

Subdivision Design

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The importance and value of sound subdivision design cannot be over-emphasized. Although subdivisions have been laid out for many centuries, it has only been in the last few years that sound land planning practices have been employed to develop new residential and commercial and industrial areas. The age-old gridiron system of long square blocks or short square blocks has given way to the modern and scientific methods of the professional land planner.

Subdivision design has become one of the vital factors in community development. Any city or village has as much responsibility to its citizens to provide for proper subdivision design and community planning as it has to provide fire and police service, water supply and sanitation. The designs and plans of today cannot overcome the faults of the past except in cases of large-scale urban renewal or rebuilding programs, but these plans can provide coordinated and attractive surroundings for the citizens of today and tomorrow.

Today, subdivision designing entails the study of many varied features of a tract of land. In order to provide for a harmonious pattern of land uses in a neighborhood or community, the topography must be carefully studied to provide proper alignment of streets, drainage of marsh areas, and to secure the best locations for homes, schools and churches. Existing structures must be noted as well as the general character of the neighborhood so that there is some uniformity, at least in the overall picture.

City planning has come a long way in the last few decades, and perhaps its greatest importance has been in the field of residential area development. The preparation of a comprehensive city plan or comprehensive county plan provides a logical pattern of residential expansion and the orderly separation of commercial, recreational and industrial districts. It provides not only for the expansion of residential areas but for the redevelopment and rebuilding of existing residential areas when age and economic conditions justify. Such a plan becomes the framework on which a community can build its future. The plan becomes the city's

working tool for shaping the individual features of expansion and redevelopment. Such a plan is not easy to acquire or readily available from text books or other plans; it must be tailor-made by experienced and professional planners working either as permanent staff or on a consulting basis to the city. Every phase of the plan must be reviewed by the plan commission and the city to obtain a final program that will work and that will be enforced.

Subdivision Regulations

One of the most important features of any city's rules and regulations are the subdivision regulations. I think two questions arise here: *first*, what are subdivision regulations, and *second*, why do we need subdivision regulations. First, subdivision regulation is the guidance of land subdivision development by a public authority, preferably the planning agency. This agency must have power to withhold the privilege of public record from plats which do not conform to the established requirements and standards. By refusing to issue building permits, pave streets, extend water or sewer lines or offer other municipal services to areas which are not shown as recorded land subdivision plats, the city has strong powers indeed to insist on conformity with its regulations. Although regarded by many builders and developers as interference, the "health, safety, and general welfare of the community" as guarded by the police power has taken precedence.

Subdivision regulations then are the published standards set up by the city to control:

- Length and depth of blocks
- Width and depth of lots
- Arrangement and width of streets
- Conformity with major street plan
- Required open spaces and utility easements
and similar items

Conformity to these standards is a most effective method of insuring the accomplishment of the master plan as well as providing desirable residential areas.

They also insure the proper and complete development of land. Although they pertain principally to residential areas, they are readily adaptable to commercial and industrial sites and institutional uses.

Why are subdivision regulations so important? They are important and necessary to protect the city and the home owner. Complete and effective regulations protect the city from excessive construction and

maintenance costs, from premature development of neighborhoods with streets and walks left vacant for years, from deterioration and obsolescence of improvements and from many problems arising from traffic circulation, sewer and water main capacity and the disgruntled citizens!

Protection is provided the home owner by providing and maintaining attractive and desirable neighborhoods where people want to live and want to maintain the character of their neighborhood. The home owner benefits also from the increased and continuing stability of his investment. Good wide streets, well shaped lots with effective drainage and proper public utility installation will help retain a larger proportion of the original purchase price of any home. Even the developer can save money and time by adhering to sound subdivision planning. Sewer and water installation costs, street paving and increased sales activity are directly traceable to planning design in conformance with sound regulations and practices.

Subdivision regulations obtain their power through the city council or county board based on powers granted by the state. Their effective operation and enforcement is strictly a local matter and should be considered as important as any other city law or ordinance. A strong plan commission working with the city officials and developers should be operating in every community. This commission should evolve subdivision regulations that can be applied to its own area and are based on local conditions.

General Requirements of Sound Subdivision Design

Sound subdivision design is based upon many factors involving the location and environment of a tract of land, and its subsequent development into lots and homes. A master plan will readily identify residential areas and the surrounding land uses that will affect its growth and stability. A residential area should not be proposed if adjacent to large and heavy industry, a stream or river which frequently floods, a major airport or a large rail terminal. These obviously are facilities which can prove only detrimental to new residential use. Therefore, the primary requirement in the planning of a subdivision must be to study the neighboring uses and the overall environmental character of the area. The integration of small unplanned areas into the larger self-sustaining neighborhood is also a prerequisite to street layout or utility extension. The zoning ordinance and building code must be studied in order that all stated minimum conditions are met. Consideration must be given to the type and size of families that will occupy these homes and depend upon the adjacent facilities, particularly schools, shopping centers and transportation, which are a daily necessity.

As for the area to be developed, the primary consideration is, of course, the size and shape of the tract in question. Very small tracts offer little opportunity for development along sound and stable lines insofar as planning of facilities, development of street patterns, and house locations are concerned. Larger tracts of 50-100 acres or more provide an opportunity for real large-scale planning in which a neighborhood is designed and built with the location of homes, schools, parks, business and shopping centers, transportation facilities and other public uses all grouped in the best relation to each other and forming a well integrated community. The street pattern particularly can be adjusted to fit the existing terrain and can provide pleasant home sites on quiet and protected residential streets and culs-de-sac.

No two residential areas will be identical although the design of such areas rests on identical features. Soil and subsoil conditions, ground water and drainage suitable for interior circulation, and possible areas for open spaces are studied before any designs are drawn.

In the preliminary design, provision must be made for community facilities within or adjacent to the area. These include elementary and sometimes junior high schools, community shopping centers, parks, playgrounds, etc. Streets, walks, and pedestrian ways or easements must be designed so as to provide maximum accessibility to the residents with minimum interference to the neighborhood itself.

Area-wide or city-wide services must also be designed and provided to best serve the residential community. These include water supply and sanitary sewage disposal, storm water drainage, refuse collection, power lines, gas mains and telephone lines, and fire and police protection. No residential area should be designed or constructed without considerable thought given to its relationship to regional shopping facilities, be they central business district or outlying major shopping centers, high schools, large-scale cultural and recreational activities and, of course, employment centers where the residents may find adequate jobs.

After the local plan commission and city officials have given their approval to the concept and design of a subdivision, accurate plans must be drawn for the construction of highways, streets and alleys, for the dedication of easements and other public uses, and for the extension and construction of sanitary sewer lines, water mains and storm water sewers.

Street Location

Let us now examine in some detail the basic requirements for subdivision street layouts and their construction standards, as well as the standards for public utilities.

There is no single factor as important in community and subdivision planning as that of street location. Alignment and continuity of existing and proposed streets into new areas must be carefully planned well in advance of any construction. No new subdivision or other development should be served solely by high-speed, through-traffic arteries. Likewise, no such area should be served solely by short, winding streets having neither destination nor origin outside the development or with a major traffic artery. Streets in such locations should be designed to minimize traffic congestion. This may include rather extensive modification of existing streets adjacent to or near the subdivision.

If the area is served by mass transit lines, then certainly provision must be made for loading facilities, increased curb radius where right turns are predominant, and ample space provided for parking and turning around of such large equipment. In metropolitan areas or small town developments there must be provided a continuous flow of traffic on at least one street bordering or bisecting the tract which will connect the downtown district and other principal traffic arteries. This continuous flow of traffic is essential if people are to get back and forth to work, shopping and recreational areas, and in turn they are necessary for the maintenance of the modern home.

The continuous thoroughfare may be a cross-country super-highway with an interchange at each of the important areas of activity within the city and its environs. In some instances, particularly in larger metropolitan districts, this is by far the most desirable means of vehicular travel. This allows local traffic the privilege of merging with high-speed traffic to cover long distances in short periods of time. With a comprehensive and efficient network of expressways and super-highways, business centers and industrial districts are only a few moments away from isolated residential districts. In the case of expressways the location of mass transit facilities, whether they be elevated lines or high-speed street cars, or trolley buses in the median strip, warrants every possible consideration.

As in the case of the new Congress Street Expressway in Chicago, thousands of people can be carried in a rush hour to or from their jobs at the same speed or even greater speed than vehicular traffic in adjoining lanes. With the natural connecting links constructed over or under the expressway this system can provide the ultimate in public transportation with feeder buses and private autos delivering and picking up passengers above, below, or next to rapid transit stations and in no way interfering with expressway traffic.

Returning to the question of street traffic continuity, the major street need not and certainly will not in most instances be an expressway or super-highway. It may be a city street bisecting both business and

residential areas which forms or connects to a state or feeder highway at the outskirts of the city. It may be a city street that continues into open country and is merely widened and improved as the extension of residential or business activity necessitates.

Any street leading through the city or that is adjacent to the city's principal living and working areas must be considered as a major thoroughfare. Almost as important as the continuity of the major street within any development is the alignment of that street. Direct alignment providing maximum volume with minimum interference and congestion is essential for the major thoroughfare servicing any large development. Jogs, offsets, and sharp turns produce only congestion and a "chopped-up" feeling for the entire community. On the other hand interior streets should be neither straight nor continuous for long distances. A series of short curved streets following the terrain is much more desirable than long straight streets laid out on a gridiron pattern.

The reasons for this are obvious. Traffic moves slowly and more cautiously, giving maximum protection to residential areas, especially to children. They give the area a much more individualistic appearance. The savings gained by shorter distances and less grading mean the builder can spend more money in the construction of houses and landscaping of lots. Also there are fewer feet of street to maintain.

Other important aspects of the major street system include design of the street system so that all minor and collector streets enter major streets at right angles or nearly so. Interior streets may intersect at less than right angles so long as sight distances are adequate for 30-mile-per-hour traffic. By using short curved streets heavy traffic is discouraged. This in turn reduces the need for the leveling of streets beyond grades of eight or even nine percent. This increase in allowable street grade reduces the cost of construction and can provide on its adjoining lots exceptionally attractive home sites. The only additional expense incurred in allowing the steeper grade is a few extra pounds of salt for winter weather.

Super-highways

The design of the various streets and highways involved in subdivision development can be defined in four general categories. The first of these, of course, is the super-highway and expressway. I will not go into the various design features involved in the construction of such highways. That would take far more time than we have here today. However, I will say a few words concerning the designs of the other types of streets usually connected with development areas, be they used residentially, commercially, recreationally, or industrially.

The major streets, those with traffic continuity, good alignment, and serving as collectors to the various areas of the community, should have at least 100-foot rights-of-way. Pavement should be in the 36-to-48-foot width range and may in some instances, particularly in major metropolitan areas, consist of two 28-foot lanes with a median strip which, of course, may vary from three or four feet up to 30 feet. These streets are designed for high-speed, through traffic and are, of course, the ultimate or utopian standard for a connecting thoroughfare. In most cases such a standard can not be met. However, this fact should not discourage any engineer from trying to obtain the widest and best pavement possible for this type of street and based on local conditions. Parking should be allowed only if practicable in relation to peak hour volumes, bus operation, and interference with commercial or industrial development.

Pavement width is determined by the number of moving traffic lanes and parking lanes required to handle traffic in any development. Ten or preferably 12 feet are needed for each moving traffic lane and eight feet necessary for parking lanes.

Collector Streets

The third type of street involved in such a development is the collector street. This street generally is so designed as to pick up short local streets and culs-de-sac and carry this traffic through residential areas to major thoroughfares. The right-of-way here should be 70 feet. This will allow 32- or 36-foot pavement with adequate shoulders and provide sufficient width for 5- or even 6-foot sidewalks and street tree planting if desired. Collector streets such as this must be designed to accommodate parking on both sides during daylight hours. Even with garages and driveways and rigid night-time parking controls there will be street parking in a varying degree throughout the night. This is particularly true if the area should build up with two-family or apartment houses. These collector streets should be well paved and well lighted. However, they should not become high-speed streets, encouraging commercial traffic. Speed limits should be low enough and well enforced to protect children and retain the residential atmosphere. Pavement for major thoroughfares and collector streets should be Portland cement concrete or equivalently rated bituminous surfaces on eight-inch crushed stone base.

Local Streets, Culs-de-sac and Alleys

The fourth class of streets is the local street and cul-de-sac which serve individual homes within the subdivision. These should be laid out with 60- or 66- or, in some instances where the area is predominantly

multi-family, even 70-foot rights-of-way. Pavement widths on such a street should run 28 to 32 feet. Here again parking must be taken into consideration and sidewalks should be provided at least on one side of the street throughout the entire subdivision. Pavement need not be the same as collector streets and major streets but it should be of non-skid type with sufficient strength to carry the anticipated traffic load over existing subsoil conditions.

Culs-de-sac should in most instances be limited to a distance of 500 to 700 feet, depending upon the terrain involved and relationship to the overall street pattern. They should also be so designed as to be acceptable to the FHA and VA underwriting authorities. The question of curb radius on culs-de-sac has been a raging controversy for some time. It is not practical to design a cul-de-sac with a short radius, then allow no parking and trust to luck for circulation. On the other hand, if the radius is too wide the purpose of the cul-de-sac is defeated and lots become too narrow or too shallow. A radius of 70 feet will allow for parking on the cul-de-sac, service by any truck common to residential areas, and will allow some maneuverability to any fire department pumper.

Alleys are not now considered either necessary or desirable in any single-family residential development. They are not particularly necessary in row house developments. However, in some large apartment house districts they should be provided as a means of interior access and loading space, and should be at least 20 feet wide, well paved and drained and lighted.

All streets within any subdivision should be lighted, and lighting should be done in conformity with the city's existing street light system and in a manner so as to be harmonious with the overall character of the neighborhood.

All streets within any subdivision should be named and signs provided at each intersection to identify each street. Here again the type and location of street name signs should be done in conformity with the city standards and of a type to match the character of the development. It is also most important that, if the area being developed is outside the city limits, street names be selected so as to provide a uniform pattern throughout the area, or even better, throughout the county, to avoid duplication of street names.

Water Supply

The provision of sanitary sewers and water mains is equally as important as the street system in any subdivision or development. Adequate water supply must be available whether the area be residential, industrial or recreational. Sanitary sewer systems must be provided in

any area regardless of its use except in instances where septic tanks are allowed for large-lot residential building. A third important feature involved here is that of storm water drainage. This may be done in a number of ways. However, almost every development has some type of surface water control problem.

Examining each of these three services in greater detail, we have no question as to their importance. Water lines should be extended from existing trunk mains throughout the subdivision with ample fire hydrants available and with sufficient capacity to take care of the maximum daily demand of the residents. In the event that municipal or public water systems are not readily available for extension into the development, wells must be sunk to provide the necessary water supply. These should be carefully checked by the state or county authorities to determine the purity and hardness of the water. The location of any septic tanks, open drains, or marshes should be carefully noted to avoid any chance of contamination through seepage into the well or a surface flow into the well.

The amount of water necessary for a normal residential development should average about 150 gallons per person per day. Of course, the average demand will not be seasonally equal and will not account for all-night lawn sprinkling or exceptionally heavy fire-fighting requirements. The figure of 150 gallons per person per day, however, should provide all necessary consumer usage plus sufficient water for fire-fighting or other emergency use. Local conditions may vary consumption figures considerably, and they should be studied in relation to proposed mains at the time the development is first planned.

Sufficient capacity should be provided to handle not only all residential usage, but also to handle residential expansion, possible commercial activity, and also school construction and expansion. This has been a particularly difficult problem to handle in areas where small mains have been extended well into residential neighborhoods and subsequent schools and commercial districts have had to lay new mains over long distances to insure sufficient capacities for their day-to-day usage.

There are a great many other facets to municipal water supply. The type and exact amount of treatment required to purify and/or soften the water will vary not only from city to city but may vary within large cities. Conformity to state and regional health standards must be maintained and the increased use of fluoridation also presents a problem. The distributing system for this water may be from storage reservoirs, impounding reservoirs, or from municipal or private pumping stations. What we are interested in primarily is the distribution system and the location and design of this system.

You are all familiar with the maze of pipes and mains which can make up a large-scale water system. It has been in the past and is at present the common practice to lay water lines under streets. On wide streets or in large commercial districts it may prove safer and more economical to install mains on each side of the street. Since the water is under pressure at all times it will flow uphill, or downhill, or around corners at all times, and thus readily adapts itself to proper design and planning in any subdivision or development. Indeed, the savings on water mains alone can be very substantial when the street system is designed in conformity with the contours and the water system designed so as to match the street lines.

While a subdivision designed on the basis of existing contours may produce a larger number of dead-end pipes in the culs-de-sac, these will not in most instances materially affect cost of installation or circulation. The proper design of the water system just as the proper design of the subdivision itself is a specialized task and one that must be tailor-made. In some high-grade residential areas standpipes and elevated tanks may not be permitted even as zoning variations. Thus, water main capacity must be increased to offset the lack of water available.

The planning agency, the engineer, and the developer should work closely with each other and with the water supplier to insure adequate water supply and proper design features to produce a good subdivision plan.

Sanitary Sewer Systems

Septic tanks have been permitted and have worked satisfactorily in sparsely populated, large-lotted developments. As the population density increases, the need for sanitary sewer systems becomes absolutely necessary. Therefore, it is wise to require complete sanitary sewer systems in the early stages of development in any area which is likely to build up rapidly or on small lots. In rare instances it is not feasible at any time to require or install sanitary sewer systems. In such cases lot sizes large enough to prevent any difficulty arising from septic tanks should be required. Depending upon the terrain and the subsoil conditions—as well as the size of the area and its estimated density—lots should range from 20,000 to 60,000 square feet.

The great difficulty in correlating the design features of any large subdivision arises principally in connection with the sewerage system. Unlike water, sewage is never under pressure and consequently can flow only downhill. This means that the street system must be so designed as to allow a continuous downhill sewage flow. Even with the use of booster pumping stations a general downhill flow must be maintained if the sewage lines are to return to existing disposal plants. Since sewer

lines, like water lines, are laid under the streets, the engineer as well as the contractor and the sewerage facility engineer must check carefully all sewer grades. On sidehill streets the sewer line must be placed on the lower side to insure proper flow. The design of interior streets to allow for normal sewage flow by following existing contours is one of the most important aspects of subdivision design.

In instances of very large developments, on-site disposal systems may be erected. There are usually very stringent requirements for the type and location of such plants, and the plant must be designed to produce the desired type of effluent without hazard or odors. Small areas which cannot readily be served by sewer systems because of the rough topography, rock outcrops or low elevations should be designated as park areas or other open spaces with sewer lines placed on higher ground. Special attention must be given the handling of sewerage systems in areas of commercial and industrial activity and school sites. Main capacities must be sufficient to handle expected total daily discharge capacities without backing up the system.

Generally speaking, it is not wise to combine sanitary and storm water sewage systems in one set of pipes. This necessitates the use of larger and more costly pipe. In periods of dry weather with little or no storm water, sewage often does not flow readily. There is also the problem of greater installation costs and maintenance costs. A combined system also greatly increases the overall amount of sewage that must be treated at the disposal plant.

The use of separate systems means smaller sanitary sewer pipe size which can result in substantial savings in several ways. The smaller size pipe is easier to adapt to winding street systems, means less installation cost, and greatly reduced volume for treatment at the disposal plant. The use of separate systems can provide a storm water course, the advantage to which lies principally in the reduced cost of pipe, since storm water run-off may be diverted into streams, rivers, or marsh areas. It also makes possible the creation of park areas and open spaces by preserving the areas of collection of the run-off.

If, however, separate systems are used, that portion of the storm water drainage system carried in pipes must have sufficient capacity to handle the average water run-off without flooding streets or basements. While it is true that occasionally very large storms will overtax the system, it has generally not been the practice to provide that capacity.

I would like to say a word about public utilities—the telephone and electric wires that cross all of our cities. Good sound design now dictates that utilities be carried underground. Overhead wires are unsightly, but more than that they create a fire hazard, can easily cause interrupted

service, and interfere with the growth of trees. However, if poles must be included in any residential area, they should be placed in easements along the rear lot lines and all wires strung on one set of poles. The use of underground utility lines will in the long run prove a substantial saving to the home owner, the public utilities, and the city.

Public Relations

In conclusion I would like to say a word about a very important aspect of subdivision design which generally has been neglected. That is the simple subject of public relations. There is hardly any one aspect of subdivision design and planning which is more important and more often neglected. The developer, the architect and the planner should work hand in hand with the city or county engineer and the public utilities people. Cooperation and mutual understanding must be inevitable if the plan is to succeed. It can be made much more effective through proper public relations techniques.

The architect, developer and planner should not adopt the attitude that theirs is the only plan for any area. They must be willing to amend their plans to local conditions, many of which they may not even be aware of. On the other hand, the city or county engineer and the plan commission should not take the stand that they will dictate all planning activities. True, within certain broad areas they must have the right to make fundamental decisions on street layout, sewer and water lines, building minimums, but they should not try to design the subdivision's interior.

A close and cordial relationship between all members of this team, whether they be on the builder's side or the city's side, will result in better planning, more efficient public services and happier home owners.