

PERFORMANCE OF ASPHALT OVERLAYS ON
CRACKED & SEATED PAVEMENT

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QUITE A CHANGE HAS OCCURRED IN HIGHWAY CONSTRUCTION AND REPAIR IN THE LAST HALF DOZEN YEARS OR SO. WE HAVE TRANSITIONED INTO AN ERA OF REHABILITATING EXISTING HIGHWAYS, INSTEAD OF PRIMARILY BUILDING NEW ROADS, AND WE HAVE CHANGED FROM THE CONCEPT OF RESURFACING TO THE CURRENT METHOD OF PAVEMENT SURFACE RENEWAL THAT IS NOW WIDELY RECOGNIZED AND GOES BY THE NAME OF RECYCLING.

WISCONSIN BECAME, AND REMAINS, THE NATIONAL, IF NOT WORLD LEADER, IN ASPHALT PAVEMENT RECYCLING. ASPHALT RECYCLING IS WELL ESTABLISHED IN WISCONSIN AND IS GROWING IN APPLICATION ELSEWHERE. THERE IS NO NEED FOR ME TO PREACH TO THIS CHOIR ABOUT THE MERITS OF RECYCLING. WISCONSIN ASPHALT PAVERS READILY ACCEPTED THE CHALLENGE WHEN THE WISCONSIN DEPARTMENT OF TRANSPORTATION EMBARKED ON A RECYCLING PROGRAM IN 1979. IT REQUIRED A MAJOR CHANGE IN ASPHALT PAVING, AND THE INDUSTRY IN WISCONSIN RESPONDED BY ACQUIRING THE NECESSARY EQUIPMENT AND TECHNOLOGY TO ENABLE RECYCLING TO SUCCEED.

2 ALONG WITH RECYCLING CAME THE OPPORTUNITY TO REMOVE THE BUILDUP OF LAYERS OF OLD ASPHALT PAVEMENT FROM THE ROADWAYS, AND EXPOSE THE UNDERLYING BASE OF CRUSHED STONE AND GRAVEL OR OLD CONCRETE PAVEMENT. EXPOSURE OF THE UNDERLYING PORTIONS OF THE PAVEMENT STRUCTURE ENABLED A VARIETY OF CORRECTIVE MEASURES TO BE MADE TO IMPROVE OR STRENGTHEN THE BASE. IT OPENED THE DOOR TO THE MEANS TO CORRECT THE CAUSE OF SOME OF THE PROBLEMS REFLECTING THROUGH THE NEW PAVEMENT FROM DISTRESSES IN THE OLD UNDERLYING PAVEMENT.

THIS OPENING UP OF THE OLD PAVEMENT STRUCTURE INITIATED THE CONCEPT OF CRACKING AND SEATING OLD CONCRETE PAVEMENT TO REDUCE OR EVEN ELIMINATE REFLECTIVE CRACKING. IN WISCONSIN, PAVEMENT BREAKING IN PREPARATION FOR ASPHALT PAVEMENT OVERLAY BEGAN IN 1980, ALTHOUGH THERE MAY HAVE BEEN A FEW PROJECTS WITH RELATIVELY SMALL QUANTITIES PRIOR TO THAT TIME. IN 1980 THIS WORK WAS GENERALLY IDENTIFIED AS "PAVEMENT BREAKING." THERE WERE TEN PROJECTS WITH BETWEEN 1,000 AND 12,000 SQUARE YARDS EACH, AND ONE PROJECT WITH 65,000 SQUARE YARDS. SPECIFICATIONS GENERALLY CALLED FOR BREAKING THE PAVEMENT INTO PIECES NOT EXCEEDING 18 INCHES ON A SIDE. THE AVERAGE COST WAS ABOUT 67 CENTS PER SQUARE YARD. THE RESULTS WERE QUITE VARIABLE. IT WAS OBVIOUS WE WERE IN A LEARNING PROCESS. PAVEMENT BREAKING WAS OFTEN REFERRED TO AS PAVEMENT SHATTERING AND THE CONCEPTION OF ITS INTENT TO SOME PEOPLE SEEMED TO BE PAVEMENT SMASHING. IN SOME CASES THE RESULTS WERE QUITE GOOD. IN OTHERS, THE RESULTS WERE SMASHING--ANYTHING BUT A SMASHING SUCCESS.

1 THE INTENT OF PAVEMENT BREAKING WAS THE SAME IN THE BEGINNING AS IT IS TODAY, BUT WE WERE GROPING FOR THE SPECIFICATION LANGUAGE THAT WOULD PRODUCE THE INTENDED RESULTS. WE WANTED TO BREAK THE OLD CONCRETE PAVEMENT INTO INTERLOCKED PIECES, SEATED IN FIRM CONTACT WITH THE UNDERLYING FOUNDATION SOILS, WITH THE PIECES BEING OF A SIZE SMALL ENOUGH SO MOVEMENT DUE TO WHEEL LOADINGS OR OTHER FORCES WOULD NOT CAUSE REFLECTIVE CRACKING. WE WANTED TO PRODUCE A FLEXIBLE BASE COURSE WITH FRACTURED PIECES OF BROKEN CONCRETE THAT WOULD BE AT LEAST EQUIVALENT TO A SIMILAR THICKNESS OF CRUSHED STONE OR GRAVEL. THE LANGUAGE OF OUR FIRST PAVEMENT BREAKING SPECIFICATIONS WAS INTENDED TO BE BROAD ENOUGH TO SPELL OUT OUR INTENT WITHOUT INHIBITING INNOVATION IN HOW THE RESULTS SHOULD BE ACHIEVED.

WE WERE ONLY PARTIALLY SUCCESSFUL IN CONVEYING THAT INTENT, BECAUSE IN SOME CASES IT APPEARED THE INTENT WAS TOTALLY MISUNDERSTOOD. IT SEEMED THAT TO SOME THE INTENT WAS TO DESTROY THE OLD CONCRETE PAVEMENT, BECAUSE THE RESULT TURNED OUT TO BE ANYTHING EXCEPT WHAT WE WANTED. MAYBE IT WAS MISUNDERSTANDING OF INTENT. MORE LIKELY IT WAS A MATTER OF NOT FULLY KNOWING HOW TO ACHIEVE THE DESIRED RESULT.

THE FIRST BREAKING JOBS WERE PERFORMED WITH VARIOUS ROUND OR BULLET NOSED HEAD-ACHE BALLS, OR EARLY VERSIONS OF DIESEL HAMMER. THE AMOUNT OF ENERGY APPLIED IN THE BREAKING PROCESS WAS ALSO QUITE VARIABLE, AND WAS MODIFIED BY TRIAL AND ERROR. MORE THAN ENOUGH OF IT WAS ERROR.

WHEN ALL THE ELEMENTS WERE PUT TOGETHER IN THE RIGHT COMBINATION, THE RESULTS WERE EXCELLENT. BUT IF THE WRONG EQUIPMENT OR WRONG TECHNIQUE WAS APPLIED TO AN INAPPROPRIATE PAVEMENT OR SUBBASE, THE RESULTS WERE NOT SATISFACTORY. IN EXTREME CASES BROKEN PIECES OF CONCRETE WERE PUSHED DOWN INTO SOFT AND OFTEN VERY WET SUBGRADES, AND IN SOME OTHER CASES, PIECES OF CONCRETE STOOD ON EDGE. THESE SITUATIONS WHERE PAVEMENT BREAKING WAS NOT A SUITABLE TREATMENT HAD TO BE COVERED WITH A BLANKET OF CRUSHED STONE OR GRAVEL.

BUT WE LEARNED BY OUR MISTAKES. OR MAYBE I SHOULD SAY WE LEARNED BY OUR EARLY EXPERIENCES, SINCE THERE WERE MORE SUCCESSES THAN MISTAKES, AND WE LEARNED AS MUCH OR MORE FROM OUR SUCCESSES AS WE DID FROM THOSE CASES THAT DIDN'T TURN OUT QUITE AS INTENDED.

WE APPLIED WHAT WE LEARNED BY REWRITING OUR PAVEMENT BREAKING SPECIFICATIONS INTO LANGUAGE THAT WAS MORE RESULTS ORIENTED AND LESS DIRECTED AT SPECIFYING METHODS AND TYPES OF EQUIPMENT. EVENTUALLY WE EVEN CHANGED THE NAME FROM "PAVEMENT BREAKING" TO "CRACKING AND SEATING" TO BETTER CONVEY OUR INTENT AND TO CONFORM WITH TERMINOLOGY THAT WAS BECOMING THE STANDARD AMONG MOST OTHER STATES APPLYING THIS TECHNIQUE.

AS WE IN THE DOT WERE IMPROVING OUR PROCEDURES AND REWRITING OUR SPECIFICATIONS, THE INDUSTRY WAS ALSO WORKING TOWARD IMPROVEMENTS. THE HEAD-ACHE BALLS WERE RELEGATED TO DEMOLITION WORK. THIS PAVEMENT WORK NEVER WAS INTENDED TO BE DEMOLITION. DIESEL HAMMER PAVEMENT BREAKERS WERE IMPROVED. THE SIZE AND SHAPE OF THE IMPACTING HEAD OR PLATE WAS REVISED, AND THE ENERGY IMPACTED TO THE HEAD WAS MODIFIED AND CONTROLLED. OTHER MACHINES ALSO BEGAN TO APPEAR ON THE SCENE AS THE VOLUME OF CRACKING AND SEATING WORK INCREASED, AND IT BECAME EVIDENT THAT THIS WAS NOT JUST A ONE SHOT TRIAL. SOME OF THE NEWER SEVERE FORMS OF EQUIPMENT INCLUDED FALLING WEIGHT HAMMERS, VIBRATORY BREAKERS, AND GUILLOTINE BREAKERS. EACH TYPE HAS ITS OWN ADVANTAGES AND PARTICULAR APPLICATIONS.

5 AS PREVIOUSLY MENTIONED, THE CONDITION OF THE OLD PAVEMENT AND THE NATURE OF THE BASE COURSE OR SUBGRADE UNDER THE PAVEMENT ARE ALSO IMPORTANT FACTORS IN ACHIEVING ACCEPTABLE RESULTS WITH CRACKING AND SEATING.

EARLY VINTAGE CONCRETE PAVEMENTS WERE OFTEN CONSTRUCTED ON THE NATURAL SUBGRADE SOILS. THESE SOILS MAY HAVE BEEN POORLY DRAINED, AND FREQUENTLY HAVE BEEN COVERED FOR MANY YEARS WITH SEVERAL LAYERS OF ASPHALT PAVEMENT. [IN MANY SUCH CASES THE OLD CONCRETE HAS DETERIORATED TO SUCH AN EXTENT THAT CRACKING AND SEATING IS NOW INAPPROPRIATE.

BUT IF THE OLD CONCRETE IS RELATIVELY SOUND AND THERE IS A REASONABLY STABLE BASE COURSE OR SUBGRADE, CRACKING AND SEATING IS AN APPROPRIATE TREATMENT, AND WHEN CORRECT EQUIPMENT AND TECHNIQUES ARE APPLIED, EXCELLENT RESULTS CAN BE PRODUCED. IN FACT IN SOME CASES, THE SURFACE OF THE CRACKED AND SEATED PAVEMENT CAN PROVIDE A BETTER RIDE THAN BEFORE THE CRACKING AND SEATING OPERATION WAS PERFORMED. DISPLACEMENT AND DISTORTION OF THE CONCRETE PAVEMENT IS NOT NECESSARY TO ACHIEVE DESIRED CRACKING AND SEATING. WHEN CONDITIONS OF THE OLD PAVEMENT ARE RIGHT, AND CRACKING AND SEATING IS PROPERLY PERFORMED, IT IS SOMETIMES VERY DIFFICULT TO EVEN SEE THE CRACKS PRODUCED IN THE OLD CONCRETE.

OUR 1980 EXPERIENCES WITH CRACKING AND SEATING WERE PRETTY MUCH SEAT-OF-THE PANTS TRIALS, BUT WE LEARNED QUITE A BIT, AND PROGRESS WAS MADE.

THE EFFORT CONTINUED INTO 1981 WITH FEWER PROJECTS--ONLY 8 AS COMPARED WITH THE 11 IN 1980--BUT THE QUANTITY INCREASED FROM 123,000 SQUARE YARDS IN 1980 TO 430,000 SQUARES IN 1981.

INCLUDED AMONG THE PROJECTS IN 1981 WAS A 17 1/2 MILE JOB ON HIGHWAY 8 BETWEEN HEAFFORD JUNCTION AND RHINELANDER, INVOLVING 215,000 SQUARE YARDS. THE COST PER SQUARE YARD WAS 39 CENTS. THE EXISTING PLAIN CONCRETE PAVEMENT WAS 20 FEET WIDE, CONSTRUCTED IN 1948 ON A QUITE STABLE PIT RUN GLACIAL TILL BASE. THE PAVEMENT WAS BADLY FAULTED, AND ALTHOUGH THE PAVEMENT SLABS WERE GENERALLY QUITE SOUND, IT GAVE A PRETTY ROUGH RIDE. WE FIRST INTENDED TO SURFACE THE SHOULDERS AND THEN RUN TRAFFIC ON THE SHOULDERS WHILE CRACKING AND SEATING THE OLD CONCRETE PAVEMENT. AS THE WORK GOT UNDER WAY, IT BECAME APPARENT THAT IT WOULDN'T BE NECESSARY TO ROUTE TRAFFIC ON THE SHOULDERS.

THE RIDE ON THE OLD PAVEMENT WAS MUCH BETTER AFTER IT HAD BEEN CRACKED AND SEATED THAN IT HAD BEEN BEFORE. CRACKING AND SEATING PRODUCED THE DESIRED CRACK PATTERN AND SEATED THE OLD PAVEMENT WITH ALMOST NO DISPLACEMENT OR DISTORTION OF THE PAVEMENT SURFACE. FOLLOWING THE CRACKING AND SEATING, AN ASPHALT PAVEMENT SURFACE WAS CONSTRUCTED TO A 30-FOOT WIDTH OVER THE OLD 20-FOOT CRACKED AND SEATED CONCRETE PAVEMENT AND THE CRUSHED GRAVEL SHOULDERS, PROVIDING TWO 12 FOOT DRIVING LANES AND 3 FEET OF SHOULDER PAVING ON EACH SIDE. NOW, FOUR YEARS AFTER CONSTRUCTION, THERE IS LITTLE EVIDENCE OF REFLECTIVE CRACKING, OR OF LONGITUDINAL CRACKING OVER THE EDGE OF THE OLD 20 FOOT WIDE CONCRETE PAVEMENT.

THERE IS SOME LIMITED AMOUNT OF TRANSVERSE TEMPERATURE CRACKING, BUT THIS WOULD BE NORMAL OVER ANY TYPE OF A BASE. THERE IS ALSO SOME LIMITED EVIDENCE OF LONGITUDINAL CRACKING IN THE WHEEL PATHS AND I'LL COMMENT ON THAT FURTHER IN A FEW MOMENTS.

WE IN THE DEPARTMENT WERE VERY PLEASED WITH THE RESULTS OF THIS PROJECT, AND I HAVE TO THINK THAT THE GENERAL PUBLIC THAT DRIVES THIS ROAD HAD TO BE PLEASED TOO. IT GAVE THEM A SMOOTH RIDING 30-FOOT PAVEMENT, INCLUDING PAVED SHOULDERS, TO REPLACE THE OLD ROUGH RIDING 20-FOOT CONCRETE.

ALL THIS IS INTENDED TO DEMONSTRATE THAT WE DID ACHIEVE GOOD RESULTS ON SOME OF OUR EARLY CRACKING AND SEATING PROJECTS, AND WE SHOULD NOT BE OVERLY DISSUADED FROM THIS TYPE OF WORK BY THE FEW PROJECTS THAT DID NOT WORK OUT SO WELL.

IT POINTS OUT THAT WHEN YOU HAVE THE RIGHT CIRCUMSTANCES, YOU CAN EXPECT TO HAVE GOOD RESULTS. A REASONABLY SOUND CONCRETE, A FIRM AND STABLE WELL DRAINED SUBBASE, THE RIGHT TYPE OF EQUIPMENT, AND THE RIGHT METHODOLOGY ARE WHAT IT TAKES, AND WE HAD ALL THOSE INGREDIENTS ON THE HIGHWAY 8 JOB.

THERE WERE OTHER NOTABLY SUCCESSFUL JOBS CONSTRUCTED WITH CRACKING AND SEATING TOO, AND I'M NOT MEANING TO IGNORE THOSE, BUT THIS WAS ONE OF OUR BETTER EARLY PROJECTS AND ONE WHICH WON A CONSTRUCTION AWARD IN 1981.

NOW ONE OF THE CONCERNS THAT I HAVE HEARD ABOUT CRACKING AND SEATING OLD CONCRETE PAVEMENTS IS THAT IT DESTROYS MUCH OF THE LOAD SUPPORTING STRUCTURE OF THE OLD PAVEMENT. THIS ARGUMENT GENERALLY COMES FROM THOSE OPPOSED TO THE CONCEPT OF CRACKING AND SEATING. I'M NOT SURE BUT THAT THERE MIGHT BE SOME VALIDITY TO THEIR CONTENTIONS. THE FACT OF THE MATTER IS THAT AT THIS POINT IN TIME WE SIMPLY DO NOT KNOW. WE JUDGE EACH PROJECT, AFTER THE FACT, ON THE BASIS OF HOW WELL IT ACTUALLY PERFORMS. THESE JUDGEMENTS ARE OF COURSE QUITE SUBJECTIVE.

IN THE NOT TOO DISTANT FUTURE WE WILL BEGIN TO ELIMINATE MUCH OF THIS GUESS WORK BY TAKING LOAD DEFLECTION MEASUREMENTS SO WE CAN SCIENTIFICALLY DETERMINE APPROPRIATE SUPPORT VALUES, AND MORE ASSUREDLY DESIGN COST EFFECTIVE LOAD CARRYING PAVEMENT STRUCTURES.

WE ARE PLANNING TO DO THIS BY THE ACQUISITION OF NEW STATE-OF-THE-ART PAVEMENT DEFLECTION MEASURING EQUIPMENT, COMMONLY REFERRED TO AS A FALLING WEIGHT DEFLECTOMETER. THIS IS A FORM OF NON-DESTRUCTIVE TESTING THAT GIVES US THE MEANS TO MEASURE THE DEFLECTION OF A PAVEMENT OR FOUNDATION UNDER LOAD, DETERMINE ITS RELATIVE STRENGTH, AND ASSIGN A REALISTIC LOAD SUPPORT FACTOR.

THIS IS THE METHODOLOGY AND EQUIPMENT THAT IS NOW BEING USED IN A NUMBER OF OTHER STATES (MINNESOTA, ILLINOIS, AND MICHIGAN TO NAME A FEW OF OUR NEIGHBORS) AND IS THE SYSTEM THAT IT APPEARS WILL BE UTILIZED BY THE MAJORITY OF THE STATES.

WITH THE DATA THAT THIS FALLING WEIGHT DEFLECTOMETER EQUIPMENT WILL PROVIDE WE WILL BE BETTER ABLE TO DETERMINE THE STRENGTH OF A CRACKED AND SEATED PAVEMENT, AND WILL BE ABLE TO MORE ACCURATELY DETERMINE APPROPRIATE THICKNESSES OF ASPHALT PAVEMENT OVERLAYS ON ANY TYPE OF BASE OR FOUNDATION COURSE.

NOW IN COMMENTING ON THE HIGHWAY 8 PAVEMENT A FEW MOMENTS AGO I STATED THAT WE HAVE OBSERVED SOME LONGITUDINAL CRACKING IN THE WHEEL PATHS. WHAT CAN BE THE CAUSE OF THIS? WELL, I SUSPECT A POSSIBLE CAUSE MIGHT BE THAT WE INDEED DID LOSE SOME OF THE LOAD CARRYING ABILITY OF THE OLD CONCRETE PAVEMENT BY CRACKING AND SEATING IT. IT MIGHT BE THAT THE PAVEMENT STRUCTURE WE NOW HAVE MIGHT BE marginally ON THE LIGHT SIDE FOR THE LOADINGS THAT ARE BEING EXPERIENCED. AT THIS TIME WE CAN ONLY SPECULATE. HOPEFULLY IN THE FUTURE WE WILL HAVE THE ANSWERS TO THIS QUESTION.

5 IF THE LOAD SUPPORTING VALUE OF A PAVEMENT IS NOT ADEQUATE, WHAT COULD BE DONE ABOUT IT IF WE WANT TO REHABILITATE AN OLD CONCRETE PAVEMENT? THE MOST OBVIOUS SOLUTION WOULD SEEM TO BE SIMPLY PLACING A THICKER OVERLAY OF ASPHALT PAVEMENT. DEPENDING UPON THE APPARENT STRENGTH AND CONDITION OF THE OLD PAVEMENT STRUCTURE, INCLUDING BOTH THE CONCRETE SLAB AND ITS SUPPORTING FOUNDATION, THERE MAY BE OTHER THINGS THAT COULD BE DONE TO ENHANCE THE STRUCTURAL CAPACITY OF THE OVERLAID PAVEMENT. ONE OF THESE MIGHT BE THE INSTALLATION OF PAVEMENT EDGE DRAINS IF THERE IS EVIDENCE OF EXCESSIVE MOISTURE BENEATH THE OLD SLAB. ANOTHER MIGHT BE THE PLACEMENT OF A LIFT COURSE OF SEVERAL INCHES OF CRUSHED GRAVEL OR STONE, IF THE CRACK PATTERN AND DISTORTIONS IN THE OLD PAVEMENT SUGGEST WEAKNESS OF THE PAVEMENT STRUCTURE.

IMPROVING SUBGRADE DRAINAGE AND INCREASING PAVEMENT STRUCTURE THICKNESS BY PLACING LIFTS OF BASE COURSE MATERIAL ARE TWO OF THE MEANS THAT CAN BE EMPLOYED TO INCREASE THE STRUCTURAL CAPABILITY OF A CRACKED AND SEATED PAVEMENT BEFORE PLACING AN OVERLAY.

I THINK YOU ARE GOING TO SEE AN INCREASED USE OF EDGE DRAINS IN MANY RESURFACING PROJECTS, WHERE THERE IS EVIDENCE OF EXCESSIVE MOISTURE UNDER THE EXISTING PAVEMENT STRUCTURE. USE OF EDGE DRAINS WILL ALSO LIKELY INCLUDE SOME OF OUR CRACKING AND SEATING PROJECTS.

THE USE OF LIFT COURSES OVER CRACKED AND SEATED PAVEMENTS WILL GENERALLY BE LIMITED TO THOSE SITUATIONS WHERE THE EXISTING PAVEMENT'S BASE COURSE OR FOUNDATION IS SO WEAK THAT CRACKING AND SEATING CANNOT BE PERFORMED WITHOUT EXCESSIVE DISPLACEMENT OF THE OLD SLAB. THEN A LIFT COURSE CAN BE EMPLOYED TO LEVEL OUT THE IRREGULARITIES OF THE NEWLY BROKEN PAVEMENT AND TO STRENGTHEN THE PAVEMENT STRUCTURE, BEFORE PLACING THE NEW ASPHALT PAVEMENT SURFACE COURSE.

SO YOU CAN SEE THERE ARE A VARIETY OF THINGS THAT CAN BE DONE TO ENSURE A SUCCESSFUL CRACKING AND SEATING AND ASPHALT OVERLAY PROJECT. IN ALL SITUATIONS IT REQUIRES AN UNDERSTANDING OF WHAT WE ARE TRYING TO ACCOMPLISH, A KNOWLEDGE OF THE TECHNIQUES AND EQUIPMENT IT TAKES TO GET THE RIGHT RESULTS, AND INFORMATION ABOUT THE CONDITION OF THE EXISTING PAVEMENT AND ITS FOUNDATION.

IF THE EXISTING PAVEMENT IS SOUND AND THE BASE IS STABLE, CRACKING AND SEATING IS A FAIRLY SIMPLE MATTER. IF THE PAVEMENT IS IN AN ADVANCED STAGE OF DETERIORATION, OR IF THE BASE IS UNSTABLE, THE SOLUTION IS MORE INVOLVED AND MAY INCLUDE IMPROVING DRAINAGE AND PLACING LIFTS. IN SEVERE CASES IT MAY BE IMPRACTICAL TO CRACK AND SEAT EVEN WITH THE AID OF IMPROVED DRAINAGE AND LIFT COURSE, AND IT MAY BE NECESSARY TO SIMPLY PLACE AN OVERLAY OF 3 OR 4 INCHES OF ASPHALT PAVEMENT AND ACCEPT THE FACT THAT PAVEMENT PERFORMANCE MAY BE SHORT LIVED, THEN HOPE THAT WE CAN HOLD IT TOGETHER UNTIL COMPLETE RECONSTRUCTION CAN BE UNDERTAKEN. IN THESE SEVERE CASES, THE INABILITY TO HANDLE TRAFFIC THROUGH CONSTRUCTION WHEN CRACKING AND SEATING CAUSES EXCESS SLAB DISPLACEMENT IS ALSO A MAJOR CONSIDERATION IN DETERMINING THE SCOPE OF THE WORK.

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ALL THINGS CONSIDERED, CRACKING AND SEATING IS A PRACTICAL LOW-COST PROCESS OF REJUVENATING A PAVEMENT TO PROVIDE A NEW SMOOTH RIDING SURFACE THAT SHOULD HAVE EVERY PROBABILITY OF GIVING A REASONABLE SERVICE LIFE. IT IS A PROCESS THAT CAN'T BE DECIDED UPON HAPHAZARDLY, BUT WHEN APPLIED APPROPRIATELY SHOULD HAVE GOOD PROSPECTS FOR SUCCESS.

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AS I STATED IN MY OPENING REMARKS, OUR OBJECTIVE IN CRACKING AND SEATING OLD CONCRETE PAVEMENT IS TO CONVERT A RIGID PAVEMENT INTO A FLEXIBLE BASE IN A WAY THAT WILL NOT CAUSE THE CRACKS AND JOINTS IN THE OLD PAVEMENT TO REFLECT THROUGH THE NEW SURFACE.

THERE ARE MANY MEDICINE MEN ON THE CIRCUIT TODAY WHO ARE PROMOTING VARIOUS FABRICS AS A BETTER WAY TO REDUCE OR EVEN TO PREVENT REFLECTIVE CRACKING. THERE ARE A NUMBER OF KNOWLEDGEABLE HIGHWAY ENGINEERS WHO BELIEVE IN THE EFFECTIVENESS OF FABRICS TO CONTROL REFLECTIVE CRACKING. I AM NOT ONE OF THOSE WHO ADVOCATE FABRICS TO CONTROL REFLECTIVE CRACKING, AND I'D LIKE TO TELL YOU WHY. WE HAVE INSTALLED A VARIETY OF FABRICS IN TEST INSTALLATIONS AT LOCATIONS REPRESENTATIVE OF SOILS AND CLIMATIC EXTREMES ACROSS WISCONSIN, AND COMPARED THEM AGAINST CONTROL SECTIONS WITHOUT FABRICS. OUR RESEARCH HAS REVEALED ALMOST NO IMPROVEMENT IN REDUCTION OF

REFLECTIVE CRACKING THROUGH USE OF FABRICS. FURTHER LOGIC JUST DOES NOT EXPLAIN HOW AN ASPHALT PAVEMENT CAN STRETCH AND CONTRACT WITHOUT CRACKING WHEN AN UNDERLYING RIGID PAVEMENT JOINT OPENS AND CLOSES, SIMPLY BECAUSE THERE IS A STRETCHABLE FABRIC PLACED OVER THE JOINT. FABRICS TYPICALLY COST IN EXCESS OF ONE DOLLAR PER SQUARE YARD OF PAVEMENT, WHILE CRACKING AND SEATING NOW TYPICALLY COSTS ON THE ORDER OF 25 TO 40 CENTS PER SQUARE YARD.

⑥ SIMPLY PUT, CRACKING AND SEATING IN WISCONSIN HAS BEEN FAR MORE EFFECTIVE IN REDUCING REFLECTIVE CRACKING THAN FABRICS, AND COSTS SUBSTANTIALLY LESS.

SINCE BEGINNING THE CRACKING AND SEATING TECHNIQUE, THE VOLUME OF SUCH WORK HAS GROWN FROM 123,000 SQUARE YARDS IN 1980 TO AN AVERAGE OF NEARLY 1,600,000 SQUARES IN EACH OF THE LAST 3 YEARS, EXCLUSIVE OF 1985. I DON'T HAVE DATA ON THE QUANTITY FOR 1985 YET, BUT I EXPECT IT IS COMPARABLE TO THE PREVIOUS THREE YEAR AVERAGE AND I WOULD EXPECT SOMETHING ON THAT ORDER IN FUTURE YEARS. THE COST OF THIS WORK HAS RANGED FROM AS LITTLE AS 15 CENTS PER SQUARE YARD TO AS MUCH AS \$1.75. THE AVERAGE COST IS CURRENTLY ABOUT 25 CENTS PER SQUARE YARD.

PLACEMENT OF LIFT COURSES MAY BE AS EFFECTIVE IN REDUCING REFLECTIVE CRACKING AS CRACKING AND SEATING ON OLD CONCRETE PAVEMENT; BUT ITS COST IS SUBSTANTIALLY GREATER, IT CONSUMES LARGE QUANTITIES OF A GRAVEL OR STONE NATURAL RESOURCE, AND IT TENDS TO NARROW THE ROADWAY.

CRACKING AND SEATING IS ALSO FAR LESS COSTLY THAN ANY OF THE PAVEMENT FABRICS WHICH ARE CLAIMED TO INHIBIT REFLECTIVE CRACKING, AND IN MY OPINION, CRACKING AND SEATING WORKS AND THE FABRICS DON'T.

THERE IS ONE TYPE OF SITUATION WHERE SCHOOL IS STILL OUT ON THE EFFECTIVENESS OF CRACKING AND SEATING. THAT IS THE SITUATION OF CRACKING AND SEATING MESH AND DOWEL REINFORCED CONCRETE PAVEMENT.

MOST OF THE CRACKING AND SEATING PROJECTS HAVE INVOLVED PLAIN CONCRETE PAVEMENTS WITHOUT REINFORCEMENT, ORIGINALLY CONSTRUCTED 30 OR MORE YEARS AGO. A FEW HAVE INVOLVED NEWER VINTAGE REINFORCED CONCRETE.

WITH THESE REINFORCED PAVEMENTS THE RESULT OF CRACKING AND SEATING HAS NOT BEEN SO POSITIVE AS WITH PLAIN CONCRETE. IT APPEARS THAT EVEN THOUGH THE REINFORCED CONCRETE PAVEMENT IS THOROUGHLY CRACKED, THE REINFORCING STEEL STILL HOLDS THE PIECES TOGETHER, AND EACH 80-FOOT PANEL CONTINUES TO PERFORM MUCH AS IT DID BEFORE.

5 A CASE IN POINT IS THE SECTION OF INTERSTATE 94 IN EAU CLAIRE COUNTY FROM THE HIGHWAY 53 INTERCHANGE SOUTH TO THE TREMPLEAU COUNTY LINE. IN 1982 A 1 1/2 MILE SECTION WAS OVERLAID WITH VARYING THICKNESSES OF ASPHALT PAVEMENT OVER CRACKED AND SEATED PAVEMENT, PLUS A CONTROL SECTION OF ASPHALT OVERLAY OVER UNBROKEN CONCRETE. VERY LITTLE TRANSVERSE CRACKING APPEARED DURING THE FOLLOWING WINTER AND SUMMER.

IN 1983 THE REMAINING 16 MILES WAS CRACKED AND SEATED AND OVERLAID WITH AN ASPHALT PAVEMENT. THE WINTER OF 83-84 HAD SOME PRETTY EXTREME TEMPERATURES AND A FAIRLY EXTENSIVE AMOUNT OF TRANSVERSE CRACKING APPEARED.

WE STILL DON'T KNOW THE REASON FOR THIS CRACKING IN THE OVERLAY MAT. IT MAY BE DUE TO THE TEMPERATURE EXTREMES, OR IT MAY BE DUE TO THE MESH IN THE CONCRETE PAVEMENT, AND IT MAY BE PARTLY DUE TO EACH. IN 1985 WE DID SOME MORE WORK OF THIS TYPE ON I 94 AT EAU CLAIRE, AND INCLUDED A TEST SECTION OF TRANSVERSE SAWING THROUGH THE PAVEMENT MESH BEFORE CRACKING AND SEATING, TO DETERMINE WHETHER THIS MIGHT HELP.

WE ARE STILL LOOKING FOR THE ANSWERS. IT MIGHT BE THAT CRACKING AND SEATING IS NOT AN APPROPRIATE TREATMENT FOR MESH AND DOWEL REINFORCED CONCRETE PAVEMENTS.

CRACKING AND SEATING HAS COME ALONG QUITE WELL IN THE PAST SIX YEARS IN WISCONSIN, AND FOR THE MOST PART WE ARE QUITE SATISFIED WITH THE WAY IT HAS TURNED OUT. WE HAVE LEARNED THAT THERE ARE SOME SITUATIONS WHERE CRACKING AND SEATING IS NOT THE RIGHT CHOICE.

WE EXPECT TO CONTINUE IMPROVING ON OUR TECHNIQUES AND EXPANDING OUR KNOWLEDGE OF THE SUBJECT.

CRACKING AND SEATING CONCRETE IS A NEW TECHNIQUE THAT ADDS TO OUR OPTIONS FOR REHABILITATION OF HIGHWAY PAVEMENTS. I BELIEVE THE FUTURE OUTLOOK FOR CONTINUED APPLICATION OF CRACKING AND SEATING IS QUITE GOOD, BUT LIMITED BY THE MILES OF CONCRETE PAVEMENTS IN EXISTENCE.

WHILE NOT EVERYONE AGREES WITH THE CONCEPT OF CRACKING AND SEATING, I AM CONFIDENT THAT THE FUTURE PERFORMANCE OF THESE PROJECTS WILL PROVE THE WISDOM OF OUR DECISION.