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Washington State Transportation Center Research Review

CD-ROM Version of Pavement Guide Makes Pavement Information More Accessible

Late last year the Washington State Department of Transportation's well-respected Pavement Guide - the state's authoritative compilation of WSDOT pavement policy, processes, and computer design programs - became available as a CD-ROM. As a result, this important guide has become even more useful and popular.

According to Linda Pierce, WSDOT pavement and soils engineer, conversion of the Pavement Guide to CD-ROM has made the guide more accessible. She said that anyone within WSDOT who is involved in pavement design now has the CD. "The bottom line," Pierce said, "is that it is easy to use, and it helps engineers understand what they are doing with pavement design and assessment and the effects their efforts will have. With a new engineer, it is the first thing we give them so they understand what we are doing and what it is all about."

Shelf Space Savings

The new version also saves six inches of shelf space. The original massive guide comprised three volumes, which now fit on one CD. Volume 1 describes WSDOT pavement design policies for flexible and rigid pavements, new and rehabilitated pavements, and the pavement type selection process.

The Northwest Technology Transfer Center
TransAid-WSDOT

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Volume 2 covers an overview of pavement structures, fundamental design parameters, pavement evaluation, flexible and rigid pavement responses and related design processes, the AASHTO flexible and rigid pavement design procedures, pavement rehabilitation, life cycle cost analysis, subsurface pavement drainage, and various construction considerations.

Volume 3 discusses three pavement design programs developed for WSDOT: the pavement layer elastic analysis program EVERSTRS, the pavement layer back calculation program EVERCALC, and the empirical-mechanistic overlay design program EVERPAVE.

New for the CD-ROM

In addition to the original text, the CD-ROM incorporates over 200 photographs and illustrations. Particularly useful are a large number of new, full-color construction photos. "Visualization is no longer a problem," commented Pierce.

Another important feature of the CD-ROM version is that it includes AASHTO Guide pavement design equations that have been programmed to be interactive. These cover design, though not rehabilitation, for both asphalt and concrete.

Engineers can use the guide on-line for interactive pavement design. Pierce said that having the CD saves engineers from needing to refer to the AASHTO notebook or software (which are still necessary for pavement rehabilitation, however). (Note that while the CD discusses WSDOT's three design programs, it does not actually contain EVERSTRS, EVERCALC, OR EVERPAVE.)

"The bottom line is that it's easy to use, and it helps engineers understand what they're doing with pavement design." - Linda Pierce

Also included on the CD is a digitized version of the 20-minute videotape Guidelines for Spring Highway Use. This program discusses the issues related to spring load restrictions and presents guidelines for determining where to apply load restrictions, how much to restrict loads, and how long to enforce them.

The original Pavement Guide, published in February 1995 through TRAC, was written in large part by Joe P. Mahoney, professor of civil engineering at the University of Washington. He also led production of the electronic version. Also crucial to the development of the CD were George Turkiyyah, UW associate professor of civil engineering, and then civil engineering student Dan Axelrod, who did much of the programming and production work.

According to Mahoney, the original guide was intended to be a clear statement of WSDOT pavement policy, as well as a training tool for WSDOT personnel and a pavement education tool for a broader audience. WSDOT's objective was to have a compilation of state-of-the-art pavement knowledge that, until the guide was written, had not been gathered and published in one place. Placing the guide on CD-ROM and making it available over the Internet are logical extensions of those goals. "The approach taken by WSDOT is unique, and this CD appears to be the first time in the pavements area that this has been done," he said.

Mahoney plans to use the Pavement Guide CD and the Engineering Publications CD Library as his only "textbooks" for a senior pavement design class at the UW. "It will make a massive quantity of information available to my students at a low cost and will enhance their education," he said.

As of late December, WSDOT Engineering Publications had distributed over 80 copies of the CD, not only within WSDOT, but also to other agencies that have requested it within and outside of Washington, including cities and counties.

The CD-ROM is available for $15 through WSDOT Engineering Publications. The text, without photos and video, is also available on the Web. Both ordering the CD and downloading the text can be accomplished through the WSDOT Engineering Publications site: <http://www.wsdot.wa.gov/fasc/EngineeringPublications/

NCHRP 350 - What Does it Mean?

Questions and Answers

Edited by Dan Sunde, Director of Technology Transfer, NWT2 Center
Sources: ATSAA, http://www.atssa.com/nchrp350.htm and
FHWA memorandum dated August 28, 1998, HNG-14

On July 27, 1997, the FHWA's Office of Engineering issued a guidance memo mandating that all work zone devices used on the National Highway System (NHS), be crash tested to NCHRP 350 requirements. The memo went on to divide many of these devices into four (4) categories, with each having their own level of testing requirements and compliance dates. These categories are defined as:

Category 1 - includes those items that are small and lightweight, channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These include cones, tubular markers, flexible delineator posts, and plastic drums with no attachments.

Category 2 - includes devices that are not expected to produce significant vehicular velocity change, but may otherwise be hazardous. Examples of this class are barricades, portable sign supports, intrusion alarms, and drums, vertical panels, or cones with lights.

Category 3 - is for hardware that is expected to cause significant velocity changes or other potentially harmful reactions to impacting vehicles. Barriers, fixed sign supports, crash cushions, and other work zone devices not meeting the definitions of Category 1 or 2 are examples from this category.

Category 4 - includes portable or trailer-mounted devices such as Arrow Displays, Temporary Traffic Signals, Area Lighting Supports, and Portable Changeable Message Signs. After compliance date of October 1, 2002, this class of devices may not be used unless they are placed behind crashworthy barriers or shielded with TMAs or crash cushions.

*(Source of the above: ATSSA, **http://www.atssa.com/nchrp350.htm**)*

In light of FHWA's guidance memo the T^2 Center has have received requests for information on the new requirement. Although specified for NHS roadways, the guidance poses impacts to local agencies in the areas of:

- standard of care
- liability
- cost of devices
- availability of devices
- fabrication of devices

Although somewhat lengthy, the following are the responses by the Federal Highway Administration to a series of questions posed by state transportation agencies and the traffic safety industry. These responses shed light on FHWA's position and intent. They were taken from an FHWA Memorandum dated August 28, 1998, HNG-14.

General

Q. Was the public involved in adopting the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 for the NHS?

A. *The public was involved through a formal process that culminated in a final rule in the July 16, 1993 Federal Register. In that notice, the FHWA added NCHRP Report 350 at paragraph 625.5(a)(13) of Title 23, Code of Federal Regulations (23 CFR). Since then, the "Guides and References" section of 23 CFR, Part 625, under which the NCHRP Report 350 was cited, has been removed. The NCHRP Report 350 is now cited in Section 16, Paragraph (a)(12) of the Non-Regulatory Supplement to the Federal-aid Policy Guide, Subchapter G, Part 625 (NS 23 CFR 625). The rulemaking process involved publishing the proposed rule and*

receiving public comments on the proposed rule.

The July 16, 1993, Federal Register stated that contingent upon the results of ongoing research and service performance evaluation, the FHWA anticipated that approximately five years after the adoption of NCHRP Report 350 all new installations of traffic barriers and other roadside safety features on NHS projects would be only those that have been judged to meet the testing and evaluation criteria in Report 350.

Using the effective date of the adoption of that rule would imply an implementation date of August 16, 1998. By our July 25, 1997 memorandum, "Information: Identifying Acceptable Highway Safety Features," the FHWA interpreted this milestone to be the "advertising date" and changed the effective date to October 1, 1998 to conform to the beginning of the Federal fiscal year.

On July 1, 1998 AASHTO proposed an agreement on revised implementation dates for Report 350 hardware including work zone devices. FHWA concurred with the agreement and has changed the deadline dates for Category 2 and Category 3 devices. All deadlines regarding work zone traffic control devices refer to the date by which all newly purchased devices must meet Report 350 criteria. Existing hardware may be used until they meet the end of their normal service life.

The agreed dates are as follows:

- *Category 1 devices:* ***October 1, 1998***
- *Category 2 devices:* ***October 1, 2000***
- *Category 3 devices, Attenuators:* ***October 1, 1998***
- *Category 3 devices, temporary barriers: New units must have tensile and moment resistance after* ***October 1, 2000****. New unit must meet Report 350 criteria by* ***October 1, 2002.***
- *Category 4 devices. The deadline has been* ***deferred****. An announcement of the implementation schedule for these devices is expected by October 1, 2000.*

All new safety features on the NHS covered by the guidelines in the NCHRP Report 350 included in projects advertised for bids or included in work done by force-account or by State forces on or after the dates listed above are to have been tested and evaluated and found acceptable in accordance with the guidelines in the NCHRP Report 350.

Q. (a)Why is it necessary to establish the crashworthiness of work zone appurtenances, since performance of existing devices does not appear to be a problem? Devices are hit resulting in only minor damage.

(b)The need for the criteria is unclear. Thousands of devices have been hit and the vehicles have left the scene, so is there really a problem? There have been no known incidences of a light coming off a sign and coming through a windshield.

A. *From the results in two States that recently conducted work zone (WZ) accident studies, we know that the severity of the crash increases with WZ appurtenances is generally what would be expected. That is, the severity of the crash increases with the mass of the devices impacted. Impacts with channelizing devices are less severe, those with sign supports more so and barriers the most. In a soon to be published study of WZ crashes, it was reported 22 of 495 crashes involved signs and similar devices. Two crashes resulted in injuries requiring hospital treatment. In one, a vehicle struck a portable sign on the shoulder. The sign broke the windshield, and the driver suffered internal injuries. In the other, a portable sign blew down, leaning across a concrete barrier in the travel lane. A vehicle struck the sign, breaking the windshield, with the driver receiving facial lacerations. In another WZ crash study, 12 of 589 crashes studied involved channeling devices (barrel), three of which resulted in injuries.*

In summary, there is evidence of a problem. This problem is with devices that are often placed in the travel way or on shoulders where they can be easily impacted by errant drivers. There is also technology that can address the problem at a minimal cost per device. Since we have a cost effective solution to the problem, we believe we should implement it.

Q. The supply of crashworthy WZ devices is a concern. Will the manufacturers of approved products be able to meet the demands throughout the country?

A. *We cannot speak for the manufacturers, but we do not expect wholesale shortages. If there are spot shortages we will adjust to them. Most of the WZ devices are generic so we would expect that anyone who is willing to enter the market could easily manufacture them.*

Q. Will the FHWA use the results of tests conducted by one company to accept similar hardware offered by another, and what makes one product "similar" to another?

A. *We believe we should not require testing when we have the information in hand. Therefore, if a product has been shown to be crashworthy via full scale or bogie testing, other products that are identical or nearly identical can be assumed to perform in an acceptable manner under impact. We have accepted certain small sign supports and some recycled guardrail offset blocks on this basis.*

When public agencies sponsor testing, such as Federal Highway Administration (FHWA) managed research studies or "pooled-fund" crash testing programs, there is a tendency to focus on "generic" hardware rather that testing specific proprietary devices. When the occasional proprietary device is tested under these studies, the results may be examined to see how far they may be extrapolated to cover other existing hardware.

We agree that there is a question when it comes to determining whether a product is "nearly identical" to a previously tested product. Our assessment will be made by comparing the design drawings, material specifications, and the as-tested information on an accepted device with design details and the material specifications for a candidate device. When these are not an exact match, we will evaluate how we believe the differences might influence the test results and, we will be cautious when the performance of the device is close to the acceptable limit. This will likely result in our requiring testing.

Q. It is not economically feasible to replace all necessary equipment by October 1, 1998.

A. *Knowledge about the availability of crashworthy WZ appurtenances, including traffic control devices, has been accessible since 1989 in the AASHTO Roadside Design Guide, and the deadline for safety appurtenances to meet the requirements of NCHRP Report 350 was published in 1993. Notwithstanding, many agencies did not feel that they were prepared for this deadline. For this and other reasons AASHTO and FHWA signed the agreement revising some dates for implementing work zone traffic control devices.*

Q. The October 1 deadlines refers to what day?

A. The *October 1 dates refer to the advertising date for contracts and for use by maintenance and force account activities on the NHS.*

Q. Will data from the pooled-fund study on work zone devices be made available to the industry?

A. *The member States of the pooled-fund study will be the first to receive the results of the testing. We will endeavor to provide this information to the other highway agencies and industry once the pooled-fund States have been informed.*

Channelizing Devices

Q. Who is responsible for testing various combinations of devices such as drums, lights, and flags etc., and which combination(s) should be tested.

A. *The providers of the traffic control devices (TCDs) are responsible for the testing of the individual devices and/or the combinations they are used in. Since lights may detach and impact the windshield or may remain attached to the TCD and be knocked clear by the vehicle, it would seem that all parties would benefit from a cooperative effort between the manufacturers of the TCDs (manufacturers of basic devices and the optional devices) to determine crashworthy combinations and to have the "worst case" examples tested.*

We appreciate the concerns regarding the difficulty of identifying "generic" configurations of optional features for crash testing purposed and the potential costs for testing many alternative designs. We believe there are a number of options open for reducing the costs of testing, specifically of warning lights:

a. If the light breaks loose from the TCD and impacts the windshield there must be no penetration of the passengers' compartment. If a relationship between the size, shape, structure, and mass of the lights and the probability of the light penetrating the windshield could be established, this could be used to lights that can be assumed to be less hazardous.

b. For lights that fall outside of the crashworthy standard because of density, mass, or configuration (i.e., sharp corners on the battery pack or mounting hardware), then a standard attachment specification would be needed to assure that the light does not come free of the basic TCD. A crash test of representative TCDs with the heaviest light or light/battery device firmly attached would then be required. It will

probably also be necessary to demonstrate that a specific TCD has the capability to "hold on" to the light during impact. (Recent testing has shown that relocating the battery assembly to the base of the device yielded successful results.)

c. *If a surrogate test can be developed to show that the strength of the connection of the light to the TCD is sufficient to prevent separation during impact, this test can be used by the various basic TCD vendors to show that their device will be acceptable when used with the light. This surrogate testing should be markedly less expensive than crash testing, and can be used when minor changes to the geometry or chemical composition of the TCD are made. The mass of the light must still be significantly less than that of the drum so as not to alter the center of gravity of the drum causing it and the light to fly up and damage the windshield.*

Q. By what date do Category 1 and 2 devices used on projects on NHS highways have to conform to NCHRP Report 350?

A. *Newly purchased Category 1 and 2 devices will need to comply on projects advertised by the agreed upon dates. Contracts currently in preparation for award after this date should inform contractors that the TCDs they intend to use on NHS routes are to comply. The states do not typically include TCD fabrication details in their specifications or special provisions, and there will be no need to do so in the future except to require that crashworthy devices be used on the NHS. (See first Question for information on dates.)*

Q. When the Department (State Department of Transportation) is accomplishing work on NHS highways utilizing our own State forces, what date do our Category 1 and 2 devices have to conform to NCHRP Report 350?

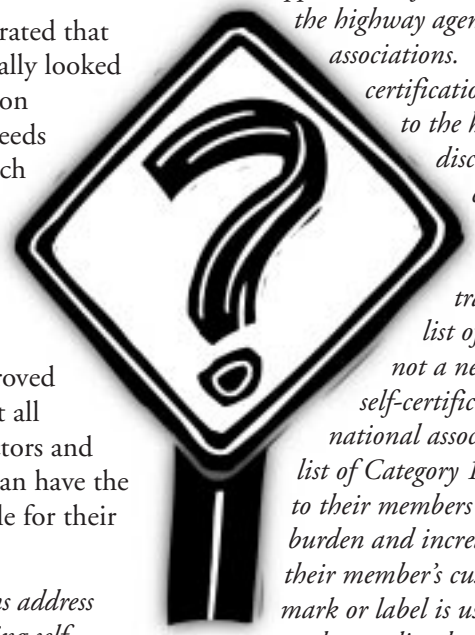
A. *Standards for NHS routes apply no matter where the funding comes from or who is doing the work. (See first Question for information on dates.)*

Q. Will the FHWA delay the full implementation of the National Cooperative Highway Research Program (NCHRP) Report 350 criteria for work zone devices by one-year to October 1, 1999.

A. *(See first Question for information on dates.)*

Q. (a) Will the FHWA maintain a list of Category 1, 2, 3 & 4 devices that conform to the NCHRP 350?

(b) We feel frustrated that FHWA hasn't really looked into the inspection (enforcement) needs of the states. Such as: How does an individual state (or states) keep an up-to-date listing of accepted or approved devices such that all industry contractors and subcontractors can have the same list available for their use?



A. *These questions address concerns with using self-certification (also called manufacturers' declaration of conformity) as one of two acceptance processes for Category 1 devices. FHWA chose this process because of the administrative and regulatory burden for FHWA. State and local highway agencies, and industry is commensurate with the potential low risk of the devices. Also this process responds to feedback about implementing the crashworthiness of WZ features that we do not inhibit innovation.*

In proposing self-certification, the FHWA is recognizing an acceptance procedure used in other regulated product sectors for where level of risk is low. It is believed that this level of assurance will adequately address safety and impose the least costs on industry and consumers.

FHWA will maintain lists of Category 2, 3, and 4 devices but we will not keep a list of the numerous Category 1 devices. The intent of FHWA is not to simply transfer the keeping of an approval list for Category 1 devices to the highway agencies or to industry associations. The details of a self-certification program are left to the highway agency discretion but we would expect it to be commensurate with the risk to the traveling public. A list of accepted devices is not a necessary part of a self-certification program. A national association may keep a list of Category 1 devices as a service to their members to reduce the burden and increase the confidence of their member's customers. Often a mark or label is used to identify each product as listed as certified by that association.

Q. If a highway agency does not believe that the vendor's self-certification of a device is accurate, what can be done?

A. *By the nature of the Category 1 devices we would expect this to be a rare occurrence. First, the highway agency should review the basis (supporting information). Since the vendor's self-certification is subject to approval by the individual highway agencies, if they find it unsatisfactory they will discontinue accepting it. If the highway agency has an actual or suspected product failure, they should perform tests or have an independent or "check" test performed.*

Q. A contractor has devices in his inventory that he believes meet Category 1 but is having problems obtaining a letter of self-certification for them from the manufacturer. Does that mean these devices cannot be used on the NHS after the October 1st date?

A. *A vendor who is supplying the devices for use on a highway agency's project is responsible for the self-certification. Therefore the contractor can self-certify his current inventory of Category 1 devices as meeting NCHRP Report 350 standards if he is willing to be responsible for the crashworthiness of the devices.*

Q. What should be in the letter of self-certification?

A. *The letter should contain at a minimum:*

i) A title, e.g., "Certificate of Crashworthiness";

ii) Name and address of vendor making the certification.

iii) Unique identification of the certificate (such as serial number) and of each page and the total number of pages;

iv) Description and unambiguous identification of the item tested;

v) Identification of the basis as listed in the July 25, 1997-memo as crash test experience with similar devices or years of demonstrably safe operational performance. (Simplified crash testing showing that a device poses no risk to vehicle occupants may be used to support the manufacturer's certification. This simplified testing must, as a minimum, be documented by a written report, observed by an independent, impartial observer, recorded on videotape, and include a means, other than the test vehicle's speedometer, for determining the vehicle speed at time of impact.)

vi) A signature and title, or an equivalent identification of the person(s) accepting responsibility for the content of the certificate (however produced), and date of issue:

vii) A statement that the certificate shall not be reproduced except in full.

Q. Can a Category 1 device be self-certified by a vendor as safe solely on the basis of height and weight?

A. *No. Category 1 devices will be allowed based upon the vendor's self-certification if the device meets a specification proved safe by crash or surrogate testing, crash testing, or safe operational performance. This self-certification is based on an analysis and determination by the vendor that the size, weight, material and shape are similar to devices proven safe. We expect the vendors would have an analysis on file to support their self-certification.*

Q. Is there crash test information available to assist vendors in analysis of their Category 1 device?

A. *Test reports on Category 1 devices will be available in July 1998 on the FHWA Office of Highway Safety's homepage-http:www.ohs.fhwa.dot.gov/design. A video or videos will be available from the FHWA-NHTSA National Crash Analysis Center for a fee. The center's homepage is http://gwuva.gwu.edu/ncan/.*

Q. Many traffic control contractors manufacture their own Type III barricades. This will be costly; those costs will be passed on to the State Department of Transportation.

A. *We assume that the above comment means that since many TCD contractors currently manufacture their own devices it will be more costly for them to begin using crashworthy work traffic control devices.*

It may be marginally more costly to begin using a crashworthy devices rather than a noncrashworthy device. For example, if a TCD contractor begins to manufacture a crash-tested generic design, the additional cost will be that of revising the manufacturing process. If a TCD contractor decides to have their own type III barricade design crash-tested the only cost is that of the crash test(s). This of course will be amortized over the number of barricades built.

There may be an increase in the effort spent in quality control from the existing level so that a contractor can ensure that each device is manufactured correctly.

Q. There is a lack of uniformity among work zone traffic control devices. What if the States use devices that have not been found acceptable by the FHWA?

A. T*he provision in our July 25 memorandum permits a State to use a "home grown" device it has determined to be crashworthy according to the NCHRP Report 350. FHWA headquarters acceptance is not a requirement.*

If a device is determined to be crashworthy, it will be the State's prerogative to accept or reject that product, as it has always been. The FHWA will not take a position on State's selection from among competing crashworthy devices.

Q. Will the implementation of the NCHRP Report 350 procedures mean the banning of wooden barricades?

A. *The NCHRP Report 350 procedures are not material based, but performance based. Accordingly, the appurtenance design is being evaluated and not solely the material. While we may speculate about the potential crashworthiness of a class of appurtenance, crash testing and in-service evaluation is the validation.*

Q. How will all of the varieties of barricades in current use be tested?

A. *We look to the industry to recommend how highway safety can best be served when crashworthy barricades are required. If a small number of standard crashworthy barricade designs could be developed, the various manufacturers would have an easier time providing crashworthy barricades. The standard designs should provide guidance on variations in size, materials, fastener hardware, permissible auxiliary devices, etc.*

The results of a survey conducted by the American Traffic Safety Services Association (ATSSA) will be most helpful in determining the extent of the crash tests needed to quality (or disqualify) the range of currently used barricades. ATSSA intends to sort the barricades and other devices into categories and the "worst case" example(s) from each category tested to qualify the remaining devices in a category.

Q. Manufacturing their own equipment allows a contractor to control their own work. Will having crashworthy barricades prevent that?

A. *As long as satisfactory quality control is used and the devices meet the requirements of NCHRP Report 350, contractors and other entities can manufacture their own devices. For example, there are generic Type III barricades mentioned in the Roadside Design Guide of perforated square metal tubes, plastic tubular elements or wood that have been satisfactorily crash tested and seem suitable for easy assembly.*

Signs

Q. There are many varieties of trailer-mounted sign supports. Will they have to be crash tested?

A. *Yes. The crashworthiness of trailer-mounted sign supports is a concern. We understand that some have been banned by certain States because of the potential hazard.*

Q. How will the sign substrate affect the performance of a portable sign support? Plywood (now allowed) will perform differently from aluminum.

A. *In crash tests of various types of portable sign systems, both the plywood and the aluminum substrates separated from the sign support and penetrated the windshield. The fabric sign panel performed satisfactorily when tested. Other substrates are currently being considered for crashworthiness.*

Improvements in the connections between sign panels and supports may address the problem of separation for some type of supports. Also, the use of plastic sign substrates for use with plastic drums has been successfully crash tested by the Texas Transportation Institute.

Q. Should portable/temporary sign stands be crash tested at a 90 degrees angle as well as head on?

A. *NCHRP Report 350, in section A3.2.3, states:*

"Because errant vehicles may approach a support structure, work zone traffic control device, … at various angles, it is recommended that the device be tested assuming the most severe direction of vehicle approach consistent with the expected traffic conditions …"

Temporary sign stands are often used near intersections where traffic approaches from many directions. Also, when along highways sign stands are sometimes turned 90 degrees to conceal the message from the driver. In this orientation the cross brace that spreads the fabric sign panel is critical. Full-scale testing has shown that

tubular metal cross braces will penetrate the windshield, whereas thin, flexible cross braces will not. Therefore any portable or temporary sign stand should be evaluated to determine if the cross brace is a potential hazard.

Barriers

Q. Concerning temporary concrete barrier - we (State DOT) don't want to get rid of what we have and use something new in 1998 that will meet Report 230; then in 2002 get rid of that, and use something that will meet NCHRP Report 350. We want to find something acceptable to use that will meet 350. A phase-in period is desired. The life of a barrier could be ten years or more.

A. *We agree it seems reasonable to begin using portable concrete barrier (PCB) joint details that meet the requirements of NCHRP Report 350. There are some currently available for use. As of July 1, 1998 they are the Iowa PCB (TL-3, F-shape w/pin 7 loop), Rockingham Precast (TL-3, F-shape w/slotted tube/T-bar connection) and the Low Profile barrier (TL-2).*

The AASHTO/FHWA agreement permits the use of connections meeting NCHRP 230 guidelines until they complete their normal service life. Connections that do not meet those criteria may be considered for a retrofit. In addition, in the current work zone pooled funded study it has been proposed to develop a retrofit for strengthening existing PCB joint details. If successful that may allow continued use of an existing PCB on the NHS until the end of its useful life. Any phase in period beyond 2002 would depend on the particular circumstances of the State including how safe is their current joint detail.

Q. Will contractors be allowed to continue using their existing barriers (providing it is one of the five barriers identified tested in the 1996 RDG) until a reasonable amount of time has passed after the NCHRP Report 350 acceptance of a non-proprietary, reasonable priced temporary barrier?

A. *(See Question 1.0 for information on dates which may alter the answer that follows.) Old barrier segments can be used until October 1, 2000, as long as they are still serviceable and conform to the NJ or F shape. After October 1, 2000, they must be one of the five listed in the "crash tested and operational" section of Chapter nine of the RDG (or otherwise meet the tensile and moment requirements of the AASHTO/FHWA agreement.) The key element, of course, is the connection between barrier segments. This was a major concern of the states that are participating in the pooled-fund study "Crash Testing of Work Zone Traffic Control Devices." Ranked highly by the group was the need to "retrofit" current barriers that do not meet the NCHRP Report 350 criteria. Through a combination of computer modeling and test simulation and actual crash testing of practical designs, the highway community should have jointed temporary concrete barrier designs available at the end of the study. This should occur well ahead of the 2002 deadline. If any barrier segments that do not meet the NCHRP Report 350 criteria are still serviceable by 10-1-02 they may be candidates for this retrofit.*

It is recommended that no new non-NCHRP Report 350 barriers be purchased or manufactured.

Q. The large deflection of portable barriers in the adjacent work space is a concern.

A. *Agree, that is why maximum allowable deflection should be considered when selecting the type of barrier to use. When using PCB's, the maximum allowable deflection should govern whether to use stiffeners for joints or attachment of the barrier to the pavement or deck.*

Q. a) The 25-degree angle hit is questionable in real applications.

Q. b) Installing a device exactly is often not practical in a real application as it was tested (installing barriers on a curve for example).

A. *An appropriate answer to this is to quote from NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."*

From the Summary:

"These procedures are devised to subject roadside safety features to severe vehicle impact conditions rather than to typical or average highway situations. Although the innumerable highway-site and safety-feature application conditions that exist are recognized, it is impractical or impossible to duplicate these in limited number of standardized tests. Hence, the approach has been to normalize test conditions: straight longitudinal barriers are tested although curved installations exist, flat grade is

recommended even though installations are sometimes situated on sloped shoulders and behind curbs: idealized soils are specified although roadside safety hardware are often founded in poor soil or frozen ground. These normalized test conditions have a significant effect on a feature's performance but are of secondary importance when comparing results or two or more systems.

Page 4, Section 1.4 PERFORMANCE LIMITATIONS, 2nd paragraph:

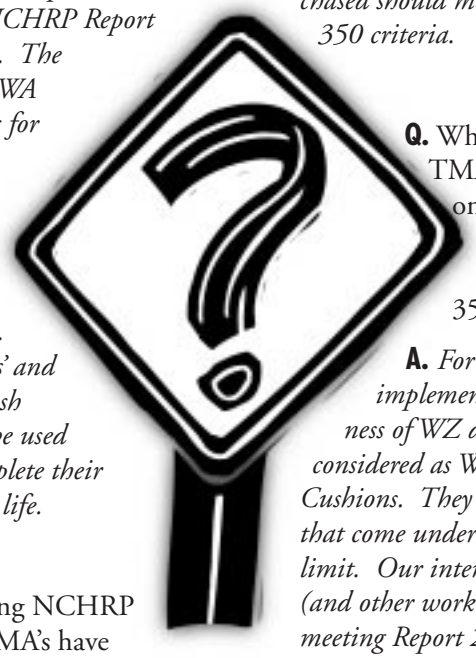
"For these reasons, safety features are generally developed and tested for selected idealized situations that are intended to encompass a large majority, but not all of the possible in-service collisions. Even so, it is essential that test results be evaluated and interpreted by competent researchers and that the evaluations be guided by sound engineering judgment."

Note: The Test levels 1 through 3 in NCHRP Report 350 represent increasing severe impact severity's. In general, each impact severity's is described by a combination of test vehicle (weight), impact speed and impact angle. The decision in NCHRP Report 350 to vary impact severity's by holding the vehicle and angle constant while varying the speed was based on the desire to limit the cost of testing rather than an attempt to mimic real life conditions. Therefore, depending upon the site conditions a portable concrete barrier meeting TL-2 test criteria may be appropriate.

Crash Cushions and Truck Mounted Attenuators

Q. Please clarify the FHWA position on the use of NCHRP Report 230 qualified work zone crash cushions after October 1, 1998.

A. *FHWA is no longer reviewing testing conducted under NCHRP Report 230 guidelines, so there will be no new crashworthy work zone crash cushions found acceptable that do not meet the NCHRP Report 350 guidelines. The AASHTO/FHWA agreement calls for new units purchased after October 1, 1998, to meet Report 350 guidelines. Existing TMAs' and Work Zone crash cushions may be used until they complete their normal service life.*



Q. Since existing NCHRP Report 230 TMA's have been tested at the equivalent of Test Level 2 will they still be allowed after October 1, 1998.

A. *The Test level 2 is the basic test level for TMA's in NCHRP Report 350. As such, TMA's designed to this test level can be used on the NHS. Review of crash performance shows that TMA's designed to this test level perform well. A transportation agency may use TMA's designed to test level 3 if they want the higher performance.*

Q. If a State wants to use vehicles with truck mounted attenuators in maintenance activities or in force account work on the NHS, does FHWA expect these State-owned TMAs to be upgraded to NCHRP Report 350 (or modified 350) criteria? Are existing non-NCHRP Report 350 TMAs not going to be allowed even if they are in good shape?

A. *Existing NCHRP Report 230 TMAs can be used on the NHS until the end of their useful life (see question 5.3 below). Any new TMAs purchased should meet NCHRP Report 350 criteria.*

Q. What is the date that TMA's used on projects on NHS highways have to conform to NCHRP Report 350?

A. *For the purpose of implementing the crashworthiness of WZ devices, TMAs may be considered as Work Zone Crash Cushions. They are Category 3 devices that come under the October 1, 1998, limit. Our intention is that TMAs (and other work zone attenuators) meeting Report 230 guidelines may continue to be used until they are worn out and ready for replacement with hardware conforming to NCHRP Report 350.*

Q. If a TMA manufacturer has a lesser weight recommended for the support vehicle than what they were tested at and they have based this weight off of some procedure, are they required to submit this to the FHWA for approval?

A. *Our procedures permits the use of devices/procedures that have been shown to meet NCHRP Report 350 guidelines without FHWA Headquar-*

ters acceptance. Our acceptance letters are a service to the industry that acknowledge the crashworthiness of a *device so to that a manufacturer does not have to provide the same detailed documentation to every highway agency. If a highway agency considers itself qualified to review the vendor's documentation in light of NCHRP Report 350, they are free to do so, preferably with the concurrence of the FHWA division office when NHS routes are concerned. To our point of the lesser-weight host truck, this should only be a problem with roll-ahead, which is not covered as an acceptance criteria in NCHRP Report 350. Our acceptance letters usually indicate that the test host vehicle is the maximum mass vehicle we consider acceptable with the covered TMA and, if not stated, is implied. If a contractor chooses to use a lighter vehicle to mount the TMA, then the contractor is responsible for being aware of the impact that vehicle will have on the roll-ahead distance and take appropriate action. Also NCHRP Report 350 includes evaluation criteria for the support vehicle as well as the impacting vehicle for TMA tests.*

Other

Q. How were work zone devices determined to be in category IV?

A. *Category IV devices are devices which have proven to have significant value in the work zone by contributing to safer traffic operations though these devices may cause great harm to occupants of impacting vehicles. We believe that, as currently configured and deployed, these devices provide a net benefit to motorists. Substantial crash experience to date shows that crashes with these devices are rare. They have been identified by FHWA as portable, usually trailer-mounted, devices such as area lighting supports, flashing arrow panels, temporary traffic signals, and changeable message signs which are often used in or adjacent to the traveled way. The AASHTO/FHWA agreement calls for these devices to be studied and an implementation date announced by October 1, 2000.*

We would not expect to identify any new category IV devices unless they have a proven substantial operational benefit.

Contact

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Endangered Species Act Update!

Brian Hasselbach, TransAid Environmental Engineer
WSDOT -TransAid Service Center

A biological assessment evaluation is required for every project or activity with a federal nexus (i.e., federal funds, federal permits, or located on federal land) . Further complicating the issue is the lack of a grandfather clause in the Endangered Species Act (ESA). The net result is the biological assessment requirement will affect projects currently underway as well as future projects.

...significant delays of the concurrence process and stoppage of some projects are possible.

The enforcement of the ESA for marine species is under the control of the National Marine Fisheries Service (NMFS). Freshwater and terrestrial species are under the enforcement of the U.S. Fish and Wildlife Service (USFWS). Due to the increase in work load caused by the new requirements and the limited staff within the National Marine Fisheries Service significant delays of the concurrence process and stoppage of some projects are possible.

In an effort to alleviate a portion of this limitation in the long term, WSDOT and the National Marine Fisheries Service will be concentrating heavily on the development of biological assessments on a program level. The program level evaluations could then streamline much of the biological assessment evaluation currently done on a project-by-project basis.

Also, the ESA requirements do not allow FHWA to approve right of way or construction funding without satisfactory NEPA compliance, which includes conducting a biological assessment. FHWA approval will be given when the ECS form is signed and concurrence with the biological assessment's effect determinations has been obtained.

If a project is determined to have "no effect" on a listed species or critical habitat, National Marine Fisheries Service has authorized FHWA and WSDOT to conduct the concurrence review. These projects can continue forward as long as WSDOT and FHWA concur with the no effect determination using the process outlined in the interim Local Agency Guidleline (LAG) requirements. Not all of our projects will be "no effects" but for those that are, this opportunity significantly decreases the time period required for concurrence.

For projects with a potential to effect a species, every possible option to minimize those impacts (stormwater treatment, riparian habitat protection, limiting in-waterwork, strict erosion control, etc.) need to be evaluated.

...every possible option to minimize those impacts...needs to be evaluated.

Potential Solutions

To help address the problems and minimize the imports there are a number of efforts currently underway.

1. DOT's Environmental Affairs Office (EAO) will be adding staff to work on the review of individual biological assessments and the programmatic biological assessments. They have a decision package for additional funding and staff for ESA response, which will hopefully be available as of July.

2. WSDOT is aggressively pursuing an effort to provide staff at the resource agencies to assist in the review of biological assessment. WSDOT has already placed two individuals at NMFS to work on ESA issues, including biological assessment reviews. TransAid has joined the effort to ensure local agency projects receive an appropriate portion of the staff time.

3. TransAid, through the NWT2 Center, will be conducting more

training sessions on the ESA and how to conduct biological assessments. The workshops, "Introduction to ESA/ Biological Assessment," will be held in May and June at various locations throughout the state. Flyers/ registration forms are in the process of being completed and will be sent to the agencies, consultants, WSDOT personnel, and other interested participants. Look for further information on the TranAid homepage at:

Environmental/EnvNews.htm
www.wsdot.wa.gov/TA/

4. Coordination with NMFS and USFWS to develop programmatic biological assessment as well as opportunities to provide input on the upcoming "4d" ruling are currently underway. TransAid is working with the EAO, USFWS, and NMFS to ensure local agency input is included in the efforts. It is likely, however, the program level process will not be completed for four to six months. The program level approval process will not remove the biological assessment requirements, but it will increase processing speed and efficiency.

Further information on these efforts can be found in the Environmental section on TransAid's homepage at **www.wsdot.wa.gov** and clicking on TransAid Service Center.

5. Finally, TransAid has initiated a weekly ESA update mailing list via e-mail. Current events and information seem to be changing daily. The updates will help ensure we all have access to current information, requirements, and potential solutions. If you would like to be added to the mailing list please contact Brian Hasselbach at (360) 705-6975 or **e-mail, hasselb@wsdot.wa.gov**

You can also find additional information via the TransAid homepage or by contacting your Regional TransAid office.

Govener to Present the Washington State Y2K Readiness Report

Gov. Gary Locke will be releasing the first Washington State Year 2000 Readiness Report, the most extensive review ever done of Y2K technology-transition preparations in Washington.

It was produced by the State Year 2000 Office and the agencies of state government with information contributed by many local government and private-sector service providers.

The purpose of the new report is to accurately present the most current information available in Washington on actions taken in several public and private service sectors to find and repair technology problems that might occur as a result of the millennium date change.

The report identifies sources of additional information more specific to individual needs, helping Washington residents make their own plans for the Year 2000 transition.

This is the first of three volumes of the Readiness Report that will be produced this year. It reviews the readiness of these service sectors: electricity, telecommunications, financial services, natural gas and petroleum, water supply and treatment, emergency management, transportation, local government, and Washington State government.

Future reports, in July and November, will examine additional service sectors in the state.

The Washington State Year 2000 Readiness report is one of several initiatives under way in Washington to make Y2K information readily available to the state's residents.

A GEM of An Idea

EMPLOYEES TRY TO SHARE, SAVE ALIKE

One nut and one bolt at a time, a group of public employees is quietly linking 26 government agencies to save tax money in Clark County. Estimates are elusive, but most agency heads think the savings are substantial. "It's got to run into the hundreds of thousands of dollars over six years," said Bruce Cross, deputy director of Clark County public works, who heads the cooperative group.

The effort is known as GEM, for Grounds Equipment and Maintenance. Under GEM, overlapping jobs are orchestrated so agencies share resources: the county with the city of Vancouver and with six smaller cities, the bus system, ports, fire and school districts and soon, perhaps agencies in Kelso and Longview.

In Southwest Washington, GEM's chief participants are the state Department of Transportation, Battle Ground School District, the city of Camas, C-Tran and Clark County, Cross said. Ties also are forming with similar groups in Multnomah and Washington counties in Oregon.

Members are reluctant to talk about the amount of specific savings from the sharing of equipment, brain and muscle power. This reluctance is political. "Some people are concerned that if they talk too much about the savings, people will expect cutbacks," Cross said. "And the goal here is not to lay anybody off or cut back on service levels.

"The goal is to be able to do more with less."

The effort appears to be working as the cooperative concept expands. In fact, if intergovernmental agreements and accounting systems can be forged to handle the concept, GEM could well lead to big money deals, Cross said. For example, buildings might be built jointly for state, county, school, fire district and city use. One building could serve where before several might have been built.

GEM could lead to intergovernmental equipment repair shops open 24 hours a day, seven days a week with mechanics working together on cars, trucks and buses from multiple agencies. GEM's work could dovetail with the idea of a unified maintenance agency being talked up in Clark County government as a sort of visionary concept: an independent contracting organization to handle road, park and facilities maintenance for government agencies.

How Does GEM Work?

The goal is economy of scale, and GEM works informally: a dollar here, $100 there. Cross says GEM is ready to take on bigger jobs, and one obvious example is the sharing of shops.

The county runs a state-of-the-art equipment repair shop two shifts a day, five days a week; Clark Public Utilities runs its shop two shifts, five days a week; the state transportation department runs its shop one shift a day, five days a week.

C-Tran needs a new shop, and the city of Vancouver is outgrowing its space on Fourth Plain. Cross suggests existing shops might run seven days a week, 24 hours a day, each specializing in certain jobs, taking work from several agencies.

C-Tran, which has 150 buses in a facility built for about 100, has taken GEM's idea seriously, and ordered its consultant to explore joint operations while it looks at enlarging its facility, said spokeswoman Gail Spolar.

The city of Vancouver has doubled its fleet size and has no immediate plan to increase its repair facilities although it is outgrowing its shop.

The Port of Vancouver expects its fleet to grow with the completion of the Mill Plain extension project, Cross said.

"It just makes sense,"

In all these cases, cooperation would be logical. "It just makes sense," said Cross.

The idea looks simple, but it will have to run through political mine fields. People tend to be reluctant to give up their power bases; agencies have different pay scales for the same jobs, so that a mechanic in one agency may be paid more than a mechanic in another.

It's also difficult to get workers who are accustomed to laboring independently to think cooperatively.

The challenge is to change attitudes, "so the worker thinks of doing things cheaper and easier," said Steve Canter, maintenance supervisor for the state Department of Transportation.

Monte Brachmann, operations manager at the city of Camas, said cooperative efforts like Camas' shared ownership of a street sweepers with Washougal is fairly easy to manage. A trickier idea, and one not yet tried, would be for Camas to use Clark County equipment and gravel from English Pit in east Vancouver for sanding streets on Prune Hill rather than running city trucks all the way across town to the city's own gravel pit. Camas then would pay the county for gravel, Brachmann said. "This is a concept that's worth looking at," he said.

How Gem Acts

- A Clark County dump truck pulls into a city of Camas repair shop to get a flasher light repaired, a fix that would have cost $50 an hour in driving time or dispatching a mechanic. Cost is a new light bulb.
- Larch Mountain Offenders Group puts a new skin on greenhouses at Battle Ground High School. No labor cost.
- Cities of Camas and Washougal jointly own two street sweepers, effectively halving the purchase price.
- C-Tran lends its paint booth to Clark County to repaint a county snow blower.
- City of Portland donates a replacement for a blown engine in a Clark County patrol car.
- Clark County and Battle Ground School District take turns mowing school grounds and parks in the Battle Ground area.

At a Glance

- **WHAT:** GEM, an interagency cooperative
- **WHY:** To save taxpayer money
- **WHERE:** Clark County
- **WHO:** 26 agencies: Clark County, cities and school districts of Vancouver, Battle Ground, Camas, La Center, Ridgefield, Yacolt, Washougal,Woodland, plus C-Tran, Washington State Patrol, Washington State Department of Transportation, and Fire Districts 1, 5, and 6.

Y2K Confusion

Roger Chappell, Technology Integration Specialist, NWT²

I'm sure by now you've heard of Y2K. It seems there is something in the news every few days, your favorite periodicals have featured articles on the subject, and most of your friends and coworkers have shared their insights and opinions with you. With all this attention on this one subject you would think that it would be easy to sort out what direction to go and what steps it will take to get there. If you feel the Y2K waters are as clear as mud then you are not alone.

Because of my occupation in computer technology I have been involved in this issue from the start. I have seen this topic evolve from "Y2K what?", to mild hysteria, to the current polarized states of "don't worry be happy" and "total melt down". I would like to offer a more moderate view then the two extreme views that we find so prevalent today.

First I would like to thank those of you who find yourselves in the "melt down" camp. You were the one's who got our attention, you sounded the wake up call, and you are the one's who kept this important issue in the for front of our business practices. It is because of people like you we have focused millions of dollars and hours of effort confronting the Y2K problem.

Is it fixed? No, but there have been huge strides made to prepare for it. Will we have time to fix everything? Again no, but because of the work that has been accomplish, we are in better position then any nation in the world to meet the challenges ahead. If we had done nothing, the consequences could have been devastating on our modern infrastructure. But because of the efforts that have been, and will continue to be made, the impact of Y2K has been greatly diminished. I say diminished, because part of this effort comes down to you and me.

Some people have prepared well and positioned themselves and their organizations to meet this challenge. Others have not. Even with all the effort that has gone into this some things still may slip through the cracks. From the work I've seen done here at WSDOT, I am optimistic that the infrastructure will not collapse, but there still may be some inconveniences and challenges ahead.

It is important to keep in mind that this is not just a single event that will occur only on New Years Eve 2000. It started several years ago when forecasting software started to use dates projected into the year 2000. In the last T2 Bulletin we featured a long list of dates that can impact us for various reasons. Any organization that has planning or budget cycles that extend over a multiple year period, have been dealing with Y2K failure issues for quite some time. Some have even experienced failures already and fixed them, with minimal or no disruption of services to the end user. The difference with the coming of the new year is that there could be multiple fixes needed simultaneously.

Not just with software but hardware as well. Embedded chips with date algorithms could need fixes also It is important to realize that not all computers or equipment with embedded chips will automatically fail or malfunction. The challenge is locating those that potentially will fail, especially those that are a integral part of your agencies infrastructure, and dealing with those that are missed.

If you have not taken this problem seriously and been proactive in your Y2K efforts, the required number of fixes and duration of service disruption could be substantial. If you have done a thorough job with

your Y2K remediation efforts, the number of fixes and the resulting disruption should be minimal. Perhaps the most important thing to mention at this point is the need to have a thoroughly thought out and tested Y2K contingency plan in place. This is critical to ensuring continued continuity of the services you provide. The effort you invest in contingency planning will enhance your ability to respond to any emergency situation that you may face in the future.

Will this be a bump in the road, or will your organization be driving on gravel? The answer to that question depends on how well you have prepared. There are many good resources available to help you plan for this event, but you must plan for it. I would like to say that when you are walking the tight rope of preparedness, **balance is the key.**

More information on Y2K :

http://www.wa.gov/2000 and **http://www.ga.wa.gov/y2k/**
CONTINGENCY

I have also included an outline of the "Y2K readiness report". Gov. Gary Locke will soon be releasing the first Washington State Year 2000 Readiness Report, the most extensive review ever done of Y2K technology-transition preparations in Washington. It is the first-of-its-kind. The report details what Washingtonians are doing to get their technology ready for 2000.

To get more information:

- The Washington State Year 2000 Readiness Report will be available in many libraries around the state.
- The report, and other information about Y2K, will be available on-line at: **http://access.wa.gov/2000/**
- A limited number of copies may be requested through a message line at 360-586-4204.

Did you know?

Here are some things that the report writers learned in their research:

The U.S. Department of Energy has asked the North American Electric Reliability Council (NERC) to coordinate Y2K efforts so that electricity power production and delivery systems in the United States maintain a reliable supply of electricity during the Year 2000 transition.

NERC scheduled drills, and recommends that utilities conduct testing by May 31, 1999, and that critical systems and components are Year 2000 ready by June 30, 1999. Consequently, the "transition through critical Y2K rollover dates is expected to have minimal impact on electric system operations in North America," according to the January, 1999, NERC report.

The Year 2000 isn't a single event. Its effects will be spread out over several years as a result of the wide variety of fiscal years, technology differences, and other factors around the globe. Analysis by an international technology consulting firm, the Gartner Group, indicates that only 8 to 10 percent of technology failures related to Y2K will occur during the first two weeks of 2000.

The Y2K problem is solvable. Businesses and governments know how to fix non-compliant systems and are devoting significant financial and personnel resources toward doing so.

Solving the Y2K problem is primarily a management challenge. Ensuring that critical systems are ready for the Year 2000 is a matter of setting priorities about what

needs to be fixed, devoting adequate personnel and financial resources to the project, and developing contingency plans to be used in the event that internal or external systems malfunction.

Many service providers have self-imposed early deadlines — requiring themselves to have mission-critical systems ready several months ahead of the date change. Likewise, many regulatory bodies have set early deadlines for their regulated industries.

The largest local and long distance telecommunications carriers are expected to be 100 percent ready, including having their contingency plans in place, by the second quarter of 1999, according to a march 1999 "Y2K Communications Sector Report." The report was produced by the Federal Communications Commission (FCC) in conjunction with The Network Reliability & Interoperability Council.

The remaining carriers, defined as medium and small, lag behind the large carriers in their remediation and contingency planning efforts. Nearly half the medium and small carriers surveyed by the FCC reported not having formal processes for managing Year 2000.

As of March 1, 1999, no state-chartered financial institution reviewed to date under the Year 2000 compliance process had received an unsatisfactory rating, according to the Washington State Department of Financial Institutions. The review included all state-chartered credit unions and 90 percent of state-chartered banks.

Because more than 80 percent of Washington's crude oil comes from Alaska, Year 2000 preparations on the Trans Alaska Pipeline, operated by Alyeska Pipeline Service Company, is of particular importance to Washington State. Alyeska identified 127 mission critical systems, all of which the company says it has fixed.

In consultation with the U.S. Coast Guard, the Department of Transportation has identified and prioritized mechanical bridges that must be opened to marine traffic. In cases of potential power outages, DOT crews are prepared to open some bridges the old-fashioned way - by hand - if necessary.

As of April 5, 1999, 79 percent of Washington State government's mission-critical computer data systems had been fixed and tested. All are required to be ready for the Year 2000 by June 30, 1999.

As of April 5, 1999, 77 percent of the vital services had low or moderate risk of experiencing failures related to embedded chips in facilities and equipment. As with computer systems, all preparations of equipment and facilities supporting vital public services have a June 30, 1999, completion goal.

Executives, technology leaders advise state government

In developing the Readiness Report and other information about Y2K, the State Year 2000 Office, within the Office of Financial Management, is working with a diverse group of over 20 private and public sector executives and technology leaders, who serve on our Washington State Year 2000 Advisory Board.

The board, and state government, are working together to help establish Washington as a national model for making information easily available to the public.

Information

How to get more information

The Washington State Year 2000 Readiness Report will be available in many libraries around the state.

The report, and other information about Y2K, will be available on-line at: **http://access.wa.gov/2000/**

A limited number of copies may be requested through a message line at 360-586-4204.

Controlling Dust

Which materials should you use?

Source: Better Roads, June 1998

Dust kicked up on our nation's unpaved roads may not seem like a big problem, yet there are numerous ways that this action can adversely affect not only the roads, but vehicle and equipment maintenance, and even public health and safety. Add them all up and dust control becomes much more important.

Dust causes obvious safety problems in road visibility, and health hazards in its effect on allergies and by carrying airborne diseases. It also adds wear to vehicle exteriors and clogs fuel systems, stunts crop growth, and damages homes and property. For our unpaved roadways, dust erodes surfaces, and a 1993 Dow Chemical report says that the average untreated road loses 300 tons of aggregate per mile every year.

In a Better Roads survey several years ago, dust control was singled out as the worst unpaved road maintenance problem, with nearly 23 percent of respondents saying it tipped their road problems. (By comparison, poor drainage followed with 18 percent.) And the survey also showed that 31 percent of a county's annual budget was spent on the maintenance of these dust-producing roads.

Dust control is not only a big problem, it's a big business. There are currently five prevalent ways to deal with dust using calcium chloride, magnesium chloride, petroleum-based resins (oil and asphalt emulsions), lignin sulfonates, or water.

Water is a very temporary way to deal with the problem and not very economical considering the application rates. As soon as it dries up, dust returns. Not only that, engineers say that water does not work well because it forms even more dust particles than you would have had without it.

The other four kinds of materials (see sidebar) all work well, industry professionals say, but vary in a number of ways, such as the length of time before another applications is necessary, and environmental and corrosive impact. Material prices differ mainly because of shipping and freight costs.

Friendly debate?

The two biggest competitors for the dust control market are calcium chloride and magnesium chloride. In fact, the question as to which is the best performer may be the industry's friendliest major debate.

"In my 12 years of experience, I would say the performance is very, very comparable," says Jim Wilson, a vice president with a chemical background at Scotwood Industries in Kansas and head of the company's liquid division. He later added, "I will say that the straight calcium chloride and magnesium chloride products outperform the mixtures (of the two)."

Scotwood distributes both chemicals in either a liquid or dry form, although the liquid is usually preferred because a coating of water has to be applied to the dry, requiring more time and effort. The company's calcium chloride products come from Tetra Technologies. "Whether you get calcium chloride from Tetra, General Chemical, or Dow, it's going to be essentially the same," Wilson said, but with magnesium chloride, there can be some differences."

A National Association of Corrosion Engineer's study showed that calcium chloride is more corrosive than magnesium chloride, but on the other hand, Wilson pointed out that calcium chloride is an ASTM spec product, while magnesium chloride is not. "Therefore, a civil engineer will use calcium chloride in his project," Wilson said. One other aspect in calcium chloride's favor is its preferred use as road stabilizer.

Otherwise, it is pretty much a toss up. Wilson said that it was hard to evaluate the differences between the two in a seasonal application where only one chemical is used because of

the variables in weather and road use. "If you really want to find out which performs better, you need to do a side-by-side comparison under the same conditions," he said.

Wilson said that there are generally two determining factors in the user's decision on what product to buy: 1) the product he has used before, and 2) the cost. With most dust control materials, he said that the cost factor will almost entirely be dependent on freight and shipping fees, which is especially true of calcium and magnesium chloride. Since calcium chloride is mainly produced in the east and magnesium chloride in the west, states are generally divided along those lines as to what they use, he said.

"For example, a lot of people in the state of Iowa would not use anything but calcium chloride. . . while Utah uses magnesium chloride," Wilson said.

2001 Road Builders's Clinic Call Papers

Washington State University

Pullman- The Program Committee for the Annual Road Builders' Clinic is seeking papers from qualified individuals who would like to give presentations at the clinic in March of 2001. Industry-related papers and abstracts will be accepted until March 9, 2000.

The one-to two page abstracts will be reviewed by the clinic's Program Committee and abstracts will be selected by June 1, 2000. All presentations must be technically based and final papers will required for the Conference Proceedings.

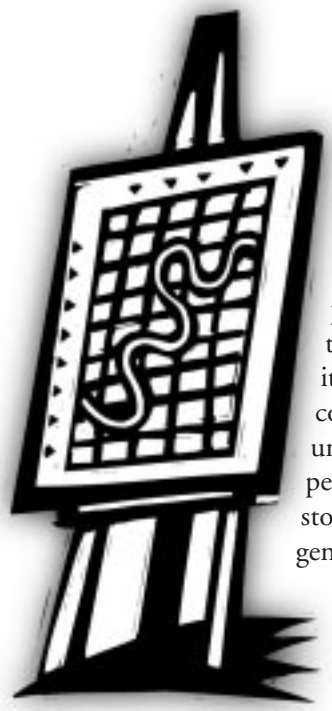
The Road Builder's Clinic annually attracts more than 250 highway and roadway engineering professionals and is an excellent venue for discussion of current road issues and product demonstrations.

Abstracts may be submitted to Kris Finch at WSU Conferences & Institutes via e-mail: **kfinch@wsu.edu** or by mail to Conference & Institutes; Washington State University: 208 Van Doren Hall; PO Box 64522; Pullman, WA 99164-522.

For more information, call Conferences & Institutes at 1-800-942-4978.

Potholes: Cold-Mix Can Solve the Problems

Source: Better Roads, March 1999



Despite the occasional humor column or Find-the-biggest-pothole contest, potholes are not much fun. In most areas, they seem to be like living pests - you think they have been eradicated when they pop up again with the first rain.

Of course, there are several different reasons why that happens, and why potholes appear in the first place. If a road's subbase is bad, no patch job is going to work for long, experts say. But on most roads, it is more likely to be the patch job itself that is at fault. Theoretically, a patch should last almost as long as the pavement whether it is a hot or cold mix.

Material Problems

To clear up some of the problems agencies may have with pothole patching materials, we talked at length with Fred Closs, an engineer for Unique Paving Materials Corporation, which President Tom Letizia, Jr. says is the largest high-performance cold-mix manufacturer in the country. The company's UPM mix is one of the major patching materials tested in the Strategic Highway Research Program's pothole patching study, H-106.

"First, we need to recognize that there are three types of asphalt road repair materials: Hot mix, cold mix, and high-performance cold mix," says Closs, adding that his company spear-headed the HPCM industry over 20 years ago. "UPM is the original high-performance cold mix. . . created to make permanent pothole repairs in all weather conditions."

Initial problems with regular cold mixes caused a poor response from agencies, but Closs said, "we had no problems early on with UPM because it was not introduced into the market until we were sure that it worked. (It) was very well received by the different agencies once their doubts were overcome by its performance. We did, however, have some problems later as the product expanded across the country since there are major differences in (local) aggregate characteristics. After much research and development, we now have many different formulations to compensate for this. This is a primary reason the copycats have problems with their material once they leave their home area."

Hot mix is made fresh each day and is primarily used for building or revamping roads, Closs said. "Hot mix is thought to make permanent repairs in good weather - dry and above 40 degrees F. Cold mix was invented so that the industry would have a pavement repair material that could be stored until it was needed. However, cold mix does become unusable after only a short period of time in a stockpile. Also, cold mix is generally thought to be a temporary material that will have to be replaced with hot mix at a later date. Both hot mix and cold mix are known to fail when applied in poor - especially wet - weather conditions."

High performance cold mix makes permanent pothole repairs in all weather conditions, including cold, wet weather, Closs says, adding that many people think of the mix only for use when the weather is bad - which makes it tougher to sell for good weather - but the upside to that thinking is that, when it comes to making repairs in bad weather, it is received very well.

Road Problems

Closs says that potholes are generally caused by two problems - moisture getting below the pavement surface, and traffic load. "Moisture primarily gets under the pavement through cracks in the pavement, expansion joints, and leak paths left by

improperly sealed road repairs," he said. "Water can also enter from the edge of the roads through a pumping action caused by the pavement flexing up and down with traffic loading.

"Once the road base becomes wet, it softens and can no longer support the pavement, as designed. When this pavement is subjected to traffic load, it breaks up, fails, and a pothole is created. If a wet road base becomes frozen, the pavement can often fracture without load due to the expansion of water as it freezes," Closs said. "Also, during heavy rains, water can form a channel underneath the pavement and the base can be washed away, leaving the pavement without support."

Sand and clay are not mechanically stable enough to handle traffic load, he says, and they tend to shift and ooze, leaving the pavement without support and causing failure - often even in dry weather. "Nothing will work for long in this situation," he said, adding, "a proper foundation is of paramount importance when building any structure meant to last. Many roads were built on a poor base, if any, and you can usually spot them by the massive numbers of pavement cracks and pothole repairs."

Repair Problems

"Potholes were a major issue in the last mayoral race in Houston, Texas, and I suspect this is true in many cities across the USA," Closs said. "Every city, large and small, has problems with potholes, and potholes are a major source of citizen complaints. Citizens get irate after a bone-jarring pothole collision and the subsequent repairs. . . They also see crews repair the same potholes over and over, time and again. They see the waste of materials, equipment, and manpower and it upsets them further."

So, if potholes are such a big deal with the public, why can't cities keep up with them? Closs says, "One, most street departments are underfunded and do not have the manpower to perform all of the functions that are assigned to them.

Two, if you are having to re-repair just 25 percent of the potholes, you will be wasting 33 percent of tomorrow's efforts. . . The cities cannot keep up with the potholes using their current manpower and methods.

"I would like to say that the cities have come around, but they have not, on a daily basis," he said. "Hot mix has been the staple of street repair departments for decades - and it still is - because it is the cheapest material available. Standard cold mix is slightly more expensive, and high-performance cold mix is more than twice the price of hot mix. We often see an attitude that says, 'our current mix does not work, but it is still the cheapest.'"

Hot mix has several problems that make it higher in costs when it comes to pothole repairs, according to Closs. "First, you have to send trucks to the hot-mix plant every morning to get the hot mix, and sometimes they have to go again in the afternoon. Often, the city trucks have to wait in a long line at the plant (and) this wastes a lot of time," he says.

"Second, if the hot mix gets cold - below 200 degrees F - it will not work, so the crew must throw it away. Money is wasted on material and time because they will have to go get more material at the hot-mix plant. This happens a lot," Closs said.

"Third, hot-mix repairs require larger crews - four to six versus two to three persons - and more heavy equipment, such as rollers, and trucks to bring them to the job site, which costs the city more in man and equipment hours.

"Fourth, hot mix requires tack coat to be used so that it will adhere to the pothole," he said. "If not used properly, the repair will fail. Also, the edge of the pothole must be sealed to prevent moisture from penetrating the pavement during the next rain and causing more potholes to form in the same area."

And finally, compared to HPCM, hot mix is very brittle, Closs said. "Over time, with seasonal changes, the repair will expand and contract, as will the surrounding pavement. This will stress the pothole repair, causing it to develop cracks and subsequently fail."

Remember the Essentials to Maintain Good Roads

Source: The Link, the Kentucky Transportation Center's newsletter, Spring, 1983

1 Keep Water Away from the Road

Drainage cannot be overemphasized in road construction and maintenance. Water affects the entire serviceability of a road. Too much water in the base material weakens the road. Water allowed to remain on top of a gravel or black-topped road weakens the surface, and, combined with traffic causes potholes and cracking. If improperly channeled, water causes soil erosion and a breakdown of pavement edges. A good surface drainage system that incorporates road crown, shoulders, ditches, and culverts is the best way to lessen water damage on a road.

2 Build on a Firm Foundation

A highway wears out from the top, but it falls apart from the bottom. The road base, therefore, determines the service-life of a road. The base supports everything above it, including traffic. A good road requires a suitable foundation composed of stable material.

A road material is stable if it has negligible soil settlement with a change in moisture content and it does not deform excessively under repeated loads whether the material is wet or dry.

3 Use the Best Soils Available

The supply of natural, good-quality soils and aggregates is beginning to disappear. Blended or crushed gravel is a more expensive alternative. The quality of soils used often depends on local availability and budget, but the long-term consequences of using lower-quality material should always be considered.

4 Compact Soils Well

The more dense the material, the stronger it is. When soil is improperly compacted, future traffic loads or changes in moisture content can cause settling and failure of the roadway.

Compaction is achieved by pressing soil particles together, which expels some of the air from the mass and makes the material more dense. Well-graded soils having a fairly even distribution of particle sizes will compact more easily than poorly graded soils that have mostly one particle size. A certain amount of moisture is necessary for good compaction.

5 Design for Winter Maintenance

In areas that receive substantial snowfalls, roads that are designed for winter maintenance should be adequate for the rest of the year. Road width, ditches and roadside area volume, grades, and sight distance are things that should be considered.

6 Build for Traffic Loads and Traffic Volumes

Thin ice on a pond may support a young skater, but it will crack and break apart under the weight of an automobile. A road built to serve residential traffic will break down when it starts to carry a number of large trucks. Roads, like bridges, should be designed with the expected traffic type and volume in mind.

A good rule of thumb is to design a road to accommodate the largest vehicles that will use the road under normal operation.

7 Pave Only Roads That Are Ready

Sometimes, roads are paved that are not properly prepared in an effort to quickly get rid of another dusty gravel road. Paving will not cure the other problems that the gravel road may have. The road must still be build of well-compacted soil, be able to carry expected traffic loads, and be able to drain well.

8 Build from the Bottom Up

A road that has a poor base and poor drainage cannot be adequately improved with a top dressing of gravel or new pavement. It may be necessary, in some cases, to dig out the old road, put in new materials, and build up the road in layers.

9 Protect Your Investment

Roads and bridges need regular

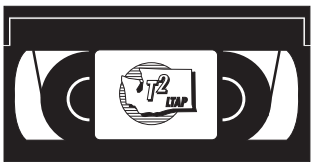
maintenance to keep them from deteriorating. The increased weight and frequency of traffic on roads, combined with adverse weather conditions, means an increased rate of road and street deterioration. Regular road and bridge maintenance, such as the activities listed below, preserves our road investment and prevents costly major rehabilitation later on.

- Roadway surfaces: blading and shaping, patching, resurfacing, controlling dust, removing snow and ice.
- Drainage: cleaning and repairing culverts and ditches.
- Roadside: cutting bushes, trees, and grass, repairing and preventing roadside erosion.
- Bridges: clearing channels, repairing rails, decks, and structures, cleaning and painting.
- Traffic Services: maintaining signs, cutting vegetation to maintain visibility.
- Special Projects: restoring or making improvements, emergency work such as removing slides, repairing washouts, and repairing retaining walls.

10 Keep Good Records

Good record keeping makes roadwork much easier for everybody. Formulating budgets and showing citizens roadwork plans becomes easier. Recording which type of work was done on roads or bridges, when, and what materials were used can help when making decisions later on. Good records also help when foremen and workers retire or leave.

A good start is to inventory all roads and bridges with such data as length, width, surface types, culverts, problem areas, and other pertinent items. Placing this information on a map also helps. Next, list and prioritize areas needing improvement, estimate costs, and take care of a few problems each year.



Walkable Communities: Designing for Pedestrians

Videotape of the class by Dan Burden. Four tapes, 5.5 hours. Available for purchase ($75) or can be borrowed by local agencies. Call T^2 Center for further information (360) 705-7386 or grayl@wsdot.wa.gov.

Driver Expectancy, Traffic Control, and Roadway Design

by Keith Knapp, Manager, Traffic Engineering and Traffic Safety Programs
The Center for Transportation Research and Education

Driver Expectancy is "an inclination, based on previous experience, to respond in a set manner to a roadway or traffic situation." It affects how drivers control, guide, and navigate their vehicles. In fact, the characteristics and consequences (good or bad) of a driver's reaction to a particular situation can, in many cases, be related to how well the situation met his or her expectancy. The concept of driver expectancy forms the basis of many traffic control and urban street design requirements in the "Manual of Uniform Traffic Control Devices" and the "Policy on Geometric Design of Highway and Streets."

Drivers bring two types of expectancy to their driving experience:

1. Long-term (or a priori) expectancy is based on past experience, upbringing, culture, and education. For example, based on past driving experience in the United States, drivers do not generally expect stop-controlled intersections on freeway-standard rural roadways. The addition of such stop controls would therefore typically violate long-term driver expectancy.

2. Short-term (or ad hoc) driver expectancy is based on local practices or situations encountered on a particular roadway during a particular trip. For example, if a roadway is paved and straight, a driver will typically expect that the roadway will continue in this manner. Suddenly encountering curves or an unpaved surface would violate short-term driver expectancy.

Driving errors typically occur when driver expectancy is violated - in other words, when a driver is surprised by a situation. A driver's reaction time increases in these situations, perhaps resulting in a crash. In general, therefore, a primary goal of transportation professionals is to design roadways and traffic control to reinforce drivers' short-term expectancy and conform to their long-term expectancy. If this is not possible, a secondary goal should be to change driver expectancy through the proper use of advance signing and/or marking.

Drivers assume or expect a standard driving situation unless signing, markings, and/or the general roadway environment indicates otherwise. When a roadway design or traffic control device is different from what drivers would normally expect, drivers must be told what to expect in a uniform and understandable manner.

A large number of warning and regulatory signs are used to alter driver expectancy - in other words, to prevent surprises. For example, the sign shown in Figure 1 informs drivers that the roadway is about to turn left (i.e., the sign overrides and changes driver expectancy). Drivers' initial expectation, even in this urban area, is that the roadway alignment will continue straight ahead. Drivers who are unfamiliar with this roadway and miss this sign will probably continue straight through the intersection.

The "minor" street approach at the intersection in Figure 2 is controlled by a stop sign. An auxiliary sign

informs stopping drivers that through movement at the intersection is different from what they would normally expect (i.e., the auxiliary sign overrides and changes driver expectancy). An alternative to the auxiliary sign would be to redesign and reconstruct the corner and driveway radii to match the intersection layout with its intended function and operation. Such reconstruction would meet driver expectancy better, allow the removal of some signs, and produce an intersection that operates more efficiently and safely.

Any changes in roadway design or traffic control (e.g., signals or signs) must accommodate the long-term and short-term expectations of drivers. Figure 3 shows an auxiliary regulatory sign used with traffic signals that includes a green left-turn arrow. Such signal equipment now allows the treatment of left-turn movements to change from cycle to cycle. In some cycles, left turns are protected (as indicated by the green left-turn arrow); in other cycles, left turns are permitted only after drivers yield to oncoming traffic (as indicated by the green ball); in still other cycles, left turns are protected and then permitted (as indicated by the green left-turn arrow changing to a green ball). Having experienced a protected left turn at one or more intersections, however, drivers (especially older drivers) may begin to expect that all left turns are protected at all intersections within the jurisdiction. The auxiliary left-turn-yield-on-green sign (a symbolic green ball) overcomes that expectancy, reminding drivers to yield to oncoming traffic before turning left on a green ball.

Meeting driver expectancy through consistent, uniform, and understandable roadway designs, traffic controls, and general roadway environments will improve overall driving operation and safety. When drivers can predict a roadway design, traffic control, or vehicle movement, they are less likely to make driving errors.

Free Publications From Your T^2 Center

For Washington residents only.

Name _____

Agency _____

Address _____

City and Zip _____

Phone _____

Check the items you would like to order.

___ Current Application and Successful Implementation of Local Agency Pavement Management in the United States, FHWA, 1997

___ Scrap Tire Utilization Technologies, NAPA

___ State-of-the-Art Survey of Flexible Pavement Crack Sealing Procedures in the United States, CRREL, 1992

___ Maintenance of Aggregate and Earth Roads, NWT^2 Center (1994 reprint)

___ International State-of-the-Art Colloquium on Low-Temperature Asphalt Pavement Cracking, CRREL

__ Geotextile Selection and Installation Manual for Rural Unpaved Roads, FHWA

___ Guide to Safety Features for Local Roads and Streets, FHWA, 1992

___ Family Emergency Preparedness Plan, American Red Cross, et al.

___ Getting People Walking: Municipal Strategies to Increase Pedestrian Travel, Rhys Roth, Energy Outreach Center

___ The Superpave System – New Tools for Designing and Building More Durable Asphalt Pavements, FHWA

___ A Guide to the Federal-Aid Highway Emergency Relief Program, USDOT, June 1995

___ Asphalt Seal Coats, T^2 WSDOT

___ Pothole Primer — A Public Administrative Guide, CRREL, 1989

___ Redevelopment for Livable Communities, Rhys Roth, Energy Outreach Center

___ A Guidebook for Residential Traffic Management, NWT^2 Center, 1994

___ A Guide for Student Pedestrian Safety, KJS, 1996

___ Pavement Surface Condition Field Rating Manual for Asphalt Pavement NWPMA, WSDOT. 1999

___ A Guide for Local Agency Pavement Managers, NWT^2 Center, 1994

___ Local Agency Pavement Management Application Guide, NWT^2 Center, 1997

___ Positive Guidance and Older Motorists — Guidelines for Maintenance Supervisors, Texas A&M

___ Planning, Design, and Maintenance of Pedestrian Facilities, FHWA, 1989

___ Traffic Calming: A Guide to Street Sharing

___ Basic Metric System, WSDOT

___ The Impact of Excavation on San Francisco Streets. This study evaluates the impacts utility cuts have done to the street and road network. September 1998

___ Rating Unsurfaced Roads, CRREL A Field Manual for Measuring Maintenance Problems

___ The Pedestrian Facilities Guidebook, Otak/WSDOT

Workbooks and Handouts From T2 Center Workshops

___ Access Management, Location and Design, FHWA/NHI, 1998
___ Access Management Guidelines for Activity Centers, NCHRP Report 348, TRB/NRC, 1992
___ Handbook for Walkable Communities, by Dan Burden and Michael Wallwork
___ Geosynthetic Design and Construction Guidelines, National Highway Institute
___ Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, TRB
___ Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations
___ Historic and Archeological Preservation: An Orientation Guide, FHWA/NHI
___ Partnering Handbook

Self-Study Guides

The following noncredit self-study guides are available through WSDOT Staff Development and can be obtained from the T2 Center. An invoice will be sent with the books.

___ Technical Mathematics I, $20
___ Technical Mathematics II, $20
___ Contract Plans Reading, $25
___ Basic Surveying, $20
___ Advanced Surveying, $20

Orders may be faxed, mailed, or phoned to
Laurel Gray
Phone: (360) 705-7386
Fax: (360) 705-6858
Mailing Address: NWT2 Center, WSDOT TransAid
P.O. Box 47390
Olympia, WA 98504-7390

Computer Programs

The following computer programs may be downloaded from the Internet at ***http://www.wsdot.wa.gov/TA/T2/computer.htm***

Design Cost Estimate. A software database program that calculates cost projections based on standard items.

Materials Approval Tracking. A software program designed to track materials data, need, status, and approval of any materials sampling and documentation needed for approval.

HyperCalc. A shareware utility for converting between metric and English units.

Force Account Macros. A series of ready-made Excel spreadsheets and macros to save you time on daily force account calculations and reports, including wage and equipment rates.

APWA CAD Symbol Standards and Menus. A public domain program of standard AutoCAD symbols developed by the Washington Chapter of APWA for use with AutoCAD release 14. The program may also be downloaded at :**http://users.ap.net/~fredlee**

Microsoft Access Runtime Program. Assists in running the Materials Approval Tracking and Design Cost Estimate Program.

UTEC System. A software program consisting of a main menu designed to provide a record base for identifying street locations within an agency.

Opportunities to Enhance Your Skills

For more information, contact the training provider listed. For additional training needs contact the Northwest T2 Center at (360) 705-7386 or 1-800-973-4496.

http://www.wsdot.wa.gov/TA/T2/T2HP.htm

NWT2 Center
Contact Laurel Gray, T2 Center, WSDOT
(360) 705-7386, fax (360) 705-6858
http://www.wsdot.wa.gov/TA/T2/train.htm

Roundabouts

June 3, Tumwater; June 18, Wenatchee. **Free**. Instructor: Darlene Sharar, WSDOT.

Bridge Condition Inspection Training (BCIT I and II)

June 7-11 and 21-25, at the Oxford Suits (1st week) and Mt. Hood Community College (2nd week), Portland Oregon. **Free**. A two-week course based on the updated "Bridge Inspector's Training Manual 90." The course will provide extensive training on the condition inspection of in-service bridges. Satisfactory completion of this class will fulfill the training requirements of the National Bridge Inspection Standards (NBIS) for "a comprehensive training course" based on the manual.

Snow and Ice Control Chemicals — Theory and Practice

July 12, Kent; July 13, Everett; July 14, Vancouver; July 26, Ellensburg; July 27, Spokane; July 28, Walla Walla. Four hours of training. **$25**. This class will examine the difference between anti-icing and deicing, when each is appropriate for use, and how to use each method correctly.

A Toolkit for Pedestrian Design

October 6, 13, 19, 27 in Everett, South Seattle, Vancouver, Yakima. The October 19th session will be held during the Fall APWA Conference in Yakima. **$25**. Instructors: Consultants Dan Dawson and Mandi Roberts of Otak. A one-day session at each location. Instruction will be based on the "Pedestrian Facilities Guidebook." This guidebook was published recently by WSDOT and provides guidance in the planning and design of a wide range of pedestrian facilities.

Roundabout Conference

February 7-9, 2000, Wenatchee.

Courses in Progress

Contract Administration

September/October 1999, in a minimum of six locations around the state, one in each WSDOT region. **Free**. 8 hours. Instructor: Jim Powell, FHWA. The class will discuss contract provisions, administrative procedures, and applicable policies related to Federal-aid construction contracts. Discussions will include those contract procedures, policies, and requirements prescribed in 23 CFR and their applicability.

Grant Writing

Late Fall 1999.

WSDOT, Staff Development
Local Agencies should call Laurel Gray in the
T2 Center to register (360) 705-7386

The 14 WSDOT courses listed below are offered in various locations around the state whenever enough interest warrants scheduling a class. You may call the T2 office and have names put on request lists. You will be notified when a class has been scheduled and your name included on the roster. A description of the classes can be faxed to you. No fee.

- PCC Field Testing Procedures (ABT)
- Aggregate Production Inspection (ACA)
- Asphalt Paving Street Inspection (ACB)
- Bituminous Surface Treatment Inspection (ACC)
- Drainage Inspection (ACF)
- Bridge Structures Inspection (ACM)Miscellaneous Documentation (ACY)
- Excavation and Embankments Inspection (AC3)
- Nuclear Gauge, Operator Qualification (ALG)
- Nuclear Gauge, Overview for Supervisors (ANE)
- Nuclear Gauge, Embankment/Surfacing/Pavement Applications (ANQ)
- PCC Pavement Production and Placement (APG)
- Electrical-Illumination and Signals (API)
- Asphalt Concrete Pavement Testing Procedures (BG9)

Contract Plans, Specifications, and Estimate Preparation (PS&E) (A4J)
Contract Special Provision Writing (B6N)

Instructor: Jon Cox, WSDOT. Classes will be developed for May and June from request lists. Call the T^2 Center to have your name placed on one of these lists. PS&E is a two-day class and includes the Contract Special Provisions Writing class (below). The first day will cover the PS&E portion dealing with the most recent requirements for preparing complete, biddable, constructable, and defensible plans. The second day covers contract special provision writing. Contract Special Provision Writing: This one-day class is recommended for all designers and design team leaders who have taken the (above) PS&E course within the last few years. It will cover the most recent requirements for writing complete, concise, and well-formatted special provisions. **No Fee.**

TRANSPEED, University of Washington
Contact Julie Smith
(206) 543-5539, fax (206) 543-2352
http://www.engr.washington.edu/~uw-epp/Transpeed/index.html

Course participants will earn CEUs for each course completed. The CEU is a nationally recognized measure of participation in non-credit continuing education programs which meet established criteria for increasing knowledge and competency.

Prices shown are for local agencies/all others.

Basic Roadway Geometric Design
June 2-4, Seattle, $180/$350.

Advanced Roadway Geometric Design
June 16-18, Seattle, $180/$350.

Legal Liability for Transportation Professionals
June 22-23, Seattle, $150/$300.

Hydrology and Basic Hydraulics
June 29-30, Seattle, $150/$300.

Managing Project Delivery
July 7-9, Lacey, $750/$950.

Roadway Culvert Hydraulic Design
August 17-18, Seattle, $150/$300.

Advanced Highway Capacity Analysis for Engineers and Planners
August 25-27, Seattle, $275/$445 (includes laboratory/materials fee).

University of Washington Professional Engineering Practice Liaison (PEPL)
(206) 543-5539, fax (206) 543-2352
http://www.engr.washington.edu/~uw-epp/Epp/upsc.html

All classes are held on or near the University of Washington campus in Seattle. Prices indicate early registration/late registration. Early registration fees are applicable up until two weeks before the date of the course.

Use of Constructed Wetlands for Improving Stormwater Quality
September 8-9. $345/375. P

Basics of Project Management for Design Professionals
September 14, 16, and 21 (three sessions), 4:30-6:30 pm. $175/195.

Stormwater Treatment: Chemical, Biological and Engineering
September 15-16. $345/375, City University.

10th Northwest On-Site Wastewater Treatment Short Course
September 20-21. $225.

Fundamentals of Urban Surface Water Management
October 13-14. $345/375.

Engineering Exam Prep Courses

Mechanical Engineering Refresher
September 7 to October 14, Tuesday and Thursday, 6:30-9:00 pm. $495 early registration.

Civil Engineering Refresher Course
September 9 to October 14, Tuesday and Thursday, 6:30-9:00 pm. $345 early registration.

E.I.T./Fundamental
September 13 to October 20, Monday and Wednesday, 6:30-9:00 pm. $325 early registration.

Autumn/Winter/Spring 1999-2000

Ground Response Analysis for Earthquake Engineering
Date/location/cost TBA.

Effective Writing for Technical Professionals
September 14, 16, 21, 23, and 28, 1999 (five sessions) 3:30 to 6:30 pm. $320/345.

Design and Retrofit of Culverts for Fish Passage in the Northwest
October 1999 (tentative), 8:30 am to 4:30 pm. $345/375.

Introduction to the Use of Geosynthetics in Engineering
December 4, 1999. $TBA.

Advanced Uses of Geosynthetics in Design and Construction
December 5-6, 1999. $TBA.

Successful Project Negotiation Skills
December 8, 1999, City University. $TBA.

Creating Winning Technical Presentations
December 9-10, 1999, City University. $TBA.

Effective Writing for Technical Professionals
January 6, 11, 13, 18, and 20, 2000 (five sessions) 3:30 to 6:30 pm. $320/345.

Construction Site Erosion and Pollution Control
January 11-12, 2000, 8:30 am to 4:30 pm. $345/375.

Geology and Geomorphology of Stream Channels
February 16-17, 2000. $345/375.

Achieving Real Success as a Project Manager
March 30-31, 2000. $TBA.

Hydrologic Modeling and Design of Retention/Detention Facilities
April 12-14, 2000. $TBA.

New Technologies and Concepts in Stormwater Treatment
May 8-9, 2000. $TBA. Vancouver, WA.

Seismic Hazard Analysis for Constructed Site Facilities
May 18-19, 2000. $TBA.

Evergreen Safety Council
401 Pontius Avenue North
Seattle, WA 98109
(206) 382-4090
1-800-521-0778
http://www.esc.org/ecourse.html

Prices are for members/non-members.

Fire Safety/Emergency Response (SPT114AB)
June 10, Seattle. $165/195.

Safety Gear and Personal Protection Equipment/Materials Handling and Storage and Workplace Housekeeping (SPT109AB)
June 8, Spokane. $165/195.

Lift Truck Instructor Certification (ITLT001)
June 7-11, Seattle;
July 12-16, Portland. $795/865.

Fall Protection, Trenching and Shoring (HST212/213)
June 1, Seattle. $195/235.

Employee Orientation/Safety Comm. (SPT108AB)
June 7, Spokane. $165/195.

Construction Safety (HST/C214)
Day 1: June 15, Seattle. $195/235.
Day 2: June 29, Seattle. $195/235.

Flagger Instructor Certification (ITFG004)
June 21-22, Seattle. $355/395.

Lift Truck Update (LTU001)
July 7, Portland; July 8, Seattle. $178/198.

Injury/Illness Prev. Prog./Hazard Comm. (SPT101AB)
July 15, Seattle. $165/195.

Defensive Driving Course 6-8 hr. Instructor Certification (ITD8020)
July 19-21, Seattle. $335/375.

Washington State Department of Personnel (DOP)
(360) 664-1921
http://www.wa.gov/dop/edtp/pages/contents.htm

Human Resource Education & Liability Prevention (HELP Academy)

The modules are taught by practicing attorneys from the firm of Littler Mendelson in Seattle. The firm specializes in employment law and the trainers highlight the training material with their actual courtroom experiences.

Module A: Hiring, Performance & Corrective Action (01-09-HR08)

June 1-2, July 6-7, Aug 2-3, Aug 18-19, Sept 8-9, Oct 4-5, Oct 21-22, Nov 8-9

Seattle: Oct 18-19

Spokane: Sept 27-28

Vancouver: May 3-4

Walla Walla: Sept 1-2

Yakima: Nov 4-5

Module B: Workplace Violence and Employee Safety (01-09-HR10)

Olympia: June 23-24, July 8-9, Aug 4-5, Aug 26-27, Sept 7-8, Sept 30-Oct 1, Oct 28-29, Nov 18-19

Seattle: Oct 20-21

Spokane: May 10-11, May 24-25, Oct 25-26

Vancouver: Sept 9-10

Wenatchee: Dec 1-2

Yakima: Mar 18-19

Module C: Equal Treatment (01-09-HR20)

Olympia: June 3-4, July 14-15, Aug 5-6, Aug 30-31, Sept 15-16, Oct 6-7

Seattle: May 27-28, Oct 12-13, Nov 1-2, Nov 15-16

Spokane: Oct 21-22, Nov 18-19, Dec 6-7

Wenatchee: Sept 23-24

Yakima: Dec 9-10

Module D: Compensation and Labor Relations (01-09-HR30)

Olympia: June 16-17, July 21-22, Aug 11-12, Sept 22-23, Oct 13-14, Nov 3-4, Nov 17-18

Seattle: Sept 20-21, Oct 4-5

Vancouver: Sept 13-14

Walla Walla: Nov 8-9

Human Resource Module (01-14-HR05) 7 days

Olympia: June 14-15/21-22/28-30, July 12-13/19-20/26-28, August 9-10/16-17/23-25, Sept 13-14/20-21/27-29, Oct 11-12/18-19/25-27, Nov 30-Dec 1/6-7/13-15

Spokane: Nov 1-2/8-9/15-17

Budgeting for the Non-Financial Manager
(01-09-M091) – $80

Olympia: June 17-18

Effective Meeting Management
(01-14-M084) – $75

Olympia: June 7

Entry Management Development Core Program – Phase 1
(01-09-M002) – $100

Olympia: Jun 21-24

Seattle: May 3-6

Tacoma: June 14-17

Facilitator Skills Training, Advanced
(01-14-EPC2) – $120

Olympia: June 10-11

First Aid, Basic (1 Day)
(01-07-EE31) – $25

Olympia: June 9

First Aid, Basic (2 Days)
(01-07-EE29) – $35

Olympia: June 14-15

Internet: Basics for Government
(01-04-D165)

Olympia: June 14

Internet: Creating Agency Web Pages Using HTML – Level 1
(01-04-D196) – $110

Olympia: June 10 & 14

Internet: Creating Agency Web Pages Using HTML – Level 2
(01-04-D254) – $110

Olympia: June 18

Internet: FrontPage 98 - (2 Days)
(01-04-D052) – $190

Olympia: June 15 & 17

Internet: Introduction
(01-04-DO04) – $95

Tacoma: June 25

PowerPoint (7.0/97) – Level 1
(01-04-DO74) – $95

Olympia: June 7

PowerPoint (7.0/97) – Level 2
(01-04-DO74) – $95

Olympia: June 11

Presentation Skills
(01-03-E002) – $105

Olympia: Jun 7-9

Professional Development: Being Professional in the Office
(01-14-EP58) – $100

Olympia: Jun 14-15

Success Habits
(01-14-EP04) – $75

Olympia: May 25; June 17

Time Management
(01-14-MO94) – $75

Olympia: June 18

Tacoma: June 8

Writing Minutes & Meeting Notes
(01-03-EW19) – $55

Olympia: June 9

Conferences and Meetings

Association of Washington Cities

"Exhibit 99: Navigating A River of Change"

June 22-25, 1999, Wenatchee Convention Center, Wenatchee, WA. For information: AWC, 1076 Franklin St. SE, Olympia, WA 98501-1346, (360) 753-4137.

ITE 69th Annual Meeting

August 1-4, 1999, Las Vegas Hilton, Las Vegas, Nevada. For information: (202) 554-8050, fax (202) 863-5486, www.ite.org (click on Meetings and Conferences on the menu bar).

APWA's Annual Conference

"1999 International Public Works Congress and Exposition"

September 19-22, 1999, Denver, Colorado. Contact Cheryl McOsker at (816) 472-6100 x 3521 or e-mail at cheryl.mcosker@mail.pubworks.org.

Road and Street Maintenance Supervisors' School – East

October 5-7, 1999, Doubletree Hotel Spokane Valley, Spokane, WA. Contact WSU Conferences and Institutes at 1-800-942-4978, fax (509) 335-0945, or wsuconf@wsu.edu.

Road and Street Maintenance Supervisors' School – West

December 6-8, 1999, Sheraton, Tacoma, WA. Contact WSU Conferences and Institutes at 1-800-942-4978, fax (509) 335-0945, or wsuconf@wsu.edu.

1999 Bicycle and Pedestrian Conference

"Footprints and Bike Tracks"

October 7-8, 1999 Seattle Center NW Rooms, Seattle, WA. For further information contact Julie Matlick at WSDOT at (360) 705-7505.

2nd Annual Livable Communities Fair

October 9, 1999, Seattle Center NW Rooms, Seattle, WA. For further information contact Julie Matlick at WSDOT at (360) 705-7505.

Northwest Pavement Management Association Fall Conference

October 18-21, 1999, Columbia River DoubleTree Hotel, Portland, Oregon. For Information contact Paul Sachs, T^2 Center at (360) 705-7352 or e-mail Sachsp@wsdot.wa.gov.

International Conference on Accelerated Pavement Testing

October 18-20, 1999, Reno, Nevada. First announcement and call for papers. Information: Maria Ardila-Coulson, Director, Nevada T2 Center/257, University of Nevada, Reno, NV 98557, Phone (702) 784-1433, fax (702) 784-1429, or e-mail maria@unr.edu.

APWA Fall Conference

October 20-22, 1999, Yakima Convention Center, Yakima, WA. For information contact Nancy Gaudette, City of Yakima, (509) 575-6005.

51st Annual Road Builders' Clinic

March 7-9, 2000, Coeur d'Alene, ID. A preconference workshop on superpave is scheduled for March 6-7. Contact WSU Conferences and Institutes at 1-800-942-4978, fax (509) 335-0945, or wsuconf@wsu.edu.

Roundabout Conference Dates Have Been Set!!!

By:Darlene Sharar/TransAid/T2 Center
Technology Transfer Engineer

Mark your calendars for February 7-9, 2000!!! This is the date that has been set for the roundabout conference. The conference will be held in Wenatchee, Washington at the WestCoast Wenatchee Center Hotel. For you snow lovers, this means - bring your snow gear!

Next bulletin I will be letting you all know who our speakers will be …

I plan to have specifics for hotel accomodations and the conference events also in the summer edition of the T2 bulletin, so stay tuned!

For conference, roundabout session and/or roundabout reference resource information, please contact Darlene Sharar at either or sharard@wsdot.wa.gov or (360)705-7383.

Two New Videos Added to the Library

#394 The New Generation of Snow and Ice Control

FHWA
7 minutes

This brief but informative video introduces the latest in practical leading edge winter roadway maintenance technologies. It describes the use and benefits of such technologies as:

- anti-icing advanced weather
- forecasting methods
- Road Weather Information Systems
- (RWIS) raveler information system

#395 Avoid Cracks in Slabs -on-Grade

By Harvey Haynes
Tape 1: 32 minutes
Tape 2: 36 minutes

This is a very practical two-tape set. The first tape provides a straight forward description of:

- the material characteristics of concrete how concrete slabs interact with the surrounding soil and adjacent structural elements
- the different types of cracks that occur in concrete slabs how each of these cracks are caused

The second tape directly parallels the topics in the first. The video describes the various methods to eliminate each type of crack and which methods do or don't work. The reasons behind the "whys" are directly tied to the concepts on concrete developed in the first video.

Although the two tapes can be viewed separately as stand-alone sessions, we highly recommend viewing them together as a set. It is very important not to just understand what to do or not to do but also why!

This is an ideal set of tapes for anyone who places concrete, inspects concrete pours, or needs to analyze the failure of concrete.

The WSDOT Engineering Publications

CD Library…

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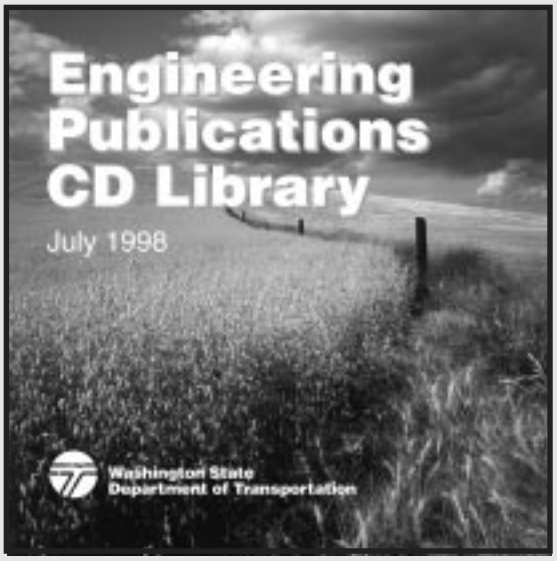

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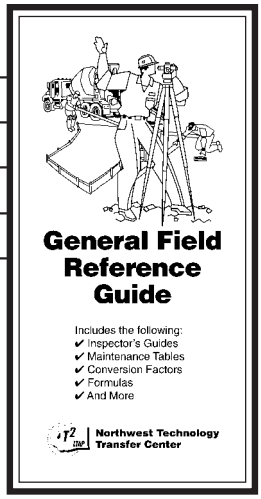

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T2 Web Site
http://www.wsdot.wa.gov/TA/T2/T2HP.htm

Toll Free Training Number
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A newsletter of the Local Technical Assistance Program (LTAP)

T2 Bulletin

Issue Number 62, Spring 1999

The Local Technical Assistance Program (LTAP) is a national program financed by the Federal Highway Administration (FHWA) and individual state transportation departments. Administered through Technology Transfer (T2) Centers in each state, LTAP bridges the gap between research and practice by translating state-of-the-art technology into practical application for use by local agency transportation personnel.

Any opinions, findings, conclusions, or recommendations presented in this newsletter are those of the authors and do not necessarily reflect the views of WSDOT or FHWA. All references to proprietary items in this publication are not endorsements of any company or product.

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