Hot Mix Asphalt for County Roads:

Private Providers or Public Plants?

John G. Morgan
Comptroller of the Treasury
Office of Research
State of Tennessee
January 2005

STATE OF TENNESSEE

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Comptroller

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January 31, 2005

The Honorable John S. Wilder
Speaker of the Senate
The Honorable Jimmy Naifeh
Speaker of the House of Representatives
and
Members of the General Assembly
State Capitol
Nashville, Tennessee 37243

Ladies and Gentlemen:

Transmitted herewith is a report requested by House Joint Resolution 858 (2004) analyzing whether or not counties should produce hot mix asphalt. The report considers the economics of hot mix asphalt production, reasons for variations in costs, and information about the feasibility and implications for counties if they produce their own. The information may be useful to state policymakers considering whether or not to amend *Tennessee Code Annotated* 12-8-101(b), which prohibits Tennessee counties from making hot mix asphalt.

Sincerely,

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EXECUTIVE SUMMARY

In 2003, county highway departments sought legislation to allow them to manufacture their own road-building materials because of the apparent lack of competition in some areas. This report attempts to provide an overview of the state's hot mix asphalt industry, and to help decision-makers make choices about government's role in building and maintaining county roads.

Tennessee Code Annotated 12-8-101(b) (Public Chapter 767, 1976) prohibits counties and municipalities from owning or operating hot mix asphalt plants, with the exception of plants in existence on March 29, 1976. Only Jefferson, Sullivan, and Washington Counties, and the City of Memphis make their own hot mix asphalt (referred to as hot mix in this report), while the rest purchase hot mix from private providers or contract with private companies for road construction and maintenance. Office of Research staff identified 48 private companies that operate 155 asphalt plants in Tennessee.

House Joint Resolution 858 (2004) of the 103rd Tennessee General Assembly requested the Comptroller's Office to study:

- the process by which counties procure asphalt;
- the effectiveness of current procurement methods;
- the economics of asphalt production;
- reasons for variations in asphalt costs;
- implications of allowing counties to singly and/or jointly develop asphalt production capabilities; and
- any other related issues that may come to the attention of the Comptroller.

This report concludes:

In most cases, it is probably not cost effective for single counties to own and operate their own asphalt plants. Counties should consider several issues when evaluating such an effort's feasibility, with demand being the most important. The fixed operating costs of an asphalt plant are high, and to reduce the unit cost, an operator must produce relatively large volumes. However, most of the counties that appear to have problems getting competitive bids also do not need large volumes of hot mix. Counties requiring large volumes are usually within major population centers and receive multiple competitive bids. Because of the lack of competition in rural areas, multiple counties would likely need to join together to make asphalt production cost effective.

Other circumstances that might affect the feasibility of a county making its own hot mix include:

- Access to or ownership of raw materials
- Lack of other providers
- Multiple, contiguous counties with high combined demand.

In addition, county officials would need to consider a number of other issues, including acquiring the necessary paving equipment, hiring paving crews, hiring experienced plant operators, providing employees work when weather does not permit paving, and deciding whether or not to operate quality control labs. They should also examine potential local economic effects, materials costs, and environmental permit and monitoring requirements. (See pages 19-22.)

Local government ownership of asphalt plants would probably have an insignificant impact on sales and use tax revenues statewide, but might significantly affect local option tax collections in some counties. Because no one knows how many and which counties might decide to enter the asphalt business given the opportunity, it is impossible to accurately estimate the impact on state Sales and Use Tax and Local Option Sales Tax collections. However, the table in Appendix E presents potential Sales and Use Tax losses based on the volume of hot mix sales lost if counties began making their own. (See pages 22-23.)

County procurement practices may result in higher prices and limit competition. Some asphalt company officials expressed concern about the current volatility in the oil market. Because many counties solicit bids once a year, providers have difficulty projecting raw materials and transportation costs. This might discourage some providers from bidding on annual contracts, limiting competition further, and giving a distinct advantage to companies with their own source of aggregate or those located closer to sources of aggregate or petroleum. (See page 23.)

The number of asphalt companies and plants in Tennessee varies; urban areas typically have more. Researchers selected contiguous clusters of counties from all areas of the state to analyze the regional markets in greater detail. Each cluster contains a primary county and secondary counties. For example, analysts chose Knox County as a primary county and classified all of the counties that border Knox as secondary counties. The Knox County cluster has 35 plant locations owned by 10 companies compared to the Henry County cluster, which includes 14 plants owned by eight companies. The Putnam County cluster hash 21 locations owned by eight companies. (See pages 23-24.)

Companies located within a county won bids more often than companies outside of the county. Of the counties that have at least one private asphalt plant, 36 (90 percent) awarded the bid to a company owning a plant within the county from 1999 through 2003. (See pages 24-25.)

The number of counties receiving only one bid for hot mix purchases appears to be increasing. Among the 50 counties sampled, 22 percent received only one bid for hot mix in 1999. In 2003, 35 percent received only one bid. Regardless of the reason, it appears that competition for county hot mix business is dwindling. (See page 25.)

Recommendations

The General Assembly may wish to amend *Tennessee Code Annotated* 12-8-101(b) to allow local governments, alone or cooperatively, to own and operate hot mix asphalt plants, but with some very specific requirements. Analysts from the National Conference of State Legislatures (NCSL) found no similar law in any other state.

Legislation should require that county highway department(s) develop a detailed analysis of need and a cost-benefit analysis. Legislation should also require that once the highway department(s) has compiled such information, the head of the county highway department should recommend action to the county commission(s). The county commission(s) should closely examine the feasibility of any proposal by the highway department(s), and approve or deny the action in a separate resolution before the county expends public funds for this purpose.

County highway departments may wish to examine their procurement processes for hot mix. Highway departments may benefit from examining the local hot mix market to determine if portions of the county are at the edge of the reasonable service areas for some private providers. Some providers might be more competitive if they could bid on jobs closer to their plants. Counties may also want to consider soliciting bids for hot mix purchases on individual projects or contracts shorter than one year.

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Introduction

In 2003, county highway departments sought legislation to allow them to manufacture their own road-building materials because of the apparent lack of competition in some areas. However, in examining the hot mix asphalt industry, decision-makers should understand the limitations of these somewhat regional markets and how current government policies attempt to compensate for perceived market failures. They should also try to analyze all the potential issues related to entering the asphalt business. This report attempts to provide an overview of the state's hot mix asphalt industry, and to help decision-makers make choices about government's role in building and maintaining county roads.

Tennessee Code Annotated 12-8-101(b) (Public Chapter 767, 1976) prohibits counties and municipalities from owning or operating hot mix asphalt plants, with the exception of plants in existence on March 29, 1976. The law exempts Jefferson, Sullivan, and Washington Counties, and the City of Memphis because they were operating plants prior to 1976. The statute also exempts counties with a metropolitan form of government: Davidson, Moore, and Trousdale Counties. Only Jefferson, Sullivan, and Washington Counties, and the City of Memphis currently make their own asphalt. In Tennessee, there are 55,596 miles of local county roads and 14,458 miles of road classified as city streets.[1]

House Bill 1734/Senate Bill 1920 (2003) of the 103rd Tennessee General Assembly would have allowed any county to own or operate asphalt plants. The bill, however, did not become law. Also in 2003, the Tennessee County Highway Officials Association surveyed counties about asphalt procurement and costs, the results of which indicated:

- Of the eighty counties responding, 42 reported receiving only one bid for hot mix, 25 reported receiving only two bids, and 13 reported receiving three or more bids.
- The survey results indicate that West and Middle Tennessee Counties (TDOT Regions 3 and 4) typically pay higher prices for asphalt than do those counties east of Nashville (TDOT Regions 1 and 2).
- Shelby County reported the highest asphalt cost per mile at $45,825; Wilson County reported the lowest cost per mile at $22,031 for paving a 20-foot wide road surface with two inches of hot mix.
- 49 responding counties support legislation that would allow counties to own and operate asphalt plants, 20 do not support such legislation, and 11 were undecided.
- 16 responding counties reported that they would like to own and operate an asphalt plant, 55 reported that they would not, and nine answered "maybe."

House Joint Resolution 858 (2004) of the 103rd Tennessee General Assembly requested the Comptroller's Office to study:

- the process by which counties procure asphalt;
- the effectiveness of current procurement methods;

[1] Betty B. Vickers, Vickie C. Cunningham, ed., *Tennessee Statistical Abstract 2003,* (Knoxville, TN: The University of Tennessee, Center for Business and Economic Research) Chapter 9, Table 9.16.

- the economics of asphalt production;
- reasons for variations in asphalt costs;
- implications of allowing counties to singly and/or jointly develop asphalt production capabilities; and
- any other related issues that may come to the attention of the Comptroller.

The Comptroller must complete the study and publish findings and recommendations no later than February 1, 2005.

Methodology

The findings and recommendations of this report are based on:

- review of relevant laws, regulations, policies, procedures, and legislative audio tapes;
- a literature review of relevant articles and research;
- interviews with staff from the Tennessee county highway departments, Tennessee County Highway Officials Association, private asphalt companies, the Tennessee Department of Transportation, and the Tennessee Department of Environment and Conservation;
- review of county asphalt bid information collected by The Comptroller of the Treasury, Division of County Audit; and
- analysis of Tennessee asphalt plant locations using a geographic information system (GIS).

Background

What is Hot Mix Asphalt?

Hot mix asphalt (referred to as hot mix in this report), is composed of aggregate (both coarse and fine materials, typically a combination of different size rock and sand) and liquid asphalt cement (AC) which binds with the aggregate. The mix design, created and tested in a laboratory, determines the amount of liquid and amount and sizes of aggregate required. Exhibit 1 lists some design mixtures and the percent of aggregate and liquid AC required for each mix. Mixes that contain smaller sizes of aggregates require higher percentages of binder to coat increased surface area.[2]

State and local road officials use various grades of hot mix asphalt depending on the type and volume of traffic. Hot mix generally is more durable than cold mix,[3] and less expensive to install and maintain than concrete. Roads made from hot mix asphalt are also generally smoother than cold mix, concrete, tar-and-gravel, or other types of road surfaces. Installation methods for all grades of hot mix also differ from cold mix and

[2] Liquid Asphalt Cement (AC) is obtained from the refining of crude oil. Various grades of liquid AC can be used. In Tennessee, many private providers use PG 64-22 on county roads. The number designation has a distinct meaning. For example PG 64-22, is meant to resist environmental conditions in which the average seven day maximum design temperature is 64 degrees Celsius (147 degrees Fahrenheit) or lower and the minimum design temperature is -22 degrees Celsius -8 degrees Fahrenheit) The Transportation Research Board, *Hot-mix Asphalt Paving Handbook 2000,* pp. 1, 4, 14, 15.

[3] "Cold mix" is a type of asphaltic concrete made with a lower viscosity AC that is workable at lower temperatures and generally used for temporary repairs rather than complete paving jobs.

other types of road surface, and the methods make a difference in the road quality. While all hot mix must be installed at temperatures high enough so that the material remains "workable," hot mixes using polymer-enhanced AC must be installed and compacted at higher temperatures than others, while those using standard AC may be workable for longer periods of time and at lower temperatures. High-volume, heavy traffic roads sometimes require a more durable mix that could incorporate polymers and more precisely timed installation. Emerging technologies for "warm mix asphalt," which remains "workable" at lower temperatures, could soon eliminate some of the limitations of hot mix and provide a loophole to the current prohibition against local governments making their own hot mix.

Exhibit 1: Proportions of Total Mixture

Mixture	Combined Mineral Aggregate	Asphalt Cement (AC)
A	95.8 - 96.7%	3.3 - 4.2%
B, BM, and BM-2	93.8 - 95.8%	4.2 - 6.2%
C and C-W	93.8 - 95.8%	4.2 - 6.2%

Source: Tennessee Department of Transportation, *Standard Specifications for Road and Bridge Construction, Part 2 Base and Subgrade Treatments, Section 307.03,* p. 165, accessed September 14, 2004, http://www.tdot.state.tn.us/construction/specbook/95sec300.pdf.

Liquid AC comprises approximately four to six percent of the volume of most hot mix, but accounts for around half the cost, depending on the mix type.

Effectiveness of Current Hot Mix Procurement Methods

Tennessee Code Annotated 54-7-113 (c)(1) requires that with limited exceptions, purchases in excess of $5,000 by a county road department must be advertised publicly and competitively bid.[4] Comptroller's staff collected bid information from counties selected for this study. County officials in some counties solicit bids for asphalt once per year. At least one county solicits bids for materials every six months.

In at least one county, the county purchasing agent assembles a bid document. The agent then reviews the previous year's bid to determine vendors who did and did not bid. The agent also reviews a vendor database to identify any new vendors. The agent mails bids to vendors, and at a subsequent county meeting, opens the bids. The county highway department has an opportunity to review the bid and offer a recommendation. However, the purchasing agent makes the final decision and awards the bid. Counties also advertise upcoming county road projects in newspapers for one to two weeks. At least one county places ads on public bulletin boards.

Private providers told researchers they learn about upcoming county road projects in a variety of ways, including advertisements in newspapers and official bid invitations sent by county officials. Others stated that they subscribe to services such as Dodge Reports.[5]

[4] T.C.A. 54-7-101 *et seq.*, the statute does not apply to counties with populations of 200,000 or more. Davidson, Knox, Hamilton, and Shelby Counties operate highway or public works departments under metropolitan or county charters, or private acts.

[5] Dodge Reports, a service of McGraw-Hill Construction Dodge, lists public and private projects.

Still others learn about projects through memberships in professional associations. Because of all the methods by which counties advertise projects, none of the private providers told researchers they have difficulty learning about upcoming county road projects.

Other Factors Affecting Companies' Bidding Decisions
Company officials indicate they consider a variety of factors when deciding whether to bid on a road project or county business including:

- Equipment and manpower availability; backlog of other projects.
- Location of the job, which affects the cost of hauling hot mix to the site.
- Size of the job.
- Type of mix required.
- Amount of preparatory work involved.

They also consider the type of project. For example, one private producer explained that the company may be less effective on an airport project, but are more effective on state projects with high volume. Others mentioned that they subcontract with primary contractors when they have unused capacity, but not enough capacity to complete the entire job. Still others complained that some counties do not plan well, and it was sometimes inconvenient to try to meet their needs.

Types of Asphalt Plants
Manufacturers produce hot mix at asphalt plants. The two main types of plants used are:

- Batch-mix plants and
- Drum-mix plants.[6]

In the U.S., approximately 3,600 asphalt plants were in use as of 1996. This includes 2,300 batch-mix plants and 1,300 drum-mix plants, which produced approximately 500 million tons of hot mix.[7] In Tennessee, the total number of plants in 2004 was 159. Local governments own four of these. Exhibit 2 shows the basic components of a batch plant, and Exhibit 3 shows the basic components of a drum plant. The Tennessee Department of Transportation (TDOT) specifies requirements for all plants (drum and batch) which include many of the components referred to in Exhibits 2, 3 and 4.[8]

Plants may be portable or stationary. Of the companies interviewed, some own only stationary plants, some own only portable plants, and some own a combination of portable and stationary plants.

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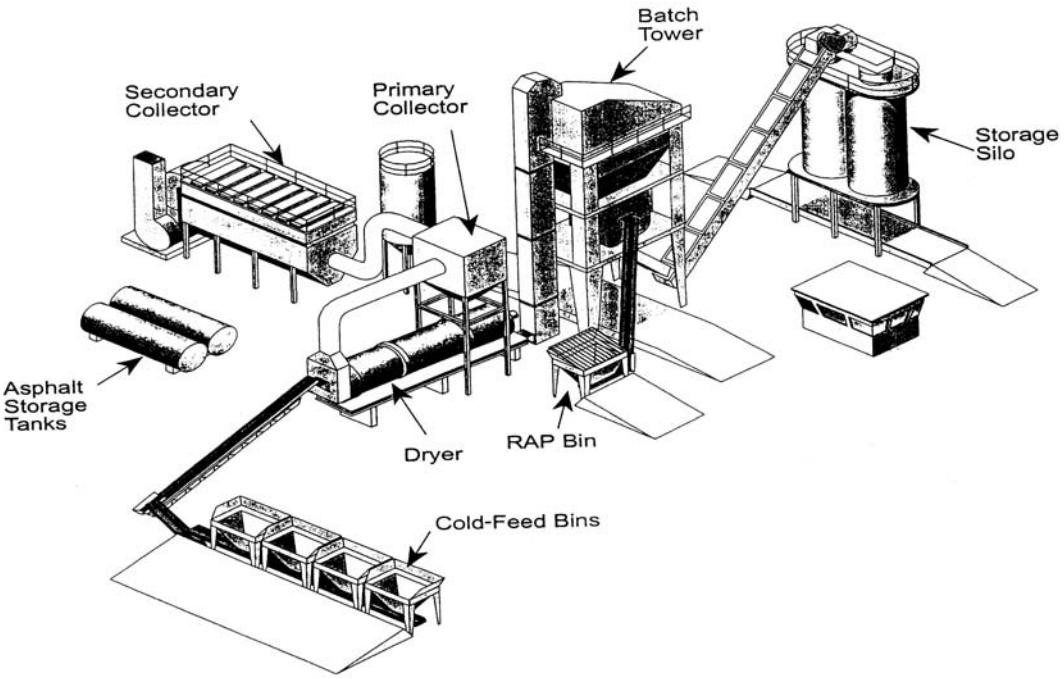
[6] While drum plants are further divided into parallel and counter flow, this study refers to drum plants generally.
[7] U.S. Environmental Protection Agency, *Compilation of Air Pollution Emissions Factors* (*AP-42), Fifth Edition, Volume 1,* Chapter 11, p. 11.1.1, April 2004, accessed August 19, 2004 http://www.epa.gov/ttn/chief/ap42/ch11/.
[8] Tennessee Department of Transportation, *Standard Specifications For Road and Bridge Construction, Division II, Construction Details, Part 3 - Flexible Surfaces, Section 407 – Bituminous Plant Mix Pavements (General)*, pp. 231-241, March 1, 1995, accessed September 14, 2004, http://www.tdot.state.tn.us/construction/specbook/95sec400.pdf.

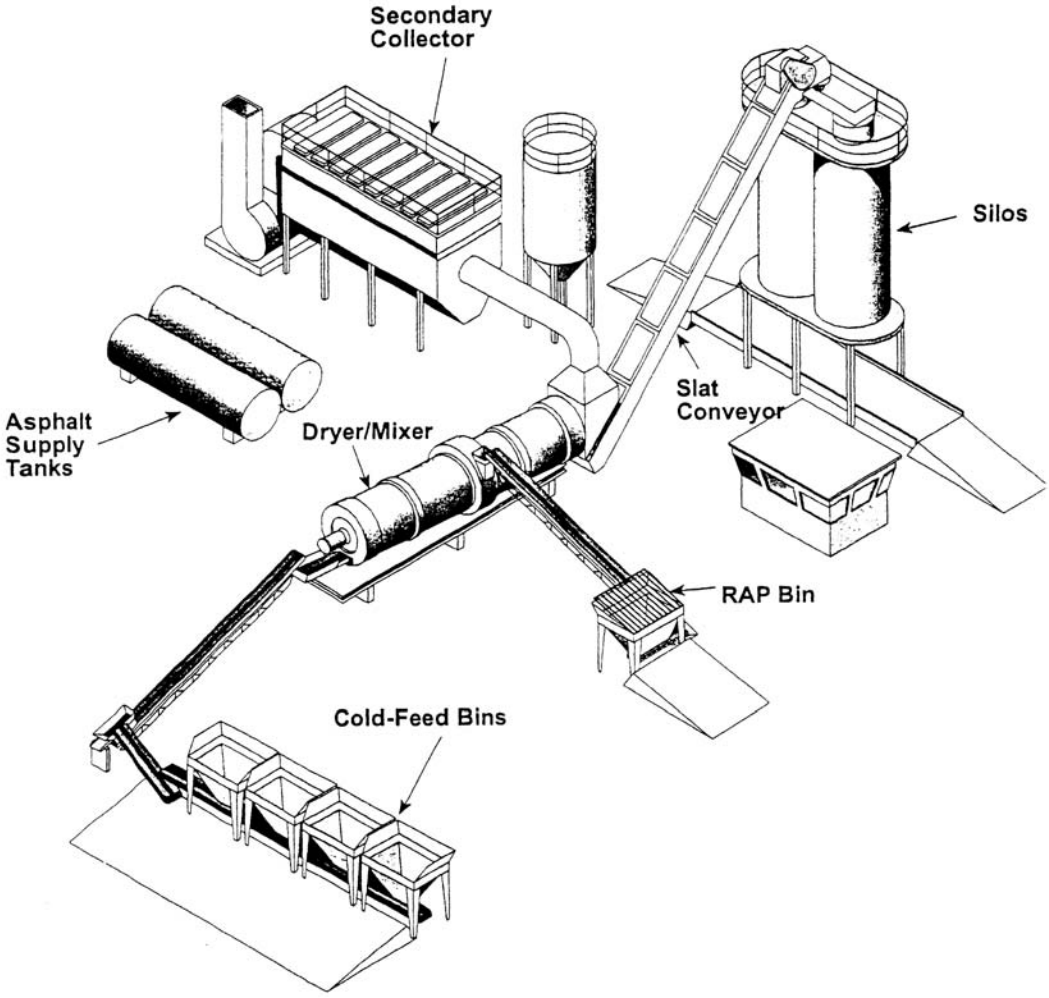
Office of Research staff identified 48 private companies that operate 155 asphalt plants in Tennessee. Researchers contacted 21 companies owning 99 plants, approximately 64 percent of all asphalt plants in Tennessee. Researchers interviewed private companies in almost every region of the state including small and large companies. The companies interviewed owned between one and 21 plants each.

Exhibit 2: Components of a Batch Plant



Source: Transportation Research Board, *Hot-mix Asphalt Paving Handbook 2000,* p. 43.

Exhibit 3: Components of a Parallel-Flow Drum Plant



Source: Transportation Research Board, *Hot-mix Asphalt Paving Handbook 2000,* p. 46.

Batch-Mix Plant

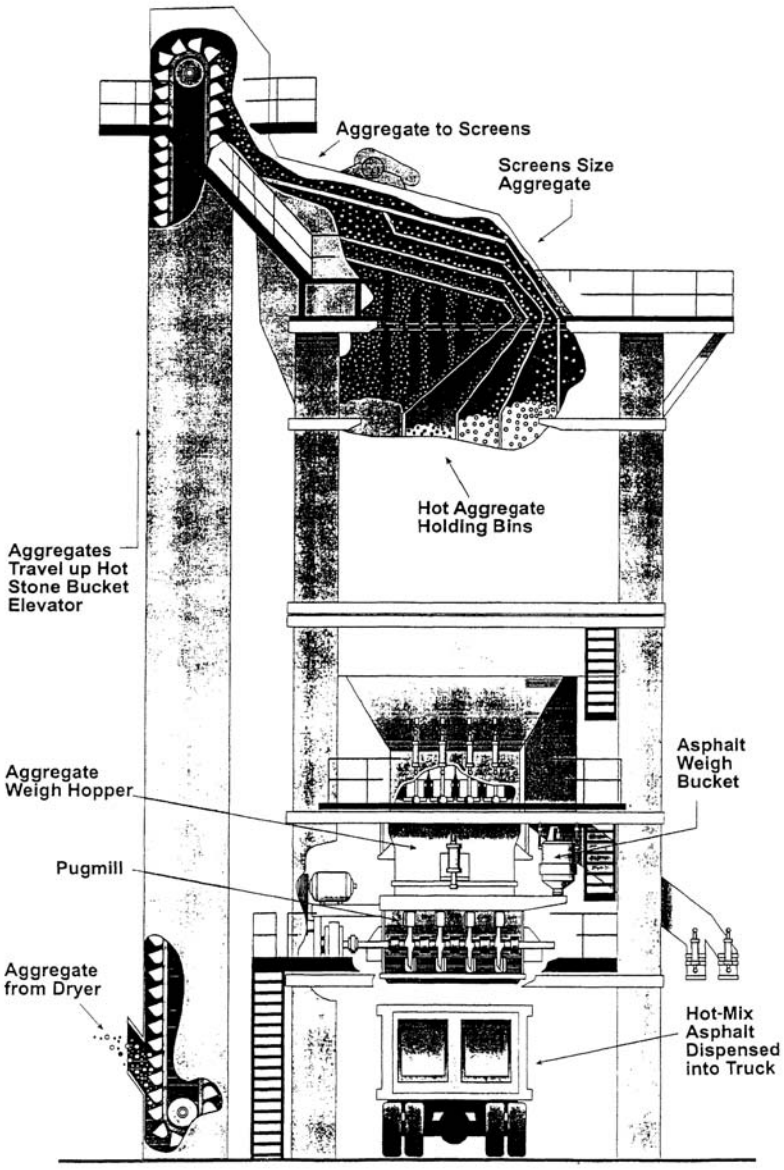
The hot mix production process in a batch plant includes the following steps:

- A set of screens sorts various sizes of aggregate into bins.
- The aggregate drops from the bins onto a conveyor belt and the belt moves the aggregate to a dryer.
- The dryer removes moisture from the aggregate by heating the aggregate to a specific temperature, usually between 290 and 325 degrees Fahrenheit. Excessive moisture requires additional heat, which increases drying costs. Typically, a batch plant uses less fuel to dry than a parallel-flow drum plant.[9]
- The drying process creates exhaust gases that cannot be released into the air. An emission control system, which typically includes a baghouse, collects these gases.
- Once the drying process is complete, the aggregate rides an elevator to a mixing tower, sorted further, and weighed. A device called a pugmill mixes the aggregate.
- The liquid AC is stored in tanks and requires heating so that the viscosity is low enough that the liquid will flow through the pipes. Producers typically heat liquid AC to 300 to 350 degrees Fahrenheit; the exact temperature depends on the grade and type of liquid AC used.[10]
- Some type of control mechanism transfers the heated liquid to the tower where scales ensure the proper volume goes into the mix. The pugmill mixes the liquid with the aggregate.

The mix design determines the amount of liquid and aggregate required. Exhibit 4 provides a brief overview of the hot mix production process in a batch plant.

[9] Transportation Research Board, *Hot-mix Asphalt Paving Handbook 2000,* p. 69.
[10] Ibid., p. 62.

Exhibit 4: Flow of Materials in a Batch Plant



Source: Transportation Research Board, *Hot-mix Asphalt Paving Handbook 2000,* p. 44.

Drum Plant

Similar to batch plants, drum plants also include a process to sort the aggregate into bins, remove moisture from the aggregate, and collect exhaust gases. However, the dryer in a drum plant consists of two parts; one-half removes moisture and the other half mixes the liquid with the aggregate. Once mixed, conveyors transfer the hot mix to silos for storage. Manufacturers rate drum plants by the number of tons of mix they can make per hour.[11]

Of the companies interviewed, six own batch plants only, six own drum plants only, and nine own both batch and drum plants. (See Exhibit 5.)

Exhibit 5: Types of Plants Owned by Selected Tennessee Companies

	Number
Batch plants only	6
Drum plants only	6
Combination of Batch and Drum	9
Total	**21**

Source: Office of Research interviews with private asphalt companies in Tennessee.

Private producers reported that plants ranged in age from two years to 40 years and produced from 23,000 tons to over 600,000 tons.

Private providers may choose to operate a batch or drum plant based on a variety of factors. One private provider told researchers that a drum plant is more economical to operate and another explained the maintenance costs for batch plants tend to be greater than for drum plants. One private provider believed that for high volume production, he would use drum plants. Another private provider explained that to meet the needs of multiple customers, a batch plant makes it easier to change rapidly from one type of mix to another.

Issues with Operating an Asphalt Plant

Numerous variables can influence the decision of whether or not to buy and operate a plant including:

- Environmental issues, including permits, testing, environmental controls, actual environmental impacts, and potential penalties.
- Fixed and variable costs.
- Market size and economic viability for a company to enter a particular market.
- Materials sources.
- Distance between the plant and potential job sites.
- Zoning ordinances' impact on plant location.

[11] Transportation Research Board, *Hot-Mix Asphalt Paving Handbook 2000,* p. 89.

The Costs of Building an Asphalt Plant

Some private providers interviewed estimated the costs of an asphalt plant range from $1 to $2 million. Some new, large capacity plants can cost nearly $4 million, not including land for the plant and material stockpiles. Exhibit 6 illustrates three annual debt-service scenarios for three cost levels, representing a range of potential costs to buy and set up an asphalt plant and the necessary attachments. Interest rates used in this exhibit are hypothetical, and counties must determine the market rate applicable at the time they issue the bonds. The rate used for 13-Year Capital Outlay Notes is purely hypothetical, as local banks sometimes negotiate interest rates with local governments on such notes if the banks happen to be issuing this type of debt at any given time.

Exhibit 6: Hypothetical Annual Debt-Service Scenarios for Asphalt Plant Purchase

Amount Borrowed	*12-Year G.O. Bonds	**15-Year G.O. Bonds	***13-Year Capital Outlay Notes
$1.5 million (Annual Debt-Service)	$159,828.26	$139,191.02	$147,894.64
Total of Payments	$1,917,939.11	$2,087,865.28	$1,922,630.28
$2 million (Annual Debt-Service)	$213,104.35	$185,588.02	$197,192.85
Total of Payments	$2,557,252.14	$2,783,820.37	$2,563,507.05
$2.5 million (Annual Debt-Service)	$266,380.43	$231,985.03	$246,491.06
Total of Payments	$3,196,565.18	$3,479,775.46	$3,204,383.81

*12 yr. bonded, 4% interest rate (on 9-23-04), G.O., un-credit-enhanced, B-AA rating (small, rural counties)
**15 yr. bonded, 4.45% interest rate (on 9-23-04), G.O., un-credit-enhanced, B-AA rating (small, rural counties)
***13-yr. Capital Outlay Note, local bank, 3.75% (purely hypothetical) rate
Source: Created by Office of Research Staff, based on information from Comptroller of the Treasury, Division of Bond Finance and Office of Public Finance

In addition to the plant itself, owning and operating an asphalt plant requires some ancillary equipment –another significant financial investment. Such equipment might include a loader to load materials in cold-feed bins, a dozer for stockpiling, a small tractor/loader for cleanup, and a dump truck in which to dump waste in between mix types. If a county planned to lay the asphalt themselves, they would also need additional special equipment. Such equipment might include at least one paver, dump trucks to haul hot mix to the job site, at least two rollers (one heavy, one finish), a tractor-trailer with a Lo-Boy (a specialized trailer) to haul the paver, trucks and trailers to haul the rollers, and possibly transportation (pickup, SUV) for the paving crew and foreman. Some counties already own some of the necessary ancillary equipment, reducing the initial investment required for these items.

Also, if a county wants to produce hot mix for State Aid work, they would need a lab for quality control, with cost estimates in the $50,000-100,000 range. Some might plan to use a generator for electricity instead of a public utility to avoid the demand charge applied to

each user's peak demand for any given month, adding another initial cost. A county opting for a drum mix plant would need a silo or silos for storage and scales to weigh materials leaving the plant. Counties, based on decisions made at the outset, could avoid or minimize some of these costs.

Asphalt Plant Operating Costs – Direct Costs Only

Costs to operate an asphalt plant, as with any operating costs, fall into *fixed* and *variable* costs categories. Fixed costs are those that remain the same regardless of the volume of hot mix produced at the plant; variable costs vary with volume. These costs probably do not vary much with production:

- Operating costs, including electricity demand charge, engineering, oil and lubricants, fuel for boiler operation
- Labor
- Direct overhead, including insurance, telephone, office supplies, scale checks, control house supplies, and environmental permits and testing

Private Certified Public Accountant (CPA) firms that have asphalt producers as clients include as fixed costs dryer fuel, maintenance, and repairs. While it may be appropriate for private providers to consider these costs as fixed based on relatively constant volumes produced, analysts decided to place these costs in the variable cost category, as they tend to vary widely depending on volume.

In this analysis, variable operating costs include:

- Electricity usage charge, dryer fuel
- Maintenance and repair, parts, equipment, labor, and other
- Fuel and electricity for ancillary equipment, generator, and heating/cooling control house
- Lab supplies, if running State Aid mix

Finally, there are costs for materials to make hot mix:

- Crushed gravel and/or limestone, varying gradations
- Washed sand
- Liquid asphaltic cement (AC)
- Anti-strip additive
- Stockpile loss and moisture loss from drying
- Transportation costs for all raw materials and finished product

Appendices C and D contain two cost models. A CPA firm developed the first model based on three plants, owned by different companies, in three different areas of the state, each producing and selling varying volumes of hot mix. Office of Research analysts developed the second model. Analysts have provided these two models so that counties or other governments can insert estimated costs from their own calculations based on regional differences for materials, transportation, fuel, and labor costs. Again, readers

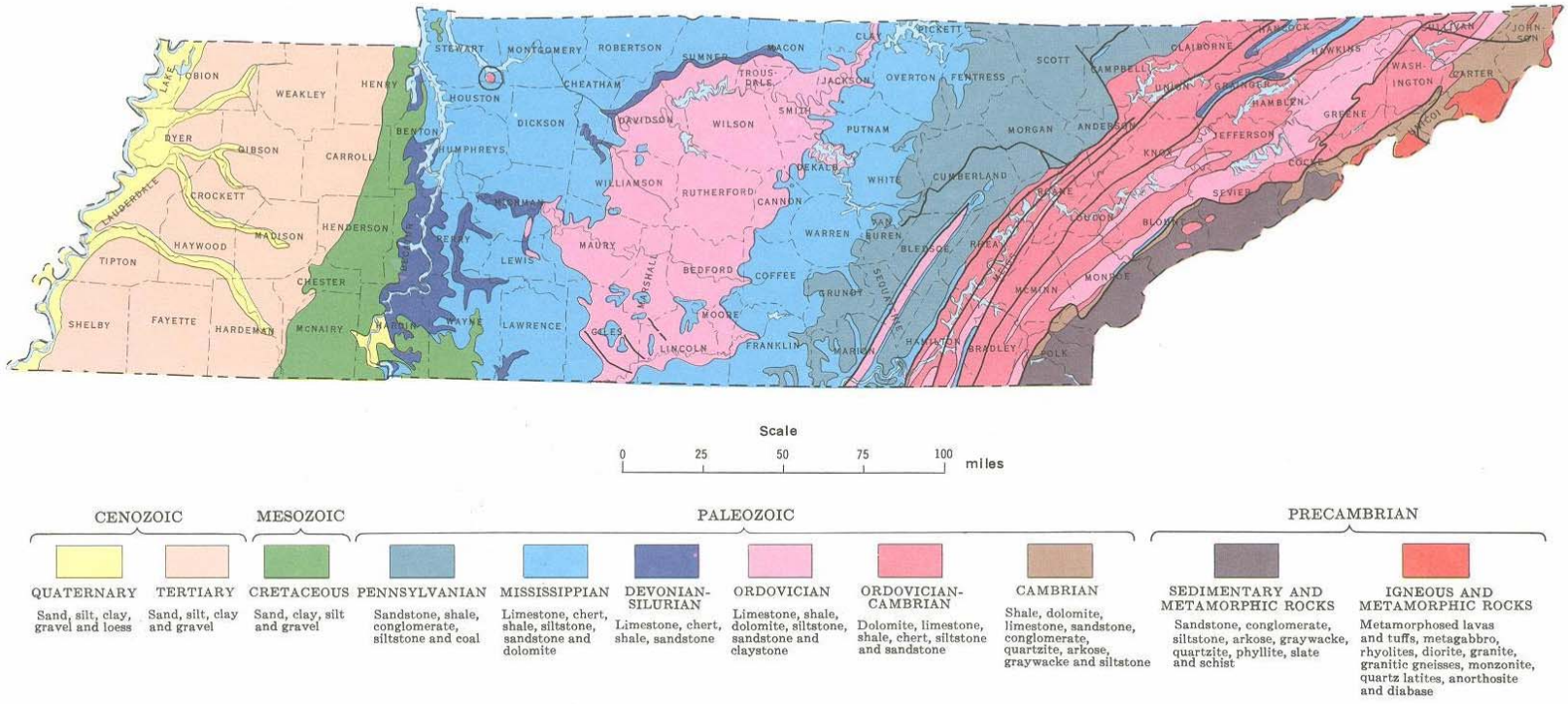
should view these only as models. The numbers reflected in these models do not represent real costs in any region of the state.

Key Economic Factors Affecting Asphalt Production in Tennessee

Location is important to the economic viability of producing and selling hot mix asphalt. Not only is there a cost to transport the finished product to the job site, but there is a significant cost to transport the raw materials (stone, sand, and liquid AC) to the plant. All producers must pay to transport liquid AC from one of several distribution centers in the state, but providers that operate plants at or very near their sources of aggregate have an advantage in material transportation costs. Providers owning rock quarries have an advantage in controlling production costs in addition to avoiding the cost of hauling aggregate to their plant.

Availability of raw materials is also important, as illustrated on the map in Exhibit 7. West Tennessee has no limestone, so companies must haul most of the aggregate in by truck. Some aggregate providers ship materials into the state on barges, then hot mix producers truck it to their plants. Raw materials transportation costs obviously add cost to hot mix. Some companies mine siliceous material (hard, non-polishing gravel and sand in West Tennessee) for use in mix types that require non-polishing aggregate. These gravel deposits are small, however, compared to the large rock quarries in other parts of the state. Middle and East Tennessee have multiple sources of limestone, and parts of far East Tennessee have granite (used as the siliceous material in some mixes where available locally). A limited number of companies operate quarries, and an even more limited number of quarries produce the siliceous material necessary for most State Aid jobs. Because of this varying geology, hot mix is generally more expensive to produce west of the Tennessee River (whether it is required to meet State Aid standards or not) than in other parts of the state.

Exhibit 7: Geologic Map of Tennessee



GENERALIZED GEOLOGIC MAP OF TENNESSEE

Source: Tennessee Department of Environment and Conservation
Note: The color-coding indicates the age of minerals and not the density or prevalence of minerals.

Aggregate costs vary across the state depending on several factors including the type of stone and location of the aggregate in relation to the plant. One private provider in West Tennessee explained that the cost of limestone is about $10.50-$11.00 per ton, not including the cost to haul the stone to the plant, an additional $1.50- $2.00 per ton. A private provider in Middle Tennessee indicated that the cost of rock ranged from $4 - 7.50.

Sand prices vary, with some providers in Middle Tennessee paying between $7.00 and $9.00 per ton. West Tennessee sand costs about $4 per ton.

Some private providers explained that liquid AC and aggregate suppliers will usually quote a selling price for a particular job, but some suppliers might guarantee a price for a year, particularly for aggregates. Current volatility in the oil market has prevented AC suppliers from guaranteeing prices for any period.

The majority (71.4 percent) of privately owned asphalt companies interviewed do not own their own aggregate source and must purchase from other companies. Exhibit 8 includes information on whether or not companies own their own aggregate source.

Exhibit 8: Asphalt Companies in Sample that Own Aggregate Sources

	Rock Quarries	Gravel/Sand Pits
	Number	Number
Do not own	15	13
Own	6	8
Total	21	21

Source: Office of Research interviews with private asphalt companies in Tennessee.

Most private companies interviewed told researchers they use river and mountain sand. However, some use manufactured sand.

Visualizing Potential Competition
Appendix A contains several maps of clusters of counties and indicates the locations of asphalt plants in or near those counties. Researchers have placed conservative 30-mile "service area" buffers around each of the plants to indicate where reasonable service areas for each plant might overlap, indicating areas of likely competition.

A third economic factor related to location is local demand for hot mix. Demand varies widely from county to county in Tennessee. Rural counties and cities often require hot mix volumes of less than 10,000 tons annually, compared to more populous counties that may use 50,000 to 100,000 tons or more per year. The fixed operating costs associated with an asphalt plant are high regardless of the volume produced. Providers that produce and sell large volumes can spread these fixed costs (listed above and in models in Appendices C and D) over more asphalt tons than those that produce less, significantly reducing production cost per ton. Regional cost

differences for materials and transportation make it impossible to determine a "break even point" that would apply to the entire state. However, such calculations might be possible regionally by examining the volume of hot mix required by the state, nearby counties and municipalities, as well as the private market for driveways, parking lots, and private developers. Some areas of the state do not need the hot mix volume necessary to support multiple private providers. Low demand in these areas may result in fewer private providers and higher asphalt prices.

Because paving requires that hot mix arrive at the job site at high temperatures, the potential service area for individual plants is somewhat limited by the distance trucks must travel from the plant to the paver. Company and local government officials interviewed reported hauling hot mix no more than an hour before the temperature dropped below the "workable" point, depending on weather conditions. Obviously, a one-hour trip will vary in distance depending on terrain and other traffic conditions. Because of this limitation alone, the service area for one centrally located asphalt plant would typically encompass four to six counties, at most. In rural areas, establishing a private asphalt plant requires extensive evaluation of local market supply and demand. Transport distances, limited demand, and cost issues limit the rural regions where competitive areas of multiple plants overlap. It is difficult to justify a $1 million to $3 million investment in an area where a company cannot guarantee sales volumes necessary to offer regionally competitive prices. Therefore, few new companies enter the market. The result is less competition among a few older companies that have established strong customer bases and enough volume to spread out fixed costs and offer competitive prices. For an illustration, see Appendix B indicating the dollar amounts selected counties spent on paving and/or hot mix from FY 1999 to FY2003.

The oil market's recent volatility provides another challenge. Liquid AC is a petroleum product composed mainly of refining by-products. Both public and private asphalt producers interviewed for this project experienced repeated AC cost increases over the last two years, after a long period of relative stability, making long-term hot mix bids risky. Fuel prices have also affected transportation costs for raw materials and the finished product, to run pavers and other heavy equipment, and the cost to heat and dry the aggregate at the plant. (Many plants use natural gas, #2 or #4 fuel for this purpose.) Some plants use inexpensive waste oil in their dryers, but several providers explained that burning waste oil increases plant maintenance costs and is less cost-effective. In addition, some plants (especially in rural areas that might lack electric infrastructure or where demand charges are high) use diesel generators to provide the electricity to operate their plants. Therefore, when the crude oil market is volatile, the hot mix market favors those companies that have well-established customers and sell larger volumes over which to spread any potential losses resulting from rising oil prices.

Economic Factors Affecting Competitive Market Behavior[12]

The actors, products sold, geographic limits of competition, customers, and prices all help to define a market. Competition itself refers to a specific type of market conduct. Some characteristics of competitive markets include:

- Many firms;
- A homogenous product;
- Free entry to and exit from the market;
- Perfect knowledge by participants; and
- Independence in the decisions firms make.

When conditions disrupt a purely competitive market, different market types arise – most often monopolies or oligopolies. In a monopoly, the market has one producer with barriers to market entry resulting in higher prices and lower production.

An oligopoly is similar in that there only a few sellers in the market. The sellers recognize that they produce substitutable goods and that they and their competitors can influence the price of the goods based on interdependence among sellers. Maximizing profits depends on each seller's behavior relative to the other sellers. Each seller's individual output decisions affect the price of the goods, depending on the seller's size relative to the market. In the asphalt business, however, producers have little influence on their output, as demand is often a function of government budgeting and local development trends. In other words, the buyers (state and local governments, developers, private businesses, and private citizens) establish annual demand for the most part, while existing competitors attempt to gain a large enough share of the market to turn a profit. To increase output beyond the available demand, companies must establish production capacity (through new investment or acquisitions) in new areas.

The U.S. prefers competitive markets because they allow supply and demand forces to solve economic problems. Economists also generally believe that producers and sellers choose less costly production methods when rivals can threaten their market share.

Market structures created by monopolies and oligopolies can lead to market failure. When a market fails, it typically means that firms do not use resources as efficiently as possible (firms do not combine labor, equipment, and other resources in a way that leads to minimum costs), or reduced competition leads to higher prices regardless of demand. However, market failure does not always result from market structure alone, but from the actions of market participants.

Although some more infamous cases in Tennessee have uncovered market participants actively participating in "cartelization," or explicit arrangements among or on behalf of sellers designed to limit competition among them (bid rigging, price fixing, "splitting the market"), this report is not intended to examine price fixing and explicit collusion in

[12] Gary R. Allen, Donald Culkin, and Cheryl Mills, *Legal and Economic Aspects of Competitive Market Behavior*, Virginia Transportation Research Council, Charlottesville, VA, 1988, pp. 2-11.

Tennessee's hot mix asphalt industry. However, the report does examine how this market structure may result in hot mix providers tacitly or inherently behaving in a manner that could result in market failure.

Exhibit 9: Factors Relevant to the Feasibility of Collusive Behavior and Market Failure

Factor	Conducive	Not Conducive	Tennessee County Hot Mix Market
Number of Firms	Small number of firms	High number of firms	Conducive
Industry Concentration (Top few firms control large share of market)	Highly concentrated	Not highly concentrated	Conducive, regionally
Nature of the Product	Homogeneous	Heterogeneous	Conducive
Rate of Technological Change and Industry Growth	Slow technological change, slow growth	Rapid technological change, significant growth	Conducive
Type of Sale	Small, frequent, regular orders	Large, infrequent orders at irregular intervals	Partially conducive – relatively small, regular orders, but infrequent
Secret Dealings and Sealed Bidding	Sealed bids, announced publicly – undercut bids announced publicly	Prices offered are kept secret – undercut bids are not made known to co-conspirators	Conducive – cheating on collusive agreement discovered immediately
Elasticity of Demand	Inelastic – demand does not change much with price	Elastic – demand drops with increase in price	Partially conducive – most counties' paving budget set; higher profits possible if other customers make up volume or paving budgets increase annually
Industry Social Structure and Trade Associations	Close-knit industry, strong internal discipline, strong trade association with regular meetings	Producers from diverse backgrounds, different business styles, different goals, weak or no trade association	Conducive
Production Costs	Similar production costs among firms, low fixed costs	Production costs differ significantly from firm to firm; high fixed costs combined with dropping demand results in unused capacity	Mixed – similar production costs among firms, combined with high fixed costs
Barriers to Entry	High – even with high profits, barriers prevent new entries into market	Low – with high profits, more firms will enter market	Conducive

Source: Compiled by Office of Research staff from - Gary R. Allen, Donald Culkin, and Cheryl Mills, *Legal and Economic Aspects of Competitive Market Behavior*, Virginia Transportation Research Council, Charlottesville, VA, 1988, pp. 4-11.

Analysis and Conclusions

In most cases, it is probably not cost effective for single counties to own and operate their own asphalt plants. However, specific sets of circumstances could make it feasible, and multiple counties in partnership might be able to justify such an endeavor. Counties should consider several issues, demand being the most important. As described in the economics section of this report, the fixed operating costs of an asphalt plant are high, and to reduce the unit costs, an operator must produce relatively large volumes. The model in Appendix D, for example, shows that a county acting alone that needs less than 50,000 tons of hot mix annually would probably not reduce its cost/ton below private providers' prices. If need falls between 50,000 and 100,000 tons or more, a county might be able to lower the unit cost enough to save some amount per ton over average low bids reported by counties for this project. However, most of the counties that appear to have problems getting competitive bids do not need high volumes of hot mix. Counties requiring large volumes are usually within major population centers and receive multiple competitive bids. Dealing with a lack of competition in rural areas, then, would probably require that multiple counties enter the asphalt production business jointly to succeed.

Other circumstances that might affect the feasibility of a county making its own hot mix include:

- Access to or ownership of raw materials: If a county owns its own aggregate source and has the capacity to produce the sizes and quality necessary for mix designs they typically use, making hot mix might be feasible. Likewise, if a county could locate a plant near enough to a private source of aggregate or liquid AC, that county might be able to avoid some transportation costs and keep unit prices low.
- Lack of other providers: If counties are in an area where the market has failed to provide competition and competitive prices, and can justify large volumes of hot mix, establishing asphalt production capabilities might be more feasible.
- Multiple, contiguous counties with high combined demand: Multiple contiguous counties with a combined demand could spread the fixed operating costs over a larger volume of hot mix, and split the debt service payments on an asphalt plant. Such cooperation would require planning and some initial investments, but could benefit counties with few asphalt providers.

County officials would need to consider a number of other issues, including:

- Paving equipment: If a county makes its own hot mix, it would likely require the ability to install it as well, including dump trucks, a paver, at least two rollers, and hand tools. It would also need traffic control equipment, including flags, cones, and possibly barrels and barricades. Paving crews would need hard hats, high visibility vests, gloves, and possibly boots. A county may also need a milling machine (to mill old pavement before resurfacing), a grader and backhoe (for

shoulder, ditch and tile work), and a shuttle buggy[13] for State Aid jobs where it is required. Without the shuttle buggy, equipment for a paving crew could cost from $.5 million to $1.5 million, according to people interviewed for this project. A new shuttle buggy sells for approximately $400,000.

- Paving crews: At least one paving crew is essential. Crews would need multiple people with paving experience, because paving is a specialized skill. Crews would need at minimum a foreman, paver operator, two roller operators, two feeder operators, and two laborers. If traffic control is necessary, the crew will need at least two additional people. Also, drivers to haul the hot mix from the plant to the paver will be required.
- Plant operators: As mentioned above, it takes experienced people to work on a paving crew. Asphalt plants also require an experienced operator. The most likely source of experienced people would be private providers in the area. To hire those people, counties must offer them something they do not get from their present employer, such as additional benefits, hours that are more regular, year-round employment, or higher pay.
- Providing plant and paving crews work when weather does not permit paving: Many of the private companies interviewed for this project reported that they close down asphalt plants for 3-4 months during the winter, when temperatures make paving difficult or impossible. During that time, some of those companies lay off most of their paving-related employees, keeping a small crew on hand to perform maintenance on plants and equipment. Those public entities that already own and operate asphalt plants reported that during this "down time," they keep paving-related employees busy with other jobs such as patching cracks and potholes, driving snowplows, clearing downed trees, cleaning storm drains, roadside trash pickup, and equipment maintenance. While governments hire seasonal employees, counties may have difficulty finding experienced people willing to work only part of the year. They may also encounter challenges structuring pay and benefits for such workers.
- Quality Control Labs: State Aid work requires asphalt providers to have labs to test the gradations of the aggregates used in the asphalt, AC content, tensile strength, and other hot mix properties. They also use these labs to test various mix designs and to ensure consistent quality throughout a job. However, county roads do not have to meet state standards. Jefferson and Sullivan Counties, and the City of Memphis operate their plants using fairly standard mix designs for the hot mix grades they produce, without benefit of a lab. Washington County operates its own lab, and has the capability to develop mix designs that meet State Aid standards. Counties would obviously benefit from tested mix designs that will last longer before they need resurfacing or repair, but labs would not be required for plants that only produce asphalt for non-State Aid, county roads.
- Local economic effects: Rural areas with limited demand for hot mix and limited competition might see some smaller asphalt operations go out of business. The impact on one county's property tax and local option sales tax collections might

[13] A "shuttle buggy" is a large piece of equipment used to remix hot mix asphalt at the work site, before it goes into the paver, in order to more evenly distribute temperatures and result in a more consistent paving quality.

be significant, while the impacts on overall state tax collections would probably be minimal. Conversely, if making its own hot mix provides a county increased flexibility to respond to local business needs, or improvements draw in new business or residential development, counties may be able to offset the loss of a local asphalt provider.

- County materials costs: Counties operating asphalt plants would still be bound by *Tennessee Code Annotated* 54-7-113 (c)(1), which requires that, with limited exceptions, purchases in excess of $5,000 by a county road department must be advertised publicly and competitively bid.[14] While this might ensure that they receive competitive prices for aggregates, the market structure for aggregates is, in some ways more susceptible to market failure than the market for hot mix. For example, West Tennessee has very few aggregate suppliers. Two suppliers sell most of bulk-order aggregate and river sand for use in hot mix, increasing the likelihood that the aggregate market there could fail to provide competitive prices. Transportation costs are also an issue for counties that cannot locate a plant close to ports on the Mississippi or Tennessee Rivers.
- Environmental permits and monitoring: The Tennessee Department of Environment and Conservation (TDEC) requires asphalt plant operators to obtain construction and operating permits for new air contaminant sources, and water pollution control permits for stormwater runoff. The department issues operating APC permits for a fixed term not to exceed five years, which require monitoring, recordkeeping, and reporting. TDEC has a schedule of construction fees based on the maximum anticipated annual emission rate. The construction permit fees range from $100 to $5,000, depending on the maximum anticipated annual emissions. TDEC also requires an annual emission fee with a rate for minor sources of $12.50 per ton of allowable emissions, with sources less than 10 tons per year exempt from minor source fees.

  Asphalt plant operators are required to obtain a stormwater discharge permit and pay an annual fee. The acreage of the facility determines the amount of the fees, which range from $250 - $700.[15] These permits also require monitoring and reporting stormwater discharges.

Office of Research staff contacted all 95 Tennessee county highway departments to learn about the counties' paving capabilities and obtained information from 89 counties. Of these, forty-seven counties (53 percent) own their own paving equipment, compared to 42 (47 percent) that do not.[16] Some counties lack suitable equipment for laying hot mix asphalt and use it for smaller projects, including road repairs such as patching. Of the 47 counties that own equipment, 42 (89 percent) own equipment suitable for laying hot mix, compared to five (11 percent) that do not. For the counties that own paving equipment and employ paving crews, these items would not be an issue. In addition, a multi-county

[14] T.C.A. 54-7-101 *et seq.*, The statute does not apply to counties with populations of 200,000 or more. Davidson, Knox, Hamilton, and Shelby Counties operate highway or public works departments under metropolitan or county charters, or private acts.

[15] Rules of The Tennessee Department of Environment and Conservation, Bureau of Environment, Division of Air Pollution Control, Chapter 1200-3-9 and Chapter 1200-3-26, and Division of Water Pollution Control Chapter 1200-4-11.

[16] Counties that do not own equipment contract with private companies to install asphalt.

effort would make these issues easier to work through and cooperating governments could split costs among them.

It is important to keep in mind that governments have historically provided services to the public not to make a profit, but to provide services that the private sector is unwilling or unable to provide at a reasonable cost. For many years, the private sector has provided road building and maintenance services to Tennessee's governments. However, some government representatives believe that costs have been unreasonable in recent years. If so, the impacted governments may need to ensure that they provide paving services to their taxpayers at a reasonable cost.

Local government ownership of asphalt plants would probably have an insignificant impact on sales and use tax revenues statewide, but might significantly affect local option tax collections in some counties. Hot mix produced at county-owned and privately owned asphalt plants requires the same basic raw materials: aggregates and liquid AC. Both private hot mix providers and public plants reported AC prices that were very similar from the various suppliers in the state. Counties are exempt from paying sales tax, so the amount of sales tax collected could decrease somewhat in counties from which these companies distribute AC. Sales tax collections are important because local governments use the funds generated for various governmental functions.

If the county could provide its own source of aggregates, it would not purchase aggregates from a private source, and would not pay mineral severance taxes that some counties collect. The process and costs associated with owning and operating a quarry can be complex and all counties might not have county-owned land or be able to purchase land that contains the necessary natural aggregates. Most counties, however, would probably purchase aggregates from private providers. These providers would continue to pay applicable mineral severance taxes. However, because counties are exempt from paying sales tax, the amount of sales and use tax collected could decrease.

Private hot mix providers in Tennessee pay use taxes on raw materials only if they install the hot mix themselves, and collect sales and use tax from other private entities that purchase hot mix from them. If the company sells hot mix directly to a tax-exempt entity (i.e., a local government) and the exempt entity installs the product itself, the sale is tax exempt. However, the private provider must pay sales and use tax on the raw materials. If a county purchases hot mix from a private provider and installs it using county staff and equipment, there is no sales and use tax on the finished product. If the private provider installs the hot mix for the county, they must pay sales and use tax on the fair market value of the finished product ($5.00/ton as defined by the Department of Revenue's Sales and Use Tax Guide), plus the cost of the raw materials.

Because no one knows which counties might decide to enter the asphalt business given the opportunity, it is impossible to estimate accurately the impact on state sales and use tax and local option sales tax collections. However, the table in Appendix E presents potential sales and use tax losses based on the volume of hot mix sales lost if counties began making their own. Also, Tennessee's participation in the Streamlined Sales and

Use Tax Agreement (changes become effective July 1, 2005) and the changes requiring destination-based sales tax rather than the current origin-based tax may also affect local tax collections from sales of asphalt and raw materials.

County procurement practices may result in higher prices and limit competition. Some asphalt company officials expressed concern about the current volatility in the oil market. Because many counties solicit bids once a year, providers have difficulty projecting raw materials and transportation costs. This might discourage some providers from bidding on annual contracts, limiting competition further, and giving a distinct advantage to companies with their own source of aggregate or those located closer to sources of aggregate or petroleum.

Companies in the same general area likely know their competitors well, including where they obtain raw materials, what they pay for materials, and what their transportation costs might be. Knowing their competitors' production and transportation costs could lead some providers not to bid if they feel they cannot be competitive, focusing elsewhere.

The state and some local governments solicit bids for shorter periods, or for individual projects, which might enable private providers to better estimate materials and transportation costs. If private providers can lock in prices from their suppliers for individual projects or shorter periods of time, they may incur less risk in developing bids and possibly be more competitive. If more providers were able to develop competitive bids for smaller projects or shorter time periods, county highway departments might receive more competitive prices from additional private bidders, some of which might be too far away to develop competitive bids for an entire county, but close enough to particular projects to be competitive.

The number of asphalt companies and plants in Tennessee varies; urban areas typically have more. Researchers selected contiguous clusters of counties from all areas of the state to analyze the regional markets in greater detail. Each cluster contains a primary county and secondary counties.[17] For example, analysts chose Knox County as a primary county and classified all of the counties that border Knox as secondary counties. Researchers then identified the number of private asphalt providers and plant locations within each cluster. Exhibit 10 includes information about each cluster. The Knox County cluster has 35 plant locations owned by 10 companies, compared to the Henry County cluster, which includes 14 plants owned by eight companies. Putnam County has 21 locations owned by eight companies.[18] The number of plants does not necessarily indicate the companies could serve *all* the counties within that cluster. Some road projects may be too far from the plant to haul hot mix and keep it workable.

[17] Office of Research staff selected clusters based on a variety of factors including bid information and plant locations.
[18] Some companies own multiple asphalt plants.

Exhibit 10: Hot Mix Companies in Selected Areas in Tennessee

Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 1			
Knox	Anderson, Blount, Grainger, Jefferson, Loudon, Sevier, Union	35 (4.38 plants/county in cluster)	10 (1.25 companies/county in cluster)
Washington	Carter, Greene, Hawkins, Sullivan, Unicoi	16 (2.67 plants/county in cluster)	9 (1.50 companies/county in cluster)
REGION 2			
Franklin	Coffee, Grundy Marion, Moore	21 (4.20 plants/county in cluster)	12 (2.40 companies/county in cluster)
Putnam	Cumberland, DeKalb, Fentress, Jackson, Overton, Smith, White	21 (2.63 plants/county in cluster)	8 (1.00 companies/county in cluster)
REGION 3			
Dickson	Cheatham, Hickman, Houston, Humphreys, Montgomery Williamson	28 (4.00 plants/county in cluster)	12 (1.71 companies/county in cluster)
Marshall	Bedford, Giles, Lincoln, Maury, Rutherford, Williamson	47 (6.71 plants/county in cluster)	12 (1.71 companies/county in cluster)
REGION 4			
Madison	Carroll, Chester, Crockett, Gibson, Hardeman, Haywood, Henderson	21 (2.63 plants/county in cluster)	12 (1.50 companies/county in cluster)
Henry	Benton, Carroll, Obion, Weakley	14 (2.80 plants/county in cluster)	8 (1.60 companies/county in cluster)

Source: Office of Research analysis of asphalt plant locations.

Companies located within a county won bids more often than companies outside of the county. Office of Research staff examined 52 counties from 1999 through 2003 in this study and of these, 40 counties (80 percent) have at least one private asphalt plant located within the county compared to 10 (20 percent) that do not.[19] Of the counties that

[19] Two counties produce their own hot mix and do not solicit bids.

have at least one private asphalt plant, 36 (90 percent) awarded the bid to a company owning a plant within the county.[20] If a plant is located in the same county as a project, the company might have a lower cost to haul hot mix, which may allow the company to submit a lower bid price. This is not always true; because the project location may determine the potential bidders (for example a company might own a plant in a neighboring county with a shorter distance to the job site).

The number of counties receiving only one bid for hot mix purchases appears to be increasing. The Comptroller of the Treasury's Division of County Audit collected bid information from the 50 counties sampled for this report. Among the 50 counties, 22 percent received only one bid for hot mix in 1999. In 2003, 35 percent received only one bid. A variety of factors may contribute to the increase in the number of single-bid counties, but the most likely reason appears to be new acquisitions by large companies. Regardless of the reason, it appears that competition for county hot mix business is dwindling. Appendix F lists the counties sampled for this report and the number of hot mix bids each county received from FY1999 through FY2003. Exhibit 11 (below) summarizes the information in Appendix F, indicating the number of counties receiving single or multiple bids from FY1999 through FY2003.

Exhibit 11: Bids Received by Selected Counties for Hot Mix

	Received By Year									
	1999		**2000**		**2001**		**2002**		**2003**	
Number of bids	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
One	11	22%	13	26%	14	28%	15	30%	17	35%
Two	18	36%	21	42%	15	30%	17	34%	17	35%
Three	6	12%	7	14%	9	18%	7	14%	6	12%
Four	3	6%	5	10%	7	14%	6	12%	4	8%
Five	3	6%	2	4%	2	4%	0	0%	3	6%
Six	0	0%	0	0%	0	0%	1	2%	0	0%
Seven	0	0%	0	0%	0	0%	2	4%	1	2%
No Information Available	9	18%	2	4%	2	4%	2	4%	1	2%
No Hot Mix Purchased	0	0%	0	0%	1	2%	0	0%	0	0%
Total	50	100%	50	100%	50	100%	50	100%	49*	100%

Source: Information collected by the Comptroller of the Treasury, Division of County Audit.
Note: Jefferson and Washington Counties own asphalt plants and do not bid out for hot mix.
* One county extended the contract for 1 year and therefore did not need to solicit bids.

[20] In some years, multiple companies won bids and the same company was not always awarded the same bid each year.

Recommendations

The General Assembly may wish to amend *Tennessee Code Annotated* 12-8-101(b) to allow local governments, alone or cooperatively, to own and operate hot mix asphalt plants, but with some very specific requirements. Analysts from the National Conference of State Legislatures (NCSL) found no similar law in any other state. If the General Assembly amends the law, legislation should require documented need for the facility and an analysis of costs and benefits, including:

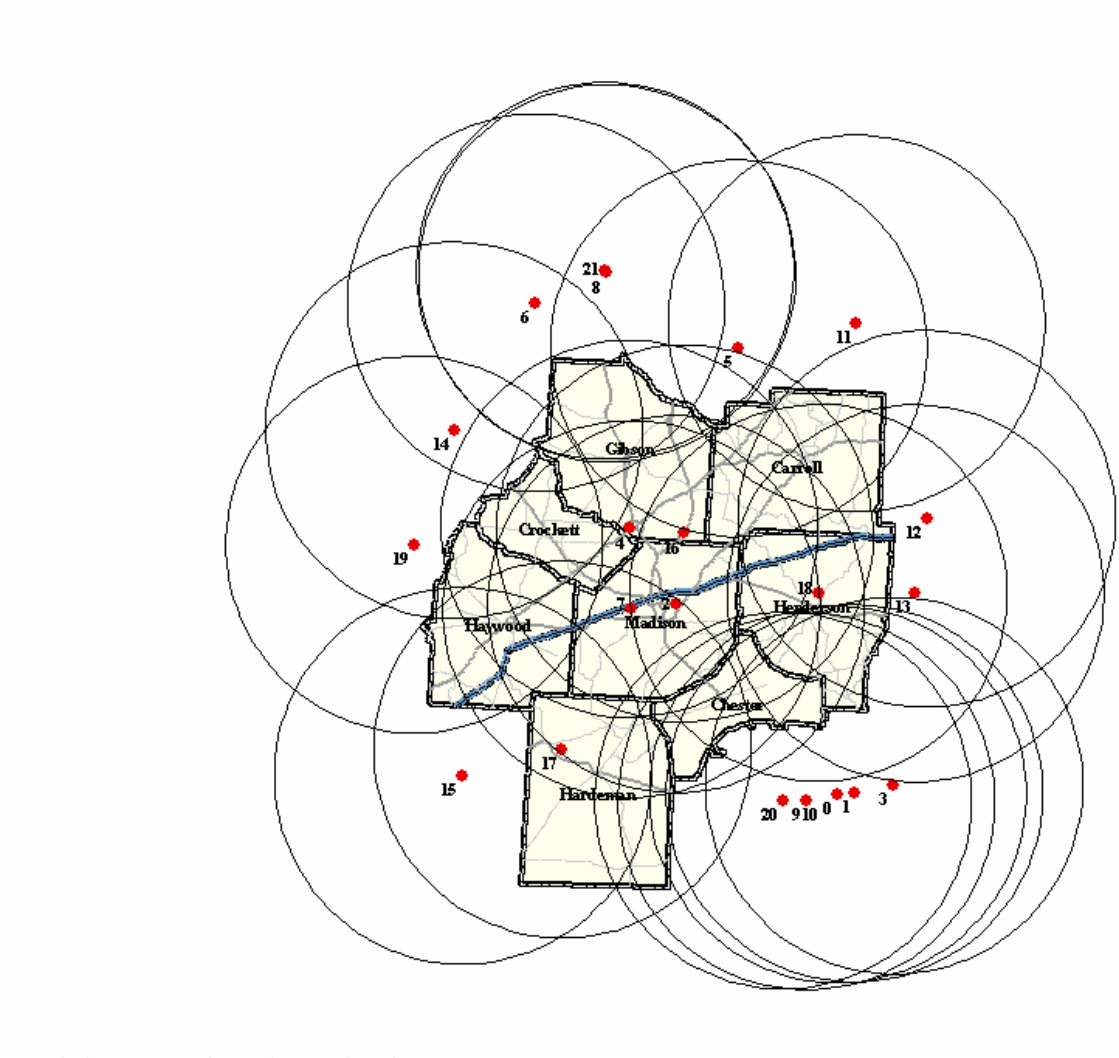
- Bid records proving that the county or counties have not received multiple competitive bids for paving or hot mix asphalt purchase for (a number) of years.
- A comparison of the prices from nearby counties showing higher costs than nearby counties that receive multiple competitive bids.
- Estimated need for paving or hot mix asphalt for 15 years to show that the county (or counties) would produce the volume necessary to realize a cost savings. Projected cost savings should be significant enough to offset the cost of the plant.
- Accurate production cost estimates, including debt service/depreciation on the asphalt plant and necessary ancillary equipment and all other fixed and variable plant operating costs.
- Agreements with suppliers of the necessary raw materials that those suppliers will sell materials to the county (or counties) at competitive prices, and the locations of those suppliers.
- Cost estimates for transporting raw materials to the plant.
- Estimates of the total operating costs for the plant, including any costs that will be absorbed in the current operating budget, any new costs to the county (or counties), and explanation of how costs that are absorbed will be avoided.
- Estimates of the plant's impact on the local economy and state and local tax revenues, including Sales and Use Tax, Local Option Sales Tax, and Mineral Severance Tax.

Legislation should also require that once the highway department(s) has compiled such information, the head of the county highway department should recommend action to the county commission(s). The county commission(s) should closely examine the feasibility of any proposal by the highway department(s), and approve or deny the action in a separate resolution before the county expends public funds for this purpose.

County highway departments may wish to examine their procurement processes for hot mix. Highway departments may benefit from examining the local hot mix market to determine if portions of the county are at the edge of the reasonable service areas for some private providers that might be more competitive if they could bid on jobs closer to the private plants. Counties may also want to consider soliciting bids for hot mix purchases on individual projects or contracts shorter than one year. Oil market volatility may increase the risk of quoting a 12-month price for asphalt, and private providers might be more willing to accept the risk involved with bidding on individual projects or a three- or six-month contract compared to an annual contract.

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

Madison County Cluster

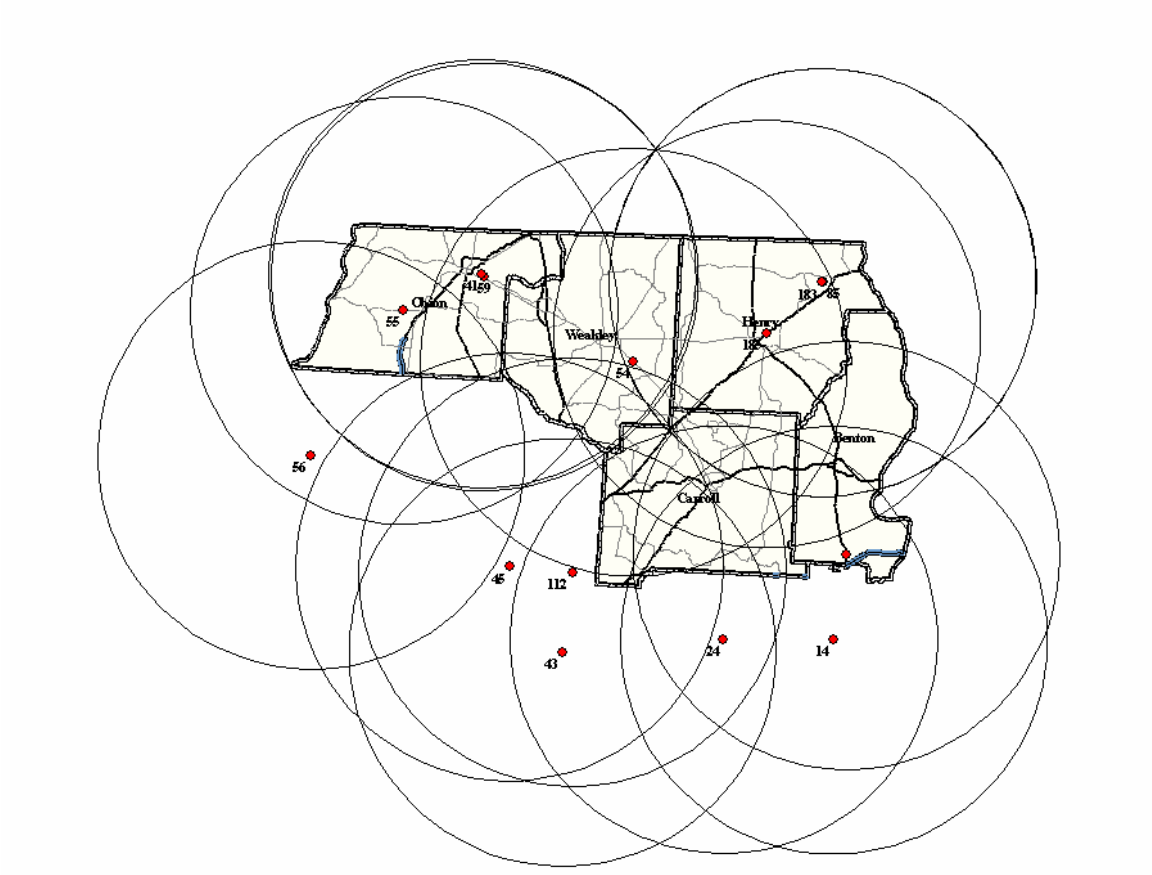


Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 4			
Madison	Carroll, Chester, Crockett, Gibson, Hardeman, Haywood, Henderson	21 (2.63 plants/county in cluster)	12 (1.50 companies/county in cluster)

Note: Maps show clusters of counties that reported limited competition for hot mix asphalt in the Tennessee County Highway Officials Association's 2003 survey of county highway departments. Numbered dots on the maps indicate the location of privately operated asphalt plants, surrounded by 30-mile "buffer zones," inside which plants could reasonably expect to be competitive. Very few companies failed to bid in counties within their 30-mile service area buffers, according to Office of Research analysis.

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

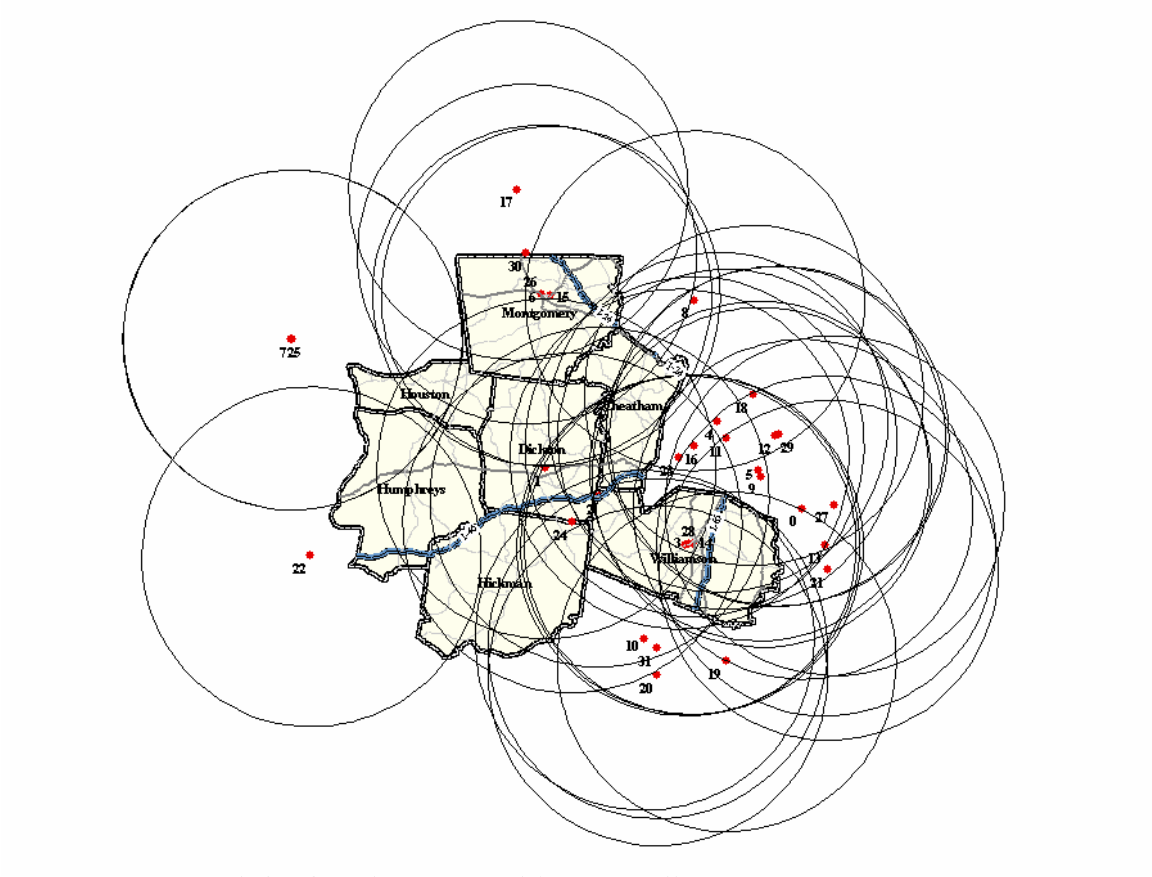
Henry County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 4			
Henry	Benton, Carroll, Obion, Weakley	14 (2.80 plants/county in cluster)	8 (1.60 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

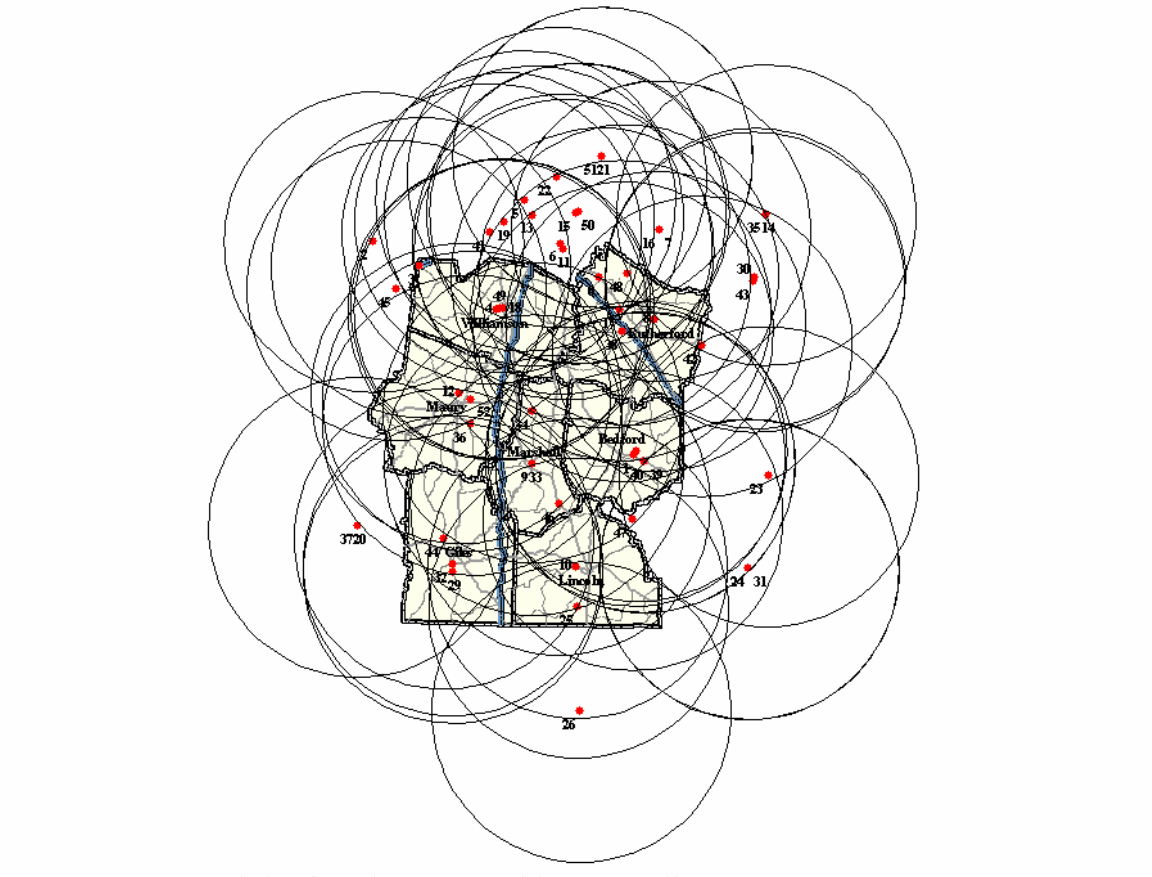
Dickson County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 3			
Dickson	Cheatham, Hickman, Houston, Humphreys, Montgomery Williamson	28 (4.00 plants/county in cluster)	12 (1.71 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

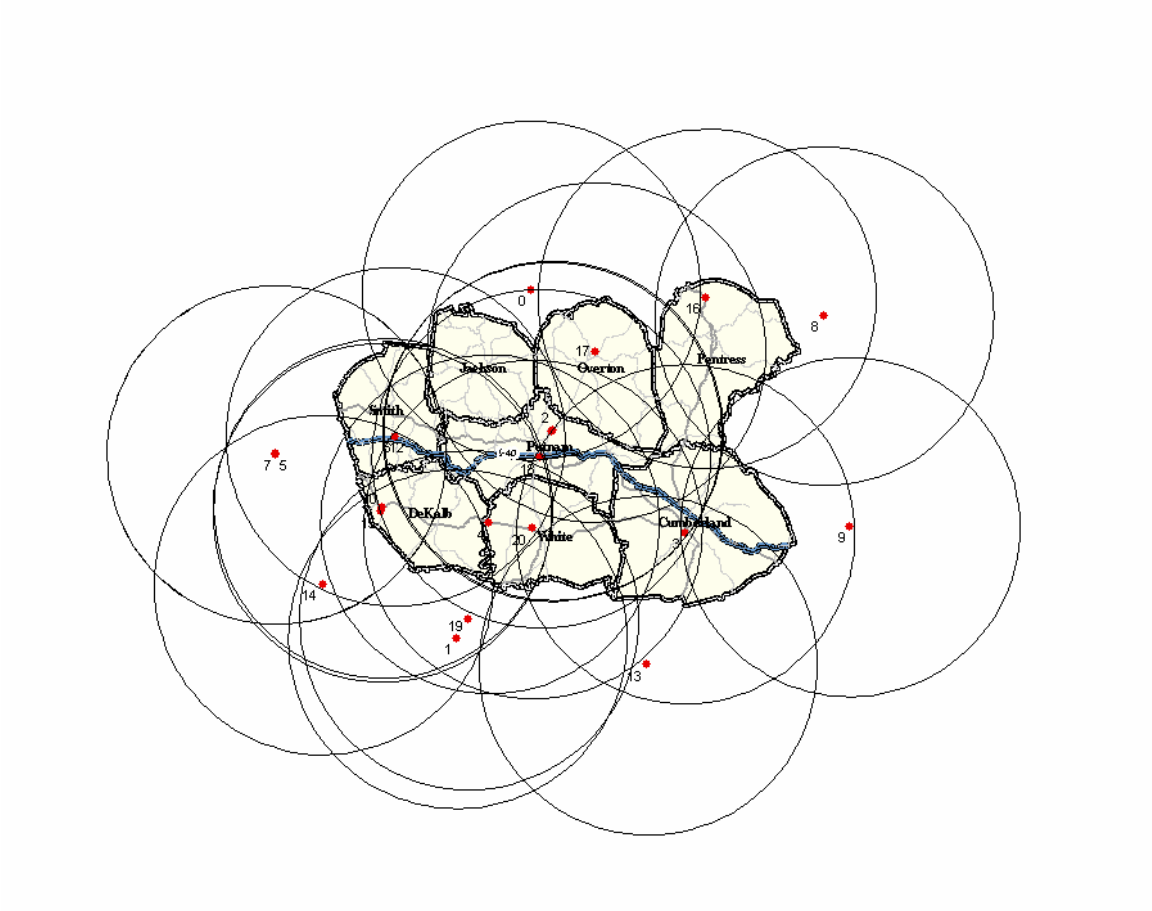
Marshall County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 3			
Marshall	Bedford, Giles, Lincoln, Maury, Rutherford, Williamson	47 (6.71 plants/county in cluster)	12 (1.71 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

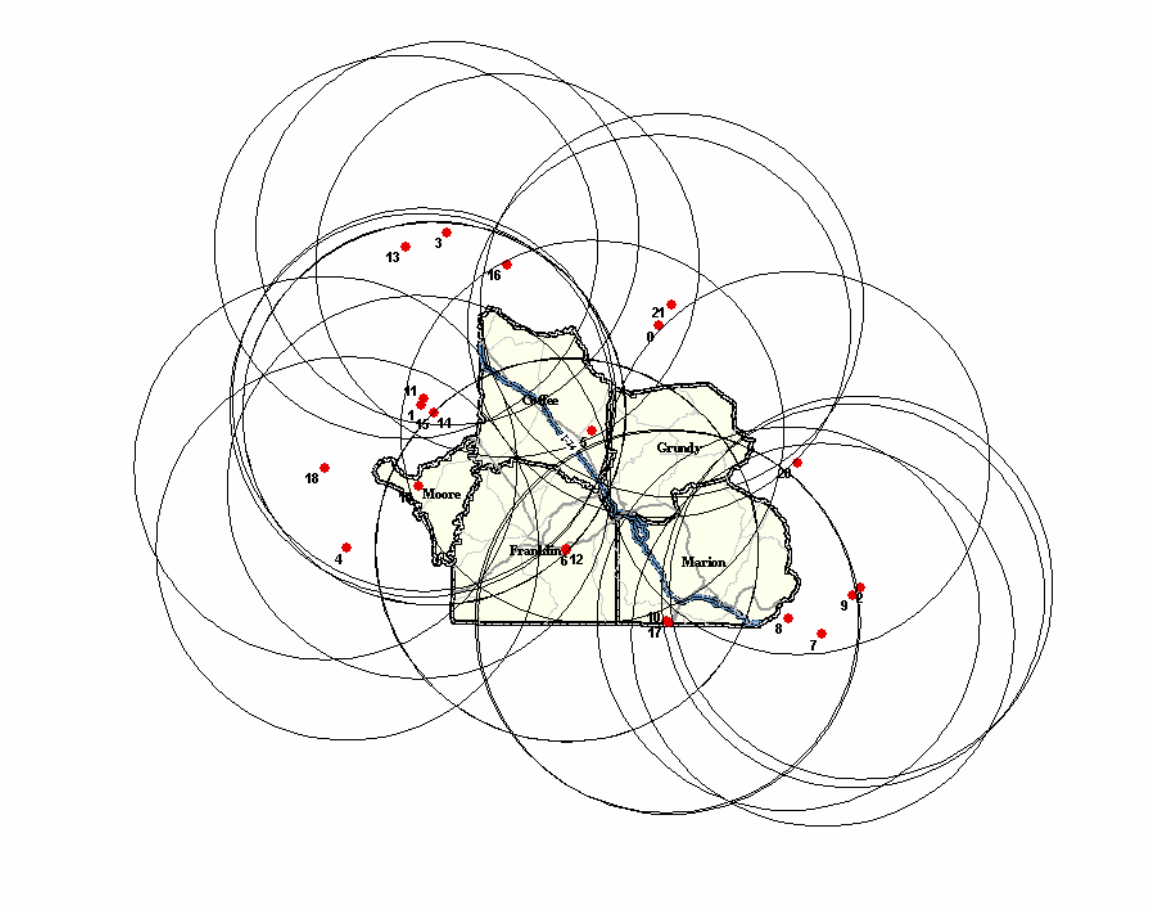
Putnam County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 2			
Putnam	Cumberland, DeKalb, Fentress, Jackson, Overton, Smith, White	21 (2.63 plants/county in cluster)	8 (1.00 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

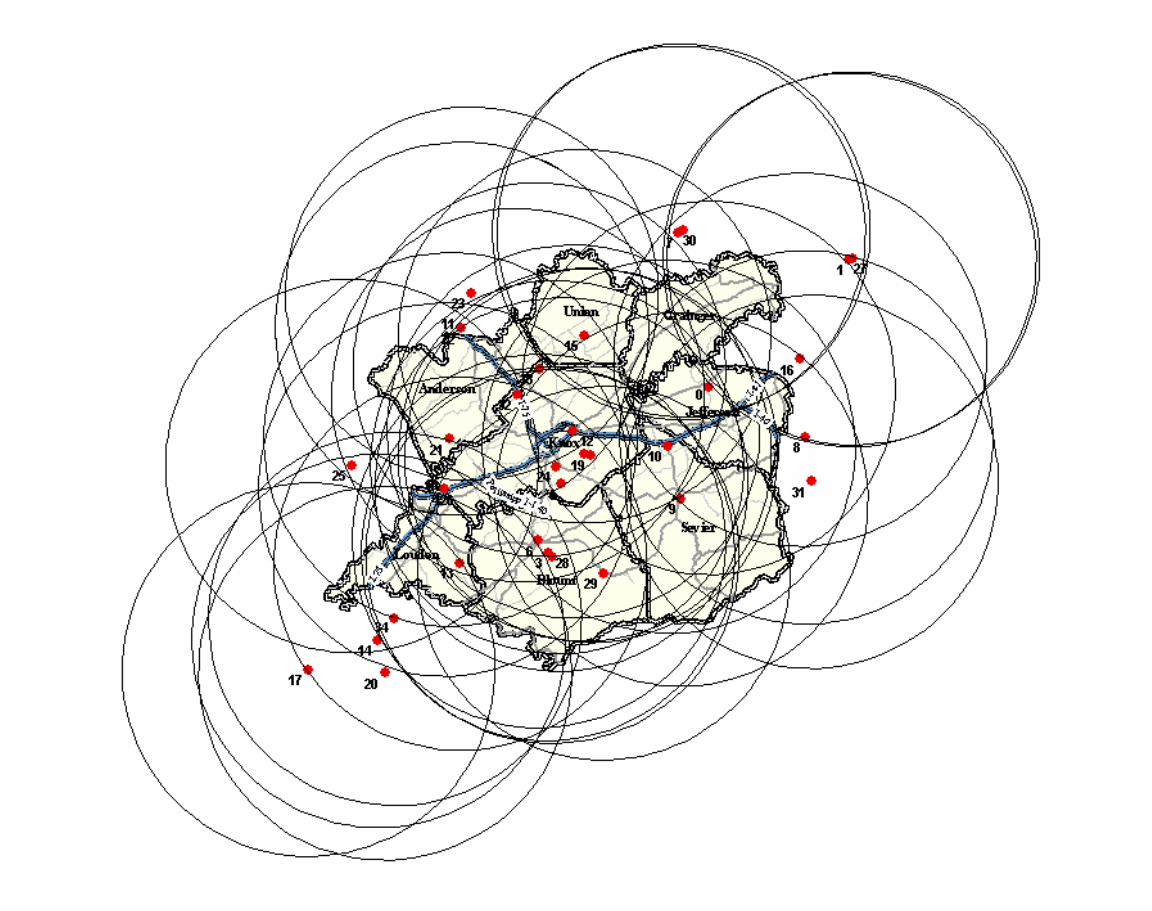
Franklin County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 2			
Franklin	Coffee, Grundy Marion, Moore	21 (4.20 plants/county in cluster)	12 (2.40 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

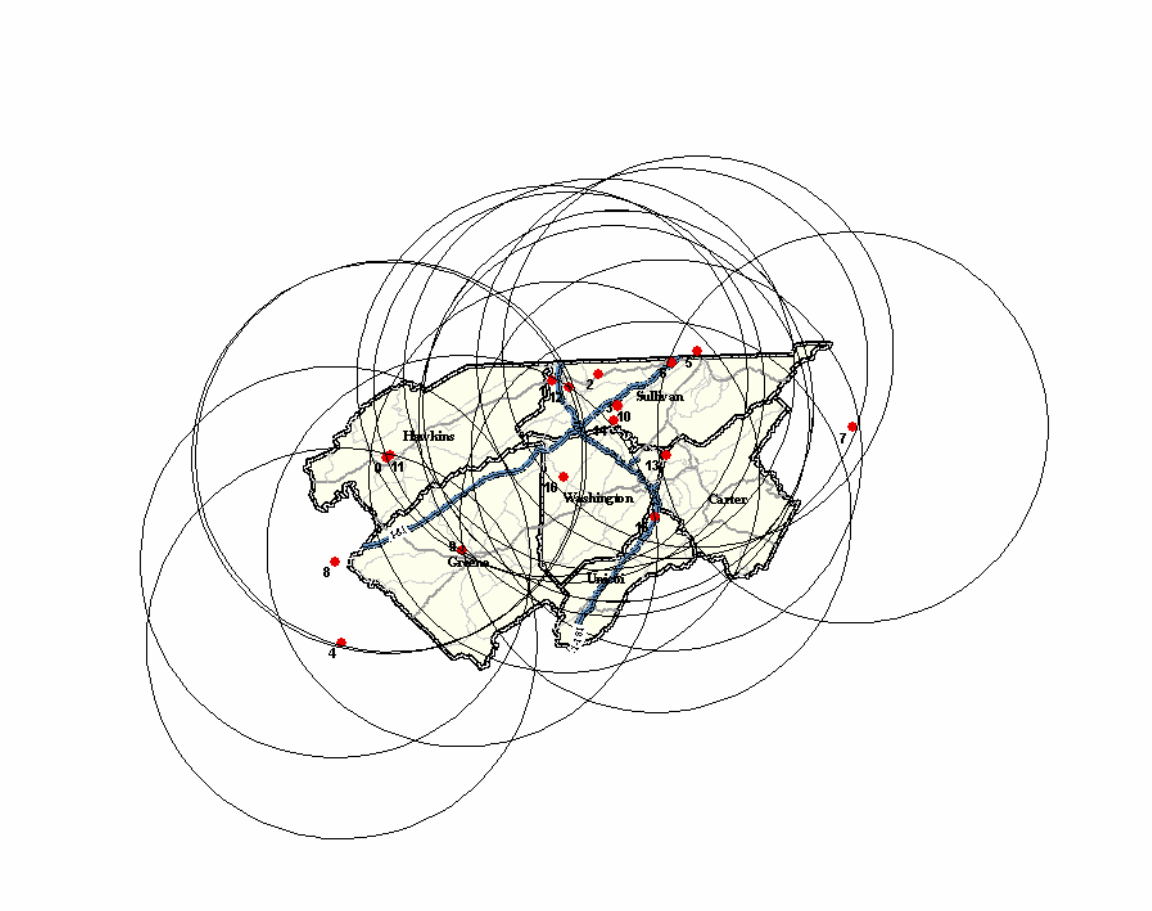
Knox County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 1			
Knox	Anderson, Blount, Grainger, Jefferson, Loudon, Sevier, Union	35 (4.38 plants/county in cluster)	10 (1.25 companies/county in cluster)

Appendix A
County Cluster Maps; Asphalt Plant Service Areas (30-Mile Radius)

Washington County Cluster



Primary County	Secondary Counties	Number of plants serving cluster	Number of companies represented
REGION 1			
Washington	Carter, Greene, Hawkins, Sullivan, Unicoi	16 (2.67 plants/county in cluster)	9 (1.50 companies/county in cluster)

Appendix B
Selected Counties' Annual Hot Mix/Paving Expenditures, 1999-2003

County	1999	2000	2001	2002	2003
Anderson	$497,363	$259,664	$319,296	$460,809	$391,746
Bedford	*	$156,963	$387,928	$187,365	$218,984
Benton	$490,436	$415,586	$508,083	$640,942	$289,349
Blount	$960,058	$687,803	$862,541	$1,631,766	$1,038,211
Carroll	$110,936	$169,670	$245,750	$353,200	$258,040
Carter	$400,775	$473,060	$849,115	$932,684	$458,528
Cheatham	*	$328,681	$441,493	$425,013	$383,887
Chester	$212,074	$148,583	$0	$228,367	$329,811
Coffee	$550,899	$693,239	$242,164	$0	$0
Crockett	$260,169	$409,802	$255,100	$481,062	$255,705
Cumberland	$336,615	$285,182	$1,117,916	$14,158	$782,772
DeKalb	*	$495,945	$350,913	$147,918	$661,067
Dickson	$1,345,738	$1,368,926	$2,891,592	$462,713	$546,294
Fentress	*	$211,269	$129,996	$359,979	$477,404
Franklin	*	$600,000	$358,063	$605,130	$446,740
Gibson	$533,357	$575,574	$752,981	$355,055	$955,713
Giles	$557,338	$560,141	$328,965	$370,567	$391,188
Grainger	$486,981	$399,285	$406,155	$371,357	$649,272
Greene	$834,381	$1,039,418	$1,766,557	$1,187,384	$1,096,253
Grundy	$216,905	$125,867	$253,925	$227,588	$248,537
Hardeman	$227,630	$264,000	$555,401	$203,759	$301,024
Hawkins	$688,732	$790,978	$1,507,195	$877,459	$513,497
Haywood	$266,624	$334,930	$548,328	$578,601	$229,108
Henderson	*	$95,101	*	*	$485, 286
Henry	$584,825	$856,265	$284,268	$514,184	$519,177
Hickman	*	$19,782	$2,678	$12,897	$25,463
Houston	$312,135	$392,102	$401,206	$363,492	$268,741
Humphreys	$434,873	$359, 291	$783,884	$457, 879	$321, 549
Jackson	$375,153	$227,457	$209,664	$254,611	$265,423
Jefferson	*	$216,653	$273,031	$164,638	$211,106
Knox	*	*	$3,999,298	$3,345,187	$3,259,947
Lincoln	$752,081	$1,030,754	$819,143	$791,712	$640,735
Loudon	$392,417	$423,998	$358,623	$920,029	$594,376
Madison	*	$199,419	No Info	$129,335	$233,213
Marion	$172,133	$185,209	$159,011	$158,058	$152,414
Marshall	$337,044	$299,388	$329,923	$338,816	$308,406
Maury	$119,429	$286,804	$140,784	$124,029	$66,695
Montgomery	$898,846	$1,023,220	$931,131	$1,160,778	$1,028,326
Moore	$295,660	$408,344	$236,452	$94,740	$195,944
Obion	$680,751	$778,401	$987,107	$378,038	$1,119,281
Overton	$241,968	$169,761	$208,115	$57,388	$418,670
Putnam	No Info	$1,299,816	$1,218,179	$1,423,595	$1,318,775
Rutherford	$2,346,922	$1,971,137	$2,082,502	$1,756,484	$1,983,927

Appendix B
Selected Counties' Annual Hot Mix/Paving Expenditures, 1999-2003

County	1999	2000	2001	2002	2003
Sevier	*	$1,656,628	$1,933,181	$2,234,311	$2,234,311
Smith	$378,428	$215,674	$244,713	$251,530	$141,152
Sullivan	$906,454	$733,402	$880,267	$977,944	$677,641
Unicoi	$185,224	$268,182	$286,462	$221,348	$247,627
Union	$283,388	$164,529	$157,324	$300,469	$254,809
Washington	No Info	$393,993	$403,097	$321,810	$344,466
Weakley	$100,925	$739,014	$741,426	$727,346	$530,176
White	$533,933	$584,569	$568,435	$599,313	$607,832
Williamson	$1,772,300	$2,477,745	$2,983,963	$2,461,810	$1,913,118
TOTAL	$21,081,901	$27,911,911	$36,703,324	$31,186,769	$30,484,880

Source: Information collected by the Comptroller of the Treasury, Division of County Audit.
* Information Not Available

State of Tennessee Comptroller of the Treasury
Office of Research
Research Project - House Joint Resolution 858
Procurement, Utilization and Production of Asphalt by Tennessee Counties

	Average Amount Rounded to Nearest $1,000	Typical Depreciable Life	Annual Depreciation
1. *Purchase of Property, Plant and Equipment*			
Acquisition of Land - *(Not Included in Depreciation)*	115,000	*Not applicable*	*Not applicable*
Depreciable Plant Related Costs Including: Drum, Burner, Silos, Baghouse, Conveyer, Control House, AC tank, Cold feeds, Hot Oil Heater, Etc… particular to each plant configuration	2,092,000	15	139,467
Depreciable Plant Setup Costs Including: Power connection, Permits, Footings, Wiring, Plumbing, Retaining Walls and Concrete Pad, Etc…	193,000	15	12,867
2. *Purchase of Auxiliary Equipment*			
Quality Control Lab	89,000	15	5,933
Generator	128,000	8	16,000
Anti-Strip System	18,000	15	1,200
Platform Scales	43,000	15	2,867
Loader	222,000	8	27,750
Dozer	193,000	8	24,125
Small Tractor/Loader	16,000	8	2,000
Dump Truck	83,000	8	10,375
Other - Water Truck and Miscellaneous	45,000	8	5,625
	837,000		95,875
3. *Total Mix Tonnage Produced During Recent 12 Month Period*	***173,000***		

Note: A private CPA firm prepared the cost model on the next three pages using cost information provided by three of its clients. **The Office of Research provides this model only as a guide**, as the numbers represented here might not apply to all areas of the state. Because the companies that provided this information wish to protect information they consider proprietary, analysts did not attempt to verify information presented. Anyone attempting to use this model should develop their own cost information.

4. ***Operating, Repair and Direct Overhead Costs for Same 12 Month Period in # 3 above***

Fixed Costs:

Operating including Electricity, Dryer fuel, Engineering, Oil and Lubricants, and Boiler operating costs	28,000
Operating Labor and Labor Burden	156,000
Other Operating Costs	20,000
Repair Costs including Labor and labor burden, Parts, Equipment, and Other	133,000
Direct Overhead Costs including Insurance, Telephone, Lab Supplies, Scale checks, Control House Supplies, and Other	38,000
Total Fixed Costs	375,000

Variable Costs Excluding Raw Materials:

Operating inlcuding Electricity, Dryer fuel, Engineering, Oil and Lubricants, and Boiler operating costs	412,000
Operating Labor and Labor Burden	67,000
Other Operating Costs	23,000
Repair Costs including Labor and labor burden, Parts, Equipment, and Other	130,000
Direct Overhead Costs including Insurance, Telephone, Lab Supplies, Scale checks, Control House Supplies, and Other	11,000
Total Variable Costs excluding Raw Materials	643,000

5. ***Raw Material Analysis - CW Mix Only***

	Per ton of CW Mix Percentage Attributable to	Typical Third Party Cost per Ton Excluding Freight & Sales Tax Low	Typical Third Party Cost per Ton Excluding Freight & Sales Tax High	Average Haul Distance Mile Assumption	Average Haul/Freight Cost per Ton Low	Average Haul/Freight Cost per Ton High	Average Loss from Stockpile & Moisture Loss Low	Average Loss from Stockpile & Moisture Loss High	Cost per ton of CW Mix Low	Cost per ton of CW Mix High
Aggregate:										
Crushed Gravel or Limestone	37.6%	$ 7.08	$ 8.10	50	$ 0.09	$ 0.15	4.0%	10.0%	4.53	6.45
Limestone	37.6%	$ 7.50	$ 8.10	50	$ 0.09	$ 0.15	4.0%	10.0%	4.69	6.45
Washed Sand	18.8%	$ 4.00	$ 7.80	50	$ 0.09	$ 0.15	4.0%	10.0%	1.66	3.16
	94.0%								10.88	16.07
Liquid Asphalt	6.0%	$ 175.00	$ 180.00	50	$ 0.18	$ 0.20	Not applicable	Not applicable	11.04	11.40

	Low	High
Average loss for stockpile & moisture loss in drying as a percent of the aggregate tonagge.	4.0%	10.0%
Aggregate Freight Costs Expressed in $ per Ton/Mile (Assuming 25 mile average)	$ 0.09	$ 0.15
Liquid Asphalt Freight Costs Expressed in $ per Ton/Mile (Assuming 25 mile average)	$ 0.18	$ 0.20
Typical Minimum Freight per Ton of Aggregate (Short hauls)	$ 0.50	$ 1.50
Typical Minimum Freight per Ton of Liquid Asphalt (Short	$ 5.00	$ 12.00

Total Raw Material Cost - Including Minimum Haul/Freight, Excluding Incremental Haul/Freight, Excluding Sales Tax	$ 21.92	$ 27.47
		24.70
		Average

6 ***Asphalt Sales to Counties***

	Average	Low	High
Of Companies Participating - 12 counties included - Total Tons Purchased During 12 Month Period	12,100	2,500	40,000

7. ***Summary Cost Per Ton of CW Mix***

		Total Tonnage Produced		Cost per Ton of CW Mix	
	Above Amount	Above Plant Average	County Average	Above Plant Average	County Average
Fixed Costs:					
Fixed Plant Costs - Depreciation	139,467	173,000	12,100	0.81	11.53
Fixed Plant Setup Costs - Depreciation	12,867	173,000	12,100	0.07	1.06
Fixed Auxiliary Equipment Costs - Depreciation	95,875	173,000	12,100	0.55	7.92
Fixed Operating, Repair & Direct Overhead Costs	375,000	173,000	12,100	2.17	30.99
Total Fixed Cost Per Ton of CW Mix				3.60	51.50
Variable Costs:					
Variable Operating, Repair & Direct Overhead Costs	643,000	173,000		3.72	3.72
Raw Material Costs per Ton of CW Mix - At Average Price Above				24.70	24.70
Total Cost per Ton of CW Mix Excluding Incremental Haul/Freight and Excluding Sales Tax				**32.02**	**79.92**

Appendix D
Asphalt Production Cost Models
Publicly Owned Plant

CW Mix Cost/ton (12-month period)	20,000 tons	50,000 tons	100,000 tons
Materials			
Aggregate @ $6.2578/ton mix*	$125,156	$312,890	$625,780
Freight ($.09-.15/ton/mile) - Assume 25-mile haul, $.12/ton/mile	$56,400	$141,000	$282,000
Stockpile costs @ $.25/ton	$4,700	$11,750	$23,500
Loss (5% stockpile & moisture)	$6,258	$15,645	$31,289
Total Aggregate + Freight	**$192,514**	**$481,285**	**$962,569**
State Sales & Use Tax	$8,761	$21,902	$43,805
Local Option	$3,442	$8,604	$17,209
Total Sales & Use Tax	**$12,203**	**$30,507**	**$61,014**
Liquid Asphalt			
6% @ $180/ton	$216,000	$540,000	$1,080,000
Freight (Assume 25-mile haul, $.12/ton/mile)	$3,600	$9,000	$18,000
Total AC + Freight	**$219,600**	**$549,000**	**$1,098,000**
State Sales & Use Tax	$15,120	$37,800	$75,600
Local Option	$5,940	$14,850	$29,700
Total Sales & Use Tax	**$21,060**	**$52,650**	**$105,300**
Anti-strip Additive			
0.3% ($.45/ton of mix)	$9,000	$22,500	$45,000
Freight (Assume 25-mile haul, $.12/ton/mile)	$180	$450	$900
Total Anti-Strip Additive + Freight	**$9,180**	**$22,950**	**$45,900**
State Sales & Use Tax	$630	$1,575	$3,150
Local Option	$248	$619	$1,238
Total Sales & Use Tax	**$878**	**$2,194**	**$4,388**
Total Materials Costs (No Sales Tax)	**$421,294**	**$1,053,235**	**$2,106,469**
Plant Operation			
Firing Cost			
2.5 gal #2 diesel/ton x $1.20/gal ($3.00/ton mix)	$56,400	$150,000	$300,000
1.77 gal #4 (waste oil) @ $1.35/gal ($2.39/ton)	$44,932	$112,330	$224,660
Anonymous Company 2003 Avg. fuel cost/ton ($.74/ton mix)	$14,800	$37,000	$74,000
Anonymous Company 2003 Avg. $1.08/ton mix	$21,600	$54,000	$108,000
Average	**$34,433**	**$88,333**	**$176,665**
Electricity/Generator			
Demand + Use, public utility ($.30/ton, avg. of 3 reported costs)	$6,000	$15,000	$30,000
Generator @ $216/day, (39 days @ 20,000 tons; 97.5 days at 50,000 tons; 195 days @ 100,000 tons)	$8,424	$21,060	$42,120
110V for control house, boiler, scales (public utility) Included in Demand + Use cost above			
Water (dust control) $2,307.11 annual avg. - 9 plants	$2,307	$2,307	$2,307
Avg. Electricity (public or generator) + Water	**$9,519**	**$20,337**	**$38,367**
Labor			
Combine Foreman/Plant Operator - $45,000/yr.	$45,000	$45,000	$45,000
Combine Feeder Man/Loader Operator - $30,000/yr.	$30,000	$30,000	$30,000
Maintenance man - $28,000/yr.	$28,000	$28,000	$28,000
Total Labor	**$103,000**	**$103,000**	**$103,000**
Boiler - Avg. 65 gal/day @ $1.20/gal x 274 days (9 mos.)	$21,372	$21,372	$21,372
Repairs/Maintenance - Assume $1/ton	$20,000	$50,000	$100,000

Note: Figures in this cost model are hypothetical, but based on actual costs reported by private company and publicly-owned hot mix asphalt plant officials in Tennessee. Analysts based the volumes of raw materials used in this model on the average composition of CW grade hot mix asphalt, commonly used to pave county roads in Tennessee. The Office of Research intends for this model to be used only as a guide with which local governments may estimate potential hot mix asphalt production costs from their region and potential production volumes.

*Each ton of CW grade hot mix asphalt contains approximately 46% crushed gravel or limestone @ $7.18/ton, 23% limestone @ $6.50/ton, and 25% washed sand @ $5.84/ton.

Appendix D
Asphalt Production Cost Models
Publicly Owned Plant

Auxiliary Equipment (operating)			
Front end loader - Avg. $45/hr. x 8hrs. X 195 days	$70,200	$70,200	$70,200
Dump truck - Avg. 1 hr./day @ $30/hr. x 195 days	$5,850	$5,850	$5,850
Dozer for stockpiling (Included in stockpiling cost)			
Small tractor/loader for cleanup under bins - $25/day x 195 days	$4,875	$4,875	$4,875
Total Auxiliary Equipment	**$80,925**	**$80,925**	**$80,925**
Purchase of plant and related equipment			
Plant/setup (used), depreciation/debt service ($1.5 million, 12-yr. G.O. bonds @ 4%) - $159,828.26/yr.	**$159,828**	**$159,828**	**$159,828**
Land (Assume they own land, industrial park)			
Anti-Strip System (Included above)			
Platform Scales (drum plant only) - Assume batch plant			
Loader - $200,000 (Included above)			
Dozer - $200,000 ((Included above))			
Small tractor/loader - $15,000 (Included above)			
Dump truck - $90,000 (Included above)			
Silo(s) - Assume not necessary in this scenario			
Direct Overhead			
Insurance			
Telephone			
Lab Supplies			
Electric Bill			
Scale Checks			
Control House Supplies			
Total $10,500/yr.	$10,500	$10,500	$10,500
Summary: CW Mix			
Material	$421,294	$1,053,235	$2,106,469
Firing	$34,433	$88,333	$176,665
Utilities (Electric + Water, average)	$9,519	$20,337	$38,367
Labor	$103,000	$103,000	$103,000
Boiler - Avg. 65 gal/day @ $1.20/gal x 274 days (9 mos.)	$21,372	$21,372	$21,372
Repairs/Maintenance	$20,000	$50,000	$100,000
Auxiliary Equipment	$80,925	$80,925	$80,925
Plant Purchase - Annual Debt Service on $1.5 million at 4%	$159,828	$159,828	$159,828
Direct Overhead	$10,500	$10,500	$10,500
Total Annual Cost, Not including Items Below	**$860,871**	**$1,587,529**	**$2,797,126**
Tax Loss if counties install			
State Sales & Use Tax	$24,511	$61,277	$122,555
Local Option Tax	$9,629	$24,073	$48,146
Total Sales & Use Tax	**$34,140**	**$85,351**	**$170,701**
Additional Tax if contractors install			
State Use Tax (add if installed by contractor)	$7,000	$17,500	$35,000
Local Option (add if installed by contrator)	$2,750	$6,875	$13,750
Additional S&U Tax if installed	**$9,750**	**$24,375**	**$48,750**
Other - Miscellaneous			
New plant site bedding loss in stockpiles (or paving)			
Original 110 power installation			
Telephone installation			
Construction permit			
Outside pollution stack emission test ($5,000)			
Benefits for employees, what they do when not making asphalt			
Road Supt. & others dealing w/plant			
Environmental permits (air & water)			
Total tons CW Mix	20,000	50,000	100,000
Cost/ton	$43.04	$31.75	$27.97

Appendix E
Potential Sales and Use Tax and Local Option Sales Tax Losses
(Based on volumes produced by publicly-owned plants and therefore not purchased from the private sector)

Potential Sales & Use Tax Losses (Annual)	**20,000 tons**	**50,000 tons**	**100,000 tons**
Aggregate @ $6.2578/ton mix*	$125,156	$312,890	$625,780
State Sales & Use Tax (7%)	$8,761	$21,902	$43,805
Local Option (at max. 2.75% rate)	$3,442	$8,604	$17,209
Total Sales & Use Tax (Aggregate)	**$12,203**	**$30,507**	**$61,014**
Liquid Asphalt			
6% of mix @ $180/ton	$216,000	$540,000	$1,080,000
State Sales & Use Tax (7%)	$15,120	$37,800	$75,600
Local Option (at max. 2.75% rate)	$5,940	$14,850	$29,700
Total Sales & Use Tax (liquid AC)	**$21,060**	**$52,650**	**$105,300**
Anti-strip Additive			
0.3% of mix @ $.45/ton	$9,000	$22,500	$45,000
State Sales & Use Tax (7%)	$630	$1,575	$3,150
Local Option (at max. 2.75% rate)	$248	$619	$1,238
Total Sales & Use Tax (additive)	**$878**	**$2,194**	**$4,388**
Tax Loss if counties install (Materials Only)			
State Sales & Use Tax Loss	$24,511	$61,277	$122,555
Local Option Tax Loss	$9,629	$24,073	$48,146
Total Sales & Use Tax Loss	**$34,140**	**$85,351**	**$170,701**
Additional Tax Loss if contractors install (Cost of materials + $5/ton)**			
State Use Tax (add if installed by contractor)	$7,000	$17,500	$35,000
Local Option (if installed by contractor)	$2,750	$6,875	$13,750
Additional S&U Tax Loss if installed	**$9,750**	**$24,375**	**$48,750**

Note: For this model, analysts used the volumes, raw materials cost estimates, and mix type used in the public plant cost model in Appendix D. It is not intended to represent actual tax revenue losses, but to offer a tool for analyzing potential tax revenue losses in counties that might wish to make their own hot mix asphalt. Counties considering entering the asphalt business should develop their own projections using actual estimates of production volume, actual costs of locally available materials, and whether the county has traditionally installed

*Each ton of CW grade hot mix asphalt contains approximately 46% crushed gravel or limestone @ $7.18/ton, 23% limestone @ $6.50/ton, and 25% washed sand @ $5.84/ton.

**According to the Department of Revenue's "Sales and Use Tax Guide," Use Tax is figured at fair market value of $5.00/ton, plus materials (tax on materials is calculated above), so Use Tax losses if a county normally has a contractor install would include tax on $5.00/ton of finished product in addition to S&U Tax on materials.

Appendix F
Number of Bids received by 50 counties from FY1999 through FY2003

	Year, Number of Bids Received				
County	**1999**	**2000**	**2001**	**2002**	**2003**
Anderson	5	5	4	7	5
Bedford	*	1	3	3	3
Benton	1	2	1	1	2
Blount	2	2	2	2	3
Carroll	4	3	2	3	2
Carter	1	1	1	1	1
Cheatham	*	2	3	3	4
Chester	5	5	**	7	5
Coffee	2	1	1	1	***
Crockett	3	3	3	2	2
Cumberland	2	2	2	2	2
DeKalb	*	1	1	1	3
Dickson	1	1	1	1	1
Fentress	*	1	1	1	1
Franklin	*	1	2	2	1
Gibson	2	2	2	1	1
Giles	2	2	2	2	2
Grainger	3	4	4	4	7
Greene	2	2	2	1	1
Grundy	1	3	2	2	1
Hardeman	2	2	3	4	1
Hawkins	2	2	2	2	2
Haywood	2	3	3	3	2
Henderson	3	3	*	*	3
Henry	2	2	1	1	1
Hickman	1	1	1	1	1
Houston	4	4	3	4	4
Humphreys	1	1	2	2	1
Jackson	2	3	5	2	2
Jefferson					
Lincoln	1	1	1	1	1
Loudon	2	3	4	4	4
Madison	*	2	*	2	2
Marion	5	4	4	4	3
Marshall	3	2	3	2	2
Maury	2	2	2	2	2
Montgomery	4	4	4	3	3
Moore	1	1	1	1	1
Obion	1	2	2	1	2
Overton	2	*	2	2	*
Putnam	2	2	3	2	2
Rutherford	2	1	1	3	1

Appendix F
Number of Bids received by 50 counties from FY1999 through FY2003

	Year, Number of Bids Received				
County	**1999**	**2000**	**2001**	**2002**	**2003**
Sevier	*	2	2	2	2
Smith	*	2	4	*	2
Sullivan	3	4	5	6	2
Unicoi	2	2	1	1	1
Union	1	1	1	1	1
Washington					
Weakley	2	2	2	2	2
White	1	2	1	2	1
Williamson	3	2	4	4	4

Source: Information collected by the Comptroller of the Treasury, Division of County Audit.
Note: Jefferson and Washington Counties own asphalt plants and produce their own asphalt.
* No information available.
** No hot mix purchased.
*** County extended the contract for 1 year and therefore did not need to solicit bids.

Appendix G
Persons Contacted

Art Alexander, CGFM**,** Director of County Audit, and Greg Worley, CPA, CGFM Audit Review Manager, Division of County Audit, Office of the Comptroller of the Treasury

Kevin Blalock, Charles Blalock & Sons, Inc.

Dr. Robert Bohm, Chairman, Department of Economics; and Dr. Glen Schuler, Visiting Lecturer, Department of Economics, UT Knoxville

David Bowling, Director of Local Finance, Office of the Comptroller of the Treasury

Ann Butterworth, Assistant to the Comptroller for Public Finance, Office of the Comptroller of the Treasury

J. Rodney Carmical, Executive Director, Tennessee County Highway Officials Association

Don Chambers, Glen Chambers, LOJAC

Billy Chandler, Executive Vice President, Summers-Taylor, Inc.

Laurie Chaudoin, Assistant General Counsel, Russell Oldfield, Vice President, General Counsel and Secretary, and Richard A. Warden, Consultant, Rogers Group, Inc.

Mary-Margaret Collier**,** Director of Bond Finance, Office of the Comptroller of the Treasury

Jerry R. Collins, Director, Herman R. Adair, Deputy Director of Maintenance, and Larry J. Cooper, Administrator of Street Maintenance, City of Memphis, Division of Public Works

Robert Davidson, Certified Public Accountant, Davidson, Golden, & Lundy, P.C.

John B. Deakins, Jr., Highway Superintendent, and Edward Canter, Plant Manager, Washington County Highway Department

Vic Domen, Tennessee Office of the Attorney General and Reporter

Mike Eubank, Sr., President and Michael Eubank, Jr., Eubank Asphalt Paving and Sealing

John Ford, President, Ford Construction Company

Tony Groce, Owner, Lincoln Paving

Joe Guyton, President, Duracap Asphalt Paving

Appendix G
Persons Contacted

David Hunt, Standard Construction Company

Bill Hyder and Gary Hyder, Owners, Construction Asphalt Paving Services

William Krickbaum, Owner, Lyons Construction Co., Inc., Tri-Cities Concrete Company, and Tri-County Materials

Jack Lambert, Vulcan Materials Company

Annette Lane, B & M Paving Co.

John R. LeSueur, Jr., Commissioner of Highways, and James S. Montgomery, Surveyor, Sullivan County Highway Department

Marcus R. McKerley, Certified Public Accountant, Crowe Chizek and Company LLC

Rick C. Moore, Jr., President, Lehman Roberts Co.

Mark Odom- Vice President, Highways Incorporated

Richard Patty, Owner, Patty Construction, Greenback Asphalt Co.

Mann Pendelton, Chief Manager, HMA Contractors, LLC

Jack Priest, Regional Sales Manager, Astec, Inc.

Donald L. Reid, Paving Manager, Metropolitan Government of Nashville and Davidson County, Department of Public Works Engineering Division

Bill Ratliff Jr., President, Phil Brown, Vice-President, and Timothy M. Webb, Controller, Tennessee Asphalt Company

Steve Redmon, Owner, Redmon Asphalt Inc.

Wiley Roark, Vice President, Maymead

Charles Tipton, Highway Superintendent, Jefferson County Highway Department

Michael R. Shinn, former Chief of Administration, and David C. Donoho, Director of Construction, Tennessee Department of Transportation

Kent D. Starwalt, Executive Vice President, Tennessee Road Builders Association

Tommy Wright, Owner, Wright Paving

Appendix H
House Joint Resolution 858 (2004)

Filed for intro on 02/12/2004

HOUSE JOINT RESOLUTION 858
By Head

A RESOLUTION requesting the Comptroller of the Treasury to conduct a study relative to the procurement, utilization and production of asphalt by Tennessee counties.

WHEREAS, the need for governments to use scarce public resources efficiently and effectively has never been greater and competitive bidding is a critical tool in public procurement activities; and

WHEREAS, in a recent survey of its membership, the Tennessee County Highway Officials Association revealed that despite advertising for competitive bids for asphalt products and materials, many counties receive only one (1) response; and

WHEREAS, the survey also revealed wide disparities in the counties' cost of buying asphalt from county to county and region to region across the state; and

WHEREAS, prior to considering potential legislative remedies to these issues the General Assembly should fully understand circumstances that contribute to variations in the level of participation in competitive bids for asphalt, the economics of asphalt production and transportation, the pros and cons of allowing counties to establish their own asphalt production capacity, and the possible impact on state and local tax collections that could result from such production; now, therefore,

BE IT RESOLVED BY THE HOUSE OF REPRESENTATIVES OF THE ONE HUNDRED THIRD GENERAL ASSEMBLY OF THE STATE OF TENNESSEE, THE SENATE CONCURRING, that the Comptroller of the Treasury is requested to conduct a study of the process by which counties procure asphalt, the effectiveness of current procurement methods, the economics of asphalt production including issues of production cost, transportation costs, and economies of scale in asphalt production, reasons for variations in asphalt costs from place to place, the implications of allowing counties to singly and/or jointly develop asphalt production capabilities and any other related matters that may come to the attention of the Comptroller during the course of the study, including recommendations for legislative action, if any.

BE IT FURTHER RESOLVED, that the General Assembly requests that all state transportation officials, all local government officials and employees, and all contractors selling asphalt to governments in Tennessee cooperate to the fullest extent with the Comptroller in this study, and to that end the Comptroller is requested to include within the results and findings of the study the degree to which such cooperation was forthcoming. It is the legislative intent that such study be concluded and its results and findings published no later than February 1, 2005.

BE IT FURTHER RESOLVED, that an enrolled copy of this resolution be transmitted to the Comptroller of the Treasury.

Offices of Research and Education Accountability Staff*

Director
◆Ethel Detch

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◆Douglas Wright

Assistant Director (Education Accountability)
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Corey Chatis
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Kevin Krushenski
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Russell Moore
Sonya Phillips

Executive Secretary
◆Sherrill Murrell

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*Former staff member Brian Doss also contributed to this project.