S. Sabina Wolfson

Urban Transportation Planning

Term paper

# Bus Rapid Transit on the East Side of Manhattan

The East Side of Manhattan needs more (and better) public transportation[1]. Eventually a Second Avenue Subway (SAS) could fulfill this need. However, there is a need for improved service *now*. A quick and cheap (relative to rail) option is to use busses. Busses in New York City are extremely slow and unreliable, but busses can become a rapid, reliable, and pleasant means of public transportation when Bus Rapid Transit (BRT) principles are applied as has been done in numerous cities[2]. BRT could never fulfill the same needs as a SAS; BRT does not have the speed or capacity that heavy rail does. However, BRT could be implemented and used while the SAS is being planned/designed/built and then in conjunction with the SAS[3]. If BRT on the East Side is shown to work well and gains support, the BRT network could be expanded (in the context of existing and planned transit in the region).

**GOALS & PURPOSE.** BRT on the East Side would attempt to move more passengers up/down the East Side as quickly as possible using busses. This should (1) reduce congestion (slightly) on the Lexington Avenue subway lines, (2) promote transit usage[4],

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[1] Metropolitan Transportation Authority (MTA) New York City Transit (NYCT), *Second Avenue Subway Supplemental Draft Environmental Impact Statement (SAS SDEIS)*, *Chapter 1: Project Purpose and Need*.

[2] Most of the truly impressive BRT systems are in South America and Europe, but there are some successful implementations in North America (for example, Los Angeles and Ottawa). Numerous case studies throughout the world are discussed in TCRP *Report 90*, *Bus Rapid Transit*.

[3] The SAS has been under discussion since at least the 1920s. Currently the SAS is in the planning and design stage; construction is scheduled to start in late 2004 and might take 16+ years to complete. Given the long history of the SAS and the poor track record of the MTA building subways, it is unclear when/if the SAS will be built.

[4] Improving bus transit by implementing BRT principles should increase ridership since ridership is quite sensitive to the attributes of transit that BRT improves such as speed and reliability.

(3) decrease travel times, (4) provide more transit options, (5) dissuade private automobile usage, (6) reduce walking distance to rapid transit, and (7) improve air quality.

Why implement BRT rather than another mode? As already stated, BRT should not be considered an alternative to the SAS; BRT should be considered a (relatively) quick and cheap partial-solution to (some of) the transit problems of the East Side. Light rail transit (LRT) could be used instead of BRT, but – generally – LRT costs more and takes longer to implement than BRT. And, BRT offers flexibility in operation that cannot be achieved with fixed-rail. (Ferry service should also be considered. Ferry service could not fill the same role as local or limited BRT service. However, ferry service might make more sense than the *express* service mentioned in the "Bus-stop position" section.)

**IMAGE.** One problem with BRT is the poor "social standing" of busses relative to rail: buses are not in any way "cool"[5]. Social-engineering based strategies should be able to eliminate some of this. For example, one could refer to a BRT implementation as something else – without the word bus in it – such as Surface Rapid Transit.

In addition, BRT can – and should – be given a distinct image to differentiate it from regular bus service by using distinct, comfortable, clean vehicles. Current NYCT busses do not meet these needs; design changes are warranted[6]. But, at a minimum, BRT

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[5] While the public's perception of busses may be poor in general, there is at least some official support for (or recognition of) BRT. New York City's "vision" for the future of transportation (*Moving Forward: New York City's Vision for the Reauthorization of TEA-21* from the Office of The Mayor, 2003) says that the city hopes to secure funding for BRT initiatives. Of course, the city hopes to "secure funding" for just about anything it can.

[6] Articulated busses should be used since they have higher capacity (than non-articulated busses). However, the current NYCT articulated busses should not be used if at all possible because they are poorly designed. Some of the purposes of articulated buses should be to:
(1) reduce trip duration by reducing dwell times, which can be implemented via
    (i) multiple entrances and exits
    (ii) low-floor busses (or high platforms)
    (iii) rapid fare payment
    (iv) use of entrances to enter and exits to exit
(2) reduce costs (per passenger per mile) by reducing labor costs (more passengers per driver)

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busses should be painted differently than regular busses. A noticeable color, such as green, might be good. To speed loading and unloading, low-floor busses should be used.

In addition to a distinct look for the busses, the bus shelters should have a distinct look. Having the color of the BRT busses used as accents in the bus shelters would help tie the system together visually. (And, while we are at it, how about painting the bus lanes in a similar color?) In addition, the functionality of the bus shelter should be improved. A method of pre-payment at major intersections would speed loading greatly. Intelligent Transportation Systems (ITS) technology at the bus shelters could also be used to improve the functionality of the system.

**TECHNOLOGY.** Incorporating ITS technology is part of a good BRT implementation. This should include providing real-time information to passengers. Information on bus arrival times could do wonders for BRT's utility, efficiency, and image (setting it apart from the subway system that does not yet have such information). This can be taken a step further – as has been done in a few cities – with real-time bus information available on wireless devices so that users can see bus arrival information before getting to the bus stop.

In addition, ITS can help achieve reliable and quick service (reduce bus "bunching", better adherence to schedules, etc.) through central coordination of real-time bus location and signal prioritization.

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The NYCT's articulated buses try to achieve (2) but make minimal attempt to achieve (1). Both the articulated and non-articulated busses have one exit and one entrance. While the articulated bus has a wider entrance and exit, only one person can enter at a time (due to one Metrocard reader) and the width of the exit is not sufficient to regularly prompt multiple passengers to exist at once. Since the articulated bus carries more passengers (than the non-articulated) more time is spent loading and unloading passengers on an articulated bus. In addition, since the exit is further towards the back of the articulated bus (than the non-articulated bus) more passengers are tempted to exit through the entrance.

If a different (and superior) style of articulated bus can pass the tests of New York City, then this should be used. (The side of the bus that has the doors would need to be changed if median bus stops are used, unless the bus-lane-traffic-flow is contra to the private-vehicle-lane-traffic-flow. Median bus stops are discussed briefly in the "Lane configuration" section.)

**WHERE.** To have truly *rapid* BRT the busses need to have a private right-of-way (ROW). In Manhattan it is near-impossible (if not actually-impossible) to create more traffic lanes. Thus, to give busses a private ROW reduces the lanes for use by private vehicles. Rather than seeing this as a negative, I generally see this as a positive aspect of BRT[7]. A private ROW does, however, create certain constraints. In particular, if the ROW is along the curbside, deliveries will be more difficult. While there are ways around this (as can be seen in various European cities), it could create massive negative publicity and should be avoided (see more below). This brings us to the point of *where* exactly is this East Side BRT going to be.

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[7] No matter how many traffic lanes are dedicated to private vehicles, these lanes will eventually reach saturation in a dense urban environment. (This may NOT be the case with some sort of congestion pricing however.) In theory you could add an infinite number of lanes and these lanes would not reach saturation, however, there would no longer be a "dense urban environment"; there wouldn't be much of an environment at all – just a bunch of asphalt. Providing private vehicles with additional lanes can never solve problems of congestion. By the same logic, if we reduce the number of private-vehicle-lanes, the remaining lanes will eventually equalize to a similar level of saturation as existed before, but since there are fewer lanes, there must be fewer vehicles. This notion may seem counter-intuitive, but there is research indicating that this is indeed the case: if the capacity for vehicles is reduced, all of those "diverted" vehicles do NOT find new (sometimes longer) routes – some just "disappear" (Cairns, Atkins, & Goodwin, *Disappearing traffic? The story so far*). There is anecdotal evidence that this works in Manhattan (MTA NYCT*, Faster than Walking? Street Congestion & New York City Transit Buses*).

If one does not believe this "disappearing traffic" hypothesis, one is left with the following situation which is still positive with respect to transit: diverted private vehicles (from the reduction in private-vehicle-lanes due to transferring lanes to BRT) will increase congestion in the remaining lanes (or nearby lanes), resulting in worse performance for private vehicles, making transit better by comparison.

Thus, no matter how you look at it, reducing the number of lanes for private vehicles will have a positive effect on transit. On the other hand the political feasibility of this move is questionable at the current time. An educational campaign would be needed, and one would want to run this as a demonstration project both to assure the public that this will NOT remain in place if it does not work and to check that it actually works! This is all nice in theory, but one would really want to try it in practice before jumping too far.

Finally, one should keep in mind that the current allocating of so much space to private vehicles is an explicit statement of priorities. This is summed up brilliantly in *Faster than Walking?*

> The current allocation of street space to transit is disproportionately small, compared to its people moving capacity. This allocation of street space represents an explicit priority for low occupancy vehicles, and an apparent decision to move vehicles rather than to move people.

**Route position.** The two most obvious route options are (i) two-way BRT service on either 1st or 2nd Ave, or (ii) one-way BRT service on each of 1st and 2nd Ave.[8] (One could run BRT service on Avenues further west, and this might be highly desirable. But, this would not take the place of BRT service on 1st/2nd Ave, just as the Lexington Ave subway is not an adequate substitution for a SAS.)

Two-way BRT service on either 1st or 2nd Ave has great appeal (this would create a sort of transit-mall) and – in conjunction with other measures – could make the area much friendlier to pedestrians and bicyclists. In addition, two-way BRT service on a single Avenue might have a psychological edge in that the sometimes-empty-BRT-lanes will not be seen as regularly by private vehicle drivers stuck in traffic. Both 1st and 2nd Ave have appeal. BRT on 2nd Ave would avoid various obstacles better (bridges, UN, etc.) and allow (eventual) easy transfer to/from the SAS (though it is not clear how useful this would be). BRT on 1st Ave would provide rapid transit further east and would make routing south of Houston St easier (BRT could continue along Allen St which already has an under-utilized and under-maintained open-space in the center of the street that could be used[9]).

One-way BRT service on each of 1st and 2nd Ave seems more practical. In particular, the logistics of curbside deliveries are much easier to cope with.

**Lane configuration.** The first question of lane configuration is curbside or median bus stops. Curbside has great appeal since it could increase contiguous pedestrian-space.

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[8] Similar alternatives – and a dedicated bus lane on the FDR Drive – were considered in SAS planning documents (MTA NYCT, *SAS Major Investment Study / Draft Environmental Impact Statement*, *Chapter 2: Project Alternatives*). Some of these alternatives were eliminated and/or added to the Transportation System Management (TSM) alternative. The TSM alternative was not carried through from the DEIS to the SDEIS (MTA NYCT, *SAS Summary Report*).

[9] Curbside deliveries are particularly important in manufacturing areas. Along the probable BRT route (see "Route" section), the majority of manufacturing is along Allen Street. Given that this area already has a median that could be used for BRT loading and unloading, we would be able to maintain significant levels of space for curbside deliveries in this manufacturing zone.

However, if we believe that curbside deliveries are necessary, such bus stop positioning is problematic if we also want to have an exclusive ROW for the busses.

Consider the implementation sketched in Figure 1. (This is, of course, just one of many possibilities.) Along one Avenue we could have bus stops at curbside for busses bound in either direction[10]. Along the other Avenue we could have two-way private-vehicle-traffic and exclusive bike lanes. The sketch in panel (a) shows the arrangement at a limited-and-local stop: busses pull off to the right side to load/unload passengers at unique stops; the sketch in (b) shows the arrangement at a local stop (with additional amenities at the position where the limited stop would have been). In (c) is a block without bus stops, allowing local traffic. This configuration would allow for curbside deliveries along street segments which do not have bus stops (and maybe the "additional sidewalk" areas on these street segments should be used for deliveries rather than for pedestrians because of the "woops" discussed below). More curbside space could be freed up for deliveries and general traffic by altering this implementation to run on both Avenues as shown in Figure 2.

There needs to be a way to keep private vehicles out of the bus lanes and bus stops. Simply labeling the lanes well (for example, by coloring the pavement) will keep some drivers out of the lanes, but more serious action will be needed to keep other drivers out of the lanes. At each bus stop a piece of sidewalk might jut out halfway through the block (as shown in Figures 1 and 2) to dissuade local traffic from trying to continue driving into the bus stop lane. Or the bus lanes could be "self-enforcing" (reverse the flow of bus traffic relative to the local traffic). Or bus lanes could be separated from general traffic by barriers. In many implementations barriers would allow no margin for

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[10] Since 1st Ave is currently 6 or 7 lanes for the length of it, I will use 6-lane configurations in all of the examples. If anything an actual application would be less constrained than this.

Also note that, in all of the examples, parking is reduced. This might have to be changed to make the plan acceptable to the public, but the idea of reduced parking is intellectually appealing. As stated in Vuchic (p 275) "transportation models reveal parking as the 'most sensitive variable in modal split'".

"woops" since busses (and local traffic) would be stuck in a single lane going in a particular direction. In any case, if private vehicles are *not* kept out of the bus-only space, the utility of the lanes will be vastly diminished.

Using median bus stops would eliminate many of the problems inherent in curbside bus stops, but such arrangements would also limit contiguous new pedestrian space. A few possibilities are sketched in Figure 3 with two-way service in the left column (2 possibilities) and one-way service in the right column (2 possibilities).

The true determination of configuration will be what is publicly acceptable. Various options will need to be presented, and, while transportation specialists can argue for the design which they think is best, the design that will be easiest to move forward will be the one the public likes best. A true transit-mall should also be presented, though I think it is unlikely that such would be acceptable at this point in time. Figure 4 shows example curbside (a) and median (b) configurations.

**Bus-stop position.** Where would the particular bus stops be? We could start by assuming the local and limited stops will be where the M15 stops currently are and work from there (by actually looking at trip distributions).

If we want to have limited and local service, there has to be a way for busses to move past a bus stop (without stopping). I have incorporated this into all the of the example implementations since I think the utility of BRT would be very low if we only had local stops (it sure would not be very rapid), or if we only had express stops (stops would be too long a walk apart for some people)[11]. In addition to limited service, this setup would allow for *express* service. Express stops should be rare – maybe one in uptown, one in midtown, and one in downtown

[11] One could run limited busses in BRT lanes and local busses in "bus only" lanes like we currently have, but this seems like a half-implementation of BRT and we should try – at least at the start – for a full implementation since this will yield the best service.

Lets assume that these busses will be priced like regular busses (limited and local at $2 a ride and express at $4 a ride). Thus, these busses will be integrated into the existing bus network in terms of bus-stop-placement and price, but the busses will have a distinctive look and better service. (In addition, to "match" regular bus service, at least some BRT service will need to be 24/7.)

**Route.** The core of the route will go up/down 1st (and/or 2nd) Ave from somewhere uptown (96th St? 125th St?) to somewhere downtown (Houston St? South St via Allen St?). At the top and the bottom of the core route it might be a good idea to have the busses fan out in a few directions (as is done on many subway routes and some bus routes such as the M14). This "fanning" would help to maximize one-seat trips (but one would have to be careful about the headways on the different portions of the route). At a minimum, it would seem that some of the busses would need to go to/from the midtown Central Business District (CBD) and some would need to go to/from the downtown CBD.

Eventually one would need to stop *guessing* about routes and look at the actual trips that real people make (or want to make). It seems quite plausible that people want to travel up and down the East Side (since they are already doing this in huge numbers), but we need to know where they actually want to go and how we can integrate this service with existing services.

**CONCLUSIONS.** Bus Rapid Transit on the East Side could improve transit options and level of service quickly and cheaply. It should be implemented in an incremental fashion where possible since this seems to make it more acceptable to the public. The implementation should also incorporate bicycle and pedestrian improvements where possible to provide increased modal choice. Obstacles to implementing BRT at this time appear to be political – not technical – in nature.

Figure 1. Curb-side bus-stops with BRT on one Avenue.

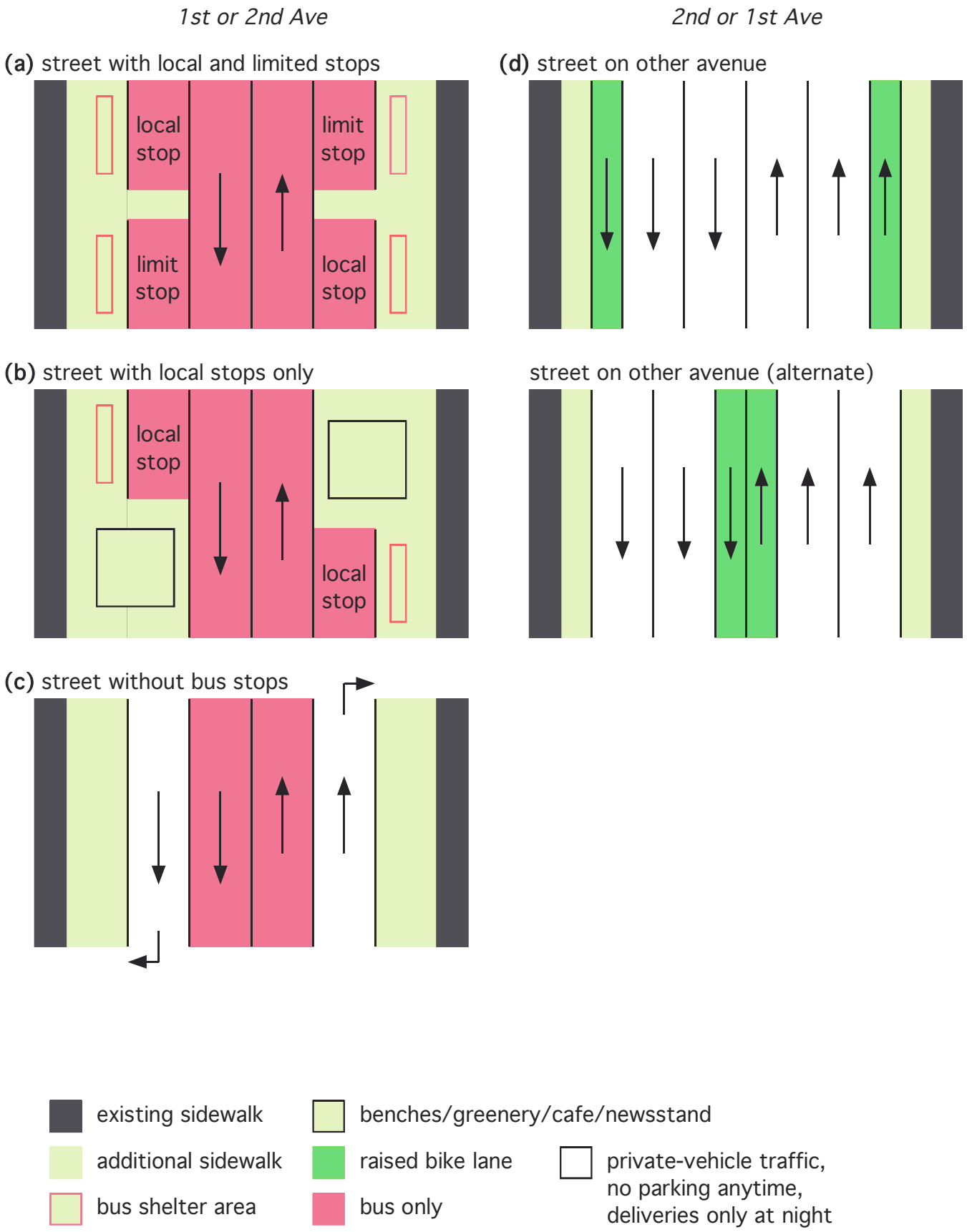

Figure 2. Curb-side bus-stops with BRT on both Avenues.

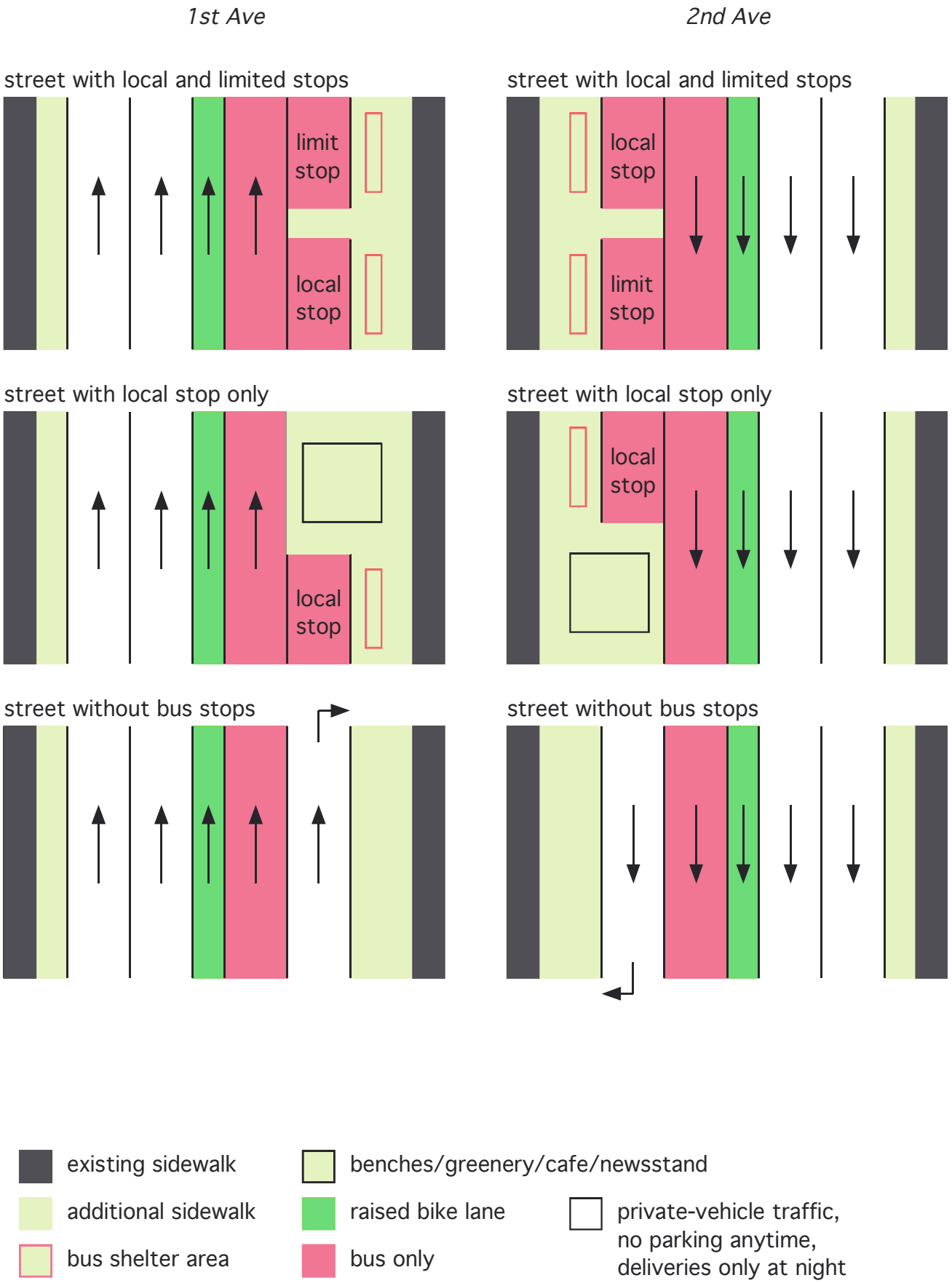

Figure 4. Transit-mall.

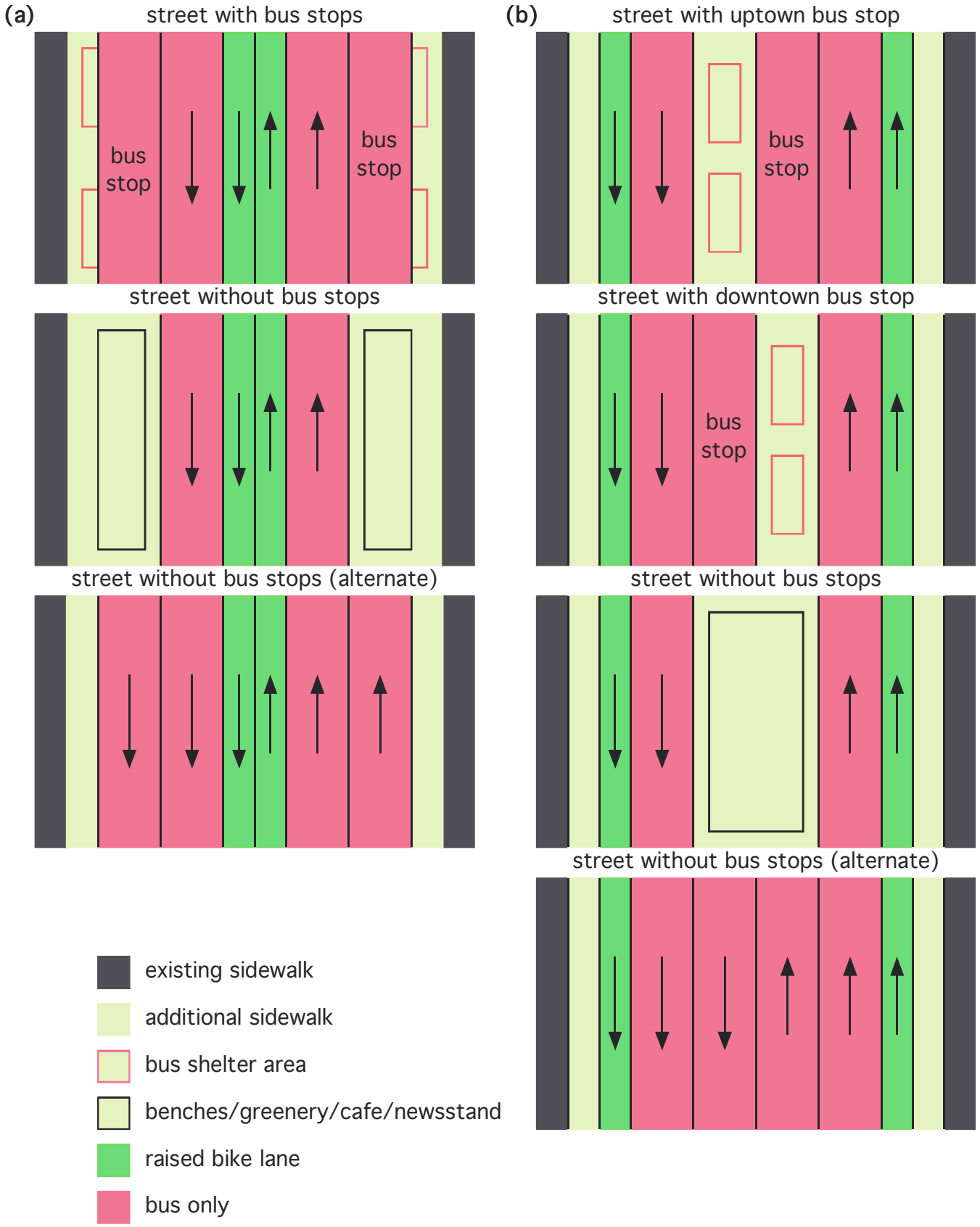

Figure 3. Median bus stops.