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TECHNICAL QUARTERLY

AN EXCHANGE OF IDEAS
Editors:
Richard L. Tyler Kathleen M. Jones

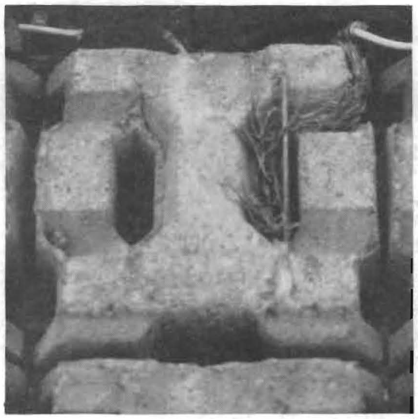
AGAINST THE TIDE: CHANNEL EROSION CONTROL

Undercut timber and rubble retaining wall along SH 82.

Beside Port Arthur's busy ship channel runs State Highway 82. The constant wave action from ships' wakes severely undercuts the right-of-way and, in places, threatens the road itself. Timber bulkheads, steel and concrete retaining walls, piles of concrete rubble, have all proven to be unsuccessful. They are temporary measures at best, preventing undercutting for four to five years.

To find a more permanent solution, Mr. William A. Potter, Supervising Resident Engineer of Nederland, is now testing concrete riprap mat. This mat is a flexible one consisting of 12″ x 12″ x 5″ concrete blocks patterned to reduce wave action. Each of the forty pound blocks has two lateral holes and a longitudinal one through which is strung English made polyester rope. Each mat is 8 feet wide and 50 feet long. The multiple sections are spliced together once the mats are in place on the channel side.

A block of concrete riprap mat.



Flexible concrete riprap mat in place.

Before the mats are placed, the slope is graded to 3:1. Excavations are made at the top and bottom of the slope to receive the anchors and the toe of the mats. Woven geotextile is spread on the upper two-thirds of the slope, non-woven impermeable geotextile on the bottom one-third. The first three rows of the mats are positioned in the top excavation, which has a 1:1 slope at an angle of approximtely 120° to the main slope. The polyester anchor ropes extend from the mats parallel to the 1:1 slope

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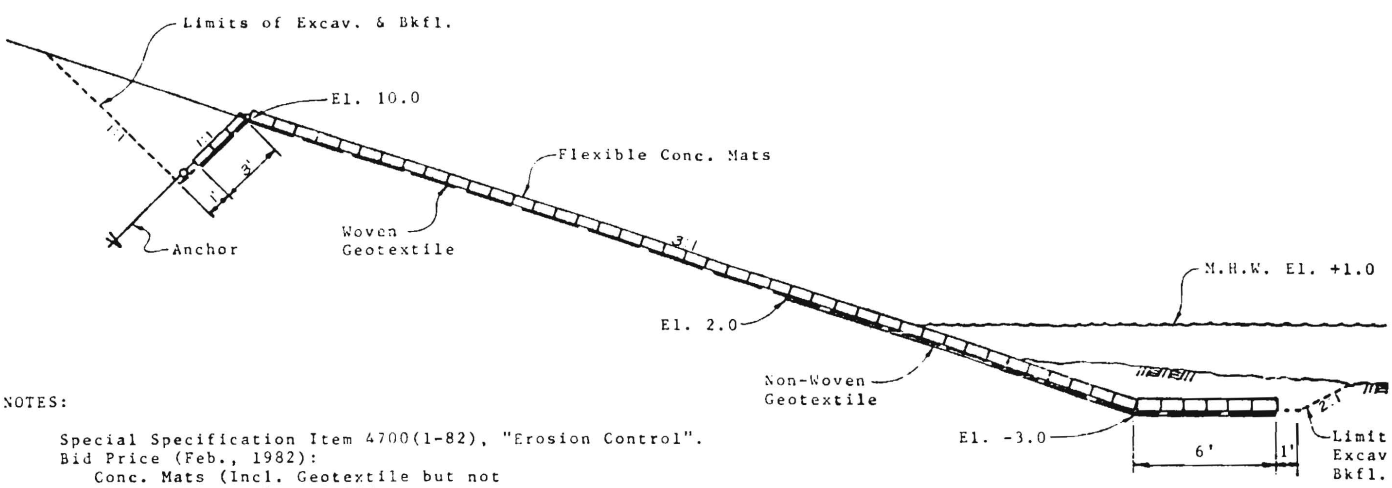


NOTES:

Special Specification Item 4700(1-82), "Erosion Control".
Bid Price (Feb., 1982):
Conc. Mats (Incl. Geotextile but not incl. Earthwork) = $4.60/S.F.
Size of conc. blocks used: 12"x12"x5" thick, wt. = 40#±
Other block sizes available: 70# & 200#
Wave surges caused by ship traffic = 10' max. (usual)

RECOMMENDATIONS:

1. Use polyester rope unless corosion is not a problem, then galvanized steel cable may be used.
2. Anchors & rope should withstand something less than 100% of weight of conc. mat (possibly 50%).
3. Use heavier blocks for severe conditions.
4. Revise Spl. Spec. to fit conditions.
5. Non-Woven Geotextile to be used with clay or silty material only.

EROSION CONTROL SYSTEM
ALONG PORT ARTHUR SHIP CHANNEL
AND STATE HIGHWAY 82
CONTROL 2367-1-22
JEFFERSON COUNTY
Scale: 1"=5'

and are anchored in the opposing face. The top excavation is then backfilled.

Using cofferdams, the bottom excavation is made at an elevation of minus three feet. Originally, the last six of the twelve rows to be buried in the toe excavation flattened out from the 3:1 slope and ran parallel to the channel floor. In order to bury the toe more securely, Mr. Potter now considers it better to continue the slope all the way to the bottom of the toe excavation. After the bottom rows are placed, the toe excavation is backfilled.

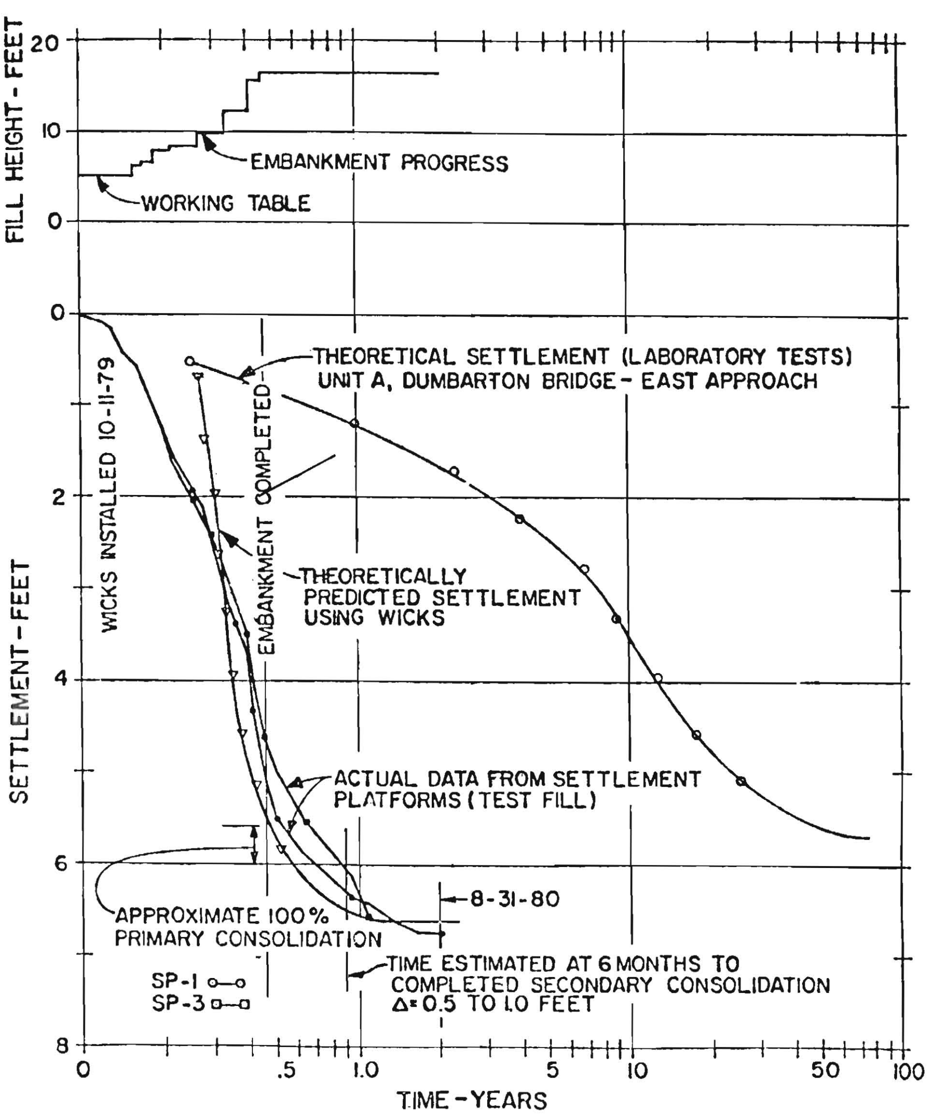
The existing two mile section of flexible riprap mat, which costs 1.5 million dollars for every eight-tenths of a mile, has been in place for a year and a half. In that year and a half, only two sections have failed. Both failures are attributed to the toe washing out and the mats being flipped and pulled by wave action. The two failures occurred soon after placement and are still in their slipped, twisted position; however, even they are not undercutting nor has the failure worsened. Neither they nor the undisturbed sections of mat are showing signs of undercutting. So far, results indicate that flexible concrete riprap mats may be a permanent solution to channel erosion.

Flexible concrete mat may not be the only or the least expensive permanent solution. Plans are to construct some sections of a mattress-gabion system and a grout-filled fabric system. The mattress-gabions are to be formed from Tensar Geogrid® and are to be lined with non-woven filter fabric to hold the slag fill material. The grout-filled fabric bags will be Armor Form® or its equal and will be cabled and anchored in a fashion similar to that of the flexible concrete mats. Comparative cost effectiveness data can be gleaned from studying these three systems side by side.

To meet the challenge of a constantly shifting tidal area, the Texas State Highway Department is using innovative engineers with ideas. ⦿

AN UPDATE ON THE SH 87 WICK DRAIN PROJECT BEFORE SHORT COURSE

State Highway 87 through the Neches River Marsh in Orange County has settled four feet in forty-seven years. It will continue to settle for perhaps the next fifty. This two lane highway, with its twenty foot wide, one hundred seventy-seven foot high ship channel bridge, cannot cope with the present volume of traffic. It must be widened. Do workable techniques exist to stabilize the forty feet of muck on the marsh bottom and to save the new lanes from undergoing a century of slow settling? Mr. William A. Potter, III, Supervising Resident Engineer of Nederland, thinks so. Basing his calculations on the Dumbarton Bridge Project in San Francisco, Mr. Potter is using wick drains in the long approaches to the new SH 87 Rainbow Bridge across the marsh to squeeze the water from the organic clay muck (moisture 80% to 140%, max. 300%; LL 80 to 110; PI 50 to 75) in three years when normally this would take one hundred.



Actual vs. predicted settlement for Dumbarton test site.

Placing wick drains.

Crane with frame and mandrel for drilling wick drains.

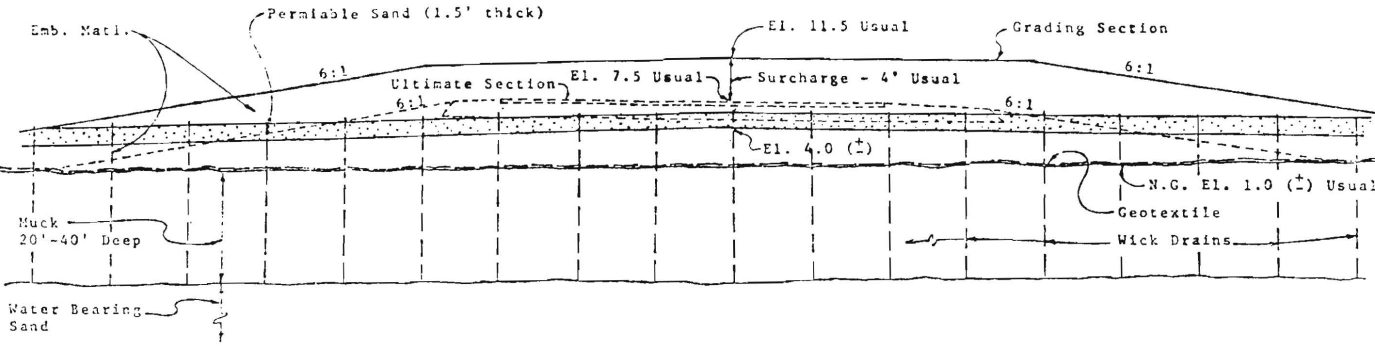
Wick drains are not a recent invention. Mr. Walter Kjellman, of Sweden, first developed them in the early forties. However, due to intrinsic material problems, they did not gain much favor at the time. New materials have been developed since the forties. Because of these newer materials, some state highway departments (Texas, California, and Mississippi among them) are experimenting now with wick drain usage.

The modern wick drain used at the Port Arthur Project is a sleeve of gray poly-fabric wrapped around a wafer of corrugated plastic. Together, the sleeve and core are less than one-fourth of an inch wide. The wick drain material comes in multi-foot rolls. The name "wick" is slightly misleading. The drain does not "wick" the water up from the muck by capillary action. Instead, the drain functions by hydrostatic pressure, rather like an artesian well. The weight of fill upon geotextile spread on the muck forces water up the wick drain and out into a permeable sand layer. From the permeable sand layer, the water evaporates or returns to the marsh.

To install the wick drains strips of woven, semi-permeable geotextile are dragged into the marsh and positioned on the site of the future roadway by airboat and by barge. The twenty-five foot wide strips are field seamed by means of a compressed air sewing machine using a modified lap-felled seam. Four feet of embankment material (a local sand, in this case) is dumped and bulldozed onto the geotextile. On to this layer, a one and a half foot thick layer of permeable sand is added. Six foot spacings for the drains are marked out with red flags in a triangular grid and a crane with a vertical frame and mandrel is positioned over the nearest red flag. The crane carries a roll of wick material attached near the base of the mandrel. The wick material is threaded up the frame and down the mandrel. Where the wick exits the mandrel mouth, an anchoring bar of reinforcing steel is looped into place.

The mandrel is vibrated down into the ground to a depth of approximately forty feet and is withdrawn, leaving the bottom of the drain anchored in the hole. The top of the newly placed wick drain is clipped from the mouth of the mandrel at a diagonal. The process is repeated at each red flag. The fill surcharge is then added.

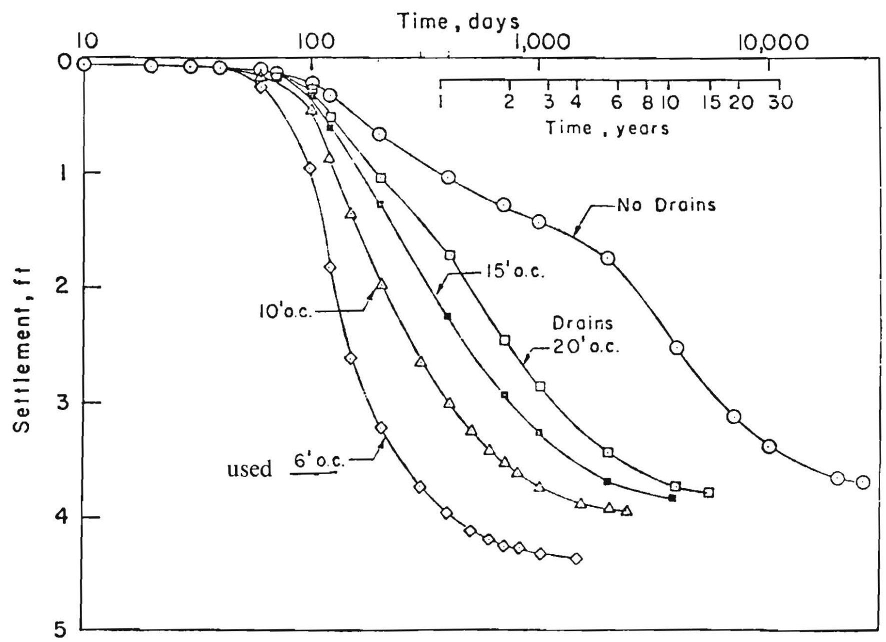
How large a fill surcharge to use is determined by several factors, among



NOTES:
 Tex. Special Spec. 1069(9-82), "Vertical Wick Drains".
 Tex. Special Spec. 1070(9-82), "Geotextile for Embankment".
 Bid Prices (Dec., 1982):
  Wick Drains $0.55/L.F.
  Geotextile $1,50/S.Y.
 Wick Drain Spacing - 6'
 Organic Clay (Muck):
  Moisture 80%-140% Usual (300% Max.)
  LL = 90-110
  PI = 50-75

TYPICAL SECTION
STATE HIGHWAY 87
THRU NECHES RIVER MARSH
ORANGE & JEFFERSON COUNTIES
CONTROL 306-2-52, ETC.

them time span desired, number of drains, soil stability and desired final elevation. A soil analysis is made and used to calculate natural speed of embankment settlement under loading. A decision is made as to how much settling time the embankment needs to stabilize given a certain number of wick drains and how much post-paving settlement is deemed allowable. These two factors are set against the cost of increased numbers of wick drains which would greatly speed compression (the closer the wick drains the faster the settling will take place). From these considerations an optimum number of wick drains and an optimum time length are determined. Of course, a larger surcharge also means faster settling, but here stability problems occur. If more than 8 feet of surcharge is placed at once at the Rainbow Bridge Project, the soil fails by sideslipping. If too small a surcharge is placed, the required settling will not take place in the allotted time and the roadway will continue to settle significantly after the pavement is placed. If too great a surcharge is placed—barring sideslipping—the embankment will settle more than the calculated amount and may actually rebound after the excess surcharge is bladed off and the pavement laid. To achieve a balance between what would be too much and too little surcharge, given the three year time limit for this project, a safety factor of 1.0 was also calculated from soil analysis and field observations. Embankment material theoretically can then be added until the safty factor approaches 1.0. In practice, since the properties of the cored muck samples can not help but be disturbed by the very act of coring them and since laboratory loading of the samples may vary from what the actual field loading may be, it has been found that staying closer to a safety factor of 1.5 rather than 1.0 has produced better results. The desired final elevation is another factor that must be taken into account. Due to hurricanes and tropical storms, this particular section of SH 87 needs a final elevation of seven feet above sea level. Right now it has an elevation of eleven feet, seven of which is surcharge. The elevation is checked against a benchmark sunk to stable sand. The muck beneath will compress four feet (which is ninty percent of the total compression) in three years and will be stable enough to bear the road; it will also be at approximately the correct elevation.



Calculated time-settlement for the "worst condition" soil profile, SH 87. Where drains are used they are installed on day 30, and are 2.7 inches in diameter. The fill elevation is raised to 2 feet on day 0, and to an elevation of 8 feet between days 60 and 120.

To keep within the safety factor, pressure on the system must be monitored. Pore pressure is measured by piezometers buried at quarter points in the muck; 10 foot intervals, in this case, since the muck is about 40 feet deep. Pneumatic lines from the piezometers run to the nearest of several control stations where the pressure is observed daily and logged. Fluctuations in

HYDRATED LIME AND STRIPPING

"Destruction of the stone-asphalt bond by entrance of water has been the subject of many investigations. Unfortunately, most of the tests have been highly empirical. The first work of practical importance was done simultaneously in the United States and Germany about 25 years ago[1935]." So wrote Dr. R.N. Traxler, Research Engineer for Texas Transportation Institute and 21-year veteran of asphalt research for Texaco Inc. in June of 1960.

Complex and elusive, the causes of this physical separation of asphalt and aggregate, known as *stripping,* have defied road builders and researchers for decades. Its elusiveness has given impetus to the peddling of untold quantities of admixtures which range from exotic snake oils to something as common as hydrated lime.

Stripping is a major cause of distress of asphalt pavements in Texas and a familiar problem elsewhere. Visually, it is evidenced by localized areas of excess asphalt known as *patch bleeding* or *flushing.* It causes loss of strength and an increase of deformations, such as rutting and shoving, to occur. Although some asphalts appear to strip more than others, aggregates have more frequently been identified as the culprits.

Researchers at the Center for Transportation Research (CTR) have identified three basic mechanisms of stripping:

(1) Smooth surface textures: may be eliminated by crushing the aggregate.

(2) Surface coatings on the aggregate: may be eliminated by washing the aggregate.

(3) Physical-chemical reactions: of prime concern, these are the least understood. None of the physical-chemical reactions fully explains stripping in all asphalt-aggregate mixtures.

While the causes of stripping are still not well understood, the presence of moisture is almost always implicated. A roadway can perform well for years, showing no evidence of stripping, but then start to manifest stripping within days of moisture penetration into the matrix. This may occur after the placement of a seal coat if moisture is trapped in the old pavement. A further indication that moisture plays a significant role is evidenced by the fact that the eastern, wetter half of the state experiences a great deal more stripping than the western half.

Possibly the foremost preventive measure is to maintain good design and construction practices: provide adequate compaction with air void content (ideally) less than 7%, provide adequate drainage, and seal the mixture surface(s) with consideration being given to the source(s) of moisture. If it is not practical to eliminate the use of moisture-susceptible aggregates, then the alternative is to treat them.

The CTR researchers investigated the use of a number of additives, including commercial liquid antistripping agents, portland cement and hydrated lime. While most of these additives appeared to work with certain aggregate and asphalt combinations, hydrated lime was generally found to be the most effective method for treating Texas aggregates. But regardless of the treatment, tests should be conducted for each candidate combination of asphalt, aggregate and antistripping agent.

Since moisture appears to play a critical part in most stripping, the CTR researchers have recommended three tests for the evaluation of moisture susceptibility of the asphalt-aggregate mixtures. They feel that the stripping proclivity can best be evaluated by running all three tests on the candidate mixtures. The tests are:

(1) Indirect Tensile Test on wet and dry specimens. Moisture susceptibility is determined by the ratio of tensile strength in a wet condition to that in a dry condition. Specimens should have about 7% air voids. Also, the researchers are tentatively recommending that

	BATCH AND DRUM MIX PLANTS			BATCH PLANTS IN PUGMILL PRIOR TO ASPHALT	DRUM PLANTS IN DRUM PRIOR TO ASPHALT
	COLD FEED	PREMIXING PUGMILL	PRIOR TO STOCKPILING		
DRY HYDRATED LIME	Poor mixing and coating; lime lost due to dusting.	Maximizes coating and mixing; some lime lost to dusting.	Not Recommended	Maximizes mixing and coating. Minimizes dusting. May lose some lime in the asphalt.	Definitely not recommended because of loss of lime.
HYDRATED LIME SLURRY	Minimizes mixing and coating. May foul scalping screens.	Maximizes coating and mixing; allows some water drainage.	Minimizes required drying time. Approx. 10 day stockpiling limit.		On slinger belt. Minimizes coating; maximizes the water to be removed.
QUICK (HOT) LIME SLURRY	Minimizes mixing and coating. May foul scalping screens.	Maximizes mixing and coating; allows some water drainage.	Minimizes required drying time. Approx. 10 day stockpiling limit.		On slinger belt. Minimizes coating; maximizes the water to be removed.

pressure warn of instabilities and possible sideslips. Alignment stakes serve as visual monitors. Stakes out of alignment mean earth movement even if the other instruments do not indicate that there is sideslipping.

The Orange County side of the Rainbow Bridge Project is nearly complete. One million, seventy-five thousand, one hundred and thirty-three linear feet of wick drain have been placed. The total cost of the Orange side is seven and a half million dollars, $591,000 of which is wick drain expense. In the scant year the wick drains have been in place on the Orange side, they have caused the roadbed to settle one foot. The Jefferson County side of the project is just getting under way. Its total cost will be three million, ninty-five thousand dollars, $1,012,000 of which will be for the 1,264,530 linear feet of wick drain to be placed.

Even though the Rainbow Bridge Project will cost 10,595,000 dollars, the wick drain expense will be $1,603,000 or about 15% of the total cost. The settling of the old section of SH 87 has cost an estimated one and a half million dollars over and above regular maintenance costs in the last twenty years alone. Until the old section of SH 87 stops sinking sometime in the next fifty years, it will require extra maintenance money each year. The use of wick drains to speed the settling of unstable, waterlogged soil beneath a subgrade, before a road is paved, may be a viable alternative to the constant maintenance that a slowly sinking road requires. ⦿

EVENTS

OCTOBER

10-11 Research Area I, Houston

15 District Engineers Meeting, Texas A&M

16-17-18 Short Course, Texas A&M

18 Research Area 4, Texas A&M

NOVEMBER

13-14 Roadside Vegetation Management Systems Training Seminar, Austin

13-14-15 Occupant Restraint Conference, San Antonio

27-28-29 Geotextile Seminar, D-8 in cooperation with FHWA, Austin

RECENT PUBLICATIONS

"Production of High Strength Concrete," M.B. Peterman, R.L. Carrasquillo, Research Report FHWA/TX-84/31+315-F1, Center for Transportation Research, Austin, 1983, 286pp.

"Evaluation of Asphalt Latex Rubber Blends," D.G. Hazlett, Exp. Proj. 631-1, State Department of Highways and Public Transportation, Austin, 1984,15pp.

"Polymer Impregnated Concrete Bridge Deck—Big Spring, Texas," H.D. Butler, Exp. Proj. 614-3, SDHPT, Austin, 1984, 43pp.

"Thin Bonded Concrete Overlays," D. Muchaw, FHWA/TX84-01 (Exp. Proj. 632-1), SDHPT, Austin, 1984, 13pp.

"The Use of a Stabilizing Additive in Hot Mix Asphalt Concrete," W.D. Clark, FHWA/TX83-08 (Exp. Proj. 629-1), SDHPT, Austin, 1984, 13pp.

EDITORIAL

We've all been hearing a lot about *technology transfer* lately. The Federal Highway Administration has been promoting technology transfer (or T^2 as some call it) for a good many years now. Industry, no doubt, has been developing methods for and promoting the transfer of technology even longer. At first the term seemed to be just some more buzz words, like "high tech," which probably emanated from the bellwether state of California sometime between the blossoming of the aircraft industry and the emergence of Silicon Valley. Perhaps the concept of an orchestrated, well defined program to transfer technology is that recent; but the "communication of applied science" undoubtedly began several centuries before this one.

In pretty fair bureaucrat-ese, technology transfer was defined in "Public Roads" [March 1982, Volume 45, No.4, page 133] as, "... the process by which existing research knowledge and new technology are transferred operationally into useful processes, products, or programs that fulfill actual or potential public or private needs." Fortunately, the writer then summed it up in three words: "Get It Done." The point here is that technology transfer is not new to Texas' highway department. Over the years we have developed a number of ways to communicate technical ideas for the purpose of "getting it done."

Probably the most obvious and longest standing T^2 effort we have is the annual Highway Short Course at Texas A&M (this year's is the 58th). And we have a variety of verbal as well as written techniques for telling each other about technical matters: telephone calls, memos, letters, and research reports all qualify. We have Research Area meetings, laboratory conferences, maintenance conferences and a variety of other gatherings, the primary purposes of which are to afford the communication of technical information.

Less than three years after the Department was established in the Spring of 1917, the first of a series of technically oriented periodicals came off the presses. It was a monthly publication which was called simply "Texas Highway Bulletin." It was followed in 1934 by "Information Exchange," in 1939 by a twice-monthly colored-cover edition of "Information Exchange," in 1950 by "Construction and Maintenance Bulletin," and in 1953 by "Texas Highways." In addition, there have been various periodicals published by divisions such as D-9's "Sample Bag," D-10's "Research Reporter," and D-18's "Maintenance News Letter." Undoubtedly the bottom line of all of them was to help "get it done." Through the years, however, most of the technically oriented periodicals were either discontinued or refocused on less technical subjects.

continued on page 9...

the wet specimens be conditioned to produce at least 55% to 75% saturation.

(2) Texas Freeze-Thaw Test. Small briquets are made from the proposed aggregate and asphalt cement. The aggregate should be of a uniform size in order to minimize mechanical interlocking of particles. These highly permeable briquets, which have a small hole formed in the bottom of them, are placed on a pedestal, submerged in distilled water, and subjected to repeated freeze-thaw cycles (15 hours at 10°F and 9 hours at 120°F). Moisture susceptibility is evaluated by determining the number of cycles which are required to crack a briquet.

(3) Texas Boiling Test. This test should not be confused with Test Method Tex-530-C. While they are similar, the Texas Boiling Test is actually a combination of boiling tests performed by various agencies. A mixture of the proposed asphalt-aggregate is prepared at 325° and boiled in distilled water for 10 minutes. A visual rating of the stripping is made by comparing the results to photographs of a standard set of mixtures which vary from 0 to 100% of the asphalt cement retained.

What can be done to increase moisture resistance in aggregate-asphalt mixtures and thereby reduce the extent of stripping? For the Texas aggregates which were tested, hydrated lime proved to be the most effective antistripping agent. Using hydrated lime slurry, aggregate should be treated with a minimum of 30% lime to 70% water at a level of 1 to 1.5% by weight, lime to aggregate. Finer aggregates have relatively more surface area and may require higher percentages of lime. (This is important to note since the finer aggregates make up the matrix which provides strength to the the mixture. Stripping of these finer components will produce more serious damage and distress than the stripping of coarser

continued on page 8...

VIBRATORY ROLLERS AND THE COMPACTION OF ACP, A CTR STUDY

Additives such as hydrated lime are not the only answer to stripping. Proper compaction is necessary to ensure that the asphalt mixture has satisfactory engineering properties which reduce the incidence of stripping. Both static and vibratory (dynamic) rollers can be used for compaction. Because of cost savings in both equipment and labor, a growing emphasis is being put on vibratory compaction of asphalt mixtures.

The purpose of the Center for Transportation Research study 317-1, "Compaction of Asphalt Mixtures and the Use of Vibratory Rollers," is to summarize an investigation of compaction of asphalt concrete and compaction using vibratory rollers. The primary objectives of the study were: 1. to clarify terminology associated with compaction and vibratory rollers; 2. to suggest effective operational procedures for vibratory rollers.

A literature review was performed in order to gain an accurate understanding of the theory of compaction. A portion of the literature review summarized in this report deals with the background and theory of vibratory compaction. Operational terms associated with vibratory rollers are presented and defined. In addition, the report lists factors affecting the compactibility of asphalt mixtures. A discussion of mixture problems that affect compaction is presented.

A brief history of the development of vibratory compactors is given along with current rollers marketed in the United States.

Manufacturers of vibratory rollers were contacted to obtain current vibratory roller specifications and recommended operating procedures. Based on this information, a set of guidelines is listed.

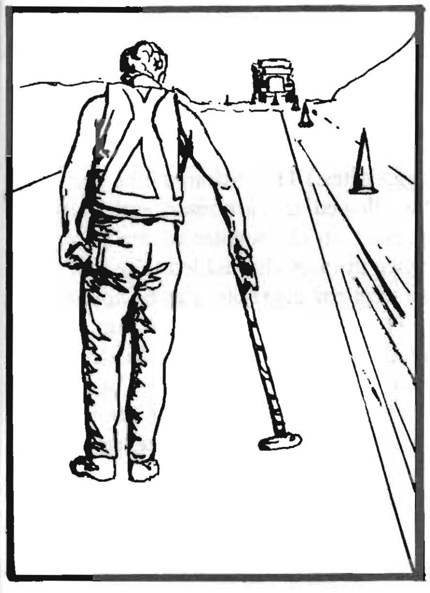
In the past, the CTR researchers feel, most of the vibratory roller difficulties stemmed from improper use of rollers (e.g., rollers designed for compacting soil) and/or improperly trained operators.

EASY LOCATION OF THE CENTERLINE

The Maintenance Division of the Utah Department of Transportation is experimenting with the use of metallic spotting tape to relocate lane lines after an AC overlay or plant mix seal. The procedure consists of marking the existing lane line at approximately 60 to 80 foot intervals with a 1 × 4-inch piece of metallic spotting tape. After the overlay or plant mix seal, one man using a commercial metal detector locates the covered tape and places a 4 × 4 inch marking piece at each detected location. This reference point is then used to re-establish the pavement lane markings.

The procedure works well for any lane line relocation; but has particular application on winding roads, roads with varying pavement widths, roads with no curb and gutter, and roads with numerous turn lanes. The only problem noted to date is that the metal detector will detect any metal object; therefore, the operator should understand that erroneous readings are possible.

Mr. Gordon Peterson, Implementation Coordinator for the Utah DOT, reported that they had successfully used the metal detector on overlays up to three inches thick. The metallic tape which they used was manufactured by 3M and the metal detector was a Garret brand. The metal detector was purchased from a local sporting goods store for about $140.00.



SAN ANGELO'S WHEEL WASHER

The cleaning process.

The mess encountered when you change a set of brake shoes is very similar to that of caliche soils—it's either goo or dust.
Whichever one squares-off at you after you pull a wheel drum usually spells blackened fingernails, pants and tools. To make it worse, that muck is not only filthy, it's deadly because it's composed of finely ground asbestos.

Fortunately, there exist talented maintenance people with the initiative to do something about problems like this. A gadget invented by the hands in the San Angelo maintenance shop cleans off the worst of the mess and certainly eliminates the possibility of inhaling any asbestos fibers. Simply but accurately called the *wheel washer,* the wagon-like device can be rolled under a disassembled wheel unit. Its heavy duty air conditioner-type submersible pump runs a healthy stream of water over the wheel and rinses the free-floating asbestos fibers and muck into the wagon's bed. The water in the wheel washer is not recycled during the cleaning process. The wagon bed is divided into two compartments. Fresh water is placed in the smaller of the two at the beginning of the wash. The wheel washer is placed with the larger empty side under the wheel. The stream of fresh water from the pump is directed to fall onto the larger compartment. Afterwards, the dirty water is disposed of through a drainage port located at one end of the portable vat.

The district shop has made two of the washers, the second improved by experiences collected from the prototype. One of the improvements made was to enlarge the dirty water compartment to two and a half times the size of the fresh water compartment so that if more fresh water was needed to finish a wash-up, it could be added without having to drain the vat. Baffles were added in the compartments to keep water from surging when the vat was being moved. Also, the tongue was put on the side opposite the cord because the pump's cord kept getting tangled around the tongue. According to Edgar Poehls, assistant equipment supervisor, credit for both the idea and the fabrication of the wheel washer goes to the entire section which "just decided to do it and did."

From *Transportation News*

HYDRATED LIME AND STRIPPING

Continued

aggregates.) The hydrated lime must not be allowed to carbonate and must be present on the surface of the aggregate when the asphalt is added. The lime used to treat the aggregate can be applied as:

(1) Dry hydrated lime: not highly recommended because it inadequately coats and adheres to the aggregate surfaces. Dry hydrated lime can be more successfully added to wet aggregate.

(2) Hydrated lime slurry: coats and adheres much more effectively than dry hydrated lime, but is more expensive due to the necessity of drying the aggregate afterwards.

(3) Hot (quick) lime slurry: as effective as hydrated lime slurry, or more so. Unslaked dry lime costs about as much as hydrated dry lime, but when slaked, yields 30% more hydrated lime. The heat released in slaking maximizes the evaporation of water from the slurry thus helping to offset drying costs.

Lime in dry or slurried form, may be applied by several methods. (See the chart.) How lime is added must take into account costs, test results, and effectiveness of technique. The effectiveness of a chosen technique should be monitored during production. It should also be remembered that lime may not always be the best additive for a specific problem. Tailor the use of lime, or any other additive, to fit specific needs.

Editorial continued

By the early to mid Seventies, personnel again began to express needs for better communication. A group comprised of district engineers, division heads and researchers expressed the following in a Project 214 report:

> Throughout the Department each year numerous new products or techniques are evaluated. There is no organized method for recording and cataloging either the work done or the results obtained. The same effort is frequently duplicated, or even worse, good ideas remain localized instead of being made available for statewide use because there is no central source for receiving and disseminating information about ideas being tried. [''Engineering Economy and Energy Considerations,'' Dec. 1974, TTI, unpublished, page 4.]

And in early 1981, the committee for Strategic Planning Analysis No. XI pointed out that we were in a period of burgeoning technology, dwindling manpower, limited resources, ecological restraints, and spiraling costs. Admittedly, enhanced communications capabilities is not the solution to all the problems, but it surely is a step in the right direction. The committee's document acknowledged the value of the technical publications of the past, and at the same time pointed out that another medium was also called for. They recommended that consideration be given to the reestablishment of ''...communication vehicles similar to those used in the past'' and ''...to eliminate duplication of effort and costs due to the lack of communication of evaluation results of new techniques or products, an organized method for recording, cataloging and dissemination of this information utilizing automation techniques is required.''

As a result of the Department's and FHWA's mutual interest in technology transfer, a T^2 effort was funded in September, 1983. It was to generally function as a departmental clearinghouse for technical information: the focal point for the collection and distribution of technology from many sources. Special field projects which involved new products, techniques, or innovations were to be observed and documented. Information generated from both within the state and from without was to be gleaned for its applicability in Texas. Specifically, it was to address itself to the shortcomings of the Department's existing technology transfer efforts as pointed out in ''Strategic Planning Analysis XI.''

We, in the Research Section, are in a position to see what is being produced by the researchers who are working within the ''cooperative research program'' in our own state; and we have ready access to a great deal of the work which is being done by the Transportation Research Board, National Cooperative Highway Research Program, and the formal research programs of other states and organizations. Paradoxically, one of the most overlooked and underreported generators of information may also be one of the most significant: our own organization—those of you who are on the front lines. You comprise one of the best testing institutions and one of the most inventive. There are literally thousands of you in this agency who are constantly searching for the best, most efficient, and least expensive product or technique to do the job. But the results, for the most part, go unreported.

The Technology Transfer group exists to coordinate more than generate information. It provides a medium (or perhaps media) for communications. The technology will come from many areas, not least of which is our own agency. ⊙

EXCHANGE OF IDEAS

Articles, techniques or ideas about any facet of highways or public transporation are welcomed. If you have a new way to handle an old problem, a helpful hint for making better use of a standard procedure or product or new application of a common item, send it to us. It doesn't have to be an earthshaker to be useful and appreciated.

If you have an idea to share, a comment to make or materials to request, use the tear sheet in this issue or call Kathleen Jones at (512) 465-7947.

The Highway Department is now a member of the Texas State Library Video Project. Of particular interest are the tapes on management.

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TECHNICAL QUARTERLY

State Department of Highways and- Public Transportation Transportation Planning Div. Technology Transfer Section P.O. Box 5051, Austin, TX 78763

Name ____________________

Dist/Div ____________________

Address ____________________

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Phone (   ) ____________________

☐ Requesting information on ______

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AN EXCHANGE OF IDEAS

☐ Ideas or comments ____________________

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(We'll call you to get the details).

☐ Question ____________________

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