

Tcat route benefits from student engineers' simulation project

By Joe Wilensky

Tcat's bustling Route 81 is running a bit more smoothly now thanks to four graduate engineering students who used operations research methods to develop recommended changes to the route's timetable that have now been adopted.

The students used modern simulation techniques to compare the efficiency of existing and proposed schedules in a class project supervised by Francis Vanek, a visiting lecturer in the School of Operations Research and Industrial Engineering at Cornell University's College of Engineering. The project is the latest of an ongoing series of collaborations between Vanek's students and Tcat that has encompassed a broad mandate to improve Tcat's services and to create a better, more comprehensive, and more accessible schedule database.

After students improved Tcat's schedule database a few years ago, they realized they had created the foundation from which a web-based trip planner could be created. In 2002, a student team designed and implemented Tcat's on-line journey planner (accessible at www.tcatbus.com), which allows riders to query the Tcat database to find the most convenient way to get from one point to another. Students developed the programming and algorithms that balanced the need for accurate (and time-consuming) calculations with web users' need for speed and a ranking of trip options.

The trip-planning site allows users to input starting points and desired destinations as well as time preferences and maximum number of transfers. Several possible trips are recommended, with total travel times, route numbers, and transfers detailed. Vanek's student teams in prior years have also targeted specific Tcat routes, analyzing performance measures such as average total journey time, average speed, how long passengers wait on average at each bus stop, and how easy it is to transfer to different routes along the way, to recommend schedule improvements.

Two years ago, Vanek and his students began analyzing GPS data that is automatically gathered on Tcat buses every time a passenger boards. The data was used to begin creating a simulation model of bus routes. Early plans called for the entire Tcat system to be simulated (with graphic animation), but it took nearly a year for students to work with the GPS data and to decide what they could do with it.

Last fall, the student team set out to build a simulation model of a specific Tcat route, using a software simulation package originally designed for devising factory floor plans. It was easily adapted for a transit system, however, with job

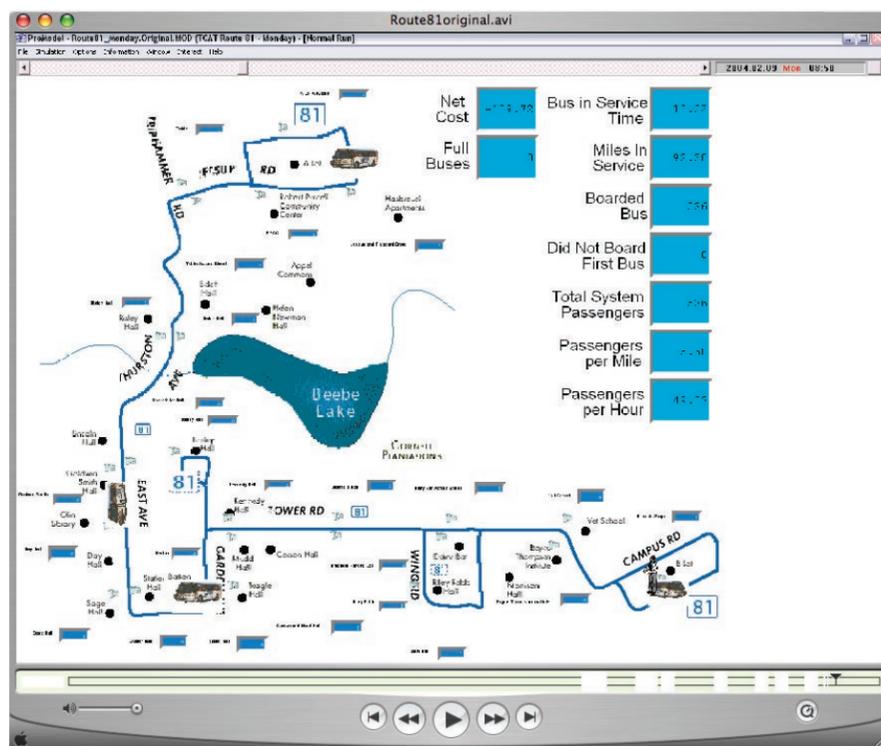
vehicles traveling to work stations transformed into buses picking up and dropping off passengers at stops. Route 81, a heavily used and meticulously scheduled campus route, was chosen because it was a candidate for streamlining by Tcat officials who wanted to know if standardizing the route at regular 10-minute intervals throughout the day would be worthwhile.

Vanek says the students created a statistical distribution from the GPS data, which created the basis for the simulation. By changing variables and comparing different schedules, the students could see how many passengers ended up waiting at stops and for how long, whether buses filled up and had to forgo picking up additional passengers during busy times, and whether passengers opted for other campus routes because of full buses or different schedule times.

Vanek notes that while different schedules can be tried out (and usually are) using spreadsheets, the simulation captures in detail what was actually happening at each stop—how many passengers are waiting by the time the next bus pulls up and how long they have been there. By comparing these details between the proposed schedule and the existing schedule, "it allowed Tcat to be more certain about their decision," Vanek says. Standardizing the schedule improved service during the busiest times of the day, and the changes in net operating cost to running buses every 10 minutes even during less busy periods were negligible.

There are limits to the simulation—it doesn't deal with elasticity of demand, for example, which could assume that with more regular service and better service, more passengers may opt to use the bus. "That's more of a transportation economics question," Vanek says. The simulation does include graphic animation, showing little images of Tcat buses crawling like bugs along a portion of the campus map, stopping at stops while several nearby counters tally data.

Vanek's students have made presentations at transit conferences, but Vanek says the transit industry has been slow to adopt computer simulation even though officials do seem intrigued. Most transit officials still revise schedules based on historical precedent or prior efforts. Schedules are often adjusted on a trial-and-error basis, he notes, without the changes being supported by any kind of computer analysis. "They may use spreadsheets to assist with what is essentially a human decision-making process," he says, "but there's no underlying simulation model to assist with that."



Cornell lecturer Francis Vanek's engineering students modified a commercial simulation software product, ProModel, to use for simulations of a Tcat bus route. Above is a single frame taken from graphic animation that the simulation rendered. The simulation tallied bus runs, tracked passengers waiting at stops, and ran different versions of the bus schedule to maximize efficiency.

Student project improves TCAT

By Daniel Palmadesso

In an effort that was launched by a Cornell junior's extra-credit project, TCAT is posting summary bus schedules at all its stops on the Cornell campus and Collegetown.

When Julia Levy '05 was given an extra-credit assignment for her AEM 240 marketing class last fall to come up with a business improvement plan for a corporation, she decided to think locally.

The goal of the project was to improve the bottom line of the selected company, Levy wanted to do more than that.

"I thought about something on the Cornell campus that wanted to change or improve," said Levy, and she set her sights on the TCAT bus system that serves the Cornell campus and the rest of Tompkins County.

The core of Levy's plan for improving TCAT's service was the posting of bus schedules at each stop on the Cornell campus.

"[More] people would ride the bus if they knew when it was coming," she said, also noting that in every other area she has been with a public transportation system, schedules are posted at each stop.

Not content with a couple of extra-credit points, Levy used the contacts she had made during the course of her research to lobby TCAT to make her plan a reality. After she presented the logistics of her plan, TCAT decided to include the bus schedule idea as part of its general improvement plan for its stops throughout Ithaca. The first schedules began to be posted throughout the Cornell campus last spring.

"We are posting summary schedules at bus stops," said Dwight Mengel, TCAT's service development manager. "Further, we are going to try out new bus stop signs designed for stops with low light ... Our goal is to eventually post information [and stop signs] at all shelters ... throughout the county."

According to Mengel, the cost of posting the schedules will be between \$5,000 and \$12,000. Levy is pleased with the outcome of her efforts. "I think this was a change that was a long time coming. I'm glad TCAT has decided to follow through on it," she said.

As a member of the Cornell University Student Assembly, Levy wrote a bill encouraging TCAT to complete the posting of schedules. The purpose of the bill, which the assembly passed unanimously, was to "show that the student body is in support of this," said Levy.

"If I knew when the buses were coming, I'd definitely ride them more," said Daniel DeRosa '06. Mengel noted that TCAT has been frustrated in prior attempts to install schedules at Cornell and Collegetown bus stops because of recurring vandalism, but the current effort is being monitored closely to maintain the posted schedules.

A version of this article first appeared in the Cornell Daily Sun on Feb. 24, 2004.



TCAT employee Andre Puca installs one of the numerous schedule summary signs that were posted at many Cornell bus stops this year as part of a project that was initiated by a student's extra-credit project for a marketing class.

PERC: For parents who work

No matter how you slice it, the cost of a bus ride can have a big impact on the family budget. That's why TCAT developed PERC (Parents who are Employed Ride Cost-free). PERC is a program in which working parents (including those who are self-employed) who live in Tompkins County and meet certain income guidelines can get free monthly bus passes.

Participants can use the pass to go anywhere TCAT goes in Tompkins County, for unlimited trips to work, school, daycare, or shopping, or even to take in some needed rest and relaxation downtown or at the mall. People who are already signed up say they like the savings the pass offers, especially when compared to the cost of owning, maintaining, and insuring a vehicle.

PERC is funded through a grant from New York State Community Solutions for Transportation.

You are eligible for a PERC pass if you can answer "yes" to all of these questions:

- Are you currently working or self-employed?
- Are you a parent—custodial or non-custodial—of a child who is under the age of 18 (or under the age of 19 and attending post-secondary school)?
- Are you a U.S. citizen or legal alien and a resident of Tompkins County?
- Is your family income equal to or less than the cut-off amounts in the chart below? (If you pay child support, figure out what your income is after paying. If you receive child support, include that amount in your income.)

Family size	Annual income	Monthly income
1	\$17,720	\$1,477
2	\$23,880	\$1,990
3	\$30,040	\$2,503
4	\$36,200	\$3,017
5	\$42,360	\$3,530
6	\$48,520	\$4,043

For each additional family member, add \$6,160 to annual income and \$513 to monthly income.

For more information about PERC, call TCAT at 277-RIDE or check the website at www.tcatbus.com. To apply for a PERC pass, call 272-7514 to make an appointment with Career Resources of Challenge in Center Ithaca. You will need to bring proof of income (such as a paycheck or Social Security check stub), birthdates, birth places, and Social Security numbers for all the people who live with you and, if you are not a U.S. citizen, proof of alien status.

Q&A

by Joe Wilensky



JAMIE PLETTER

Meet the new face of TCAT customer service

Jamie Pletter joined TCAT early this year and answers the phone at 277-RIDE. If you call TCAT with questions about routes, service, schedule information, or just about any question on how to get from one place to another via TCAT, she's likely the person you'll be talking to. She's at the desk most weekdays from 7 A.M. to 3:30 P.M., although TCAT and its help desk is open until 6:30 P.M. TCAT customer service representatives also answer questions via e-mail at tcat@tcatmail.com.

Q: What were some of your previous job experiences?

A: I managed the rental department of Maguire Ford for a few years, I owned an indoor children's playground at Buttermilk Falls Plaza, and I was a social welfare examiner for the Department of Social Services for five years.

Q: What skills and experience have you found most valuable in this job?

A: I like dealing with people, and I know the community. I know my way around town. I'm one of those people who went to school (Cornell, '81, human development), then I moved to Binghamton, but then I moved back. It only took a couple of weeks for me to learn the whole TCAT system.

Q: How many calls a day do you handle? What kinds of questions do you get?

A: It varies; it can be as many as 40 an hour to just 40 a day. It really depends. The questions I get are everything from what time is the next bus coming to a particular place, to how can I get from this place to that place. People ask about trips that would take several buses and several transfers, like getting from one end of the county to the other end of the county.

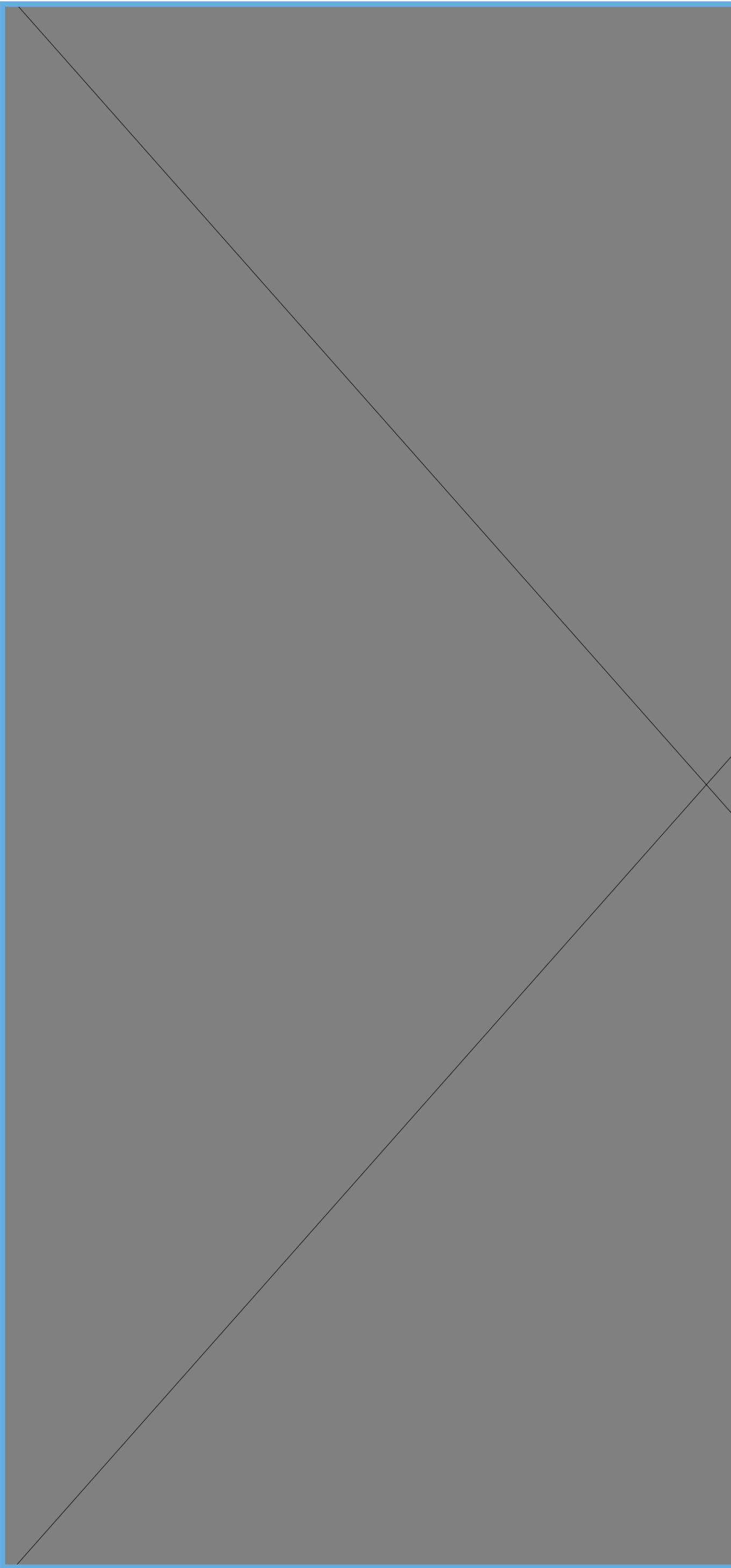
People are pretty appreciative of being able to have a transit system that gets them where they want to go. I get calls from people standing on a street corner and they want to get someplace and they don't have any other way right then to find out how to get where they need to go. I get calls from people on the buses themselves, on cell phones. They want to know when they are going to get to a particular stop, or whether they are going to be able to make a connection.

Q: What has been the biggest challenge of the job so far?

A: Probably dealing with people's frustrations when they are originally from more urban communities where buses stop every block. This is a community where there are a lot of rural buses that don't run every five minutes. We are a combination of a city and a rural area, and we have a lot of different populations here. People tend to expect what they're used to, and sometimes they get very frustrated.

Q: What is the best part of the job?

A: Being able to make complicated routes easy for customers. It's that "Aha!" moment—when they realize it works really well, and that the bus works for them. It's very satisfying.



A larger and more detailed version of this map is available wherever TcAT passes are sold or by calling 277-RIDE.

Safety tips for passengers make for better bus experience

by Michael Albanese, TCAT manager of safety & training

TCAT buses drive approximately 1.5 million miles and carry almost 3 million passengers annually in Tompkins County. All TCAT drivers have commercial driver's licenses and are trained in defensive driving, emergency management, and customer service. All TCAT bus operators must also undergo periodic refresher training, yearly road testing, biennial physical exams and written tests, and are subject to random drug and alcohol testing. All this training and testing helps make them the best transit bus operators they can be. But what about TCAT's customers? Is training available to 'learn' how to ride a bus? Is it necessary? We at TCAT would like to address that question by offering the following helpful hints to make riding the bus a pleasant, safe experience.



- Arrive a few minutes early at the bus stop. Buses are on a schedule but have to contend with traffic, delays, construction, etc., which may alter the time slightly.
- Make yourself visible to the driver—be near the curb/bus stop as the bus approaches. Riders using buses at night may want to use a small light such as a red LED light commonly used on bicycles for visibility. They flash and you can hold it in your hand to flag a bus, or pin it to your clothing.
- If you are not at a regular bus stop (one with a shelter or bus stop sign), you can 'flag' the driver by waving your arm as the bus approaches and the bus will pick you up.
- Have correct change—drivers cannot make change.
- If you use a bus pass or ID, have it ready and show it to the driver, even if you take the same bus every day. Even though many drivers get to know some of their regular riders, drivers do change routes and can't be expected to know everyone or when their pass may expire.
- Smoking, eating and/or drinking are not permitted on a bus.
- If you need a transfer, request it from the driver when boarding. Transfers are used by passengers when more than one bus or route is used to complete a one-way trip.
- Request a stop one block in advance. This gives the driver enough time to find a safe location to pull over and stop.
- Strollers and other objects must be stowed behind a seat. Nothing can block the aisles for safety reasons.
- Never cross the street in front of a transit bus. Cars do not have to legally stop for a transit bus like they do for a school bus. Wait until the bus pulls away, or cross behind the bus.
- Children 5 years old and under ride for free when accompanied by a responsible adult.

TCAT Zones and Fares

Cash fare (exact amount, please)	Single Zone	Multizone
Adult	\$1.50	\$3.00
Youth (6–17)	\$1.25	\$2.50
Senior citizens/people with disabilities	\$0.75	\$1.50

Note: No multizone charges on any TCAT routes Saturdays or Sundays. Fare is the same as single zone price. TCAT cards and passes offer convenience and—for regular riders—reduce your fare. The more you ride, the more you save.

- Ten-ride passes are intended for the casual riders and offer both flexibility and convenience. They're good for any ten one-way trips. Available at most TCAT schedule outlets.
- Unlimited ride passes are great for tourists, weekend guests, and conferees. Available only at TCAT, 737 Willow Avenue.

Cards and Passes	Single Zone	Multizone
Ten-ride card (adult)	\$15.00	\$30.00
Ten-ride card (youth, ages 6–17)	\$12.50	\$25.00
Ten-ride card (seniors/people with disabilities)	\$7.50	\$15.00
1-day pass (unlimited use)	\$3.00	\$6.00
2-day pass (unlimited use)	\$6.00	\$12.00
5-day pass (unlimited use)	\$12.50	\$25.00
8-day pass (unlimited use)	\$18.00	\$36.00
Monthly pass	\$45.00	\$45.00
Annual pass	\$495.00	\$495.00
Summer Fun Pass (K–12 students)	\$55.00	\$55.00

One-day passes (good on a single calendar day) and two-, five-, and eight-day passes (good on consecutive days from their date of issue) are sold at TCAT, 737 Willow Avenue or through the website (www.tcatbus.com). TCAT accepts MasterCard and Visa.

Ten-ride cards and monthly passes, good for unlimited rides for one month from the date they are first used, are available on the website and at the sales outlets listed on the next page.

Annual passes, good for unlimited rides for twelve consecutive months, are sold through the website and at TCAT.

The Summer Fun Pass, good for unlimited trips from mid-June to the start of school for youngsters between 6 and 18 who have not graduated from high school, is available by mail or at TCAT.

Zone 1

All of the City of Ithaca and adjacent areas of Cayuga Heights, East Hill, Ellis Hollow, Forest Home, Northeast, South Hill, and West Hill—including the airport, hospital, and shopping malls.

Zone 2

Brooktondale, Caroline, Danby, Dryden, Enfield, Etna, Freeville, Groton, Lansing, McLean, Newfield, Slaterville Springs, and Trumansburg.



TCAT ENACTS "ONE-ZONE WEEKEND" FARE REDUCTION

TCAT's "One-Zone Weekends," which were launched this spring, mean that riders who take the bus from one TCAT zone to the other will only have to pay a single-zone fare on weekends. There will no longer be a second zone charge for TCAT buses on Saturdays and Sundays.

The normal TCAT fare for multizone travel is \$3 for adults, \$2.50 for youth ages 6–17, and \$1.50 for senior citizens/people with disabilities. When the one-zone weekend fare reduction goes into effect June 3, the multizone fare on Saturdays and Sundays will be the same as the single-zone fare: \$1.50 for adults, \$1.25 for youth ages 6–17, and 75 cents for seniors/people with disabilities.

The reduced fares are directed at making it easier for people in Trumansburg, Slaterville Springs, Enfield, Groton, McLean, Brooktondale, and other rural areas to travel into the urban area on the weekends—and vice versa.

The One-Zone Weekend fares will be in effect at least through the end of the year.

For more information, visit www.tcatbus.com or call (607) 277-RIDE.



Board Meetings

TCAT Board meetings are open to the public and are held at TCAT, 737 Willow Avenue. Upcoming meetings: Aug. 28, Sept. 30, and Oct. 28, beginning at 4 p.m.

FREE RIDE FREE

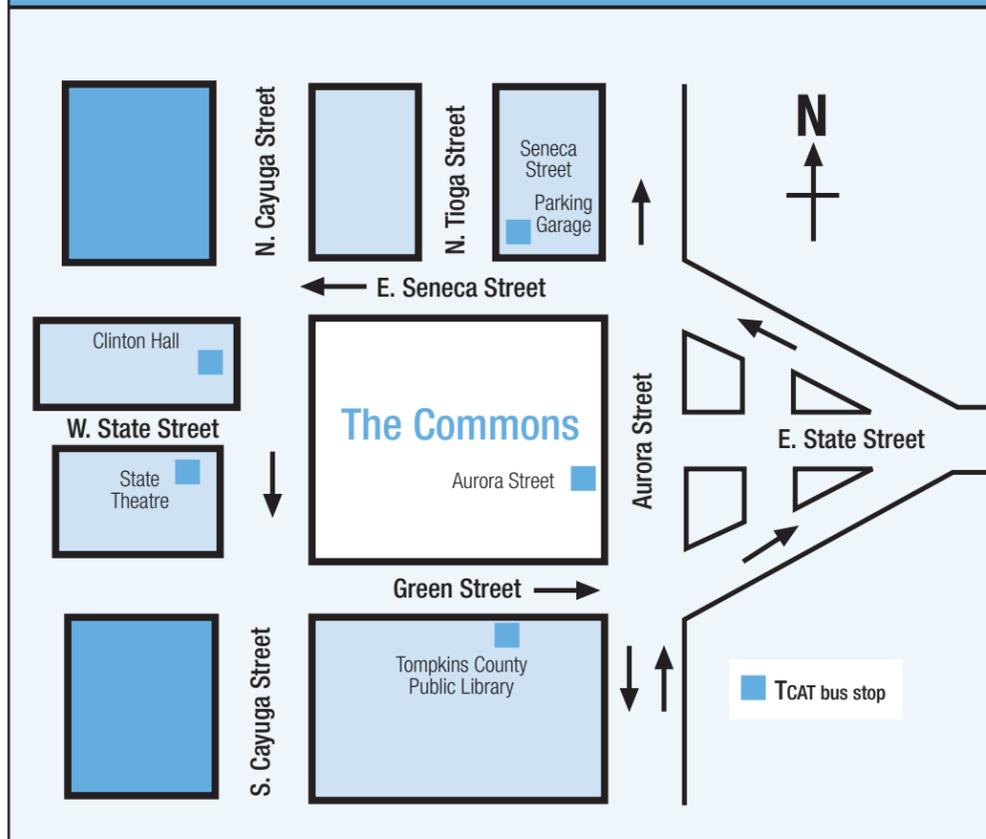
We invite you to give Tcat a try. This coupon is good for one free single- or multizone ride on any Tcat route. Present coupon to driver when boarding. No copies will be accepted. Valid until September 30, 2004. Call 277-RIDE for more information.



Going to School or Working at Ithaca College or Cornell University?

if you're a . . .	then . . .	cost . . .	get it at . . .
Cornell student	consider a student OmniRide pass (Cornell pays part of cost). Blue-light routes are free—show your ID card	semester pass: \$125.00 annual pass: \$200.00	Commuter and Parking Services, 116 Maple Avenue, 255-PARK, www.transportation.cornell.edu
Benefits-eligible Cornell employee traveling in zone 1	show Cornell I.D. card to the driver	free Monday–Friday; free all the time if you enroll in OmniRide	
Benefits-eligible Cornell employee traveling in zone 2	enroll in OmniRide	free	Commuter and Parking Services, 116 Maple Avenue, 255-PARK, www.transportation.cornell.edu
Ithaca College student	consider a semester pass (IC pays part of the cost)	semester pass: \$120.00 annual pass: \$240.00	IC Bookstore, 140 Phillips Hall
Ithaca College faculty or staff member	show the driver the back of your IC parking permit	free	Office of Campus Safety, Coddington Road 274-3756 www.ithaca.edu/safety/

Tcat's Main Bus Stops in the Downtown/Commons Area



Getting Connected Near the Commons

Downtown Ithaca is Tcat's main hub, so if the bus service in your area doesn't go directly where you want it to go, there's a good chance that you can connect to a route that does go there from downtown.

Just remember:

- Ask the driver for a transfer when you pay on the first bus. (Pass users don't need transfers.)
- Present your transfer to the driver of the connecting route in place of your fare.*

*Riders paying a single-zone fare may transfer within that zone. Riders paying a multizone fare may transfer across multiple zones.

50M--©2004 Streetwise is published annually—by Tompkins Consolidated Area Transit and Communication and Marketing Services of Cornell University—to give new and returning residents information about public transit in Tompkins County. Tcat is an equal-opportunity employer. Photos provided by Tcat.

ADA Paratransit Services

Tcat ADA (Americans with Disabilities Act) Paratransit Services provides door-to-door, demand-responsive transportation for people with disabilities. Only people who because of their disabling condition cannot use the Tcat public transit system are eligible for ADA Paratransit. Service runs the same hours and in the same areas as the Tcat bus system. Contact the ADA Transit Coordinator for an eligibility application at 277-9388, extension 420.

Gadabout Transportation Services, Inc. is a nonprofit, door-to-door, demand-responsive service for people aged sixty or older and for disabled residents of Tompkins County. Service runs from 8:30 a.m. until 4:30 p.m., Monday through Friday. Ride reservations must be made no later than 11:00 a.m. the business day prior to the requested trip. For more information, or to request a ride, call Gadabout at 273-1878.

Bikes on Buses

Every bus in the Tcat fleet has a bicycle rack mounted on its front end. These racks can help cyclists tame the hills and weather in Tompkins County. Racks are available on a first-come-first-serve basis, and users must be able to load and unload their bikes. Please do not ask the driver for assistance with the rack. There is no additional fare.

Young, Old, Working Parent, or Commuter?

if you're a . . .	then . . .	cost	get it at . . .
child under 5	you must ride with parent; up to three children	free	
6–17 year-old		\$1.25 single zone; \$2.50 multizone	
working parent who qualifies	you can apply for a free PERC pass; see story on page 1 for details.	free	Career Resources at Challenge Industries; call 272-7514 for an appointment
Medicare, Senior Citizens Council, ADA, or Paratransit or Disability Eligibility* cardholder	show your card to the driver to pay half fare or buy a half-price ten-ride pass	\$0.50 single zone; \$1.00 multizone	ten-ride passes are available at the sales outlets listed below
regular rider	consider a card or pass	the more you ride, the more you save	see below

*Disability Eligibility Cards are available to persons receiving SSI, SSD, or Disabled Veteran's Benefits (for a service-connected disability).

Where to Buy Ten-Ride and Monthly Passes

(Annual passes are also available at the Tcat Facility)

Online

- www.tcatbus.com, click on "store"

At Cornell

- **Transportation Office**, 116 Maple Avenue, 255-4600
- **Willard Straight Hall Ticket Office**

In Dryden

- **Dryden Hill Drug Store**, North Street
- **Tompkins Cortland Community College (TC3) Bookstore**

In Freeville

- **Freeville Village Clerk**, 5 Factory Road

In Groton

- **Groton Village Clerk**

In Ithaca

- **Ithaca City Hall, Chamberlain's Office**, 108 East Green Street
- **Ithaca Town Hall**, 215 North Tioga Street
- **Ithaca–Tompkins County Transportation Council (ITCTC)** Old Court House, 121 East Court Street
- **Senior Citizens' Center**, 121 West Court Street
- **Tcat**, 737 Willow Avenue, 277-RIDE
- **Tompkins County Budget and Finance Office**, 125 East Court Street
- **Tops Friendly Markets** 710 South Meadow Street
2300 North Triphammer Road
- **Wegmans Supermarket**, 500 South Meadow Street

At Ithaca College

- **Ithaca College Bookstore**, 140 Phillips Hall

In Newfield

- **Newfield Town Hall**, 166 Main Street

In Trumansburg

- **Holton's Pharmacy**, 15 East Main Street