DRAFT---NOT FOR PUBLICATION

A SHORT COURSE IN PAVEMENT FUNDAMENTALS

OR

WHY YOU SHOULD SEAL YOUR BITUMINOUS PAVEMENTS

BY

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AN OUTLINE PRESENTATION PREPARED FOR USE
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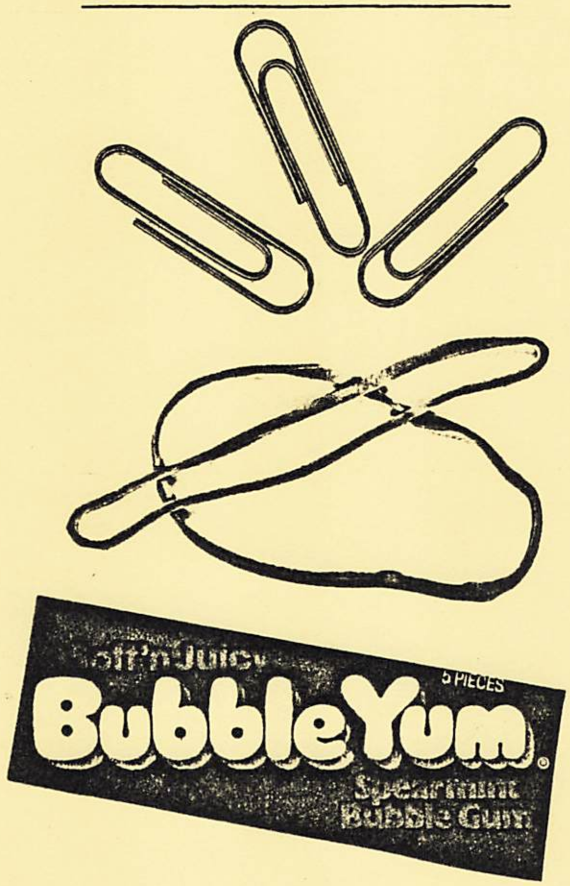

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1. INTRODUCTION--THE IMPORTANCE OF ROADS

THE FUNCTION OF A ROAD IS TO PROVIDE MOBILITY FOR GOODS AND PEOPLE. ROADS, DOUBTLESS, BEGAN AS FOOT PATHS THROUGH FORESTS, GRASSLANDS AND TRACKLESD DESERTS--TRAILS AND CATTLE PATHS. THE LOCATION AND PROSPERITY OF CITIES THROUGHOUT HISTORY HAS BEEN AND IS DETERMINED BY THE ACCESSIBILITY TO TRANSPORT: FIRST WATER THEN LAND. ONLY THE MYTHICAL SHANGRILA THRIVED WITHOUT ROADS.

THE ARMIES OF ALEXANDER FOLLOWED ANCIENT NATURAL TRAILS WHILE THE CAESARS ORGANIZED THE FIRST HIGHWAY SYSTEMS AS WE KNOW THEM--FOR MILITARY AND LATER, ADMINISTRATIVE PURPOSES. WHILE THE SPANIARDS DEVELOPED A SPECIAL SANDAL TO MOVE ARMIES 50 MILES A DAY OVER OPEN COUNTRY, NAPOLEON DEVELOPED A NETWORK OF EXTENSIVE DIRECT HIGHWAYS TO SUPPLY HIS ARMIES. EARLY IN THIS CENTURY THE ITALIANS INVENTED OUR MODERN LIMITED ACCESS DIVIDED HIGHWAY, TO BE EFFECTIVELY COPIED BY HITLER'S AUTOBAHNS IN THE 30'S. FINALLY, EISENHOWER INITIATED OUR INTERSTATE SYSTEM--TERMED THE 8TH WONDER OF THE WORLD. THE ROADS AND WATERWAYS OF OUR COUNTRY HAVE ALWAYS BEEN POPULAR POLITICAL ISSUES. IN AT LEAST ONE CASE THE ROAD TO THE WHITE HOUSE WAS PAVED WITH FARM-TO-MARKET ROADS; "MOVE THE GOODS--MOVE THE PEOPLE."

AT $1,000,000+ PER MILE, OUR STATE OF OHIO AND LOCAL GOVERNMENTS HAVE INVESTED WELL OVER $128,000,000,000. SURELY THIS INVESTMENT MUST BE CONSERVED FOR THE FUTURE!

THE PROBLEM OF ROAD CONSERVATION, MORE SPECIFICALLY PAVEMENT CONSERVATION, IS THE SUBJECT OF THIS PAPER: I.E., TO HELP YOUR UNDERSTANDING OF PAVEMENT BASICS OR FUNDAMENTALS, THE NEED AND ADVANTAGES OF CONSERVATION IN OUR TIME.

FUNDAMENTAL CONCEPTS OF PAVEMENT SYSTEMS

A PAVEMENT SYSTEM CONSISTS OF 2 MAJOR COMPONENTS

1. THE STRUCTURE--SUPPORTS THE LOAD
2. THE SURFACE----PROTECTS THE STRUCTURE

THERE ARE, THEN, 2 KINDS OF PAVEMENT DISTRESS

1. STRUCTURAL--LOAD/BASE ASSOCIATED
2. SURFACE----SURFACE ASSOCIATED

THE STRUCTURE IS THE PART OF THE ROAD WHICH IS NOT SEEN; THE SUB-BASE AND BASE. ITS PURPOSE IS LOAD BEARING AND IS THE STRENGTH OF THE ROAD.

THE MATERIALS USED IN PAVEMENTS HAVE STRENGTH. CIVIL ENGINEERS COMPARE PAVEMENT MATERIAL STRENGTHS AS ELEMENTS OF STRUCTURES SUCH AS BUILDINGS AND BRIDGES.

THE "FOUNDATION," "FOOTER" OR SUB-BASE OF A ROAD ULTIMATELY CARRIES THE LOAD AND HAS A RELATIVELY LOW LOAD CARRYING CAPACITY. THE BASE HAS A GREATER LOAD CARRYING CAPACITY OR STRENGTH; I.E., THE ROAD BASE HAS THE ABILITY TO SPREAD THE LOAD OVER A LARGE AREA OF THE SUB-BASE.

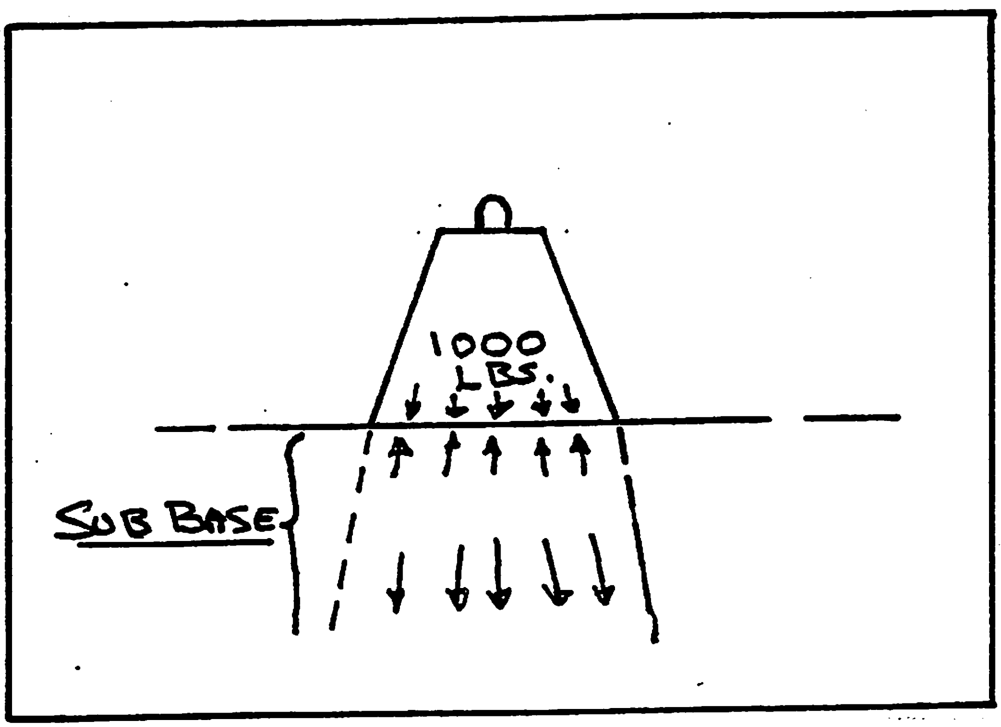


FIGURE 1. SUB-BASES HAVE LOW STRENGTH.

THICKER BASE LAYERS HAVE GREATER STRENGTH, THINNER LAYERS HAVE LESS STRENGTH; I.E., THICKER LAYERS SPREAD THE LOAD OVER A GREATER AREA OF SUB-BASE.

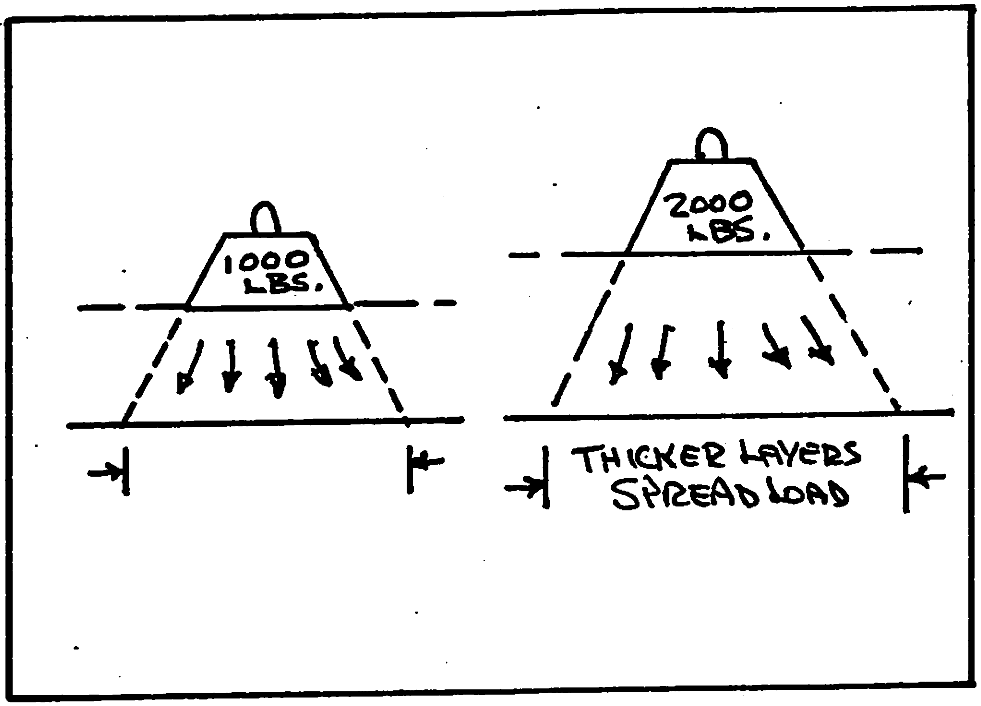


FIGURE 2. BASE LAYERS AND THICKER LAYERS HAVE MORE STRENGTH.

THE <u>DESIGN OF A ROAD STRUCTURE</u> THEN CALCULATES THE:

A. LOAD CARRYING CAPACITY REQUIRED (TRAFFIC WEIGHTS)

B. STRENGTH OF THE SUB-BASE

C. STRENGTH OF A GIVEN BASE MATERIAL

D. THICKNESS OF BASE MATERIAL REQUIRED TO SPREAD THE LOAD OVER THE SUB-BASE.

LAYER THICKNESS MAY BE REDUCED (THUS, CONSERVING MATERIAL) BY USING STRONGER BASES SUCH AS CRUSHED STONE RATHER THAN ROUND GRAVEL OR BY "GLUING" THE BASE MATERIALS TOGETHER WITH PORTLAND OR ASPHALT CEMENT (BLACKBASE).

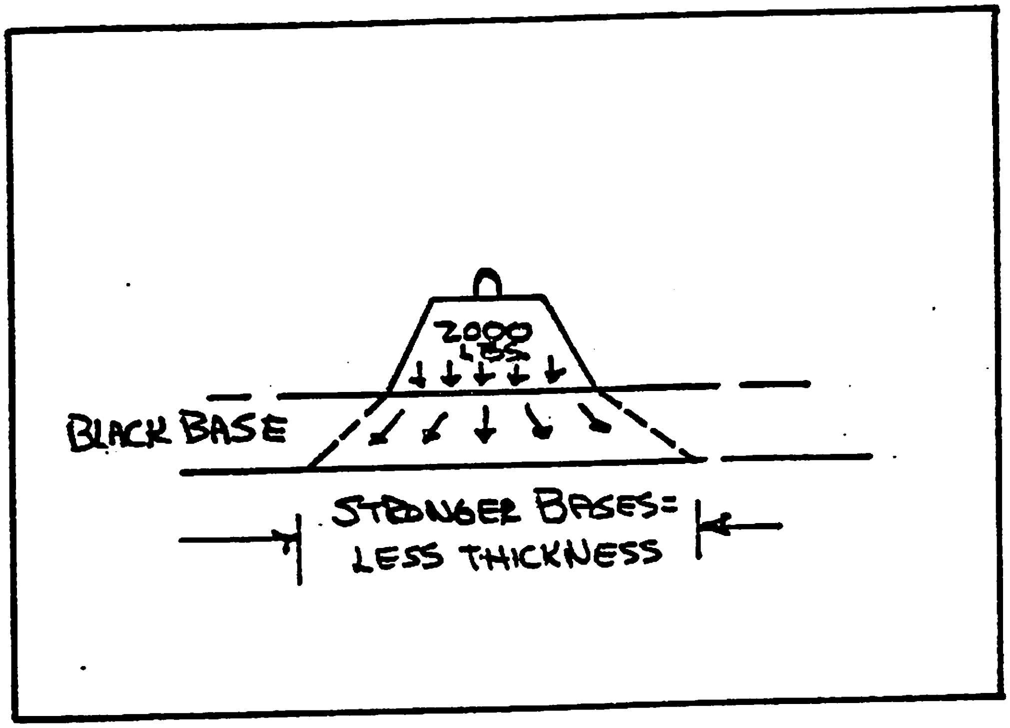


FIGURE 3. STRONGER BASES REQUIRE LESS THICKNESS.

<u>PROPERTIES OF BASE MATERIALS</u>

PAVEMENTS AND THEIR UNDERLYING STRUCTURES OR BASES ARE EXPOSED TO WEATHER (NOWADAYS CALLED "ENVIRONMENT"). THE STRENGTHS AND VOLUMES OF ROAD BASES CHANGE WITH THE ENVIRONMENTAL CONDITIONS:

1. STRENGTH OF ROAD BASES VARY WITH THEIR MOISTURE CONTENTS. MOISTURE CONTENTS VARY WITH SEASONAL RAINFALL.

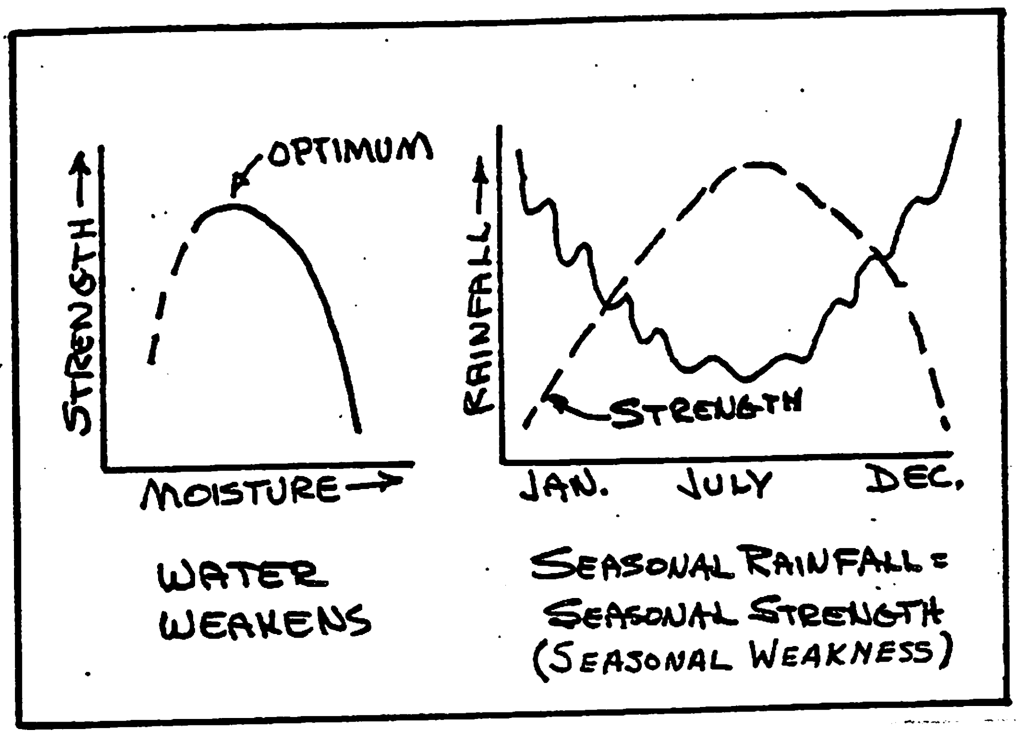


FIGURE 4. EFFECT OF MOISTURE CONTENT ON ROAD BASES AND SUB-BASES.

2. THE VOLUME OF ROAD BASES VARY WITH THEIR MOISTURE CONTENTS AND TEMPERATURE. UNDER SATURATED SUB-BASE CONDITIONS SOME ROAD BASES HAVE EXPANDED TREMENDOUSLY UPWARDS, AS MUCH AS 18" DURING A SEVERE FREEZE (FROST HEAVE). NORMALLY, THESE MOVEMENTS ARE LESS THAN 2" EACH WINTER IN OUR CLIMATE. THE PRIMARY CONSIDERATION THEN IS TO KEEP THE ROAD BASE HIGH AND DRY OR AT AN OPTIMUM MOISTURE CONTENT.

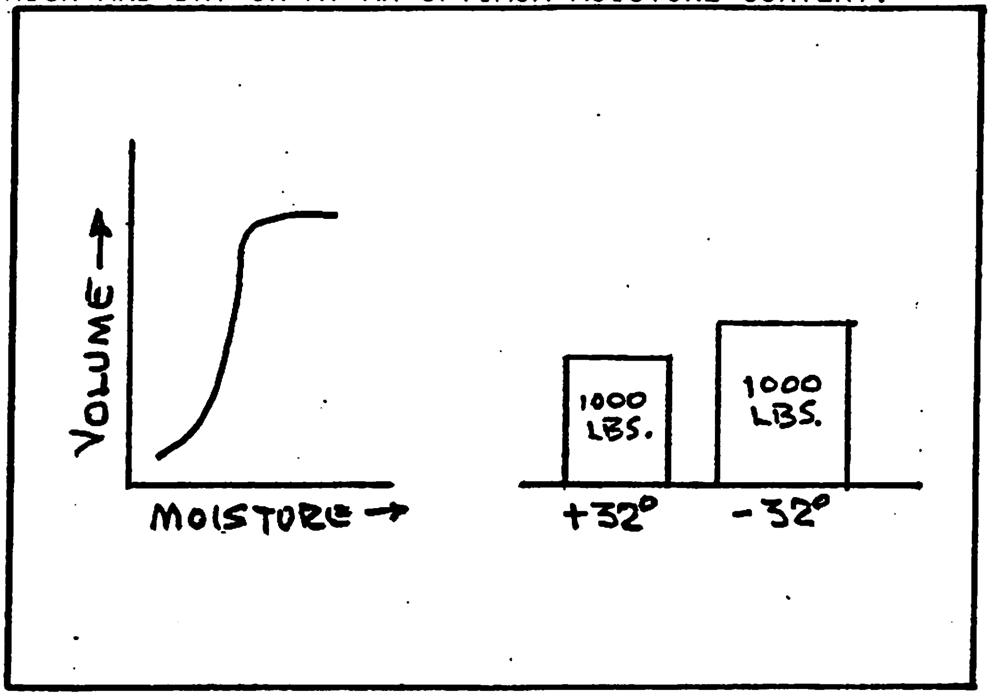


FIGURE 5. EFFECTS OF MOISTURE & TEMPERATURE ON VOLUME OF ROAD BASES.

3. THE THREE MOST IMPORTANT ENGINEERING CONSIDERATIONS OF ROAD CONSTRUCTION ARE: (A) DRAINAGE, (B) DRAINAGE, (C) DRAINAGE.

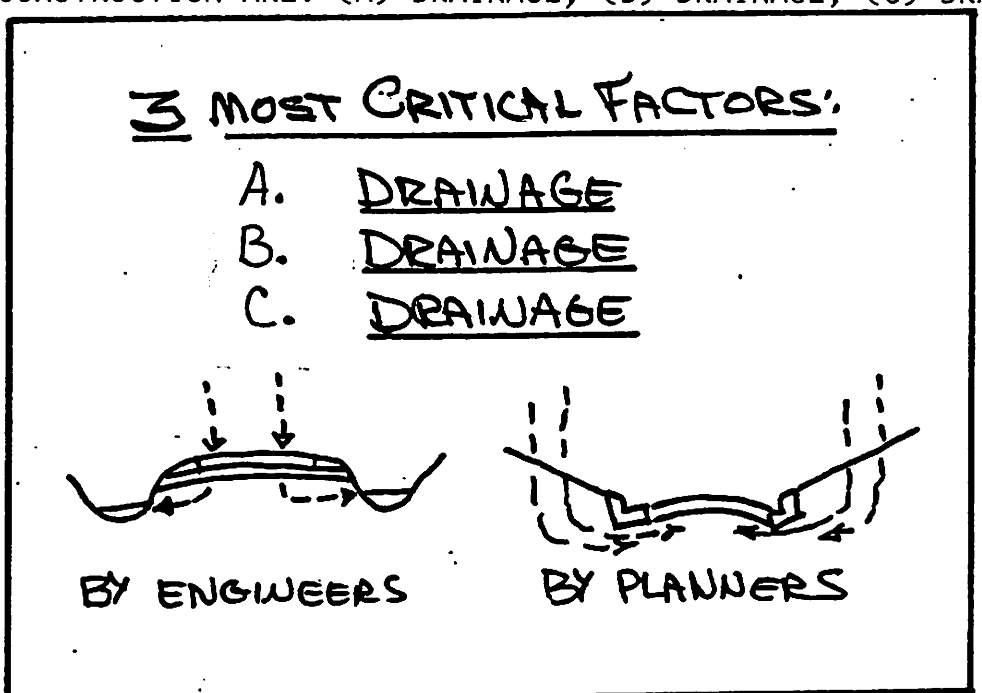


FIGURE 6. DRAINAGE.

ROAD STRESS

GALILEO'S FAMOUS DICTUM "EVERYTHING MOVES" IS CERTAINLY TRUE OF ALL ENGINEERING STRUCTURES AND PARTICULARLY ROAD AND PAVEMENT STRUCTURES. THESE MOVEMENTS CAUSE STRESS IN THE ROAD STRUCTURE. THESE MOVEMENTS OR STRESSES ARE CAUSED BY:

1. TRAFFIC FACTORS (LOADS)
2. ENVIRONMENTAL FACTORS
   - A. MOISTURE--VOLUME CHANGES
   - B. TEMPERATURE

NOTE: THE FACT THAT PAVEMENTS DEFLECT OR SAG UNDER LOAD AND BOUNCE BACK WHEN THE LOAD IS REMOVED IS IMPORTANT. MORE IMPORTANT, HOWEVER, IS THE DEGREE OR AMOUNT OF DEFLECTION.

VARIATIONS IN SUB-SOIL THICKNESS AND STRUCTURAL LAYER THICKNESS CAUSE VARIATIONS OR DISUNIFORMITY IN PAVEMENT MOVEMENTS AND CAUSE DIFFERENTIAL STRESSES.

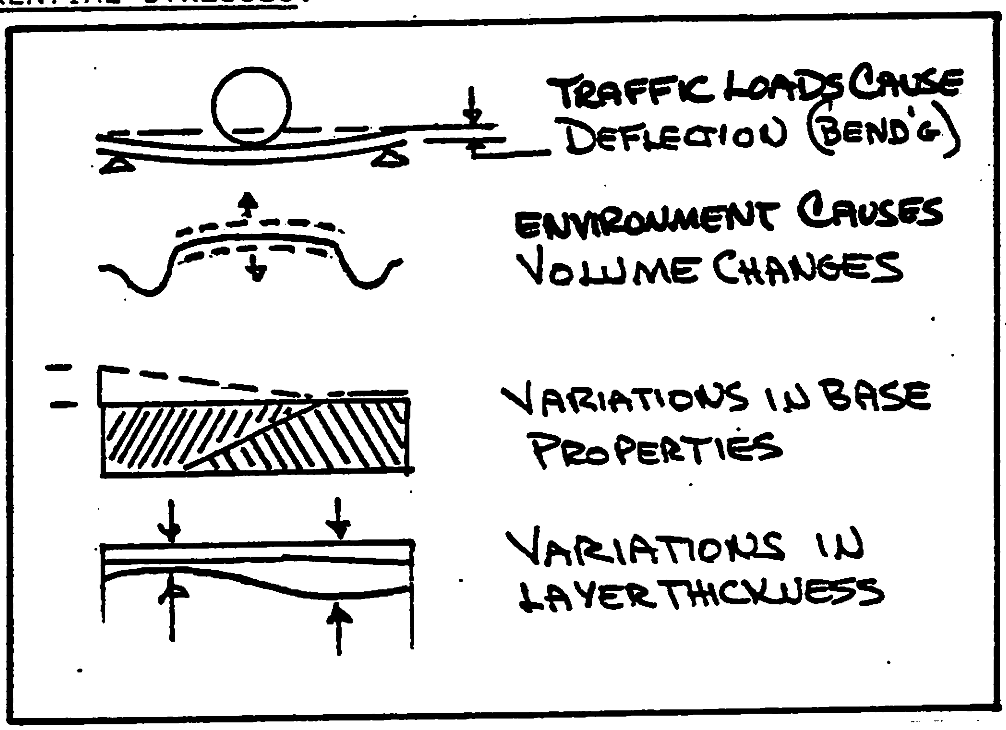


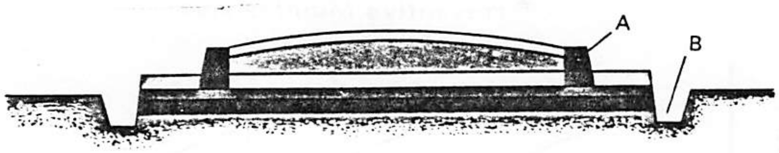
FIGURE 7. CAUSES OF STRESS

FLEXIBLE BITUMINOUS PAVEMENTS

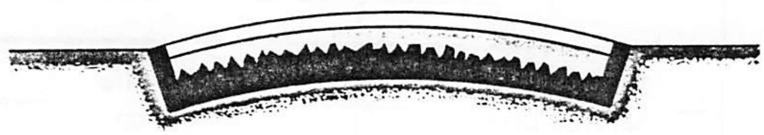
EARLY IN THE 19TH CENTURY, JOHN MACADAM, BEING THE THRIFTY SCOTCHMAN, DEVISED A ROAD BUILDING SYSTEM THAT HAS BECOME THE

MODEL FOR OUR MODERN PAVEMENTS. UNIFORM SIZE ROAD STONES WERE CAREFULLY PLACED ON A CROWN-SHAPED CROSS-SECTION WITH SIDE DRAINS. THE SPACES BETWEEN THE ROAD STONES WERE FILLED WITH CRUSHER FINES. THIS INTERLOCKED, MOSAIC-LIKE PAVEMENT WORKED PERFECTLY UNDER THE PACKING EFFECT OF THE STEEL-TIRED WAGON TRAFFIC OF THE 19TH CENTURY AND WAS CALLED WATER BOUND MACADAM OR SIMPLY MACADAM.

IN THE 20TH CENTURY, THE NEW RUBBER-TIRED VEHICLES "SUCKED" OUT THE FINES AND LITERALLY BLEW THE ROAD AWAY! BITUMEN IN THE FORM OF COAL TAR WAS FIRST APPLIED TO THE MACADAM SURFACE, NOT TO WATER-PROOF THE STRUCTURE, BUT TO PREVENT THE LOSS OF THE CEMENTITIOUS AND INTERLOCKING FINES WHICH ULTIMATELY HELD THE ROAD STONES IN PLACE. FROM THE PRACTICE OF TARRING THE MACADAM, COMES OUR WORD "TARMAC."



Section of a typical Roman road pavement, showing footing of compacted earth (red), waterproof course of small stones (brown), base course of Roman concrete (yellow), cambered middle course of any local hard filling (green), and wearing course (blue) of local material such as lava in Italy or stone slabs in northern England. Note also retaining stones (A) and draining ditch (B).



Tresaguet's pavement design, the precursor of the modern road. First came a 17-cm. foundation of heavy stones (red) laid on a cambered footing, followed by a 17-cm. base course of large stones (yellow) topped by an 8-cm. wearing surface of small stones (blue).

Telford's design for road pavements. This consists of a 17-cm. foundation of heavy flat stones (red) laid direct on the leveled topsoil, a two-layer cambered base course of 6-cm. stones, 50-cm. deep at the center (yellow), and a 5-cm. wearing surface of clean gravel (blue).

McAdam's simple but effective road pavement consisted of wearing surface and base course comprising three layers of 5-cm. stones laid on a compacted cambered footing.

FIGURE 8. HISTORICAL ROAD CROSS SECTIONS

WITH TIME, THE ADVANTAGES OF THE USE OF BITUMEN TO GLUE TOGETHER THE MACADAM AGGREGATES INTO A STRONGER STRUCTURE WHICH RESISTED BOTH THE EFFECTS OF WEATHER AND TRAFFIC ABRASION, WERE LEARNED AND QUALIFIED. THE RESULT IS OUR PRESENT-DAY BITUMINOUS PAVEMENT OR "FLEXIBLE" PAVEMENT.

FLEXIBLE PAVEMENTS DO FLEX WITH THE LOADS AND IN TIME THEY FATIGUE AND BREAK. IN FACT, THEY MUST BEND OR THEY WILL BREAK. ALL PAVEMENTS, FLEXIBLE OR RIGID, BEGIN TO DIE THE DAY THEY ARE CONSTRUCTED. LIFESPAN DEPENDS ON THEIR DESIGN, LOADING AND CARE THEY HAVE RECEIVED. DURING THEIR LIFESPAN, THEIR PERFORMANCE DECREASES AT AN INCREASING RATE UNTIL THE ROAD MUST BE TAKEN OUT OF SERVICE.

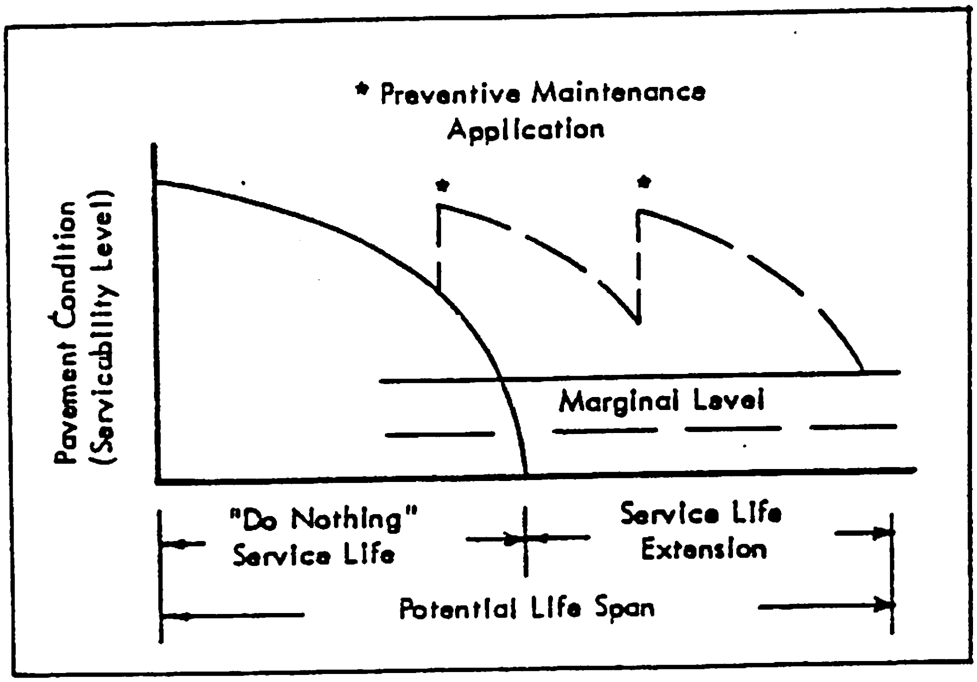


FIGURE 9. THEORETICAL HISTOGRAM SHOWING PAVEMENT LIFESPAN.

THE AMOUNT OF STRESS ACCUMULATES AND DEPENDS ON:

1. THE DEGREE OF SEVERITY OF DEFLECTION
2. THE ACCUMULATED NUMBER OF DEFLECTIONS
3. THE FLEXIBILITY OF THE STRUCTURE (ELASTIC REBOUND)*

* (RUBBER BAND DEMONSTRATION)

BY FLEXIBILITY WE MEAN THE ELASTIC PROPERTIES THAT RESIST PERMANENT DEFORMATION.* FLEXIBLE PAVEMENTS AGE BECAUSE THE FLEXIBLE GLUE (ASPHALT CEMENT) BECOMES BRITTLE AND BREAKS.** THE FLEXIBLE ASPHALT BECOMES BRITTLE BECAUSE OF THE CHEMICAL EFFECTS OF WEATHER,(ENVIRONMENT), SUN, WATER, AND AIR TO WHICH THE PAVEMENT IS CONSTANTLY EXPOSED.

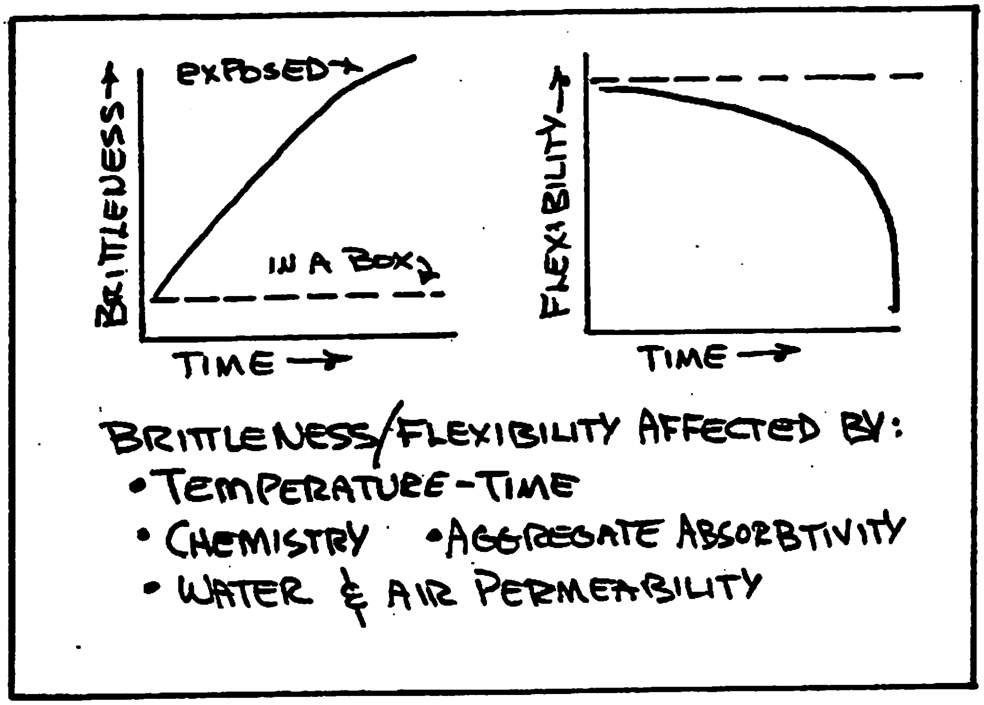


FIGURE 10. ASPHALT CEMENT BRITTLENESS

"STRESS, IN TIME = DISTRESS; DISTRESS IN TIME = DISASTER"

FLEXIBLE PAVEMENT DISTRESS; TWO KINDS:

1. STRUCTURAL (STRENGTH = LOAD SPREADABILITY)
2. SURFACE (PERMEABILITY = WEATHERABILITY)

ALL ROADS AND PAVEMENTS DETERIORATE IN TIME. EVIDENCE FOR THIS DETERIORATION IS SEEN AS:

1. STRUCTURAL: RUTTING, CRACKING, ROUGHNESS
2. SURFACE: RAVELLING, SURFACE CRACKING, SLIPPERINESS

* BUBBLE GUM DEMONSTRATION

** PAPERCLIP FATIGUE DEMONSTRATION

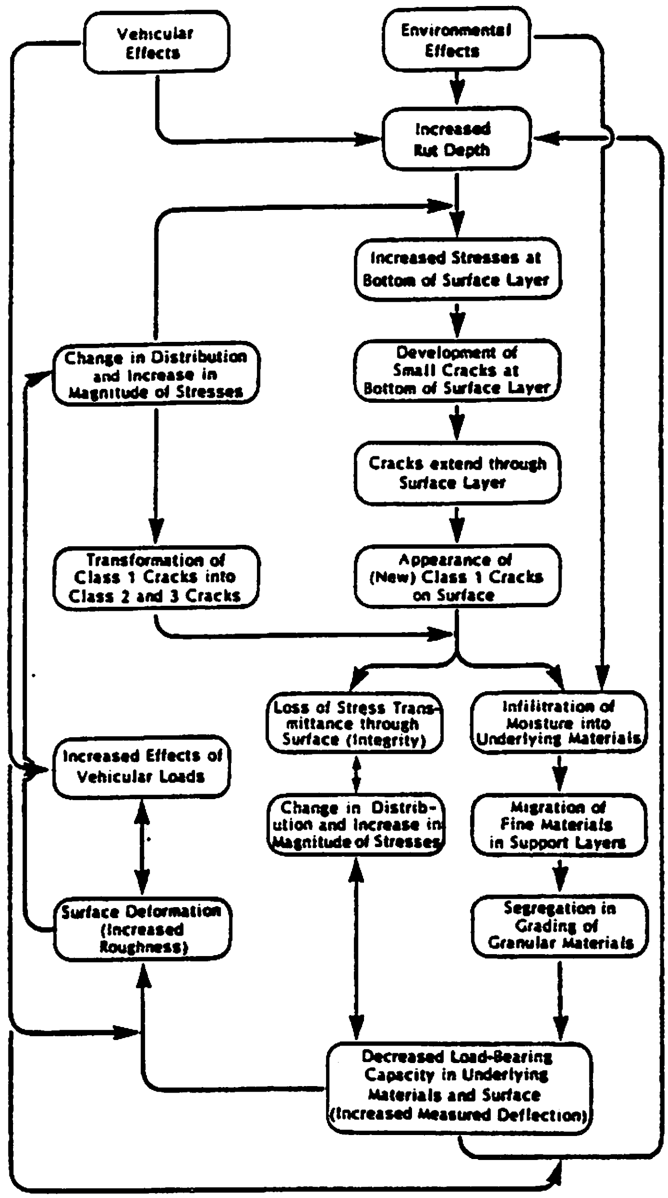


FIGURE 11. DISTRESS PROGRESSION MODEL

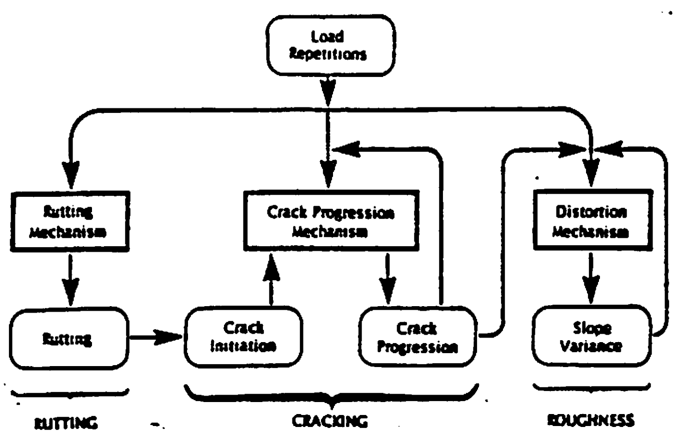


FIGURE 12. SIMPLIFIED DISTRESS PROGRESSION MODEL

A WORD ABOUT COMPACTION, VOIDS AND PERMEABILITY:

HOT MIX ASPHALTIC CONCRETE, TYPICALLY OUR ODOT 404, REQUIRES A FINAL VOID CONTENT (= SPACES FOR AIR) TO CUSHION THE PAVEMENT AND TO ALLOW FOR EXPANSION AND CONTRACTION. THIS IS USUALLY ABOUT 3-5%. TO ACHIEVE THIS RELATIVELY LOW VOID CONTENT, THE PAVEMENT MUST BE COMPACTED (ROLLED), OR SQUEEZED TOGETHER WHILE IT IS STILL HOT. THE DEGREE OF COMPACTION IS USUALLY SPECIFIED AT ABOUT 93-94%.

WHEN USED AS A LEVELING MATERIAL (= SMOOTH RIDE) VARIABLE THICKNESSES MUST BE APPLIED. THIN SECTIONS COOL FASTER AND CONSEQUENTLY RESIST COMPACTION WHILE ROLLERS (COMPACTORS) WILL BRIDGE-OVER FILLED RUT SECTIONS OF VARIABLE DEPTH. IDEAL, SPECIFIED OR UNIFORM COMPACTION IS IMPOSSIBLE.

THE RESULT OF VARIABLE COMPACTION IS VARIABLE VOID CONTENTS, VARIABLE PERMEABILITY TO AIR AND WATER AND CONSEQUENTLY A VARIABLE LIFE SPAN.

IN FACT, FOR EACH 1% LOSS OF COMPACTION THERE IS A LOSS OF 1 YEAR OF SERVICE LIFE (VADOT). BECAUSE MOST HOT MIXES ARE USED FOR LEVELING APPLICATIONS, TYPICAL AVERAGE COMPACTION VALUES ARE 3 TO 5% LESS THAN DESIGN. THIS MEANS AN AUTOMATIC LOSS OF AT LEAST 5 YEARS OF POTENTIAL LIFE SPAN.

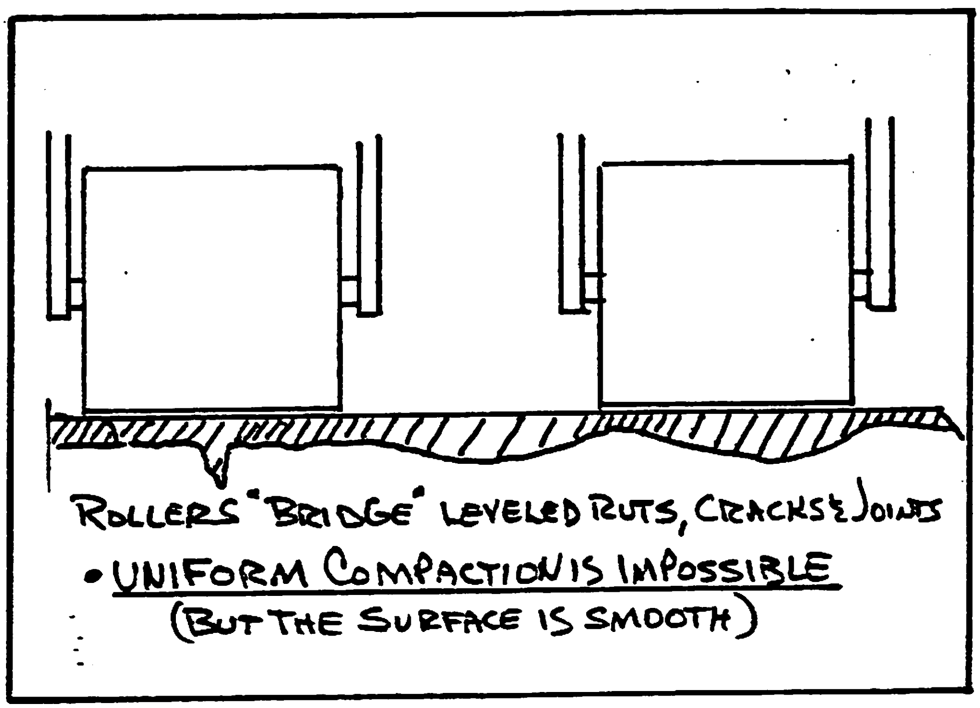
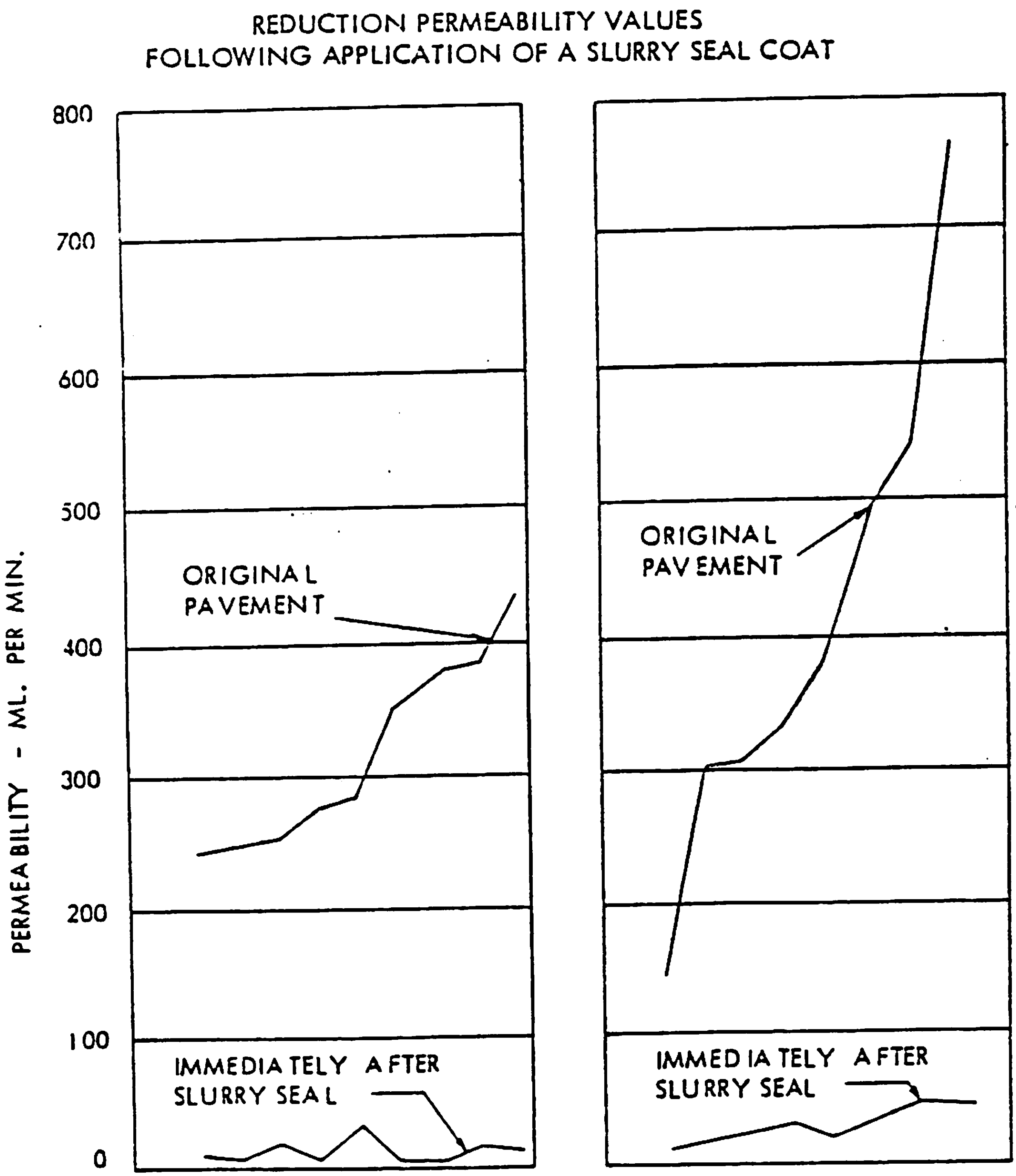


FIGURE 13.



Reference: Ernest Zube, "Studies on Water Permeability of Asphalt Concrete Pavements", Proceedings of the 4th Annual Highway Conference, Univ. of the Pacific, March, 1961.

FIGURE 14. PAVEMENT PERMEABILITY

KINDS OF CRACKS - THEIR CLASSIFICATIONS:

A. SURFACE & STRUCTURAL
B. CLASS I, II, III
C. APPEARANCE TYPE

ALLIGATOR	SLIPPAGE
EDGE	SHRINKAGE
EDGE JOINT	STRENGTH DIFFERENTIAL
LANE JOINT	
THERMAL DIFFERENTIAL	FATIGUE
THERMAL	REFLECTION
RAVELLING	PAVEMENT BASE

FIGURE 15.

WHY DOES A PAVEMENT CRACK?

ANSWER: THE STRESS IS GREATER THAN THE STRENGTH

STRESS > STRENGTH

WHERE DOES A CRACK START, FROM THE TOP DOWN OR THE BOTTOM UP?

ANSWER: BOTH

STRUCTURAL CRACKS: INITIATE FROM THE BOTTOM UP

SURFACE CRACKS: INITIATE FROM THE TOP DOWN

SURFACE CRACKS BECOME STRUCTURAL CRACKS

ONCE A STRUCTURAL CRACK OCCURS, EXPENSIVE PROCEDURES ARE REQUIRED. THESE PROCEDURES REMAIN EFFECTIVE FOR 1 TO 3 YEARS---RARELY AS LONG AS 5 YEARS.

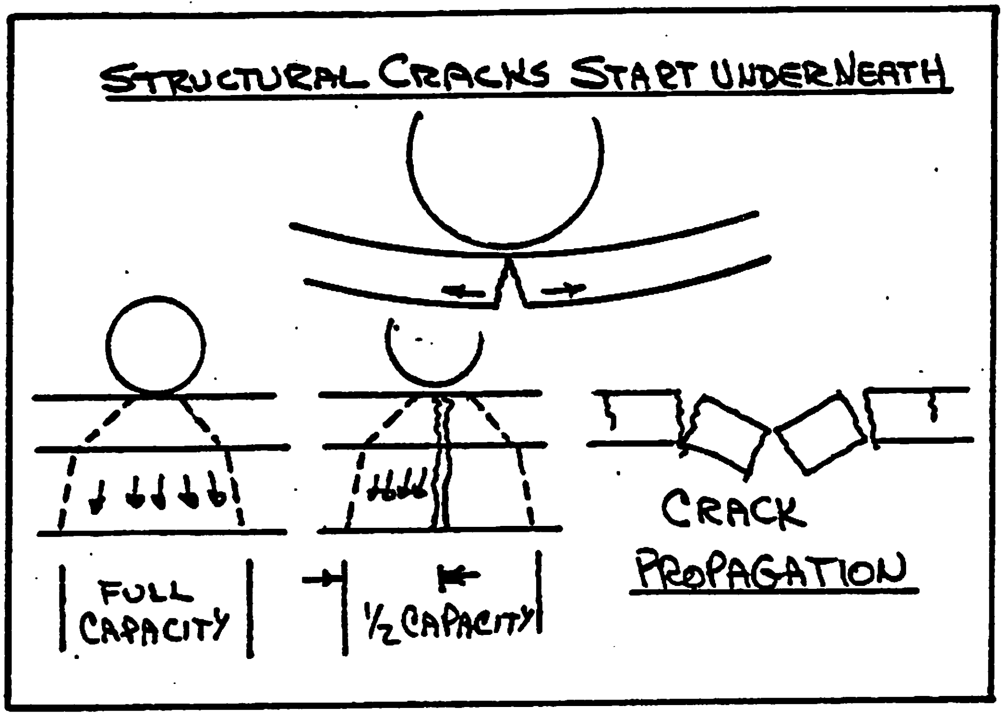


FIGURE 16.

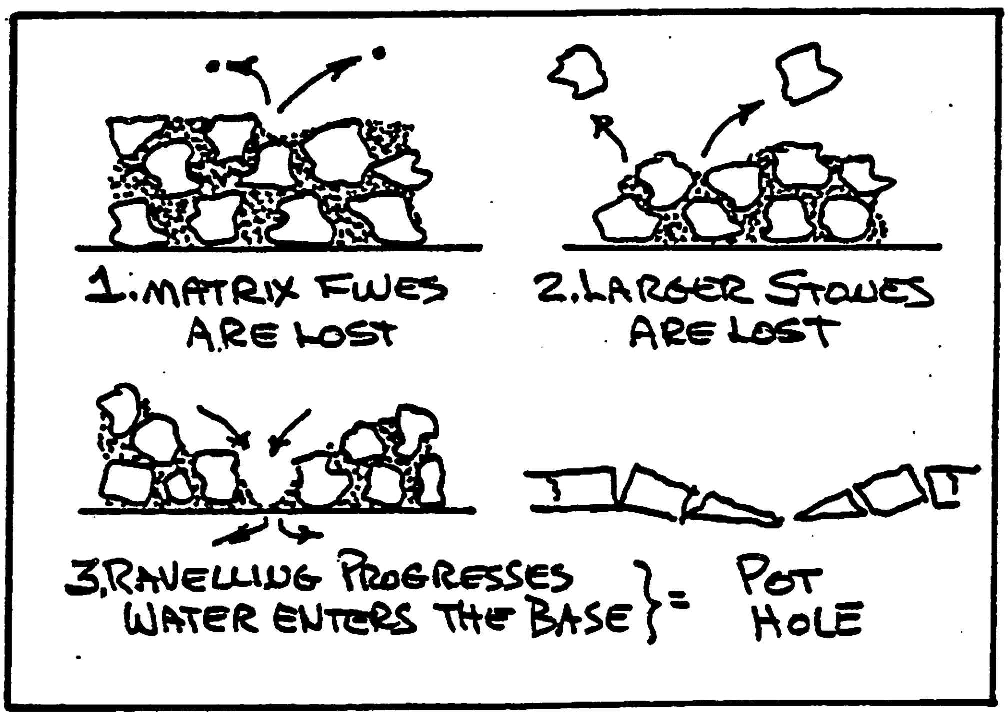


FIGURE 17. SURFACE CRACKS IN TIME BECOME STRUCTURAL CRACKS

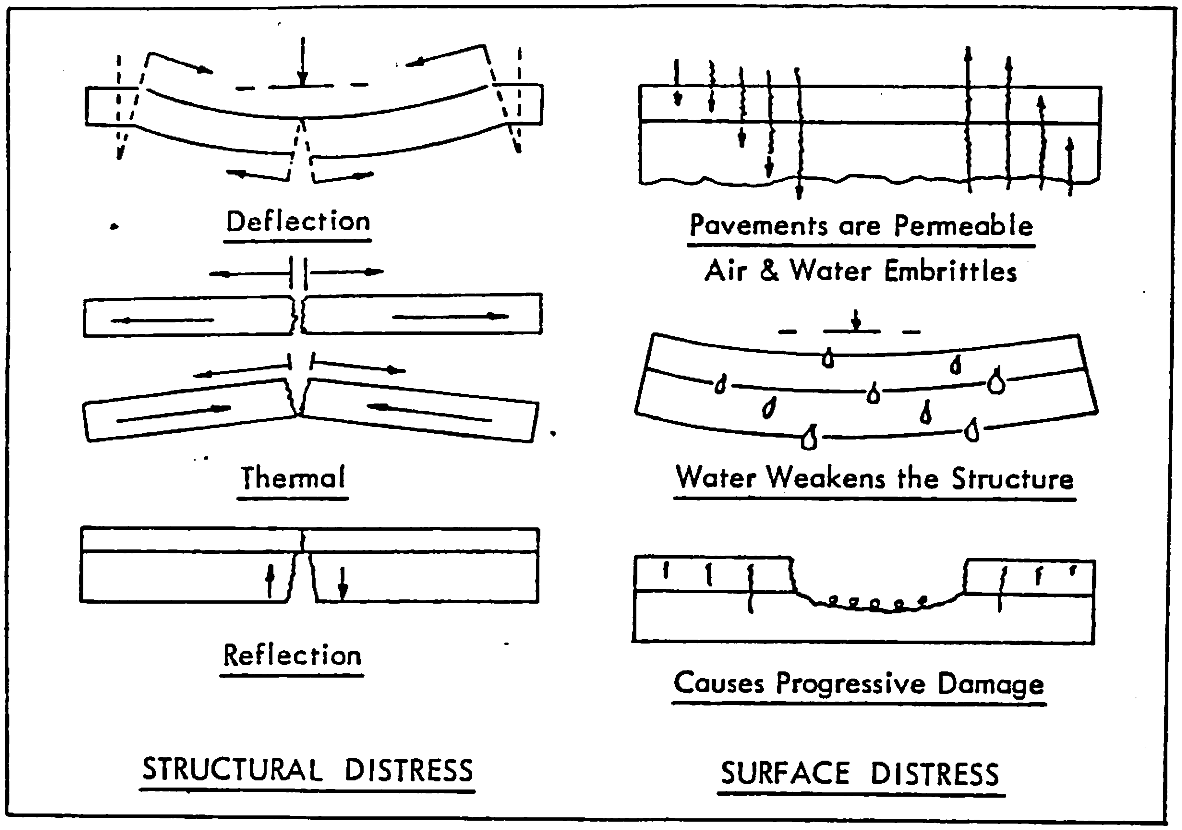


Figure 18 . Examples of Pavement Distress.

WHAT CAN BE DONE ABOUT CRACKS?

ONCE THEY OCCUR, WHAT CAN BE DONE ABOUT "A" PAVEMENT CRACK?

1. FILL AND ATTEMPT TO WATERPROOF
2. LOWER THE STRESS BY:
   A. IMPOSING LOAD LIMITS
   B. APPLYING STRAIN (STRESS) RELIEVING MEMBRANES
   C. APPLYING STRAIN (STRESS) ABSORBING, OPEN GRADED, SOFT ASPHALT/ELASTIC OVERLAYS
3. INCREASE THE STRENGTH BY
   A. IMPROVED DRAINAGE
   B. PREVENT WATER/AIR PERMEABILITY (WATERPROOFING)
   C. APPLY STRENGTHENING MEMBRANES (REDUCE CRACK PROPAGATION)
   D. APPLY STRUCTURAL OVERLAYS (3½-4")
   E. DEEP (1+) HEATER SCARIFIED + PLASTICIZER + OVERLAY AND/OR SEAL
4. RECONSTRUCTION BY TOTAL RECYCLING
5. LIVE WITH THEM
6. PREVENT THEIR OCCURRENCE!

PREVENT THE OCCURRENCE OF CRACKS? IS IT POSSIBLE?

WE ALL PRACTICE PREVENTIVE MAINTENANCE IN OUR HOMES, WHY NOT ON OUR ROADS? WE WATERPROOF OUR ROOFS, OUR HOME STRUCTURES, OUR DRIVEWAYS AND DRAIN OUR FOUNDATIONS. WE KNOW THAT NOT DOING SO WILL BECOME BOTH DESTRUCTIVE AND EXPENSIVE. WE DO NOT WAIT 'TIL THE BARN ROTS BEFORE PROTECTING IT...ANYMORE THAN WE SHOULD WAIT FOR OUR ROADS TO BECOME IRREPARABLY DAMAGED BY NEGLECT.

PAVEMENT CONSERVATION (PREVENTIVE MAINTENANCE) MEANS TIMELY MAINTENANCE APPLICATIONS; PLANNED MAINTENANCE BEFORE THE NEED IS APPARENT. MOST PEOPLE ARE NOT CONCERNED WITH ROAD CONDITIONS UNTIL THEY ARE INCONVENIENCED: THEN EXPENSIVE PANIC OR UNPLANNED MAINTENANCE IS NECESSARY.

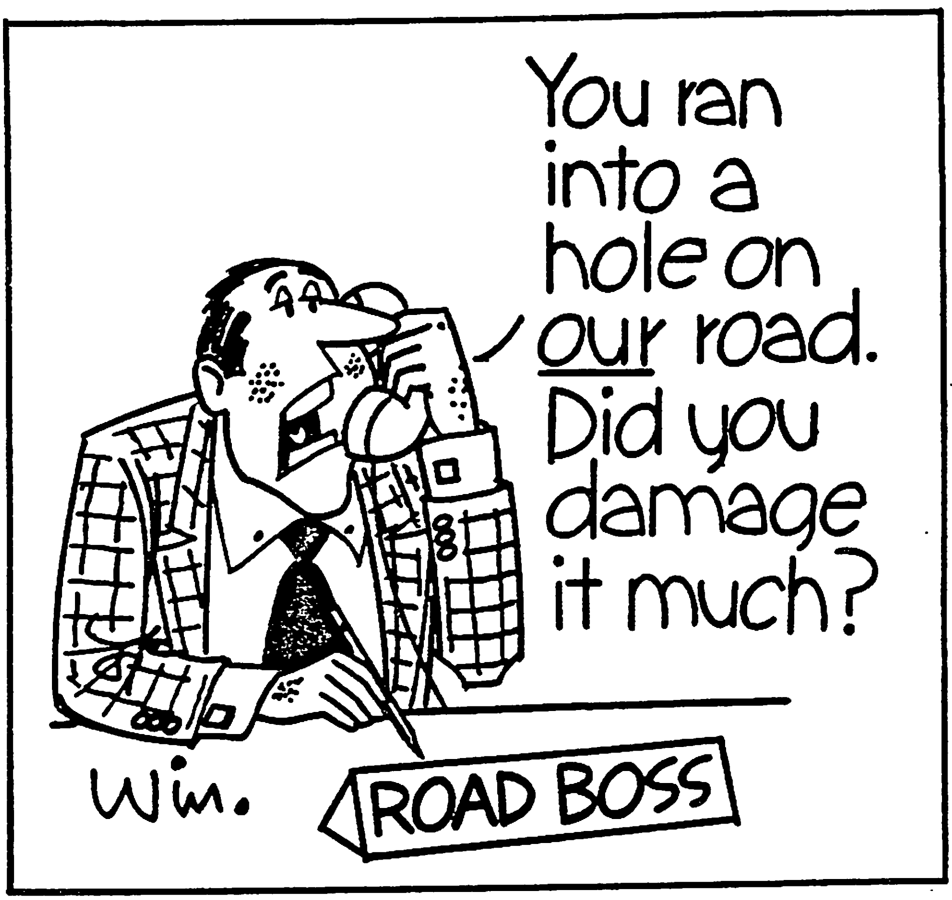


FIGURE 19.

THE APPEARANCE OF POTHOLES IS A SURE SIGN OF NEGLECT AND INDICATES PANIC MAINTENANCE (AVOIDABLE TAXPAYER EXPENSE)...AVOIDABLE BY TIMELY PLANNED CONSERVATION.

CASE STUDY #1

THE REMARKABLE SUCCESS OF LARUE DELP'S PLANNED MAINTENANCE PROGRAM FOR KANSAS HIGHWAYS DRAMATICALLY SHOWS THAT, BY MAINTAINING THE BEST ROADS FIRST AND WORKING IN THE REVERSE ORDER FROM BEST TOWARDS THE WORST, RATHER THAN RECONSTRUCTING THE WORST ROADS AND NEGLECTING THE BEST, THAT THE OVERALL QUALITY OF KANSAS HIGHWAYS INCREASED WHILE THE MAINTENANCE MATERIAL REQUIREMENTS WERE REDUCED.

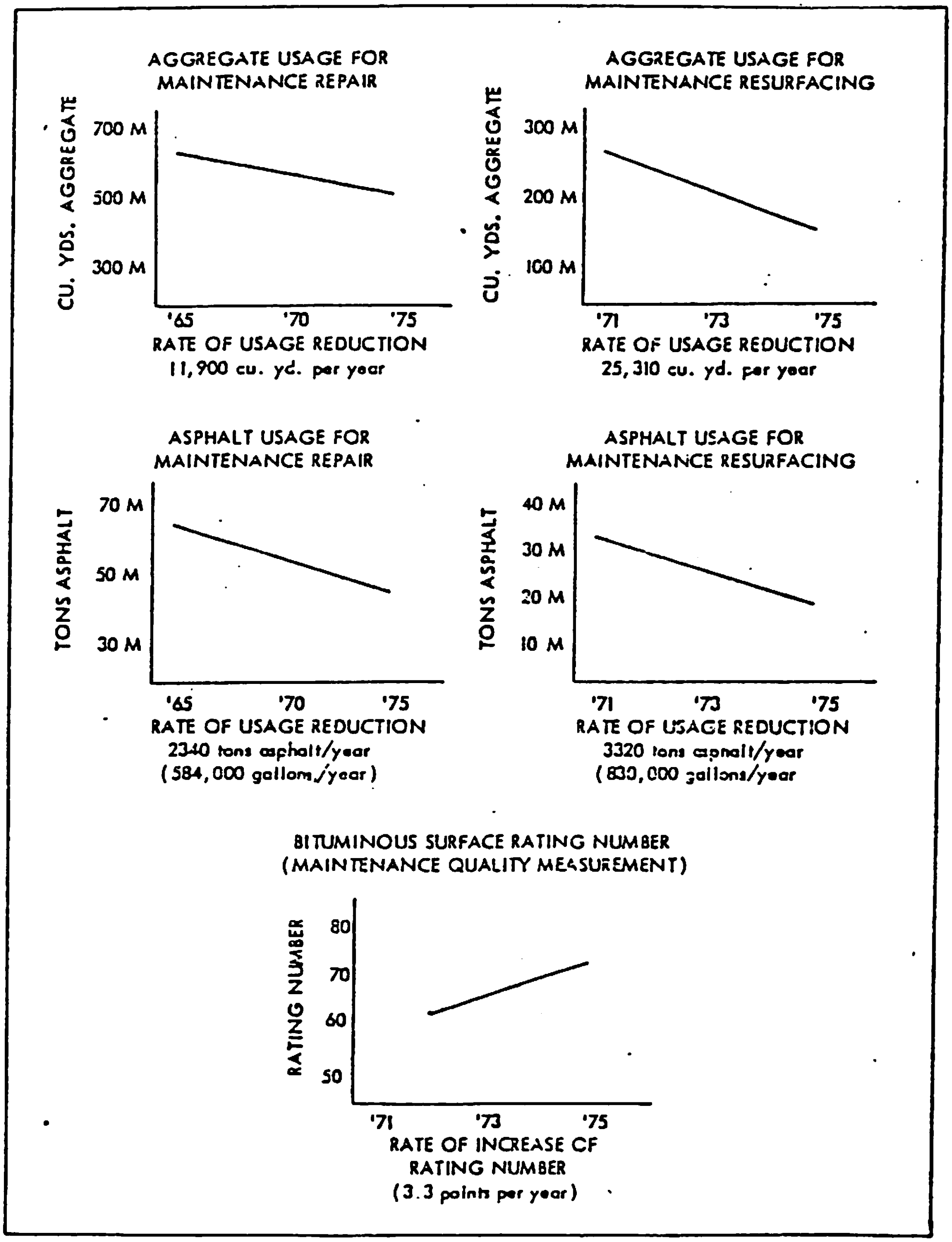


Figure 20 .Kansas Highway Department. Results of Effective Preventive Maintenance Policy. ("Economics of Preventive Maintenance," LaRue Delp - TRB - 1976)

CASE STUDY #2

EARLY IN 1968 THE SURFACE ON VADOT I-64 BEGAN TO SHOW DISTRESS MUCH SOONER THAN EXPECTED. INVESTIGATION SHOWED THAT THE SURFACE "LEAKED" WATER TO THE SUB-BASE AND CAUSED SERIOUS STRUCTURAL WEAKNESS. MAJOR CRACKS WERE TREATED AND A SLURRY SEAL APPLIED. THE DESIGN STRUCTURAL INTEGRITY RETURNED AND LITERALLY MILLIONS OF DOLLARS WERE SAVED.

NOTE: IN OUR S.W. OHIO AREA IT HAS BEEN FOUND THAT 90-95% OF THE WATER IN OUR ROAD BASES ENTER FROM THE PAVEMENT SURFACE. (R. DOLE)

CASE STUDY #3 ODOT SR 42 MADISION COUNTY

IN 1967 SR 42 RECEIVED AN 1½" OVERLAY OF 404. BY 1974 THE CENTER JOINT AND PAVEMENT EDGES WERE SHOWING SIGNS OF SURFACE DISTRESS AND WATER ENTRY. FOUR-FOOT STRIP SEALING WAS APPLIED TO THE EDGE OF THE PAVEMENT AS APPARENTLY REQUIRED AND THE ENTIRE CENTER JOINT WAS SEALED. MOST OF THE TRAVELLED SURFACE, HOWEVER, WAS NOT SEALED. NOW, IN THE SPRING OF 1981, AN OVERLAY IS NOW REQUIRED TO RESTORE THE ROAD SURFACE. IF THE ENTIRE SURFACE HAD BEEN SEALED IN 1974 ONLY AN INEXPENSIVE SEAL WOULD BE REQUIRED INSTEAD OF THE EXPENSIVE OVERLAY PROCEDURE PROPOSED.

THE REMEDIAL PROGRAM PLANNED WILL COST $17,600 PER MILE MORE THAN A SLURRY SEAL. PROJECTED OVER OUR ENTIRE OHIO HIGHWAY SYSTEM FOR THE INDICATED 7-YEAR CYCLE REPRESENTS $45,000,000 LOST YEARLY FOR THE ODOT SYSTEM AND $300,000,000 ANNUALLY FOR ALL OF OHIO'S ROADS.

NOT ONLY IS THE COST OF NON-CONSERVATION (WASTE) INCREDIBLE, BUT TIMELY AND EFFECTIVE MEASURE COULD SAVE 80% OF THE MATERIALS AND 80% OF THE ENERGY REQUIRED TO PLACE THE MATERIALS.

CLEARLY---PREMATURE FAILURES CAN BE, AND INDEED MUST BE, STOPPED---BY SURFACE SEALING---SPECIFICALLY SLURRY SEAL, A METHOD WHICH IS AFFORDABLE, ACCEPTABLE AND EFFECTIVE.

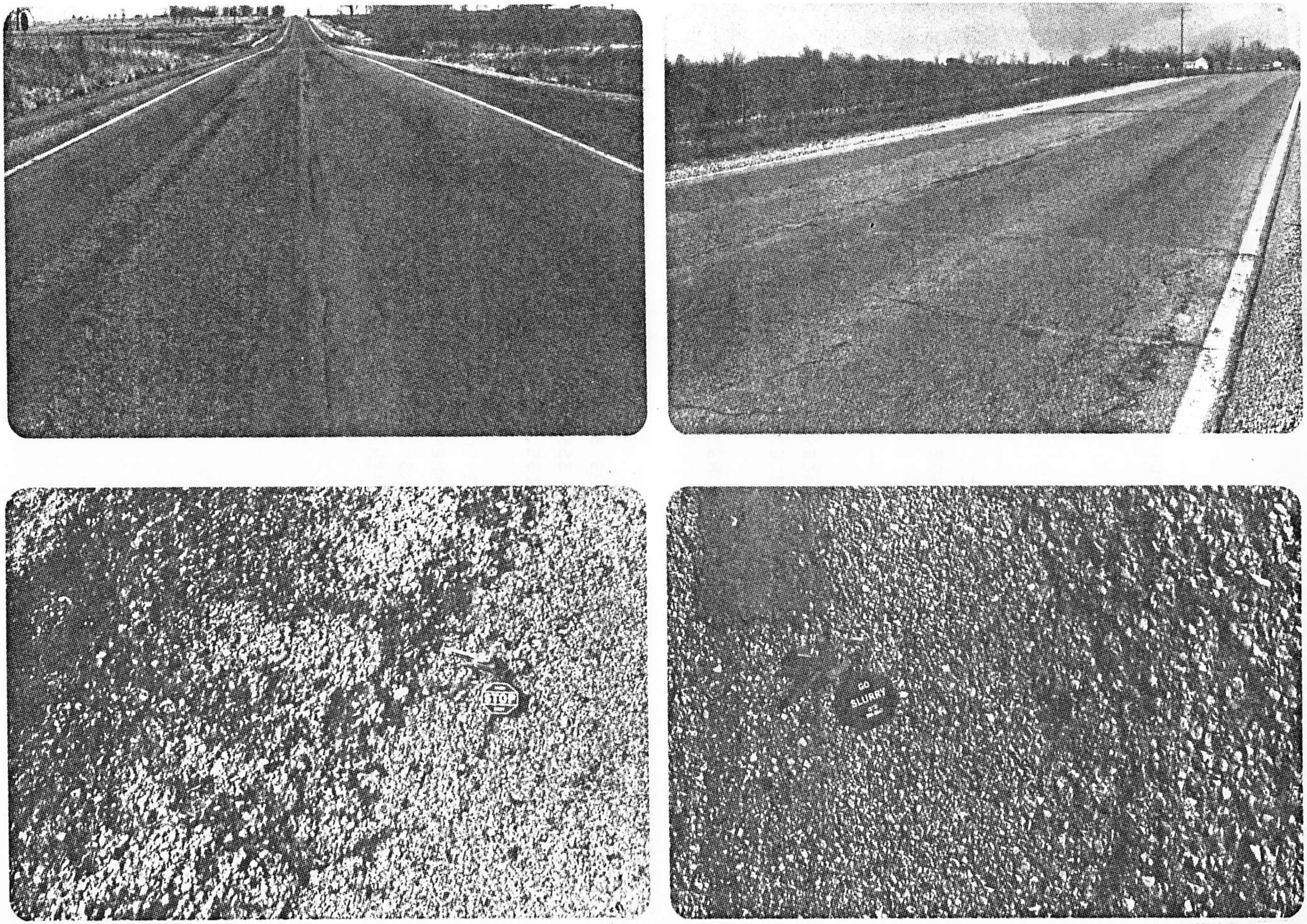


FIGURE 20.

CASE STUDY #3 ODOT SR 42 MADISON COUNTY 14 YEAR 404 7 YEAR SEAL

SUMMARY:

WE HAVE ATTEMPTED TO PRESENT A SIMPLIFIED VIEW OF PAVEMENT FUNDAMENTALS.

IN SUMMARY:

1. THE STRUCTURE SPREADS THE LOAD
2. PAVEMENTS PROTECT THE STRUCTURE
3. PAVEMENTS BECOME BRITTLE WITH AGE AND BEGIN TO LEAK WATER
4. WATER WEAKENS THE STRUCTURE
5. THE STRUCTURE FAILS

BY TIMELY SEALING OF PAVEMENT SURFACES, PAVEMENT LIFE IS EXTENDED AND MATERIALS, ENERGY AND MONEY ARE CONSERVED.

"THE SURFACES SIN BUT THE FOUNDATIONS ARE PURE."

A FINAL NOTE:

UNDER THE CURRENT FASHION, ENGINEERS EVALUATE PAVEMENT CONDITIONS BY CONDUCTING A CONDITION SURVEY. ESSENTIALLY, THIS AMOUNTS TO AN INCREDIBLE CRACK COUNTING EXERCISE...AFTER THEY HAVE OCCURRED!?!

HOPEFULLY, THE SCIENCE WILL ADVANCE TO EXAMINING THE CAUSES OF PAVEMENT DETERIORATION AND TO RECOMMEND ENGINEERING PRACTICES TO "PREVENT" RATHER THAN "COUNT" CRACKS..... BY THE MOST EFFECTIVE METHOD WE KNOW. "SEAL 'EM & SAVE 'EM." "SEAL SOONER, SAVE MORE."

ACKNOWLEDGMENTS & REFERENCES

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