

TECHNICAL MEMORANDUM #2

From: HDR Engineering, Inc. of the Carolinas Consulting Team (HDR)
To: Capital Area Bus Transit Development Plan Steering Committee & CAMPO
Technical Coordinating Committee
Date: September 30, 2011
Topic: 2010 Capital Area Bus Transit Boarding & Alighting Count

1 Introduction

One of the major elements of the Capital Area Bus Transit Development Plan involved conducting a complete ridership count for all Capital Area Transit (CAT) and Cary Transit (CTran) routes. The intent of counting each route's boarding and alighting activity is to better understand existing ridership trends. Conducting a complete boarding and alighting count is one of the most intensive data gathering efforts a system can do since it requires a counter to be on the bus during all hours of operation over the course of a single day. However, this also allows other information beyond the boarding and alighting activity to be collected as well. This includes data on passenger max load capacities, on-time performance, and the ability to identify major activity centers based on stop-level boarding and alighting information.

2 Methodology

The boarding and alighting count was completed aboard all existing CAT and CTran routes. AJM Consulting (AJM) of the HDR Team was responsible for collecting the stop-by-stop ride-checks. An equivalent one-day sample was collected for each route on weekdays and Saturdays. Ride checkers were aboard each bus and recorded all boardings and alightings for each stop on a trip-by-trip basis. The schedule adherence for the routes was also recorded by noting the time each trip passed a timepoint.

For CAT, a weekday boarding and alighting count was completed the week of September 13, 2010 through September 17, 2010. Overall, a total of 9 trips out of 1,178 total trips (0.8%) were missed. Two trips were missed because of a bus breakdown with seven trips missed due to the bus running late. Also, route 40E (Wake Tech Express), R-Line, and the Wake Forest Loop route were not surveyed due to budget constraints. Route 31 (New Hope Commons) and Route 34 (Wake Med-Poole) were not surveyed as they are not weekday routes. A CAT weekend boarding and alighting count was completed on three Saturday's on September 11, 2010, September 18, 2010, and September 25, 2010. A total of 5 out of 795 trips (0.6%) were missed, including three trips missed due to bus breakdowns and two trips due to late buses.

The CTran weekday boarding and alighting count was conducted on October 29, 2010 and November 4, 2010. A total of two trips were missed due to a passenger injury. A CTran weekend boarding and alighting count was completed on two Saturday's, October 30, 2010 and November 6, 2010. A total of three trips were missed, which includes two trips due to the bus running late and one trip late due to a train delay.

3 Boarding and Alighting Ridership Analysis

3.1 Daily Ridership

Daily ridership, defined as total boardings, is presented for CAT and CTran for both an average weekday and Saturday. Assessing individual route ridership is a critical quality of service metric for transit agencies. Decisions based on daily ridership impact passengers and the agency as a whole. For passengers, adjustments based on existing ridership may result in expansions of service, reductions in service, or new route alignments. For agencies, these service change decisions, based on ridership data, not only influence the availability of transit but also have a direct bearing on the financial performance of the system as a whole.

For CAT and CTran routes, ride checkers counted all riders who boarded each bus and recorded where they got off in order to identify active destination locations. Individual route data is provided detailing ons (boardings) and offs (alightings). For CAT weekday data, a comparison is made to a similar boarding and alighting count survey completed in 2008. In addition, both CAT and CTran weekday ridership numbers include comparisons to the recently released fiscal year (FY) 2010-2011 official farebox data.

3.1.1 CAT

3.1.1.1 CAT Weekday Ridership

CAT weekday ridership activity, on a route-by-route basis, is presented in **Exhibit 3-1**. Boardings, alightings, and total activity (boardings + alightings) are displayed for 2010 and 2008. For 2010, each route is ranked based on the total number of boardings. In order to compare ridership between 2008 and 2010, the percentage change in total activity is presented along with a corresponding growth rank. Based on recently released farebox data from FY 10-11, data is also included comparing the farebox data to the boarding data collected from the ride checkers in September 2010. This comparison provides insight into the validity of the 100 percent count sampled as an average weekday as compared to the actual full fiscal year farebox data. Overall, the farebox generated ridership is within 5 percent of the counts taken by ride checkers.

Routes highlighted in blue represent the top five CAT routes with the highest number of boardings while those in red represent the five routes with the lowest number of boardings. Routes shaded in green experienced the largest growth in ridership between 2008 and 2010. Those routes shaded in grey represent off-hour CAT routes, which run primarily during the early-morning and late-evening hours. While a boarding rank and growth rank is provided for reference purposes, their limited hours of service make comparisons to the more traditional fixed-routes with longer hours of service difficult. Therefore, the focus of comparisons was made among the major routes.

Exhibit 3-1

CAT Weekday Boarding and Alighting Activity

Route	2010				2008				FY '11		
	Ons	Offs	Total	Board Rank	Ons	Offs	Total	% change	Growth Rank	Farebox Count	% of BA
1 Capital	1,994	2,015	4,009	2	1,508	1,521	3,029	32%	9	1,989	100%
2 Falls of Neuse	1,078	1,070	2,148	5	945	943	1,743	23%	17	944	88%
3 Glascock	306	304	610	22	307	301	608	0%	31	295	96%
4 Rex Hospital	1,087	1,094	2,181	4	1,064	1,062	1,936	13%	24	1,051	97%
5 Biltmore Hills	639	629	1,268	10	536	524	1,060	20%	18	648	101%
6 Crabtree	755	743	1,498	8	714	702	1,416	6%	29	753	100%
7 South Saunders	1,211	1,204	2,415	3	937	937	1,874	29%	12	1,213	100%
7c Carolina Pines	388	388	776	18	264	264	528	47%	5	439	113%
8 Northclift	521	522	1,043	13	485	491	976	7%	28	484	93%
8c Sawmill	180	180	360	25	166	166	332	8%	26	201	112%
10 Longview	468	447	915	16	331	319	650	41%	7	414	89%
11 Avent Ferry	1,061	1,070	2,131	6	733	744	1,477	44%	6	915	86%
11c Buck Jones	304	304	608	23	236	236	472	29%	13	280	92%
12 Method	939	937	1,876	7	859	851	1,710	10%	25	853	91%
13 Chavis Heights	327	333	660	21	238	239	477	37%	8	297	91%
15 WakeMed	2,208	2,222	4,430	1	1,919	1,931	3,850	15%	22	2,051	93%
15c Trawick	709	710	1,419	9	547	553	1,100	29%	11	747	105%
16 Oberlin Road	610	612	1,222	11	528	533	1,061	15%	21	514	84%
18 Worthdale	607	607	1,214	12	484	484	968	25%	15	551	91%
19 Apollo Heights	507	507	1,014	14	288	288	576	76%	1	410	81%
21 Caraleigh	475	469	944	15	522	521	1,043	9.0%	32	419	88%
22 State Street	434	427	861	17	372	373	745	16%	20	419	97%
23c Millbrook	304	304	608	23	267	267	534	14%	23	297	98%
24c North Crosstown	364	364	728	20	229	227	456	60%	3	342	94%
25c Triangle Town Ctr	371	371	742	19	245	247	492	51%	4	347	94%
70E Brier Creek	51	51	102	32	39	39	78	31%	10	62	122%
26c Early East	8	7	15	38	12	6	18	-17%	33	9	118%
27 Southeast	25	25	50	36	20	20	40	25%	16	24	95%
28 Southwest	14	14	28	37	13	13	26	8%	27	19	137%
29c North Night	45	45	90	34	35	35	70	29%	14	44	99%
30 Northeast	46	46	92	33	55	56	111	17%	34	56	122%
32 Sanderford Road	151	145	296	26	82	88	170	74%	2	126	83%
33c Glenwood	30	30	60	35	37	37	74	-19%	35	35	116%
35 Poole Road	96	97	193	28	90	93	183	6%	30	103	108%
36 Garner Station	130	137	267	27	115	111	226	18%	19	159	122%
37 North Hills	54	63	117	31	-	-	-	-	-	79	146%
38 Blue Ridge	87	91	178	29	-	-	-	-	-	102	118%
39 Cameron Village	73	73	146	30	-	-	-	-	-	79	108%
TOTAL	18,657	18,657	37,314		15,222	15,222	30,109	24%		17,772	95%

Source: 2010 CAT Boarding and Alighting Count

Total average weekday boardings for the CAT system are 18,657. As compared to 2008, this represents an overall increase in ridership of 3,435 boardings or 24% growth overall for the system. For the FY '10-11 farebox data, total weekday boardings averaged 17,772, which is within the 95% confidence interval of the average weekday estimate from the data collected by the ride checkers. This indicates that the ridership levels from the boarding and alighting count are representative of the typical weekday.

The top five routes in terms of daily riders are:

1. Route 15: Wake Med (2,208 boardings)
2. Route 1: Capital (1,994 boardings)
3. Route 7: South Saunders (1,211 boardings)
4. Route 4: Rex Hospital (1,087 boardings)
5. Route 2: Falls of Neuse (1,078 boardings)

As would be expected, the CAT routes with the highest ridership tended to travel along major corridors and serve major destinations. Major corridors identified included New Bern Ave., Capital Blvd., South Saunders St., Hillsborough St., and Falls of Neuse Rd. Several major destinations also existed along the routes with the highest ridership, including Wake Med Hospital, Triangle Town Center, Rex Hospital, and NC State University.

The bottom five routes in terms of daily riders are:

1. Route 70E: Brier Creek (51 boardings)
2. Route 8C: Sawmill (180 boardings)
3. Route 11C: Buck Jones (304 boardings)
4. Route 23C: Millbrook (304 boardings)
5. Route 3: Glascock (306 boardings)

Routes characterized by low ridership shared several characteristics. In terms of route structure, many are loops serving lower density suburban neighborhoods. These loops increase the travel time of the route, which can negatively impact passengers' perceptions of transit service convenience. Other than Route 3 Glascock, the low ridership routes did not serve Downtown Raleigh, the area's largest activity center. Finally, routes 8C, 11C, and 70E only offer service every hour. Routes 3 and 33C provide 30 minute frequency on a limited number of peak-hour trips, and hourly service the rest of the day. By increasing service headways, passengers' perception of transit availability is diminished, which functions to reduce the appeal of using transit.

The top routes in terms of growth since 2008 are:

1. Route 19: Apollo Heights (76% increase in boardings)
2. Route 24C: North Crosstown (60% increase in boardings)
3. Route 25C: Triangle Town Center (51% increase in boardings)
4. Route 7C: Carolina Pines (47% increase in boardings)
5. Route 11: Avent Ferry (44% increase in boardings)

The routes experiencing the largest growth in ridership provide service to major destinations as well as connections to other CAT routes. Major destinations include Triangle Town Center, Mini City, Duke Raleigh Hospital, and NC State University. The connector routes in particular, including the 7C, 24C, and 25C, provide the ability to transfer to routes that have extended service hours with the opportunity to reach Downtown Raleigh. Based on results from the 2010 CAT weekday rider survey, just over 50% of riders on the 7C, 24C, and 25C stated that they would transfer after alighting from the connector route.

3.1.1.2 CAT Saturday Ridership

CAT Saturday boarding and alighting activity, on a route-by-route basis, is illustrated in **Exhibit 3-2**. CAT Saturday boardings, alightings, and total activity is presented for 2010. Each route is ranked based on the number of Saturday boardings. Routes highlighted in blue represent the top five CAT routes with the highest number of Saturday boardings while those in red represent routes with the lowest number of Saturday boardings (excluding off-hour routes). Routes shaded in grey represent off-hour CAT routes, which run primarily during the early-morning and late-evening hours. No comparison to 2008 is given because the 2008 count did not include Saturdays.

As a general rule of thumb, Saturday boardings range between 50% and 67% of total weekday boardings. Routes highlighted in orange are outside of this range. A higher percentage of Saturday boardings, above 67%, could reflect a larger share of transit dependent riders riding the bus 6 to 7 days per week. This also demonstrates a lack of choice riders using the route for weekday commuting purposes. This indicates an opportunity to increase efforts towards capturing this potential ridership market. In contrast, a Saturday boarding percentage below 50% likely reflects a higher share of choice riders riding the bus 4 to 5 days per week.

Exhibit 3-2
CAT Saturday Boarding and Alighting Activity
CAT SATURDAY BOARDINGS AND ALIGHTINGS BY ROUTE
2010

Route	Ons	Offs	Total	Board Rank	Wkdy Brd	Sat % of wkdy	Sat % Rank
1 Capital	1,246	1,252	2,498	1	1,994	62%	23
2 Falls of Neuse	473	472	945	10	1,078	44%	34
3 Glascock	178	176	354	22	306	58%	26
4 Rex Hospital	728	728	1,456	5	1,087	67%	17
5 Biltmore Hills	373	371	744	11	639	58%	25
6 Crabtree	532	533	1,065	7	755	70%	16
7 South Saunders	900	900	1,800	3	1,211	74%	14
7c Carolina Pines	255	255	510	17	388	66%	18
8 Northclift	284	282	566	15	521	55%	30
8c Sawmill	143	143	286	26	180	79%	12
10 Longview	254	253	507	18	468	54%	31
11 Avent Ferry	748	749	1,497	4	1,061	70%	15
11c Buck Jones	344	344	688	12	304	113%	7
12 Method	610	612	1,222	6	939	65%	20
13 Chavis Heights	168	172	340	24	327	51%	32
15 WakeMed	924	925	1,849	2	2,208	42%	35
15c Trawick	530	530	1,060	8	709	75%	13
16 Oberlin Road	338	341	679	13	610	55%	29

CAT SATURDAY BOARDINGS AND ALIGHTINGS BY ROUTE							
2010							
Route	Ons	Offs	Total	Board Rank	Wkdy Brd	Sat % of wkdy	Sat % Rank
21 Caraleigh	300	298	598	14	475	63%	22
22 State Street	284	280	564	15	434	65%	19
23c Millbrook	171	171	342	23	304	56%	28
24c North Crosstown	209	209	418	21	364	57%	27
25c Triangle Town Ctr	224	224	448	19	371	60%	24
70E Brier Creek	49	49	98	31	51	96%	10
27 Southeast	12	12	24	34	25	48%	33
28 Southwest	9	9	18	35	14	64%	21
29c North Night	39	39	78	33	45	87%	11
30 Northeast	52	52	104	30	46	113%	8
32 Sanderford Road	150	157	307	25	151	99%	9
33c Glenwood	41	41	82	32	30	137%	6
35 Poole Road	507	506	1,013	9	96	528%	1
36 Garner Station	216	216	432	20	130	166%	4
37 North Hills	90	89	179	29	54	167%	3
38 Blue Ridge	137	135	272	28	87	157%	5
39 Cameron Village	141	134	275	27	73	193%	2
TOTAL	11,659	11,659	23,318		17,535	66%	

Source: 2010 CAT Boarding and Alighting Count

Total average Saturday boardings for CAT are 11,659. Saturday boardings represent 66% of overall weekday boardings, suggesting a relatively high share of transit dependent riders using the system.

The top five Saturday routes in terms of ridership are:

1. Route 1: Capital (1,246 boardings)
2. Route 15: Wake Med (924 boardings)
3. Route 7: South Saunders (900 boardings)
4. Route 11: Avent Ferry (748 boardings)
5. Route 4: Rex Hospital (728 boardings)

The bottom five Saturday routes in terms of ridership are:

1. Route 70: Brier Creek (49 boardings)
2. Route 8C: Sawmill (143 boardings)
3. Route 13: Chavis Heights (168 boardings)
4. Route 23C: Millbrook (171 boardings)
5. Route 3: Glascock (178 boardings)

Overall, CAT Saturday boardings relative to the top five and bottom five routes in terms of ridership were similar to the average weekday results. For the top five Saturday routes, Route 11 was the only route not in the top five for average weekday boardings. Relative to the bottom five, Route 13 was the only route not in the bottom five for boardings on an average weekday. With Route 13 operating primarily in Downtown Raleigh, the lack of workers downtown on a Saturday and lack of classes at Shaw University compared to an average weekday likely played a role in the reduction of overall boardings.

3.1.2 CTran

CTran average weekday and Saturday ridership for all routes is presented in **Exhibit 3-3**. Blue shading indicates the route with the highest total boardings while red indicates the route with the lowest total boardings. Orange shading indicates routes that are outside of the 50% to 67% range of Saturday boardings as a percentage of weekday boardings.

Total average weekday ridership for CTran is 630 passengers. Route 6 Buck Jones has the highest number of average weekday boardings. The route serves major destinations, including Downtown Cary and Cary Towne Center, and provides connections to TTA and CAT service to Downtown Raleigh. Route 3 Harrison has the lowest number of average weekday boardings. With Route 3 serving major employment centers including Weston, Downtown Cary, and Crescent Commons, opportunities should be explored to grow ridership particularly among choice riders who work along the corridor.

Total Saturday ridership for CTran is 506 passengers. Ridership figures are similar to weekday boardings, with Route 6 demonstrating the highest number of boardings while Route 3 has the lowest number of boardings. A majority of routes possess Saturday boardings that approach average weekday levels, with Saturday boardings representing 80% of average weekday boardings systemwide. This suggests a very large proportion of transit dependent riders using the system, likely riding 6 days per week.

**Exhibit 3-3
CTran Weekday and Saturday Boarding and Alighting Activity**

2010 CTRAN BOARDINGS AND ALIGHTINGS BY ROUTE						
AVERAGE WEEKDAY						
Route	2010			Board Rank	FY '11	
	Ons	Offs	Total		Farebox Count	% of BA
Route 1 Maynard	79	79	158	4	75	95%
Route 2 Maynard	68	68	136	5	63	93%
Route 3 Harrison	45	41	86	6	65	145%
Route 4 High House	114	118	232	3	126	111%
Route 5 Kildaire Farm	146	150	296	2	133	91%
Route 6 Buck Jones	178	174	352	1	126	71%
TOTAL	630	630	1,260		589	94%

AVERAGE SATURDAY							
Route	Ons	Offs	Total	Board Rank	Weekday boardings	Sat % of wkdy	Sat % Rank
Route 1 Maynard	59	59	118	5	79	75%	4
Route 2 Maynard	67	67	134	4	68	99%	2
Route 3 Harrison	52	52	104	6	45	116%	1
Route 4 High House	68	68	136	3	114	60%	6
Route 5 Kildaire Farm	95	95	190	2	146	65%	5
Route 6 Buck Jones	165	165	330	1	178	93%	3
TOTAL	506	506	1,012		630	80%	

Source: 2010 CTran Boarding and Alighting Count

3.2 Location Activity

From the stop level ridership information, the major activity locations for both CAT and CTran can be identified. This information provides a broad-scale overview into the unique travel patterns of passengers using CAT and CTran. In addition, these locations may present opportunities to enhance passenger comfort and convenience. For example, heavily used bus stops could be upgraded with additional amenities such as real-time bus arrival and departure information, shelters, benches, etc.

3.2.1 CAT

The major activity locations for CAT were identified based on stop-level average weekday ridership. Major ridership locations, based on total ridership activity (cumulative trip ends), is presented in **Exhibit 3-4**. These are not necessarily the 25 *most* active locations, but are a list of the major locations and others that are of interest, such as Brier Creek and Forum. In some cases, such as Pecan & Wilmington and Avent Ferry & Gorman, the activity is almost entirely due to transferring, and not because of any destination in the area.

Exhibit 3-4
CAT Major Activity Locations

Major Location	Ons	Offs	Total	Percent of system	Rank
Moore Square	5,902	4,704	10,606	28%	1
Wake Med	1,242	1,132	2,374	6%	2
CBD (outside of Moore Square)	450	1,558	2,008	5%	3
Triangle Town Center	613	711	1,324	4%	4
Crabtree Valley Mall	597	646	1,243	3%	5
NCSU	501	522	1,023	3%	6
Pecan & Wilmington	450	359	809	2%	7
Falls of Neuse	378	386	764	2%	8
Mini City	339	335	674	2%	9
Garner Area	325	268	593	2%	10
Cameron Village	278	274	552	2%	11
Poole & New Bern	243	303	546	2%	12
Avent Ferry & Gorman	214	221	435	1%	13
Southgate S/C	212	194	406	1%	14
Pleasant Valley	192	144	336	1%	15
New Bern Walmart	153	176	329	1%	16
North Hills & Northclift	147	156	303	1%	17
North Hills	137	132	269	1%	18
Highwoods	128	139	267	1%	19
Rex	110	111	221	1%	20
CAT	85	85	170	1%	21
Glenwood South	79	86	165	0%	22
Wake Tech North	55	51	106	0%	23
Forum	24	27	51	0%	24
Brier Creek	18	27	45	0%	25

Source: 2010 CAT Boarding and Alighting Count

As expected, the top location for total ridership activity for CAT is Moore Square, the central location in which most of CAT routes meet in downtown Raleigh. A total of 5,902 boardings and 4,704 alightings occurred at Moore Square, which accounts for 28% of all trip ends in the CAT system. These trips do not account for both the R-Line (not counted in the boarding and alighting survey) and Triangle Transit routes serving Downtown Raleigh. For Downtown Raleigh as a whole, excluding Moore Square, there were 450 boardings and 1,558 alightings or roughly 5% of all trip ends. This imbalance between boardings and alightings at Moore Square and the rest of Downtown, in opposite directions, suggests passengers will get off their bus at their destination in Downtown, but will walk to Moore Square for their return trip.

Beyond Downtown Raleigh, four broad areas accounted for 16% of all trip ends on CAT. These areas include Wake Med, Triangle Town Center, Crabtree Valley Mall, and NC State. However, boarding and alighting activity represents data collected at stops within the general vicinity of these locations, which may include transfer activity. Therefore, the total ridership activity does not necessarily represent riders destined for these specific locations. Collectively, Downtown Raleigh (including Moore Square), Wake Med, Triangle Town Center, Crabtree Valley Mall, and NC State represent 50% of all trip ends. Overall, the 25 major locations above represent 70% of all trips ends for the CAT system.

Besides the major activity center analysis, the data allows the calculation of activity at individual stops. For the system as a whole, percentiles for total boardings by stop for CAT are as follows:

- 25th percentile: 1 boarding
- 50th percentile: 3 boardings
- 75th percentile: 9 boardings
- 95th percentile: 35 boardings

This data can be used to identify the potential impact of providing shelters or benches for any given ridership level. For example, if the decision is to provide a shelter at all stops with over 35 boardings, 5% of the 1426 recorded stops, or 71 stops, would get a shelter. The stop activity can also be arrayed in descending order in the count database. From this approach, if the decision is, for example, to provide a shelter to half of the boardings in the system, shelters would be installed at all stops with 75 or more boardings/day.

3.2.2 CTran

CTran major activity locations were identified using the stop-level boarding and alighting counts for average weekday ridership. Major ridership locations for CTran are outlined in **Exhibit 3-5**.

The major activity location for total ridership activity for CTran was the Cary Train Station. A total of 123 boardings and 119 alightings occurred at the Cary Train Station. This total ridership activity is expected since it serves as the focal point for the CTran system. For Downtown Cary as a whole, excluding the Cary Train Station, there were 23 boardings and 13 alightings or 3% of all trip ends. Taken together, nearly a quarter of all trip ends for CTran were located in Downtown Cary.

Exhibit 3-5
CTran Major Activity Locations

Major Location	Ons	Offs	Total	% of system	Rank
Cary Train Station	123	119	242	19%	1
Cary Towne Center	49	60	109	9%	2
Crescent Green	51	49	100	8%	3
Nottingham	48	32	80	6%	4
Crossroads	30	34	64	5%	5
Kroger Maynard Crossing	23	26	49	4%	6
Buck Jones Corridor	21	23	44	3%	7
Kmart Mayfair Plaza	18	25	43	3%	8
Downtown	23	13	36	3%	9
Plaza West	22	14	36	3%	9
Kildaire Plaza	22	13	35	3%	11
Highland Village	24	10	34	3%	12
SAS/Weston	13	10	23	2%	13
Harrison Pointe S/C	11	11	22	2%	14
NC 55	7	13	20	2%	15
Preston Corners	3	12	15	1%	16
Bond Park	7	5	12	1%	17
Cornerstone	8	3	11	1%	18
Western Wake Med	3	5	8	1%	19

Source: 2010 CTran Boarding and Alighting Count

The major activity location for total ridership activity for CTran was the Cary Train Station. A total of 123 boardings and 119 alightings occurred at the Cary Train Station. This total ridership activity is expected since it serves as the focal point for the CTran system. For Downtown Cary as a whole, excluding the Cary Train Station, there were 23 boardings and 13 alightings or 3% of all trip ends. Taken together, nearly a quarter of all trip ends for CTran were located in Downtown Cary.

Outside of Downtown Cary, several other areas show significant ridership activity. These include Cary Towne Center, Crescent Green, Nottingham, and Cary Crossroads. A total of 178 boardings and 175 alightings were identified at these four locations. The vicinity surrounding each of these four major activity locations combines for 353 total trip ends. As a whole, Downtown Cary (including Cary Train Station), Cary Towne Center, Crescent Green, Nottingham, and Cary Crossroads represent 50% of all trip ends. Overall, the 19 major locations shown in **Exhibit 3-5** represent 80% of all trips ends for the CTran system.

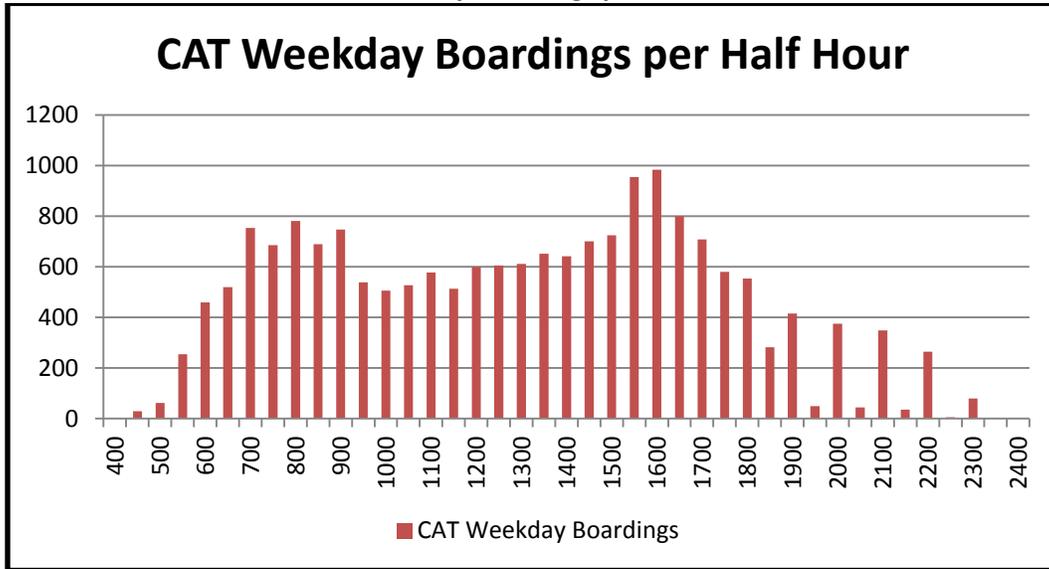
3.3 Ridership By Time of Day

Examining the time of day in which boardings occur provides insight into boarding trends over the course of a day. CAT and CTran weekday and Saturday ridership is divided into half hour increments based on the starting time of the outbound or inbound trip.

As illustrated in **Exhibit 3-6**, systemwide average weekday CAT boardings by trip is approximately bimodal with clear morning and afternoon peak periods. The overall peak hour was from 3:30pm – 4:30pm with 10% of the daily boardings. **Exhibit 3-7** presents systemwide Saturday CAT boardings by

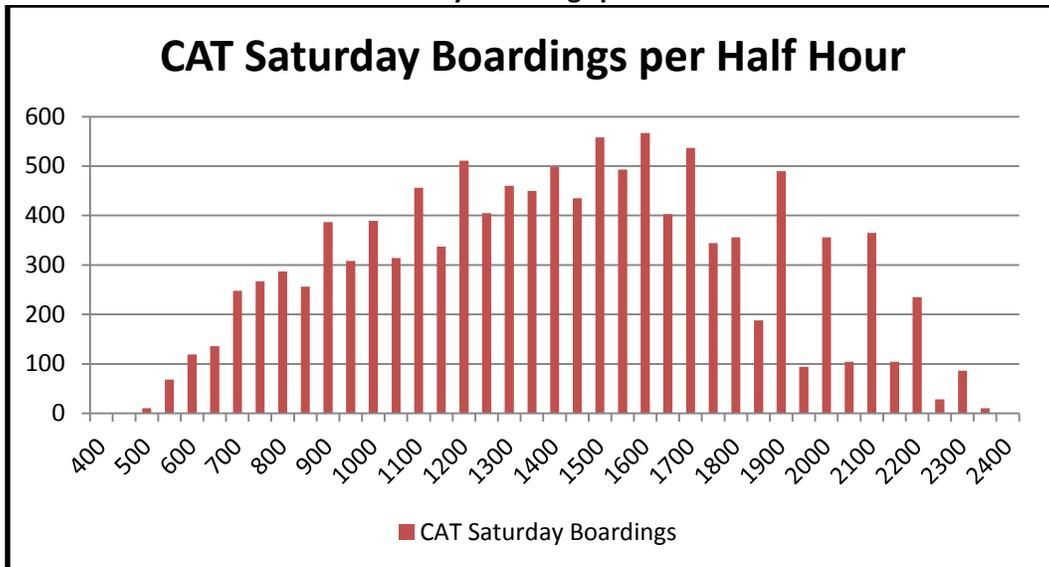
trip. Whereas CAT average weekday boardings were approximately bimodal, the distribution of Saturday boardings is approximately unimodal. With a greater share of discretionary, as opposed to work commute trip purposes, boardings build during the day with most boardings occurring in the mid afternoon between 2:30pm and 4:30pm, when each hourly period accounted for 9% of daily boardings. The choppy boardings at the end of the service day reflect the pulse leaving downtown on an hourly basis.

Exhibit 3-6
CAT Weekday Boardings per Half Hour



Source: 2010 CAT Boarding and Alighting Count

Exhibit 3-7
CAT Saturday Boardings per Half Hour

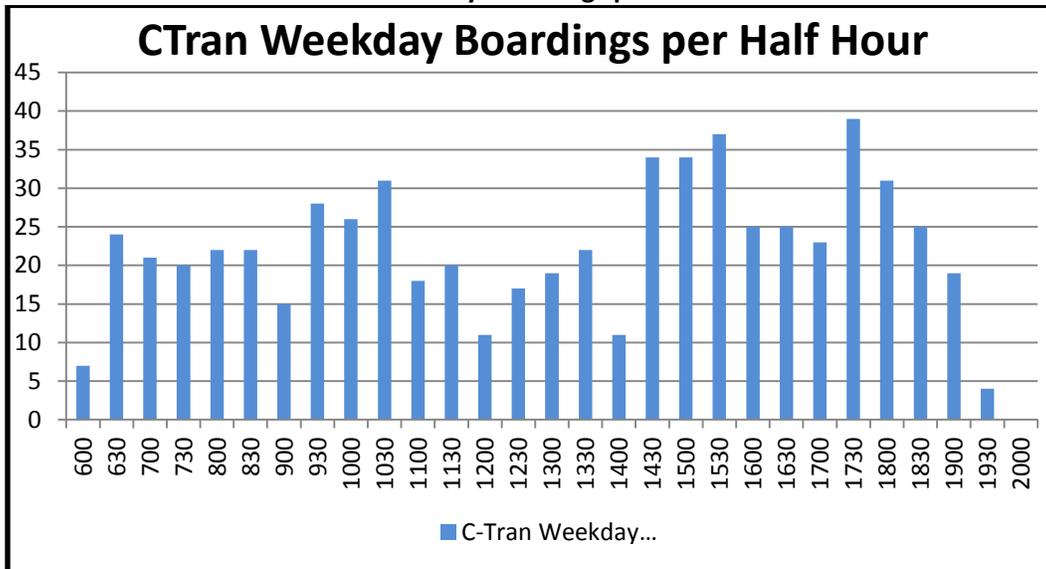


Source: 2010 CAT Boarding and Alighting Count

Exhibit 3-8 shows systemwide average weekday CTran boardings by half hour. Three unique peaks in ridership exist: mid-morning (9:30am-11:00am), mid-afternoon (2:30pm-4:00pm), and early-evening (5:30pm-7:00pm). The overall peak hour was from 3:00pm-4:00pm with 11% of the daily boardings.

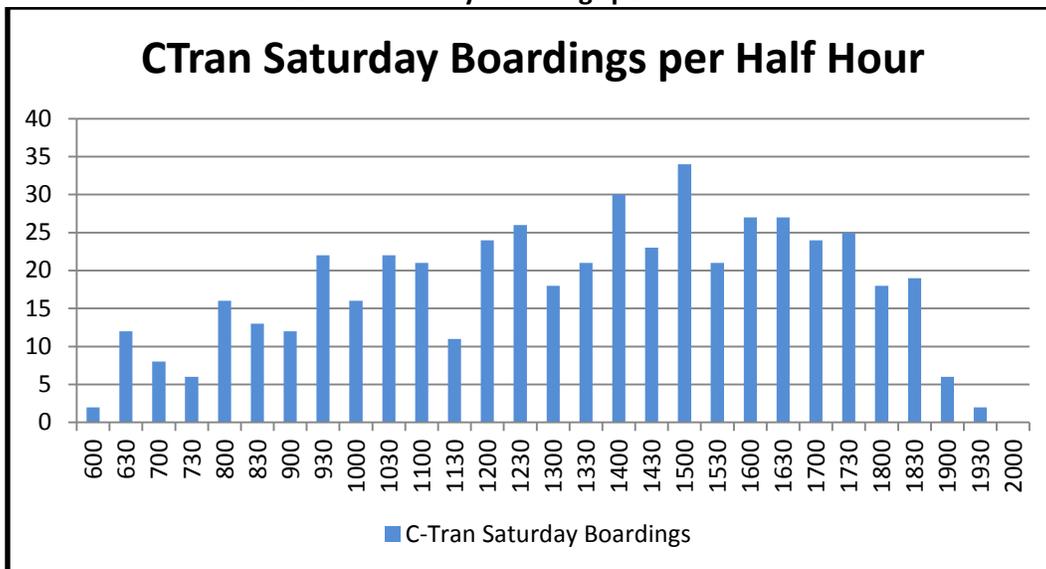
Exhibit 3-9 presents Saturday CTran boardings by half hour. Similar to CAT Saturday, the distribution is approximately unimodal. Peak boardings occurred in the mid afternoon between 2:30pm and 3:30pm, with 12% of daily boardings.

Exhibit 3-8
CTran Weekday Boardings per Half Hour



Source: 2010 CAT Boarding and Alighting Count

Exhibit 3-9
CTran Saturday Boardings per Half Hour



Source: 2010 CAT Boarding and Alighting Count

3.4 Passenger Maximum Load Analysis

Passenger loads reflect the number of individuals on-board a bus at any given point during a trip. Significant overcrowding on a bus negatively affects passengers' overall assessment of the comfort of the trip. Overloaded trips may also signal the need to increase service frequencies or vehicle sizes in order to reduce overcrowding on certain trips. While standees may be permitted during peak-hours, an excessive number should be avoided and generally every passenger should have a seat during off-peak hours.

Suggested Passenger Load LOS Standard

For systems the size of CAT and CTran, a desirable target is LOS "C" for both peak and off-peak times. Systems in larger cities may adopt LOS "D" during peak trips, but Raleigh and Cary can have a more relaxed standard that calls for no standees.

The Transit Cooperative Research Program (TCRP) *Report 100: Transit Capacity and Quality of Service Manual* (2nd Edition) provides guidance on assessing passenger loads aboard transit vehicles. Based on a calculated load factor (passengers per seat), passenger Level-of-Service (LOS) standards can assess passenger loads aboard transit vehicles. **Exhibit 3-10** provides an overview of LOS standards as applied to maximum loads aboard transit vehicles.

Exhibit 3-10
Passenger Load LOS

LOS	Passenger load factor (p/seat)	Comments
A	0.00 – 0.50	No passengers need to sit next to each other
B	0.51 – 0.75	Some passengers will need to sit next to others
C	0.76 – 1.00	All passengers can sit though choices will be limited
D	1.01 – 1.25	Some passengers required to stand
E	1.26 – 1.50	Maximum load of passengers achieved (seated & standees)
F	> 1.50	Crush load

Source: TCRP Report 100: Transit Capacity and Quality of Service Manual (2nd Edition)

3.4.1 CAT

3.4.1.1 CAT Weekday Maximum Passenger Loads

For the weekday CAT system as a whole, maximum passenger load LOS is presented in **Exhibit 3-11**. Based on CAT's existing bus fleet, a weighted average was calculated of 42 seats per bus. Most weekday CAT route trips operate below 50% capacity on a given trip. While roughly 5% approach the need for standees on the bus, less than 1% of trips actually require standees.

Exhibit 3-11
CAT Weekday Maximum Passenger Loads Systemwide

LOS	Passenger load factor (p/seat)	Max pax threshold	Total trips	% of trips
A	0.00 – 0.50	21	949	81%
B	0.51 – 0.75	31	157	13%
C	0.76 – 1.00	42	53	5%
D	1.01 – 1.25	52	7	1%
E	1.26 – 1.50	63	3	0%
F	> 1.50		0	0%

Source: 2010 CAT Boarding and Alighting Count

In order to identify routes and specific bus trips experiencing poor passenger load LOS standards, **Exhibit 3-12** presents the findings by route direction. Routes in grey shading represent off-hour weekday CAT routes. Depending on factors such as the route, direction of travel, and the time of day, increased frequency and/or bus capacity may be warranted for certain routes.

**Exhibit 3-12
CAT Weekday Maximum Passenger Loads By Route Direction**

CAT Weekday Maximum Passenger Loads By Direction							
TCRP Categories: Pax load LOS							
Route Number	Route Description	A	B	C	D	E	F
10	Capital OB	23%	48%	29%	-	-	-
11	Capital IB	39%	35%	23%	3%	-	-
20	Falls of Neuse OB	59%	36%	-	5%	-	-
21	Falls of Neuse IB	50%	36%	14%	-	-	-
30	Glascocock OB AM	100%	-	-	-	-	-
31	Glascocock IB AM	87%	13%	-	-	-	-
32	Glascocock OB PM	100%	-	-	-	-	-
33	Glascocock IB PM	100%	-	-	-	-	-
40	Rex Hospital OB	71%	25%	4%	-	-	-
41	Rex Hospital IB	88%	8.0%	4%	-	-	-
50	Biltmore Hills OB	76%	19%	5%	-	-	-
51	Biltmore Hills IB	86%	14%	-	-	-	-
60	Crabtree OB	85%	15%	-	-	-	-
61	Crabtree IB	90%	10%	-	-	-	-
70	South Saunders OB	60%	32%	4%	-	4%	-
71	South Saunders IB	54%	31%	15%	-	-	-
72	Carolina Pines EB	100%	-	-	-	-	-
73	Carolina Pines WB	100%	-	-	-	-	-
80	Northclift OB	95%	5%	-	-	-	-
81	Northclift IB	100%	-	-	-	-	-
82	Sawmill EB	100%	-	-	-	-	-
83	Sawmill WB	100%	-	-	-	-	-
100	Longview OB	95%	5%	-	-	-	-
101	Longview IB	85%	15%	-	-	-	-
110	Avent Ferry OB AM	100%	-	-	-	-	-
111	Avent Ferry IB AM	50%	40%	-	10%	-	-
112	Avent Ferry OB PM	29%	57%	14%	-	-	-
113	Avent Ferry IB PM	93%	7%	-	-	-	-
114	Buck Jones OB	100%	-	-	-	-	-
115	Buck Jones IB	100%	-	-	-	-	-
120	Method OB	75%	21%	4%	-	-	-
121	Method IB	71%	21%	8%	-	-	-
130	Chavis Heights Loop	100%	-	-	-	-	-
150	WakeMed OB	48%	28%	18%	2%	4%	-
151	WakeMed IB	63%	11%	20%	6%	-	-

CAT Weekday Maximum Passenger Loads By Direction							
TCRP Categories: Pax load LOS							
Route Number	Route Description	A	B	C	D	E	F
152	Trawick Connect OB	84%	12%	4%	-	-	-
153	Trawick Connect IB	92%	8%	-	-	-	-
160	Oberlin OB	79%	21%	-	-	-	-
161	Oberlin IB	84%	5%	11%	-	-	-
180	Worthdale OB	91%	9%	-	-	-	-
181	Worthdale IB	95%	5%	-	-	-	-
190	Apollo Heights OB	100%	-	-	-	-	-
191	Apollo Heights IB	90%	10%	-	-	-	-
210	Caraleigh Loop	76%	24%	-	-	-	-
220	State Street OB	96%	4%	-	-	-	-
221	State Street IB	93%	7%	-	-	-	-
232	Millbrook EB	100%	-	-	-	-	-
233	Millbrook WB	100%	-	-	-	-	-
242	North EB	100%	-	-	-	-	-
243	North WB	94%	6%	-	-	-	-
252	Triangle Town Ctr	69%	31%	-	-	-	-
700	Brier Creek Ex OB	100%	-	-	-	-	-
701	Brier Creek Ex IB	100%	-	-	-	-	-
262	Early East OB	100%	-	-	-	-	-
263	Early East IB	100%	-	-	-	-	-
270	Southeast OB	100%	-	-	-	-	-
271	Southeast IB	100%	-	-	-	-	-
280	Southwest OB	100%	-	-	-	-	-
281	Southwest IB	100%	-	-	-	-	-
292	North Night OB	100%	-	-	-	-	-
293	North Night Conn IB	100%	-	-	-	-	-
300	Northeast OB	100%	-	-	-	-	-
301	Northeast IB	100%	-	-	-	-	-
320	Sanderford Road OB	25%	50%	25%	-	-	-
321	Sanderford Road IB	100%	-	-	-	-	-
332	Glenwood OB	100%	-	-	-	-	-
333	Glenwood IB	100%	-	-	-	-	-
350	Poole Road OB	100%	-	-	-	-	-
351	Poole Road IB	100%	-	-	-	-	-
360	Garner Station OB	50%	50%	-	-	-	-
361	Garner Station IB	100%	-	-	-	-	-
370	North Hills OB	100%	-	-	-	-	-
371	North Hills IB	100%	-	-	-	-	-
380	Blue Ridge OB	100%	-	-	-	-	-
381	Blue Ridge IB	100%	-	-	-	-	-
390	Cameron Village OB	100%	-	-	-	-	-
391	Cameron Village IB	100%	-	-	-	-	-

Source: 2010 CAT Boarding and Alighting Count

CAT weekday routes were examined to identify specific trips where the number of passengers on-board at any point exceeded 42 passengers. Routes where passenger loads exceeded 42 passengers include: Route 15 Wake Med (6 trips); Route 1 Capital (1 trip); Route 2 Falls of Neuse (1 trip); Route 7 South Saunders (1 trip); and Route 11 Avent Ferry (1 trip).

CAT weekday routes were further examined to identify areas where a series of trips operated at LOS C or worse. As expected, maximum passenger loads at LOS C or worse took place during the morning, mid-day, and evening peak ridership periods. This occurred on two routes, Route 1 Capital and Route 15 Wake Med, which is outlined in **Exhibit 3-13**.

Exhibit 3-13
CAT Weekday Maximum Passenger Loads for Select Trips

Trip Start Time	Ons	Offs	Max Load	LOS
1 Capital OB				
Morning Peak Period (6:00 AM – 9:30 AM)				
715	45	39	36	C
745	52	42	35	C
815	31	24	22	B
845	52	50	35	C
Mid-Day Peak Period (12:00 PM – 3:00 PM)				
1315	46	41	34	C
1345	42	31	28	B
1415	30	22	17	A
1445	73	50	39	C
Evening Peak Period (3:00 PM – 7:00PM)				
1515	43	34	29	B
1545	50	40	42	C
1615	63	53	37	C
1645	76	48	39	C
1 Capital IB				
Morning Peak Period (6:00 AM – 9:30 AM)				
720	44	54	44	D
750	22	27	24	B
820	42	55	40	C
Evening Peak Period (3:00 PM – 7:00PM)				
1520	21	46	33	C
1550	37	42	35	C
1620	41	51	36	C
1650	39	49	36	C
1720	22	51	36	C
15 Wake Med OB				
Off-Peak Period (9:30 AM – 12:00PM)				
945	52	38	37	C
1015	57	32	34	C
1045	42	31	28	B
1115	58	27	35	C
1145	52	39	35	C

Trip Start Time	Ons	Offs	Max Load	LOS
Mid-Day Peak Period (12:00 PM – 3:00 PM)				
1215	91	49	57	E
1245	46	44	34	C
1315	61	42	37	C
1345	43	33	35	C
1415	66	29	39	C
1445	71	58	57	E
Evening Peak Period (3:00 PM – 7:00 PM)				
1500	31	19	19	A
1515	43	14	29	B
1530	68	51	49	D
15 Wake Med IB				
Off-Peak Period (9:30 AM – 12:00PM)				
945	10	30	27	B
1015	18	33	28	B
1045	35	58	47	D
1115	32	43	37	C
1145	22	52	41	C
Mid-Day Peak Period (12:00 PM – 3:00 PM)				
1215	22	37	32	C
1245	21	61	52	D
1315	27	34	32	C
1345	21	40	28	B
1415	23	37	28	B
1445	15	51	39	C
Evening Peak Period (3:00 PM – 7:00 PM)				
1515	38	54	46	D
1530	29	41	40	C
1545	12	36	39	C
1600	20	37	35	C

Source: 2010 CAT Boarding and Alighting Count

3.4.1.2 CAT Saturday Maximum Passenger Loads

CAT Saturday maximum passenger load LOS is outlined in **Exhibit 3-14**. Most Saturday CAT trips operate below 50% capacity on a given trip. Compared to CAT average weekday routes, a higher proportion of CAT Saturday routes operate trips at LOS D where passengers may be required to stand.

Exhibit 3-14
CAT Saturday Maximum Passenger Loads Systemwide

LOS	Passenger load factor (p/seat)	Max pax threshold	Total trips	% of trips
A	0.00 – 0.50	21	647	82%
B	0.51 – 0.75	31	102	13%
C	0.76 – 1.00	42	26	3%
D	1.01 – 1.25	52	13	2%
E	1.26 – 1.50	63	2	0%
F	> 1.50		0	0%

Source: 2010 CAT Boarding and Alighting Count

Exhibit 3-15 presents the findings by route direction. Routes in grey shading represent off-hour Saturday CAT routes. Factors such as the specific route, direction of travel, and the time of day, increased frequency and/or bus capacity may be warranted for certain routes.

**Exhibit 3-15
CAT Saturday Maximum Passenger Loads By Route Direction**

CAT Saturday Maximum Passenger Loads By Direction							
TCRP Categories: Pax load LOS							
Route Number	Route Description	A	B	C	D	E	F
10	Capital OB	28%	33%	17%	16%	6%	-
11	Capital IB	33%	28%	6%	28%	5%	-
20	Falls of Neuse OB	93%	7%	-	-	-	-
21	Falls of Neuse IB	100.0%	-	-	-	-	-
30	Glascock OB AM	100%	-	-	-	-	-
31	Glascock IB AM	100%	-	-	-	-	-
32	Glascock OB PM	100%	-	-	-	-	-
33	Glascock IB PM	100%	-	-	-	-	-
40	Rex Hospital OB	64%	36%	-	-	-	-
41	Rex Hospital IB	53%	40%	-	7%	-	-
50	Biltmore Hills OB	100%	-	-	-	-	-
51	Biltmore Hills IB	76%	23%	-	-	-	-
60	Crabtree OB	58%	17%	25%	-	-	-
61	Crabtree IB	100%	-	-	-	-	-
70	South Saunders OB	45%	45%	10%	-	-	-
71	South Saunders IB	60%	35%	-	5%	-	-
72	Carolina Pines EB	100%	-	-	-	-	-
73	Carolina Pines WB	100%	-	-	-	-	-
80	Northclift OB	100%	-	-	-	-	-
81	Northclift IB	100%	-	-	-	-	-
82	Sawmill EB	100%	-	-	-	-	-
83	Sawmill WB	100%	-	-	-	-	-
100	Longview OB	92%	8%	-	-	-	-
101	Longview IB	100%	-	-	-	-	-
110	Avent Ferry OB AM	100%	-	-	-	-	-
111	Avent Ferry IB AM	50%	33%	17%	-	-	-
112	Avent Ferry OB PM	45%	36%	18%	-	-	-
113	Avent Ferry IB PM	64%	27%	-	9%	-	-
114	Buck Jones OB	93%	7%	-	-	-	-
115	Buck Jones IB	94%	6%	-	-	-	-
120	Method OB	73%	27%	-	-	-	-
121	Method IB	60%	33%	7%	-	-	-
130	Chavis Heights Loop	100%	-	-	-	-	-
150	WakeMed OB	37%	32%	26%	5%	-	-
151	WakeMed IB	42%	32%	21%	5%	-	-
152	Trawick Connect OB	89%	5%	5.6%	-	-	-

CAT Saturday Maximum Passenger Loads By Direction							
TCRP Categories: Pax load LOS							
Route Number	Route Description	A	B	C	D	E	F
153	Trawick Connect IB	94%	6%	-	-	-	-
160	Oberlin OB	83%	17%	-	-	-	-
161	Oberlin IB	92%	8%	-	-	-	-
210	Caraleigh Loop	77%	23%	-	-	-	-
220	State Street OB	100%	-	-	-	-	-
221	State Street IB	100%	-	-	-	-	-
232	Millbrook EB	100%	-	-	-	-	-
233	Millbrook WB	100%	-	-	-	-	-
242	North EB	100%	-	-	-	-	-
243	North WB	100%	-	-	-	-	-
252	Triangle Town Ctr	100%	-	-	-	-	-
700	Brier Creek Ex OB	100%	-	-	-	-	-
701	Brier Creek Ex IB	100%	-	-	-	-	-
270	Southeast OB	100%	-	-	-	-	-
271	Southeast IB	100%	-	-	-	-	-
280	Southwest OB	100%	-	-	-	-	-
281	Southwest IB	100%	-	-	-	-	-
292	North Night OB	100%	-	-	-	-	-
293	North Night Conn IB	100%	-	-	-	-	-
300	Northeast OB	100%	-	-	-	-	-
301	Northeast IB	100%	-	-	-	-	-
320	Sanderford Road OB	50%	50%	-	-	-	-
321	Sanderford Road IB	100%	-	-	-	-	-
332	Glenwood OB	100%	-	-	-	-	-
333	Glenwood IB	100%	-	-	-	-	-
350	Poole Road OB	61%	39%	-	-	-	-
351	Poole Road IB	94%	6%	-	-	-	-
360	Garner Station OB	-	75%	25%	-	-	-
361	Garner Station IB	50%	50%	-	-	-	-
370	North Hills OB	100%	-	-	-	-	-
371	North Hills IB	100%	-	-	-	-	-
380	Blue Ridge OB	100%	-	-	-	-	-
381	Blue Ridge IB	80%	20%	-	-	-	-
390	Cameron Village OB	75%	25%	-	-	-	-
391	Cameron Village IB	33%	-	67%	-	-	-

Source: 2010 CAT Boarding and Alighting Count

CAT Saturday routes were examined to identify specific trips where the number of passengers on-board at any point exceeded 42 passengers. Routes where passenger loads exceeded 42 passengers include:

- Route 1 Capital (10 trips);
- Route 15 Wake Med (2 trips);
- Route 4 Rex Hospital (1 trip);

- Route 7 South Saunders (1 trip); and
- Route 11 Avent Ferry (1 trip).

Compared to CAT average weekday routes, Route 1 gained in the number of trips requiring standees while Route 15 reduced in the number of trips requiring standees. This finding likely reflects the increased demand for discretionary trip purposes on Saturdays. Route 1 Capital runs along a major commercial corridor, Capital Blvd., containing numerous shopping and entertainment destinations.

CAT Saturday routes were examined to identify areas where a series of trips operated at LOS C or worse. This occurred on two routes, Route 1 Capital and Route 15 Wake Med, which is outlined in **Exhibit 3-16**.

**Exhibit 3-16
CAT Saturday Maximum Passenger Loads for Select Trips**

Trip Start Time	Ons	Offs	Max Load	LOS
1 Capital OB				
1045	58	51	41	C
1145	46	33	31	B
1245	63	43	30	B
1345	86	58	57	E
1445	56	18	39	C
1545	86	56	48	D
1645	66	36	52	D
1745	40	31	25	B
1900	59	38	51	D
1 Capital IB				
1020	20	36	27	B
1120	23	30	25	B
1220	38	51	43	D
1320	27	47	39	C
1420	45	73	52	D
1520	25	63	52	D
1620	29	59	46	D
1720	53	84	63	E
1820	28	37	31	B
1930	25	50	47	D
15 Wake Med OB				
1130	69	25	44	D
1230	49	25	24	B
1330	66	35	34	C
1430	50	25	25	B
1530	74	38	36	C
1630	40	23	19	A
1730	40	36	34	C
1830	61	39	34	C
15 Wake Med IB				
1200	12	56	48	D
1300	18	42	38	C
1400	7	38	34	C

Trip Start Time	Ons	Offs	Max Load	LOS
1500	22	47	37	C
1600	6	42	37	C
1700	10	27	25	B

Source: 2010 CAT Boarding and Alighting Count

3.4.2 CTran

3.4.2.1 CTran Weekday Maximum Passenger Loads

Systemwide CTran average weekday maximum passenger load LOS is outlined in **Exhibit 3-17**. Based on CTran's existing bus fleet, a weighted average bus capacity was calculated to be 18 seats per bus.

Exhibit 3-17
CTran Weekday Maximum Passenger Loads Systemwide

LOS	Passenger load factor (p/seat)	Max pax threshold	Total trips	% of trips
A	0.00 – 0.50	9	186	99%
B	0.51 – 0.75	14	2	1%
C	0.76 – 1.00	18	0	0%
D	1.01 – 1.25	23	0	0%
E	1.26 – 1.50	28	0	0%
F	> 1.50		0	0%

Source: 2010 CTran Boarding and Alighting Count

As indicated in **Exhibit 3-17**, nearly all CTran weekday trips operate below 50% on a given trip. Due to potential variability in maximum passenger load by specific route, route direction, and time of day, additional detail is provided for each CTran route, by direction, summarized in **Exhibit 3-18**.

Exhibit 3-18
CTran Weekday Maximum Passenger Loads By Direction

Route Number	Route Description	TCRP Categories: Pax load LOS					
		A	B	C	D	E	F
10	Maynard Loop	100%	-	-	-	-	-
11	Crossroads Loop	100%	-	-	-	-	-
20	Maynard Loop	100%	-	-	-	-	-
21	Crossroads Loop	100%	-	-	-	-	-
30	Harrison Avenue OB	100%	-	-	-	-	-
30	Harrison Avenue IB	100%	-	-	-	-	-
40	High House Rd OB	100%	-	-	-	-	-
41	High House Rd IB	100%	-	-	-	-	-
50	Kildaire Farm OB	96%	4%	-	-	-	-
50	Kildaire Farm IB	91%	9%	-	-	-	-
60	Buck Jones OB	100%	-	-	-	-	-
61	Buck Jones IB	100%	-	-	-	-	-

Source: 2010 CTran Boarding and Alighting Count

CTran weekday routes were examined to identify specific trips operating at LOS C where the number of passengers on-board at any point exceeded 18 passengers. No CTran trips approached this load; with the lowest being LOS B on two trips on Route 5 Kildaire Farm.

3.4.2.2 CTran Saturday Maximum Passenger Loads

Overall systemwide CTran Saturday maximum passenger load LOS is presented in **Exhibit 3-19**. Similar to CTran weekday passenger load, nearly all CTran Saturday trips operate below 50% on a given trip. **Exhibit 3-20** provides the detail by route and direction.

Exhibit 3-19
CTran Saturday Maximum Passenger Loads Systemwide

LOS	Passenger load factor (p/seat)	Max pax threshold	Total trips	% of trips
A	0.00 – 0.50	9	186	99%
B	0.51 – 0.75	14	2	1%
C	0.76 – 1.00	18	0	0%
D	1.01 – 1.25	23	0	0%
E	1.26 – 1.50	28	0	0%
F	> 1.50		0	0%

Source: 2010 CTran Boarding and Alighting Count

Exhibit 3-20
CTran Saturday Maximum Passenger Loads By Direction

Route Number	Route Description	TCRP Categories: Pax load LOS					
		A	B	C	D	E	F
10	Maynard Loop	100%	-	-	-	-	-
11	Crossroads Loop	100%	-	-	-	-	-
20	Maynard Loop	100%	-	-	-	-	-
21	Crossroads Loop	93%	7%	-	-	-	-
30	Harrison Avenue OB	100%	-	-	-	-	-
30	Harrison Avenue IB	100%	-	-	-	-	-
40	High House Rd OB	100%	-	-	-	-	-
41	High House Rd IB	100%	-	-	-	-	-
50	Kildaire Farm OB	100%	-	-	-	-	-
50	Kildaire Farm IB	100%	-	-	-	-	-
60	Buck Jones OB	95%	5%	-	-	-	-
61	Buck Jones IB	100%	-	-	-	-	-

Source: 2010 CTran Boarding and Alighting Count

3.5 Route On-Time Performance

A fundamental measure in the assessment of overall transit quality of service output is route on-time performance. On-time performance serves as a key reliability measure that significantly impacts the perception of the system’s overall comfort and convenience. Transit passengers are very time sensitive, as they are generally motivated to reach their destination in the most time efficient manner as possible. The ease to which passengers are either able to reach their destination on-time or complete a timed transfer effectively is directly related to on-time performance of the routes in the system.

Suggested On-Time LOS Standard
 For CAT and CTran, a reasonable target is LOS “C”. Larger urban systems may adopt a lower standard of LOS “D” due to the greater variability in traffic conditions, but the relative consistent travel times in Raleigh and Cary allow for a more attractive LOS “C” standard. A higher LOS is also desirable given the relative infrequency of service – the consequences of missing a transfer can be severe (30 minutes or more), necessitating a higher standard.

The TCRP Report 100: *Transit Capacity and Quality of Service Manual* (2nd Edition) provides guidance on assessing on-time performance. Generally, transit trips are considered “on-time” if they depart at the scheduled timepoint 0 to 5 minutes late. Trips departing after 5 minutes are considered “late”. Trips departing at a timepoint early, with the exception of the last timepoint at the end of the route, are considered “early”. Trips are not penalized if they arrive early at a timepoint but leave on time. Based on an overall percentage of on-time trips for each route, on-time LOS standards can be applied to assess the on-time performance of routes. **Exhibit 3-21** provides an overview of LOS standards as applied to the on-time performance of routes:

**Exhibit 3-21
 On-time Performance LOS Standards**

LOS	On-time percentage of trips	Individual perspective based on 5 round trips per week
A	95% - 100%	1 late transit vehicle every 2 weeks (no transfer)
B	90% - 94.9%	1 late transit vehicle every week (no transfer)
C	85% – 89.9%	3 late transit vehicles every 2 weeks (no transfer)
D	80% – 84.9%	2 late transit vehicles every week (no transfer)
E	75% – 79.9%	1 late transit vehicle every day (with a transfer)
F	< 74.9%	1 late transit vehicle at least daily (with a transfer)

Source: TCRP Report 100: *Transit Capacity and Quality of Service Manual* (2nd Edition)

3.5.1 CAT

3.5.1.1 CAT Weekday Route On-Time Performance

CAT weekday on-time performance for each route is presented in **Exhibit 3-22**. Routes in grey shading represent off-hour weekday CAT routes. Overall, CAT weekday on-time performance is poor, with the system achieving LOS E. A total of 480 trips were classified early, 534 were classified late, and 3,120 were classified as on-time. Based on an overall sample of 4,134 trips, 76% of all trips arrived on-time. As illustrated in **Exhibit 3-22**, among regular peak-hour CAT weekday service, no route achieved better than LOS C with a majority of routes receiving LOS E or F. And while the CAT off-hour services generally outperformed the regular CAT routes in on-time performance LOS, this is likely heavily influenced by the off-hour services limited total trip sample sizes as well as their truncated service hour spans.

Exhibit 3-22
CAT Weekday On-Time Performance By Route

Route	Total samples	Total early	Total late	Total on-time	Percent on-time	On-time LOS
1 Capital	217	2	30	185	85%	C
2 Falls of Neuse	220	43	41	136	62%	F
3 Glascock	114	6	16	92	81%	D
4 Rex Hospital	245	39	32	174	71%	F
5 Biltmore Hills	126	2	22	102	81%	D
6 Crabtree	200	53	19	128	64%	F
7 South Saunders	153	26	13	114	75%	F
7c Carolina Pines	153	31	7	115	76%	E
8 Northclift	168	35	11	122	73%	F
8c Sawmill	93	7	10	76	82%	D
10 Longview	120	13	22	85	71%	F
11 Avent Ferry	192	7	57	128	67%	F
11c Buck Jones	174	8	38	128	74%	F
12 Method	168	17	19	132	79%	E
13 Chavis Heights	78	12	7	59	76%	E
15 WakeMed	276	37	27	212	77%	E
15c Trawick	175	41	6	128	73%	F
16 Oberlin Road	152	14	20	118	78%	E
18 Worthdale	126	2	11	113	90%	C
19 Apollo Heights	160	20	5	135	84%	D
21 Caraleigh	63	2	5	56	89%	C
22 State Street	108	1	13	94	87%	C
23c Millbrook	144	22	6	116	81%	D
24c North Crosstown	111	1	44	66	59%	F
25c Triangle Town Ctr.	65	2	27	36	55%	F
70E Brier Creek	45	2	3	40	89%	C
26c Early East	7	2	0	5	71%	F
27 Southeast	12	1	1	10	83%	D
28 Southwest	12	3	0	9	75%	E
29c North Night	21	1	1	19	90%	B
30 Northeast	28	3	0	25	89%	C
32 Sanderford Road	32	3	1	28	88%	C
33c Glenwood	18	1	1	16	89%	C
35 Poole Road	25	2	2	21	84%	D
36 Garner Station	32	5	3	24	75%	E
37 North Hills	28	5	2	21	75%	E
38 Blue Ridge	45	7	8	30	67%	F
39 Cameron Village	28	2	4	22	79%	E
TOTAL	4,134	480	534	3,120	76%	E

Source: 2010 CAT Boarding and Alighting Count

3.5.1.2 CAT Saturday On-Time Performance

CAT Saturday on-time performance by route is presented in **Exhibit 3-23**. Compared with CAT weekday service, Saturday service performed worse in on-time performance. Overall, CAT Saturday on-time performance is very poor, with a systemwide LOS F. A total of 399 trips were early, 454 were late, and 1,934 were as on-time. Based on an overall sample of 2,787 trips, 69% of all trips arrived on-time.

Exhibit 3-23
CAT Saturday On-Time Performance By Route

Route	Total samples	Total early	Total late	Total on-time	Percent on-time	On-time LOS
1 Capital	126	6	34	86	68%	F
2 Falls of Neuse	140	30	15	95	68%	F
3 Glascock	75	4	13	58	77%	E
4 Rex Hospital	144	61	1	82	57%	F
5 Biltmore Hills	78	0	13	65	83%	D
6 Crabtree	120	25	30	65	54%	F
7 South Saunders	120	27	3	90	76%	E
7c Carolina Pines	103	29	4	70	68%	F
8 Northclift	104	19	17	68	65%	F
8c Sawmill	78	11	12	55	71%	F
10 Longview	78	9	20	49	63%	F
11 Avent Ferry	166	8	56	102	61%	F
11c Buck Jones	158	21	16	121	77%	E
12 Method	105	14	8	83	79%	E
13 Chavis Heights	78	20	3	55	71%	F
15 WakeMed	114	9	13	92	81%	D
15c Trawick	126	27	6	93	74%	F
16 Oberlin Road	96	18	20	58	60%	F
21 Caraleigh	39	2	7	30	77%	E
22 State Street	100	0	6	94	94%	B
23c Millbrook	100	14	3	83	83%	D
24c North Crosstown	81	4	20	57	70%	F
25c Triangle Town Ctr.	84	7	34	43	51%	F
70E Brier Creek	45	7	1	37	82%	D
27 Southeast	6	1	0	5	83%	D
28 Southwest	6	2	0	4	67%	F
29c North Night	21	1	4	16	76%	E
30 Northeast	28	6	0	22	79%	E
32 Sanderford Road	32	4	11	17	53%	F
33c Glenwood	18	1	7	10	56%	F
35 Poole Road	90	1	55	34	38%	F
36 Garner Station	28	2	10	16	57%	F
37 North Hills	28	3	3	22	79%	E
38 Blue Ridge	45	2	4	39	87%	C
39 Cameron Village	27	4	5	18	67%	F
TOTAL	2,787	399	454	1,934	69%	F

Source: 2010 CAT Boarding and Alighting Count

3.5.2 CTran

CTran on-time performance for weekday and Saturday routes is detailed in **Exhibit 3-24**. Overall, both weekday and Saturday CTran on-time performance was poor, achieving an overall LOS E. For CTran weekday service, a total of 80 trips were early, 125 were late, and 630 were as on-time. Based on an overall sample of 835 trips, 75% of all trips arrived on-time. However, two weekday routes stood out and preformed remarkably well on on-time performance: Route 3 Harrison and Route 5 Kildaire Farm.

For Saturday CTran routes, a total of 67 trips were early, 129 were late, and 630 were as on-time. With an overall sample of 826 trips, 76% of all trips arrived on-time. Similar to weekday service, Route 3 Harrison preformed reasonably well on on-time performance as compared to other Saturday routes.

**Exhibit 3-24
CTran On-Time Performance By Route**

WEEKDAY						
Route	Total samples	Total early	Total late	Total on-time	Percent on-time	On-time LOS
Route 1 Maynard	112	16	13	73	65%	F
Route 2 Maynard	126	3	49	74	59%	F
Route 3 Harrison	115	2	1	112	97%	A
Route 4 High House	168	22	27	119	71%	F
Route 5 Kildaire Farm	138	6	0	132	96%	A
Route 6 Buck Jones	176	31	25	120	68%	F
TOTAL	835	80	125	630	75%	E

SATURDAY						
Route	Total samples	Total early	Total late	Total on-time	Percent on-time	On-time LOS
Route 1 Maynard	95	10	29	46	48	F
Route 2 Maynard	126	2	53	71	56	F
Route 3 Harrison	115	3	6	106	92	B
Route 4 High House	176	22	5	149	84%	D
Route 5 Kildaire Farm	138	9	11	118	86%	C
Route 6 Buck Jones	176	21	15	140	79%	E
TOTAL	826	67	129	630	76%	E

Source: 2010 CTran Boarding and Alighting Count