Title
Building a case for a new transportation system

Author
Austin, Mary Bell

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BUILDING A CASE FOR A NEW TRANSPORTATION SYSTEM

Mary Bell Austin, Sustainable Communities Program,
EPA, Region 10, 1200 Sixth Avenue, Seattle, WA 98101,
Phone: 206- 553-4689, Fax: 206-553-8338
Email: austin.marybell@epa.gov

Abstract: The author examines our current transportation system from a whole systems perspective. The examination includes an evaluation of the current system's performance under four criteria. In four appendices, the questions of whether the current system is clean, affordable, safe and efficient are explored. An alternate system is described in the body of the paper, with comparisons for each of the measurement criteria found in the appendices. A discussion of the necessary steps for a transition from one system to another follows. Issues explored include infrastructure logistics, economic impacts, and changes in community dynamics. Regulatory, finance, and policy tools available to facilitate the transition with minimum disruption are discussed as well.

Taking a Whole Systems Approach

Every region of the world has a transportation system created in response to the politics, economics, culture and physical characteristics of that region. All have common components: infrastructure, technology, institutions and values. Many remote Alaska villages have no road access and rely instead on riverboats, bush planes, ATVs and snowmobiles. The city of Venice, Italy moves its three hundred thousand plus residents and thousands of tourists by canal boats and pedestrian lanes, virtually car-free.

In the continental US, our system can best be described as auto-centric, with public transit, air traffic, trains, and ferries supplementing the use of private motor vehicles. The evolution and impacts of this system have been thoroughly examined by critics, supporters, and reformers. Almost without exception, transportation analysts approach our complex system from a specialized interest perspective. As a result, there is a great deal of information available about the environmental impacts of transportation (see Appendix A for a summary), its economic implications (see Appendix B), its health and safety measures (see Appendix C), and its relative efficiency (see Appendix D). What appears to be missing is an approach that examines the system as a whole. A whole systems approach is critical because it allows two questions that don't arise in any other context. First, how do we want a transportation system to function within our society? Second, what would such a system look like? These questions prompt us to set criteria and then design to achieve them.

A Personal Perspective

Examining how transportation fits into the weave of one life in our society reveals the ways in which this system interacts with every other aspect of public and private life. A hundred profiles of Americans and their relationships to transportation would reveal a thousand permutations on the same themes: health, safety, expense, enjoyment and/or separation from the larger community and the natural environment, and the simple ability to get places on time. Perhaps the overriding theme, however, would be the desire for something better.

Sitting at my desk by a window on the eighth floor, I hear the roar of freeway below. Continuously. I am disturbed, not just physically by the constant infiltration of noise but also by the impacts I observe. Mount Rainier often is obscured by a haze that extends, brown and fuzzy, for miles. On ozone alert days, I call an asthmatic friend to remind her to stay indoors in the afternoon. Several times a week I hear an ambulance, patrol car, or fire truck trying to make its way down Sixth Avenue, repeatedly using its siren, horns, and speakers to induce the stop-and-go drivers to nudge over just far enough to let the emergency driver squeeze through. I think of the life at risk, the damage unnecessarily increased by the slowed response of the aid car.

And every so often I notice Life Flight lifting off or setting down at Harborview Medical Center, not one obstacle in its way.

On the street corners, pedestrians wait to cross at the light or dash across the intersection when they see a gap in the flow of cars. During peak commute times, about five hours each day, I see them wind between vehicles blocking the intersections in their press to make it through just one more light. Sometimes they yell at the driver, or smack the car. On one occasion, I witnessed the driver strike back, a new expression of road rage. And over the last few years, I have learned never to step off the curb on a green light without checking to make sure no driver is running the red signal or taking the corner abruptly. I see a near miss close to every day now. 12 years ago, the Seattle custom of waiting for the walk sign seemed odd to me.

Living less than three miles from the office, I am fortunate to almost never have to drive in to work. When Agency guests arrive, they are often stunned to learn we cannot validate their parking under the building. Nine to twenty-two dollars is a lot to ask of someone who also has to deal with traffic in order to access our services. If they only need to run in for a moment, they may find a metered spot within a few blocks, for $2/hour in quarters. Or if they can get into one of the surface lots within a few blocks, they may get to park for a mere five to seven dollars. Out of town visitors staying nearby fare better, as long as they forego a rental car. When I drive on work time, I allow 20 extra minutes for the 8-block loop needed to access the freeway if I am headed south of town. My easiest work travel takes place on the train to Portland, working during the train ride from one downtown core to the other. Factoring in gas and parking, sometimes it is actually cheaper as well as faster.

To get home, I usually take the bus. My fare is covered by FlexPass, a non-taxed benefit of my job. The stop is only three blocks down the hill, a five to ten minute walk depending on traffic lights. The ride itself is fifteen to twenty-five minutes, depending on traffic and the number of stops needed by riders. Sometimes the bus is right on time, leaving my stop at regular twenty-to-thirty minute intervals. Other times it is twenty to thirty minutes late because of traffic problems downtown; and when it arrives there are no seats left. On a snowy day, it is better to walk than to wait. Once on the bus, I usually catch up with a neighbor, read, or just close my eyes and unwind. If I have a bag or package, it rides on my lap. At night, the bus schedules drops to once an hour and stops completely after midnight.

When it isn't too cold, dark or wet, I often walk instead. A brisk 40 minutes, it can be quicker than the bus; and I enjoy the chance to breathe, move, and think about my day. Walking up Sixth and turning onto the I-5 overpass, I look down at the crawling highway, take a deep breath of exhaust-filled air, and give thanks that I'm not stuck down there everyday. Off the main street, traffic is slower and I can see the changes of the seasons in the yards I pass. In my neighborhood, almost every street connects to another; and traffic circles or speed bumps are common ways of slowing down cars to keep children and others safer. The unplanned slow-down is parking congestion. My neighborhood is older, a mix of single family houses, duplexes, and apartments. There are some garages; but many people park on the street. On some of the smaller streets, one car must pull over to let another pass. We have not started using one-way signs, resident parking decals, or no-parking-this-side signs to maintain the flow - yet.

My own car sits on the street, waiting to be used a few times each week. Since it sits out most of the time, I chose an old, slightly battered model. Every time I see the small oil spots on the street, I feel guilty; but the engine tear down is more expensive than this car warrants. When a car prowler hits the area, it is almost always left untouched. The plastic-and-tape windows on other cars reminds me that I'm lucky to be able to afford comprehensive insurance, be able to take time off work for repairs, and to not need my car to keep my job. For the commonest errands - grocery, drugstore, library, videos - a short walk to nearby stores is a pleasure. For bigger shopping or a trip any place not right off an easy bus route, I take the car. If there is an event in or near downtown after work, I'll usually take the bus home, pick up the car, and use it instead of staying downtown and riding home after the event. After breaking my arm last summer, I learned to stay downtown and catch a taxi if I missed the bus timing. It feels like a luxury, because it is both expensive ($7-10) and fast (5 to 10 minutes). At the same time, the lack of stress from not rushing home, getting into the car, and finding parking makes it a very attractive option.

For years, I have been dreaming of better options for transportation. Driving down the highway at night, radio on and mind free, it is easy to imagine the asphalt gone and the roadway covered in grass. If I try, I can feel

the car lift a few feet and glide along the mown pathway. This flight of fancy brought me to an earnest question: why are we still rolling in boxes on top of paved roads? Is this the best transportation system we can design, construct and maintain? What good elements keep us building on our current platform? What would a better system look, sound, and feel like? What would it take to change the infrastructure? What would a better system achieve, in terms of human and ecosystem health, safety, efficiency, equity, and quality of life?

Thinking Bigger, Expecting More

The immense amount of effort being directed towards improving our current transportation system demonstrates that there is money, technology, professional expertise, social support, and political will to pursue and achieve improvements on the status quo. In fact, the demand is so great that there seems to be funding, research and marketing directed to a multiplicity of very targeted changes to address narrowly defined problems. Air quality concerns drive research and production of cleaner fuels, hybrid engines, lighter cars, and better community design. Safety concerns motivate better braking systems, internal sensing devices, on-board GPS use, hands-free cell phones, stronger body alloys, and at the same time, a proliferation of larger, heavier personal vehicles. Water quality concerns drive road placement and land-use decisions, as well as the use of less toxic brake components and auto maintenance practices. Citizen groups organize to prevent road placement or widening in some areas, obtain it in others, and slow down or speed up traffic in selected areas. Political leaders at every level vow to "do something" about stopping sprawl, re-vitalizing urban cores, and reducing commute times. Banks finance both experimental location-efficient mortgages to encourage short commutes and thousands of well-established car loan programs annually, to keep commuting by car within the reach of most workers.

The sheer magnitude of the effort suggests progress. Indeed, when any one innovation or trend is evaluated against its stated objective, it can usually be deemed successful. But when we examine our indicators of healthy, vibrant communities, we see a continuing decline across many measures, from air quality to biodiversity to time spent with family and friends. This negative trend suggests that improvements in selected aspects of the system cannot deliver a satisfactory system. For example, changes to cleaner fuels will not reduce the number of collisions or the acres of productive soil paved over. For each area improved, a multitude of negative impacts remain untouched, like heads on a hydra.

In order to transform transportation from a system where ecological destruction, economic strain, lost life, and lost quality of life are tolerated as necessary by-products of the system's function (moving people and things between places), we must conceptualize a system with minimal, acceptable costs. In other words, we must envision a system that is as clean, safe, affordable, and efficient as possible. If we start with high expectations, we may be surprised to find that the technological capacity, economic means, and political will to design and implement such a system already exists. In fact, by thoughtfully re-directing the vast resources invested today in band-aiding the current system, we may go naturally beyond creating a system with minimal harmful effects to one with actual restorative potential.

Envisioning the Future

Life in the City

Looking out over the downtown core from the 44th story office window, one sees rooftops interlaced with green space. At street level, pedestrians and cyclists move within the green space on separate trails, occasionally crossing a narrow street left in place for service vehicles or crossing a bridge over a stream brought back to the surface. Every few blocks, people enter the second-story stations of the transit system, enter a waiting car or call one to their location with their transit pass. They enter the cars in ones, twos or threes and zip quietly along the guideway directly to their destinations. Birds, frogs, and children can be heard through the open windows of shops and offices. Travelers leaving town take transit to the train station and ride the high-speed rail to the next city. As night falls, the city hums with locals and suburbanites shopping, going to the theater, eating on café terraces, and playing in the many pocket parks. From the rooftop garden of an apartment building, a child watches the stars come out.

Cityscape

If this picture of urban life sounds utopian and hard to transpose over the reality of today's urban landscape, it is probably not the science-fantasy aspect of fast, quiet, responsive transit that strikes the odd note. Rather, the radical aspect is the changed relationship of the city's human inhabitants and its ecosystem: green space and living systems are interwoven with commerce, culture and recreation. The key to the transformation comes from using a new approach to transportation to re-frame the use of land in a densely built, heavily used area.

Changing the Urban Landscape

Currently, several types of transportation use the same surfaces. Private motor vehicles, taxis and buses carry passengers; while cars, trucks and bikes make deliveries. Vehicles must stop for each other, for pedestrians, and for parking. Pedestrians have separate rights-of-way but must yield at every intersection to vehicles. With so much happening at once in the same space, congestion and collisions are inevitable. Fortunately, urban densities lend themselves well to separation of functions through layering, as we commonly see with highway overpasses and transit tunnels.

A critical technology for landscape transformation is Personal Rapid Transit (PRT). PRT systems used small, automated vehicles captive to a reserved guideway to move small groups of passengers or a standardized load of cargo. Vehicles arrive at stations located one-quarter to one-half mile apart (either free-standing or housed within a building) on demand and travel directly to the destination requested, by-passing intermediate stations. Guideways can be placed on-grade, below-grade, or above ground. Optimal placement, 16 feet above ground, allows safe passage underneath for people, animals, and road vehicles. A number of different PRT systems have been designed (see Appendix E), with each sharing the same defining characteristics: automated vehicles captive to reserved guideways, small groups of passengers in each car, service on demand available 24 hours/day, and direct service without stops between points facilitated by off-line stations. Because a PRT

network offers an acceptable service substitute to private autos, it can allow their displacement and the subsequent redevelopment of they land they consume.

Once the network of guideways has been laid out along existing rights-of-way, our attention shifts to the surface level. Here a variety of uses require a smooth surface to operate safely. These include bicycles, scooters, roller skates, and most wheelchairs. Pedestrians need reasonably level surfaces for safety, but not completely smooth ones. Pathways reserved for wheelchair users and walkers, with porous pavement to allow drainage, could be placed adjacent to paved paths to assist with their runoff. Or, they could be separated to allow walkers the highest sense of safety from bicyclers and others moving at higher speeds. Finally, some access to buildings by larger vehicles may always be needed, particularly for emergency and utility service purposes. Recent residential developments demonstrate that a narrow single-lane road with a modest shoulder is adequate even for heavy, fast-moving vehicles such as fire trucks and ambulances. If the safety issues raised by the high-speed turns and short braking distances of emergency vehicles can be addressed satisfactorily, porous pavement even for these uses will be possible.

As a side benefit of the new layout, the visual impact of some vertical elements of the cityscape can also be reduced. Where telecommunications and power lines are not already underground, these can be concealed within PRT guideways. Light posts, now commonly constructed forty or more feet tall to cast a broad pool of light onto streets, can be reduced in height or replaced by attaching softer, more diffuse bands of high-efficiency lighting (e.g., LED) to the underside of PRT guideways (which need no lighting on the top).

The space needed for pedestrian paths, wheel-trails, and narrow, limited-use roads and guideway post space will be significantly less than the amount consumed currently by roads, parking, bike lanes, driveways, and sidewalks. Once the task of designating the rights-of-way for each of those uses is completed, the opportunity for real creativity begins. Due to the existing street grid and alley-ways' often redundant provision of access to buildings, and the greatly reduced need for surface vehicle access to buildings served by PRT, some portions of the city street network will be completely dispensable, freeing those sections for re-development. In other segments, wide streets and their on-street parking lanes will be reduced in width, freeing the remaining strip for other uses.

The uses for the varied public and private "found spaces" within a city will depend both on what the site is appropriate for and on the most pressing needs in that locale. In buildings with underground parking, several stories will become available for uses not dependent on daylight (storage, and some manufacturing, stores and offices). In open spaces of adequate dimension for new buildings, (such as parking garages and surface parking lots) schools, housing, offices, stores, and public buildings may be constructed.

However, the degree to which urban areas already exceed the proportion of impervious surface allowable to avoid devastating impacts to natural ecosystems (see Appendix A), warrants cautious land use planning. A given municipality may find that its goals for protecting and restoring habitat, avoiding combined sewer-storm drain overflows, and reducing heat island effects are achievable only if the maximum amount of asphalt and concrete is removed and replaced by green infrastructure. Green infrastructure enhancements may include turning parking lots into pocket parks or community gardens, connecting existing patches of green belts together to form viable wildlife corridors, planting vegetation for bio-remediation of runoff in the long, narrow strips adjacent to paved paths and narrow surface roads, and daylighting streams (ie, uncovering those previously diverted to underground culverts and paved over). The particular combinations used will vary from one city to the next, but the common outcome should be an improvement in access to city amenities, health and safety of humans, health of local ecosystems, and 'livability' factors (quiet, shade, walkability, water features, etc).

Life in the Suburbs

Most residents of mini-ranchettes still own a private vehicle, used for commuting to the park and rides for PRT commutes into the city or to the nearest village center for shopping, services, school or work. In the older subdivisions, most people take the PRT to the village center or the city, using a neighborhood station car for trips to the locations not accessible by PRT. Village centers, created by one of two routes, house the majority of suburbanites.

One type are those where the old main-street layout, with shops, services, housing, schools and parks, allowed for PRT to be adopted in a manner similar to the urban areas. Biking and walking are common, vehicle use within town is limited, and a few miles of guideway with a dozen stations serve a few thousand people. Housing off the mixed-use, main street area tends to be clustered near the PRT stops, and several parking lots on the fringes of town hold visitors' cars, a few villagers' private vehicles, and a few station cars. At its far ends, the village PRT network connects to the next village's network or to the nearest city. Between them lie fields, forest, and a narrow country highway available for limited use by motor vehicles.

Village Center

The second type of village center grew deliberately out of greyfield redevelopment, with PRT use in mind during the design. As one old-timer describes it, "My family owned hundreds of acres in this valley until the Depression, about a hundred years ago. They raised vegetables, hay, and some livestock. There was a creek through the valley floor, some ponds with good fishing, and woods with game. During my father's day, the highway came through and developers parceled the valley out. They put in a mall, some of those big-box stores, a couple hotels, and some office parks. The rest was just roads between all that. By the time my kids were born, even the little farms eking it out between the developed areas were gone. But then about 20 years ago, after they got the PRT running in the city, there was a big push to re-develop the valley all over again. First they took the malls and other big boxes and added floors, mixing in housing all over. Then they brought the PRT in to link up the buildings and took out hundreds of acres of parking, leaving just these skinny roads, walkways and bike trails. They uncovered the creek and recreated some of the ponds; and they planted thousands of trees. I was already near retirement then; but I'll tell you, I got out and did my part, and my grandkids helped, too. They put a school in one of those old big-boxes, and used all the old parking spaces for playfields. They even set some land back up for farming, with some clusters of houses on the far edges of the fields. About 10 years ago, I moved into one of the new units on top of the old mall. From my terrace, I can see the new woods, the pond, and one of the fields. I don't think my father would quite recognize this land; but I think he'd be pleased."

Valley Trypitch

Comparing System Impacts and Benefits

Unfortunately, it is not possible to place the current transportation system, an auto-centric model with heavily paved urban areas surrounded by paved and sprawling suburbs, in a direct comparison to the described alternative. The latter does not yet exist to provide comparison data. However, some aspects of the latter model do exist and can be used to help determine whether the net gains of a transformation from one model to the other are significant enough to warrant the effort required to design and implement the transition.

To arrive at a measure of the net benefit, three issues must be pursued: the new system's requirements, the impacts displaced by the new system, and the overall level of impact after the transition is complete. The CASE criteria can again be utilized to examine the various types of relevant impacts. (See appendices A through D for new system expectations.) To keep the before and after comparisons distinct, it is helpful to examine transitions issues separately.

Managing the Transition

Transforming a system entails changing each of its elements (infrastructure, technology, institutions, and values) in a coordinated process. Often, the physical process is the least complicated part. A more complex, vital step is creating the consensus and partnerships necessary to enable the players to fit into a unified game plan. With political leadership and broad-based collaboration, nearly every financial, legal and logistical challenge can be resolved.

Participation: Players and Process

To effectively re-design a community, all the diverse interests within that community must be considered. All will share an interest in creating a cleaner, more affordable, safer and more efficient area in which to live and work. However, each person or group will place more importance on one or two of those factors than the others. Where one party advocates for protecting one interest at the expense of others, a sense of competition will lead to division and even polarization. Because local political leaders must make the final decisions and will be held accountable by all the parties involved for the outcomes, they bear the burden for creating and facilitating a public process that minimizes division and leads to solutions with the best long-term implications.

A process that engages all stakeholders in a constructive manner must begin with a clear statement of intent for the major outcomes, an identification of those involved and their roles, and an explanation of how all of the parties' input will be used in the decision making process. Non-governmental leaders in the community should be informed and consulted early on, because they control resources necessary for implementation and they influence the thinking of their constituencies and peer groups. Listening sessions, design charettes, and public information sessions all offer means for managing the different stages of the process. At every stage along the way, both social marketing and the press should be employed to crystalize key issues and inspire support.

Four categories of participants will play differing but equally important roles. First, governmental organizations with expertise in relevant areas need to communicate with one another early on, for coordinated input. Examples include metropolitan planning organizations (MPO's), community development corporations (CDC's),

and state or regional inter-governmental councils. These groups offer key insights into the potential for either using or changing existing regulations and ordinances to promote the desired changes. Second, urban planners, landscape architects, naturalists, transportation engineers, and others with technical expertise can offer their professional opinions on the issues relevant to their fields. Third, interest groups from the chamber of commerce to low income housing advocates will reveal the aspirations and concerns that determine their support or opposition to particular aspects of proposed changes. Finally, neighborhoods can represent the needs and concerns specific to their geographic and demographic characteristics. As the different parties make their voices heard, maximum transparency of the process is needed to dispel fears that certain groups have more access to and influence with decision-makers.

Infrastructure Logistics

The actual physical placement of new infrastructure and redevelopment of the old should follow simple, common-sense steps to minimize disruption in the areas being changed. Before any implementation occurs, however, local zoning rules must be reviewed and revised to allow the new uses anticipated. Many localities, for instance, prohibit mixed-use neighborhoods and features that enable increased density.

Because PRT infrastructure is one of the lightest transportation infrastructures, installing it into spaces with existing uses need not be unduly disruptive. Whether guideways are suspended from building sides or support posts, the preparation support can be completed with only a brief street closure, one city block at a time. When a course of supports is ready, a night crew can close the affected streets to traffic for a few hours and place the 60 foot sections of guideway in place, minimally affecting operations in the installation area. Renovations to buildings that will host PRT stations on their second-story levels and the construction of stand-alone stations can also be completed ahead, affecting only the immediate area during that time.

Once PRT is installed and operating in the urban core, creating car-free areas is the next step. Blocking vehicle access to areas whose use will be converted can occur nearly simultaneously to creating any new pedestrian or bike trails. Actually converting blocked roads from asphalt to its next use can happen on the time frame allowed by available resources, both human and financial. Next, the PRT service web can be extended to outlying neighborhoods, with guideway installation leading reductions in car access to developed zones as expansion continues.

As motor vehicle use is pushed outwards towards outlying neighborhoods and suburbs, the traditional modalities should be ready to adapt. To avoid park and ride overflows, transit providers may want to move the busses displaced from the urban core to the neighborhoods now acting as feeders. Providing station cars at the urban-fringe car lots will serve both urbanites now living without car ownership and residents outside the core who are relying more heavily on transit than when bringing their vehicles into the core was allowed.

Regulatory and Finance Tools

A number of federal statutes offer some authorization and resources for the goals of a local effort to improve transportation and land use. These include the Farm preservation Act, the Fair Housing Act, the Americans with Disabilities Act, the Transportation Equity Act for the 21st Century (TEA-21), and a variety of environmental statutes (NEPA, air quality, water quality, environmental justice, brownfields, endangered species). Of these, TEA-21 is probably the most significant, as the largest public works spending bill ever. Its stated goal of developing a transportation system that meets the CASE criteria, combined with billions of dollars in funding, makes it a powerful tool. Communities pursuing PRT in conjunction with land use changes could pursue funding under several of its programs, including Surface Transportation, Congestion Mitigation and Air Quality Improvement, the Federal Transit Act, and Research for Intelligent Transportation Systems.

For transition support separate from federal authority and funding, localities can pursue a number of options. These include public-private partnerships, bonds, tax shifts, and applying public funds saved from avoided automobile infrastructure costs to PRT construction and subsequent redevelopment efforts. To the extent that local governments can work with business and landowners to compensate them for revenue base shifts and land use impacts, both opposition and disruption will be averted.

Conclusion

The tremendous negative impacts of making do with our current transportation system compel citizens, scientists and political leaders to pursue improvements. The system and its impacts are so thoroughly interwoven into the fabric of life, however, that changing any one aspect simply shifts impacts. To achieve our larger social goals, we must first approach transportation as a whole system, seeing how the various parts interact. Then we must conceive solutions that take these interactions into account and create positive change in the relationships between the elements. Although their implementation may pose many challenges, the potential benefits oblige us to try.

Biographical Sketch: Mary Bell Austin works in EPA's Seattle office and serves as the smart growth coordinator for Region 10 (Alaska, Idaho, Oregon, Washington and 267 federally-recognized Tribes). In addition to being a point of contact and information clearinghouse for Regional staff in a variety of programs which address or are affected by the environmental impacts of construction and development, she provides some technical assistance and training to Agency partners interested in applying smart growth and/or green building principles at a project level. Mary Bell holds a B.A. from Duke University, a J.D. from the University of Washington School of Law, and is currently pursuing LEED (Leadership in Energy and Environmental Design) certification.

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