is let for building first 100 miles of line west of Missouri River. Company expands foreign immigration program in Europe. Billings succeeds to presidency.

1880—Northern Pacific Express company begins operations in Minnesota and Dakota. NP institutes broad program of branch line construction.

1881—Henry Villard raises millions with famous "blind pool" to create Oregon & Transcontinental Company and secretly gain control of NP. Billings resigns presidency and, later, Villard is elected to the post. Line reaches Sandpoint, Idaho, from the western end and Horton, Mont., from eastern. 110 miles of branch line are completed.



THE MINNETONKA, Northern Pacific's first locomotive, purchased in 1870, is here shown beside a modern diesel unit.

FAMED "Northern" was the last A class locomotive superseded by diesels.

VILLARD "Last Spike" Excursion in 1883. This is the first train from St. Paul to Portland, Ore.

LONG freight train on NP's main line. The power is a Z-class locomotive.

STEAM locomotives at NP terminal. Last steam units were purchased 1944.

1882—Bridge over Missouri River at Bismarck is completed. 360 miles of main line and 368 miles of branch line are completed, bringing totals to 1347 and 731 miles, respectively. First dining car is purchased.

1883—"Last Spike" is driven, September 8, as main line is completed in grand celebration at Gold Creek, Mont. Through passenger service is begun with "Pacific Express" (westbound) and "Atlantic Express" (eastbound).

1885—Construction is completed to eastern extremity of NP system, Ashland, Wis.

1888—Stampede Tunnel—first in the West to be electrically lighted—is opened to service. NP introduces use of copper wire and quadruplex circuits in telegraph service.

1890—Right of Way and Lease department is created and industrial development begins.

1893—NP adopts oriental monad as trademark motif. Road goes into receivership second time.

1896—Company is reorganized to become NP Railway. J. P. Morgan & Company become financial agents; Morgan heads voting trust.

1900—North Coast Limited is introduced. NP acquires Brainerd & Northern Minnesota and the St. Paul & Duluth (old LS&M); begins second tracking of main line.

1901—NP voting trust is dissolved. NP and GN purchase control of CB&Q. E. H. Harriman seeks to buy control of NP; J. P. Morgan stops the raid, but gives Harriman seat on NP board. (NP stock is quoted at 1000 at height of battle—a Wall Street record.) Northern Securities company is incorporated to pool ownership of NP, GN, & CB&Q.

1903—U.S. Supreme Court, by 5 to 4 decision, rules Northern Securities Co. violates Sherman antitrust laws. NP extends Yellowstone National Park branch to Gardiner, Mont.

1905—NP and GN begin construction of Portland & Seattle railway (later Spokane, Portland & Seattle). NP and UP undertake construction of Camas Prairie railroad.

1908—Company buys first of its Mallet compounds (2-6-6-2) and a Heisler, geared locomotive. SP&S is completed.

1909—NP introduces "Great Big Baked Potato."

1914—NP and GN begin construction of St. Paul general office building—largest in the city, then and now.

1921—NP organizes Absaroka Oil Development Co. and begins systematic geologic survey of company lands.

1923—Automatic block signalling is completed on all of main line between St. Paul and North Pacific Coast.

1927—NP & GN file application with ICC for unification of systems. NP introduces Northern (4-8-4) locomotives.

1929—NP introduces the Yellowstone (2-8-8-4) simple, articulated steam locomotive, largest in the world.

1931—NP and GN withdraw unification application when ICC bases approval on condition that the two lines divest themselves of their interest in CB&Q.

1932—Northern Pacific Transport company, NP-owned highway subsidiary, begins operating in Montana.

1933—NP purchases Timken's famed "Four Aces," world's first roller bearing locomotive.

1934—NP begins air conditioning of North Coast Limited.

1936—NP installs its first continuous welded rail, in tunnels.

1938—Company purchases first diesel-electric locomotives.

1939—NP begins mechanizing accounting procedures.

1944—NP installs first diesel-electric road locomotives in freight service. First diesel shops are completed at Auburn, Wash. Work is begun on new car building shops at Brainerd. NP orders its first lightweight passenger equipment. Last of steam locomotive purchases are placed in service. Company inaugurates systemwide carrier telephone service.

1947—Newly dieselized North Coast Limited goes in service with all new lightweight equipment. Company installs its first CTC, a 50-mile section in Montana; begins using end-to-end and dispatcher-to-train radio in Washington State.

1951—Board of directors elects Robert S. Macfarlane president, as C. E. Denney retires. Oil is discovered in Williston Basin; Texas Company brings in well on NP lands. Welded rail program is begun.

1952—Oil development department is established. North Coast Limited goes on new fast schedule, and second transcontinental "name" train, the Mainstreeter, is placed in service.

1954—Vista-Dome coaches and sleepers are added to North Coast Limited. NP receives 1954 Progress Award of the Federation for Railway Progress "in recognition of outstanding achievement in progressive passenger service." TOFC service is begun.

1955—New, $5-million electronic freight classification yard at Pasco, Wash., first in the Pacific Northwest. Stewardess-nurse service, another Pacific Northwest "first," is inaugurated on Vista-Dome North Coast Limited. First Budd RDC's added to passenger fleet. NP and GN institute new unification study. NP joins in building Butte Pipeline as Williston Basin discoveries continue. Accounting procedures are streamlined with installation of IBM 650 Data Processing system.

1956—NP oil and gas revenues nearly double that of 1955; shared wells grow to 166.

1957—New five-track diesel maintenance shop is opened at Livingston. 2000-mile direct-dial telephone network goes into service between St. Paul and North Pacific Coast cities.

1958—Timkin's "Four Aces," later NP 2626, is reduced to scrap as dieselization program is completed in January.

1959—Slumbercoaches are added to Vista-Dome North Coast Limited.

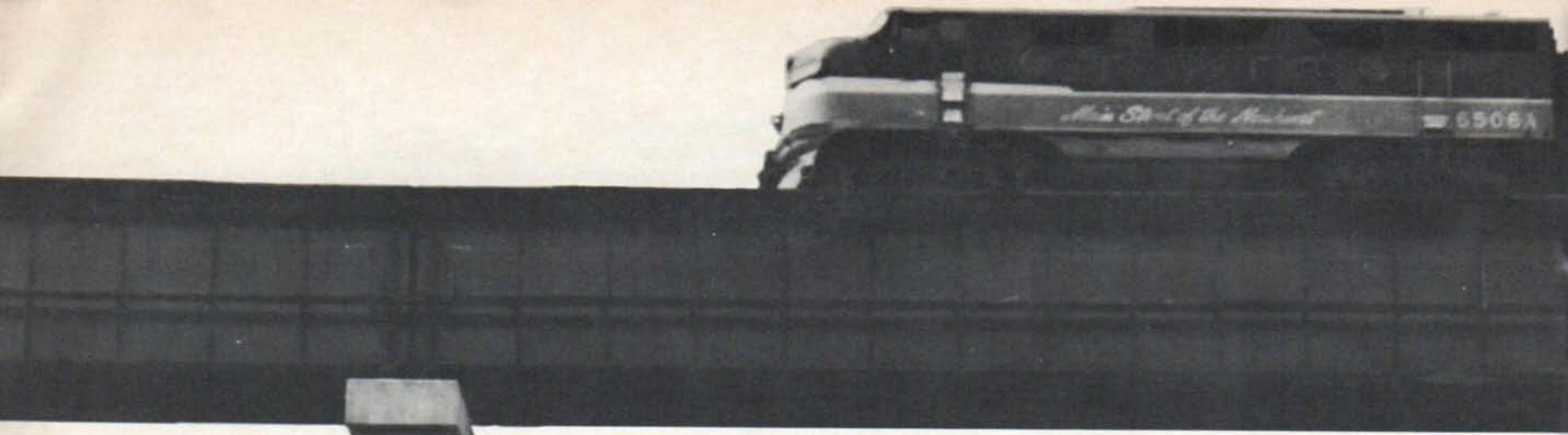
1961—NP and GN stockholders approve merger plan; ICC begins hearings on application to unify NP, GN, CB&Q and SP&S. NP becomes first railroad to install IBM 1401 Magnetic Tape Data Processing system.

1962—Merger hearings are concluded. NP installs citizens band radio system to coordinate St. Paul general offices maintenance. Oil and gas revenues near $8 million as shared wells grow to 766. Passenger revenue reaches highest peacetime level since 1929.

1963—NP further improves electronic accounting with installation of IBM 1410 Magnetic Tape Data Processing system. Addition of 80 miles of continuous welded rail boosts total on system above 400. Mileage under CTC grows to more than 400 also. Microwave radio between Seattle and Portland and intermediate points expands communications network. NP reports net income of $24,592,470, highest since 1943.

1964—For its Centennial year, NP authorizes $35 million improvement program, including more welded rail, CTC, branch line dial service, 15 new 2500-hp diesel units, 900 freight cars, and more, as President Macfarlane completes 30th year with company. ■

ONCE world's largest steam unit, "Yellowstone."



BRIDGE 74 over Green River east of Seattle. Bridge was part of $20-million, 14-mile line change completed in 1959 to permit flood control project.

NP Plans $3 Million

Property improvements since 1951 total $98 million ... include line changes, terminal and shop modernization

Keeping pace with the demands of present-day railroading, Northern Pacific has spent $98 million since 1951 for capital improvements. Over these years, NP has used $4.1 million of this sum to eliminate curves, bridges, and grades. These projects have speeded up trains and provided a safer and more maintenance-free railroad. Since 1950, NP has reduced 130 curves, eliminated 47 curves, saved 1221 degrees of central angle, and 0.46 miles of line.

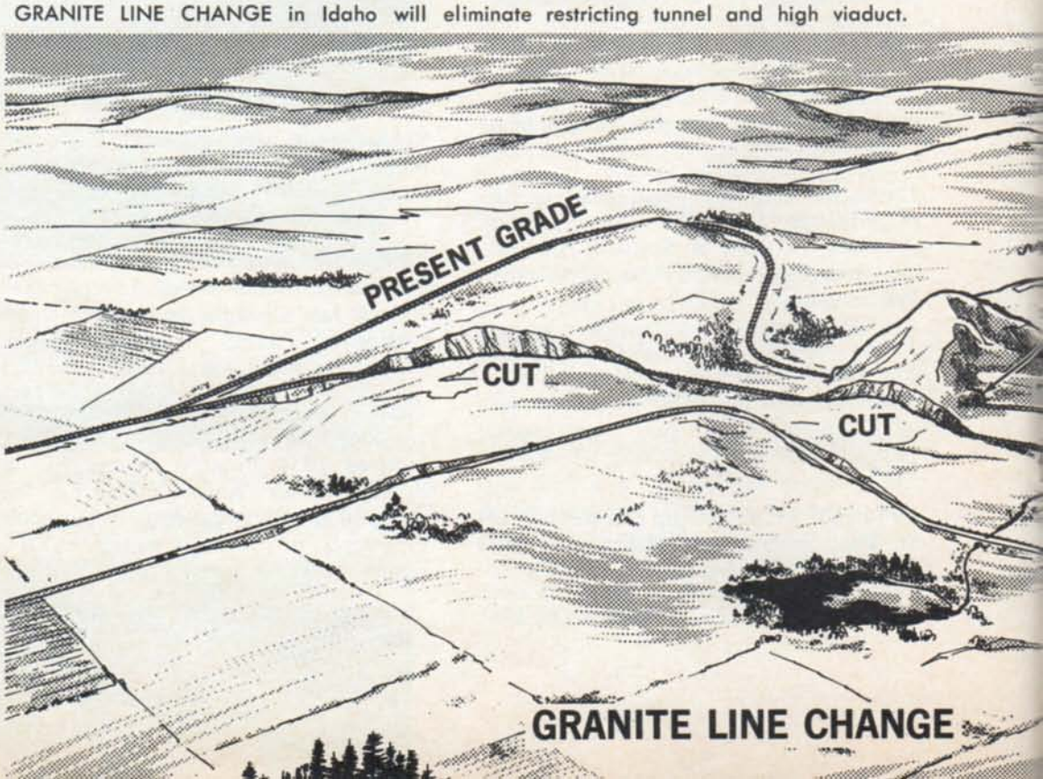
Currently, a four-mile, $30 million line change is being made in Idaho. The new route is about two miles shorter than the old line, and it eliminates NP's second most restricting tunnel and a high viaduct. Construction of the improved line is difficult because of complicated and interesting geological conditions.

Always a difficult stretch, this line was first altered in 1905 when it was moved northward to avoid heavy grades. Though the possiblility of a line change was again considered 40 years ago, the earth-moving techniques of that age did not permit economical construction of the high fill and the deep cut needed.

To obtain a relatively straight line, the railroad must cross a deep swamp. This requires a fill, 120 ft high. The crossing is located over the outlet of old Lake Missoula—a glacial lake dating back to the Ice Age. Only a remnant of the lake exists today.

"The preliminary work in locating the

GRANITE LINE CHANGE in Idaho will eliminate restricting tunnel and high viaduct.



Line Change

line across this questionable area was aided by a Terra-Scout, a refraction seismograph, which we rented," explains Chief Engineer D. H. Shoemaker. "It enabled us to find out if there was rock in the cut and where the rock lay in the big fill. The Terra-Scout made us suspicious of the initially chosen crossing. Drilling confirmed that a hole does exist in the swamp bottom, with the rock foundation down 80 ft below the existing ground line. Apparently, an Ice-Age water fall at this point eroded the 80-ft hole.

"A study of the drillings showed that the material in the hole would not support the line," explained Mr. Shoemaker. "Aerial photos of the area were studied by company geologists who suggested that a more favorable location probably existed downstream from the originally proposed swamp crossing. There we plan to dig out all swamp material, about 25 ft down to bed rock."

The new line, having a maximum curv-

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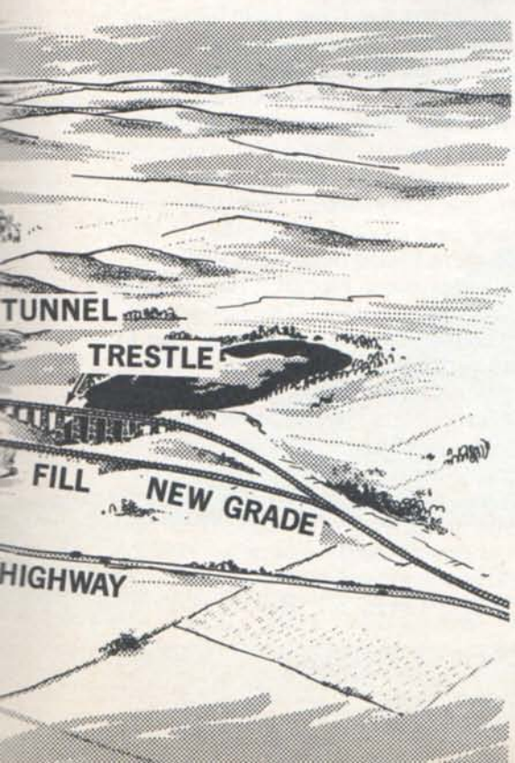

ature of 1 deg 20 min, will cut about two miles of 30 mph track from the route. Since the elevations at the beginning of the line change and at the end are fixed, with the west end being higher, the line will rise at a relatively uniform rate. This results in a somewhat stiffer grade than the present meandering line: 0.8 percent maximum compared with 0.5 maximum. NP engineers studied the effect of this on train operation on a velocity profile basis. They found that even with the slightly higher grade, trains can operate better, because there is no slow-down at the foot of the downgrade approaching the line change from the east. The new line, besides being shorter, eliminates severe curves including three of 8 deg, the restrictive tunnel, and the trestle. The new speed limit will be 75 mph instead of 30.

Schedule for the project calls for completion of grading this year with track laying to begin in 1965. The line is to open for traffic in the fall of 1965.

The Granite line change is the first and a major step in raising operating speeds between Sandpoint, Idaho, and Spokane, Wash. A total of six future additional, but minor, line changes is involved, adding another $1 million.

In any extensive program such as the line changes and the clearance program, more must be considered than the immediate rate of return on the investment. The need to keep the railroad modern in future years stands paramount.

Favorable earnings over recent years have enabled NP to tackle some of the larger, long-term projects that previous managements have wanted but were unable to pursue.

The need for these projects has become more acute with the introduction of triple deck cars, ultra-long freight cars, increasing numbers of wide loads, and increased axle loadings. Over recent years, NP has practically removed structural main line clearance restrictions on the eastern half of the railroad, St. Paul, Minn., to Livingston, Mont. Elsewhere many of the restrictions inherited from the pioneer days of the railroad are being removed; e.g., those on the old Granite line.

Several tunnels such as NP's famous Homestake and the 1069-ft Big Horn, near Custer, Mont., have either been daylighted or bypassed by a line change. Currently, over-size loads are routed around restricting tunnels or bridges.

NP's basic policy is to eliminate tunnels. In fact, NP has already eliminated all tunnels on its Eastern District. The road has three tunnels on the Western District which, in all probability, will never be eliminated. They are Bozeman, a new 3000-ft tunnel completed on July 28, 1945, replacing an 1884 tunnel; the two-mile Stampede Tunnel, NP's longest, cutting through the Cascades; and Mullan, under the Continental Divide in the Rockies. The new Bozeman tunnel has a concrete floor and continuous welded rail.

MODERN ELECTRONIC YARD at Pasco, Wash. has 47 classification tracks and six departure tracks. Completed in 1955, the $55-million yard is at western end of NP's main line.

ONE of NP's 2598 bridges. This one is 225 ft high and spans a narrow pass connecting the Flathead and Missoula Valleys in Blackfeet Indian country in Montana. The sleek vista-dome North Coast Limited completes the picture.

$2-Million Tunnel Elimination Project

Originally, NP had 30 tunnels on its main line. Over the past 15 years, the company has spent in excess of $2 million in eliminating tunnels and otherwise improving clearances. So far, nine tunnels have been eliminated by daylighting. In seven tunnels, the track has been lowered to increase clearances.

Another type of tunneling is the installation of culverts. NP is using tunnel liner plates to a large extent for new, deep culvert installations. These are upwards of 48 in. in diameter and seem especially valuable where it is not economical or not feasible to cut the track and install a culvert.

"We have found that the installation of tunnel liners is an excellent winter job for our bridge and building forces," explains Mr. Shoemaker, "and they have become very adept at this work."

Northern Pacific faces many special engineering problems because it runs through the "Big Dam Country." This means a constant shifting of main and branch lines to avoid inundation. Currently 70 miles of NP's Mandan south line branch must be relocated, because of the construction of Oahe Dam in South Dakota. This dam backs up water to within a short distance of Bismarck, N.D.

One of the largest of relocations cost $20 million. It resulted from the Howard Hanson flood control project located in the Eagle Gorge on the Green River.

This project protects the valley south of Seattle. Other relocations resulted from two dams constructed by the Washington Water Power Company. All of these relocations involve very thorough engineering studies because of the more rugged terrain in which the relocated track must be placed.

Highway construction is another disturbing influence and poses a threat to future industrial development. Typical is a complicated freeway project of the Minnesota Highway Department at Duluth, Minn., which cuts the railroad off from considerable industry and from the waterfront.

NP has a modern, $5.5 million electronic yard at Pasco, Wash. This was completed in 1955 and includes 47 classification tracks, six departure tracks, and all the facilities normally associated with a modern yard. Pasco Yard is strategically located, being the terminal for the Snake River branch, the Walla Walla branch, the Eureka branch, the main line, and the SP&S railroad, which is a tenant. NP is currently installing inert retarders at the ends of the classification tracks, thus eliminating problems and costs attendant upon the use of skates.

Like most western railroads, Northern Pacific has a number of spectacular bridges and viaducts. Depending upon the rules, several of these will qualify as system champions. Thus, the Cheyenne River bridge at Valley City, N.D., is the longest-highest bridge on the NP. It is 3861 ft long and crosses 162 ft above the river, the Soo Line, an electric railroad, and a highway. In 1908 when it was built, it set a record. It contains 6848 tons of steel. Perhaps NP's most spectacular bridge is the Marent Viaduct near Missoula, Mont. At 226 ft, it is the highest on NP's main line. It is 797 ft long. Longest bridge is that across Lake Pend Oreille. This bridge is 4770 ft long and 60 ft high and is currently being rebuilt under a three-year program.

Altogether NP has 2598 bridges with a total length of 75 miles. Among them are 1534 timber pile bridges, 812 steel span bridges, 204 concrete pile trestles, and 20 draw bridges.

Current loading standards for steel spans are Cooper's E-72; for concrete pile trestles, E-70; for wood pile trestles, E-70 on main lines and E-60 on branches. Very little bridge strengthening is currently required. Fifty new steel bridges with a total length of 17,000 track feet have been built since 1950. In this period, NP eliminated 127 bridges by filling; 93 of these representing over 9300 ft were over waterways. Either the streams were diverted, or culvert pipe was used to carry the stream beneath the fill.

Before making a fill on culvert pipe, NP makes a cost comparison on an annual basis between the cost of maintaining the bridge and replacing the fill. Generally, filling is carried out when annual costs for filling are not excessively greater than those for maintaining the bridge.

NP's standard concrete pile trestle uses 16-in. rectangular precast reinforced concrete piles and 16-ft long precast reinforced concrete slabs.

Since fire is a continual threat to wood structures, NP employs fire retardants. On timber trestles, the tops of stringers and the tops of caps are covered with galvanized metal for fire protection. Further, NP sprays a bituminous material on the ties in a number of instances and then coats them with pea gravel which provides additional fire retardant properties.

To expedite inspections, painting, and maintenance in the future, NP is adding catwalks to existing bridges whenever heavy work is performed. All new structures include catwalks.

Though heavy emphasis has been placed on the modernization of its track and roadway, its bridges and tunnels, Northern Pacific is not neglecting its fixed properties at its terminals. To keep pace with piggyback growth, TOFC platforms have been installed at most towns of any size, including especially large installations at Dilworth, Laurel, Spokane, and Seattle for unloading tri-level cars.

Since 1950, 10 track scales have been installed. The latest is a 200-ton Howe weigh-in-motion scale at Mandan, N.D., with Streeter-Amet automatic weight recorder. In the same period, NP has installed seven new load adjusters. These are of heavy-duty design for shifting timber.

Replacing large central heating plants with automatic low-pressure hot water and steam boilers has saved NP many thousands of dollars. NP has abandoned 27 heating plants. In labor and fuel costs alone, it is saving over $900,000 annually (see Modern Railroads, May, 1963, p. 72 and Sept., 1962, p. 135).

A special heating problem at Billings, Mont., has been solved by the use of a portable vapor steam generator (100 hp capacity). This is used during the holiday season to heat the many baggage cars in service then. At other times, the unit can be moved to supply emergency steam at any point within 500 miles of Billings.

At Portland, Ore., NP installed three Vapor Cyclomatic 200 hp steam generators. At its Third Street coach yard in St. Paul, NP installed three Clayton automatic 175-hp, gas-oil steam generators to replace four conventional boilers. ■

AN eastbound freight crosses trestle at Valley City, N. D. NP has 812 steel span bridges and 1534 timber pile bridges. Bridge mileage totals 75.

FIRST of 15 new 2500-hp 6-axle units marks the beginning of replacement program for NP. Here the new diesels are compared with "Minnetonka," NP's first locomotive. Fleet includes 624 units.

Upgrade Equipment and Shops

NP's modern, well-maintained locomotive and car fleets spring from centralized, fully equipped shops. NP's policy produces economy and quality workmanship

In no small measure, Northern Pacific's reputation for reliability springs from the efficiency of its mechanical department. NP mechanical men do a thorough job of maintaining, overhauling, and rebuilding locomotives, freight cars, and passenger cars. Their skills include the overhaul of such detail parts as brake mechanisms, fuel injectors, fuel pumps, and power assemblies. Not only do they keep locomotives and cars rolling, but by efficiency, are producing direct savings.

Among the larger do-it-yourself projects tackled last year was the rebuilding of five used parlor-bar-lounge cars into like-new reclining seat leg-rest coaches. A few years earlier, they upgraded some coach-buffet-lounge cars into the beautiful Traveller's Rest buffet cars.

As a general policy, NP has moved toward consolidation of locomotive and car work into fewer, but better equipped shops. Diesel work is now centralized on a system basis; car shops, on a regional basis.

"This policy has proved effective," indicates J. A. Cannon, general mechanical superintendent, "as substantiated by our rolling stock and motive power being well-maintained with a considerably reduced maintenance force."

Heavy locomotive repairs and diesel engine overhauling are done at the main locomotive shop at Livingston, Mont. An assembly-line method is employed for disassembling and reassembling the diesel engines and for rebuilding the diesel power assemblies. The assembly-line method is also employed for the repair and cleaning of air brake equipment and of diesel cylinder heads.

NP has been studying the possibility of a consolidated wheel shop, but no decision has been reached on this pending the outcome of the NP-GN-Burlington-SP&S merger proceedings.

"Considering the logistics of wheels and axles, a consolidated shop would logically be located on the east end of the railroad," stated W. R. Shannon, assistant general mechanical superintendent. "Transportation of supplies would be at a minimum at some point well east of the railroad's midpoint."

Currently, wheel shops are located at each end of the railroad (St. Paul and South Tacoma) and at two intermediate points (Brainerd, Minn., and Laurel, Mont.). The two intermediate shops handle freight car work including roller bearings. Both the St. Paul (Como) shop and the South Tacoma wheel shop per-

form all kinds of freight and passenger car wheel work.

The extent of Northern Pacific's shop improvements since 1953 can be measured only in part by the $1.7 million spent for new machine tools and equipment in its four main shops.

Methods for increasing the efficiency of shop machines have included the wide use of fixtures and indexing attachments. Automatic followers and profile attachments have also been widely applied. Carbide cutters are employed in all applications where their cost can be justified.

A 25 x 120-in. Lodge & Shipley axle lathe includes a duplicator and a Cincinnati grinder. This lathe machines the axles and grinds the required micro finish on the journals. Also used with the above equipment at Brainerd is a 52-in. wheel lathe for turning used diesel wheels and restoring their tread. The South Tacoma wheel shop includes a Niles-Baldwin-Lima-Hamilton 48-in. hydraulic wheel borer. The Brainerd car shop includes a Farrel-Betts hydraulic-feed car wheel borer and a Farrel Watson-Stillman wheel press. Brainerd also has installed a 54-in. Bullard Man-An-Trol wheel boring machine. The electrical shop at Livingston includes an automatic Peerless commutator undercutting machine.

Non-destructive testing plays an important role in assuring safe and reliable operation of NP equipment. Magnaflux, Magnaglo, Zyglo, and ultrasonic equipment is used in most NP wheel and diesel shops to check parts for hidden cracks and defects.

Cost of truing wheels on locomotives (and passenger cars in emergencies) has been substantially reduced by the use of a Standard wheel truing machine at the Livingston diesel servicing shop.

The selection of Livingston for both a central diesel servicing shop and a heavy maintenance shop was a natural. Livingston is located approximately halfway across the railroad. Another factor is an operating one. Trains moving west from Livingston need more diesel units to cross the mountains than do trains operating to the east. Hence, certain changes in motive power consists are required here. Accordingly, NP decided to do servicing at Livingston where some units would lay over in any event. Thus, locomotives are changed on all freight and passenger trains. Servicing is performed in a modern shop built especially for this purpose. A few other points do servicing for local power—switchers and branch-line diesels.

In contrast to the centralization of diesel work in a system shop, car shops are centralized on a regional basis. In addition to three regional "heavy" car shops, NP has nine "light" shops. At these nine, NP uses a modified spot pull-through repair system. The "light" shops are located at Minneapolis (Northtown), Staples, Minn., Dilworth, Minn., Missoula, Mont., Spokane, Pasco, Wash., Auburn, Wash., Tacoma, and Seattle. Cars needing more than average light repairs and, thus, requiring longer than average repair time, are set on a second track.

The three "heavy" shops do new car construction and heavy rebuilding: the Brainerd, Minn., shop is building 150 RBL refrigerator cars. (AAR's designation for insulated boxcars with loading devices) and 300 50-ft, 70-ton, standard boxcars. Brainerd also overhauls gondolas and hoppers on an assembly-line basis.

The Laurel, Mont., shop overhauls box, stock, flat, and open-top cars on an assembly-line basis and does heavy repair work on miscellaneous cars. This shop handles a lot of programmed repairs. It is building 50 53-ft, 6-in. bulkhead flatcars.

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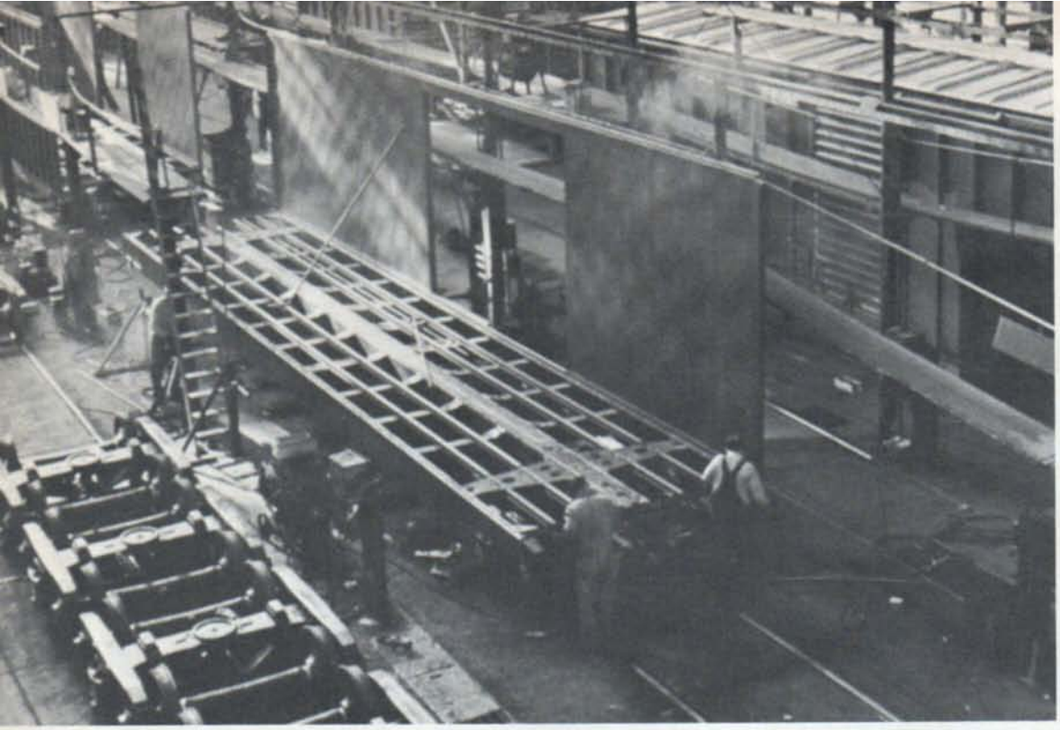


BRAINERD shop built 236 of these combination plug and sliding door boxcars in '63. Shop is now building 150 RBL cars and 300 standard boxcars. As of July 1, fleet totaled 36,263.

AT LEFT: Car shops are centralized on regional basis, with three heavy and nine "light" shops. Here at Brainerd, sides are placed on combination plug and sliding door boxcar. Car uses welded underframe with steel end castings.

EQUIPMENT AND SHOPS CONTINUED

The South Tacoma (Wash.) shop overhauls refrigerator, box, and flatcars, also using assembly-line methods. It also does heavy repair work on miscellaneous cars and performs some shop manufacturing for the west end.

Before rebuilding or scrapping cars, NP mechanical men evaluate the car. In some cases they may decide to convert a group of cars from one type to another. Thus, NP gets a lot of its log and company flats by converting old boxcars. Through its rebuilding and overhaul program, NP attempts to hold its bad order ratio to less than five percent.

The average age of NP freight cars has been declining, as new cars, to the extent of one-third of the fleet, have been put in service since 1950. Average age of all freight cars stands at 18.9 years as of July 1, 1964.

NP's approach to new types of car accessories and components is progressive. "We have built several thousand box and refrigerator cars with nailable steel floors and several thousand boxcars with steel end linings," explains G. A. Webster, superintendent car department. "We make use of paper and corrugated board linings in upgrading cars for grain loading every year. We have installed both ABLC and ABEL (empty-load) brakes on several hundred ore cars. We've installed Wabco-Pak brakes and ASF Unifrate brakes on 120 special service phosphate cars, 60 of each type. These brakes use composition shoes and eliminate linkage along the car. We expect that servicing of such items as brake shoes will be reduced."

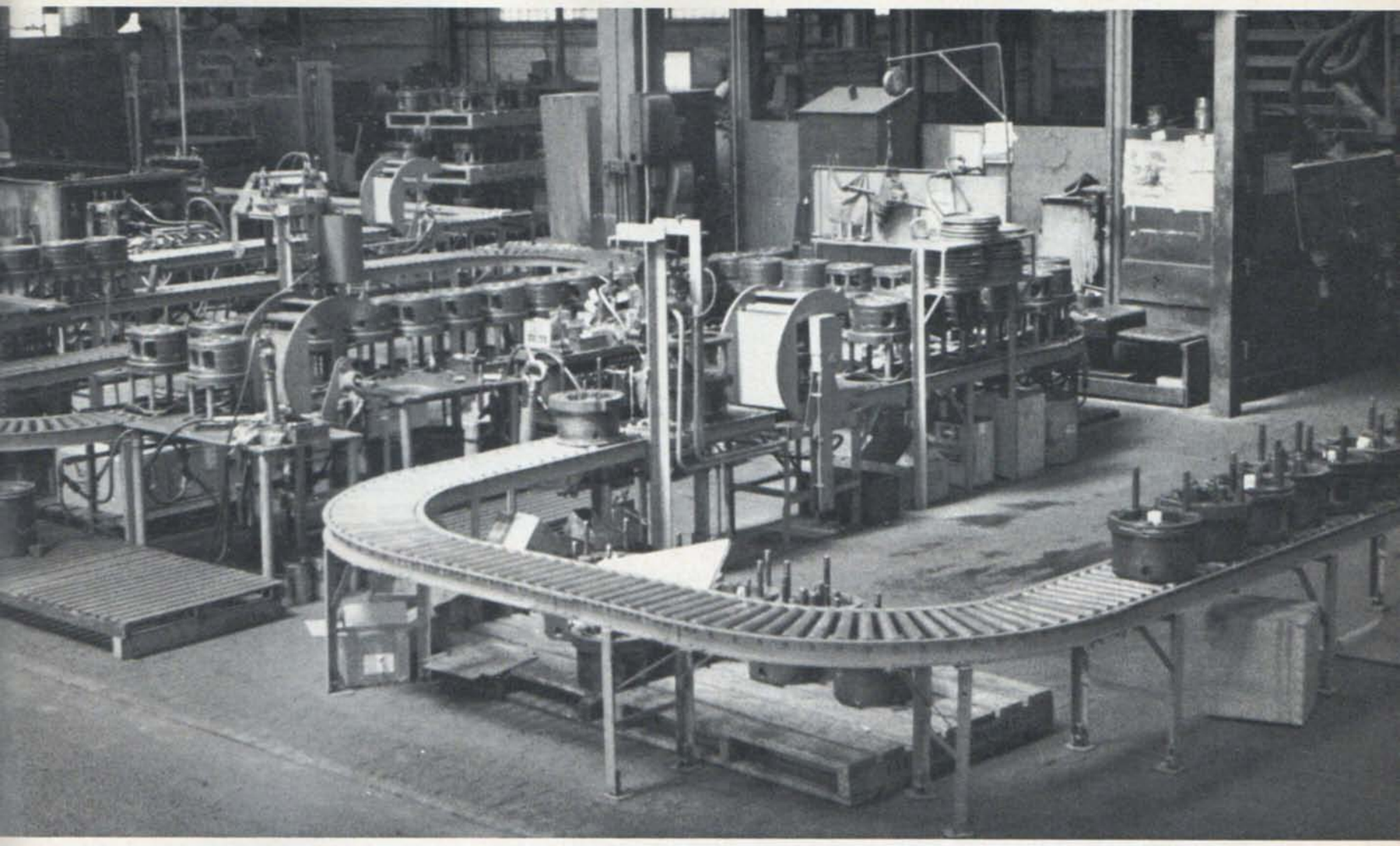
Recognizing the importance of shock control on freight cars, Northern Pacific is utilizing a variety of cushioning devices —Hydra-Cushion, Barber Center Sill Cushion Tube of Standard Car Truck Co., A. O. Smith's Hydra-Buff, Halliburton's FreightMaster, National Castings' 3-C Gliding Sill, and Keystone's Shock Control. These devices are proving highly successful in protecting shipments in regular boxcars, RBL (insulated box) cars, mechanical reefers, and cabooses.

"NP has 4033 cars equipped with roller bearings in service," states Mr. Cannon. "We have had excellent results with them. The failure rate is very low."

NP keeps its passenger car fleet in splendid condition through ingenuity in purchasing and in rebuilding. Car improvement programs continue actively right down to the present. Currently, NP shops are modernizing a number of cars, including a group of quality lightweight cars recently purchased from the Chicago and North Western Railway. Not only is the ingenuity of NP's mechanical department responsible, but some astute purchasing of prime used equipment has given NP 106 superb cars . . . all acquired since 1950 and all lightweight equipment. (This is in addition to 64 lightweight cars acquired for the North Coast Limited in the years 1946-50.) With these NP has been able to upgrade its second echelon trains and have a comfortable reserve to meet vacation travel peaks.

Recent acquisitions include the purchase of eight Slumbercoaches from the Budd Company. Five of these had previously operated on the North Coast Limited under lease. Slumbercoach service went into effect on the Main Streeter

POWER assemblies are overhauled on conveyor line operation at NP's Livingston shop. This is central servicing point as well as heavy diesel repair facility for the entire railroad. Much work is done in converted steam locomotive backshop; diesel servicing, in new building.



between St. Paul-Minneapolis and Seattle on June 20. NP now provides room sleeper service to coach passengers on both the North Coast and the Main Streeter. Utilization of the Slumbercoaches is increased, and Slumbercoach service is made available to the Burlington's Denver Zephyr, by NP's lending one car each day at Chicago to the Burlington. (Otherwise this car would lie idle in Chicago for 22 hr.)

Currently NP's shop is converting three tap lounges into leg rest coaches. These cars formerly ran on C&NW's "400." Recent purchases of passenger cars has also included some new equipment. In December, 1963, NP took delivery on 10 new baggage cars from Pullman-Standard. In addition, nine used lightweight coaches in good condition and one mail-dormitory car were bought from the C&NW.

An achievement of NP's shops was the creation of an intriguing and attractive buffet-lounge car for its North Coast Limited, the luxury train which to many persons typifies the Northern Pacific. Theme of the car, known as "The Traveller's Rest," was taken from the Lewis and Clark journals. (Much of the Northern Pacific route follows the trail blazed by those pioneers on their famed expedition to the Pacific in 1804-1806.) Walls consist of a light beige, buckskin-like plastic material. Colorful murals on the upper walls and ceilings of both the lounge and buffet sections portray graphically episodes in the Lewis and Clark Expedition. These were painted by famed muralist Edgar Miller. Central feature of the murals is a large map showing the explorers' route. The car, besides being handsomely interesting, is entirely practical. It includes a 30-seat lounge section with beverage service and a buffet section with a counter and 14 comfortable leather-cushioned stools. A la carte economy meals and snacks are served here during the day. This car is placed directly ahead of the diner. Other cars in the North Coast consist include a streamlined buffet-observation-lounge car with bedrooms and compartments; dome sleeping cars; and dome coaches.

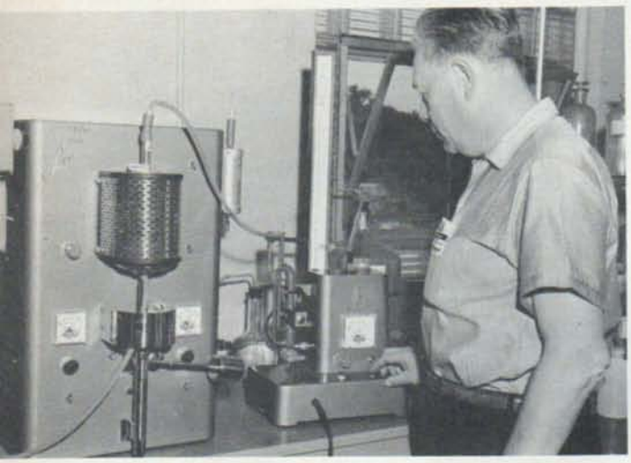
Passenger car repair and overhaul is done in the Como coach shop at St. Paul. Here NP has Air Reduction Heliweld, Airco Midget, and Aircomatic welding equipment for working on stainless steel, aluminum, and Cor-Ten steel cars and car parts.

With successful operation of three Budd stainless steel RDC (self-propelled rail) cars behind it, NP very astutely seized upon the opportunity for buying three used RDC's—two from the Western Pacific and one from the Duluth, Missabe & Iron Range. RDC's are used on a connection between the main line at Fargo, N.D., and Winnipeg, Manitoba; on a branch between Spokane, Wash., and Lewiston, Idaho; and on the original RDC run from Duluth to Staples, Minn., connecting with main line passenger trains. One RDC is held as a spare; it can be used in multiple with any of the others if necessary.

Last but not least in Northern Pacific's mechanical "complex" is its long-range policy of "good housekeeping." This policy is followed in its shops, its cars, and all over its general property. Good housekeeping contributes much to NP's efficiency, especially in its shops. ■

NP Lab Guards Quality

Oil control and "Action-Codes" program for diesels saves Northern Pacific countless thousands yearly



AT LEFT: Induction furnace enables rapid determination of sulphur content of fuel oil. Quality control is a major function of the Como (St. Paul) laboratory, which also has a branch for petroleum testing at Livingston, Mont. shop.

AT RIGHT: Another of the many tests made at the Como Shops is seen here—testing the viscosity of oil. Continued research such as this leads to improvements in machinery and operation so necessary today.

Like a modern Sherlock Holmes, Mr. L. O. Hanson, engineer of tests, Northern Pacific, seeks out defects and checks the causes of failure in working parts of locomotives, cars, and track. This detective work saves Northern Pacific many thousands of dollars each year. Faulty materials and newly purchased items that are not up to specifications are rejected before they cause trouble on the railroad. Parts that fail are investigated. The cause is pinned down, and steps are taken to eliminate similar failures in the future.

To do this, Mr. Hanson has well-equipped physical and chemical laboratories. In the physical laboratory, he tests both the tensile and the compression strength of many parts and many materials. Equipment includes a 300,000-lb Riehle beam-type testing machine, a 120,000-lb Southwark-Tate-Emery hydraulic testing machine, a Tinius Olsen testing machine, Brinell & Rockwell hardness testers, a hydraulic test device, an abrasion tester, a testing vibrator, a testing sieve shaker, metallographic equipment, and photographic facilities.

Sand and ballast tests alone have saved NP countless thousands of dollars. In one instance, Mr. Hanson showed a local, hence, a low-cost supplier of locomotive sand how to improve his sand to meet NP requirements. The Los Angeles abrasion tests on aggregate, ballast, and riprap determine what materials best resist wear. Use of approved material reduces expensive replacements in the future.

The test laboratory is located at Como (St. Paul) with a branch at Livingston, Mont., for petroleum testing. Recently, NP completely remodeled the Como chemical laboratory, adding glass block windows, new work counters, new sinks, stainless steel hoods and exhaust units.

"Accurate control of fuel and lube oil is imperative if locomotive operation is to be reliable," believes Mr. Hanson. "We check both fuel and lube oils at the time of their purchase. Then we follow the lube oil while it is in use and again upon its reclamation."

Part of the detection process is the determination of diesel engine condition from samples of crankcase lubricating oil. Tieing in with the lube oil tests are seven Action Codes. These have been selected so that terminology is uniform and instructions are clear over the entire Northern Pacific.

Here is the way the Action Codes are determined: Samples of crankcase lube oil are generally taken monthly on switchers, weekly on freight, passenger, and general-purpose units. Then a blotter test is run on each sample. NP's chemists place strong emphasis on the blotter test. Oils that indicate an adverse ash condition are checked for wear metals such as iron, copper, lead, and chromium. A Beckman DU spectrophotometer with a photomultiplier and flame photometry attachments is used. This instrument is less costly than the more complex spectrograph, but it is slower to use. According to Mr. Hanson, it is also less critical to maintain.

The Como laboratory maintains an individual lube oil test record card for each diesel unit. This shows the place and date that the oil was sampled, dates of filter changes, flash point, viscosity, water and fuel dilution, percent ash, dirt content, oil spot test record, and whether the oil is suitable for continued use. If an adverse lube oil condition exists, as determined by the tests, the proper Action Code number is assigned.

The Action Codes are:

W-1 Slight water leak
W-2 Severe water leak
F-3 Slow fuel oil leak
F-4 Severe fuel oil leak
F-5 Very black, dirty oil
F-6 Moderately dirty oil
V-7 High viscosity oil

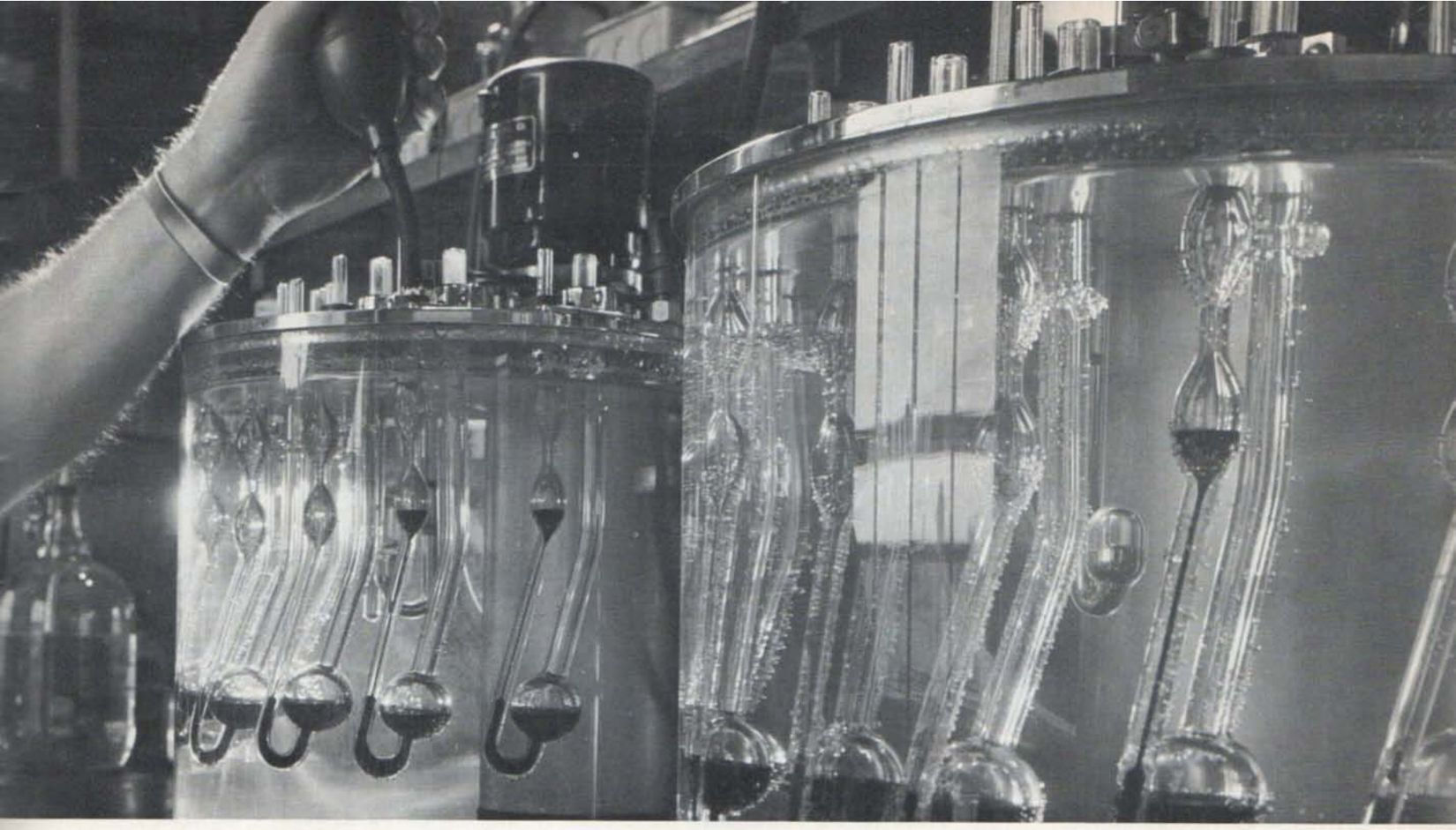
Follow-up from Action Codes

The report form lists these codes and shows the action which an engine foreman should take. Thus, the card shows, "F-6 —Moderately dirty oil: Change filters but do not change oil. Check engine for piston blow-by and improper filter operation and stuck by-pass valves. Report findings to engineer of tests on Form 3689."

The engineer of tests follows up on each engine that has had an Action Code reported for it. From the Form 3689 returned by the foreman, he can see what the foreman discovered and what remedial action he took. Then on the next regular test, he checks to see if this improved the engine condition.

"These procedures have enabled the shops to remove defective pistons, rings, liners, injectors, and other parts in time to prevent costly engine failures," states Mr. Hanson.

Samples of the various fuel oils purchased are checked routinely, and a monthly report is prepared showing how these oils conform to company specifica-



tion. Mr. Hanson uses a King cloud and pour point test cabinet (refrigerator unit), a Leco induction furnace for rapid determination of the sulphur content of fuel oil, and other necessary test equipment to determine the physical and chemical properties of fuel oil.

"Suppliers tending to deviate from the specifications are warned accordingly," points out Mr. Hanson.

Because of the large variety of paints, the testing of this product is an important function of the laboratory.

The Como laboratory has also developed a number of standardized cleaning materials. These are formulated at the Como compound building under the supervision of the stores department. Annual over-all savings have been determined to be in excess of $58,000 with a plus feature: The number of different types of cleaners in stock has been reduced.

Through NP's improved lube oil test program, unnecessary diesel crankcase changes have been eliminated. This action has reduced the load on the Livingston oil reclamation plant. Accordingly the plant was able to switch over for a time to car oil, and it reclaimed 60,000 gal of this oil during 1963 in addition to handling crankcase lube oil.

Crankcase oils furnished by the various suppliers are not mixed—neither in the locomotive nor in the re-refining process. The laboratories maintain close control on the various brands of re-refined and refortified oils which are dispensed as the equivalent of new oil. This results in savings which totaled about 191,000 gal of lube oil in 1963. All re-refining is done by the stores department at one central plant at Livingston, Mont.

Quality control is an important function of the test laboratory. The lab's material inspection department includes three inspectors each in Chicago and St. Paul; and one inspector each in St. Louis, Pittsburgh, and South Tacoma, Wash.

Inspection of critical material at the producers' plants has minimized complaints from NP's engineering and mechanical departments, the users of this material. This in-plant inspection cuts delays and reduces shop labor costs involved in welding, annealing, grinding, and other operations that may be required when suppliers' materials do not meet specifications. Inspection of the critical material used in new car building programs definitely aids the shops in speeding construction of new cars. The inspection for quality of rail, track fastenings, and other related materials is another precaution that insures safety and assures the company that it is getting its money's worth.

During 1963, material inspectors were forced to reject about 1200 pieces of critical material for stock temporarily and 3400 pieces permanently. They also rejected critical material for new freight cars and for passenger cars of about 1300 pieces temporarily and about 80 pieces permanently in this period.

A considerable amount of track material was also rejected, both temporarily and permanently during this period.

In carrying out his material inspections, Mr. Hanson does not use any predetermined sampling plan or complicated mathematical formula for determining rejection points. Typically he'll receive a sample from a shipment of items such as brake hose gaskets. These he checks carefully for dimensional accuracy. He also watches for thin fins which tend to break off and be blown into the brake valve mechanism. Similarly with oil filters, he'll check over a lot for obvious physical defects such as holes in the socks. Currently, he is testing paper filters.

How NP Handles Defective Materials

"If any of the initial sample appear to have defects, we'll ask for a few more and feel our way," explains Mr. Hanson. "We may reject the whole shipment if it seems warranted, though we seldom do this. We talk to the manufacturer so that he knows what we want. That makes it easier for him and helps us to get what we need. In short we handle each item on its own merits."

The purpose of the Test Department is to serve the various departments of the railroad. Not only are the mechanical and engineering departments aided but so are communications, freight claim, general claim, geology, and purchasing and stores. Work for freight claim and general claim departments frequently establishes whether or not claims are valid.

Mr. Hanson does not believe that an individual railroad should conduct uncoordinated basic and developmental research that will probably duplicate similar work being done elsewhere. He feels that such work should be handled as a joint project through the Association of American Railroads. ■

Flexibility Marks P&S Operations

An aggressive purchasing philosophy seeks improved products, while stores seeks better methods for maintaining a perpetual inventory

Northern Pacific operates both its purchasing and its store departments with remarkable efficiency and flexibility. Centralized purchasing is controlled from the railroad's main office in St. Paul, Minn., the road's eastern terminus. This office also supervises the western office which buys largely forest products.

"Functions of the purchasing department are actually rather broad in scope," states W. K. Smallridge, director of purchases. "The first and most important responsibility is the placement of orders for material, supplies and equipment with the many suppliers throughout the country with whom we do business. Naturally, our aim is to make purchases in the best interests of the railway, not only price-wise, but also from the standpoint of quality and delivery when needed."

"We encourage new suppliers whenever their product, price and service warrant consideration," states Mr. Smallridge. "This policy not only keeps both new and old suppliers competitive, but it has been instrumental in this department's efforts to fulfill its service function.

Estimated total purchases for 1964 are $49 million. This is more than $12 million above the 1963 figure and slightly above the $42.6 million spent in 1951. It is, however, much less than the 1956 peak-year figure of $61.9 million.

Still another major responsibility of the purchasing department is the sale of all company personal property, including locomotives, cars, material, supplies, machinery and scrap. The financial return from these sales ranges from $1.5 million to $2 million annually.

NP's central stores office in St. Paul keeps track of supplies over the entire system; as a result of this centralization, it has not been caught with excessive or large obsolete stocks "lost" at distant stores. NP does not hide inventory by consignment buying nor by heavy dependence upon suppliers' regional warehouses. Through close control exercised over inventory, it prevents wasteful accumulations of materials by individual departments. NP does not take material off its inventory until it is actually used. This policy makes its total inventory appear somewhat higher than it otherwise would, but by doing this, the department is not fooling itself. Inventory for 1963 (monthly average) was $18.6 million and is running slightly lower for 1964.

NP stores department includes four district stores (Brainerd, Como, Livingston, and South Tacoma), seven division stores, and three local stores. NP requests all suppliers to palletize shipments so that these can be handled efficiently by the mechanized equipment.

E. L. Jensen, general storekeeper, feels that his department has solved the difficult problem of cataloging the 50,000 items used by the railroad. Instead of preparing a bound catalog and issuing periodic supplements to it, NP uses a card record system. The flexibility of the card system permits quick updating of the card records in each store. Approximately 300 cards, representing new items or improved parts, are issued each month to every storekeeper.

Cards (3x5 in.) are filed by a code number made up from an AAR classification plus either a manufacturer's number or NP's own number. While every storekeeper has a complete set of cards even though he does not stock all the items, the cards give him full information for requisitioning any needed part.

DIESEL PARTS STOREROOM at Livingston typifies modern Northern Pacific stores facility.

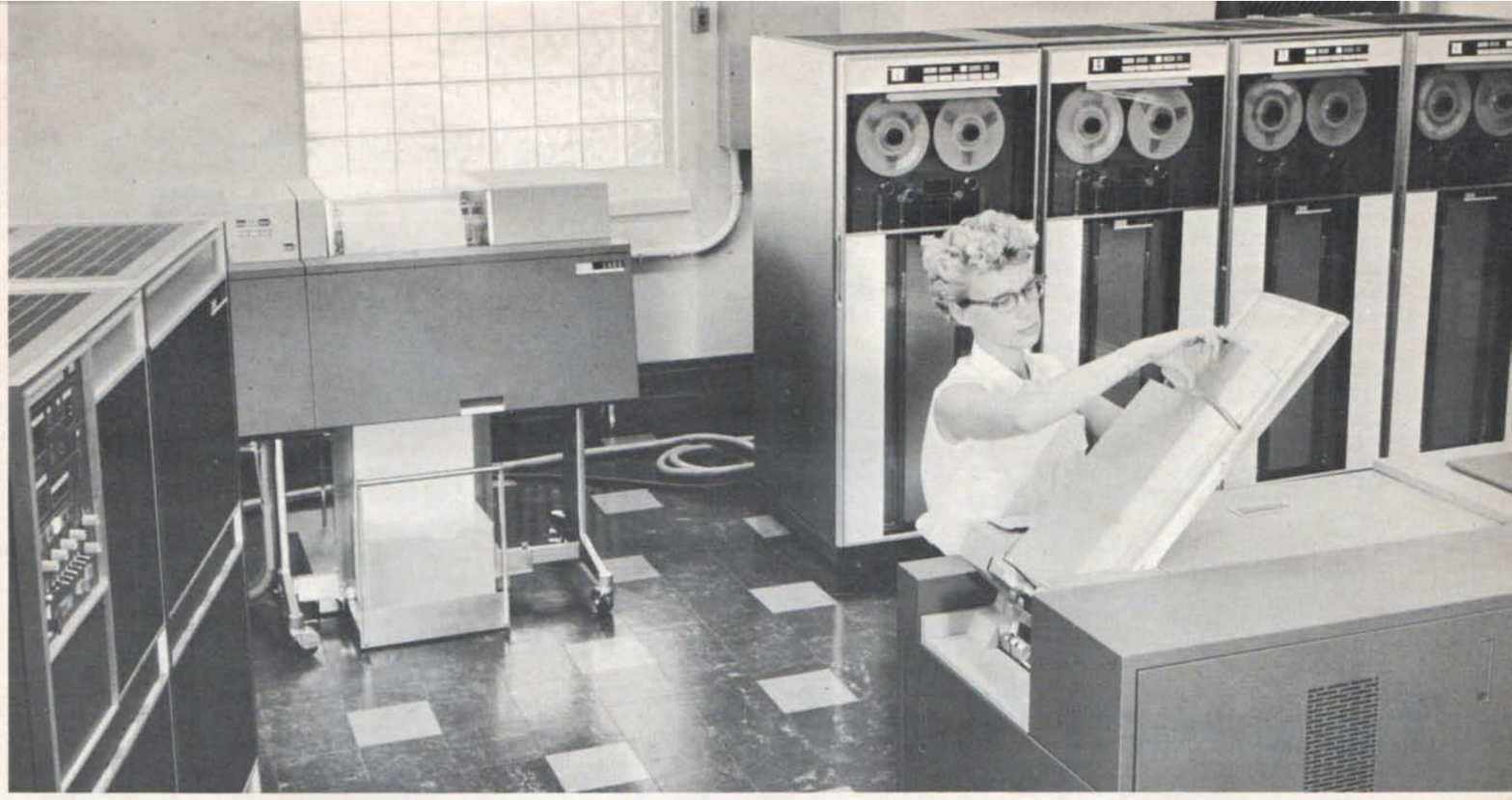
Cards are printed in the stores office from Addressograph plates.

For stock keeping, stockbooks are employed. Stockbook pages are sent to all stores.

Mr. Jensen is currently using electronic data processing to a limited degree, largely in the annual inventory procedure. All stores materials appear on permanent punched cards. At inventory time, the actual count of each item at each store is entered on the appropriate punched card, each of which is priced. This data is then punched into the card. By running these cards through appropriate sorting and tabulating equipment, Mr. Jensen can obtain a variety of tabulations giving him such information as the stock on hand at each store, items which have not moved during the past year, a master list showing items by AAR classification.

"In a sense, this method is a stopgap procedure," explains Mr. Jensen. "When we complete a study now in progress, we expect to completely mechanize inventory procedures, handling both disbursements and materials received on data processing equipment, thus maintaining a perpetual inventory." ■

NP HAS SOLVED the problem of cataloging stores by using a card file system. The file is easily kept up to date; each store keeper has a complete file, even though he does not stock every item.



FIRST mechanization of accounting procedures began in 1927; today NP has computerized and mechanized many accounting chores in all departments.

Machines Broaden Accounting Services

NP turns to newer computers as fast as they prove their value

"Mechanization" and "electronic data processing" have become by-words in the world of business. But they've been a part of systems and procedures on the Northern Pacific for many years.

"The first mechanization of accounting procedures began in 1927 with the installation of Moon-Hopkins bookkeeping machines on the Lake Superior Division," notes E. L. Ordell, comptroller. "They were used for payroll processing. In that same year, National Cash Register accounting machines were purchased for other procedures."

In 1939, NP embarked on mechanized accounting procedures using a punch card system. The initial machine room was established in the office of the manager of freight revenue accounting with the rental of eight International Business Machines. Today a separate machine accounting department has been established under a manager of data processing which utilizes 90 such machines.

Electronic data processing began in 1950 when an IBM 604 electronic calculator was installed. A second 604 was put into service in 1954. Both were replaced in 1957 by a 650 magnetic drum processing machine. "A steady upgrading of equipment has since taken place," says Earl Ordell. "An IBM 1401 data processing system replaced the 650 early in 1961; and a 1410 system, currently in use, replaced the 1401 in July, 1963."

NP's President Macfarlane outlines the road's computer policy in this way: "We will explore and develop computerization as fast as feasible, and not just because it's good advertising. The system must show its desirability." (NP, incidentally, leases its computer equipment.)

Mr. Ordell notes that each upgrading of equipment has produced payroll savings as well as a reduction in the number of machines required. Payroll savings alone since 1957 approximate $425,000.

Currently, NP's computerization of accounting chores includes: complete payroll; car accounting; freight and passenger revenue accounting; and other statistics. The road's annual inventory is in the computer, and a team from Accounting and Stores is currently studying mechanization of material and supplies accounting, which will include a perpetual inventory. Further reductions in stores are expected. A future goal is automatic ordering of supplies by computer.

Other management tools in the program stage are: new customer statistics for the freight traffic department, including an up-to-the-minute record of all shipments by all shippers at all locations; faster car tracing; a perpetual car inventory of expensive specialized equipment for better utilization.

The new seven-digit standard transportation commodity code, which became effective Jan. 1, is expected to produce much more accurate statistical information of commodities being transported, which will be beneficial to the traffic department for analyses.

For a number of years, NP has been engaged in a selective logging and reforestation program throughout its timber holdings. To facilitate this program, a complete timber inventory was necessary. The initial mechanization in 1956 of a timber inventory utilized the computer, based entirely on card input and output. Reprogrammed through the present 1410 computer, card and magnetic tape input and output is used. ■

Such ingenious devices as "line fault analyzers" for CTC code lines, snow removal indicators, magnetic tape recorders, broken flange detectors, and many other similar developments reflect the ingenuity to be found in NP's signal personnel. Remarkably, NP has had only three chief signal engineers in the 55 years since the founding of the department—a most unusual record.

Since Northern Pacific is essentially a single-track railroad, it is quite natural that its signal engineer should turn to centralized traffic control as a means for increasing both NP's capacity and its efficiency. Present CTC road mileage is 437.22, consisting of 444.91 track miles, excluding sidings.

The heavy traffic of World War II pointed up the need for increasing the operating efficiency of the main line. Consequently, in 1947 NP installed its initial 50 miles of CTC—between Helena and Garrison, Mont. This is controlled from Missoula, approximately 70 miles away. Expansion of this system continued until today it reaches from Missoula through Garrison to Helena and beyond to Livingston, a CTC total of 247.3 miles. Seventy-five miles of this track lies on heavy mountain grades where helper locomotives are frequently required. It is in just such "difficult" operating territory that CTC shows best its ability to increase track capacity. From the original control machine at Missoula, the operator handles this 247.3-mile territory.

In 1961 NP installed CTC from Laurel to Livingston, Mont., (96.18 mi). A two-level control machine at Glendive, Mont., controls this segment and ultimately will control the entire Yellowstone Division, extending eastward through Billings to Mandan, N.D.

NP's newest CTC installation covers the 66.96 miles from Spokane, Wash., to Kootenai, Idaho. Ultimate plan is to extend this eastward to Paradise, Mont. Here NP has installed its first GRS Traffic Master control unit. This is the push button type in which the indication panel is entirely separate from the control unit. The panel displays 70 of the ultimate 180 miles of CTC. The panel sections may be further expanded to include the remainder of a 440-mile division.

In addition to the major CTC installations, NP has several short sections of isolated CTC to meet special operating conditions. Thus, 10.81 miles of CTC cover, for the most part, track jointly owned and operated with the Union Pacific. NP has a 3.13-mile stretch approaching and through the Stampede Tunnel, NP's longest (two miles) and one of its more restrictive tunnels, built in 1887. This was cut through the Cascades shortly after the line was opened in 1883.

Ingenuity Typifies NP Signaling

ELECTRIC track switch heaters guard nearly 200 switches in NP's CTC territory from ice and snow during the winter.

AT LEFT: Modern signals east of Helena, Mont. NP has 893 searchlight-type signals and 363 older color-light signals. In case of commercial power failure, signals are lighted by a reserve battery.

ROTATING light that can be seen for a mile on sunny day is lit remotely by CTC operator to call field man to phone.

NP Signal Personnel Display Ingenuity

Over the years, since the founding of the signal department in 1909, many dedicated employees have contributed ingenious ideas. Typical of these is the rock slide detector fence developed in 1922. Since then, nearly 250,000 ft of line have been protected by this detection method on Northern Pacific alone. In addition, approximately 1200 ft of umbrella fence have been placed beneath shear rock walls at the entrances to tunnels. These detect vertical rock falls as well as slides.

Today, standards of ingenuity are even higher than those of earlier days. An examination of the features of some recent signaling installations shows many valuable innovations.

Power-off indicators on outdoor relay cases aid signal maintainers in locating power trouble. Neon indicator lights are mounted in the side wall of all relay cases where block signals are served with commercial power. These indicators enable a maintainer to see at a glance whether or not the power is on. He does not have to open the case and use a meter. At night, he can make this check from the highway without stopping. This is time saving and especially valuable in country subject to heavy lightning storms during the summer and to severe wind and sleet storms in the winter.

A valuable safety innovation is the use of "approach aspects" to dark searchlight signals. All recent installations feature searchlight signals. NP has 893 such signals installed since 1947 and 363 color light signals installed between 1928 and 1937. Signal power lines are provided so that signals can be continuously lighted.

By the use of a reserve indication relay in series with the lamp filament, NP provides an approach aspect on the preceding signal when a lamp failure occurs. Power-off relays are provided to introduce approach lighting in the event the commercial power fails. The signals are then lighted from the reserve battery.

New train order signals are of the four-unit, color-light type. Two green units are provided at the top, but only one of these is illuminated, the second being brought into play by a reserve indication relay when the lamp in the primary green unit fails. A small control box, usually located on the operator's table, includes a visual indication of the signal displayed, visual approach indicators, and an audible alarm bell, rung by approaching trains.

Incorporates Design Innovations in CTC

NP has incorporated design innovations into its CTC system as successive installations have been made. Especially noteworthy is the use of a 150-watt rotating beacon as an employee call light. This is used in conjunction with the CTC telephone. The circuit for this is carried on the CTC code line. When the control operator wishes to call an employee at a field location, he transmits a control signal to place a 150-watt rotating beacon light into operation. These call lights are extremely arresting, even in broad daylight, and can readily be seen for a mile on a bright sunny day. The main beacon is powered by 115-volt commercial power. Below it is a standard 18-watt signal lamp mounted in a weatherproof glass housing. This serves as a reserve unit and is energized from the 10-volt battery.

To monitor its CTC code line, NP uses a Soundscriber magnetic tape recorder. All control and indication codes as well as voice communications between the control operator and the field personnel are continuously monitored by the recorder. This uses one 300-ft reel of two-inch tape each day. A time scale is printed on the plastic tape which travels approximately 2.5 inches per minute. Magnetic tapes are sent to the St. Paul signal office. There, monthly samples are studied to see if proper control procedures are being used, to check on courtesy, and to look for causes of delays to trains. The monitoring system helps to determine the time and character of service interruptions of the control system.

Effective use of a CTC system depends to a considerable extent upon the CTC telephone for communication between the CTC control operator and all the control points or other places where wayside telephones are located. To insure more efficient use of the CTC telephone, NP installed a call register and acknowledging system. A conventional voice-actuated relay causes a three-second buzzer to sound at the control center and an "Answer Telephone" indicator lamp to flash at the control desk until the call is answered. The voice-actuated relay also causes a pulsing 400-cycle register and acknowledgement tone to be returned over the line to the caller. This tone tells the caller that his call has reached the control center but has not yet been acknowledged.

Center-of-block indication has proved helpful to NP control operators. This assists him in more closely judging the speed of two trains approaching a meet point. Two block lights are displayed. A distinctive two-tone chime sounds when a train reaches the center of the block.

Continuity of the CTC code line is vital to the successful operation of a railroad by CTC. To enable faults to be found quickly and accurately, NP has a pulse-type line fault analyzer. By means of an undulating track on the screen of a cathode ray tube, this device displays the impedance characteristics along the code line. Faults in the line can be quickly located by comparing a photograph of the normal wave pattern with the new pattern. At the point where the fault has developed, an unusual peak or valley is present in the wave pattern. A 200-mile section of the code line can be checked in this fashion from the control office. Maintenance personnel operate the line fault analyzer once each month and oftener when conditions dictate.

"Many valuable hours have been saved with this device in searching for line faults at night and under severe weather conditions," states A. J. Hendry, signal engineer.

NP also makes good use of the pen graph associated with the CTC control console. This records not only occupancy of the switches at the ends of controlled sidings but also includes three pen units for recording respectively the time duration of each telephone conversation on the CTC phone, each control cycle, and each indication cycle. The former serves as a ready reference in searching monitor tapes for voice recordings while the latter two afford maintenance personnel a visual means of determining the activity of the system. Some unusual disturbances of the system have been detected by this method.

Northern Pacific's control centers handle a number of interesting and special remote control functions. For example, the CTC operator at Missoula can raise or lower the tunnel doors 230 miles away on the tunnel through Bozeman Pass. These doors are closed to prevent excessive icing conditions in the tunnel during the winter weather. Tunnel fans at Stampede Tunnel are remote controlled from the Easton, Wash., control office, 12 miles east of the tunnel. An anemometer located at the opposite end of the tunnel from the fan tells the control center the velocity of the wind. If the velocity is high enough to exhaust the tunnel without the use of the fans, power is saved.

To expedite movements out of yards where the first CTC control point is some distance away, NP uses a lunar white starting signal. This is placed near the departure switches at major terminal yards. By this, the control operator can indicate to train crews that the CTC is ready to accept their trains. This device is used in terminal areas where trains would obstruct street crossings if they departed from the yard before the CTC entrance was cleared.

In flat yards at Livingston, Mont., and Spokane, Wash., NP controls "drilling" operations—the to and fro movement of switches—from one of the control centers. Drilling may proceed in the yard as long as dwarf signals display a flashing red aspect. When the control operator desires the track to be cleared for a through movement of a train, he causes the dwarfs to display a steady red. All drilling movements then cease.

Because of the heavy snow fall in NP's territory, switch heaters are vital. With additional electric switch heaters being applied this year, NP will have about 225 such installations. In addition, five snow blowers are in operation in both power and spring switches.

To enable the CTC operators to control the switch heaters, a snow detector is placed at one end of each CTC siding. When snow begins falling, the detectors transmit an indication to the control center. NP places control of the heaters with the CTC operator, believing that he can better interpret weather conditions than a fully automatic device.

"We prefer to have heaters stay on for about an hour after the snow has ceased falling to be certain that the switch has dried out," states Mr. Hendry.

Typical of recent interlocking installations on the NP is a General Railway Signal NX plant installed at Tacoma, Wash., in 1962. This is a push button control machine of the entrance-exit type, controlling 20 switches and 30 signals. Flexibility of operation is aided by telephones located at each of the control signals so that prompt communication with the control operator is always possible. Train-to-way-station radio is used frequently at this inter-locking. Operations and functions of the plant are checked regularly by the use of a 20-pen recorder.

A detection device that has proved most valuable is the broken flange and loose wheel detector. This consists of a Wheel Checker detector and a recording system developed by NP's signal department (see Modern Railroads, April 1962, p. 107). This device provides a printed record showing the location of any defects.

Signaling Milepost in 1924

An early milepost in Northern Pacific signaling occurred in July 1924. In that month, the main line from St. Paul to the Pacific Coast was fully protected by automatic block signals for the first time. Installation of automatic block signals had started in 1910, the year following the organization of the signal department. Previously what little signaling and interlocking the railroad had was under the maintenance of way department. ■

THREE-WAY repeater at Chehalis, Wash. is part of new microwave system linking Seattle and Portland. System includes two three-way repeaters and two back-to-back repeaters. Chehalis repeater also has stub link with Centralia.

Tying together the many operating points along NP's famous "Main Street" to the Northwest is a tightly knit communications system. Each of the modern techniques—microwave, train radio, dial telephone, teleprinter—is carefully integrated into a single system.

Today an official in St. Paul can dial directly over NP's own lines to co-workers in Seattle, Wash., or in Portland, Ore. He can just as easily dial a tiny station on a remote branch line. Whether his conversation is being carried by open wire, microwave radio, or a carrier system is unknown to the telephone user. But behind the ease of making such a call lies vast technical know-how plus a cooperative, understanding management. A system that can provide fast, easy communication by voice, teleprinter, or punched card adds greatly to the over-all operating efficiency of the railroad.

As on all large railroads, communication demands on the NP have grown steadily in recent years. To meet this growth, NP communications engineers have added carrier circuits to existing wire lines. Modern carrier systems, such as Lenkurt's Type 45A, permit as many as 12 additional telephone conversations to be carried on a single pair of wires. Application of carrier techniques to NP's pole lines began in the 1950's.

Today, Northern Pacific has 6000 miles of communication pole lines. On the poles are 32,579 miles of open wire and cable. Carrier telephone and telegraph superimposed on the open wire facilities amounts to 48,000 miles of circuits.

Despite this big increase in communication channels, NP has been able to eliminate very little pole line. However, in the near future NP will remove 31 miles of pole line on the West Coast where its first microwave went into operation last year—between Seattle, Wash., and Portland, Ore.

The new microwave system consists of four repeater sites, including two three-way repeaters and two back-to-back re-

RADIO plays important role in modern NP communications, as do shops to keep radios in repair. This is the radio shop at Missoula, Mont. NP has more than 1100 radios in service.

NP Pioneers Long-Distance Dialing

Microwave and advanced electronic techniques provide a thoroughgoing communications system

peaters. The three-way repeater at View Park has a stub microwave which carries terminating circuits to Tacoma, Wash. The Chehalis (Wash.) three-way repeater has a stub microwave link with Centralia. At Centralia, a number of the microwave circuits connect with branch line wire circuits. The new microwave will not only save year-to-year maintenance on the old pole line but will save rebuilding it.

The microwave system is a Motorola MR-60 with a capacity for 600 telephone voice channels; 18 teleprinter channels may be placed on each voice channel if desired. The system is fully transistorized except for the Klystron. The microwave is being used to connect Portland to the system dial telephone network and the system teleprinter network. It will be the backbone of an automatic multi-circuit dial facility which will connect practically all offices between Seattle and Portland to NP's transcontinental dial facilities.

D. C. Hill, superintendent of communications, foresees the future expansion of the microwave eastward to St. Paul. He also indicates that this can stand as the basic element in a system-wide facsimile transmission network.

NP engineers recently demonstrated their technical prowess in solving a switching problem which occurs where microwave or carrier channels join conventional telephone lines, especially when these channels meet in tandem exchanges with switching facilities. A tandem exchange, such as Billings or Missoula, is an intermediate city or station where two or more circuits from distant cities can be linked together to form a through circuit or where the circuits may be used for connection to or from the local city.

Working in conjunction with Stromberg-Carlson, a Division of General Dynamics, the NP communications engineers came up with a significant development known as "four-wire switching." This type of switching is proving vital to the successful operation of dial telephone systems in conjunction with microwave and tandem carrier systems. The new technique cuts losses that occur when two one-way circuits such as those derived from microwave and from carrier are converted to the conventional two-way telephone circuits. The signal-to-noise ratio of circuits using this system is improved (see Modern Railroads, March 1964, p. 100).

Train radio is considered invaluable on the Northern Pacific. This railroad equips both freight, passenger, and switcher locomotives with radio. Thus, of NP's 451 locomotives (619 units), 442 diesel locomotives are equipped with radio. Radio-equipped cabooses total 225; base stations, 112. Counting portable units, automotive units, locomotive units, and rolling stock units, NP has 1161 radio units, manufactured by Motorola, Bendix, and Wabco.

"NP operates no trains on the main track without train radio," states Don Hill with a justifiable note of pride.

In summer, NP furnishes track relay gangs and ballast gangs with portable radios. Rail inspection cars, as well as train master and yard vehicles, are radio-equipped. In addition, Northern Pacific has an efficient citizens' band radio system in the general office building in St. Paul. This speeds instructions to maintenance and delivery personnel.

Indicative of the important role which radio plays in Northern Pacific operations is the varied use it makes of its 112 base stations. Five operate on special yard frequencies and serve classification activities. Two are on SP&S Ry. Co. assignment for joint operation at the Pasco classification yard. Two others are located on drawbridges in Duluth-Superior and provide communication with trains of both NP and three other railroads. Also associated with the drawbridges are two marine installations which provide communication with ore boats and harbor craft using the channels beneath the bridges. Radio thus coordinates bridge, train, and ship operations.

Ninety-eight base stations serve point-to-train assignments. Of these, 31 are in general service for joint train, terminal, and industrial service, and 67 are in strictly train service.

Still another use of base radio stations by the NP stems from its trucking operations. Base stations in the Twin Cities area and around Billings, Mont., and Seattle, Wash., are used to contact 37 trucks of the Northern Pacific Transport Company.

Wabco and Bendix CRC (centralized radio control) enables dispatchers in the West to contact any train on 992 miles of main line railroad plus those on a considerable number of branch line miles. Largest stretch of CRC extends for 850 miles from Dillworth, Minn., to Missoula, Mont. CRC is also being installed between Spokane, Wash., and Paradise, Mont. Ultimately, the two CRC sections will join at Missoula.

In addition to full-size train radios in cabooses, conductors of both freight and passenger trains are supplied Motorola portable two-way radios. These are sufficiently powerful to enable the conductor, located anywhere in the train, to speak with the engineer.

Tying together the many far-flung offices, both on- and off-line, with the general office is an extensive teleprinter system. In addition, all major yards and terminals have teleprinters which transmit to one or more relay offices. NP has five of these centers which relay messages.

Most of the teleprinter circuits are telegraph carrier channels operating in the voice frequency band of physical circuits or superimposed on voice carrier channels. Fifteen off-line points in the East have teleprinter service over leased Western Union facilities. NP uses Teletype Model 28 at 60 words per second as its standard.

Northern Pacific also operates card-to-card data Transceivers on telephone carrier channels between Tacoma and St. Paul. These devices transmit payroll data at the rate of 11 fully-punched cards per minute. About 3000 such cards are transmitted daily. ■

"To Educate and Develop"

Personnel program is designed to assure management talent for NP's future

NP's policy on personnel development is, in short, to educate and develop employees; to sharpen their skills and chances for advancement.

"This program is designed to assure the railroad of an adequate and continuing upward flow of young, capable management talent to meet our staffing requirements," says Guy M. de Lambert, director.

He reports directly to the president. Indeed, it was Mr. Macfarlane who established the personnel department shortly after becoming the company's chief executive officer.

Mr. de Lambert notes that "personnel development" is one of the major responsibilities of anyone who has people under his direction, and his managerial functions in this context are:

1. Determining what people are to do
2. Selecting the most qualified one to do it
3. Checking periodically on how well they are doing it
4. Seeking methods by which they can do it better.

Several programs and activities have been developed to accomplish these aims. Some are on a departmental basis; in others, all employees participate.

Programs developed for an individual department are usually handled by that department. "Here again," says Guy de Lambert, "we are emphasizing that a manager or supervisor must assume personal responsibility for the training and development of all people reporting to him. Examples are programs of the Safety, Dining Car, and Accounting Departments."

Programs involving all employees are usually handled by or through the Personnel Department. Most employee training programs are, of course, job-oriented. Material used is geared to the type and number of participants in a given program. NP has used slides, movies, booklets, and several correspondence courses, some of which were prepared and handled by the company, e.g., the Traffic course.

Supervisory training has been on a more individual basis and is even more job-oriented than the employee training. "We have availed ourselves of outside training sources provided by equipment and manufacturers, special programs offered by organizations and numerous university management programs," Mr. de Lambert said.

NP has found it necessary to set up a special recruiting program to attract college graduates. It actively recruits at colleges and universities in its geographical area.

Many men are recruited for special training programs in the Operating, Mechanical, Engineering, Accounting and Traffic Departments. The program in the Accounting Department takes one year; the other three require two years. The programs are designed to give the trainee the maximum experience during the training period.

Recruiting has at one time or other been done for nearly every department in the company, including civil engineering, law, general claim, purchasing, signal, industrial development, forestry and geology. ■

Fleet Management Gets Results

NP has obtained solid results from turning administration of its fleet of automobiles and trucks over to a fleet supervisor in the personnel department, which reports directly to the executive department.

The whole fleet represents an investment of about $2 million. (Truck units are entirely separate from those of NP's wholly owned subsidiary, Northern Pacific Transport Co.)

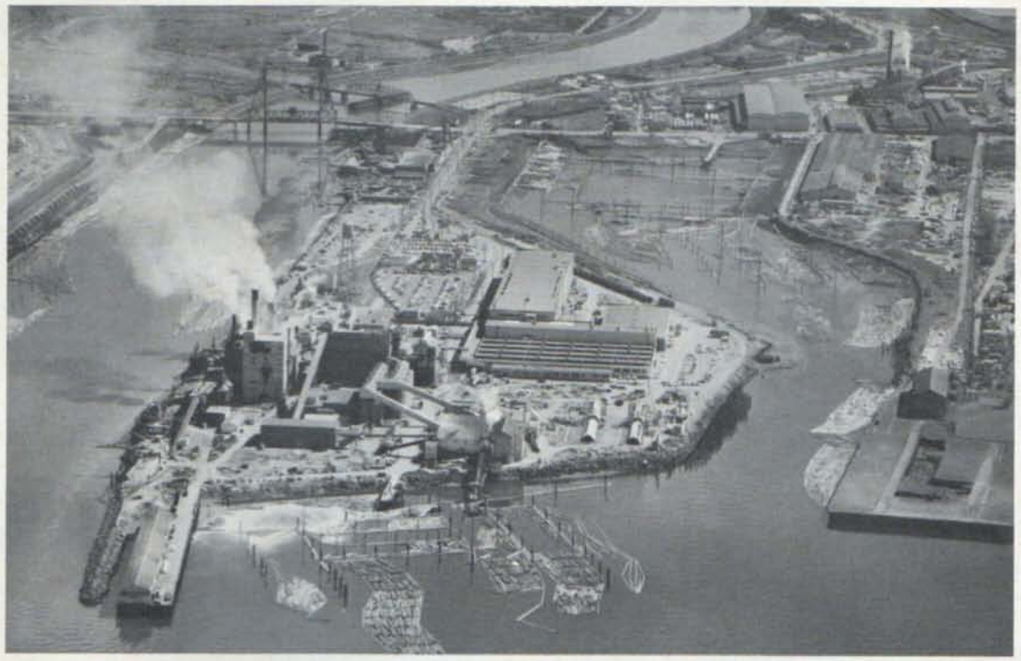
Primary responsibility of the fleet office at its inception was to formulate and administer policy in all phases of operation, including vehicle selection, purchase, use, maintenance and ultimate disposition.

An initial step for better utilization was establishment of car pools, where feasible. Today there are 12 pools, ranging in size from five to 25 units, with an average of 11 units per pool. In addition, there are a number of cars assigned both on and off line where pooling is not practicable.

During the most recent fiscal year these 207 cars traveled an average of 22,000 miles per unit. Total cost of operation, including running, fixed and administrative expense, was $267,653, or 5.89 cents a mile.

While all of the more than 400 trucks in operation are departmentally assigned, they are still under direct supervision of the fleet office with respect to purchase, maintenance and disposition. This fleet, comprised of units ranging from 5000 to 36,000 lb gross vehicle weight, ran up a total of 4.6 million miles in the last fiscal year and expenses of $422,700, or 9.01 cents a mile.

HI-RAIL inspection car on NP's Idaho Division. Road's automobile and truck fleet represents an investment of about $2 million, is run by fleet supervisor in personnel department.



ABOVE: NP "inventories" timber lands by aerial photos taken from its own plane; develops and prints photos in its own lab. Here composite picture, created from many aerial photos, is glued together.

UPPER LEFT: Typical of the way the huge Columbia Basin is being developed industrially is Bruce, Wash. A crossroads in 1956, this still-growing group of installations is now producing over $4 million yearly revenue for NP.

AT LEFT: $30 million St. Regis Paper Co. in Tacoma, completed in 1961. Timber sales are an important part of revenue; road owns 1.3 million acres of timber land.

Industries Bring New Traffic

A look at the operations and responsibilities of the Properties and Industrial Development Department of NP is a look at a promising growth potential.

The potential is not only from expanding income from real estate and natural resources (exclusive of oil and gas, managed separately) but from new tonnage originating with industries locating on NP lines.

The P&ID department is headed by a general manager—P. D. Edgell—who reports to E. B. Stanton, vice president, executive department. It has two major divisions: The Industrial Division, which manages all operating lands and those suitable for industrial development; and the Land Division, which manages the extensive non-operating lands of the company.

Excluding oil, Burlington dividends and interest, 1963 "non-operating income" was a substantial $7.1 million. Timber sales alone were $4.2 million; real estate rentals, $2.4 million; mineral income, $526,000.

The department staff includes specialists in industrial development, real estate management, appraising, forestry, geology, mining, agriculture, range management and engineering.

In addition to managing leases of the road's operating and industrial lands and purchases of additional industrial property, major functions of the industrial division are the planning and development of industrial sites, and the providing of services and information that facilitate the location of industry. It cooperates closely with the traffic, agricultural and operating departments.

"The big advantage of having Properties and Industrial report directly to the executive department," says Ed Stanton, "is that faster decisions can be obtained. We can act, if necessary, in 24 hours."

NP owns, and continues to buy, desirable industrial property at all major points along its line, and to develop industrial districts wherever feasible.

This active program has put an average of 117 new industries on NP lines each year since 1951. An average of 33 industries removed operations each year. Net gain was 84 each year.

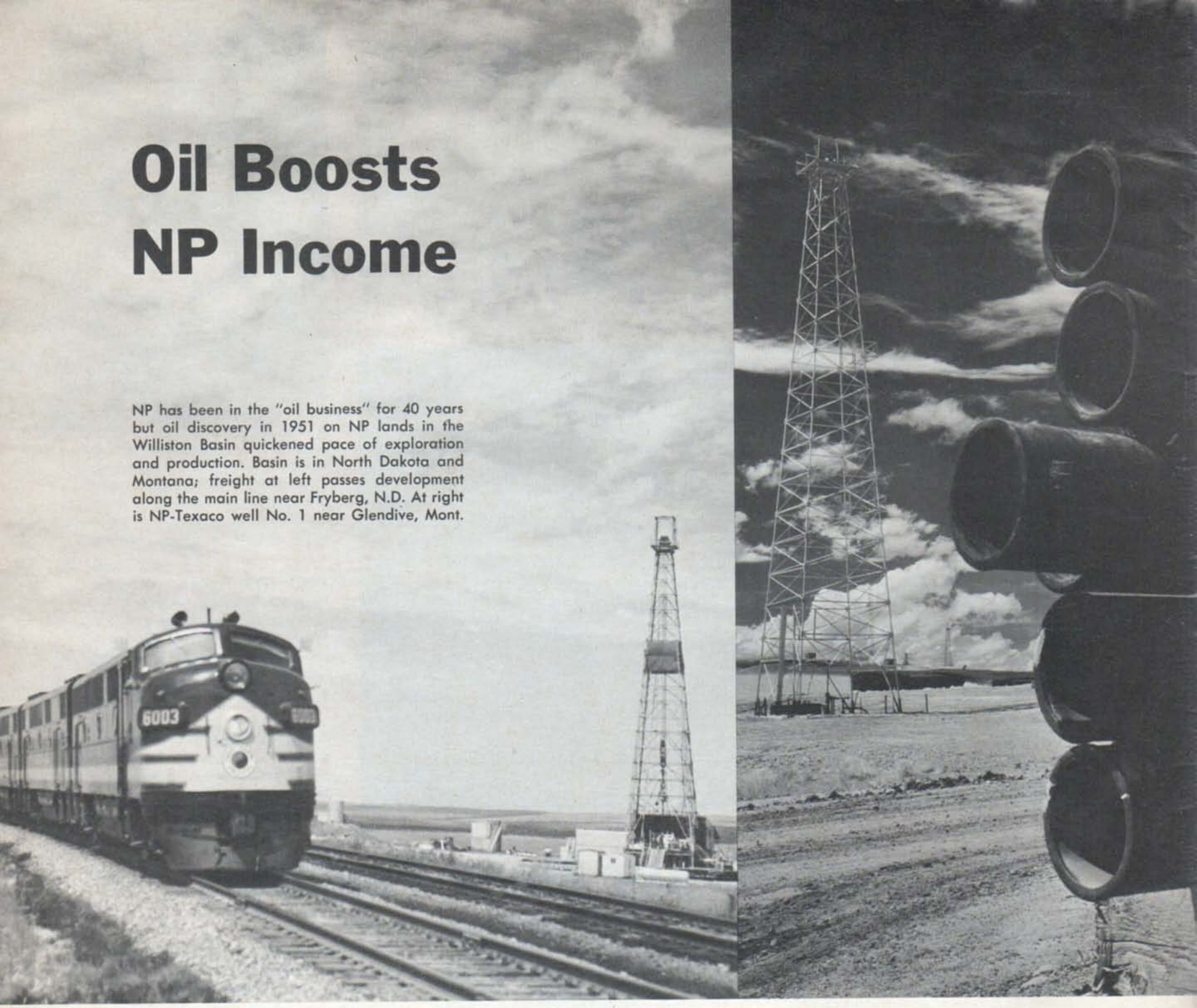
"No breakdown is available of revenues generated through new or expanded installations," says Mr. Stanton, "but we do know the added traffic has been of major proportions and has gone a long way toward replacing other traffic which has been lost to competing forms of transport."

NP's extensive timber properties are a source of raw material for industries, and for its own use in the form of ties, bridge material and lumber for buildings, freight cars and fences.

The railway owns approximately 1.3 million acres of timbered or timber-growing lands in Washington, Oregon, Idaho, Montana and Minnesota, most of it in the West. NP sells for cutting only on a "sustained yield" basis, which means that timber is harvested only as fast as a replacement crop can be grown.

It also means that a detailed and complete timber inventory must be kept. NP "inventories" by aerial photography from its own plane. It also has its own photo laboratory in Seattle where it develops, prints and prepares all types of needed reproductions. ■

Oil Boosts NP Income



NP has been in the "oil business" for 40 years but oil discovery in 1951 on NP lands in the Williston Basin quickened pace of exploration and production. Basin is in North Dakota and Montana; freight at left passes development along the main line near Fryberg, N.D. At right is NP-Texaco well No. 1 near Glendive, Mont.

Friday the 13th, in July of 1951, was anything but unlucky for shareholders of the Northern Pacific. On that day, oil was discovered on its lands in the Williston Basin, which lies in North Dakota and Montana.

Although there had been production of oil from NP ownerships for more than 40 years, the pace of explorations and productivity accelerated quickly with the 1951 discovery.

A separate oil department, reporting to NP's executive department, was promptly established in Billings, Mont. Its staff—largely of men brought in from the oil industry—is under the direction of George M. Washington, vice president.

NP owns in fee, or has oil and gas rights in, approximately 4.6 million acres in western North Dakota, eastern and central Montana, and northern Wyoming in portions of which there is oil and gas production, and approximately 890,000 acres in areas in which no production has been developed in Montana, Washington, and Oregon.

The railroad does not engage as operator in exploration, development or production. Properties are developed through contracts with operating oil companies, in some instances on a royalty and bonus basis; in other instances, on a share of the working interest, which is equivalent to a partnership basis.

At the close of 1951, NP shared in the production from 229 oil wells which netted the company approximately 905 barrels of oil per day. At the 1963 year-end, the figures were 819 wells and 7959 barrels per day.

The major part of this production moves to refineries in the mid-continent area by pipelines of Butte Pipe Line Co., of which NP owns 10 percent. Northern Pacific's own haulage of this output is minor.

A geophysical exploration program begun in 1963 by The Superior Oil Co. and NP in the Montana portion of the Williston Basin is nearing completion. It is expected that the first exploratory well will be drilled this summer.

"Income from oil and gas has leveled off," notes President Macfarlane. "We're taking out oil faster than new production is coming in."

Nevertheless, the railroad's oil interests have pumped out substantial profits for NP owners. Over the last five years gross oil revenues have averaged about $7.6 million annually ($7,797,000 in 1963), and NP has netted about $5.4 million a year from this source ($5,708,000 in 1963). (Net is before federal income tax but does not include allocation of interest on funded debt, real property taxes or certain general office overhead.) ■

THE MODERN NORTHERN PACIFIC
28th in Modern Railroads' series, Private Enterprise at Work
by Nancy Ford and Edward T. Myers

The Front Cover

Northern Pacific photographer E. W. Nixon snapped the beautiful Ektachrome on this month's front cover.

It shows an NP freight running eastward along the Yakima River near Easton, Washington. The train, operating as an extra but known to NP customers as No. 602, is one of many through trains that run on stepped-up schedules. NP's fastest freight now makes the 1900-mile Minneapolis-Seattle run in just 45½ hours!

Freight trains like No. 602 and luxurious passenger trains such as the famous North Coast Limited typify the excellent service NP provides today as it celebrates its centennial.

The story of the Modern NP—alert and still improving as it starts its second century—is told in this special Northern Pacific issue of Modern Railroads. It's a fascinating story—one of which Northern Pacific and all railroaders may be proud.

Note: This reprint from the July, 1964, issue of MODERN RAILROADS, without advertising, presents a comprehensive editorial and pictorial description of the modern Northern Pacific Railway Company. It is being distributed by the railroad as a matter of public information.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