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Residential Streets

Streets are the backbone of communities and cities, serving as the primary infrastructure for connecting places, but also the most used public commons. Residential streets, in particular, are the defining features of neighborhoods and form a significant portion of the local environment and living experience for residents.

Attitudes towards residential street design in the United States have transformed over the past century, affecting the street standards that formed different networks and characteristics of streets, and ultimately the type of residential development. With the rise of the automobile and suburban development, residential streets began to be mistakenly viewed as fulfilling only three functions: providing access, providing on-street parking, and conveying traffic as efficiently as possible. Through certain street standards such as increased street and pavement width, residential streets have become larger, which thus reduces the size of the lots, increases construction and maintenance costs, lowers densities, and increases travel times between points[i]. Street networks in many suburb communities have evolved discontinuous, insular patterns that isolate communities for the sake of greater privacy for residents. Along with the lack of good network connectivity, the large scale of these streets places greater emphasis on the car without much consideration for the wide range of other functions that residential streets can actually serve.

Beyond vehicular access, residential streets are meant to be public settings for social activity, the framework for pedestrian and bicycle circulation, and the space that provides a visual setting and entryway to homes. Therefore, residential streets should be designed in a way that compliments and enhances its multiple functions as the backbone of the built environment. They must be designed to be more than a transportation facility yet planned as part of a hierarchy of streets that form an efficient and safe network for both vehicles and pedestrians. As strong visual elements of a community, well-designed residential streets can create more attractive communities and contribute to a clearly defined sense of place. Home buyers look for more than just good quality homes, but also good quality streets and surrounding community. Regarding new community developments, streets are a significant element in total housing construction costs, therefore, building them in a way that is safe and cost-effective while designing a street network that is attractive and accessible can add value to homes.

Residential streets must be considered as part of a hierarchy of streets, each conveying a certain kind of traffic at individual levels. Within this hierarchy, residential streets serve the fundamental functions of connecting cities and communities to homes and contributing to the neighborhood environment. With these in mind, residential streets can be rethought and designed with certain principles in mind[ii]:

1. Street planning should relate to overall community planning, including pedestrian and bicycle activity.
2. Traffic in residential areas should be kept to a minimum.
3. The street is an important component of overall residential community design.
4. Street design standards should permit flexibility in community design. They should allow street alignments to follow natural contours and preserve natural features or to respond to other design objectives such as the creation of urban or village scale streetscapes.
5. Street pavement layouts should be planned to avoid excessive stormwater runoff and avoid heat buildup.
6. Streets can function socially as meeting places or centers of community activity.
7. In the interest of keeping housing affordable, street costs should be minimized.
8. Different streets have different functions and need to be designed accordingly. Blanket guidelines are inappropriate.

Design Considerations

The layout of the street system in a new development is the first step of the design process, primarily established through considering the natural site features, connection points to the external road system, and the preliminary concept of a site plan. The next step in the design process involves the identification of the cross-section features, which refers to the functional classification of streets within the street network hierarchy. These include the number of lanes, the type of drainage, the pavement width, the sidewalk placement, and the necessary right-of way. Finally, the design of the longitudinal features are controlled by the details of the site, involving the horizontal alignment, the vertical profile, and the gradient.

The aforementioned hierarchy of streets forms the base of the street network, differing by the balance between mobility and access. Residential streets form the connectors between local and arterial streets, making the transition from high mobility to high access to dwellings. Collector streets are typically fronted by more mixed and active uses, such as businesses, public buildings and multifamily residences and make up 5 to 10 percent of the total street mileage in new development. Ideally, they should provide residential communities with commercial uses and local destinations without having to venture much higher on the hierarchy. Well-designed collector streets with proximity to many local streets can have a high value as frontage for the local community's residential and commercial properties.

Local streets serve the primary purpose of directing access to residential properties, often accounting for 90% of street mileage in new communities. Because of their primary role of access, safety and reduced through-traffic volumes are more important considerations in their design than are mobility and faster flowing traffic. Local streets contribute to the local character of a neighborhood because of their prevalence in the network, but also the direct frontage with residential properties and the daily interaction residents have with them. Local streets further contribute to the backbone of the pedestrian and bike networks, where if they are well-designed, can greatly encourage these alternatively essential functions. Therefore, they should be smaller in scale to accommodate more pedestrian-oriented activities. A major distinction between local streets and residential collector streets involves their differences in accommodating parking, which affects the flow of traffic through the street.

Street Layout

Street networks come in varying types, incorporating collectors and local streets to promote mobility and access while defining the neighborhood character. The traditional gridiron system is a basic geometric concept with short block lengths, straight and parallel streets, back alleys, and a higher level of connectivity. Pervasive throughout most American urban form, the gridiron system was simple, efficient, and a cost-effective way to subdivide land[iii]. Criticisms of this system include architectural monotony and disregard for topological variables, as well as the realization that it is not the best form to increase connectivity. Post World War II residential development was typified by the more curvilinear street network with narrower streets, planting strips, and cul-de-sacs that changed the suburban landscape. This design had children's safety in mind, limiting vehicular traffic through a defined hierarchy of streets, separating the residential tracks from faster collector streets. The loop and lollipop network, in particular, separated pedestrian and vehicular traffic with an internal park and walkway system and an external roadway system. This design would often result in poor internal connectivity lacking in direct routes between places, thus discouraging walking and bicycling. Hybrid networks emerged in neotraditional development resulting in neighborhood patterns that combined the dead-end streets with connective grid qualities that would provide service efficiency to all users[iv]. These hybrid designs seek to create a fabric of local streets can accommodate more of the driving without heavier use of arterial streets. These highly connected street networks also typically feature lower-speed streets, thus still increasing safety and service to bicycles and pedestrians. Communities can have flexibility in arranging their internal street networks to meet the desired level of connectivity while preserving neighborhood identity and privacy.

The street layout is a large determinant of a residential community's success in terms of function and house marketability. It also determines the location of utility installations, the solar orientation of houses (and thus their energy usage and efficiency), the degree of interaction among neighbors, and many other community features[v]. The layout of residential streets can follow a few strong guiding principles:

- Paved access should be provided to all developed parcels.
- Through traffic should be discouraged and creating excessive travel lengths should be avoided.
- The community's circulation system and land development patterns should not cause unnecessarily large volumes of local traffic to be routed onto adjacent major streets.
- Traffic generators (destinations) within residential areas should be considered in the local circulation pattern.
- The local street system should be designed for relatively uniform low volume of traffic.
- To discourage excessive speeds, streets should be designed with curves, changes in alignment, and short lengths.
- A minimum amount of space should be devoted to streets.
- Local street layout should permit the economical development of land and efficient layout of lots.
- Local streets should be responsive to topography and other natural features.
- Public transit service should be provided where appropriate in residential areas.

An essential component of designing a street network is its external access to adjacent street networks. Neighborhood connectivity, both within and beyond, determines the trips that residents make to their destinations and what mode they choose to do so. The challenge is in finding the balance between the competing goals to best suit the community. Multiple access points increase connectivity by creating alternative routes to destinations that reduce congestion on arterial streets and provide more continuity within the system for emergency and delivery services. The drawback is that there can be more traffic on residential streets. Meanwhile, fewer or single access points eliminate through traffic, thus increasing security and privacy for local residents. However, it does decrease connectivity and discourage alternative modes through auto dependence. As aforementioned, the desired characteristics of the neighborhood can largely influence the selection of how many access points the community will have, so that decision depends on the overall goals for the community.

Pedestrian and Bicycle Access

A good residential street will safely accommodate multiple modes of transport, especially pedestrians and bicycles. Comprehensive community planning has now made sidewalks, pedestrian pathways, and bicycle paths an integral part of residential land development. In general, residential streets should have sidewalks on both sides of the public right-of-way to allow access to all the properties without having to cross only at intersections. A three to five-foot border area or grass strip between the sidewalk and the street provides many benefits, including safety for children walking and playing, temporary storage for trash receptacles, and an area to store snow plowed off roadways. In some instances, such as where side slopes are steep, historic areas exist, or where large lot developments have frontages exceeding 150 feet, sidewalks on one side can be appropriate. Destinations that generate higher traffic should also have wider sidewalks to comfortably move foot traffic through. Certain conditions may make accessibility difficult for people with disabilities, requiring alternative walkways.

Bicycling as a form of transport is becoming increasingly integrated with residential street planning as communities link up regional bike paths and accommodate bike lanes in connector and arterial streets. Well-designed local and access streets and networks will not need special modifications in order to accommodate bicycles as they offer good connectivity and lower vehicle speeds that can accommodate bike travel. On residential collector streets where there are higher traffic volumes and speeds, it may be necessary to add a bike lane. Collector streets often have destinations accessible by bicycle and connect to an exterior system of bicycle lanes and trails, making it favorable to include bike lanes along these streets to further integrate a safe network for cyclists in residential areas.

Higher connectivity, which is related to the street layout, allows for shorter travel distances and will encourage walking and bicycling. Multiple neighborhood characteristics can contribute to higher levels of both non-motorized and vehicular traffic flow, but a successful design will accommodate both. Path sharing by bicycles and pedestrians is appropriate when the path is not used by through traffic, and the path should be wide; at least eight feet wide to accommodate the traffic. Street crossings, in particular, need to be designed to offer adequate sight distance, include safety devices such as signs and painted crosswalks, and curb cuts for bicycles and other wheeled devices.

Emergency Vehicle and Service Access

Emergency medical service, trash collectors, police, utility providers and other municipal services all need well-connected neighborhoods to fulfill their functions. Dead-end street networks make navigating them very difficult for these service providers, adding time and cost to their service[vi]. Though narrower streets are becoming increasingly preferred for improved livability, they can also be a problem for service access. Therefore, it is important to consider the connectivity issue alongside street widths and on-street parking to create a favorable situation for service vehicles. Even on streets with a 24 to 26 foot width, cars parked on both sides can collectively occupy 13 to 14 feet, leaving minimal space for emergency vehicle passage. On small residential streets where this can pose a problem, no-parking areas can be established on the street's frontage as well as eliminating parking on one side of the street. Therefore, it is still possible to keep smaller residential streets and maintain a neighborhood character while still being able to accommodate service vehicle access.

Pavement, Right-of-Way Widths and Skinny Streets

As previously discussed, street and pavement widths should only be as wide as necessary, otherwise, they can reduce the livability of a community and incur maintenance costs while taking up too much land. Streets that are too wide not only encourage higher traffic speeds that make it unsafe for pedestrians, but take away from the intimate scale of a street, making it a less attractive setting for housing. A right-of-way should only be as wide as its functions need it to be, for example, to accommodate sidewalks, bike paths, and utility access. Including space for grass strips and trees and storm gutters is also integral in planning the necessary width of the right-of-way as they are part of improved street aesthetic and stormwater management.

Street Type	Pavement Width
Local Streets	
No Parking Expected	18 Feet
Low or Restricted Parking	22-24 Feet
Normal Residential Parking	24-26 Feet
Residential Collector	32-36 Feet

Regarding sidewalks and bike paths, instead of being located on the right-of-way, they can be located on land owned by the community association, contributing to an internal network of interconnected paths that can add valuable living feature to the community.

The concept of *skinny streets*, involves emerging community planning principles that aim to create more compact neighborhoods through narrower streets to preserve space, improve

land use efficiency, and create more livable communities. Through narrower street standards, communities can still serve traffic effectively while encouraging low speeds and safety for other users. From the typical recommendation of 34-36 feet of pavement to 26 feet for "skinnier" residential streets, the standard has proven effective in several circumstances to produce low traffic volumes.

Skinny streets are also an integral part of creating *green* communities that consider other environmental features, specifically preserving open space and reducing impermeable surfaces for improved stormwater drainage. Combined with more strategic residential street layout design as part of a mechanism to manage urban growth and create more livable communities, skinny streets can be used to create more complete neighborhoods that can meet the functions of residential streets while preserving environmental resources.

Traffic-Calming Measures and Design Speed

The priority of residential streets should be to provide a safe environment for its inhabitants. Traffic calming measures can be used to alter driver behavior and improve conditions for nonmotorized street users. At the neighborhood scale, the street layout design determines the level of connectivity, and subsequently, the traffic flow through local streets. Combined with strategic design to reduce through-traffic without compromising connectivity, traffic calming measures can ensure the harmony of multiple street functions.

Most traffic-calming is achieved through a combination of the following: 1) narrowing the width of the street or its apparent width to drivers, 2) reducing site distances with curves and 3) adding textures to the driving surface[vii]. Well-designed residential streets will already have traffic-calming features, such as the narrow streets, natural terrain contours, and plenty of street tree plantings along the pavement edge. In existing streets, adding parking along some curbs and creating textured surfaces at important areas, such as intersections and crosswalks, can help reduce traffic speeds. Installing small intersection circles and roundabouts can also reduce the sight distance for streets at intersections for existing communities. Even the intermittent narrowing of two-way streets to a single effective lane to force opposing vehicles to share the street would be an appropriate mechanism.

Planning speeds in select roadways are inherently related with traffic-calming and community safety. The following street design features affect speed:

- Open width or clearance of the street
- Horizontal curvature- the longer the radius of a curve, the higher the speed through that curve
- Sight distance- long sight distances tend to encourage higher speeds
- Number of access points to the street- the presence of many obvious conflict points tends to inhibit speeding
- Number of parked cars and other traffic calming devices
- Signs and signals at controlled intersections

Since residential streets serve multiple purposes, they should be designed for lower vehicle speeds. A design speed of 20 mph is recommended for local streets, incorporating the variety of traffic-calming measures and design features that naturally lower speeds while creating visually appealing and safer streets.

On-Street Parking

The availability of on-street parking depends on the type and width of the street. There are three options for on-street parking: 1) parking on one side of the street, 2) parking on both sides of the street, and 3) parking allowed only in parking bays provided at the edge of the street. Local streets can employ a variety of these options depending on the width and the traffic volume on the street, considering the desired speed as well. Paved parking lanes are usually appropriate only on collector streets and require an eight-foot width. On streets without curbs, an eight-foot improved shoulder can be used in lieu of paved lanes. These shoulders need to be sensitively landscaped to meet functional and aesthetic objectives so they can ensure permanence. Where continuous on-street parking is impossible, angle parking may be a suitable option, though it may require a depth for the spaces and more moving-lane space.

Streetscape

With home buyers placing greater and greater importance on the neighborhood over the individual home, residential streets must be attractive and create a sense of place. The character that a good streetscape provides not only creates a more appealing pedestrian atmosphere, but can increase the value of the home.

Trees and shrubs are the most visible aspect of a streetscape, so careful selection should be left up to an urban forester, arborist, or landscape architect. They would carefully consider the mature height, spread, the root system's potential for damaging sidewalks and street pavements, maintenance requirements, and ability to adapt to local environment. Selecting native plants can give a regional character to the neighborhood and they are often the most drought-tolerant and accustomed to the environment. Plantings should allow clear sight distance to provide visibility to vehicles. In new developments, existing trees should be part of the careful planning process to preserve and incorporate them in whatever way possible on the right-of-way and on private property. This could involve planning the site structures and utilities around them and selecting which ones are greater preservation priorities.

Utility structures should be placed underground, wherever possible, and if they are located above ground, they should be coordinated with the proposed landscape plans. Above ground utilities can be camouflaged to blend in with the background. Light poles and fixtures could relate to the architectural styles and character of the surrounding neighborhood, further contributing to its unique sense of place.

Streets as a Drainage System

Residential streets serve an important secondary function of collecting and conveying stormwater runoff. The large extent of impervious surfaces in developed areas results in a high amount of runoff that can be a potential hazard to life and property.

In a closed drainage system, runoff is collected from the street and adjacent properties and retained within the roadway by curbs and gutters that convey the flow to the main drainage system, typically consisting of storm drains. An open drainage system is alternative method that encourages drainage into the surrounding soil. Swales on the sides of roads are a common open drainage system feature, where water is conveyed into a grass-lined open channel. This allows for the water to soak into the soil, thus reducing runoff and removing some of the pollutants. These systems require appropriate soils and slopes for proper functioning to help prevent widespread urban flooding and runoff.

Regardless of whether a street drainage system is open or closed, it should parallel the street layout and gradient planning. The design should pay special attention to street slopes, the location and capacity of these drainage points, and the coordination of street grades with individual lot drainage.

Traffic Circles and Roundabouts

Traffic circles and roundabouts have been resurging in residential street design. Intersection circles on local streets are usually small, ranging from 15 to 20 feet in diameter, and installing them in a normal intersection requires no additional street space. They are better suited for local streets with relatively low speeds and volumes. Roundabouts are larger than traffic circles, ranging from 25-40 feet in diameter, requiring special street features at the intersection. They are more suited for higher-speed and volume collector streets.

These street features increase safety through reducing speed from the vehicle's curbed path, and reducing the likelihood of collisions in the intersection. Their capacity to keep traffic flowing in a safer manner exceeds that of intersections controlled by conventional stop signs and traffic signals.

Dead-end Turnarounds

In neighborhoods with dead-end streets, circular turnaround areas are preferable. The recommended radius for the paved area without a center island is 30 feet, but can be up to 42 feet for frequently serviced areas to accommodate larger vehicles without creating difficulties in backing up. T of Y-shaped turnarounds may be used for streets having short length, alleys, and streets serving up to 10 houses. These turnarounds are more ideal for low volume streets and require less paving, less construction and maintenance costs, and provide greater flexibility in land planning and the location of the homes. Their recommended dimensions are 60 feet by 20 feet, much smaller than a circular turnaround. Turnarounds are not required in instances where streets are extremely short and serve no more than five houses.

Curbs

Curbing contains the edges of street pavement and is used to control drainage and protect sidewalks and properties from encroaching vehicles. Curbs come in two general categories, vertical and sloping, each of which has a different design variation that differ in the way they either restrict or permit vehicle access.

Vertical curbs have steep sides and rang from six to eight inches in height and are designed to restrict vehicles to the roadway. They are more suitable to protect pedestrians and the streetscape, provide good drainage control, and are able to better control parked vehicles if they roll. Sloping curbs meet at the pavement and are designed so that vehicles can cross over them. They can accommodate off-pavement parallel parking and provide developers with some flexibility in the timing and location of driveway construction.

As part of "green streets," bioretention curb extensions are special green patches between curbs and sidewalks that allow for infiltration of stormwater to reduce runoff into storm drains. They can be combined with either vertical or sloping curbs to reduce runoff and the possibility of flooding.

Alleys

More often associated with older and higher density urban areas, alleys are increasingly used in new suburban developments. They provide accessory vehicular access to homes and are effective in reducing driveway entrances to the street. With rear access to homes, cars and garages no longer carry such a heavy presence on streets and allow for home designs that do not present the garage as the dominant feature. Therefore, not only do alleys free up space for on-street parking without having to include large driveways, they allow for more pleasant home and streetscape design that can change the character of a community. Alleys should consume no more space than necessary to allow the passage of a service vehicle. A 12-foot pavement width with a 16-foot right-of-way can accommodate a typical eight-foot wide vehicle with room to spare. Surrounding garages and fences should be set back from the right-of-way by three to five feet to allow an adequate turning area for vehicles.

Pavement

Notably the most prominent feature of streets, well-designed and constructed pavement reduces soil erosion, provides a safer travelling surface for vehicles, and has the capacity to handle loads without sinking or shifting. The initial cost and cost of maintenance are important considerations when deciding the kind and extent of pavement that will be used in constructing the streets. Residential street pavement must be designed to consider the volume and characteristics of expected street traffic. It must account for the soil, available range of paving materials, and the behavior of those materials under loads and probable climactic conditions. Communities have varying pavement standards and aesthetic values related to the color and texture of street surfaces that plays a role in selecting materials. The wide of range of materials provides communities with different options, but they must be suitable for the aforementioned conditions as communities must consider the short and long-term economic costs of the particular pavement selection and the design of the streets through a life-cycle cost analysis.

What Can Builders Do to Increase Flexibility in Street Design?

Builders play an important role in shaping the character of a neighborhood, and ultimately the quality of life of its residents. With a renewed emphasis on creating more “complete” residential streets, there is a possibility to re-envision and design them as public amenities that successfully accommodate multiple functions and create a more livable environment that address community values and user needs. Beyond using a functional classification system, residential streets need to be designed contextually meet the needs of the community at hand. This involves a collaborative process with different stakeholders, beginning with working with the local planning department to focus policies and standards that serve all users and modes of transport. If designing narrower street networks, then working with the local fire chief is important to coordinate safety standards and provide examples where such designs work. Creating a neighborhood that has a defined sense of place and provides continued value to home buyers requires innovative design and community benefits in the plan that relate to a good street design.

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This report was produced alongside NAHB staff Claire Worshtil

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[i] Southworth, Michael and Ben-Joseph, Eran. *Streets and the Shaping of Towns and Cities.* 2003

[ii] Urban Land Institute. *Residential Streets.*
[iii] *Planning for Street Connectivity: Getting From Here to There.* Pg 3
[iv] *Residential Streets.* Pg 20
[v] *Residential Streets. Pg. 21.*
[vi] *Planning for Street Connectivity: Getting From Here to There.* Pg 17

[vii] *Residential Streets. Pg. 49*