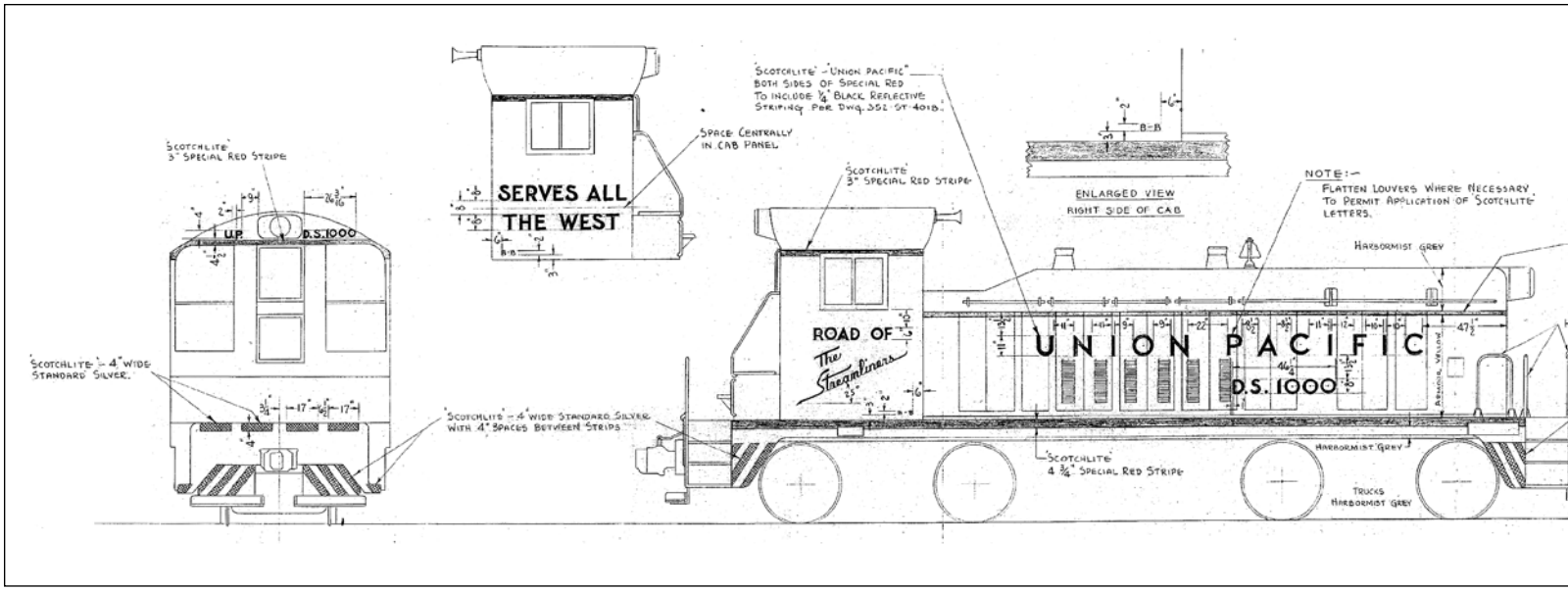


UNION PACIFIC AND SCOTCHLITE

By Dick Harley & Don Strack

For over 50 years, Scothlite lettering has been a hallmark of the Union Pacific paint scheme. It is believed that the first use of Scotchlite by the UP on rolling equipment was on some diesel yard switchers in mid-1951. By 1953, UP was also applying Scotchlite to road diesels and turbines, passenger cars and new cabooses. At least up until 1980, UP did not apply Scotchlite to their freight cars.

It has been over 65 years since the 3M Company (Minnesota Mining & Manufacturing Co.) of St. Paul, Minnesota, developed the light reflective material Scotchlite. That material has found nighttime safety uses on items ranging from shoes, jackets, raincoats and hardhats to highway signs and safety cones to life rafts to school buses and truck chassis to railroad cars and locomotives.

Scotchlite trademark ca. 1953.
-From Modern Railroads

Initial development work at 3M started in the latter 1930s as a search for a way to make highway lane divider stripes more visible at night. First, they had to figure out how to make the tiny glass spheres to be used as reflectors, and then they searched for a way to adhere them to the highway surface. That second problem resulted in several failures. But in the midst of trying, it was suggested that the material would more easily stick to signs. And thus, Scotchlite reflective sheeting was commercially born in 1938. The first traffic sign using Scotchlite went up in 1939 in Minneapolis.

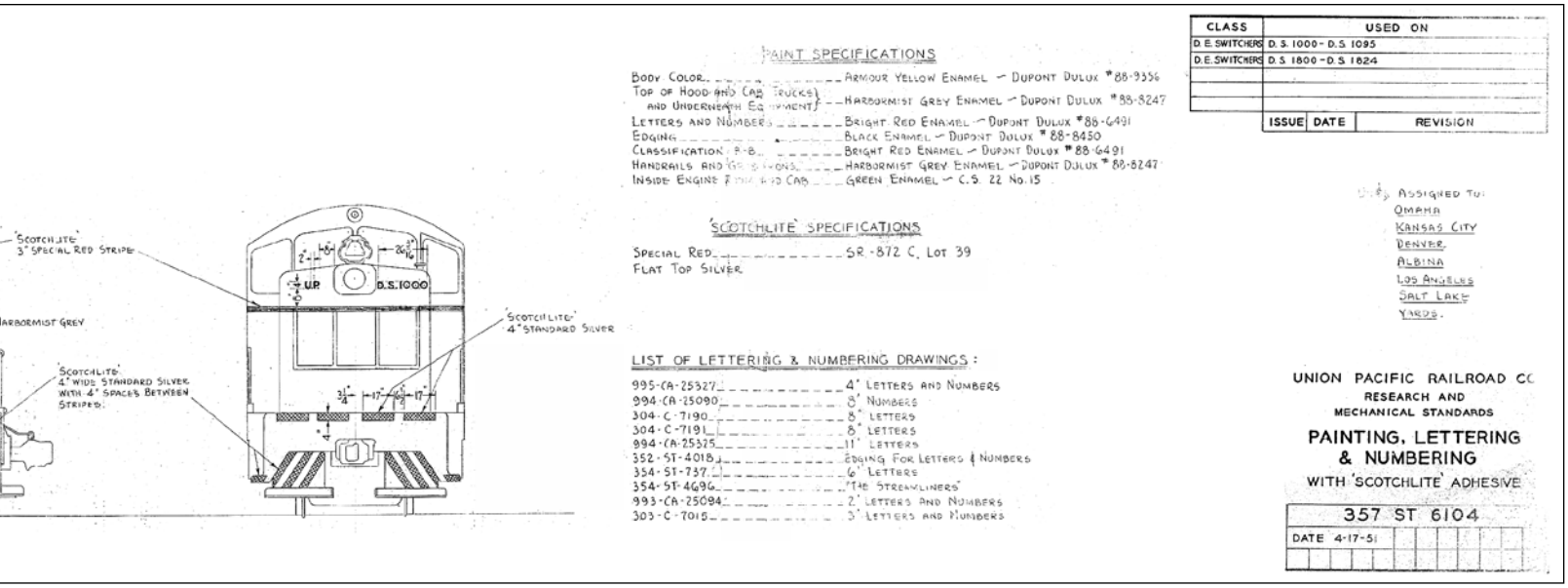
The main physical principle used by Scotchlite is that much of the light entering a transparent sphere is reflected internally and exits in the opposite direction, or back toward the source of the light. It is the reason many animal eyes appear to glow in the dark and is the cause of "red eye" in flash photos. Individual glass spheres ranging in size from about 0.5 to 2-inch had been used for many years in signs to make them more noticeable at night. But it was the researchers at 3M who figured out how to make and attach thousands of very tiny (the first ones were about 0.015-inch) glass spheres to a material to make an entire surface reflective.

As the use of Scotchlite on highway signs slowly spread from Minnesota to the rest of the US, it was noticed by other industries that had nighttime safety concerns too. A search at the Colorado Railroad Museum Library for articles in *Railway Age* magazine found the first article on Scotchlite to be in 1942 about testing by the B&O at their Chicago Terminal. A late 1944 article described using Scotchlite for lettering and the herald on Great Northern boxcars. Another article in 1948 described Rock Island applying Scotchlite to new freight cars. A March 1950 3M ad featured a C&NW E unit. Other early railroad uses of Scotchlite included crossing gates and crossbucks at grade crossings, roadway signs and switch targets, and even advertising. By 1950, Scotchlite was available in 17 colors.

The First UP Application

The initial 1951 plan was to apply Scotchlite to 119 of the 228 diesel switchers that UP owned at that time.[1] The required material would be prepared into locomotive sets at the Omaha Shops, and would be distributed to six terminals for application to engines in the following way: Omaha - 28 sets, Kansas City - 27 sets, Denver - 11 sets, Albina (Portland)

1. Much of this material came from research at the the CRM Library in a series of UP correspondence that documents the 1951 application of Scotchlite to diesel switchers.



Drawing 357-ST-6104 (NW2, SW7) This is the first UP drawing used to apply Scotchlite in 1951. An earlier drawing issued in 1948 was never implemented. *-Warren Johnson collection*

- 13 sets, Salt Lake City - 18 sets, and Los Angeles - 22 sets. These large terminals operated both day and night, and the introduction of Scotchlite was, no doubt, to improve nighttime safety.

An order was placed on April 11, 1951, for 6,000 sq.ft. of "flat top Special Red SR-872-C, lot 39" Scotchlite material. The color was intended to match No. 29 Striping Red paint, which had been used many years for lettering and striping on Armour Yellow paint schemes. That material was to be used to produce the locomotive sets. Each loco set would consist of 75 ft. of striping 4¾" wide, 94 ft. of striping 3" wide, and two sets of 11½" (including a ¼" black outline) "Union Pacific" lettering. Additionally, each loco set had 66 ft. of "flat top Silver" striping 4" wide. So, it is easy to identify Scotchlite switchers in photos, since Scotchlite was the only way that the 'white' safety striping on the pilots and corners was done.

The terminals were to "arrange at first opportunity to apply" the new material. The first Painting, Lettering & Numbering (PL&N) drawing prepared for this project was 357-ST-6104 dated April 17, 1951, which was for NW2 (D.S. 1000-1095) and SW7 (D.S. 1800-1824) engines. That drawing was sent out on May 31, 1951, along with an accompanying letter from D.S. Neuhart, General Superintendent Motive Power & Machinery, stating that drawings for Alco, Baldwin and Fairbanks-Morse switchers were being prepared. Drawing 357-ST-6331 dated July 6, 1951, for Alco S-2 (D.S. 1100-1153) engines followed on July 10th; drawing 355-ST-6335 dated July 10, 1951, for Baldwin VO-1000 (D.S. 1200-1205) and DS-4-4-1000 (D.S. 1206-10) engines was sent July 16th; and drawings 357-ST-6338 dated July 13, 1951 for F-M H-10-44 (D.S. 1300-1304) and 357-ST-6342 dated July 17, 1951, for Alco RSC-2 (D.S. 1180-1190) and RS-2 (D.S. 1191-1195) engines were sent July 24th. The RSC-2 and RS-2 drawing was only to be used for engines "assigned to regular yard service." The last of this initial series of "Scotchlite" drawings were 357-ST-6345 dated July 20,1951, for GE 44-ton (D.S. 1399) and 357-ST-6349 dated July 25, 1951, for F-M H20-44 (D.S 1360-1370) engines – again only "when assigned to regular yard service" – which were sent August 1st.

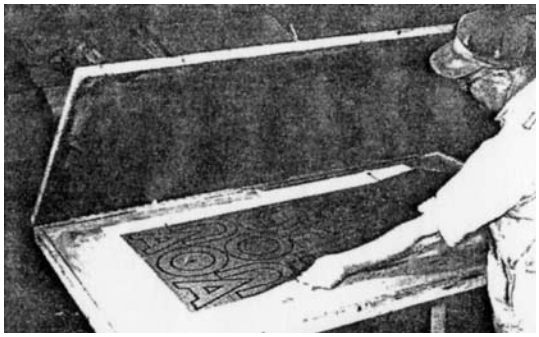
On August 6, 1951, D.S. Neuhart sent out a letter informing the terminals that 3M would "furnish the services of an engineer to assist with the initial application of this material..." It was requested that each terminal give sufficient notice before the first application to allow for the 3M engineer to be present. Apparently the "first opportunity" may have taken awhile. It is not certain whether these switchers were freshly repainted or whether this initial Scotchlite application was simply placed over the existing paint job.

Note that at this time all lettering other than the 11-inch "Union Pacific" (including slogans and road numbers) was to still be painted. Also note, at this time UP maintained two different PL&N drawings for these diesel switchers – one using Scotchlite, and one without.

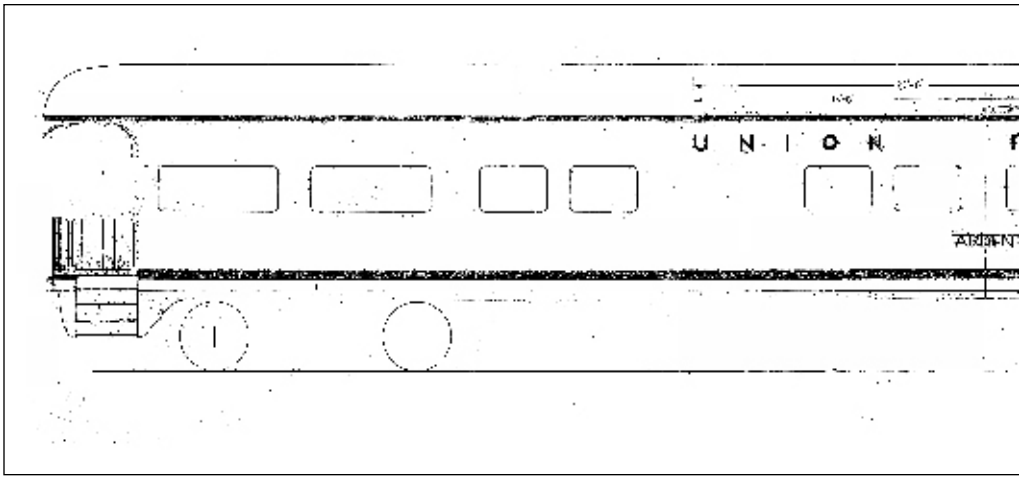
An interesting side note here is that UP apparently thought about using Scotchlite much earlier than 1951, but then decided against it. PL&N drawing 357-ST-5211 dated July 24, 1948, was prepared for applying Scotchlite to NW2 diesel switchers, but it apparently was never used. A copy of that drawing has not yet been located, so it is not known where the Scotchlite would have been used.

The TR5 "cow-calf" switchers (D.S. 1870-1877) were delivered in September and October of 1951. The only PL&N drawing for them is a Scotchlite drawing 357-ST-6471 dated September 26, 1952. This drawing is unique for locomotives in that it calls for the upper red stripe to be painted, rather than Scotchlite. This is similar to the passenger car PL&N drawings being done at about the same time. Whether this was actually done to the TR5s is uncertain. It is believed that the TR5s were delivered from EMD fully painted with red stripes and UP lettering, and the Scotchlite was applied by UP Omaha Shop workers.

The Baldwin AS-616 switchers (D.S.



UP workers silk screen letters on Scotchlite sheets at Omaha Shop in 1953. *-From Modern Railroads*



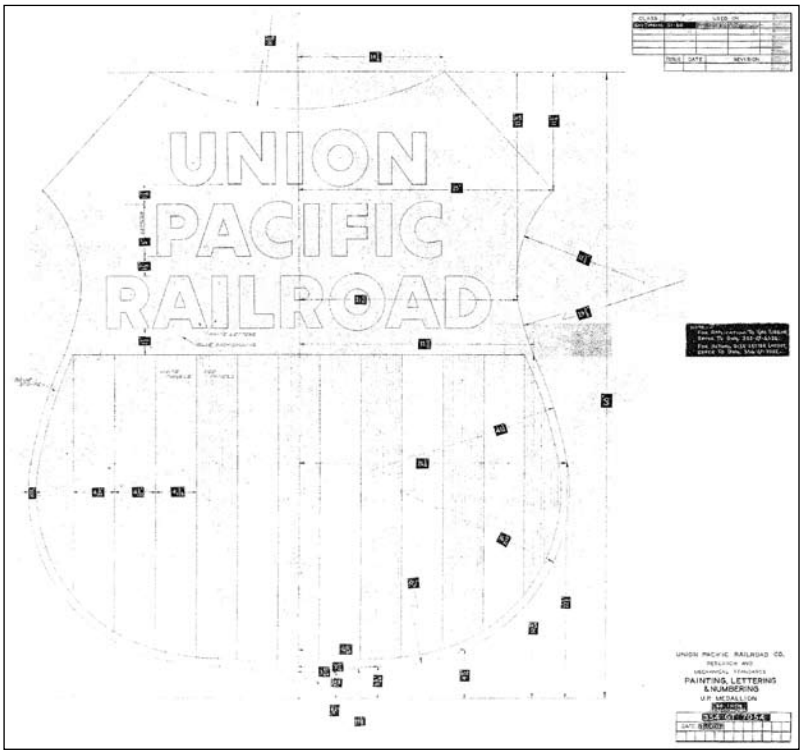
1260-1265) were delivered in December 1951 and January 1952. A Scotchlite PL&N drawing was done for them, drawing 357-ST-6475 dated October 2, 1952, but it says only for engines at the same six terminals listed above. The reason for these delayed drawing dates for both the TR5 and the AS-616 is not known. Since the AS-616s were not assigned to any of those six terminals, it is not known if the AS-616s received Scotchlite or not. Again, it is easy to identify the Scotchlite Silver stripes on the pilots and corners. The AS-616s were also added to 357-ST-5207 (with no Scotchlite) on September 29, 1952.

The first Scotchlite UP medallion (shield) was the 60-inch medallion shown in drawing 354-GT-7054 dated February 20, 1952, which was applied to the modified paint scheme on the Standard Turbines (51-60). The PL&N drawing for those turbines is 355-GT-6326 dated June 29, 1951, and the medallion was added on revision A, also dated February 20, 1952. That same medallion was used on the Veranda Turbines, which began arriving in March 1954. Similar medallions on freight cars were eventually done with a "Scotchcal" – not Scotchlite.

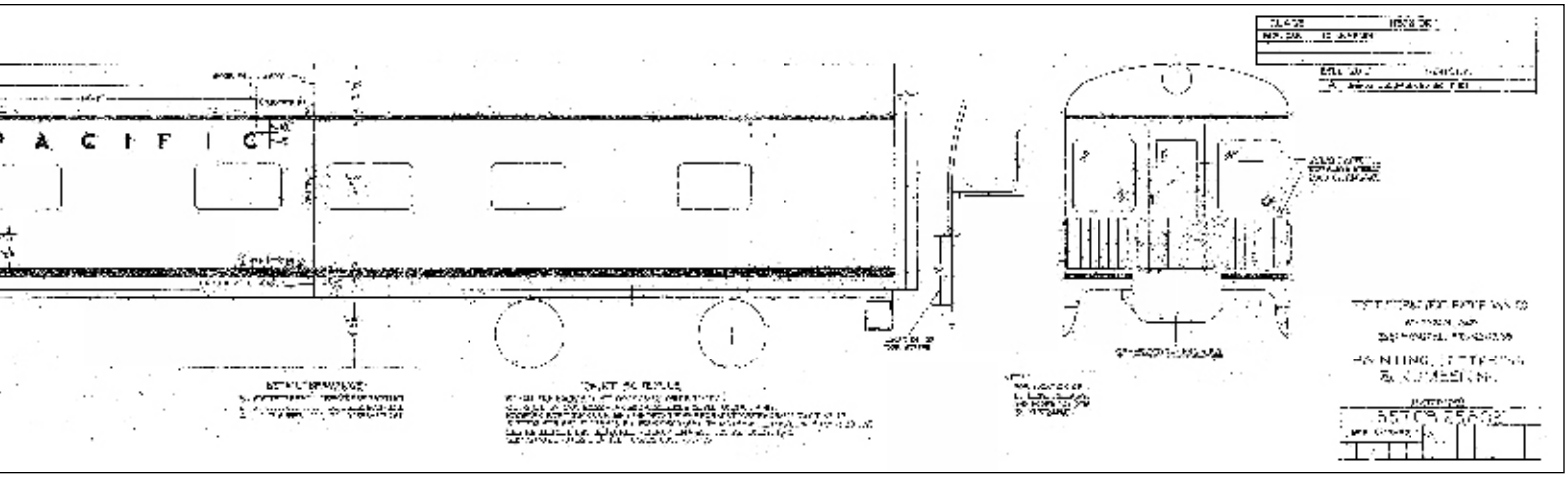
The use of Scotchlite increased to include the road number in November 1952 when letters were sent from Omaha authorizing the application of Scotchlite for striping, "Union Pacific" lettering, and the large road number on all diesel and turbine locos. This was to be done whenever a loco was in the shops being repainted. As an example, the Standard Turbine PL&N drawing was revised to Issue B dated February 18, 1953, to include Scotchlite "Union Pacific," road number and stripes. All materials were still to be prepared and cut by the Omaha Shops and ordered by the various loco terminals. Whether all diesel locos actually received Scotchlite is not known.

The PL&N drawing for the GP7s (357-ST-6541, dated January 27, 1953) was the first new drawing to call out for the 11-inch "Union Pacific" and the 8-inch road number to be Red Scotchlite with ¼" Black edging, as well as the Scotchlite 3" and 4¾" red stripes. These units were delivered new from the factory without that lettering or the stripes, but they did have painted ROTS/SAW slogans and smaller lettering. This was also the first PL&N drawing to specify Scotchlite be applied to all units, and not just those units at the six terminals.

The October 1953 issue of *Modern Railroads* magazine describes UP's application of Scotchlite to its passenger cars. By this time, it had been found that Scotchlite's color was much more durable than Striping Red paint. So there was an economic advantage to use Scotchlite on passenger equipment, as well as a safety advantage. An intriguing part of the article describes how the letters and numbers were cut by the Omaha Shop. A silk screen was used to apply the black paint for the letter and number outline edging. About 25 to 30 characters would fit on a 2 x 6 ft. sheet of red Scotchlite. After the Scotchlite sheets were screen painted and dried, 50 sheets were sandwiched in between two pieces of ¼" plywood, which had also been screen



Drawing 354-GT-7054 (60" medallion) This was the first Scotchlite Medallion, applied to Standard Turbines in 1952. Freight car medallion were non-reflective "Scotchcal," not Scotchlite. *-Dick Harley collection*



Drawing 357-CB-25802 ("Arden") This is the first UP passenger car drawing to specify Scotchlite. It set the standard for the use of Scotchlite on passenger cars that was used up until the end of passenger service in 1971. Note that the top red stripe is painted, and not Scotchlite. *-Dick Harley collection*

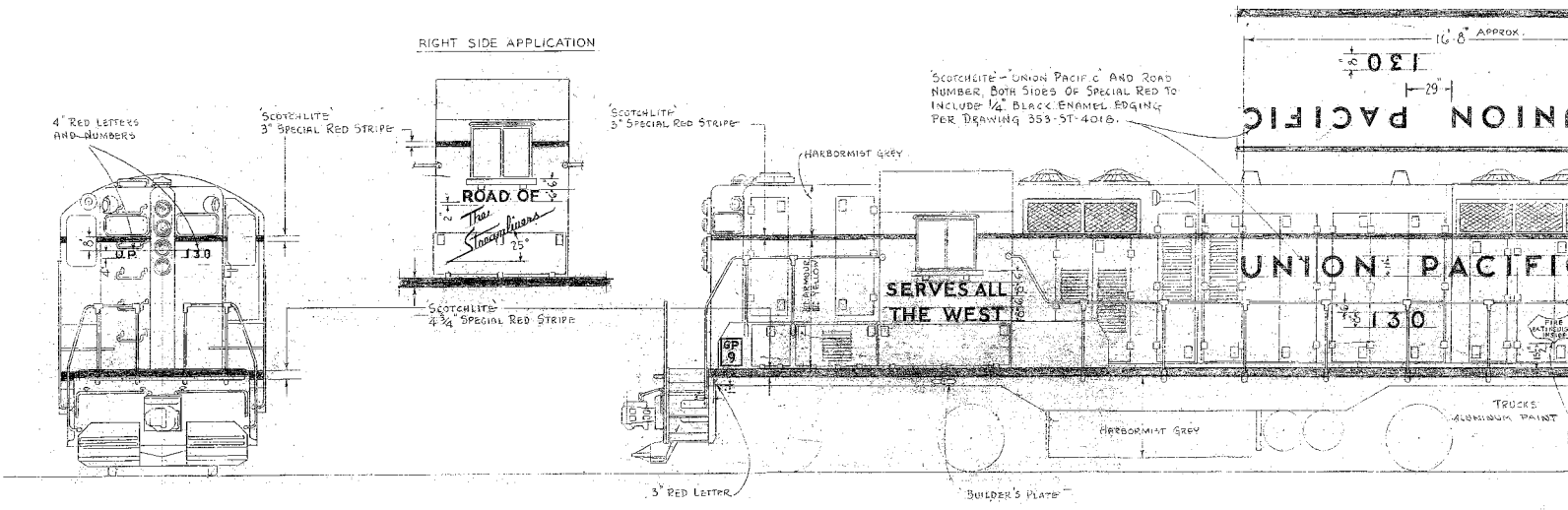
painted. Then the 'sandwich' was taken to a band saw, where the characters were cut out. The individual characters were applied to the cars using traditional pounce stenciling to indicate their proper position.

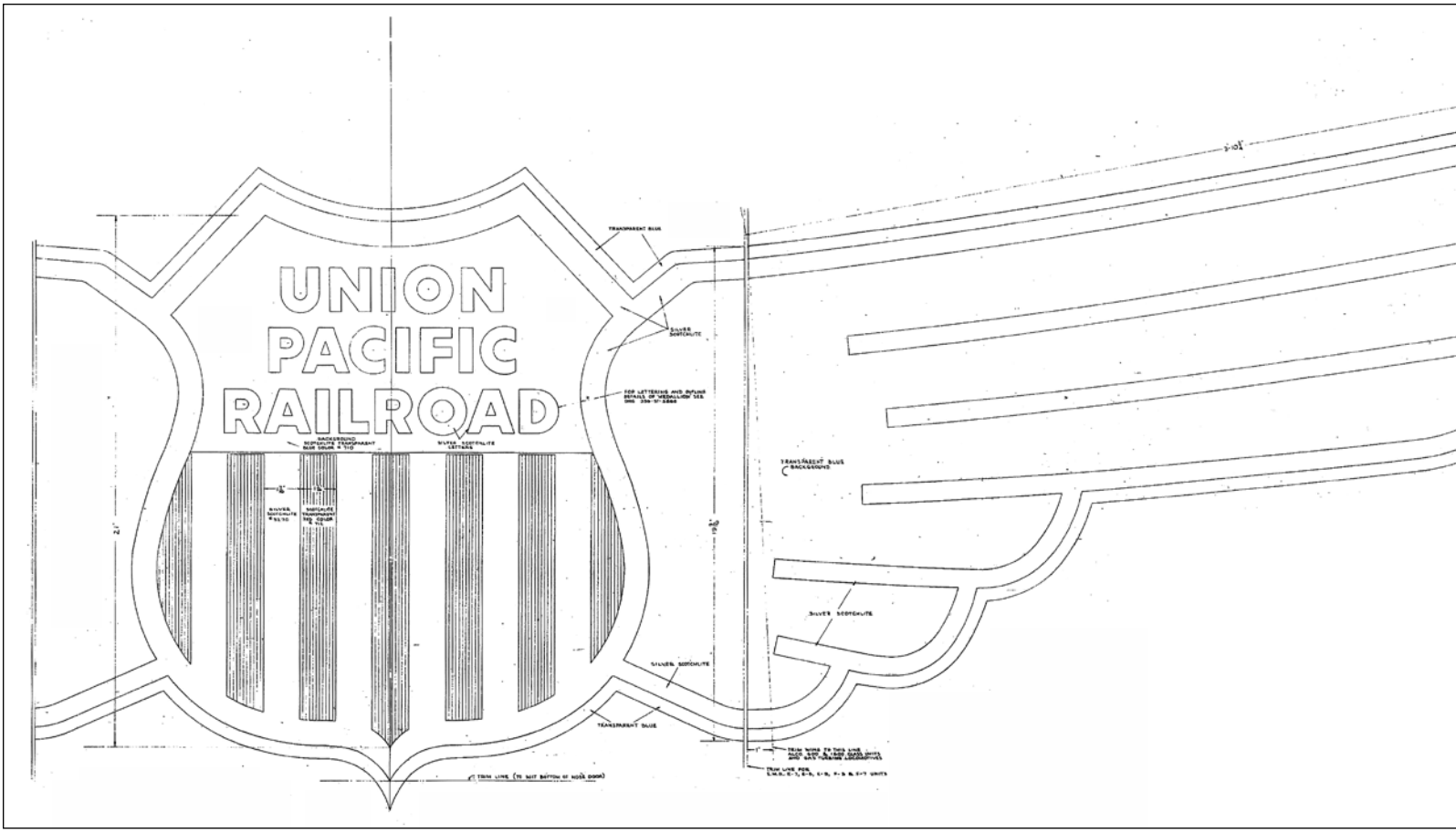
Passenger Equipment

The earliest dated UP passenger car PL&N drawing with Scotchlite was 357-CB-25802, dated March 13, 1952. That drawing was for Business cars No. 100 and the *Arden*, which were being rebuilt at that time from Chair cars 5448 and 5449. When the decision was made in 1952 to paint all UP passenger cars in the Armour Yellow and Harbormist Gray scheme, a series of PL&N drawings were made to cover all types of cars, both heavyweight and lightweight. Those drawings were 354-CB-25998 to 353-CB-26002, all dated August 12, 1952, covering dining cars, chair cars, baggage and mail cars, sleeping cars, and business cars. On all of these passenger car drawings, the lower red stripe was to be Scotchlite, but the upper red stripe was to be painted. The letter board "Union Pacific" and "Pullman" as well as the car name or number below the windows were also Scotchlite. This use of Scotchlite on passenger cars appears to stay the same until the end of passenger service in 1971, since subsequent PL&N drawings and revisions also show the top red stripe as painted.

Another letter from Omaha on March 11, 1953 noted that the regeared passenger F3s (900 to 910 series) would be renumbered to the 1451 to 1461 series and have Scotchlite applied by the Omaha Shop as they returned to UP from EMD. So, for the first two

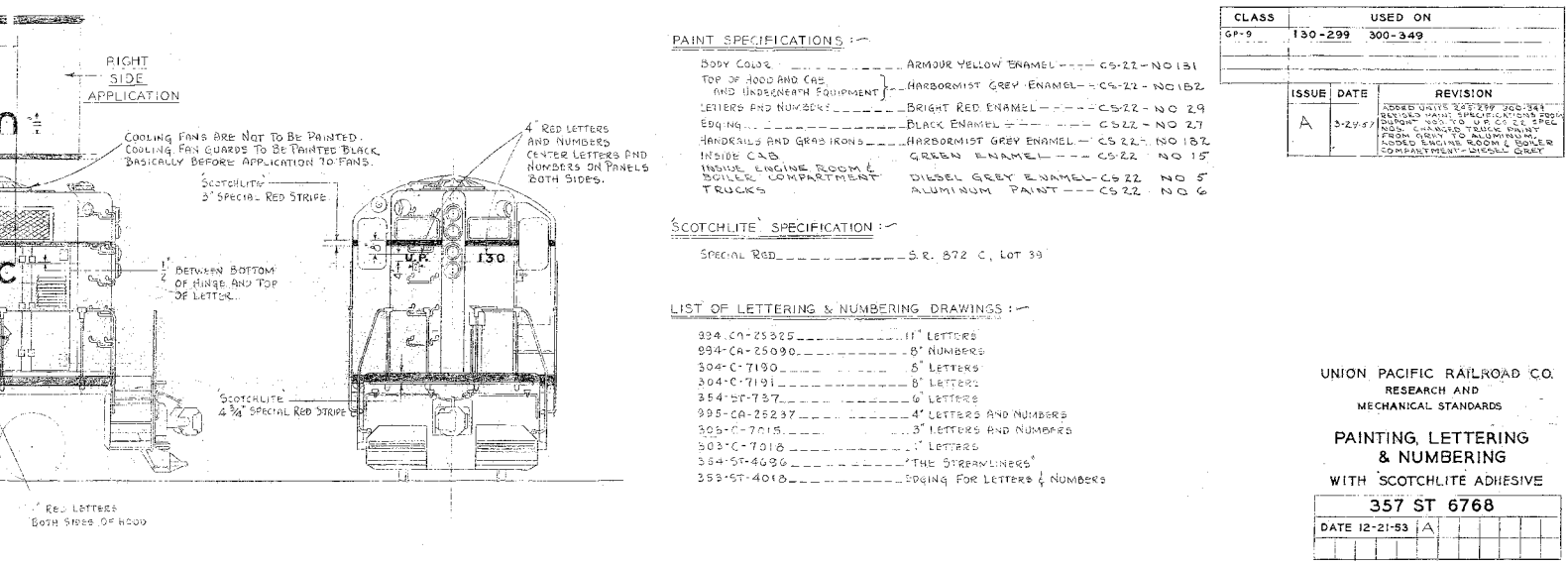
Four 300 series GP9s dead in train arrive at Omaha in August 1957 from EMD without large side lettering or striping. B-units did not have slogans, which were painted at this time. UP personnel at Omaha Shops would apply the Scotchlite. *-H. E. Ranks photo, A. J. Wolff collection*



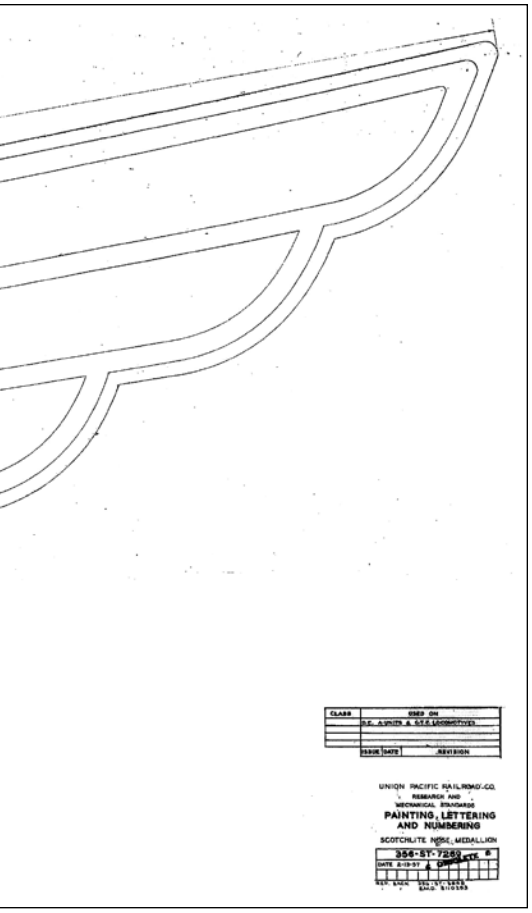


years of Scotchlite use by the UP, all of it had been applied by the UP's own shop personnel. And this practice continued even with new locomotives for the next 20 years. As everything from the GP7s, SD7s and GP9s were built by EMD, they were delivered to UP at Omaha with slogans and small lettering painted, but without large lettering and stripes. The Omaha Shop forces applied all of the Scotchlite to complete the loco lettering. Starting with the SD-24s, even the small lettering and DT slogans became Scotchlite and were not painted at the factory. That practice lasted up through SD40-2 3172, delivered February 1972.

The first Scotchlite Nose (winged) Medallion is believed to have been on the E8A units 931-933 (931-942 series) delivered in March 1953. It consisted of three pieces – the right and left wings and the center portion that fit the nose door. It is not known whether it was factory applied, like the previous metal nose medallions. The Veranda Turbines (61-75) also had a Scotchlite nose medallion. The UP drawing for that nose medallion is 356-ST-7269 dated February 13, 1957. It is not known if there was an EMD drawing for that winged medallion or



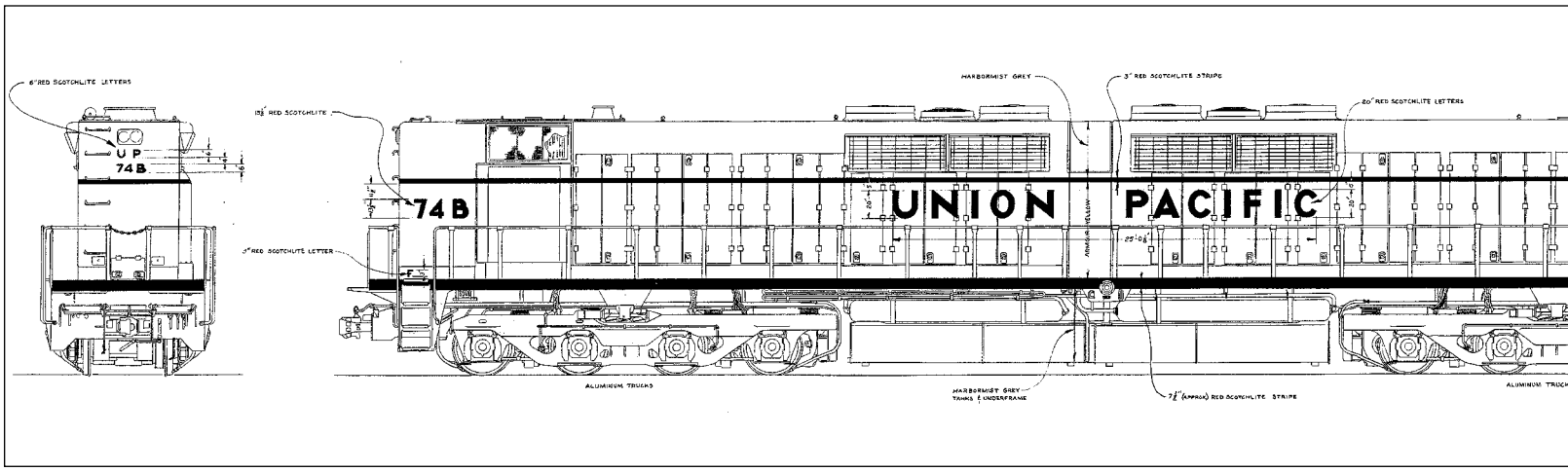
Drawing 357-ST-6768 (GP9). This is typical of drawings in the mid-1950s that showed both the large Road Number and "Union Pacific" to be Scotchlite, while all other lettering was painted. The GP7was the first new locomotive to be lettered this way. *-Dick Harley collection*



Drawing 356-ST-7269 (Nose Medallion) This Scotchlite Winged Medallion was first used on E8s in March 1953. Note different trim lines for the wings to keep the wing tips at the same height as the top of the shield, on different shaped loco noses. *-Dick Harley collection*

Caught in the glare of automobile headlights at a grade crossing in Southern California in 1961, these E units demonstrate Scotchlite's benefits in grade crossing safety. -Morris Abowitz

Ex EMD GP35 demonstrator 5652, sold to Union Pacific as No. 762, arrives Omaha in a fresh coat of paint during May 1964 for application of Scotchlite striping and lettering (including Dependable Transportation slogan) by UP forces. *-H. E. Ranks Photo, A. J. Wolff collection*



Drawing 357-ST-9139 (DD-35). This drawing was issued in September 1972 and reflected UP's brief experiment in economy by eliminating the black edging from lettering. Otherwise it is typical of drawings issued after 1960, when all exterior lettering was done with Scotchlite, and Red Paint was removed from the Paint Specifications. This drawing was superceded quickly by drawing 357-ST-8304 which had a black-edged lettering arrangement. *-Dick Harley collection*

why the delay in creating the UP drawing. An interesting aspect of that medallion is that for units with vertical noses (like turbines and Alcos) the Scotchlite wings needed to be trimmed so that the wing tips were at the same horizontal level as the top tips of the shield. While this was initially done to properly apply the wings, the UP shop forces (especially after 1960) did not always do this. The result was wings that had very high tips and an almost "V" appearance.

Pre-masked Scotchlite was introduced by 3M in 1958. This new material had a removable paper masking over the face of the Scotchlite, so that it could be applied before a unit was painted. The masked Scotchlite sped up the painting process, and the paint sealed the edge of the Scotchlite to help it adhere longer than Scotchlite applied after painting. With UP still applying its own Scotchlite to new factory painted units, this new material was only used by UP at this time for repaints.

In January and February 1959, drawings were issued to place the words "Union Pacific" on the nose of full-body A-unit locos such as E-units, F-units, PAs, FAs, Erie-builts and turbines. This nose lettering was of various sizes, but it all was to be done in black-edged Scotchlite. The delivery of the SD24s in June 1959 initiated the "Dependable Transportation" slogan, which was also done in Scotchlite. The PL&N drawing for these units (357-ST-7687, dated April 22, 1960) did not list C.S. 22 – No. 29 Striping Red paint. The units were delivered from EMD with no stripes or exterior lettering. All exterior lettering was done with Scotchlite in the Omaha Shops, including the 6-inch end road numbers and the words "Union Pacific" on the front nose and the 3 inch letter "F" on the side to designate the front of the unit.

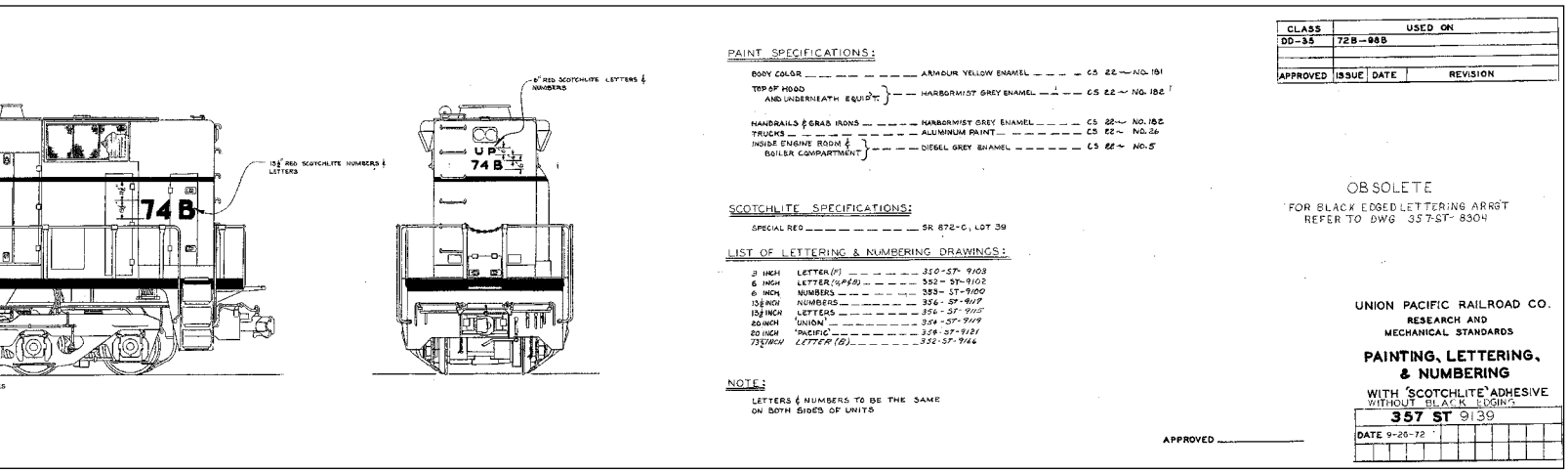
An Experiment in Economy

It appears that UP initiated EMD factory applied Scotchlite at the same time as it initiated letters and numbers on locomotives without black edging in 1972. Factory applied Scotchlite from GE appears to have started in the 1960s, but that subject is still being researched. The first EMD factory applied units were the SD40-2 series 3173-3202 in June through August 1972. Upper management at UP quickly rejected this new borderless look, and the black edging of letters and numbers was back on locos and drawings within months, but the practice of factory applied Scotchlite continued.

In early 1972, while UP was developing the new "We Can Handle It" advertising campaign that would replace the long-standing "Dependable Transportation" slogan, the railroad began talks with 3M for them to provide the slogan as pre-cut and pre-masked decal sets. The new slogan would be delivered as individually cut letters, without UP's trademark black outline, since adding the outline added to the production costs by 3M having to silkscreen the cut letters with the black outline. At the same time, UP contracted with 3M to provide all of the die-cut letters and numbers needed to finish a locomotive. The missing black outline was a major change in UP's lettering plan, but removing the outline saved much of the labor costs associated with manufacture of letter and number sets, especially at Omaha shops.

The cost benefits of the change were immediate, as was the reaction of interested observers. There were rumors that labor unions representing the Omaha paint shop workers had filed a grievance about the railroad's contracting-out a task that was already well established and being successfully performed by union members. Since Omaha shops was where the previous process of silk screening the black outline and cutting the letters and numbers was completed, another location was selected for the initial use of the new die-cut decals. That location was Salt Lake City, which had a team of skilled painters that regularly painted as many as three locomotives a week. Test applications of the borderless letters and numbers were arranged, with the first units being completed in July 1972. The road numbers of the initial test units also showed the monthly capacity of Salt Lake's painters: GP9Bs 302B and 323B, SD24 413, SW9 1841, and SD40 3032.

New units delivered in 1972 received the still-current "Dependable Transportation" slogan. SD40-2 units 3123-3172 were delivered in January and February 1972 without stripes or lettering. Omaha Shops applied the Scotchlite



A new DD-35 is about to be sent to Omaha shops for the application of Scotchlite lettering and striping in September 1964. - *H. E. Ranks photo, A. J. Wolff collection*

Union Pacific DD-35A 72 prepares to depart the EMD plant at La Grange, Illinois, July 17, 1965, en route Omaha for UP application of striping and lettering. -*A. J. Wolff collection*

stripes and black outline lettering, but it is not known if they used die-cut Scotchlite decals. It is possible that the costs of 3M providing the die-cut decals, with black outline, was the impetus of seeking a lower cost alternative. The first EMD factory applied Scotchlite was on SD40-2s 3173-3202 beginning in June 1972. Those units had the Dependable Transportation slogan and were done without any black edging to the lettering. The concerns of the labor unions were worked out and Council Bluffs was the first shop to apply die-cut "We Can Handle It" slogan decals to newly repainted locomotives; GP9s 202 and 206 were the first, completed in October 1972.

The cost-cutting measure of not using black edging on the railroad's Scotchlite decals was short lived. Within six months, a member of senior manage-

While the first factory-applied Scotchlite occurred with the delivery of new SD40-2s from EMD in 1972, it appears that there was some carryover between railroad applied applications. Witness brand new "Fast Forty" SD40-2 8054 at Council Bluffs August 29, 1976, prior to the application of Scotchlite lettering by UP shop forces. Note the unit already has striping. *-Lou Schmitz photo, A. J. Wolff collection*

ment was heard to say that the new lettering was entirely inappropriate (his language was actually much stronger), and in March 1973 a letter was issued stating that the black outline would return as a feature of UP's lettering scheme. The outline was the same as before: 3/16 inch on smaller 6-inch letters, ¼ inch on larger 8- and 11-inch letters and 5/16 inch on the larger 20-inch letters. Keep in mind that these black outline dimensions were in addition to the dimensions for the letters themselves, meaning that the standard 11-inch letter had a finished height of 11½ inches. The first new units to receive the newly restored design style were new U30Cs in February and new SD40-2s in April, and these units also had their lettering applied by UP at Omaha upon delivery.

From 1972 on, including the 1973 restoration of black outline edging, all decals used by UP were die cut by 3M. We can only assume that UP was paying the additional labor costs of having 3M add the black edging, since as yet, no documents have come to light that describes the level of effort that UP's Omaha shop forces were providing to the new lettering program.

Diamond Grade

Scotchlite remained as the standard reflectorized material used by UP at least until the late 1980s. Meanwhile, 3M had developed a new product known as "Diamond Grade," and because it was seen as such a dramatic improvement over Scotchlite, the product received its own 3M brand name: Diamond Grade Visual Impact Prismatic reflectorized sheeting. The major difference is higher reflectivity, from a wider viewing angle, a major benefit for Diamond Grade's most popular uses, which include highway signs worldwide, and truck trailer conspicuity mandated by the U. S. Department of Transportation regulations in 1992.

The specific date that UP adopted the use of Diamond Grade is not yet known. But the dates are likely similar to currently merged C&NW, which started the use of 3M "Engineering Grade" side stripes in 1987, and full Diamond Grade striping, letters and numbers in 1991. In a 1995 history of C&NW diesel locomotives, Mike Iden, C&NW's assistant chief mechanical officer-locomotives, wrote that "newly-painted C&NW locomotives [were] much more visible at night, since the Diamond Grade film reflects light even at low angles of incidence (as little as 15 degrees off the surface)." Best estimates of when UP adopted Diamond Grade reflectorized striping and letters point to the 1988-1990 delivery of new SD60Ms from EMD (numbered above 6085), and new C40-8s and C40-8CWs from GE (numbered from 9135).

3M's "plain old Scotchlite" meets ASTM D 4956, Type I, the oldest and least reflective specification, while the newest Diamond Grade DG3 product meets Types VIII and IX, with its wide angle prismatic retroreflective performance.

While not a pioneer in the application of Scothlite, over the past half century the application of this reflective material to its rolling stock has become a hallmark of Union Pacific mechanical department policy. And today the need for high reflectivity at railroad highway crossings is filled on Union Pacific by state-of-the-art Diamond Grade yellow frame stripes on its fleet of locomotives, and by short side sill stripes (either vertical or horizontal) being applied to UP's current fleet of cars.

-Thanks to the following for help with research for this article: Bill Kratville and Don Snoddy of the UPRR, Kenton Forrest of the Colorado Railroad Museum Library, Ken Kenyon for planting the seed for this project, and Warren Johnson for making his drawing collection available. ■

Assembled switch engines display early Scotchlite striping at Kansas City, above, September 18, 1954. The first applications included red sill stripe and silver saftey stripes on the pilot. Business car *Arden*, seen at Los Angeles, right, in 1962, was the first UP passenger car to get the Scotchlite treatment, in March 1952. Train No.6 displays its bright Scotchlite UP medallion at East Los Angeles, below, in May 1968. The first Scotchlite nose medallions were applied to UP E8s in March 1953. *-Above, Clayton Tinkham photo courtesy Tom Gildersleeve; right, Morris Abowitz photo, Bill Sheehan collection; below, Harry D. Peat*