

**FINAL REPORT**

**FORENSIC INVESTIGATION OF PAVEMENT DISTRESS:  
OLD AIRPORT ROAD IN BRISTOL, VIRGINIA**

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## ABSTRACT

A few years after Old Airport Road in Bristol, Virginia, was reconstructed, inordinate distortions of remarkable uniformity began to appear in the paved asphalt surface directly above concrete pipe culverts, which were buried beneath and across the road to transport storm runoff. The distortions closely resemble broad speed bumps that extend across all lanes. The growing influence of the distortions on ride quality and subsequent complaints from the traveling public prompted the City of Bristol to request the investigation reported here. A summary of the project's construction background, methods and findings of the investigation, conclusions regarding the cause of distress, and recommendations for remedial action are presented.

The portion of Old Airport Road afflicted by the distress is five lanes wide and extends approximately 0.80 mile in length from its intersection with Bonham Road to I-81 toward the north. Of the 20 pipe culverts that were constructed transversely beneath the road, 14 exhibited some sign of surface distortion at the time of this report. The culverts were placed as part of the Old Airport Road widening and reconstruction project in 1994. This forensic investigation, which included visual and video surveys of pavements and culverts, a geotechnical examination of subgrade conditions, a non-destructive pavement deflection analysis, laboratory and microscopic analyses of culvert trench backfill material, and review of a pertinent geotechnical exploration conducted by others, was designed to determine if the distress was the result of (1) settlement between culverts, or (2) heaving of the trenches themselves.

Results of this work demonstrate that the cause of the observed distortions is attributed to expansive heave of the black pyritic shale that was used to backfill transverse culvert trenches. In addition, significant structural damage to culvert pipes resulting from excessive heave expansion pressures was documented. The laboratory analysis of shale backfill samples indicates that heave, which results from the oxidation of pyrite and the formation of new minerals, is ongoing. Recommendations for remedial action include removing all shale trench backfill in distorted zones, replacing damaged pipes, and properly backfilling with a flowable fill or a suitable, compactable non-shale granular material.

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#### **INTRODUCTION AND BACKGROUND**

The work reported herein was performed to determine the cause of inordinate distress manifest in the paved asphalt surface of Old Airport Road in Bristol, Virginia. Following is a presentation of the project background, methods and results of the investigation, and recommendations for rehabilitation of the distressed infrastructure.

The segment of Old Airport Road in question is located between Bonham Road and I-81 and extends approximately 0.80 mile in length. The five-lane facility was built in 1994 for the city with construction responsibility by the Virginia Department of Transportation (VDOT). The city resumed maintenance responsibility for the facility in 1996. Construction documents indicate that the pavement structure consists of 8 inches of asphalt surface, intermediate, and base materials supported by an 8-inch cement-treated aggregate subbase layer. Bound by curb and gutter on both sides, road surface runoff is captured by a series of curb inlets and catch basins and is transported beneath and along the road through concrete pipe culverts. The culverts, which range in diameter from 15 to 78 inches, traverse the road at 20 different locations.

City of Bristol public works employees first noticed a succession of apparent bumps or distortions in the pavement surface about 5 years ago. The distresses, which resemble “speed bumps,” are best described as a series of uniform protuberances ranging in height from approximately 1 to 4 inches that exist directly on top of most of the transverse culverts. The bumps extend fully from the curb and gutter at one side of the road across all lanes to the opposing curb and gutter. At the locations in question, the pavement surface appears to be elevated over distances of about 10 to 15 feet parallel with the direction of traffic (i.e., bump width). The distortions are fairly rounded in shape, not unlike broad speed bumps. The distresses have become severe enough to create a ride quality nuisance to motorists at the slightest locations and a safety hazard at the worst, which prompted the City of Bristol to post a warning sign at one site. In April 2003, the city conducted a video survey to document the conditions of the interior of culvert pipes. That survey reportedly indicated that several culvert pipes exhibited structural damage. The continued deterioration of the pavement and the consequent decline in ride quality provided the impetus for the city’s request for the investigation reported herein.

It has been suggested that expansive black pyritic shale, known to exist in southwest Virginia and reportedly used here as trench bedding and/or backfill material, may be the cause of

uplift pressures and heave in Old Airport Road. Several documented cases involving the expansion of unweathered Appalachian shales in the presence of water have resulted in damaging heave to overlying structures.<sup>1</sup> In these cases, it was determined that heave was caused by oxidation of pyrite in the black shales underlying structures. Therefore, this investigation was designed in part to determine if expansive pyritic shale was a contributing factor to the distress observed at Old Airport Road.

The preceding information is based on observations made during a visit to the site on May 1, 2003; conversations with Bill Dennison and Jack Hurlbert, P.E., of the City of Bristol Department of Public Works and Steve Mullins, P.E., and Sam Graybeal of VDOT's Bristol District Office; and a review of construction drawings.

## **PURPOSE AND SCOPE**

The purpose of this investigation was to determine the cause of the observed inconsistencies in pavement surface elevations at the distressed locations and to address the cause(s) of culvert pipe damage observed by the City of Bristol's video survey of pipes. Further, this investigation was designed to determine if the observed road surface distortions are the result of (1) pavement settlement between pipe culverts, or (2) actual heaving or uplift of the culverts/trenches themselves. In addition, recommendations for rehabilitation of Old Airport Road were also developed.

## **METHODOLOGY**

The work involved a series of destructive and non-destructive examinations in the field and lab to document and characterize surface and subsurface materials and load-bearing conditions beneath and within the pavements and trenches. Specifically, the investigation included a pavement visual condition survey, a video and visual survey of culvert pipes, a two-part subsurface investigation, non-destructive pavement deflection testing, laboratory analyses of culvert trench backfill material, and review of a pertinent geotechnical exploration report conducted independently by others.

The field investigation was conducted on June 3 and 4, 2003, within secure work zones in the center lane and outer northbound lane. For ease of execution and to minimize traffic disruptions to the extent possible, all of the fieldwork was conducted between Bonham Road and Coronet Drive, which exhibited the most severely distorted surface of the entire length of Old Airport Road.

### **Pavement Visual Condition Surveys**

A detailed visual examination of the pavement surface including the taking of photographs was performed to document location, severity, and extent of distress. The examination revealed bumps across all five lanes at 14 of the 20 transverse culvert sites. All

sites received one of three ratings—non-existent, slight or severe—to define the degree of distortion in the paved surface parallel with and above culverts. That exercise yielded no evidence of distortion above six culverts, whereas seven sites each were judged to exhibit slight and severe distortions. The Appendix includes a tabular summary of these results by culvert location. Figure 1 is a photograph of a severe surface distortion above one culvert.

Close examination of the curb and gutter above some culverts revealed separated and/or vertically displaced joints and cracks. The configuration of these faulted joints and cracks is consistent with localized upward heaving of the pavement. Notice how the upward bow along the top of curb accentuates the distortion in Figure 2.

Aside from the distortions above culverts, the paved surface of Old Airport Road was relatively free of significant distress. However, some locations along the outer lane in both directions exhibited cracking of low to medium severity.



**Figure 1. Pavement Surface Distortion, Old Airport Road Near Coronet Drive.**



**Figure 2. Displaced Curb and Gutter Above Culvert Pipe, Old Airport Road.**

It is worth noting that wheel path rutting was not visible in any lane throughout the length of Old Airport Road. Distortions in the paved surface resulting from subgrade settlement between culvert trenches would likely have been accompanied by other visible load-induced distress such as rutting or other surface deformations. Further, it is unlikely that settlement of the subgrade would yield the degree of uniformity in grade transversely across all lanes such as that observed.

### **Video and Visual Condition Survey of Culvert Pipes**

The city's recently made video, which documented the internal conditions of culverts, was reviewed for evidence of pipe disturbance that may have been caused by heaving soils. In addition, the alignment of representative transverse culverts was visually examined by accessing pipes through the large-diameter trunk line parallel with the east side of Old Airport Road.

Video footage of the interior of culvert pipes, made by the City of Bristol in April 2003, was reviewed to look for evidence of heaving trench backfill or bedding material in the form of structural damage to pipes. The videotape clearly revealed structural damage to all four culverts between Bonham Road and Coronet Drive (three 18-inch- and one 24-inch-diameter reinforced concrete pipes), the tops of which were placed approximately 6 to 9 feet below the pavement surface according to construction drawings. The most prevalent distress observed was circumferential shear cracking near the end of the pipe segments at the edges of the bells. This distress afflicted on the order of 20 percent of the pipe segments comprising those four culverts.

Several sheared pipe segments exhibited some degree of vertical displacement at the pipe joints. A substantial quantity of material noted in the vicinity of some of the damaged joints was indicative of trench backfill infiltration through discontinuities in the pipe. Longitudinal cracking observed along the bottom of some pipe segments was judged to be significant. Figure 3 is a video image of a distressed pipe. Note the circumferential shear cracking at the left of the image and infiltrated backfill in the bottom of the pipe. The pipe's oval shape is indicative of structural failure.

The interiors of the four culverts between Bonham Road and Coronet Drive were also visually examined during the field investigation by walking through the connecting main storm trunk line that exists parallel with Old Airport Road just behind the curb and gutter to the south. This examination did not yield conclusive findings with regard to interior transverse pipe condition because of relatively poor visibility. Likewise, observations about transverse pipe alignment were inconclusive. However, it is worth noting that one junction box, which was connected to an 18-inch pipe underlying a severe pavement surface distortion, permitted access to trench backfill material. More succinctly, a large, irregular hole in the junction box that had been broken out to accommodate the transverse pipe connection exposed some of the backfill material above the pipe. A chunk of material, approximately 3 inches in diameter, was extracted from the top of the pipe through the junction box hole. The sample, which was wet and quite friable, was visually examined and determined to be weathered black shale. A few pieces of light-colored, clean stone pipe bedding material, which did not appear to be shale, were observed just beneath the pipe. No significant distress was noted along the inside of the main trunk line.



**Figure 3. Video Image of Damaged Culvert Pipe Beneath Heaved Pavement.**



## **Subsurface Investigation**

To characterize and assess subsurface material type and support conditions, a two-part investigation including soil penetration testing and the excavation of a test pit to access culvert trench backfill material was performed.

### **Bearing Capacity Evaluation**

To facilitate a visual examination of pavement layer thickness and material integrity, five full-depth cores were removed from representative locations along Old Airport Road. Four of these cores were removed from the center lane between culverts and one was taken from the center lane within a distorted pavement zone directly on top of a culvert to enable access to culvert trench backfill. The last several inches of cores were drilled without the introduction of cooling water to permit a subsequent assessment of natural subgrade moisture conditions. An evaluation of subgrade load-bearing conditions was made with a VDOT rig by drilling through the five core holes to maximum depths of approximately 15 feet. A sixth soil test boring was performed on top of the main storm sewer trunk line just behind the curb on the south side of Old Airport Road to permit an examination of material used to backfill that trench. At all boring locations, soils were sampled continuously and soil penetration resistances were measured and recorded in general accordance with the procedure outlined in ASTM D-1586. At regular intervals of depth, soil samples were obtained with a standard split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final 12 inches was recorded and is designated the “penetration resistance.” The penetration resistance, when properly evaluated, is an index to the soil’s strength and load-bearing capacity. This exercise provided information about the level of compactive effort during construction and augmented the deflection analysis discussed later by providing supplementary information about the propensity of the encountered soils to settle between culverts. A field classification of the encountered soils was made, and soil samples were collected for additional laboratory testing.

Core length measurements indicated a consistent total asphalt layer thickness of approximately 10 inches. Measurements of the unstabilized aggregate base layer through core holes consistently yielded a thickness of about 12 inches.

The borings between culverts encountered fill and residual materials consisting predominantly of clay silt mixtures of somewhat variable consistency. Penetration resistances at most of the locations tested were quite high and generally ranged from 8 to 15 blows per foot, which is indicative of good bearing conditions and does not suggest an inclination toward excessive settlement. Of the four soil test borings located between culverts, one encountered a zone of wet silty clay at depths of 3 to 8 feet below the pavement. Penetration resistances at this location were on the order of two or three blows per foot. The boring located in the center lane on top of a 24-inch culvert encountered large fragments of black shale at all depths sampled beneath the pavement base layer. Interestingly, no shale was recovered from the boring located above the large storm trunk line just behind the curb. Instead, the recovered trench backfill here

consisted of a clay silt mixture similar to the pavement subgrade material recovered between trenches.

### **Evaluation of Trench Backfill Material**

A backhoe was used to excavate a test pit in the center lane within the most severely distorted zone to permit recovery and examination of culvert trench backfill. The test pit was excavated to the top of the culvert at a depth of approximately 9 feet below the pavement surface. All trench backfill material from the bottom of the pavement base layer to the top of the culvert pipe was determined to be black shale consisting of particles ranging in size from coarse sand to boulders, with a significant quantity of the particles being at least 4 inches across. Two boulders removed near the bottom of the test pit were on the order of 18 inches across and were judged to weigh in excess of 100 pounds each. The shale backfill was quite damp, partially weathered, and friable at all depths and was uniformly black in appearance. Upon drying, the material became gray in color. Approximately 150 pounds of the backfill was placed in bags and transported to the Virginia Transportation Research Council's (VTRC) soils lab for further analysis. Figure 4 is a photograph of the partially excavated test pit. Note the tan colored material in the right side of the photograph, which is the clay/silt pavement subgrade beyond the boundary of the culvert trench.



**Figure 4. Test Pit Excavation of Culvert Trench.**

The source of the shale backfill was reported to be a borrow site located on the east side of Old Airport Road at the north end of the project between Stagecoach Road and I-81. One bag sample of relatively unweathered shale was taken from the borrow site and transported to the VTRC soils lab for further analysis. Figure 5 is a photograph of the borrow site.



**Figure 5. Shale Borrow Site.**

### **Nondestructive Deflection Testing**

An evaluation of pavement layer deflection under known loads was conducted with VDOT's falling weight deflectometer (FWD) to generate information about pavement support conditions and to provide an indication of the propensity of subgrade soils to settle between culverts. Deflections were measured longitudinally at 10-foot intervals in the center lane of Old Airport Road. Data captured during the subsurface investigation were used to augment the deflection analysis.

Stronger pavements (good quality materials and thick layers) deflect less under a given wheel load than weaker pavements (thin sections). In response to the need for reliable tools to evaluate pavement structures, deflection devices for use in nondestructive testing have been developed whereby tests can be rapidly conducted at any point along a pavement section. VDOT routinely uses the Dynatest Model 8000 FWD to evaluate pavement structures for thickness design work and as an analysis tool for failure investigations.

The Dynatest FWD, which is trailer mounted and towed behind a van with an on-board processing computer, is probably the most widely used in the United States. The impulse force is created by an operator dropping weights (110, 220, 440, or 660 pounds) from different heights (0.8 to 15 inches). By varying the drop heights and drop weights, a peak force range of 1,500 to 24,000 pounds can be developed. The load is transmitted to the pavement through an 11.8-inch-diameter loading plate and measured using a load cell. In keeping with standard procedures for evaluating flexible pavement structures, pavement basin testing was performed to generate information about the response of subsurface pavement layers to the applied test loads.

The sequence of operation used in this investigation was as follows. The FWD was moved to the beginning of a segment. The loading plate and transducers were then lowered hydraulically to the pavement surface. Then, two tests were conducted at each point by imparting the equivalent of 9,000 pounds followed by 16,000 pounds. The system automatically recorded and stored deflections measured by the nine velocity transducers, which were located at radial distances of 0, 8, 12, 18, 24, 36, 48, 60, and 72 inches from the center of the load plate. In addition to the load and deflection data, pavement surface temperatures were measured automatically with the FWD at each test location. The sequence was then repeated for each segment along Old Airport Road.

Results of the deflection analysis indicated that subgrade support was quite uniform and consistently good. No evidence of inordinately soft or compressible base or subgrade layers was identified in this exercise.

### **Laboratory Analysis of Borrow Site and Trench Backfill Shales**

According to a report<sup>1</sup> on expansive Appalachian shales, heave is caused by the oxidation of pyrite ( $\text{FeS}_2$ ) and the formation of new minerals. The new minerals have a significantly lower density and greater volume than pyrite, and therefore, uplift pressures and potentially damaging heave result. The shale expansion process begins with the oxidation of pyrite when unweathered shale is exposed to oxygen and humidity. As pyrite is oxidized, sulfuric acid is created, which then reacts with available calcium carbonate to form sulfate-rich solutions. The sulfate-rich solutions eventually precipitate out as gypsum, and the resulting volume change can be on the order of 25 to 33 percent. The sulfide sulfur content of unweathered shale can provide a good indication of the material's heave potential. The report goes on to state that Appalachian shales with sulfide sulfur contents in the range of 0.1 to 0.5 percent or greater have caused heave in overlying structures. The laboratory phase of this investigation included a determination of sulfide content of one shale sample and microscopic examinations of weathered and unweathered shale samples to look for evidence of pyrite, oxidized pyrite, and gypsum, the presence of which could provide an indication of heave potential or evidence of expansion.

### **Sulfide Content Determination**

The sulphide content of one material sample from the borrow site tested by personnel in the Chemistry Lab in VDOT's Materials Division yielded a sulfide content of 1.5 percent. Given

that the sulfide content measurement of a single sample is hardly indicative of actual borrow site conditions, caution is taken here not to overstate the significance of this finding.

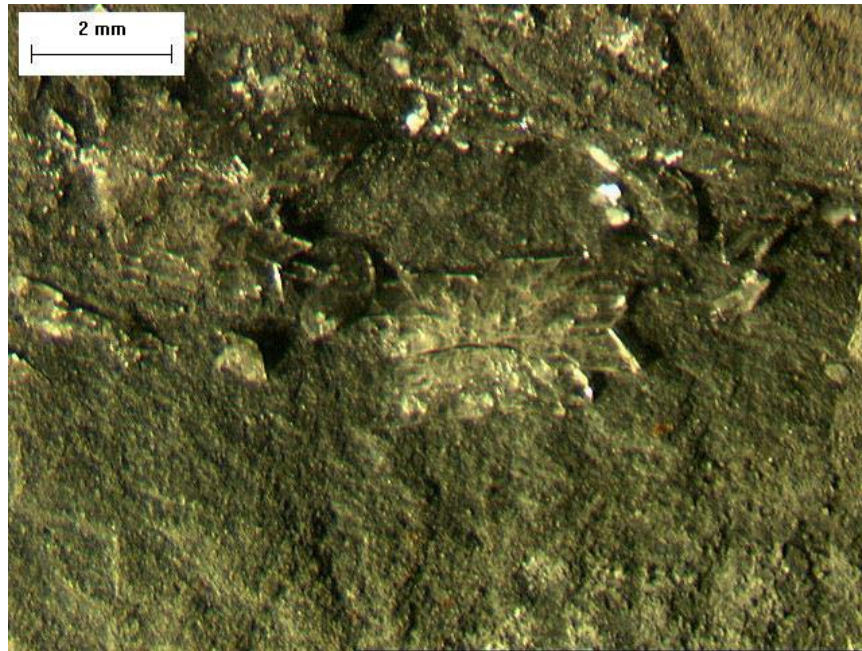
### **Microscopic Examination**

Microscopic examination of the unweathered shale sample taken from the borrow site revealed a significant quantity of pyrite and some oxidized pyrite. Figure 6 is an image of one such sample, which shows some of the finely disseminated pyrite. There are also areas of iron staining where the pyrite has oxidized, one of which is depicted by the horizontal arrow at the bottom of the image.

Figure 7 is an image of a weathered shale sample removed from the culvert trench. It illustrates gypsum crystals that have precipitated on the bedding and cleavage planes of the shale. Gypsum is recognized by its low hardness and optical properties (colorless, index of refraction and low birefringence). The shale has a carbonate component indicated by slight effervescence with dilute HCl.



**Figure 6. Magnified Image of Relatively Unweathered Shale from Borrow Site.**



**Figure 7. Magnified Image of Weathered Shale from Culvert Trench.**

### **Review of Geotechnical Exploration Report by Others**

In September 2003, a geotechnical exploration of the 20-acre site that was the source of the culvert trench backfill reported here was conducted for the City of Bristol by S&ME, Inc., in response to a private proposal to develop the site commercially. According to the S&ME Report of the geotechnical exploration,<sup>2</sup> the primary purpose of that work was to evaluate the expansive heave potential of the shale material underlying the site. The relevant findings of that report are presented here to augment our understanding of the cause of damage to the Old Airport Road pavement and drainage infrastructure.

The S&ME report states that a sulfide sulphur content greater than 0.1 percent combined with a source of carbonate minerals in shale rock has been shown to be a good indicator of shale expansion potential. Sulfur tests conducted as part of the S&ME exploration yielded sulfide contents ranging from 0.26 to 1.26 percent in the 19 samples analyzed. The report goes on to state that:

Based on this geotechnical exploration, there is a high potential for expansion of the shale subgrade associated with the formation of secondary minerals such as gypsum. In the formation of gypsum and other secondary minerals, expansion of the rock surface at a relatively high expansion pressure is highly likely unless steps are taken to mitigate the condition. As has also been shown, portions of the site are underlain by fills whose source is partly the shale bedrock. Our experience has been that shale fills are likewise subject to expansion due to the same oxidation process that occurs in bedrock. Accordingly, the substantial areas of the site that have been filled are also considered prone to expansion risks. In addition, the compaction and support quality of the fills is unknown and of doubtful quality.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this investigation and our review of reports by others, the author concludes that the cause of the observed inordinate distress in the surface of Old Airport Road is the result of expansive heave of the black pyritic shale that was used to backfill culvert trenches. Results of this subsurface investigation and deflection analysis suggest that the pavement subgrade material between transverse culverts was not sufficiently soft or compressible to cause roadbed settlement consistent with the magnitude and uniformity of the observed surface distortions. Likewise, the video survey of culverts revealed considerable structural damage to pipes. The large number of circumferential shear failures and associated vertical displacements at pipe joints directly beneath heaved pavement is indicative of material movement beside and above the pipes. The absence of shale within the trench containing the main trunk line, and the absence of structural distress in that conduit, further brings into question the role of shale used as transverse culvert backfill. The relatively high sulfide contents of the 20 samples tested suggest that the potential for expansion is great. Finally, the microscopic examination of samples removed from the culvert trench test pit and the shale borrow site documented the presence of pyrite, oxidized pyrite, and gypsum, which is conclusive evidence of expansion as well as the potential for expansive heave.

The referenced report<sup>1</sup> on expansive Appalachian shale states that the duration of the heaving process has been observed to continue over a 40-year span and that the resulting uplift pressures can approach 500 kPa where pyrite contents are high. In light of the potential for the long-term continuation of expansive heave in the project investigated herein, the complete reconstruction of heaved trenches is recommended.

Specifically, the 14 culverts identified in the Appendix as being slightly or severely heaved should be rehabilitated by removing all shale trench material and replacing with suitable non-expansive backfill. Sawing full-depth through the asphalt above those culverts to be reconstructed should be required to minimize damage to pavements beyond the zone of excavation. After shale backfill is completely removed and wasted, visibly damaged culvert pipe segments should be removed and replaced with new reinforced concrete pipe. Needed patch repairs to junction boxes, manholes, curb inlets, catch basins, trunk lines, etc., resulting from connections made during original construction and/or reconstruction should be included in this work. Likewise, needed repairs to curb and gutter resulting from reconstruction should be anticipated. Trenches should then be properly backfilled and compacted with a moisture controlled, non-shale granular material in accordance with applicable VDOT construction specifications. As an alternative to using a compacted granular material, consideration should be given to backfilling trenches with a low compressive strength, cementitious flowable fill. Although the initial material cost will be higher, the use of flowable fill should expedite construction by eliminating the need for compaction, thereby reducing the potential for trench settlement. After placement of the backfill, properly compacted asphalt patches should be constructed on top of the trench repairs. This may first require milling or neatly sawing approximately 1 foot beyond the edges of the disturbed area if damage to the adjacent pavement so warrants.

In light of the variability of the sulfide contents and, hence, the expansive heave potential of this shale, the six culverts that do not exhibit evidence of heave are not recommended for reconstruction at this time. Instead, they should be examined visually for evidence of heave propagation on an annual basis and addressed later only if problems evolve. However, given that the expansive action is ongoing, a final visual inspection of all culvert sites is recommended prior to finalizing contract documents to account for changed conditions beyond the time of this writing.

#### REFERENCES

1. Belgeri, J.J., and Siegel, T.T. *Design and Performance of Foundations in Expansive Shale*. S&ME, Inc., Blountville, Tennessee, n.d.
2. S&ME, Inc. *Report of Geotechnical Exploration: Twenty Acre Commercial Site. Bristol Virginia*. Project No. 1401-03-272-A. Blountville, Tenn., September 22, 2003.





## APPENDIX

### SEVERITY OF PAVEMENT HEAVE ABOVE CULVERTS (as of November 2003)

Culvert No.	Pipe Diameter, In.	Station Location	Culvert Location Description	Degree of Surface Heave		
				<i>None</i>	<i>Slight</i>	<i>Severe</i>
1	15	1+25	1 <sup>st</sup> culvert N of Bonham Rd.			<b>X</b>
2	15	3+00	Just S of Riso Road			<b>X</b>
3	24	4+45	Just N of Riso Road			<b>X</b>
4	18	5+70	Just S of Coronet Drive			<b>X</b>
5	15	9+75	In front of 2-story brick/frame house	<b>X</b>		
6	15	13+15	Just S of Utah Street		<b>X</b>	
7	36	14+50	Just N of Utah Street	<b>X</b>		
8	15	17+00	In front of 1-story frame house	<b>X</b>		
9	66	20+70	Just S of Scenic Park Townhouses		<b>X</b>	
10	24	22+05	Just N of Scenic Park Townhouses	<b>X</b>		
11	15	23+10	Just S of New York Street			<b>X</b>
12	15	24+35	Just N of New York Street		<b>X</b>	
13	24	25+50	2 <sup>nd</sup> culvert N of New York Street		<b>X</b>	
14	78	28+60	Discharges into creek at east		<b>X</b>	
15	36	29+20	Discharges into creek at east		<b>X</b>	
16	18	30+30	Discharges into creek at east	<b>X</b>		
17	15	31+90	S of Stagecoach Road	<b>X</b>		
18	15	34+15	Just N of Stagecoach Road		<b>X</b>	
19	24	35+35	S of entrance to Days Inn			<b>X</b>
20	15	37+50	S of entrance ramp to I-81			<b>X</b>

*Note:*

Station 0+00 = Center of intersection of Bonham Road at Old Airport Road, increasing north toward I-81.