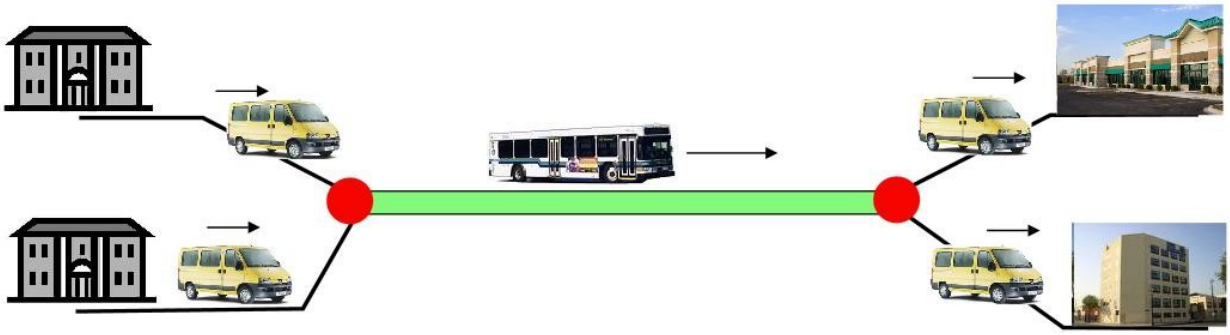
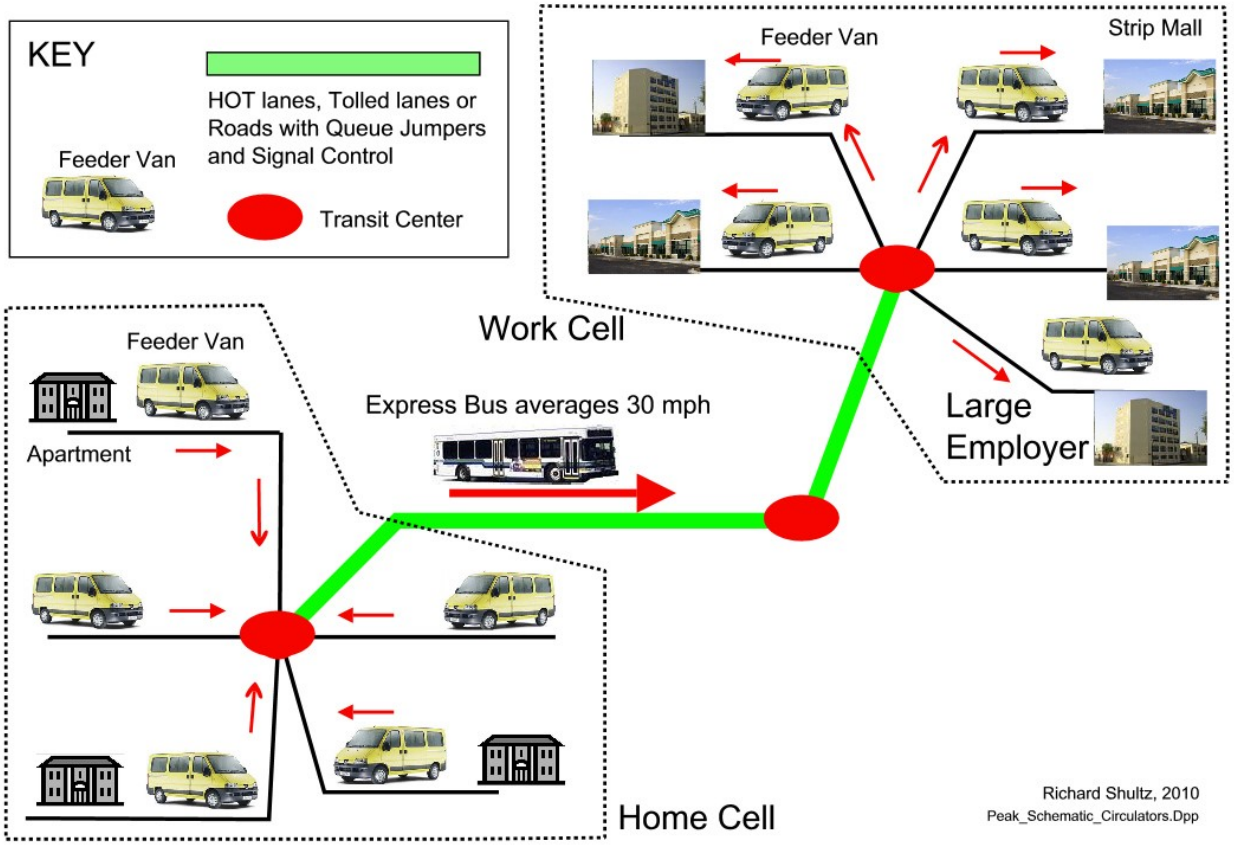
Cellular Mass Transit



Cellular Mass Transit (CMT) would use a combination of bus, minibus and tall cabin van to provide better service. The service area would be divided into 20 cells of 12 square miles each. Each cell would have a hub, or transit center (red circles) fed by 8 short feeder routes. These 20 hubs would connected by 33 express routes. Most of these express routes would run at least part of the way on the 35 miles of managed express lanes that Austin will have within the near future. More people would be able to get from home to work in less than 90 minutes.



Most feeder route miles would be run by minibus and tall van.

Minibuses would be like the parking shuttles at the airport. These are roomy enough to comfortably seat 14 riders.

Vehicles that have seats for fewer than 15 riders do not have to have a driver with a CDL or commercial driver's license.

That is why drivers at the airport make only $14 an hour

Compare that to Cap Metro bus drivers that make $22 an hour. Total cost of Capital Metro bus driver compensation, with benefits and overtime, is $44/hour.

The minibus would have a cabin that is tall enough for riders to walk down a center aisle without having to bend over.

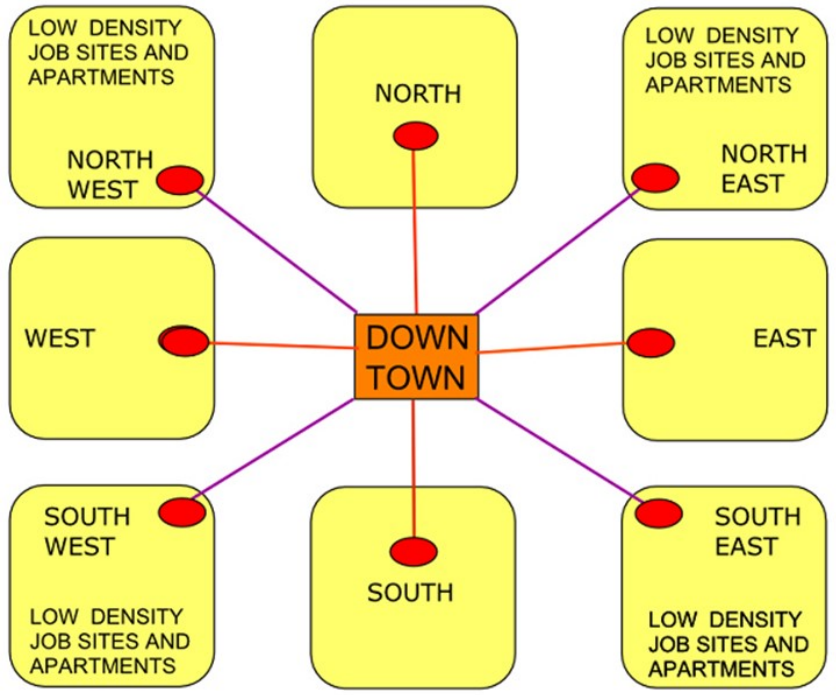
A minibus will be able to carry the typical off-peak group of 6 riders.

On a 4 mile feeder route trip, with 1.5 boardings per mile, the minibus will pick up only 6 riders in the off peak hours.

Why Cellular? What is wrong with conventional transit? Conventional transit suffers from a number of serious flaws:

- It is too slow
- Transfers are not sheltered
- There are long waits between bus runs
- Low ridership
- Only one commercial area gets service

Conventional transit is based on the obsolete observation that most people work and shop downtown. Transit is set up to connect many residential areas with only one commercial area: the Down Town, or central business district (CBD).

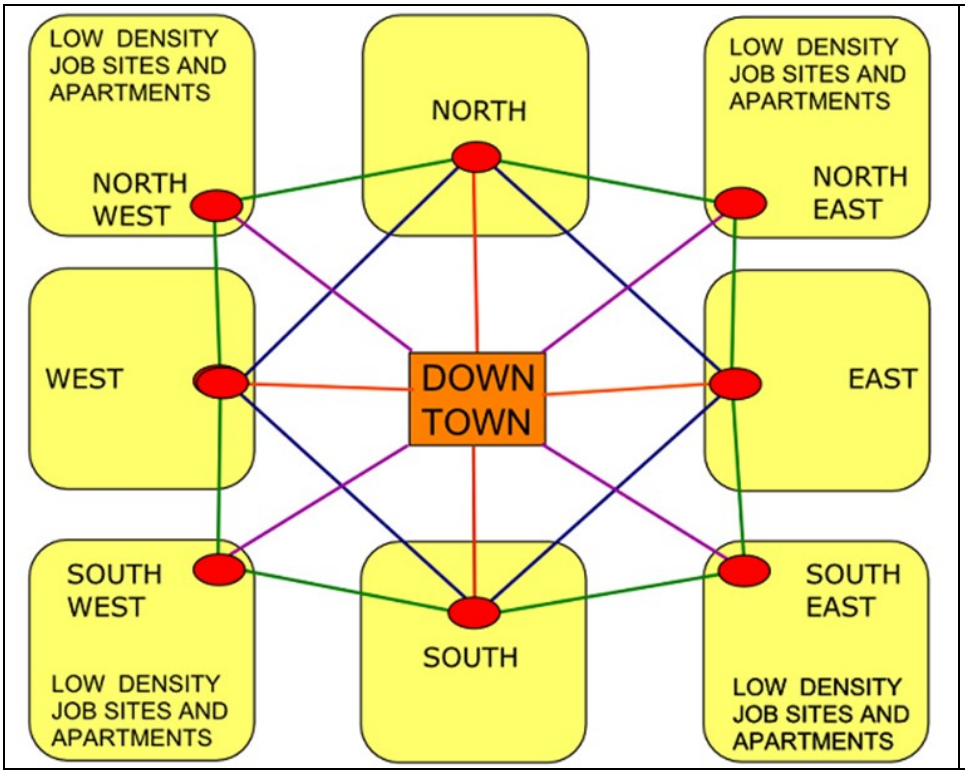


Transit is slow because it serves only one commercial area with express routes and frequent service.

If you want to get from one part of town to any other, by express routes you have to go through the congested city center.

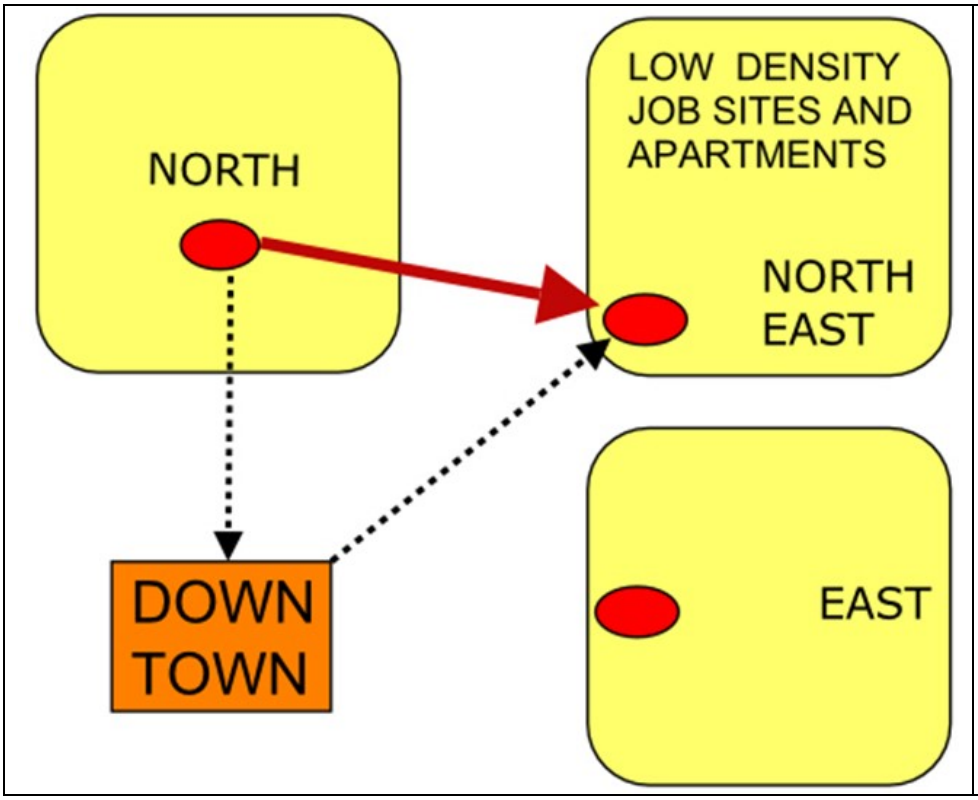
It is a Many to One express network.

Most people now shop and work in dozens of smaller commercial areas that are scattered over several hundred square miles of low density urban area.



What Austin needs is a many-to-many (M2M) system that connects many neighborhoods to many commercial areas with express routes.

This shows how such an express network would connect outlying low density areas with routes that are more direct.



With more express routes riders could get from North to North East without transferring down town.

Dotted route is the old way.

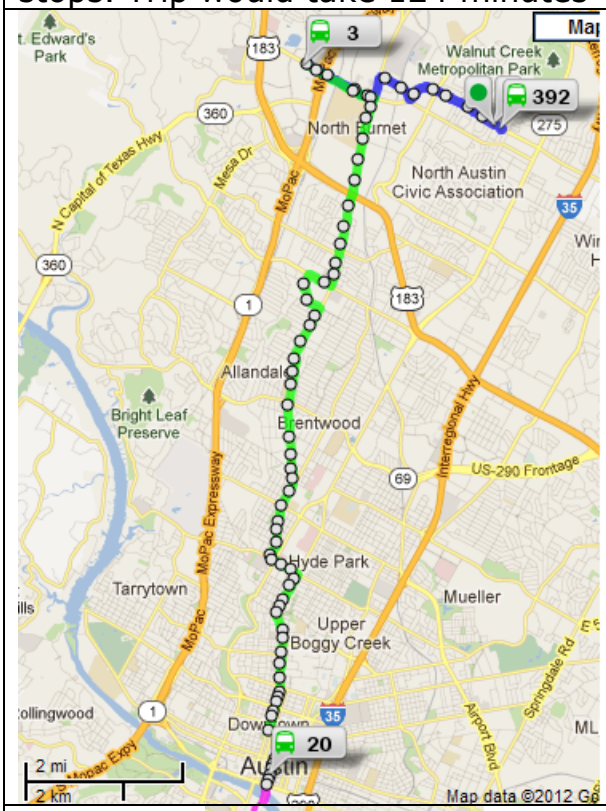
Solid red arrow is the new.

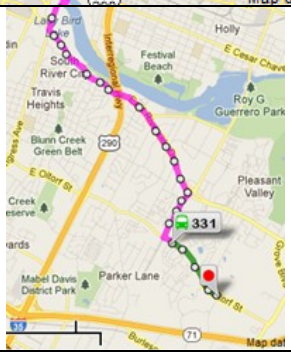
A more direct route would cut travel time from 120 minutes down to 60. There would be fewer miles and faster travel since the route does NOT pass through congestion at the core.

The next page compares two sample trips.

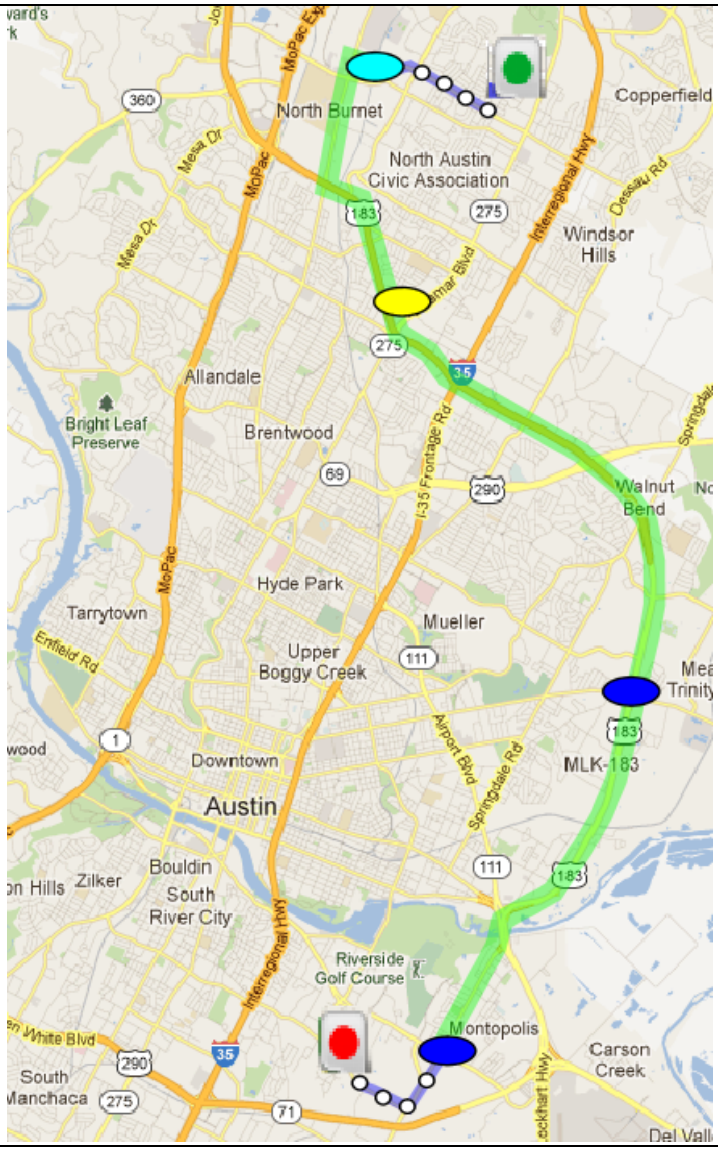
Both trips are from Parkfield & Braker to Oltorf & Alvine Devane.

The old way is slow because the long service routes make many stops per mile and pass through the congested core. White dots are stops. Trip would take 124 minutes





With the new way travel time is cut in half. Most miles of travel are by express route (green band) that stops only at hubs (colored ovals). Trip would take 73 minutes



The old way requires 3 transfers that are not sheltered. The two CMT transfers would occur at hubs that have an enclosed, air conditioned transfer room. A typical trip by CMT would take three legs and two transfers. The first leg would be by feeder route from apartment to hub. Feeder routes make many stops per mile. The second leg would be a fast express route. A typical 18 mile express route would make only 5 stops at hubs. The last leg would be by feeder.

Express routes would run many miles on managed express lanes. These lanes on MOPAC and 183 will be dynamically tolled to keep the vehicle count low enough that the lane is in a free flow state. A bus can make 60 mph on a managed lane while cars in adjacent regular lanes shuffle along at 10 to 20 mph.

Express lanes are denoted by wide colored bands.

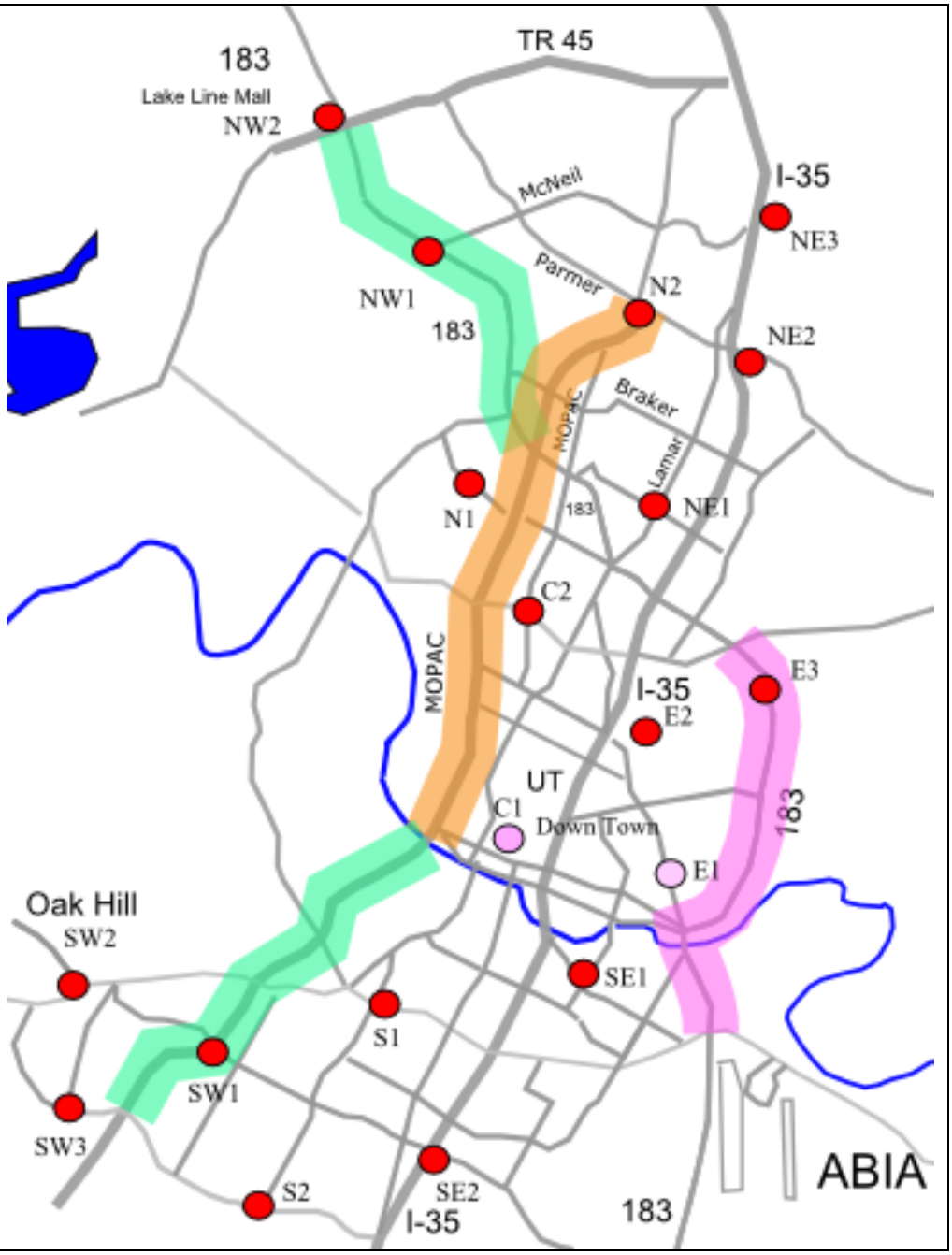
MOPAC north express lanes will run 11 miles on MOPAC from Cesar Chavez north to Parmer.

South MOPAC Express lanes will run from river to Slaughter Lane, a distance of eight miles.

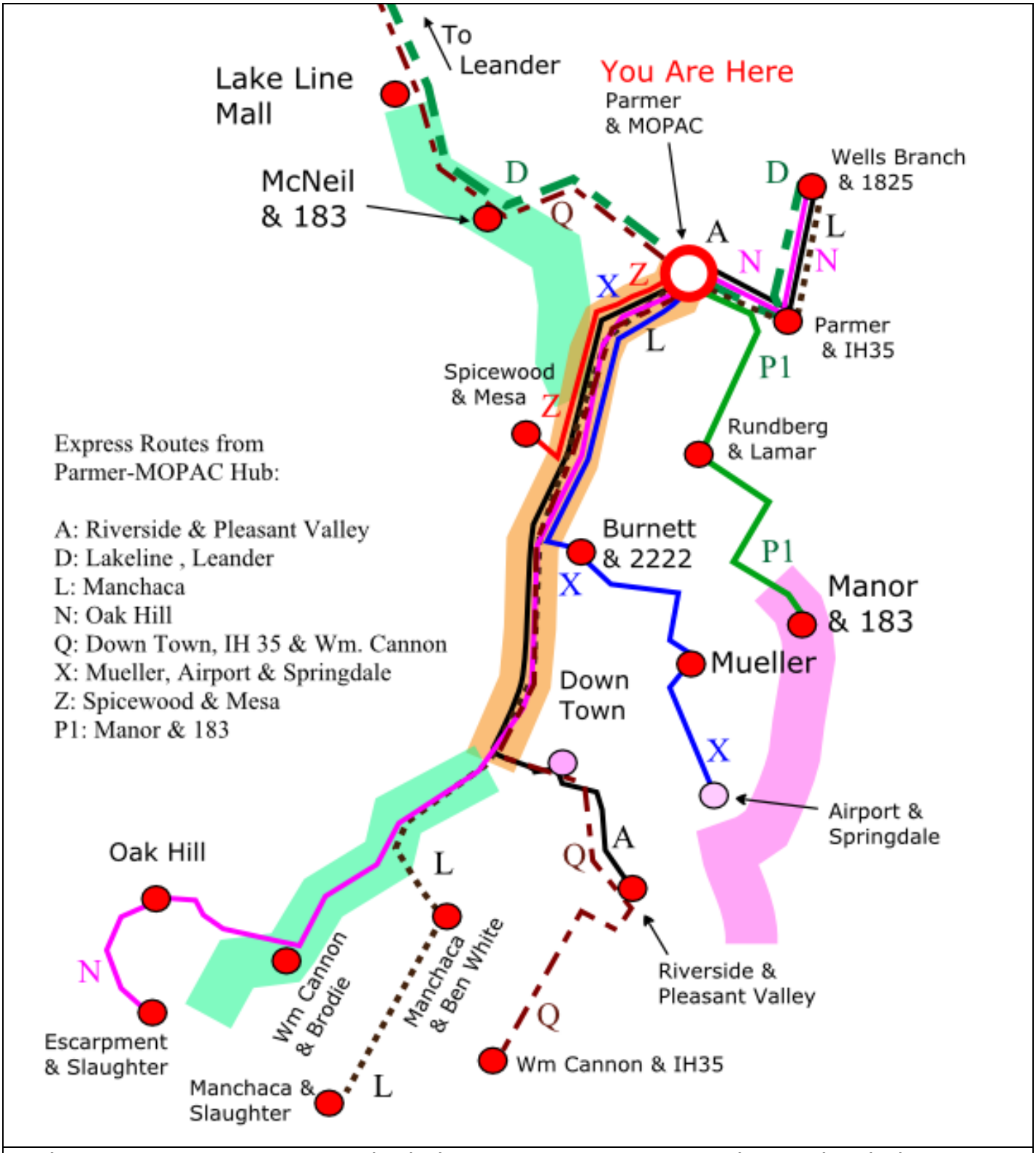
On north 183 a green band denotes an 8 mile managed lane.

The purple on 183 east is another 8 miles.

Total managed lane miles would be 35.

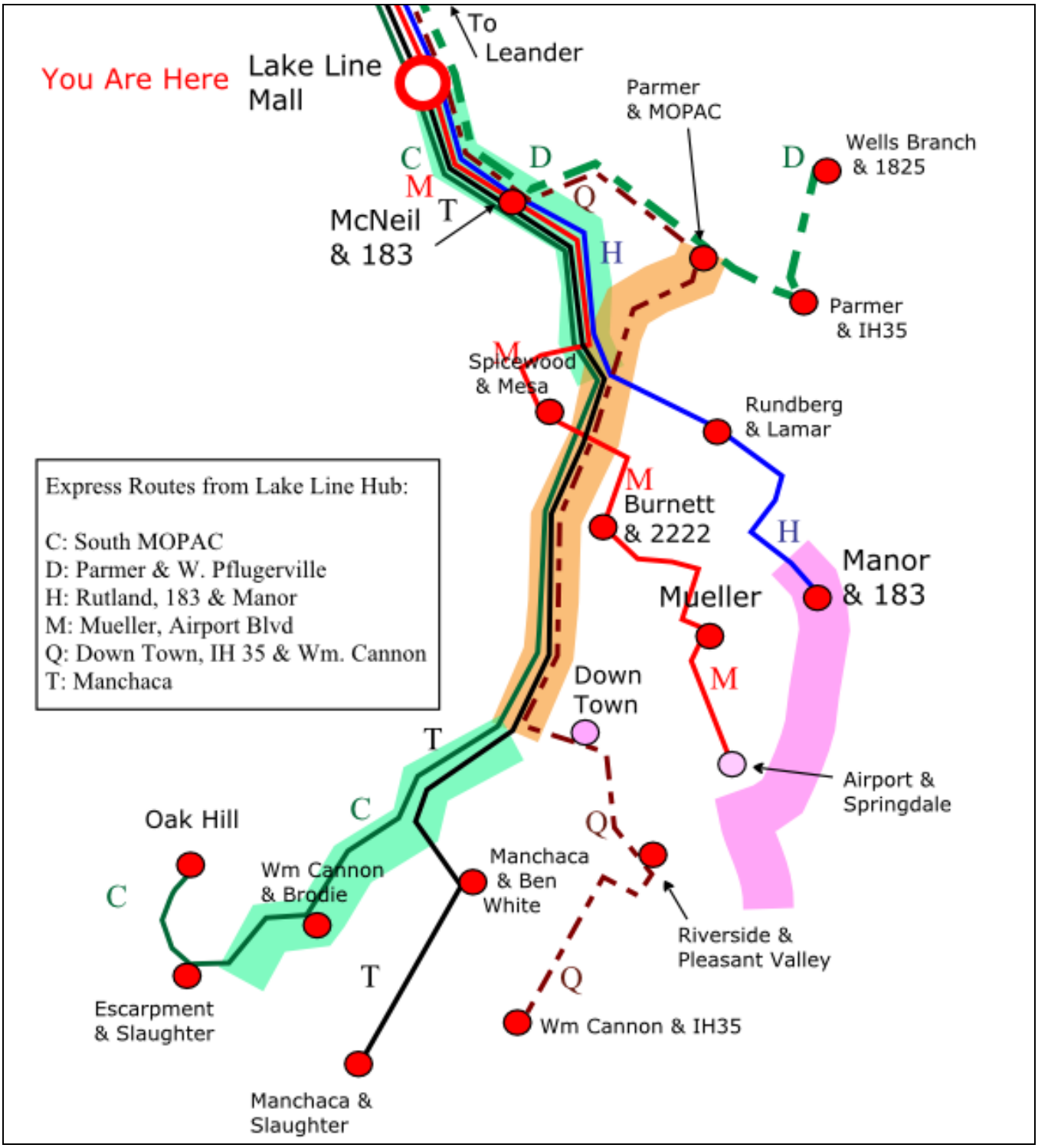


A Many-to-Many express network that connects 20 hubs with 33 routes can be best viewed from the vantage point of the hub where you start your trip. Here are some examples. If you start your trip at Parmer & MOPAC Hub you would see this map:



Eight express routes connect the hub at Parmer & MOPAC with 19 other hubs.
Six use the MOPAC express lane. Two more use the 183 north express lane

If you start your trip at Lake Line Hub you would see this map:



Six Express Routes would connect a Hub at Lake Line to all of the other 19 hub. Express buses would travel fast on managed express lanes.

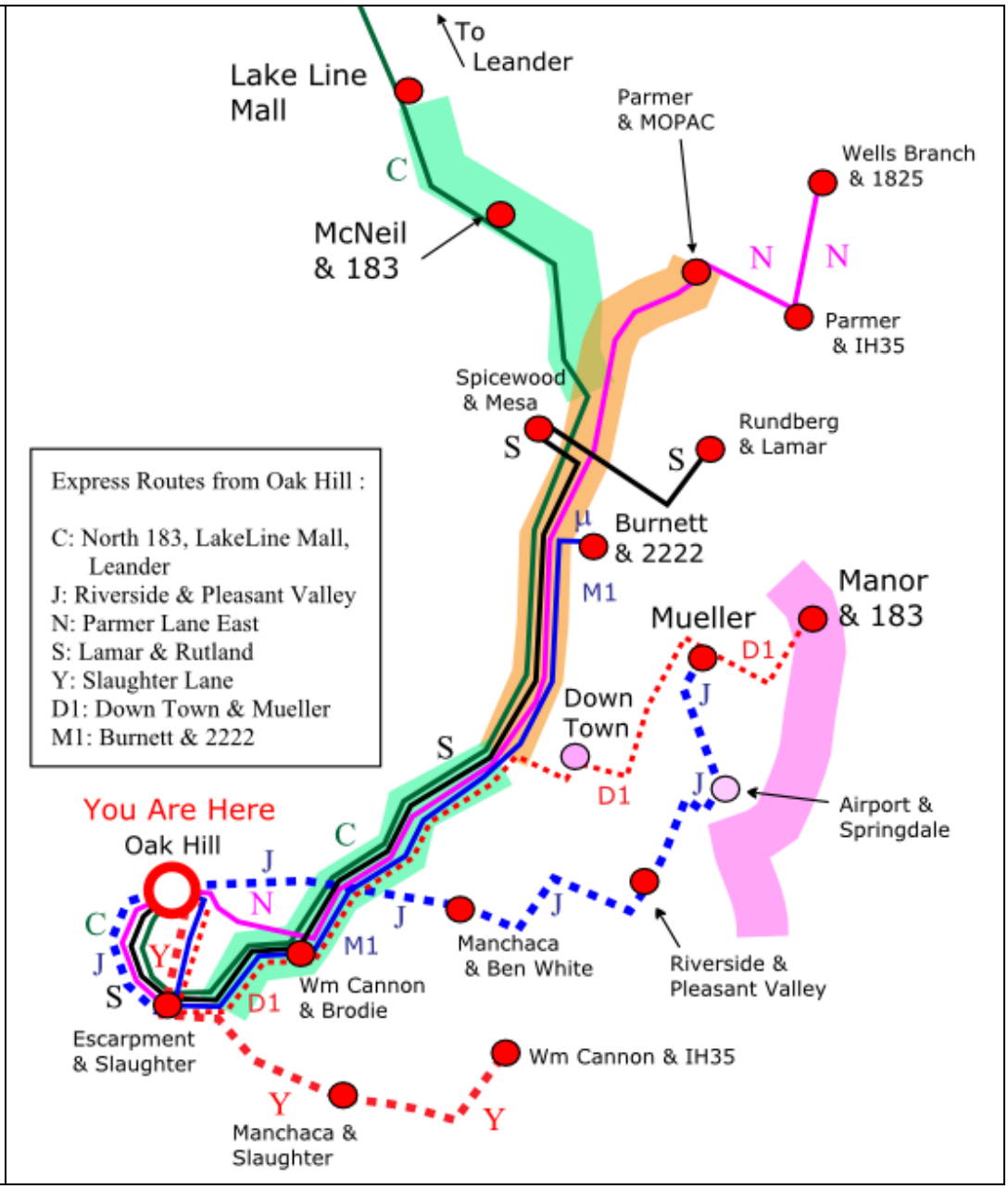
A typical 18 mile express route would make only 5 stops at hubs. Express route C would depart Lake Line hub , stop at McNeil hub and then <u>travel 17 miles non-stop along managed lanes, at 60 mph</u>, to three hubs in south west Austin.

And if you start your trip at the hub in Oak Hill:

Starting at the Oak Hill hub.

Seven express routes connect to all of the other 19 hubs

Five of these routes travel part of the way on express lanes



Each hub would have its own similar map showing just those routes needed to get to the 19 other hubs.

Express routes:

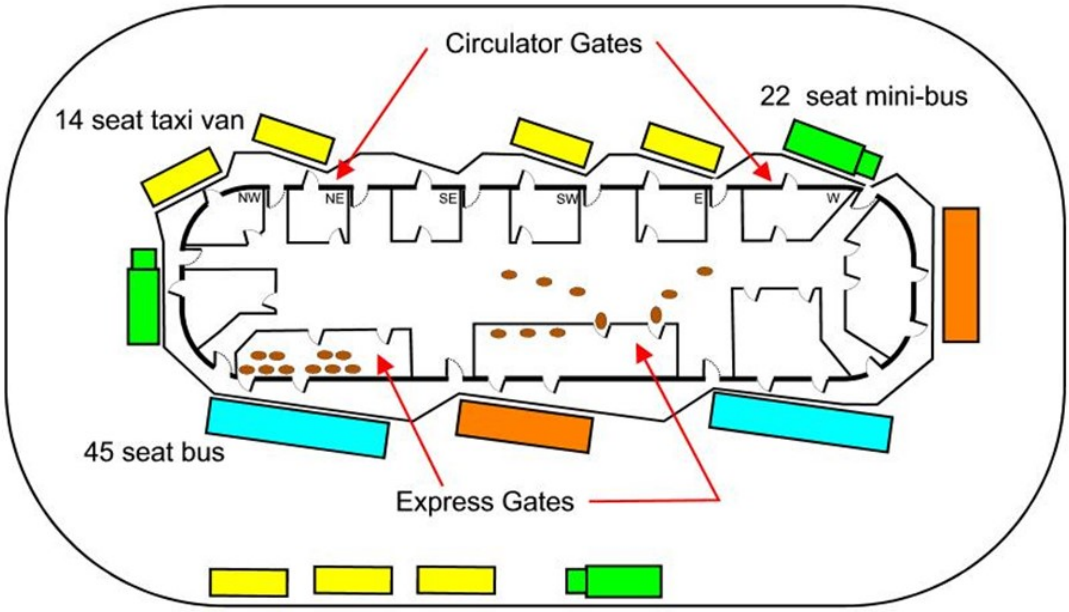
- Run every ten minutes
- Run 18 hours a day
- Run 7 days per week
- Stop only at transit hubs

Hubs would provide sheltered transfers

The transit center, or hub, would have four express gates for buses. There would also be 6 or 7 smaller gates for feeder or circulator routes. These would have bays big enough for vans and minibuses. Gates would have seating. Riders enter a gate by paying fare with a smart pass at a turnstile. Up to 60 riders can collect at a gate within three minutes. They then board a bus, without paying fare, in under a minute as on a subway.

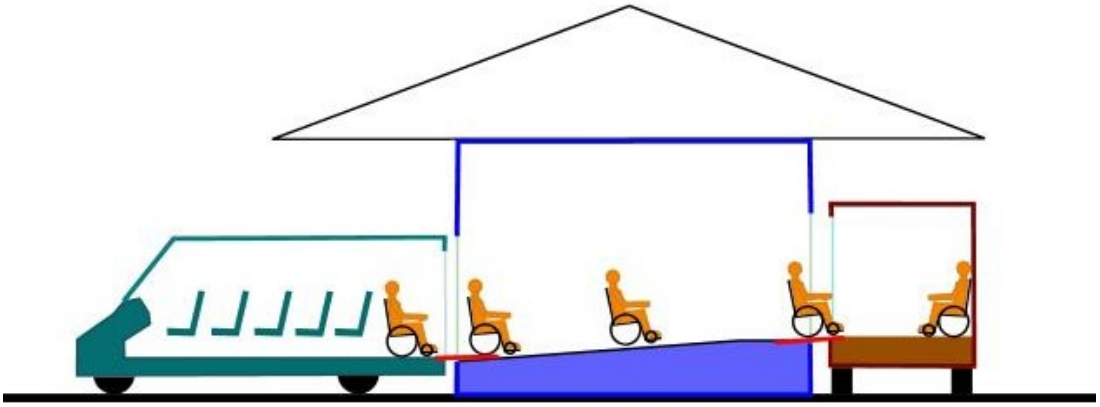
The Curitiba Brazil bus rapid transit uses subway style boarding gates for buses. The fast boarding gates are level with the bus deck. An automatic bridge connects the two. Riders in wheelchairs can cross this bridge without assistance. All riders in the gate can board quickly since they have already used tickets to enter the gate.

The central hall would also have seats along with ride request terminals and destination and gate displays.



Each hub would have an enclosed climate controlled waiting area.

There would be amenities like bathrooms , water fountain, and security guard



A rider in a wheel chair is shown leaving a van on the left, then rolling across the transfer platform and rolling onto a bus on the right.

Sheltered transfers reduce transfer penalty. While an unsheltered transfer with infrequent bus service can have a high penalty of 45 minutes, a sheltered transfer with frequent service has a low penalty of only 5 minutes. Transfer penalty in the London subway is estimated to be only 5 minutes. Riders will be willing to make two transfers when the penalty is only 5 minutes.

CMT would provide six times the vehicle miles now provided by an all bus system. Instead of 14 million vehicle miles per year the CMT would provide 84 to 89 million. More miles are needed to run trips every 10 minutes on 33 express routes and 160 feeder routes. A six fold increase in vehicle miles is possible because the subsidy per vehicle mile would be greatly reduced by the use of smaller vehicles driven by low wage drivers during off-peak hours.

Off Peak Hours **Express** Route Subsidy

off peak express				
average riders				
on board	cents/pass-mile			fares /mile
6	times	15	equals	$ 0.90
MPH	fares / mile			fares/hour
25	times	$ 0.90	equals	$ 22.50

In off peak hours the rider groups would average 6. With a fare of 15 cents per mile per rider the bus would collect $22.50 an hour.

					off peak express	
	cost/hr		fares/hour		subsidy/hour	
BUS	$ 85.00	minus	$ 22.50	equals	**$ 62.50**	BUS
MINIBUS	$ 37.00	minus	$ 22.50	equals	**$ 14.50**	MINIBUS
				ratio of subsidies per hour		**4.3**

If we use a 40 seat bus the direct cost per hour is $85. Subtracting fares, $22.50, leaves a loss of $62.50 an hour. This loss is covered by the tax payer provided subsidy. With CMT these off peak express trips would be run by minibus that have a much lower direct cost of only $37 an hour. The resulting loss is reduced, from $62/hour to $14.50/hour.

When the subsidy is reduced by 4 fold we can provide 4 times the vehicle miles for the same amount of taxpayer provided subsidy.

Most off-peak express trips would be run by minibus. Most peak hour express trips would be run by 40 seat bus.

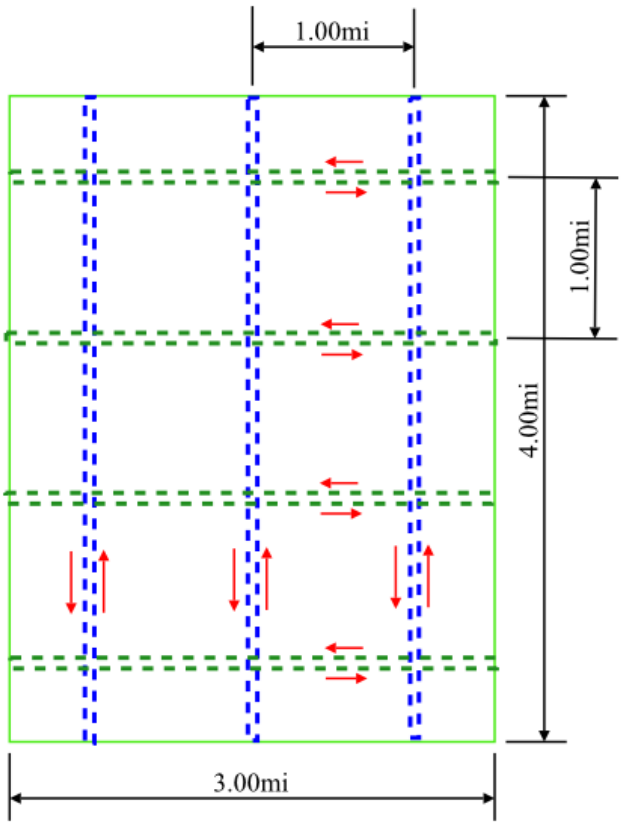
Off Peak Hours **Feeder** Route Subsidy

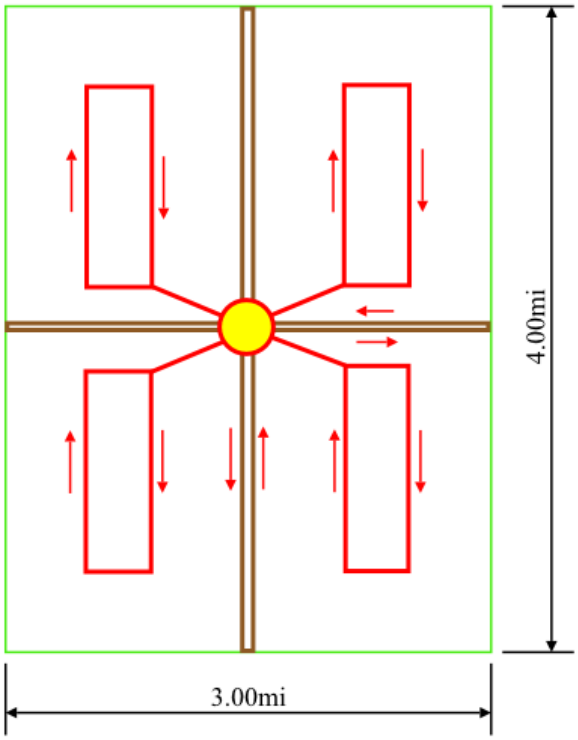
The calculation for off-peak feeder subsidy is similar. In off peak hours the current system has only 1.5 rider boardings per mile. A 5 mile trip will collect only 7.5 riders. We do not need a 40 seat bus to carry 7 or 8 riders

estimated fares per hour			Bus40	Minibus14
boardings/mile	1.5	cost/hr	$ 85.00	$ 37.00
mph	13	fares/hr	$ 9.75	$ 9.75
boardings/hour	19.5			
fare per boarding	$ 0.50	subsidy/hr	$ 75.25	$ 27.25
fares/hour	$ 9.75	mph	13	13
		subsidy/mile	**$ 5.79**	**$ 2.10**
			Bus40	Minibus14
		ratio	**2.8**	

If we use a 40 seat bus the direct cost per hour is $85. Subtracting fares, $9.75, leaves a loss of $75.25 an hour. With CMT these off peak feeder trips would be run by minibus that have a much lower direct cost of only $37 an hour. The resulting loss is reduced to $27.25 an hour. Subsidy per vehicle mile would be reduced from $5.79 to $2.10.

Not only would the subsidy per vehicle mile be reduced but the subsidy per square mile would also be less. The next drawing shows how a CMT cell would require fewer vehicle miles per trip. On the left is a patch of conventional grid covering 12 square miles. On the right is a cell of 12 square miles. The grid has 40 seat buses running in both directions on routes a mile apart. To run two trips per hour would take 96 vehicle miles per hour (vm/hr). The cell has four loops which run in only one direction. There would also be two connecting feeder routes that run in both directions. To run six trips per hour in the cell would take 204 vehicle miles. Even though the cell has trips three times as often the number of vehicle miles only doubles (96 vm/hr to 204 vm/hr).





When the lower subsidy per vehicle mile is factored in the calculation indicates a lower subsidy per hour:

Grid Patch : 96 vm/hr x $5.79 per bus mile= $556

and Cell: 204 vm/hr x $2.10 per mini bus mile = $428

Grid Patch

Routes			2	
	Miles	dir	Trip/hr	VMPH
N-S 1	4	2	2	16
N-S 2	4	2	2	16
N-S 2	4	2	2	16
E-W 1	3	2	2	12
E-W 2	3	2	2	12
E-W 3	3	2	2	12
E-W 4	3	2	2	12
	directions			
			96	VMPH
			$ 5.79	Subsidy/mile
			$ 556	**Subsidy/hr**

CMT Cell

Routes			6	
	Miles	dir	Trip/hr	VMPH
N-S	4	2	6	48
E-W	3	2	6	36
N-E Loop	5	1	6	30
S-E Loop	5	1	6	30
S-W Loop	5	1	6	30
N-W Loop	5	1	6	30
	directions			
Miles per loop				204 VMPH
5				$ 2.10 Subsidy/mile
Ratio				**$ 428 Subsidy/hr**
0.77				

When the subsidy per square mile is reduced 23% we can cover 30% more area for the same amount of taxpayer provided subsidy.

Feeder route trips would run every ten minutes. Compare that to most existing routes like the 392 that make riders wait more than 30 minutes for the next bus.

During peak hours most feeder trips would be run by full size bus because boardings per mile increases from 1.5 to 3.5.

You might ask:

Are there any precedents for a transit system based mostly on minibus or van?

Is there any proof that vans can operate at a lower subsidy per rider?

The proof is all over the world!

The dollar vans of Brooklyn NY operate with no tax payer provided subsidy. These vans provide 45 trips per hour while the city bus provides only four. 830 vans have 100 to 120 thousand boardings per day. Van drivers charge each rider $2, the same fare as the city bus.

Vans are a big part of public transit in many developing countries.

Cape Town , South Africa

Over 60% of South African commuters use shared minibus taxis (16 seater commuter buses).

Combi Taxis in Lima Peru

Atlantic City
New Jersey,

Jitneys have been in service since 1915

Other examples are the jeepneys in the Phillipines, the dolmus in Turkey, marshrutka in eastern Europe. Hong Kong has the public light bus. In most cases these small vehicles are not subsidized.

Demand Response

Minibuses (or vans), which have only 14 seats, may run out of seats on feeder route trips. To compensate for low capacity vehicles CMT will be demand responsive. The feeder routes would be fixed but a dispatcher would be deciding which vans run which routes and the number of runs per hour. Routes would be organized into sets of six. Each route set would be served by a team of 20 minibuses. All drivers on the team would know how to run the six routes. A driver might run the east route, then go into a pool of waiting vans, and then be assigned to run the north route. Each time the driver would return to the home hub for that route set. Typically there would be two or three vans waiting in the pool for assignments. If there is surge in demand for any one route the dispatcher could assign trips to that route more frequently than every ten minutes. A route that has a lot of riders might get ten trips per hour, while a low demand route might get only five. The dispatcher will have a computer display showing both outbound and inbound demand. Riders waiting at the hub to leave on a feeder route are considered outbound. Riders out on a route waiting to catch a ride to a hub are considered inbound. Outbound riders would enter ride requests at the hub either with a cell phone or a ride request terminal. Inbound riders, out on the route, would swipe their smart bus pass over an electronic reader at the route stop. Or they could text in a ride request as they stand at the route stop. All ride requests would be compiled by a dispatch application and displayed for the human dispatcher.

More Riders Save Money

When CMT provides faster service, sheltered transfers and 6 times the vehicle miles we can expect a 5.5 fold increase in ridership. CMT would add 147,000 new riders. Those new riders could save $2000/year since they would no longer be paying $4000 to $6000 to operate car.

Collectively, new riders would save $294 million/yr. In one decade they would save $2.9 billion.

In conclusion:

CMT will …

- Cut travel time in half for most home to work trips of 15 miles or more.
- Cut wait time on cross town routes from 30-45 minutes down to 10 minutes.
- Reduce transfer penalty from 45 minutes to 5 with sheltered transfers.
- Increase ridership 5.5 fold
- Enable workers from any neighborhood to get to jobs all over Austin.
- Improve public transit without racking up billions in debt.