IMPROVEMENT REQUIREMENTS IN SUBDIVISIONS

A Critical Analysis
of
Standards and Policies
on
Subdivision Control in Massachusetts

by

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B.S., University of Colorado, 1948

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Submitted in partial fulfillment of the requirements
for the degree of Master in City Planning
Massachusetts Institute of Technology
May 1957

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Title: IMPROVEMENT REQUIREMENTS IN SUBDIVISIONS: A critical Analysis of Standards and Policies on Subdivision Control in Massachusetts

Author: William Ernest Barbour

Submitted to the Department of City and Regional Planning on May 20, 1957, in partial fulfillment of the requirements for the degree of Master in City Planning.

The objective of this thesis is to analyze the adequacy and shortcomings of improvement requirements in current local subdivision regulations and the policies governing their administration, and to suggest whatever reforms appear needed in both standards and administration.

The study consists of (1) a technical review of the improvement standards recommended by accepted authorities, (2) an analysis of the requirements in fifteen sets of local regulations, (3) an analysis of the improvements built in eleven subdivisions, and (4) an inquiry into some problems of administration of the regulations.

The standards for subdivision improvements recommended by the recognized authorities are found to be in substantial agreement. The improvement requirements in selected local regulations agree in general with the authorities, as do also the improvements actually built in the selected subdivisions. But the methods of administering the requirements and applying them to local situations are the main area of dissatisfaction.

Four problems of administration are identified and explored. Suggestions toward alleviation of two of them are offered: (1) limitation of discretionary powers of local officials to vary requirements, and (2) use of moderation in the upgrading of improvement standards. Such upgrading appears to have little or no effect on rate of development. Therefore its use as a deterrent is not encouraged. In conclusion, substantially little fault is found with present subdivision regulations and methods of implementation. Rather, the need is indicated for a comprehensive reappraisal of the relationship between builders and municipalities.

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Burnham Kelly
Associate Professor of City Planning
Dear Professor Adams:

I submit, herewith, IMPROVEMENT REQUIREMENTS IN SUBDIVISIONS as my thesis in partial fulfillment of the requirements for the degree of Master in City Planning.

Respectfully yours,

William E. Barbour
ACKNOWLEDGEMENTS

I wish to extend my appreciation to...

Frederick J. Adams  John T. Howard
Allen Benjamin  Kevin Lynch
Alexander J. Bone  Alan McClennan
Edward L. Diehl  Lloyd Rodwin
Charles E. Downe  Louis H. Smith
Roland B. Greeley  Caroline Shillaber
Werner Gumpertz

... and especially to my adviser, Burnham Kelly

... and most especially to my wife, Shirley, who stood by me through all of the trials and did the entire typing of this thesis.
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INTRODUCTION

"These tangible improvements, such as grading, road surfacing, storm drainage, and so forth, are the essential elements in the transformation of raw acreage into lots suitable for human habitation and building purposes. Such inclusion, in regulations, of improvement requirements insures the establishment, in physical reality, of the subdivided status which approval and recordation establish legally." -- Lautner.

Thus was the purpose of improvement requirements explained by the leading writer on the subject in his book, Subdivision Regulations. During the boom period of the past ten years the process of controlling improvements in subdivisions by local regulation has evolved and matured. It may be useful now to review the present status of this process and to inquire into some of the problems raised by its critics.

Objectives and Scope

This thesis will analyze both the adequacy and shortcomings of those requirements in the hope that problems may be identified and reforms suggested.

Municipalities of the Boston area offer particularly fertile ground for such an inquiry, because of their experience in the use of public controls, their high degree of local autonomy, and the substantial number of new subdivisions created there in the post-war era.

The subject matter is limited to those improvements and utilities required in the streets of new subdivisions, and to standards governing
their construction, installation and design. It is not concerned with zoning nor the procedural aspects of subdivision regulations, nor with other elements of subdivisions not governed by regulation, such as house design and landscaping.

Background of the Problem

The evolution of subdivision control has brought with it much criticism from members of the home building industry - criticism of both the requirements and the manner in which they are applied to various local conditions. Local regulations are claimed to be arbitrary and discriminatory, and to raise costs with the intent of limiting development to homes for the well-to-do. Local officials are charged with misuse of discretionary power. The officials, on the other hand, feel a natural obligation to maintain high standards in land subdivision and development, so that the community will not run the risk of becoming permanently blighted by low standard, large scale development.

Bitter controversies have ensued, and both factions have been guilty of exaggeration and deviation from the facts in order to justify their positions. Impartial inquiries into this controversy have been rare, although the literature on subdivision improvements is extensive. With this in mind, the author felt that an objective criticism of the regulations and methods of control would be useful to planning board members and other local officials.

Approach

The four sections which make up this thesis consist of (1) a technical review of the improvement standards recommended by accepted authorities, (2) a study of the requirements from fifteen sets of local regulations, (3) a study of the improvements built in eleven actual subdivisions,
and of costs thereof, and (4) an inquiry into some of the problems of administering and interpreting the local improvement requirements.

Interviews with six builders, four planners and ten local town officials provided the main body of facts and opinions in Section IV. Though this survey was not broad enough to show conclusive opinions of each group on every issue, it did indicate trends and suggest areas for further study.
STANDARDS RECOMMENDED BY THE AUTHORITIES

Before an intelligent appraisal of improvements and improvement standards in local subdivision regulations can be undertaken, each improvement and standard must be reviewed and analyzed to determine whether it is necessary or advisable. The purpose of this section is to summarize the recommendations of the recognized authorities on subdivision design and engineering regarding the most appropriate capacities, sizes, and quality levels of those improvements—most appropriate, that is, for the particular densities of development, traffic volumes, and other local physical conditions.

In order to formulate such a summary, it is also necessary to investigate briefly the nature of each improvement and the factors affecting its use. Since the need must be weighed against the cost of building or installing each item, it is also important to review capital and maintenance costs.

What Are the Improvements?

Only those physical installations (or standards thereof) that represent a capital outlay to the developer are relevant to this study.
Thus, gas, electric, and telephone service - ordinarily installed by the respective utility companies - are not considered. Omitted also are standards of street alignment and location, whose affect on costs is not significant. Further, since this review is presented as a background for study of local regulations, it includes only those aspects of land development that are ordinarily subject to municipal subdivision control. Thus such items as lot grading and landscaping, or construction of buildings and most other on-site improvements are also omitted.

Two different aspects of improvement policies are considered:

(1) **improvement requirements**, which refer to the presence or absence of the particular item (for instance, the roadway or water main); and

(2) **improvement standards**, which refer to the standard of capacity, adequacy or durability to which the item is built (for instance, roadway width, pavement thickness and material, or water main diameter).

The requirements and standards reviewed in this section are as follows:

<table>
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<th>Requirement</th>
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Finally, the most important improvement standards will be summarized in Table I at the end of this section.

**Street Classification**

Three functional classifications of streets are noted by the National Committee for Traffic Safety (NCTS)\(^1\) and others: (1) local...
streets serving one-family dwellings - streets on which drivers can be expected to weave in and out between occasional parked cars, (2) local streets serving multi-family dwellings - those where higher densities require continuous parking lanes on both sides of the roadway, and (3) feeder or collector streets that join the local system to major streets or thoroughfares - streets where greater freedom for turning and space for two lanes of curb parking is needed, and where traffic volumes and speeds are higher.

A fourth classification (which is not usually met in subdivisions) is major streets and thoroughfares. A fifth (sometimes classed separately) might be dead-end and minor loop streets, and also those serving large lot or rural districts.

**Width of Right-of-way**

Street rights-of-way of one or more standard widths are specified in all subdivision regulations. Because they largely determine the amount of land used for circulation, and therefore the number of lots that can be platted in a given tract, street widths may be a controversial matter.

A right-of-way must accommodate a paved roadway and sometimes curbs or shoulders, planting strips, and sidewalks. If street trees are desired in the planting strips, at least a six-foot wide strip is needed. Sidewalks must be at least four feet wide to enable two persons to walk abreast. Roadway widths for minor streets vary from 20 feet to 30 feet, with an average of about 26 feet. For multi-family or collector streets the roadway may be between 32 and 36 feet. (These standards are treated more fully on page 9.)
The rights-of-way necessary to accommodate the foregoing elements are as follows:

- Collector and multi-family residential streets: 60 feet
- Ordinary minor residential streets: 50 feet
- Cul-de-sacs, loop streets, and streets in large lot districts or where sidewalks are unnecessary: 40 feet

In no case should less than a 40-foot street be permitted; nor is it advisable, for economic reasons, to exceed appreciably the widths listed above.

Most Massachusetts regulations call for a minimum right-of-way of 40 feet for minor streets, while in western states the 50-foot street is more usual. The choice is primarily a matter of local precedent. Although economic motives in pre-automobile times no doubt justified the 40-foot standard, its use today for even minor streets is questioned by many. Actually a 50-foot street with 20-foot setbacks gives the equivalent light, air, and spatial feeling of a 40-foot street with 25-foot setbacks.

In construction cost the 40-foot street holds a slight economic advantage over the 50, which may run as high as $150 per 100-foot lot with full improvements (computed from unit costs in Table III, page 35). The cost difference would be proportionately less in the case of fewer improvements or cheaper land. The greater width does not commit the municipality to additional maintenance cost since care of planting strips is customarily the responsibility of abutters.

Where there is the possibility of future widening of roadway, due to altered street function or increased traffic, the reservation of extra right-of-way beyond immediate needs is thoroughly justified, since the
taking by eminent domain of strips of improved frontage is an expensive process. Eventual widening should be especially considered in the case of 40-foot rights-of-way which might later become collector streets. Such eventualities can be avoided by skillful design of street layout, and understanding of future traffic needs on the part of local officials.

In summary, the important considerations in determining street width are (1) the requirements of traffic and parking, (2) the space needs for sidewalks and street trees, (3) the possibility of future widening of pavement, and (4) proper spacing between opposing dwelling facades.

Dead-end Streets

Streets designed to be permanently dead end should not be longer than 400 to 500 feet. Greater lengths cause diseconomies in constructing utility lines and inconvenience to traffic and to persons making deliveries. If permanently dead-ended, streets should be terminated with a turning area, thus forming a cul-de-sac. The paved turnaround should have an outer curb radius of at least 40, and preferably 50, feet. This radius is usually determined by the turning requirements of fire fighting equipment.

In the past innumerable dead-end streets without turning areas were created by the failure to extend streets in arrested subdivisions. Good practice today calls for a temporary turnaround when a right-of-way for future extension is ended at the tract boundary.

Many municipalities disapprove of cul-de-sacs in subdivisions because of their inconvenience to traffic. Loop streets provide all the safety, privacy and quiet of the cul-de-sac, are fully as effective in discouraging traffic, and in addition are better for circulation and
utility lines, and are usually more economical.

Roadway Width

For local residential streets serving one-family dwellings, the most desirable roadway width is 24-27 feet, with 26 feet the preferred width. This standard is endorsed by all of the authorities on street design. It has stood for over 25 years and there is little likelihood that it will be modified in the future. It is derived from the width necessary to accommodate two lanes of moving traffic of 9 feet each plus a parking lane of 8 feet. This is also the minimum roadway that allows a car to back out of a driveway in one maneuver when cars are parked opposite.

Although off street parking is generally provided in all present day developments, occasional standing or parking in the roadway must be expected and provided for. A greater width would add needlessly to the cost of construction, as well as maintenance and snow removal. Most Massachusetts communities require only 24 feet, which probably represents the desirable minimum for two vehicles to pass where a third vehicle is parked.

Some authorities approve roadways as narrow as 20 feet in dead-end or loop streets or in a large lot area. "In open developments, a 20-foot roadway may prove ample if there will be little or no street parking."

Both Delaware County and Baltimore County permit 21-foot roadways on minor streets in lot size districts of 20,000 square feet or more. The Tennessee model regulations allow a 22-foot roadway where lots exceed one acre, frontage 150 feet, and where there is no through traffic.

The American Association of State Highway Officials recommend, where traffic exceeds 200 vehicles per hour per lane, 12-foot lanes; and for less than that figure, 11-foot lanes.
For streets serving apartments or row houses, authorities recommend a roadway width between 32 and 34 feet. This width permits two parking lanes of 7 or 8 feet each and two moving lanes of 9 feet. Although local in function, such streets must ordinarily accommodate more parking than the single residential street - thus the need for an additional parking lane beyond the 26-foot width. Where ample parking bays are provided for multi-family housing, however, the 26-foot width, with one parking lane only, is considered sufficient.

For feeder or collector streets, the best roadway width recommended by several authorities is 36 feet, although some favor a greater figure. This street, if it is to function as a collector, should contain a relatively large number of intersections with local streets. The larger amount of turning traffic as well as the greater volume and higher speed of through traffic requires lanes of at least 10, and preferably 11, feet. Two curb lanes are also needed for parking, deliveries and breakdowns.

The practical capacity of a residential street is 300 vehicles per hour per lane. For collector streets serving most residential districts this is ample capacity, even at peak hours. If capacity is exceeded, however, an additional two lane street is to be preferred to a four lane collector because the latter tends to become a barrier to pedestrian movement through residential areas. Assuming that not over 40 vehicles per 100 family units move during peak hours, one traffic lane of a residential street will provide for 750 family units. This is a safe rule to follow in designing collector streets.

The usual width required for local roadways in subdivisions is 24 to 27 feet. Where greater widths appear necessary for reasons of (1) volume, speed, and weight of traffic, or (2) density of property
served, municipal authorities have the duty to require it, whether or not specific standards are set forth for them in the regulations. The determination of location of principal or collector streets is traditionally a duty of the local planning board, and ideally is expressed on a community thoroughfare plan.

Cost effects of variation in street width. Since all improvement standards must be judged in economic terms, it is important to know the cost differences between various roadway widths. Reducing a roadway of penetrated macadam from 24 to 18 feet would produce a capital saving of about $100 per 100-foot lot and a saving in maintenance and snow removal of from $1.30 to $2.00 per year. An increase from 24 to 27 feet would add about $40 to the capital cost for a 100-foot lot. 15

Roadway Construction

Roadway construction consists of four processes: (1) clearance of the right-of-way, (2) excavation to subgrade, (3) preparation of the gravel sub-base and base course, and (4) construction of the surface. All but the first process are executed to the full width of roadway only.

Clearance usually necessitates removal of all trees and other objects in the right-of-way. Excavation includes removal of all unfirm material, boulders, stumps and the like from the roadway area.

The base course consists of compacted binding gravel, varying in thickness from 9 to 12 inches, sometimes laid and rolled in two separate layers.

The surface courses used on local streets in Massachusetts are almost entirely of bituminous materials, and of four general classifications: (1) bituminous treated gravel surfacing, (2) bituminous road mix surfacing (of two types), (3) bituminous macadam surfacing, and
(4) bituminous concrete pavement. These are listed in the order of increasing quality, durability and construction cost.

**Bituminous treated gravel surfacing (Type A-1)** consists of approved gravel placed on prepared or existing base and treated with bituminous material (tar, asphaltic oil, cut-back asphalt, or emulsified asphalt) in one or two applications, rolled and sanded. It is satisfactory only in rural areas on low volume roads where traffic does not exceed about 400 vehicles per day. It is useful as a temporary surface and serves as an excellent base for a more permanent asphaltic surface to be applied after utilities have been installed. Its maximum life is about 8 years, but it is easily patched.

**Bituminous road mix surfacing** is of two types (Type C-1 and Type C-2). The first consists of graded gravel aggregate spread and mixed with bituminous material (same as above with the omission of asphaltic oil) directly upon prepared or existing base in two or more applications, rolled, and a seal coat added. The second type differs in the use of crushed stone instead of gravel aggregate, and in the use of peastone binder and cover. These surfaces are for intermediate volume traffic - from 400 to 1000 vehicles per day. Their maximum life is about 10 years.

**Bituminous macadam surfacing (Type D-1)** is laid on a crushed stone base and consists of a layer of crushed stone penetrated with bitumen, bound with keystone and/or peastone, sealed with bitumen, and covered with peastone. (Bitumen may be oil asphalt, fluxed native lake asphalt, refined tar, or emulsified asphalt.) The probable life of this surface is about 17 years, which makes it a so-called permanent surface, and it can handle approximately 3000 vehicles per day.
Bituminous (or asphaltic) concrete pavement (Type I-1) is composed of mineral aggregate (sand), mineral filler (Portland cement) and bituminous material (various asphalts), plant mixed and laid hot, usually in two courses. The aggregate is carefully graded so that the fine material fills the voids in the coarse material, and the bitumen fills the voids in the fine material. The mixture is very dense and, when machine laid, creates a smooth, durable pavement. This surface can handle maximum volumes of traffic and has a probable life of 20 years. In spite of its high first cost its use on residential streets is increasing due to its durability. Its chief disadvantage is that it is difficult to replace or patch, thus making the installation of underground utilities prior to roadway construction important. 18

Table II shows the various roadway types with the construction and maintenance costs, length of life, and capacity of each. The best choice of the innumerable combinations of base and surface courses depends on volume of traffic, axle loading anticipated, strength characteristics of materials, climatic conditions, and the nature of subgrade and drainage conditions. Economic considerations should include not only construction cost but also maintenance and replacement over many years. Under average conditions of use, and where the proper aggregates are available, asphaltic concrete has been found to be cheaper over a twenty-year period than the next type in general quality, bituminous macadam. 19

It is difficult to select any one roadway type best suited for local residential streets for the costs involved. But the trend seems to be towards requiring the permanent surfaces - bituminous macadam and bituminous concrete. This is probably due to the current practice of requiring developers to build all streets in new subdivisions, whereas
street maintenance and replacement are still municipal responsibilities. Therefore the public benefits from a long-life, low-maintenance pavement.

These rather convincing economic arguments suggest that the cheaper type of surface is on the way out. Its main justification is in non-builder subdivisions or where a roadway must later be torn up for the installation of utilities. The bituminous concrete, therefore, seems likely to increase in popularity.

**Sidewalks**

The case for sidewalks is summed up by the National Committee for Traffic Safety thus:

> Vehicular traffic and pedestrians should be segregated. It is unsafe, unreasonable, and often disagreeable to pedestrians to be forced to walk on the paved roadway. Parents do not want children playing in the roadway - yet if they have roller skates, scooters or other wheeled toys, they will use the roadway unless a smooth sidewalk is available. Mothers with baby carriages and elderly persons should have sidewalks.  

Whether or not to have sidewalks depends on the amount and type of pedestrian movement (which is a function of density and lot size), and amount and speed of traffic (which is affected by car ownership, street design, and layout of streets.) Where the density is so low that children have no inclination to play in the street or must be transported to school, sidewalks might be considered unnecessary. According to NCTS, "There may be places, as in estate-type developments, where a sidewalk only on one side, or even no sidewalks, can be justified, but this should be a very rare exception." The Community Builders Handbook offers the standard that "...in open developments of large lots of 100-foot frontage or more, sidewalks may be eliminated without objection. This is a density of roughly two families per gross acre. Another authority mentions four families per acre as a desirable limit. Even at
such densities, however, sidewalks are generally deemed necessary on collector streets and access streets to schools, shopping centers, and focal points of pedestrian travel.

The need for sidewalks, besides being related to the number of pedestrians, also depends on the amount of vehicular traffic. The Traffic Engineering Handbook suggests that a single sidewalk is justified where:

a. vehicles number 30 to 100 per hour and pedestrians, 150 per day,
b. vehicles number over 100 per hour and pedestrians, 100 per day,

but two sidewalks are justified where:

a. vehicles number 60 to 100 per hour and pedestrians, 500 per day,
b. vehicles number over 100 per hour and pedestrians, 300 per day. 24

If we assume a density of 10 persons per acre and not over 40 vehicles per 100 family units moving during peak hours, then (according to the above standard) one sidewalk is justified. This figure must be adjusted by the fact that children playing in the streets are probably enough of a hazard to be counted as several pedestrians. 25

Upon examining some 200 local subdivision regulations, the American Society of Planning Officials (ASPO) research found that:

... although frequently the sidewalk section of the improvement requirements contained a discretionary clause, there was no clear standard on which to base the exercise of discretion. Because of the fact that sidewalks provide safety as well as convenience and neatness, the current tendency is for subdivision regulations to require sidewalks in areas in which a certain density of population is anticipated. 26

The same observation could be made of requirements for curbing - their installation is frequently waived by reviewing authorities on the basis of certain vague location factors, but those factors are never tied down in the regulations.
The minimum sidewalk width, according to a recent manual on sidewalk construction, is four feet. This is the minimum width at which two adults can walk comfortably abreast. It is generally agreed, according to the NCTS, that sidewalks should not be adjacent to the curb, particularly if it is a roll curb, nor adjacent to any curb on a collector street.

Most technicians favored the recommendation that sidewalks be set back from the curb at least 3 feet, and if trees were planted in the strip the set-back should be at least 7 feet. Advantages of setting sidewalk back from the curb 3 feet or more include:

1. There is space to pile snow removed from the roadway or sidewalk;
2. Pedestrians are not as likely to be "splashed" by passing cars;
3. There is a "safer" distance between the moving vehicle and the pedestrian;
4. Children are less likely to ride wheeled toys into the roadway over an "insulation" strip;
5. There is space for placing fire hydrants, utility poles and street sign outside of the sidewalk area.

Although sidewalks are one of the items of improvement that could probably be eliminated from many developments without disastrous consequences, they are not costly as improvements go. Including gravel base, a 4-foot walk of cement concrete costs from $2 to $3, and of asphalt, from $1.20 to $1.80 per lineal foot.

Sidewalks of cement concrete should be at least 4 inches thick except at driveways, where they should be increased to six inches. Bituminous concrete, the usual sidewalk construction material in New England, is usually required to be 2 inches on 6 inches of gravel.

The ASPO report concludes that:

Examination of trends reveals nothing that diminishes the case for sidewalks in most residential developments. The rising birth rate, the expansion of the population into suburbs, the growing number of old people, and the increase in car ownership all combine to make an increasingly hazardous situation. If sidewalks are needed in new developments now, it is hard to avoid the conclusion that they will be needed even more in the future.

**Curbing**

The need for curbing involves many of the same considerations as do sidewalks. Curbing is one of those improvements in many ways desirable
in residential streets but not absolutely necessary. Curbs serve the following purposes:

a. they form a channel along the edge of pavement to carry surface water to catch basins and drains,

b. they prevent the unraveling or undermining through erosion of the pavement,

c. they form a definite line of demarkation between pedestrian and vehicular circulation and thus provide a measure of security,

d. they give the street a neat, finished appearance that is in keeping with a landscaped or urban environment.

Although curbs may be found in many shapes and sizes, there are three general types: (1) separate, (2) integral with pavement, and (3) combined curb and gutter. Each type may be either mountable or non-mountable, depending on the abruptness of the transition from gutter to curb top. The non-mountable type has the advantage of forming a definite roadway boundary to keep vehicles from overrunning pedestrian areas, guide the parking of cars, and serve as a psychological barrier for children. The mountable curbing obviates the need for curb outs and returns at driveways and provides an easy transition for perambulators, tricycles and the like in crossing the street.

The most popular mountable type is the combined (rolled) curb and gutter section, which can be formed easily in concrete by use of a template. It is often built integral with a narrow concrete sidewalk, and in this form has been termed one of the most practical cost reducing items in street construction. At intersections it can be warped into a straight curb to prevent corner cutting. It is impractical on steep grades.

The usual curbing materials are granite, concrete and asphalt, listed in order of decreasing cost and durability. Granite curbing costs $4.50 per foot for straight and $6.50 per foot for radius sections, prices
which discourage its use on residential streets. Concrete curbing runs $1.50 to $1.75 per foot. 32 Asphalt curbs may now be laid by extrusion from a machine at a cost as low as $.70 per foot. 33

The question that concerns us is, under what circumstances is curb and/or gutter unnecessary? In most rural and many suburban communities no curbing is required. Frequently a lip at the edge of a bituminous roadway is an adequate curb. Sometimes swales of turf serve adequately as gutters, although some sort of pavement edging is needed where grades are 4 percent or over. The NCTS is emphatic, however, in recommending curbing at intersections to prevent corner cutting.

One disadvantage in the use of curbing of any type is that it necessitates a roadway of 26 feet or greater between curb faces to accommodate safely two moving lanes and one parked lane of cars. Even where mountable curbs are used on narrow roadways it is neither neat nor practical to require cars to overrun the curb to park.

In the case of a roadway less than the standard 26-foot width, particularly in large lot or rural districts, the Home Builders Manual recommends cement concrete valley gutters for pavement edging. 34 This method of carrying surface water is preferred to grass swales since it affords better drainage and provides a firm parking lane or substitute sidewalk.

Planting Strips

Nearly all authorities recommend that some portion of the right-of-way be loamed and seeded to provide a green strip on either side of the roadway. The purposes of planting strips are summed up in the justifications for sidewalk setback noted on page 16. In addition they serve an esthetic function by providing grass and space for street trees.
To serve adequately all of those functions, planting strips should be at least six or seven feet wide, this being what is left from a 50-foot right-of-way after deducting a 26-foot roadway and two sidewalks. The 2 to 4-foot strips that flank most local streets in Massachusetts are inadequate for most of their intended purposes, but have one substantial advantage in ease of maintenance. Since maintenance is left to abutters, planting strips are frequently areas of neglect, and a neglected 3-foot strip is less unsightly than a neglected 7-foot strip.

Where there are no sidewalks, planting strips become a continuation of the front lawns, thus simplifying maintenance.

**Street Trees**

Authorities differ on the advisability of locating street trees in planting strips or beyond property lines. The strip location offers the following advantages:

- a. more effective street shade,
- b. a margin of safety or at least a feeling of security to pedestrians on the sidewalk,
- c. a more closed-in feeling for the street and a strong repetitive visual element.

Placement of trees beyond sidewalks, however, provides the following advantages:

- a. better visibility at intersections,
- b. more effective shade for dwellings,
- c. less interference with sidewalk paving, street lights, and underground or overhead utility lines,
- d. a street of more open, spacious character.

If street trees are desired in planting strips, the strip should be at least seven feet wide for reasons of traffic safety, suggests the NCTS.
The 2 to 4-foot strips on most Massachusetts streets cramp trees and do not satisfy this safety measure. Therefore the trend in recent practice has been toward placing street trees on private land beyond sidewalks.

In any case, there is fairly general agreement that street trees, in one location or the other, add greatly to the attractiveness of a residential environment, purify the air, cool the summer atmosphere, break the winter winds and provide a relatively cheap way to give lasting value to property.

Sewer and Sewage Disposal

Three generally accepted methods of domestic sewage disposal are: (1) public sewer and treatment plant, (2) community or group sewer and plant, and (3) individual septic tank soil absorption systems. The most satisfactory method from all points of view is public sewer and treatment. The Housing Research Division of the Housing and Home Finance Agency (HHFA) states that, in addition to sanitation advantages of sewer, "when all economic factors over the life period of the house are considered, public sewer connections are less costly than other methods". 35

But the recent building boom has produced a situation in which it is impracticable, if not impossible, to sewer the vast areas of new outer suburban development. Local governments have been unable to extend their systems fast enough to keep up with new construction.

Individual septic tank systems are the usual method of serving many such outlying developments, and they have become more widely used in recent years. (According to House and Home, one-third of all non-farm houses being built in 1955 were scheduled to be serviced by septic tanks.) 36

Group plants have, until recently, been uneconomical for individual developments; they are little used at present but seem to offer good possibilities in the near future. 37
Public sewerage. Of all improvements required in subdivisions, the one that has the most critical effect on population density is sewerage. It is the most expensive utility in capital cost, ranging from $6.50 to $10.00 per lineal foot installed, plus $150 to $200 for house connections. Unlike some improvements, it is not subject to reduction in cost by reducing quality or capacity of pipe or depth of cover. The cost is governed by population served and by depth of excavation that is determined by the terrain. Sewer extension beyond built-up areas is probably not economically justified where density is less than 50 dwellings per mile. Consequently, sewerage is generally confined to already built-up areas and immediately adjacent fringe development. Where a system is extended some distance to serve new areas, local practice varies in the proportion of construction cost the developer is required to pay.

Most subdivision regulations of communities having public systems require developers to install sewers and connect to existing lines, if they are within a reasonable distance. Where a municipality has a public system it is important, for the sake of achieving economies of scale and utilizing excess plant capacity, to hook up with all new development that can be reached without undue cost.

In planning new developments, the question of whether they shall be designed for sewer or not is a fundamental one, affecting their density and street alignment. Some peripheral developments are designed with the proper density and street alignment for public sewer, but with septic tanks installed as an interim facility, pending eventual extension of the public system. This is a wasteful practice, especially if the individual units are replaced before serving out their normal life, since they have no salvage value. On the other hand, a development laid out with the
large lots and meandering streets appropriate for septic tank installations cannot later be sewered except at high cost per lot. Thus it is important that local officials, before they approve plans, should decide whether or not new subdivisions should connect to the public system.

The possible alternatives facing local officials in determining the proper method of sewage disposal are best illustrated in a local zoning ordinance. This one, from Hamilton County, Ohio, is fairly comprehensive:

1. Where a public sewer is reasonably accessible, a subdivider shall connect to it and provide connections to each lot.

2. If sewer is not accessible, but plans have been made for its extension, the subdivider may:
   a. install permanent sewers to be connected later to the main system and provide, as an approved interim method, one of the following:
      (1) group plant
      (2) septic tanks, if lots average at least 10,000 square feet with frontage of 60 feet
   b. omit sewer and install a group plant if lots average at least 20,000 square feet with minimum frontages of 100 feet

3. If no plans have been made for system extension, lots must be 20,000 square feet and frontages 100 feet, and the method may be either:
   a. group plant, or
   b. individual septic tanks.40

Septic tank disposal. A septic tank soil absorption system is the most satisfactory individual disposal method developed to date. It is relatively reliable, provided the soil will admit ready absorption, the ground water table is sufficiently deep, and the facility is not overloaded with liquid wastes. It may not be suitable in low, swampy, frequently-flooded areas, or where the water table, rock strata, or impervious soils are near the surface. The soil should be light, sandy and gritty; soils having clay, silt or muck are less satisfactory.41

Such a system consists of (1) an underground, watertight tank to
take raw sewage discharge, (2) a distribution box, and (3) an absorption field of open joint or perforated tile in gravel-packed trenches to distribute liquid wastes into the soil. The total area of the trench bottoms may vary for a single house from 150 to 1000 square feet, depending on the percolation rate of the subsoil around the trenches and the number of gallons per day to be distributed. From the total trench area the required pipe length may be computed. The length and arrangement of the trenches help determine the minimum lot size requirements for such a system. Additional area should be allowed on the lot for future relocation of the field when the leaching quality of the original soil has become exhausted.

Seepage pits are frequently installed in place of absorption fields, although they should not be used where the water table is high, nor in the vicinity of shallow wells. In computing the required size of seepage pit, the total wall area for absorption depends, likewise, on the soil percolation rate and the volume of liquid to be disposed of. Space requirements for seepage pits are less than for leaching fields, thus making their use more suitable for smaller lots. Cesspools are no longer considered a satisfactory permanent method for disposal of both solids and liquids unless they overflow into seepage pits.

An analysis of local soil characteristics should precede all new construction in unsewered localities. This analysis should (1) identify the soil type, (2) determine the level of ground water from test holes, and (3) determine the soil percolation rate by making standard percolation tests (These tests are gauged according to the average number of minutes water takes to fall one inch through the soil.)

The disposal system should be on the downgrade side of the lot and
preferably where the largest free yard area is available. If future connection to a public sewer is likely, the system should be located to cause a minimum rerouting of the house connection. The minimum clearances specified for a septic tank system are as follows:

**Septic tank:**
- 50 ft. from a water source
- 5 ft. from buildings

**Absorption field:**
- 100 ft. from a water source
- 25 ft. from a stream
- 10 ft. from buildings or property lines

**Seepage pit:**
- Same as for absorption field

**Cesspools:**
- 150 ft. from a water source
- 20 ft. from buildings

**Sewer line (if cast iron and watertight):**
- 50 ft. from a water source.

The size of lot that will safely accommodate a septic tank system and allow the above clearance varies considerably, depending on the seepage quality of the subsoil, the ground water level, and the topography. In most localities a 50' x 100' lot is inadequate. The following general lot size recommendations for such systems (subject always to analysis of local conditions) are made by the Connecticut State Department of Health:

a. Where public water is available - four dwellings or less per acre

b. Where water supply must be on the site - a minimum of \( \frac{3}{8} \)-acre lots.

These standards are fairly minimum. At the other extreme are recommendations that no lot in a septic tank subdivision should be less than an acre. Such blanket statements are of little value, since they tend to substitute high factors of safety for definite knowledge of local conditions. A recent exhaustive government study of individual disposal systems stresses the importance of basing space standards for such systems on percolation tests of soil quality on the site.
Community systems. Many authorities stress that the septic tank soil absorption method is not as economical nor as foolproof as it appears to be. In many cases septic tanks are still being installed on lots that are too small, or where local soil conditions are inadequate. Local governments are often slow to enact proper sanitary regulations and are lax in enforcing them. However, the septic tank subdivision may not be a permanently widespread phenomenon on the suburban landscape. "The time will probably come," states House and Home, "when few states will permit big builders, even those putting up as few as 25 to 50 houses in a project, to get along without public sewers."46

For areas not served by public sewer, but where septic tanks may for various reasons be unsuitable, the practical alternative is group or community plants, built to serve single developments of from 25 to several thousand houses. Relatively few such systems have been built to date, partly because construction cost is higher than most developers think they can afford, and partly because maintenance of such plants involves continuous responsibility and expense. Actually, however, few builders or local officials are aware of recent developments in this method, which have made them economically competitive with septic tank systems.

The capital cost per unit of a group treatment plant runs from $330-$380 for a 25-unit development, down to $120-$170 for 1000 units. To this should be added 15%-20% for engineering, land, overhead, and profit, as well as cost of house connection, outflow lines and other extras, which may bring the total cost per house up between $500 and $1000. Compared to this a septic tank of 600 gallon capacity, with absorption field of 150 feet of tile in 24-inch trenches, costs about
$330 installed. The same tank with a 6-foot diameter leaching pit costs about $300; and with a 390-square-foot sand filter and chlorine contact tank, about $600.47

An important advantage of group plants is that the accompanying sewer lines and accessories can easily be connected to a public system at a later date, thereby salvaging most of the above-noted capital cost. Where a septic tank system is replaced by public sewerage, no part of it can be re-employed as part of the new system. Another advantage of group plants is that they make possible the use of small lots in outlying localities without the danger of sewage contamination.

Some of the methods of group treatment which have been found economically feasible for small developments are described as follows:

For the small development up to about 50 homes, a plant consisting of a septic tank, dosing tank, open or earth covered sand filters and chlorine contact tanks has been found practical. For more than 50 homes a plant consisting of an Imhoff tank, standard rate filter with provision for recirculation, sanitary settling, chlorination and open sludge drying beds has been preferred. Other methods are the septic tank-trickling filter plant, the Imhoff tank-high rate trickling filter plant, the activated sludge plant, the aeration type plant, intermittent sand filter plant, primary treatment plant, oxidation ponds, irrigation, and variations or combinations of these processes. For 250 homes or more it is usually recommended that the treatment plant include primary settling tanks with cleaning mechanism and separate sludge digestion.

Although economies of scale have in the past made group treatment plants impractical for small developments, now such facilities are being installed for as few as fifty houses. It is likely that further improvements and economies will be made in this method in the near future, and that it will, in many instances, replace the present widespread and often unsatisfactory reliance on individual septic tanks.
Drainage of Surface Water

Part of the construction of all new streets must include provision for carrying off surface water. Drainage installations vary considerably in type and complexity and each local situation must be handled almost as a special problem. Therefore no standards that can be applied generally were found in the literature.

The amount of storm water run-off increases in any locality as it becomes built up. Generally the more completely developed with buildings and pavement an area is, the more elaborate must be the drainage installations. On country roads, for instance, all that may be needed are open swales or valley gutters and occasional outlets at low points. The more built-up sections, however, require underground storm drainage systems, which may include catch basins leading to storm sewers, manholes, culverts, and bridges.

Catch basins are normally needed at roadway intersections, low points in roadways, and elsewhere at intervals varying from 250 to 600 feet. Usually the minimum allowable interval is specified in local regulations and is, in fact, about the only convenient standard for relating drainage requirements to density of the community. Existing water courses may often be maintained and dedicated for drainage purposes. Where streets can be laid out so as to make use of existing water courses and topography, some economies can be achieved in construction of drainage facilities.

The cost of a storm drainage system, including surface drains, catch basins, and manholes runs between $4.50 and $7.00 per foot of street for an average subdivision. Costs increase somewhat for multi-family development, and decrease in large lot districts.
Most regulations merely call for "adequate" disposal of surface water and list the facilities that may be required where, in the opinion of the local engineering department, their use is necessary. This is about as far as a regulation can go in specifying such a variable item.

Water Supply

Water systems are of three general types: (1) public, (2) group or cooperative, and (3) individual. Wherever possible new subdivisions should be connected to the municipal or metropolitan system. The finding of a local water source and the construction and maintenance of a group system involves serious engineering and financial problems that small developers would do well to avoid. Against this must be weighed the cost of extending public mains, a cost usually shared by developer and municipality.

In areas not served by public water there are a few examples of cooperative water companies, in which property owners are members. Generally these have not proved satisfactory and are not recommended. In rural areas or very low density developments there may be no alternative to the installation of individual systems with well source, pump and storage tank. Due to the many problems of individual maintenance and pumping, this system is recommended only as a last resort. If wells are called for, however, they should be located in flood-free areas, above all possible sources of contamination, and beyond the foundation walls of buildings. The following distances should govern well location:

a. from watertight cast-iron sewer or drain lines: 50 feet
b. from property lines: 15 feet (drilled or driven wells)
   25 feet (dug or bored wells)
c. from building foundations: 20 feet
d. from tile or concrete sewers, septic tanks, or disposal fields: 100 ft.
e. from seepage pits: 100 feet (drilled or driven wells only)
f. from cesspools: 150 feet (drilled or driven wells only).
Where individual well sources are located on house lots, the above minimum distances should be observed by local officials in determining minimum lot size requirements.

However, since all but a small fraction of today's new subdivisions are within reach of metropolitan or municipal systems, the usual water supply is from public mains. Water mains should be located in street rights-of-way, never in the same trench with storm or sanitary sewers, but preferably in planting strips so that they may be reached without disturbing roadway pavements. Where utilities are installed prior to construction of buildings, it is advisable, at that time, to tap water mains and run service stubs to property lines for each lot. This avoids the necessity of disturbing roadway surfaces later.

Water main size is determined by the number of dwelling units to be served, including those to be served by future extensions. Most water departments now require an eight-inch pipe in all main residential streets, and larger sizes in business districts or for trunk mains. Only in dead-end or minor loop streets, where there is no likelihood of future extension, is the six-inch main recommended.

The cost of an 8-inch main installed, including hydrants and fittings, is: (a) for transite $5.00-$5.25 per foot, and (b) for cast iron $5.25-$6.50. The cost of house service line is $1.25-$1.50 per foot plus an average of $75 to connect to the main; this makes connection cost for a 30-foot setback about $120.54.

The requirements for fire protection are frequently the governing factor in determining size of main and of other installations. Hydrants should be located close to the roadway for ready access but not where they will obstruct walks or parking. In determining the spacing of
hydrants, one rule of thumb recommends one hydrant per 400 to 500 feet of street, or approximately the square footage of the area divided by 200,000. Where buildings are large, closely grouped, or inflammable, one hydrant per 300 to 400 feet is desirable.

Summary

In the following table the recommended standards for subdivision improvements are outlined. The standards cover width or capacity, location, type, and conditions governing use or non-use. The authorities listed as endorsing or suggesting each standard are representative, though not necessarily the only authorities. Also, certain important subjects, such as roadway construction, have been purposely omitted from the table, since no simple standard exists - a choice of types being a matter of weighing costs against serviceability.

Where standards conflicted, as they frequently did, the choice for presentation was made on the basis of (1) the greatest number of endorsing authorities, and (2) endorsement by the authority considered to have the most scientific, reliable and impartial approach. In the few cases where there was neither a consensus of agreement nor a single most reliable authority, the choice had to depend on the judgement of the author.
TABLE I
SUMMARY OF RECOMMENDED STANDARDS AND PRACTICES

<table>
<thead>
<tr>
<th>Authority Consulted&lt;sup&gt;a&lt;/sup&gt;</th>
<th>NCTS</th>
<th>ITE</th>
<th>NAHB</th>
<th>ULI</th>
<th>ASCE</th>
<th>FHA</th>
<th>HHFA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right-of-way width</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector streets</td>
<td>60'</td>
<td>60'</td>
<td>-</td>
<td>60'</td>
<td>-</td>
<td>60-60'</td>
<td>60'</td>
</tr>
<tr>
<td>Multi-family residence</td>
<td>60</td>
<td>60</td>
<td>60'</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Single family residence</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Dead-end &amp; minor loop</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Country roads</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>50</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td><strong>Roadway width</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector streets</td>
<td>36</td>
<td>36</td>
<td>-</td>
<td>34-36</td>
<td>-</td>
<td>20-36</td>
<td>-</td>
</tr>
<tr>
<td>Multi-family residence</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>34-36</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Single family residence</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>-</td>
<td>20-36</td>
<td>-</td>
</tr>
<tr>
<td>Dead-end &amp; minor loop</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>26</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Country roads</td>
<td>-</td>
<td>22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cul-de-sac</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length</td>
<td>400-</td>
<td>400-</td>
<td>400-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Turnaround, minimum</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Curb radius</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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**Sidewalks**

Width: 4 feet minimum  
4½-5 feet near generators of pedestrian circulation

Location: Preferably set back from curb 3 or more feet

Permitted on one side only: Where either vehicular or pedestrian traffic low (see p. 15) or opposite long, undeveloped frontages

Not needed: In open development of large lots with frontages of 100 feet or more  
In open development with 3 lots per acre or less

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a. For explanation of abbreviations, see end of table, next page.
b. Recommended for rural roads carrying less than 200 vehicles per day.
Table I (continued)

Curbs, or curbs and gutters

Type: Straight curb recommended for safety
Cement concrete valley gutters in large lot districts

Use desirable: At all intersections
On grades over 4 percent

Not needed: At densities of 3 lots per acre or less

Grass strip

Width: 3 feet minimum without trees
7 feet minimum with trees

Sewer

Installation should be required wherever the existing municipal system is reasonably accessible

Septic tank soil absorption system

Should be allowed only where sewer not reasonably accessible, where soil quality has been tested and approved by the local public health authority, and where the system can be accommodated on the lot without violating the minimum clearances specified on page 24

Water main

Installation should be required wherever the existing municipal system is reasonably accessible

Individual water supply

Should be allowed only where public system not accessible, where the source has been approved by local health authorities, and where there are no sources of contamination closer than the distances specified on page 28

Authorities Consulted - Explanation of Abbreviations Used in Table:

ASCE - American Society of Civil Engineers
FHA - Federal Housing Administration
HHFA - Housing and Home Finance Agency
ITE - Institute of Traffic Engineers
NAHB - National Association of Home Builders
NCTS - National Committee for Traffic Safety
ULI - Urban Land Institute
Adequacy to fulfill a need is not the only measure governing choice of improvements. They must also be considered in relation to their capital and maintenance cost. In Tables II and III, following, information has been assembled covering capital cost of the items discussed in this section. (Maintenance costs are given for roadway surfaces only.) These costs are from sources believed to be reliable, and are accurate and up-to-date.

The unit costs listed in Table III are used later, in Section III, to compute total improvement cost per average lot in eleven actual subdivisions.
### TABLE II
APPROXIMATE COST OF CONSTRUCTION AND MAINTENANCE FOR DIFFERENT TYPES OF PAVEMENTS
(Surface and base only, excluding grading, drainage, and structures)

<table>
<thead>
<tr>
<th>Type</th>
<th>Construction Cost per mile of 24 ft. rdwy.</th>
<th>Annual Maint. Cost per mile of 24 ft. rdwy.</th>
<th>Approx. traffic limit per day</th>
<th>Probable life of surface in years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bituminous surface</td>
<td>$10,000-14,000</td>
<td>$350-600</td>
<td>600</td>
<td>84</td>
</tr>
<tr>
<td>treated gravel</td>
<td>$0.71-0.99</td>
<td>$0.025-0.043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road mix</td>
<td>16,000-20,000</td>
<td>300-500</td>
<td>1000</td>
<td>12</td>
</tr>
<tr>
<td>1.13-1.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bituminous macadam</td>
<td>20,000-30,000</td>
<td>250-500</td>
<td>3000</td>
<td>17</td>
</tr>
<tr>
<td>1.42-2.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bituminous concrete on flexible base</td>
<td>35,000-45,000</td>
<td>200-400</td>
<td>full capacity</td>
<td>20</td>
</tr>
<tr>
<td>2.48-3.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Cost ranges are for the year 1956, when *Engineering News Record* construction cost index was 690 and U.S. Bureau of Public Roads index for composite mile was 167. (Other surfaces omitted from original table are (1) gravel, (2) bituminous concrete base, (3) Portland cement concrete 9" thick.)

Source: Alexander J. Bone, Associate Professor of Civil Engineering, M.I.T.
### TABLE III

**UNIT COSTS FOR SUBDIVISION IMPROVEMENTS**

<table>
<thead>
<tr>
<th>I Street Improvements</th>
<th>Cost per Lineal Foot of Road (min.)</th>
<th>Cost per Lineal Foot of Road (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering</strong></td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td><strong>Clearance and excavation (or fill) to subgrade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cleared land</td>
<td>1.50</td>
<td>4.50</td>
</tr>
<tr>
<td>wooded land</td>
<td>2.00</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Roadway (24') surface and base</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bituminous surface-treated gravel</td>
<td>1.90</td>
<td>2.65</td>
</tr>
<tr>
<td>bituminous road mix</td>
<td>3.00</td>
<td>3.80</td>
</tr>
<tr>
<td>bituminous macadam</td>
<td>3.80</td>
<td>5.70</td>
</tr>
<tr>
<td>bituminous concrete</td>
<td>6.50</td>
<td>8.50</td>
</tr>
<tr>
<td><strong>Sidewalks (two 5' walks)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot; asphalt on 6&quot; gravel</td>
<td>2.00</td>
<td>2.50</td>
</tr>
<tr>
<td><strong>Curbing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>granite</td>
<td>9.00</td>
<td>9.00</td>
</tr>
<tr>
<td>concrete</td>
<td>3.00</td>
<td>3.50</td>
</tr>
<tr>
<td>asphalt</td>
<td>1.40</td>
<td>1.80</td>
</tr>
<tr>
<td><strong>Grass plot (7') loam and seed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Sanitary sewer (8&quot; vit. clay pipe) with manholes</strong></td>
<td>6.50</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Surface drains with catch basins and manholes</strong></td>
<td>4.50</td>
<td>7.00</td>
</tr>
<tr>
<td><strong>Water main with hydrants and fittings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; transite</td>
<td>3.75</td>
<td>4.50</td>
</tr>
<tr>
<td>8&quot; transite</td>
<td>5.00</td>
<td>5.25</td>
</tr>
<tr>
<td>6&quot; cast iron</td>
<td>4.25</td>
<td>5.25</td>
</tr>
<tr>
<td>8&quot; cast iron</td>
<td>5.25</td>
<td>6.50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II Improvements on Site</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driveway (10' wide from bldg. line to curb)</strong></td>
<td></td>
</tr>
<tr>
<td>2&quot; asphalt on 6&quot; gravel</td>
<td>$2.00</td>
</tr>
<tr>
<td><strong>Sewer connection to building</strong></td>
<td></td>
</tr>
<tr>
<td>conn.-$75; plus pipe, prop. line to bldg.</td>
<td>$2.00</td>
</tr>
<tr>
<td><strong>Water connection to building</strong></td>
<td></td>
</tr>
<tr>
<td>conn.-$75; plus pipe, prop. line to bldg.</td>
<td>$1.25</td>
</tr>
<tr>
<td><strong>Septic tank soil absorption system</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$350</td>
</tr>
<tr>
<td><strong>Well (individual), drilled or driven</strong></td>
<td></td>
</tr>
<tr>
<td>incl. pump, storage tank, and fittings</td>
<td>$600</td>
</tr>
</tbody>
</table>

(see next page for notes)
Table III (continued)

Note: All preceding unit costs include installation, assuming average site conditions. No adjustment was made in the figures for economies of scale. The items of clearance and excavation, and of surface drainage may vary more than indicated, where unusual conditions of ledge, topography or ground water are encountered.

Sources: a) Figures compiled by Alfred D. Cole, Realtor, of Hingham, Mass., for the Massachusetts Department of Commerce in 1955 in connection with a study of large lot zoning. They were prepared by a committee of land developers composed of Messrs. Cerel, Tambone, Campanelli, Peiper, Crewson, and (presumably) others, and they were submitted to and agreed to by officials of the FHA and VA. These costs apply to average Massachusetts suburban communities (not Brookline, Newton, or Boston) and are current as of August, 1955.

b) Derived by the author from per mile construction cost figures in Table II, which are from Professor A. J. Bone, Civil Engineering Department, M.I.T; they are current for 1956.


d) J. A. Salvato, Jr., "Experiences with Subdivision Regulation in New York State" (unpublished paper, 1956); Mr. Salvato is Director, Div. of Environmental Hygiene, Rensselaer County Health Dept., Troy, N. Y. These costs are for 1955 for north-eastern U.S.A.

e) Costs were a composite obtained from town engineering departments of Lexington, Needham, Natick and Dedham in 1955.

STANDARDS SPECIFIED IN LOCAL REGULATIONS

The recent past has witnessed an evolution in municipal policy regarding the design of subdivisions and the requirements for installation of improvements as a condition to plat approval. Such policies are made by local planning boards, town engineers, health departments and other officials and set forth in rules and regulations governing the subdivision of land.

The purpose of this section is to study a representative sample of up-to-date regulations; to compare them with the standards from the authorities (described in Section I); to evaluate them, especially with regard to improvement requirements; and to examine any policies for varying such regulations where local conditions warrant it.

Time did not permit an exhaustive survey such as the one done by Lautner in 1941; rather a selective survey was made. Regulations of some fifteen typical communities were chosen for scrutiny — not from mature urban areas, nor from rural sections, but from the most rapidly growing suburbs of the Boston metropolitan area. These communities are
afflicted with acute growing pains. In suburbia, as nowhere else, the
effectiveness of modern planning controls - subdivision regulations and
zoning - is being put to the test.

Survey of Selected Regulations

The following fifteen communities provided the material for this section:

Canton  Lincoln  Newton
Dedham  Lynnfield  Norwood
Framingham  Milton  Waltham
Hingham  Natick  Wayland
Lexington  Needham  Wellesley

The main physical improvements specified in the regulations of each of
these communities are summarized in Table V, page 49.

All of the selected regulations are of recent adoption. One dates
from 1951, another from 1953, and the rest from 1954 or later. The
reason for this is the 1953 revision of the State Planning Enabling
Law, which required each municipality accepting the law to file a copy
of its rules and regulations with the Registry of Deeds and the Land
Court before subdivision control might become effective in that
municipality. As a result, many cities and towns used the opportunity
to revise their regulations in 1954 before placing them on file. Some
have revised them again since then, and some do it regularly every year.

Many similarities can be noted among the examples. As to design
standards, such as street alignment or grades, all are quite similar
and follow closely the State's Suggested Rules and Regulations
Governing the Subdivision of Land. There is little disagreement or
controversy over standards of this sort, since they do not add appreci-
ably to the subdivider's financial outlay. Therefore this section is
concerned principally with requirements governing installation of
improvements. These have been compared, item by item, with the accepted standards and practices from the literature.

With two minor exceptions, all 15 sets of regulations require the subdivider to provide all improvements which local authorities deem necessary in the subdivision. All provide for the posting of a bond as a condition to plat approval, in lieu of completion of improvements. All require the reservation of a reasonable amount of land for public open space when deemed necessary by the planning board. Most of them permit the board to waive or vary requirements considered necessary or in the public interest.

The individual improvement requirements, most of which represent a recent up-grading of standard, are described as follows:

Roadway surface. Of particular note is the definite trend in specifying bituminous concrete (Type I) pavement, which now is required in nine of the fifteen communities. Three more require other permanent-type surfaces, and only three still permit gravel and asphalt penetration plus seal coat. Apparently most local engineers now feel that the economies achieved through low maintenance and durability justify higher first cost in pavement. It is interesting that even in some large lot communities where traffic is slight, the Type I pavement is now required.

Street width. The predominant right-of-way width for minor streets is 40 feet. However all but two regulations state that greater width shall be required where deemed necessary by the board, and five of these specify a width of 50 feet. Thus in all examples a width greater than 40 feet is either required outright or left to the discretion of the board.

Roadway width. Roadways range between 20 and 33 feet in width for minor streets; no single dimension predominates, but 24 to 26 feet is the
most common range. In only four cases is an alternative roadway width specified if and where, in the opinion of the board, the traffic justifies it. But presumably in the others also, a greater, though unspecified, width may be required. Under the new Framingham regulations no width is specified, the determination being entirely at the discretion of the board.

**Sidewalks.** In five of the communities sidewalks are required without qualification in all new subdivisions. In six others they may be required at the option of the board, and in the four remaining ones, never. The average width is $4\frac{1}{2}$ feet and some regulations specify two alternative widths.

**Curbing.** Twelve of the regulations now specify some sort of curbing, which, in five cases, is of granite. But in most cases curbing is required only on steep grades, at intersections, or elsewhere at the option of the board.

**Water supply.** All communities but one require the subdivider to install water mains, hydrants, and related fittings without qualification. (In Newton the city still installs all water mains, upon a 15 percent deposit from the subdivider.)

**Sewer.** Eleven of the regulations require the installation of public sewer, but with the qualification, "where the existing municipal system is reasonably accessible." In three of those municipalities virtually all territory that can be developed is accessible to sewer, so that the requirement applies, in effect, without exception. What constitutes reasonable accessibility must be determined by some municipal official, based on the technical-physical factors in each local situation. In Waltham a sewer is now required in all new subdivisions, regardless of whether the
existing system is accessible. Since it will take many years to extend
the system to all parts of the city, this requirement places a consider-
able burden of unusable assets on some property owners. It will
probably have the effect of discouraging all development far beyond the
immediately sewerable areas.

In none of the regulations is the sewer requirement keyed to density
or minimum lot size zoning. This is apparently not a feasible method for
designating what parts of the municipality (if not all parts) should be
sewered. But, conversely, those portions that cannot be sewered are
frequently zoned for large lots. Sometimes, however, sewer is required
in large lot districts which happen to be accessible to the public
system. (Needham, for example, requires it in a one-acre zone near a
trunk sewer.)

Drainage. All regulations require the subdivider to install
adequate drainage to carry off surface water, but the manner of speci-
fication varies widely. Some, like the Dedham regulation, simply state,
"Adequate disposal of surface water shall be provided for in a manner
satisfactory to the Board. . ." Others, like the Framingham regulation,
specify in considerable detail the installations that might be required
if local circumstances warrant it - surface drains, manholes, catch basins
and culverts - the materials of each, the methods of construction, the
spacing of catch basins and manholes, and other minutia. In either case,
however, the determination of what drainage facilities are adequate must
depend, in the end, on the judgement of the town engineer and/or some
other qualified technician.

In general, the trend among all communities seems to be a more
thorough spelling out of each requirement, covering not only the standard
for the particular improvement, but also the step-by-step procedure by
which it is to be installed or built. Such detailing relieves reviewing officials of some of the pressure of decision making and eliminates some of the chance for human error in judgement. Also it gives developers more reliable guidance at the outset in planning improvements and in knowing the costs they will be required to assume. Its disadvantage, of course, lies in its lack of flexibility. Various methods for incorporating the proper amount of flexibility into local regulations are discussed below.

The Variation of Standards with Respect to Density

For municipalities that are made up of both urbanized areas and outlying rural districts, there is much justification for modifying certain requirements and standards when applied to the outlying areas. Various systems have been proposed of either waiving certain requirements at low densities or of adopting separate regulations to apply to those areas. There is much discussion in the literature of land development on the matter of varying subdivision standards according to density, of which this quotation from the Home Builders Manual is typical:

Small lots require not only the maximum lineal feet of road per acre, but also better and more complete improvements, because of the higher density and more intensive use. The more houses crowded on an acre, the greater will be the need for complete drainage facilities, for wider and better paving, and for walks to take care of pedestrian use.

Where there are only two or three lots per acre, and the storm water run-off from impervious surfaces is low, curbs, expensive drainage systems, and walks can often be omitted with safety. Paving can also be held to a minimum width, as there will be little automobile parking in the streets.7

This statement is both a justification (to builders) for large lot development and a polite suggestion (to municipalities) that standards could safely be reduced in large lot districts.
In his book, *Real Estate Subdivision*, McMichael decries the use of a single set of standards for all densities:

> Streets are subject to greater flexibility as to type and extent than are other essential facilities. Many communities of charming character are served with narrow lanes devoid of curbing, walks, and street lighting. This is typical of some of the large estate types of development. The population density and functional use of the street are the determining factors in deciding upon the extent of improvement. A cul-de-sac, serving a minimum number of homes obviously requires less pavement than does a highway or street that collects a volume of traffic. Furthermore, lighter and less expensive pavement will suffice for lower volumes of traffic. Hence the design of the community has a direct bearing on the extent and cost of street improvements, and the establishment of a standard applicable to all streets is utter folly, resulting in inadequacy for some and in over-improvement for others.

While the principles of this statement seem valid, the wistful references to such things as "narrow lanes devoid of... street lighting" show rather clearly that this work was written before the recent trend in up-grading standards.

Scott Bagby, a planner, writing on the relationship of standards to lot size, takes a different approach:

> A single standard for all subdivisions would either seriously decrease land values in the outer area or the zoning regulations would be held unreasonable by the courts.

Most subdivision regulations, nevertheless, do contain but a single set of standards for all subdivisions, and rarely have either they or the zoning requirements which they complement been held unreasonable by courts.

The fifteen sets of regulations examined above use various methods for adjusting the street requirements in relation to the expected traffic — itself a reflection of density. In Milton, requirements may be relaxed according to whether the street carries only traffic generated by the subdivision. But the subdivider proposing such streets has no
guarantee that standards will be lowered in his case, since that matter is at the option of reviewing authorities:

A subdivision may be approved, however, without requiring that each street include all the elements shown in the typical 50-foot cross section, provided: (a) that no street shall be excepted from these requirements if it is likely, immediately or in the future, to carry traffic except to the houses on that street; and (b) that all streets shall be laid out with a width between lot lines of fifty feet (50') except as otherwise provided in the Town Bylaw, Chapter 8, Section 1, and improved according to the Typical Cross Section for 50-foot streets. 10

Although much has been written on the concept of density, or lot size, as a criterion for varying improvement standards, actual regulations embodying this principal are rare. In the Lynnfield regulations two different widths of street are specified - principal streets of 50-foot width with 32-foot pavement, and all other streets of 40-foot width with 26-foot pavement. This regulation is practically unique in specifying not only a width variation, but also an alternative type of pavement. The use of the lower standard street is keyed neatly to the lot size zoning districts of the town:

All roadways shall be brought to and include a finished grade as shown on the profiles of the definitive plan and shall be provided with a finished surface for their full width and length as follows: All principal streets and all streets in Residential "A" Zones,* 3-inch bituminous concrete pavement of type "I" state specification; all other streets to receive gravel penetration with 1-inch stone seal. 11

The provision for cheaper roadway construction in large lot districts is here based on the concept that low densities generate less traffic and therefore justify lower standards. As stated on page 14, however, durability and ease of maintenance also affect type of pavement, and these factors have little relation to density. It remains to be seen whether this pioneering attempt to "zone" improvement requirements will be workable - i.e. whether the zoning districts (whose creation is

* Residence "A" zone in Lynnfield has a 60,000 sq.ft. minimum lot size. Other zones require 30,000 sq.ft. and under.
beyond the jurisdiction of planning boards) can be a convenient vehicle for varying street construction standards (which are within the jurisdiction of planning boards).

The proposed regulations for Walpole, which were prepared by Allen Benjamin who also drafted those of Lynnfield, go beyond the latter in relating variation in street requirements to zoning of lot size and frontage. The following table summarizes these variations:

**TABLE IV - SUMMARY OF STREET REQUIREMENTS FOR WALPOLE**

<table>
<thead>
<tr>
<th>Streets</th>
<th>Subdivision Lots</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OVER(30,000 sq.ft. area) (150 ft. frontage)</td>
<td>UNDER(30,000 sq.ft. area) (150 ft. frontage)</td>
</tr>
<tr>
<td>Minor</td>
<td>Roadway width</td>
<td>Grass shoulder width</td>
</tr>
<tr>
<td>Collector</td>
<td>20' plus 3'</td>
<td>26'</td>
</tr>
<tr>
<td>Major</td>
<td>24' plus 4'</td>
<td>32'</td>
</tr>
<tr>
<td></td>
<td>30' plus 5'</td>
<td>40'</td>
</tr>
</tbody>
</table>

**Curbing**

| On grades over 4% | Bituminous concrete | Granite |
| On curves less than a specified radius | None required | Granito |

**Sidewalks**

| Minor streets   | One side only, if within 3/4-mile of school, etc., and if on route to same | Both sides required except permanent cul-de-sacs and streets abutting non-res. land, in which case one req'd |
| Collector & major | One side only | Same as minor streets |

**Special water supply for fire protection**

| None required | Special facilities (such as project hydrants) req'd where public mains & hydrants not installed |
In these regulations the standards, which are keyed to lot size districts, include width of roadway (for all three classes of street), use of curbing at grades and curves, curb material, use of sidewalk (whether on one side of street or both), and need for special water supply facilities for fire protection.

In regulations of other towns alternative standards are sometimes provided, but choice is left to the discretion of reviewing authorities. The Canton regulations specify a minimum street width, with greater width required where deemed necessary by the planning board: "The minimum width of street rights-of-way shall be forty (40) feet. Greater width shall be required by the Board when deemed necessary for present and future vehicular travel." This wording, found also in regulations of other towns, is popular with planning boards because it gives them discretionary power to raise width requirements wherever the situation warrants it. However it provides them with no guidance or justification for doing so. Nor does it afford the subdivider any protection against the arbitrary use of those powers to his disadvantage - no guide for predicting which, of two or more alternative standards, he may be required to provide.

In Natick three different street widths are called for - a 40, 50, and 60-foot right-of-way, including respectively a 26, 32, and 40-foot pavement - all of similar construction. Again the factors determining which road section to require in a given situation are not specified. Ideally, the approximate location of important streets would be indicated in the community master, or general, plan - the guide to which new streets are enjoined to conform in all of the regulations studied. Actually many regulations specify two different roadway widths, leaving
to local officials the determination of which width is needed in a particular situation. Thus the subdivider may be uncertain of both the width and location of the streets (if other than minor streets) he is required to provide. This is one justification for preparing (on paper) a community plan, and for making public the thoroughfare proposals of such a plan - to give consistency to the ad hoc determinations of street width and location.

The traditional manner of specifying improvements is to require all items at full standard and relax certain standards when reviewing officials consider them not necessary or appropriate. For instance, the Saugus regulations state, "Sewer pipes and related equipment, such as manholes and connecting Y's shall be constructed in conformity with specifications of the Public Works Department." The usual condition, "when public sewer is reasonably accessible," is not mentioned. Actually the existing Saugus system is minute and runs nowhere near any of the potential subdivision land. Naturally the planning board always waives this requirement.

Such methods afford a high degree of flexibility in the application of standards, but have the disadvantage of leading subdividers to expect relaxation of standards in their particular case. Also, in those cases where a board does not waive requirements, subdividers may claim that arbitrary action was taken in an effort to frustrate their operations.

Conclusions

If the foregoing examples are typical, it is hard not to conclude that subdivision regulations which vest broad discretionary powers in the hands of lay planning boards and other public officials may lead to abusive practices and discrimination. A requirement which has always
been waived (as, for example, the Saugus sewer requirement) could be upheld for the purpose of thwarting a particular development. Regulations giving no limitation or guidance in the use of discretion invite the exerting of pressure on officials to gain concessions. A town may not always have officials with sufficient devotion to duty to resist such pressure.

Yet the need for flexibility to vary certain standards and requirements is obvious, especially in such items as: (a) type of surface drainage, (b) connection to public sewer, and (c) street width (to determine which streets should be designated as higher standard). For some improvements, the most comprehensive document cannot entirely replace the judgement of competent technicians in the respective municipal departments.

So, while each municipality must be guided by its peculiar needs in determining what measure of flexibility should be retained, an acceleration of the general trend toward more accurate detailing of the items where discretion may be exercised would seem to be indicated. Such clarification would relieve much of the aforementioned pressure on the planning board, and should protect the developer against any arbitrary, and sometimes deliberate, action against him.
STANDARDS IN SELECTED SUBDIVISIONS

However comprehensive a set of local regulations may be, the final test of their effectiveness lies in the subdivisions themselves. The purpose of this section is to analyze the improvement requirements as they have been applied in eleven actual subdivisions. This group of representative subdivisions, built within the past ten years, was examined in an attempt to form impressions of (1) whether their improvements met the standards of accepted authorities or otherwise appeared adequate, and (2) whether any improvements seemed excessive in view of the lot size, street layout, character and location of the community.

While the adequacy of improvements was determined by comparison with the standards and practices discussed in Section I, the choice of which standard should apply to each real example necessarily depended, to a considerable extent, on the author's judgement. Determination of adequacy is limited to those improvements which can be observed in each
example. Such installations as sewerage or drainage are usually difficult to pass judgement upon without detailed facts about topography, soil permeability, water table and the like. Where purely engineering considerations were involved, no inquiry was made into the adequacy of those installations - i.e., if a sewer existed in the street, it was assumed to be adequate.

In most cases the examples were not compared to their respective local regulations directly, since the standards in force at the time of plat approval have, in most municipalities, been subject to numerous subsequent amendments.

Selection of Examples

All examples in the survey have the following characteristics in common:

a. They are contemporary - built within the past ten years, and the majority in the past five. Recent trends in local requirements, therefore, have affected most of them.

b. They are relatively large in size - constituting at least 10 gross acres and having at least 20 platted lots. This orients the study toward the operations of professional subdividers and builders.

c. They exemplify a wide variety of lot sizes - including the full range of sizes currently being platted in suburban and semi-rural areas.

d. They exemplify a variety in location and character of community - so that the effects of these factors upon improvements may be studied.

Each example is in a different town, with the exception that two were chosen from Lincoln. The subdivisions selected, however, are not necessarily typical of their respective communities. In order to simplify the identification of examples, each is hereafter referred to by
the name of the town in which it is located instead of its local designation or street name. In no instance should use of the town name be interpreted as referring to subdivisions in general within that town, but only to the example under study.

The subdivisions of this survey, in order of increasing average lot size, are as follows:

- Stony Brook Village in Hyde Park, Boston
- Spruce and Hickory Roads in Norwood
- Greenlodge Estates in Dedham
- Livingston Circle in Needham
- Redwood, Clifton, Westgate, and Sycamore Roads in Newton
- Cedarcrest in Canton
- Southgate and Radcliffe Roads in Wellesley
- Five Fields in Lexington
- Sunnyside and Morningside Roads in Lincoln
- Hillside Road in Lincoln
- Woodridge Road in Wayland

Method of Analysis

Data on the improvements in each subdivision example was recorded from field inspection of the sites and (in some cases) from local engineering departments. Examples were then studied in the light of the accepted standards and practices of Section I. Detailed findings are compared in Table VI, page 60; generalized findings are noted below. The effect of density on the use of each improvement is noted wherever it is significant.
Because the term "excessive" implies "too expensive", the most convenient measure of this quality as applied to standards is a cost study. The following procedure was used in analyzing costs:

1. Each subdivision plan was traced from the recorded plan in the Registry of Deeds, and measurements were made from it of length of new street, area of subdivision, net area in house lots, and number of lots.

2. From these were computed average lot area and new street length per average lot.

3. Capital costs of all improvements in the street were computed per lineal foot of new street, using the unit cost data assembled in Table III, page 35. These per foot costs were then plotted in Figure 1, page 58, according to average street length per lot.

4. Capital costs were also computed per average lot, using the same unit cost data, and including also on-site costs. These improvement costs were then plotted in Figure 2, page 59, on semi-log coordinates representing average lot area.

Findings of the Survey

Right-of-way width. The predominant width for local streets is 40 feet, including those both with and without sidewalks. In the large lot (over an acre) examples and elsewhere in the case of collector streets, the width is 50 feet. Only one collector street is 60 feet wide.

Roadway width. Widths of minor streets range all the way from 20 to 30 feet, 24 feet being predominant. In large lot examples roadways are 20 and 22 feet (even though right-of-way width, oddly enough, was found to be 50 feet, as noted above). In the high standard subdivisions they are 29 and 30 feet.
Roadway surface. The most common type of surfacing is the cheapest type - gravel with bituminous treatment. Almost equal in popularity, however, is bituminous concrete, the most expensive type in local use. Intermediate pavement types are used in only two cases. If built under current regulations, most examples would have roadways of bituminous concrete (illustrating how recent has been the trend toward permanent-type pavement).

Sidewalks. Sidewalks have been built in all of the examples of 12,000 square feet or less average lot size - this being roughly half the sample. All examples with average lot size over this figure are without sidewalks. In no case has sidewalk been installed on but one side of the street. Widths are between 4 and 5 feet, 4 1/2 feet being the average. Asphalt is the prevailing surface.

Curbing. Curbs are present in only two examples, Boston and Newton. In both they are of concrete and built throughout the subdivision (not just at curves or grades). They flank roadways of 30 and 29 feet respectively - a width that allows two cars comfortably to pass a third parked car. If built under current regulations, over half the examples might be required to have curbing.

Grass strips and street trees. The width of grass strips in those examples having sidewalks ranges from 1 1/2 to 4 feet, 3 feet being the most usual. Only one example, Newton, has street trees in its strips. In those examples without sidewalks, where ample right-of-way remains for street trees, no trees have been set out by the developer.

Drainage. The amount of underground drainage installations present in the examples relates approximately to the density. The average spacing of catch basins varies from 300 feet for the smallest lot sizes
to 600 feet for the largest. Also, storm sewers are present in some of the higher density examples and omitted in the others.

**Sewer.** As in the case of sidewalks, sanitary sewers are installed in all examples of 12,000 square foot average lot size or less, and are omitted in all examples above that size. Some such clear-out differentiation between sewered and non-sewered areas, based on density, is what one would expect because of the space requirements necessary for septic tank systems.

**Water supply.** All examples are served by municipal water systems. The average pipe size is 8 inches.

**Conclusions**

In general the improvements in the eleven subdivision examples appear to be adequate for the density and character of each community, and in most respects meet the standards of the accepted authorities. The three examples built before 1950 are noticeably inferior to the others in standard. This may be due to increases both in the effectiveness of municipal controls over installation of improvements, and to the quality of recent construction methods. Also if built today in the same communities, most examples would be of definitely higher standard as a result of recently upgraded regulations.

The widths of right-of-way and roadway in the sample are, for the most part, narrower than those recommended by the authorities. This seems to be in keeping with a traditional smallness of scale found in New England generally, and perhaps should not be considered substandard anyway, since greater widths are used where needed for heavier traffic.

No serious cases were noted of laxity or failure of local reviewing
authorities to enforce requirements. Although in the Dedham and Norwood examples the subdividers did not provide paved sidewalks throughout, a check of the regulations revealed that neither town had enacted sidewalk requirements until sometime after these two plans had been approved. Thus lack of this improvement cannot be attributed to laxity of reviewing officials, but rather to a slowness of the towns to adopt the control measures then available. In the more recent examples, on the other hand, (those approved since 1950) strict control was exercised and no such omission of necessary improvements was observed.

The cost study was undertaken to show the relative investments in capital improvements which the new home owner must assume in subdivisions of various lot sizes with various complements of improvements. By measuring improvement costs per foot of street and per average lot, one may approximate the extent to which any example is excessively costly or over-supplied with improvements.

Figure 1, page 58, shows that, in small lot subdivisions having full improvements, capital improvement costs per foot of street may be as much as three times the costs in large lot subdivisions having a minimum of improvements. When plotted on rectangular coordinates, these per-foot costs tend to decrease in a smooth (hyperbolic) curve as street length per lot increases.

Figure 2, page 59, shows how the combined off-site and on-site improvement costs per average lot compare when plotted by lot area. It is apparent that such costs may be as high in the small lot examples (under 12,000 square feet) with full improvements, as costs in large lot subdivisions (over an acre) with limited improvements. The figure suggests that such costs are lowest in the middle lot sizes, where most improvements can be omitted.
Perhaps the most striking observation that one can make about Figure 2 is the similarity in improvement costs per lot for such a wide range of lot sizes. Such costs range between $1700 and $3100 per lot, whereas lot sizes range all the way from 7000 to 85,000 square feet. Furthermore, the highest and lowest cost lots (in the Newton and Canton examples) are not at opposite extremes in the lot size spectrum, but happen (in this study) to be adjacent to one another. If the findings of this limited survey are typical, one is led to the conclusion that the complement of improvements, not the lot size, is the significant element governing lot cost.
LOCAL ADMINISTRATIVE POLICIES GOVERNING IMPROVEMENT REQUIREMENTS

Many problems are produced in the administration of improvement requirements which are not apparent from studies of the regulations themselves or of actual subdivisions. The purpose of this section is to explore some of the chief criticisms and problems of present policies of subdivision control.

Extent of Subdivision Control

Under current regulations in most communities, subdividers are required to post a performance bond guaranteeing the installation of all necessary improvements (with the exception usually of gas, electric power, street lights and telephone) as a prior condition to plan approval. It is interesting to follow the trend indicated by some of the surveys of the recent past and to note how, as time goes on, an ever higher proportion of each improvement has become the developer's responsibility. The following table summarizes the results of four such surveys:

-61-
## TABLE VII

**SUMMARY OF IMPROVEMENTS REQUIRED BEFORE PLAT APPROVAL**

(by percentage of cases)

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Lautner&lt;sup&gt;a&lt;/sup&gt; 215 cases 1941</th>
<th>Urban Land Institute&lt;sup&gt;b&lt;/sup&gt; 98 cities 1950</th>
<th>Urban Land Institute&lt;sup&gt;b&lt;/sup&gt; 115 cities 1955</th>
<th>This Thesis&lt;sup&gt;c&lt;/sup&gt; 15 Boston suburbs 1957</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street grading</td>
<td>57</td>
<td>87</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Street paving or surfacing</td>
<td>24</td>
<td>74</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Curbs and/or gutters</td>
<td>15</td>
<td>82</td>
<td>78</td>
<td>86</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>19</td>
<td>84</td>
<td>74</td>
<td>73&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Water mains</td>
<td>22</td>
<td>44</td>
<td>60</td>
<td>93&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sanitary sewer</td>
<td>24</td>
<td>75</td>
<td>78</td>
<td>80</td>
</tr>
<tr>
<td>Storm sewer and drainage</td>
<td>35</td>
<td>64</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>Street trees</td>
<td>16</td>
<td>--</td>
<td>--</td>
<td>47</td>
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<tr>
<td>Street signs</td>
<td>3</td>
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<td>53</td>
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Sources:

- c. From Table V, p. 49 of this thesis.
- d. This is the only improvement in the list still provided by the municipality. The City of Newton, alone among the fifteen examples, still builds all water mains.

Note:

The figures in the right-hand column, while they represent the percentage of each improvement required of the subdivider, do not emphasize the fact that virtually all improvements necessary in new subdivisions of the fifteen communities have now become the subdivider's responsibility. In other words (with only one exception), those improvements not required of subdividers are not items to be made up by the towns; they are considered unnecessary and are omitted.
The policy of requiring full improvements, which has now gone about as far as it can go, is aimed at preventing a recurrence of the regrettable land speculation excesses of the past, in which house lots were platted far in advance of their need. Recent times have afforded no adequate test of the effectiveness of improvement requirements in combating this problem of over-subdivision, since there has been a continuous housing boom. But if the boom should slacken, the expectation is that supply would be more closely tailored to consumer demand than it was in the past, because of the higher investment which subdividers now make in each lot. Thus, improvement requirements appear to be a strong weapon in the hands of municipalities to combat the problem of excessive subdivision of land.

Developer Attitudes

An attempt was made by the author to obtain a cross section of developer attitudes on, and criticism of, requirements in local regulations. Unfortunately, objective criticism of the regulations proved difficult to assemble by the interview technique for the following reasons: (1) Some developers were reluctant to criticize because of fear of unfavorable publicity; (2) Some were unreasonably critical because of prejudices and misconceptions over the purpose of such controls; and (3) Some had no clear understanding of the distinction between subdivision regulations and zoning, claiming them both to be part of a legalized conspiracy of the privileged few to deprive a growing population of moderately priced home sites.

The official spokesmen for this group, however, take pains to voice the general acceptance of subdivision control on behalf of their rank and file. "Although frequently imposing a hardship on the developer of
land," states the National Association of Home Builders, "it must be said that this policy has eliminated to a great degree the marketing of unwarranted subdivisions and the operations of the fly-by-night subdivider."²

Some of the developer reactions to subdivision control were more outspoken, though sometimes contradictory:

"Requirements go too far in some municipalities," it was charged. Street and utility installations are specified which are unrelated to the need and run lot costs up to the point where they become non-competitive. When asked which improvements they considered unnecessary or excessive in standard, or which towns had been unreasonable in requirements, most respondents were unable to give specific answers. In fact, when several developers were shown a list of improvement requirements in one-acre lot districts (requirements which the author considered excessive) they thought that nearly all items on the list were necessary, even at that lot size.*

"Some regulations tend to be too detailed." Subdividers objected to the exacting standards and minuteness of detail on installation of improvements sometimes specified. But such objections seem unreasonable, since the spelling out of requirements protects not only the public, but also the subdivider himself from arbitrary deviations from set policies.

In general, however, the sampling of attitudes of developers, and others who understand the builder's point of view, did not indicate a

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* Questionnaire - Do you think it is unreasonable to require the following in a subdivision with an acre minimum lot size: (a) sanitary sewer, (b) sidewalks, (c) bituminous concrete roadway surface, (d) street right-of-way of 50 feet, (e) curbing at intersections and slopes over 5%?
widespread disapproval of the regulations themselves. Almost all agreed that improvements are necessary in subdivisions and that it is important for municipalities to enact regulations governing their installation in new subdivisions. But the major area of controversy appears to lie in the policies and practices of local officials in administering the regulations.

The main problems of administration, which will be discussed in the order given, may be summarized as follows:

a. Subdividers are sometimes required to provide, without compensation, trunk utility lines and streets to connect with existing facilities - thereby improving properties other than their own, with no benefit to themselves.

b. Planning boards (or other reviewing officials) sometimes depart from adopted regulations or are inconsistent in the use of discretionary powers granted them under the regulations.

c. Planning boards (or other reviewing officials) periodically raise standards and require additional improvements by amendment to the adopted regulations, thereby creating uncertainty and confusion for subdividers.

d. The procedures required of subdividers are unnecessarily complicated and time consuming, due to the multiplicity of jurisdictions and the dilatory practices of the various agencies with which they must deal.

Improvements that Serve Areas Outside the Subdivision

The first problem is one that particularly involves communities on the fringe of metropolitan areas. The Urban Land Institute puts it this way:

The responsible developer has no objection to installing at his expense such utilities as are required for the site improvement he needs in creating residential lots of his own project. However, he does object when excessive demands are made for utility installations, street pavements, or assignments of area not for the benefit of his own project.

In providing streets and utilities to serve areas beyond, the developer creates new tax values and builds improvements that
benefit adjacent vacant areas. Thus it seems unfair that developers should have to pay for trunk lines and arterial streets to serve those areas... these are not properly a charge against the subdivision in question.

In practice, this criticism is only partially justified. Many communities have policies of sharing with developers the cost of installing oversized utilities and additional improvements to serve areas beyond the development in question. According to a survey conducted by ULI on this question, "... the majority of cities recognize part or all of the obligation for additional cost on oversize utilities. Out of 90 cities answering this question (Ed. note: "Who pays for trunk lines?"), 41 pay all of the additional cost, 23 part of it, and 26 pay none."4

However, the trend does seem to be toward the municipality's assuming increasingly less of this expense. Inquiries into local policy on who pays for oversized utilities among the suburban communities studied, indicate that some towns which recently shared the capital cost of such extensions now require the subdivider to pay all. The reason for this change of policy is partly a growing realization by local officials that extended utility lines and scattered outlying development cost more tax dollars than the equivalent development in areas within, or adjacent to, municipal systems. With towns already acutely aware of the cost of new schools precipitated by new development, local officials are naturally anxious to place a damper on any avoidable extension of utility lines into new areas.

Inconsistencies in the Interpretation of Requirements

It is conceivable that a planning board may consider the time not yet right for development of a new area, since it would involve uneconomic extension of town services and new school construction. By relaxing standards on subdivisions in older, partially built-up areas
where utilities are available, and **upholding** standards in outlying areas, a board might control the timing of development. Or, in the interest of preserving the character of the existing community, it might use a similar technique to prevent large scale, low valuation development.

However, there is no clear precedent or court decision granting municipalities power to postpone or prohibit the subdivision of private lands (for reasons other than public health). And, in fact, nearly everyone interviewed in connection with this study was of the opinion that planning boards and other reviewing officials are now very careful to hold to the letter of their specifications when it comes to improvement requirements. No instances were identified where boards relaxed particular requirements in order to favor high valuation development, or discriminated against certain developers by "throwing the book" at them. "All planning boards will do everything possible to live within the letter of the law and their jurisdiction," said one builder's representative, "and by and large I think they do this. However, they can favor one builder against another in their procedure and attitudes, and this is something very hard to pin down or correct."5

Inconsistencies in the use of discretionary powers would not normally appear in minutes of board meetings, nor be admitted by most board members to a casual inquirer. Therefore a deliberate search for examples of such inconsistencies was not made, especially since the finding of an occasional example would not be sufficient cause for criticism. As a result of the interviews, however, the author received the impression that elasticity in imposing requirements had been prevalent in many municipalities until quite recently. This was the case with the Woburn
Planning Board, for instance, according to an informed public official. Similarly, a report on subdivision problems in California states:

Even where seemingly good subdivision or related ordinances appear on the record, variations from set practice may be readily set aside at the whim of local bodies, leaving no guarantee that good development will follow.

But as far as this author could ascertain, this practice has now been largely corrected in the Boston suburban communities. The reforms brought in by the 1955 amendment to the Subdivision Control Law, plus some active criticism from builders, have apparently forced most planning boards to adopt more detailed regulations and hold closely to them.

**Upgrading of Standards**

One of the primary causes of controversy between subdividers and local public officials, according to representatives of both groups interviewed, is the periodic raising of standards and upgrading of requirements, seemingly in an effort to retard all development. Many subdividers look upon such policy as a deliberate conspiracy to thwart their operation and preserve the status quo of the existing community against the pressures of an expanding population. The situation is well summarized by the Urban Land Institute:

Caught in a dilemma between limitations on raising the property tax rate and lack of other available sources of tax revenue, municipal jurisdictions (particularly those that are predominantly residential) upgrade their requirements governing the development of land. When such action is capricious or inflexible, developers protest.

One need not look far afield nor far back in time to find examples of the raising of these improvement standards. The following list of recently upgraded standards was compiled at random from some of the fifteen municipalities whose requirements were analyzed in Section II:
Dedham, within the past year, has begun requiring road surfaces of either 4 inches of penetrated macadam or a 1-inch Type I-1 wear course on a 2-inch Type I-1 binder course, and also (with either type) a 6-inch asphalt curb. This supersedes a 3-inch gravel with asphalt penetration surface and no curb.

Norwood, since the beginning of 1957, has gone from a 40 to a 50-foot minimum right-of-way for minor streets, and from a 26 to a 33-foot roadway width. The reason given for the particular dimension of 33 feet was that it is 2/3 of the right-of-way width.

Lincoln, in 1955, went to a bituminous concrete, 2 1/2-inch road surface on 10 inches of gravel with oil penetration from its previous gravel and oil penetration surface. It also now requires bituminous concrete curbing on all grades over 2 percent.

Hingham, which before 1956 specified a roadway surface treatment of tar or asphalt satisfactory to the town engineer, now requires a Type I-1 bituminous concrete road surface.

Canton, which revised its regulations in 1954, added a requirement for sidewalks (which was made optional at the discretion of the planning board, and never yet invoked) and granite curbing at intersections and other locations where deemed necessary by the board.

Randolph, in 1957, enacted a requirement calling for granite curbing on grades over 4 percent and at roadway intersections. The reason given for this amendment was to slow down the rate of development.

Waltham now requires public sewer in all streets of all new subdivisions, regardless of the distance to connect to the existing system and regardless of whether septic tanks are also necessary as an interim disposal method. The full cost of connection to the system must also be borne by the subdivider.

In Wellesley the regulations have been revised every year as a matter of policy. Improvements have been added and standards raised with every revision as their need became apparent. Some of the upgraded standards include bituminous concrete sidewalks, a 50-foot secondary street with 34-foot roadway (at the discretion of the planning board), concrete curbing, water mains and sewer, street signs, and a 90-foot diameter turnaround. This year's amendment is to require the subdivider to pay the cost of checking for compliance by the town engineering department.

Local governments can usually justify the above revisions upward of improvement requirements. All are claimed to serve useful purposes, give added value to property and often reduce maintenance problems of a municipal department. It is easy to understand why a planning board,
observing the high standards called for in nearby communities and noting that those communities are thereby able to attract generally higher value development, would feel constrained to upgrade its own requirements correspondingly. Faced by steadily rising costs of public works construction, many municipalities are also still plagued with the burden of providing streets and utilities in arrested subdivisions, laid out before the era of subdivision control. To avoid the recurrence of such a dilemma in the case of subdivisions currently being platted, is no doubt a primary reason for the continual raising of standards. Growing demands on municipal resources make it increasingly important to minimize maintenance costs of streets and utilities and avoid, as far as possible, the capital outlay of constructing or reconstructing them. The responsibility of planning boards is first toward their taxpayers, not toward new home seekers of lower income groups. Therefore the trend is toward ever higher improvement standards - to strive for low maintenance, durability and adequacy in the face of the rapidly changing needs of modern life.

The subdivider's viewpoint. The subdivider, on the other hand, cannot help but view the trend toward higher improvement standards with misgivings. Even though he passes along his capital outlay for frontage improvements to the buyer of each lot, he usually produces for a definite market and price bracket. His product - a house and lot - must compete with similar products in other localities, towns where improvement standards may be sufficiently lower to place his product in an unfavorable competitive position. His house price is governed by the rule of thumb used in the real estate business: the cost of an improved lot should be between 10 and 20 percent of the total cost of house and lot. Recent trends in higher cost of raw land, plus this trend in higher
standards, have forced him to build a more expensive house than he otherwise would. This - the higher value house - not merely the higher value lot - is claimed by some builders to be the objective sought by municipalities in raising standards.11

Many subdividers do not judge improvement standards on the basis of whether they promote good design, low maintenance, durability, safety for children, sanitation and the like. Rather they view each additional upgrading of requirements as a further attempt to impede their operations and thus retard population in-migration. Other subdividers would argue that improvement requirements should be based on need and on site characteristics - not on their effect as an inducement to higher valuation development. Sewers, for example, should be required to promote the public health, not to rule out cheap housing. It would be absurd to suggest that a prestige neighborhood should have a sewer where a low income one could get along on septic tanks. Yet some developers suggest that improvement requirements are becoming an instrument in the hands of entrenched minorities to limit development to homes for the well-to-do.

Developer Alfred D. Cole draws the distinction between legitimate and illegitimate motives for requirements:

'... it is not possible to vary the nature and cost of improvements in relation to the buying power of the prospective occupants of the area as is possible with some of the other costs. For example, cost and quality of sewers and water main depends upon density of population, not income; the material, width, and thickness of streets, curbs and walks are governed by amount of traffic, not the wealth of the prospective adjacent resident.'12

The community's position. In some communities the public officials have been quite frank in admitting to the author that certain subdivision standards had been raised in an effort to retard development or to induce
new house construction above a certain value. But this is obviously not the whole reason nor even the most important one why standards must continually be upgraded. "The home buyer himself has been insisting on higher subdivision improvement standards," states the Urban Land Institute. "Also the FHA and lending institutions insist on higher standards." 13

In its research report on subdivision standards, the ASPO sees the continual raising of standards as an evolutionary process:

These standards are principally a matter of engineering design and are in a constant state of evolution. On the whole, standards that were satisfactory ten years ago are likely to be inadequate today. It should be noted in passing, however, that there is ample justification for higher standards in new subdivisions than obtain in the average construction of improvements in most cities. This is based on this same idea of the constant evolution of construction methods in engineering design. If it were possible to rebuild all of the improvements of any city, they would be rebuilt to higher standards than were used in their original construction. Any addition to the city's physical plant should be constructed to the most recent standards. 14

The task of regulating the quality of land development is a reflection of technical progress. The raising of standards is a natural consequence of the advance of urbanization into formerly rural or low density sections. It is irreversible - i.e. one never finds municipalities lowering their standards. Completely rural communities do not need high standards because the pressure for development hardly touches them. Completely built-up communities can continue safely with their existing standards, since their situation is static and they offer little opportunity to change the quality of their physical environment through new subdivisions. But communities in a dynamic or growth situation, even though of low density, would be expected to react to rapid immigration and urbanization by raising subdivision standards to the level
of high density communities, in an effort to combat or retard what they may consider to be too rapid growth for their economies to sustain.

Complexities and Delays in the Approval Process

The average subdivider, especially if he is not experienced in a given town, is faced with a bewildering array of jurisdictions with which he must deal and regulations with which he must comply. Many public agencies and officials, other than the planning board, must review and approve his plan. Besides the subdivision regulations, he may be required to comply with the local zoning ordinance, building code, sanitary code, fire underwriter specifications, FHA minimum standards, local deed covenants, and other controls that apply less directly. He has no comprehensive "how to do it" to guide him through all of the administrative barriers - no one agency that provides all answers. If operating in a small community he may deal with unpaid officials who are not familiar with this total control procedure, beyond their own departmental concerns. In order to minimize his costs he must schedule the sequence of referrals so that a change in plans ordered at any step will involve him in a minimum of wasted effort.

Although planning boards must complete action on subdivision proposals within a statutory time limit, no such time limit applies to some of the other officials concerned. Inevitably there are administrative delays, and some subdividers charge that many of these delays are unnecessary and deliberate. For example, in submitting a certain proposal in Weston, the subdivider was shunted back and forth between four separate agencies, with the result that it took two years to secure approval. A spokesman for the subdivider complained that such delays cost money - money which must be added eventually to the price of the home. 15
Nevertheless, as it usually happens, neither a multiplicity of jurisdictions and regulations nor the alleged dilatory practices of reviewing officials can be eliminated without sacrificing much of the benefit of the control process. Land development is necessarily a complicated operation, over which no single agency can have the competence to exercise controls on behalf of the others. In a large city—Denver, for instance—the planning agency assumes responsibility for "processing" subdivision applications through the various municipal departments concerned. But in small municipalities that responsibility must usually be left to the subdivider.

It is naturally improper for public officials to delay action deliberately on subdivision applications (even though it isn't for the purpose of thwarting development). But a reasonable amount of time spent in making decisions seems well worth whatever cost must therefore be added to the new homes. For new streets and utilities in subdivisions are items of great permanence and considerable cost—cost not only of construction, but also of maintenance, devolving on the community. Therefore subdividers should expect dealings with the various officials to be time consuming, and should write them off as a necessity for the protection of the public. Some charges were made of unreasonable and deliberate stalling by planning boards, but the author made no inquiry to verify it.

The Relation of Standards to Rate of Development

Inquiries were made to determine whether the upgrading of improvement requirements actually retards land development. Due to the many factors affecting rate of development, there is no adequate device that can measure the influence of this one variable. Building permit data
does not ordinarily give a true reflection of the effect of standards since much new construction occurs outside statutory subdivisions, and also since a time lag of several years is usually necessary to exhaust the existing supply of platted buildable lots - lots to which revised standards would not yet apply.

Several spokesmen for municipalities ventured the opinion that the upgrading of improvement requirements had made no noticeable difference on the rate of development in their communities - this in spite of the fact that several town engineers informed the author that standards had been raised in an effort to retard development.

In exploring the developer's point of view on this question, the author found opinions also mixed. One builder thought that the lot size requirements, not improvements, were the real deterrent, since any responsible developer would, of his own volition, provide nearly all improvements called for in the regulations. Another felt that the general effect of high standards on the operation of developers was to weed out the marginal builders - those who are under-capitalized and small in scale of operation. The large-scale operator is not so seriously hampered by the upgrading of standards since his profit can be spread over more units and more time.

There are other methods of retarding development besides raising requirements. One planning board member observed that when a board wants to make it tough for a subdivider it can require him to be bonded for his entire project at the outset, instead of bonding in stages (the usual procedure).

Another improvement required primarily as a deterrent to low cost development, according to a knowledgeable town engineer, is granite
curbing, which he considered an expensive luxury. 22

It is perhaps surprising that members of the building industry have not opposed the upgrading of local improvement requirements more openly and consistently. One developer's representative, when interviewed by the author, was most anxious, for the sake of public relations, that his tirade against certain local subdivision policies did not reach the officials of the towns concerned. 23

McMichael, writing in an earlier era, confirms this attitude:

It is usually more economical (Ed. note: "for the builder") to grant even excessive concessions than to devote time and effort to producing favorable adjustments. 24

If the expectation is that the raising of improvement requirements does, by itself, retard development, the evidence is far from conclusive. Indeed it is likely to make an area more popular for all income groups. The insistence of the FHA that their mortgage insurance commitments in new subdivisions be limited to areas supplied with sewerage, graded and surfaced streets, and adequate water supply, has been a most powerful force in creating a popular demand for those improvements. 25

Again, "There is no question," writes Seward Mott, "that the value of good street improvements accruing to a home property is much greater than the actual expense of installation." 26

But a large body of uninformed observers, including many public officials, have the notion that raising of requirements does retard development. This is unfortunate in many instances because it is the new home buyer, not the subdivider, who must pay ultimately for the improvements. If a particular standard is adopted, not on the basis of whether it is needed to improve the design of subdivisions, assure safety, decrease maintenance costs, or for some other tangible objective,
but especially to retard development - then (it seems to the author) the goal is misdirected. Such a policy not only appears ineffective, it also places an unwarranted burden on the home buyer, who frequently has nothing to say about what goes into the street in front of his property.

Examples of specific requirements that appear to have been enacted for their deterrent effect are not easy to identify since so many factors enter in. However, two possible examples might be the Canton and Walpole regulations, which require granite curbing at grades and intersections. These two towns are relatively rural and open in character. Most of their streets, far from having granite curbing, have never seen curbs of any kind.

If it cannot be proved that the raising of subdivision standards tends to retard development, one might however suppose that the reverse is true, i.e. that rapid development, or the threat of it, may induce the raising of standards. The author attempted to demonstrate this supposed fact by trying to establish a correlation between the number of upgraded requirements in five selected municipalities and the number of building permits issued there between 1946 and 1956. Two groups of towns, those having many and those having few changes, were compared. The building permit records did not show any definite relationship between the two groups. Since the assembling of accurate data on standards proved very time consuming, and since no significant correlation was indicated, a wide sample was not taken on this point.

This section has dealt with some of the problems involved in administering subdivision regulations. These were found to be (a) the requiring of improvements that serve areas outside the subdivision,
(b) inconsistencies in the interpretation of requirements, (c) the upgrading of standards, and (d) complexities and delays in the approval process. The section also explored the present extent of subdivision control, criticisms of developers, and the relation of standards to the rate of development. Conclusions drawn from these discussions are summarized in the section which follows.
SUMMARY AND CONCLUSIONS

Section I of this thesis presented and discussed the standards for streets and utilities in new subdivisions, as recommended by the recognized authorities in the field of engineering and land development. In general, those authorities were found to be in substantial agreement on the improvements considered necessary or desirable in subdivisions and the standards to which they should be built for varying local conditions. Those standards believed by the author to be the most generally accepted and reliable for average needs are summarized in Table I, page 31.

Section II examined and compared the improvement requirements specified in the current subdivision regulations of fifteen fast-growing suburban communities. Most regulations were found to be in substantial agreement with the standards recommended by the authorities, and some actually exceeded those authorities. Studies in methods of varying and interpreting standards, however, suggest the need for more sensitive schemes of relating requirements to local situations.

Section III studied the improvements actually installed in eleven recent subdivisions of various lot sizes, and analyzed the capital cost of improvements. In general, those installations appeared to be adequate
and in agreement with the standards of the authorities. Most improvements seemed reasonable in their capital cost in relation to the benefits they bestowed on property; but several seemed unreasonably costly, suggesting the need for moderation in future upgrading of requirements.

In Section IV interviews with both subdividers and local officials inquired into the main problems and sources of disagreement regarding improvement requirements. The main criticism does not seem to center on the requirements themselves, but rather on interpretation and administration of regulations by local reviewing authorities. Several of the most controversial problems of administration were identified (on page 65) and then discussed in detail. Some observations and conclusions are offered below:

The Problems Summarized

Improvements to serve outside areas. In the problem of extension of oversized utility lines and streets connecting new developments with existing systems, there has been a trend toward requiring subdividers to pay part or all of the construction cost, even though such facilities benefit other property than the subdivision in question. This is a matter for which no single solution exists, each local jurisdiction having its own policy, and each instance requiring separate consideration. However, municipalities which refuse to assume this cost appear justified in such a policy. For besides holding down municipal expenditures, it tends to discourage premature and uneconomical suburban sprawl in outlying, undeveloped territory. There are fewer restraints to this type of growth than there used to be. In the absence of more positive methods of control the refusal of local governments to pay for utility extensions into new areas seems a reasonable deterrent.
Complexities and delays. Problems are created for the subdivider by the excessive number of jurisdictions, agencies, and regulations that govern his operation, and by the time-consuming procedures involved in dealing with all of them separately. Although planning boards have primary jurisdiction over subdivision applications they cannot usually be expected to "process" these applications through all of the agencies involved. Developers complained of unreasonable delays and charged local officials with deliberate stalling in an effort to thwart their operations, in spite of the statutory time limit on review. No inquiry was made, however, to verify or discount this charge.

Inconsistencies of interpretation. The wide discretionary powers granted planning boards and other reviewing officials under most local regulations may lead to inconsistencies and discrimination in the waiving or varying of requirements. This is apparently no longer a serious or widespread practice (at least in the Boston area), according to a number of developers and local officials consulted. Such deviations from set standards no doubt do occur and evidently did occur in the past, but are reportedly not now a cause for much criticism. Recent reforms in the enabling law plus criticism from builders have apparently forced most planning boards to adopt more detailed regulations and hold to them.

The granting of wide powers of discretion, however, creates the opportunity for inconsistent or arbitrary action by boards. This situation assures neither the public nor the subdivider the measure of protection they need from inept or discriminatory board rulings, and it fails to provide public officials with the measure of guidance they need. Therefore the author suggests that blanket provision in local regulations
granting boards power to vary or waive any requirement be discontinued, and that in its place be substituted discretionary provisions governing several specific requirements or standards which cannot be firmly stated in regulations. These he hesitates to name because they would vary from one community to another. Some suggestions, however, are given on page 48.

The trend toward limiting the discriminatory power of boards is already in progress. The author merely underlines the need to encourage and accelerate this trend.

Upgrading of standards. Municipalities find it necessary, from time to time, to upgrade the requirements specified in their regulations as the pressure of urbanization begins to have an impact upon them, and as new methods and materials are perfected and new needs in modern living become apparent. Communities in a dynamic or growth state would be expected to raise standards in order to achieve better quality, higher value development, and to retard rapid growth.

The subdivider, on the other hand, views the trend toward higher standards with misgiving and resentment. He is not so much troubled by the stiffness of requirements existing at any one time as by their continual upgrading. Such a revision may occur after he has made his original proposal, involving him in changes and serious economic losses. He is particularly critical where it appears that standards have been raised, not because they are needed for better functioning subdivisions, but because of their supposed effect in retarding development.

Unfortunately, there appears to be no one solution to this problem - no master standard by which to arbitrate the controversy. Improvement standards in growing communities will necessarily be in a state of
evolution, and subdividers may as well accept the fact. Yet it is important that public officials understand the position of subdividers in this matter and observe moderation in such policy. Furthermore, subdividers seem entitled to protection from any raising of standards after submitting their preliminary plans.

**Effect of Standards on Rate of Growth**

The question of whether the stiffening of requirements retards development was explored. Most persons interviewed thought it had no effect on rate of development. But a minority believed that members of planning boards think it does, and that boards therefore tend to raise standards periodically. Actually, though, indications are that stiff requirements, if anything, encourage development by creating higher value property.

It had seemed to the author that the practice of upgrading standards must be a direct consequence of the pressure of urbanization. However, on the basis of the data available, no correlation could be established between the raising of standards and the number of building permits issued in those communities.

Realizing, then, that the raising of standards does not by itself retard development, an unwarranted burden is placed on new home owners where expensive improvements not actually needed are required.

**Questions for Further Study**

If it is true that high subdivision standards do not retard development, and also if the upgrading of standards for the purpose of discouraging low cost growth is an unwarranted practice, the question still remains - how can municipalities retard development when and where they consider such action to be in the public interest? What methods are constitutionally defensible and acceptable to subdividers and yet effective in giving the public the protection it needs against the incursion of
large scale, low cost development? How can local officials slow down growth throughout a town to a rate consistent with the town's ability to provide public facilities? How can sites not currently suited for development be set aside for the future? How can development be induced in partially built-up sections already supplied with utilities so that outlying vacant territory is not exploited prematurely and perhaps committed to an inappropriate use and street pattern? Municipalities still have inadequate tools to cope with these problems.

There has been no real judicial clarification of the two constitutional questions: (1) may a municipality regulate the order of development, and (2) may development be forbidden because of the cost of public facilities to serve it? The State of Washington has enacted enabling legislation permitting municipalities to regulate where and when new development may take place, but this has reportedly never been tested by the courts.

By far the most common device for curtailing development or controlling the rate and sequence of new growth has been large lot zoning. (This subject has been by-passed because of the necessity to limit the scope of this thesis.) Large minimum lot requirements can later be down-graded when and where areas seem ready for more intensive development. Although zoning was considered by some local officials and builders to be a more effective deterrent than high improvement standards, indications are that neither would thoroughly protect otherwise popular communities from rapid, mass suburbanization.

Much additional study is needed in the possible administrative techniques for coping with the problems outlined above. Also, more experimentation by municipalities is indicated, if they are to have the
means to control excessive growth. As for improvement requirements, their function is not to retard, postpone or prohibit development, but primarily to assure home buyers and the community at large that the subdivider will provide the necessary elements for good subdivisions, at adequate standards.

Recapitulation

In summary, the author has examined a sample of recent subdivision regulations and found that the adopted standards, in general, are in line with the recommendations of accepted authorities. He has found several methods in use for interpreting and varying requirements and suggests that this is the area where more detailed spelling out of those requirements and less reliance on official discretion is indicated. And he has analyzed some of the alleged administrative abuses of subdivision control, including those produced by the periodic upgrading of standards. This last he found to be a necessary and desirable policy for the protection of the public, but likely to be an unfair instrument against subdividers and home owners if not pursued with moderation.

The original intent of this thesis was to study local subdivision control policies as critically as possible in the expectation that substantial reforms were in order. Although problems have been identified, and the need for certain corrections and refinements in the application of regulations indicated, the overriding fact remains that subdivision control has been effective in producing subdivisions of a far higher quality than would have been possible without it. Therefore, honesty requires the author to admit that substantially little fault can be found with the regulations (as represented by the examples of this study), nor with the administrative policies that implement them.
A Final Thought

Criticisms received as a by-product of the interviews for this thesis emphasize the fact that a study of improvement requirements is of limited value when treated in isolation, and that broader considerations of public policy are necessary if the best use is to be made of land resources. Municipal administration has tended to compartmentalize the elements that make up the whole complex of community building - subdivision control, zoning, building construction, planning, and provision of community facilities. But builders do not view the situation in such segmented form.

It is not difficult to defend individual instruments of public control, as this thesis has attempted to do. But the very existence of an undercurrent of dissatisfaction, in spite of what appears, in the light of close analysis, to be a reasonable and functionally effective system of regulation, suggests the need for something more basic - a comprehensive reappraisal of the overall relationship between subdivider-builders and municipalities. Toward that end this thesis is presented, with the hope that it will be a meaningful contribution.
NOTES: Section I


2. Ibid. p. 3, and other authorities as listed on p. 31 of this thesis.


4. Ibid.

5. NCTS, p. 15, and other authorities as listed on p. 31 of this thesis.

6. Ibid.


11. NCTS, p. 17.

12. Ibid., p. 18.

13. Ibid., p. 10.

14. Ibid., p. 11.


17. This and the three succeeding estimates of capacity and probable life are provided by Alexander J. Bone, Assoc. Prof. of Civil Engineering, Mass. Inst. of Technology. See also Table II, p. 34, this thesis.

18. George Olson, Town Engineer of Woburn, Mass., from interview of April 24, 1957.

20. NCTS, p. 25.

21. Ibid.


24. ITE, p. 106.


27. ASPO, Report No. 95, Part C.

28. NCTS, p. 25.


30. ASPO, Report No. 95, p. 3.

31. ULI, p. 83.

32. Alfred D. Cole. See also Table III, this thesis.


37. Ibid.

38. Composite of costs from town engineering departments of Lexington, Needham, Natick and Dedham, 1955. See also Table III, p. 35 of this thesis.

NOTES: Section I
continued

40. ASPO, Report No. 38, p. 10.

41. HHFA, Construction Aid No. 5, p. 4.


44. Ibid.


47. All figures in this paragraph from J. A. Salvato, Jr., Experiences with Subdivision Regulation in New York State (unpublished paper, 1956).

48. Salvato, p. 11.

49. Alfred D. Cole. See also Table III, p. 35 of this thesis.

50. NAHB, p. 63.

51. Ibid.


53. Ibid., pp. 5, 7.

54. Figures on water main cost from Alfred D. Cole. Figures on water service connection costs adapted from town engineering departments of Lexington, Needham, Natick and Dedham. See also Table III, p. 35, of this thesis.

55. ULI, p. 100.

2. The Subdivision Control Law, as contained in Chap. 41, Secs. 81K-81GG of the Massachusetts General Laws. The specific requirement referred to here is contained in Sec. 81Q.


6. Framingham Planning Board, Rules and Regulations (1956)


12. Adapted from a table summarizing the proposed Walpole regulations, supplied by Allen Benjamin, Planning Consultant for Walpole and Lynnfield.


14. Natick Planning Board, Rules and Regulations

15. Saugus Planning Board, Rules and Regulations (1957)
NOTES: Section IV

IN THE REFERENCES BELOW, the names of certain individuals interviewed have been withheld because of the confidential nature of their remarks.


7. Marybeth Branaman, Control of Subdivisions in California (Berkeley, Univ. of Calif., 1953), p. 45.

8. ULI, p. 10.

9. From the following municipal officials: Messrs. Cox of Dedham, Ryan of Norwood, King of Waltham, and officials of Randolph and Wellesley, and from subdivision regulations of Lincoln, Hingham and Canton.

10. Adapted from American Society of Civil Engineers, Land Subdivision (New York, ASCE, 1939), p. 45. The following relationship to package price of house and lot is prescribed: land and rough grading - 7%, street improvements plus profit on lot - 13%, and house plus profit - 80%.

11. The foregoing argument adapted from remarks by a builder's consultant in interview of Dec., 1956.


16. Based on personal acquaintance with procedures of the Planning Department, City & County of Denver.
17. From interviews with five municipal officials, 1956-57.

18. From interviews with three town engineers, 1956-57.


25. ASPO, p. 2.