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Roads

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Roads as Expressways for Polluted Runoff

In a study of "sources of pollutants in Wisconsin stormwater," Roger Bannerman and his colleagues collected over 300 runoff samples from lawns, driveways, rooftops, parking lots and various types of streets. The monitoring revealed that streets were the single most important source area for urban pollutants. Not only did streets produce high concentrations of phosphorus, suspended solids, bacteria and various metals, but they also generated a disproportionate amount of total watershed runoff.

Streets are major sources of pollutant loading because of a number of factors. First, most other pollutant sources such as sidewalks, driveways, rooftops and lawns drain into streets on their way to storm drains. The curbs and drains found in streets trap, collect and convey many pollutants, especially fine particles. Streets are receptacles of emissions and leaks from the vehicles that travel over them. Metals from cars such as copper and cadmium reach their highest levels on streets.

A study of car accidents in Longmont Colorado found that narrower streets are safer than standard width residential streets. Dan Painter in his study entitled, "residential street typology and injury accident frequency," reviewed 3,000 police reports to find that the standard 36' wide residential street had four times as many accidents as 24' wide streets

Roadway Systems

The automobile has become a basic functional unit in site design. As a result, an understanding of how cars circulate within the roadway system and the system's impact on natural resources is critical to help local officials make rational land use decisions and formulate plans of conservation and development.

Roadway systems are grouped into a number of different classifications for planning and design purposes. These classifications are usually based on the function of the road and the projected traffic volumes and vehicle speeds it will accommodate. A typical roadway system includes the following four classes of roads:

Freeways, expressways and parkways

Carry large volumes of rapid, through traffic between and across urban areas. They have limited access with grade separated interchanges. They have design speeds of 60+ miles per hour and usually have at least 4, 12' traffic lanes in a 120+ foot wide right-of-way.

Arterial roads

Carry through traffic between and across developed areas with some direct access to abutting properties. They are subject to control of exits, entrances and curb use. They have design speeds of 30 to 40 miles per hour and have 4 to 6, 12' traffic lanes in rights-of-way 100' to 120' wide.

Collector roads

Carry traffic between arterial and local roads, with direct access to abutting properties. Traffic control is provided by stop signs on side roads. They have design speeds of 30 miles per hour and have 2 to 4, 12' traffic lanes in 60' to 80' rights-of-way.

Local roads

Carry local traffic and offer direct access to abutting property. They have design speeds of 20 miles per hour and have 2 to 4, traffic lanes 10 to 11 feet wide, in 50' to 60' rights-of-way.

This paper will focus on local roads, particularly those serving residential uses, the road type over which local land use officials have the most control. While some mention is made of collectors and arterials, which greatly contribute to an area's impervious cover, local officials spend most of their time reviewing and approving local roads associated with proposed subdivisions. Local officials are not generally involved in the planning, design, construction or maintenance of expressways, so they are not discussed in any depth.

Transportation Goals and Policies

A primary goal for a community's transportation network is to provide for the safe and efficient movement of persons, goods and services while preserving the natural resources and character of the community. Transportation policies that might help achieve the above goal include:

- Promote energy efficient transportation alternatives to the single occupancy vehicle such as ridesharing, mass transportation, bicycling and walking.
- Design road networks that accommodate these transportation alternatives.
- Maintain and improve the existing road network, while preserving the historic, aesthetic and environmental resources located along it.
- Prevent traffic congestion.
- Design a road system that will provide an adequate level of service to the community throughout its design life.
- Design a road network that emphasizes safety and enhances the natural and cultural resources of the area.
- Utilize flexible road design standards to reduce adverse aesthetic and environmental impacts.

Roadway Location

The location of a roadway should be based on a review of the following:

- Present and proposed land use
- Present and proposed transportation facilities
- Proposed traffic volumes
- Topographic features
- Environmental considerations
- Historical features
- Safety
- Scenic opportunities
- Acquisition and development costs
- Operation and maintenance costs

The proposed location of a roadway must consider its potential impact on the area in terms of noise, odor, drainage, safety and visualization. A proposed road must be responsive to natural features. A good road fits the lay of the land so it is less likely to be so visible as to destroy the character of the area. A road should be so aligned and constructed that it preserves and accentuates the best features of the landscape. A well-fitted road avoids disturbing natural drainage patterns or ruining special natural features of the site. The road should be secondary to open spaces, helping to define them rather than overwhelming them.

Roadway Widths

In designing road widths it is important to differentiate between the width of the total road right-of-way and the pavement width.

The right-of-way width must be sufficient to contain the following: pavement and curbing, street utilities installed in border areas, sidewalks where required, shoulder areas for drainage, overflow parking or storage of plowed snow. While rights-of-way widths vary based on the widths of its component parts, the most common recommended right-of-way width is 60 feet. The pavement width is determined by the following factors:

- The type and density of land use
- The type of parking (i.e., Off-street versus on-street)
- Traffic volume
- Traffic speed
- Type of vehicle (i.e., Cars, trucks, buses)
- Distance between pavement edge and any roadside obstacles.

As the density of land use increases, the volume of vehicular and pedestrian traffic increases, as well as the probability of curb parking. For example in medium density residential areas of 3 to 6 dwelling units per acre, pavement widths of 32' to 34' are suggested. In higher density residential areas of over 6 dwellings units per acre, curb parking increases still more requiring curb parking on both sides of the road. Traffic volumes are higher increasing the likelihood of two cars in opposite lanes meeting one another next to cars parked along the curbs. These conditions call for 36" wide pavement to provide for continuous movement at reasonable rates of speed.

Where curb parking is permitted, pavement width increases. For example, a 20' wide local road might be expanded to 27 feet to allow one side, curb parking. Curb parking will occur occasionally in all land use areas, whether allowed or not. The rate of occurrence is a function of land use, land use density and off-street parking regulations. Even in low density residential areas, with two car garages and large driveways to accommodate most parking needs, there will be occasional vehicle breakdowns and overflow parking. Providing a graded 8-foot shoulder on one or both sides of the road is a good way of accommodating the occasional curb parker. The graded shoulder can also be designed to provide pedestrian walkways, bicycle trails and vegetated swales, to accept and filter road runoff.

A minimum pavement width must allow safe passages of moving traffic in each direction. The criteria most often used to determine minimum pavement widths are projected traffic volume and speed. For example, the suggested minimum width for a two-lane road with a design speed of 30 miles per hour and an average daily traffic of 50 to 250 vehicles is 20 feet. By contrast, the suggested minimum width for a two lane road with a design speed of 70 miles per hour and a projected hourly traffic volume of over 400 vehicles, is 24 feet.

The other factor that can influence pavement width is topography. As the terrain becomes hilly the frequency of curves increase requiring wider roads.

NEMO Recommendations Regarding Roads

- Roads should be built for the minimum required pavement width needed to support projected traffic volumes.

- As road length is directly related to lot width, review minimum lot widths and side yards mandated by zoning and revise where feasible.
- Minimize the number and width of cul-de-sac roads. Where they are built, the radii of turnarounds should be minimized and designed as landscaped filters, sunken below the grade of the road pavement.
- Where feasible build uncurbed roads. Install instead vegetated swales to treat road runoff.

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