CALIFORNIA
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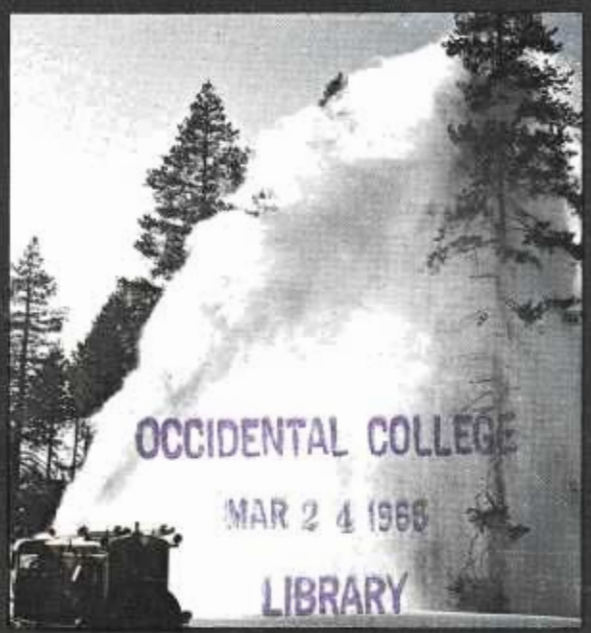

JANUARY
FEBRUARY
1966

next month

In San Diego during its October 1965 meeting, the Highway Commission adopted a route for extension of State Highway 190 from its present terminus at Quaking Aspen Meadow across the southern Sierra to Haiwee Pass at the Tulare-Inyo county line.

During a photographic reconnaissance of this route last summer, Chief Photographer William Chaney made color and black-and-white photographs of the country the new route passes through. A selection of these photos will be included in the March–April issue.

CALIFORNIA highways and public works

OFFICIAL JOURNAL OF THE DIVISION OF HIGHWAYS, DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA

VOLUME ~~44~~ 45 JANUARY-FEBRUARY NOS. 1-2

Editors are invited to use information contained herein and to request prints of any black and white photographs.

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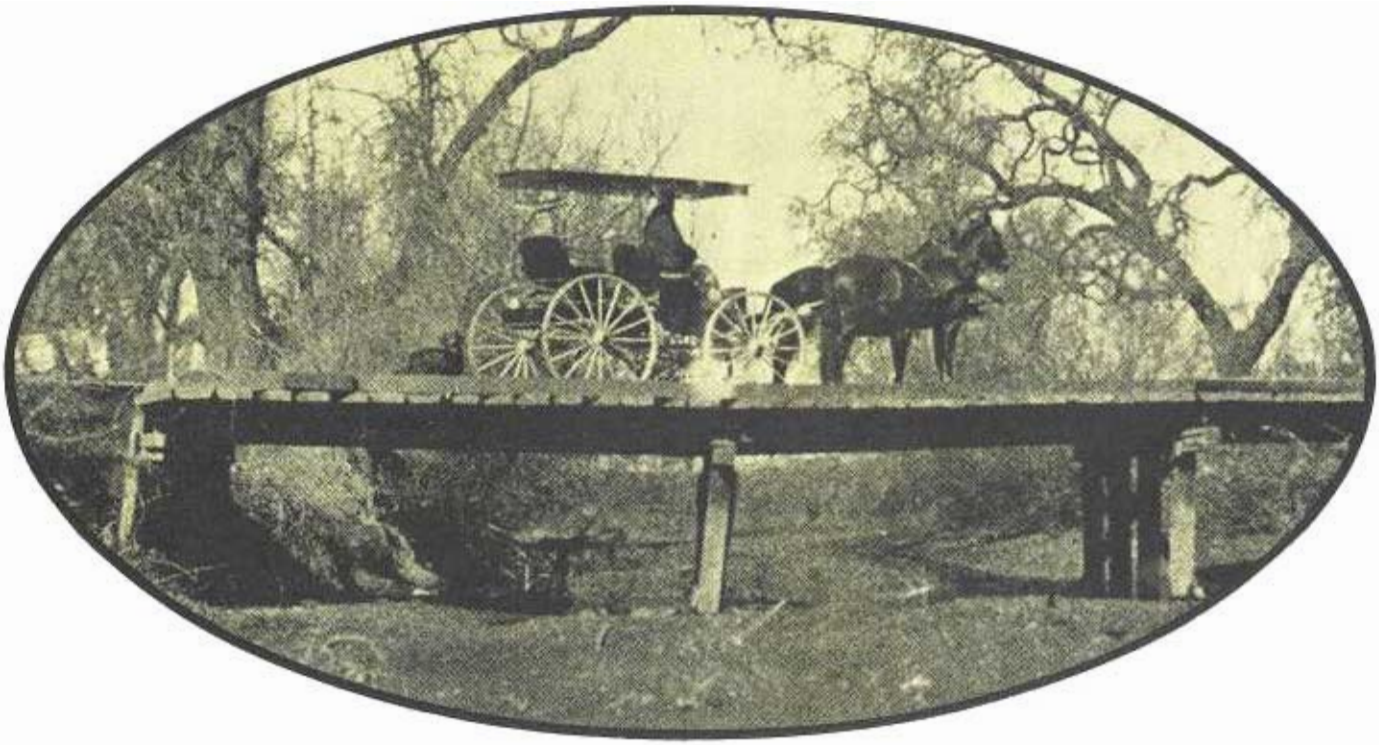
FRONT COVER: Chances are that when this copy of the magazine comes off the press daffodils and flowering trees will be in bloom in the California valleys, but winter will still be hanging over the Sierra Nevada. The front cover stresses the highway maintenance man's view of winter in the mountains. (See article on page 21.)

BACK COVER: Winter comes to southern California mountains, too. Scene on back of magazine is in the San Bernardino Range, on Rim of the World Drive (State Route 18), and not many miles as the crow flies from the City of San Bernardino. Photo by John Meyerpeter.

"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*



At one time a handshake and now a complex instrument of planning

FREEWAY AGREEMENTS

BY JOHN ERRECA

Formal freeway agreements, signed, sealed and attested, are a must today; no California freeway is complete without one.

But these pacts between the state and cities or counties have not always had their *t*'s crossed and their *i*'s dotted so meticulously.

Back in 1895, when commissioners of the then Bureau of Highways traveled the state in buckboards, a meeting of state and local minds on a road matter was often sealed with just a handshake.

Those forerunners of today's Highway Commission and Division of Highways clippety-clopped about the state, consulting with supervisors and city councilmen about road locations, and setting many of the patterns that are still in use today—including local public hearings at which everybody can blow off steam.

Their surveys and consultations led to recommendations for a state highway network so good that most of its routes are in the system to this day.

Fifteen years were to pass before their roads began to be built, and then there was only $18 million available for about $36 million worth of work. But the cities and counties took up a lot of the slack; counties by providing right-of-way and bridges, and cities by simply taking over the job within their own boundaries.

The habit of cooperation built up over these 70 years, now formalized almost into a ritual, still exists, as the League of California Cities and the County Supervisors Association periodically affirm.

But today the cost of highway projects is counted in the millions instead of the thousands, highway and traffic engineering are more complex, and right-of-way and planning problems more involved, to say nothing of the sudden changes brought about by unforeseen new industrial or commercial enterprises in our vigorous economy.

So today it seems advisable to all parties concerned to have these things down on paper so that there is no question what everybody agreed to during the long period between the time a route is adopted and the time construction begins.

The freeway agreement document—detailed on a map—becomes a reference for any venture, private or public, with plans to build or develop anything on any kind of

property near a future freeway. And sometimes not so near.

In other words, a planning guide. Basically the agreement is that when the state is ready to build, the city or county will cooperate by closing the streets and roads it is necessary to close in order to build the freeway.

Actually it establishes where access to the freeway will be provided by interchanges, which streets or roads will be closed or carried over or under the freeway, the location of frontage roads to carry local traffic to interchange points, and how streets or roads may be relocated or extended to maintain traffic circulation in relation to the freeway.

The authority of the highway people to act as the state's agent is spelled out in the Streets and Highways Code of the California Statutes, which is periodically amended and refined by the Legislature.

The law says that a freeway cannot close off any city street or county road without the agreement of the city or county and that no city street or county road can be connected to a freeway without the agreement of the state.

The law does *not* say that a freeway cannot be built without a freeway agreement, and it would be at least theoretically possible to build one despite the opposition of local government as long as it did not close off local streets.

But the long-established practice of consulting with local people has led the department to adopt a policy that no freeway will be built without the agreement of local government.

The same code of laws also says where highways must begin, where they must end, and sometimes through which points they must pass. Within these limits, however, it does not say around which hill the road must go, or through whose barn, or on which side of the valley.

This is the province of the Highway Commission, which determines the road's course by majority vote after all the evidence is in.

However, in order for the State Highway Engineer to be able to recommend one alignment over another, his representatives will have been working with local planning and engineering staffs and public officials for months or years before a route is adopted or a freeway agreement signed.

Once the commission has adopted the alignment, it is up to the Division of Highways to negotiate the freeway agreement.

Much more often than not, all sides having been kept informed at all stages, no mysteries remain about the terrain features, buildings, schools and other controls that led the commission to adopt the line it did, and the freeway agreement moves in a routine manner through local and state staff procedures to final approval.

A resolution of the city council or county board expresses official approval for the community, and the Director of Public Works signs it for the state.

Delays in signing the agreement are sometimes occasioned by planning or engineering differences that have been at issue from the beginning, with all parties negotiating right down to the wire.

Occasionally they are prompted by a strong local urge to deny that any such lengthy exchange of information took place; to assuage the disappointed with the consolation that their woes came as a complete surprise, sprung by a far-off and rascally state bureaucracy.

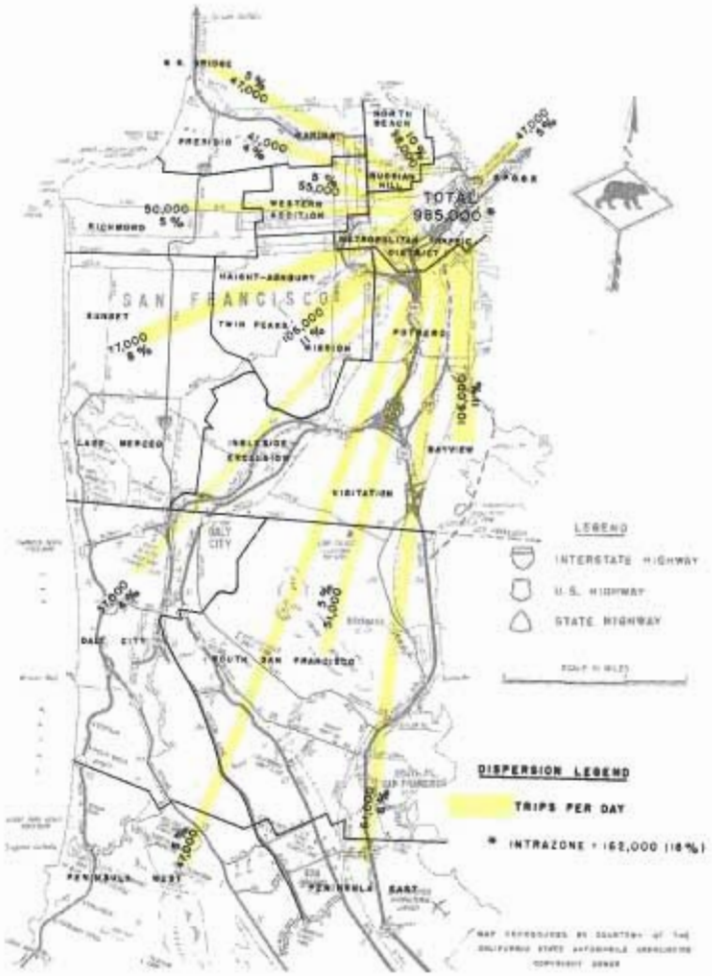
In this "Who struck John?" a standard gambit is to view with alarm any state purchase of right-of-way before the local government has signed the freeway agreement. This makes good copy about who is forcing whose hand.

The fact is that the state will not buy property before the agreement is signed, except under the following two conditions (bearing in mind that the route itself has been adopted, regardless of whether the details have been worked out):

(1) Where some homeowner in a genuine hardship case (a death in the family, orders to Schenectady or Saigon) has to get rid of his house and can't sell it to anybody but the state because nobody else will buy in the freeway's path.

(2) Where a property owner intends to build a facility the state will have to pay handsomely for at some time in the future. (A current case of this kind is one where city and state agree that they will need a certain piece of property for a highway, but where the property owner has a chance to put up and lease a $500,000 building. The formal

Traveling by buckboard, as highway commissioners did in 1895, provided incentive for building good state highways.



Traffic projections show where most cars will want to go. How to get them there is tempered by how **not** to disrupt a community.

City street closures are clearly defined in freeway agreements as are frontage roads leading to interchanges.

The Highway Commission, seated on dais, considers positions of all interested local citizens before adopting a route line.

freeway agreement is many months off, but if the Division of Highways wants to save the taxpayers the $500,000, it must act soon.)

The long process leading to a freeway agreement begins when state highway engineers apply to local planners for information about local master plans, projected land use patterns, present and future transportation facilities, and projected population figures, and, in turn, explain what they have learned about "traffic desires."

(*Desire line* is traffic engineer shorthand for where the bulk of the people are driving from and where they want to drive to. It is usually shorter and more direct than the way they actually have to go, and, when it is indicated on a map, it is often taken to be that mythical straight-line route engineers are supposed always to build if they can get away with it.

(It is actually a reference line which is almost always modified by the presence of such things as schools, parks, hospitals, office building and so forth that the freeway must go around or over or under. The search is essentially for the route that will disrupt the community the least and be the most economical, while not straying too far from the theoretical line that satisfies the needs and desires of those who drive cars—which these days is practically everybody.)

The state engineers are required to notify and consult a long list of federal, state and local agencies about things like transit, water, redevelopment and public housing, fish and game, parks and conservation. They also work with highway advisory committees, chambers of commerce, businessmen's associations, and civic improvement clubs.

During the preliminaries, a lot of alternate lines will be looked over. As studies progress some of these will be dropped from contention when some practical impossibility shows up (such as a line that would, indeed, miss a corner of the golf course, but would take out the county hospital in order to do it).

No final engineering is completed at this stage, but the same basic engineering yardsticks will be applied to all the surviving alternates for purposes of comparing costs, community effects, traffic service and so on.

The highway district conducting the studies will send its information to headquarters in Sacramento for review and approval. Then the approved studies will be explained to the city or county planning and engineering people and to local officials, and after this to the general public in the traditional public hearing and in informal information meetings.

These will be simple illustrated explanations of what the engineers have learned about the various possible routes, with no opinion expressed about which one they think is superior.

A report on the public hearing, together with statements by local public officials, public correspondence sparked by the hearing, and a complete transcript of the proceedings will be sent to Sacramento where the State Highway Engineer and his staff will study the material and the Highway Engineer will recommend to the commission the alternate he considers best.

The commission then: (a) notifies the city or county that it intends to adopt a freeway route connecting points A and B, (b) sends along the State Highway Engineer's map showing how he proposes to accomplish this connection, and (c) asks if the city or county believes another public hearing would be in the public interest.

Usually the reply is "No," and the commission, if it agrees with the engineer's recommendation, goes ahead and adopts the route. Where the city or county asks for a further hearing before adoption, the commission is required by law to hold one.

When the commission has acted, state people can get down to the business of drafting the specifics of a freeway agreement to propose to the council or board. It may be in fairly broad terms to begin with, because the freeway may not be built for several years. It is always subject to modification by mutual agreement and in fact *is* often modified as new traffic changes take place and construction time approaches.

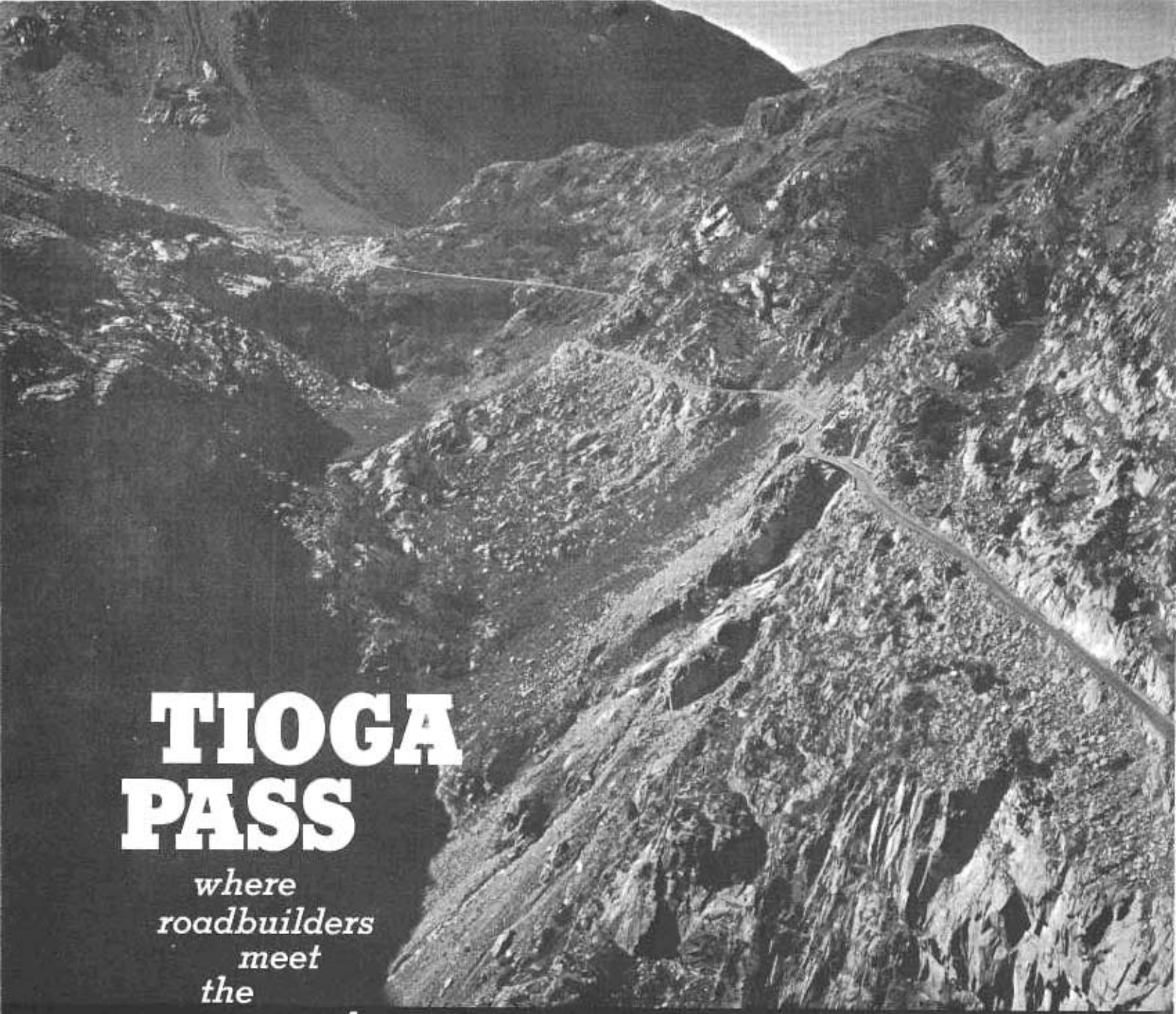
During this time the close association of local and state people will continue with local planners looking out for the traffic requirements of new firehouses, schools, shopping centers, industrial parks and subdivisions; and state people keeping an eye on all these things plus the protection of the smooth flow of through traffic against too many ramps and interchanges too closely spaced.

The need to have a freeway agreement implies the need to have a city or county plan, and this has acted both as a spur to local planning and as a way to lend state help in this direction.

A professor of city planning, T. J. Kent, of the University of California, has said:

"I also feel quite certain that the constructive hard-driving postwar program of the California State Division of Highways to provide freeways in and around the cities of the state will be seen in retrospect, as one of the major explanations for the establishment of effective local planning programs and the preparation and use of general plans by our city and county governments during the decade of the 1950's."

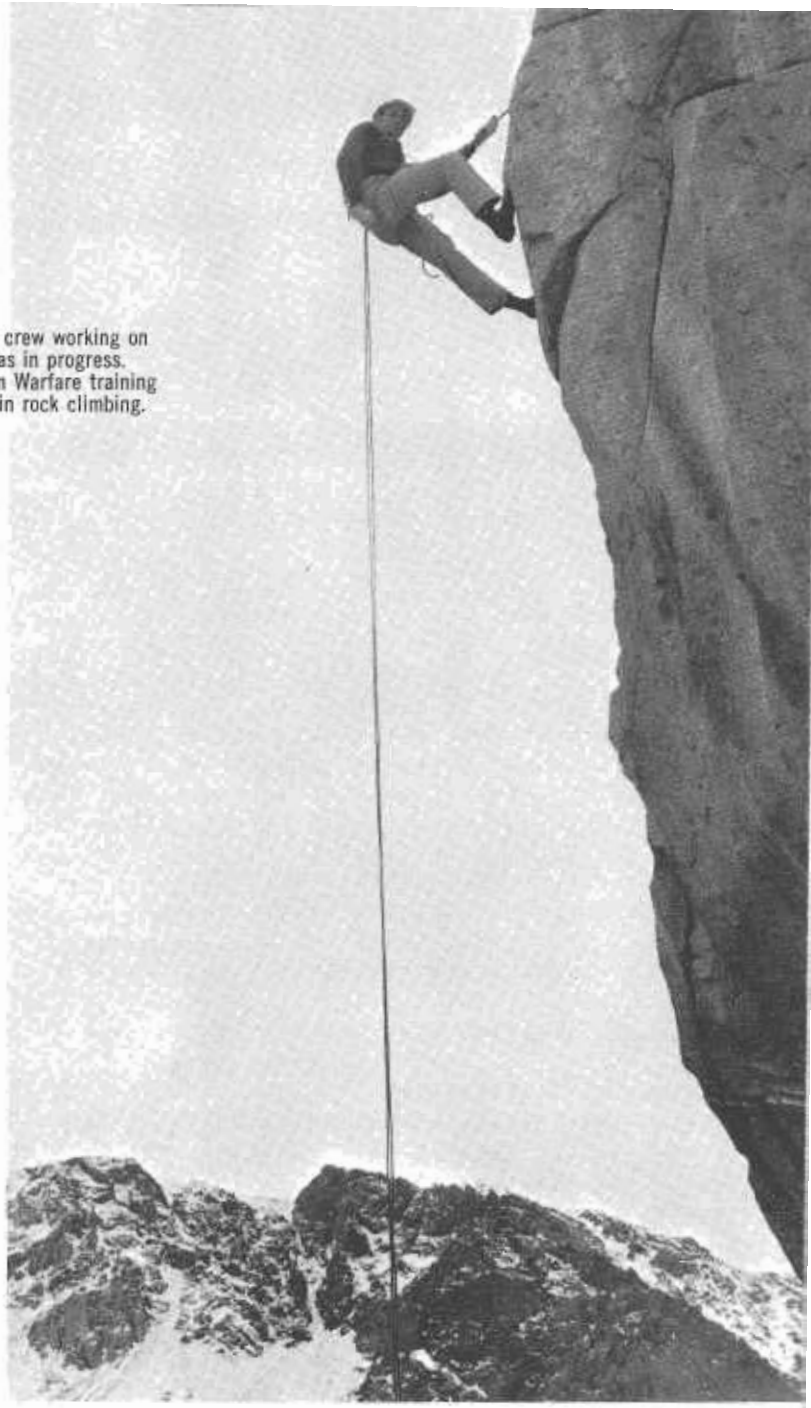
So what started out as a friendly okay and a handshake over who would oil the road, or feed the hayburners that pulled the scraper, has evolved into an invaluable instrument of city and county as well as of statewide planning.



TIOGA PASS

where roadbuilders meet the rugged west

What has been one of California's most frightening roads, the eastern entrance to Yosemite National Park via Tioga Pass, is undergoing extensive modernization all the way from the park gate down to the valley floor just outside of Lee Vining. At a cost of more than five and a half million dollars, three separate contracts have been let on State Sign Route 120 here to widen and improve this road, particularly along the high, sheer cliffs of Lee Vining Creek Canyon. When all three contracts are completed, possibly in late 1966, the grade and alignment will have been substantially bettered, and the switchbacks which have been so difficult for some drivers will have been eliminated.



Member of Division of Highways survey crew working on rock face when staking for realignment was in progress. U.S. Marines at Pickle Meadows Mountain Warfare training base put highway personnel through course in rock climbing.

On the left, looking up Lee Vining Canyon, with old section of Highway 120 passing diagonally across picture. Around curve at upper center is Lake Ellery. Glacial carving is everywhere apparent in this photo.

The present route through Tioga was a traditional trail for the Indians for thousands of years. Through Yosemite and down several canyons, including Lee Vining, the western slope Miwoks came with acorns, beads, baskets, and other trade goods, to take back things like insect larvae, buffalo robes, salt, and obsidian which they obtained in exchange from the eastern slope Piutes.

From the early 1850's on, prospectors crisscrossed the area, and many claims were located. Copperopolis, in Calaveras County, became the railhead for travel into Yosemite, and the Big Oak Flat road connected to it. Today this is still the continuation of the Tioga Pass State Route 120 when it leaves the park at the western side.

With so many prospectors and other opportunists traveling through, the fame of the scenic valley began to spread, and many visitors came to enjoy the beauty. As early as 1864 Yosemite was made a state park, and in 1890 became a national park.

The growing popularity of Yosemite Valley as a tourist attraction had considerable effect on development of roads on the western side, but mining was the stimulant which brought the road on through the park to the eastern side.

In 1860 the rich "Sheepherder Mine" silver lode was discovered and lost the same year, but was rediscovered in 1874.

By the early 1880's the mining developments of the Tioga Ridge were in full swing, with the Great Sierra Consolidated Silver Mining Company driving a tunnel deep into the mountain in search of an elusive vein. More than 350 claims were located in the vicinity, and Bennettville was established as an official post office. The enthusiastic inhabitants claimed the town would rapidly grow to 50,000 people.

In 1881 there was a telegraph line from the east side through the neighboring development of Lundy, then to Bennettville, and on into the Yosemite Valley. In 1882 the California and Yosemite Short Line Railroad was incorporated in Sacramento to run from Modesto to the Mono Valley either through Lee Vining Canyon or McLean Pass, with its principle destination Bennettville. Although this route was never built, the surveys were completed.

In 1882 the Great Sierra Company, suffering from its

Handling traffic on road while reconstruction was in progress was difficult. Drills had to be moved out of position in cases like this, when traffic passed through.

need for a connection with the railhead at Copperopolis, decided to continue the Big Oak Flat Road to Bennettville. The estimated cost was $17,000, and surveys and construction were started the same year from Crane Flat, at that time the terminus of the Big Oak Flat Road.

Although the season was too late to get much work done that year, construction was resumed in April 1883, and the 56 miles of road were completed in 130 days, being opened for use on September 4, 1883. Cost proved to be $1,100 a mile for a total of more than $61,000, considerably more than the estimate, but a laughable figure compared to modern construction costs. The road was built with a combination of Chinese labor, horse-drawn graders, and black powder. On the section along the shore of Lake Tenaya a hundred "powder monkeys" were working at one time.

In anticlimax, the road never carried a single wagonload of ore, for the mines petered out in the following year, and the Bennettville area was abandoned. Although built as a toll road, traffic dropped off rapidly, and there was not enough revenue to pay collectors. With no funds for maintenance, the roadbed rapidly deteriorated, and by 1890, when Yosemite became a national park, it was little better than a pack train trail. Since the park ranger of that day was a U.S. Army cavalryman, the troopers patroling the park used it for just that.

In the studies by the special state highway commissioners in 1895 and ensuing years, heed was given to the citizens of Mono County and vicinity who were begging for a connection to the more settled areas of the west. A route was recommended which started at Gilroy, in Santa Clara County, and terminated in Mono County with a connection on the then unbuilt north-and-south route which today is US 395, but then was called the "Mono Lake Basin Road." The east side road would connect with the Tioga Mine Road, and continue down the Big Oak Flat Road. Today this is Route 120.

Three alternatives were considered. One was via Mill Creek, a second was through Bloody Canyon, and the Lee Vining Canyon route was the third possibility. The Mill Creek Route turned west from the north-south route above Mono Lake about at the foot of today's Conway Grade, and approximately where Pole Line Road now heads east. It climbed past Lundy Lake and presumably crossed the ridge at Dore Pass or Lundy Pass, then connected to the Tioga Mine Road at the site of the abandoned town of Bennettville.

The Bloody Canyon route is about three miles south of Lee Vining, the next canyon below the present 120 route. Here the road would climb Bloody Canyon, past Walker Lake and over Mono Pass, then down Parker Pass Creek to join the Tioga Mine Road in Dana Meadows.

These five criteria were weighed: (1) elevation, (2) slope stability and possibility of slides, (3) length of useful season, (4) cost, and (5) service. Tioga Pass was the lowest, but all were close to 10,000 feet, plus or minus a few hundred.

Lee Vining Canyon was chosen because it was first in categories 1, 3, and 4, and a close second in 2. Although it was third in service, this was a relative value, as even today the east side here is only sparsely settled, and much of the traffic is recreational. To be sure he was right in his recommendation, Commissioner Manson, in 1898, actually went over the entire route on foot. Afterward, the commission recommended a total of $30,000 to build the road.

In 1899 a special commission serving the Secretary of War, of which one state highway commissioner was a member, again restudied the three possible routes, and again recommended Lee Vining Canyon. In February of that year, the State Legislature had already appropriated $25,000 for the work.

By 1901 surveys were completed, and in 1902 the first few miles of the lower part of the route were let in contract. Specifications called for a road 12 feet wide with 18-foot turnouts. The contractor failed in his obligations on this job, and in 1905 the state had to complete the work.

In 1903 the Legislature voted another $25,000 for the highway, and a second contract for the higher portion of the job was let. On this job the contractor failed to satisfy the state in carrying out the specifications, and his bonding company took over to complete the work about 1910. Total construction expenditure by the various agencies was more than $75,000, rather than the $30,000 originally estimated.

Although the road remained under the State Engineer until 1917, when the State Highway Commission became more than an advisory body, the route did not get much attention until about 1913, when automobiles were first allowed in the park. Occasionally, well-prepared wagon parties took the trip through and made the loop to Tahoe and back via the Tahoe Wagon Road to the Sacramento Valley, but with the admission of the automobile, the traffic load began to build up. This was increased again when the state engineers laid out the John Muir Trail in 1915.

Lower end of Lee Vining Canyon with Elephant Head in upper center. Photo was made just before blast. Office complex is right center where dust is seen.

Same view as on left, about a minute after blast. Dust has cleared sufficiently so notch blasted for new right-of-way can be seen.

View of old section of Route 120 just after Elephant Head shot. Small amount of rock on road from blast directly above shows excellent control of the shot.

By the close of World War I, there was great pressure for a better route into the park—an "all-year highway" up the Merced Canyon directly into the Yosemite Valley Floor. The Yosemite Valley Highway Association put 200,000 certificates on sale at $5 each to raise $1 million which would be matched by $700,000 state and federal money to build the road. The certificates were to be purchased by each of the state's 477,450 registered motorists (in 1919), in return for which each subscriber would receive a season's pass to Yosemite.

In 1926, when Governor Friend William Richardson dedicated this route at its opening, the fund actually had reached the sum of $112,000, but construction to El Portal at the park entrance had cost $1,200,000! Where the old routes had climbed close to 6,000 feet, suffering serious snow difficulties in winter, the new "water-level" route stayed below 3,000 feet, with snowfall negligible. The commission hoped to have enough money to pave the new road the following year.

The National Park Service in the meantime had taken over the old Tioga Mine Road, and it still was the main thoroughfare through the park. Some improvements were made, but funds were short, and the old route continued to serve, although it unnerved many of the drivers of the 20's, 30's, and 40's who, with the improvements in road design, had become somewhat less adventurous than those of the first decade.

In the late 1930's, with minimum funds, the state made some improvements on the eastern end of the route, and repaired the Big Oak Flat Road, which it had taken over in 1915. The Wawona Road was also in the state system by now, so that the park had three routes feeding into it from the west, with only a single substandard route to carry traffic through the park. Actually, only a small percentage of the traffic goes beyond the valley floor, but it was not unusual, when drivers unaccustomed to mountain roads continued through, for them to freeze at the wheel on the descent from the pass, causing considerable delay on the narrow right-of-way.

In recent years the National Park Service, with Mission 66 funds, has realigned and modernized the old road in the park, bypassing much of the Tioga Mine Road route. The current state jobs on the eastern section will now make it possible to travel all the way through the park on a modern highway.

After leaving US 395, on the first six miles of the climb to the pass, the road ascends from 7,400 feet on the valley floor to 9,600 feet at Lake Ellery. At a few places the grade goes to 7 percent and once or twice to 8 percent, but, generally speaking, the new alignment produced by the design team gives an overall grade of slightly under 6 percent. However, Tioga Pass will always be a high mountain route, and probably never will be kept open in winter.

Of the three contracts which will bring this eastern portion up to modern standards, the first and completed one was perhaps the most difficult because of its height and the great amount of rock work required. This job, started in 1963, could not be completed until late autumn last year, and, due to early storms, it was for a while touch and go whether it would be completed then.

Above Lake Ellery a three-mile section which continues to the park gate rises only an additional 341 feet, and here a second contract has been let for widening and realignment. This project includes a cooperatively financed agreement for also widening the entrance to the park.

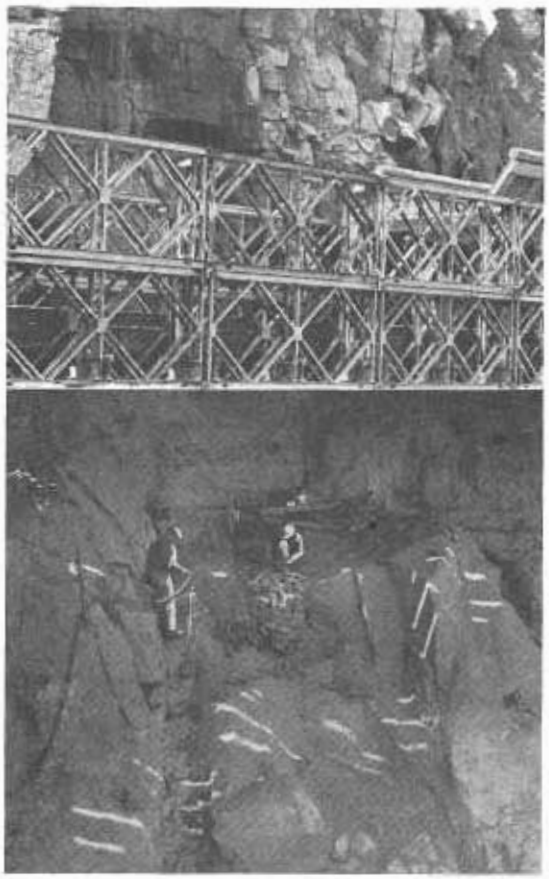
The terrain here is fairly level and little blasting was necessary. However, much of the construction is over glacial moraine, with some of the soil being fine powder created by rocks being ground against each other. Since there is a great amount of subsurface water, even at the end of the dry season, compaction of the fill is difficult. Also, the Forest Service has set strict requirements on preservation of the wildlife habitat. In places Division of Highway employees removed trout by hand from disturbed pools and placed them farther downstream.

Work has been going forward this summer for four miles of grading and paving on a third contract, also let in 1965, costing nearly $4 million, much the largest of the three. This lower job is costing about a million dollars a mile because it leaves the old road and continues on completely new alignment along the steep canyon wall until it reaches the old grade about three miles from Lee Vining.

The main deterrent to a satisfactory grade in the past has been the big rock face near the valley entrance called "Elephant Head." In previous projects design engineers have avoided this face, and kept the road on the valley floor until it was beyond Elephant Head. This has compressed the climb into too small an area for a satisfactory alignment and grade.

The present design calls for bringing the road around the rock face by cutting a small notch to carry the roadway.

Upper left: When blasting was necessary near contractors' and resident engineers' office complex, contractor placed big dump trucks as shields for office trailers. Above: Photo made in 1964 on middle Tioga Pass job shows baled hay used on old sidehill viaduct to protect it from rocks thrown in blast.



Men working in shadow of bridge are doing preliminary work on supports for new sidehill viaduct. Bailey bridge carried traffic for months during reconstruction.

Traffic moving along Tioga Pass road, Route 120, before improvements. In background is "Blue Slide" area which posed special problems of stabilization.

By October 1965 the work had progressed far enough to proceed with the blasting of Elephant Head. The contractor estimated it would require 13 tons of 40 percent gelatin dynamite to do the job correctly, about a pound to the yard of rock. The quality of the explosive was important, as it was desired to shatter this rock as much as possible, to make it suitable for road base.

Since the face of the cliff was so sheer, transport of this much material was difficult. A helicopter was brought in, and it made shuttle trips, with a 750-pound payload each time. The dynamite was carried in a sling. The chopper never landed. Each trip it hovered until the crew on the ground loaded it, and then hovered over the gang on the rock face for unloading, making in all about 30 trips with the explosive.

A seven-by-seven pattern was used in drilling the holes for the shot—that is—the roles were on the corners of continuous and contiguous squares seven feet on a side. Depth of the holes in places was almost 100 feet.

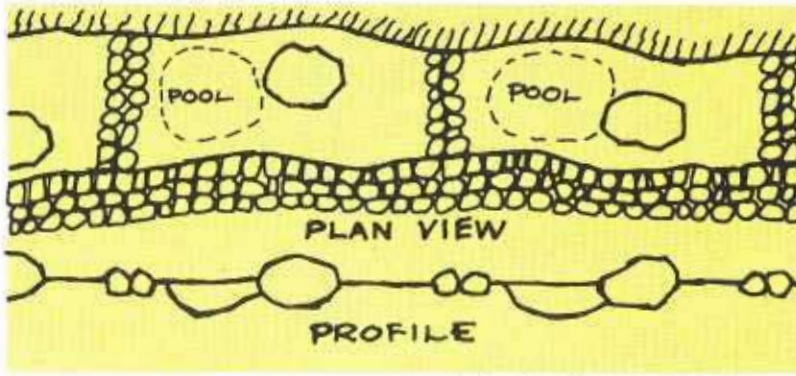
The drilling and the placement of the charges required considerable care and skill, for the old road, which was still carrying traffic, lay directly below the shot area, and a poor shot would cover it with thousands of tons of debris which would take days to clear. On the other hand, one or more additional shots to "baby up" on the cut would be expensive. The shot was designed to throw the 29,000 yards of material to either side, not only keeping it off the roadway below, but breaking it up and dumping it in one tremendous shove, to put it in position as fill for the grade which was coming through.

The blast was fired at 10:50 on October 15, and it was unqualifiedly successful. Not only did the material go where it was intended it should, but the debris which spilled over on the road below was so insignificant that traffic was coming through again in less than two hours. The first vehicle through was a utilities repair truck with crew to repair powerlines damaged by the blast; a casualty that could not be avoided.

Of course, at this altitude, the working days each year on these contracts has been limited. Because of deep snow, the equipment cannot get into the upper project until mid-May or even June, while it might be necessary to move out as early as October. On the middle canyon job, work was suspended the first year on November 20, but the second year the contractor was able to work as late as December 20. This job was completed on October 26, 1965, after three seasons' work, although the original contract called for only 160 working days. It had presented many problems.

The towering walls of the canyon extend upward several thousand feet above the right-of-way, and the sun shines on some parts of the road only a few hours daily. In the shade at 9,000 feet it is often cold on the warmest day elsewhere, and equipment operators working in these areas were bundled up as though working on a winter job, while men in the sun on the same job were working in shirt-sleeves. Because they were often operating really large pieces of equipment on narrow ledges, and the slightest miscalculation meant a fall of hundreds of feet, all three jobs have, in the words of John Sexton, supervising project engineer, produced the "world's finest operators."

The extreme temperature ranges, and the cool days, of course make working with portland cement and asphalt especially difficult. In early September 1965, six inches of snow fell, and there was also snow in mid-October 1965, as the contractor was trying to get the last of the asphalt paving laid.



Sketch shows elevation and plan view of required construction of artificial riffles, pools, and resting areas for trout where channel changes were necessary in realignment of road near summit.

Since the total amount of asphalt paving was insufficient to justify bringing in a hot-mix plant, the asphalt concrete was mixed by the windrow method. The difficulties in maintaining the necessary 60° in the mixture at times seemed almost insurmountable. A traveling pugmill fitted with a fuel oil tank and flame jets to keep the metal surfaces warm was special equipment designed by the contractor in dealing with this problem.

The footings of the slidehill viaduct presented a unique problem, since they had to be constructed on the face of a precipice. A "donicker" which had been planned on as a base for the footing proved insecure, and had to be discarded, but below the bridge there was a slight incurving of the rock face which gave precarious footing to rope-suspended workers. Two foremen refused the job before the contractor could get a man to take charge of forming and concrete pouring.

The footings were anchored by steel dowels made from reinforcing rods, and set in the solid rock. A special type 5 class D (seven-sack) portland cement was used, with low alkali and air entraining not to exceed 4–5 percent. As a timesaver, the concrete was mixed down on the flat, and brought to the job in Goodyear Rota bags, holding about 1½ cubic yards. This method, developed for concrete work at radar stations on high peaks, proved very satisfactory. Tremie tubes were used to deliver the material, about 205 yards altogether, to the footing forms.

At that stage in the job when it became necessary to remove the old viaduct, the contract called for building a one-way detour bridge, but the contractor asked permission to use a Bailey Bridge instead, and a change order was issued. The Bailey, a "double triple," was set in place across the gap, above the old structure, and remained there a year, carrying contractor's heavy equipment as well as routine traffic. Of considerable help in handling the Bailey bridge sections were the existing bin walls at either end of the abutments.

Although the road is not heavily traveled, it does carry a steady flow of traffic, mostly vacationers and tourists, during the summer months. In July 1965 this totaled 30,000 vehicles. The summer season, of course, is also the only opportunity a contractor has to work on the road. Construction of a detour was out of the question, and, although the contractor was working on and directly adjacent to the right-of-way, usually 60 or more hours a week, traffic had to be allowed to pass through somehow.

The problem was greatly complicated by the large amount of hard rock blasting necessary, plus the fact the broken material had to be removed to disposal areas. Traffic

Widened route near Dodge Point here awaits final asphalt surfacing. Note snow on windrow of material which must be applied warm.

Bulldozer operator here clearing blast debris from right-of-way in Tioga Pass widening operation bears out resident engineer's comment—"They had to be the best equipment operators in the world."

Aerial view of Route 120, Dodge Point, and sidehill viaduct gives best concept of terrain and problems it presents to roadbuilders. This photo was made before road was improved.

Section of State Route 120, Tioga Pass Road, made in spring 1963, before contractor began work. Curve in center of photo rounds Dodge Point, with sidehill viaduct just beyond. Contract now completed has widened road here, and provided viewpoint.

had to be protected during the shots, of course, but there was also the continual movement through the jobs of a number of oversize rock trucks, as well as debris on the road from the shots.

The district prepared a very effective "handout" sheet, explaining the problem to the traveling public, pointing out the movement of earth and rock involved in the three contracts—1½ million yards—would require a loaded freight train 430 miles long. These problems were met by scheduling the hours the route would be open and closed each day, and these schedules were given the widest circulation in all press media. No mishaps had yet occurred by the close of work this winter, and, since the job in the area most difficult to negotiate—along the cliffs of the upper canyon—is completed, traffic movement in the future will be much simpler in the construction zones.

However, it was not sufficient just to open and close the route. Because of the terrain, the presence of working equipment, the narrow roadbed, and the tendency of travelers to stop for sightseeing, picturetaking, and an occasional vapor lock, there was considerable straggling. While the rule of thumb adopted allowed traffic 45 to 60 minutes to clear, it was found expedient for a Division of Highways vehicle to follow the last car through all three projects, otherwise an occasional straggler might have gotten into serious trouble.

This traffic problem was complicated by the arrival in August 1965 of the Inqua Conference—a group of eminent geologists from all over the world, hosted by the University of California at Berkeley—traveling in buses which could not make the switchbacks. Since the Tioga Pass area and Lee Vining Canyon are of absorbing interest to these men, they had come to study it. By pooling most of the pickups available at the job, assisted by the local national forest officials, all were transported through the job as necessary, and left at the end of the day in a happy mood.

Both the upper job and the lower job at Tioga will continue through at least one more season, before the new alignment is graded and paved. The lower job probably won't be completed until 1967. Some inconvenience to the traveling public will be necessary during this time, but the worst is over.

When all three jobs are completed, the eastern entrance to Yosemite and the Tioga Summit vicinity will be much more easily accessible. For some of the things which will be found up there, see the following pages.

(Contractor on middle job—C. W. McGrath of El Cajon; Division of Highways Resident Engineers Charles Jackson, Lloyd Hopper; contractor on upper job—McGrath also; Resident Engineer E. G. "Lou" Wadsworth; contractor on lower job—Harms Bros., H-B Investment, Inc., & J. W. Briggs Construction, Inc.; Resident Engineer W. R. Coons. During 1965 area supervisor was Associate Highway Engineer John Sexton of District 9.)

TIOGA PASS

its enduring beauty

Disregarding the value of the Tioga Pass route as the only eastern entrance to Yosemite, the Mono Lake-Dana Plateau country outside the park entrance has much to attract the visitor in its own right. The terrain surrounding the summit, in the words of District Ranger Jack Reveal of Lee Vining, "offers even a little old lady a satisfying subalpine experience," which she can easily reach within a few hundred feet of the highway. Since the improvements now underway on the road will make ascent of the pass much easier, it is helpful to look at some of the things in the vicinity which can expand the experience of those using the route.

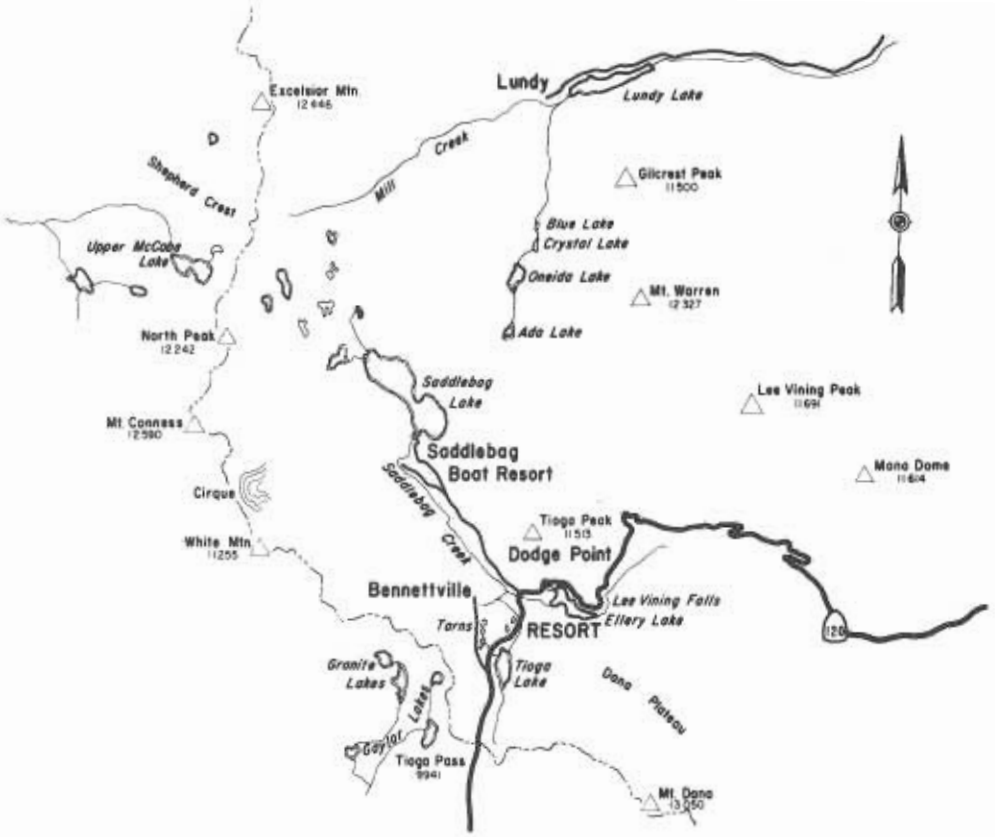
Even before entering the pass there is much to fascinate the traveler on US 395. Not only is this entire section exceedingly scenic, as it passes below one of the most beautiful mountain scarps in the world, but there is everywhere evidence of the great glaciers which carved the present landscape. There is also interesting evidence of volcanic action in the Mono Craters area. The layman can learn to read much of this evidence.

The Sierra Nevada is a single block of granite, with its western edge disappearing under the great Central Valley and its eastern face uptilted and still rising. Its slow rise in response to the great pressures forcing up its eastern edge can be compared to the way a tree root slowly forces up a block of paving in a sidewalk.

This great piece of granite, cracked and faulted here and there, of course, stretches all the way from the southern edge of Lassen Volcanic National Park to Walker Pass in Kern County. As it extends southward, it gradually gets higher, reaching its greatest elevation at 14,495-foot high Mount Whitney, which is also the highest point in the continental United States.

In the several millions years the Sierra Nevada has existed in its present stage, frost has cracked its rocks, and streams have cut deep canyons. During the past half-million years, six glacial epochs have unmistakably marked it for the practiced eye to see. In fact, much of the beauty and grandeur of the scenery can be traced back to the slow grinding of these thick,

A sub-Alpine experience available "even to a little old lady" five minutes from the road



Travelers descending Tioga Pass catch this view of valley beyond through notch of lower Lee Vining Canyon. Odd-looking formations in middle distance are Mono Craters, with White Mountains on horizon.

heavy ice rivers of ancient times which once flowed down all the east side canyons.

As the ice melted at the end of each glacial age, the water ran into the valleys east of the Sierra and made a chain of great inland lakes. One of these, Lake Russell, was at one time 700 feet above the present surface of Mono Lake, and its ancient shoreline is visible along the slopes north and east of the lake about at the 6,800-foot level. The town of Lee Vining is situated on one of this lake's beaches which was created from glacial debris as both lake and glacier were disappearing. Mono Lake is all that remains of Lake Russell. Its moisture evaporated into the air, but its mineral content was concentrated into the relatively small Mono basin to give today's lake its heavy salinity.

Contrary to public belief and Mark Twain's story about the dog, people sometimes swim in Mono Lake and occasionally use it for water skiing. There are beaches along the shore good for sunbathing, and some of the local people, accustomed to the odd smell and the flies, use them at times. The water does sting, however, when it comes in contact with open cuts or raw places on the skin.

Mono's flies were once a major source of food for the local population when it was the Piute Indians of the "Cutza Dika" group. These east side Piute tribes lived a happy but precarious existence, almost "hand to mouth," and each tribe was classified by the major food source available to it.

In the Mono Lake area it was the larvae of the local fly, called *cuzavi*, which collected in piles in and around the lake and which the local Piutes harvested and dried. Sometimes they ground it into meal. If they had a bumper crop, they traded the surplus to other tribes for necessities.

In other seasons the Mono area Indians lived on greens, rodents and a rare deer when they were lucky; berries, roots, seeds of grasses, and the larvae of the pandora moth which they collected in summer in the Jeffrey pine forests on the higher slopes. In the fall they gathered great quantities of piñon pine nuts from the cones of the singleleaf piñon, *Pinus monophylla*. This was their favorite food, high in nutrient value with good keeping qualities, and they stored as much as they could gather. If the pine nut harvest was poor and a hard winter followed, many Piutes starved before spring.

Seagulls are an important part of the scene in the Mono Lake-Lee Vining area, returning each year in May when the valley has warmed somewhat, and the winter snow has melted. They like Negit, one of the islands in the lake, as a place to nest. The black volcanic rock absorbs the sun's heat and keeps their eggs warm. For the bird lover, the shores of Mono Lake offer haven at one time or another to grebes, mergansers, ducks, swans, teals, bitterns, rails, coots, geese, phaleropes, pelicans, herons, cranes, and other waterfowl.

Just to the south of Mono Lake are the Mono Craters, a series of volcanic cones which geologists say are geologically very young. Studies show that the most recent have risen after Lake Russell evaporated, and are only 6,500 years old. Save for Mount Lassen, this is probably California's most interesting volcanic exhibit. That part of State Route 120 which continues eastward to Benton Station passes close to the craters.

The Mono cones should not be confused with the many small hills and ridges which are seen in the Lee Vining area and, for that matter, all along the eastern scarp of the Sierra. These are glacial moraines, although they are often a mixture of moraine and alluvial fan, resulting from stream action after the glaciers melted. Bloody Canyon, which opens into the Mono Valley just a few miles south of Lee Vining Canyon, has much glacial evidence. This canyon is said to have gained its name because the first pack animals through the canyon in 1852 rubbed themselves raw against the rock cliff faces at the sides of the narrow Indian trails.

The canyon, the creek, the peak, and the town of Lee Vining all take their name from Leroy or "Lee" Vining, the first homesteader in the canyon. In the 1850's he settled near the mouth of the canyon and operated a sawmill for a while, selling his lumber to the many mining camps scattered along the eastern slope and throughout the Mono Lake region. His productivity ended when he accidentally killed himself in an Aurora saloon while handling a pistol he did not know was loaded. Despite popular belief, he did not found the town. It was started in 1923 by a garage owner named Gus Hess, formerly a blacksmith at Mono Mills.

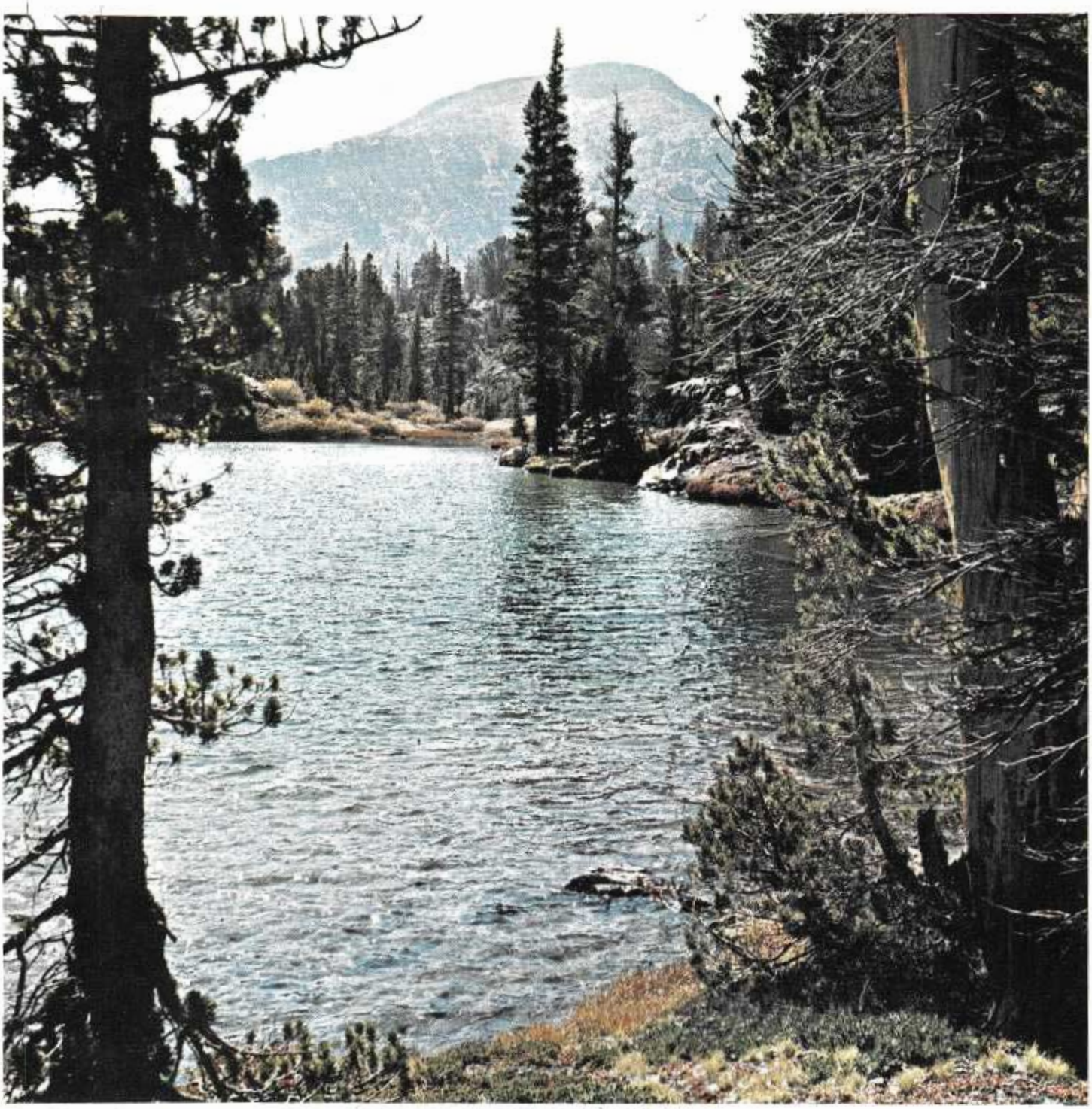
The traveler who turns off on Route 120 just south of Lee Vining and starts the climb toward Tioga Pass will begin to see glacial moraines everywhere. Some are parallel to the sides of the valley; others are like giant steps across the valley—recessional moraines dating back to the end of the last glacial advance, and marking a point where the glacier terminated for a number of seasons before another warm cycle came and it retreated farther up the canyon.

Be sure to stop at the U.S. Forest Service ranger station on the left a few hundred yards outside Lee Vining. Here is easy parking, with nature exhibits and a selection of information sheets on the geology, flora, and fauna of the vicinity.

As the road climbs upward in the pass, it reaches a hard rock area where the right-of-way had to be blasted from solid granite walls. Here evidence of glacial carving and "plucking" is everywhere. On the newly completed section of road there is now an opportunity for study of these features, as well as superb views of the valley, from a new pullout area at Dodge Point, just above the sidehill viaduct.

Dodge Point is said to have gotten its name from an unhappy accident which occurred there in the early days of automo-

Another view of one of Tioga Tarns, with Mount Dana in background. Trees are mostly lodgepole pines.



Tioga Tarns, tiny glacier-made lakes, are like little gems set in rugged surroundings.

bile touring, resulting in the road's only recorded fatality. A pair of young men were traveling the road in a Dodge automobile, and the driver stopped to make a picture of his car perched on the side of the canyon, with his friend at the wheel. When ready to take the photo, he decided the composition would be better with the car in a slightly different place, so he asked his friend to pull it ahead a little. The car was a Dodge of the vintage when those cars still had a gear shift exactly opposite to the standard shift. Unsuspecting, the friend put the gears in reverse instead of ahead, and backed off the cliff, to the horror of his friend, who stood watching, camera in hand.

A mile or so above Dodge Point the road reaches the head of the canyon, and from that point on makes a very gradual ascent to the top of the pass. In this section are continually changing views of Mount Dana, Ellery and Tioga Lakes, and several lesser peaks. Here also, immediately adjacent to the road, are excellent subalpine natural areas.

Both of the lakes, manmade for power development but located in glacier-gouged hollows and surrounded by superb scenery, appear to be natural. About a mile above the Dodge Point overlook there is to be an Ellery Lake viewpoint on the left, and just beyond this the turnoff to Ellery Lake campground. A few hundred yards farther along, on the right, is the turnoff to Saddlebag Lake, about two miles away over a gravel road but normally passable for conventional passenger cars.

High Sierra, Mono Valley, and Mono Lake as seen from ridge at top of Conway Summit on US 395. Lighter line along base of mountains marks old shoreline of Lake Russell. Behind ridge at extreme right center is Division of Highways viewpoint.

Farther along on Route 120, 2½ miles above Dodge Point and just east of Tioga Lake, are the Tioga Tarns—small, glacier-created lakes in a beautiful setting. Since grazing has been prohibited in these portions of the national forest for nearly 50 years, the high country ecology has nearly returned to the natural balance which existed prior to the coming of the white man. In the Tioga Tarns area the U.S. Forest Service has established a nature trail. There are two turnoffs here a short distance apart.

About a half-mile beyond is another connection to the old mining road, and just beyond that, less than a mile from the park entrance, is a left turnoff to the Tioga Lake vista point. This is a total of nine turnouts for recreational purposes in a four-mile stretch, but parking will be permissible at other points where vehicles can get completely clear of the traveled way.

The vista points have been selected in each case to give the best possible view of the scenic area, and the campgrounds are Forest Service administered with the usual facilities of that agency. The old town of Bennettville will be disappointing to all but inveterate history buffs, for nearly all the buildings are gone, and the machinery has been moved down to the Pioneer Museum at Wawona.

The Smithsonian Institution has been trying to get at least one piece—the Burley Air Compressor—but the park rangers are obdurate. It turned out this is the only specimen of this type compressor left in the world.

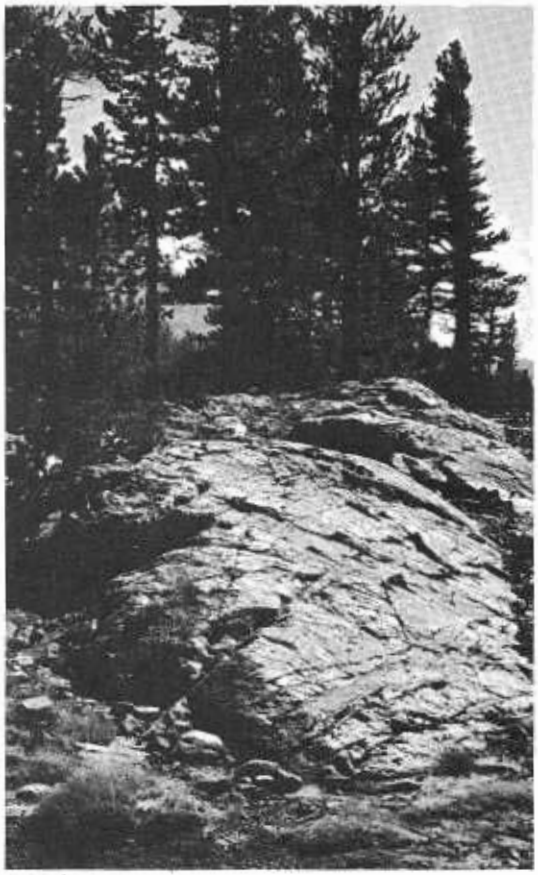
The trip to Saddlebag Lake is a slow but easy trip along the side of Tioga Peak, partially through superb groves of lodgepole pines. In places the trees open up to provide vistas across a great open valley to White Mountain and Mount Conness, with their many intricately carved glacial cirques. The lake, another manmade one, is very dramatic, surrounded by high rock ridges and battered whitebark pines. Here a Forest Service boat concessionaire takes backpack parties to the Hoover Wilderness at the north end of the lake.

It was approximately over today's route to Saddlebag Lake that the Tioga Mine crew traveled its last lap when it brought in the machinery for digging its tunnel. When it was decided in February 1882 that it was impossible to get the shaft as deep as it should go with hand labor, 16,000 pounds of machinery was brought up Mill Creek Canyon in March and April. A single pair of mules and about a dozen men hauled the equipment, loaded on homemade sleds, through snowbanks and up several thousand feet of precipices and impossible grades, mostly by block and tackle, a few hundred feet a day. Carrying their bedding and cooking equipment along, they made camp each evening. The nine-mile trip took slightly more than two months.

The Inyo National Forest nature trail in the Tioga Tarns area is delightful. A few steps from the road, across a low ridge, and all signs of civilization are gone. There are several tarns, each in its own little basin, surrounded by ridges of resistant rock the glacier failed to wear down to the level of the valley floor. Here are some fine lodgepole and white-bark pines, and in July and August an outstanding display of high mountain wildflowers. In the mud along the shoreline you may see a cougar's tracks. The Forest Service has marked the spots of special interest with small wooden plaques.

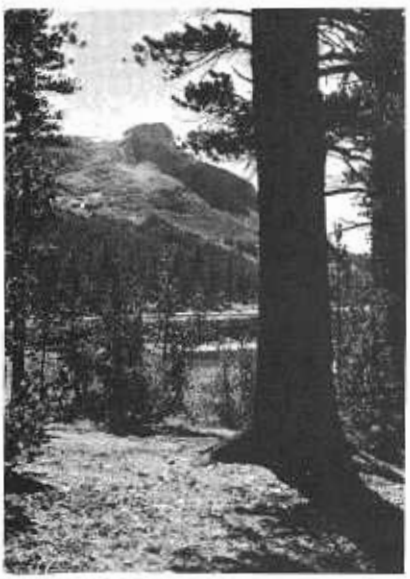
For the more ambitious outdoorsman, several of the surrounding peaks are easy climbs. The crest of Mount Dana, over 13,000 feet high, is only about 2½ miles from the highway as the crow flies, and only a little over 3,000 feet higher than the road here. Although somewhat more than 2½ miles on foot, the climb up the ridge to the summit is not difficult, and the view from the peak is superb. An easier project is the Dana Plateau, just to the east of the peak, a climb of about 1,300 feet. Of course, from this portion of the Sierra, there is access to a big portion of the High Country, but the average traveler will have time for just a quiet sojourn of a few hours, perhaps on his way north or south on US 395. This the improvements in Route 120 will make infinitely easier.

Granite outcropping which resisted abrasive action of glacier remains as mute evidence of its passing, its polished surface gleaming in the sun.



View of north side of Tioga Pass, one of the tarns in the foreground. This country was prospected almost inch by inch in 1870's and '80's.

Perfect example of glacial cirque to be seen from road to Saddlebag Lake. Glacier gradually "ate back" into ridge, creating vast amphitheater or classical "circus arena" effect. Peak at right is Mount Conness.



On the far left a view of Mount Dana framed by lodgepole pines, with one of the Tioga Tarns at right. This is virtually by roadside of Route 120, seen as light line across middle of photo.

LEFT: Although not as common as lodgepoles, dramatically picturesque whitebark pines add considerable interest to the terrain at Tioga's summit. Peak in background is Mount Dana.

winter maintenance

AN ALL-YEAR JOB

BY MARCIA J. MICKELSEN

Snow falls on approximately 35,000 square miles in California, and from time to time nature's white coverlet envelops about one-fifth of the state where the elevation is 5,000 feet or higher. This necessitates snow removal on about 2,740 miles of state highway, from Mount San Jacinto in the south to Mount Shasta in the north, which in turn involves the seven highway districts in the easterly half of the state.

For some people, getting ready for winter was a simple task: They put up storm windows, added antifreeze to the car, and changed to a winter wardrobe.

For the Division of Highways, getting ready for winter was like getting ready to clear a colossal driveway over and over again. To prepare for this annual long sweep, some activities were begun as long ago as last March. In the time that followed, hundreds of projects were carried out, and the same is true every year. November 1 is always circled as the cutoff date—after that possible snows could make getting ready for winter an afterthought spelled disaster.

This 19-ton rotary plow is used in areas of combined heavy snow and high traffic volume, such as Interstate 80 in the high Sierra.

This machine, same as above, can throw up to 2,200 tons of snow per hour. Power comes from two diesel engines (220 horsepower for propulsion and 335 horsepower for feeder and rotary blades).

Some idea of the hustle-bustle a heavy snow fall brings about is indicated by a score of ready-to-go vehicles ranging from rotary plows to sand spreaders and snow loaders.

Several passes on state routes—Carson, Ebbetts, Sonora, Tioga, and Monitor—are not included in snow removal operations. The elevation and weather at these points is such that winter maintenance is too dangerous and too costly to pursue. On the average, these passes are closed in late November and reopened around Memorial Day, but portions of these routes below the passes are usually open for recreational purposes.

In spite of the closure of these passes, there are still plenty of roads to clear. All major highways, including Interstate routes 5, 8, 15, and 80, are kept open in all but the most extreme conditions by crews working out of 69 winter maintenance stations. Many of the maintenance stations are far removed from population centers. Some, perched high in the mountains, bear fascinating names such as Eskimo Summit, Dead Horse, Keen Camp, and Fawnskin. These stations are the "hubs" from which the men propel the big orange snowplows out to and down the roads, and to which they return after a 12-hour shift or combat with nature.

The first flurry of white crystals sets the snow crews to work with a full array of equipment. The state has 440 snowplows of several types, 179 motor graders, and 666 pieces of allied equipment such as sand spreaders and snow loaders.

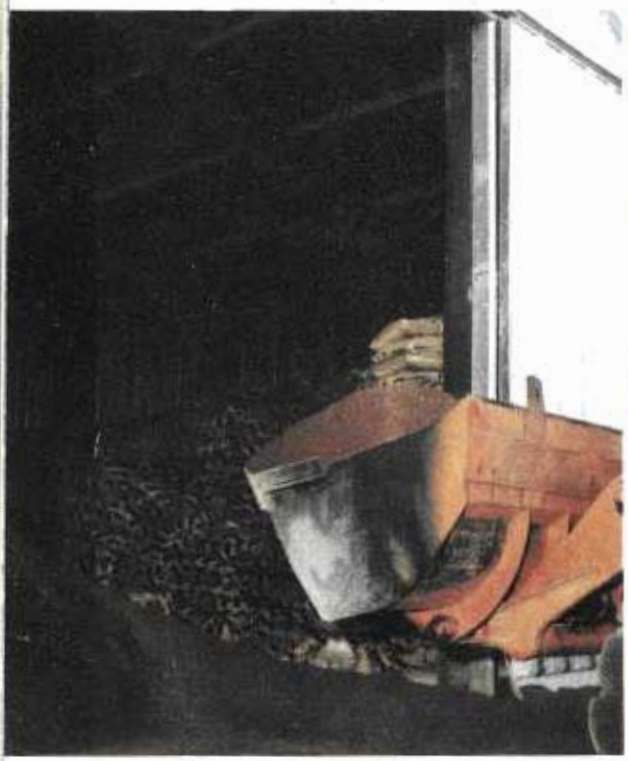
It takes a massive grader and lots of power to push snow from the traveled way.

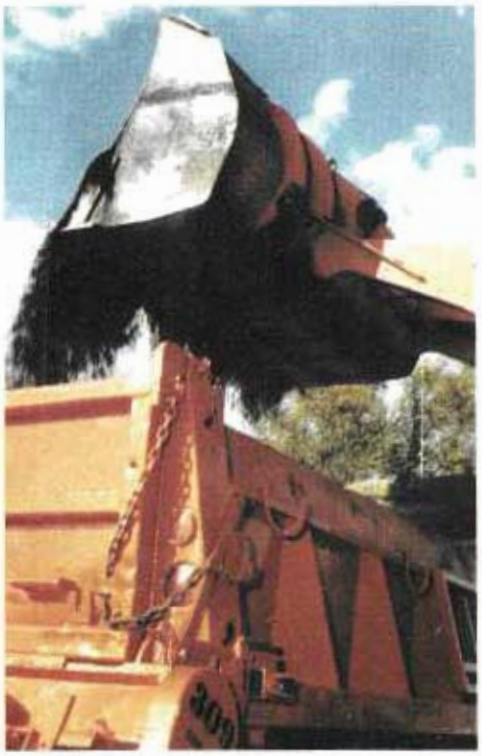
When the force of a particular storm subsides and the roadways have been cleared, the crews use the reprieve for repairs incidental to bad weather. They replace snow poles, unplug snow-packed culverts, restore sight markers and fixed objects (damaged by motorists when visibility is poor), patch portions of blacktop damaged by tire chains, and spread sand to cope with the daily melting and freezing cycle.

Done on a day-to-day basis, these tasks are dwarfed by what took place before the snows had come. The snow stakes (which mark the highway in deep snow) were driven; altogether more than 88,000 were put in place; 129,000 tons of sand (enough to create a pile 100 feet high) were stored in sand bunkers; 11,000 tons of salt were toted to maintenance stations, and all equipment was inspected, overhauled and modified to improve the season's clearing operation.

In mid-March, snow equipment slated for modification was shipped to the Equipment Department in Sacramento. Machine after machine was modified to increase its effectiveness in dealing with villain snow. Auger boxes were changed; larger fans in them help throw more snow. Diesel engines were installed. Conventional truck transmissions were replaced with power shift transmissions for more efficient operating and maneuvering. "No spin" differential modifications were made to enable a snowplow to move out of the way even with a broken axle, and improved power steering systems have given better maneuverability as well as reduction in operator fatigue. Only a few machines can be done at a time, but little by little all equipment is updated.

Changing wiring on snow-going machines to synthetic rubber jacketing has prevented freezing and corroding that once made lights inoperable.

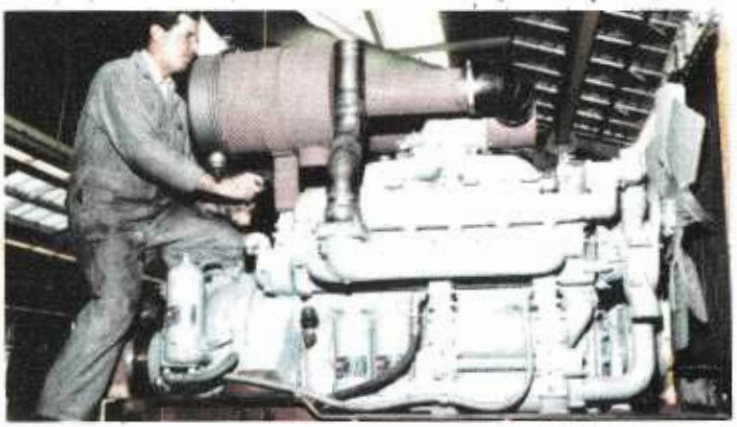


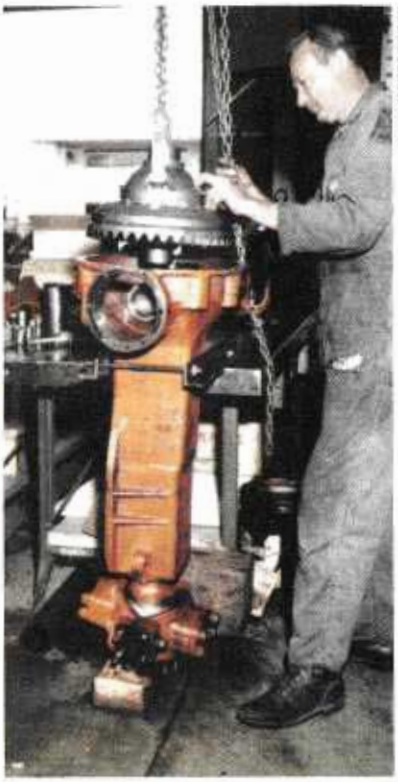


ROBERT J. ROSE

District 2 employees load cinders from bunker into waiting trucks while other men fill salt spreaders. Although the sky is blue in Susanville, traction materials may be needed upon very little notice.

Automatic snow stake driver was invented by District 9. Mechanism on front left wheel determined when next pole should be plunged earthward by the hydraulic rig. Workmen place one stake every 50 seconds for a daily total of 600.





JOHN MEYERPETER

At right, differential carrier and ring gear goes by chain into bearing cage midway in "no spin" installation operations. At top left, axle is bolted together and re-installed. At bottom left, welder fastens air cleaner brackets above new diesel engine.

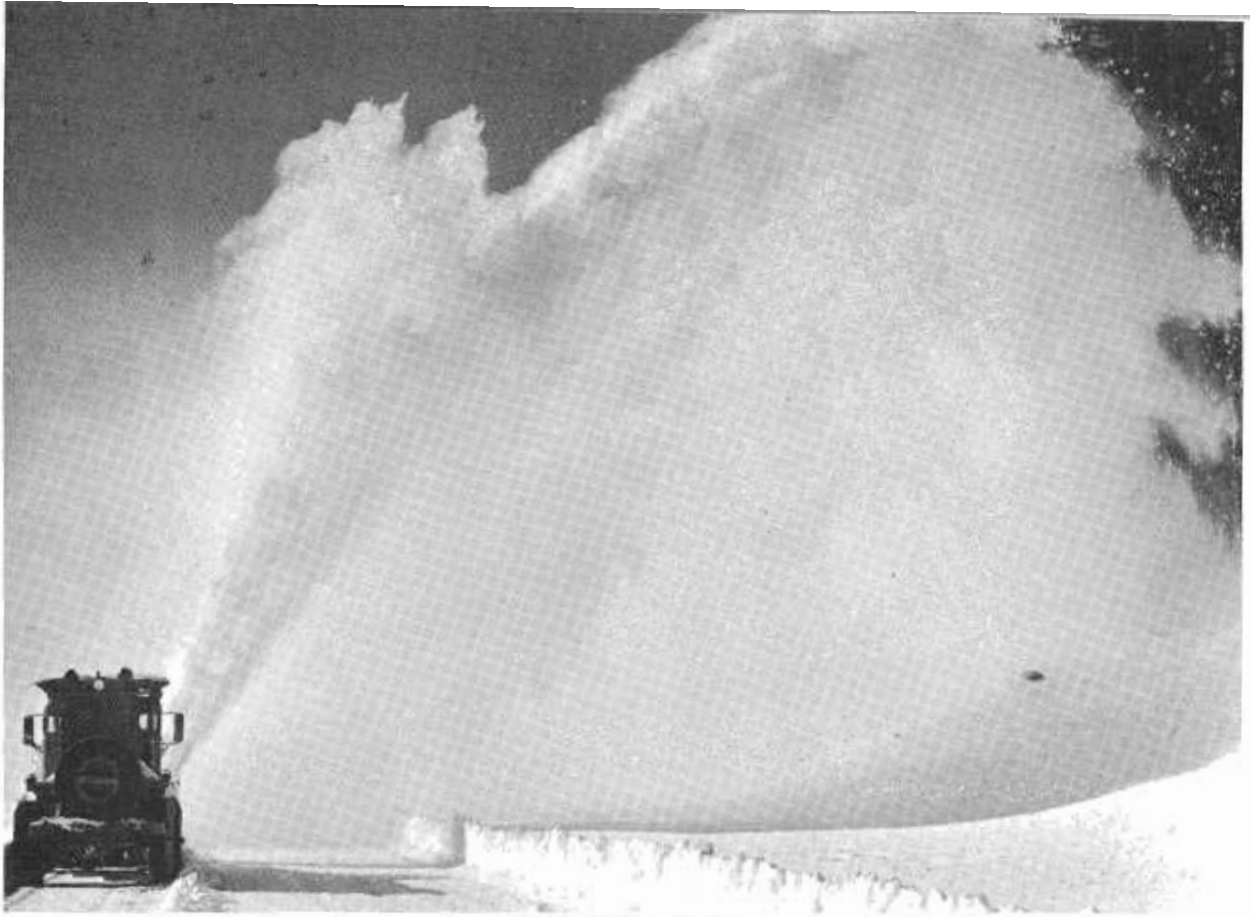
WILLIAM R. CHANEY

Beating a November 1 deadline, modified rotary snowplow is trucked to its winter home at Kingvale. Machine will see duty on Interstate 80 near Donner Summit.

When roads are icy or snow is falling, the motorist may encounter signs which provide two choices: put on chains or turn back. Most go through the rigors of the former.

In areas without wide medians for snow storage, rotary plows funnel their intake into waiting snow loaders. The loaders then proceed to other areas where they deposit their winter bounty.

Chain control·stop point on Interstate 80 seems to feature some last-minute frolicking in snow as well as chain removal on westbound lanes. Motorists in eastbound lanes more seriously attack the problems of putting them on in order to drive over nearby Donner Summit (elevation 7,127 feet).

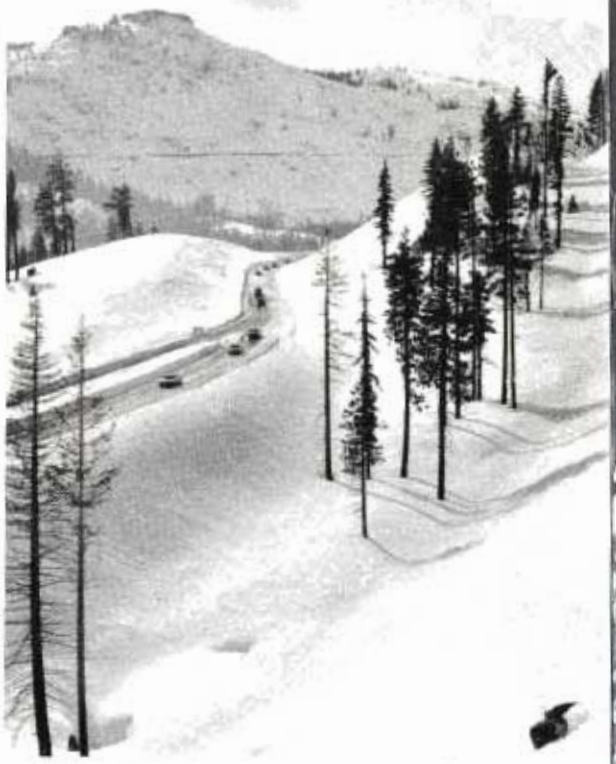


Rotary snowplows of lesser size than in previous pictures can also throw a mighty spray across the horizon. Machine capabilities have been increased through many modifications by the Equipment Department.

The Squaw Valley parking lot is filled to the brim by cars, skis, and skiers who arrive at this resort area by way of Interstate 80 and State Route 89 (south). The area, which lies southwest of Truckee, is best known as the site of the 1960 Winter Olympics.

JOHN MEYERPETER

Conway Summit maintenance station, elevation 8,138 feet, lies east of the main Sierra ridge (background) above Mono Lake. North-south traffic on U.S. 395 (foreground) is dependent upon clearing operations of this District 9 station when snows come.



JOHN MEYERPETER

Interstate 80 eastbound lanes near Donner Lake are rapidly opened after a snowfall of less than major proportions. Clearing this transcontinental corridor is facilitated by gently sloping grades designed for this new road.

The increased efficiency made possible by equipment changes is perhaps best shown by the fact that Interstate 80, opened over Donner Summit last year, was cleared without using any additional snowplows—yet there were twice as many lanes to clear as there had been on the old US 40.

All phases of getting ready for winter, as the transcontinental traveler, the trucker, the bus operator, and the ski buff can tell you, pay handsome dividends in winter mobility. The open road, flanked by walls of white, proves that demon weather can be successfully challenged.

Signs on turnabout mountings are inspected and repaired each fall. When Route 20 east of Nevada City is clear, Highways personnel turn sign to present a blank face to the motorist.

WILLIAM R. CHANEY

combating snow

via radio

By Alice Wiegand

New over-the-snow vehicle will enable communications specialists to service unmanned radio repeater station network despite heavy snow.

On left is one of six radio repeater stations in the District 3 network. Built on mountain peaks, these units support antenna and reflector dishes sending radio and microwave signals to highways units in 11 counties. Mrs. June DeVore, dispatcher (above), gives complete road/weather information to field workers and highway officials using a three-way combination of telephone, VHF radio and microwave.

(Editor's Note: This story about communications in District 3 holds true for all highway districts in California which have mountain roads to maintain.)

The radio communications network used by the Division of Highways at no time serves with more frequency or urgency than during snowstorms or low-visibility periods when mountain travel is hazardous and traffic must have safe passage over the Sierra Nevada range.

The mile-and-a-half-high granite passes pierced by US 50 south of Lake Tahoe and Interstate 80 north of the lake, are under constant surveillance by highway maintenance men and their supervisors who can relay any change in road conditions instantly. They use a communications system combining direct telephone lines, high frequency radio and microwave. The three-way combination is used because of its economy, flexibility and time-saving efficiency.

The network is centered in Marysville, headquarters for Highway District 3, and it links 16 base stations, over 200 mobile units and 6 radio-repeater microwave stations. These effectively blanket the 12,600 square miles and the 1,400 miles of state highways inside the district's boundaries which include the only two major trans-Sierra routes in northern California.

The repeater stations bounce radio signals beamed to them and are, therefore, located on remote mountain peaks where reception is good but access to them difficult.

Although they are serviced monthly, severe storms, high winds and ice sometimes interrupt the power and for these emergencies the stations are fortified with emergency generators.

In order to improve maintenance of them and to reduce hazard of power failure at these units, a new vehicle with wide tracks for over-the-snow mobility has been purchased for the radio communications department in Marysville. It will permit technicians, for the first time, to have their own means of transportation to the isolated relay stations.

Up to this year the specialists have been hitchhiking to remote stations whenever snow vehicles operated by other public or private agencies made a trip. But the trips did not always coincide with Division of Highways' emergencies!

A soundproof, dustproof studio at Marysville highway headquarters is the nerve center for the radio communications network. There, a skilled, competent dispatcher, Mrs. June DeVore of Sutter County, maintains constant contact with all stationary and mobile units.

Mrs. DeVore is able to keep state offices, including Sacramento headquarters, informed of highway conditions, including those over the Sierra, which are constantly changing during inclement weather.

Public news media have immediate access to this information.

Two important installations which are vital to the smooth flow of trans-Sierra traffic are remote-control signs, one on US 50 at Placerville and the other on Interstate 80 at Colfax. Black with white letters, the signs are blacklighted for high visibility day or night. Six messages are stored on each sign, and, when activated by special coded dialing, flip into place advising motorists of chain requirements and road conditions over the mountain summits. Great timesavers, they are the best known means for conveying instant information to the motorist.

The highway division is charged with responsibility for maintaining a safe and orderly progression of traffic for the 7,000 to 9,000 motorists who daily drive over the crest of the Sierra in winter on Routes 50 and 80. While no amount of equipment can forestall road closures, the use of it by highly trained men and women enables the highways' communications staff to advise motorists in advance of the caprices of nature which may impair safety.

SOUTHERN CALIFORNIA

STORM DAMAGE

By Paul Brown

Resident Engineer John Feenstra (above) inspects a maintenance truck buried in mud on Route 111 near the Interstate 10 junction. A total loss, this truck was the only vehicle damaged in the storm. No one was reported injured. At left, a mangled reminder of the storm had been a bridge (located at Snow Creek near Windy Point). It collapsed when floodwaters washed out falsework.

In the series of storms which struck Riverside and San Bernardino Counties last November, Division of Highways maintenance crews, working around the clock, struggled mightily to keep the roads open despite flooding, washouts, and slides. Occasionally they looked up from their work and peered into the darkness, trying to see the huge boulders they could hear bouncing and grinding their way down the hillsides nearby. When the storm passed it left a nasty trail of mud, rock, and debris over the highways.

Surprisingly, not a single State Division of Highways maintenance or construction man was injured during the storm—which, although it lasted a week, concentrated its destructive force into a two-day period, November 22 and 23.

The storm did not single out one spot, but hammered away at a multitude of locations throughout Riverside and San Bernardino Counties. There were two areas which received severe punishment. One of these—the most severely damaged area in the two counties—was at Mill Creek on Route 38 in the San Bernardino Mountains. Water roaring down the creek bed broke through the dike and undermined the roadway. About 500 feet of road was lost in one area; and the storm wiped out approximately 800 feet of roadway at another section.

The second severely damaged area was located on Interstate 10 and Route 111 near Palm Springs. Flood waters pouring out of the mountains dumped heavy quantities of mud and debris on Interstate 10 along a two-mile section stretching westerly from the Route 10/111 junction. Route 111 near the junction also was buried in mud and debris.

About 100 cars and trucks were stuck in the mud in this area. Mud on the highway was three to four feet deep in some spots.

The storm also left its mark at Snow Creek near Palm Springs on Route 111. A contractor's bridge, under construction on a new project at this location, collapsed when falsework washed out.

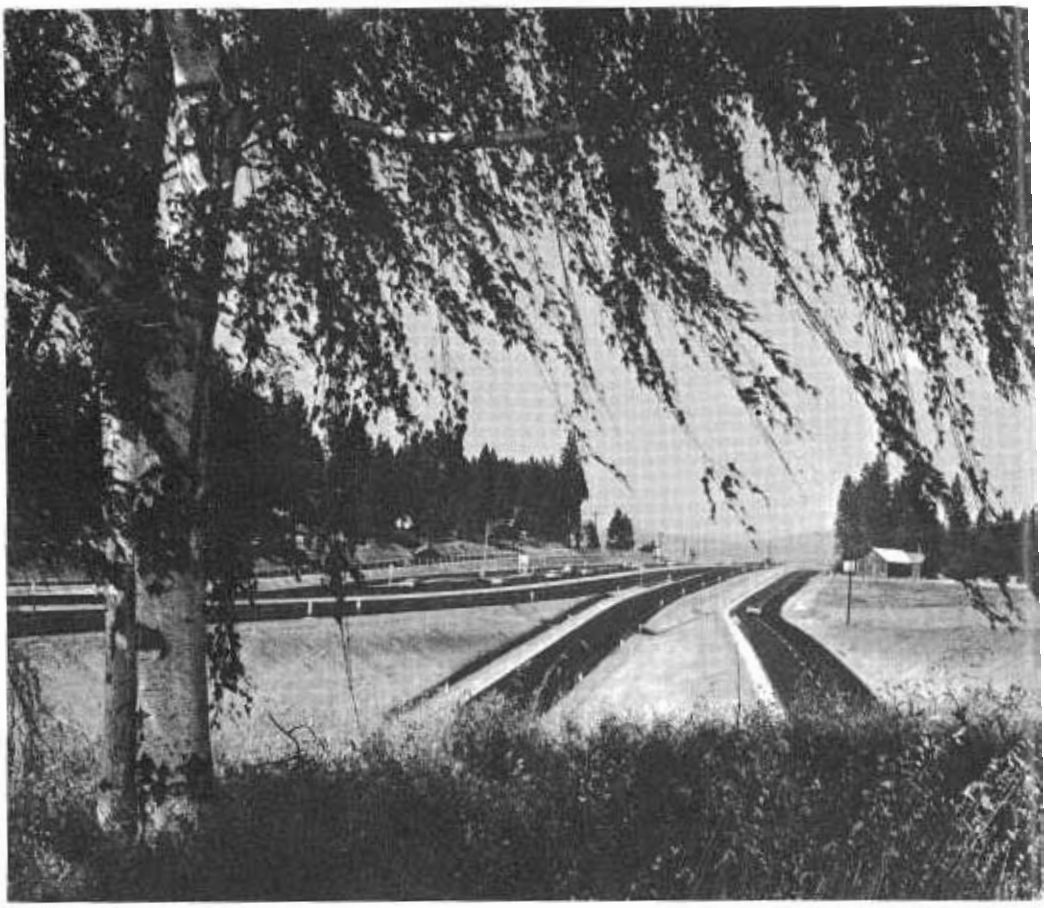
During the storm, maintenance crews closed sections of roads and made detours, as necessary. There were 22 closures (including opening and reclosures on the same locations). Sixteen of these were in San Bernardino County.

The cost of damage to state highways was about $600,000, of which about a third was for emergency openings. Riverside and San Bernardino County roads suffered about half this amount each. (Damage in Ventura County from the same series of storms was about $175,000, although damage to the state system there was relatively negligible.)

Both Riverside and San Bernardino Counties' boards of supervisors asked the Governor to declare the counties as disaster areas. This was done.

The maintenance crew at the Panorama Station (on Route 18 in the San Bernardino Mountains) keeps a record of precipitation at that location. During the entire year of 1964, the rainfall total at the Panorama Station was 19.7 inches. The rainfall total for just the month of November 1965 at the Panorama location was 21 inches.

Camino-Pollock Pines Freeway



Rural freeway bypassing Pollock Pines carries average daily traffic of 11,500 vehicles in peak period.

Tranquillity of small community returns as new freeway opens

By Ray Sorum

Heavy traffic on US 50, California's first state highway, has been commonplace for a hundred years, and during those years it has bit by bit been changed from a winding, dusty, freighters' haul road to a modern highway. Today, with the route still increasing in popularity, US 50 is being converted to freeway as rapidly as availability of funds allows. The latest unit in this transition is 6½ miles completed in late summer last year, bypassing the communities of Cedar Grove and Pollock Pines, and relieving the serious bottleneck which has traditionally developed in the latter community on weekends and holidays.

In the late 1850's this route was the main connection between Sacramento, Placerville and Nevada's Comstock mines. By the 1860's uncounted hundreds of freight wagons rolled over its dirt and corduroy surface with cargoes ranging from drygoods and flour to blasting powder and whiskey.

Traffic was said to be so heavy that it was "nose to tailboard" and that if a wagon dropped out of the traffic stream "it waited until nightfall to get back into line."

The road was first opened between Placerville and the Carson Valley in Nevada in 1852 by Col. J. B. Johnson and with a few deviations from its original location has become US 50.

The first stage line between Placerville and the railroad at Folsom began operation in 1857 and improvements began to follow with moneys subscribed by El Dorado, Sacramento and Yolo Counties. Construction during 1860–65 fixed the location for what came to be known as the "Lake Tahoe Wagon Road" for more than 60 years.

Tolls were collected on the road between Smiths Flat (near Placerville) and the Nevada state line until 1886 when the rights were purchased by El Dorado County and the route declared a public highway. In 1895 it was officially designated as the "Lake Tahoe Wagon Road" and the following year became the first state road in California.

In the intervening years the old wagon road became a federal aid route, getting its US number, and today is a vital east-west highway which serves the popular Lake Tahoe resort area as well as the year-round recreation areas

Project limits were from 0.3 mile east of Camino to 1.1 miles east of Sly Park Road.

At left: In 1963, traffic through residential area was heavy. Bottom: Now, two-thirds of the cars use the freeway.

in eastern El Dorado, Placer and Nevada Counties and the State of Nevada —including fishing, hunting, camping and hiking, skiing, water sports, sightseeing, or just plain loafing at summer homes and resort hotels.

Another freeway section, between the Folsom Junction and the vicinity of Clarksville, was opened to traffic last November. The adjoining two miles east of Clarksville will be completed later this year, which will make a continuous 15-mile eastward stretch of four- and six-lane freeway from Rancho Cordova on the outskirts of Sacramento.

The Pollock Pines section completes a stretch of 25 miles of four-lane highway between Missouri Flat Road, three miles west of Placerville, and Riverton in the center of the county where the road crosses the American River's south fork. Interchanges were built east of Camino, which was bypassed by four-lane construction in 1958; near Sportsmans Hall between Cedar Grove and Pollock Pines; and at Sly Park Road near the end of the job not far from the eastern limits of Pollock Pines.

The $4½ million cut-and-fill project was built by Granite Construction Co. of Watsonville. Work started in March 1963 and was completed in August 1965. Ribbon-cutting and dedication ceremonies were held July 28 under the sponsorship of the El Dorado County Chamber of Commerce.

Average daily traffic through the Camino-Pollock Pines corridor is about 8,000 vehicles. Peak month ADT is 14,100 with approximately 11,500 vehicles of this total using the freeway. The remainder is local traffic using the old road.

Using recent traffic counts, savings to motorists are in the neighborhood of $1,000 per day average. Based on an estimated 5 percent traffic increase per year, this will amount to $12,400,000 in savings to the traveling public over the next 20 years.

Time saved will add up to roughly 130,000 traveling hours per year, based on the fact that the average 40-mph on the old route will rise to a 55-mph average on the new route.

On the old road, within the project limits, there were 59 accidents in 1963 and 72 in 1964. Based on years of statewide experience, opening of the freeway will reduce this by two-thirds.

MARIPOSA

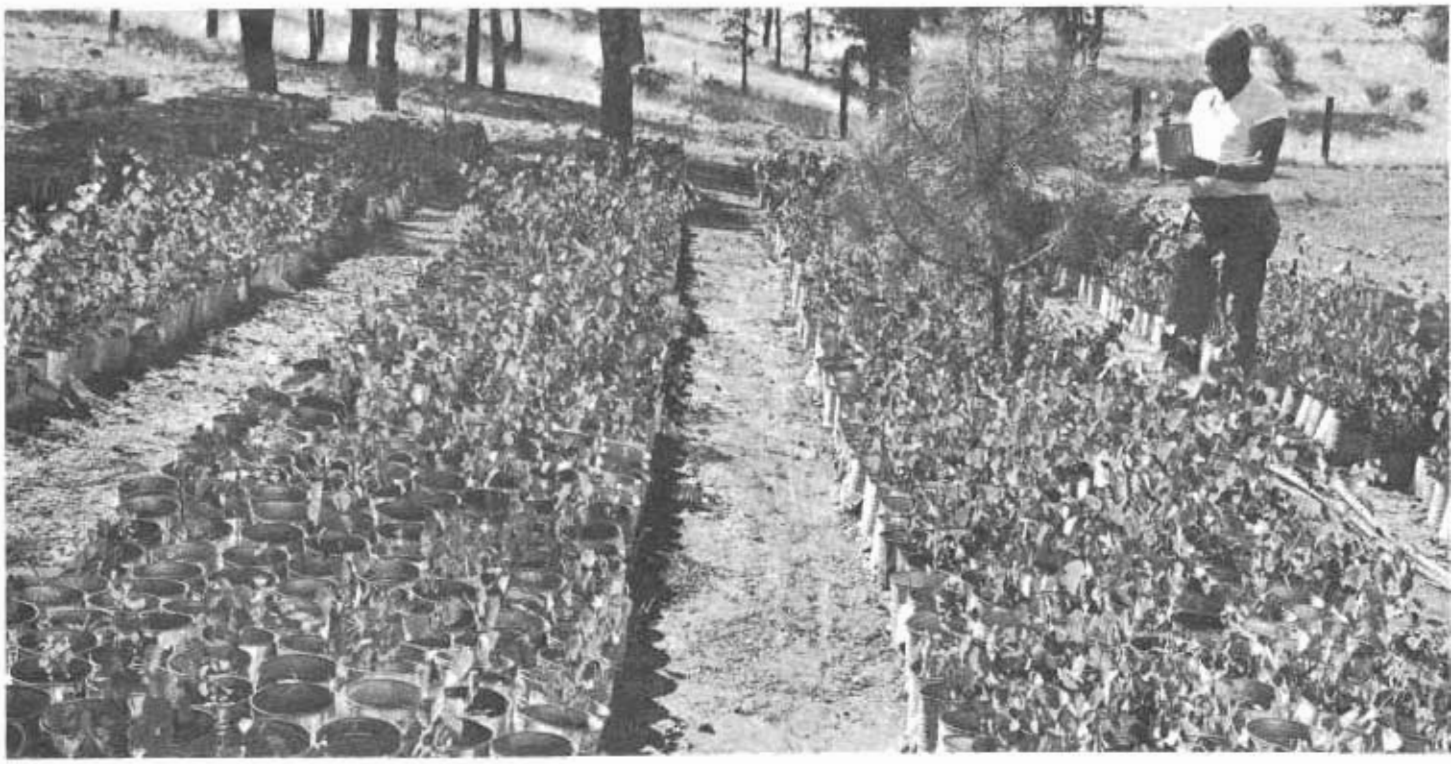
and their do it yourself roadside beautification

Take 25,000 empty two-pound coffee cans, a like number of redbud seeds, add a state highway and mix with the ingenuity, nursery knowhow and enthusiasm of a community and what have you got? Perhaps the biggest do-it-yourself roadside beautification program in the history of California.

The community is the City of Mariposa and the state highway is Route 140, a main entry point into Yosemite National Forest.

The project had its beginning in 1964 with William Brady, who had the thought of planting redbud shrubs throughout the county. Brady, an amateur horticulturist, had developed a successful germinating process that can simulate—in a two-pound coffee container—conditions found in nature. When Brady and a friend, Keith Kaylor, passed the idea on to various civic groups, the Mariposa Chamber of Commerce and the Highway 140 As-

Rows of redbud seedlings are nurtured for their eventual planting to beautify Route 140.



Governor Edmund G. Brown accepts a redbud plant from William Brady. Mrs. Brady watches with Robert Romaine (center right), president of the Highway 140 Association, and Roy Radanovich (right), the group's publicity charman.

sociation agreed to take over.

Last spring they made a nationwide appeal for people to send them empty coffee cans. Thousands were received with many coming in by parcel post. The project seemed to sound a particularly responsive note in Brooklyn for many were forwarded to Mariposa from that city. But Air Force bases, schools and civic groups from all over the nation also responded with bulk shipments.

Since then 8,000 shrubs have sprouted and are being planted. The first was emplanted in a permanent place of honor adjacent to Route 140 during ceremonies on September 21.

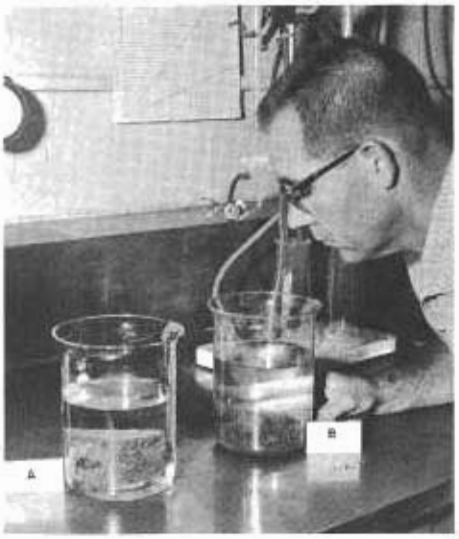
The date coincided with National Highway Week and the California Division of Highways took cognizance of the project by issuing a permit authorizing the planting of a single redbud. Later, a permit covering the remainder of the thousands of shrubs was mailed to the chamber of commerce.

The project has received recognition from numerous officials and private citizens who are interested in beauty. Included are Mrs. Lyndon Johnson, Governor Edmund G. Brown and California's State Highway Engineer, J. C. Womack.

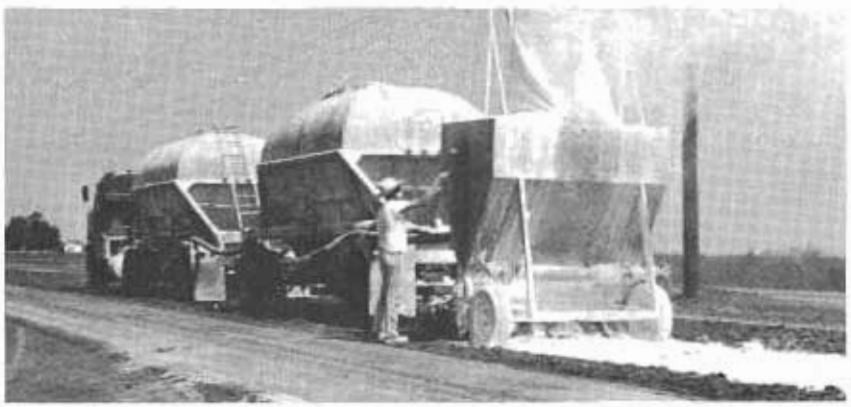
In a letter to the Highway 140 Association, Governor Brown said, "Alaska and Texas may dwarf California in mere geography, but when a group of our citizens envision and carry out a plan such as yours, it again proves that California is second to none in noteworthy accomplishments and love of beauty."

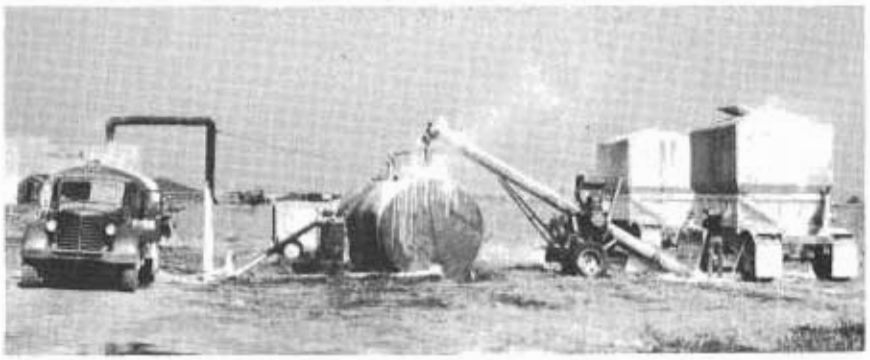
Brady prepares the soil for the planting of the first redbud at a special ceremony in Mariposa.

LIME STABILIZATION



Experiment on cohesiveness of lime-treated clay. Specimen A was kept damp before immersion; specimen B was allowed to dry before immersion. Note B's more rapid disintegration.





PHOTOS LEFT, TOP TO BOTTOM. A tank truck spreads lime slurry in an area where lime dust could cause damage to airplanes stored nearby. SECOND PHOTO—Mechanical road mixing of lime with damp aggregate. THIRD PHOTO—Large tank truck and spreader used in laying dry lime. BOTTOM PHOTO—Dry lime is converted into slurry in mixing tank.

California's Experience With Lime Treatment in Road Construction

By Ernest Zube and Clyde Gates

Introduction

Highway engineers are constantly seeking better and more economical ways of building highways which will safely carry traffic and give more years of service with a minimum of maintenance. This is a never ending job. Design criteria have had to be modified as traffic, and particularly wheel loads have increased. Specifications for road-building materials have had to be more rigid as the supply of good roadbuilding materials becomes scarcer. New materials have had to be found and methods of treating or stabilizing the poorer materials have had to be developed. Newer and better methods of construction have had to be developed.

Rock, stone, gravel and sand have long been used successfully and economically for road building. While these materials are plentiful in many areas of California, there is a scarcity in certain areas. Many of the good sources of aggregates are being depleted or fail to meet the rigid specifications required for modern road building. Urban expansion and zoning ordinances are limiting the development of new sources. In recent years it has become quite obvious that methods of treating or stabilizing local available soils would have to be developed.

Clays or clayey soils are usually quite abundant in areas where good natural roadbuilding materials are scarce. This aggravates the situation, since clays have little load-carrying capacity when wet and therefore require blanketing with thick roadway structural sections. Many methods of waterproofing with bituminous products or stabilizing clays such as blending with better aggregate have been tried but most have been impractical. The most promising stabilizing agent, in recent years, has been hydrated lime. The results in many cases have been phenomenal. These problem clays can now be converted into stable bases and subbases and used in the structural elements of modern highways.

History

The use of lime for the stabilization of soils is not new. Lime is actually one of the oldest man-developed construction materials. Early history does not record the first use of lime stabilization. However, it is known that mixtures of clay and lime were used in constructing the pyramids of Shensi in the Tibetan-Mongolian Plateau more than 5,000 years ago. The Romans used lime in subbases of many of their roads, including the famous Appian Way.

Some interest was shown in lime stabilization in the United States about 40 years ago. A few small experimental projects were constructed but soon failed due to the lack of proper wearing surfaces. The first real lime stabilization project was consrtucted in 1943 by the Corps of Engineers. Two percent of hydrated lime was used to reduce the plasticity of a caliche gravel used as a base course for runways and taxiways at Chase Field in Texas. Since that time the State of Texas has been a leader in the use of lime stabilization.

In the late 1940's the California Division of Highways became interested in lime stabilization. Our Highway District 3, with headquarters at Marysville, was very progressive in its application. Many projects, some of a maintenance nature, were constructed in El Dorado, Placer, and Sutter Counties. The ready availability of a cheap waste lime in this area made its use particularly attractive from an economical standpoint. Two small experimental projects constructed in the Sierra, one near Truckee and the other near Georgetown, were particularly successful * and led to the use of lime on further projects. At the present time, lime is being used on more and more projects by counties, cities, and the state. It is estimated that lime treatment has been used on more than 200 projects in California. Over 600,000 tons of lime were used for stabilization last year in the United States.

Lime Reaction

There are two main chemical reactions which take place when lime and water are added to clayey soils. The first is an agglomeration of the fine plastic clay particles into coarse friable particles through a phenomena called base exchange. This action is rapid and is usually completed within an hour or two if the soil is pulverized and thoroughly mixed with the proper amount of lime and water. The second action is a cementing or hardening action in which the lime reacts chemically with available silica and some alumina in the raw soil forming calcium silicates and aluminates. This is a slow action which continues for a period of a year or longer providing there is adequate moisture available.

Types of Lime

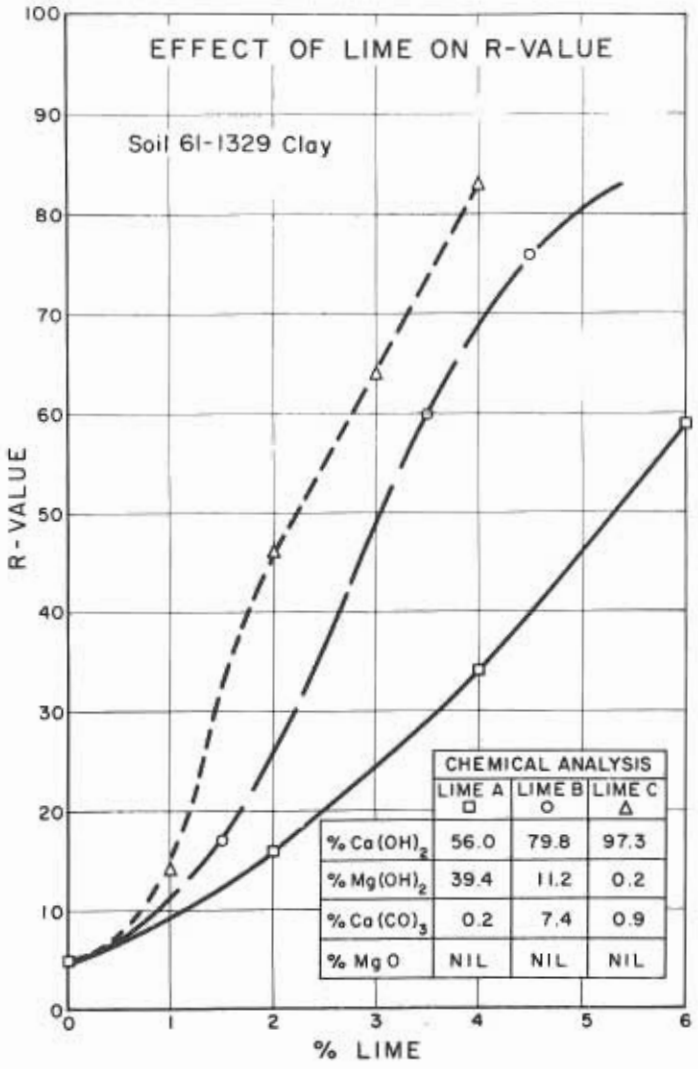
Ground or pulverized limestone is often called "lime." However, when we speak of lime for soil stabilization, we think primarily of calcium hydroxide. Limestone is calcium carbonate and has little or no chemical reaction when mixed with clay soils. When calcium carbonate is heated to a temperature of about 1,800° F., carbon dioxide is driven off and calcium oxide, commonly called quicklime, is formed. Quicklime is quite effective for soil stabilization but is dangerous to use and can produce severe burns when in contact with moist skin. Calcium hydroxide is formed by adding water to quicklime. Calcium hydroxide can also be produced as a byproduct in the manufacture of acetylene and carbide. Calcium hydroxide is the type of lime normally used for treating soils in California. Another type of lime, produced from dolomite, is normally a mixture of magnesium hydroxide and calcium hydroxide and is called dolomitic lime. It has also been used for stabilizing certain types of clays.

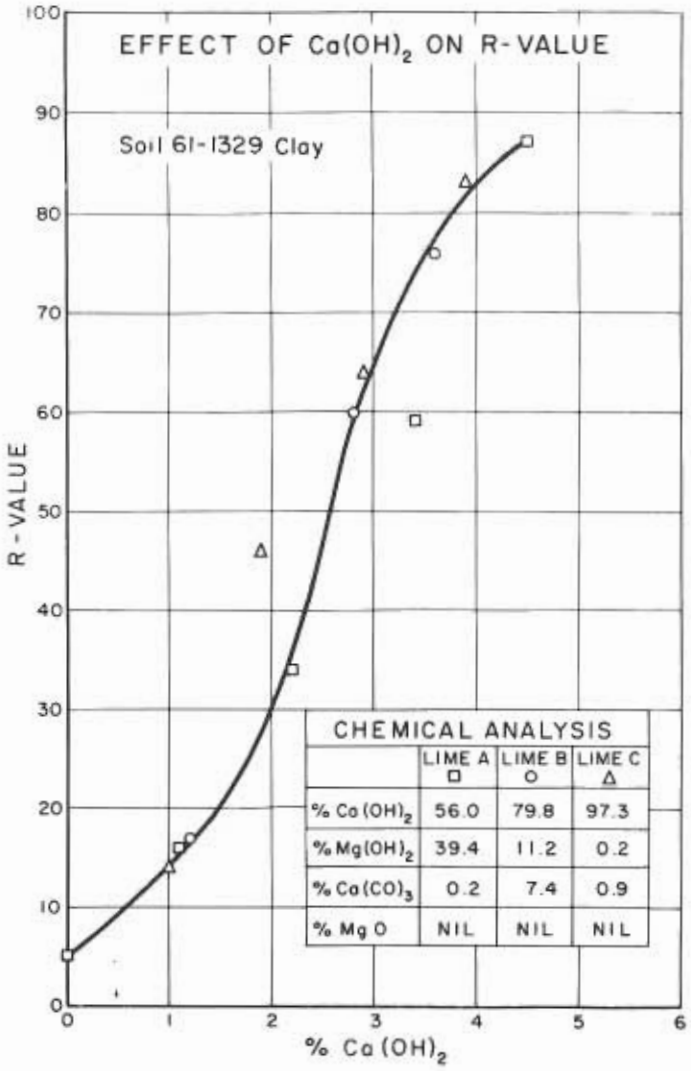
Uses of Lime in Highway Construction

The most common use of lime treatment or stabilization in highway construction is for subbase. Normally the "in place" clayey soil or a locally imported soil is treated with about 3 or 4 percent of lime, by weight of the dry aggregate. The R-value of the untreated soil is frequently as low as five and after lime treatment the R-value is usually well above 60. This type of treatment has been used successfully on many projects. (R-value is resistance to deformation.)

Graded aggregates which contain plastic fines can be treated with lime and used as base material. Even heavy clays have been treated with lime and used as base material on secondary roads having light traffic. However, experience with this latter type of design is limited, especially insofar as heavy traffic is concerned. Laboratory tests indicate that the R-value of many clays, when mixed with from 4 to 6 percent lime, can be raised to 80+. However, designers should proceed with caution until more information is available on field performance. Several experimental projects are under-

* *These projects described in article entitled "Experimental Use of Lime for Treatment of Highway Base Courses" by E. Zube,* California Highways and Public Works, *July–August 1950.*





way to gain objective knowledge in this area.

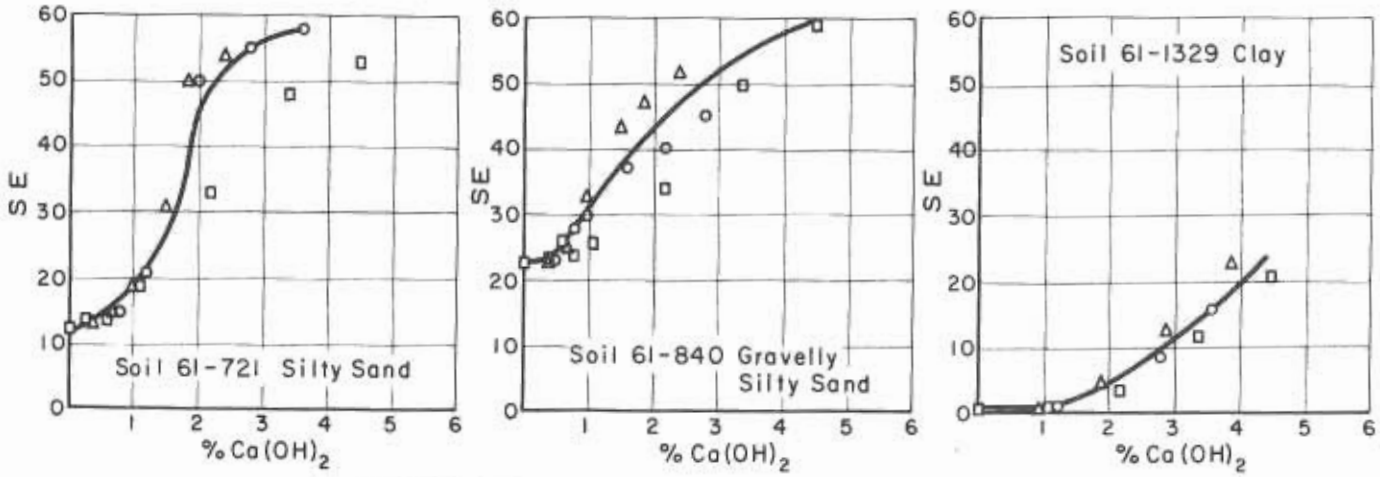
Another use of hydrated lime has been for the treatment of expansive clay soils under portland cement concrete pavements. The lime reduces the expansion of the treated layer and also serves as a moisture barrier, thus preventing water which might enter joints or cracks in the pavement from getting to the expansive clays in concentreated amounts and raising the joints. By using lime treatment it is often possible to decrease the thickness of aggregate subbase by as much as two feet, thus effecting a substantial saving in cost.

Lime is also used successfully for treating wet subgrades which will not support construction equipment. The lime not only blots up some of the excess moisture but also stabilizes the layer to which it is added. Therefore, lime treatment of wet subgrades can speed up construction by negating the need for extensive digouts or delays in drying operations.

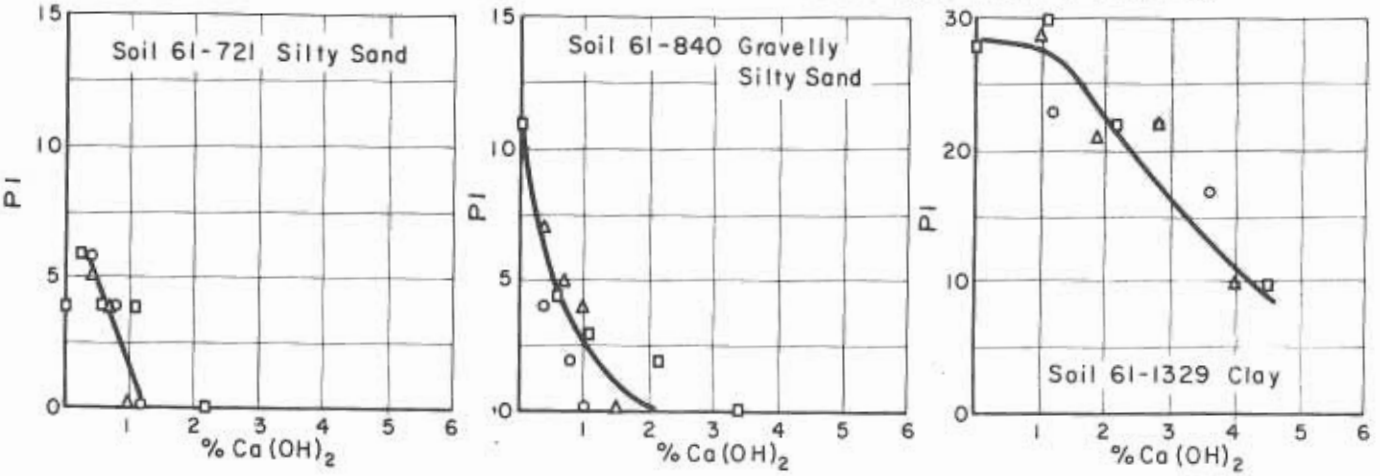
In certain areas of California there is a scarcity of good mineral aggregate for asphalt concrete. One such area is in Modoc County where asphalt concrete pavements, using highly absorptive local aggregates, have shown early failures due to stripping, raveling and cracking. Texas has had similar problems with their aggregates in the Panhandle area. They found that lime treatment of the mineral aggregate, before the addition of the asphalt, corrected the problem. Therefore, it was decided to use this method of treatment on a project just completed in Modoc County near the town of Likely. One percent of hydrated lime, in a slurry form, was added to the mineral aggregate before it passed into the drier. Laboratory tests show that the lime treated aggregate has satisfactory resistance to moisture.

About two years ago the Oklahoma Highway Department developed a new maintenance technique referred to as "drill-lime stabilization" for correcting both distressed flexible pavements and sliding highways fills. With this technique, hydrated lime is introduced into the wet unstable plastic subgrade by means of holes drilled through the pavement. It is claimed that the lime permeates through the subgrade, stabilizing it to the extent that further distress is minimized or even stopped. The holes are usually about nine inches in diameter and about 30 inches deep and spaced on approximately five-foot centers. About one-half sack of lime is poured into each hole, water added and the holes backfilled, tamped and patched. In California, at least three

EFFECT OF CALCIUM HYDROXIDE ON SAND EQUIVALENT



EFFECT OF CALCIUM HYDROXIDE ON PLASTICITY INDEX



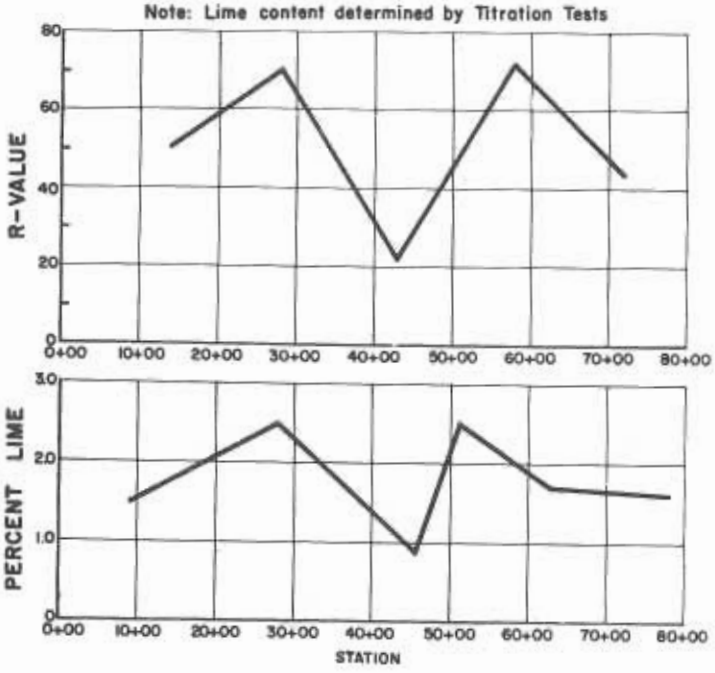
small projects with drill-lime have been constructed, but it is too early to determine their success.

On a recently completed freeway in the Sierra, a large side hill fill began to show signs of slippage after a wet winter, with failure apparently imminent. Horizontal drains were installed to remove as much water as possible. As an added precaution, six-inch-diameter vertical holes on five-foot centers along both shoulders, were drilled through the fill, some to a depth of 70 feet, to intercept the potential slippage plane. The holes were filled with a thick lime slurry and again refilled after a period of standing. The fill has now gone through another winter without failure. It is recognized that the horizontal drains had the most effect on the stabilization, however, we feel that the drill lime contributed somewhat to the stabilizing effect.

COMPARISON OF LIME CONTENT WITH R-VALUE ON STREET SAMPLES OF LIME TREATED SUBBASE

MATERIAL FROM ALTHEA AVENUE, FRESNO COUNTY PROJECT

Note: Lime content determined by Titration Tests



Hydrated lime can be used to reduce frost damage in subbases and basement soils. At the Wingate Ordnance Depot at Gallup, New Mexico, lime treatment of existing base course materials eliminated frost-heaving damage on roads which previously had perennial problems of frost heaving. Luckily in California frost heaves are a minor problem.

Construction Details

The construction procedure for lime treatment is similar to that used for road-mixed cement treatments. The only difference is that lime treatment is not as critical to mixing delays.

The soil or aggregate, either material in place or imported, is brought up to the proposed finished surface of the layer to be treated and then rolled. The compacted surface is carefully trimmed to grade so as to provide the proper amount of material for lime treatment. The aggregate is then loosened to the proper depth. Dry clayey soils should be premoistened to facilitate pulverization of clods.

Lime, in either the dry form or in a slurry, is spread in carefully measured amounts. Mixing is then accomplished by a road-mixing machine which adds the required amount of water during the mixing operation. If clay lumps persist after the first mixing, the material should be allowed to "mellow" for a day or two and then remixed.

The distribution of lime is checked by the titration test method No. Calif. 338. If the lime content varies more than 0.6 percent lime from the planned lime content, the cause is determined and corrective measures taken before proceeding with further operations.

After the mixed material has set long enough for the clay to become nonplastic, sometimes only an hour or two, the material is spread to the required thickness and compacted.

Compaction should be accomplished within 48 hours after the addition of lime and water to the soil or aggregate. Measurable reduction in quality takes place with certain types of soils when delays in compaction exceed 48 hours.

Good compaction is essential for best results. A sheepsfoot or segmented roller is best for initial compaction to insure good density in the lower portion of the layer. The final rolling can be accomplished by pneumatic-tired or steel-tired rollers.

Compacted lime treated soils should not be reworked after the material has been compacted and cured for a few days. This reworking disrupts the cementing action and permits additional carbonation of the lime. Therefore, there is less available lime for further cementing action. The reworked material will usually have lower strength than the undisturbed material. If reworking is necessary, additional lime and water should be incorporated before recompacting.

Lime-treated soils should not be permitted to dry out after mixing. The chemical action not only ceases when the lime dries but some carbonation of the lime takes place, thus preventing a complete return of the chemical action when water is again added. California specifications require the compacted lime treated material to be kept damp until such time as the curing seal is applied. Liquid asphalt MC-250 is normally used for the curing seal.

Research

The Materials and Research Department of the Division of Highways has been interested in lime stabilization for many years and has been exploring the possibilities of expanding the use of lime for various types of construction. Several research projects have been undertaken.

In 1961 a research study was undertaken to determine the effect of the calcium hydroxide content upon stabilizing ability of lime. This study revealed that the higher the percentage of calcium hydroxide, the greater the improvement in R-value, sand equivalent and plasticity index. The results shown in Figures 1, 2 and 3 taken from a paper presented at the University of the Pacific,* shows some of the data.

The early specifications for lime in California called for a minimum of 85 percent calcium hydroxide. However, this required a high grade limestone to be used. An economic study in 1962 showed that a saving could be made by lowering the calcium hydroxide requirement to 75 percent minimum, thereby permitting the use of lower grade limestone, but requiring the use of a little more lime.

Several years ago a titration test, test method No. Calif. 338, was developed for determining the percentage of cement or lime in treated soils and aggregates. This test has been very helpful for controlling cement and lime distribution during construction.

The use of lime for treating expansive soils, when used under portland cement concrete pavements, was the subject of a research project during the past year. While the project is not completed, the results have shown conclusively that lime treatment of a six inch layer of clay is effective in eliminating the expansion of the layer and also in forming a barrier for preventing water which enters joints and cracks in the pavement from getting to the expansive basement soils in concentrated amounts.

A research project is now underway on a current construction project for determining the benefits of using a lime treated heavy clay for base and subbase under an asphalt concrete pavement.

In the near future, it is planned to develop improved tests for a better evaluation of lime treatment. It is intended to explore present construction methods with the hope of improving uniformity of mixing. Another project that will be investigated is the basic reaction between lime and various types of clay.

Conclusions

Lime treatment provides a means of utilizing low-quality aggregates and soils in the structural design of highways. In many areas of the country this is important since good aggregates are not always available within reasonable haul distance. The decision to use lime treatment, in lieu of other types of construction, should be based upon economic cost comparison.

Not all types of soils and aggregates respond favorably to lime treatment. Lime treatment is most effective with clayey soils or gravel-clay mixtures. It can make the clays friable, reduce the plasticity index, increase the sand equivalent, increase the R-value and reduce the amount of volume change. Sands and the coarser silts are generally not benefited by lime treatment. Laboratory tests, such as the R-value (test method No. Calif. 301), should be used for determining the beneficial effects of lime treatment and the percentages of lime to use. Additional lime, usually about 0.5 percent, should be included to compensate for construction variations.

Good construction control is essential for consistent results. It is necessary that the proper amount of lime and water be used and that uniform mixing, proper compaction and adequate curing be maintained.

The use of lime in highway construction has increased during the last few years and will undoubtedly continue to increase as sources of good aggregates become scarcer.

California's Experience With Lime Treatment of Soils and Aggregates by Clyde G. Gates, Fifth Annual Highway Conference, University of Pacific, Stockton, 1962.

STATEMENT BY GOVERNOR EDMUND G. BROWN

I was grieved to learn of the death of George T. McCoy, former State Highway Engineer and Chief of the Division of Highways, who retired in 1959.

It was under Mr. McCoy's strong and capable leadership as State Highway Engineer from 1943 to 1959 that California attained a position of preeminence throughout the nation and the world in the development of freeways and other contributions to the economy, efficiency and safety of motor vehicle transportation so essential to the growth and welfare of our state.

It was given to him to be the one in charge of the vast expansion of our state highway system which represented the expenditure of more than 2½ billion dollars and construction of 2,300 miles of multilane, divided highways.

Mr. McCoy was accorded nationwide professional recognition and honor. He was elected president of the American Association of State Highway Officials in 1954. In 1958 he received the Thomas H. MacDonald Award for outstanding achievement in the development of highways.

His career reflected great honor on our state and its highway program.

Internationally Known Former State Highway Engineer G. T. McCoy Dies

A few years before her death a writer interviewed Mrs. Edith Wilson McCoy on the subject of her husband, George T. McCoy, who at the time was the California State Highway Engineer.

"George has never been interested in acquiring personal wealth," Mrs. McCoy said.

"His life has always been on the idealistic side. He finds satisfaction in building something worthwhile and enduring, and building it so as to do the most good for the most people."

Although she preceded him in death, Mrs. McCoy's words make an epitaph worthy of George T. McCoy, who died Christmas eve, 1965, at the age of 76.

There were many facets to the man. He was a classical scholar who spent eight years studying Greek and Latin. He was an athlete who won college letters in football, basketball and track. He was an engineer and worked at his profession for more than 44 years—32 of them with the California Division of Highways and 16 of those years (1943–1959) as State Highway Engineer.

He was responsible for the spending of more than 2½ billion dollars in tax funds during the period he served as State Highway Engineer, and he lived up to his Scottish ancestry by making sure that full value was returned for every single dollar.

He tried to avoid arguments, debates and controversy. Nevertheless, McCoy was a master of logic and always stated his recommendations and position in a firm but soft-spoken voice.

McCoy was born on September 12, 1889, on a ranch near Milton, Oregon. After completing grammar school, he attended Pearson's Academy and Whitman College (both in Walla Walla, Washington).

He graduated from college in 1913 with an A.B. degree, *summa cum laude*. It was at Whitman that he first became affiliated with Beta Theta Pi fraternity. The scholastic honor society, Phi Beta Kappa, did not have a chapter at Whitman during the years that McCoy attended, but when one was organized there in 1918 McCoy was one of those retroactively chosen for membership.

It was at Whitman that McCoy first met Edith Wilson, and when they graduated he proposed marriage, but she insisted that first she wanted to go to an eastern school for postgraduate work.

Going east fitted in with McCoy's plans, for he, too, wanted to continue his education. Although his undergraduate work was preparatory to entering law school, McCoy had decided to switch to engineering and intended to enroll at Massachusetts Institute of Technology.

But Edith Wilson had enrolled at Columbia and McCoy stopped off in New York to help his fiancée get settled. He never got back on the train but changed universities instead and graduated from his civil engineering studies at Columbia in 1915.

McCoy returned to the west coast, for Miss Wilson had joined the faculty of Spokane's College of Puget Sound. The couple were married in that city on April 3, 1916.

McCoy's first job in 1916 was as an instrumentman for the Washington State Highway Department, and his salary was $65 a month. Of course there were fringe benefits such as assignments in 28 different locations the first year.

But the newlyweds found moving wasn't difficult, for the highway department furnished them with a tent that included a portable board floor. A few packing cases that doubled as furniture carried their belongings safely to the next place they pitched the tent.

The McCoys kept on the move until 1927, for during those years he worked as a bridge engineer in North Dakota, as a highway engineer in Idaho and Montana for the federal Public Roads Administration, and once again for the Washington State Highway Department.

He remained with the organization until 1927 and then joined the California Division of Highways.

California's present State Highway Engineer, J. C. Womack, worked in close association with McCoy for a number of years.

"California will reap benefits from his highway planning for the next several generations," Womack said. "Every person who drives on the state highways is indebted to George McCoy, for much of the system's efficiency is directly attributable to the leadership and guidance that he provided for so many years."

John Erreca, the Director of the Department of Public Works, was a mayor and a county supervisor during some of the years McCoy served as State Highway Engineer.

"His integrity was his shield," Erreca said in describing McCoy. "It didn't matter how big or small a community's problem might be, if it had to do with highways, Mr. McCoy was anxious to know about it and help if he could.

"But there was one thing always certain. Political pressure wasn't going to sway him, for he had no pet projects. He was guided solely by the merits of each situation."

The Administrator of the California Transportation Agency, Robert B. Bradford, also was well acquainted with McCoy. "George McCoy was a quiet, modest person who made immeasureable contributions to his adopted State of California. He will be long remembered by those who knew him as a man who willingly gave much and asked for little in return."

McCoy's contributions have received previous recognition. In addition to serving as president of AASHO, he was the recipient of that organization's Thomas H. MacDonald Award in 1958. The MacDonald Award is presented for "outstanding service in highway engineering."

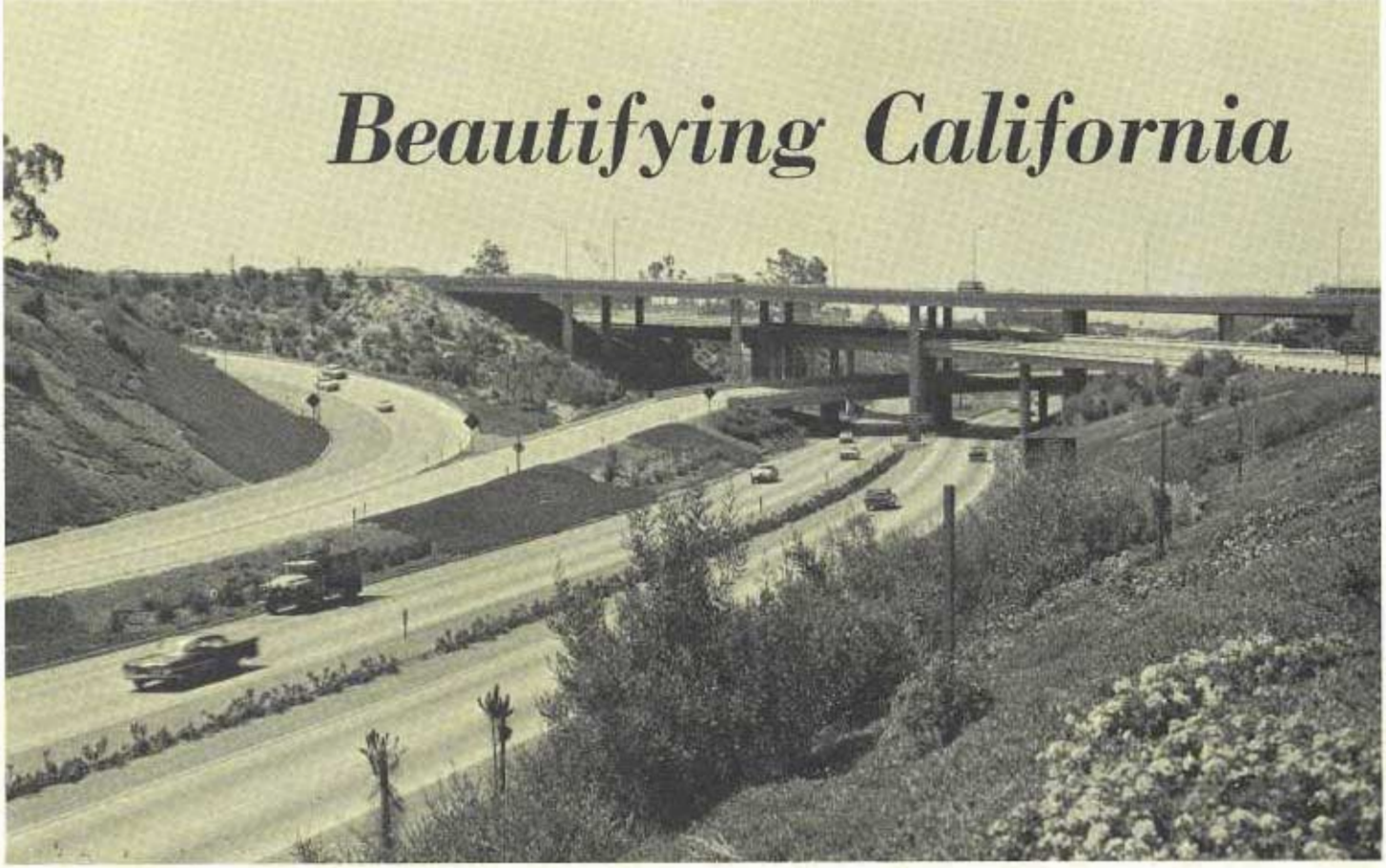
And just before he retired in 1959, separate resolutions honoring McCoy were adopted unanimously by the State Senate and the Assembly. House Resolution Number 346 was introduced by Assemblyman Vincent Thomas of San Pedro, and Senate Resolution 168 by Senator Randolph Collier of Yreka.

Both took note of the growth and progress of California highways during Mr. McCoy's 16-year tenure as State Highway Engineer and called attention to the nationwide professional honors accorded to him.

Mr. McCoy is survived by a son, George T. McCoy, Jr., and two granddaughters. The younger McCoy also is an engineer and resides with his family in Millbrae.

Funeral services were held in Sacramento on Tuesday, December 28, 1965.

Beautifying California



Four-level interchange in downtown San Diego at junction of Cross Town Freeway and US 395 through Balboa Park. Beauty of landscaping here was factor in award to District 11 from Downtown Improvement Association.

With additional funding for highway beautification, and more liberalized directives on the spending of these funds, activity in this facet of highway design has been considerably increased recently.

Typical of these activities are a recent award of the largest highway landscaping contract ever let in California; appointment by State Highway Engineer J. C. Womack of a special beautification committee in the Division of Highways; and substantial changes in the Division of Highways landscaping section.

The three-man committee to coordinate the division's efforts at highway beautification, and to develop special training in aesthetics for Division of Highways employees, is composed of Design Engineer A. C. Estep, Bridge Planning Engineer A. L. Elliott, and Principal Landscape Architect D. P. Van Riper.

At the time of the appointments, State Highway Engineer Womack said, "We are simply centralizing a program that has been in effect—and successfully so—for many years. In 1964 three of our freeways received national recognition in the *Parade* magazine 'scenic highway' contest. This year three state highway bridges have won blue ribbons and two others won merit awards in similar competition."

Winners in the *Parade* magazine contest are chosen for their success in a "marriage of the designs of man and nature." The bridge awards were given for cleanness and simplicity of design, plus the success of the designer in fitting them into their environment.

Starting in January this year, the division instigated a new training program in aesthetics for all levels of employees. Top-level engineers participated in six-hour workshop sessions, and beginning in February this program is being extended to the 11 highway districts, with special emphasis on the application of aesthetics to problems of design, right-of-way construction and maintenance.

In November 1965, the name of the Headquarters Roadside Development Department was changed to Headquarters Landscape Architecture Department. The change in name was made as more indicative of the various functions of the department, since roadside development is but one part of its responsibilities. The unit continues as a part of the Planning Department of Headquarters.

James Gordon, senior landscape architect, has transferred from the District 7 office in Los Angeles to the District 4 office in San Francisco, to head up a reorganized landscaping section there. He will also have additional duties as chairman of the District 4 Aesthetics Committee. Replacing Gordon in charge of the Los Angeles unit is Richard Paine, promoted to senior landscape architect from his position with the Division of Beaches and Parks in Goleta.

Since the Legislature made the scenic highway system into law in 1963, this program also has taken long strides forward. There is now a Citizens Advisory Committee composed of specialists in design and aesthetics, and also an Interdepartmental Coordinating Committee of qualified individuals of the various agencies involved.

Early in January the Department of Public Work's *Guide for the Designation of an Official Scenic Highway* came off the press, and was immediately mailed to all local governing bodies in the state. The booklet, which spells out the minimum standards to be met for a scenic highway, goes into considerable detail on what must be expected from such a highway.

One of the introductory paragraphs of the new book covers the subject of responsibilities. In clarifying this point,

it quotes from the scenic highways portion of the Streets and Highways Code as follows: "The department [of Public Works] shall take into consideration the concept of the 'complete highway' which is a highway which incorporates not only safety, utility and economy but also beauty. The department shall also take into consideration in establishing such standards that, in a 'complete highway,' pleasing appearance is a consideration in the planning and design process. In the development of official scenic highways, the department shall give special attention both to the impact of the highway on the landscape and to the highway's visual appearance."

This section also says that "The standards . . . shall . . . require that local government agencies have taken such action as may be necessary to protect the scenic appearance of the corridor, the band of land generally adjacent to the highway right-of-way, including, but not limited to, (1) regulation of land use and intensity (density) of development; (2) detailed land and site planning; (3) control of outdoor advertising; (4) careful attention to and control of earth moving and landscaping; and (5) the design and appearance of structures and equipment."

Typical of the chapter on "Criteria for Delineating the Scenic Corridor" is paragraph 3.3.3—Ecology. It says "An ecological unit is often destroyed when parts of it are encroached upon or damaged. The integrity of such unit, and the flora and fauna constituting its scenic value, should be preserved by including all of it in the corridor wherever feasible, regardless of the visibility factor."

There has also been activity in the highway districts. In San Diego District 11 was recipient of an award from the city's Downtown Association, for "Improvement and Beautification of Downtown San Diego." The citation was given in recognition of outstanding leadership, property improvement and beautification through the design and landscaping of the Interstate 5 and US 395 freeways in San Diego.

District 7, Los Angeles, has advanced the cause of highway beautification through joint programs with communities and girl scout troops. The attendant newspaper publicity featuring the tree-planting program has been excellent. (See photo herewith.)

On November 10 a teletype went out to all highway districts to report junkyards needing screening, so a priority program could be set up for this work. Although only about $100,000 of federal and state matching funds will be available for this work in the fiscal year 1966, a number of projects are already in the planning stage.

In December the Highway Commission acted on a federal grant of $5,214,000 for restoring, preserving or enhancing the scenic beauty of California state highways.

"Every project is a brand new one that for lack of funds could not possibly be included in the California Division of Highways budget just approved in October," Robert B. Bradford, Transportation Agency head, declared.

"When the Congress approved the distribution of these funds to the 50 states, there was considerable speculation that some states might simply divert them to projects that could be financed from other sources. That won't be true in California, for every cent of our share is pledged to improvements that we know our citizens want, need and deserve but for which no funds were available."

Unlike the junkyard screening funds, the money for these projects is a direct grant without any matching state funds being required. It is California's share of $60 million apportioned to the states as a part of the federal Highway Beautification Act of 1965 that was signed into law by President Lyndon B. Johnson in October.

State Highway Engineer J. C. Womack identified 31 locations where safety roadside rests will be built and five others where rights-of-way will be purchased so that similar construction can take place when more funds are available. Womack also identified 10 highway locations where vista points will be located and 27 others where landscaping projects will be accomplished.

The right-of-way purchases will require only $291,800 and the remainder will be devoted to development.

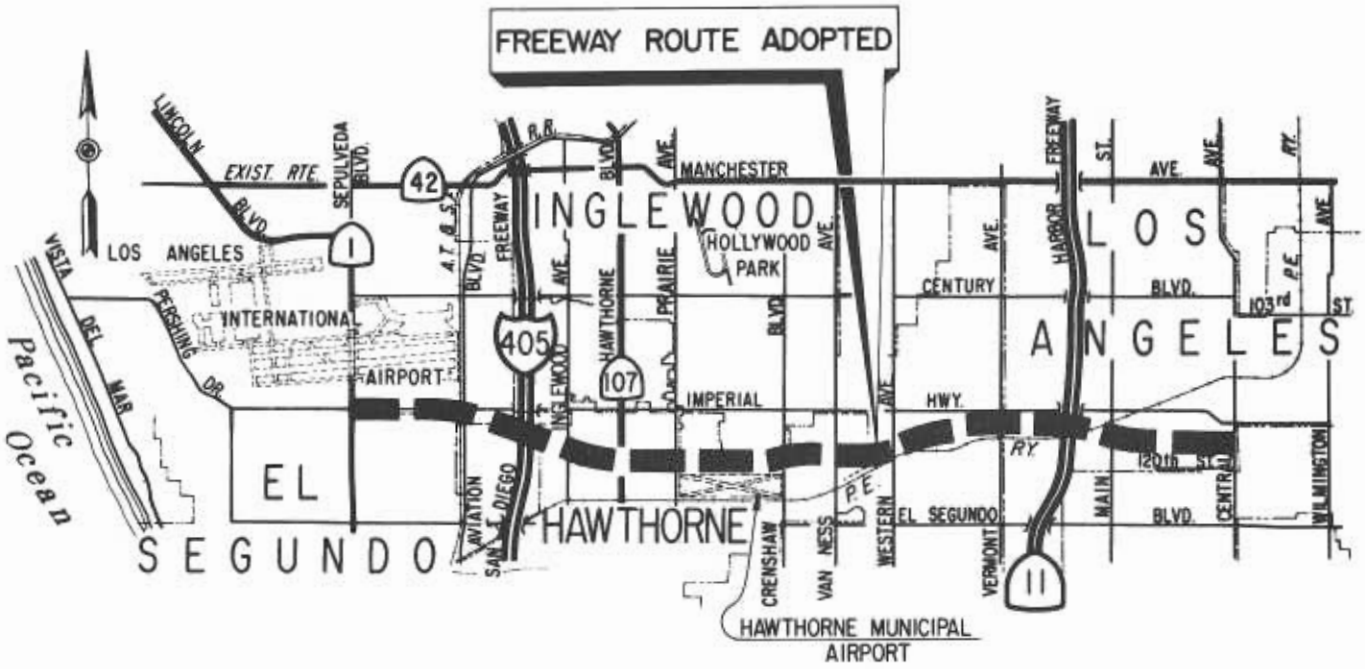
The locations of construction projects are listed on the following page.

Los Angeles area Girl Scouts planting pines on the cut slopes of the San Diego Freeway in joint operation between Los Angeles Beautiful group, Western Federal Savings, Richfield Oil, and Division of Highways. In December girls returned and planted 200 Aleppo pines furnished by Los Angeles County.

Mr. O. Henry, Jr., of Western Federal Savings and Loan Association, Panorama City, poses for picture with Los Angeles area Girl Scouts Judy and Janet McKinley. Tree in photo is one of 1,500 eucalyptus donated by Henry's company, and planted by 200 Girl Scouts during National Highway Week to beautify state freeways in Santa Monica Mountains.

BEAUTIFICATION PROJECTS

County	Route	Description	Approximate mileage	Estimated cost
Del Norte	199	At Collier Tunnel; grading to improve view	0.7	$15,000
Humboldt	36	At Devils Elbow, approximately 7.7 miles west of Bridgeville; vista point	..	6,500
Humboldt	101	About 8.5 miles south of Myers Flat; safety roadside rest	..	75,000
Humboldt	101	1.7 miles south of Fortuna to Elk River; functional and tree planting	15.7	22,500
Humboldt	101	Mad River, approximately 0.3 mile north of Arcata to 0.2 mile north of Little River; functional and tree planting	8.0	10,000
Humboldt	101	At McKinleyville Vista Point; 4.1 to 4.3 miles north of Route 200; convert to safety roadside rest (lighting, picnic tables, comfort facilities)	..	40,000
Mendocino	101	6.0 miles north of Hopland to 0.5 mile east of Forsythe Creek; functional and tree planting	14.5	50,000
Mendocino	101	At Moss Cove, approximately 10.5 miles south of Laytonville; safety roadside rest	..	119,000
Mendocino	101	At Irvine Lodge, approximately 7.9 miles south of Laytonville; safety roadside rest	..	54,000
Mendocino	101	At Empire Camp, approximately 2.6 miles south of Cummings Post Office; safety roadside rest	..	100,000
Lassen	139	At south end of Eagle Lake; vista point	..	15,000
Lassen	395	7.7 miles north of Milford; safety roadside rest	..	42,000
Modoc	299	7.0 miles northeast of Adin; safety roadside rest	..	45,500
Plumas	70	1.5 miles west of Route 89 near Keddie; safety roadside rest	..	37,000
Plumas	70	7.0 miles east of Quincy; safety roadside rest	..	46,700
Shasta	44	3.0 miles east of Shingletown; safety roadside rest	..	46,500
Shasta	44	Approximately 5.0 miles north of Route 89 near Lassen National Park; vista point	..	17,000
Shasta	299	3.5 miles east of Montgomery Creek; safety roadside rest	..	42,000
Shasta	299	Approximately 4.0 miles west of Burney; vista point	..	16,000
Shasta	299	Approximately 1.5 miles west of Fall River Mills; vista point	..	17,500
Siskiyou	97	Approximately 19 miles north of Weed; vista point	..	19,500
Siskiyou	97	21.8 miles north of Weed; safety roadside rest	..	41,000
Trinity	299	3.5 miles east of Weaverville; safety roadside rest	..	32,000
Butte	70	0.1 mile east of West Branch Bridge; safety roadside rest	..	35,000
El Dorado	50	Snowshoe Thompson Memorial Overlook at Echo Summit; vista point	..	30,000
El Dorado	89	Above Christmas Valley on Luther Pass; vista point	..	10,000
Nevada	20	Alpha-Omega Monument, 4.1 miles east of Washington Junction; safety roadside rest	..	27,000
Sacramento	99	At Grant Line Road Interchange; 2 safety roadside rests	..	130,000
Sierra	49	Depot Hill near the Yuba County Line; safety roadside rest	..	17,000
Alameda	17	South of Route 262 to north city limits of Fremont; functional and tree planting	8.6	45,000
Contra Costa	4	East of L Street to H Street in Antioch; landscape	0.2	22,000
Contra Costa	242	North of junction of Routes 680/242 Interchange to Olivera Road in Concord; landscape	2.6	236,000
Marin	131	Blackfield Drive to 0.7 mile west of San Rafael Avenue in Tiburon; landscape, functional and tree planting	1.4	15,000
San Mateo	101	Marsh Road Interchange in Menlo Park; functional and tree planting	..	25,000
San Mateo	114	Cypress Avenue to Route 101; landscape	1.1	25,000
Santa Cruz	35	At junction of Routes 35 and 9; safety roadside rest	..	30,000
Monterey	1	1.3 miles north of Vicente Creek; vista point	..	15,000
Monterey	101	2.5 miles north of Camp Roberts Overcrossing; safety roadside rest	..	75,000
San Benito	25	At Willow Creek, approximately 7.0 miles north of Route 146; safety roadside rest	..	25,000
San Benito	156	Route 101 to west city limits of San Juan Bautista; tree planting	2.4	5,000
San Luis Obispo	1	1.2 miles south to 1.2 miles north of Cayucos; functional and tree planting	2.4	10,000
San Luis Obispo	46	At Cholame Valley Road near Cholame; safety roadside rest	..	70,000
San Luis Obispo	58	0.7 mile west of San Juan Creek; safety roadside rest	..	35,000
San Luis Obispo	101	At Santa Barbara Road Overcrossing, Santa Rosa Road Overcrossing and Curbaril Avenue Overcrossing; tree planting	3.1	5,000
Santa Barbara	101	0.6 mile south to 0.8 mile north of Gaviota Tunnel; 2 safety roadside rests	..	164,000
Santa Barbara	154	0.5 mile north of Cold Spring Canyon Bridge; vista point	..	30,000
Kern	99	1.0 mile north of Herring Road to 0.2 mile south of Planz Road; functional and tree planting	11.1	90,000
Kern	99	Perkins Avenue in McFarland to 0.5 mile south of Woollomes Road; functional planting	4.0	25,000
Tulare	99	Kern County Line to Tulare Airport; functional planting	25.9	160,000
Tulare	99	0.5 mile south and 0.4 mile north of Kings River; 2 safety roadside rests	..	163,000
Los Angeles	7	Long Beach Freeway—Pacific Coast Highway to Willow Street; landscape	1.1	160,000
Los Angeles	7	Long Beach Freeway—Willow Street to Wardlow Road; landscape	1.2	135,000
Los Angeles	11	Harbor Freeway—190th Street to 0.2 mile south of 149th Street; landscape	2.2	260,000
Orange	22	Garden Grove Freeway—Trask Avenue to Manchester Avenue; landscape	2.0	220,000
Riverside	60	Santa Ana River to 8th Street Interchange (portions); landscape	2.6	267,000
Riverside	60	South junction of Routes 60/395 to Pennsylvania Avenue; tree planting	3.3	5,000
Riverside	91	East city limits of Corona to east end of Magnolia Avenue Interchange; tree planting	4.3	6,500
Inyo	395	At Haiwee; safety roadside rest	..	15,000
Kern	14	At Red Rock Canyon; safety roadside rest	..	80,000
Mono	395	North of Casa Diablo; safety roadside rest	..	60,000
Merced	152	Santa Clara County Line to Route 207; tree planting	15.0	25,000
San Joaquin	99	Calaveras River to Armstrong Road; functional and tree planting	7.2	200,000
Solano	21	Route 680 in Benicia to Route 80 near Cordelia; functional and tree planting	13.1	225,000
San Diego	94	22nd Street to west limits of F.A.I. 805 in San Diego; landscape, functional and tree planting	2.3	240,000
San Diego	94	East limits of F.A.I. 805 Interchange to west limits of Route 125 Interchange in San Diego and Lemon Grove; landscape, functional and tree planting	5.7	595,000



Highlights of CHC Actions, Sept.–Dec.

In addition to budgeting more than $739,000,000 for highway purposes in the 1966–67 fiscal year, plus more than $157,000,000 for functions not under state highway jurisdiction, the California Highway Commission made several important decisions involving freeway routings during the last quarter of 1965.

Two freeway route adoptions in Los Angeles County followed community controversies that required public hearings by the Highway Commission itself, after earlier hearings conducted by the Division of Highways.

The first concerned a routing for 8.4 miles of the Route 42 (Century) Freeway, extending from Sepulveda Boulevard (Route 1) at Imperial Highway, near the southeast corner of the Los Angeles International Airport, to Central Avenue in Los Angeles (see map).

The second concerned a 9.3-mile adoption of the Route 2 (Beverly Hills) Freeway from the San Diego Freeway (Interstate 405) through Beverly Hills to Ardmore Avenue in Los Angeles.

The commission also adopted a routing for 8.2 miles of the Interstate 80 Freeway in Sacramento between C Street and the future Route 244 Freeway at existing Route 80 near Watt Avenue. Although the existing route between these limits is constructed to freeway standards, State Highway Engineer J. C. Womack had told the commission that it was not feasible to widen it to the number of lanes that will be required by future traffic.

Because of problems arising from the planning of the City of Fremont's proposed civic center-recreational complex, the commission had authorized the Division of Highways to explore possible alternate routings jointly with the city for the southerly portion of a freeway routing adopted in 1961.

These studies led to the commission revising the routing of a 3.6-mile section of the future Route 238 Freeway between the future Interstate 680 Freeway and Peralta Boulevard (Route 84.)

In other actions, the commission reaffirmed its routings for the Route 1 (Pacific Coast) Freeway through Huntington Beach and Newport Beach; the Interstate 280 (Junipero Serra) Freeway near the Upper Crystal Springs Reservoir in San Mateo County; and the Route 7 (Long Beach Extension) Freeway in Pasadena. Various local governments had urged revising these routings.

The Highway Commission adopts routings for conventional highways as well as freeways. Two such adoptions of considerable interest made in the year's last quarter were a 47-mile routing to extend Route 190 in Tulare County from its present terminus at Quaking Aspen Meadow to Haiwee Pass at the Tulare-Inyo County line, and a 12.7-mile routing for Highway 267 in its entirety between the Interstate 80 Freeway near Truckee, Nevada County, and Route 28 near Kings Beach, Placer County.

The latter route was added to the state highway system by the 1965 Legislature. Its use will result in substantial time-distance savings to motorists traveling to Lake Tahoe's north shore.

At its November meeting, the commission adopted a resolution which directed the Division of Highways to undertake further studies of possible freeway alignments in the Prairie Creek area of Humboldt County, and that would skirt the boundaries of Jedediah Smith State Park in Del Norte County. Both parks contain some of California's prime redwoods.

The commission had earlier resolved to call for practical cooperation between itself, the Depatrment of Public Works and the California Division of Highways with various federal agencies and the California Legislature implementing the federal highway beautification program.

A night view of a pedestrian overcrossing lighted by one of the new fluorescent fixtures.

New Lighting For Pedestrian Overcrossing

By T. N. Kreiberg

The lighting of pedestrian crossings over freeways has usually been limited to installing a few incandescent or mercury vapor lamps on 20-foot standards spaced along the top of the structures. These, with their conduit and embedded pull boxes, are no longer in harmony with the precast, prestressed superstructure design employed today. Since the basic lines of the pedestrian overcrossings are horizontal, vertical standards detract from the basic horizontal silhouette.

An essential part of the pedestrian overcrossings is the chain link sidewalk railing. The top rail on this chain link railing can be used for installing fluorescent lighting.

Development

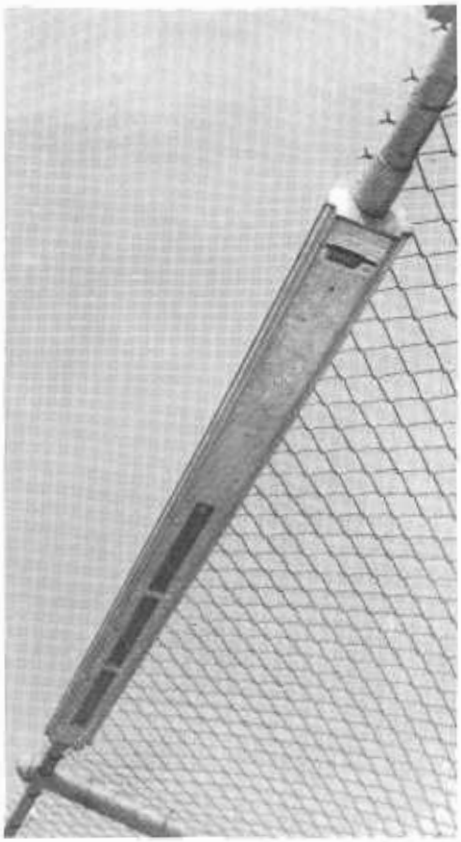
Such a lighting system involves the same problems which were successfully solved in the design of the undercrossing or tunnel fixtures now used extensively in pedestrian tunnels under freeways throughout the state, namely: resistance to vandalism; adequate light distribution; provision for heat dissipation; and easy accessibility for relamping and other maintenance. These problems suggested the use of the fluorescent lamp and plastic lens that had been adapted for the undercrossing fixtures. A four-foot lamp was developed with a ½-inch-wide slit in the phosphor coating along the full length of the glass tube. The lamp operates at a current of 1½ amperes. (This is three to five times the current in the ordinary fluorescent lamp.) Lenses of clear methyl-methacrylate plastic resin castings are mounted parallel to the lamp. This lens system was adapted to fit a protruding aluminum housing of two parts 6 feet 4 inches long and less than 5 inches in width. The fixture can be positioned to concentrate light on any portion of the walkway.

Two such fixtures were produced as the result of a Bureau of Public Roads participating research project. These fixtures were tested in the Materials and Research Department of the Division of Highways. The tests included plotting isolux curves for a variety of plastic lens shapes, measuring temperatures developed in the fixtures, and checking the ability of the fixture to withstand bad weather.

Some improvements were also made in the components of the fixture, including development of a cast methyl-methacrylate resin lens to replace the machined acrylic rods originally used.

Evaluation

The cast acrylic lens afforded an opportunity to experiment with various lens shapes. Three different shapes of hollow lenses were produced and tested in addition to the solid flat lens and solid concave lens. The usable portion of the light is normally considered to be the central 10 feet of the pattern indicated by the unshaded portion of each isolux curve. Ideally, the pattern should extend as far as possible parallel to the fixture. There was not much difference in the shapes produced by the lenses, as far as the light in the usuable portion was concerned. The isolux curve of the hollow concave lens appeared to extend slightly farther and consequently is being used for the time being. It may be possible to improve the lengthwise distribution of light by



A new fluorescent luminaire unit in a chain link sidewalk railing.

A pedestrian overcrossing with the old-style luminaires mounted on 20-foot standards.

The Tweedy Lane pedestrian overcrossing in Los Angeles with the new-style fluorescent luminaires in the chain link sidewalk railing.

further experimenting although preliminary trials with additional prisms in the lenses have not been encouraging.

Tests also showed that an aperture lamp gives twice as much light underneath the fixture as a very high output (VHO) lamp and over twice as much light at a 10-foot distance endwise from the centerline of the fixture.

The water tests included spraying a stream of water from a garden hose nozzle at the fixture at an angle to simulate a wind-driven rain. Some moisture did penetrate the fixture by capillary action through the hinge connection. However, lubrication of the hinge with silicon grease eliminated the leak.

Fixtures will be aimed to direct the center of the light pattern along the centerline of the structure walkway. This would normally tilt the fixture about 15 degrees from the vertical, causing any moisture to collect on the inner surface nearest the hinge and drain from the end of the door. Fixture wiring from the ballast to the lamps will be clipped to the door on the opposite side of the lamp in order to keep it out of this moisture.

Study of the isolux curves suggests that enough light can be provided with spacing the units 40 feet apart. The light pattern on the walkway is not completely uniform but will be adequate.

Conclusion

The unique feature of this lighting method is the combining of the lighting components and the fence members as one unit in which the top rail not only supports the fixture and houses the circuit conductors but is a structural part of the fence, presenting a neat appearance and simplicity of design.

The fixtures developed as a result of this project are being installed on most pedestrian overcrossings on state highways. The first such installation was the Tweedy Lane pedestrian overcrossing on the Santa Ana Freeway in Los Angeles County which was completed in April 1965. The manufacturer of the fixtures estimates that they can be produced at a cost of under $250 each.

A condulet fitting (upper left) on the end post of the chain link railing on a pedestrian overcrossing.

Langsner Receives A.S.C.E. Award

George Langsner (right), Deputy State Highway Engineer, receives a certificate of appreciation from Wayne MacRostie, president of Sacramento section of the American Society of Civil Engineers, for completing a term of office as chairman of the Highway Technical Division of the national society.

Earl W. Taylor Ends 42-Year Career

District 6 Traffic Engineer Earle W. Taylor retired November 30 ending a 42-year career with Highways.

Taylor was among the first district traffic engineers in the division, being appointed in 1938. From his Fresno-based headquarters, he pioneered numerous improvements in highway design and signing which have had statewide impact in traffic safety. Through his close association with city and county engineers in the southern San Joaquin Valley, he became known as an "experts' expert" in the traffic engineering field.

He organized the first district safety committee in the state and served as a member and its chairman for many years. Upon his retirement he was presented with a certificate of merit citing his 42 years' lost-time-free accident record.

Taylor's first job with Highways was in District 4 working on the Pacheco Pass Road. Later he worked in Districts 1, 3, 5, 7, and 9 before going to District 6 in 1934. During his early career he held engineering jobs with the Oregon Highway Commission, the City of San Francisco, P.G. & E., and the City of Santa Barbara. For 2½ years during World War II, he was highway branch chief of the U.S. Army Transportation Corps covering the six New England states. He retired from the Army Reserve in 1955 as a lieutenant colonel.

He was born in Pullman, Washington, and attended schools there and in Salem, Oregon. He later attended the University of California.

He is a member of the Institute of Traffic Engineers and the Engineers Club of Fresno.

Taylor and his wife, Norma, have two sons, Bob and Bill. Bill is an associate right-of-way agent for the division.

Richard S. Quintrell Retires in Eureka

Richard Samuel Quintrell, assistant highway mechanic foreman at Shop 1, Eureka, has retired from state service.

Quintrell started working for the Division of Highways in June 1938 at Shop 2 in Redding as a heavy equipment mechanic. He later worked at Shops 7 and 9, served in the Army during World War II, and then came to Shop 1 in Eureka in 1945.

Twenty-five-year Awards Announced

The following Division of Highways employees have received their 25-year awards since the last list was published in the November–December 1965 issue of the magazine:

Lloyd A. Lane, Luis Aramayo, Marion W. McCleary, Charles K. Bruner, William Travis, William D. Rambo, Everett P. Pyles, Omar G. Alexander, John H. Bennett, Abe Brodkin, Seymour Cowan, Leo Linde, Arthur E. Bethurum, Bliss A. Hinshaw, Charles L. Sexauer, Dudley B. Hatch, Homer H. Moore, Mary Catherine Malloy, Herbert A. Rooney, Thomas C. Royce, Dale F. Downing, Oliver Arnold, O. W. Perry.

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HARRY D. FREEMAN . . Deputy Director (Planning)
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C. RAY VARLEY . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

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J. A. LEGARRA . . Deputy State Highway Engineer
GEO. LANGSNER . . Deputy State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
FRANK E. BAXTER . Assistant State Highway Engineer
GEORGE A. HILL . Assistant State Highway Engineer
J. C. BURRILL . . . . . Comptroller
NEAL E. ANDERSEN . . . . . Equipment Engineer
JOHN L. BEATON . . Materials and Research Engineer
C. G. BEER . . . . . Urban Planner
A. N. DUNHAM . . . Computer Systems Engineer
ALVORD C. ESTEP . . . . . Engineer of Design
J. F. JORGENSEN . . . . . Construction Engineer
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C. T. LEDDEN . . City and County Projects Engineer
JACK E. PEDDY . . . . Project Control Engineer
DANA G. PENGILLY . . . . . Planning Engineer
E. J. L. PETERSON . . Program and Budget Engineer
R. V. POTTER . . . . Systems Research Engineer
PAUL C. SHERIDAN . . . . . Office Engineer
E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
H. R. HINEMAN . . . Bridge Engineer—Operations
R. J. IVY . . . Bridge Engineer—Administration
DALE DOWNING . . Bridge Engineer—Southern Area

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HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

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SAM HELWER . . . . . District Engineer

District 2, Redding

H. S. MILES . . . . . District Engineer

District 3, Marysville

W. L. WARREN . . . . . District Engineer

District 4, San Francisco

ALAN S. HART . . . . . District Engineer
R. A. HAYLER . . . . . Deputy District Engineer
HAIG AYANIAN . . . . . Deputy District Engineer
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EMERSON RHYNER . . . Deputy Chief (Sacramento)
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printed in CALIFORNIA OFFICE OF STATE PRINTING