



P O L I C Y R E P O R T

Charlotte's LYNX Line: A Preliminary Assessment

DAVID T. HARTGEN, PH.D., P.E.
SEPTEMBER 2008

Charlotte's LYNX Line: A Preliminary Assessment

DAVID T. HARTGEN, PH.D., P.E.
September, 2008

3	Introduction and Method
4	I. Ridership
4	What is the 'big picture' of Charlotte commuting?
4	How is LYNX ridership doing?
5	Who is using LYNX?
7	Has LYNX convinced auto drivers to switch to transit?
7	What about gasoline prices?
8	How does LYNX ridership compare with forecasts?
9	II. Costs
9	How much did LYNX cost to build?
10	What is LYNX costing to operate?
11	What are LYNX's total costs?
12	How much is LYNX's cost per trip and subsidy per trip?
12	III. Impacts
12	Has LYNX affected traffic congestion?
13	Has LYNX reduced commuting travel?
13	Has LYNX reduced air pollution?
14	Has LYNX affected real estate development?
18	Has LYNX affected residential development?
20	IV. Benefit-Cost Assessment
20	How are transportation benefits and costs determined?
22	What are the benefits and costs of the LYNX line?
24	Acknowledgments
24	About the Author

Executive Summary

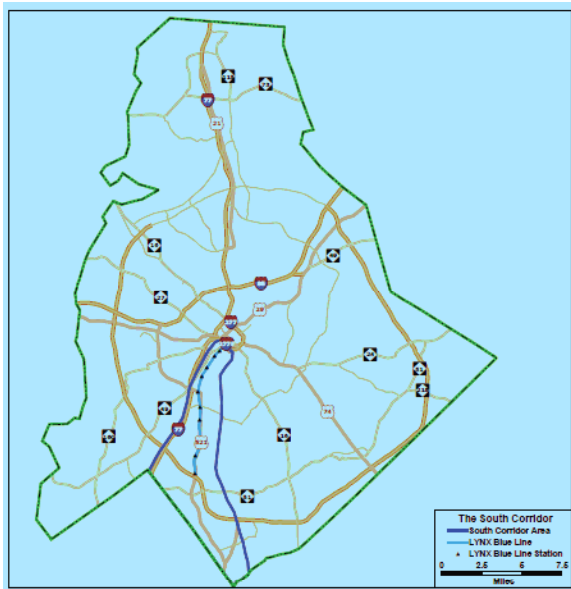


(LYNX trains at I485/South Boulevard Station)

- Final LYNX construction costs are about \$521.9 million, about 130 percent above the initial estimate (\$227 million)
- LYNX operating costs are about \$9.22 million/year, but data are incomplete and likely to be low. Revenues are averaging about 31 percent of operating costs. The 'average' fare (including discount fares, transfers, and on-fare rides) is about \$0.58.
- Average weekday ridership initially reached 12,457 (Dec. 2007), about 37 percent higher than the official forecast. However, the initial forecast did not consider present gasoline prices, which if included would have produced a higher estimate of initial ridership.
- Since December 2007 ridership is up about 23% (Dec. 2007-July 2008), but CATS (bus) ridership has risen slightly faster, 24%. LYNX ridership is about 19 percent of total CATS traffic.
- About 1/3 of the rise in LYNX ridership is based on better transit service, and about 2/3 from continuing increasing gas prices, regional growth and economic circumstances.
- About 64 percent of trips, but 74 percent of ticket sales, are for 1-way or round-trip adult tickets, suggesting continuing 'trial' occasional use.
- About 1/2 of the LYNX ridership is shifted from buses, about 1/4 is diverted from cars, 1/4 is from walk, drop-off, etc.
- About 19% of the auto driver traffic diverted to LYNX, totaling about 838 weekday trips, is from vehicles with South Carolina tags.
- LYNX's cost/trip is about \$6.90, of which 91% is subsidized. In other words, taxpayers are paying \$6.30 per LYNX trip, or about 91 percent of the cost, and the LYNX rider is paying about \$0.60, or about 9 percent of the cost.
- LYNX has diverted about 0.079 percent of regional travel, but about 4 percent of peak-hour travel in the corridor.
- Street traffic volumes, although incomplete, show trends that counter the conclusion that LYNX has visibly affected auto traffic in the corridor.
- Impacts on congestion are too small to be seen in street traffic, but are computed to be about 1/2 minute in travel-time savings for corridor drivers remaining on the street system.
- LYNX's impact on air quality is about 0.05-0.09 percent of regional emissions, too small to be observable.
- The South Boulevard corridor's incremental growth of commercial development, beyond background growth, is about \$50.6 million over 20 years. Its incremental growth of residential development, beyond background growth, is about \$198.8 million over 20 years. These estimates, based on observed construction between 2005 and 2007 and the economic value of commercial and residential space, are much lower than the \$1.86 billion estimate based on "announcements."
- Benefit-cost analysis shows total costs at \$706.4 million, compared with quantifiable benefits of \$480.2 million, yielding a benefit-cost ratio of 0.68. If just the local costs (\$400.4 million) are considered, the benefit-cost ratio is about 1.20. This means that if the local governments had to pay the full cost of the project, they could not justify it on benefit-cost grounds.

Introduction and Method

After nearly a decade of planning and construction, Charlotte's light rail line, termed LYNX, opened on November 27, 2007. The 9.6-mile, 15-station line is located along South Boulevard and serves the South Corridor (one of five potential 'rapid transit' corridors identified by city officials) from the central business district to Carolina Place Mall, near Interstate 485 (**Map 1**). Since its opening numerous articles and observations have appeared, noting the basic statistics of the line – its ridership, parking lot use, costs of construction, and potential development impacts. But no comprehensive assessment of the



Map 1. Mecklenburg County and the South Boulevard Transit Corridor.

line's performance, the source of its ridership, or its impact has yet been prepared.

This assessment is intended as a preliminary straightforward overview of LYNX's performance, based on about eight months of operation. While not

lengthy, this time period is viewed as long enough to discern most of the impacts, at least in preliminary form. The assessment is based on the information presently available (generally through July 2008, with some August 2008 statistics). It uses methods common in transportation performance assessment. We hope that this assessment will provide benchmarks and factual information against which later comparisons can be made. In the years ahead these impacts will come into focus more clearly, and the findings can then be updated appropriately.

The methods used to prepare this report are straightforward. Largely, they are based on factual information provided from published reports, CATS, and other agencies, on-site observations, and summaries of real estate databases or Web sites. Data are then summarized into straightforward spreadsheets and tables or charts. Where external statistics are required, for instance air pollution emission rates, they are drawn from national sources. The primary sources of all information are listed. Individuals interested in viewing the supporting spreadsheets behind the report are invited to contact the authors.



(LYNX train outbound, near I485/South Boulevard Station)

I. Ridership

What is the 'big picture' of commuting in Charlotte?

- The Charlotte urbanized area has a population of 824,000 and about 425,000 resident workers¹; another 100,000+ workers enter Mecklenburg County daily from surrounding counties. The total regional travel (for a slightly larger area) is about 20 million vehicle-miles daily².
- The following table summarizes the commuting profile for Charlotte urbanized area resident workers. About 2.6 percent of the urbanized area commuters, about 11,092, use public transportation as their primary commuting mode. But almost twice as many, 17,232, work at home.
- The same source also shows that:

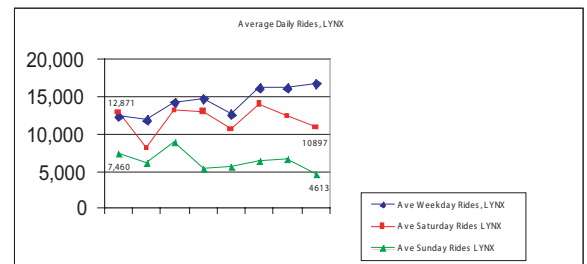
Charlotte Urbanized Area Commuting, 2005

Mode to Work	Number of Workers	Percent
Drive Alone	333,744	78.6
Carpool	51,626	12.2
Public Transportation	11,092	2.6
Walk	5,413	1.3
Bike	5,705	0.2
Taxi/Motorcycle/Other		1.2
Work at home	17,232	4.1
Total, Workers 16+	424,812	100

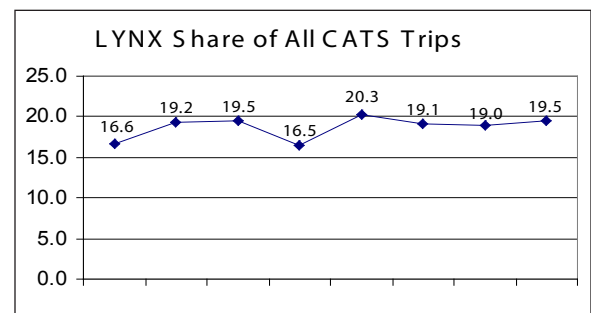
- Just 2.9 percent of all commuters have no vehicle available.
- The average travel time to work is 24.9 minutes, but transit commuters average 41.6 minutes, compared to 23.7 minutes for auto drivers and 29.2 minutes for carpoolers.
- 64% of transit commuters are African American, 9.5% are Latino.
- 75% of transit commuters earn less than \$25,000.
- These findings generally mirror those of on-board surveys of CATS riders³ (62% African American, 8% Hispanic, 46% income under \$20,000). This data, however, does NOT contain information for LYNX riders, for which an on-board survey has not yet been released.

How is LYNX ridership doing?

- In the first full month of operation (December 2007), LYNX weekday ridership⁴ averaged 12,457 unlinked trips⁵, about 37% above the 'official' forecast. But the prior estimates were prepared six years ago and do not include the recent run-up in gasoline prices, which encourages more traffic. If redone with current gasoline prices, ridership estimates would be somewhat higher⁶.
- Since December 2007, LYNX average weekday ridership has risen from 12,457 to about 16,895⁷, about 35 percent.

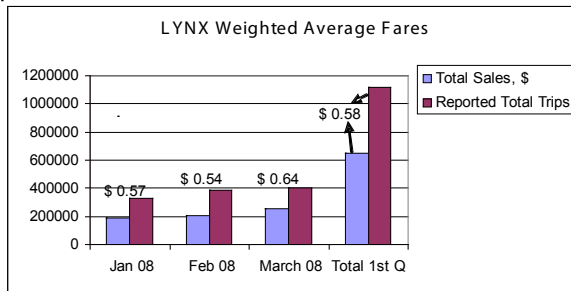


- However, as a share of traffic, LYNX's share has hovered between 16.5 and 20.3 percent, and has averaged about 19 percent of all CATS ridership. This share has not significantly increased since December 2007, and seems to be leveling off.



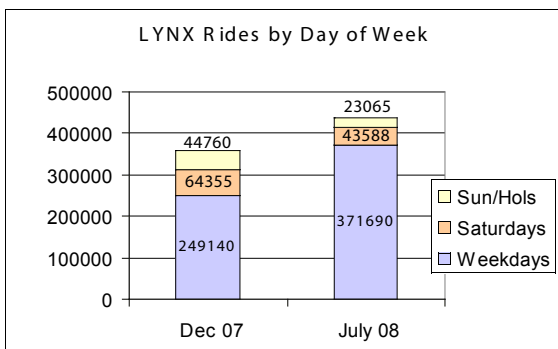
- Further, Saturday-Sunday-Holiday traffic appears to have softened somewhat. In the initial full month of service (December 2007), about 30 percent of the total LYNX ridership was Saturday/Sunday/Holiday traffic. However by July 2008 this portion had fallen to 15 percent. By July

2008 average Sunday ridership had fallen 39 percent to just 4,613, and Saturday traffic had fallen 15 percent to 10,897. Clearly a significant portion of the initial ridership was recreational and ‘try-out’ traffic, which has subsided somewhat. August 2008 weekend traffic rebounded due to festivals and sports events, and some pick-up of weekend traffic is likely in the fall of 2008. Nevertheless, LYNX usage seems to be evolving into primarily weekday traffic⁸, at about 19 percent of CATS ridership.

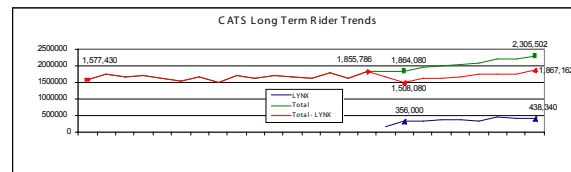


Who is using LYNX?

- No on-board survey of LYNX riders has yet been released. This would be needed to determine the demographics of LYNX riders, their originating modes, and locations. Therefore, the assessment must initially focus on general trends and supporting information.
- In the first full month of operation (December 2007) total reported LYNX ridership was 356,000 rides (one-way unlinked trips). But ridership on the remainder of the CATS system declined by 347,706 riders, almost the same as the LYNX increase.



(LYNX train crossing 7th St, downtown Charlotte)

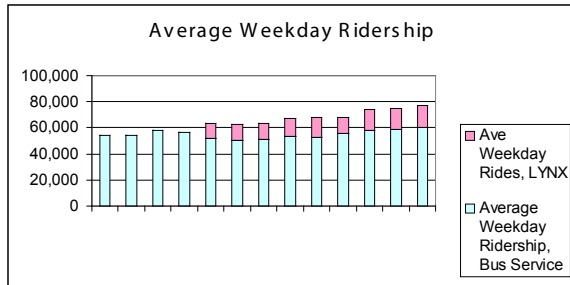


- Details of ridership trends in the following graphic show that about 1/2 of the initial average weekday LYNX traffic was former bus riders.



(The I485/South Boulevard bus transfer station, at the end of the LYNX line)

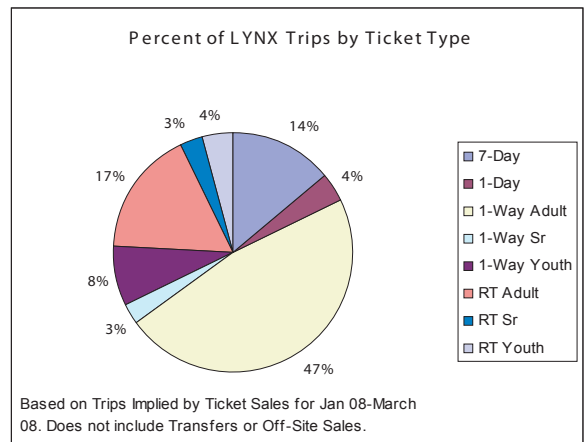
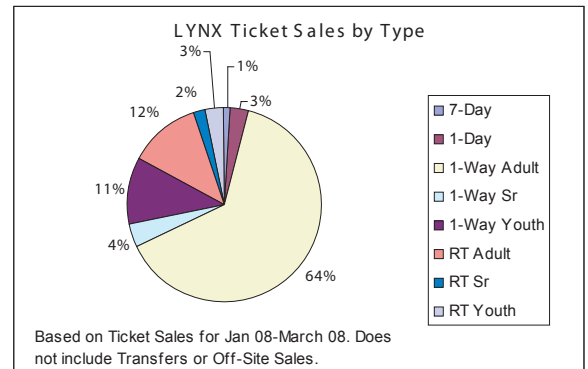
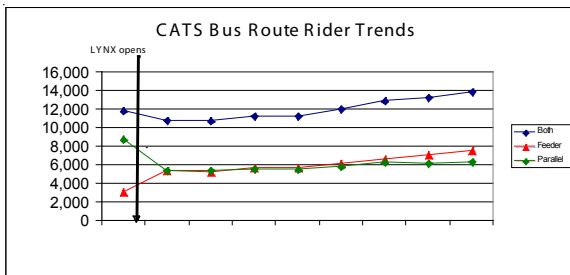
- LYNX ticket sales and revenues from fares are averaging about \$250,000 per month, or just over \$3 million per year. This puts its ‘weighted average fare’ (revenue divided by ridership) at about \$0.58 and its farebox ratio (percent of expenses covered by fares) at about 30 percent. LYNX ticket sales also indicate that about 1/2 of the LYNX ridership is from transfers or did not purchase a pre-ride ticket.



- Even discounting historic declines in ridership between October and December, this suggests that *a considerable portion of the initial ridership was prior bus riders who shifted to LYNX*⁹.
- Further evidence of considerable shifting from buses comes from detailed route data showing large ridership drops on CATS routes that ‘parallel’ the new LYNX line, and sharp increases on ‘feeder’ routes going to LYNX stations. ‘Parallel’ routes dropped about 3,300 weekday trips between November 2007 and December 2007, while ‘feeder’ routes increased about the same amount. Then, both groups experienced growing traffic during 2008¹⁰.
- About 64 percent of trips are ‘adult (1-way or round trip)’, 6 percent ‘senior’ (1-way or round trip), 11 percent ‘youth’ (1-way or round trip), and 14 percent ‘7-day.’ However, 76 percent of ticket sales (not trips) are for 1-way or round trip adult tickets. This data, based on ticket sales for Jan-Mar 2008¹¹, imply considerable ‘trial’ and ‘occasional’ travel.



(LYNX customers using ticket vending machine)



Average Weekday Ridership, CATS Routes Near LYNX										
	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Apr 08	May 08	June 08	July 08	Pct Ch, Dec-July
Feeder	3,079	5,367	5,236	5,665	5,751	6,197	6,609	7,054	7,476	39.3
Parallel	8,738	5,440	5,447	5,614	5,536	5,820	6,249	6,209	6,357	16.9
Both	11,816	10,807	10,683	11,279	11,287	12,017	12,858	13,262	13,833	28.0

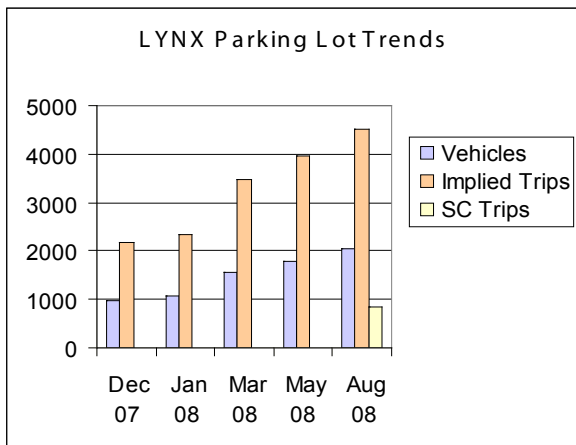
Has LYNX convinced auto drivers to switch to transit?

- *Diverted traffic*, that is traffic from prior auto drivers, was initially about 17 percent of LYNX ridership. Initially (December 2007) about 986 vehicles (about 2,169¹² trips) used the LYNX lots, compared with 12,457 initial average weekday trips. This does not include a (probably small) number of prior auto drivers getting on LYNX directly from home.
- Parking lot use has risen over time to about 2,050 vehicles¹³ (about 4,510 daily trips). So, at last count, about 27 percent of LYNX average weekday ridership can be directly traced to diverted auto trips.



(LYNX's South Boulevard/I485 station, with bus transfer and parking deck right)

- As an interesting aside, about 18.5 percent of vehicles parked at LYNX lots have South Carolina tags. This implies about 838 average weekday trips on LYNX by South Carolina residents.



- Parking lot trends also provide insight into one of the key reasons for LYNX's traffic: savings in parking lot costs. Downtown parking averages about \$5.15 per day¹⁴, based on averages for sur-

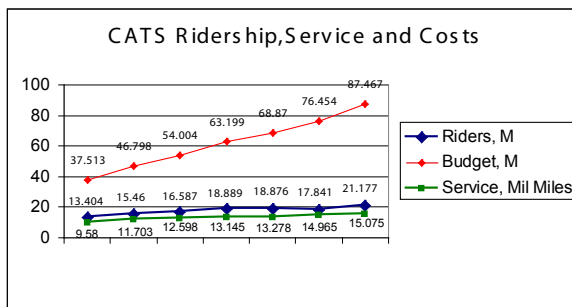
face and garage rates, and can be much more for event parking or short-term parking. Individuals using LYNX save those costs. However, those same 'savings' are also 'losses' to parking businesses. So the effect on regional economics is a net zero, even though it is a substantial plus for auto diverters.



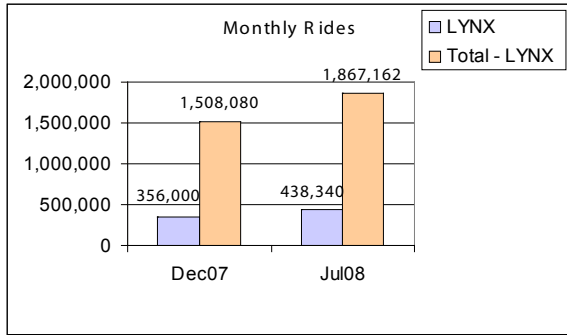
(Paved overflow lot, I485/South Boulevard)

What about gasoline prices?

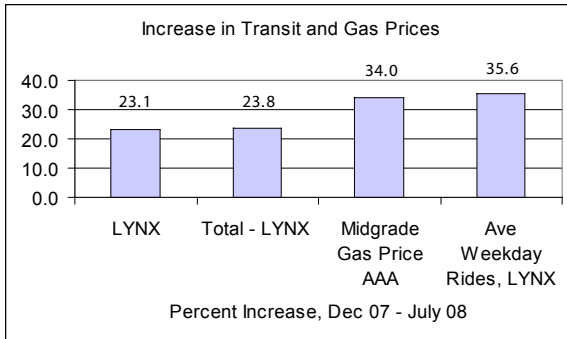
- Rising gasoline prices, along with increasing service (revenue vehicle-miles of bus service) have increased both LYNX ridership *and* the non-LYNX bus ridership. In the 16 months *prior* to the opening of LYNX, monthly CATS ridership had already increased about 17.6 percent (from 1.577 million to 1.856 million rides)¹⁵.
- This continues a longer-term trend of rising ridership. Between 2000 and 2006, CATS ridership increased 58 percent, but bus service (revenue vehicle-miles) also increased 57 percent, and costs rose 133 percent¹⁶.



- Since December 2007 (through July 2008) total LYNX ridership is up about 23.1 percent, a growth rate actually *slightly less* than the remainder of the CATS system (23.8 percent).



- However, average *weekday* LYNX traffic has increased about 35.6 percent, about the same as gasoline price rises through July 2008¹⁷.



- This suggests that almost 1/3 of the *growth* in weekday LYNX traffic (36 percent – 23 percent) is attributable to the improved service that LYNX offers relative to other bus service, and about 2/3 of the growth is attributable to underlying pressures of rising fuel prices, increasing inflation, economic activity, and bus service (revenue vehicle-miles). Without this background pressure, LYNX average weekday ridership would likely be about 12-13% higher now than in December 2007.



(Inside the LYNX train, inbound, near Archdale)

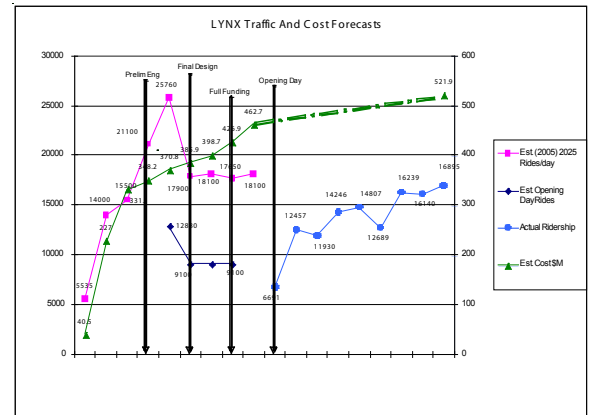
- Recently (August-September 2008) gasoline prices declined somewhat then rebounded sharply as Hurricane Ike approached. Ridership statistics for August 2008 show that weekday traffic was slightly 'lower' than July 2008, but weekend traffic was higher. This suggests that if gasoline prices continue to moderate, some softening of both bus and LYNX traffic is likely. Indeed, according to CATS, August 2008 average weekday ridership for the system as a whole was 83,758, down about 7.5 percent from about 90,539 rides in July 2008.



(CATS downtown Transportation Center, serving bus and LYNX traffic)

How does LYNX ridership compare with forecasts?

- Forecasts of transit ridership are typically made only for *average weekday traffic*, and do not include weekend or holiday traffic. They are based on computer models that use 20-year forecasts of population and employment, costs and travel times for typical trips, auto availability, incomes, 'captive' and 'choice' markets, and congestion on roads¹⁸.
- Forecasts of LYNX performance go back to the late 1980s. The earlier forecasts of LYNX traffic were prepared with simplified models and then



were later refined with better models. The early forecasts put the estimated average weekday ridership at 5,535/day, and the construction cost at just \$40.5 million.

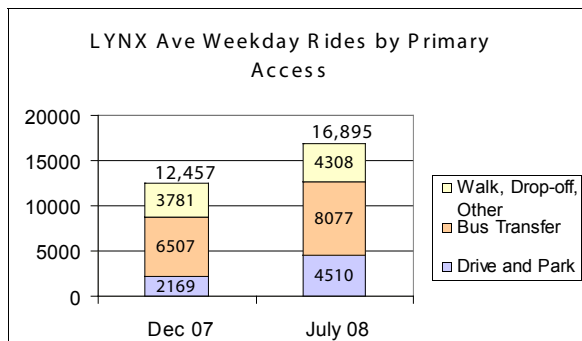
- More extensive studies in the late 1990s raised the 2025 weekday ridership estimate to 14,000 riders, and the ‘official’ cost estimate to about \$227 million. As the project neared federal approval, cost estimates and ridership forecasts increased to about \$371 million and 25,700 rides. But after approval, more careful assessments lowered the ridership estimates to 18,100 (first year 9,100), but cost estimates continued to rise. The latest forecasts were prepared in 2001-2002, for the initial (opening year) and year 2025.¹⁹
- As noted above, these forecasts were prepared prior to the surge of gasoline prices. If revised to account for that, they would undoubtedly yield higher forecasts²⁰. But they also assumed higher downtown employment, higher parking rates, and a full 4-line system; if corrected, these assumptions would probably yield a lower forecast.

Summary

- Consolidating these observations, the following chart summarizes LYNX ridership by source. Initially, about 52 percent of traffic was shifted from other transit routes, and about 17.4 percent was drive-and-park; now, about 47.8 percent of

traffic is shifted from prior transit routes, and about 26.7 percent is from drive-and-park. The remainder of the traffic is from walk-up, drop-off, outbound transfers, and other sources.

- LYNX ridership is averaging about 19 percent of



total CATS system ridership. LYNX ridership has grown about 23 percent since December 2007, about the same as non-LYNX bus ridership. About 2/3 of the growth in average weekday ridership is likely attributable to rising gasoline prices, economic conditions, and more transit service. This means that ridership is likely to be vulnerable to declining gasoline prices or a strengthening economy.

- LYNX average weekday ridership is higher than initially forecast, but those forecasts did not foresee the recent sharp rise in gasoline prices.

II. Costs

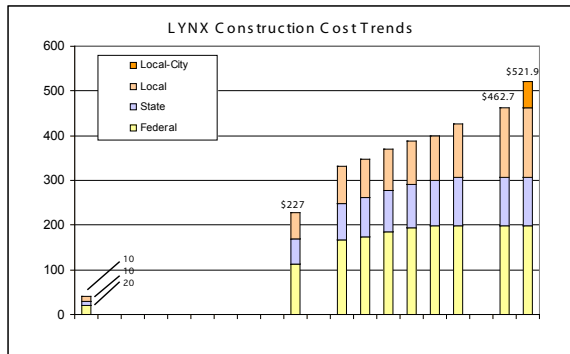
How much did LYNX cost to build?

- When the LYNX South Boulevard corridor line was initially discussed, the projected construction cost was \$40.5 million, in 1987 dollars.
- Official projected costs rose to \$227 million in July 1998. This was the estimate used to put the project to the voters in the fall of 1998. As part of the initial estimate, federal funds were assumed to cover half of the construction costs, and state and local funds would be responsible for the remaining half.
- Several outside observers at the time, notably Wendell Cox²¹, concluded that these costs were low. Estimated ‘final’ total costs near \$500 million; this turned out to be within 5 percent of the actual value.
- Over the nine years that it took to plan and build the LYNX line, construction costs increased substantially. These increases have been attributed to inflation, changes in line length (actually a cost reduction), rising construction costs, exten-

LYNX Construction Cost History					
Date of Estimate	Federal Funds, \$M	State Funds, \$M	Local Funds, \$M	Other City Funds, \$M	Total, \$M
Jun-89	20.25	10.12	10.13		40.5
Jul-98	113.5	56.75	56.75		227
Nov-00	167	82	82		331
Nov-01	174	87	87		348
Nov-02	185	93	93		371
Nov-03	193	97	97		387
Nov-04	199	100	100		399
Nov-05	199	107	121		427
Apr-07	199	107	156.7		462.7
Jul-08	199	107	156.7	59.15	\$ 521.85

sions of opening year, better engineering details, and inclusion of additional items. Funding from various sources changed. The federal share was initially 50 percent, but in 2004, the Federal Transit Administration capped federal funding for the LYNX line at \$199 million. Similarly, the State funding was also limited to \$107 million in 2005. Cost increases after these dates were born by local government. The final ‘official’ estimate was \$462.7 million, not including ‘off-budget’ projects (sidewalks, intersections, utilities, etc.) funded by the City. These total about \$59.15 million²².

- Final cost figures have not been released, but they are expected to total about \$521.85 million, based on published costs for various work.

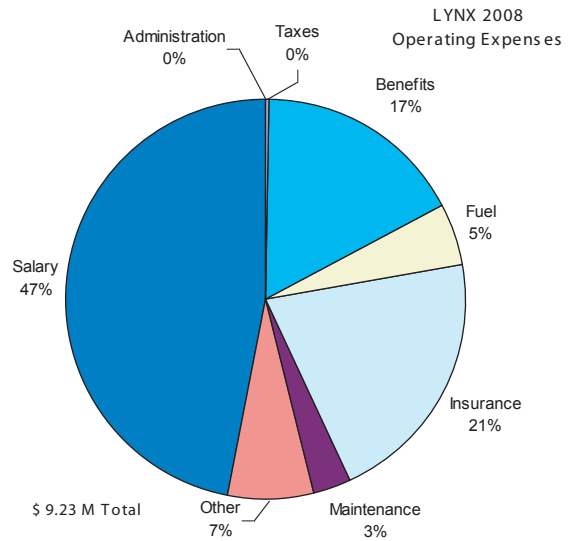


- So the project’s construction costs grew from \$40.5 million to \$521.85 million in a span of 19 years, from concept to reality. Over the nine-year

‘approved’ portion of the study (1998-2007), costs increased from \$227 million to \$522 million, about 130 percent. This is somewhat higher a cost overrun than the average, 104 percent, identified by Flyvbjerg²³ for major transit projects around the world.

What is LYNX costing to operate?

- The LYNX operating expense estimate for Calendar 2008 is \$9.226 million. This estimate uses ‘actual’ expenditures for five months (January-May), partial expenditures for June-July, and estimated expenditures for August-December. In spite of these caveats, this is the best source for estimates of operating costs²⁴.



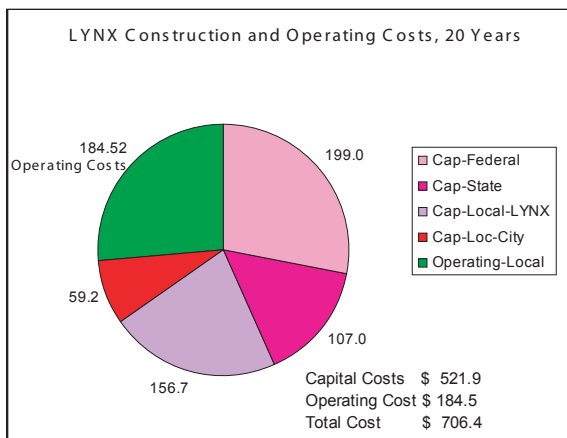
LYNX 2008 Operating Costs	
Administration	29,406
Benefits	1,560,096
Fuel	489,517
Insurance	1,948,041
Maintenance	252,681
Other	602,374
Salaries	4,339,013
Taxes	4,640
Total	9,225,768

What are LYNX's total costs?

• Although transit lines often have longer lifetimes than 20 years, this is a prudent estimate since many components would probably need to be replaced in that timeframe. This is also the forecast period for LYNX ridership. Twenty years is also the usual lifetime assumed for major road improvements. To compare construction and operating costs we use 20 years as the effective lifetime, understanding that some components may wear out faster and some slower.

- The largest portion of the operating costs for the LYNX system funds the work force behind the operations. About 64 percent of the budget is allotted for the salaries and benefits of LYNX employees.
- Insurance (\$1.948 million) is the second-largest item in the operating expense listing, even exceeding benefits and maintenance.
- Some of the operating cost estimates appear to be on the low side (and some of the data is projected), so these expenditures could be subject to change and are likely to increase. This is particularly true for administrative and maintenance costs. FTA justification for the projects was based on operating costs averaging about \$17 million per year.

- LYNX's *annual* operating and capital costs presently total about \$32.3 million, in 2008 dollars. Capital costs are \$23.1 million, about 2/3 of the total.
- Over 20 years, LYNX capital and operating costs total about \$706.4 million. The local share of these costs is \$400.4 million.²⁵



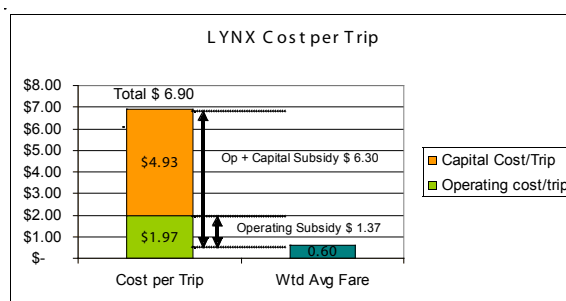
LYNX Operating and Capital Costs				
		Total 20 yrs	Annual	Basis
Capital Cost, \$M	Cap-Federal	199.0	9.950	Total/20 years
	Cap-State	107.0	5.350	Total/20 years
	Cap-Local-LYNX	156.7	7.835	Total/20 years
	Cap-Loc-City	59.2	2.958	Total Off-Budget/ 20 years
	Total	521.85	26.095	
Operating Costs	Operating-Local	184.52	9.226	CATS Est.2008. Likely to rise
Total Costs (2008\$)	Total	706.37	32.321	

- Of this, \$521.9 million is the initial capital cost, consisting of \$462.7 million in federal/state/local funds, and an additional \$59.2 million in local funds expended for ancillary work on nearby streets, utilities, sidewalks, etc.
- The current estimated operating budget is about \$9.226 million annually or about \$184.5 million over 20 years. This estimate, in 2008 dollars, is likely to be low since operating costs for transit systems have been increasing more rapidly than either ridership or service levels.

How much does LYNX cost per trip?

- Costs per trip are summarized below. Using the 'operating' budget, the cost per trip is about \$1.97. Adding the capital cost, the total (capital and operating) cost per trip is about \$6.90²⁶.
- The 'nominal' fare, \$1.30, is not the 'average' fare paid, since many trips use transfers or special fares (commuter, elderly, student, etc.). Most U.S. systems have weighted average fares about 1/2 of the nominal fares.

- For LYNX, the weighted average fare is estimated to be about \$0.60/trip. This estimate is based on 2006 CATS data showing a weighted average fare of \$0.55/trip, and \$0.58/trip for the first quarter of 2008.
- Using a weighted average fare of \$0.60/trip, the 'operating subsidy' is about \$1.37, implying a fare box ratio (the portion of costs paid by riders) of about 31 percent. However, using the total cost per trip, the total subsidy is actually \$6.30 per trip, implying a farebox ratio of about 8.7 percent.



- In other words, taxpayers are paying \$6.30 per LYNX trip, about 91 percent of the cost, and the LYNX rider is paying about \$0.60, about 9 percent of the cost.

III. Impacts

Has LYNX affected traffic congestion?

- LYNX was initially justified primarily on its ability to reduce the growth of (not reduce) future congestion, by providing a 'choice' for auto driving. So, one way to judge LYNX's effect on traffic is to determine if the growth of congestion has been reduced, looking at trends in traffic counts in the South Boulevard corridor.
- The data come from counts conducted every two years by CDOT and NCDOT. Unfortunately, the only counts available for 2008 are those for Interstate 77, which were conducted in April. However, sufficient count information was available to determine basic pre-LYNX trends.
- Interestingly, I-77 traffic volumes have *declined slightly* over the past six years, possibly due to

slowing economic growth. Average traffic volumes in 2003 were 157,286, compared with 153,622 in 2008. The interim 2004 and 2006 data show that *this drop pre-dates LYNX* and therefore is not related to the opening of LYNX²⁷.

- Traffic volumes for other parallel arterials show a slight increase over the six years, but a drop between 2004 and 2006. South Boulevard/U.S. 521, which runs along the LYNX route, shows a slight decrease in increase in traffic over four years, but an increase from 2002 to 2004. These figures indicate that the road traffic on the major routes parallel to LYNX was probably on the decline *before* the LYNX System was even opened²⁸.
- Traffic on cross streets might be expected to increase with the arrival of LYNX, since those streets would

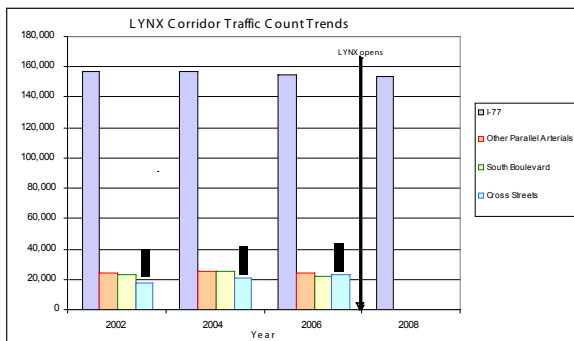
South Corridor Traffic Counts* (Number of sites)	2002	2004	2006	2008
I-77 (7 sites)	157,286	157,000	155,571	153,622
Other Parallel Arterials (20 sites)	24,842	25,800	25,053	
South Boulevard (5 sites)	23,500	26,090	23,200	
Cross Streets (12 sites)	18,029	22,075	23,325	

probably be the primary ‘feeder’ streets to LYNX stations. However, the data show a moderate increase in traffic, *before* LYNX, suggesting that further increases might be part of this trend rather than attributable to LYNX.

- In short, the traffic volume data, while incomplete, show trends that counter the conclusion that LYNX has affected traffic in the corridor.

Has LYNX reduced commuting travel?

- Another way to view the impacts of LYNX on traffic congestion is to look at how much commuting the LYNX line has saved or taken off Charlotte roads, relative to traffic volumes.



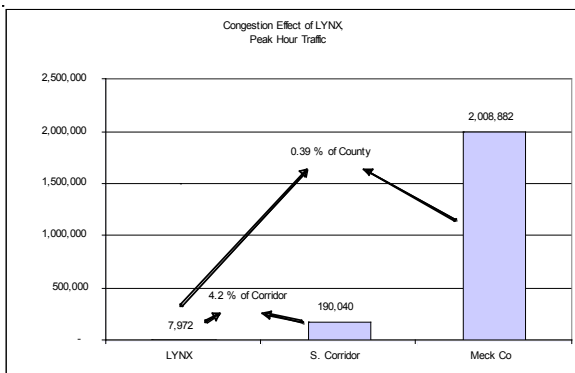
(Traffic at the I-77 and Clanton Rd area.)

- Traffic diversion to LYNX can be determined from the number of *trips diverted from auto driving*. The numbers come from counts of vehicles at LYNX parking lots. These estimates slightly underestimate impacts since walk-up, drop-off, and some carpooling traffic is not included. Mileage saved is then determined by calculating the distance from each station to the central business district (assuming no LYNX trips to intermediate destinations; if those trips were included, the numbers would be lower).
- Auto drivers diverting to LYNX save, in total, about 15,944 daily vehicle-miles by using LYNX or about 7,972 vehicle-miles in the morning or afternoon peak hour. This is about 0.08 percent of regional travel, 0.4 percent of peak hour travel, but 4.2 percent of corridor peak hour travel. Even within the corridor, therefore, the effects are small, and are probably not measurable in traffic flows²⁹.

- LYNX also produces small savings in travel time for auto commuters who can save travel time since other traffic has been diverted. Using congestion-delay curves, this effect is estimated to average about 0.27 minutes per trip for peak-hour drivers in the corridor.
- These estimates do not consider possible congestion *increases* near stations or on portions of South Boulevard, or additional traffic that might move in to take the place of diverted traffic.

Has LYNX reduced air pollution?

- Estimates of air quality improvements attributable to LYNX are also derived from diverted traffic (parked cars at LYNX stations). These counts are multiplied by mileage saved (distance to the Charlotte CBD), then by emissions rates, to determine emission reductions. This measure slightly underestimates savings, since it does not include walk-up and drop-off traffic, or some bus transfers that might have been prior auto drivers.



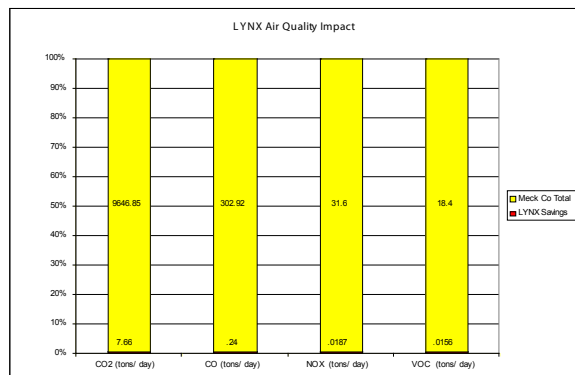
- Overall reductions in emissions attributable to LYNX are:

LYNX Emissions Savings and Cost per Ton Saved

Chemical Compound	Meck. Co. Total ¹	LYNX Savings	Percent of Co.	Cost/Ton Saved*
CO ₂ (Carbon dioxide, tons/ day)	9646.85	7.66	0.079	\$ 18,439
CO (Carbon monoxide, tons/ day)	302.92	0.24	0.079	\$ 586,180
NOX (Nitrous oxides, tons/ day)	31.6	0.018	0.057	\$ 7,848,330
VOX (Volatile organic compounds, tons/ day)	18.4	0.015	0.082	\$ 9,418,000

*Based on daily cost of \$ 141,250 (\$706.4 M/20 Years/250 commuting days)

- Emissions savings attributable to LYNX constitute less than 1/10 of 1 percent of major compounds. Savings of this magnitude would not be measurable in the region’s air quality monitoring programs.
- On a cost per ton saved basis, LYNX costs \$18,439 to \$9,418,000 depending on the compound. This compares with about \$55/ton saved for typical pollution control actions.



Has LYNX affected real estate development?

- Much has been written about land use in the South Corridor. The City of Charlotte recently estimated³⁰ that the South Corridor has had about 219,512 square feet of commercial development (built or under construction) between 2005 and 2007³¹, and that housing units increased by 1,175 units (built or under construction), together totaling \$219 million in ‘development value.’ Another 408,000 square feet of commercial development and another 6,406 housing units have been ‘announced’ with an estimated value of \$1.569 billion. The report thus asserts that the South Corridor has had (or will have) \$1.86 billion in

commercial and residential development. The report does not say but certainly implies that this growth is largely attributable to the LYNX line and therefore justifies its \$462 million expenditure. The report also notes that ‘assessed valuation’ (presumably defined as tax value for property tax purposes) increased 52 percent in the corridor since 2000, compared with 42 percent for the city as a whole. It concludes by estimating the ‘tax take’ from this increase at about \$24.1 million annually; this number is not ‘forecast’ forward over LYNX’s expected lifetime. So, the City report focuses on units constructed, under construction, and announced, then converts this into taxable values and tax ‘takes’ from property tax rates.

- The report errs in its assessment in a number of basic ways:
 - First, the report contains summation errors that undermine its presumed data accuracy.
 - Second, it treats ‘announcements’ as if they

were *built-and-occupied* properties, and therefore significantly overstates, by nearly a factor of 4, the actual observable on-the-ground growth. This is highly significant since growth has slowed sharply in the last year, and some of the ‘announced’ growth may be delayed or canceled.

- Next, the report does not quantify the *difference* in growth rates in the corridor relative to the *rest* of the region (it incorrectly counts the corridor growth as part of the city growth).
- Further, the report implies that all of the corridor’s growth is attributable to LYNX, when clearly many factors have contributed to the corridor’s resurgence.
- Further, it treats *all* of the corridor’s growth as new to the region, and does not consider that some growth in the corridor might have come from within the region.
- Further, the report treats ‘assessed valuation’ as the appropriate measure of development, when in fact it is the ‘economic rental’ value of land, not its assessed value, that should be the basis for analysis³².
- Further, it does not consider (in its favor) some growth *outside* the corridor might have been influenced by LYNX, the flip side of assuming that all growth in the corridor is LYNX-based.
- Finally, it treats taxes as benefits. This is inappropriate since taxes are NOT benefits but transfers from the private sector to the public sector, and if left in the private sector they would also have generated economic activity.



(Some development along South Boulevard pre-dates the LYNX line by about 10 years.)

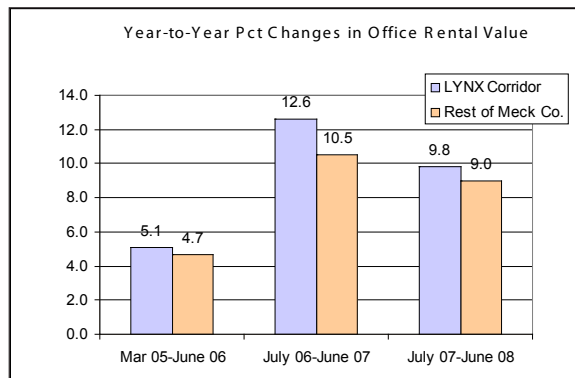
In short, the report presents an overly optimistic view of the South Corridor growth and LYNX’s effect.

- Many transportation economists feel that the economic activity itself is not a benefit but merely a separate manifestation of the gain in user benefits. But if they are evaluated, the appropriate way to measure land use impacts from transportation actions is to isolate transportation user benefits or economic activity, not use ‘assessed valuation’ or ‘taxes.’ And of course ‘announcements’ are not growth and should not be counted until they actually appear as in-use property. The separate effect of LYNX itself on growth should be isolated, and the relative growth within the corridor versus the rest of the region should also be determined. The usual way of gathering this information is through careful studies of the change in economic activity as a function of location to the LYNX line, versus changes in economic activity elsewhere, and interviews of businesses to determine the relative importance of LYNX versus other factors.
- An important question is the expected length of benefits streams. User benefits are typically assumed to flow throughout the project’s expected life, in this case 20 years. Other benefits, such as land use changes, are often discounted over much shorter lifetimes, sometimes just one year. This is because longer-term land use benefits are partially double-counted in user benefits, are not directly attributable to the project, and are subject to economic forces beyond the project. For the analysis below, we counted each year’s increment of growth as a single one-year ‘benefit.’ This produces a conservative estimate of land use impacts; an assumed longer life of land use benefits would increase the project’s benefit-cost ratio.
- Another important point is that growth in the *remainder* of the region also needs to be accounted for and ‘factored out’ of the corridor growth rates. The Mecklenburg County economy is growing everywhere, and the key question here is what *difference in growth rates* the LYNX line is making, relative to the rest of the region.

- To study these issues we track commercial activity from several sources. One useful source is the quarterly reports of square footage of commercial space *actually in use*, and average rents for office, retail, and industrial commercial space, as maintained by Karnes Research and reported in the *Charlotte Business Journal*³³. This source maintains summaries of activity by sub-region within Mecklenburg County, permitting partial extraction of South Boulevard corridor activity versus the rest of the county.

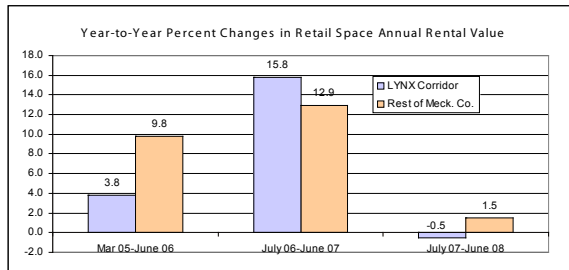
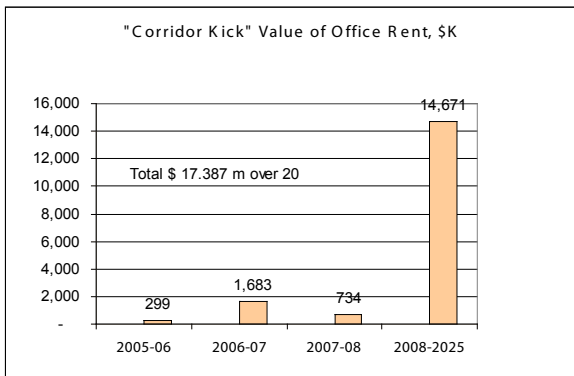
Office space

- Karnes Research summarizes office space by 11 zones, of which five are within or partially within the LYNX corridor. For each zone, or part, we computed the annual rental income (occupied square feet times average rent) in the LYNX corridor and in the rest of Mecklenburg County, and then computed changes in rental income over time. This method accounts for occupancy rates, growth in constructed space, actual use and rental value 'on the ground,' and inflation. It is a reasonable estimate of the value of office space over time.
- The LYNX corridor accounts for about 12 percent of Mecklenburg County's \$852 million in office space annual rental value. However, it has been growing at a faster rate than the rest of the county. From 2005 to 2006, as LYNX construction began, the growth rate of office space rental income in the South Boulevard corridor was slightly faster than the rest-of-county office growth rate (5.1 versus 4.7 percent), or a 'corridor kick' of about 0.4 percent. This may be due to pre-2005 construction activity and greater parcel availability, or other factors, as well as anticipation of LYNX.
- In the next year, 2005-06, the South Corridor also grew more rapidly in office space rental value, 12.6 percent versus 10.5 percent for the rest of the county, implying a 'corridor kick' of about 2.1 percent. This seems to be indicative of a mild 'rush' to build office space in the corridor in advance of LYNX, but the rest of the county was also adding office space rapidly.
- After LYNX opened (in late November 2007) the LYNX corridor office market continued to grow slightly more rapidly than the remainder of the region (9.8 percent versus 9.0 percent), implying a smaller 'kick' of about 0.8 percent, but the overall rates slowed as the U.S. economy began to slow.
- Converting these differences in growth rates into dollar value, the 2005-06 increment is about \$299,000³⁴. Similarly, the increment for 2006-07 is about \$1.683 million, and for 2007-08 it is \$734,000. For future years, we use the last year's increment times 20 years to arrive at an estimate of \$14.671 million, in 2008 dollars (treating each year's increment of growth as a benefit for just one year, not the full project life). Therefore, the 'corridor kick' for office space is about \$17.387 million; even though not all of this can be directly attributed to LYNX, we optimistically assume so.



Retail space

- For analysis purposes, Karnes Research divides the county into eight zones, of which two are partially in the LYNX corridor. Counting the Carolina Place Mall and nearby space, along with some of the Ballantyne area space, the corridor contains (optimistically) about 22 percent of the county's \$614 million of retail annual rental value.
- During the period April 2005 to June 2006, retail space rental income in the South Corridor increased at a much slower rate, 3.8 percent, than the rest of the county, 9.8 percent. This 6.0-per-

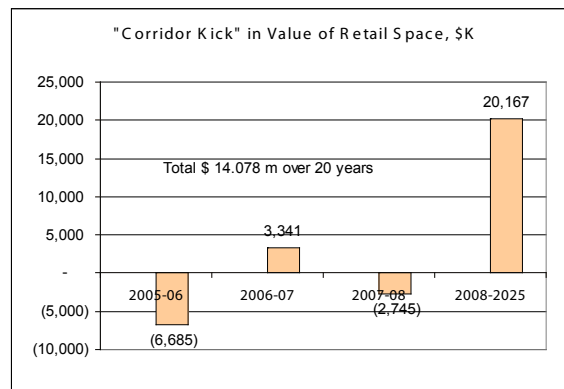


cent ‘drag’ may be due to LYNX construction, lack of availability of appropriate sites, or weaker demand within the corridor.

- However in the next year, 2006-07, growth in the corridor actually exceeded growth in the rest of the county, 15.8 percent versus 12.9 percent, implying a ‘corridor kick’ of about 2.9 percent. This is likely due to a combination of factors, including LYNX construction, the opening of more space, and some effect of rising rental prices.
- In the last year, 2007-08, the corridor’s retail rental value actually contracted slightly, about -0.5 percent, while the remainder of the region continued to expand at a very low rate, just 1.5 percent.
- Converting these differences in growth rates into dollar values, the estimated ‘corridor kick’ for 2005-06 is a *negative* \$6.685 million, since the corridor grew slower than the region. For 2006-07, the increment is \$3.341 million, and for 2007-08, the increment is also negative, - \$2.745 million.
- Going forward, it is likely that the corridor will continue to show a small advantage for retail growth. Assuming a small 0.75% differential in the per-year growth rate (but only for a single year of each increment), based on comparisons with office and industrial trends, the total is about \$20.167 million in incremental growth of retail rental value.

Industrial space

- Industrial space is summarized in the Karnes reports by eight zones, two of which are partially in the South Corridor.
- From April 2005 to August 2006, industrial space rental income in the South Corridor increased considerably more slowly than in the rest of the county. The difference, 6.5 percent, may be due to conversion of industrial space in the corridor for other uses, LYNX construction, space availability or quality, or other factors.

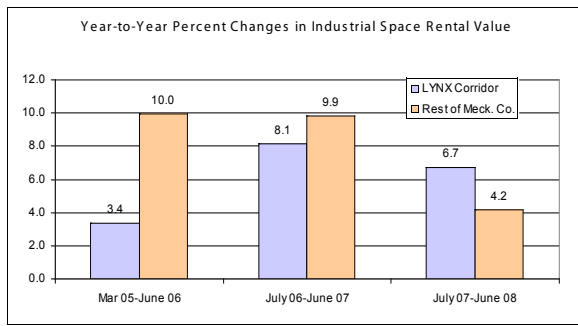


(Parcel under development along the LYNX line, near Arrowood)

- Combining these statistics, about \$14.078 million in added value to retail space can be attributed to corridor growth, compared with the rest of the county.

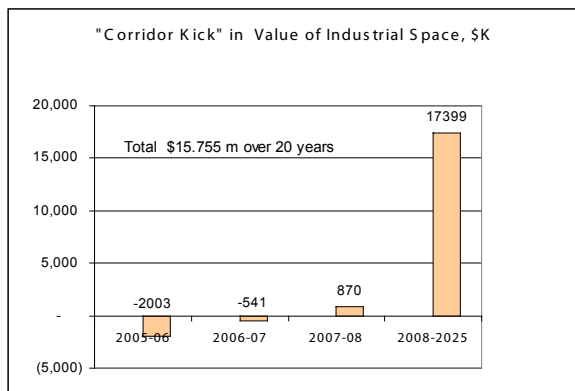
- From 2006 to 2007, the corridor grew more rapidly, but not as fast as the remainder of the region. However, the differential, 1.9 percentage points, narrowed considerably.

- Between 2007 and 2008, the corridor’s growth of industrial space value was faster than the remainder of the county, 6.7 percent versus 4.2 percent. So, in the final year, the corridor exhibited a “corridor kick” of about 2.5 percent.
- Converting these statistics into dollar values, the LYNX corridor shows a negative – \$2.003 million difference in the first year, a negative – \$0.541 million difference in the second year, but a \$870,000 ‘kick’ in the third year. Over 20 years, the increment is about \$15.755 million (once again, assuming just one year of ‘benefit’ for each year’s incremental growth).



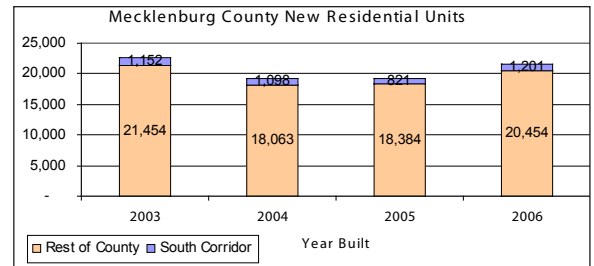
Has LYNX affected residential development?

- LYNX’s effect on residential housing activity is analyzed in a similar fashion. We determine, first, the magnitude of the *incremental* growth in housing units of various types in the corridor versus the rest of the region, then determine the annual ‘economic rent’ for those units. This permits estimation of the corridor’s incremental growth and economic activity.
- We retrieved the residential parcel data by zip code from the Residential Building and Land



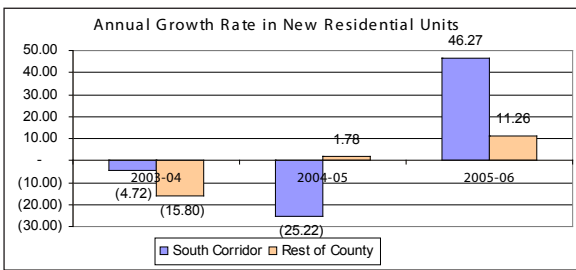
Summary report in the Charlotte-Mecklenburg Integrated Data Store. There are 40 zip codes assigned to Mecklenburg County, 29 of which are currently in use. Of these 29, 21 are fully outside the South Corridor; one is fully within the South Corridor; and seven are partially within the South Corridor. We also reviewed South Corridor TOD³⁵ Redevelopment data from the City of Charlotte³⁶. We then combined both data sets to assess the impact of the LYNX system on residential development in the South Corridor and the rest of Mecklenburg County.

- During the period 2003-2006, Mecklenburg County added more than 82,500 residential units, about 20,600 units annually. Of these, almost 1,100 (5.2%) are in the South Corridor. (2007 data was incomplete and so was not used.)
- After a 16% decline from 2003-04, the growth rate of new residential units has been increasing in the rest of the County, with over 11% more units added in 2006 than 2005. In the South Corridor, growth in *new* residential units declined in both the 2003-04 and 2004-05 time periods, before showing a significant rise from 2005 to 2006.



- The current value of the units can be determined from the total parcel values and is reflected below. Total value in the South Corridor is a small fraction of the total value of new residential units across the County, but the value *per* new residential unit is higher in the South Corridor (24% higher, on average). While this could perhaps be part of the ‘corridor kick,’ it could also be a result of differing sizes of new units (larger units command larger prices) and differing land values (more accessible parcels command higher rents).

- Projecting new unit completion rates, as well as the values of those units, into the future is highly problematic. Both the South Corridor and Mecklenburg County have limited space for future residential development and this space will likely be 'built out' over time. When this occurs, the only ways for new residential units to come on line is for old residential units to be replaced or other land uses to be converted. While this is likely to occur, the pace at which new residential units are added is likely to slow down in the future.



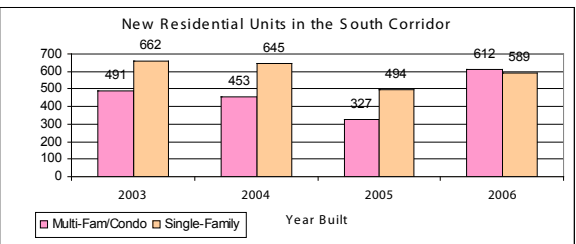
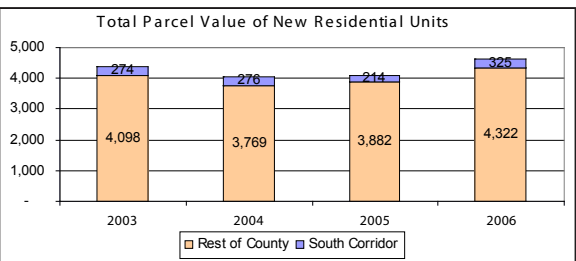
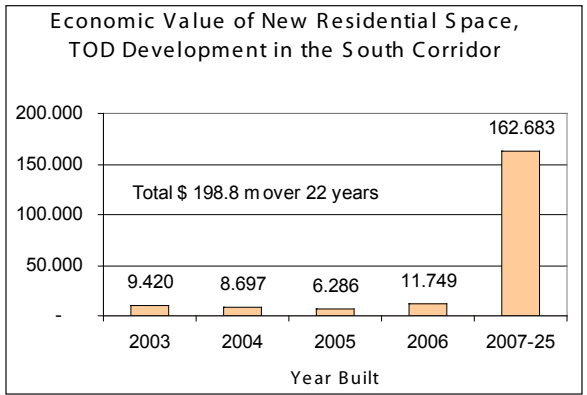
- The South Corridor added more than 1,000 residential units each year during the period 2003-2006. Of these, about 56% are single-family detached homes, with the remainder (around



(Residential condo development at Carson, next to the LYNX line)

470) being multi-family units and condominiums. This 470 per year estimate is consistent with earlier estimates of TOD development, which predominantly consist of multi-family units and condominiums located near transit stations. This 470 per year baseline would be a good estimate of the initial 'corridor kick.'

- The 'kick,' however, is not expected to continue at that pace, but is likely to slow over time. With this in mind, we estimated the annual 'corridor kick' at 300 units per year over the next 20 years. Then, for consistency, we value this new development in terms of rentable value at an average of \$1,600/month, or \$19,200 annually. We consider only the first year of the development as directly attributable to LYNX, since after that the units are subject to local economic forces and many other factors. This yields a total 'economic rent' value of about \$198.8 million over 20 years.



Summary

- Contrary to reports issued previously, the land use growth in the South Corridor has been generally only mildly faster than in the rest of the region. When carefully compared using actual on-the-ground growth, the picture of growth for the corridor shows an effect, on the order of about \$246 million over 20 years, much smaller than the \$1.86 billion based on 'announcements.'

Category	2003-06	2006-07	2007-08	20 More Years	Total
Office Space	0.299	1.683	0.734	14.671	17.387
Retail Space	- 6.685	3.341	-2.745	20.167	14.078
Industrial	-1.961	-0.580	0.871	17.425	15.755
Residential	18.117	6.286	174.432		198.835
Total	9.770	10.730	225.555		246.055

IV. Benefit-Cost Assessment

How are transportation benefits and costs determined?

- Classical transportation economics determines benefits flowing to *users* of new services (savings in travel time, savings in operating costs, and savings in accidents), and to *non-users* (reduced air pollution or congestion, better land use patterns, reduced environmental impacts, etc.). Most analyses do not compute the impacts of more or wider choices or minor secondary impacts such as reduced oil dependence. Some economists (but not all) consider land use changes to be secondary benefits since they are generally derived from user benefits (travelers switching to new routes or modes to save time). Specialized benefits, such as savings in parking costs, are sometimes offset by reductions in revenues to parking companies.
- Costs are typically computed as total costs of construction and operation over the project's life-time, or through one complete 'life cycle' (initial construction through maintenance and repairs, ending just before the second reconstruction).
- Taxes are not considered as either benefits or costs, since they are transfers from the private to the public sector.
- Future benefits and costs are often 'brought back' to present value (to account for the time value of money), although this may not be done if most costs are in current dollars. Inflation is generally not considered in cost estimation.
- Some benefits and costs such as construction costs or increased economic activity are sometimes 'expanded' to account for their ripple effect through the local economy. This step, sometimes called 'multiplier' modeling, can be done using sophisticated economic software, or by using simple factors. This method is not generally done in transportation impact studies since it is not generally known *where* transportation costs or benefits are spent. In this assessment, we did not include multipliers.
- For the present study of the LYNX line, the costs are essentially known or can be estimated with reasonable certainty. Some user benefits, particularly savings in travel time, operating costs, and accidents by prior car drivers, can also be estimated reasonably well. Benefits from land use changes can also be reasonably well estimated. Environmental benefits such as air pollution or CO₂ reduction can also be estimated but are more difficult to 'dollarize.' Benefits from 'increased mode choices,' 'choices for urban TOD housing,' 'visually pleasing environment,' 'smart growth,' and the like cannot be estimated easily and are not quantified.
- Local officials often point to transportation construction itself as a 'benefit' to the region. This 'benefit' is sometimes called the construction benefit, and consists of the dollar value of the construction, expanded to account for its ripple through the local economy. However, those expenditures are really just re-investments of taxes taken prior (hence transfers), and most are not even spent locally but are expended on steel, electrical, and other materials produced out of the region. These expenditures are also shortlived and dissipate quickly after construction. Some analysts take a 'middle ground' and count only the non-local (federal and state funds) as a benefit.

9/16/2008					
			LYNX Benefit/ Cost Assessment		
Item		Category	Basis	Annual Estimate 2008 M\$	20-Year Estimate 2008 M\$
Costs		Construction	Construction cost + Additional City cost	26.095	521.9
		Operating Costs	LYNX Est. Annual Operating Budget	9.226	184.5
		Total Costs		35.321	706.4
Benefits	User	Auto Diversion Time Savings, \$m	4,510 daily trips at @\$ 10/hr and 10 minutes saved/trip (probably high)	1.872	37.4
	User	Transit Shifter Time Savings, \$ m	8,077 daily trips@\$10/hr/ and 5 min saved/trip.	1.683	33.7
	User	Walk-up Time Savings	4,308 daily trips*10/hr and 5 min saved/trip	0.897	17.9
	User	Auto Driver Operating Cost Savings	VMT Reduced*0.20/mi vehicle operating cost	0.797	15.9
	User	Auto Driver Accident Cost Savings	VMT Reduced*1.25 fatalities/100 mm*\$5m/life	0.249	5.0
	User	Parking Costs Savings for Diverting Wkdy Drivers	2,050 Parked cars*\$5.15 avg CBD pkg cost/day	2.639	52.8
	User	Parking Cost Savings for Weekend Auto Drivers	800 parked cars*5.15 avg parking cost/day*115 days/year	0.474	9.5
	Non-User	Travel time savings to non-user drivers (from diverted vehs)	4% reduction in corridor PH traffic (0.27 min. savings)*190,040 non-users*\$ 10/hr	0.428	8.6
				9.039	180.783
	Land Use	Office, retail, industrial value of economic rent	Initial Corridor 'kick' + 20 yrs of incremental growth	2.530	50.6
		Residential housing, value of economic rent	Initial Corridor 'kick' and 20 years of incr growth	9.941	198.8
		Increased CBD Activity (new econ. activity)	500 trips/day *\$ 30/trip (increment)	5.475	109.5
		Losses to the Parking Industry	- Losses from reduced parking fees, equal to user 'gains'	-3.113	-62.3
				14.832	296.7
	Environ	Reduced energy consumption	Included in operating cost savings		
		Reduced air pollution (CO, NOx, VOC)	0.275 tons/day saved*\$55/ton removed	0.004	0.1
		Reduced greenhouse gases (CO ₂)	7.66 tons/day saved*\$55/ton removed	0.105	2.6
				0.109	2.7
	Other	Value of Mobility/Choice			
		Total Benefits		\$ 23.98	\$ 480.18
		Benefit-Cost Ratio		0.68	0.68

Our policy here is to follow common transportation planning practice, which is NOT to count the construction expenditure as a benefit since it is essentially a tax-based transfer, is shortlived and has an unknown local component.

What are the benefits and costs of the LYNX line?

- The table on page 21 summarizes the computation of benefits and costs for the LYNX line.
- Total construction and operating costs are about \$706 million over 20 years in current dollars. These are likely underestimated, since operating costs tend to rise faster than inflation in most transit systems.
- User benefits total are approximately \$180.8 million over the 20-year life of the facility. These include benefits from savings in travel time, operating costs, accidents, parking, and time savings to non-using drivers from reduced traffic congestion. CBD parking cost savings (a direct benefit to drive-and-park users, but a loss to the parking industry) are about \$62.3 million over 20 years.
- Benefits from additional corridor land-use economic activity, additional (not-duplicated) downtown CBD activity, along with losses to the local parking industry, are estimated at \$296.7 million over 20 years, using somewhat optimistic assumptions about continuing growth in the corridor. But even though these benefits are thought by some economists to be mere double-counting of user benefits, we include them because they are of considerable local interest. If not included, the benefit-cost ratio would be substantially lower.
- Environmental benefits are estimated at about \$2.7 million over 20 years. These are primarily from reduced pollution by diverted auto drivers.
- Thus, the total estimated benefits of the project are about \$480.2 million, compared with a total cost of \$706.4 million, of which \$400.4 million is the local cost.
- The overall benefit-cost ratio for the project is therefore about 0.68. If only local costs are included, the benefit-cost ratio is near 1.20. This means that if the local government had to pay for the full project, \$706 million, it could not be justified from a benefit-cost basis. In essence, what makes the project justifiable from the local government's perspective is that the local government pays only 57 percent of costs (state and federal governments pay the remainder), yet the local government reaps all benefits. But from the perspective of overall benefits and costs, the project has benefits that are lower than costs, and it therefore would have to be justified on other grounds.
- The benefit-cost methodology does not quantify some benefits. These include the benefit of different land use patterns, reduction in sprawl (if any), arguments for 'world class' status, benefits of 'just having choice' for future residents, etc. This is not to say that these benefits do not exist, just that they cannot be easily quantified. But the benefit-cost procedure allows determination of the 'remaining value' that these additional benefits would have to be to make the project viable.
- It is widely understood that there are many problems with the benefit-cost methodology. Among the most widely cited are the failure to determine geographic disparities between who gets and who pays; uncertainties of computation of virtually all terms; and uncertainties about interest and inflation if considered. Nevertheless, it remains one of the central ways by which transportation projects are evaluated.

Notes

¹ US Census Bureau, American Community Survey, 2005, Urbanized Area Data. See www.census.gov.

² A 'vehicle-mile', defined as one vehicle traveling one mile, is a widely used measure of urban travel.

³ Charlotte Area Transit System, Market Research Results 2000-2007, Summary Fall 2007.

⁴ "Ridership" (rides, riders, traffic) is defined as *one-way unlinked trips*, not the persons making those trips. So for instance if a commuter walked to LYNX and then returned, that would be 2 unlinked trips. If the commuter used a bus to transfer to LYNX and then returned, that would be 4 unlinked trips.

⁵ Metropolitan Transit Commission, Charlotte Area Transit System Ridership Report, July 2008, and earlier reports. Received August 2008.

⁶ The forecast also assumed 4 transit lines, higher downtown parking fees, and about 100,000 workers downtown. If redone with revised (lower) assumptions, the forecast would have been lower.

⁷ Ibid. August 2008 average weekday traffic was 16,357, 3.2 percent lower than July, but August Saturday and Sunday traffic was higher.

⁸ August 2008 traffic (454,524 trips) was 75 percent weekday. Source: MTC, CATS Ridership Report, August 2008, received September 16, 2008.

⁹ Metropolitan Transit Commission, Charlotte Area Transit System Ridership Report, Data July 2007-July 2008, Received August 2008.

¹⁰ Charlotte Area Transit System, Ridership by Routes for Routes That Connect to LYNX, Data November 2007-July 2008, Received August 2008.

¹¹ Charlotte Area Transit System, Ticket Sales, Memo from O. Kinard to J. Taylor, April 29, 2008.

¹² Parked vehicles * 2 trips/day * 1.1 riders/vehicle. Source: Charlotte Observer parking lot counts.

¹³ Parking lot observations by The Charlotte Observer and counts by the Hartgen Group, Wed., August 20, 2008, 9:20 am-11:20am.

¹⁴ City of Charlotte CDOT Planning and Design Office, Central parking report 2006-2007.

¹⁵ Metropolitan Transit Commission, Charlotte Area Transit System Ridership Report, July 2007-July 2008, Received August 2008.

¹⁶ Federal Transit Administration, National Transit Database, 2000-2006, available at www.ntdprogram.org

¹⁷ AAA Carolinas, Monthly Average - Metro Average - North Carolina - Charlotte-Gastonia-Rock Hill (N.C. only), January 2006-August 2008, Received August 2008.

¹⁸ CATS Four-Corridors Major Investment Study, Travel Demand Models Methodology Report, Feb 12, 2003. The technical term for these mode choice models is 'nested logit.'

¹⁹ Federal Transit Administration, New Starts Reports, various years. Available at www.fta.dot.gov.

²⁰ Raising the gasoline price from \$3 to \$4 per gallon increases the cost of a 10-mile trip by about \$0.50, or about 9 percent of the total cost of driving 10 miles, \$5.80. In the computer models, this would produce about a 1/3

percentage-point increase in the weekday transit share, noticeable in transit ridership but too small to be seen in auto traffic.

²¹ Wendell Cox, Analysis of the Charlotte South Boulevard Corridor LRT, 2000. www.demographia.com.

²² South Corridor Infrastructure Program (SCIP), Charlotte Engin. (James Keenan) and then verified/edited. <http://www.charmeck.org/Department/City+Engineering/See+Our+Projects/Transportation/home.htm>, Received August 2008.

²³ Flyvbjerg, B. et al, *Megaprojects and Risk: Anatomy of Ambition*, Cambridge University Press, 2003. He also notes that *highway* projects also have cost overruns, averaging about 40 percent.

²⁴ Charlotte Area Transit System, Light Rail FY2008 Operating Expenses, Received August 2008.

²⁵ Assumes no state or federal funds will be spent for operations. Most cities do spend some federal and state funds for transit.

²⁶ This assumes no increase in either operating costs or ridership. If both increase, this cost might be even higher since historically costs have risen faster than ridership.

²⁷ <http://www.ncdot.org/it/img/DataDistribution/Traffic-SurveyMaps/byYear.html?year=Urban>, Data Year 2002-2006, Received August 2008. Additional 2008 counts for I-77 were obtained from NCDOT's Traffic Monitoring Center, Received September 2008.

²⁸ <http://www.charmeck.org/Departments/Transportation/Traffic/Traffic+Counts.htm>, Data Year 2003-2007, Received August 2008.

²⁹ Traffic volumes typically fluctuate 5-10 percent from day to day, about twice the likely LYNX savings.

³⁰ City of Charlotte, South Corridor Economic Development Update, August 27, 2007. The supporting spreadsheet is dated 8/24/06, a year earlier.

³¹ The report contains an error in the spreadsheet; the actual total is 164,512 square feet.

³² For instance, a condo valued at \$300,000 might be rented for only \$750/month, or \$9,000 year, if (say) the owner had no mortgage on it. This is the 'economic rent' of the property, which must cover carrying costs and profit, and is the basis for comparison with other investments such as stocks, bonds, etc.

³³ *Charlotte Business Journal*, Commercial Real Estate Quarterly, April 2005 and August 2006-August 2008. (for the first quarter of 2005 and the second quarters of 2006, 2007, and 2008).

³⁴ 0.39 percent times \$76.68 million, the value of annual office rent in the South Corridor in 2005.

³⁵ Transit Oriented Districts (TODs) are planned small-area developments, usually only 1/4 mile in radius, around transit stations. They typically have mixed land uses (residential and commercial together), higher densities, a variety of activities, oriented toward the station.

³⁶ City of Charlotte, South Corridor Economic Development Update, August 27, 2007. The supporting spreadsheet is dated 8/24/06, a year earlier. Received July 2008.

About the Authors

David T. Hartgen, Ph.D., P.E., is Professor Emeritus of Transportation Studies at UNC Charlotte and President of The Hartgen Group. Prof. Hartgen is widely known in transportation circles. He established the UNC Charlotte's Center for Interdisciplinary Transportation Studies in 1989 and now conducts research in transportation policy. He is the author of about 335 publications on a wide variety of topics in transportation policy and planning, is US Co-Editor of the international academic journal *Transportation*, and is active in professional organizations. He is a frequent local and national media interviewee. Before coming to Charlotte he directed the statistics and analysis functions of the New York State Department of Transportation and served as a Policy Analyst at the Federal Highway Administration. He holds engineering degrees from Duke University and Northwestern University. He has taught at SUNY Albany, Union College and Syracuse University and lectures widely. His recent studies of congestion reduction, performance of state highway systems, sprawl, and cost-effective highway investment have attracted wide national attention.

M. Gregory Fields is a retired military officer, currently enrolled in the PhD program in Urban Regional Analysis at UNC Charlotte. A West Point graduate, he has masters degrees from Webster University in St. Louis and UNC Charlotte and has participated in a number of comparative studies, including the Fraser Institute study of the Canadian provinces, Reason's recent national study of congestion, Reason's recent study of accessibility and productivity, and global climate change.

Elizabeth San Jose is a researcher with the Hartgen Group, working on studies of transit service, urban congestion and climate change. She holds a BS from Indiana State University.

Anthony Layzell is a graduate student at UNC Charlotte, Department of Geography and Earth Science. He holds a BS in Geography from the University of Nottingham in England.

Matthew Scott holds a BA in Economics from Davidson College and is a graduate student in economics at UNC Charlotte. His projects with the Hartgen group include transit performance and climate change.

About the John Locke Foundation

The John Locke Foundation is a nonprofit, nonpartisan policy institute based in Raleigh. Its mission is to develop and promote solutions to the state's most critical challenges. The Locke Foundation seeks to transform state and local government through the principles of competition, innovation, personal freedom, and personal responsibility in order to strike a better balance between the public sector and private institutions of family, faith, community, and enterprise.

To pursue these goals, the Locke Foundation operates a number of programs and services to provide information and observations to legislators, policymakers, business executives, citizen activists, civic and community leaders, and the news media. These services and programs include the foundation's monthly newspaper, *Carolina Journal*; its daily news service, *CarolinaJournal.com*; its weekly e-newsletter, *Carolina Journal Weekly Report*; its quarterly newsletter, *The Locke Letter*; and regular events, conferences, and research reports on important topics facing state and local governments.

The Foundation is a 501(c)(3) public charity, tax-exempt education foundation and is funded solely from voluntary contributions from individuals, corporations, and charitable foundations. It was founded in 1990. For more information, visit www.JohnLocke.org.

*“To prejudge other men’s notions
before we have looked into them
is not to show their darkness
but to put out our own eyes.”*

JOHN LOCKE (1632–1704)

AUTHOR, TWO TREATISES OF GOVERNMENT AND
FUNDAMENTAL CONSTITUTIONS OF CAROLINA



200 West Morgan St.
Raleigh, NC 27601
V: 919-828-3876
F: 919-821-5117
www.johnlocke.org
info@johnlocke.org