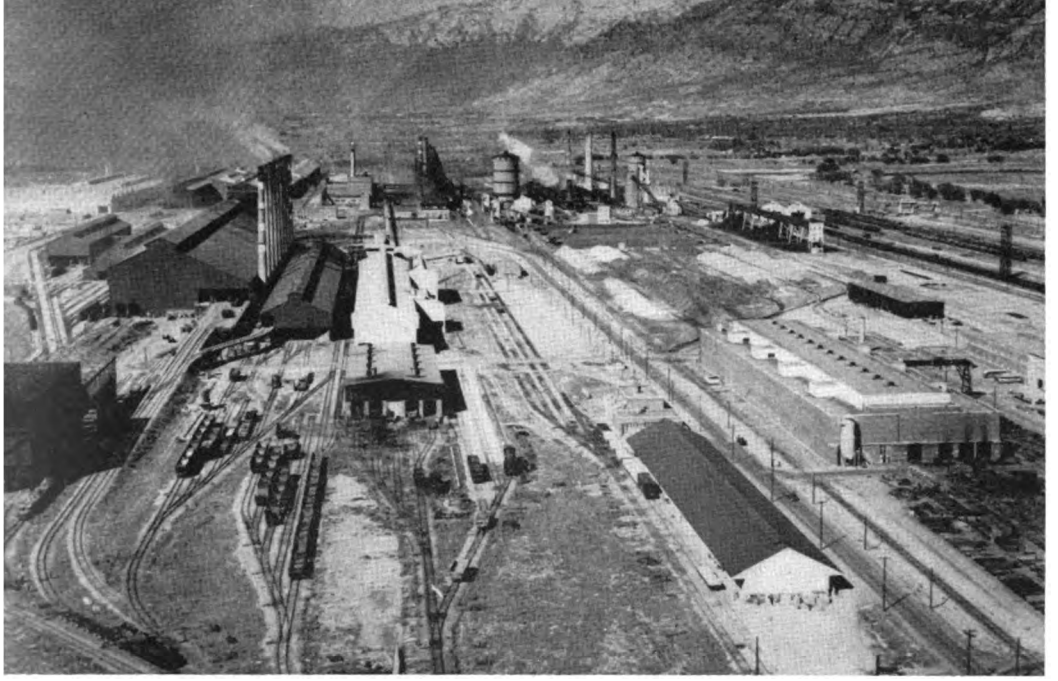


Left—Geneva Steel, served by the Union Pacific and Denver & Rio Grande Western, has an unusual setting for a steel mill. It is the West's largest steel plant, with a capacity of 1,284,300 net tons a year

Facing page (left)—Geneva Steel is ideally laid out. The storage bins of coal and iron ore are in the foreground. To the left and rear is the rolling mill area. To the right are two rotary dumpers for unloading inbound cars of coal and iron ore

Facing page (right)—At Geneva's new mine in Horse Canyon, long belt conveyors carry the coal to the tipples

Railroads Bring Everything to Geneva

West's largest steel mill is at apex of triangle for raw materials which are 100 per cent rail-borne

The largest steel plant in the West—United States Steel Corporation's Geneva—is peculiarly dependent upon good railroad transportation. Unlike the large steel plants of the East and Midwest, which are served in part by water transportation, Geneva receives 100 per cent of its inbound raw materials by rail. For this reason the selection of the plant's site and the design of its grounds and buildings were made only after close conferences between steel men and the officers of the two railroads which serve the plant.

Geneva is 38 mi. south of Salt Lake City, Utah, and 7 mi. northwest of Provo. It lies in a fertile irrigated valley, on the shores of Utah Lake, at the base of the high snow-capped Wasatch mountains. While most steel mills lie in smoky valleys in crowded industrial districts of the East, at ocean ports, or along the Great Lakes, modern, "built-all-of-a-piece" Geneva is set among fruit orchards and truck farms. Just outside of its gates the single-track line of the Union Pacific is marked by cattle guards at each crossing, while nearby Bunker station comprises only a feed mill.

This striking incongruity of the site and character of the West's largest steel producer is but the outward sign of a problem in wholesale adaptation which has few parallels in business history. For a project of comparable novelty and complexity one must look to the founding of the Steel Corporation's great plant at Gary, Ind., in the early 1900's, where, in a few short years, a barren beach was turned into a complete steel-making plant with a whole new town to house its employees and an entirely new main-line railroad built to bring in coal. Like Gary, Geneva was built only after the steel men and the railroaders talked over every possibility of plant location from points of view of ease of funneling in raw materials, adequacy of outlets to markets and, of course, the important question of rate levels and breaks.

Plant Linked with Railroading

Since, it is commonly said, every ton of iron requires, on the average, two tons of iron ore, one ton of coke and a half ton of limestone for its making, there had to be overcome—and quickly—the problem of adapting the two railroads which serve Geneva to the task of hauling in necessary raw materials to a plant producing some 800,000 net tons of finished and semi-finished steel in 1948. Although pig iron was first produced west of the Mississippi in Utah as early as 1852, and Columbia Steel Corporation (purchased by U. S. Steel in 1930) started to make pig iron at Provo commercially for West Coast steel plants in 1924, neither the Union Pacific nor the Denver & Rio Grande Western was accustomed to serving "big steel" in Utah until the Geneva plant was opened in 1943. Both the Rio Grande and the so-called "Utah Coal Route" (U. P. and Utah railway), it is true, have for many years hauled solid trains of coal from the Utah fields to Salt Lake City and the Northwest, and are well fitted for the heavy traffics around the copper mines and smelt-

ers in the Garfield district, but Geneva presented them, for the first time in Utah, with the task of engineering their properties and operations to cope with traffic of the magnitude and controlled regularity incident to a full-fledged steel-producing facility.

Geneva's story is, therefore, both a milepost and a saga in modern-day railroading — an outstanding example of the fact that the rail transport machine must continue to expand if the needs of commerce are to be met.

Short of Everything

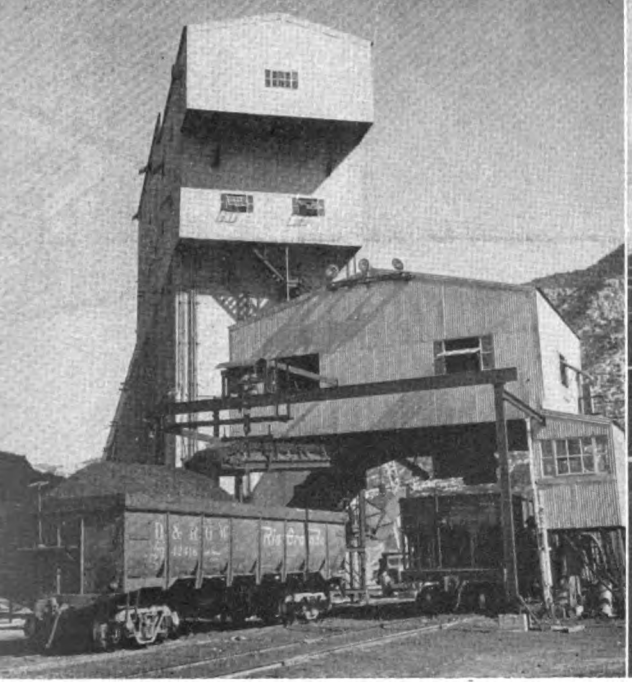
The creators of Geneva Steel "started from scratch" at a period when *all* of the heavy goods necessary to equip a steel plant were in short supply—and particularly railroad facilities. In May, 1941, when war threatened the country, United States Steel, at the request of the federal government, submitted initial plans for the construction of a completely new, integrated government steel plant to back up the Pacific Coast shipbuilding program—to be located somewhere in the West. Because the site had to possess adequate railroad facilities, at minimum distances from sources of ore. coal, limestone and dolomite, with fresh water near at hand, Geneva—then an unimportant whistle stop on the Rio Grande—was chosen as the apex of a traffic triangle. Here the railroads which would supply the plant with nutriment intersected; from here easy access was had to rail routes to the Pacific Coast; and there was available plenty of relatively flat land so that a plant unhampered by physical barriers—a steelman's dream—could be laid out.

Built in record time, without charge or fee, by Columbia Steel, and upon its completion in 1943-44, operated for the government by Geneva Steel Company, a new U. S. Steel subsidiary, the new mill, producing chiefly plates and structural shapes for ships, included 252 by-product coke ovens, three 1,100-ton blast furnaces, nine 225-ton open hearth furnaces, a 45-in. slabbing and blooming mill, a 132-in. continuous plate mill, a 26-in. structural mill, and numerous complementary facilities. The scheduled capacity of the plant was 1,150,000 net tons of iron, 1,283,400 net tons of steel ingots, 700,000 tons of plates and 250,000 tons of structural shapes.

Even with government priorities, Geneva Steel had trouble getting almost everything it needed. For plant locomotives, for example, it had to "scour the country for anything that would pull cars," and wound up with a dozen 20 to 30 year-old steam locomotives of practically every make and description. They were lots of trouble to keep in repair, but served the plant until modern Diesels could be procured. They are now lined up for dismantling into scrap which will feed Geneva's own furnaces. The plant is now switched by 16 Diesel-electric units, 12 of which are 1,000-hp. Baldwins, and the remainder General Electric 80-tonners.

Similarly, the railroads serving the plant received the impact of the new traffic at a time when, as vital transcontinental routes, their own lines and rolling stock were overloaded with traffic of a quantity and type never before experienced in the West. The Carbon County railroad. for example, which taps Geneva's new coal mine at Horse Canyon, Utah, was forced to buy some 600 aged second-hand coal hoppers from "back East." Scheduled for retirement by their former owners, the relics were run until they'd run no longer. Their sides bulged; their plates buckled; they groaned and protested their heavy loads. The Rio Grande ran them in separate trains at restricted speeds, with continued and careful inspections en route. Their working days now over, these old cars are, one by one, being broken up to join Geneva's old locomotives in furnace charges; now, they too are raw material. In their place, the Carbon County has purchased 300 new 70-ton, all-steel, high-side hoppers, which may roll at speed.

Although the traffic which feeds Geneva is entirely bulk commodities, the railroads must give it carefully timed service to keep the coal, ore and limestone flowing into the plant in an orderly manner. Here transportation is essential—an integral part of the production process. Despite the fact that both the Union Pacific and the Rio Grande were greatly overstrained during the war, Geneva's management asserts that the plant was never slowed a single moment by failure of



the roads to deliver the goods. Both lines, somehow, acquired the additional power and cars to serve the plant; made line changes and additions to yards and sidings; and improved signaling and communication facilities to ready themselves for the increased load.

From April, 1944, to November 12, 1945, when the last of the war orders was completed, Geneva produced a total of 634,010 tons of plates and 140,706 tons of structural shapes and shell steel billets—all of which were shipped out by rail.

On June 19, 1946, Geneva was acquired from the government by United States Steel, and Geneva Steel company started at once the conversion and additions necessary to equip it for peacetime production. Chief of these was revision of the plate mill facilities to permit the rolling of slab-breakdowns in coils for shipment to the new cold reduction mills of Columbia Steel at Pittsburg, Cal., and Los Angeles, where they are converted into cold-rolled sheets and tinplate for the consumers-goods market. Hence, Geneva is now in a position to serve both durable goods and consumers goods industries. In addition, its coke ovens turn out a number of by-products, such as tar, ammonium sulphate, benzol and light oils, which are shipped out to widely scattered markets.

Availability of steel at Geneva is attracting a large number of important processors into the western states —some of them right in the immediate area. Typical of these newcomers is Chicago Bridge & Iron Co. (manufacturer of tanks and water towers), which has recently opened its first western fabricating plant at Salt Lake City.

Bringing Down the Ore

The map herewith shows the situation of Geneva Steel with respect to its sources of supply. Ore for its blast furnaces comes from the Columbia Iron Mining Company's mines at Iron Mountain, Utah, 252 mi. southwest of Geneva. About 100 cars of the rust red "guts of the steel business" are brought to Geneva daily by the Union Pacific. Iron Mountain also produces ore for Geneva Steel's Ironton plan at Provo and substantial quantities for movement via Provo and the D. & R. G. W. across Utah and Colorado to the Colorado Fuel & Iron Co. at Minnequa, Col., in the Pueblo district.

Iron Mountain is at the end of a sub-branch of the Cedar City branch of the U. P., which strikes off south from the main line of the Utah division at Lund. The yard serving the mine was greatly enlarged and improved to handle the additional traffic for Geneva, and provides seven tracks on which to make up trains of cars which have been loaded at the tipple. Five additional yard tracks are provided a mile down the subbranch at Wye.

One 1,000-hp. Diesel switcher is worked three shifts a day by crews which are brought over from their home terminal at Cedar City by bus.

From Iron Mountain to the junction with the Cedar City line at Iron Springs the road is laid with 90-lb. rail on crushed rock ballast. The grade descends almost continuously from 6,432 ft. elevation at Iron Mountain to 5,398 at Iron Springs. The maximum grade is 2.5 per cent and maximum curvature, 8 deg. From Iron Springs to Lund the ore trains make a much easier descent (maximum grade 0.50 per cent) over 90-lb. rail laid on Cruz gravel. The line is virtually tangent for the entire stretch. Once on the main stem at Lund, the trains enter on one of the longest continuous stretches of centralized traffic control in the world, extending 625 mi. from Salt Lake City to Daggett, Cal. The 35 mi. to the classification yard at Milford are on a mildly undulating profile, with no grade more severe than 0.3 per cent.

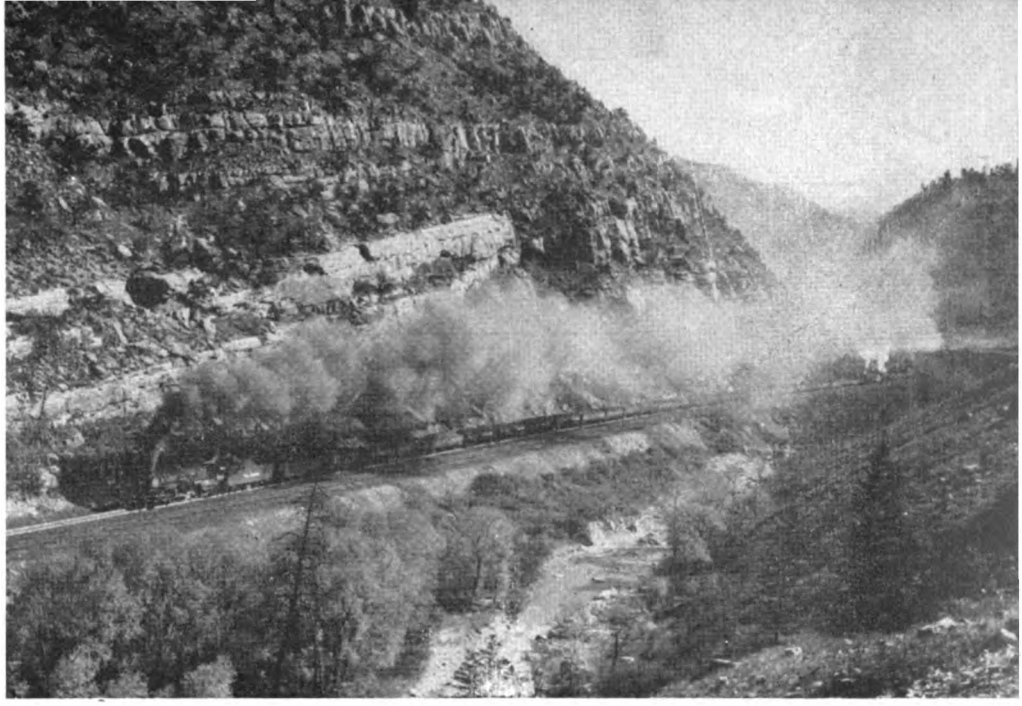
The ore is handled for the 71 mi. from Iron Mountain to Milford by crews working out of the latter point, who haul up to 90 empties to the mines and the same number of loads back down to Milford. Three-unit, 4,500-hp. Diesels generally are assigned to the job. No helper is used at any point. A round-trip generally takes from 10 to 12 hours.

From Milford east to Lynndyl the line is gently undulating, with the severest adverse grade a one per cent momentum rise, and with but light curvature. At Lynndyl the ore trains leave the main line to move

Facing page (left)—A modern tipple loads coal for Geneva

Facing page (right)—Interchange tracks at Columbia Junction, where the Carbon County turns the coal over to the Rio Grande

Right—A long coal train ascending the 2.6 per cent grade into Soldier Summit before Dieselization replaced steam locomotives at the head-end



over the Provo subdivision, the original main stem of the old Los Angeles & Salt Lake.

For the 38 mi. to Sharp the grade is generally adverse, with a one per cent maximum, and considerable curvature is encountered. For the remainder of the run to Provo the line is generally descending, with an 0.9 per cent maximum grade in favor of loaded movement. At Provo — where extensive additions were made at the time Geneva was opened — the ore trains may be broken up for destinations other than Geneva or kept intact for that point.

On the almost completely level five-mile stretch between Provo and Geneva loads and empties are moved by 3502-class simple articulated steam locomotives of the 2-8-8-0 type, which handle up to 150 cars. Their crews work back and forth in short turn-around service between Provo and Salt Lake City, handling ore into Geneva and finished products, coke oven by-products and empty ore cars out.

West from Provo empty ore cars may be run as full trains or used to fill out trains of mixed consist. In some cases they are moved in local service to Lynndyl and there added to main-line road trains. At Milford the empties are dropped off, assembled and run up to the mines by the Milford-Iron Mountain turns.

The complete round trip of 504 mi. between Iron Mountain and Geneva takes about 32 hr. running time. Complete turn-around time of cars in ore service averages 5½ days.

At Geneva, where only a limited storage space is provided, the ore cars are moved by plant switchers to Link-Belt rotary dumpers, where their contents are fed by conveyor into automatic mixing beds, which make it unnecessary to classify cars by grade of ore. To keep this mixing process going 24 hours a day, orderly, regular "on-time" receipt of inbound ore is a "must." The turn-around time of both ore and coal cars within the plant averages 1½ days.

The ore is handled principally in ordinary hopper cars of U. P. ownership. The cars are not necessarily assigned to this service and may be used for coal or for sugar beets and other seasonal products. Up to this year, the U. P. has, during the winter, when the Lake ore movement from Michigan and Minnesota ranges is suspended, supplemented this equipment with as many as 500 special type ore cars leased from the Chicago & North Western. Since the latter are only 21 ft. long, they didn't fit the clamps on Geneva's rotary dumper, and had to be laboriously unloaded by hand, until plant personnel devised supplementary clamps made of old rails and bars so that two ore cars could be coupled and unloaded in one move.

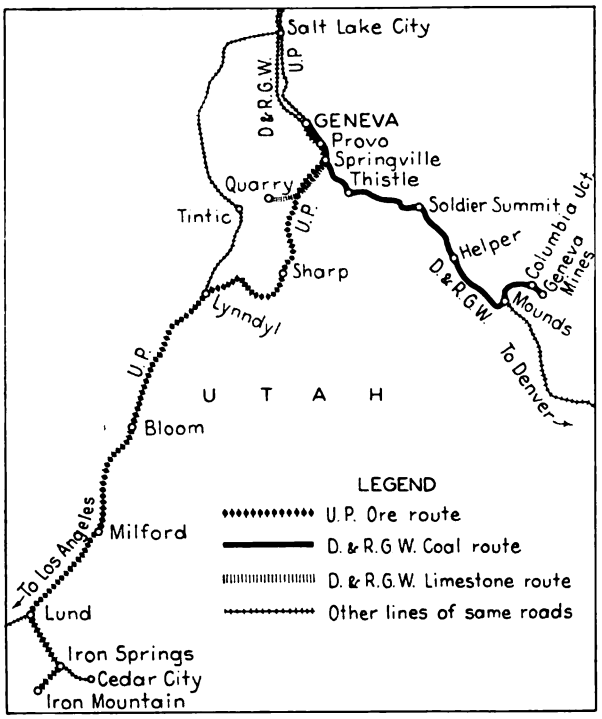
Black Diamonds Over the Mountains

Geneva consumes about 85 cars of coal a day (averaging 70 tons each), all except a fraction of which originate at Geneva, or Horse Canyon, Mine. They are moved 11 mi. over the Carbon County by 1,500-hp. road-switchers to Columbia Junction, 13 mi. from the main line of the D. & R. G. W. on the Sunnyside branch. Here the coal is turned over to the Rio Grande for road haul.

While Geneva's coal moves only 118 mi. over the Rio Grande from Columbia Junction, as compared with 252 mi. for the iron ore over the U. P., the former encounters far more severe grades and curvature, crossing as it does a major mountain range. To meet this special operating problem, the D. & R. G. W. has devised a standard routine of handling which seeks to maximize train loads.

The loads move generally downhill to the main line at Mounds. On this stretch 6,000-hp., four-unit Diesel-electrics handle up to 105 loads, aggregating 8,500 to 10,000 tons. At Mounds, tonnage is reduced to a maximum of 7,200 tons, or 80 cars, and is handled by the same locomotive up to Helper, a distance of 23 mi., over a maximum grade of one per cent.

At Helper (which is truly named) the real fight against gravity starts. Train tonnage is not reduced, and the Diesel which started out of Columbia Junction remains at the head end, but behind its authorized tonnage for the grade there is cut in a twin 6,000-hp. Diesel, and at the rear of the train there is coupled on, as a second helper, a simple articulated steam locomotive of the L-131 class, a 2-8-8-2 type, with 131,800 lb. tractive force — the heaviest steam power on the Rio Grande. Thus powered, the 80-odd loads move



Lines by which coal, ore and limestone are funneled into the Geneva plant

up the 2.4 per cent grade — the heaviest westbound main-line grade on the D. & R. G. W. — over the 25 mi. to Soldier Summit.

Thence west to Thistle, 29 mi., the grade is downward, generally two per cent. While there is no tonnage limitation, to obtain optimum utilization of the dynamic braking on the four-unit Diesel, coal trains may fill out at the summit only up to 90 cars. All retainers are set in "light" position, and no inspection stops are necessary. At Thistle, retainers are restored to normal and the coal train proceeds with the same locomotive through to Geneva without further stops, where it heads directly into the plant receiving track.

The road Diesel cuts off, sets its caboose over to a train of 100 to 120 empty hoppers and, after about an hour from the time it headed in with the loads (including brake test), moves out on the main line for a straight run of 82 mi. to Helper. Included in this run is a 29-mi. pull up the two per cent grade from Thistle to Soldier Summit, which is performed without additional power. At Helper, bad-order cars are switched out and repaired hoppers placed in the train, which proceeds with the same power to Columbia Junction, traversing the 1.76 per cent ruling grade on the branch without a helper.

The coal trains are handled between Helper and Columbia Junction by two crew turns daily out of the former point, known as DPC-1 and DPC-2 (after Defense Plant Corporation, which owned the mine originally). These runs are about 12 hours apart. As a rule, if DPC-1 brings full tonnage down to Mounds (where the train is reduced) DPC-2 will come down with a lighter train and fill out at Mounds with the cars left by DPC-1. Between Helper and Geneva, two crews handle two turns every 24 hours. On occasion they may set out commercial coal for other points at Provo.

Typical of the time sequence of the Geneva coal runs is departure from Columbia Junction with loads at 2 p.m.; arrival at Helper at 4 p.m.; leaving Helper 8 p.m., arriving at Geneva 4 a.m.; leaving Geneva 5 a.m. and arriving back in Helper 10 a.m. Upon call, a turn works out of Helper to Columbia Junction, starting a new sequence.

Some 800 hopper cars are involved in the Geneva mine movement, of which 300 are new 70-ton units purchased by the Carbon County. The latter are equipped with a special type of brake-shoe key which does not "lose out" when the car is overturned in the unloader. Formerly, Geneva Steel experienced trouble with brake shoes and keys buried in its furnace charges and the railroad was plagued with bad-order cars. The new cars also have Lewis type "empty-and-load" brakes.

Because Utah coal is "just on the border line between coking and non-coking," Geneva uses, for blending purposes, a small proportion of a "caky" variety of coal from Oklahoma, which strengthens the coke structure. This is hauled by the Rio Grande in mixed consist trains from its eastern gateways at Pueblo and Denver.

The main line over which coal is hauled west of Mounds is laid, for the most part, with 131-lb. rail on slag ballast, with occasional stretches of 115-lb. From Mounds to Helper, the line is single track, equipped with C.T.C. Between Helper and Geneva two main tracks are provided, in part by pairing with the Utah railway. This stretch is equipped with automatic block signals throughout.

To ready the Sunnyside branch for its greatly increased load, the Rio Grande, in 1943 and 1944, spent about $284,000. Projects included a change of line for a short distance near Mounds to reduce the grade against loaded movements from 0.70 per cent to 0.50 per cent, and against empty movements from 1.76 per cent to 1.33 per cent; a relocation at Columbia Junction which reduced the grade against empty movement from 2.54 per cent to 1.78 per cent; and construction of two new interchange tracks and a wye at the same point. In addition to this expenditure, the entire branch has been relaid with 90-lb. relay rail (to replace 85-lb. rail dating back to 1912 and 1913), and six inches of gravel ballast was put in between Mounds and Dragerton, one mile north of Columbia Junction.

To handle limestone loads and empties, to assemble empties for plant loading at Geneva, and to care for such set-outs of coal as might be made, the D. & R. G. W. enlarged its Provo yard, revamping the leads and putting in additional tracks. To handle all traffic in and out of Geneva (other than solid through coal trains), "tramp" assignments operate between Provo and Roper yard (Salt Lake City), 44 mi., moving empties into Geneva for loading, taking out finished products for movement north and west, and handling coal and limestone loads and empties.

Limestone and dolomite, which Geneva consumes at the rate of 15 to 20 cars a day, originate 33 mi. from the plant at Geneva Steel's Keighly quarry, near Payson, Utah, on the Tintic branch of the D. & R. G. W.

(Continued on page 88)

RAILROADS BRING EVERYTHING

(*Continued from page* 86)

This branch joins the main line at Springville, 6 mi. south of Provo. The rock is handled from the quarry by local freight trains working out of Provo, or by special pick-up moves, and between Provo and Geneva is moved by the "tramp" assignments mentioned above. It is loaded in D. & R. G. W. or C. C. coal hoppers.

Rate Basis for Geneva

Under section 22 of the Interstate Commerce Act there was established during the war a rate for outbound products of the Geneva mill to Pacific Coast destinations of 40 cents per 100 lb., compared with the "normal" commercial rate, at the time, of 60 cents. When U. S. Steel took over on a peacetime basis, one of the conditions of its ability to compete on the coast with local steel and that shipped from the East via the Panama Canal was a continuation of this rate.

Effective April 1, 1947, following protest and a short suspension by the Interstate Commerce Commission, the D. & R. G. W., Union Pacific, Western Pacific and Great Northern put in a commodity rate on finished products of 48 cents (the old government rate plus the nationwide general rate increase), subject to a minimum of 80,000 lb., applicable to Los Angeles (which takes a substantial portion of Geneva's production), San Francisco and Stockton, Cal., and Portland, Ore., and 54 cents to Seattle, Wash. These rates are, currently, 58 cents and 65 cents, respectively. Discussed editorially in the *Railway Age* of January 25, 1947, as "The Geneva Experiment," these rates have been attacked by virtually every other producer of steel in the country, on grounds that they are: (1) too low; (2) discriminatory; and (3) burdensome on other traffic. Final decision of the I.C.C. is still pending.