Final Draft

STREET DESIGN ASPECTS OF "SMART DEVELOPMENT"

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Initial Concepts

Streets are perhaps the most prevalent of public spaces; essentially every parcel of land abuts one or more streets.[1] Together with the infrastructure located within their rights-of-way, streets are also commonly the most costly element of subdivisions and other developments. Clearly, the appropriate design of streets is an integral component of Smart Development.

[1] For the sake of clarity in this document, all those linear corridors which mix motor vehicles, pedestrians, bicyclists and/or transit facilities over quite wide volumetric ranges will be referred to with the simple and inclusive term “street”. See The Traditional Neighborhood Development Street Design Guidelines, ITE for additional discussion of street labeling.

Smart Development streets are considered in this text to be equivalent to "Traditional Neighborhood Development" (TND) streets.[2] The Institute of Transportation Engineers (ITE) has recently published a Proposed Recommended Practice for the design of TND streets that was principally authored by C.E. Chellman (the author of this section). Because of the similarities of topic and authorship, some of the text from the ITE document has been adapted for this text. The ITE document is recommended for additional details and more technical data on these topics.

Smart Development includes the design of streets that create an environment where drivers will realize that to drive too fast or too aggressively is inappropriate, anti-social and, perhaps most effectively, uncomfortable. With the appropriate design techniques, drivers will more automatically choose the lower target speeds and less aggressive behaviors desired by the planners. In this desired "self-enforcing" environment, both motorists and non-motorists will feel more equivalent occupants of each particular Smart Development street; this sense of equivalency should be a design goal as it will enhance the livability of the street and neighborhood.

Children and other non-drivers are needlessly impacted by any environment that is motorist-predominated. When a non-motorist cannot safely or conveniently travel to a day's events without a vehicle, even simple matters such as children's recreation outside of the home become more rigidly scheduled due to travel coordination needs. This travel coordination also places demands on the drivers who must also modify their schedules to transport the non-drivers. The societal impacts of such requirements are difficult to measure, but they are doubtless significant; the net effect of a motorist-dependent environment is certainly hobbling to both non-drivers and some drivers. Smart Development allows the possibility of non-motorist travel and the replacement of some vehicular trips with non-vehicular trips.

If planners begin to design for the particular facilitation of only one user of a street, the design focus has likely become too narrow. Planners need to be cautious not to tread on this "slippery slope" of narrow focus, because it can easily result in a substantial degradation of the quality or safety of the street environment for other users of the street. This problem is presented if the single-minded focus is either the motorists or the non-motorists (exceptions include, for example, single-focus

[2] "Traditional Neighborhood Development Street Design Guidelines", Chellman et al, Institute of Transportation Engineers, Washington, D.C. 1997 publication #RP-027

needs such as wheelchair ramps, truck loading docks and high speed/volume streets).

Particular Topics

Connectivity

Smart Development streets are interconnected. This principle is central to Smart Development design. Cul-de-sacs and other dead end streets are not a part of a Smart Development; except and only where extreme topographic or wetland conditions preclude connection are streets not connected (even in such instances, continuous non-vehicular connections should still be attempted). The need for street connection is twofold: for vehicles, Smart Development streets function in an interdependent manner that is better-served by connected streets; otherwise, connected streets provide continuous and generally more comprehensible routes which serve to enhance the beneficial purpose of non-vehicular travel.

Where it is difficult to provide full through streets, there are design alternatives to cul-de-sacs. One option is the “close” (pronounced “cloze”). The close is a simple “U”-shaped street with a natural or landscaped interior of the “U”. Keys to making an appropriate close are to have a one-way loop and to have the middle area generally between fifty and one hundred fifty feet in width.

Concept of "Lanes" and Shared Street Space

A principle that is central to the design and sizing of streets in a Smart Development is that where streets are not striped for separate lanes of travel, planners must not automatically think of separate "lanes" of traffic or parking in an additive sense (with respect to lane dimensions). An example of this concept can often be found on relatively narrow residential streets, either at low densities or when rear alley access is provided to the buildings. On these streets, with intermittent on-street parking, the street's width may occasionally require one driver to slow down or pull over to let an oncoming vehicle pass before proceeding, particularly if one of the vehicles is a truck or other large vehicle. The keys here are the words "occasionally" requiring drivers to pull over or stop and "intermittent" on-street parking that allows such pulling over.

There are many such streets in the U.S., and they are typically well-liked by residents[3]. From the designer's perspective, where volumes are low and large vehicles few, one may actually only need one relatively clear or through lane. This same concept applies for all streets in a Smart Development: street width, which defines the primarily vehicular space and which must be crossed by pedestrians, must not be larger than is actually needed.

Scale

Scale is a threshold design parameter that determines the size and amounts of several important design elements, and is of paramount importance in a Smart Development. The principle of design scale in a Smart Development neighborhood is that of the pedestrian; in another manner of speaking, human scale predominates.

Describing what is of a "human scale" is perhaps first best described by noting that which is not. A highway billboard beside a 55 mph highway is a good example of vehicular scale. In order to attract attention, such a sign must be very large (typically 15' x 40' or more), with lettering large enough to be noticed, and read, by a motorist passing by at 81 feet per second (55 mph). A pedestrian, on the other hand, typically walks at only 3.5 to 4 feet per second, and small details are more noticed than are large ones. A pedestrian walking next to a billboard likely would not feel comfortable next to that billboard- simply attempting to get the perspective needed to even read it would be very difficult.

What this matter of scale equates to for the planners of streets is a new focus: instead of being primarily concerned with and designing for vehicles and then "accommodating" pedestrians and others, Smart Development planners must consider the sometimes competing needs and impacts of each design parameter on all of the users of the street. Given successful design in accordance with these principles, there should be a larger than usual number of pedestrians in the makeup of the users of the street. However, and obviously, the pedestrians share the street with: bicyclists; transit vehicles; passenger cars; trucks; and emergency vehicles. All of these users and occupants of the street require many competing design factors to be considered.

Street Space

The Smart Development street begins at the front of a vertical element such as a building (or fence) on one side of a street and runs to the front of a building on the other side of the street.

3 Examples include Madison Wisconsin (22', two way, on-street parking) and San Francisco Ca. (21', two way, on-street parking)

Some planners call this building-to-building space around a street the "streetscape. Where the land is not yet developed, a Smart Development street designer must know with some certainty the scale of the buildings, existing and projected vehicular, bicycle and pedestrian volumes and the general form(s) of development that are expected to occur on the undeveloped land. In the same vein, the evolution of improved land in a Smart Development should generally be known with some specificity. Where the scale and general forms of types of development are known, it is more practical to accurately predict and design for the needs of the vehicular and non-vehicular users of each Smart Development street.

Bicycles

Bicycles are perhaps the most energy efficient means of travel, on average five times more efficient than walking and, of course, bicycles do not consume fossil fuels. Bicycle travel should be encouraged in Smart Development projects wherever local weather conditions allow them to be practical. Designers must be aware that bicycles are not necessarily easily accommodated: the on-street parking typical in a Smart Development may present conflicts and bike lanes adjacent to parked cars must be designed with care to avoid conflicts between the bicycles and opening car doors.

It is also important to note that at the speeds associated with Smart Development streets, there is often less need for separate bicycle lanes or facilities; bicycles are an appropriate and expected element of the street.

Smart Development Street Capacity

The concept of minimizing through traffic ties in with another Smart Development principle: more of the capacity of all of the Smart Development street network is utilized than is typically the case in conventional "dendritic" street networks. By way of explanation, in conventional networks, traffic is expected to begin at local (often cul-de-sac) streets and then "flow" to collector and then to arterial streets; ultimately into the more regional systems. This type of network collects and focuses traffic, often leaving few choices to drivers. Non-drivers are also conventionally excluded from large portions of the network either by regulation or by the vehicular orientation of the designed and constructed environment itself.

This sort of dendritic street network and the usually accompanying separation of land uses also creates a highly weighted directional distribution away from residential areas in the A.M. and into them I the P.M.

In a Smart Development network, with no dead-end streets there are always multiple ways to connect any two locations. With multiple routes presented to motorists and non-motorist options made more possible, vehicular trips at least are afforded the opportunities to be diffused or reduced by drivers choosing alternative routes, or by choosing to travel by means other than the automobile.

This Smart Development principle should not, however, be taken as a mandate to eliminate larger streets or to eliminate all hierarchy of streets in a Smart Development. Private vehicular travel is still a part of travel today, and larger vehicular corridors should be located at the edges of Smart Development neighborhoods. One of the challenges of Smart Development design is to allow the diffuse flow of traffic without creating "short-cuts" that encourage cut-through traffic.

Pedestrian Networks

Smart Development streets are shared with pedestrians. While a network of streets is important for vehicular efficiency, networked, safe and convenient connections are of paramount importance to the pedestrian. For these reasons, all lots and sites have pedestrian connections. Smart Development streets typically have sidewalks five and more feet in width along both sides of the street except at the lowest densities, or at the edge of the neighborhood.

In addition to sidewalks, pedestrian networks can be formed with connections across wetlands and slopes that may not be crossed by streets without difficulty. In the center of neighborhoods, pedestrian networks may also be formed by additional walks between buildings -- but not at the expense of maintaining the continuity of the pedestrian network adjacent to the streets.

Pedestrian Street Crossings and Curb Return Radii

In order to allow convenient street crossings by pedestrians at street intersections, the curb return radius must be very carefully selected. The principle is to carefully consider the traffic mix expected, particularly the size and frequency of vehicles, the size of single unit (SU) and larger trucks, and the percentage of right-hand turns those larger vehicles will make and then to balance the needs of those vehicles with the numbers of pedestrians. If the proportion of large vehicles is few, then it is usually acceptable to allow these vehicles to swing across the centerline of the street: either the street the vehicle is turning from or the street it is turning into. When this occurs, if there is a vehicle approaching along the street the larger vehicle is turning into, either the larger vehicle or the approaching vehicle will have to stop to let the other complete its turn, or the turning vehicle has to wait to let the oncoming vehicle pass by. This concept is in accord with the concept of shared lanes. Larger curb return radii more easily accommodate the right-turning vehicles, but at the expense of increasing pedestrian crossing distance.

Emergency Vehicles

Emergency vehicles must be afforded access throughout a Smart Development neighborhood to every parcel and structure. However, planners must be careful to consider several factors when designing emergency access. Unlike dendritic street networks, there will always be at least two routes of access to any particular parcel in a Smart Development. In addition to access from the street, parcels in a Smart Development will also usually have access from a rear alley.

It should also be noted that emergency vehicles have the legal right of way in emergency situations. Again in emergency situations, emergency vehicles also have the legal right to use all of the travelled portion of the street. Also, while not generally recommended, in unusual circumstances special emergency equipment may be needed to service a Smart Development neighborhood.

In short, planners should be cognizant that emergency vehicles have greater access options and rights than other vehicles, and the effects of decisions concerning turning radii and paths must be made with a full understanding of the implications of such decisions on the other users of the street.

Some other larger vehicles, including transit and infrequent vehicles, may need to be specially-scheduled or to have special rights of way so that they have the necessary access where needed. Otherwise, the street or street element under consideration may be improperly designed for the automobile and the non-motorists.

There are concerns that some fire department vehicles in particular "require" a clear lane of twenty or more feet in width. Access by all emergency vehicles is important, but such presumed requirements are more accurately preferences. In a Smart Development, and a traditional neighborhood (as defined by the ITE), the ramifications on other users of the street for wider widths and clear lanes are significant. As previously discussed, the increased passenger vehicle speeds that such clear lanes will create will more often than not lead to a degradation of the overall safety of the neighborhood.

Finally, with respect to emergency vehicles, it is often extremely helpful to set up a test route in a parking lot. Such test routes can include example turning and maneuvering conditions that may be temporarily striped or- better yet- marked with cones and parked vehicles. In this manner, actual drivers of the actual vehicles in question may sample the proposed conditions and adjustments, if any, may be made in advance of actual construction.

Utilities

As with emergency vehicles, but somewhat more simply addressed, the location of utilities is important in a Smart Development neighborhood and along Smart Development streets. Where space is available, utility outlets, service entrances, transformers and the like should generally be centrally clustered in a neat and orderly fashion and should be located to the rear of Buildings or screened from public view wherever permitted by building and electrical codes. Similarly, where overhead utilities and poles are used, these should be located to the rear of lots in alleys where alleys are provided.

Where overhead utilities exist or will be located in the street to the front of lots, the competing needs of the vehicles and the non-vehicular users of the street will be evaluated in accordance with the principles of these Guidelines. In the event of conflict not otherwise addressed by these principles, the simple convenience of a utility provider should not take precedence over the needs of the vehicular or the non-vehicular users, or the aesthetics, of the street.

Locations of Highways and Other Large Vehicular Corridors

Arterial highways, major collector roads and other streets with peak hourly traffic flows or projected peak hourly flows of 500 vehicles or average daily traffic volumes of more than 15,000 vehicles are all too large to penetrate a Smart Development neighborhood. Such streets may be thought of as rivers to pedestrians (in an effective sense) and the other non-motorists: these streets can be crossed, but usually only with extraordinary measures. Pedestrians confronted with one of these streets will quickly realize that they are out of their element, and will likely not return except by vehicle.

For these reasons, these larger streets must be located at the edge of Smart Development neighborhoods, or in areas between Smart Development neighborhoods.

Eye Contact and Street Safety

Societal factors aside, the safest streets include a high degree of eye contact among pedestrians, drivers and bicyclists. Designers of Smart Development neighborhoods should strive to create this condition**:** if the users of the street establish eye contact, then awareness has been established and the opportunities for a safer street have been established.

Street Trees

Trees are perhaps one of the very few elements of a street, along with well-designed buildings, that can be large and yet still effectively be of human scale. In addition to their naturalization of the street, trees can serve to create a frame around a street, and such "outdoor rooms" are recognized as being very conducive to enhancing the non-motorist environment (see figure 10).

Where climate and soil conditions permit, trees will generally line the streets in a Smart Development. In areas with few commercial uses, trees are usually located within planting strips six and more feet in width, and in areas with higher commercial densities, trees are located in tree wells located in sidewalks that are usually approximately ten feet wide.

On-Street Parking

Most streets in a Smart Development allow on-street parking. On-street parking is known to slow passing vehicular traffic and parked vehicles also serve to establish a buffer between the moving vehicles and pedestrians.

Parallel parking is the recommended method for on-street parking, but other on-street parking methods including diagonal and head-in may be appropriate under certain circumstances, especially including the renovation or adaptation of older neighborhoods. Diagonal parking can prove problematic from the pedestrian perspective because of the sawtooth type encroachments that the fronts of the parked vehicles can make into the sidewalk area.

Head-in parking on the street is relatively efficient and is often preferred by merchants because of the greater yield of spaces per foot of street. However, when compared with the street width that is required to be dedicated and for striped parallel parking, the additional eleven or twelve feet of street width that is required for **each** side of the street and the backing movements that are required to use head-in parking must be carefully evaluated before head-in parking is to be provided. Additional street width directly affects pedestrian crossing times and that section of these guidelines should also be reviewed before the street width is increased. An additional consideration where head-in parking is to be provided is the transition to a narrower section where the head-in parking stops or transitions to another element of the street.

On-street parking along one or more sides of the street, usually parallel parking, is the normal Smart Development street condition. On-street parking serves to both slow the adjacent vehicular traffic and to provide a buffer between the non-motorist and the motorist. The beneficial aspects of on-street parking are also generally recognized: "[o]n-street auto parking is permitted and provided for along many of the best streets, far more than where there is [no on-street parking]...".[i4]

On-street parking is usually problematic to bicyclists, but is less so where good levels of awareness exist among bicyclists, other non-motorists and motorists. Designers need to be aware of the problems associated with parked vehicles and bicyclists, such as swinging doors and backing movements, and to try to develop means to accommodate both, as both bicycling and parked vehicles are important elements.

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[4] Jacobs, Allan B. *Great Streets.* Cambridge, MA. Massachusetts Institute of Technology. 1993, pg. 306.

Smart Development Street Width

The width of a particular street seems a simple topic, but this is actually a complicated topic that requires considerable thought and attention by planners. Indeed, few design topics are seemingly as simple but which have as much lasting significance and actually involve the interplay of conflicting needs as is the topic of the width of a Smart Development street.

Traffic engineering for “conventional” vehicular-dominated development accepts as a fundamentally paired premise that vehicles should travel "safely and efficiently.” The efficiency component of this coupling is often taken to mean that vehicles should travel the streets either without interruption or with interruption only at designed traffic control devices such as traffic signals and stop signs. It is sometimes believed by planners that any other stop or interruption to a driver directly equate to a reduction in safety and efficiency. This approach to street design does not comport with the principles of Smart Development design, and the need for lower overall vehicular speeds. The **overall** function, comfort, safety and aesthetics of a street are more important than is its vehicular efficiency alone in a Smart Development. In a Smart Development, the fundamental premise is that non-vehicular travel is to be afforded every advantage practical so long as safety is not adversely affected.

The data clearly shows that where the non-motorist travel is to be encouraged, and therefore the numbers of non-motorists are expected to be higher than is the case elsewhere, then safety considerations mandate the consideration of means and methods to slow the motor vehicles and thereby better “balance” the street for all of its users, motorist and non-motorist alike.

Designers should consider that which is reasonably foreseeable, certainly not that which is possible, in matters of Smart Development street design. This standard will show that the most frequent and therefore likely users along Smart Development streets are motorists (in automobiles) and non-motorists of all forms. Each of these predominate users must be considered fairly. This will mean that to design to *facilitate* (as opposed to providing means and measures to *accommodate*) an infrequent visitor to a particular street, may be wrong more often than not for the more frequent users of that street.

By example, to facilitate a very large but infrequent truck will establish street turning radii and other dimensions that are so much larger than those for automobiles that to provide the additional street surface for the truck will encourage faster travel speeds by the more frequently found automobiles. As noted previously, however, generally faster automobile speeds do not comport with the safety needs along Smart Development streets, and the faster automobiles serve to further reduce the likelihood of more non-motorists.

Designers will often find examples of older neighborhoods that are sought out by residents as preferred places to live. Many of these neighborhoods exhibit street sizes and networks that are quite unlike most "subdivisions" designed to current criteria. Within these older neighborhoods the levels of service on the streets and at intersections may be found from "D", to "E" or even "F". These levels of service would not seem to encourage new residents, but in many cases the quality of traffic flow along the street does not adversely affect residents’ desires to live along these older streets. Smart Development proponents will note that this sort of acceptance of a neighborhood is, in part, *because* traffic may be slowed and inconvenienced due to more difficult older street widths and networks.

Examples of older streets are found throughout the United States and elsewhere; often many concepts -both good and bad- can be observed in older neighborhoods and these conditions may then be emulated or modified to the current condition under consideration.

If appropriately designed, vehicles travelling along Smart Development streets will occasionally make unscheduled stops in the street, particularly when larger vehicles travel these streets, or when opposing vehicles meet on the narrower streets. This sort of occasional vehicular stopping along a street should be considered normal along Smart Development streets; in some cases, such streets are known as "queuing streets".[5]

To design for the continuous opportunities for completely freely-flowing vehicles (as is the case with 10 feet and wider travel lanes), is to create situations where most of the time passenger cars - far and away the predominate vehicle- will travel at speeds greater than are desirable for nearby pedestrians. This becomes a self-worsening situation of degradation of the pedestrian environment: faster vehicles are noisier and more dangerous to pedestrians; faster vehicles generally mean fewer pedestrians; and fewer pedestrians generally mean even faster vehicles.

The concept of "lanes" and shared street space is especially relevant to the matter of designing street widths. Where vehicles are allowed to travel and to park, there may not be a need for continuous "lanes" of travel in both directions or of parking along one or both sides of a street. Especially for lower volume streets, as well as streets where significant non-motorist oriented retail is located, queuing and slower-moving vehicles may represent the best design for the street. As soon as the street is conceived of as individual "lanes" of parked and moving vehicles (as it generally must be for higher volume streets), then each "lane" of the street must be allocated its own width. This thought process is fated to result in a street that is wider than it need be if the volumes of vehicles are such that the street surface will be shared by parked and moving vehicles.

The actual design of a street is an engineering matter. For Smart Development, this design should be particularized for each street involved. Otherwise, the design will contemplate conditions that may occur only infrequently or not at all along a particular street and the design will thereby be inappropriate.

The new ITE Guidelines state that "[a] street should be no wider than the minimum width needed to accommodate the typical and usual vehicular mix that street will serve.[6]" This

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[5] Bray, Terrence L., Karen Carlson Rabiner. Report on New Standards for Residential Streets in Portland, Oregon. City of Portland, Oregon: Office of Transportation: August 1, 1994

[6] ITE TND Guidelines, supra, page 26

simple statement results in streets that vary widely in width depending on the functions of that street.

Design Speed and Minimum Centerline Radii

Several jurisdictions in the U.S. have lower thresholds of speed limits that are either 25 mph or 30 mph; often the lowest limits are also allowed only in school zones. This is problematic to Smart Development.

However, for safety and aesthetic reasons, planners should strive for streets in Smart Development neighborhoods that have vehicular travel and posted speeds of 20 miles per hour and below. The design of the streets should also create a self-enforcing condition.

Speed may be controlled by a number of measures, including the surface of the street, as in the example photo to the right.

Some other national bodies have recently created model regulations that seek to establish lower design speeds for all forms of subdivisions. For example, the American Society of Civil Engineers (ASCE) Subdivision and Site Plan Standards Committee has developed some recommended subdivision and site plan standards in cooperation with the US Department of Housing and Urban Development. These standards establish maximum design speeds of 20 and 25 miles an hour for "access" and "sub collector" streets, respectively. It is hoped that as these matters receive more focus and consideration, other agencies will acknowledge the logic in the concept of these lower speeds.[7]

Minimum design centerline radii are sometimes difficult to find for design speeds less than 25 miles per hour. Using accepted methods of calculation, the following shows the criteria for minimum centerline radius for design speeds of 25 mph and less (no superelevation):[8]

[7] *Proposed Model and Development Standards and Accompanying Model State Enabling Legislation 1993 Edition* ,Instrument Number DU100K000005897, Page 11.

[8] AASHTO, supra, pgs.151& 188, the formula (feet) is:

$$R_{\min} = \frac{V^2}{15*(e+f)}$$

R = centerline radius (ft)   V = velocity (mph)

f = coefficient of friction   e = superelevation

Design Speed	Min. Centerline Radius
10 mph	**22 feet**
15 mph	**50 feet**
20 mph	**89 feet**
25 mph	**166 feet**

Table 1: Minimum centerline radii

Curb Return Radius

When one curbed street meets another, the curbs at the sides of each street are joined by a curved section of curb known as the "curb return". With larger curb return radii (Crr), turning movements of right-turning vehicles are more easily accommodated, but the length of the crosswalk needed to cross the street for pedestrians at that point is also increased, sometimes dramatically. As the Crr increases, the likelihood of right-turning automobiles decreases due to larger curb return radii creating essential “free-right” turning lanes for automobiles (this typically happens with Crr at and above 30 feet).

The geometrics of the pedestrian crossing distance are dependent on 5 variables: sidewalk width; planting or "buffer" width between the sidewalk and the curb; street width; the angle of the intersection; and the curb return radius.

Examples of the relationships among curb return radius, planting buffer and sidewalk width are shown in Table 2 and Table 3 for several examples with and without planting buffers adjacent to the street. Note the near doubling of extra crossing distance between a 15' curb return radius and a 10' curb return radius with no planting strip (in bold in Table 2).

Example #	1	2	3	4	5	6	7	8	9	10
Sidewalk Width	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'
Planting/Buffer Width (to curb)	0'	0'	0'	0'	0'	0'	0'	0'	0'	0'
Curb Return Radius	5'	8'	10'	12'	15'	20'	25'	30'	35'	40'
Crossing Distance to be added to Street Width	1.3'	4.4'	**6.8'**	9.3'	**13.4'**	20.6'	28.2'	36.0'	44.0'	52.2'
Pedestrian Crossing Time to be added to street cross time (seconds)	0.4	1.3	1.9	2.7	3.8	5.9	8.1	10.3	12.6	14.9

Table 2: Effects of curb return radius on pedestrian crossing times and distances (no buffer).

Other examples are shown where a buffer or planting strip has been provided in Table 7 below:

Example #	11	12	13	14	15	16	17	18	19	20
Sidewalk Width	6'	6'	6'	8'	8'	8'	10'	10'	10'	10'
Planting/Buffer Width (to curb)	6'	6'	6'	6'	6'	6'	6'	6'	6'	6'
Curb Return Radius	15'	25'	30'	15'	25'	30'	15'	25'	30'	35'
Crossing Distance to be added to Street Width	2.5'	11.6'	17.2'	1.7'	10.0'	15.3'	1.1'	8.6'	13.6'	19.0'
Pedestrian Crossing Time to be added to street cross time (seconds)	0.7	3.3	4.9	0.5	2.9	4.4	0.3	2.5	3.9	5.4

Table 3: Effects of curb return radius on pedestrian crossing times and distances (with buffer).

Practitioners will find that for conditions where a turning vehicle crosses the center of the street, whether or not it is striped, some will feel that an "encroachment" into an oncoming lane may have occurred. This is erroneous thinking for most Smart Development streets, because infrequent vehicles will **usually** cross the center of a Smart Development street when making a right-hand turn, otherwise the street has been improperly designed to facilitate that infrequent vehicle.

Curb return radii are one design tool which can used to slow vehicular speeds, and to promote non-motorists. The zoning, subdivision and street standards of many cities and other urban areas generally provide for curb radii of 5 to 30 feet, but most of which are between 10 and 15 feet. Within a specific Smart Development, curb radii should be selected based on reasonably anticipated traffic volumes, traffic types, and the intersection traffic control devices proposed or in place. In the United Kingdom, Crr of 7 meters (23 feet) are considered “large”, while a “small” curb return radius is only 1 meter (3 feet).[9]

[9] Traffic Calming Guidleines, Devon County Council, 1991, page 46

Quoting from AASHTO, "...it is often extremely difficult to make adequate provisions for pedestrians. Yet this must be done, because pedestrians are the lifeblood of our urban areas, especially in the downtown and other retail areas. In general, the most successful shopping sections are those that provide the most comfort and pleasure for pedestrians."[10]

Widths Of Rights Of Way

Designers should be flexible and open to varying street rights of way to include only the travelled surface, to be offcenter with respect to the travelled way, or to other variations that serve to assist with the overall design, use and maintenance of the street in concert with the other aspects of the street, especially including the adjacent land uses and building types.

Bicycles

Bicycles are an increasingly important form of non-motorist travel. This is true for recreational and utilitarian trips. Therefore, bicycles should be facilitated wherever practical.

In some areas, particularly in Northerly recreation areas, practitioners may find that seasonal air quality degradation peaks occur during times of year where weather conditions are also prime for non-motorist travel. This condition exists along much of the mid-coast region of Maine, for example, where air quality is poorest during the summer months. This sort of situation can be mitigated by encouraging some of the seasonal surge in travel demand to shift to non-motorist means, and bicycles are prime candidates for some of this shift.

On lower-volume streets, bicycles should be considered a normal part of the mix of travelers on the street. With higher volumes of motorists and bicycles, bicycling routes for less experienced bicyclists should be separate from the motorists, but bicycles should be expected and accommodated along all streets. Designers should work to aid the routing of bicyclists within and through Smart Development neighborhoods with signage and striping as may be appropriate. The technique of changing the color of the entire bike lane so that it differs from the vehicular space has been found effective at slowing adjacent vehicular speeds in some locations, such as Minnesota.[11]

Planting Strips And Street Trees

A planting strip at the curb and parallel with a street provides some additional buffering to adjacent land uses and non-motorists from the vehicles on the street. Local conditions vary, but typically strips of six or more feet work well for trees and other vegetation. Practitioners should be careful not to create larger planting strips to “push” pedestrian crossing areas back from intersections with larger curb return radii. What may occur in those situations is that

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[10] AASHTO, supra, pg. 98-99
[11] Discussions with Michael J. Monahan, Assistant Director of Public Works, Minneapolis, Minn. Dec., 1995.

more aggressive pedestrians will not use the intended crossing area, but will cross in front of motorists attempting to enter the intersection, thereby creating conflicts.

Planting strips are important in northerly climates because they also provide long and short term snow storage areas.

Alleys

Alleys serve many useful purposes in Smart Development designs. Alleys can assist site planners by allowing narrower lots, and they can enhance safety by eliminating front driveways and the associated backing movements across sidewalks and into the street.

Alleys can also have secondary, or reduced size, dwelling units that are either free-standing or are above garages along alleys. Such housing helps to aid safety concerns along alley by providing "eyes" (in the form of residents) along the alley. This is especially true where senior housing is so-situated and the seniors are available to provide this informal surveillance throughout the day.

Alleys also give streetfront residents one side of their lot that is more public, toward the street, and another that is more neighborhood-oriented along the alley. This allows these residents to have a more ordered and formal front to their properties, while play areas and maintenance areas can be situated along the alleys and shared with neighbors.

Lighting

The general rule for lighting in a Smart Development project is to prefer more, smaller, lights as opposed to fewer high-intensity lights. This is in keeping with the overall goal of keeping the elements of a Smart Development street in a human scale, but this also allows for more aesthetic matters, such as allowing people to see the night sky (which is not possible under large lights).

The following have been found to work well along Smart Development streets: lightpoles eight to twelve feet in height; lighting elements should provide full-spectrum light so that colors at night are realistic; and, in some instances (along alleys, for example) building or fence-mounted lighting may replace the need for additional street lighting.

Resolution of Conflicts

Wherever a designer or policy maker associated with a Smart Development, after due consideration of all relevant factors, determines that an irreconcilable conflict exists among vehicular and non-vehicular users of a Smart Development street space, that conflict should be resolved in favor of the non-vehicular users unless the public safety will truly be jeopardized by the decision. In resolving such conflicts, part of the decision-making process should include consideration of the design goal of maximizing the non-private vehicular mobility for residents and visitors, and should also include the presumption of higher numbers of pedestrians and the other non-vehicular users of the street.

The design of streets is one of the more lasting contributions to neighborhood developments and urban conditions. Primary property divisions are created as are the principle routes of travel and commerce. All of the multiply-involved factors should be given due consideration in the design process.