See our new Traffic webpage at: ceds.org/traffic.html

Perhaps no other aspect of growth management affects so many people as traffic. Surely none causes as much frustration.

When traffic is managed poorly we lose: time, wages, productivity, property value, the quiet and safety of our neighborhood streets, open space, our health, and our overall quality of life. But if there is a villain here it is, as Pogo said, the vast majority of us (76%) who commute to work alone in a car. Fortunately, there are a number of steps that can reduce the impact of traffic generated by existing and proposed development.

Following is a brief review of the impacts caused by traffic.

ACCIDENTS

According to the National Safety Council, motor vehicles were the leading cause of accidental death in the United States in 2001 (and have been for many years). Of the 98,000 U.S. accidental deaths in 2001, 43% were due to motor vehicles. For every person killed by a vehicle another 90 are injured.

In 2001 motor vehicles also accounted for 6,000 pedestrian deaths and 90,000 pedestrian injuries. Speed is a major factor determining whether a pedestrian will be killed or injured by an automobile. A person is nine times more likely to die if struck by a car traveling at 30 mph compared to 20 mph.[172] Other factors contributing to the high pedestrian accident rate on our streets include the inadequacy of sidewalks, bike lanes, and crossings.

As traffic volume and speed increase so does the accident rate. Of course, when volume builds to the point where delays become common, slower traffic results mostly in fender-bender type accidents as opposed to those causing death or severe injury.

A study conducted in Longmont, Colorado found a relationship between street width, sinuosity and accident rates.[173] After reviewing 20,000 accident reports, the authors found that the safest residential street width was 24 feet (curb face to curb face), especially those with some curves. The highest accident rates occurred on streets 50 feet wide.

AIR QUALITY

In the section of this book on air quality, the pollution from cars and trucks was shown to be a considerable threat to public health. Particularly at risk are those living within a quarter-mile of a

[172] *Mean Streets 1998: Children at Risk*, by the Surface Transportation Policy Project. http://www.transact.org

[173] The study, *Improving Traffic Safety: Reducing Deaths and Injuries through Safer Streets*, can be viewed online at: http://www.transact.org/library/safetydecoder.asp

high-volume road (one carrying more than 10,000-20,000 vpd) as well as those living near roads with a large amount of truck traffic.[174] Of course vehicle noise also affects health and pedestrian safety is certainly a health issue.

CONGESTION

Each year the Texas Transportation Institute releases the *Urban Mobility Report.*[175] The latest report compared traffic conditions between 1982 and 1999 in the 75 largest metropolitan areas of the United States. The report shows that we are now spending four times longer in traffic congestion compared to how things were in 1982. The average commuter is delayed 62 hours a year by congestion. The cost of this delay comes to $67.5 billion a year. The delay also wastes 5.7 billion gallons of gasoline annually and generates a lot of unnecessary air pollution.

The *Urban Mobility Report* states:

> *To keep congestion from growing between 1999 and 2000 would have required 1,780 new lane-miles of freeway and 2,590 new lane-miles of streets—OR—an average of 6.2 million additional new trips per day taken by either carpool or transit, or perhaps satisfied by some electronic means—OR operational improvements that allowed three percent more travel to be handled on the existing systems—OR—some combination of these actions. These events did not happen, and congestion increased.*

In other words, to minimize the need for more roads we each need to drive alone less and ride bus/rail more, while advocating for improved transit.

NOISE

Traffic noise can interfere with sleep, conversation, and other neighborhood pursuits. About 2% of us are exposed to traffic noise at a level which affects our health.[176] Sound is measured in units known as decibels (dB) and highway noise is measured on an "A-weighted decibel" (dBA) scale. The noise level in a library might be 30 dBA while an air conditioner would emit 60 dBA. Quiet human speech has a volume of 55 dBA while normal speech occurs at 65 dBA.

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[174] Kim, J.J., S. Smorodinsky, M. Lipsett, B.C. Singer, A.T. Hodgson, and B. Ostro, 2004. Traffic-related air pollution near busy roads. Am J Respir Crit Care Med Vol 170, pp. 520-526. Available for download at: http://eetd.lbl.gov/ied/pdf/LBNL-55586.pdf Pearson et al. (2000). "Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers." *Journal of Air and Waste Management Association* 50:175-180.

[175] For the 2003 Urban Mobility Report visit: http://mobility.tamu.edu/ums/

[176] U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report*, available online at: http://www.bts.gov/publications/tsar/2000/

Traffic volume, speed, and vehicle type all affect noise levels. At 2,000 vehicles per hour (vph) traffic noise will sound twice as loud as at 200 vph.[177] Traffic moving at 65 mph will sound twice as loud as at 30 mph. And one truck traveling at 55 mph will sound as loud as 28 cars moving at the same speed.[178]

Traffic noise can have a significant effect on property value. A home located adjacent to a major highway may sell for 8% to 10% less when compared to one located along a quiet neighborhood street.[179] Heavy truck traffic lowers property value at a rate 150 times greater than cars. This is because at 50 feet heavy trucks emit noise at 90 dBA while car traffic produces noise at a level of 50 dBA.[180] An increase in heavy truck traffic may also cause damage to nearby homes due to vibrations transmitted through the earth. While some truck traffic is essential on neighborhood streets (e.g. refuse collection, delivery trucks, and fire engines) an excessive increase in trucks passing through a neighborhood could lower property value and overall quality of life.

LOSS OF OPEN SPACE

In the section of this book on open space, I pointed out that building new roads into rural areas can accelerate the pace of sprawl. For example, an analysis of a proposal to widen I-93 in New Hampshire from four lanes to eight showed that this action would induce 20,000 to 100,000 acres of development which would not otherwise occur.[181]

PREVENTING TRAFFIC IMPACTS

The best way to prevent traffic impacts is to upgrade transportation services so new residents and employees will rely upon bus, rail, car- or van-pools, and other modes that reduce driving alone. Following are traffic-impact minimization measures applicable to individual development projects:

- concentrate growth in areas served by buses, trains and other forms of mass transit;
- direct growth to sites within or adjacent to existing towns, cities or other population centers;
- discourage development necessitating the construction of new roads into rural areas;
- traffic should not be increased on neighborhood streets, especially truck traffic;

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[177] Highway Traffic Noise - FHWA, available online at: http://www.fhwa.dot.gov/environment/htnoise.htm

[178] Ibid.

[179] Highway noise and property value by J.P. Nelson, *Journal of Transport Economics & Policy*, May 1982, p. 117-138.

[180] Residential noise damage costs caused by motor vehicles by D. Haling and H. Cohen, *Transportation Research Records*, Issue 1559, p. 84-95.

[181] *Comments on Aquatic Resource Impacts: Draft Environmental Impact Statement Interstate 93 Improvements Salem to Manchester IM-IR-93-1(174)0, 10418-C*, prepared by Community & Environmental Defense Services, 8100 Greenspring Valley Road, Owings Mills, MD 21117., 410-654-3021.

- new intersections should have adequate sight-distance and the gap between cars should allow for safe turns, otherwise traffic control devices should be employed;
- traffic should not be added to roads that are overly congested or where the accident rate is high; and
- new roads should only be built after all reasonable alternatives for minimizing single-occupancy vehicle use have been exhausted.

To implement these measures the following approaches should be considered for proposed development projects.

Measuring Congestion

Many local traffic review agencies rely upon the *Level Of Service* (LOS) approach for assessing the impact of proposed development projects on road congestion. The handbook on this topic is the *Highway Capacity Manual*[182] which presents a methodology for determining the amount of traffic a road can handle. For example, each lane of freeway can handle about 2,000 vehicles per hour (vph). But road capacity declines with narrowing lane width, increasing curves, hills, changes in road surface, and other factors. LOS is used to rate the degree of congestion based on a scale of A to F, with A being free-flowing traffic and no delay while F is essentially gridlock. Many traffic review agencies require a LOS of D or better on suburban-urban roads and C or better on rural roads.

Traffic congestion is usually worse at intersections. Therefore, most traffic impact studies focus on how a project will impact LOS at the nearest intersection(s). Unfortunately, analyzing LOS is highly specialized and requires the services of a traffic engineer or other qualified professional. However, if a signalized intersection is notorious for rush-hour delays, then there is a good chance it is operating at a failed level of service.

The LOS at unsignalized intersections is also evaluated using the procedures in the *Highway Capacity Manual*. Another guidance document, *Manual on Uniform Traffic Control Devices*.[183], is used to determine if conditions at unsignalized intersections *warrant* the installation of traffic control devices. There are 12 warrants and include factors such as five more accidents a year at an intersection as well as the amount of delay, pedestrian volumes, presence of a school, and so forth. The table on the next page provides examples of the traffic generated by development.

[182] The *Highway Capacity Manual* is published by the Transportation Research Board: http://trb.org/

[183] The *Manual on Uniform Traffic Control Devices* is available online at: http://mutcd.fhwa.dot.gov/

Neighborhood Streets

Most neighborhood streets can handle about 1,000 vpd or the traffic generated by about 100 houses.[184] When traffic volume rises above this level than aggressive driving becomes more common and pedestrian safety declines. But for a small, secondary residential street even 700 vpd may be too high.[185]

Land Use	Trips per Day per Unit
Single Family House	10 trips/day/home
Apartment Building	6.6 trips/day/dwelling unit
Mobile Home Park	4.8 trips/day/dwelling unit
Single Tenant Office Building	11.57 trips/day 1000 sq. ft.
Day Care Center	4.5 trips/day/student
Home Beauty Salon	42 trips/day/stylist

The data presented in this table was obtained from the Maine Access Management Program.

Unfortunately, many traffic review agencies only look at Level Of Service (described elsewhere in this section) to determine whether a proposed development project will cause excessive impacts. The LOS approach allows higher traffic volumes than is desirable on most neighborhood streets.

Local governments throughout the nation have instituted Neighborhood Traffic Management Programs designed to keep traffic volume and speed at a reasonable level using a variety of calming measures. These measures include speed humps, narrowing street width, rumble strips, closing a street, and so forth. The intent is to slow down traffic or discourage through traffic to increase pedestrian safety and to reduce noise and air pollution. For further information on traffic calming visit the Institute for Transportation Engineers excellent website on this topic at: http://www.ite.org/traffic/tcdevices.htm

New Roads

Building new roads or adding lanes to existing streets is not necessarily a solution to traffic congestion. There is a phenomenon known as *induced traffic* where an increase in road capacity

[184] See *Techniques and measurements for neighborhood traffic management planning*, available online at: http://www.ite.org/traffic/soartm/Appendix_C.pdf

[185] The Prince George's County, MD, Neighborhood Traffic Management Program uses 600 vpd as the desirable traffic volume for a minor secondary residential street (a 26-foot wide local access street).

causes people to drive more.[186] Folks who used to limit their driving because the roads were so crowded make more trips after congestion is relieved. In the section of this book on open space it was shown how extending new roads into rural areas can cause *induced growth*.

Before a new road is built it is crucial that a thorough analysis be made of how it will affect sprawl, public health and whether it really will solve existing traffic congestion. Furthermore, the analysis should also look at the benefits of using limited resources to expand transportation choices, such as bus, rail and other forms of mass transit.

To prevent excessive noise impacts, a new road (and other projects) should not be approved if it would increase truck traffic on residential streets. New roads should be located sufficiently far from homes to prevent noise from causing a significant quality of life impact. The Federal Highway Administration (FHWA) allows up to 72 dBA at the exterior of homes and 67 dBA at the exterior of picnic areas, recreational areas, playgrounds, active sport areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.[187] With an interstate highway the 67 dBA threshold may extend 100- to 600-feet out from the edge of pavement.[188]

A number of states and local governments regulate activities which would cause residential noise levels to exceed 65 dBA during the day and 55 dBA at night. Those proposing activities which would exceed these thresholds should be required to take steps to resolve the impact. For example. noise barriers of earth, wood or concrete can reduce noise by 10-15 dBA.[189] A forest measuring 200 feet in depth can reduce noise by 10 dBA.[190]

Parking

A new development project can impact quality of life if either too little or too much parking is provided. Too little and project residents/visitors may take up limited parking space on nearby residential streets. Too much parking creates more impervious area which increases aquatic resource impact.

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[186] For further information on induced traffic visit the Sierra Club's congestion webpage at: http://www.sierraclub.org/sprawl/transportation/congestion.asp

[187] See 23 CFR Part 772, which can be viewed online at: http://www.fhwa.dot.gov/hep/23cfr772.htm

[188] Based upon environmental impact statements for the Tuscaloosa Bypass and I-93 in New Hampshire.

[189] Highway Traffic Noise - FHWA, available online at: http://www.fhwa.dot.gov/environment/htnoise.htm

[190] Ibid.

Parking requirements vary from land use to land use. For example, typically two parking spaces are needed for each single-family home while five spaces are usually provided for each 1,000 square feet of floor area in a shopping center.[191]

Frequently, parking ratios are based upon peak use. For a shopping center the peak use period may last for only a few days a year - the Thanksgiving to Christmas shopping season. For the rest of the year the parking lot is only half full.

The *Better Site Design* handbook[192] calls for adjusting parking requirements to minimize unneeded impervious area. Adjustments should take into consideration factors such as the availability of transit. Parking facilities can also be shared. I know of several churches with congregations much larger than available parking on the church grounds. The church leadership encourages parishioners to use a nearby park and ride lot for Sunday services. The church operates shuttle buses to get folks to and from the lot. Many parishioners actually come to prefer the shuttle approach. They get home more quickly.

A typical parking space is about 10 feet by 19 feet. Parking spaces make up about half of a parking lot. The rest of the lots is drive lanes, islands, and entrances. For each vehicle accommodated in a parking lot about 380 square feet of impervious area is created. This amount of impervious area would generate nearly 7,000 gallons a year of polluted runoff. For each space provided the impervious area would be sufficient to degrade four feet of a high-quality stream. Obviously, even effort must be made to minimize unneeded parking while ensuring that existing residents are not forced to compete for parking.

Sight-Distance

Imagine for a moment that you are leaving for work and sitting at the end of your driveway. You need to turn right so you look left. At what point can you first see cars approaching from the left? The length in feet between you and that point is the *sight-distan*ce. If the sight-distance is too short then there is a good chance you will get rear-ended some morning making that right-hand turn.

The "bible" on sight-distance (and manner other aspects of road design) is *A Policy on Geometric Design of Highways and Streets*, published by the American Association of State Highway and Transportation Officials (AASHTO).[193] There are several kinds of sight distance, but two most commonly occur in land use cases: *stopping* sight-distance and *intersection* sight-distance.

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[191] These parking ratios were obtained from Table 6.1, in *Better Site Design*, by the Center for Watershed Protection.

[192] Ibid.

[193] For further information on this and other AASHTO publications visit https://www.transportation.org/

Stopping sight-distance is the length of roadway needed for a driver to recognize then react to a hazard ahead plus the distance required to bring the vehicle to a full stop. Intersection sight-distance is the length of unobstructed view required by the driver of a stopped vehicle to see approaching traffic and turn on to the intersecting road safely. Obviously, intersection sight distance varies depending upon the turning movement. A driver making a right turn requires less sight distance when compared to those making a left turn from a full stop.

Of the two, intersection sight distance is the greater. For example, at a design speed of 50 miles per hour (mph) stopping sight distance is 425 feet whereas for the same design speed intersection sight distance for right turns is 480 feet and 555 feet for a left-turn.[194]

Minimum sight-distance, both stopping and intersection, varies with the speed of approaching vehicles, presence of hills, road surface condition and other factors. One gross rule of thumb calls for 11 feet of intersection sight-distance for each mph of approaching vehicle speed. In other words, if vehicles approach an intersection at 40 mph then a minimum of 440-feet of sight-distance is required. Again, this is a very general rule of thumb and actual sight-distance is best determined by a qualified professional. However, this rule of thumb might be used to get a feeling as to whether you should bring in a traffic engineer.

One of the traffic engineers who frequently helps CEDS clients offered another rule-of-thumb: If ten seconds passes from the time you first see most (85%) approaching vehicles until the moment they reach your position, then sight-distance is probably okay. This rule-of-thumb makes sense if you consider that a car moving at 30 mph travels 440 feet in ten seconds. The minimum sight-distance required at 30 mph is 330 feet. At 60 mph the same car covers 880 feet in ten seconds and the minimum sight-distance is 660 feet.

Some jurisdictions base sight-distance on posted speed limit; others the 85th percentile speed (the 85th fastest moving vehicle). The approach based on 85th percentile speed makes more sense. Procedures will be found on the CEDS website[195] for doing an unofficial citizen speed study.

Sight-distance is measured by stooping down at the point where a driver would be waiting to turn. Get your eye about 3.5-feet above the road surface. In other words, you are trying to get the view of a passenger car driver at an existing or proposed intersection. You then look for the point where you can first see vehicles approaching in both directions. With a tape measure you then determine the distance to each point. If you feel sight-distance may be inadequate then ask a qualified professional to verify your findings, including the speed of vehicles traveling on the road. But also make local traffic review staff aware of what you have found.

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[194] These stopping and intersection sight distance values are from Exhibits 3-1, 9-55, and 9-58 in *A Policy on Geometric Design of Highways and Streets*.

[195] www.ceds.org

Traditional Neighborhood Design

With this design approach higher density residential is located around a central commercial district fronting on an open space commons. The community is laid out on a grid pattern, which allows for more efficient mass transit, with neighborhood parks and retail spread throughout the project. In other words, it looks like the neighborhoods of old and is far more pedestrian friendly. You can walk or bicycle to many places, including to the bus or rail stop. Visit the Preservation Institute's Traditional Neighborhood Design website for further detail: http://www.preservenet.com/index.html

Transit Oriented Development

The idea behind transit oriented development (TOD) is to concentrate a mixture of high-density residential and commercial land uses around locations served by mass transit services. The goal is to situate homes, retail shopping and offices within walking or bicycling distance of transit stops. Usually a rail transit station is the focal point (either light-rail or metro-style heavy rail), but TOD can also work with bus rapid transit. For further detail on Transit Oriented Development see the Brookings Institution report available online at: http://www.brook.edu/dybdocroot/es/urban/publications/belzertod.pdf