Designing Functional Streets That Contribute to Our Quality of Life

MARGARET A. KUBILINS
Kubilins Transportation Group, Inc.
8701 Mallard Creek Road
Charlotte, NC 28262
mkubilins@kubilins.com

ABSTRACT

Traffic engineers are encouraged to design local streets that accommodate modal choices. This can be accomplished through understanding the safety in speed differentials between modes and using a design speed equal to the desired speed. As engineers, we are inspired to help form a high quality of life. As traffic engineers, we translate that quality of life into safety and efficiency. However, our focus on safety and efficiency has become clouded. We need to refocus on modal choices: pedestrians, bicycles, automobiles, and transit. Traffic engineers continuously analyze safety and efficiency. Safety focuses on reducing the number of conflict points, which has led to segregation of modal choices. We design roadways without room for bicycles, and intersections that restrict access movements. The public has forgotten how to share the road. Efficiency is measured in terms of speed and delay. Signal systems are designed for continuous flow. Access is managed by limiting the number of driveways and left turn movements. The roadway is designed for the safe and efficient movement of automobiles only. This preoccupation has distracted us from our original goal to help form a high quality of life. The segregation has taken away our choices and made us dependent upon the automobile. If we can provide safe, efficient roadways for the public making modal choices, then we are meeting the commitment to a high quality of life. Traffic engineers should create streetscapes that do not force people to drive to parks, the grocery store, school, and work.

As engineers, I believe that we are dedicated to forming a high quality of life. As traffic engineers, we primarily translate quality into safety and efficiency. My definition of a high quality of life relates to the choices we have. But traffic engineering's concern for safety and efficiency has been focused on movement of cars only. There are no choices when it comes to transportation. And the lack of choices forces our exclusive auto use. It clogs up our streets, increases air pollution, and—above all—it endangers the lives of motorists, cyclists, and pedestrians. Designing choices into transportation plans will reduce capacity demands, decrease air pollution and increase our quality of life.

In order to enhance the general quality of life we, as engineers, need to design more functional streets that can accommodate modal choices. By that I mean account for pedestrians, motorists, bicycles, and transit. It is our responsibility to create these choices, to design streets that allow these modes of transportation to co-exist within the same right-of-way safely.

Having choices is closely related to our quality of life. I like to be able to choose the foods that I buy, the restaurants I dine in, the clothes I wear, the friends I share my life with, and how I get around in my life, in other words, the mode of transportation I use. At least, I would like to be able to choose. Unfortunately, we often do not have a choice when it comes to transportation.

Many roads were designed to accommodate a single mode of transportation—cars. Roads are built for safety and efficiency of the motorist. Traffic engineers continuously analyze safety and efficiency. Safety focuses on reducing the number of conflict points, and that has led to the segregation of modal choices. We design roadways without sidewalks, street widths without room for bicycles, and intersections and driveways that restrict access movements. Frankly, the public has forgotten how to share the road. And efficiency is measured in terms of speed and delay. Signal systems are designed for continuous flow. On-street parking is limited due to its effects on car traffic flow. Engineers are often looking for ways to reduce "friction" along the corridor. Roadways are often designed for the safe and efficient movement of automobiles only.

A better approach is to design functional streets that create more modal choices. The forms of modal transportation that I am specifically referring to are: pedestrians, bicyclists, automobiles, and transit—trolleys, buses or trains.

The history of transportation shows us that these modes of transportation co-existed within a shared right-of-way. Each mode respected the other. When the trolley came through town motorists automatically stopped to let the trolley go by. Cars and bicycles used the same roadway and were respectful of one another. Cars did not dominate the right-of-way with such aggressive driving behavior. Motorists knew to slow down for cyclists to a speed where each was safe and knew to pass with enough clearance for the cyclist to feel safe—not "pushed" to the side.

Relative speed is the key to safe multimodal streets. The desired speed for each mode determines the relative placement of each mode. We need to start with determining the intended street function. Land use and transportation must work in harmony. When the roadway infrastructure is built will it divide the land uses? And do we want to accept that? Or do we need to connect them? Will we design a system with transportation choices?

Based on what the street function is, we set the design speed and decide how to assemble the modal choices. Safety in a shared right-of-way situation is created through the differences in speeds between the transportation modes and the physical boundaries between each. As the speed differential becomes narrower so does the need for separation. For example, the most segregated roadway is the interstate highway system. It is designed with a median or barrier so that head-on collisions are avoided when cars are travelling at 60, 65 or 70 mph. Mass transit, rail in this case, is built within a separate area from automobiles and other potential conflicts; and bicyclists and pedestrians are strictly prohibited. Although the interstate is not multimodal, it serves a very important function in our complete transportation system.

A second classification is the major thoroughfare. In that classification, we see that transit, in this case buses, functions within the same area as cars. Buses and cars move at the same speed of approximately 45 mph—a safe sharing of street space. Here we can also see the introduction of bikes and pedestrians. If the street is designed for an intended speed of 45 mph, then bicycles should either have a designated lane or a bike

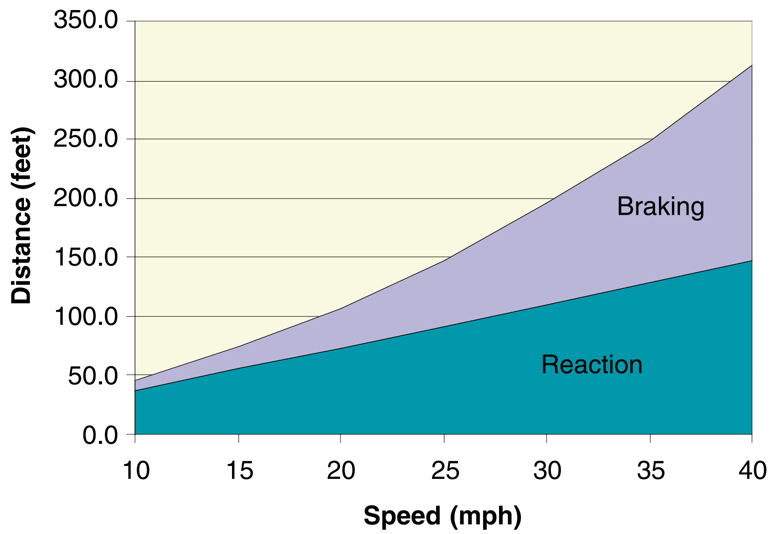

FIGURE 1 Reaction and braking distances versus speed

lane should be placed off the road behind the curb. Pedestrians are placed behind the curb and protected by a buffer between the back of curb and the walking area.

Minor thoroughfares designed for a posted speed limit of 35 mph can allow buses, cars and bicycles to use the same area within the right-of-way. The sidewalk should be set back behind the curb with a buffer between the vehicles and the pedestrians.

Speeds of 25 mph or less can accommodate all modes, assuming motorists understand that just because they are bigger they do not have more rights than pedestrians.

Urban streets typically fall in the 25- to 35-mph ranges. The safety of a street relates to the driver's speed, reaction time and braking distance relative to the other modes of travel. When the design speed is set higher than the desired speed we need to realize the ramifications of not designing the street for the appropriate speed.

When we evaluate the distance it takes for a driver to stop once he realizes an accident may occur, it becomes clear as to why the safety of the street for all modes is based on the speed differential. The reaction and braking distance at 40 mph, about 300 feet, is three times greater than at 20 mph, about 100 feet.[1] (Figure 1).

A decision needs to be made that if alternative modes of transportation are included, how will each be managed safely. The pedestrian must be an element of the design for the chance that impact with a vehicle may occur. If we choose to put the pedestrian in close proximity to a vehicle we need to design the street with a low speed, narrowing the speed differential. Ideally, a potential conflict will be avoided since the motorist should be able to react and stop in a short distance when traveling at a low speed. Remember that if a vehicle strikes a pedestrian, the pedestrian is struck again when he hits the ground. It is important to realize that the severity of the pedestrian's injury increases with the square of the vehicle's speed.

[1] ITE Transportation Planning Council Committee 5P-8, Traditional Neighborhood Development Street Design Guidelines, Institute of Transportation Engineers, Washington, DC. 1994.

On a scale of 1 to 6, with 6 being fatal, at 20 mph a pedestrian's injury might be a 2, whereas at 35 mph, the impact becomes a 6, which is fatal. In Limpert's *Motor Vehicle Accident Reconstruction and Cause Analysis*,[2] it is shown that the probability of a pedestrian being killed when a vehicle is traveling at 15 mph is 3.5%. Driving at 31 mph it increases more than tenfold to 37%. And when you go to 44 mph you are suddenly at an 83% probability of being killed. These statistics clearly support that the slower the speed of the vehicle, the safer the street is for the pedestrian and the bicyclist.

Now, as we discuss the safety of a narrow speed differential, it is important for us to look at how the basic design of the street will influence the speed of the motorist. We often speak of the activity of the public realm and there are currently many programs on traffic calming. But, if we strip away the "friction factors" from the road, the motorist will still drive at a speed that he is comfortable driving. We need to structure streets to be self-regulating.

When involved in designing a street, ask yourself, "Would I send my 12-year-old child to the store for bread on this path?" Responsible children are old enough to handle some levels of independence. Yet we have designed our communities forcing them to be auto-dependent children. Designing the roadway in a method that includes the safety of these children will change their as well as our dependency on the automobile.

The street layout is the first step in creating a quality roadway infrastructure. The ability to establish multimodal communities evolves from the harmony between land use and transportation. The transportation issue is secured through proper design at the rudimentary level. The design criteria are set by: the width, horizontal and vertical alignment, superelevation, centerline radii, vista terminations[3] and curb radii to guide drivers' speed. Design speeds establish the limits on roadway curvature and sight distance.[4] So, if we set lower design speeds and build our streets for the intended speed then we will win a significant battle in the war for speed control and for safety.

A great example for the design speed issue is a four-lane road in Charlotte that I've often driven on, built with a design speed of 60 mph—and it is comfortable to drive at 60 mph. After it was posted with a 55-mph speed limit for almost 10 years, the limit was dropped to 45 mph. No other features of the roadway were changed. Now it has been that way for probably 18 months, and I still catch myself driving at 60 mph—because that is the way it was designed.

Over time, it seems that engineers have adopted a separation or elimination approach to safety versus attention to the speed differential methodology and accommodating modal choices. We are moving back to the understanding that as long as the speed differential is narrow and we design for the appropriate conditions, we can safely put different modes of transportation within a shared space.

In summary, our preoccupation with safety and efficiency—which is an admirable goal—has distracted us from our original goal to help form a high quality of life. Segregation, which has been appropriate in some cases, has now entirely taken

---

[2] Limpert, R., *Motor Vehicle Accident Reconstruction and Cause Analysis,* Charlottesville, VA. Michie Company, 4th Edition. 1994. p. 663.

[3] ITE Technical Committee 5P-8, Traffic Engineering for Neo-Traditional Neighborhood Design, Institute of Transportation Engineers, Washington, DC. 1994.

[4] AASHTO Policy on Geometric Design of Highways and Streets, 1990. American Association of State Highway and Transportation Officials, Washington, DC, 1990. p. 296.

away our choices and made us dependent upon our automobiles. As a result, we have congestion and pollution decreasing our quality of life. If we, as engineers, can provide safe, efficient streets for the public so that they can make more choices, then we can reach for that goal to contribute to a higher quality of life. Imagine a world where each day you could decide whether or not to drive your car, or take the bus, or ride your bike, or walk to your destination—a world that offers choices. Not just choices in health care, retail, schools, entertainment, but in transportation.

When we design, remember this quote from John Muir, the founder of the Sierra Club. It says . . . “Tug on anything in the universe, and you will find it connected to everything else.”

This applies so well to the transportation field. Our choice in design speed sets the design criteria we use, and that results in what is built, and that determines whether we can choose our mode of transportation. And if we choose to walk or ride our bike, the roads will be less congested, our air will be cleaner, our bodies will be healthier, and our quality of life better.