



Engineering Construction

MEMORANDUM

DATE: Monday, July 07, 2008

TO: Peter Knudson
Deputy Engineer, Construction

FROM: Stephen Ganstrom
Sr. Civil, Construction

SUBJECT: MAG Case 07-02 – Revisions to Asphalt Concrete, Section 321 and 710
by the Asphalt Paving Technical Committee.

The following issues brought to the Technical Sub-Committee's attention and are yet to be address: *(The following list is a summery of issues requested throughout the process verbally and in writing)*

1. A strike-add version of 321's or 710's original vs. the new re-writes has not been provided.
 - a. Comments provided by other jurisdictions such as McDOT, City of Phoenix, and City of Scottsdale where not cataloged, shown to be incorporated, or address during the subsequent meetings.
 - b. In general, the method for incorporation of comments has been haphazard and very cumbersome.
2. The new Section 321.8 "Placement" is missing many of the quality control items from the old Section 321.5
 - a. How and where will placement temperatures are taken
 - b. Spread requirements
 - c. Lane staggering
 - d. Many topics like: joint heaters, in-place rutting, screed length requirements, spreader box restrictions, etc...)
3. The sub-division of pavement in Lots and Sub-Lots is unacceptable. (321.10)
4. AGC's "Asphalt Concrete Coring Method" is not a regionally or nationally recognized procedure. (321.10.4)
5. Use of "Engineering Analysis" is unacceptable. (321.10.6)

In the process of working with the MAG Sections 321 and 710 Sub-committee, only some of the comments provided have been addressed. It is recommended that the City of Mesa does not support the proposed Case 07-02.

[Attached: 4-10-08 DRAFT Copies of Sec. 710 and 321, Meeting Comments from 3/12/2008]

SECTION 321

Revised 4-10-08

ASPHALT CONCRETE PAVEMENT

321.1 DESCRIPTION:

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for the following situations or projects

SURFACE, BASE AND/OR CURB

- A capital improvement project where the work is being performed under a contract directly between the contractor and the Owner.
- A project being constructed under a permit, where the Owner's control and responsibility for maintenance will eventually be transferred upon dedication of the project or roadway to a city, county, or other entity.
- A project where the Owner is a private individual, company, or group and no city, county or other agency specifications apply to the project.

No. needed
where etc.
Noted
to be moved
to same
section

321.2 MATERIALS AND MANUFACTURE:

The materials shall conform ~~with~~ Section 710 for the type specified. The specific required mix type shall be called out in the contract documents or as directed by the engineerEngineer.

321.3 WEATHER AND MOISTURE CONDITIONS:

At least

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. or above. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base on which the material is to be placed contains excessive moisture and is unstable. Excessive moisture is defined as the base or subgrade moisture is in excess of 2 percent above optimum moisture, determined in accordance with AASHTO T 99 corrected for the appropriate rock percentage. Asphalt concrete shall be placed only when the Owner's EngineerEngineer determines that weather conditions are suitable

321.4 APPLICATION OF TACK COAT:

2.0

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. The tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Owner's EngineerEngineer.

SHOULD BE BETTER DEF.

The application of the tack coat shall comply with Section 329. The grade of emulsified asphalt shall be SS-1 h or CSS-1h as specified in Section 713.

The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.

The surface to be covered may require repair or patching as directed by the Owner's EngineerEngineer. This shall be addressed in the project specifications prior to the bidding of the project.

321.5 MIX DESIGN

10 WORKING DAYS

The mix design shall be submitted to the ~~Owner's EngineerEngineer~~ at least ~~five~~ working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the ~~Owner's EngineerEngineer's~~ discretion. The ~~Owner's EngineerEngineer~~ will review and approve the mix design to assure it contains all of the required information as outlined in Section 710.3.1. The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

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Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the ~~Owner's Engineer~~ Engineer with a new mix design, which meets the requirements of Section 710, as amended by the Project Specifications.

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the ~~Owner's Engineer~~ Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented.

The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

TABLE 321-1	
<u>ALLOWABLE SELF DIRECTED TARGET CHANGES</u>	
MEASURED CHARACTERISTICS	ALLOWABLE SELF-DIRECTED TARGET CHANGES
Gradation (Sieve Size)	
3/8 inch	± 2% from mix design target value
No 8	± 2% from mix design target value
No 30	± 1% from mix design target value
No 200	None
Binder Content	± 0.2% from mix design target value
Effective Air Voids	None

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the ~~Owner's Engineer~~ Engineer. The ~~Owner's Engineer~~ Engineer will determine if the proposed target change will result in mix production that that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

321.6 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. Mixing plants shall conform to the requirements of AASHTO M 156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weigh belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent ~~so there is not a significant~~ loss of mineral admixture through the dust collection system of the plant.

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A positive signal system shall be provided and utilized during production whereby the mixing shall automatically stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls or the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 24-12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued

THIS WILL TAKE ALLOW FOR "MODIFIED" NOW ADD SECTION FOR MODIFIED...

The temperature of the asphalt concrete, with unmodified binders, upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased on the recommendation of the binder supplier, when approved by the ~~Owner's Engineer~~ Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

321.7 TRANSPORTATION

The use of petroleum distillates or other substances that will have a detrimental effect on the asphalt concrete shall not be used as a release agent.

The beds of all transportation units shall be clean and smooth to allow the free flow of material into the paving machine's hopper.

Tarpaulins shall be furnished and used when the ambient temperature is below 65 degrees F. at all times

321.8 PLACEMENT:

321.8.1 Placing

*MISSING 2 LARGE SECTIONS OF TEXT FROM LAST / OLD SECTION
* HOW TEMPS ARE TAKEN
* HOW Lanes ARE TO BE STRIPPED
* SP READ REQ.
* JOINT HEATERS (2 in. dia)
* IN PLACE DISTANCE
* LENGTH OF AUGERS*

All courses of asphalt concrete shall be placed and finished by means of a self-propelled paving machine equipped with an automatically actuated control system, except under certain conditions or at locations where the ~~Owner's Engineer~~ Engineer deems the use of a self-propelled paving machine impracticable.

The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternatively when directed, by controlling the elevation of each end independently.

The control system shall be capable of working with one of the following devices:

- (A) Ski or non-contact device of not less than 30 feet in length, supported throughout its entire length
- (B) Taut stringline or wire set to grade
- (C) Short ski or sonar sensing units from curb control
- (D) Joint matching shoe

Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the asphalt concrete is dumped from the hauling vehicles directly into the paving machine, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

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If asphalt concrete is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphalt concrete shall be picked up and loaded into the paving machine.

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the Project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture uniformly in front of an adjustable floating screed. Care should be utilized when operating the paving machine. The raising of the hopper wings should be minimized and the paving machine should not be operated when in an empty or near-empty condition.

Req. use of SPREADER BOX

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers and finished to provide a uniform and smooth layer over the entire area compacted in this manner.

USE OLD P FROM 321.5 (4TH)

321.8.2 Joints

Longitudinal joints of each course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course. Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth and exposing a fresh face. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

change to

Longitudinal Joints of each course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth and exposing a fresh face. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline. The joint will be tack coated if required by the engineer.

ALL S SHALL HAVE

APPLIED ALONG VERT. SURF.

321.8.3 Leveling Course

A leveling course shall be used when specified, or as directed in writing by the Owner's Engineer, to bring existing pavement to a uniform grade prior to placing an overlay or other course. The compaction requirements contained in Section 321.10 do not apply to leveling courses.

321.8.4 Compaction Base and Surface

MISSING ITEMS * TACK COAT * DISTANCE * THICKNESS MAX OR MIN * ADJUSTMENTS ALL IN OLD SEC

It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. Asphalt concrete immediately behind the laydown machine shall be a minimum of 250 degrees F as measured from a probe type thermocouple thermometer that has been calibrated to an AASHTONIST standard. The probe type thermocouple thermometer shall have a current calibration sticker attached. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements.

WAS TOO VAGUE. TON MIN? IS IN THE CURRENT MAS SEC. I CAN'T COUNT HOW MANY TIMES CONTRACTORS BRING OUT

Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

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The ~~Owner's Engineer~~ Engineer will determine the acceptability of the pavement compaction in accordance with Section 321.10 - "Acceptance".

321.8.5 Smoothness:

The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than one-fourth (1/4) inch from the lower edge of a ~~12-12-foot~~ straightedge when the straightedge is placed parallel to the centerline of the roadway.

321.9 QUALITY CONTROL:

It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during asphalt concrete production to achieve the required compaction and ~~it is the supplier's responsibility to perform any desired Quality Control monitoring and/ or testing during asphalt concrete production to achieve the required mix properties.~~ The ~~Owner's Engineer~~ Engineer reserves the right ~~to~~ may obtain samples of any portion of any material at any point of the operations for his own use. Also, the ~~Owner's Engineer~~ Engineer reserves the right ~~to~~ may order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture. *When will the results of this QC be available to the Agency.*

The asphalt concrete produced shall conform to the properties of the mix design. When the asphalt concrete does not conform to the approved mix design properties, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or the production shall cease immediately at no additional cost to the contractor Agency or Engineer. *What will the initiate "start-up"?*

321.10 ACCEPTANCE:

321.10.1 Acceptance Criteria:

Unless otherwise specified, asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be considered to be one day's production. When the quantity of asphalt concrete placed in a day exceeds 500 tons but is less than 2000 tons, the lot shall be divided into 500 ton sublots or fraction thereof. Where the quantity of asphalt concrete placed in a day exceeds 2000 tons, the day's production will be divided into four (4) approximately equal sublots. A minimum of one sample will be obtained from each lot. ~~day's production.~~

Tests used to determine acceptance will be performed by the Engineer or a laboratory employed by the Engineer. In either case the laboratory shall be accredited by the AASHTO Accreditation Program (AAP), for the tests being

performed. The acceptance laboratory will take a representative samples of the asphalt concrete from each subplot to allow for gradation, binder content, air voids, pavement thickness and compaction of base and surface course. Each subplot will be accepted based upon the test data from the sample(s) from that subplot. All acceptance samples shall be taken using random locations or times designated by the ~~Owner's Engineer~~ Engineer in accordance with ASTM D 3665.

~~The random locations or times shall be determined per ASTM D 3665.~~

321.10.2 Gradation, ~~Binder~~, Binder Content and Air Voids:

The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T168 from each subplot. The minimum weight of the sample shall be ~~45~~ 5 pounds. Asphalt Binder ~~binder~~ content and gradation shall be determined in accordance with AASHTO T308 using the ignition furnace for each subplot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall ~~mix~~ Mix designs shall be tested in accordance with AASHTO T245. The bulk density for Gyratory mix designs shall be tested in accordance with AASHTO T312. The maximum theoretical density shall be tested in accordance with the requirements of AASHTO T209. Effective voids determined on the laboratory

No way to track and reduces overall penalties

not needed

still to be done 25-30 min

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compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table 321-5, additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

The allowable deviations for acceptable production of each measured characteristic from the values established in the JMF for each subplot are as follows:

TABLE 321-3

ACCEPTANCE LIMITS FOR ASPHALT CONCRETE

Maximum Aggregate Size	100% passing
Nominal Maximum Aggregate Size	±7%
No. 8 Sieve to the Nominal Maximum Aggregate Size	±6%
No. 100 and No. 30 Sieves	±4%
No. 200 Sieve	±2%

If the results from a single acceptance sample fall outside of the acceptance limits in Table 321-3 a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table 321-3 production of asphalt concrete shall cease. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in table 321-3. the results of an asphalt concrete mix sample fall within the acceptance limits in Table 321-3.

WHERE WOULD THIS SAMPLE COME FROM?

TABLE 321-4

ASPHALT BINDER CONTENT CORRECTIVE ACTION FOR DEVIATIONS

Deviation from that permitted	When the contracting agency is the owner:	When the contracting agency is not the owner (i.e. permits):
	Payment Reduction (\$ per ton of asphalt concrete)	Corrective Action
0.0 to 0.1% points	\$0.50 1.00 /ton	EA (see 321.10.6) No corrective action
Over 0.1 to 0.2% points	\$2.00 3.00 /ton	EA (see 321.10.56)
Over 0.2% points	EA (see 321.10.5) or Removal*	EA (see 321.10.5) or Removal*

Note: Removal* refers to Section 321-10.6

TABLE 321-5

LABORATORY VOIDS ACCEPTANCE AND PENALTIES

Laboratory Air Voids (Measured at N _{des} or 75 blows as applicable)	When the contracting agency is the owner:	When the contracting agency is not the owner (i.e. permits):
	Payment Reduction (\$ per ton of asphalt concrete)	Corrective Action
Less than 1.5%	EA (see 321.10.5) or Removal*	EA (see 321.10.5) or Removal*
1.5-2.0%	\$1.25 2.50	EA (see 321.10.56)
2.1-2.7%	\$0.50 1.00	EA (see 321.10.6) No corrective action
2.8-6.2%	Full Payment	No corrective action

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6.3-6.9%	\$0.50	EA (see 321.10.6) No corrective action
7.0-8.0%	\$1.25	EA (see 321.10.56)
Greater than 8.0%	Removal* EA (see 321.10.5) or Removal	Removal* EA (see 321.10.5) or Removal

Note: Removal* refers to Section 321-10.6

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section 321.10 and specifically tables 321-3, 321-4 and 321-5 from Section 321.10 when determining the acceptance of the asphalt concrete with the material supplier.

321.10.253 Surface Drainage:

If directed by the Engineer surface drainage test shall be performed. ~~in accordance with (?).~~ The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

AND HORIZONTAL?

~~When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance, or shall be cut out along neat straight lines and replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.~~

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

REF. ?

~~When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance, or shall be cut out along neat straight lines and replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.~~

~~If directed by the Engineer surface drainage shall be performed in accordance with (-). The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.~~

321.10.4 Asphalt Pavement Thickness:

Asphalt Pavement thickness will be determined from cores secured from each subplot for this purpose. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found at www.azrockproducts.org or www.azagc.org websites. Each core location will be patched by the party responsible for the testing.

AT THE TIME OF CORE. AGAIN, NOT A RECOGNIZED SPEC.

If the pavement thickness is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price. If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following steps will apply:

If the thickness deficiency of the pavement exceeds 0.25 inch, the limits of the deficient area will be isolated by coring at maximum intervals of 100 feet from the deficient core. The thicknesses of the original deficient core will be averaged with the thicknesses of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements.

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2. If the pavement thickness from step one above deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action will consist of application of a Type II slurry seal coat in accordance to Section 715. The Contractor may present an engineering analysis outlining other proposed remedial measures for the consideration of the ~~Owner's Engineer~~ Engineer. The ~~Owner's Engineer~~ Engineer will review the engineering analysis and decide within ~~40-30~~ working days whether to accept the proposed remedial measures.

No SKIN PATCHES!


If the pavement thickness from step one above deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area will be overlaid ~~equal in thickness to the deficiency but not less than 1/2" inch depth~~ for the full width of the pavement ~~to meet or exceed the designed thickness~~, with the appropriate end and edge milling, with a mixture approved by the ~~Owner's Engineer~~ Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the ~~Owner's Engineer~~ Engineer's consideration. The ~~Owner's Engineer~~ Engineer will review the engineering analysis and decide within ~~40-10~~ working days whether to accept the proposed remedial measures. If the ~~Owner's Engineer~~ Engineer chooses to reject the engineering analysis, the indicated overlay will be constructed by the Contractor at no additional cost to the Owner.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is the owner, Table 321-2 will apply.

TABLE 321-26	
ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION (AC) For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches	
Specified Mat Thickness	Reduction in Payment or Corrective Action
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and over	17%

321.10.4-5 Density:

Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the Lot as outlined in 321.10.1.

The ~~Owner's Engineer~~ Engineer will designate two random test locations for each subplot and the acceptance laboratory will obtain two cores from each location. The two cores will be averaged for acceptance. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The ~~Owner's Engineer~~ Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

The Contractor will provide the traffic control to facilitate any coring operations necessary for compaction acceptance.

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NOT A RECORD NO. 321
PROCEDURE

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found at www.azrockproducts.org or www.azagc.org websites. The acceptance laboratory will furnish test results within 3 working days of receipt of the cores.

If the pavement density has in-place voids of 8.0% or less, the asphalt concrete will be paid for at the contract unit price. If the pavement density has in-place voids greater than 8.0%, the limits of the deficient area will be isolated within the subplot by coring at maximum intervals of 100 feet from the deficient core. The in-place voids of the original deficient core will be averaged with the in-place voids of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the average of the in-place voids is greater than 8.0% then Table 321-6 shall apply to the subplot.

UPPER LIMIT OK, WHAT ABOUT LOW IN-PLACE VOIDS.

TABLE 321-7		
PAVEMENT DENSITY PENALTIES		
Limits of In-place Air Voids	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
8.1% to 9.0%	\$41.00/ton of Asphalt Concrete penalty	EA
9.1% to 10.0%	\$64.00/ton of Asphalt Concrete penalty	EA and Type II Surry Seal
Greater than 10.1% to 11.0%	Removal* \$96.00/ton and an EA (see 321.10.5) or Removal*	EA (see 321.10.5) or Removal*
Greater than 11.0%	Removal	Removal

Notes: Removal refers to Section 321-10.6. The Contractor shall remove and replace the entire subplot that is deficient. Removal for In-place Air Voids greater than 11.0% is not eligible for Section 321.10.6.

321.10.6 Engineering Analysis (EA):

Within ten 10 working days after receiving notice that a subplot of asphalt concrete is deficient for removal-“Removal” by the Owner’s Engineer/Engineer, the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties listed in the “Removal” category. Engineering Analysis can also be proposed for non-removal categories of “Corrective actions” when the contracting agency is not the owner (i.e. permits).

The proposal-Engineering Analysis shall contain an engineering-an analysis of the anticipated performance of the asphalt concrete if left in place. The engineering-Engineering analysis-Analysis shall also detail the effect of any proposed corrective action on the performance. The engineering-Engineering analysis-Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs. If the subplot is submitted for referee testing by the contractor, the ten working days allowed to prepare an engineering analysis will begin upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or subplot not be removed, the Engineering Analysis will recommend that the following penalties (Table 321-8) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 321-8

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New

<u>ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE</u>		
<u>Acceptance Criteria</u>	<u>Acceptance Limits</u>	<u>Penalty When Contracting Agency is the Owner (\$/Ton)</u>
<u>Asphalt Binder Content</u>	<u>Over 0.2% points from that Permitted</u>	<u>\$9.00</u>
<u>Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)</u>	<u>Less than 1.5% or Greater Than 8.0%</u>	<u>\$3.75</u>
<u>Limits of In-place Air Voids</u>	<u>10.1% to 11.0%</u>	<u>\$9.00</u>

Within ~~three~~ 15 working days, the ~~Owner's Engineer~~ Engineer will determine whether or not to accept the contractor's ~~proposal~~ proposed Engineering Analysis.

Payment is req. by who?

321.11 REFEREE:

In the event the contractor elects to question the acceptance test results for a subplot, the Contractor may make a written request for additional testing of that subplot. The ~~Owner's Engineer~~ Contractor will engage an independent laboratory (at the Contractor's own expense) who is accredited by AAPAMRL or equivalent in all of the acceptance tests. The independent laboratory shall be acceptable to the Engineer ~~paid by the Owner's Engineer~~ and shall perform a completely new set of acceptance tests (as required by Section 321.10 representing the area or set of tests in question).

These tests shall include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, and maximum theoretical unit weight. Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer. ~~splits from the acceptance tests held by the acceptance laboratory, or from additional samples cored from the roadway.~~

The number of samples taken will be the same as specified in Section 321.10. The independent laboratory shall compile the test results and transmit them to both the ~~Owner's Engineer~~ Engineer and the Contractor. The independent laboratory shall include a letter signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix designs. The signed letter shall give an opinion that the material evaluated either does or does not comply with project specifications, and shall clearly describe any deficiencies, and the results will be binding between all parties.

321.12 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, ~~filler material,~~ asphalt ~~ement~~ binder, and mineral admixture and sand. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the ~~Owner's Engineer~~ Engineer.

~~The bid price per ton or square yard for asphalt concrete shall include the cost of the asphalt cement in the percentages as specified in Section 710.~~

321.13 PAYMENT:

The asphalt concrete measured as provided ~~above,~~ above will be paid for at the contract price per ton or square yard, as adjusted per Section 321.10 ACCEPTANCE, which price shall be full compensation for the item complete, as herein described and specified.

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Payment for tack coat will be by the ton diluted, based on the rate of application, as directed by the ~~Owner's~~ Engineer.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent based on actual field measurement of area covered, design thickness, and the mix design unit weight. The calculations and payment for overrun will be by individual bid item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the ~~Owner's Engineer~~ Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit bid price.

Except as otherwise specified in the special provisions, no separate payment will be made for work necessary to construct miscellaneous items or surfaces of asphalt concrete.

SECTION 710

Current comments

7-7-08

ASPHALT CONCRETE

SDG

Revised 54-115190-08

710.1 GENERAL:

Asphalt concrete shall be a mixture of asphalt cement and mineral aggregates. Mineral admixture shall be included in the mixture when required by the mix design or by the Engineer. Asphalt concrete shall be produced in accordance with Section 321.

The designation for asphalt concrete mixes shall be based on the nominal maximum aggregate size of the mix. The applicable mix designations are 3/8 inch, 1/2 inch, 3/4 inch and Base mix.

MM?

Each mix shall be designed using Marshall or Gyratory compaction methods. Marshall mixes may be used for low or high traffic conditions, while Gyratory mixes are recommended for only high traffic conditions. Low traffic conditions are conditions where the asphalt mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets, most parking lots and residential minor collector streets. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on major collector, arterial and commercial streets. Street classifications (i.e. minor collector and major collector shall be determined by the specifying agency).

The following table (Table 710-1) displays the recommended lift thickness for various asphalt concrete mix designations found within Section 710. Please note that these recommended lift thicknesses are minimums based on each mix designation's "Nominal Aggregate Size" and the relative coarseness of its gradation. The compacted thickness of layers placed shall not exceed 150% of the Design Target Lift Thickness of Table 710-1 except as otherwise provided in the plans and specifications, or if approved in writing by the Engineer. (From 321.5.4 of existing MAG)

TABLE 710-1		
RECOMMENDED MINIMUM LIFT THICKNESS'S for ASPHALT CONCRETE MIXES		
Designation (inches)	Target Lift Thickness Marshall Mixes	Target Lift Thickness Gyratory Mixes
3/8"	1.0 inches	1.5 inches
1/2"	1.5 inches	2.0 inches
3/4"	2.5 inches	3.0 inches
Base	3.0 inches	n/a

710.2 MATERIAL:

710.2.1 Asphalt Binder: The asphalt binder specified in this section has been developed for use in desert climate conditions. Should it be utilized in other climates, consideration should be given to adjustments in the asphalt binder selection. The asphalt binder shall be Performance Grade Asphalt conforming to the requirements of Section 711 for PG 70-10, unless otherwise approved by the Engineer or specified differently in the plans or special provisions.

710.2.2 Aggregate: Coarse and Fine aggregates shall conform to the applicable requirements of this section. Coarse mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert material with similar characteristics, or a combination thereof, conforming to the requirements of these specifications.

Coarse aggregate for hot mix the No. 4 sieve.

4 sieve and Fine aggregate is material passing

that prevent coating with the asphalt binder. tested in accordance with the applicable test methods.

conform to the following requirements when

700 VAGUE, Presently is "Free of"

TABLE 710-2
COARSE/FINE AGGREGATE REQUIREMENTS

Characteristics	Test Method	Low Traffic	High Traffic
Fractured Faces, % (Coarse Aggregate Only)	Arizona 212	75, 1 or more	85, 1 or more 80, 2 or more
Uncompacted Voids, % Min.	AASHTO T-304, Method A	42	45
Flat & Elongated Pieces, % 5:1 Ratio	ASTM D-4791	10.0 Max.	10.0 Max.
Sand Equivalent, %	AASHTO T-176	50 Min.	50 Min.
Plasticity Index	AASHTO T-90	Non-plastic	Non-plastic
L.A. Abrasion, % Loss <i>not good enough! needs new method!</i>	AASHTO T-96	9 max. @ 100 Rev. 40 max. @ 500 Rev.	9 max. @ 100 Rev. 40 max. @ 500 Rev.
Combined Bulk Specific Gravity	AI MS-2/SP-2	2.35 – 2.85	2.35 – 2.85
Combined Water Absorption	AI MS-2/SP-2	0 – 2.5%	0 – 2.5%

Tests on aggregates used in asphalt concrete outlined above, shall be performed on materials furnished for mix design purposes and composited to the mix design gradation.

Blend sand (naturally occurring or crushed fines) shall be clean, hard and sound material which will readily accept asphalt binder coating. The blend sand grading shall be such that, when it is mixed with the other mineral aggregates, the combined product shall meet the requirements of Table 710-2.

The natural sand shall not exceed 20 percent for the Marshall mixes, and 15 percent for the Gyratory mixes by weight of the total aggregate for a mix.

710.2.3 Mineral Admixture: Mineral admixture when used as an anti-stripping agent in asphalt concrete shall conform to the requirements of AASHTO M-17. Mineral admixture used in asphalt concrete shall be dry hydrated lime, conforming to the requirements of ASTM C-1097 or Portland cement conforming to ASTM C 150 Type II or ASTM C 595 Type IP. The amount of hydrated lime or Portland cement used shall be determined by the mix design. The minimum Mineral admixture content within a mix will be ~~0.75~~1.00 percent, by weight of total aggregate.

AND PRODUCTION

710.3 MIX DESIGN REQUIREMENTS:

710.3.1 General: The mix design for asphalt concrete shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program (AAP) in Hot Mix Asphalt Aggregates and Hot Mix Asphalt. The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, and who is listed by ADOT as a "Qualified Asphaltic Concrete Mix Design Engineer" within ADOT's current latest list of approved laboratories. The current latest list of approved laboratories is available on ADOT's web page www.azdot.gov. The date of the design shall not be older than two years from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

1YR! 2 IS TOO LONG

The mix design report shall include the following elements as a minimum.

- (1) The name and address of the testing organization and the person responsible for the mix design report.
- (2) The mix plant identification and/or location, as well as the supplier or producer name.
- (3) A description of all products that are incorporated in the asphalt concrete along with the sources of all products, including admixtures and asphalt binder, and their method of introduction.
- (4) The supplier and grade of asphalt binder, the source and type of mineral aggregate, and the percentage of asphalt binder and mineral admixture used.
- (5) The mix design report shall state the traffic condition (low or high traffic) and size designation. In all cases Gyratory based mix designs shall be designated as high traffic mixes. Marshall based mix design shall be designated either low or high traffic mixes.

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56) The results of all testing, determinations, etc., such as: specific gravity and gradation of each component, water absorption, sand equivalent, loss on abrasion, fractured coarse aggregate particles, ~~immersion compression results~~ Tensile Strength Ratio (Index of Retained Strength, wet and dry strengths AASHTO T 283), Marshall stability and flow, asphalt absorption, percent air voids, voids in mineral aggregate, and bulk density. Historical abrasion values may be supplied on existing sources. The submittal should include a plot of the gradation on the Federal Highway Administration's 0.45 Power Gradation Chart, plots of the compaction curves and the results of moisture sensitivity testing.

*No
Needs
Now*

(67) The laboratory mixing and compaction temperature ranges for the supplier and grade of asphalt binder used within the mix design.

(78) A specific recommendation for design asphalt binder content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

(89) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was performed.

The mix design shall be submitted to the Agency or Engineer by the Contractor/Supplier for which it was developed as part of his project submittals. Once the mix design has been approved by the agency or Engineer, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producer's pit, the asphalt binder, including modifiers in the asphalt binder, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

710.3.2 Mix Design Criteria: The mix design shall be performed by one of two methods, Marshall Mix Design or Gyratory Mix Design. The method shall be specified on the plans, special provisions, or by the Engineer. A minimum of 4 points will be used to establish the mix design results. The oven aging period for both Marshall and Gyratory mix design samples shall be 2 hours.

Why is that

710.3.2.1 Marshall Mix Design: The Marshall Mix Design shall be performed in accordance with the requirements of the ~~current~~ latest edition of the Asphalt Institute's Manual, MS-2 "Mix Design Methods for Asphalt Concrete." The mix shall utilize the compactive effort of 75 blows per side of specimen. The mix shall comply with the criteria in Table 710-3.

TABLE 710-3
MARSHALL MIX DESIGN CRITERIA

*Restricted Zone
Has Been Removed.*

Criteria	Requirements				Designated Test Method
	3/8" Mix	1/2" Mix	3/4" Mix	Base Mix	
1. Voids in Mineral Aggregate: %, min	15.0	14.0	13.0	12.0	AI MS-2
2. Effective Voids: %, Range	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2	AI MS-2
3. Absorbed Asphalt: %, Range *	0 - 1.0	0 - 1.0	0 - 1.0	0 - 1.0	AI MS-2
4. Dust to Eff. Asphalt Ratio, Range **	0.6 - 1.4	0.6 - 1.4	0.6 - 1.4	0.6 - 1.4	*AI MS-2
5. Tensile Strength Ratio: %, Min.	60	60	60	60	AASHTO T-283
6. Dry Tensile Strength: psi, Min.	100	100	100	100	AASHTO T-283
7.	2,000	2,500	2,500	3000	AASHTO T-245
8. Flow: 0.01-inch, Range	8 - 16	8 - 16	8 - 16	8 - 16	AASHTO T-245
9. Mineral Aggregate Grading Limits					AASHTO T-27
	Percent Passing with Admix				
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix	Base Mix	
1-1/4 inch				100	
1 inch			100	90-100	
3/4 inch		100	100	85-95	

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1/2 inch	100	85 – 100	---	---
3/8 inch	90-100	62 – 85	62 – 77	57-72
No. 8	45-60	40 – 50	35 – 47	33-43
No. 40	10-22	10 – 20	10 – 20	9-18
No. 200	2.0 – 10.0	2.0 – 10.0	2.0 – 8.0	1.0 – 7.0

* Unless otherwise approved by the Engineer.

** The ratio of the mix design composite gradation target for the No. 200 sieve, including admixture, to the effective asphalt content shall be within the indicated range 0.6 to 1.4.

710.3.2.2 Gyrotory Mix Design: Gyrotory Mix Designs shall be performed in accordance with the requirements of ~~current~~latest edition of the Asphalt Institute’s SP-2 manual. Mix design laboratory compacted specimens shall be prepared using a gyrotory compactor in accordance with AASHTO T-312.

The mix design shall be formulated in a manner described for volumetric mix designs in the current edition of the Asphalt Institute Manual SP-2, except the number of trial blend gradations necessary will be determined by the mix design laboratory. Duplicate gyrotory samples shall be prepared at a minimum of four (4) binder contents to select the recommended binder content. The completed mix design shall meet all the mineral aggregate and mix design criteria specified herein.

WHY DOES THIS NEED TO CHANGE? For purposes of design, the number of gyrations shall be 8 for Nini, 100 for Ndes, and 160 for Nmax. The corrected density of the specimens shall be less than 89.0 percent of maximum theoretical density at 8 gyrations. The corrected density of the specimens shall be less than 98.0 percent of maximum theoretical density at 160 gyrations.

The mix shall comply with the criteria in Table 710-4.

TABLE 710-4
GYRATORY MIX DESIGN CRITERIA

Criteria	Requirements			Designated Test
	3/8" Mix	1/2" Mix	3/4" Mix	Method
1. Voids in Mineral Aggregate: %, Min.	15.0	14.0	13.0	AI SP-2
2. Effective Voids: %, Range	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2	AI SP-2
3. Absorbed Asphalt: %, Range *	0 - 1.0	0 - 1.0	0 - 1.0	AI SP-2
4. Dust to Eff. Asphalt Ratio, Range **	0.6 – 1.4	0.6 – 1.4	0.6 – 1.4	*AI SP-2
5. Tensile Strength Ratio: %, Min.	70	70	70	AASHTO T-283
6. Dry Tensile Strength: psi, Min.	75	75	75	AASHTO T-283
7. Mineral Aggregate Grading Limits				AASHTO T-27
	Percent Passing with Admix			
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix	
1 inch			100	
3/4 inch		100	90-100	
1/2 inch	100	90-100	43-89	
3/8 inch	90-100	53-89	-	
No. 8	32-47	29-40	24-36	
No. 40	2-24	3-20	3-18	
No. 200	2.0-8.0	2.0-7.5	2.0-6.5	

* Unless otherwise approved by the Engineer.

** The ratio of the mix design composite gradation target for the No. 200 sieve, including admixture, to the effective asphalt content shall be within the indicated range 0.6 to 1.4.

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710.3.2.3 Moisture Sensitivity Testing: Moisture sensitivity testing will be performed in accordance with AASHTO Test Method T-283 for both Marshall and Gyratory mix designs, without the freeze/thaw cycle(s). The minimum required Tensile Strength Ratio is indicated in the tables above.

Comments (taken from revision draft dated "11/9/07" supplied to city staff February 1st)

1. Fix, compete or spell-out any outstanding text, acronyms and revisions noted in the text. (ie. "?" in section 321.10.3)
2. (Section 321.5, add this text) The contractor shall be responsible for providing the engineer with an acceptable product per the applicable current MAG Section. Routine testing of the aggregates, binder, anti-strip material and the asphalt mixture shall be the responsibility of the contractor or his representative.
3. (Section 321.6, last paragraph) ...minimum temperature noted herein. **where?** excessive amount of ~~heat loss~~...**heat, heat loss, drain down,**
4. (Section 321.7, last sentence) Tarpaulins shall be furnished and used ~~when the ambient temperature is below 65degrees F.~~ **at all times.**
5. (Section 321.9, second paragraph) The production shall cease immediately **at no additional cost to the Contracting Agency or Engineer.**
6. (Acceptance Tables 321-4, -5, -6 and -7) Up penalties by attached Table #1 for -4, -5 and -7, change -6 to simple \$/sy AND to \$ shown in Table #1 also.
7. (Section 321.10, first paragraph). Specify "patching material" and acceptable time frame the patch occurred.
8. Replace any and all "EA" with only "removal". In the majority of cases an "engineering analysis" is not needed and can be used as just referee by the contractor. **(NOT ADDRESSED)**
9. (Section 321.11, first paragraph)

Issues (to the discussion would be):

1. Who will keep track of the "sub-lots" and/or "lots" **(NOT ADDRESSED)**
The pavers and rollers should not start and stop as the mat is being put down. Once begun, the paving process should be continuous. **?**
3. Delivery Temperatures 6"below surface **?**
4. Any use of a "Referee" shall be at the contractor's expense.