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# Research Report

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## **The Initial Price Impact of Closing the Production of Crushed Rock in the Lake Belt Region of Miami–Dade County**

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Florida is the third leading state in the nation, trailing only Texas and Pennsylvania, in the production of crushed stone according to the United States Geological Survey (USGS). In terms of limestone production, Florida trails only Texas.

Crushed Rock and limestone are vital materials in the production of a wide variety of products, which in turn, have numerous uses by consumers, businesses and governments. These include residential, commercial and public construction; transportation infrastructure and especially highways and roads; and agricultural uses. Virtually every resident, business, and governmental entity in Florida has a need for the products derived from crushed rock and limestone. Moreover, Florida's robust economic and population growth in recent years have undoubtedly contributed to sizable growth in the public's demand for the many products derived from crushed rock and limestone.

The North Carolina Geological Survey estimated that about 10 tons of aggregates are required annually for each citizen; that a residential subdivision home requires 300 tons of aggregate per home and one mile of typical 2-lane asphalt road with an aggregate base requires about 25,000 tons.<sup>1</sup>

In 2004, the latest year for which data are available, Florida production accounted for almost 7.00 percent of the national production of 1.59 billion metric tons of crushed stone and an equivalent 7.00 percent of the \$9.59 billion national value of this product.

Owing to its unique geography roughly 56 percent of the state's entire production of crushed rock and limestone comes from what is known as the 'Lake Belt' region in Miami – Dade County.<sup>2</sup> The 'Lake Belt' is located in the sparsely populated western part

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<sup>1</sup> North Carolina Geological Survey web site:  
<http://www.geology.enr.state.nc.us/NAE%20aggregates%20Internet%20NRC%20with%20USGS%20sheet/Aggregate%20overview%20new.htm>. Accessed on June 7, 2006.

<sup>2</sup> United States Geological Survey. *Minerals Yearbook 2004. The Minerals Industry of Florida*. Table 4b, "Florida: Crushed Stone Sold or Used by Producers in 2004, By Use and District."  
<http://minerals.usgs.gov/minerals/pubs/state/fl.html>. Accessed on June 5, 2006.

of Miami – Dade County and extends throughout almost the complete length of the county.

On March 22, 2006, the United States District Court for the Southern District of Florida ruled that several mining permits for the Lake Belt area in South Florida had been improperly issued. The ruling affects most of the 12 mining permits issued for this area. The Court remanded the permitting process to the U.S. Army Corps of Engineers for further review and consideration. It is not known whether mining will be interrupted pending the Army Corps of Engineers' reconsideration of the permits or whether the permits will be reissued to mining companies holding permits in the Lake Belt area.

This analysis looks at the impact of a complete shutdown of the mining region. Clearly, if a smaller portion of the region's mining operations are impacted by future rulings, the resulting economic impact would be reduced accordingly.

The risk that more than one-half of the state's production of crushed rock and limestone could be halted poses a serious threat to the entire Florida economy. A supply shock and disruption of such a large magnitude to such an important industry and product would be unprecedented –at least in Florida's recent economic history. The initial effects might be comparable to the 1973 – 1975 oil embargoes, which contributed to sharp spikes in the prices of many goods and services and severe national and statewide economic recessions. However, the oil embargoes were an external shock beyond the control of Florida as opposed to the current situation, which has all the earmarks of a 'home grown' shock. And, while crushed rock and limestone are not nearly as visible as gasoline to the typical Floridian, the initial price impacts and resulting increases in costs for a large number of goods and services – ranging from housing costs to foodstuffs – could be substantial.

Our purpose here is to provide a credible estimate, based on accurate data and sound economic principles, of the potential initial escalation in the price of crushed rock and limestone should some 56 percent of statewide production be halted. This initial price increase estimate can then be used to determine the cost increases for a broader range of goods where crushed rock and limestone are significant inputs.

## Methodology

A rather straightforward and widely used method of estimating the initial price effect of a supply disruption is given by the following formula:<sup>3</sup>

$$\text{Percent Change in Price} = - \frac{\text{Percentage Change in Supply}}{E_S + E_D}$$

Where:

$E_S$  represents the price elasticity of supply, a measure of the sensitivity or responsiveness of the amount produced of a good to changes in the price sellers receive; and,

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<sup>3</sup> This formula can be found in most basic economics texts. See, for example, A.O. Sullivan and S.M. Sheffrin, *Microeconomics: Principles and Tools*, 4<sup>th</sup> edition. Pearson – Prentice Hall, 2005, pp. 112-115.

$E_D$  represents the price elasticity of demand, a measure of the sensitivity or responsiveness of the amount purchased of a good to changes in the price buyers pay.<sup>4</sup>

In terms of the data requirements for the above formula, as noted previously the disruption to supply, that is the percentage change in supply, is expected to be on the order of a 56 percent decline.

Information and data from the USGS, summarized in Table 1, allows us to estimate the price elasticity of supply in Florida and the United States. For Florida the estimated supply elasticity ranges from 0.69 to 0.73, depending on the estimation procedure.<sup>5</sup> Nationally, the estimated elasticity of supply is significantly lower, ranging from 0.20 to 0.29.<sup>6</sup> For both Florida and the U.S. the elasticity of supply is numerically less than one, indicating that the supply of crushed stone is price inelastic - at least in the near term. A price inelastic supply is one where changes in production levels are quite insensitive to variations in prices. This low price elasticity of supply may reflect the increasing scarcity of suitable land for crushed stone mining and processing, the high fixed cost nature of the business, and capacity constraints faced by producers.

USGS data also permit us to estimate the price elasticity of demand for crushed stone. However, unlike production, data on crushed stone consumption are only available for the United States and only through 2002. For these reasons only the arc method of estimating a price elasticity of demand is employed. The estimated price elasticity of demand for crushed stone is -.20. This indicates a price inelastic demand, at least in the near term, where the amount of crushed stone purchased is not very sensitive to changes in price. The price inelastic demand likely reflects the absence of good substitutes for crushed stone from the buyer's perspective.

## Price Impact

With the above information we can substitute the relevant values into the formula to obtain an initial estimate of the price impact on crushed stone of closing the Lake Belt region. Two price impact estimates are provided: the first uses the (average) of the national price elasticity of supply; the second employs the (average) of the Florida price elasticity of supply.

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<sup>4</sup> The formula for price elasticity of supply (demand) is  $(\Delta Q/\Delta P) \times (P_0/Q_0)$  where  $Q_0$  is the base period quantity produced – sold;  $P_0$  is the base period price per unit received; and  $\Delta Q$  and  $\Delta P$  are the respective changes in the quantity produced and price received from the base period for the case of price elasticity of supply. In the case of price elasticity of demand  $Q_0$  is the base period quantity consumed – purchased;  $P_0$  is the price per unit paid; and  $\Delta Q$  and  $\Delta P$  are the respective changes in the quantity consumed and price paid from the base period. Ideally, statistical techniques should be employed to estimate supply and demand functions for crushed stone, and the respective elasticity and price impacts derived from these functions. Data and time limitations, however, make this infeasible.

<sup>5</sup> Elasticity's were estimated using both the midpoint and arc methods.

<sup>6</sup> There are several possible reasons why the price elasticity of supply in Florida is higher than in the United States. One cause may be that the typical Florida mine is more productive than the typical U.S. mine; that is per unit and incremental costs may be lower for Florida mines than for mines in the rest of the country.

$$\text{Percent Change in Price} = - \frac{-.56}{.25 + .20}$$

*Percent Change in Price = 1.244, or 124%.*

$$\text{Percent Change in Price} = - \frac{-.56}{.71 + .20}$$

*Percent Change in Price = .615, or 61.50%.*

Thus, closing the Lake Belt mining region and reducing the supply of crushed rock could cause the price to increase by approximately 61.50 percent to 124 percent. In 2004, USGS data showed the average price per metric ton for crushed rock in Florida was about \$6.43. If some 56 percent of supply was disrupted then the price per metric ton could increase to between \$10.38 and \$14.40. Using the quantities estimated as needed for construction by the North Carolina Geological Survey cited earlier, the price increase, if completely passed through, could add between \$1,185 to \$2,391 to the construction cost of an average house and \$98,750 to \$199,250 to the cost of a mile of a 2-lane asphalt road with an aggregate base. Clearly, these are substantial price hikes for a commodity, which indirectly and directly is widely used by households, businesses and the public sectors in Florida.<sup>7</sup>

**Table I**

**Annual Production and Prices for Crushed Stone in Florida, 2000 – 2004**

<u>Year</u>	<u>Production</u> (million of metric tons)	<u>Value</u> (millions of \$)	<u>Price per Ton</u>
2000	93.0	\$495	\$5.32
2001	95.1	\$515	\$5.41
2002	97.7	\$573	\$5.86
2003	97.1	\$587	\$6.04
2004	105.0	\$675	\$6.43

Source: United States Geological Survey. *The Minerals Yearbook, 2002 and 2004 editions.* "The Minerals Industry of Florida." Table 1, Non Fuel Raw Mineral Production in Florida. <http://minerals.usgs.gov/minerals/pubs/state/fl.html>, Accessed June 4, 2006

<sup>7</sup> As noted previously, if a smaller portion of the region's mining operations are impacted by future rulings, the resulting economic impact would be reduced accordingly.

**Table II**  
**Annual Production and Prices for Crushed Stone in the United States, 2000 – 2004**

<b><u>Year</u></b>	<b><u>Production</u></b> <b>(billions of metric tons)</b>	<b><u>Value</u></b> <b>(billions of \$)</b>	<b><u>Price per Ton</u></b>
2000	1.55	\$8.29	\$5.35
2001	1.59	\$8.87	\$5.58
2002	1.51	\$8.65	\$5.73
2003	1.53	\$9.06	\$5.92
2004	1.59	\$9.59	\$6.03

Source: United States Geological Survey. Valentin V. Tepordei, “Stone, Crushed 2004.” Table 1, Salient Crushed Stone Statistics.  
[http://minerals.usgs.gov/minerals/pubs/stone\\_crushed](http://minerals.usgs.gov/minerals/pubs/stone_crushed). Accessed on June 5, 2006.

**Table III**  
**Annual Apparent Consumption and Prices for Crushed Stone in the United States, 1999 – 2002**

<b><u>Year</u></b>	<b><u>Apparent Consumption</u></b> <b>(billions of metric tons)</b>	<b><u>Value</u></b> <b>(billions of \$)</b>	<b><u>Price per Unit</u></b>
1999	1.550	\$8.29	\$5.35
2000	1.569	\$8.41	\$5.36
2001	1.600	\$8.91	\$5.57
2002	1.530	\$8.74	\$5.71

Source: United States Geological Survey. Carl A. DiFrancesco and Valentin V. Tepordei, “Stone (Crushed) Statistics.” February 9, 2004.  
[http://minerals.usgs.gov/ds/2005/140/stone\\_crushed.pdf](http://minerals.usgs.gov/ds/2005/140/stone_crushed.pdf). Accessed on June 6, 2006

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Florida TaxWatch's research recommends productivity enhancements and explains the statewide impact of economic and tax and spend policies and practices on citizens and businesses. Florida TaxWatch has worked diligently and effectively to help state government shape responsible fiscal and public policy that adds value and benefit to taxpayers.

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Florida TaxWatch has a historical understanding of state government, public policy issues, and the battles fought in the past necessary to structure effective solutions for today and the future. It is the only statewide organization devoted entirely to Florida taxing and spending issues. Its research and recommendations are reported on regularly by the statewide news media.

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