NCAT Test Track Construction Visit

SPR 2199
Validation of Superpave Mix Design and Analysis Procedures Using the NCAT Test Track

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Executive Summary:

The Indiana Department of Transportation (INDOT) is participating in a pooled fund study along with eight other State Highway Departments and the Federal Highway Administration (FHWA) entitled "*Accelerated Loading Pavement Study*," currently being conducted by the National Center for Asphalt Technology (NCAT) in Opelika Alabama. The objective of this project is to design and build a 1.7 mile oval test track consisting of 26 HMA test sections in the tangents with supplemental test sections in the curves and apply 10,000,000 ESALs to it in two years. The INDOT is participating in the NCAT Test Track project through the sponsorship of two test sections. These two test sections compliment eight others that will be developed using the same materials (limestone/slag mixtures) and sponsored by the Alabama Department of Transportation (ALDOT) and FHWA. Experimental factors being considered include gradation type, asphalt binder type, and asphalt content. Two standard gradations, one each fine and coarse graded relative to the Superpave restricted zone, will be used along with three binders and two target asphalt contents.

In addition to sponsorship of two test sections, INDOT is supporting a cooperative research effort with Purdue University through the Joint Transportation Research Program (JTRP) entitled, "*Validation of Superpave Mix Design and Analysis Procedures Using the NCAT Test Track*." The primary objective of the research is to develop relationships between laboratory wheel track, prototype scale accelerated pavement test, and in-service rutting performance. As part of this effort all of the limestone/slag mixtures placed at the test track will be tested in the INDOT prototype scale Accelerated Pavement Test (APT) Facility as well as several other laboratory rutting tests.

The test track construction has been completed up through the HMA binder course and placement of the surface course mixtures was recently initiated. A group from Indiana visited the NCAT Test Track facility the week of May 15th to observe the surface course construction operations. Materials handling, hot plant, paving, and quality control/quality assurance (QC/QA) operations were all rigorously inspected over a two day period. Both NCAT and APAC/Couch personnel were very hospitable and cooperative which facilitated a successful visit. An excellent working relationship exists between the NCAT test track and APAC/Couch teams. They clearly demonstrated a sincere partnership, working together to build a quality facility essentially under ALDOT specifications. State-of-the-art hot mix plant, paving, and QC/QA laboratory tools were all in place and effectively used. Overall the group was very pleased with the conscious efforts of the track and construction management teams to construct a high quality test track. The group did express concern over a few minor items to them. The concerns were accompanied with recommended changes that were appreciated and sincere efforts were made to address them.

The groups construction visit was very beneficial for multiple reasons. In addition to developing a clear understanding and thorough documentation of the construction operations being used to construct the track, a sense of the positive attitude and sincere effort of the construction team was observed. This provided the group with confidence that a quality job is being conducted. Significant information was also gained that will be used to facilitate the construction of the APT test sections in the INDOT APT facility as well as the laboratory performance test program.

The test track construction is rapidly progressing and is slated for completion in September, after which trafficking will be initiated. The trafficking is tentatively scheduled to begin September 18th and a dedication ceremony is scheduled for October 23, 2000.

Additional information on the NCAT test track project can be found at the project web site located at the following url: www.pavetrack.com.

Introduction:

The Indiana Department of Transportation (INDOT) is participating in a pooled fund study entitled "*Accelerated Loading Pavement Study*," currently being conducted by the National Center for Asphalt Technology (NCAT) in Opelika Alabama. The objective of this project is to design and build a 1.7 mile oval test track consisting of 26 HMA test sections in the tangents with additional supplemental test sections in the curves and apply 10,000,000 ESALs to it in two years. Performance of the sections will be periodically evaluated during the two year loading period and the results will be provided to participants. Improved methods of predicting rutting performance will be evaluated so that HMA mixtures incorporating various materials may be optimized. The test track construction has been completed up through the HMA binder course and placement of the surface course mixtures was recently initiated. An aerial view of the test track is presented in Figure 1.

Figure 1. Aerial View of NCAT Test Track Facility.

A total of nine State Departments of Transportation, including INDOT, are supporting the research effort along with the Federal Highway Administration (FHWA). The Alabama Department of Transportation (ALDOT) is the primary sponsor ($7.5 million) and pooled fund study host agency. The INDOT is participating in the NCAT Test Track project through the sponsorship of two test sections. These two test sections compliment eight others that will be developed using the same materials and sponsored by the ALDOT and FHWA. Table 1 is a summary of the experimental design associated with the ten test sections. Experimental factors include gradation type, asphalt binder type, and asphalt content. Two standard gradations, one each fine and coarse graded relative to the Superpave restricted zone, will be used along with three binders and two target asphalt contents. All of the surface course mixtures that will placed in the test sections will be composed of limestone and blast furnace slag supplied by Vulcan Materials Company. The neat PG67-22 as well as the SBS modified PG76-22 binder will be supplied by Ergon Asphalt while the SBR modified PG76-22 binder will be supplied by Eagle Asphalt. Target asphalt contents include the Superpave design or optimum and the optimum plus 0.5 percent.

Table 1. NCAT Test Track Limestone/Slag Mixtures.

Binder Type	Target AC	Gradation Type	
		Fine	Coarse
PG67-22 (Neat)	Optimum	INDOT	ALDOT
	Optimum +0.5%	INDOT	ALDOT
PG76-22 (SBS)	Optimum	X	ALDOT
	Optimum +0.5%	X	ALDOT
PG76-22 (SBR)	Optimum	N/A	FHWA
	Optimum +0.5%	N/A	FHWA

In addition to sponsorship of two test sections, INDOT is supporting a cooperative research effort with Purdue University through the Joint Transportation Research Program (JTRP) that revolves around the experimental design presented in Table 1. The project is entitled, "*Validation of Superpave Mix Design and Analysis Procedures Using the NCAT Test Track*." The primary objective of the research is to develop relationships between laboratory wheel track, prototype scale accelerated pavement test, and in-service rutting performance. As part of this effort a plan has been developed which includes the testing of the limestone/slag mixtures placed at the test track in the INDOT prototype scale Accelerated Pavement Test (APT) Facility as well as several other laboratory rutting tests. Conventional HMA construction techniques are used to build test sections in the APT facility depicted in Figure 2.

Figure 2. INDOT Accelerated Pavement Test Facility.

Purpose of Test Track Visit:

The JTRP SPR 2199 Study Advisory Committee (SAC) met on May 4th. It was decided that it would be beneficial for a group of SAC members to visit the track facility while the INDOT, as well as other, limestone/slag surface course mixtures were being placed to inspect construction operations. Of specific interest were materials handling, hot mix plant, paving, and quality control/quality assurance (QC/QA) operations. Additionally, there was a strong desire to meet directly with the paving contractor (APAC/Couch) project manager, the NCAT track manager, and other key NCAT personnel while construction was underway.

Due to the dynamic paving schedule it was decided that the group would drive rather than fly to ensure flexibility in a travel schedule and conserve project funds. The NCAT track manager kept the group well informed of the paving schedule and ultimately indicated the optimum dates for a visit would be May 17th through the 19th. Thus Adam Hand, Lee Gallivan, and Gerry Huber, study advisory committee members and Bill Pine of Heritage Research Group drove to Alabama on May 16th and returned on the morning of the 19th. The visit was very successful, particularly due to the cooperation and hospitality of the NCAT and APAC/Couch team. An excellent working relationship exists between the NCAT track manager (Buzz Powell) and the APAC/Couch project manager (Chris Jones). They clearly demonstrate a sincere partnership, working together to build a quality facility essentially under ALDOT specifications.

On-Site Visit:

The group observed the construction operations associated with both the fine and coarse graded limestone/slag mixtures over a two day period. Buzz Powell led the group on a general tour of the on-site laboratories (Figure 3), the test track, and hot mix plant the first morning. This included introductions to key NCAT and APAC/Couch personnel. He then provided a review of construction activities to date along with the tentative surface course paving schedule (Figure 4).

Figure 3. On-site laboratory and truck maintenance facilities.

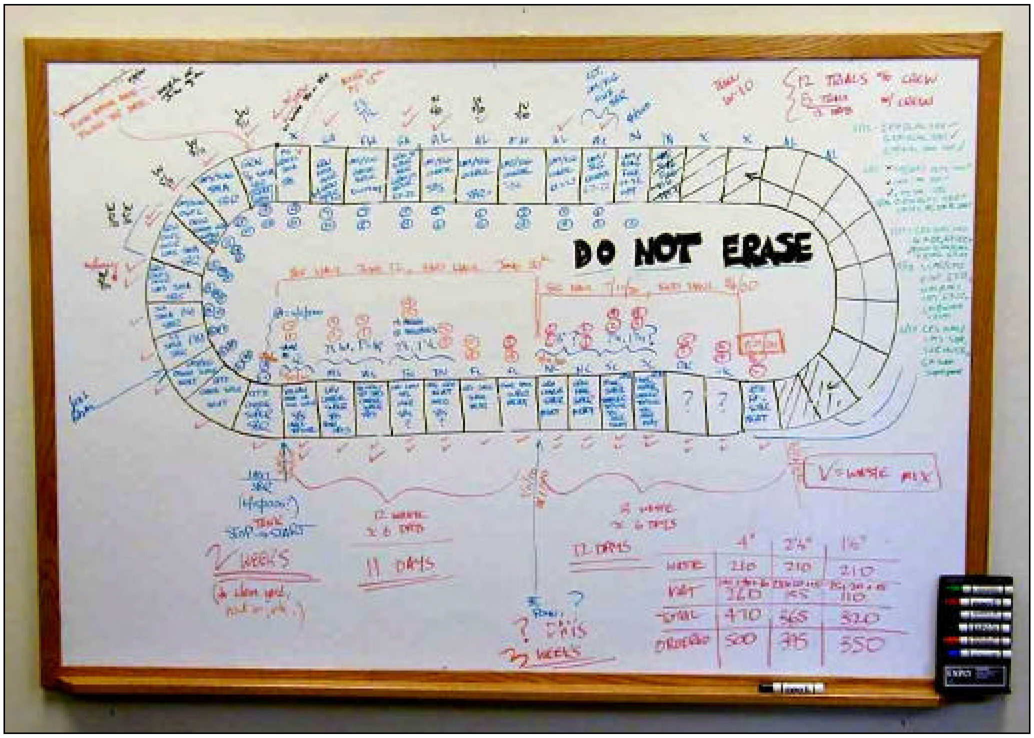

Figure 4. Surface Course Paving Schedule.

He indicated that surface course paving was scheduled for completion August 25th, after which the striping and signage would be conducted over a three week period. The initiation of loading is currently scheduled for September 18th.

At that point the group was encouraged to observe all aspects of construction and recommend any changes they felt were appropriate. Both NCAT and APAC/Couch personnel were very open providing any and all detailed information requested by the group. The group reviewed fine and coarse job mix formulas and trial mixture quality control data obtained up to that day. Bill Pine performed an analysis of the JMFs using the Bailey Method with necessary assumptions. He indicated that both the fine and coarse mixture gradation parameters were within the criteria he is currently suggesting for design purposes. The Bailey Method is a proposed new method used to evaluate aggregate particle packing/structure.

The group then proceeded to observe each component of the construction operations associated with both fine and coarse mixtures placed in the two day period. Observations made while inspecting materials handling, plant, paving, and quality control/quality assurance (QC/QA) operations are summarized in the subsequent sections.

Materials:
Three asphalt binders are being used in the limestone/slag mixtures. They are a neat PG67-22, a SBS modified PG76-22, and a SBR modified PG76-22. The asphalt binders are being accepted on certification and samples are taken each day of production for post-construction testing. There are two horizontal asphalt binder storage tanks at the plant as show in Figure 5. One tank is partitioned in half to provide for a total of three binders to be stored at any time. One half of the

Figure 5. Asphalt Binder Storage Tanks.

asphalt binder storage tank that is partitioned incorporates a circulation system. The neat PG67-22 and the SBS modified PG76-22 are being stored in uncirculated horizontal tanks. Both of these materials are being supplied by Ergon Asphalt. The SBR modified PG76-22 is being stored in the tank with circulation. It is being supplied by Eagle Asphalt.

Vulcan Materials Company is supplying both the limestone and blast furnace slag materials being used. Each of the 12.5mm nominal maximum size mixtures is composed of three aggregates. A break down of the material types, stockpile identifications and bin percentages is presented in Table 2. Both the fine and coarse mixtures incorporate #78 and #8910 blast furnace slag. The fine and coarse mixtures also incorporate #892 and #820 limestones, respectively. A global picture of the stockpiles is presented in Figure 6 and close ups of each material are presented in Figures 7 through 10.

Table 2. Mixture Type, Stockpile, and Bin Percentages.

Mixture Type*	Number of Test Sections	Material Type			
		Blast Furnace Slag Stockpiles and Percentages		Limestone Stockpiles and Percentages	
		#78	#8910	#820	#892
Fine	4	31.0	34.0	0.0	35.0
Coarse	6	47.5	17.5	35.0	0.0

*Indications gradation type relative to the Superpave restricted zone. Fine mixture gradations plots above and coarse gradation mixtures plot below the restricted zone on a 0.45 power chart.

Figure 6. Blast Furnace Slag Stockpiles.

Figure 7. Blast Furnace Slag #78.

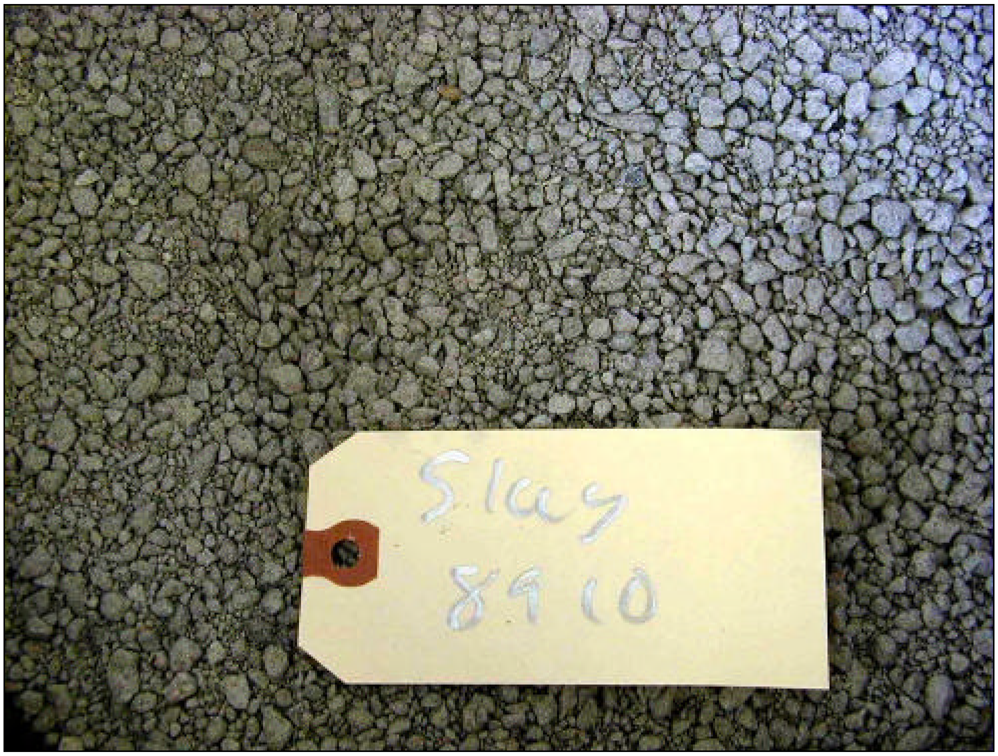

Figure 8. Blast Furnace Slag #8910.

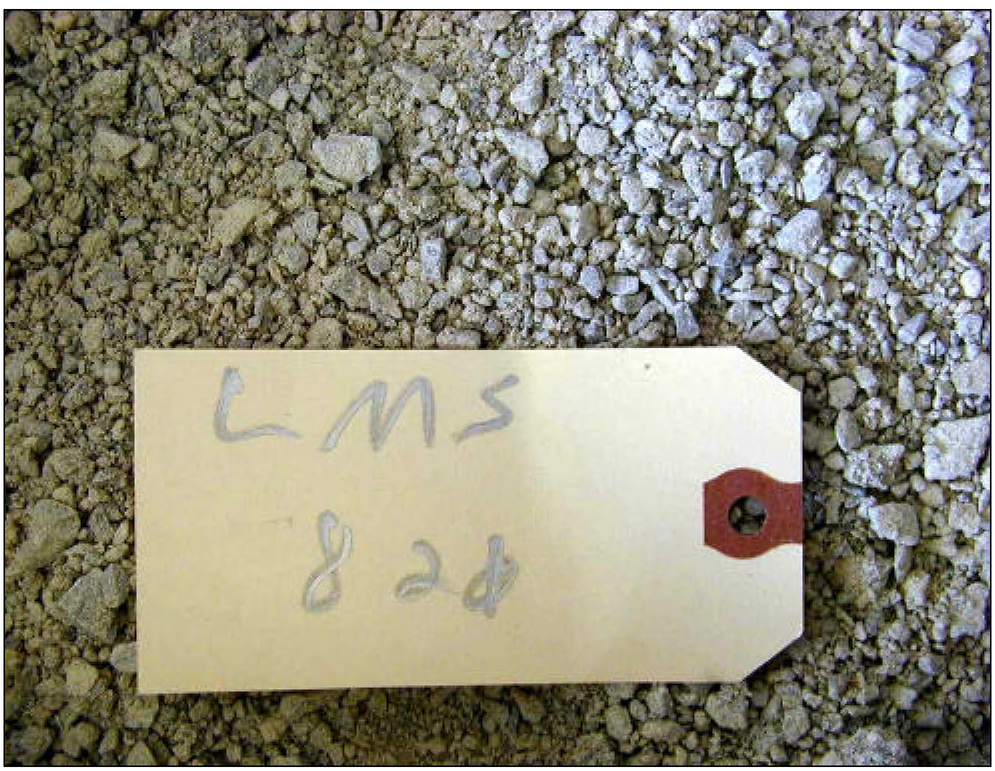

Figure 9. Limestone #820.

Figure 10. Limestone #892.

As can be seen in Figure 6, stockpiles are being managed to reduce contamination as much as possible. The slag stockpiles are all in a large yard area while the limestone stockpiles are being stored in individual bins with paved floors which can be seen in the upper right portion of the figure. Aggregate contamination was noted between a couple of adjoining stockpiles, but none being used in the Indiana sponsored test sections. The loader operator blends the face of each individual stockpile at the beginning of each day prior to feeding coldfeed bins. Stockpile moisture content determinations are also being performed each morning to facilitate accurate plant control settings.

Hot Plant:
A brand new Astec plant has been set up on site for track construction as depicted in Figure 11. Experience was gained with the plant while building the lower layers of the pavement structural section. The plant is a double barrel drum plant with the following features:

1. two horizontal asphalt binder storage tanks (one of which is partitioned);
2. five coldfeed bins;
3. a RAP induction system;
4. a fiber induction system (for SMA mixtures);
5. a baghouse;
6. two silos (one each being used for mineral filler and hydrated lime);
7. a 75 ton surge bin (no mixture silos); and
8. a control building.

Figure 11. Double Barrel Drum Plant.

This is a counterflow plant and asphalt binder/aggregate mixing is achieved in the outer drum where both the asphalt binder and baghouse fines are introduced, eliminating direct contact with burner flames. The plant is being used to produce approximately 95 tons of mixture without stopping per test section lift at a rate of approximately 200 hundred tons per hour. The plant operator indicated that this rate was selected to optimize uniformity in mixture production. Approximately the first 20 and last 15 tons produced are wasted to ensure a uniform product is used for test section paving. A 75 ton surge bin is used to store material until approximately 20 tons have been produced, at which time this first 20 tons is loaded into a truck and wasted. The remainder of the mixture produced is stored in the surge bin until the plant is shut down. This technique not only eliminates the need for storage silos, but also preheats the surge bin.

The plant is operated to produce mixtures with neat and modified binders (SBS and SBR) at 320 and 360°F, respectively. The plant operator indicated that although stockpile moisture levels typically averaged 5 percent, the moisture level of mixture sampled from trucks immediately after loading had not exceeded the maximum ALDOT specification limit of 0.2 percent. However, the NCAT track manager indicated that mixtures produced with large percentages of #78 slag (eg. SMA and coarse limestone/slag mixtures) had approached the limit on occasion. All of the baghouse fines generated during production are being reintroduced into the individual mixtures via a vane feeder system.

The plant also incorporates a mechanical coldfeed sampling device which facilitates sampling without stopping the plant. The device is called a Clean Sweep® Belt Sweeper and is shown in Figure 12. The sampler works by sweeping a cross section off the belt while the belt is in motion.

Figure 12. Mechanical Coldfeed Sampling Device.

It takes only 1/20 of a second for the scoop to traverse the belt. The sample is dropped down a tube (on the left side of the sampler as shown in Figure 12) into a sample container placed on the ground. Experience with the sampler has shown it to work well unless fine aggregate is not feeding uniformly at the coldfeed (plopping off the end of the belt). Clearance between the sweeping scoop and the belt is small. There is no experience with wet aggregates with fines that tend to build up on the belt.

Charging of the coldfeed bins was sufficient to ensure a constant feed of material. Very nominal cross bin contamination of aggregates was noted as bin dividers were not employed. The track manager indicated that there had been some problems with gradation variation with very coarse mixtures which were utilizing small amounts of sand. This was attributed to the sand not falling onto the collector belt uniformly and thus affecting the sample taken with the belt sweeper device. The gradation variation was not observed in the mixture sampled from the trucks however. A suggestion was made to lower the coldfeed bin opening and increase the belt speed, as well as hanging chains near the opening to break the flow of the material.

Paving:
Two ten-wheel trucks are used to transport material from the plant to the track. A proprietary release agent called “SPX-7” which is marketed by Synthetics Incorporated is used on the truck beds as shown in Figure 13. This release agent is on the ALDOT acceptable products list. NCAT staff indicated that the release agent was also satisfactorily evaluated by NCAT although significant amounts of the release agent are being used.

Figure 13. Truck Beds Being Spraying with SPX-7 Release Agent.

Each truck is loaded using multiple separate drops from the surge bin in an effort to minimize segregation. No visible segregation was observed in the trucks for either the fine or coarse graded mixtures. Prior to leaving the plant, mixture is sampled for QC/QA purposes using a Remote Truck Sampling Device (RTSD) marketed by Pavement Technology Incorporated (PTI) as shown in Figures 14 and 15. Note the multiple piles in the truck as well as the uniformity of the mixture in Figure 15.

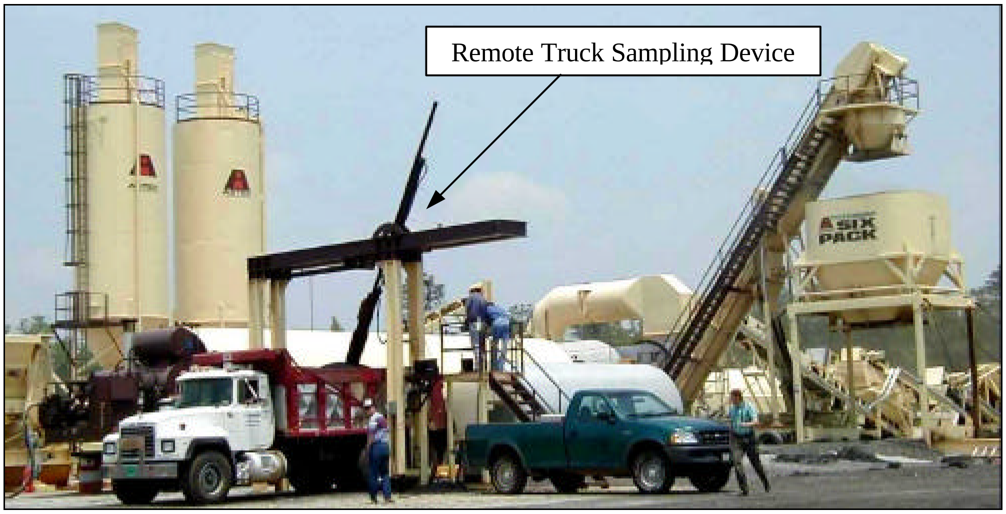

Figure 14. Remote Truck Sampling Device (RTSD).

Figure 15. Sampling with the RTSD.

The RTSD is essentially a hollow tube sampler with a clamshell at the end that is introduced into the mixture. The clamshell is closed and introduced into the mixture in the truck to a depth of about 12 inches. It is then opened and inserted approximately another 24 inches after which the clamshell is closed. The sampler is then retracted and unloaded into a 5-gallon bucket. This process is repeated twice to obtain a bucket of mixture (50 to 70lbs). Two 5-gallon buckets of mixture are sampled for QC/QA purposes and immediately transported to the on-site laboratory for analysis. The RTSD is a new device and problems have been experienced with heating coil failures and the clamshell derailing from its track. However, both NCAT and APAC/Couch personnel indicated that they are very happy with the quality of the samples being obtained with the device. The RTSD is a new device so it is not an AASHTO approved technique for mixture sampling.

Sample variability when sampling from trucks proved to be greater than originally anticipated. When using good truck sampling techniques (multiple locations, cutting benches into the mixture, square point shovels, etc.) test values were variable. The variability was originally thought to be in the hot mix process, however it was determined to be in the samples. The RTSD sampler reduced the variability.

In preparation for paving a transverse joint is prepared at the beginning of the test section and an emulsion tack coat is applied. Both are depicted in Figure 16. The transverse joint is formed by paving beyond the end of the previous test section to improve uniformity and facilitate rolling, then a vertical joint is cut with a saw and the excess material is removed. Note the streaks in the tack coat in Figure 16. Concern over this was brought to the attention of the NCAT track and APAC/Couch construction managers who indicated they would strive to achieve a more uniform coat.

Figure 16. Transverse Joint and Tack Coat Preparation.

The haul to the laydown operation takes only about five minutes. The required three truck loads of mixture per test section lift are dumped into a Roadtec SB2500 Material Transfer Vehicle which is used to feed a Blaw Knox PF3200 Paver as shown in Figure 17. Each 2 inch thick test section was placed in a single continuous operation in the direction that traffic will be applied. No systematic or random segregation was observed in the mat upon laydown. However light centerline segregation was observed as shown in Figure 18.

Each test lane is 12 feet in width and is accompanied by a 4 foot wide shoulder. The cross slope in the test lane and shoulder are 2 and 4 percent, respectively. The test lane and shoulder are placed in a single paving operation. Hydraulic screed extensions are used to accommodate the 16 foot wide paving width. The screed is extended further on the shoulder side of the paver as shown in Figure 19. The paver was not being run with the vibrators on. Neither auger or screed extensions were employed. The mat appearance was generally good although the light centerline segregation was observed. The streak occurred at the auger drive box location even though the paver was equipped with reverse auger sections at each side of the auger drive box. The light centerline segregation was located approximately 8 to 9 feet from the edge of the shoulder which will likely be in the wheel path under traffic loading. This was brought to the attention of both the NCAT track and APAC/Couch construction managers who indicated they would strive to correct it.

Figure 17. Loading, Material Transfer, and Laydown Operations.

Figure 18. Light Centerline Segregation in Coarse Limestone/Slag Mixture.

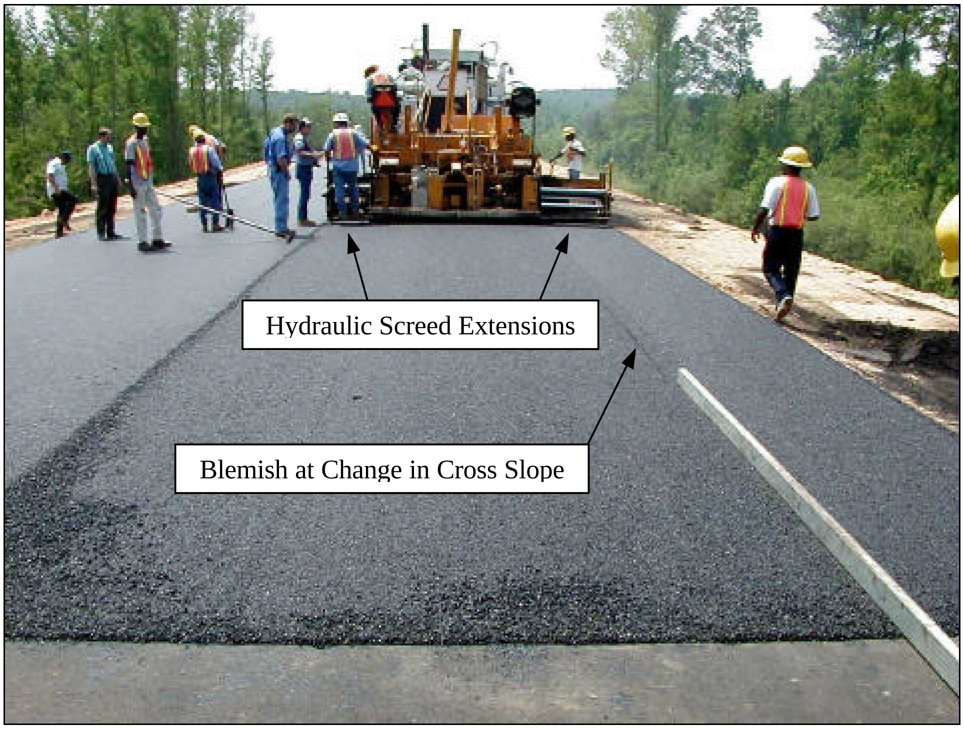

Figure 19. Rear View of Paver Showing Hydraulic Screed Extensions.

Recent research has indicated that non-uniform temperature can lead to what has been termed temperature segregation. What has been found is that lower density is observed in areas of a mat where mixture is cooler than it is at other areas. A classic example of this occurs at the ends of loads where mixture temperature typically drops. Differences in gradation are not typically observed between these areas, but rather just low density that appears to be segregation from visual inspection of a mat. The use of material transfer vehicles has been shown to significantly reduce this temperature segregation. Infrared cameras are used to precisely measure mat temperatures and identify areas of low temperature. These types of measurements are being conducted at the test track also. Figure 20 is an example of an image measured while the group was present. It is important to note that Figures 19 and 20 do not correspond with one another. Figure 19 was taken at the beginning of the test section facing forward and Figure 20 was taken at the end of the test section facing back. The paver is gone and a joint has been made (line in lower right corner of image). The mixture has cooled slightly from the laydown temperature. Many features of the paving operation are detectable from the figure including the locations of the screed extensions and the centerline streak. They are easily detected by the observed temperature differentials.

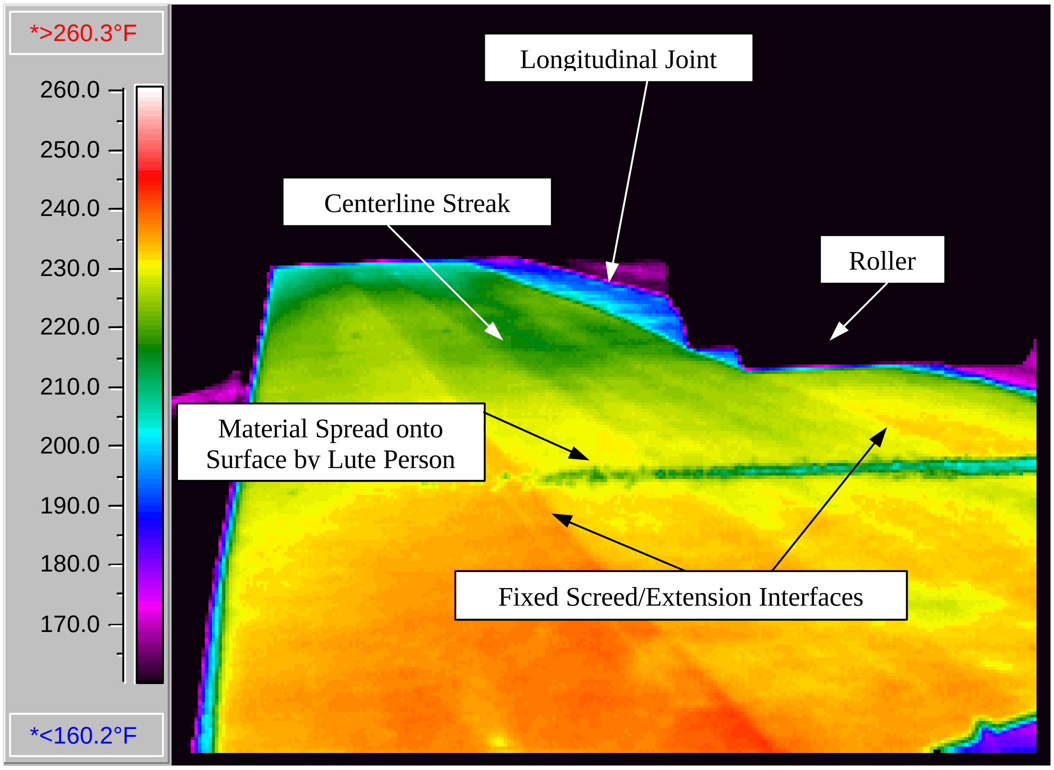

Figure 20. Infrared Mat Temperature Image.

Although the contractor had multiple rollers available on site, only a Hypac C778B vibratory double drum compactor was used to achieve density. It was an 11.8 ton roller with a 78 inch drum width. It was run in a combination of vibratory and static modes for breakdown and the static mode for finish rolling. Both density and temperature were monitored after each pass of the roller. Raytech infrared thermometers and Troxler nuclear density gauges were used. Both Troxler Models 4640 (thin lift) and 3440 gauges were employed. The roller and nuclear density gauges are shown in Figure 21. Each lift placed was 2 inches thick (4 times the nominal maximum aggregate size) and the in-place air void target of 6 ±1.2 percent was achieved according to the nuclear gauges prior to core verification. Longitudinal joints were rolled from the hot side overlapping onto the previously placed mat approximately 12 inches.

Breakdown and finish rolling were performed at approximately 280 and 160°F when the neat asphalt was used. It should be noted that the rolling was performed slowly, at a rate of approximately 170ft/min (≈2mph). Low amplitude and high frequency were used to compact the fine graded mixture while high amplitude and high frequency were used to compact the coarse graded mixture. Bill Pine questioned whether using high amplitude and frequency on the coarse graded limestone/slag mixtures would lead to breakdown of the coarse slag. No visible breakdown was noticeable from inspection of the mat and Buzz Powell further indicated that no visible breakdown was occurring in the Superpave gyratory compactor either. This observation was later verified by the group.

Figure 21. Hypac C778B Vibratory Double Drum Compactor and Density Monitoring.

Both the finished fine and coarse graded mixture mats were aesthetically pleasing. A visible difference in fine and coarse mixture mat surface textures was observed as expected. A picture of each finished mat is presented in Figure 22 and 23, respectively.

Figure 22. Fine Graded Mixture Finished Texture.

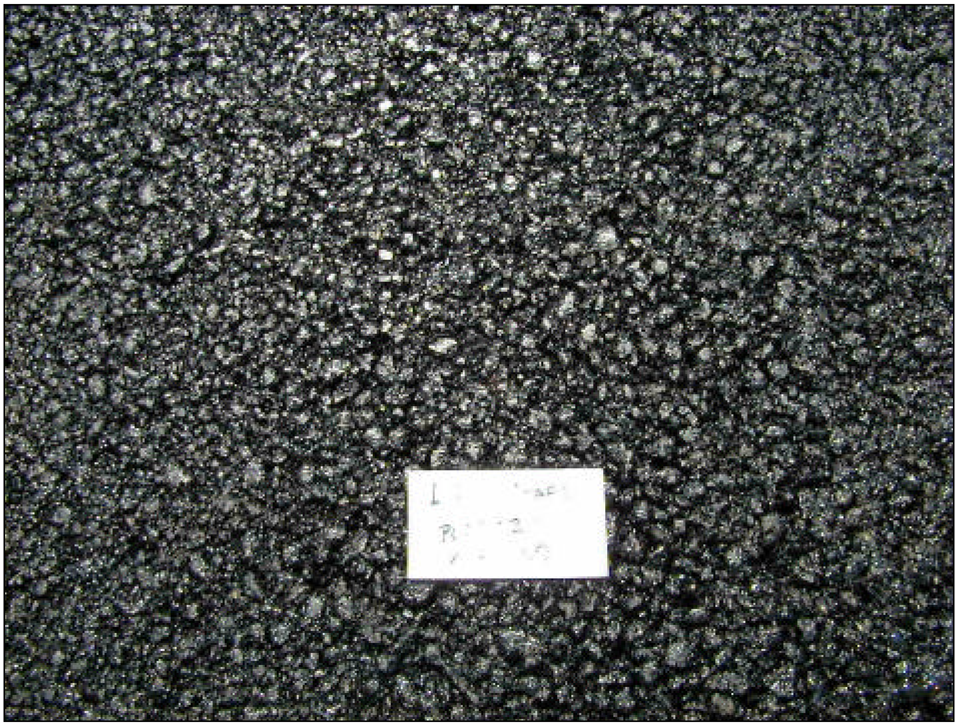

Figure 23. Coarse Graded Mixture Finished Texture.

Quality Control:

The group observed a conscious effort on the part of both the NCAT test track and APAC/Couch personnel to control the quality of the product being produced. Several aspects of the quality control operations have been discussed throughout this report, and they will be subsequently summarized. The contractor had two NICET (National Institute for Certification in Engineering Technologies) certified technicians on the project, one working in the laboratory and one at the laydown operations. NCAT had two experienced technicians in the same locations. Additionally, there were three to six other NCAT technicians working in the laboratory. Most were graduate research assistants preparing performance test samples rather than performing process control testing. The laboratory facilities, as well as most of the equipment in them were new and in excellent operating condition.

Table 3 is a summary of the quality control testing that is being conducted. Each test section represents a lot and each lift per lane represents a sublot. The two buckets of mixture being sampled from the truck using the RTSD are combined and split to produce samples for asphalt content, ignition and solvent gradation, and laboratory (SGC) volumetric determinations. A Gilson “Quartermaster,” sprayed with the same SPX-7 release agent used on the truck beds, is being used for splitting. The Quartermaster splitter and small receiver buckets are shown in Figure 24. An insert from the Quartermater along with the receiver buckets are placed in an oven and preheated prior to splitting to reduce adhesion as much as possible. The total time used to split out all of the process control samples was less than two minutes. The coldfeed gradation samples are being obtained with the Clean Sweep® Belt Sweeper device. Four inch diameter cores are being extracted from the mat for in-place density determinations from the bottom and top lift of trial lanes and only the bottom lift of the test lanes. The thin lift nuclear density gauge is being used on the mat also. After bulk density measurements are performed on the cores they are stored for future non-destructive analysis.

Table 3. Summary of quality control testing.

Property	Test Method	Lots/Test Section	Sublots/Lot	Tests/Sublot	Sampling Location
Moisture Content		1	4	1	Truck with RTSD
%AC (Nuclear)	D4125	1	4	2	
%AC (Ignition)	TP53	1	4	1	
%AC (Solvent)	T164	1	4	1	
Coldfeed Gradation	T11, T27	1	4	1	Belt Sweep
Extracted Gradation	T30	1	4	2	Truck with RTSD
Volumetrics	TP4	1	4	1 (3 SGC)	
In-Place Density	D2726	1	4	3	Cores
In-Place Density	D2950	1	4	3	Mat
Temperature		1	4	3	Mat

Figure 24. Splitting with the Gilson Quartermaster.

Asphalt content determinations are being performed using three methods; nuclear, ignition, and solvent extraction. The nuclear asphalt content measurements are actually being used along with asphalt storage tank measurements at the plant for process control. Coldfeed gradations are being performed for informational purposes only. Two Rainhart Company "Mary Ann" sieve shakers with 12 inch diameter sieves are used for sieve analyses. Volumetrics properties are being measured on specimens prepared with the Troxler Model 4140 SGC shown in Figure 25. There are three SGCs in the on-site laboratory, but a Troxler Model 4140 was employed to perform the mixture designs so the same model is being used for process control compaction.

Figure 25. Superpave Gyratory Compactors.

The initial splitting of mixture for SGC samples, in the Quartermaster, reduces each sample to approximately 6000 to 7000 grams. The samples are placed in pans in an oven immediately after splitting to bring them to compaction temperature. Once the mixture reaches compaction temperature it is poured from the pan into a heated mold that is resting on a tared balance in a single pour through a funnel (eg. concrete slump cone). Because approximately 4800 grams of mixture is required excess mixture is removed with a spoon to achieve the desired mass. Neither the initial splitting technique nor the technique used to charge the SGC molds employed by the contractor and NCAT technicians are in accordance with AASHTO procedures. The samples are then compacted to the design number of gyrations (N_d = 100). Three specimens are compacted per sublot and their properties are averaged to represent a single test value. After compaction and cooling bulk specific gravity measurements are made. Bulk specific gravity water tanks are equipped with temperature control/circulation devices. Theoretical maximum specific gravity measurements are performed in accordance with AASHTO T209 using the supplemental or "Dryback" method. Observed air voids and voids in mineral aggregate values are then compared with the mixture design data. When necessary, field asphalt contents are being adjusted to ensure SGC air voids of 3 to 5 percent are achieved. The asphalt cement and combined aggregate bulk specific gravity values obtained in the mixture design process are being used in process control calculations.

In-place density is being measured using a thin lift nuclear gauge as well as on cores. Three tests are being performed using each method after compaction is completed. The testing locations are randomly selected in accordance with AASHTO guidelines. The cores are then ultimately used to make corrections to nuclear density determinations. As previously noted, temperature and density are actually monitored with each pass of the roller during the compaction process. This information will be used to establish roller patterns for the APT test sections.

Performance Test Samples:

An extensive performance test program is also associated with the project that will be conducted by NCAT. The plan includes a total of thirteen tests, eight of which are rutting related. The materials and specimens that will be evaluated using multiple test methods are sampled and prepared concurrently with process control testing. A draft performance test plan that is currently being followed is summarized in Table 4. The plan applies to all of the test sections placed on the test track. The large quantities of bulk samples will serve multiple purposes including support of the Superpave models project.

Table 4. Draft Proposed Performance Test Plan.

Research Test	Specimen Geometry						Bulk Samples	
	Beams	Beams	Cylinder	Cylinder	Cylinder	300 Gyro	Metal Buckets (lbs)	Paper Boxes (lbs)
	Target Specimen Air Voids							
	4%	7%	3%	4%	7%			
TSR					6			
COE Shear						3		
MTS Creep				12				
MTS Fatigue								100
Hamburg LWT				3	3			
British LWT				3	3			
APA LWT	3	3		3	3			
APA Fatigue	3	3						
Rutmeter LWT				3	3			
IDT					10			
SST			3	3	3			
Pine Shear						3		
Workability		3						
Extra	1	1	0	1	1	0	420	300
Totals	7	10	3	28	32	6	420	400

All of the performance test specimens are being made from loose field mixture that is diverted from the material transfer vehicle directly into the bucket of a loader while paving the top lift of each test section. The loader is then driven to the on-site laboratory where adequate materials for all the performance test and bulk storage samples are taken as shown in Figure 26. Some of the mixture is placed directly into ovens after sampling and approximately seventy performance test specimens are compacted without having to reheat any material. The compacted specimens are then stored in an on-site temperature controlled storage building for post-construction testing which will be conducted at the NCAT research facilities. The performance testing will not be initiated until track construction is completed.

Figure 26. Sampling for Performance Test Specimen and Bulk Storage Purposes.

NCAT Research Facilities:
Mary Stroup-Gardiner hosted a tour of the NCAT research facilities on the campus of Auburn University. The laboratory facilities that will be used on campus for performance testing associated with the test track were toured. The facilities are state-of-the-art and staffed with both full-time management as well as graduate research assistant personnel. The NCAT laboratories are currently AASHTO accredited (AMRL) for asphalt cement, hot mix asphalt, and hot mix asphalt aggregate testing. The Superpave mixture designs conducted using the limestone/slag aggregates for the test track were performed in the NCAT laboratories by Mike Huner. Mike is a full-time research engineer with extensive Superpave mixture design experience.

The group also met with Ken Kandhal and Allen Cooley of NCAT. They indicated that a new 40,000 square foot NCAT research facility is currently under construction. The facility is targeted for completion by late summer.

Schedule and Future Events:

The current construction schedule (as of 5/18/00) suggests that paving will be completed on August 25th. Signage and striping will then be conducted after which trafficking is scheduled for initiation on September 18th. At this point in time the trucking contract is out for bids, so questions such as the exact number of trucks, truck configurations, autonomous versus manually operated trucks, etc. have not been answered.

A dedication ceremony for the NCAT Test Track as well as the new forty thousand square foot NCAT research facility is scheduled for October 23rd. INDOT Commissioner Klika and Acting Chief Engineer Zandi, as well as Indiana FHWA Division Administrator John Baxter have all indicated a willingness to attend and represent Indiana interests.