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THE COSTS OF SPRAWL: CASE STUDIES AND FURTHER RESEARCH

PREPARED FOR
EXECUTIVE OFFICE OF THE PRESIDENT,
COUNCIL ON ENVIRONMENTAL QUALITY
and
THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
OCTOBER 1975

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Mr. James Hoben
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and Research
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Washington, D.C. 20410

Dear Sirs:

Real Estate Research Corporation is pleased to submit the enclosed report, entitled The Costs of Sprawl: Case Studies and Further Research. As the title indicates, the research summarized herein is intended to expand and supplement various analysis undertaken by RERC in 1973 and 1974 in our original study of the environmental and economic effects of alternative development patterns. The investigation of a limited number of case study suburbs, representing a variety of growth and development modes, has resulted in new insights into the relationship between community planning and delivery of public services.

Our association with CEQ and HUD in the last three years has resulted in major research breakthroughs, as evidenced by the considerable nationwide interest in and reaction to The Costs of Sprawl. We at RERC look forward to further cooperative research ventures with both CEQ and HUD in the areas of development impact analysis and growth management.

Respectfully submitted,

REAL ESTATE RESEARCH CORPORATION

Robert S. DeVoy
Senior Vice President

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CHAPTER I

INTRODUCTION

In the spring of 1973, Real Estate Research Corporation was commissioned by the Council on Environmental Quality, in conjunction with the Department of Housing and Urban Development and the Environmental Protection Agency to undertake a study of the environmental and economic effects of alternative development patterns. Two volumes of findings from that study have been published, as follows:

1. The Costs of Sprawl: Detailed Cost Analysis (Government Printing Office; April, 1974). This volume utilized relevant information from the literature review in an analysis of the comparative costs of alternative development patterns. Costs of public and private facilities and services for six housing types (ranging from single family homes to mid-rise apartments) and for six community types (ranging from totally planned[1] to totally conventional developments) were calculated; in addition, a number of environmental and personal effects were quantified for comparative purposes. All references to The Costs of Sprawl in this report refer to this volume unless otherwise noted.

2. The Costs of Sprawl: Literature Review and Bibliography (Government Printing Office; April, 1974). This volume contains the results of an extensive literature review on the direct economic costs or adverse environmental effects associated with development in suburban fringe areas. Over 1000 sources were reviewed; a significant number were annotated in brief. In addition, this volume contains an essay describing the types of literature available and their usefulness in evaluating costs of alternative development patterns.

   An executive summary of methodology, findings, and conclusions from these studies has been published. For the reader who is not familiar with the Costs of Sprawl, we advise reading the executive summary prior to beginning this report.

Once these volumes were completed, the need for further research was apparent -- both to refine the previous study and to add related elements not undertaken previously. The findings and conclusions of that further research are the subject of this report. Where this additional research resulted in changes in assumptions or other revisions to the previous work, such changes were made and are incorporated in this report. We suggest that reference to the two major volumes of The Costs of Sprawl might be advisable, because it is difficult to condense a large

---

[1] "Planned" development as referred to in The Costs of Sprawl describes a compact physical pattern which minimizes "leapfrog" development -- the passing over of fully serviced vacant land in favor of less costly parcels at more distant locations.

amount of material into a brief summary. Conclusions from this supplemental research are summarized in Chapter II of this volume. Subsequent chapters cover the substantive body of the research -- covering the following topics:

Chapter III	A statement of the basic approach to the research topics, including the criteria for selecting the case study communities used as a basis for the analysis.
Chapter IV	An evaluation of community planning, with two approaches discussed.
Chapter V	The incidence of development-related costs to government and private participants in the development process.
Chapter VI	The incidence of shelter cost allocations for private households.
Chapter VII	An examination of how both capital and operating costs occurred over time, building upon conclusions shown in Chapter VI.
Chapter VIII	The impact of adding financing costs to direct capital costs.
Chapter IX	A discussion of economies of scale in the planning and construction of capital facilities.
Chapter X	A discussion of relative efficiencies and economic costs resulting from alternative means of installing facilities.

Much of the current research presented in this volume was based upon extensive interviewing and analysis in a number of case study communities. The selection criteria for those communities are documented in Chapter III and the findings from case investigations are used throughout the report. The particular findings from individual communities are included in a technical appendix to this report. The case study summaries provide supporting information for many of the assumptions, findings, and conclusions used in this volume.

CHAPTER II

SUMMARY - THE COSTS OF SPRAWL: CASE STUDIES AND FURTHER RESEARCH

A. BASIC PURPOSE OF THE EXTENDED RESEARCH

Since its publication in April, 1974, The Costs of Sprawl study has created considerable interest on the part of both local officials and private developers. For the first time, a comprehensive study of the cost effects of alternative development forms -- fiscal, environmental, personal -- was available to help guide development decision making. Much of the study's emphasis was on quantitative cost comparisons and the means of deriving these estimates. We soon realized that certain study elements could benefit from analyzing the experience of actual communities. The value of The Costs of Sprawl would be enhanced by looking at how different types of communities are actually paying for development-related costs, and how public expenditures are timed to meet the needs of growing suburbs. Thus, we studied five actual communities with varying development patterns to shed further light on these issues. Also, the original Costs of Sprawl study did not include interest charges in its estimates of capital costs. Because most public capital improvements are financed over long periods of time, interest costs often exceed direct capital outlay for facility construction. Thus, the differences in capital costs among alternative development patterns that were a major conclusion of The Costs of Sprawl are magnified with the addition of interest costs.

While The Costs of Sprawl addressed the variation in development related costs attributable to different housing types, their ultimate effect on a household's shelter outlay was not calculated. It is this "bottom line" that is of greatest importance to the housing consumer choosing among alternative unit styles and sizes. An estimation of the shelter costs associated with alternative housing types is therefore an important part of this volume.

The Costs of Sprawl included a brief, non-quantitative sensitivity analysis considering how scale economies (or diseconomies) resulting from city size could affect our cost estimates. That discussion is expanded in this volume to cover factors other than city size that influence the unit costs of providing public facilities. Because The Costs of Sprawl dealt with prototype communities that assumed no pre-existing services, we did not

consider the need to replace or duplicate facilities that were no longer adequate for a rapidly growing suburb. Based on case studies and secondary research, the likelihood of such seeming inefficiencies occurring under alternative development patterns is considered in this follow-up study.

B. FURTHER DEFINITION OF A "PLANNED COMMUNITY"

Perhaps one of the most important contributions of this study is in furthering the definition of "what is a 'planned' community." In The Costs of Sprawl, we distinguished between "planned" and "sprawl" community prototypes on the basis of their physical land use patterns. "Sprawl" prototypes were characterized by a proliferation of "leapfrog" subdivisions and apartment projects with large tracts of vacant land interspersed among them. "Planned" developments were constructed in a more orderly, contiguous manner so that there was no need to extend costly infrastructure across vacant areas.

In moving from prototypes to actual case study communities, this definition proved inadequate. "Planning" has procedural elements as well as end state results. Some of the attributes of "planned communities" result from activities of developers -- the number, size, staging, and location of projects. However, "planned development" can also result from the guidance and regulatory powers exercised by local governments, and the manner in which services and facilities are provided -- in anticipation of, along with, or lagged behind growth-induced demand. Most importantly, no communities are perfectly planned or totally uncontrolled sprawl. Rather, communities can be ranked on a continuum which considers three major elements that determine the degree of planning. These are:

1. Planning process elements - the community's planning program, use of professional staff, regulatory ordinances and implementation tools, and project review processes.

2. Development progress elements - reserving land for needed public improvements, providing needed facilities with adequate capacities when needed.

3. Development pattern elements - quality of site design and land use interrelationships, conformance of facilities and services with commonly accepted standards, preservation of important environmental areas, prohibiting or limiting growth in unsuitable locations.

We found substantial differences among our case study communities in the above cited planning indicators. But over time, these distinctions tend to blur. Two case study communities commonly referred to as "planned new towns" had relatively small populations and were still facing considerable future growth. This was true of one of the "conventional" communities as well. However, a second "conventional" community now reaching maturity exhibited many of the positive attributes of the "new towns," although it experienced growth-related problems in the past. Established modes of service delivery may be transferred from community to community regardless of the physical pattern of development or the size of individual residential projects. These latter factors may affect the absolute cost of public improvements more than the manner in which they are provided. Likewise, the financial status of the community and the attitudes of its political leaders can also influence the "outcome" of long range community growth.

C. SHARING OF DEVELOPMENT-RELATED COSTS BETWEEN GOVERNMENT AND THE PRIVATE SECTOR

The major share of development-related capital costs is borne by the private sector in all communities, if only because the per unit cost of constructing individual dwelling units greatly exceeds the cost of providing roads, utilities, parks, and public buildings. Nevertheless, there are significant differences among communities as to the share of nominally "public" improvements paid by developers and builders. While secondary sources indicate that virtually all communities require developers to install on-site roads and utilities, here the unanimity stops. In some growing suburbs, cost conscious governments are requiring land (or fees in lieu) for parks or schools, or asking developers to pay for extension of interceptor sewers and needed improvements to access roads. In "planned new communities" being created by a single developer, those developers are also building the first schools, providing recreation improvements, donating space for libraries, selling land to government bodies at cost, and contributing to the cost of other on-going services and facilities, at least temporarily. In some instances, these contributions are being required by local governments as part of a negotiation process needed to obtain project approvals. In other situations, they are being provided as part of an amenity package designed to attract potential residents. Developers in both the planned new communities and the more conventional suburbs provided incentives for early facility construction by donating the land required for public improvements although this practice was more common in the "planned" case studies.

The Costs of Sprawl: Case Studies and Further Research

1. Capital Costs

With respect to capital costs, the planned communities studied showed a lower incidence of cost to government than conventional development, due to the following contributions:

- Donation of sites for fire and police stations, libraries, recreation, open space, and government buildings.
- Provision of recreation and open space facilities.
- Sale of land at developers' cost or below market prices to governmental bodies.
- Construction of facilities for public use, either as a donation or under deferred purchase or below-market rental agreements.
- Payment for necessary extensions of existing major roads or utility interceptors or mains; construction of some improvements to existing roads.

Applying our case study findings to the estimates of direct capital costs for six prototypical communities taken from The Costs of Sprawl: Detailed Cost Analysis, we arrived at the following:

TABLE 1.

INCIDENCE OF COST: GOVERNMENT/PRIVATE-CAPITAL COSTS

Prototype	Government Share (millions)	Percent of Total Cost, Including Residential	Percent of Total Cost, Excluding Residential
I-Planned Mix	$ 79.1	19%	47%
II-Combination Mix	100.8	23%	56%
III-Sprawl Mix	110.8	25%	59%
IV-Low Density Planned	79.0	14%	39%
V-Low Density Sprawl	117.6	19%	51%
VI-High Density Planned	79.8	24%	54%

Source: Real Estate Research Corporation

This represents a slightly larger share of total costs borned by government than previously predicted in the aforementioned study. Note that, regardless of density, the cost to government in all three "planned" prototypes (I, IV, VI) was about $79 million, while in "sprawl" communities it ranged from $110-117. The dollar cost to government in the high density planned community would be one third less than in low density sprawl.

By far the largest capital cost item borne by the private sector is housing construction. When housing costs are excluded, the share of costs allocated to government in the planned prototypes is 12 percent less than in conventional communities with the same overall density. While the results indicate that a larger proportion of costs are borne by government with higher density, this is due to the fact that many public facility costs are not density-sensitive (i.e., schools, libraries, police stations). On the other hand, privately borne costs for on-site roads and utilities decrease with increasing densities.

2. Operating and Maintenance Costs

Private contributions to operating and maintenance expenditures that result from new residential development were not found to be as extensive as for capital outlay. In all of the case study communities, on-site open space, recreation facilities, streets, and utility pipelines that were not publicly dedicated but rather turned over to private homeowners' associations, held by owners of rental units, or otherwise retained privately were maintained by these private entities. These arrangements tended to occur more frequently in the planned new communities than in the conventionally developed suburbs we studied.

The planned communities also showed other, more unique contributions to the cost of on-going operations. Developers have maintained roads and utility lines where government resources were inadequate. In one case, the developer also agreed to maintain various public buildings and publicly owned open space. Such arrangements are generally short term; once the community has grown to the point where adequate staff can be hired and equipment purchased, these contributions will cease. Thus, developer contributions on the operating cost side were less than we had previously predicted in The Costs of Sprawl. When applying our findings to the six prototype communities' estimated total operating costs, we arrived at the following:

TABLE 2.

INCIDENCE OF COST: GOVERNMENT/PRIVATE-OPERATING AND MAINTENANCE COSTS

Prototype	Government Share, Year 10 (millions)	Percent of Total Cost, Year 10
I-Planned Mix	$13.9	62%
II-Combination Mix	14.1	63%
III-Sprawl Mix	14.4	64%
IV-Low Density Planned	14.0	59%
V-Low Density Sprawl	14.8	61%
VI-High Density Planned	13.9	65%

Source: Real Estate Research Corporation

"Low density planned" development shows the lowest percentage share of costs paid by government bodies; "high density planned" has the largest government share. That is because cost items that decrease with density (road and utility line maintenance) account for a small proportion of total operating costs, while other items (education, police and fire protection, libraries) either increase or do not vary with density. As noted in the table, the range of dollar costs paid by government is quite small -- less than one million dollars separate the least costly and most expensive alternatives.

D. PHASING OF COSTS

As mentioned previously, a conventionally developed suburb at maturity may closely resemble a planned new community. But we found significant differences in how public facilities and services are provided during the interim growth period. In the planned new communities, we found that facilities such as fire and police stations, libraries, and government buildings would be constructed earlier than in conventional communities. On the operating cost side, we found that certain services were likely to be available earlier in the planned prototypes, resulting in higher costs per capita at a given population size. In none of the case study communities -- planned or conventional -- were all facilities or services provided optimally. Schools were overcrowded at various times in all the communities studied, because school districts covered large areas with many

growth centers needing new facilities. However, the overall picture again tends to favor the well planned communities, which were less likely to experience problems of inadequate facility capacity. Yet none of the communities studied would oversize their facilities at any one point in time. Improvements tended to be sized so as to avoid excessive carrying costs for underutilized capacities. In conventional suburbs (where many developers are planning separate projects) the uncertainty of future growth levels results in a natural and understandable hesitancy on the part of local officials to put in improvements in anticipation of growth.

The most significant factor affecting facility construction timing may well be developer contributions. If developers provide more of the needed improvements themselves, such services are available early to attract buyers and renters. Moreover, donation of land or providing low cost loans acts as an incentive for early government action. Conventional suburbs that do not receive such contributions tend to be constrained by inadequate fiscal resources and restricted bonding capacities that do not grow as fast as the demand for urban services, or by the reluctance of older residents to approve new facilities for growth areas.

Differences in the timing of public facilities among the alternatives are greatest for schools and public facilities (police, fire, library, general government). "Sprawl" suburbs tend to "catch up" with their planned counterparts later in the development period so that total expenditures at the end of the development period (in constant dollars) are quite similar. For roads and utilities, a different pattern appears. These infrastructure items must be provided to all units as they are built -- the timing will be the same regardless of development pattern (given the same unit absorbtion schedules), but the incidence of cost to government will be lower in planned communities. Where growth requires additions to existing treatment plants, extension of trunk lines, or arterial improvements, the greater certainty of the location of new construction in planned communities would encourage earlier public action. The timing of facility construction in turn affects the provision of on-going services and their costs. In applying our findings and conclusions to total government capital costs (see Table 1) we see the following pattern:

TABLE 3.

GOVERNMENT CAPITAL COSTS: CUMULATIVE, YEAR-BY-YEAR [1/]
(in millions)

Prototype	Development Year 0	1	2	3	4	5	6	7	8	9	10
I-Planned Mix	$4.0	$13.1	$17.2	$23.4	$28.2	$44.0	$49.0	$54.0	$60.1	$63.8	$79.1
II-Combination Mix	4.1	18.8	22.5	30.3	37.6	56.1	61.7	70.9	78.6	83.6	100.8
III-Sprawl Mix	4.2	21.2	21.2	30.2	39.1	60.6	66.2	78.3	86.9	92.3	110.8
IV-Low Density Planned	4.0	12.0	16.1	22.4	27.3	43.3	48.3	53.3	59.7	63.4	79.0
V-Low Density Sprawl	4.2	25.1	25.3	33.7	46.2	67.0	72.7	86.1	94.4	99.5	117.6
VI-High Density Planned	4.0	14.3	18.5	24.6	29.4	45.0	50.0	55.0	60.9	64.6	79.8

[1/] In 1974 dollars

Source: Real Estate Research Corporation

Table 4 indicates the results of applying our findings regarding annual government expenditures for on-going operating and maintenance costs during the ten year development period. Cost differences year-by-year are most pronounced for municipal services (recreation, police, fire, general government, library, road maintenance) where construction of facilities earlier in the development period, and other resulting staff and maintenance demands cause higher expenditures in the "planned" prototypes prior to year 6. By year 10, however, operating costs are lower in the planned prototypes than in conventional prototypes of the same density.

TABLE 4.

GOVERNMENT OPERATING AND MAINTENANCE COSTS YEAR-BY-YEAR[1/]
(in millions)

Prototype	Development Year 1	2	3	4	5	6	7	8	9	10
I-Planned Mix	$1.3	$2.7	$4.0	$5.6	$7.0	$8.3	$9.8	$11.1	$12.5	$13.9
II-Combination Mix	1.3	2.6	4.0	5.5	7.0	8.4	9.8	11.3	12.8	14.1
III-Sprawl Mix	1.3	2.6	4.1	5.5	7.0	8.4	9.9	11.4	12.9	14.4
IV-Low Density Planned	1.3	2.7	4.1	5.6	7.0	8.4	9.9	11.2	12.6	14.0
V-Low Density Sprawl	1.4	2.7	4.1	5.6	7.1	8.6	10.1	11.7	13.2	14.8
VI-High Density Planned	1.3	2.7	4.1	5.6	7.0	8.4	9.8	11.1	12.5	13.9

[1/] In 1974 dollars

Source: Real Estate Research Corporation

E. FINANCING OF CAPITAL IMPROVEMENTS

We investigated the means of financing public capital improvements in the five case study communities to see if any variation based on the physical pattern of development could be ascertained. We found that in four of five case study communities, general obligation bonds were used to finance the construction of most major public buildings, parks, and drainage improvements. Equipment was purchased with current funds or short term notes. Some major recreation facilities, as well as sewer and water system improvements, were financed with revenue bonds to be retired with user fee proceeds. In all of the communities studied, responsibility for major road construction or improvement rested with higher authorities. Limited local contributions were largely for paving, lighting, sidewalks or intersection improvements, and were financed with general obligation bonds, current funds, motor fuel tax rebates, or special assessments. Bond issues for major facilities carried terms of 20-30 years, while short term notes had terms of 10 years or less. Park bond issues had shorter durations than most others -- only 10 to 20 years. Interest rates were closely tied to prevailing market conditions and community ratings with revenue bonds bringing higher yields than general obligation bonds. Overall, we did not find any variation in financial practice due to development pattern. The utility of this finding is limited by the fact that one of the

planned new communities studied had yet to issue any bonds, while the second was part of an urban county with many growth centers. Thus, the financial practices of the county could not be correlated with any attributes of the new community itself.

After determining the proportion of estimated government capital costs that would be financed with local debt, we applied typical terms and interest rates which resulted in the following conclusions.

TABLE 5.

CAPITAL COSTS BORNE BY UNITS OF LOCAL GOVERNMENT, INCLUDING INTEREST CHARGES [1/]

(in millions)

Prototype	Municipal[2/]	Schools[3/]	Utilities[4/]	Totals
I-Planned Mix	$16.3	$115.9	$5.7	$137.9
II-Combination Mix	33.3	116.6	14.1	164.0
III-Sprawl Mix	40.0	116.9	17.8	174.7
IV-Low Density Planned	16.0	115.9	5.8	137.8
V-Low Density Sprawl	41.9	116.5	26.1	184.5
VI-High Density Planned	16.7	116.3	5.8	138.7

[1/] Includes only those costs financed with local bonded debt.

[2/] Includes land and facilities for open space, recreation, police, fire, library, general government, roads and storm drainage.

[3/] Includes land and facilities for elementary and secondary schools.

[4/] Includes land and structures for water and sewage treatment plants and pipelines.

Source: Real Estate Research Corporation

All three planned communities are estimated to pay $138-139 million in principal and interest for locally financed capital improvements. They save anywhere from 21-25 percent over conventional communities of the same density. A similar savings of 25 percent occurs when the high density planned prototype is compared with the low density sprawl suburb. The "combination" prototype, partly conventionally developed and partly PUD, saves an estimated six percent over the "sprawl" community of the same density. Thus, the earlier findings of The Costs of Sprawl -- that significant capital cost savings can be attributed to planning -- are even further magnified when finance charges are also included.

F. COSTS TO THE CONSUMER - THE SHELTER BUDGET

This volume also includes consideration of the effect of housing type (and therefore density) on annual shelter outlays. Such expenditures include mortgage amortization, which is determined by the sales price of the unit, the down payment, the interest rate, and length (term) of the mortgage. Other factors are property taxes, utilities, furnishings, homeowners' association dues, maintenance, and homeowners' insurance. In our analysis of annual shelter outlays attributable to the five different housing types outlined in The Costs of Sprawl, we assumed that all units were owner-occupied to assure comparability. Results were as follows:

TABLE 6. ANNUAL SHELTER COSTS

Housing Type	Shelter Costs Per Year (in thousands)
Single Family Conventional (1,600 square feet)	$7.5
Single Family Clustered (1,600 square feet)	7.4
Townhouse (1,200 square feet)	4.7
Walk Up Apartment (1,000 square feet)	3.8
High Rise Apartment (900 square feet)	4.6

Source: Real Estate Research Corporation

The table illustrates the high cost of living in new single family housing presently available in suburban communities of most metropolitan areas. Although the single family prototype has 60 percent more floor space than the walk up unit, it does so at about twice the cost. With a constant floor area of 1,200 square feet for all five

housing types, annual shelter outlays would be highest for the high rise unit (about $6,000 per year, compared to $5,800 for a conventional single family home, $4,700 for the townhouse, and $4,500 for the walk up). The high cost of living in a high rise unit of that size is due to high unit construction costs for mechanical systems and the cost of maintenance services provided by owners' associations. A high proportion of this latter cost does not occur in single family homes or townhouses, where much of the maintenance in a new unit is "do-it-yourself."

G. ECONOMIES OF SCALE

Planners, government officials, and economic analysts have demonstrated considerable interest in the variations in cost/size relationships for public facilities and services. This interest stems from the notion that public services can be provided in some manner that minimizes costs, and that such efficiency and least cost may be found with larger size facilities, larger scale projects, or increased service populations. The available information in this area is sketchy, however, with much more attention being devoted to ongoing delivery of public services than the construction of public facilities. In some areas, there are relatively good data on economies of scale, but for the most part the question of potential economies in the public sector is complicated and clear cost-size relationship have not been derived.

The focus of this research effort was principally on the construction of capital facilities, rather than the provision of public services. This focus was adopted because of the lack of information in the capital facilities area. Thus, we focused on determining the cost/size relationships for a number of public facilities -- schools, sewer and water treatment plants, and sewer and water distribution networks. These particular facilities were selected for analysis because they constitute a major portion of capital improvements budgets; presumably the findings for these facilities might be roughly extrapoplated to other types of facilities as well.

The major findings was that although economies of scale can be demonstrated for capital facilities, there are a number of factors that may preclude the use of potential economies in facilities planning. Some of these factors are described below:

- Capital facilities are built incrementally. However, it is unrealistic to undertake a constant program of construction that would result in adequately sized facilities as population increases occur. Rather, a series of projects may be built, so that facilities are delivered in phases on a somewhat infrequent and perhaps erratic schedule.

- It is very difficult to measure economies of scale in the public sector, both for capital facilities and services. Economies of scale assume that the same product or output is produced, at a less expensive per unit cost, as scale increases. With the public sector, the outputs (services or facilities) are not fixed, but may vary widely in quality or scope. If costs increase or decrease with size, it is difficult to attribute those changes to economies of scale if different levels of or types of facilities are being delivered. For example, although costs on a per square foot basis or a per pupil basis are less for larger high schools -- as has been demonstrated -- it cannot be said that those economies are due to scale exclusively; the smaller high school may have more physical amenities as well as a broader curriculum. The outputs (in terms of educational facilities or services) are not comparable in this case.

- The availability or lack of governmental funding for capital goods and public service provision will distort the "economical" and "efficient" scheduling of facility construction or service delivery. If money is available from state or Federal sources, local governments will find some means of utilizing it at whatever "scale" these funds will support. In the more prevalent case, where there are never enough funds for the needs of a community, spending priorities do not always reflect the maximization of scale economies. Many local governments cannot propose the larger bond issues necessary to achieve economies of scale and still attain voter approval.

- A final example of factors that preclude the use of potential economies of scale lies in diverse community preferences and attitudes. Because of varying tastes and perceptions, different levels of service or types of facilities are required by communities. In many communities, larger facilities are not necessarily favored by residents. For example, residents of low density suburbs may prefer smaller schools within walking distance rather than larger facilities that would necessitate busing or private auto use. Therefore potential economies may not even get considered in planning.

In spite of these factors, economies of scale were found for the capital facilities investigated -- so that per unit costs declined with scale of population, project size, or numbers of dwelling units. Such economies were attributed to the following factors:

- Bulk purchasing of materials and supplies.
- Economies in mobilizing and managing larger projects.
- Economies in engineering and architectural fees.
- Spreading certain fixed costs (required regardless of size) over a larger number of units. For instance, a sewage treatment plant requires laboratory facilities, administrative offices, and other features regardless of size; these costs are fixed, so that as plant capacity increases they are a smaller proportion of total costs; costs per unit of capacity are reduced.
- Economies in distribution networks, due to the geometry of pipelines. If pipe sizes are doubled in diameter, the resulting cost increase is not as great per unit as the increase gained in volume. The scale economies resulting from purchase of larger pipes is somewhat offset, however, by higher costs of installation and changes in the flow characteristics of the pipe.

It might be argued that in planned communities there is a greater potential for accurately projecting future population levels, locations, and densities of land use. With this better information, facilities and services may be planned to take advantage of economies of scale. In fact, however, public facilities and services planning is distorted by many of the factors cited above; maximizing potential scale economies may not be the key determinant in "planned" communities, despite greater certainty regarding ultimate needs.

The future requirements of a planned community can be estimated and needs determined, so that decision for regional water and sewage treatment plants, school systems, transportation networks, and other facilities can be made on a more rational basis; part of that rational basis involves the utilization of economies of scale.

H. ECONOMIES OF INCREMENTAL DEVELOPMENT

A common premise regarding the benefits of community planning is that it will minimize unnecessary replacement and duplication of public facilities as a community matures. Better planning implies more certainly in predicting potential growth, and would therefore result in more cost efficient, design and staging of public improvements. Conventionally developed suburbs, on the other hand, would be more likely to either under or overestimate their needs. The economic cost of facility replacement and duplication is considerable when useful operating life still remains in an obsolete facility, or when existing facilities are not used to maximum efficiency.

Four means of constructing public facilities in a growing community can be identified:

1. Initial construction sized for not only present but projected future demands.

2. Incremental construction, so that additions are built as demand increases.

3. Construction of a facility adequate to serve the present population, to be replaced in the future with larger units as needed.

4. Construction of a facility adequate to serve the present population, with future demand served by parallel or duplicate facilities.

In looking at the five case study communities, a number of examples of replacement were apparent regardless of development pattern -- e.g., two lane rural arterials were widened to handle urban traffic flows. New roads and utilities in planned communities tended to be sized to handle future, as well as initial flows when first built. In conventional suburbs, we found instances of undersizing that later necessitated construction of new pipelines or wider roads. In most instances, however, facility replacement occurs because of physical deterioration or technical obsolescence rather than poor planning. The most common cause of facility duplication is the proliferation of small government jurisdictions, each with minimum size structures providing essentially identical services, when less floor space would suffice to serve the area.

The dollar magnitude of inefficiencies resulting from replacement or duplication of facilities depends on (1) the selection of an appropriate discount rate (to show the present value of future expenditures), (2) determination of the useful life of the improvement and, (3) whether or not inflationary effects are considered. Table 7 summarizes conclusions which can be achieved under different scenarios depicting the provision of a high school and a segment of a sewer pipeline:

Table 7. EFFECT OF REPLACEMENT AND DUPLICATION ON FACILITY COSTS

A. High School

Assumes construction of a high school which would serve 1,500 pupils within five years.

Alternative 1 - Construct school to serve 1,500 pupils in Year 1 (no additions). Cost = $8.6 million

Alternative 2 - Build to accommodate 900 pupils in Year 1; construct an addition serving 600 pupils in Year 5. 1/ Cost = $7.6 million (constant dollars); $8.7 million (inflated dollars)

B. Sewer Line

Assumes that 5,000 feet of 18" pipeline would hold adequate capacity to serve a developed area in its 10th year of growth.

Alternative 1 - 5,000 feet of 18" pipeline is installed in the first year (no additions, replacement, or duplication) 2/ Cost = $151.0 thousand

Alternative 2 - 3,000 feet of 18" pipeline are installed in Year 1; 2,000 feet (18") are added in Year 10. 3/ Cost = $117.1 thousand (constant dollars); $146.7 thousand (inflated dollars)

Alternative 3 - 5,000 feet of 10" pipeline is installed in Year 1; it is replaced by 5,000 feet of 18" pipe in Year 10. 4/ Cost = $160.2 thousand (constant dollars); $234.4 thousand (inflated dollars)

Alternative 4 - 5,000 feet of 14" pipeline is installed in Year 1; a parallel 14" pipe is installed in Year 10 (two 14" pipes equal one 18" pipe in capacity). 5/ Cost = $171.2 thousand (constant dollars); $238.2 thousand (inflated dollars)

Source: Real Estate Research Corporation.

NOTES:

1/ Per pupil cost in Year 1 is $5,720; with inflation at 7.8% per annum it rises to $8,327 in Year 5. The discount rate (over a five-year period) equals the rate of interest on school district general obligations (7%) used in Chapter VIII of this report.

2/ Initial cost per linear foot of 18" pipe = $30.20.

3/ By Year 10, 18" pipe costs $64.00 per linear foot if a 7.8% annual inflation is assumed. The discount rate equals the rate of interest on utility revenue bonds (8.5%) as used in Chapter VIII. For cost calculation methodology, see Chapter X.

4/ Initial cost of 10" pipe is $18.80 per foot. Discount and inflation rates same as in Note 3. See Chapter X for cost calculation methodology.

5/ Initial cost per foot of 14" pipeline = $23.80. Inflated cost = $54.35. Discount and inflation rates same as in Note 3. See Chapter X for cost calculation methodology.

In constant dollars, it appears to be less costly to build a smaller school at the outset and then construct an addition when needed. On the other hand, building initially to ultimate capacity is less costly if inflation is considered. For sewers, laying 3,000 feet of pipe initially and 2,000 feet in year ten is the least costly alternative in both constant and inflated dollars. It is interesting to note that replacing a 10" pipe with an 18" pipe in the 10th year is less costly in constant dollars than initial construction of an "18" pipe. Duplication is the most expensive alternative, regardless of whether or not inflationary effects are considered.

The most economical means of providing public facilities depends on the difference between the rate of inflation and the interest rate on municipal obligations. If the interest rate can be kept below the rate of inflation, it will be more economical to build in increments. Whether municipalities can take advantage of such economies will depend on other factors -- the likelihood of future technological change that would caution against larger projects, availability of bonding capacity, risk of disruption of on-going services with frequent building projects, and uncertainty regarding future needs.

CHAPTER III

APPROACH TO THE STUDY

A. BASIC PURPOSE OF THE EXTENDED RESEARCH

As stated in the introductory chapter in this volume, there are two main objectives of the research presented herein:

1. Further refinement of selected elements of research initially presented in The Costs of Sprawl, including the allocation of costs to public and private participants in the development process, their timing, and the manner in which they are ultimately borne by private housing consumers.

2. Addition of elements not previously analyzed with respect to alternative development patterns, such as the effect of financing costs and facility sizing practices on the total costs of capital improvements.

The elements listed above relate only to the analysis of economic cost differences among development patterns. No environmental or personal costs are the subject of investigation in the extended research effort.

B. BASIC APPROACH TO THE EXTENDED RESEARCH

1. Use of Case Study Approach. In order to verify assumptions made in The Costs of Sprawl regarding the incidence of costs and their timing, we decided to study actual communities in the United States to determine their recent experience in absorbing new development. Although cases were not selected on the basis of a scientifically designed sample, their choice was based on the following criteria:

   a. Communities chosen were to be located at the fringe of a major metropolitan area.

   b. They were to have experienced substantial new development within the last five years (although a number of the communities selected had older core areas which had been settled for many years).

   c. The communities were to represent some geographic dispersion across the U.S.

   d. Included in the case studies were to be at least two communities which are considered "planned" by commonly accepted definition -- that is, having a detailed development program for a significant tract of land under the control

of a single developer -- including one Title VII development. This definition is somewhat different from that used in the Costs of Sprawl relative to physical compactness (see Chapter I). However, we feel these definitions are complementary and help to broaden what we mean by "planning" in this report.

e. At least one community was to have undergone development of PUDs as well as conventional suburban subdivisions and apartment projects.

f. Whenever possible, two communities would be chosen from the same metropolitan area so as to facilitate comparison of alternative development patterns within a single regional setting.

g. Communities selected were to have a reasonably complete and documented data base which would be supplemented with secondary sources.

h. Residents would be primarily middle class -- no predominantly wealthy or poor communities would be chosen.

Utilizing the above criteria, an initial sample of five communities was chosen for analysis. A brief description of their location and characteristics is presented in Table 8. Further information can be obtained from examining the case study summaries in the Appendix to this report.

2. Investigation Process. Once case study communities were selected, government officials and developers in each of the communities were informed by letter of the nature of our assignment and our desire to obtain information from their communities, and a preliminary list of research questions. Site visits were then conducted during the spring and summer of 1974. We soon discovered that hard data was not available in a form that would facilitate easy determination of answers to our research questions. Most of the information gathered in the case study communities came from the comments provided by developers, planners, village managers, engineers, and school officials, both informally and in structured interviews. The type of questions asked in the interviews is described in the following chapters under the various research topics.

Interview information was supplemented with written sources such as comprehensive plans, financial reports, capital improvement programs, zoning and subdivision control ordinances, PUD ordinances, and plan commission hearing records. These sources provided additional background information as well as confirmation or negation of opinions and information provided in interviews. In all communities visited, developers as well as public officials were asked for their response to the research questions. Overall, individuals and organizations contacted during the course of the research cooperated fully and answered questions thoughtfully and honestly based on their knowledge and perceptions of practices occurring in the community.

Table 8. CASE STUDY COMMUNITIES

Arlington Heights, Illinois

1960 Population: 27,878
1970 Population: 64,884
1973 Population (estimate): 73,000

Location:	30 miles northwest of downtown Chicago
Housing Stock:	Predominantly single family, with some apartment and condominium construction in recent years
Growth Pattern:	Older area increased through successive annexations
Comment:	Mature community -- little vacant land remaining. Limited PUD activity.

Park Forest South, Illinois

1960 Population: 1,000 (estimate)
1970 Population: 4,900 (estimate)
Ultimate population envisioned: 50,000-75,000

Location:	30 miles south of downtown Chicago
Housing Stock:	Predominantly multi-family at present. Ultimate housing mix planned at 70% multi-family, 30% single-family.
Growth Pattern:	First neighborhoods growing around pre-existing small subdivision, with industrial and university acreage not contiguous to residential areas.
Comment:	At very early stage in development period. Site under control of single developer, New Community Enterprises. Title VII New Community.

Town of Amherst, New York

1960 Population: 56,521
1970 Population: 87,094
1973 Population (estimate): 100,000

Location:	13 miles northeast of downtown Buffalo
Housing Stock:	Predominantly single family, with limited apartment construction in recent years
Growth Pattern:	Proliferation of small subdivisions along existing rural roads
Comment:	Covers very large area; despite population size, only 50% developed. Site of large PUD already well underway, as well as New York State Urban Development Corporation's Audubon New Community, whose first units opened in the summer of 1974.

Reston, Virginia

1960 Population: 400 (estimate)
1970 Population: 7,083
1973 Population 20,700 (estimate)
Ultimate population envisioned: 75,000++

Location:	18 miles west of Washington, D. C.
Housing Stock:	Mixture of housing types, with approximate breakdown as follows: rental 40% (apartments and townhouses), owner-occupied 60% (2/3 of which are townhouses and 1/3 single-family homes)
Growth Pattern:	Development occurs in sequential manner, consisting of villages with residential and commercial components; each village is completed before the next one is begun. Limited light industry developed within designated area as demand dictates.

Table 8, continued.

Reston, Virginia, continued

Comment: Under control of single developer, Gulf-Reston Corporation; privately sponsored new community with over ten years of development experience; seemingly few obstacles to completion of the community according to overall comprehensive plans.

West Springfield, Virginia

1960 Population:	Unknown
1970 Population:	11,153
1973 Population:	22,300 (estimate)

Location: 13 miles southwest of Washington, D.C.

Housing Stock: Largely single family homes (estimated at 80% of housing supply), with increasing numbers of owner-occupied townhouses (estimated 10%) and rental multi-family units (estimated 10%) in recent years.

Growth Pattern: Development has occurred on a leapfrog basis, with subdivisions separated by vacant areas, some of which are later developed. Commercial development has occured along two main arteries, with a large shopping center under construction at edge of community.

Comment: A number of developers operate in the community; there is one large planned unit development, which was begun early in the current growth period. Vacant land scattered at the edge of the community, but the developed portion is becoming fairly mature.

Source: Real Estate Research Corporation.

3. Use of Case Study Findings. The overriding purpose of using case studies was to refine those assumptions made in The Costs of Sprawl regarding the incidence of cost to public and private entities, the timing of facility construction and the pattern of operating cost increases. The case studies were seen as illustrative examples from which conclusions could be drawn and then applied to the prototypes used earlier in The Costs of Sprawl. Moreover, the case studies were to shed light upon the effect of policies regarding the sizing of facilities and the extent to which diseconomies would occur to unnecessary duplication of facilities and repeated replacement of inadequately planned infrastructure.

The case study communities were not to be used to revise basic cost estimates for categories such as schools, roads, utilities and other facilities and services that were presented in The Costs of Sprawl. However, the effects of financing charges on the capital costs estimated previously were to be indicated. In addition, case study findings were to be used in determining whether any revisions were necessary to the percentage allocation of capital and operating costs to public and private participants, as well as the timing of expenditures for capital facilities and the increase in service costs resulting from residential construction activities.

Given the limited size of the sample, it is impossible to generalize to a "universe" of suburban development practices from the information provided in the case investigations. As was noted in The Costs of Sprawl, secondary source literature in this area of inquiry is extremely limited; no mass surveying has been undertaken regarding the allocation of development-induced costs among participants in the development process, nor have the differences in timing of public facilities in communities of different types been explicitly documented. Thus, findings from the case study communities as the sole basis for refining earlier assumptions or adding new elements to the earlier study are used with some reservation.

Another hesitancy which we encountered in applying the findings of our case study research to the percentage allocations and timing assumptions shown in The Costs of Sprawl relates to the characteristics of the case study communities themselves and how they apply to the "prototype" communities used as the basis for earlier cost estimation. The prototypes used in the earlier research effort represented specific housing mixes, densities, and land use patterns. The labels of "planned" and "sprawl" were attached to these communities, implying a set of extremes on the development spectrum. The prototype communities were not assumed to be influenced by any externalities, e.g., the need to extend sewer lines from outside the community, the existence of the community as part of a very large school district crossing community boundaries.

In moving to the "real world" of actual communities, many of the simplifying assumptions -- necessary and appropriate in an analysis of prototypes -- are no longer valid. It would be impossible to find actual communities with the housing mixes, gross and net densities, and land use patterns specified by the prototypes. Externalities due to the

multiplicity of jurisdictions operating and the lack of uniform boundaries among them are more the rule than the exception. Extremes of "planned" and "sprawl" do not exist in actual suburban fringe development. As will be discussed further in Chapter IV, communities illustrate a combination of traits and attributes which place them at points along a "planning spectrum," but not at the extremes of pure "planned" or "sprawl". While these labels may still be useful for purposes of the research described in this volume, it is useful to remember that in actuality no pure forms of these patterns exist. Application of findings from the limited sample of case study communities to the assumptions used in a study of prototypical constructs must, therefore, be undertaken with some care so as not to distort the validity of either approach to development pattern analysis.

Despite the drawbacks in the case study approach noted above, we feel that information gained from this investigation goes a long way toward precise quantification of the differences among alternative development patterns for those questions addressed in this extended research effort. "Real world" conditions regarding development practices, governmental policies, and other influencing factors have been applied to the earlier conclusions suggested by the analysis of prototypes, and appropriate modifications suggested. We found that in most cases the nature and direction of our judgments regarding the differences between planned and conventional development patterns were borne out by the case studies; only in the quantitative magnitude of differences were adjustments needed.

CHAPTER IV

EVALUATION OF COMMUNITY PLANNING

A. INTRODUCTION

In The Costs of Sprawl, six community prototypes representing various housing types and development patterns were devised and analyzed. The planned prototypes assume development in an orderly manner, making both efficient and effective use of capital and land. On the other hand, the conventional prototypes assume considerable bypassed lands and time lags in meeting needs for community facilities and services. Since the differences between sprawl and planned developments were explicitly built into the prototypes, no further attempt was made to define the nature and extent of community planning.

In the early course of the case study research it became increasingly clear that conventional wisdom as to the attributes of sprawl and planned communities was inadequate for purposes of this research. Accordingly, we have undertaken this attempt at operational definition.

B. DEFINING PLANNED COMMUNITIES

The dichotomy of planned and sprawl communities is convenient for theoretical purposes, but neither pure type is common in reality. Rather, apparently all communities are comprised of both planned and "sprawl" elements in varying degrees. That is, communities might appropriately be placed on a continuum representing the nature and extent of their planned-unplanned characteristics.

There are significant differences between planned and sprawl communities as to participants, processes and products. Planned communities usually have one major land developer who dominates the planning, implementation and marketing of the project. Conventional suburbs are created by many developers and builders.

The process of creating a planned community includes centralized decision-making, based on an explicit comprehensive plan and formal development programs. Implementation occurs systematically according to schedule and usually on a large scale. "Sprawl" communities, on the other hand, result from a process of disjointed incrementalism involving many separate and relatively uncoordinated decisions and actions. Often, specific projects tend to be smaller than in planned communities.

In theory, planned communities are efficient and effective at each stage of development as well as at maturity. Land uses are properly allocated both spatially and quantitatively. Facilities

and services meet high standards of design and performance. "Sprawl" communities are typified by leadfrogging (passed-over lands), other poor land use arrangements, and inadequate facilities and services.

It is noteworthy that the distinctions between community development patterns are not based on land uses, densities, price levels, or socio-economic characteristics. While suburban planned communities tend to have more of a housing mix, higher densities, and provisions for wider ranges of socio-economic types, these are not intrinsic elements of planned communities.

In summary, planned communities entail centralized decision-making, pursue specific goals and objectives and encompass a comprehensive plan and related development programs which are implemented accordingly by timely projects; the end result is efficient and effective land uses, facilities and services. Sprawl can, therefore, be defined as the absence of planning, and results in inefficient land use and service delivery.

C. COMMUNITY PLANNING: DETERMINANTS APPROACH

Two basic approaches to ascertaining the nature and extent of community planning have been explored as part of this study. The first approach was to identify the key determinants of planning and then trace the effects of these determinants through to their community results. While these factors are not indicative of the nature and extent of planning per se, they set the framework within which planning takes place, and describe constraints upon development such that planning may not be possible.

1. General Market and Governmental Factors: For conceptual purposes, the process of development is viewed as consisting of the following major elements:

   (a) Demand (Consumer Preferences): The demand side of the development process can be expressed as consumer preferences. Thus, individuals or households exercise preferences for housing type, public services, facilities, amenities, and even a quality of life or lifestyle; the aggregate effect of such demands determines much of the form and substance of development.

   (b) Demand (Economic Base): Local economic factors such as availability of job opportunities, types of positions available, prevailing wage and salary levels, commercial and industrial expansion potential will in turn affect the market for housing.

   (c) Prevailing Supply Factors: The supply side of the development process is directly affected by technology, money availability, cost of labor and materials, price of land, and developer capabilities.

(d) Environmental Constraints: At the present time, there is an increasing awareness of the impact of development on ecological systems -- so that what happens to water resources, air quality, vegetation and wildlife habitats, noise levels, and other factors becomes of crucial importance. Certain areas cannot support intensive development and remain ecologically undiminished. Therefore, the physical environment may serve as a constraint on whether development takes place at all, and if so, the nature of that development.

(e) Governmental Constraints: A fifth element which determines the type of development that takes place is governmental regulation. Even though consumer preferences and developer choices would dictate development of a particular type, governmental regulation may constrain activity which does not conform to overall development policies, does not support itself in economic terms, or causes a conflict between the preferences of current housing consumers and previous community residents.

These factors interact with one another in a variety of ways, and largely determine the nature and quality of development that takes place. Development patterns emerge as a consequence of such interactions.

2. Key Determinants. The determinants of community planning -- those factors which set the framework within which development decisions are made -- are outlined below, with each determinant's likely impact on planning:

(a) Age of Community. The degree of planning that is possible may vary directly with the age of the community and the amount of undeveloped land remaining. Older communities may better be able to undertake a wider range of planning activities because of greater funds available, a desire to retain or improve the character of the community as it has developed. However, as development takes place and as a community matures, there may be less opportunity for planning to have significant impact -- unless large amounts of passed-over land or undeveloped land adjacent to the community are available.

(b) Local Government Fiscal Capability. The degree of planning that may be possible in a community may be limited by financial constraints. Where government resources are scarce, extensive planning may be viewed as a "frill." Moreover, inadequate facilities may result not from poor planning per se, but rather from inadequate financial resources for implementation at the time when the facilities are needed.

(c) Extent of Governmental Fragmentation and Overlapping Jurisdictions. If a number of governments have responsibility for providing facilities and services for a given area, then the lack of cooperation or coordination among

governmental units will surely affect the efficiency of planning and implementation activities. If there is not a single governmental unit -- or at least some "clearing-house" function among units -- with some overall responsibility for setting goals and objectives, wasteful duplication of facilities and services may result.

(d) Land Ownership Pattern. The degree of planning will be influenced by the pattern of land ownership and by the number of owners. With a large number of small owners, it is difficult to achieve the degree of coordination and comprehensive planning that might be possible with one or more large owners.

(e) Size of Development Projects. The size of development projects has a clear and definite impact on the degree of planning that is possible. If a project is small, a developer cannot devote significant resources to research and design activities; resources for provision of amenities may be scarce. On the other hand, larger development projects -- which encompass vast land areas -- require greater effort, but afford more opportunity for planning on the part of both governmental bodies and developers.

(f) Number of Developers. As might be expected from the previous two points, the number of developers also can have a significant impact on the extent of planning that occurs. Where a single developer is involved in an area, a greater degree of integration and coordination is possible than with a larger number of developers, regardless of the size of projects or land ownership pattern.

(g) Developer Dedication of Facilities and Services. Another determinant of planning lies in the capability of developers to dedicate facilities or services that would otherwise be provided by the local government, and in the willingness of the local government to insist upon exactions. Many developers provide adequate public facilities not merely because local governments require them, but also because such facilities will be perceived by consumers as enhancing the quality of the development, thereby resulting in greater sales. Dedications can encourage the provision of facilities and services earlier than would otherwise occur.

(h) Citizen Involvement. Where citizens are closely involved and aware of ongoing governmental activities, as well as the potential impacts of proposed new developments, there is a greater sensitivity to planning. For example, the homeowners associations found in many communities have had a large impact on project review and decision making that take place in or affect that community.

D. COMMUNITY PLANNING: INDICATORS APPROACH

Planning indicators are those readily observable or ascertainable aspects of community development and management that can be used to rank suburbs on a continuum of planning. Table 9 shows the selected list of indicators. Note the three categories: planning process; development progress; and development pattern. The planning process elements are the basic research efforts and implementation techniques fostering community planning. The development progress elements are the performance measures of planning during the course of community development. Development pattern elements are the physical results or end-states attributable to the planning process and development progress elements.

In order to utilize the indicators approach in the actual evaluation of planning in the case study communities, rating criteria and a scoring system have been devised. A five-point scoring system is used whereby a score of 5 is excellent (very highly planned), 4 is good, 3 is fair, 2 is marginal, and 1 is poor. The higher the score, the more "planned" is the community; the lower the score, the more the community exhibits unplanned or sprawl characteristics. With 20 indicators and a maximum score of 5 for each, the total possible score is 100. A refined approach to this analysis would weigh each of the indicators based on its relative importance. This has not been done here for both simplicity of analysis and uncertainty as to appropriate weightings.

Specific criteria for each of the indicators are presented in Table 10, with the rating for each criteria. No specific criteria for the development pattern elements are outlined, but rather a statement of the judgments used to provide a qualitative assessment of community planning for those measures is presented. Since it was difficult to quantify these indicators, which were felt to be important measures of community planning, a subjective evaluation was made on a scale from 1 to 5 for each of these indicators.

E. COMPARISON OF INDICATORS OF COMMUNITY PLANNING

The rating of each case study community, according to the indicators of community planning, is presented in Table 11. In this analysis, the sub-totals for a group of indicators are perhaps as useful as the overall total, since the sub-totals allow comparisons that are submerged in the total.

TABLE 9. INDICATORS OF COMMUNITY PLANNING

Planning Process Elements

A. On-Going Planning Program and Use of Professional Planning Assistance
B. Status of Comprehensive Plan
C. Status of Zoning Ordinance
D. Status of Capital Improvements Program
E. Adherence to Comprehensive Plan and Development Regulations in Reviewing and Approving Specific Projects
F. Cooperative Planning Arrangements with Special Districts, Adjoining Communities, County and Regional Planning Agencies

Development Progress Elements

G. Plans for and Commitment of Lands for Open Space and Recreation
H. Acquisition of School Sites
I. Anticipation of School Enrollments
J. Pace of Road Improvements and Extensions
K. Extension of Water and Sewer Trunk Lines
L. Adequacy of Water and Sewer Plant Capacities
M. Conformance of New Developments with Comprehensive Plan and Availability of Public Facilities and Services
N. Adequacy of Tax Base, Fiscal and Bonding Capacity

Development Pattern Elements

O. Quality of Neighborhood and Community Design
P. Conformance to Accepted Standards for Open Space, Recreation, Schools, and Other Community Facilities
Q. Quality of Transportation Systems
R. Quality of Utility Systems
S. Preservation of Flood Plains and Other Important Environmental Areas; Preservation of Historical Features
T. Quality of Land Use Patterns

Source: Real Estate Research Corporation

Table 10. INDICATORS OF COMMUNITY PLANNING CRITERIA FOR EVALUATION

Indicator	Rating	Criteria
Planning Process Elements		
A. On-Going Planning Program and Use of Professional Planning Assistance	5	Full-time planning staff supplemented by consultants for special projects
	4	Planning consultant on long-term retainer basis with other consultants for special projects
	3	Frequent use of planning consultants
	2	Use of engineer or engineering consultant for planning assistance
	1	No professional planning assistance
B. Status of Comprehensive Plan	5	Prepared within past five years, includes full land use, transportation and facility elements as well as attendant statements of goals and policies and background studies
	4	Prepared within past five years, some elements missing
	3	Prepared longer than five years ago, revisions underway
	2	Prepared longer than five years ago, no revisions underway
	1	No comprehensive plan
C. Status of Zoning Ordinance	5	New ordinance within past five years, including PUD and other incentive provisions
	4	New ordinance within past ten years, same as above
	3	PUD provisions added to older ordinance
	2	Zoning ordinance with no PUD provisions
	1	No zoning ordinance
D. Status of Capital Improvements Program	5	Prepared for at least five years for all types of major capital expenditure, updated annually, closely related to comprehensive plan and annual budget
	4	Municipal improvements only, otherwise as above
	3	Not explicitly related to comprehensive plan, municipal improvements only
	2	Only for exceptional projects, otherwise like 3 above
	1	None separate from annual budget
E. Adherence to Comprehensive Plan and Development Regulations in Reviewing and Approving Specific Projects	5	Strict adherence to plan, policies, zoning regulations and other development codes and ordinances
	4	Regular compliance with plan, policies and regulations, but notable exceptions from time to time
	3	General use of plan and policies as guide to development decision-making, but several exceptions; rezoning and other exceptions occur often
	2	Occasional attention to plan, policies and ordinances, but exceptions are common
	1	Infrequent reference to and compliance with plan or policies in acting on proposed developments; frequent rezoning and zoning variations and special uses.

Table 10 INDICATORS OF COMMUNITY PLANNING CRITERIA FOR EVALUATION (continued)

Indicator	Rating	Criteria
Planning Process Elements (continued)		
F. Cooperative Planning Arrangements With Special Districts, Adjoining Communities, County and Regional Planning Agencies	5	Full complement of planning arrangements, well functioning coordination and cooperation
	4	Formal planning arrangements with most other governments, some shortcomings in coordination but good cooperation
	3	Cooperative arrangements with some other local governments, but problems are evident
	2	Limited informal arrangements only
	1	No such arrangements, frequent problems of coordination and cooperation
Development Progress Elements		
G. Plans for and Commitment of Lands for Open Space and Recreation	5	Substantial open space and recreation plan with commitments of land prior to development; well-funded implementation underway; developer site dedications nearly always required
	4	Substantial open space and recreation plan; funded implementation program; developer site dedications usually obtained
	3	Standard open space and recreation plan; some implementation including site dedications in some cases
	2	Nominal open space and recreation plan, as part of comprehensive plan; site dedications not obtained from developers
	1	No open space and recreation plan; site dedications not obtained from developers
H. Acquisition of School Sites	5	All high school and elementary school sites acquired in advance of development
	4	Most school sites acquired in advance
	3	Some school sites acquired in advance
	2	Only one or two sites acquired in advance
	1	No advanced site acquisition
I. Anticipation of School Enrollments	5	New schools built on permanent sites with no overcrowding or busing and limited school restricting required
	4	No overcrowding but some temporary busing and significant redistricting
	3	Some short-term overcrowding, substantial busing, significant redistricting
	2	Same as above only worse, use of temporary schools
	1	Substantial overcrowding, substantial busing, heavy reliance on older schools and temporary buildings

Table 10

INDICATORS OF COMMUNITY PLANNING
CRITERIA FOR EVALUATION
(continued)

Indicator	Rating	Criteria
Development Progress Elements (continued)		
J. Pace of Road Improvements and Extensions	5	Arterials, highways, and expressways built in anticipation of needs; no over-capacity sections nor rush-hour congestion
	4	Arterials, highways, and expressways built to keep pace with traffic volumes, but not in anticipation of needs
	3	Some arterials improved to adequate level as needed; shortcomings with some others
	2	Generally inadequate arterials, some exceptions
	1	Grossly inadequate road system year after year
K. Extension of Water and Sewer Trunk Lines	5	Trunk line extensions used as a positive force to guide and control the location, pace, intensity and quality of development in accord with the comprehensive plan and development policies; system designed to anticipate future volumes
	4	Extensions provided with some consideration of development policies; conforms to comprehensive plan; system designed to anticipate future volumes
	3	Timing of extensions based on demand without regard to development policies; specific design related to land use plan
	2	Trunk line extensions and sizing based on demand; not related to comprehensive plan or overall development policies
	1	Trunk line extensions and sizing based solely on short-run demand without regard for long-term impacts on development or needs
L. Adequacy of Water and Sewer Plant Capacities	5	Sewer and water capacities always meet demand, with planned surpluses and high quality treatment; capacities impose no limits on development
	4	Sewer and water capacities generally meet or exceed demand, only brief periods of slight deficiencies
	3	Some problems with meeting increasing demands, but capacities generally are adequate
	2	Water shortages at peak periods and sewage plant deficiencies in both quantity and quality of treatment -- both over one year and longer
	1	Grossly inadequate sewer and water capacities at several times and/or extended periods; capacities limit development, and health hazard posed to residents

Table 10 INDICATORS OF COMMUNITY PLANNING CRITERIA FOR EVALUATION (continued)

Indicator	Rating	Criteria
Development Progress Elements (continued)		
M. Conformance of New Developments with Comprehensive Plan and Availability of Public Facilities and Services	5	All development fully conforms to comprehensive plan and occurs on an orderly contiguous basis; supply of public facilities and services matches increase in demands
	4	Most new development occurs in accord with the comprehensive plan, on an orderly contiguous basis, with facilities and services generally adequate
	3	Some development occurs in an orderly contiguous manner, where the demand for facilities and services would warrant it; other development occurs on a leapfrog basis
	2	Some conformity to land use plan, but developments are approved upon request, resulting in leapfrogging and the need to extend facilities and services past undeveloped areas; periodic lack of availability for facilities and services
	1	Developments approved as requested without regard to plan; little consideration of the availability of facilities and services; largely non-contiguous development
N. Adequacy of Tax Base, Fiscal and Bonding Capacity	5	More than ample tax base for provision of all facilities and services; tax rate less than neighboring communities; less than one-half of bonding capacity committed
	4	Growth in tax base ample to meet growing demands for facilities and services; tax rate similar to neighboring communities; less than one-half of bonding capacity committed
	3	Tax base growth more or less adequate to provide full range of services; tax rate high, bonding capacity nearly all employed
	2	Just able to provide basic urban services using all financial resources and imposing a relatively high tax rate
	1	Lack of funds year after year to provide adequate facilities and services, consistently much higher tax rate than neighboring communities, full use of bonding capacity

Table 10 INDICATORS OF COMMUNITY PLANNING CRITERIA FOR EVALUATION (continued)

Indicator	Rating	Criteria
Development Pattern Elements		
O. Quality of Neighborhood and Community Design	1 to 5	This measure considers but is not limited to the following factors: street design and layout; location of community facilities, particularly schools; location and use of open space, particularly in relation to residences; use of natural features and topography.
P. Conformance to Accepted Standards for Open Space, Recreation, Schools, and Other Community Facilities	1 to 5	This measure is a qualitative assessment of the degree of conformance for all elements of the community with accepted national planning standards. Although there may be lack of conformity in some areas, the rating is based on an overall assessment, hence a quantitative measure was not derived.
Q. Quality of Transportation Systems	1 to 5	The rating in this instance is an assessment of the safety, accessibility, and overall contribution of the transportation system to enhancing the quality of the community.
R. Quality of Utility Systems	1 to 5	This rating is used in the same manner as the quality of the transportation systems, and measures in non-quantitative terms how the design and layout of such systems have affected community development.
S. Preservation of Flood Plains and Other Important Environmental Areas; Preservation of Historical Features	1 to 5	This measure is self-explanatory, giving an assessment as to how unique features have been utilized as part of community development.
T. Quality of Land Use Patterns	1 to 5	An assessment of the degree of harmonious and efficient patterns of land use would consider, but not be limited to, the following factors: presence of commercial strip development; location of particular land uses in relation to one another, particularly the location of industrial uses; and contiguous versus leapfrog development.

Source: Real Estate Research Corporation.

Table 11

INDICATORS OF COMMUNITY PLANNING
COMPARATIVE RATINGS, CASE STUDY COMMUNITIES

Indicator	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
1. Planning Process Elements					
A. On-Going Planning Program and Use of Professional Planning Assistance	5	5	5	5	5
B. Status of Comprehensive Plan	3	5	3	5	3
C. Status of Zoning Ordinance	5	5	2	4	4
D. Status of Capital Improvements Program	3	1	4	5	5
E. Adherence to Comprehensive Plan and Development Regulations in Reviewing and Approving Specific Projects	2	4	2	5	4
F. Cooperative Planning Arrangements with Special Districts, Adjoining Communities, County and Regional Planning Agencies	4	3	1	5	5
Sub-Total	22	23	17	29	26
2. Development Progress Elements					
G. Plans for and Commitment of Lands for Open Space and Recreation	4	5	2	5	3
H. Acquisition of School Sites	4	5	4	5	4
I. Anticipation of School Enrollments	4	2	3	3	3
J. Pace of Road Improvements and Extensions	3	5	2	3	2
K. Extension of Water and Sewer Trunk Lines	3	5	1	4	4
L. Adequacy of Water and Sewer Plant Capacities	4	5	1	4	4
M. Conformance of New Developments with Comprehensive Plan and Availability of Public Facilities and Services	3	5	2	4	3
N. Adequacy of Tax Base, Fiscal and Bonding Capacity	4	3	3	4	4
Sub-Total	29	35	18	32	27
3. Development Pattern Elements					
O. Quality of Neighborhood and Community Design	3	5	3	5	4
P. Conformance to Accepted Standards for Open Space, Recreation, Schools, and Other Community Facilities.	4	5	3	5	4
Q. Quality of Transportation Systems	3	5	2	3	3
R. Quality of Utility Systems	5	5	2	5	3
S. Preservation of Flood Plains and Other Important Environmental Areas; Preservation of Historical Features	4	5	2	5	5
T. Quality of Land Use Patterns	3	4	3	5	3
Sub-Total	22	29	15	28	22
Total	73	87	50	89	75

Source: Real Estate Research Corporation.

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With regard to the planning process elements (the basic tools and techniques used either by local governments or by planned community developers who provide planning services in the early years) there appear to be clear differences. The two Virginia communities (Reston and West Springfield) were rated high, largely as a consequence of the planning acumen of Fairfax County, which has been distinguished in recent years by its planning efforts. Arlington Heights, an almost fully developed community, has had years of experience in planning activities. The Town of Amherst was rated lower, largely because of its overlapping governmental jurisdictions and the resulting limits on coordination of planning activities. Park Forest South's ratings were lowered by the absence of a capital improvement program in this fledgling community.

There is considerable variation in the development progress elements, which represent the provision of facilities and services in a timely and efficient manner commensurate with the increased demands from growing populations. Such variations, however, tend to cancel one another out -- one community may be highly rated in one indicator, while low in others, with other communities showing an opposite score. The sub-totals for this group of indicators then show limited variation for several communities -- Arlington Heights, Park Forest South, and Reston and West Springfield. The Town of Amherst was rated lower, due to its apparent inability to provide infrastructure and treatment facilities at the pace and in the appropriate size required by rapid development.

In the third set of measures, the development pattern elements, which indicate the quality of the end-states or mature communities, the clearest distinction arises between the nominally "planned" communities and conventional developments. The ratings for Park Forest South and Reston are significantly higher than the other communities, and are uniformly high for all indicators in this group. Arlington Heights and West Springfield seem to form a second cluster, and exhibit a similar pattern for all indicators; the Town of Amherst was lower for most measures.

The same clustering is apparent in the total scores. Park Forest South and Reston emerge clearly as exhibiting a high degree of planning, while Arlington Heights -- perhaps due largely to its age and maturity -- and West Springfield -- perhaps due to the overall level of planning in Fairfax County, Virginia -- exhibit moderate degrees of planning. The Town of Amherst was rated the lowest due to its leapfrog pattern of development, and the lack of centralized planning and plan implementation (until most recently). The Town of Amherst may suffer by comparison due to a relatively recent period of rapid growth. As the community matures, its planning function should become more important and it should catch up with the demands for improved facilities and services. There is evidence of this in the fact that one large PUD is now underway, as well as a large planned new community within the Town. Amherst evidenced an increasing degree of planning sophistication in dealing with this proposed new community. This may be indicative of a change in local attitudes toward planning and development regulation which would lead to higher ratings in the future.

F. SUMMARY AND CONCLUSIONS

In summary, there are substantial differences among urbanizing communities in regard to the level, quality, and end-state products from planning, as well as the diverse impacts of determinants that may enhance or deter efforts at high quality community development. There are several additional points that must be made regarding the distinctions among planned and conventional development patterns.

Over a period of time, the differences between planned and "sprawl" development become blurred and any sharp contrast is diminished. The distinction between planned and "sprawl" communities at any given time are relative. But even where distinctions do exist, the extent of such differences tend to decline with time. Because of the ready and free transfer of information, a development concept or innovative technique that is applied in one instance which results in higher quality, less costly, or more efficient provision of facilities and services will be rapidly disseminated and applied in both planned and conventional development alike.

Because rational planning is certainly viewed as a positive goal, established planning principles may be applied in a variety of communities. For example, planning for sanitary sewer systems is a fairly well documented procedure, and is based upon established engineering principles. These aspects of rational planning may be found in all communities. The differences that emerge may then be the result of the presence and impact of key determinants, rather than substantial differences among patterns of development in themselves.

For purposes of this study, from the above evaluation it seems appropriate to use Reston and Park Forest South as planned community case studies. Arlington Heights and West Springfield are indicative of conventional communities with some significant planning activity and results. Of the five case studies, Amherst most closely qualifies as a typical "sprawl" suburb.

CHAPTER V

INCIDENCE OF COST -- GOVERNMENT/PRIVATE

A. INTRODUCTION

An overriding concern of every municipal government and every developer currently involved in suburban fringe developments is precisely the question of "Who bears the cost?" It is desirable to determine the proportion of the costs resulting from suburban fringe development that is borne by the public sector -- federal, state, and local governments -- and by the private sector -- developers and/or builders or other private bodies. In turn, this allocation affects the manner in which households eventually pay these costs -- the proportion of costs paid as part of the sales price of homes, in taxes or other revenues to public bodies, or as other economic costs. The purpose of this chapter is to determine a reasonable allocation of these costs among public and private participants in the development process; the following chapter will discuss the components of shelter costs paid by housing consumers.

The purpose of this analysis is to determine what differences exist between planned and conventional development in terms of contributions to service and facility costs from developers and local governments, what types of contributions occur, and what impact such differences in contribution have upon the total costs of development. In The Costs of Sprawl, we constructed a series of assumptions regarding the allocation of capital and operating costs among government bodies and private participants in the development process. The basic theory behind those assumptions was that planned development would result in a higher proportion of capital and operating costs borne by private parties (developers, builders, homeowners' associations) and a lower cost burden to government. The degree of variation by development pattern depended on the category of costs being analyzed. More variation was shown for capital than operating and maintenance costs; among capital expenditure items, open space, recreation, and infrastructure cost allocations were expected to be most heavily influenced by development pattern. This chapter will utilize findings from the case study communities to further refine these earlier estimates and the thesis which lies behind them.

B. KEY RESEARCH QUESTIONS

1. Critical Research Needs. The incidence of cost analysis revolves around such fundamental research questions as the following:

   a. What are the differences among communities (distinguished by development patterns) in terms of contributions by private developers of land, facilities, or services that are typically provided by local governments?

The types of private contributions which have been identified are:

- dedication of land
- payment of fees-in-lieu of land
- construction of facilities, as permanent contribution
- construction of facilities, with later reimbursement by public bodies.
- provision of equipment for use in government operations
- sale of land at less than current market prices
- leasing of space in privately owned structures to government agencies at less than market rent levels
- provision of low cost loans to local government at reduced interest rates
- provision of operation subsidies for public expenditures.

b. Who bears the costs of services or facilities for passed-over land in conventional (or, in some cases, planned) development?

c. How do differences in the types or amounts of private contributions affect the total costs to government of providing facilities and services?

d. For what expenditure items are these contributions likely to occur? What governmental units, or levels of government, are benefiting?

e. How does the extent of private contributions vary according to scale of project, or number of developers; that is, is a local government able to exact more in dedications or other donations if there is a larger scale development and/or smaller number of developers?

f. Within conventional suburbs, will construction of PUDs result in a higher proportion of developer contributions than in conventional subdivisions or apartment projects?

The above key questions were posed to developers and public officials in the case study communities. At the outset we discovered that, in most cases, no comprehensive inventory of the extent and value of developer contributions over time could be found. It was necessary to use project approval records, annexation agreements, and information from interviews to assess the cost burden to public and private parties. A number of secondary

questions arose from this process. Although resources allocated to this research did not allow detailed investigation of these points, they are mentioned here as possible questions for further exploration and analysis.

2. Secondary Issues

a. Process of Obtaining Exactions. This point relates to the effectiveness of the process by which developer contributions are obtained. Contributions are made under two sets of conditions -- the first is negotiation, in which the local municipality's desires are tested against the developer's willingness to contribute, resulting in some exactions occurring as a compromise between the two participants. On the other hand, requirements may be determined according to pre-set formulas, so that for certain types of developments, specified amounts of land or types of facilities must be dedicated -- such formulas may be simply calculated on a per capita or per acre basis, or in more complex form as a function of density. There are, of course, many combinations of these two approaches, but these are the basic arrangements. The first approach, negotiation, usually occurs under a variety of scenarios -- when a developer requests rezoning of his parcel or requests PUD approval from local authorities. In addition, negotiation can result from deliberately vague provisions in subdivision ordinances which require, for example, provision of some unspecified amount of land or fees-in-lieu of land for school and recreation purposes based on currently identified needs and the projected impact of the new development. Developers requesting subdivision approval then negotiate with the locality on the exact amount to be required. The second approach -- application of a formula -- will be used at the time when final plats are approved. It is beyond the scope of this research to determine which process is more effective or beneficial to local governments. Much depends on the degree of coordination among local jurisdictions, and the extent to which the process is handled on a uniform and equitable basis for all proposed projects.

It should also be noted that a number of private contributions (especially recreation facilities) occur not because they are required by ordinance or as part of an approval negotiation process, but because the developer determines that they are necessary to the successful marketing of his project. He may offer operating subsidies or other payments when he feels that provision or upgrading of a publicly provided service early in the development period is vital to his success in the most difficult initial years.

b. Role of Homeowners' Associations. A second point which became apparent in the process of identifying and quantifying cost allocations was the need to assess the contributions made by homeowners' associations. These associations are typically created by the developer to provide certain services and management functions; the role of the developer in running the association diminishes as units are sold and residents take over its operation. It is now an increasingly common practice in

planned communities, in planned unit developments, and even in conventional subdivision developments for the developer to set up these homeowners' associations for certain purposes that can supplant or substitute for local government services.

Quite often, the association will receive title to recreational amenities, community centers, parking lots, open space, and local circulation that the developer has provided for use by the residents. The problem posed to the researcher is determining the extent to which these privately provided facilities and services are substitutes for expenditures that would otherwise be made by government. Should these associations experience financial failure after development is completed, local government may be obliged to pick up the operation and maintenance cost burden; when these failures occur, the incidence of cost to public and private bodies is altered.

c. Value of Short-Term Contributions. Yet a third point is the need to determine an appropriate time frame for calculating the value of privately provided facilities or services. As stated previously, many contributions may be short term. For example, the cost of constructing an elementary school might initially be borne by the developer in the form of a loan to the government, with arrangements for a payback over a period of time. Such loans may or may not incur a financial charge to compensate the developer for the use of his money over the payback period; alternatively, the government could be charged a below market interest rate.

The economic value of such assistance has two sides -- savings in the cost of financing local government expenditures is one side; the advantage of deferring utilization of capital resources by spreading costs over a number of years is the other. If the local government has limited funds and/or if the rate of inflation is high (so that the future value of funds borrowed now is significantly lower), then such arrangements with developers are advantageous in an economic sense. Both the developer and local government benefit in that a facility is provided before it would otherwise be affordable, while early completion of such facilities enhances the marketability of the project. Therefore, the precise value of these short term contributions is difficult to estimate.

d. Definition of Beneficiary Groups. Where dedications of land, facilities or services benefit citizens outside of the developer's particular project as well as residents within the project, it is difficult to distinguish the economic cost ascribable to that project itself. A number of court rulings have questioned the right of local governments to require dedication of land for school and park sites in that the need for the land cannot always be uniquely attributable to the activities of one developer. Where facilities or services are required of the developer, only new homeowners or

residents are assumed to benefit, (there are no external beneficiaries); if facilities are provided by the government, however, such costs would be spread over all residents, both old and new. An example of this type of situation arises, for example, in the provision of the park site. If privately retained, that site will be used by the new residents in that area exclusively. On the other hand, if publicly held, the park will be used by both previous and new residents, although certainly new residents in the area will use the park more since it is more convenient to them.

C. METHODS AND ASSUMPTIONS

1. Analytical Procedure. The procedure that was followed through the course of the case study analysis is as follows:

- Land dedication practices and other private contributions that prevailed in the case study communities were assessed based on two approaches. The first was to attempt to quantify in detail the dollar amounts of specific contributions made by developers of new residential projects within a designated time frame as a percentage of total investment (public and private) in land, facilities, and services during that time period. The second approach was to learn, through interviews and review of documents, about those mandated and voluntary contributions which have occurred, the circumstances of their occurrence, and their effect on public service and facility needs - without precise quantification of their dollar value. The latter approach was selected; the former did not seem to yield any better information, but did present problems because of the lack of data or the inconsistency in presentation or estimation procedure. Although this approach does not appear on the surface to be very precise, we feel that it yielded an accurate picture of the nature and extent of developer contributions for various cost categories, which can form the basis of more precise conclusions regarding the overall allocation of development-related costs.

The findings from particular communities were analyzed to arrive at some set of common practices which would distinguish between community types or development patterns -- if such differences were found to exist. The findings were quantified and compared to previous assumptions used in The Costs of Sprawl; where changes in previous assumptions were necessitated, revised assumptions were made. The revised assumptions were then applied to the basic costs derived in The Costs of Sprawl, to show the differences in how costs are borne between the public and private sectors, and how such cost sharing varies by development pattern.

2. Key Assumptions. A number of assumptions were necessary in order to draw conclusions from case study findings.

a. Conclusions were based on the reality of development experience in the case study communities, not statutory requirements alone.

b. Facilities and services provided by the developer through homeowners' associations,

or as a marketing vehicle for rental projects, were assumed to act as substitutes for similar items which would otherwise be provided by governmental bodies. No assumptions were made regarding the possibility of failure of the associations; their maintenance responsibilities were assumed to continue through the development period. This largely pertains to recreation facilities and open space, but also covers maintenance of privately retained roads and parking areas.

c. Short term private contributions, such as deferred repayment on capital facility loans or below market rents on facilities leased by public bodies, were estimated to have less than a ten percent impact on the total costs (both capital and operating) and thus were excluded from consideration as marginal in terms of the scope of the research effort.

d. Because the costs estimated in The Costs of Sprawl are based on an assumption of no externalities or spillovers in benefits or costs, the incidence of cost shown represents the cost of servicing new development only. We recognize that, in reality, new development activity will have spillover effects in older areas, necessitating what will largely be governmental investment (for items such as road widenings); however, we have limited our analysis to a breakdown of those costs directly attributable to new residents and development activity.

D. FINDINGS AND CONCLUSIONS

The findings indicate significant variations among the communities studied as to the proportion of development-related costs which are paid by private parties (developers, builders and homeowners' or residents' associations). This is true for both capital and operating costs, but is more significant for the former than the latter. Moreover, the differences found among communities can largely be attributed to their development pattern. Findings are summarized in Tables 12 and 13.

1. Capital Costs. With respect to capital costs, the planned communities studied showed a lower incidence of cost to government than conventional development, due to the following contributions:

- Donation of sites for fire stations, police stations, government buildings, libraries, and public open space/recreation.
- Provision of privately retained recreation facilities and open space servicing all parts of the community.
- Sale of land to governmental bodies at developers' cost or at below-market prices.
- Construction of facilities for public use, either as a donation or under deferred purchase or below market rental agreement.

TABLE 12.

SUMMARY OF FINDINGS
CASE STUDY COMMUNITIES
INCIDENCE OF COST - CAPITAL COSTS

COST CATEGORY	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Government Regulation and Administration	No developer contributions to construction of Village Hall.	Developer built Village Hall; eventually Village will pay rent or purchase; site will be dedicated.	No developer contribution to construction of Town Hall.	Does not apply; unincorporated area without municipal building.	Does not apply; unincorporated area without municipal building.
Police	No developer contributions.	Police department occupies temporary building owned by developer; Village pays no rent. Future sites will be sold to Village at cost. Developer provided first police car.	No developer contributions.	Does not apply; no station located within the community.	No developer contributions.
Fire	No developer contributions.	Developer built fire station (part of Village Hall building); Village will eventually pay rent or purchase; site will be dedicated. Future sites to be sold to Village at cost. Developer also provided some equipment.	Some voluntary donation of sites for sub-stations; site donation likely to occur in Ransom Oaks PUD.	Site for station donated by developer; funds for construction loaned to County with repayment agreement.	No developer contributions.
Library	No developer contributions.	Library presently rents at nominal rate; building owned by developer. Temporary facility. Policy for future sites likely to be the same as for police and fire station sites.	No developer contributions up to the present; developers of Audubon and Ransom Oaks are likely to donate library sites. Ransom Oaks developer has offered to build library and lease it to the Town. Future action still unclear.	Developer built buildings occupied by the two libraries; rents space to the County system at a subsidized (below prevailing market) rate of $1 per square foot per year at one location and a subsidized rate of $4 per square foot at the other.	No developer contributions.
Parks and Recreation	Dedication of land or fees-in-lieu of land required by ordinance. No set formula; amount exacted according to needs identified in recreation plan. Some provision of private recreation facilities, largely for condominium projects.	Costs for all recreation and open space land and facilities thus far borne by the developer. Some sites donated to the Village; others retained by neighborhood associations or the developer. Expect that major open space areas will be purchased by the Village, while resident associations will receive tot lots, pathway systems, and neighborhood centers from the developer with repayment at a later date.	Dedication of land or fees-in-lieu required. Quality and quantity of donated land has been poor; fees inadequate to purchase good sites. Significant private recreation facilities in multi-family developments. Town does not accept dedication of parcels under 10 acres. Improvement in quantity and quality of dedications foreseen in Audubon and Ransom Oaks.	All parks, open space, and recreational facilities constructed by the developer, and donated to homeowners associations; no public dedications.	Some open space with few improvements dedicated to Fairfax County but most of it is Stream Valley parks located on flood plains with limited use for active recreation; some recreation facilities including clubhouses, pools, and tennis courts were provided and privately retained.
Schools					
Elementary and Junior High Schools	Land or fees-in-lieu of land required by ordinance; no set formula - tied to school facility plans.	One existing elementary school built by the developer, who is being reimbursed by the school district. Will continue to donate 10-acre sites for elementary schools. For junior high, donated part of the site and sold the remainder at cost. Future policy will be donation of elementary sites; sale of junior high school sites at cost.	No school contributions thus far; sites for elementary schools will be donated in Audubon; donated or sold at cost in Ransom Oaks. Developer of Ransom Oaks may build elementary school and lease it to district.	All elementary and junior high school sites donated. First elementary school constructed by developer and sold at cost to the County.	Elementary school sites donated by developers.
High Schools	No developer contributions.	Will sell land for high schools at developer's original cost.	No developer contributions thus far; land for high schools (if needed) would be donated in Audubon, donated or sold at cost in Ransom Oaks.	Land for one site sold at developer's original cost; another site sold at less than market price.	No developer contributions.
Streets and Roads					
Minor Streets and Interior Circulation	Required by ordinance to be provided by all developers; rights-of-way and improvements may be dedicated or retained privately (the latter practice is not encouraged by the Village).	Built by the developer; likely to be retained by neighborhood associations.	Provided by developers by ordinance; may be privately retained or dedicated to public authority.	Developer or homebuilders provide streets, which are turned over to cluster associations.	Developers provide streets; largely dedicated to the state; some privately retained.

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TABLE 12.

SUMMARY OF FINDINGS
CASE STUDY COMMUNITIES
INCIDENCE OF COST - CAPITAL COSTS
(continued)

	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Streets and Roads (continued)					
Collector and Arterial Streets, Primary Roads	Village occasionally requires developers to provide improvements to existing arterial and collector roads as a condition of rezoning or PUD approval; may share costs 50/50 with developer. Decisions made on an ad-hoc, case-by-case basis.	Thus far, major road improvements paid for by the developer without payback agreements. Future improvements will be made in cooperation with State, County, and Village. Provided limited maintenance equipment.	Occasionally developers have donated land for road widenings. For Ransom Oaks and Audubon, new major roads will be built by the developer; improvements to existing roads will be made by Town, County or State.	Developer constructed all new secondary roads; also built access road to major highway, although this was not required; have offered land and/or financing to encourage more rapid State improvements on pre-existing roads.	Developers required to donate land and complete improvements for road widenings abutting their property; in one instance, a road was realigned through a trade of land between the State and a developer.
Utilities					
Water and Sewer					
Minor branches and collectors	Required by ordinance of all developers; may or may not be dedicated.	Provided by the developer; retained by neighborhood associations.	Provided by developer; may or may not be dedicated.	Provided by developer; turned over to cluster associations.	Provided by developer; in most cases dedicated to the County.
Major trunks or mains	Developers of parcels requiring trunk extensions pay the cost; are later reimbursed by other developers hooking up to that line.	Provided by developer, who owns and operates private utility system.	Developers must pay for lateral extensions required to service their properties; all other extensions or improvements paid by Town. Audubon has offered to construct new water mains if paid back by water authority; offer rejected.	Water and sewer line extension financed by developer; will be compensated by County as future developers hook into that line; on-site trunk lines paid by developer.	Costs allocated on a case-by-case basis; in some instances, developer pays cost of extension of lines to subdivision; in other cases splits cost of extension with water authority; sewer line extensions more likely to be paid by developer.
Other facilities	Village occasionally requires dedication of well sites where needed; no contributions to treatment facilities.	Treatment plant and wells provided and retained by the developer, who operates a private utility system; arrangement expected to continue.	No developer contributions.	No developer contributions.	No developer contributions.
Storm Drainage					
Minor branches and collectors	Same as for water and sewer.	Same as for water and sewer.	Same as for water and sewer.	Same as for water and sewer.	Same as for water and sewer.
Major trunk lines	Where hookups to existing Village systems are not available, developer must provide his own outfall.	Up to this time provided by developer; expect further improvements to be made by Village.	Thus far, no developer contributions. However, Audubon will pay 40% of major drainage facility cost.	Major on-site improvements provided by the developer; improvements to passed-over land usually provided by county.	Major on-site improvements provided by developer; improvements to passed-over land usually provided by county.
Other storm drainage facilities	Retention basins required, where needed, as a condition of approval.	Developer has provided a small lake for retention purposes; privately retained thus far.	Some voluntary construction of retention ponds by developers; used for recreation purposes; privately retained.	Developer provides retention ponds.	No other facilities.
Other (Specify)	Village collects a fee-in-lieu of land dedication for Village purposes; used to purchase cultural center site.	Donated 200 acres for construction of State university.	Does not apply.	Donated numerous public facilities such as day care centers, a marina, a music center, and a coffee house.	Does not apply.

Source: Real Estate Research Corporation.

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- Payment for necessary extensions of existing major roads, construction of all new roads, and some limited improvements to existing roads.

- Payment for extensions of water, sewer, and storm drainage trunks and mains; provision of major on-site utility pipes.

With the exception of Arlington Heights, none of the conventional communities received the above contributions from developers. Arlington Heights may be exceptional in the level of exactions they have received from developers through a very stringent project approval process and through use of written annexation agreements. While Amherst has received little from developers in the past, indications are that more contributions for open space, roads, and utility improvements will be required in the future. Limited observation of large scale PUDs in Amherst indicates that their contributions will be greater than the conventional subdivision but not as extensive as that of new communities. The degree of variation depends on the cost category in question. Reston and West Springfield present a clear contrast between planned and conventionally developed communities within the same county. The contributions of Gulf-Reston clearly exceed those of small scale developers in West Springfield.

a. General Government, Police, Fire, Library. For these cost categories, it is evident that significant private contributions occurred only in the planned case study communities. Contributions of the developers in the planned communities included donation of sites and construction of facilities (with below market rents or deferred repayment agreements). In the one case the developer also contributed equipment for fire and police protection. Moreover, future sites needed for these functions are likely to be sold at developer's cost or at below the current market price for land in the planned communities, offering an additional savings to the local governments. Large scale planned unit developments are more likely either to donate sites for these functions or enter into lease/purchase agreements (whereby developers would construct facilities) than are conventional projects, judging from the limited evidence offered.

b. Parks and Recreation. As can be seen from the summary of findings, all of the case study communities experienced some developer contributions toward the provision of open space and recreation facilities. Two mechanisms were primarily used:

   - Public donation of land or fees-in-lieu of land (all communities except Reston)

   - Provision of privately retained land and facilities, held by owners of rental projects or turned over to owners' associations (all communities).

Thus, the extent of developer contributions must be evaluated on the basis of their frequency of occurrence, the quality of these contributions and their accessibility to all residents. In the planned communities, developers donated land and facilities to public authorities and/or turned over land and facilities to associations regardless of housing type. In the conventional communities studied, public land dedications occurred only where they were made a condition of subdivision approval. In no cases did developers in conventional communities provide facilities for public parks or play grounds.

Private facilities were provided as marketing vehicles for condominium and large scale rental projects (but not in most single family subdivisions) in the three conventional communities studied. PUDs are more likely to offer public donations and provide privately-retained facilities for all housing types.

Thus, although all communities experienced some developer contributions for open space and recreation, the planned communities studied had a higher proportion of these costs paid privately. All land and improvements thus far in the planned communities have been funded by the developer while only land contributions have occurred in the other case study communities.

c. Schools. A clear distinction in the incidence of school costs occurs between elementary schools (viewed as servicing a given neighborhood) and secondary schools (viewed as serving the general community-at-large). In all case communities except Amherst, developers have been donating sites for elementary schools. Large scale PUDs in Amherst will be dedicating these sites in the future. Contributions to facility construction occurred only in the planned communities, but these were short-term contributions where the developer built the first school subject to a repayment agreement with school authorities. Although this constitutes a short run savings for school districts able to offer services in these growing areas without having to float new bond issues before a strong tax base is established, its dollar value over a long development period is very small.

With regard to high schools, developer contributions occurred only in the planned communities, and were limited to the sale of sites at developer's cost or below-market prices.

d. Streets and Roads. In all of the case study communities, developers were required to provide local streets. The practice of retaining these streets privately (by homeowners' associations or management corporations) or dedicating them did not vary by development pattern. Private streets will occur where developers can construct such roads at lower standards (and hence, lower cost) than are required for dedicated public streets. Some communities will discourage this practice if they feel it will result in low quality construction or a later abdication of maintenance responsibilities.

A distinction appears between improvements to pre-existing collectors and arterials and construction of new major roads. Where development is of such scale as to necessitate new major roads or extension of existing roads, costs are borne by the developer. This generally occurs only in planned new communities or PUDs. Upgrading or widening of existing roads is usually provided by the appropriate governmental body. Land dedication for road widenings was required at some point in all of the communities, but on an ad-hoc, case-by-case basis.

e. Utilities (Water, Sewer, Storm Drainage). Regardless of community type, it seems that all on-site utilities must be provided by the developer. However, in developments of the size of a large scale planned community, on-site utility lines are also likely to include major trunk lines. Thus, in Reston and Park Forest South, on-site trunk lines were provided by the developer. For the latter community, the developer has chosen to own and operate his own private utility system.

The system in Arlington Heights is similar to that of Reston -- the developer must pay for extensions of mains needed to service his property, but he is reimbursed later as other developers tap in. Thus, governments in the planned communities are paying a lower share of the cost of providing mains and trunk line extensions to growth areas; the same can be said for Arlington Heights. While conventional developments in Amherst do not pay for main extensions and improvements, PUDs in Amherst have offered to bear these costs. In West Springfield, decisions on how improvements should be paid for are made on a case-by-case basis. A developer could pay all, part, or none of the costs incurred.

Where utility systems are publicly operated no contributions were found for treatment facilities. Retention basins were provided by developers as needed in Amherst, Arlington Heights, and Reston, resulting in some public cost savings. The developer provides all sewage treatment and water supply facilities in Park Forest South, but he owns the system and collects revenues from it. He is bearing the total water and sewer burden which would otherwise be a public cost. The importance of this contribution is significant, given the high cost of constructing treatment plants and supply facilities. Private utility systems also serve all or part of conventional suburbs throughout the U.S., although this was not true of our limited sample.

TABLE 13.

SUMMARY OF FINDINGS
CASE STUDY COMMUNITIES
INCIDENCE OF COST - OPERATING AND MAINTENANCE COSTS

COST CATEGORY	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Government Regulation and Administration	No developer contributions.	Developer paid costs of consultants' services for the Village prior to hiring of Village staff. Has maintained the Village Hall. Paid one time flat fee per unit used for Village operating purposes.	No developer contributions.	No formal local government.	No formal local government.
Police	No developer contributions.	Developer provided operating subsidies for police salaries for two years.	No developer contributions.	No developer contributions.	No developer contributions.
Fire	No developer contributions.	For two years developer provided operating subsidy for firemen's salaries. Maintained fire station building.	No developer contributions.	No developer contributions.	No developer contributions.
Library	No developer contributions.	Developer maintains temporary library building.	No developer contributions.	No developer contributions.	No developer contributions.
Parks and Recreation	No developer contributions for public operation of private facilities by non-governmental bodies.	Developer thus far maintains land and facilities which have been donated to the Village or turned over to neighborhood associations; will continue to do so until sufficient funds are available for hiring maintenance staff and purchasing equipment.	No public contributions; however, the developer has provided operating subsidies for neighborhood associations owning private facilities in Ransom Oaks. Same pattern is expected in Audubon. Private facilities in rental projects maintained by owners.	No publicly-owned space; however, the developer maintains privately-owned space or helps homeowners associations maintain parks and recreation areas.	No developer contributions.
Schools					
Elementary and Junior High Schools	Village has required payment of flat fee per unit to cover first year operating costs of pupils generated by new subdivisions not yet on the tax rolls as a condition of approval of certain projects. Decision made on an ad-hoc, case-by-case basis.	No developer contributions.	No developer contributions.	No developer contributions.	No developer contributions.
Secondary	No developer contributions.	No developer contributions other than planning services.	No developer contributions.	No developer contributions.	No developer contributions.
Streets and Roads	Maintenance of privately-retained roads (thus far, private retention of minor streets not a popular practice) done by owner or association. No private contributions for public road maintenance.	Developer presently maintaining all roads, including those already dedicated to the Village or turned over to neighborhood associations, until they can afford equipment and hire staff.	Maintenance of privately-retained local access streets undertaken by developers, owners' associations, or owners of rental projects. No contributions for public road maintenance. Likely to be the same in Ransom Oaks and Audubon.	Developer occasionally mows grass or removes snow on public roads when state efforts are not satisfactory; privately-owned streets maintained by developer or private associations.	Maintenance of privately-owned streets by developer or homeowners' associations; no private contributions toward maintenance of public roads.
Utilities					
Water and Sewer	Same as for streets and roads.	Entire system maintained by developer.	Same as for streets and roads.	Maintained by government when dedicated; maintained by private associations in all other instances.	Same as for streets and roads.
Storm Drainage	Same as for streets and roads.	Public facilities maintained at present by developer; will ultimately be done by Village.	Same as for streets and roads.	Same as for water and sewer.	Same as for streets and roads.

Source: Real Estate Research Corporation.

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2. Operating and Maintenance Costs. Private contributions to operation of public services and maintenance of their facilities were found to fall into two categories:

   a. Maintenance of open space, recreation facilities, streets, and utility pipelines which are not dedicated to public bodies, but rather are turned over to residents' associations, held by owners of rental apartment projects, or retained by the developer.

   b. Direct contributions to government bodies (short-term).

   All of the case communities showed some contributions of the first type; however, these arrangements occurred more frequently in the planned communities. In Park Forest South, the entire water and sewer system is privately maintained and operated, thus lifting this burden from local governments.

   Contributions of the second type occurred only in the two planned communities. In both Reston and Park Forest South, the developer provides some road maintenance services. In the case of Reston, this was limited to snow removal and mowing where State efforts were unsatisfactory. In Park Forest South, the contribution was more extensive, and included maintenance of roads and storm sewer lines already dedicated. This is an interim arrangement which will last until the time when the Village has an adequate tax base for staff and equipment. The same arrangement exists for maintenance of the village hall, library, police station, and dedicated recreation areas. Although these arrangements are short term, they are clearly unique to the planned communities studied. The only exception is in Arlington Heights, where developers have been required to pay a one-time-only contribution to school districts (on a per unit basis) to cover part of the cost of the first years' services for pupils generated by new development (prior to that development being placed on the tax rolls at its improved value).

   The overall, long-term contributions of private developers to public operating costs are only a small proportion of the costs included; however, the private share is likely to be larger in planned communities than conventionally developing suburbs.

3. Verification of Findings. Although secondary source information on this subject is scarce, we made an effort to verify the findings from the case study communities. In a study published in the 1969 Municipal Yearbook (International City Management Association, Washington, D.C.), a survey of dedication and subdivision improvement requirements was undertaken. The percent of all cities requiring dedication of school sites and open space, or payment in lieu of dedication, was indicated for the total sample, as well as by city size and city type (central city, suburban, and satellite communities). Although the material is somewhat outdated, it is interesting to note that more than half

of all the communities surveyed required no land dedications. School site dedications occurred in only 18 percent of the communities, with open space required in 34 percent. Use of cash payments in lieu of land dedication was the exception rather than the rule, occurring in only 16 percent of the communities. Exactions occurred most frequently in communities with population of 250,000 to 500,000, with little variation by community type. It is probably reasonable to assume that, given the fiscal crisis which has faced many suburban communities in the intervening years since 1969, the percent of municipalities requiring one or more of the above mentioned contributions has significantly increased. Nevertheless, the overall lack of uniformity in requirements nationwide can be compared to the planned communities and large scale PUDs analyzed in this chapter, where privately borne costs for elementary school and open space sites are common practice.

The Municipal Yearbook study indicated that the vast majority of all communities nationwide require the developer to provide street grading, paving, drainage, sewers, curbs and gutters, and water lines within subdivisions. Requiring street lighting, trees, and street signs is a less common practice, occurring in less than half of all communities surveyed. This confirms our contention, based on the findings from the case study communities, that on-site roads and branch utility pipes are likely to be paid for by developers regardless of the overall pattern of community development. A more comprehensive survey of this type would be most useful in determining common suburban fringe practices, which can then be compared to findings in the far fewer planned new communities and PUDs across the United States.

E. RELATIONSHIP OF FINDINGS TO PREVIOUS CONCLUSIONS FROM THE COSTS OF SPRAWL

As stated previously, one of the primary objectives of the case study research was to provide evidence upon which previous assumptions made regarding the allocation of costs among public and private participants could be verified. Earlier research on this question, presented in Chapter VII of The Costs of Sprawl, was limited to the presentation of a series of carefully considered assumptions as to how costs would be borne proportionately among participants, and how this incidence of cost (for both capital and operating costs) would vary by development pattern. The assumed percentage allocations were then applied to the total costs shown for each cost category to indicate the likely differences in the burden of costs to government that could be attributed to development pattern. Assumptions made for individual cost categories in the community cost analysis of The Costs of Sprawl, are reprinted here for ease of comparison, in Table 14.

These early assumptions have been re-examined in light of research carried out in the case study communities. Upon careful review of the findings presented earlier in this chapter, and the background thinking which determined the previous percentages, refined incidence of cost allocations are suggested. They are shown in Table 14 along with earlier assumptions. The rationale for the changes indicated is presented below.

Table 14.

COMPARISON OF PREVIOUS ASSUMPTIONS WITH REVISIONS SUGGESTED BY CASE STUDY FINDINGS
(Government/Private Percentage Allocations) 1/

	Community Type					
	I	II	III	IV	V	VI
	Planned Mix	Combination Mix 50 Percent PUD, 50 Percent Sprawl	Sprawl Mix	Low Density Planned	Low Density Sprawl	High Density Planned
CAPITAL COSTS 2/						
Residential						
Costs of Sprawl:	0/100	0/100	0/100	0/100	0/100	0/100
Revisions:	None	None	None	None	None	None
Open Space/Recreation						
Costs of Sprawl:	30/ 70	50/ 50	70/ 30	60/ 40	80/ 20	20/ 80
Revisions:	20/ 80	30/ 70	40/ 60	20/ 80	80/ 20	20/ 80
Schools						
Costs of Sprawl:	80/ 20	90/ 10	90/ 10	80/ 20	90/ 10	80/ 20
Revisions:	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Police, Fire, Government, Library						
Costs of Sprawl:	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Revisions:	None	None	None	None	None	None
Hospitals, Churches						
Costs of Sprawl:	0/100	0/100	0/100	0/100	0/100	0/100
Revisions:	None	None	None	None	None	None
Solid Waste Collection and Disposal						
Costs of Sprawl:	30/ 70	30/ 70	30/ 70	30/ 70	30/ 70	30/ 70
Revisions:	0/100	0/100	0/100	0/100	0/100	0/100
Streets and Roads 3/						
Costs of Sprawl:	20/ 80	40/ 60	60/ 40	20/ 80	60/ 40	20/ 80
Revisions:						
Minor streets	0/100	0/100	0/100	0/100	0/100	0/100
Collector streets	0/100	40/ 60	50/ 50	0/100	50/ 50	0/100
Arterial roads	80/ 20	90/ 10	100/ 0	80/ 20	100/ 0	80/ 20
Expressway	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Utilities 3/						
Costs of Sprawl:	20/ 80	40/ 60	60/ 40	20/ 80	60/ 40	20/ 80
Revisions:						
Gas, Electricity, Telephone	0/100	0/100	0/100	0/100	0/100	0/100
Water, Sewer, and Storm Drainage Pipeline	0/100	30/ 70	40/ 60	0/100	40/ 60	0/100
Plants	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0

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Table 14.

COMPARISON OF PREVIOUS ASSUMPTIONS WITH REVISIONS SUGGESTED BY CASE STUDY FINDINGS
(Government/Private Percentage Allocations) 1/

(continued)

	Community Type					
	I	II	III	IV	V	VI
	Planned Mix	Combination Mix 50 Percent PUD, 50 Percent Sprawl	Sprawl Mix	Low Density Planned	Low Density Sprawl	High Density Planned
LAND						
Costs of Sprawl:	20/ 80	30/ 70	30/ 70	10/ 90	20/ 80	30/ 70
Revisions:	None	None	None	None	None	None
OPERATING AND MAINTENANCE COSTS						
Open Space/Recreation						
Costs of Sprawl:	60/ 40	70/ 30	80/ 20	70/ 30	80/ 20	20/ 80
Revisions:	20/ 80	40/ 60	60/ 40	20/ 80	80/ 20	20/ 80
Schools						
Costs of Sprawl:	80/ 20	90/ 10	90/ 10	80/ 20	90/ 10	80/ 20
Revisions:	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Police, Fire, Government, Library						
Costs of Sprawl:	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Revisions:	None	None	None	None	None	None
Hospitals, Churches						
Costs of Sprawl:	0/100	0/100	0/100	0/100	0/100	0/100
Revisions:	None	None	None	None	None	None
Solid Waste Collection and Disposal						
Costs of Sprawl:	30/ 70	30/ 70	30/ 70	30/ 70	30/ 70	30/ 70
Revisions:	0/100	0/100	0/100	0/100	0/100	0/100
Streets and Roads						
Costs of Sprawl:	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0
Revisions:	90/ 10	90/ 10	100/ 0	90/ 10	100/ 0	90/ 10
Utilities 3/						
Costs of Sprawl:	20/ 80	20/ 80	20/ 80	10/ 90	10/ 90	20/ 80
Revisions:						
Gas, Electricity, Telephone	0/100	0/100	0/100	0/100	0/100	0/100
Water, Sewer, Storm Drainage	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0	100/ 0

Notes: 1/ "Government" refers to public bodies at all levels. "Private" costs could be borne by developers, builders, homeowners' associations, owners of private recreation facilities and other non-governmental bodies.

2/ Capital cost allocations are exclusive of land, which is treated separately.

3/ For purposes of clarity, the revised percentage allocations are broken out into sub-components to illustrate variation within broad categories such as streets and roads or utilities.

Source: Real Estate Research Corporation.

1. Capital Costs

a. Open Space/Recreation. We found that government investment in recreation facilities (exclusive of land) is likely to be very low in planned communities, where most facilities are provided by the developer or through homeowners' association. The extent of private investment in planned communities does not appear to vary by density -- hence the same percentage allocation for all three planned prototypes. In conventional development, however, higher density multi-family development is much more likely to contain privately financed recreational amenities than is a single family subdivision.

b. Schools. The cost allocation presented in The Costs of Sprawl assumed a greater likelihood of private schools in planned communities. We now find no evidence to support this contention. Developer contributions to public school facility costs (exclusive of land) in planned communities are likely to be short-term; the value of these contributions is much less than ten percent of total investment in school facilities over the development period. While private schools can carry a significant share of the education cost burden in suburban communities, their occurrence is not related to the pattern of development. Given these findings, and a desire to simplify assumptions regarding the effect of private schools, we have revised the cost incidence to show 100 percent public incidence of cost for all community types for both high schools and elementary schools.

c. Police, Fire, Government Regulation, Library. Developer contributions to facility costs in planned communities for these categories are short-term (deferred payment on facilities constructed by developer, below market rents, etc.). These contributions do not amount to 10% of total investment in these facilities over the development period. Therefore, no changes are suggested in earlier allocation.

d. Hospitals, Churches. No changes indicated.

e. Solid Waste Collection and Disposal. Previous assumptions stated that collection costs would be borne publicly and disposal privately. However, a totally private disposal system is just as likely in fringe communities. Because of the variety of practices which can occur, we have adjusted percentage allocations to reflect the simple case of a totally private system.

f. Roads. Given our experiences in the case study communities, we feel it would be useful to break out the incidence of cost for roads into a number of subcategories.

(1) Minor Streets. As mentioned earlier, these costs are almost universally borne by developers. In some instances under "sprawl" conditions, certain minor

roads may be viewed as having some public benefit, and their costs allocated between government and private homeowners paying special assessments; this tends to be the exception rather than the rule in new subdivisions. Thus, we are allocating the entire cost burden to private participants regardless of development pattern.

(2) Collector Streets. We show an allocation of 100 percent of the costs to developers in planned communities, a 50%/50% sharing in sprawl and 40% public share in the combination situation. Because all collectors would be "on-site" in large scale planned development, they are more likely to be paid for by the developer. While moderate sized conventional subdivisions may contain some collector roads within their boundaries, these are likely to be subject to "public benefit" provisions, and their costs paid all or in part by government. This is also true where collector streets are used to connect subdivisions through passed-over land.

(3) Arterial Roads. New on-site arterials in planned communities would be paid for by the developer, while improvements to existing county or state arterial roads would be provided by the appropriate government bodies. We estimate the developer's contribution to arterial road construction in planned communities to equal 20 percent of total investment, which would be used largely for construction of new roads or extensions of existing roads. In sprawl situations, public bodies would pick up 100 percent of the cost, with only ten percent borne privately under "combination". In both of these cases, little or no construction of new roads would occur, with improvements to older roads paid by governmental units.

(4) Expressway. An allocation of the entire cost burden to public bodies is likely under all patterns.

g. Utilities. Again, our findings suggest that a more detailed breakout of cost allocations would clarify the exact nature of the cost burdens borne publicly and privately.

(1) Gas, Electric, and Telephone. All of the costs are borne privately (by utility companies) in all development patterns.

(2) Water, Sewer, and Storm Drainage Pipeline. In planned communities, all pipelines would be provided by the developer, given the assumption of no externalities. Hence, all pipelines would be on-site, and no extensions of mains or trunks from the outside affects the incidence shown. In "sprawl"

and "combination" situations, major trunks and mains, as well as some lateral extensions to the perimeter of subdivisions, would be paid by public authorities. PUDs would result in a slightly larger private share. Minor branches would be provided privately in all development patterns.

(3) Plants, Wells, and Other Facilities. For purposes of clarity and simplicity, we are showing these costs to be borne 100 percent publicly for all development patterns. Privately owned facilities do occur, however, as was seen in one of the planned case study communities. They can also be found in some conventional suburban locations covering either all or part of a given community. Thus, the incidence shown could be reversed in whole or in part.

h. Land. Quantifying the contributions of the developer to the cost of land for semi-public and public facilities is important with respect to this analysis in two ways. In The Costs of Sprawl, community land costs were estimated using built-in assumptions regarding the degree of dedication of land to public bodies and homeowners' associations, so as to avoid double counting. No dollar land costs were directly calculated for dedicated land -- these costs were assumed to be passed on in the sales price of land sold outright. Thus, the findings from the case study investigation can affect both the incidence of cost, as shown in Chapter VII, of The Costs of Sprawl, and the land cost analysis, as shown in Chapter VI of that volume.

Briefly, the assumptions which went into the calculation of land costs in The Costs of Sprawl are as follows:

(1) In planned communities, 70 percent of open space and recreation acreage was assumed to be dedicated, with 10 percent in conventional communities and 20 percent in combination.

(2) 80 percent of elementary school sites were dedicated in planned, 30 percent in sprawl, and 50 percent in combination.

(3) 50 percent of high school sites were dedicated in the planned alternatives, with no dedication for this purpose in the other communities.

(4) For public facilities, 50 percent of the land was assumed to be dedicated in planned communities, with no such contributions in sprawl and combination situations.

(5) All rights-of-way within or bordering neighborhoods, as well as streets in vacant improved areas, were dedicated in planned communities. Only rights-of-way for minor and collector streets were dedicated in other communities. This amounted to 75 percent of acreage in neighborhood

rights-of-way. In all cases, expressway construction and rights-of-way in vacant semi-improved and unimproved areas entailed no contributions.

Dollar costs were attached only to that acreage which was not sold outright by the developer(s). Once the total cost of land had been determined, an incidence of cost was applied to that figure, reflecting the allocation of directly purchased land among public and private parties. Hence, all costs for residential land were shown as being paid privately, along with 10 percent of the recreation land, and that acreage in vacant, improved areas. All other costs of land -- for schools, public facilities, recreation, and rights-of-way -- were assumed to be borne publicly.

Findings from the case communities have led to a revision of the above assumptions (1 through 5) regarding the dedication of land. These changes are stated below.

(1) A higher proportion of dedicated sites in planned communities was indicated than was previously assumed for open space and recreation (90 percent). In light of our findings, which showed a significant proportion of private recreation facilities even in conventional communities, the percent of land dedicated for these purposes is raised to 30 percent in low density conventional communities, 50 percent in medium density conventional, and 70 percent in "combination" situations.

(2) For elementary schools, we noted that in the planned case study communities all elementary school sites are being dedicated, so we are revising our assumption to indicate that fact. No changes are recommended in the indicated percentage of elementary school site dedication in the remaining communities.

(3) We found no high school sites dedicated in any of the planned communities, although sites have been sold at developer's cost. Thus, no differences are shown between community types.

(4) We found that land contributions for other public facilities were not as extensive in planned communities as previously assumed; thus, we lowered the percentage of dedication for these land uses to 20 percent, with no contributions shown in the conventional or "combination" prototypes.

(5) For neighborhood rights-of-way, we have lowered the percent dedicated from 75 to 60 in conventional and "combination" situations noting that some land for collector streets may still have to be purchased by government where a

number of small subdivisions forms the predominant development pattern. No change is indicated for neighborhood rights-of-way in planned communities. However, we found that in planned communities, roads passing through what would be temporarily vacant areas would be dedicated by the developer, while expressway right-of-way would be purchased by governmental bodies where needed. In the other community types, no contributions would be entailed for right-of-way in vacant areas or expressways, as was previously assumed.

While these changes in dedication assumptions lead to adjustments in the total dollar cost of land in each of the six community prototypes, they did not result in any changes in the overall incidence of cost for land that is purchased outright. Thus, no change is shown in Table 14 with respect to land cost incidence. However, the dollar amount against which this incidence is applied is modified as shown below:

TOTAL COMMUNITY LAND COSTS
(in thousands)

	Costs of Sprawl	Revisions
Community I	$18,491	$16,952
Community II	23,531	21,776
Community III	23,810	23,000
Community IV	25,692	24,465
Community V	29,539	29,973
Community VI	16,814	14,659

2. Operating and Maintenance Costs.

a. Open Space/Recreation. Operating cost assumptions are adjusted to reflect perceived changes resulting from a greater incidence of privately operated recreation complexes. The public share of recreation operating costs seems to be declining in sprawl situations, (especially in multi-family housing projects) and is very small in planned communities. Privately provided recreation facilities, operated by homeowners' associations or rental project management, are becoming an increasing part of the suburban scene.

b. Schools. The rationale for changes is the same as that indicated for capital costs.

c. Police, Fire, Government, Library. Short-term operating subsidies seen in at least one of the planned case study communities are unlikely to still be in effect in year ten of the development period. Thus, no change in the allocation of 100 percent of costs to government (regardless of development pattern) is suggested.

d. Hospitals and Churches. No changes are recommended.

e. Solid Waste Collection and Disposal. The rationale for changes is the same as that indicated for capital costs.

f. Roads. Private homeowners' associations and project management groups (for large rental developments) in planned communities are likely to bear at least some cost of maintaining local access streets which are not dedicated to public bodies. In conventional communities, dedication of all roads (and therefore, public maintenance) is more likely. Where PUD is a popular vehicle for development, the practice of private retention and maintenance of local roads is likely to be more common than where conventional subdivisions predominate.

g. Utilities. Operating costs for gas, electricity, and telephone service are borne by private utility companies. By contrast, water, sewer, and storm drainage systems are likely to be maintained entirely by governmental bodies except where private sewer and water utilities are permitted (as occurred in one of the planned case study communities and does occur in parts of conventional communities). As with capital costs, we prefer to show this allocation as 100% public to reflect most common practice; however, the opposite situation may occur in planned communities and conventional suburbs.

F. APPLICATION TO COST ESTIMATES

1. Capital Costs

The revised percentage allocation of total development related capital costs among public and private participants shows only a very slight increase in the public share when compared to the earlier conclusions presented in The Costs of Sprawl. (See Table 15) Only the low density sprawl prototype (Type V) showed no change. In 1974 dollars, the government share of total costs for all three planned community prototypes was about $79 million; government costs in "sprawl" or "combination" suburbs ranged from $101 million ("combination") to $117 million (low density "sprawl"). While percentage figures indicate a higher proportion of government costs with increased

Table 15.

INCIDENCE OF COST (GOVERNMENT/PRIVATE)
CAPITAL COSTS

	Community Type											
	I Planned Mix		II Combination Mix		III Sprawl Mix		IV Low Density Planned		V Low Density Sprawl		VI High Density Planned	
	Government	Private	Government	Private	Government	Private	Government	Private	Government	Private	Government	Private
	($000s of dollars)											
Residential	$ 0	$253,580	$ 0	$253,580	$ 0	$253,580	$ 0	$376,857	$ 0	$379,354	$ 0	$189,795
Recreation/Open Space	703	2,811	1,004	2,342	1,271	1,906	703	2,811	2,542	635	703	2,811
Elementary/Secondary Schools	53,731	0	53,731	0	53,731	0	53,731	0	53,731	0	53,731	0
Police/Fire/General Government/Library	3,902	0	4,168	0	4,183	0	3,915	0	4,337	0	4,044	0
Health Care/Churches	0	15,031	0	15,031	0	15,031	0	15,031	0	15,031	0	15,031
Solid Waste	0	266	0	266	0	266	0	304	0	304	0	229
Minor Streets	0	8,165	0	8,524	0	8,872	0	13,354	0	20,449	0	4,696
Collector Streets	0	9,568	3,996	5,993	5,199	5,198	0	11,175	3,809	3,808	0	8,791
Arterial Roads	8,240	2,060	11,363	1,263	14,849	0	9,139	2,285	12,690	0	7,646	1,911
Expressway	4,027	0	4,107	0	4,188	0	4,030	0	4,194	0	4,024	0
Gas/Electric/Telephone Lines/ Electric Transmission	0	4,000	0	4,250	0	4,513	0	5,690	0	7,272	0	2,753
Water and Sewer/Storm Sewer Networks	0	30,847	10,179	23,751	14,718	22,077	0	45,897	24,608	36,911	0	19,362
Plants	4,492	0	4,492	0	4,492	0	4,587	0	4,587	0	4,446	0
Land	4,014	16,057	7,735	18,048	8,170	19,062	2,897	26,070	7,098	28,390	5,207	12,149
Total Costs	$ 79,109	$342,385	$100,775	$333,048	$110,801	$330,505	$ 79,002	$499,474	$117,596	$492,154	$ 79,801	$257,528
Percent Government/Private	19%	81%	23%	77%	25%	75%	14%	86%	19%	81%	24%	76%
Less Residential Costs	$ 79,109	$ 88,805	$100,775	$ 79,468	$110,801	$ 76,925	$ 79,002	$122,617	$117,596	$112,800	$ 79,801	$ 67,733
Percent Government/Private	47%	53%	56%	44%	59%	41%	39%	61%	51%	49%	54%	46%

Note: All costs are shown in 1974 dollars and are rounded to the nearest thousand.

Source: Real Estate Research Corporation.

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density (holding development pattern constant), the dollar cost to government in prototype VI (high density planned) is one-third less than for low density "sprawl". Moreover, the share of total capital costs borne by government is 5-6 percent less in planned communities than in conventionally developed suburbs of the same density.

By far the largest capital expenditure item borne by the private sector is housing construction. Looking at the allocation of development related capital costs exclusive of housing, the differences among alternative development patterns are even more pronounced. The share of costs borne by government in planned communities is twelve percent less than in "sprawl" communities of the same density. It should be noted however, that the government share of capital costs (exclusive of housing) increases with higher density. This is due to the fact that many costs borne by government remain fairly constant regardless of density (i.e., schools, libraries, police protection) while privately borne costs for on-site road and utility systems decrease with increasing density.

2. Operating and Maintenance Costs

With regard to operating and maintenance costs, revisions in previous assumptions resulting from our case study investigations resulted in an increase in the public share of these costs, especially in the planned community prototypes (See Table 16). Developer contributions on the operating cost side were found to be less extensive than previously assumed. "Low density planned" development showed the lowest share of operating costs allocated to government (59 percent). However, the high density planned prototype had the largest government percentage, for much the same reasons described above. The reader should note that the dollar cost to government exhibited a very limited range among the six prototypes; year ten operating costs ranged from a low of $13.9 million to a high of $14.8 million.

Table 16.

INCIDENCE OF COST (GOVERNMENT/PRIVATE)
OPERATING AND MAINTENANCE COSTS

	Community Type											
	I Planned Mix		II Combination Mix		III Sprawl Mix		IV Low Density Planned		V Low Density Sprawl		VI High Density Planned	
	Government	Private	Government	Private	Government	Private	Government	Private	Government	Private	Government	Private
	($000s of dollars)											
Open Space/Recreation	$ 87	$ 349	$ 147	$ 220	$ 179	$ 119	$ 87	$ 349	$ 238	$ 60	$ 87	$ 349
Schools	11,061	0	11,071	0	11,167	0	11,061	0	11,167	0	11,061	0
Police/Fire/Government/Library	1,770	0	1,988	0	2,109	0	1,811	0	2,260	0	1,880	0
Hospitals/Churches	0	3,792	0	3,792	0	3,792	0	3,792	0	3,792	0	3,792
Solid Waste	0	292	0	295	0	298	0	321	0	343	0	251
Streets and Roads	268	30	268	30	299	0	365	41	454	0	216	24
Gas/Electric/Telephone	0	3,907	0	3,907	0	3,907	0	5,203	0	5,203	0	3,170
Water and Sewer	665	0	668	0	669	0	681	0	693	0	655	0
Total Costs	$ 13,851	$ 8,370	$ 14,142	$ 8,244	$ 14,423	$ 8,116	$ 14,005	$ 9,706	$ 14,812	$ 9,398	$ 13,899	$ 7,586
Percent Government/Private	62%	38%	63%	37%	64%	36%	59%	41%	61%	39%	65%	35%

Note: All costs are shown in 1974 dollars and are rounded to the nearest thousand.

Source: Real Estate Research Corporation.

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CHAPTER VI

COSTS TO THE HOUSEHOLD

A. INTRODUCTION

The purpose of this chapter is to illustrate the effect of alternative housing types on annual household shelter budgets. The family budget is the "bottom line" for housing consumers, and is perhaps most meaningful to them in analyzing and selecting among alternative housing choices. There are many family budget items for which expenditure levels are determined by lifestyle preferences, household composition, and income characteristics rather than development patterns or housing attributes. Nevertheless, a significant share of family expenditures goes for shelter related costs -- mortgage amortization (or rent), property taxes, insurance, maintenance, utilities, furnishings. Other non-shelter outlays can be affected by the physical pattern of development. Transportation costs will vary depending on the degree of development compactness, the proximity of jobs, schools, and shopping, and the availability of mass transit. Recreation expenditure may vary to the extent that facilities are made available to project residents as part of their purchase price, monthly rent, or community association membership. These latter items are not quantified in this chapter, however; we were limited by a lack of empirical data on differences in recreation expenditures by community development pattern.

B. METHODS AND ASSUMPTIONS

To present a clear-cut, easily understandable analysis of variation in shelter budgets by housing type, a few procedural assumptions were necessary:

- Each of five housing types are analyzed: single family conventional, single family clustered, townhouse, walk up apartment, and high rise apartment. These were fully described in Chapter IV of The Costs of Sprawl: Detailed Cost Analysis.
- All units are assumed to be owner-occupied to allow comparability of shelter costs among housing types. The walk-up and high rise apartments are considered as condominiums with homeowners' associations.
- The sales price of the units (in 1974 dollars) used in the analysis are:[1/]

[1/] Derived from housing construction costs from The Costs of Sprawl: Detailed Cost Analysis, Chapter IV. Attributable land and site improvement costs are included in the above figures.

Type A	Single Family Conventional (1,600 sq. ft.)	$50,906
Type B	Single Family Clustered (1,600 sq. ft.)	$50,237
Type C	Townhouses (1,200 sq. ft.)	$29,433
Type D	Walk Up Apartments (1,000 sq. ft.)	$21,294
Type E	High Rise Apartments (900 sq. ft.)	$27,489

- Mortgage terms include a 20% down payment, 9% interest, over a term of 30 years. This approximates the average for conventional home mortgages obtained from savings and loan associations in the fall of 1974, according to statistics compiled by the Federal Home Loan Bank Board.

- Expenditures for gas and electricity are for homes with gas heating, cooking, water heating and clothes drying. Energy use estimates from The Costs of Sprawl: Detailed Cost Analysis determine the variation in cost by housing type. Other utility costs (water, sewer, solid waste collection) are based on service charges in suburban fringe communities. They are paid directly by owners of single family units and townhouses, and through homeowner's association fees in condominiums. Telephone service costs reflect company estimates of monthly service charges in suburban locations for popular service packages and the number of phone extensions likely to be found in different size units.

C. Findings and Conclusions

Table 17 illustrates a wide range of yearly shelter expenditures among the five housing types. The most expensive single family home shows an annual shelter outlay that is nearly double the cost of the least expensive walk-up unit. Monthly payments for debt service, property taxes and insurance in the prototypical new single family home used here would be $439 per month, while in the walk-up condominium unit they would be only $185.

Because the size of our dwelling unit prototypes varies so widely (1,600 square feet for the single family home, only 900 square feet for the high rise apartment), we have prepared a sensitivity analysis assuming a constant floor area of 1,200 square feet for all housing types. The price of each unit would be as follows:

Type A	(Single Family Conventional)	$38,179
Type B	(Single Family Clustered)	$37,678
Type C	(Townhouse)	$29,433
Type D	(Walk-up)	$25,553
Type E	(High Rise Apartment)	$36,652

Table 17. COSTS TO THE HOUSEHOLD: SHELTER BUDGETS

Housing Related Expenditures	Housing Type A Single-Family Conventional (1,600 sq. ft.)	B Single-Family Clustered (1,600 sq. ft.)	C Townhouse (1,200 sq. ft.)	D Walk-Up Apartment (1,000 sq. ft.)	E High-Rise Apartment (900 sq. ft.)
Mortgage Amortization 1/	$3,934	$3,882	$2,275	$1,646	$2,124
Property Taxes 2/	1,212	1,196	700	507	654
Household Services 3/	1,185	1,185	1,031	817	799
Household Furnishings 4/	1,060	1,047	613	444	573
Homeowners' Insurance 5/	100	100	73	68	68
Association Dues 6/	-	-	-	360	420
Total	$7,491	$7,410	$4,692	$3,842	$4,638

Notes:

1/ Assumes an 80% mortgage for a term of 30 years at 9 percent interest. Source: Federal Home Loan Bank Board (Fall, 1974 data).

2/ Assumes that property is assessed at 34 percent of fair market value (sales price) and taxed at a rate of $7.00 per $100 in assessed valuation. Source: Real Estate Research Corporation.

3/ Includes utility bills (electric, gas, water, sewer, telephone). All units are assumed to be of brick construction, with gas heat, cooking and clothes drying. All other appliances are electric. Sources: The Costs of Sprawl: Detailed Cost Analysis and utility company estimates from telephone survey.

4/ Assumes that the total value of home furnishings is calculated at 1/4 of the sales price (value) of the dwelling unit. Annual expenditures based on a useful life of ten years for 2/3 of such expenditures, and twenty years for the remainder. Source: estimates of interior decorators in the Chicago metropolitan area.

5/ Source: Allstate Insurance Company.

6/ Typical condominium owners' association dues are $30-50 per month depending on the nature of services offered. Given a similar package of services in both the walk-up and high-rise complex, dues would be higher in the more expensive high-rise unit because they are apportioned based on the units' sales price. Costs shown here include water, sewer, and waste disposal service costs, as well as maintenance and utilities in common areas.

Source: Real Estate Research Corporation.

Accordingly, we have modified the various components of shelter cost to reflect smaller single family homes and larger condominium units. All townhouse costs remain the same. The results are presented in Table 18. While the walk-up apartment still shows the lowest shelter expenditures, the high rise apartment becomes the most costly. The higher cost of shelter in the high rise apartment is due to homeowner's association charges not incurred by occupants of single family homes. Thus, the high rise condominium dweller pays for maintenance services which the single family resident often does on his/her own or receives from government, and for heating and power in common areas.

As mentioned previously, a number of non-shelter expenditures could vary depending on the pattern of community development.

In The Costs of Sprawl, it was estimated that the average household in a planned, medium density community would drive their automobile(s) 30 percent fewer miles than in a conventionally developed suburb of the same density. This would occur due to greater reliance on walking and bicycling, shorter average trips, and fewer trips to clustered facilities. Some form of public transportation would also be more likely in a planned suburban fringe community than in its "sprawl" counterpart. The importance of minimizing transportation costs through more compact, better planned development has become increasingly critical as fuel prices continue to rise. Transportation will no doubt continue to increase as a share of the total household budget.

In a planned community, it is also likely that the manner of paying for certain maintenance and utility expenditures would be different from that shown in Table 17. Community associations would take over maintenance of grounds, roads and utilities in common areas, functions which are normally provided by individual homeowners or governmental bodies (through tax revenues or service fees) in single family subdivisions. Owners of single family homes and townhouses (as well as condominiums) would pay a fee for landscaping, snow removal, etc. rather than doing these things themselves or contracting on an individual basis. For those persons who would otherwise perform these functions themselves, they are paying a service fee in return for increased leisure time. Other owners who would normally contract individually for these services may benefit from a lower cost per unit where a service contract covers a large number of units. Considerable research remains to be done in order to compare the cost of maintenance services provided by homeowners' associations and those provided by private owners on a "do-it-yourself" or private contract basis.

Recreation expenditures could also vary based on available common facilities. There may well be truth to the commonly accepted belief that the owner of a conventional single family home with its own private backyard would not seek outside recreation to the extent that apartment dwellers do. Recreational amenities within multi-family projects have considerable market appeal, but they can greatly increase the price of a condominium or the monthly rental. In a single family,project, these amenities tend to be more oriented to children, and less likely to influence adult recreation expenditures.

Table 18. COSTS TO THE HOUSEHOLD: SENSITIVITY ANALYSIS
(Constant Floor Area - 1,200 Square Feet)

	Housing Type				
	A Single-Family Conventional	B Single-Family Clustered	C Townhouse	D Walk-Up Apartment	E High-Rise Apartment
Mortgage Amortization	$2,950	$2,912	$2,275	$1,975	$2,832
Property Taxes	909	897	700	608	872
Household Services	1,066	1,066	1,031	899	958
Household Furnishings	795	785	613	532	764
Homeowners' Insurance	88	88	73	70	75
Homeowners' Association Dues	-	-	-	420	460
Total	$5,808	$5,748	$4,692	$4,504	$5,961

Source: Real Estate Research Corporation.

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Again, there is a dearth of quantitative analysis of differences in recreation expenditures of single- family and multi-family dwellers, and in differences attributable to the presence of absence of on-site facilities such as clubhouses, pools, trails, tennis courts, golf, etc.

CHAPTER VII

PHASING OF COSTS

A. INTRODUCTION

In describing the various aspects of suburban residential development, particularly as they relate to alternative development patterns, it is rather simple to deal with end-states or results from development process. What presents a more complex analytical problem is the question of how development takes place over time. Thus, the shift from consideration of alternative end states to consideration of processes of development over time will yield a new set of analytical problems, one of which is the determination of how public facilities and services are provided in response to growth.

Because the purpose of this analysis is to suggest necessary revisions to assumptions presented in The Costs of Sprawl, it is useful to summarize the basic theory behind those assumptions. We suggested that, in planned communities, facilities would be constructed earlier in the development period and in larger increments than would occur in conventional suburbs. This implies that, at all points in the development period, public facilities would be adequate to meet the demands of existing population, with some allowance for short term future growth. In actual situations, this means that schools would be completed as needed, with no double shifts or other indices of overcrowding; that utility capacities would be adequate to serve present and future needs; and that roadway congestion would be minimal. Conventional suburbs, on the other hand, would be beset with problems of facility inadequacy and crowding. On the operating cost side, it was assumed that higher levels or varieties of public services would be available earlier in the development period to residents of planned communities; hence, operating and maintenance costs would be higher in the planned communities as early as the first year of the development period.

In theory, there should be some process of capital improvement programming and service delivery whereby facilities and services are phased in some optimal fashion, so that as population or dwelling units increase, there are adequate capacities and service levels available to accommodate the increase. Moreover, as the community grows, shifts occur in the preferences of the community regarding the range of services or facilities that should be available. Levels of service that may have been adequate at the outset of the development period may become inappropriate as the community matures. Thus, there should also be some optimal phasing of the changes in service levels or demands for new services as the community matures.

Finally, given that there is some optimal level of services or facilities that is adequate to meet demands over time, there should be some degree of economic efficiency in the provision of facilities and services. That is, the provision of facilities and services should be such that neither excess capacities (underutilized facilities or excessive services for a given population) nor inadequate service levels are incurred over time.

In reality, such optimal development phasing rarely occurs in either conventional or planned communities for a variety of reasons; more often than not, provision of facilities and services lags behind the demand resulting from population growth or a change in consumer preferences.

The focus of this analysis is on determination of what differences exist between planned and conventional development in terms of the timing of facility construction and service provision. The effect of facility sizing on construction costs, including issues related to the degree of replacement and duplication of facilities under alternative development patterns, is presented in Chapter X.

B. KEY RESEARCH QUESTIONS

1. Critical Research Needs

a. How are public and privately provided capital facilities timed -- in anticipation of, along with, or in response to growth?

b. At what point in the development period are major capital facilities constructed?

c. What facilities are likely to have high priority early in the development period? Which investments are deferred until a community is substantially mature?

d. What are the sizes of individual facility construction projects? That is, which construction costs are likely to be phased in small increments throughout the development period? What types of facilities are likely to be constructed in one stage without repeated additions?

e. How does the pattern of development (planned community, PUD, or conventional development) affect the timing of improvements? The magnitude of individual capital improvement projects?

f. How do the phasing and timing patterns which emerge compare with population growth patterns?

g. What affect does the incidence of cost have on timing of facility construction? Does the provision of a larger share of facility cost by the developer result in those facilities being provided earlier in the development period than would otherwise occur? Does the pattern of development have any influence on the timing of those facilities provided out of public funds?

h. With regard to operating and maintenance costs, how do costs increase over the development period? How do costs in the early years of the development period relate to expenditures shown for the last year analyzed?

i. What relationship exists between the increase in operating costs and population growth over time?

j. To what extent are increases in operating costs tied to the timing of capital facility construction?

2. Secondary Issues. The following topics are briefly addressed below but are not systematically incorporated into the research effort. They are presented to frame the discussion and present background material which provides an additional perspective on conclusions presented in later sections.

a. Differentiating between Growth-Related and Other Factors. The timely construction of adequate facilities or the provision of needed services is not dependent entirely upon the extent of planning in a community. Constraining factors might include the following: multiplicity of jurisdictions involved in implementation, uncertainty of future growth, legal limits on bonding, inadequate fiscal capacity, or consumer unwillingness to bear construction costs, so that either legal or political constraints determine the funds available for public expenditures. Instead of anticipating growth-related demands, only a cautious response to development activity occurs. The distinction must be made between changes in the service level which are a response to growth and those that respond to other factors, such as changes in socio-economic composition of the population, changes in governmental policy, and innovations in service delivery.

b. Timing of Grants and Availability of Funding. The availability of funding from Federal or state sources for particular costs has a great impact on the timing or phasing of costs. If such funding is available, certain facilities might be provided more rapidly than would otherwise be possible. On the other hand, lack of such funding may make it impossible to furnish services and facilities in a timely fashion.

c. Economies of Scale. The economics of facility sizing and construction staging can also affect the provision of capital improvements as a community grows. The potential effects of scale economies on facility costs is discussed in Chapter IX of this volume, while Chapter X deals with the constraints imposed by construction phasing.

C. METHODS AND ASSUMPTIONS--CAPITAL COSTS

1. Analytical Procedure. The analysis of capital expenditure timing reflects the following research methods:

   a. By means of interviews, review of comprehensive plans (particularly the community facilities portions of those plans) and review of capital improvements schedules, we noted when and at what size or capacity facilities were constructed.

   b. The adequacy of those facilities over time was assessed using actual measures of capacity in comparison to needs indicated by population levels and service standards as well as interviews, plan documents, and space inventories.

   c. The schedules of capital facility construction -- coupled with the assessment of facility adequacy -- from the case study communities were then compared to determine whether distinct patterns could be associated with different community types.

   d. Timing schedules appropriate to the alternative development patterns were then quantified for those costs calculated in The Costs of Sprawl; where changes in previous timing assumptions were necessary, revised assumptions were made.

   e. The revised phasing assumptions were then applied to the costs derived in The Costs of Sprawl. (Updated to 1974 dollars).

2. Key Assumptions. In order to accurately and thoroughly utilize data from the case study communities regarding the timing of capital costs, the following assumptions were necessary.

   - The timing of facility costs shown is presented without regard to replacement of facilities and equipment which would normally occur during a ten year development period.

   - Cost allocations shown in this chapter are exclusive of financing charges, which are covered in Chapter VIII.

   - We distinguished between "major maintenance projects" involving replacement of obsolete facilities and construction projects related to new growth. Such replacement or upgrading projects occurring in older sections of the community were not analyzed in determining the phasing patterns used as the basis for evaluating earlier assumptions.

   - No assumptions are made regarding the timing of land purchases during the development period.

D. FINDINGS AND CONCLUSIONS FROM CASE STUDIES-CAPITAL COSTS

A summary of the findings from each of the case study communities is presented in Table 19. Because the findings vary significantly by cost category, the conclusions presented below will deal separately with each cost item, as well as in summary.

1. Summary. Overall, we found that in planned communities facilities are likely to be provided earlier than in conventionally developed suburbs. Moreover, planned communities are less likely to experience problems with inadequate facility capacities. No significant variation due to development pattern in the size of increments constructed at any one point intime was found. In all cases, improvements will be sized so as to avoid excessive carrying costs for underutilized capacities.

   The most significant factor affecting the variation in timing of facility construction may well be the incidence of cost. To the extent that developers in planned communities are providing more of the development-related improvements themselves, these facilities will be provided earlier in the development period. Where developers have provided either permanent or temporary facilities for schools, fire and police stations, government operations, or libraries early in the development period, the result is a significant difference in facility timing when compared to conventional development. Conventional suburbs are far more constrained in meeting the demand for facilities resulting from growth; constraints include an inadequate tax base that is not growing as fast as the need for new facilities, lack of available bonding capacity, or the reluctance of older residents of the area to pay for the costs of servicing new development.

   An additional constraining factor that was found to operate to some extent in planned as well as conventional suburbs relates to the size of governmental jurisdictions that are providing facilities. Although large governmental units may experience some economies of scale, they must also service the demands of many growth areas at the same time. A planned community,which is part of a large school district or sewage treatment authority,will have little control over the pace at which facilities are provided unless the developer is willing to absorb the costs for initial permanent or temporary facilities, at least in the short run.

2. Government Regulation and Administration. Municipal buildings were generally found to be built in large increments without frequent additions. In one planned community, the municipal building was provided early in the development period, more out of a desire to provide an image for the community than out of need to accommodate services. The planned communities studied are more likely to provide the government buildings as part of a large multi-purpose facility, constructed well into the development period. Overall, it was found that results from the case communities are inconclusive with regard to differences in the timing of municipal building construction. A broader set of secondary observations lead to the conclusion that when municipal buildings are constructed is determined by many factors more related to community size,wealth and space availability than to type of development pattern.

Table 19.

SUMMARY OF FINDINGS

PHASING OF CAPITAL COSTS

Cost Category	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Government Regulation and Administration	Present municipal facility adequate; inadequate prior to 1962. Built at start of current rapid growth period; addition built in 1972.	Municipal facility presently adequate; will probably need new facility with more space in a few years. Present facility constructed early in development period.	Municipal facility presently inadequate; will need new facility, as possibility for expansion is limited. Facility built mid-way in current rapid growth period (1966).	Presently have no municipal facility, as Reston is not an incorporated village. Proposed sub-center for 1978, with land acquisition to start in 1975.	Same as for Reston; however, site for sub-center already acquired and construction scheduled for 1975.
Police	Part of municipal building; presently adequate, have had no additions for police use. Provided at the start of current growth period.	Present temporary facility inadequate; must cover large area. Have had difficulty providing equipment and vehicles as needed. Present facility provided for police use early in development period.	Space in present facility inadequate; moreover, a very large area is served with no sub-stations. Present facility built mid-way in current rapid growth period.	Presently no station in Reston; current patrols limited and inadequate for population served. Sub-station planned for 1978.	Presently no station; police service limited to patrols from neighboring communities. Station planned for 1975.
Fire	Fire facilities are and have been adequate for service areas; stations planned in anticipation of growth and located to service newly developing areas.	Present facility adequate for population served but not for large area; need sub-station. Existing facility provided early in the development period.	Present facilities adequate; sub-stations cover most areas, including vacant tracts. Lack of coordinated facility location planning among multiplicity of small districts may be a problem in the future. Stations provided as needed in growth areas.	Existing station serves only northern sector to adequate level; service in southern sector inadequate. Present station not completed until 1972; second station slated for 1977, with land acquisition in 1974.	No station presently; existing service inadequate. Construction of station slated for 1975.
Library	Large main library adequate to service most parts of the village; bookmobile used to service outlying areas. Inadequate service prior to construction, which occurred toward the end of the rapid growth period (1969).	Existing facility adequate at present but will need to be replaced by permanent facility. Facility provided early in the development period.	Presently have three libraries within the town, only one servicing the growth area. Will soon need fourth facility, for which site has been acquired. Service lagged behind until well into the recent growth period, caught up with two new facilities in 1968, but are again falling behind.	Two existing facilities; small for the high volume of use but service adequate for the present. First facility opened early in the development period, the second ten years later. Site acquisition for regional library slated for 1975.	No facility in West Springfield; must use those in neighboring communities. No facility planned, at least until 1979-80.
Parks and Recreation	Amount of land presently inadequate, despite developer dedications; some sites remain unimproved. Acreage per 1,000 showed a steady decline during the growth period. Received donations and purchased land throughout the sixties and early seventies. Private facilities provided after or near completion of development.	Little permanent open space has been reserved as yet, although this is ultimately planned. Publicly-owned recreation facilities are not of adequate size but were provided early in the development period. Private facilities provided as neighborhoods were developed and adequately serve needs of residents.	Provision of active recreation facilities adequate; serious deficiency in the provision of permanent open space or passive recreation areas. Active recreation facilities, public and private, timed to coincide with demand; passive areas far behind need.	Although no publicly-dedicated areas, open space and recreation facilities are of high quality, abundant, and accessible to all residents. Provided ahead of development or on schedule with housing construction.	Total acreage adequate at present; somewhat inadequate active recreation facilities. Lacks variety and accessibility from all parts of the community. Land provided at the same pace as development, but improvements have lagged behind.
Schools					
Elementary and Junior High Schools	Facilities presently adequate due to declining enrollment; have been inadequate in the recent past and needed additions. Schools not constructed in anticipation of growth; built when existing facilities already crowded.	Present elementary school is nearly at capacity, but no second site chosen as yet. Junior high pupils attend overcrowded facility outside community. First elementary school not built as early as needed; junior high only now under construction.	Present facilities adequate due to stabilizing enrollment. Have used boundary shifts and extensive busing to relieve past crowding by using excess capacities in older parts of the town. Some sites acquired in anticipation of need, but schools not constructed until demand is apparent by overcrowding.	Elementary schools presently overcrowded despite a large number of pupils attending school outside the community. Have been over capacity 50 percent of the time during last eight years. Intermediate school not within Reston; overcrowded every year since 1969. No double shifts. Timing of school construction has lagged behind need.	Elementary school capacity overall presently adequate, due to construction of three new schools and additions to both these and pre-existing facilities. Temporary crowding has occurred in growth areas until construction of new facilities occurred. One junior high, built prior to the current growth period (with one addition) has not been crowded in recent years.
High Schools	Overall capacity adequate at present. Interim boundary adjustments prevented past overcrowding; no double shifts experienced. Site acquisition done well in anticipation of growth; construction timed in response to demand. No additions were needed.	At present, pupils attending high school outside the community on double shifts. No decision yet on site for new facility; planning and construction is lagging far behind apparent needs.	Some overcrowding presently in eastern part of town; one school on split shifts, but new school under construction. High school in western portion has had two additions during the current growth period. Sites acquired in anticipation of demand; facility construction reasonably well paced.	No high school within Reston; consistent overcrowding in recent years in nearest school, somewhat relieved by bussing. No double shifts. Two sites available for construction of high school in Reston; site preparation scheduled for 1975 or 1976, but construction date not known at present.	High school has been overcrowded since 1968, but no new facility planned; will shift pupils to other schools if needed. Existing facility built about mid-way into the current growth period.

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Table 19.

SUMMARY OF FINDINGS

PHASING OF CAPITAL COSTS (continued)

Cost Category	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Streets and Roads					
Minor Streets and Interior Circulation	Phased along with housing construction.	Phased along with housing construction.	Phased along with housing construction.	Phased along with housing construction.	Phased along with housing construction.
Collector and Arterial Streets, Primary Roads	Irregular pattern of repair and improvement by Village, County, or State as funds are available. Timing based on priorities not necessarily related to local growth patterns.	Construction of new roads completed in advance of significant demand; improvements to existing roads delayed until definite pattern of future growth established. Upgrading will occur after growth is certain.	Lag in improvement of existing roads; improvements often do not occur until after congestion becomes a major problem. Priorities of County and State not necessarily tied to local growth patterns.	Pre-existing state roads inadequate to handle present traffic volumes. Improved as state funds become available. New roads accompany construction of village centers and residential areas.	Improvements to existing roads reflects priorities of State; upgrading may occur alongside developed tracts for short stretches. Improvements undertaken are usually long overdue. Roads within subdivisions or providing necessary access completed along with subdivisions.
Utilities					
Water and Sewer					
Minor Branches and Collections	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.
Major Trunks or Mains	Capacities adequate except in older areas; extension of lines in response to specific development's projects and not in anticipation of long-term growth. Generally in small increments.	Capacities anticipate future needs. Constructed in advance of growth; pass through large tracts of undeveloped area to reach industrial park and university.	Present water mains inadequately sized for urban densities. Sewer trunk capacities adequate, except in older parts of the town. Exterior policy unclear and subject to debate among government units. Timing of water line improvements lags behind need; sewer line improvements provided as needed except in older areas, where replacement is necessary.	Adequate water and sewer line capacities sized for future needs. Timing of extensions did not delay development.	Adequate capacities in lines installed according to county-wide plans; pipes sized for future flows. Timing did not delay development.
Facilities	Well capacity adequate in early part of growth period, fell behind, and has recently caught up with demand. Sewage treatment provided regionally; timing of construction not subject to community control.	Treatment plant and well capacities adequate for next few years and quality is high. Additions will be built as capacity needs are demonstrated.	Treatment facilities have operated consistently in excess of design capacities during the recent growth period; quality of treatment is low. Addition now under construction will upgrade existing primary treatment plant. Water supply facilities not under Town jurisdiction.	Capacity of treatment plants has been adequate during the growth period. Now reaching limits. Plants serve entire County; timing of facility construction determined by region-wide needs.	Capacity of treatment plants has been adequate during the growth period. Now reaching limits. Plants serve entire County; timing of facility construction determined by region-wide needs.
Storm Drainage					
Minor Facilities	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.	Completed prior to street construction and along with residential growth.
Major Trunk Lines and Facilities	Adequate system still lacking in parts of the Village. Timing of improvements related to availability of funds and not growth-related demands. Retention ponds provided at the start of development within individual subdivisions.	Capacities anticipate future needs. Constructed in advance of growth; pass through large tracts of undeveloped area to reach industrial park and university.	System very inadequate; heavy reliance on open ditches of insufficient size in an area with high flood hazards. Improvements lag behind need, but pace has been improving in recent years.	Adequate system designed to retain run-off within the community. Retention ponds constructed early in the development period, as were other main system elements.	On-site systems are adequate and provided slightly ahead of construction; off-site facilities provided by the County have not been timed to meet development pressures.

Source: Real Estate Research Corporation.

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3. Police. Findings from the case study communities lead to the conclusion that, regardless of development pattern, some inadequacies in police facility construction will occur early in the development period in rapid growth areas. These inadequacies are apt to be more pronounced in conventional communities, where spread-out development makes patrol from a limited number of stations all the more difficult. In all the communities, service levels tend to improve with age. As to timing variations among development patterns, only Park Forest South had a police station early in the development period. Future stations in both Reston and Park Forest South are likely to be part of multi-use complexes. Whether or not a community provides its own municipal police force is probably a stronger influence on the timing of station construction than is the type of development.

4. Fire. In both of the planned communities, fire stations were provided early in the development period; however, the need for additional substations is now apparent in both communities. In one of the conventional communities, stations were provided in anticipation of significant development. In one of the others, facilities were provided as areas became substantially developed; one community still lacks its own facility. Thus, we can conclude that fire protection facilities are likely to be provided earlier in planned communities, although the size of facilities is not likely to vary by development pattern. Fire stations appear to have an overall higher priority in capital improvements programming early in the development period than do permanent police stations.

5. Library. Planned communities were found to enjoy library facilities earlier in their development than conventional communities, although temporary facilities were often used. Conventional communities lagged behind in the provision of libraries, and seemed to catch up only as they became substantially mature. Where library facilities exist in neighboring communities, some areas may be passed over by county-wide library authorities for facility location. Nevertheless, it is evident that facilities are available earlier in the planned communities, although not necessarily at a larger scale. Construction of permanent library facilities is likely to lag behind police, fire, and government building construction in all cases.

6. Parks and Recreation. Different types of recreation facilities will show unique patterns of improvement timing, as shown below.

   a. Passive Recreation Areas. In planned communities, major open space reservations -- including lakes, forest preserves, nature study areas -- are available during the entire development period. Other open space reservations, such as areas within clusters of housing, become available as residential clusters are completed. In planned communities, open space is utilized as an amenity for existing residents and as a marketing device by the developers, and hence tends to be emphasized.

In conventional communities, by contrast, passive recreation areas tend to be owned by public authorities, following dedication by developers or purchase by governments. Public open space tends to be a much smaller proportion of land use than in planned communities, and is usually provided on the basis of when it is available, rather than correlated with population growth or area development.

In general, then, major open space in planned communities is provided well before significant residential construction takes place; smaller areas become available as residential clusters are completed. In contrast open space in conventional communities is not necessarily provided in anticipation of growth or to meet existing demands, but rather is provided as it might be made available, or as it can be afforded by public authorities.

b. Active Recreation Areas. Similar to passive recreation areas, in planned communities active and improved recreation areas are provided to assist in marketing and to enhance the amenity value of the community. Thus, facilities such as tennis courts and swimming pools tend to be installed at the same pace as residential construction. Other facilities, such as golf courses, are provided early in the development period.

In conventional development, facilities that are closely related to residential areas, such as tennis or swimming areas that serve those residents, are provided at the same pace as residential construction. Facilities that are provided out of public funds, however, tend to lag behind the demands of growth and development, and in comparison to planned communities, such facilities are often inadequate or lacking.

7. Schools. A distinction must be made between elementary and secondary schools as to their timing and adequacy. In all of the case communities, overcrowding occurred in elementary schools at some point during the development period. Temporary adjustments were made involving busing or boundary shifting, especially where schools in older areas had excess capacities. Construction of building additions occurred frequently in the conventional communities; often this was part of a deliberate policy to gradually increase capacities as space was needed. Although the first elementary schools within the two planned communities were assisted by the developer and were provided earlier than otherwise would have occurred, they lagged behind an already apparent need. With respect to secondary schools, the record for all communities except Arlington Heights indicates fairly consistent overcrowding.

No variation in the timing of high school construction by development pattern was observed in the communities studied; in all cases, new facilities were generally not built until substantial crowding and even double shifts occurred. The inability of the two planned case study communities to be more successful in the provision of both elementary and secondary school facilities may rest on the fact that they are part of large school districts that have needed to accommodate growth in a number of locations while at the same time replacing facilities in older areas. Only when the developer constructed the first elementary school on a payback basis -- as was the case in both of the planned communities studied -- was the timing of construction improved. The degree to which school construction is undertaken to serve areas of new development depends upon the holding capacities of existing facilities elsewhere in the district and the degree to which busing and boundary shifting can relieve overcrowding.

8. Streets and Roads.

a. Minor Streets. In all cases construction of minor streets occurred just prior to residential construction. No variation by development pattern was seen. Construction of these roads significantly in advance of residential occupancy was seen as uneconomical by all developers interviewed.

b. Collector, Arterial Streets and Primary Roads. A distinction must be drawn between the timing of construction of new roads as opposed to improvements to existing roads necessitated by growth. In planned communities, because of their large scale, a number of new roads may be necessary within the confines of the community. These new roads will be provided fairly early in the development period because the developer is usually willing to bear the cost. New roads occur fairly infrequently in conventional communities due to the small scale of most subdivisions. Moreover, those new roads which are needed in conventional developments are more likely to be provided by local, county, or state governments. Where this occurs, there is likely to be a delay in construction; new roads commonly are not built until well after congestion occurs on existing roads.

With respect to needed improvements to existing roads, they are likely to be provided by governmental bodies regardless of development pattern. Public authorities allocate road improvement funds based on fiscal and political considerations, and usually must respond to demands from many growth centers, while at the same time improving roads in older areas. Thus, these public improvements tend to lag behind the demands of increased population and higher traffic volumes.

The timing of road construction in planned communities as compared to conventional communities will be superior only when the developer pays the costs of new road construction or improvements to existing roads himself, or offers incentives such as right-of-way donation to encourage governments to act before congestion occurs.

9. Water and Sewer Utilities. All facilities within subdivisions or residential clusters are completed as part of site improvements prior to housing construction, regardless of development pattern.

Insofar as trunks and mains are concerned, the size of the developer and the extent to which he is willing or required to pay for needed extensions to his property line will determine how quickly lines are extended and thus how soon he can begin on-site development. Differences by development pattern in the timing of on-site mains and trunks are not significant. They will generally be built as needed to provide service to subdivisions or clusters according to a development program. The adequacy of pipe size to handle future as well as present needs is likely to be better in planned developments.

The greatest problem with respect to the timing of sewer and water facilities is not that adequate pipelines were not available when needed, but that the capacity of wells or sewage treatment plants was not adequate to meet demand. Inadequate capacities have occurred at various points in time in two of the case study communities. By contrast, the treatment plants and wells provided by the developer in one of the planned communities have been adequate to meet the needs of the community as it grew and to provide limited excess capacity to meet the demands of the near future. The timing of plant construction in the other planned community could not be attributed to its development pattern, as it is part of a county system. In all cases, however, investment in large plants with excess capacities to be carried over a long period of time was considered uneconomical. Overall, plant capacities will be adequate to handle short-term anticipated growth in planned communities, with facilities in conventional communities exceeding their design capacities before new plants or additions are built.

11. Storm Drainage. Within residential areas, gutters and storm sewers will be completed just ahead of residential construction regardless of the pattern of development. If larger components of the total drainage system are provided by private developers (as is more likely to occur in large scale planned development), improvements to existing facilities or additional infrastructure is likely to also be completed prior to residential development. If storm drainage facilities must be improved to handle increased run-off

volumes caused by urbanization, and these improvements must be made by public authorities, they may lag behind apparent need due to fiscal constraints and the need to service simultaneously many areas of growth. Sound engineering practice dictates that on-site storm drainage be adequately sized to handle volumes that are generated off-site but whose natural drainage patterns may cross property lines; problems of inadequate sizing are less likely to occur in large scale planned communities where comprehensive engineering studies will cover the entire area ultimately slated for development.

Moreover, in planned communities, strategically located detention and retention ponds are provided very early in the development period. In conventional communities, where these facilities are provided, they will be completed as individual subdivisions are constructed or later if provided by local governments.

E. RELATIONSHIP OF FINDINGS TO PREVIOUS CONCLUSIONS FROM THE COSTS OF SPRAWL - CAPITAL COSTS

The basic thesis regarding the differences in capital facility timing by development pattern stated that planned development would result in facilities being provided earlier in the development period and in fewer increments than conventional communities. Timing assumptions for individual capital cost categories, as used in The Costs of Sprawl, are presented here in Table 20. The timing shown in Table 20 is for total costs, regardless of their incidence among public and private participants.

Reflecting upon the findings of the case study research, revisions were made in these estimates so as to more precisely demonstrate where differences in timing are likely to occur due to development pattern. The revised estimates, which we feel accurately reflect existing practice, are also presented in Table 20.

1. Recreation. While our estimates of facility timing in The Costs of Sprawl assumed large increments of recreation facility construction, we now feel that such improvements are likely to occur in every year of the development period, closely tied to the rate of residential absorbtion. Facilities will occur somewhat earlier in the planned communities, as was assumed previously, because of the importance of recreational amenities in the developer's marketing scheme. In accord with earlier assumptions, we found that PUD projects would closely follow the pattern of planned communities with respect to recreation; thus, the "combination" prototype would show an overall pattern somehwere in between that of conventional and planned alternatives.

Table 20.

COMPARISON OF PREVIOUS ASSUMPTIONS WITH REVISIONS SUGGESTED BY CASE STUDY FINDINGS
PHASING OF CAPITAL COSTS

Cost Category	Year	Costs of Sprawl (Percent of Total Costs Over Development Period)											Revisions (Percent of Total Costs Over Development Period)										
		0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
Recreation																							
Planned		-	25	-	25	-	25	-	25	-	-	-	-	20	10	10	10	10	10	10	10	10	-
Sprawl		-	-	20	-	20	-	20	-	20	-	20	-	-	10	10	10	10	10	20	10	10	10
Combination		-	12.5	10	12.5	10	12.5	10	12.5	10	-	10	-	10	10	10	10	10	10	10	10	10	10
Open Space																							
Planned		-	40	-	-	40	-	-	20	-	-	-						No Change					
Sprawl		-	-	-	-	20	-	30	-	30	-	20						No Change					
Combination		-	20	-	-	30	-	15	10	15	-	10						No Change					
Elementary Schools																							
Planned		-	25	-	25	-	25	-	25	-	-	-	-	10	10	10	10	10	10	10	10	10	10
Sprawl		-	10	10	10	10	10	10	10	10	10	10	-	-	-	10	10	15	15	20	10	10	10
Combination		-	10	10	10	10	10	10	10	10	10	10	-	-	10	10	10	10	15	15	10	10	10
Secondary Schools																							
Planned		-	50	-	-	-	50	-	-	-	-	-	-	-	-	-	-	50	-	-	-	-	50
Sprawl		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	-	50	-	-	-	-	50
Combination		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	-	50	-	-	-	-	50
Police																							
Planned		-	70	-	10	-	10	-	10	-	-	-	-	-	-	100	-	-	-	-	-	-	-
Sprawl		-	-	40	-	30	-	20	-	10	-	-	-	-	-	-	-	100	-	-	-	-	-
Combination		-	-	40	-	30	-	20	-	10	-	-	-	-	-	-	-	100	-	-	-	-	-
Fire																							
Planned		-	75	-	-	-	25	-	-	-	-	-	-	10	60	-	-	20	-	10	-	-	-
Sprawl		-	-	50	-	-	-	-	50	-	-	-	-	10	-	50	-	-	-	25	-	15	-
Combination		-	-	50	-	-	-	-	50	-	-	-	-	10	-	50	-	-	-	25	-	15	-
Government																							
Planned		-	75	-	-	-	25	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
Sprawl		-	-	50	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	100	-	-	-
Combination		-	-	50	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	100	-	-	-
Solid Waste																							
Planned		-	20	10	10	10	10	10	10	10	10	-						No Change					
Sprawl		-	10	10	10	10	10	10	10	10	10	10						No Change					
Combination		-	15	10	10	10	10	10	10	10	10	5						No Change					
Health Care																							
Planned		-	50	-	-	-	50	-	-	-	-	-	-	-	-	-	50	-	-	50	-	-	-
Sprawl		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	50	-	-	50	-	-	-
Combination		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	50	-	-	50	-	-	-
Library																							
Planned		-	50	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-
Sprawl		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	100
Combination		-	-	40	-	-	40	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	100
Churches																							
Planned		-	25	-	25	-	25	-	25	-	-	-						No Change					
Sprawl		-	10	10	10	10	10	10	10	10	10	10						No Change					
Combination		-	10	10	10	10	10	10	10	10	10	10						No Change					
Transportation-Minor Streets																							
Planned		-	20	10	10	10	10	10	10	10	10	-	-	10	10	10	10	10	10	10	10	10	10
Sprawl		-	10	10	10	10	10	10	10	10	10	10	-	10	10	10	10	10	10	10	10	10	10
Combination		-	15	10	10	10	10	10	10	10	10	5	-	10	10	10	10	10	10	10	10	10	10

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Table 20.

COMPARISON OF PREVIOUS ASSUMPTIONS WITH REVISIONS SUGGESTED BY CASE STUDY FINDINGS
PHASING OF CAPITAL COSTS
(continued)

Cost Category	Year	Costs of Sprawl (Percent of Total Costs Over Development Period) 0	1	2	3	4	5	6	7	8	9	10	Revisions 0	1	2	3	4	5	6	7	8	9	10
Transportation - Collector Streets																							
Planned		-	25	-	25	-	25	-	25	-	-	-						No Change					
Sprawl		-	20	-	20	-	20	-	20	-	20	-						No Change					
Combination		-	22.5	-	22.5	-	22.5	-	22.5	-	10	-	-	25	-	25	-	20	-	20	-	10	-
Transportation - Arterial Streets																							
Planned		-	50	-	-	-	50	-	-	-	-	-	-	15	-	20	-	25	-	-	25	-	15
Sprawl		-	25	-	25	-	25	-	25	-	-	-	-	5	-	25	-	25	-	-	25	-	20
Combination		-	37.5	-	12.5	-	37.5	-	12.5	-	-	-	-	5	-	25	-	25	-	-	25	-	20
Expressway																							
Planned		100	-	-	-	-	-	-	-	-	-	-						No Change					
Sprawl		100	-	-	-	-	-	-	-	-	-	-						No Change					
Combination		100	-	-	-	-	-	-	-	-	-	-						No Change					
Utility Distribution and Collection Networks																							
Planned		-	20	10	10	10	10	10	10	10	10	-	-	30	5	5	20	5	5	15	5	5	5
Sprawl		-	10	10	10	10	10	10	10	10	10	10	-	30	5	5	20	5	5	15	5	5	5
Combination		-	15	10	10	10	10	10	10	10	10	5	-	30	5	5	20	5	5	15	5	5	5
Utility Plants and Facilities																							
Planned		-	50	-	-	-	50	-	-	-	-	-	-	30	-	-	25	-	-	25	-	-	20
Sprawl		-	25	-	25	-	25	-	25	-	-	-	-	30	-	-	-	25	-	-	25	-	20
Combination		-	25	-	25	-	25	-	25	-	-	-	-	30	-	-	-	25	-	-	25	-	20
Electric Transmission																							
Planned		100	-	-	-	-	-	-	-	-	-	-						No Change					
Sprawl		100	-	-	-	-	-	-	-	-	-	-						No Change					
Combination		100	-	-	-	-	-	-	-	-	-	-						No Change					
Land																							
Planned							Not Analyzed						-	100	-	-	-	-	-	-	-	-	-
Sprawl							Not Analyzed						-	100	-	-	-	-	-	-	-	-	-
Combination							Not Analyzed						-	100	-	-	-	-	-	-	-	-	-

Source: Real Estate Research Corporation.

REAL ESTATE RESEARCH CORPORATION

2. Open Space. No changes are indicated in the earlier timing estimates, which reflected the larger amounts of open space provided earlier in the development period in planned communities.

3. Elementary Schools. Our findings from the case study communities indicate that school construction is likely to be more incremental (spread out over a greater number of years) in the planned alternatives than was previously assumed. Nevertheless, the first school is more likely to be constructed earlier in the development period in planned communities because of the incentives offered by the developer. "Catch-up" periods are now indicated for both the conventional and "combination" prototypes, reflecting a lag in the provision of facilities in the early years of development.

   These conclusions must be stated with some qualification. Beyond the early construction of the first school, the planned community may also fall behind if (1) the school district must serve additional needs beyond that of the planned community (2) tax revenue and bonding capacity growth is insufficient to meet rapidly rising demand or (3) voter approval of bond issues is not forthcoming.

4. Secondary Schools. Contrary to previous assumptions, we now indicate no differences in the timing of secondary school facilities nor in the size of individual construction projects by development pattern. This change is made in light of findings from the case study communities; because high schools are generally part of large districts covering many communities, the timing of facility construction is not likely to be affected by the pattern of development in any one community.

5. Police. Whereas estimates made in The Costs of Sprawl assumed that the one police station found in each of the prototypes would be constructed in a number of increments, our findings from the case study communities indicate that construction of additions to police stations is the exception rather than the rule. Because the cost of patrol vehicles needed in the last year (the basis for our previous cost estimate) are a small proportion of the cost of the station, our earlier cost allocation has been revised to show 100 percent of the costs incurred in one year for all development patterns. In reality, however, some police cars are likely to be replaced in every year of the development period.

   The findings indicate that construction of the police facility, although occurring somewhat earlier in planned communities than conventional suburbs, will occur later in the development period than previously assumed. Some temporary facility will be used in the interim, but the cost of the facility (most likely provided free by another public agency or rented from a private party) would not be a capital cost.

6. Fire. Previous timing estimates assumed only two increments to fire station construction, with building of the first fire station occurring in the first year in the planned prototypes (preceding construction in conventional and "combination" communities by one year). Although our case study findings verify that facilities are constructed earlier in planned communities, a number of modifications to previous assumptions are shown. Smaller increments indicated in the revised timing allocations represent periodic purchase of equipment in both planned and conventional communities. The construction of a fire station will predate most other public buildings; however, it is not likely to occur as early as the first year of the development period (as was shown for the planned alternative in the previous estimates).

7. Government Building. Contrary to previous estimates, we now show the entire cost of the government building in one year; evidence from the case study communities did not indicate construction of additions to be variable among development patterns. Although the provision of a permanent government facility will occur earlier in planned communities than conventional, its construction will not occur until well into the development period; costs would not be incurred in the first year as was shown previously.

8. Solid Waste. No changes are proposed.

9. Hospital. Although the planned communities studied do not as yet have hospital facilities, a facility is planned for a later date in at least one of them. There is no evidence from the case study communities that indicates a difference in timing of hospital construction by development pattern. However, there is some indication that overall health service provision is being given greater emphasis in Columbia and some of the other planned communities across the country than would otherwise occur in conventional suburban development. This does not change our overall conclusions from the case studies regarding hospital construction timing -- no variation by development pattern.

10. Library. As previously assumed, library facilities are likely to occur earlier in planned communities than conventional suburbs; however, they will be built later in the development period than shown in our earlier estimates. Temporary facilities are more likely in the planned alternatives early in the development period, although these are not included in the capital cost estimates.

11. Churches. No changes are suggested.

12. Minor Streets. Our revised assumptions show only minor variation from the previous timing patterns shown. Because we assumed in The Costs of Sprawl that the residential absorption rate is the same regardless of development pattern, no differences are now shown between planned and conventional development in the timing of minor streets, which were found to immediately precede residential construction.

13. Collector Streets. No changes are shown in the previous pattern of collector street construction for planned and conventional prototypes. For the "combination" situation, revisions reflect the finding that construction timing in large PUDs would closely follow the pattern of planned new communities in the early years of development. The expenditure pattern shown is modified to show a larger proportion of costs in the early years, with increments decreasing in size as collectors are built later in conventional subdivisions.

14. Arterial Streets. Revised assumptions reflect the finding that arterial road construction will be more incremental than previously assumed for both planned and conventional communities. This results from the involvement of numerous public agencies and (in the case of the planned and "combination" situations) private developers as well. The earlier construction of arterials shown in the planned prototypes reflects developer activity in providing "new" roads early in the development period. The timing patterns tend to converge over time, given our finding that public improvements to existing roads will not show significant variation by development pattern. (See Section G below for a discussion of the timing of improvements provided by the public sector).

15. Expressways. No changes are indicated. Expressways are likely to exist before the start of development, although they may be improved at a later date after substantial urbanization.

16. Utility Distribution and Collection Networks. In contrast to previous estimates, which showed minor variation in the timing of utility construction among development patterns, these differences are eliminated altogether in the revised estimates. The increments of cost shown in each year of the development pattern have been revised to indicate significant investment in those years when trunks or mains are being constructed, with small cost allocations for branch pipe installation in the intervening years.

    Differences in the pace of utility construction may occur in the initial years when extension of lines is required from outside the community to service new development. Because such externalities were not considered in The Costs of Sprawl, they do not affect the timing assumptions shown.

17. Utility Plants and Facilities. Evidence from the case communities did not substantiate the differences in the size of increments to water and sewer plants among development patterns which were shown previously. Whereas the previous assumptions indicated significant anticipation of capacity needs, we found that this did not represent actual practice. Moreover, facility capacities in conventional communities are likely to fall behind in the middle of the development period.

    As was shown in our earlier estimates, the "combination" prototype was found to follow the conventional pattern because the PUD developers will have little influence over expansion timing where these facilities are provided on an area-wide basis.

18. Land. The timing of land purchases was not considered in the earlier Costs of Sprawl study. Our investigations in the case study communities indicate that a variety of expenditure patterns occur which seem to be more dependent on the foresight and financial resources available to both private developers and government officials than to the pattern of development. Developers of planned communities, PUDs, and conventional projects would ideally prefer to purchase all the land they expect to ultimately market prior to the escalation of land prices which occurs when development pressure begins. However, this may not always be financially feasible. On the public side, governments can and often do purchase sites for schools, fire stations, or government complexes in anticipation of need. This was seen in both planned and conventional case study communities. Of course, it is a rare community that can accurately forecast the exact amount of land in appropriate locations needed for public purposes at maturity. To the extent that a single overall developer operates in a planned community, local government units may more accurately project the demands which will be placed upon them. However, planned communities are not immune to changes in market conditions which could significantly alter projected absorption rates and therefore alter land purchase patterns for both the private and public sectors.

Because of the complexities outlined above, we have assumed, for purposes of this analysis, that all land is purchased in the first year of the development period. This is an admitted oversimplification of a variety of complex factors which are not necessarily correlated with physical development patterns.

19. Residential. We have not proposed any modifications in the timing of residential construction costs as indicated by the absorption schedules presented in Chapter VII of The Costs of Sprawl. Without repeating the schedules in this volume, a recap of their assumptions is in order. In the three planned prototypes, equal proportions of each appropriate housing type are built in each year of the development period. In conventional developed and "combination" communities, the more costly single family housing is built first. This is a standard marketing approach in suburban fringe communities, where the presence of single family homes is viewed as a "drawing card" which helps attract additional families to the area. For all prototypes, a total of 1,000 units are built each year.

F. APPLICATION TO COST ESTIMATES

Table 21 applies the revised timing patterns to the dollar cost estimates developed in The Costs of Sprawl, updated to 1974 dollars. The general pattern which emerges is that a higher proportion of expenditures occurs in the earlier years of the development period in the planned prototypes. At the same time, however, total dollar costs for most expenditure items are lower in planned communities than in their conventional counterparts. In examining the year-by-year and cumulative totals exclusive of residential construction, the reader may note that the planned prototypes show lower costs than sprawl communities of the same density in all years except two and three. Type VI (high density planned) is always less costly than Type V (low density sprawl). Including residential construction costs (which are higher in "sprawl" communities than "planned" in the early years) results in lower costs for the planned prototypes in all years of the development period, both on an annual and a cumulative basis.

Table 21.

PHASING OF CAPITAL COSTS
SUMMARY - YEAR BY YEAR
(1974 Dollars)

	Development Year											
	0	1	2	3	4	5	6	7	8	9	10	Total
						(in thousands)						
Residential												
Community I (Planned Mix)	$ 0	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$ 29,448	$294,480
Community II (Combination Mix)	0	34,242	33,150	31,748	30,657	29,286	28,977	27,145	27,145	25,979	26,141	294,470
Community III (Sprawl Mix)	0	39,038	36,854	34,051	31,868	29,125	28,507	24,842	24,842	22,510	22,834	294,471
Community IV (Low Density Planned)	0	43,763	43,763	43,763	43,763	43,763	43,763	43,763	43,763	43,763	43,763	437,630
Community V (Low Density Sprawl)	0	44,198	44,140	44,082	44,053	44,053	44,053	44,053	43,966	43,966	43,966	440,530
Community VI (High Density Planned)	0	22,040	22,040	22,040	22,040	22,040	22,040	22,040	22,040	22,040	22,040	220,400
Open Space/Recreation												
Community I (Planned Mix)	$ 0	$ 799	$ 303	$ 303	$ 496	$ 304	$ 303	$ 400	$ 303	$ 303	$ 0	$ 3,514
Community II (Combination Mix)	0	366	302	302	400	302	351	335	351	302	335	3,346
Community III (Sprawl Mix)	0	0	300	300	334	301	352	602	352	301	335	3,177
Community IV (Low Density Planned)	0	799	303	303	496	304	303	400	303	303	0	3,514
Community V (Low Density Sprawl)	0	0	300	300	334	301	352	602	352	301	335	3,177
Community VI (High Density Planned)	0	799	303	303	496	304	303	400	303	303	0	3,514
Schools												
Community I (Planned Mix)	$ 0	$ 3,617	$ 3,617	$ 3,617	$ 3,618	$ 12,396	$ 3,617	$ 3,618	$ 3,617	$ 3,617	$ 12,397	$ 53,731
Community II (Combination Mix)	0	0	3,617	3,618	3,617	12,396	5,426	5,426	3,617	3,617	12,397	53,731
Community III (Sprawl Mix)	0	0	0	3,617	3,617	14,205	5,426	7,235	3,617	3,617	12,397	53,731
Community IV (Low Density Planned)	0	3,617	3,617	3,617	3,618	12,396	3,617	3,618	3,617	3,617	12,397	53,731
Community V (Low Density Sprawl)	0	0	0	3,617	3,617	14,205	5,426	7,235	3,617	3,617	12,397	53,731
Community VI (High Density Planned)	0	3,617	3,617	3,617	3,618	12,396	3,617	3,618	3,617	3,617	12,397	53,731
Public Facilities												
Community I (Planned Mix)	$ 0	$ 1,972	$ 436	$ 3,127	$ 3,839	$ 2,665	$ 1,347	$ 5,759	$ 27	$ 27	$ 0	$ 19,199
Community II (Combination Mix)	0	874	767	1,234	4,579	2,030	767	5,465	767	908	2,074	19,465
Community III (Sprawl Mix)	0	860	766	1,234	4,578	2,046	767	5,466	767	908	2,088	19,480
Community IV (Low Density Planned)	0	1,981	443	3,139	3,843	2,670	1,350	5,764	30	30	0	19,250
Community V (Low Density Sprawl)	0	881	772	1,315	4,584	2,049	771	5,507	770	933	2,090	19,672
Community VI (High Density Planned)	0	1,978	517	3,124	3,835	2,691	1,343	5,770	23	23	0	19,304
Transportation												
Community I (Planned Mix)	$ 4,027	$ 4,753	$ 817	$ 5,268	$ 817	$ 5,783	$ 817	$ 3,208	$ 3,392	$ 816	$ 2,362	$ 32,060
Community II (Combination Mix)	4,107	3,980	853	6,506	853	6,006	853	2,850	4,010	1,851	3,377	35,246
Community III (Sprawl Mix)	4,188	3,708	887	6,678	887	6,678	887	2,967	4,600	2,968	3,858	38,306
Community IV (Low Density Planned)	4,030	5,843	1,336	6,414	1,336	6,985	1,335	4,129	4,191	1,335	3,049	39,983
Community V (Low Density Sprawl)	4,194	4,202	2,045	6,740	2,045	6,740	2,045	3,569	5,218	3,569	4,583	44,950
Community VI (High Density Planned)	4,024	4,100	469	4,578	469	5,057	470	2,668	2,859	470	1,904	27,068
Utilities												
Community I (Planned Mix)	$ 394	$ 11,684	$ 1,722	$ 1,723	$ 8,013	$ 1,723	$ 1,723	$ 6,290	$ 1,723	$ 1,723	$ 2,621	$ 39,339
Community II (Combination Mix)	394	12,684	1,890	1,887	7,557	3,013	1,890	5,667	3,013	1,889	2,788	42,672
Community III (Sprawl Mix)	394	13,622	2,045	2,045	8,183	3,168	2,045	6,136	3,170	2,047	2,945	45,800
Community IV (Low Density Planned)	394	16,733	2,560	2,560	11,385	2,560	2,560	8,825	2,560	2,560	3,477	56,174
Community V (Low Density Sprawl)	394	21,894	3,420	3,420	13,679	4,567	3,420	10,260	4,567	3,420	4,337	73,378
Community VI (High Density Planned)	394	7,849	1,087	1,087	5,455	1,087	1,087	4,371	1,085	1,085	1,974	26,561
Land												
Community I (Planned Mix)	$ 0	$ 20,071	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 20,071
Community II (Combination Mix)	0	25,783	0	0	0	0	0	0	0	0	0	25,783
Community III (Sprawl Mix)	0	27,232	0	0	0	0	0	0	0	0	0	27,232
Community IV (Low Density Planned)	0	28,967	0	0	0	0	0	0	0	0	0	28,967
Community V (Low Density Sprawl)	0	35,488	0	0	0	0	0	0	0	0	0	35,488
Community VI (High Density Planned)	0	17,356	0	0	0	0	0	0	0	0	0	17,356
Totals Exclusive of Residential												
Community I (Planned Mix)	$ 4,421	$ 42,896	$ 6,895	$ 14,038	$ 16,783	$ 22,871	$ 7,807	$ 19,275	$ 9,062	$ 6,486	$ 17,380	$167,914
Community II (Combination Mix)	4,501	43,688	7,429	13,546	17,006	23,747	9,287	19,743	11,758	8,567	20,971	180,243
Community III (Sprawl Mix)	4,582	45,422	3,998	13,874	17,599	26,398	9,477	22,406	12,506	9,841	21,623	187,726
Community IV (Low Density Planned)	4,424	57,940	8,259	16,033	20,678	24,915	9,165	22,736	10,701	7,845	18,923	201,619
Community V (Low Density Sprawl)	4,588	62,465	6,537	15,392	24,259	27,862	12,014	27,173	14,524	11,840	23,742	230,396
Community VI (High Density Planned)	4,418	35,699	5,993	12,709	13,873	21,535	6,820	16,827	7,887	5,498	16,275	147,534

REAL ESTATE RESEARCH CORPORATION

Table 21.

PHASING OF CAPITAL COSTS
SUMMARY - YEAR BY YEAR
(1974 Dollars)
(continued)

	Development Year											
	0	1	2	3	4	5	6	7	8	9	10	Total
Cumulative Totals Exclusive of Residential												
Community I (Planned Mix)	$ 4,421	$ 47,317	$ 54,212	$ 68,250	$ 85,033	$107,904	$115,711	$134,986	$144,048	$150,534	$167,914	
Community II (Combination Mix)	4,501	48,189	55,618	69,164	86,170	109,917	119,204	138,947	150,705	159,272	180,243	
Community III (Sprawl Mix)	4,582	50,004	54,002	67,876	85,475	111,873	121,350	143,756	156,262	166,103	187,726	
Community IV (Low Density Planned)	4,424	62,364	70,623	86,656	107,334	132,249	141,414	164,150	174,851	182,696	201,619	
Community V (Low Density Sprawl)	4,588	67,053	73,590	88,982	113,241	141,103	153,117	180,290	194,814	206,654	230,396	
Community VI (High Density Planned)	4,418	40,117	46,110	58,819	72,692	94,227	101,047	117,874	125,761	131,259	147,534	
Totals Including Residential												
Community I (Planned Mix)	$ 4,421	$ 72,344	$ 36,343	$ 43,486	$ 46,231	$ 52,319	$ 37,255	$ 48,723	$ 38,510	$ 35,934	$ 46,828	$462,394
Community II (Combination Mix)	4,501	77,930	40,579	45,294	47,663	53,033	38,264	46,888	38,903	34,546	47,112	474,713
Community III (Sprawl Mix)	4,582	84,460	40,852	47,925	49,467	55,523	37,984	47,248	37,348	32,351	44,457	482,197
Community IV (Low Density Planned)	4,424	101,703	52,022	59,796	64,441	68,678	52,928	66,499	54,464	51,608	62,686	639,249
Community V (Low Density Sprawl)	4,588	106,663	50,677	59,474	68,312	71,915	56,067	71,226	58,490	55,806	67,708	670,926
Community VI (High Density Planned)	4,418	57,739	28,033	34,749	35,913	43,575	28,860	38,867	29,927	27,538	38,315	367,934
Cumulative Totals												
Community I (Planned Mix)	$ 4,421	$ 76,765	$113,108	$156,594	$202,825	$255,144	$292,399	$341,122	$379,632	$415,566	$462,394	
Community II (Combination Mix)	4,501	82,431	123,010	168,304	215,967	269,000	307,264	346,526	393,055	427,601	474,713	
Community III (Sprawl Mix)	4,582	89,042	129,894	177,819	227,286	282,809	320,793	368,041	405,389	437,740	482,197	
Community IV (Low Density Planned)	4,424	106,127	158,149	217,945	282,386	351,064	403,992	470,491	524,955	576,563	639,249	
Community V (Low Density Sprawl)	4,588	111,251	161,928	221,402	289,714	361,629	417,696	488,922	547,412	603,218	670,926	
Community VI (High Density Planned)	4,418	62,157	90,190	124,939	160,852	204,427	233,287	272,154	302,081	329,619	367,934	

Note: Residential costs include housing construction costs and builders' overhead and profit. They do not include financing, land, or site preparation costs.

Source: Real Estate Research Corporation.

REAL ESTATE RESEARCH CORPORATION

G. TIMING OF PUBLIC CAPITAL EXPENDITURES.

The timing assumptions presented in The Costs of Sprawl, as revised in Section E of this chapter, cover total capital expenditures regardless of their incidence among public and private participants. Determining the effect of alternative development patterns on government expenditure patterns sheds further light on the differences between planned and conventional development. Where government expenditures were indicated in Chapter V, we constructed a timing schedule, shown in Table 22. For those cost categories where the incidence of cost is 100 percent public, the timing estimates are the same as shown in Table 20.

Findings from the case study communities indicate that the major factor affecting the timing of facility expenditures may well be the degree to which the developer is required to or is willing to bear the cost, at least in the short term. Thus, to the extent that developers are providing a larger share of land and facility costs for most cost categories in planned development alternatives, this also results in facilities being provided earlier in the development period than in conventional development. What variation exists in public expenditure timing among development patterns is probably attributable to the greater uncertainty regarding future growth potential in conventional suburbs, as well as the incentives for early facility provision offered by the planned community developer (such as site dedications).

The rationale for the individual timing estimates shown in Table 22 is presented below:

1. Recreation. Expenditures for all community types will be fairly evenly spread over the development period. Expenditures would occur slightly earlier in planned communities due to the incentive offered by dedicated recreation sites.

2. Open Space. In planned communities, development increments will be larger because donated open space sites are likely to be large parcels. Public open space improvements will lag behind that provided by developers in all instances.

3. Elementary and Secondary Schools, Police, Fire, Government, Libraries. Timing shown is the same as in Table 20. Differences between development patterns illustrate the effect of developer-provided incentives (site dedication, sale of land at cost) that are more likely to occur in planned communities.

4. Collector Streets. Because these costs are entirely borne by the developer in planned communities, no public expenditure timing is shown. Initial public construction of collectors will occur earlier in "combination" situations than conventional, where PUD developers offer land for rights-of-way as an incentive. Beyond this, the timing patterns are fairly similar for both conventional and "combination" prototypes; the majority of improvements are delayed until well into the development period.

Table 22 PUBLIC SHARE OF TOTAL CAPITAL COSTS ON AN ANNUAL BASIS

Cost Category	Overall Incidence of Cost (Public/Private)	Development Year 0	1	2	3	4	5	6	7	8	9	10
		(Percent of Public Costs)										
Recreation												
Planned	20/ 80	-	-	20	10	10	10	10	20	10	10	-
Medium Density Sprawl	40/ 60	-	-	10	10	10	10	10	20	10	10	10
Low Density Sprawl	80/ 20	-	-	10	10	10	10	10	20	10	10	10
Combination	30/ 70	-	-	15	10	10	10	10	20	10	10	5
Open Space												
Planned	20/ 80	-	-	-	-	60	-	-	40	-	-	-
Medium Density Sprawl	40/ 60	-	-	-	-	20	-	30	-	30	-	20
Low Density Sprawl	80/ 20	-	-	-	-	20	-	30	-	30	-	20
Combination	30/ 70	-	-	-	-	30	-	30	-	30	-	10
Schools - Elementary												
Planned	100/ 0	-	10	10	10	10	10	10	10	10	10	10
Sprawl	100/ 0	-	-	-	10	10	15	15	20	10	10	10
Combination	100/ 0	-	-	10	10	10	10	15	15	10	10	10
Schools - Secondary												
Planned	100/ 0	-	-	-	-	-	50	-	-	-	-	50
Sprawl	100/ 0	-	-	-	-	-	50	-	-	-	-	50
Combination	100/ 0	-	-	-	-	-	50	-	-	-	-	50
Police												
Planned	100/ 0	-	-	-	100	-	-	-	-	-	-	-
Sprawl	100/ 0	-	-	-	-	-	100	-	-	-	-	-
Combination	100/ 0	-	-	-	-	-	100	-	-	-	-	-
Fire												
Planned	100/ 0	-	10	60	-	-	20	-	10	-	-	-
Sprawl	100/ 0	-	10	-	50	-	-	-	25	-	15	-
Combination	100/ 0	-	10	-	50	-	-	-	25	-	15	-
Government												
Planned	100/ 0	-	-	-	-	-	100	-	-	-	-	-
Sprawl	100/ 0	-	-	-	-	-	-	-	100	-	-	-
Combination	100/ 0	-	-	-	-	-	-	-	100	-	-	-
Libraries												
Planned	100/ 0	-	-	-	-	-	-	100	-	-	-	-
Sprawl	100/ 0	-	-	-	-	-	-	-	-	-	-	100
Combination	100/ 0	-	-	-	-	-	-	-	-	-	-	100
Transportation - Collector Streets												
Planned	0/100	-	-	-	-	-	-	-	-	-	-	-
Sprawl	50/ 50	-	-	-	20	-	20	-	30	-	30	-
Combination	40/ 60	-	10	-	20	-	20	-	30	-	20	-
Transportation - Arterial Streets												
Planned	80/ 20	-	-	-	15	-	30	-	-	30	-	25
Sprawl	100/ 0	-	-	-	25	-	25	-	-	25	-	25
Combination	90/ 10	-	-	-	25	-	25	-	-	25	-	25
Transportation - Expressway												
All Community Types	100/ 0	100	-	-	-	-	-	-	-	-	-	-
Water, Sewer, Storm Drainage Distribution and Collection Networks												
Planned	0/100	-	-	-	-	-	-	-	-	-	-	-
Sprawl	40/ 60	-	50	-	-	35	-	-	15	-	-	-
Combination	30/ 70	-	50	-	-	35	-	-	15	-	-	-
Utility Plants												
Planned	100/ 0	-	30	-	-	25	-	-	25	-	-	20
Sprawl	100/ 0	-	30	-	-	-	25	-	-	25	-	20
Combination	100/ 0	-	30	-	-	-	25	-	-	25	-	20
Land												
Low Density Planned	10/ 90	-	100	-	-	-	-	-	-	-	-	-
Medium Density Planned	20/ 80	-	100	-	-	-	-	-	-	-	-	-
High Density Planned	30/ 70	-	100	-	-	-	-	-	-	-	-	-
Low Density Sprawl	20/ 80	-	100	-	-	-	-	-	-	-	-	-
Medium Density Sprawl	30/ 70	-	100	-	-	-	-	-	-	-	-	-
Combination	30/ 70	-	100	-	-	-	-	-	-	-	-	-

Source: Real Estate Research Corporation.

5. Arterial Streets. In the planned communities, arterial construction occurring in the early part of the development period will be paid by the developer. In the later years, little variation occurs in the timing of arterial improvements, in all cases, substantial delays are experienced where a multiplicity of governmental bodies are constructing or widening arterial roads.

6. Expressway. The timing pattern is the same as shown in Table 20. No differences in timing among development patterns are indicated.

7. Water, Sewer, and Storm Drainage Networks. No costs are borne by public bodies in planned communities; hence, no public timing is shown. For conventional and "combination" prototypes, costs are shown for those years in which major trunks and mains are likely to be built.

8. Utility Plants. Because plant construction is borne entirely by government, the timing of improvements shown is the same as that for total costs presented in Table 20.

9. Land. As in Table 20 all government purchases of land are assumed to occur in year one of the development period. We recognize that is a gross oversimplification of what is often a very complex pattern. Our investigations in the case study communities indicate that land for public use may be purchased before the buildup of development pressure, once development has commenced, or after substantial growth has occurred. These practices are dependent on the financial resources of individual communities, and thus cannot be correlated with the pattern of development. Conventional suburbs may buy land early in their development but not improve the site until much later, while planned communities (with greater certainty regarding the magnitude and/or direction of future residential expansion) may build public works earlier.

H. APPLICATION TO COST ESTIMATES

Table 23 summarizes the application of timing assumptions for public expenditures to total government costs as estimated in Table 15, Chapter V. The reader should recall that, with the exception of schools and public facilities (police and fire stations, government buildings, and library), total government expenditures are far lower in the planned communities than in conventional prototypes of the same density. This is due to the significance of developer dedications and contributions to recreation facilities, streets, utility systems and public land needs. Total costs to government are virtually identical ($79 million) in all three planned community prototypes, saving anywhere from 29 to 33 percent over "sprawl".

Table 23.

GOVERNMENT CAPITAL EXPENDITURE PHASING
Year By Year

	0	1	2	3	4	5 (in 000s)	6	7	8	9	10	Total
Open Space/ Recreation												
Community I	$ 0	$ 0	$ 121	$ 61	$ 118	$ 61	$ 60	$ 160	$ 61	$ 61	$ 0	$ 703
Community II	0	0	136	91	119	91	120	181	120	91	55	1,004
Community III	0	0	120	121	134	121	140	241	140	120	134	1,271
Community IV	0	0	121	61	118	61	60	160	61	61	0	703
Community V	0	0	241	240	268	240	282	481	282	240	268	2,542
Community VI	0	0	121	61	118	61	60	160	61	61	0	703
Schools												
Community I	$ 0	$ 3,617	$ 3,617	$ 3,617	$ 3,618	$12,396	$ 3,617	$ 3,618	$ 3,617	$ 3,617	$12,397	$ 53,731
Community II	0	0	3,617	3,618	3,617	12,396	5,426	5,426	3,617	3,617	12,397	53,731
Community III	0	0	0	3,617	3,618	14,205	5,426	7,234	3,617	3,617	12,397	53,731
Community IV	0	3,617	3,617	3,617	3,618	12,396	3,617	3,618	3,617	3,617	12,397	53,731
Community V	0	0	0	3,617	3,618	14,205	5,426	7,234	3,617	3,617	12,397	53,731
Community VI	0	3,617	3,617	3,617	3,618	12,396	3,617	3,618	3,617	3,617	12,397	53,731
Public Facilities												
Community I	$ 0	$ 68	$ 409	$ 1,249	$ 0	$ 788	$ 1,320	$ 68	$ 0	$ 0	$ 0	$ 3,902
Community II	0	93	0	467	0	1,263	0	885	0	140	1,320	4,168
Community III	0	93	0	467	0	1,278	0	885	0	140	1,320	4,183
Community IV	0	69	412	1,256	0	789	1,320	69	0	0	0	3,915
Community V	0	109	0	543	0	1,278	0	924	0	163	1,320	4,337
Community VI	0	82	494	1,249	0	817	1,320	82	0	0	0	4,044
Transportation												
Community I	$ 4,027	$ 0	$ 0	$ 1,236	$ 0	$ 2,472	$ 0	$ 0	$ 2,472	$ 0	$ 2,060	$ 12,267
Community II	4,107	400	0	3,640	0	3,639	0	1,199	2,841	799	2,841	19,466
Community III	4,188	0	0	4,752	0	4,752	0	1,560	3,712	1,560	3,712	24,236
Community IV	4,030	0	0	1,370	0	2,742	0	0	2,742	0	2,285	13,169
Community V	4,194	0	0	3,934	0	3,934	0	1,143	3,172	1,143	3,172	20,693
Community VI	4,024	0	0	1,147	0	2,294	0	0	2,294	0	1,911	11,670
Utilities												
Community I	$ 0	$ 1,348	$ 0	$ 0	$ 1,123	$ 0	$ 0	$ 1,123	$ 0	$ 0	$ 898	$ 4,492
Community II	0	6,438	0	0	3,563	1,123	0	1,526	1,123	0	898	14,671
Community III	0	8,707	0	0	5,151	1,123	0	2,208	1,123	0	898	19,210
Community IV	0	1,376	0	0	1,147	0	0	1,147	0	0	917	4,587
Community V	0	13,680	0	0	8,613	1,147	0	3,691	1,147	0	917	29,195
Community VI	0	1,334	0	0	1,111	0	0	1,112	0	0	889	4,446
Land												
Community I	$ 0	$ 4,014	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 4,014
Community II	0	7,735	0	0	0	0	0	0	0	0	0	7,735
Community III	0	8,170	0	0	0	0	0	0	0	0	0	8,170
Community IV	0	2,897	0	0	0	0	0	0	0	0	0	2,897
Community V	0	7,098	0	0	0	0	0	0	0	0	0	7,098
Community VI	0	5,207	0	0	0	0	0	0	0	0	0	5,207
Total												
Community I	$ 4,027	$ 9,047	$ 4,147	$ 6,163	$ 4,859	$15,717	$ 4,997	$ 4,969	$ 6,150	$ 3,678	$15,355	$ 79,109
Community II	4,107	14,666	3,753	7,816	7,299	18,512	5,546	9,217	7,701	4,647	17,511	100,775
Community III	4,188	16,970	120	8,957	8,903	21,479	5,566	12,126	8,592	5,437	18,461	110,801
Community IV	4,030	7,959	4,150	6,304	4,883	15,988	4,997	4,994	6,420	3,678	15,599	79,002
Community V	4,194	20,887	241	8,334	12,499	20,804	5,708	13,473	8,218	5,163	18,075	117,596
Community VI	4,024	10,240	4,232	6,074	4,847	15,568	4,997	4,972	5,972	3,678	15,197	79,801
Cumulative Total												
Community I	$ 4,027	$13,074	$17,221	$23,384	$28,243	$43,960	$48,957	$53,926	$60,076	$63,754	$ 79,109	
Community II	4,107	18,773	22,526	30,342	37,641	56,153	61,699	70,916	78,617	83,624	100,775	
Community III	4,188	21,158	21,278	30,235	39,138	60,617	66,183	78,311	86,903	92,340	110,801	
Community IV	4,030	11,989	16,139	22,443	27,326	43,314	48,311	53,305	59,725	63,403	79,002	
Community V	4,194	25,081	25,322	33,656	46,155	66,959	72,667	86,140	94,358	99,521	117,596	
Community VI	4,024	14,264	18,496	24,570	29,417	44,985	49,982	54,954	60,926	64,604	79,801	

Source: Real Estate Research Corporation. All costs in 1974 dollars.

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Differences in the timing of public expenditures by development pattern are most significant for schools and public facilities. Here costs are incurred earlier in the development period in the planned communities, with conventional suburbs "catching up" after the fifth year. There are little or no differences in total costs at the end of the development period for these items. The construction of facilities earlier in the development period in planned communities can be viewed as a positive response by government to planned development; planning offers government officials a greater degree of certainty regarding the magnitude and location of future development activity. Moreover, contributions made by developers act as an incentive for governmental bodies to provide facilities earlier. Often, developers dedicate land or provide amenities beyond that required as a condition of project approval as part of an agreement with local bodies to construct schools, parks, libraries, etc. earlier than would otherwise occur. This in turn improves the attractiveness of the planned community, whose developers and builders must compete in the market place for new residents.

A different pattern can be seen for road and utility expenditures. Given absorption schedules with an identical number of units being built in each year regardless of development pattern, roads and utilities must be available to service these units regardless of the type of development. Thus, year by year cost variations shown in Table 21 are largely attributable to the developer's construction of utility lines and collector streets in planned communities, which lower costs to government; differences in timing of government-provided improvements would not be significant. However, the greater certainty of the location of future development activity afforded by unitary planning on a large scale would allow for earlier construction of treatment plant additions, trunk line extensions, or arterial improvements.

I. METHODS AND ASSUMPTIONS--GOVERNMENT OPERATING AND MAINTENANCE COSTS

1. Analytical Procedure

a. Data from municipal budgets and/or financial reports for the most recent growth period were analyzed for the case study communities.

b. A profile of operating and maintenance expenditures was then constructed, relating each year's expenditures (in constant dollars) to costs in the last year of the study period. We then compared the rate of change to the rate of population growth.

c. For certain cost categories, changes in expenditures over time were contrasted with changes in service level, as reflected in the number of patrolmen or firemen per thousand population, or pupil/teacher ratios over time.

d. We supplemented data accumulation with interviews of public officials regarding operating expenditure patterns.

e. Conclusions were formulated regarding the differences in expenditure patterns by development pattern.

f. Revisions to previous assumptions were made based upon the patterns observed.

2. Key Assumptions. Although all expenditure categories were investigated to some extent, we concentrated our efforts on those cost categories where operating costs are significant expenditure items in local budgets. These are: general government, police, fire, schools, and sewage treatment.

J. FINDINGS AND CONCLUSIONS-OPERATING AND MAINTENANCE COSTS

Table 24 summarizes the findings from the case study communities regarding the pattern of timing of operating and maintenance expenditures. Findings are presented for each community by major cost category.

As can be seen from the summary table, investigations undertaken in the case study communities did not in and of themselves yield information which could be used to form reliable conclusions as to the differences in the timing of operating expenditures between planned and sprawl communities.

In two of the case studies, all of the functions studied are provided by a large county government. The pattern of operating expenditures on an annual basis, therefore, cannot be directly related to development patterns, nor does data manipulation show how on-going services were provided to our case study communities as they grew. The same situation occurred with respect to one or more expenditure items in the other three communities.

Table 24.

SUMMARY OF FINDINGS
CASE STUDY COMMUNITIES
PHASING OF OPERATING AND MAINTENANCE COSTS

Cost Category	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Government Regulation and Administration	Irregular pattern of expenditure increase; no relationship to population growth can be inferred.	Cannot infer pattern; variety of services increasing but many operating costs are still paid by developer.	Expenditures increased more rapidly than population growth.	Services provided county-wide; cannot attribute pattern of expenditure to Reston itself.	Services provided county-wide; cannot attribute pattern of expenditure to West Springfield itself.
Police	Consistent increase in expenditures; increase in staff and service standards during rapid growth period.	Consistent increase in staff and expenditures; staff standards adequate given small size of village.	Consistent increases in expenditures; staff standards have kept pace with growth.	Rate of expenditure increase lower than rate of population increase in Reston. Cannot infer pattern of service delivery due to county-wide service area.	Rate of expenditure increase lower than rate of population increase in West Springfield. Cannot infer pattern of service delivery due to county-wide service area.
Fire	Consistent increase in expenditures; increase in professional staff and variety of services (i.e., rescue squad) during period of rapid growth.	No professionalization of force seen; no data on expenditures from which pattern can be inferred. Service level and variety good considering size of community.	Consistent increase in expenditures with no discernable rise in service quality (still all-volunteer departments) except for central communications.	Services provided county-wide; cannot attribute pattern of expenditure to Reston itself.	Services provided county-wide; cannot attribute pattern of expenditure to West Springfield itself.
Library	Significant staff increases following facility construction; expenditure thus tied to capital facility construction - now increasing faster than rate of population growth.	Presently not operated with public funds.	Operated as part of county-wide system; pattern of expenditure cannot be attributed to Amherst.	Services provided county-wide; cannot attribute pattern of expenditure to Reston itself.	No library located within West Springfield.
Parks and Recreation	No consistent expenditure pattern; cannot infer response to growth.	Cannot infer pattern; variety of services provided publicly is limited; many costs of maintenance are still borne by the developer.	Expenditures remained relatively stable; much maintenance work done by highway department. Increased active recreation programs for children.	No public recreation activities within Reston; pattern is county-wide.	Cannot attribute county-wide pattern of expenditures to West Springfield itself.
Schools	Consistently increasing expenditures; greater than rate of public increases as more services were provided. Rate of budget increases now declining.	School district covers large area; cannot attribute pattern of costs to Park Forest South alone.	During most of the growth period expenditures increased at a higher rate than pupil growth as new services were provided; rate of budget increases now declining.	Cannot attribute pattern of county-wide school expenditures to Reston alone.	Cannot attribute pattern of county-wide expenditures to West Springfield alone.
Streets and Roads	Cannot discern pattern due to multiplicity of jurisdictions involved.	Expenditures limited thus far; inadequate staff and equipment. High proportion of costs still borne by developer. Cannot infer pattern of public expenditures.	Cannot discern pattern due to multiplicity of jurisdictions involved.	Roads maintained by the state; no expenditure pattern can be attributed to Reston.	Roads maintained by state; no expenditures can be attributed to West Springfield.
Utilities	No consistent pattern of expenditures during major growth periods; increases occured in years when small private systems were acquired. Relatively stable in the last four years. Sewage treatment not provided locally. Storm drainage maintenance not treated as a distinct item in financial reports. No pattern can be inferred.	No public expenditure for water and sewer operation; storm drainage maintenance still undertaken by developer. Cannot infer pattern of public expenditures.	Part of county-wide water authority; no expenditure pattern attributable to Amherst. Overall operating costs for the sewer system increased faster than population growth. Irregular pattern of costs for storm drainage, with highest costs in years when major maintenance projects undertaken.	Services provided county-wide; cannot attribute pattern of expenditures to Reston itself.	Services provided county-wide; cannot attribute pattern of expenditures to West Springfield itself.

Source: Real Estate Research Corporation.

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Moreover, in those communities where expenditure data reflected purely local services, distinct patterns were not always apparent. Costs for general government were especially erratic, perhaps due to the multiplicity of functions included in this broad category. Expenditures for fire and police protection increased each year, after adjusting for inflation, at a rate higher than the rate of population increase. However, one community professionalized its fire department during the time period analyzed, while the other two remained with volunteer forces. Thus, a pattern of service delivery could not be inferred from financial report data.

Just as consistent cost increases do not necessarily imply improved services, decreasing or stable cost patterns during a period of rapid growth do not necessarily mean that service levels are declining. In some situations, operating costs remained fairly constant despite population increases. Perhaps some scale economies are occurring which serve to keep costs down despite increased demand.

For libraries, parks and recreation, our findings lead us to conclude that the patterns for operating expenditures are closely tied to facility construction, and do not show consistent expenditure trends. Maintenance of roads, sewer, water and storm drainage infrastructure is an on-going service whose costs are likely to show dramatic increases in years when major maintenance projects are undertaken, and very low costs in the intervening years.

Thus, it is difficult at best and misleading at worst to infer a pattern of anticipation or response to growth from the quantitative data examined in the case study communities. The results of the analyses were inconclusive insofar as the differences in service timing between planned and conventional communities are concerned. However, certain key variables which affect the pattern of operating cost increases became apparent. They are:

- The timing of construction of capital facilities, which upon completion must be staffed and maintained.
- The demands of increased population which require increased expenditure for staff (especially for police, fire, schools, libraries, and general government).
- The desire to upgrade service standards or provide a wider variety of services while at the same time serving an increased population (such as professionalization of fire departments or provision of planning staff).
- The degree to which developers are willing to subsidize on-going services in the first few years of development so that they can be provided earlier.
- The extent to which a developer can influence local governments to provide services at an early date to his project.

The last point highlights a key conclusion that could not be derived from a study of financial data but rather flows from the earlier analyses of cost incidence and capital facility timing. It is apparent that both of the planned communities studied experienced reasonably high levels of public services early in their development. In Park Forest South, services that would not normally be available to a community of only 4,000 persons (local police protection, library, fully equipped fire department, recreation program) were provided early in the development period because they were initially subsidized by the developer and still are to some extent. Although Reston's developers have not directly subsidized the operations of Fairfax County within their community, they have used their considerable prestige and influence in the area to press for early facility construction and associated services. Thus, we can conclude that it is reasonable to assume that services will be provided earlier in planned communities for two reasons: because of the greater likelihood of incentives provided by the developer, and because public facilities to accommodate said services will be constructed earlier in the development period. Thus, the costs of on-going services are likely to be higher earlier in the development period in planned than in "sprawl" communities.

K. RELATIONSHIP OF FINDINGS TO PREVIOUS CONCLUSIONS FROM THE COSTS OF SPRAWL-GOVERNMENT OPERATING AND MAINTENANCE COSTS

Table 25 indicates the assumptions regarding the timing of increases in government operating and maintenance costs by development pattern as they were presented in The Costs of Sprawl, and revisions suggested based on the conclusions stated above. Percentages shown for each year represent a proportion of the costs indicated for on-going services in the tenth year of the development period.

For many cost categories the increase in operating costs over the years is closely related to the timing of capital improvements. While most operating costs consist largely of personnel expenditures, they are somewhat sensitive to the need to maintain facilities once built. To the extent that facilities are put in place earlier in the development period in planned communities, operating and maintenance costs will increase earlier. Because the differences among alternative development patterns are greatest for municipal capital costs (police, fire, general government, libraries, parks and roads), these categories show operating cost increases earlier in the development period for the "planned" prototypes. For schools and utilities, differences in the timing of operating expenditure increases are less pronounced, as they are more closely related to changes in the population served over time (e.g., number of pupils, number of units served by treatment facilities.). Differences among development patterns would be greatest at the earliest stages of development, at which time many major facilities are already in place in the planned communities, but are still to be completed in

TABLE 25

REVISION OF ASSUMPTIONS

ANNUAL GOVERNMENT OPERATING AND MAINTENANCE COSTS

Costs of Sprawl	Development Year 1	2	3	4	5	6	7	8	9	10
	(Percent of Year 10 Costs)									
Planned Communities	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%
Sprawl Communities	10	20	30	40	50	60	70	80	90	100
Combination	15	25	35	45	55	65	75	85	95	100
Revised Assumptions										
Municipal Costs (Open space, recreation, police, fire, general government, library, roads)										
Planned Communities	5	15	25	40	50	60	70	80	90	100
Sprawl Communities	5	10	20	30	40	50	60	75	85	100
Combination	5	10	20	35	45	55	65	80	90	100
Schools										
Planned Communities	10	20	30	40	50	60	70	80	90	100
Sprawl Communities	10	20	30	40	50	60	70	80	90	100
Combination	10	20	30	40	50	60	70	80	90	100
Utilities (Water and sewer)										
Planned Communities	15	20	30	45	55	65	80	85	95	100
Sprawl Communities	15	20	30	40	55	65	75	85	95	100
Combination	15	20	30	40	55	65	75	85	95	100

Source: Real Estate Research Corporation

conventional communities. The combination of PUD and conventional subdivisions will show a "middle of the road" pattern, more closely following the "sprawl" pattern earlier in the development period, and moving gradually closer to the planned characteristics.

Thus, given the same rate of population growth, municipal service levels (expressed as expenditures per capita) would be lower in the conventional communities than in the planned prototypes during each interim year of development. This does not mean that "sprawl" residents go without public services in the early years, but rather that they must rely on the county or neighboring municipalities to provide them when needed (as in the case of police and fire protection, libraries) or go without them (e.g. maintenance of minor streets). If one assumes that the increase in costs each year should be proportional to the increase in population (an admitted over simplification which does not account for changes in service levels or economies of scale), the sprawl community's assumptions imply some lag in resource allocation throughout, while the planned community would be "on schedule" for most of the development period.

Because school operating costs are highly dependent on pupil loads (which are identical for each prototype in each year of the development period) we show no differences in timing of school expenditures. For utilities, operating expenditures increase slightly in those years when major additions to treatment plants are built. In those years where plant capacities are the same in all communities, there are no differences assumed in operating expenditures.

L. APPLICATION TO COST ESTIMATES

Table 26 indicates annual expenditures for on-going government operations in each year of the development period. Expenditures are grouped as municipal, school, and utility costs. Cost differences are most pronounced for municipal services, where the construction of facilities earlier in the development period, and their resulting staff demands, cause higher operating expenditures in Community I (planned mix) than Community III (sprawl mix) prior to year 6. By year 10, however, operating costs are lower in the planned prototypes than in conventional communities of comparable density.

Table 26.

GOVERNMENT OPERATING AND MAINTENANCE COSTS (Year by Year)
(in thousands)

		Development Year									
		1	2	3	4	5	6	7	8	9	10
Municipal											
	I	$ 106	$ 319	$ 531	$ 850	$ 1,062	$ 1,275	$ 1,487	$ 1,700	$ 1,912	$ 2,125
	II	$ 120	$ 240	$ 481	$ 841	$ 1,080	$ 1,322	$ 1,562	$ 1,922	$ 2,163	$ 2,403
	III	$ 129	$ 259	$ 517	$ 776	$ 1,035	$ 1,293	$ 1,552	$ 1,940	$ 2,199	$ 2,587
	IV	$ 113	$ 339	$ 566	$ 905	$ 1,131	$ 1,358	$ 1,584	$ 1,810	$ 2,037	$ 2,263
	V	$ 148	$ 295	$ 590	$ 886	$ 1,181	$ 1,476	$ 1,771	$ 2,214	$ 2,509	$ 2,952
	VI	$ 109	$ 327	$ 546	$ 873	$ 1,091	$ 1,310	$ 1,528	$ 1,746	$ 1,965	$ 2,183
Schools											
	I	$ 1,106	$ 2,212	$ 3,318	$ 4,424	$ 5,530	$ 6,637	$ 7,743	$ 8,849	$ 9,955	$11,061
	II	$ 1,107	$ 2,214	$ 3,321	$ 4,428	$ 5,535	$ 6,643	$ 7,750	$ 8,857	$ 9,964	$11,071
	III	$ 1,117	$ 2,233	$ 3,350	$ 4,467	$ 5,583	$ 6,700	$ 7,817	$ 8,934	$10,050	$11,167
	IV	$ 1,106	$ 2,212	$ 3,318	$ 4,424	$ 5,530	$ 6,637	$ 7,743	$ 8,849	$ 9,955	$11,061
	V	$ 1,117	$ 2,233	$ 3,350	$ 4,467	$ 5,583	$ 6,700	$ 7,817	$ 8,934	$10,050	$11,167
	VI	$ 1,106	$ 2,212	$ 3,318	$ 4,424	$ 5,530	$ 6,637	$ 7,743	$ 8,849	$ 9,955	$11,061
Utilities											
	I	$ 100	$ 133	$ 199	$ 299	$ 366	$ 432	$ 532	$ 565	$ 632	$ 665
	II	$ 100	$ 134	$ 200	$ 267	$ 367	$ 434	$ 501	$ 568	$ 635	$ 668
	III	$ 100	$ 134	$ 201	$ 268	$ 368	$ 435	$ 502	$ 569	$ 632	$ 669
	IV	$ 102	$ 136	$ 204	$ 306	$ 375	$ 443	$ 545	$ 579	$ 647	$ 681
	V	$ 104	$ 139	$ 208	$ 277	$ 381	$ 450	$ 520	$ 589	$ 658	$ 693
	VI	$ 98	$ 131	$ 196	$ 295	$ 360	$ 426	$ 524	$ 557	$ 622	$ 655
Totals											
	I	$ 1,312	$ 2,664	$ 4,048	$ 5,573	$ 6,958	$ 8,344	$ 9,762	$11,114	$12,499	$13,851
	II	$ 1,327	$ 2,588	$ 4,002	$ 5,536	$ 6,982	$ 8,399	$ 9,813	$11,347	$12,762	$14,142
	III	$ 1,346	$ 2,626	$ 4,068	$ 5,511	$ 6,986	$ 8,428	$ 9,871	$11,443	$12,881	$14,423
	IV	$ 1,321	$ 2,687	$ 4,088	$ 5,635	$ 7,036	$ 8,438	$ 9,872	$11,238	$12,639	$14,005
	V	$ 1,369	$ 2,667	$ 4,148	$ 5,630	$ 7,145	$ 8,626	$10,108	$11,737	$13,217	$14,812
	VI	$ 1,313	$ 2,670	$ 4,060	$ 5,592	$ 6,981	$ 8,373	$ 9,795	$11,152	$12,542	$13,899

Source: Real Estate Research Corporation.

CHAPTER VIII

FINANCING OF CAPITAL EXPENDITURES

A. INTRODUCTION

All of the capital costs which have been utilized in previous chapters have deliberately excluded financing charges, as was consistent with the assumptions used in The Costs of Sprawl. This chapter deals with adding financing costs to the previously derived year by year allocation of capital costs (both public and private) and analyzes how this affects the degree of variation in total costs by development pattern.

Municipal capital expenditures can be categorized as follows:

Purchase of land
Construction of new facilities
Improvements to existing facilities
Purchase of operating equipment

The manner in which local governments pay for these various improvements will depend on a number of factors, including the magnitude of investment required, the useful life of the improvement, and the number of years over which construction or purchase can be staged. Moreover, state and local legislation restrict use of certain financing mechanisms, thereby encouraging use of alternative payment schemes.

Overall, it can be said that for large scale improvement programs for facilities or structures with long term useful lives, some form of debt financing is used. The reasons for this are apparent: the inability of the municipality to pay for these items out of current tax revenues (without drastic tax increases) and a desire to spread the burden to future as well as current users of these facilities.

Three forms of long term debt are commonly issued by municipalities: general obligation bonds, special tax bonds, and revenue bonds. General obligation bonds are backed by the "full faith and credit" of the issuing municipality; these bonds are retired with general fund monies based on a pre-determined debt service schedule. Municipalities may be restricted by state or local legislation as to the amount of general obligation bonds which they can issue. Limits are typically expressed as a ratio of outstanding debt to assessed valuation of real and personal property. These maximums may be different for general purpose governments and special districts in the same area. Moreover, governments may be restrained by maximum tax rates established by law.

Special tax bonds are retired with the proceeds of special tax levies, such as motor fuel, cigarette or liquor taxes. Revenue bonds are payable from user charges, tolls, or fees paid for use of the facility to be constructed with the proceeds of the issue. Interest rates on revenue bonds are likely to be higher than for general obligation bonds, because of their greater risk.

The extent to which these kinds of bond issues are subject to voter approval varies by state, type of obligation, and type of governmental unit. In some instances, revenue bonds may be issued without voter approval. General obligation bonds may need approval only after outstanding debt reaches a specified amount. Alternatively, all bond issues might depend on the approval of the voters, or debt may be absolutely limited regardless of voter choice.

Local governments may also issue short term obligations (with payback periods of one to five years) where it is deemed desirable to spread the cost of equipment purchases over a short number of years so as to lessen the impact on current revenues. Or they may have the fiscal resources to make limited capital purchases (e.g., isolated parcels, office equipment) out of current funds and thus save on interest charges.

There are a number of determinants of the terms under which a community's financing may be negotiated -- some that are dependent upon general economic and capital market conditions or extraneous factors, but others that are determined by factors internal to the community itself. Thus, the fundamental credit worthiness of the community may be dependent on the maturity of the community, fiscal health, rate of growth, or other characteristics, rather than development pattern alone. The community's bond rating will significantly affect the interest rate it must pay to investors, as well as the overall marketability of its obligations.

B. RESEARCH SUBJECTS

1. Key Questions

a. What are the public financing practices that are followed in suburban fringe communities at the present time -- in terms of method of financing, interest rates, types of obligations incurred? How do these practices vary for different types of facilities?

b. Do public or private financing practices vary by development pattern; that is, do planned communities finance their public improvements in a manner distinct from conventional suburbs?

c. Once financing charges are added to previously derived construction costs, how are the total cost comparisons altered?

d. To what extent are these differences attributable to financing charges, as compared with the differences in cost incidence or timing of construction by development pattern?

2. Secondary Issues. A major factor influencing the total cost of capital improvement projects is the extent to which debt financing is used to pay for capital costs. The research questions posed above are largely limited to that portion of capital costs that are debt-financed. In some instances, current funds (either raised locally or obtained as intergovernmental transfers) are used to pay for major improvements. This is especially true for parks, roads, and water and sewer projects, where state and federal categorical programs have been extensively used by suburban governments. In these cases, only a limited share of the total project cost is financed with local debt. The extent to which these improvements must be paid for locally depends on how aggressive and successful the locality is in pursuing available federal funds, as well as the kinds of state programs offered.

   Although federal categorical programs have been less extensively used in recent years, they have been supplanted to some extent by general revenue sharing and the recently adopted block grant programs whose funds can be used for a variety of purposes. Thus, to accurately determine the effect of interest costs on total capital outlay, some assumptions must be made regarding the percent of total costs that are borne locally and that must be debt-financed. These assumptions are presented in Section E.

C. ANALYTICAL PROCEDURE

The derivation of assumptions for use in the analysis of the financing cost attributable to alternative development patterns was based on the following criteria.

1. The procedure was based on interviews and source documents from the case study communities; the financing practices for all cost categories were observed.

2. This source of information was supplemented by a brief scan of the relevant literature on municipal finance and a limited number of interviews with knowledgeable experts so that those financing practices which emerged from case study investigation and from other sources could be merged and so that the major patterns could be discerned.

3. Prevailing rates and terms in the recent past were used to construct a prototypical set of terms. Likewise, a prototypical schedule for the issuing and sale of bonds was assumed. These assumptions are documented in Section E, following.

4. Using these assumptions and according to the variations in financing practice noted, debt service costs were calculated for public facilities and added to the costs of construction and installation as derived in Chapters V and VII.

5. The effect of financing costs on private expenditures was then calculated. The potential complexities of private financing are outside the scope of this study. However, to provide a rough approximation of this cost, an average rate of 15 percent is applied to total private development and construction cost estimates. The 15 percent reasonably represents both current interest rates and developer opportunity costs for development loans (average term one year) and construction loans (average term 6 months at 7 1/2 percent interest). Land is financed over 3 year terms at 15 percent per year.

D. FINDINGS AND CONCLUSIONS

1. Use of Various Financing Mechanisms. Table 27 lists the methods used by the case communities to finance capital improvements for various cost categories. A number of patterns become evident. Most government buildings in the case communities (village halls, police stations, libraries, and schools) were financed with general obligation bonds. Equipment is generally purchased with current funds as needed, or with short term obligations. With respect to fire stations, a variety of mechanisms were seen, including general obligation bonding, fund raising projects, and installment notes. Equipment is typically purchased with current funds or short term obligations.

   For parks and recreation, most land purchases and site improvements are financed with general obligation bonds. An exception exists in the case of major recreation facilities where fees are charged, such as golf courses or recreation centers for which revenue bonds could be used. Revenue bonds are more likely to be used where local debt limitation regulations apply only to general obligations, and the debt limitation is virtually exhausted. Because of the higher interest rates carried on revenue bonds, local officials may hesitate to issue them if general obligation bonds are legally and financially feasible.

   Much of the same can be said with regard to sewer and water system improvements. Revenue bonds have been used for sewer and water authorities charging user fees; fee scales are then set to cover debt service. Where such authorities are also taxing bodies, general obligations may be more frequently used, again depending on the restrictions of state and local legislation. In four of the case study communities, revenue bonds were used to finance certain water and sewer system improvements. Storm drainage improvements, which do not generate revenues from user fees and charges, must use general obligation bonds.

   With regard to public road improvements, a clear pattern does not emerge from the case communities. In all of the communities studied, responsibility for major road improvements did not rest with the local government. Limited local contributions were largely for repair and improvement of existing roads through paving, lighting, sidewalk construction, or intersection improvements. These are financed with general obligation bonds or current funds (motor fuel tax rebates, general tax monies, or special assessments).

Table 27. SUMMARY OF PUBLIC FINANCING PRACTICES - MAJOR FACILITIES
CASE STUDY COMMUNITIES

Cost Category	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston (Fairfax County, Virginia)	West Springfield
Village Halls	General obligation bonds	1/	General obligation bonds	1/	General obligation bonds
Police	General obligation bonds	1/	General obligation bonds	1/	General obligation bonds
Fire	Installment notes	1/	Current funds, donations	Borrowed from Developer	General obligation bonds
Library	General obligation bonds	1/	General obligation bonds	1/	General obligation bonds
Parks and Recreation					
Parks and Open Space	General obligation bonds, federal funds	1/	General obligation bonds	1/	General obligation bonds
Major Recreation	Revenue bonds	1/	General obligation bonds	1/	General obligation bonds
Schools	General obligation bonds	General obligation bonds	General obligation bonds	General obligation bonds	General obligation bonds
Roads	County and state funds, motor fuel tax funds	1/	County and state funds	State funds	State funds
Water	Revenue bonds, service charges, current funds	1/	Revenue bonds (county); general obligation bonds (town)	Revenue bonds, current revenues	Revenue bonds, current revenues
Sewer	Revenue bonds, service charges, current funds	1/	General obligation bonds, state and federal funds	State and federal funds, general obligation bonds	State and federal funds, general obligation bonds
Storm Drainage	General obligation bonds	1/	General obligation bonds	General obligation bonds, current funds	General obligation bonds, current funds.

1/ Thus far, facility of this type has not been financed by local government.

Source: Real Estate Research Corporation.

2. Terms of Obligations. The term of any bonded indebtedness will show variation based on:

   Projected revenues for debt retirement
   Local considerations (available funds)
   The useful life of the improvement
   Bond market conditions, locally and nationally

   Findings from the case communities indicate long term (20-30 year) obligations for major facility and infrastructure construction (schools, village halls, police stations, libraries, sewer and water system improvements and facilities). Equipment purchases have a shorter useful life; generally, they have terms of 10 years or less. Facility renovation issues will have varying terms but they will be shorter than for new construction issues. Park bond issues indicate shorter terms than for most major permanent facilities, generally 10 to 20 years.

3. Interest Rates. Interest rates paid on municipal bonds show extreme variation. They are closely tied to current market conditions (the return available from alternative investments). Generally, it can be said that municipal bonds yield a lower-than-average rate of interest, largely due to the security of the investment and the tax advantages associated with their purchase. Revenue bonds will yield a higher interest rate than general obligations because of the greater risks involved. Interest rates on short term debt will closely approximate or equal the rate paid by the private sector for similar loans, unless secured by anticipated tax revenues which would tend to lower the interest rate.

4. Variation in Financial Practices Between Planned and Sprawl Communities. Examination of case studies do not indicate a variation in financial practices or bond ratings due to development pattern. This conclusion is limited in its validity, however, because the two planned communities are not good examples for analyzing financing practices. In one of the two planned communities, the local government has yet to undertake any debt financing of capital improvements on its own. In the other, the unit of local government is the county, which covers a large area with many growth centers, each of which must be serviced with capital improvements. Thus, the financial practices of the county are not attributable to the planned community itself. In order to see if any variation does exist due to development pattern, we would need to find a planned community that is a separately incorporated municipality with sufficient tax base to issue bonds and undertake public improvement projects.[1/] The pattern of development does not seem to be a major factor in determining the proportion of capital costs which would be paid out of current funds or intergovernmental transfers.

1/ The new community of Columbia, Maryland is not an incorporated municipality; Jonathan, Minnesota has been annexed by the village of Chaska: the only bonds which have been issued for Jonathan are for sewer, water, and road improvements. Terms are similar to those shown in Table 27.

E. APPLICATION OF FINANCING COSTS TO PUBLIC CAPITAL EXPENDITURES

1. Key Assumptions. Because of the variety of financing practices indicated in the case study communities, it is necessary to make a series of simplifying assumptions in order to apply financing charges to the annual capital cost allocations shown in Chapter VII. These assumptions represent typical financial practices as indicated by various secondary sources as well as the case studies.

   a. For public capital expenditures, we assume that all local costs (with the exception of vehicles and office equipment which are periodically replaced) will be debt financed.

   b. The local share of public capital expenditures is determined as follows:

      - Police, fire, municipal building, library, schools, and recreation facilities are financed 100 percent with local funds.
      - Sewer, storm drainage, and water lines and plants are financed 50 percent with local funds and 50 percent with intergovernmental aids (for which debt financing charges are not calculated).
      - Expressway construction utilizes no local funds, thus incurring no local debt service charges.
      - Where public investment in arterial roads is indicated, 25 percent of the cost will be financed with local debt, as would 100 percent of public investment in collector streets.
      - Purchase of land by governmental bodies is financed 50% with cash and intergovernmental transfers and 50% with local debt.

   c. All of the local government debt financing indicated above will be in general obligation bonds, except for water and sewer facilities, which are financed with revenue bonds.

   d. Although bonds are typically issued one or more years prior to construction outlays, net debt financing costs are not incurred until the time that funds are spent, as they are typically placed in interest-bearing accounts in the interim.

   e. All bond issues are serial bonds with 25 year payout periods, except for land purchase, which covers 10 years.

   f. Interest rates used are 7 percent for general obligation bonds, and 8.5 percent for revenue bonds.

g. Annual debt service for each bond issue is scheduled on a "level debt service basis", with equal annual payments (similar to a mortgage). Thus, a larger proportion of interest is paid earlier in the amortization period, with principal repayment becoming more significant over time.

Table 28 indicates the effect of the financing assumptions presented above when they are added to local government capital costs. For each of the six prototypical communities, Table 28 shows the amount of principal financed by local bonded debt, interest charges over the appropriate bonding period at the stated interest rate, and total costs including financing charges. The expenditures are grouped into three categories -- municipal, school, and utility -- reflecting the most likely allocation of these expenditures among units of local government. The table shows that, when all charges are summarized, the planned communities cost 21-25 percent less than the conventional prototypes. Over a 25 year period, anywhere from $37 to $47 million less will be spent by units of local government in the more planned suburbs. Thus, the savings due to developer contributions in planned communities are further magnified when interest costs are included; the higher government costs incurred in conventional suburbs are further increased when interest is computed. Note that over a 25 year term, interest charges exceed the principal amount.

F. FINANCING OF PRIVATE NON-RESIDENTIAL COSTS

A wide variety of financing mechanisms are likely to be used by private developers and other non-governmental parties constructing capital improvements in growing suburbs. Because a year by year calculation of finance charges paid by various segments of the private sector would necessitate a very complex and detailed cash flow analysis (with many interest rates and amortization periods), simplifying assumptions are again necessary. As mentioned earlier in this chapter, interest on privately incurred debt other than land is calculated at 15 percent for an average term of one year; for land costs, the appropriate term is three years.

Table 29 illustrates the effect of these interest charges on total private costs of exclusive housing construction. Holding density constant, costs borne by the private sector are 8-14 percent greater in planned communities, amounting to about $9 to 10 million. This can be compared with the significant savings attributable to planning on the public side (21-25 percent, $37-47 million). Thus, a net savings of $28-$37 million is registered for the planned prototypes as compared with sprawl communities of the same density when financing costs for local government expenditures and private non-residential construction are included. The reader will note that density is not as significant a variable as is the degree of planning on the public side; on the private side, comparing "low density sprawl" with "high density planned" results in a savings of $56 million (42 percent) for the latter. Much of the overall cost savings attributable to higher density are in costs which would be borne by the developer/builder: residential construction, minor streets, and on-site utilities.

Table 28.

TOTAL LOCAL GOVERNMENT COSTS INCLUDING FINANCING

	Community Type					
	I Planned Mix	I Combination Mix	III Sprawl Mix	IV Low Density Planned	V Low Density Sprawl	VI High Density Planned
	(in thousands)					
Municipal (open space/recreation, public facilities, transportation, storm drainage) 1/						
Costs Financed by 25-year G.O. Bonds @ 7%	$ 6,665	$ 13,673	$ 16,770	$ 6,903	$ 17,844	$ 6,658
Interest Charges	7,633	15,659	19,206	7,906	20,436	7,625
Subtotal	$ 14,298	$ 29,332	$ 35,976	$ 14,809	$ 38,280	$ 14,283
Costs Financed by 10-year G.O. Bonds @ 7%	$ 1,372	$ 2,780	$ 2,813	$ 813	$ 2,563	$ 1,687
Interest Charges	581	1,178	1,192	345	1,086	715
Subtotal	$ 1,953	$ 3,958	$ 4,005	$ 1,158	$ 3,649	$ 2,402
Total Municipal Costs	$ 16,251	$ 33,290	$ 39,981	$ 15,967	$ 41,929	$ 16,685
Schools (elementary and secondary) 2/						
Costs Financed by 25-year G.O. Bonds @ 7%	$ 53,731	$ 53,731	$ 53,731	$ 53,731	$ 53,731	$ 53,731
Interest Charges	61,536	61,536	61,536	61,536	61,536	61,536
Subtotal	$115,267	$115,267	$115,267	$115,267	$115,267	$115,267
Costs Financed by 10-year G.O. Bonds @ 7%	$ 480	$ 932	$ 1,117	$ 480	$ 866	$ 693
Interest Charges	203	395	473	203	367	294
Subtotal	$ 683	$ 1,327	$ 1,590	$ 683	$ 1,233	$ 987
Total School Costs	$115,950	$116,594	$116,857	$115,950	$116,500	$116,254
Utilities (water and sewer systems and plants) 3/						
Costs Financed by 25-year Revenue Bonds @ 8.5%	$ 2,246	$ 5,671	$ 7,199	$ 2,293	$ 10,613	$ 2,223
Interest Charges	3,240	8,182	10,386	3,308	15,312	3,207
Subtotal	$ 5,486	$ 13,853	$ 17,585	$ 5,601	$ 25,925	$ 5,430
Costs Financed by 10-year Revenue Bonds @ 8.5%	$ 155	$ 155	$ 155	$ 155	$ 120	$ 223
Interest Charges	81	81	81	81	63	117
Subtotal	$ 236	$ 236	$ 236	$ 236	$ 183	$ 340
Total Utility Costs	$ 5,722	$ 14,089	$ 17,821	$ 5,837	$ 26,108	$ 5,770
Total Local Government Costs, Including Financing	$137,923 (79% of III)	$163,973 (94% of III)	$174,659	$137,754 (75% of V)	$184,537	$138,709 (75% of V)

Notes: 1/ Proportion of government costs financed with local debt: open space/recreation facilities, police, fire, government and library buildings, collector streets - 100%. Storm drainage - 50%. Arterial roads - 25%. Land for right-of-way acquisition, open space, recreation and public buildings - 50%. Land costs are financed with ten year bonds; all other costs, 25 year bonds.

2/ All school construction costs are financed with local debt. School sites purchased by government are financed 50% with local debt. For number of acres purchased, see incidence of cost analysis (Chapter VI). Cost per acre in 1974 dollars: $10,656 (Communities I, II, III, IV), $8,288 (Community V), and $15,392 (Community VI).

3/ Fifty percent of all utility costs borne by government are financed with local debt. All communities devote 29 acres of land at the prices shown in Footnote 2 to utility system use.

Source: Real Estate Research Corporation.

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Table 29. FINANCING OF PRIVATE, NON-RESIDENTIAL COSTS

	Community Type					
	I	II	III	IV	V	VI
	(in thousands)					
Private Costs Excluding Residential and Land	$ 72,748	$ 61,420	$ 57,863	$ 96,547	$ 84,410	$ 45,584
Interest (15%, 1 year term)	10,912	9,213	8,679	14,482	12,661	6,838
Subtotal	$ 83,660	$ 70,633	$ 66,542	$111,029	$ 97,071	$ 52,422
Land Cost	$ 16,057	$ 18,048	$ 19,062	$ 26,070	$ 28,390	$ 12,149
Interest (15%, 3 year term)	5,041	5,666	5,984	8,184	8,912	3,814
	$ 21,098	$ 23,714	$ 25,046	$ 34,254	$ 37,302	$ 15,963
Total Principal	$ 88,805	$ 79,468	$ 76,925	$122,617	$112,800	$ 67,733
Total Interest	15,953	14,879	14,663	22,666	21,573	10,652
Cost, Including Financing	$104,758	$ 94,347	$ 91,588	$145,283	$134,373	$ 78,385
	(114% of III)	(103% of III)		(108% of V)		(58% of V)

Source: Real Estate Research Corporation.

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CHAPTER IX

ECONOMIES OF SCALE

A. INTRODUCTION

In the previous work on The Costs of Sprawl, economies of scale as a cost - determining factor received only brief consideration. The purpose of this chapter is to present further discussion of economies of scale, with particular regard to capital costs. The focus is on the economic costs of providing facilities rather than services because: (1) the provision of on-going services depends in large part on the presence of capital facilities, and (2) the state of knowledge is much better developed with regard to public services. Thus, the provision of the public services will be addressed only where it is necessary to support the analysis of capital facilities.

1. Approach to Economies of Scale

This chapter consists of a summary of the conceptual aspects of economies of scale, with particular modifications that are necessary for consideration of capital costs; a brief discussion of key issues relating to economies of scale in the public sector; and discussion of the particular forms that economies of scale may take for three public capital cost categories: schools, sanitary sewerage, and water supply and treatment. These cost categories were selected because they constitute a major portion of the community development costs.

2. Sources of Information

For each cost category, the discussion includes empirical evidence of economies of scale, notes reasons for particular economies, and states implications for alternative development patterns. In several instances, generalized cost curves relating costs and size are presented. It should be cautioned that the curves are presented to show likely variations and magnitudes of economies. They will not be useful for application to particular projects or localities, and are not intended for use in detailed facilities planning or evaluation.

The information presented is distilled from a number of questionnaires and interviews conducted with consulting engineers, facility planners and architects, and other professionals involved in the design and construction of capital facilities. In addition, a limited literature survey was conducted with regard to economies of scale and the provision of public facilities. These sources were combined to provide the basis of the discussion as it is presented.

B. DEFINING ECONOMIES OF SCALE

1. Cost-Size Relationships

There are a variety of relationships between the size or scale of goods or services and the cost of producing them. These relationships may be specified as follows:

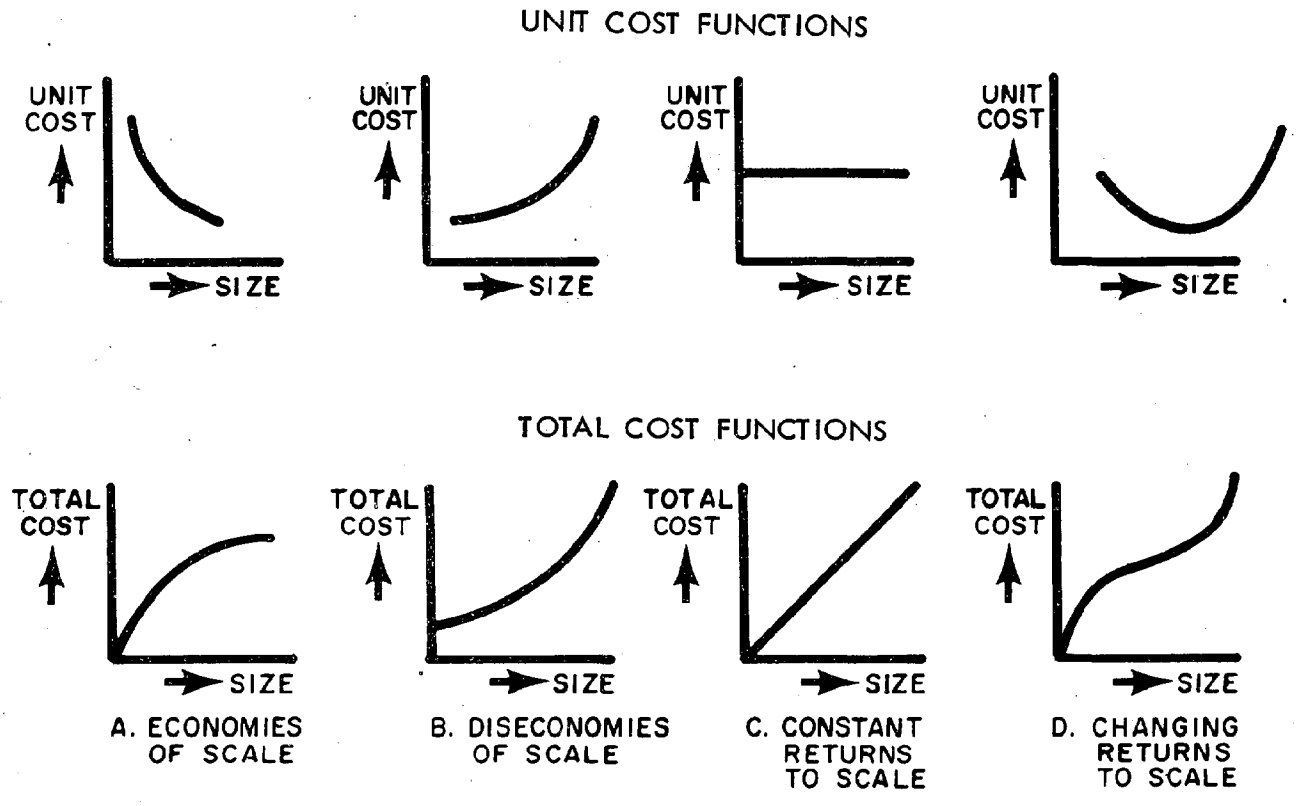
a) Economies of scale: as the size or scale increases, the per unit cost decreases.

b) Diseconomies of scale: as the size or scale increases, the per unit cost increases.

c) Constant returns to scale: the per unit costs are the same irrespective of scale.

The relationships are presented graphically in Exhibit 1.

EXHIBIT 1: ECONOMIES OF SCALE -- COSTS/SIZE RELATIONSHIPS



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In the case of example a., economies of scale, as the number of units produced increases, the per unit cost of each unit declines, and the total cost of producing all units tapers off. Similar interpretations may be given for the diseconomies and constant returns to scale. A fourth set of cost curves is also included in the chart, a U-shaped per unit cost function and the corresponding S-shaped total cost function. Many of the cost-size relationships that occur are of this form. The interpretation of these curves states that per unit costs are decreasing over some size range and increasing over others, such that there is some minimum cost per unit at some optimal size. In terms of total costs, there are increasing returns to scale up to some size, followed by decreasing returns to scale, with the point where the shift occurs representing some optimal size of production.

2. Relating Economies of Scale to Public Facilities and Services

There seems to be a widely held belief among local government officials and economic analysts alike that there are prevelant economies of scale and that it should be possible to define some optimal set of services and facilities. A number of attempts to define such relationships have been made. However, there are problems of drawbacks in the application of economies of scale to public facilities and services that make such analysis both difficult and of uncertain value.

The difficulties with economies of scale analysis may be summarized as follows:

a) Output Definition: Regarding public facilities and services, it is difficult to define precisely what outputs are, and to specify how outputs may shift. For example, units of production are easy to specify for a manufacturing process, but units of production in terms of police service, education, or health care may become more complicated. And changes in levels of services over time mean that the outputs are changed and that comparability may be lost, so that a shift from volunteer to full-time professional fire services may result in two quite different sets of outputs.

   This problem relates both to the quantity and quality of services. Thus, a measure of output in education might be number of pupils graduating. This quantifiable result does not, however, give any indication of the quality of education, and it might be desirable to measure some variable as reading test score or number of pupils proceeding to higher education, so that the quality of graduates might also be assessed.

b) Scale or Size Definition: There are a variety of ways of specifying the size or scale of a facility or service; some ways may be more appropriate for particular expenditure categories than others. Alternative definitions of size or scale would relate to the following:

1. Population served
2. Numbers of dwelling units served
3. Size or scale of project (e.g. facility, subdivision or PUD, neighborhood, community)

The relationships between costs and population or number of dwelling units are apparent, and the discussion in this chapter will relate largely to increases in population (and therefore also to increase in dwelling units). Project scales vary from a single facility to an entire community network.

3. Economies of Scale of Public Facilities

The analysis of economies of scale as related to public facilities requires some modification of the conceptual framework outlined at the beginning of this section. 1/ The major difference is that while on-going services are delivered on a more or less continual basis, capital facilities are provided on an incremental basis. Costs then are incurred at specific points in time rather than continuously. Another difference is that as population or number of dwelling units increases, ongoing services are provided to new as well as old residents. Facilities may either lead or lag service demand increases, but will probably never correspond directly to or occur at the same pace as such increases. Finally, there may be a threshold size below which it is uneconomical to provide a capital facility.

1/ A full discussion of the economies of scale of public services is not presented, since they have been covered in other sources; references to that discussion would include the following:

Alesch and Dougharty; Economies of Scale Analysis in State and Local Government; Council on Intergovernmental Relations, State of California; May, 1971.

Berthovex; "Evaluating Economy of Scale"; Journal of the Water Pollution Control Federation; November, 1972; Pp. 2111-2119.

Gabler; "Economies and Diseconomies of Scale in Urban Public Sectors"; Land Economics; November, 1969; Pp. 425-434.

Gabler; "Population Size as a Determinant of City Expenditures and Employment - Some Further Evidence"; Land Economics; May 1971; Pp. 130-138.

Grave; Economies of Scale in the Provision of Public Services; Massachusetts Institute of Technology; Department of City Planning; Boston, Massachusetts; Masters Thesis; September, 1967.

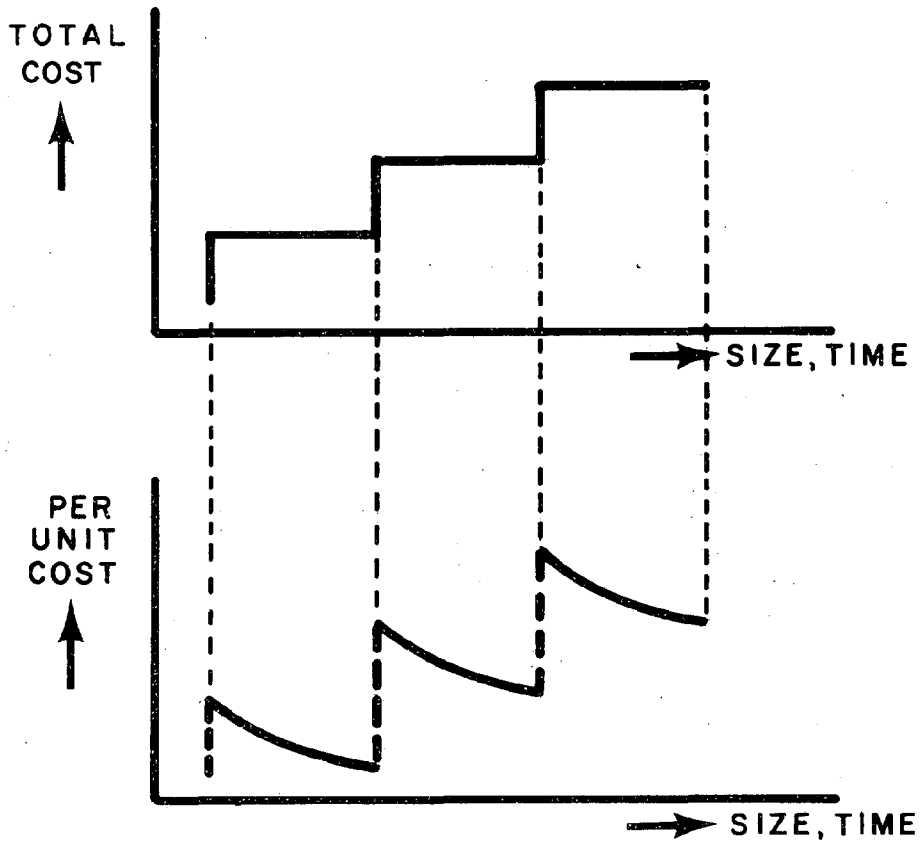
Hirsch; The Economics of State and Local Government; McGraw Hill; New York New York; 1970.

Hirsch; Urban Economic Analysis; McGraw-Hill; New York, New York; 1973.

Kain; Urban Form and the Costs of Urban Services; M.I.T. - Havard Joint Center for Urban Studies; Cambridge, Massachusetts; May, 1967.

The course of the provision of public facilities may be described in graphic terms in the following exhibit.

EXHIBIT 2: ECONOMIES OF SCALE -- PUBLIC FACILITIES



In the exhibit, the upper portion illustrates the construction or installation of facilities in increments over time (in response to or in anticipation of population growth) When facilities are installed, costs are incurred; the graph shows these points as vertical steps. At all other times, funds are not being expended, as represented by the horizonal steps. The lower portion of the exhibit represents per unit costs that correspond to the incremental installation of facilities in the upper portion. Costs per unit for each increment are declining because larger populations are served by the same facility. For purposes of illustration, the cost curves imply that per unit costs for each increment are somewhat higher than for the previous increment. Possible reasons for such higher costs would include escalating inflation or shifts in facilities or service levels, with the more current levels costing more. If the rate of inflation is held constant and if the level of service offered by a facility does not change, then the per unit cost curves would presumably have the same form for each increment, but would start from the same, rather, than a higher per unit base. In practice, the cost-size relationships are more complex than can be illustrated. Despite the fact that construction and installation of capital facilities can take place in incremental fashion, it is possible that economies of scale will prevail over the range of each increment. Because individual increments may be relatively small, there is only a relatively small range over which economies of scale can be defined.

4. Summary

The preceding sections have summarized a conceptual framework within which economies of scale can be outlined. Although such a framework is useful, the lack of explicit knowledge in two areas has limited the application of that framework. The two areas are (1) the imprecise notion as to where the "break-points" in the provision of facilities occur, and (2) the difficulty of expressing the provision of public capital facilities in terms that do not become complicated by a variety of service levels or facilities qualities.

The balance of this chapter will present a more concrete discussion of likely economies of scale to school, sewer and water facilities. The cost curves that are presented are illustrative only, and should not be used as precise engineering, architectural, or construction estimates.

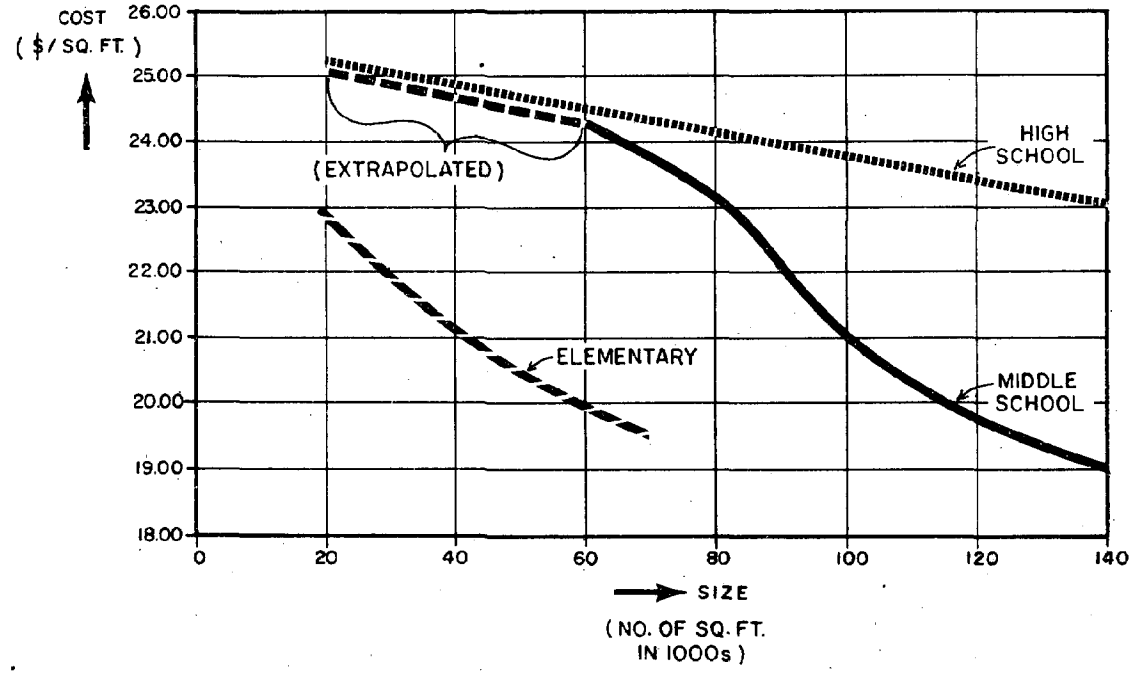
C. SCHOOLS

The evidence in support of economies of scale in the construction of school facilities seems fairly conclusive, but some doubt remains as to the possible utilization of such economies, since how facilities are designed and built is dependent upon a variety of factors.

1. Empirical Evidence

From construction cost estimating tables it was found that economies of scale do not occur; the cost curves for school construction are as follows: 1/

EXHIBIT 3: ECONOMIES OF SCALE -- SCHOOLS



The exhibit shows a decline in unit cost with an increase in facility size, regardless of level of school. For example, for elementary schools there is nearly a 15 percent costs savings per square foot by building at 60,000 square feet rather than at 20,000 square feet. The potential economies for middle and high schools are somewhat smaller, as indicated by the more gradual decline in cost as size increases. These curves do not include profit to the contractor, engineering fees, and overhead charges. Such additional costs, however, will not substantially change the form of the curves. Profit and overhead, usually expressed as a percentage

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1/ Derived from Dodge Building Cost Calculator; McGraw Hill Information Systems, Inc., New York, New York; (annual). Costs are expressed in 1970 dollars but in large measure the cost/size relationships will hold regardless of the basis of costs -- whether in current or deflated dollars. Another source relating to economies of scale is Department of Public Instruction, State of Wisconsin. Planning for Better Education in Wisconsin, Madison, Wisconsin, 1973. This source contains compilations of guidelines and data for planning school facilities and programs, with an exhaustive review of related research. Summaries of cost-size relationships on pages 27-69, based on research nationwide, are particularly useful.

of construction cost, will shift the curve outward but will not change the slope; engineering fees do not exhibit economies of scale, but that cost is relatively minor as a part of total construction costs, and will only slightly alter the curves as exhibited.

2. Sources of Economies

A number of reasons may be suggested for economies of scale in school construction:

a) The fundamental reason for economies may lie in reduced square footage per pupil in larger buildings. Up to some limit, educational spaces can be utilized more efficiently. By program and design adjustments, more pupils can be accommodated in given areas -- for example, fulltime use of gymnasiums will prove more economical; similarly, where spaces can serve several functions, such as a multi-purpose lecture hall, auditorium and theater, there are potential savings.

b) For many school systems, savings in construction costs can result by bulk or volume purchasing of materials, particularly if standardized components are used.

c) Additional economies have been realized where a total building program involving a number of projects underway at the same time can be coordinated. This has proven advantageous not only for purchasing materials, in fabricating components, and in time savings by tight scheduling, but also assists program planning -- so that enrollment loads can be smoothed, and staff resources are increased more systematically; another advantage is if voter approval is achieved for a coordinated and larger building program, referenda are not necessary for each project.

3. Discussion of Economies

There is evidence that economies of scale exist. But there is also reason to believe that such economies may not be applied or systematically taken into account in the planning of school facilities. School facilities may not be provided in the most efficient or economical manner -- particularly with regard to scale -- since planning and design are dependent on other factors that may prevent use of potential economies:

a) Community preferences both for facility type and academic program may prevent potential economies. Residents of any area are particularly concerned about the quality of education offered, and may desire higher quality facilities and better instructional programs than might be selected on purely economic grounds.

b) As a companion to community attitudes, local school boards have different financial limitations. Many school districts not only desire, but are willing to pay for more elaborate and costly facilities. Other districts are perpetually short of funds, have limited sources of funds, and must be very conscious of capital expenditures. Similarly, there are variations in the amounts of funding available due to a variety of state and local laws, each specifying a different mixture and level of funding.

c) An obvious factor that determines the type of school facility built lies in the instructional program that will be carried on at the school. Such factors as the use of an extended school day, widespread community-oriented education where pupils only spend a portion of their day in the building itself, use of team teaching or open space methods, and curricular considerations all will determine the space needs of the school, and may override potential economies in construction.

d) Another limitation to potential use of economies of scale lies in the range of sizes available for a particular school or school district. Such ranges may be relatively small, so that insufficient size can be mustered. The size limitations may result from several factors. If school districts are fragmented and undersized, sufficient numbers of pupils cannot be accumulated. The response to this in many areas has been to consolidate districts encompassing larger areas. The limits of school size may result from reliance on neighborhood schools, combined with limits on desirable travel distances or on transportation costs. These factors may result in under-sized schools. Regardless, the range of possible school sizes is not wide enough to result in significant economies of scale.

e) Where state or local standards prevail in the planning of facilities, the result may be facilities that are conceivably less economical. For instance, minimum state standards often evolve to mean acceptable standards. If minimum standards call for unwarranted or excessive facilities, then the resulting project may be less efficient from an economic standpoint. When such instances occur, there is usually some adjustment so that minimum standards become more economical, and as mentioned above, consolidation may occur. For example, if state requirements specify that a gymnasium be provided, many small districts or rural areas may be compelled to combine in order to provide a large enough base of pupils to support such a cost.

4. Implications for Alternative Development Patterns

The costs of school construction may be affected by the physical pattern of development depending on several factors. It should be noted that these factors are not exclusively found in planned communities, but could in fact occur anywhere. There is perhaps a greater likelihood of their occurrence in planned communities, however:

a) A major source of cost savings in planned development lies in the combined use of facilities. There have been experiments in using facilities not only for education, but for a wide range of community activities as well. Recreation areas are shared, common areas can be used for both school and public purposes, and adult-oriented programs are scheduled as well. By avoiding duplication of facilities, cost-savings have been realized. Such sharing of facilities may be more likely not only in planned communities but also in larger projects where the opportunities for combined use of space may be more efficient and economically feasible.

b) Also in planned communities it is presumably possible to anticipate somewhat better how enrollment of school pupils will increase and decrease, and how numbers of pupils will differ in sub-areas of the community. Because of this, school needs can be determined relatively more precisely than in conventional development, and capital facility construction can be more coordinated, more tightly scheduled, and therefore would be less costly.

D. SANITARY SEWERAGE

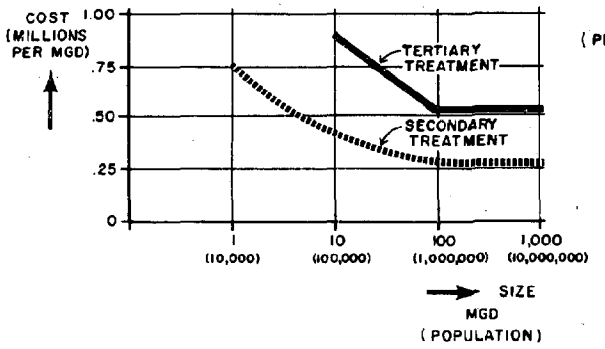
Perhaps the area where the greatest investigation and analysis of economies of scale has been undertaken lies with the costs of sanitary sewerage, both for capital and operating and maintenance costs. There are a number of sources with consistent findings citing the economies of sewage plant construction; the investigation of the economies of sewage networks has lagged, but evidence of such economies is accumulating.

1. Empirical Evidence

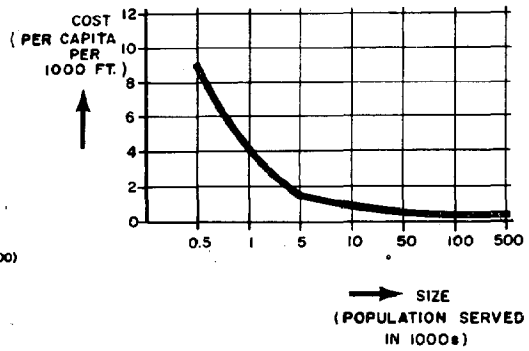
The following cost curves will serve as examples of the types of cost-size relationships that have been observed; the data vary according to different sources, but such variations are due in large part to the different assumptions that may have been used to derive the cost curves. In total, the trend and shape of the curves are the same regardless of source. 1/

1/ Treatment plant cost curves derived from CEQ and published in Costs of Municipal Wastewater Systems (1974) by GPO. For secondary treatment, activated sludge removal with outflow to surface water is assumed. Tertiary treatment also assumes outflow to surface waters. Full documentation of treatment level is stated in the source cited. Network cost curves derived from Classen and Voight, "The Cost of Wastewater System Facilities", Public Works; May, 1973; P.100. Costs are expressed in 1970 dollars.

EXHIBIT 4: ECONOMIES OF SCALE -- SANITARY SEWERAGE



A. TREATMENT PLANT COST



B. NETWORK COST

It should be noted that for plant costs, costs will vary according to the level and type of treatment that is used, but that economies of scale are observed regardless. This is illustrated in the exhibit by the curves for secondary and tertiary treatment, where the cost curve for tertiary is somewhat uniformly higher than secondary. Population equivalents are expressed for plant sizes to give a notion of the economies at different levels of population. With regard to network costs, there seems to be a rapid decline in per unit cost (expressed as per 1,000 feet per capita) for smaller population sizes, with less rapid decline for larger populations. In the range of population sizes more typical of suburban fringe areas (from 10,000 to 100,000 population) there is less variation in the network economies of scale, since the curve flattens at larger sizes.

2. Sources of Economies

Several reasons are apparent for economies of scale for plant and network costs, as follows:

a) With regard to plant capital costs, there are certain fixed costs that must be incurred regardless of plant size; such costs would include laboratory facilities and equipment, administrative areas, and to an extent pumping and other equipment. The costs of these facilities are spread over large

volumes, and hence have lower per unit costs, with larger plants.

b) There are material cost savings with larger plants, so that volume purchases of construction materials will result in economies of scale.

c) There are considerable economies (per unit length) in the installation of sewer networks, largely because installation costs do not vary a great amount by size of pipe. A trench is required which may accommodate a range of pipe sizes. With very large pipe sizes, the costs of installation do increase more rapidly; but for such larger projects, there are economies from more efficient use of time, labor, and equipment.

d) The cost-size relationships illustrated in the exhibit above neglect a major source of savings in pipeline networks; thus the economies were conservatively stated. The exhibit shows economies based on the lineal distance of the pipe; there was no accounting for the greater economy that results from the relationship between cost and pipeline capacity. As pipe sizes increase, the pipeline capacity increases by a disproportionate amount; if the size of the pipe is doubled, for example, the flow capacity is increased almost fourfold. This means that costs are increasing roughly in proportion to pipe size, while the capacity of the pipe is increasing more and the costs per volume of capacity are therefore decreasing. For example, one set of empirical observations has found that an increase in capacity fivefold represents a cost increase of about 3.5 times. 1/

e) In both plant and network construction, there is evidence of economies of scale in engineering fees; however, there is little reason to believe there are economies in profit and overhead. In use of labor there are no economies if the number of labor units is reduced. That is, assuming union wage scales, the per hour costs of labor will not vary with project size; but the number of hours necessary to complete the project may vary substantially, depending on how the work is organized and how efficiently the labor is utilized.

3. Discussion of Economies

The scale economies cited above were described without regard to two important factors that may prevent or modify potential economies:

1/ Source: Classen, Scalf, and Copeland; "Economics of Regional Sewerage Systems"; Public Works; April, 1970; p. 78.

a) The operation of Federal, state and local water quality regulations work in a manner that the least cost network and plant in many instances are not permitted, and that some higher level of treatment is mandated. Although economies within treatment levels may be realized, in many cases lesser levels of treatment may not be viable options for a community.

b) There was also no consideration of how the particular terrain in a locality will affect costs. Since sewerage systems are largely gravity-based, pipelines are usually established along the lines of the terrain, and plants are located advantageously in a watershed. Where sewer flows cannot be based on the terrain, it is necessary to provide pumping stations and equipment which results in higher cost. There are economies of scale for pumping, but total costs of the system are increased. It could occur that the costs of pumping are so significant as to limit the size of plant, and not allow greater economies of scale.

4. Implications for Altemative Development Patterns

There are several key factors relating to sewer plant and network construction that bear upon differences among development patterns. Perhaps the most significant factors relate to the variation in costs according to density and contiguity of development. The finding that costs of sewer networks vary indirectly with increasing densities -- so that at higher densities, per capita costs for sewer collection systems are less -- is significant not only in itself, but as it relates to differences in development patterns as well. 1/

The corollary finding, that networks costs are reduced by contiguity of development, is also significant in terms of alternative development patterns. Since in planned development there is presumably less passed-over land, the costs of development of sewer lines are less. It was estimated that the con-construction of sewer lines to contiguous rather than passed-over development would cut the costs of development of the network by two-thirds. 2/

1/ For a full discussion of the relationship between sewer costs and density, refer to Anderson; "Community Improvements and Services Costs"; American Society of Civil Engineers: Journal of The Urban Planning and Development Division; March, 1973; Pp. 77-92, and Dajani and Gemmell; "Economic Guidelines for Public Utilities;" American Society of Civil Engineers: Journal of the Urban Planning and Development Division; May, 1973; Pp. 171-182.

2/ A discussion of both the density and distance variations in sewer networks is found in Downing; "Extension of Sewer Service at the Urban-Rural Fringe"; Land Economics; February, 1969; Pp. 103-111.

There is a further relationship between the design and construction of a sewerage system and alternative development patterns. If planned development results in better projections and locating of expected population increases, then it is possible to utilize economies in the sizing and design of both treatment plants and networks. With adequate information, the tendency in less-planned development to design with over-capacity -- because of uncertainty regarding future populations -- would be necessary. Similarly with planned development, the trade-offs between large, regional plants and smaller, subregional plants may become more clear. The costs of constructing larger plants may benefit from economies of scale, but as stated previously, may suffer from not only additional pumping costs but also the added expense of lengthier networks in themselves.

E. WATER TREATMENT AND SUPPLY

In many respects the economies of scale in the construction of water supply, treatment, and distribution facilities are similar to those noted for sewage systems. There are two particular differences, however, that result in major cost variations. The first lies with the source of supply -- whether water supplies are drawn from surface or ground water sources. The second lies in the fact that distribution systems are usually pressure fed, and hence require more pumping than sewage systems, which rely more on gravity flows.

1. Sources of Economies

If the cost of water systems are considered by their component parts, the following observations may be made with regard to economies of scale. 1/

a) For water supply, since there is such dependency on the nature, quantity and location of sources, it is not particularly useful to discuss economies of scale. Particular communities are dependent on the available and least-costly source and hence costs do not necessarily vary with size or scale. It is true that, in general, surface water sources provide a less expensive supply than ground water, but the treatment costs for surface waters are often very great and may perhaps offset the lesser costs of supply.

b) For water treatment, there are clear economies of scale according to size of plant -- assuming that the costs associated with water supply sources are excluded or held constant, and if the level of treatment required is comparable. Costs according to scale of plant are proportional to and take the same form as those associated with sewage treatment plants.

1/ The economies of water supply and distribution are discussed in full in Hirshliefer, DeHaven, and Milliman; Water Supply: Economics, Technology, and Policy: University of Chicago Press: Chicago, Illinois; 1960. Another source is Hines: "The Long Run Cost Function of Water Production for Selected Wisconsin Communities;" Land Economics ; February 1969; Pp. 133-140.

c) For water distribution networks, economies of scale exist for installation of pipelines, for bulk purchases of materials, and for engineering fees for size of project. As with sewer lines, the disproportionate increase in capacity with increase in pipe size results in a scale economy, but the extent of the economies is less. This is due to the fact that generally smaller pipe sizes are used for the transmission of water than for sewage.

2. Implications for Alternative Development Patterns

The considerable variation in water facility costs due to the availability and type of water source is not only independent of scale, but also appears to be independent of the physical pattern of development. That is, the cost of obtaining water for the community is influenced heavily by the type of source and not by the degree of community planning.

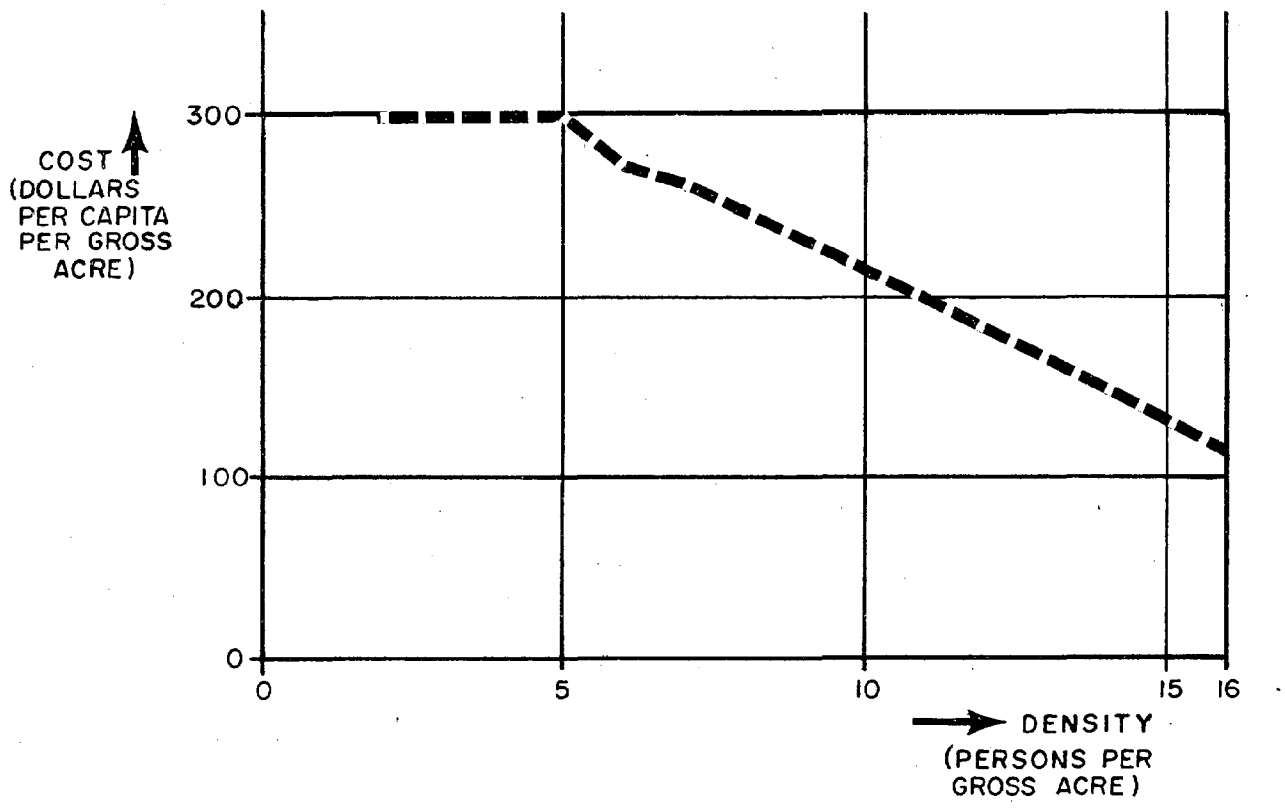
It could perhaps be argued that in planned communities, more potential exists for utilization of economies of scale in water treatment facilities. This could be attributable to previously cited factors -- larger scale of project, better population projections, or closer coordination with other jurisdictions. As a practical matter, however, such decisions are made on a rational basis, and factors such as long-term needs, efficiency and economical sizing of plant, and regional concerns are reflected in the design of water treatment plants. As mentioned, the constraint seems to lie more with the type and availability of water supply. If a large regional surface source is used, planning would dictate some regional (and therefore larger scale) plant. Alternatively, if community wells are the source, then economies of treatment plant size may only operate over a narrow size range.

Finally, in the area of water distribution network -- as with sewage networks -- there is a relationship between economies of scale and development pattern, or at least a relationship between scale and density of development. For such networks, as density increases, the per unit cost of the networks declines. Likewise, under conditions of contiguous development, the per unit costs follow the same pattern.

The relationship between costs and density for water distribution networks is illustrated in Exhibit 5. It should be noted that these findings were based on suburban locations, but only for single-family residential development. No data were available for other land uses or for residential uses at higher densities. It was suggested that similar curves would be found for multi-family residential development, so the conclusion that economies of scale might be found in association with higher density is affirmed. 1/

1/ Cost curve derived from Anderson; "Community Improvements and Service Costs;" American Society of Civil Engineers: Journal of the Urban Planning and Development Division; March, 1973; pp. 77-92.

EXHIBIT 5: SCALE ECONOMIES IN WATER DISTRIBUTION COSTS



The analysis presented data on the relationship between cost per acre and density per acre for actual single-family residential suburban developments with some scattered vacant parcels (non-contiguous development) and for a hypothetical comparison that was fully developed (contiguous development). Costs include water mains, hydrants, and valves. Similar analysis of the relationship between density and costs of sewer networks is also presented.

CHAPTER X

ECONOMIES OF INCREMENTAL DEVELOPMENT

A. INTRODUCTION

The Costs of Sprawl assumed that all construction occurring over the development period was for new facilities; thus, there was no consideration of the cost impact of duplication or replacement of existing capital facilities. In fact, however, instances of duplication or replacement of existing facilities have occurred. The frequency of duplication and replacement might be expected to vary by development pattern. It might be presumed that the more planned a community is, the less duplication and replacement of public facilities there is likely to be. This premise is based on two key assumptions which need testing: (1) that more planning means better forecasting, better control of development and better design of facilities; and (2) that duplication and replacement of facilities are less desirable than providing for all future facility needs at once or through systematic additions.

Duplication of facilities entails: (1) initial undersizing, (2) poor design, or (3) inappropriate siting that necessitates construction of supplemental facilities in order to achieve adequate service capacity. Duplication can occur with either buildings or networks. A community may need duplicate facilities to accommodate the demands of growth within a given district, or because a service area is expanded and inadequate capacity is available. Duplication can also occur with proliferation of small governmental jurisdictions; each endeavors to construct and operate a facility of some minimum size, when fewer but larger facilities would be more efficient. Replacement occurs when a new building or network is substituted for an existing facility. There are three basic reasons for replacing a facility: (1) to change location, (2) to improve quality, and (3) to increase capacity. Changing technologies, changing design and operating standards, financial considerations, and community preferences are among the factors that complicate capital improvements programming.

Because duplication and replacement are but two of several possible ways that capital facilities might be provided to meet the demands of growing populations it is necessary to compare the economic costs of providing facilities under a number of alternative means of sizing and timing:

- To construct initially with not only adequate size and capacity to serve present needs, but also to provide excess capacity for anticipated demands for some period in the future -- perhaps even for the complete development of the area;
- To construct facilities in increments, such that additions to the facility are built over time to meet increasing demands from a growing population;
- To construct initially with adequate capacity, and to respond to future demands by constructing parallel or duplicate facilities; or
- To construct initially with adequate capacity for the present, and to replace the initial facility in the future with larger facilities.

This chapter will focus primarily on: (1) a more precise statement of alternative ways of providing (and therefore valuing) capital facilities -- including a comparison of initial construction to full capacity, building additions, facility duplication and replacement construction; (2) demonstration analyses of the economic costs entailed in each alternative; and (3) the possible effects of physical development patterns on facility construction practices, including a summary of the likelihood and occurrence of facility duplication and replacement as found in the case study communities and in other sources.

B. CAPITAL COST ALTERNATIVES

1. Capacity Utilization

The ideal manner of providing facilities would be to exactly add capacity for each unit increase in demand. In reality, this never occurs. As was described in the previous chapter on economies of scale, capital facilities do not render themselves to small incremental additions. Therefore, some difference between the actual capacity of a facility and user demand will exist at any point in time. Excess capacity may exist, or needed capacity may be greater than actual capacity. In both cases, there is some "cost" incurred for deviation from the needed capacity at any given time.

2. Defining Capital Cost Alternatives

Each alternative scenario on the provision of capital facilities, as described above, results in varying amounts of available capacity; each requires capital expenditures at different points in time. Because expenditures are incurred at different times, they must all be discounted back into present value terms in order to insure comparability. While there is some disagreement as to what discount rate is appropriate for public investments, one reasonable percentage is the rate of interest paid on money borrowed to undertake the capital project (an alternative is the overall average rate of interest on borrowing by the jurisdiction). That rate represents the costs to the local government for capital, and approximates the return received on funds invested by the government.

The alternative means of providing capital facilities are as follows:

a. Initial Construction

The essence of this alternative is that a facility is constructed to its ultimate size at one time. The economic cost of this alternative then is expressed as follows:

$$\underset{(\text{year} = 1)}{\text{Initial Capital Cost}} = \text{Total Capital Cost}$$

where capital cost is defined as the total of construction cost; year 1 is defined as any year in which initial construction of a facility takes place. This may be alternatively defined as nonincremental development.

b. Construction by Addition

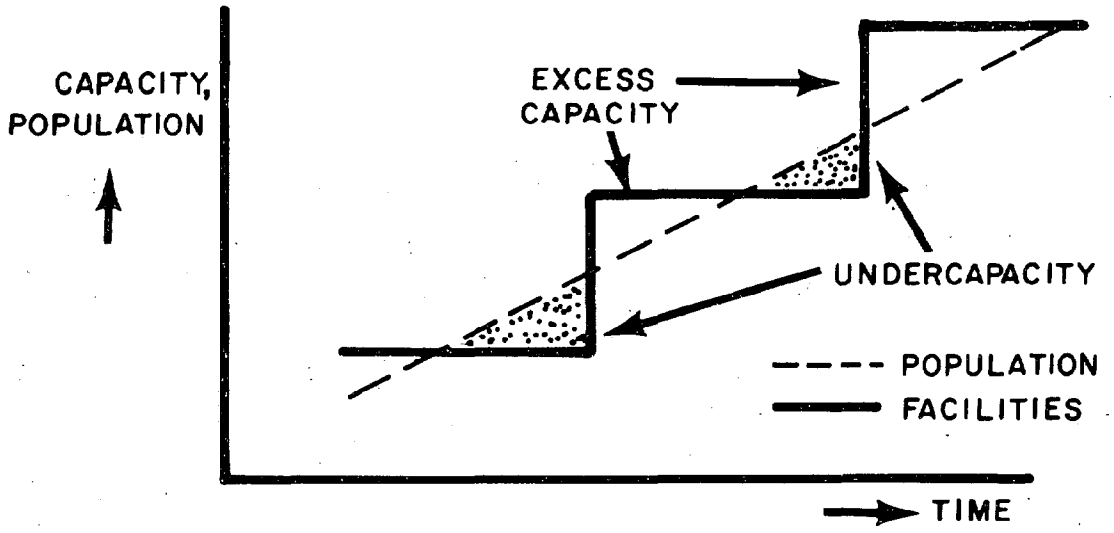
The capital cost in this case is the sum of initial capital costs and the costs of each addition. This alternative may be expressed as follows:

$$\underset{(\text{year} = 1)}{\text{Initial Capital Cost}} + [\underset{(\text{year} -n)}{\text{Additional Capital Costs}} - \text{Residual Capital Costs}] =$$

$$\text{Total Capital Costs}$$

The following exhibit illustrates the "cost" of capacity utilization. It assumes that some idealized profile of facility capacity, which corresponds to the demands of an increasing population, may be defined. This is then compared to the actual pattern of facility construction. When facility capacity exceeds the population-related demand, some excess exists. At other points, there is a shortage of capacity and perhaps an inadequate level of service is being provided.

EXHIBIT 6: CAPACITY UTILIZATION IN RELATION TO FACILITY STAGING



For every period in which there is overcapacity in the short-run, higher costs are being incurred because excessive investment was made -- more than was warranted by population demands. Alternatively, undercapacity results in some higher cost as well, but not in the same terms. Shortage of capacity results in less direct dollar costs since necessary expenditures are deferred to the future.

If facilities are provided in increments so that present or anticipated needs are met -- where the supply of facilities is closely matched to the demands of a growing population -- the "holding cost" of excess capacity is lessened. The risk, however, is that inadequate capacity may result. Also, the increased costs of expenditures in the future, due to inflation, may outweigh the advantages of building later.

The term referring to residual capital costs is found in construction by duplication and replacement, as well as for construction by addition. It is an adjustment for the added but unused economic life that results from incremental development. In other words, when addition, duplication, or replacement take place at some time after initial construction, additional economic life is gained. For example, if a facility with an economic life of 50 years is constructed without increments, some adjustment must be made when comparing other cases in which the initial facility is added to, replaced, or duplicated. The incrementally-built facility will also have an economic life of 50 years, but will last longer than the initial facility. How to make the appropriate adjustments that result in cost comparability is outlined below in Section 3a.

Duplication occurs when it is necessary to supplement existing facilities with additional facilities so that construction takes place in more than a single increment, with duplication of the existing facilities. An example of duplication occurs when the capacity of existing infrastructure is overtaxed, and a parallel line is constructed at some time later than the time of the initial construction.

The formula for deriving the costs of duplication is the same as for construction by addition.

c. Construction by Replacement

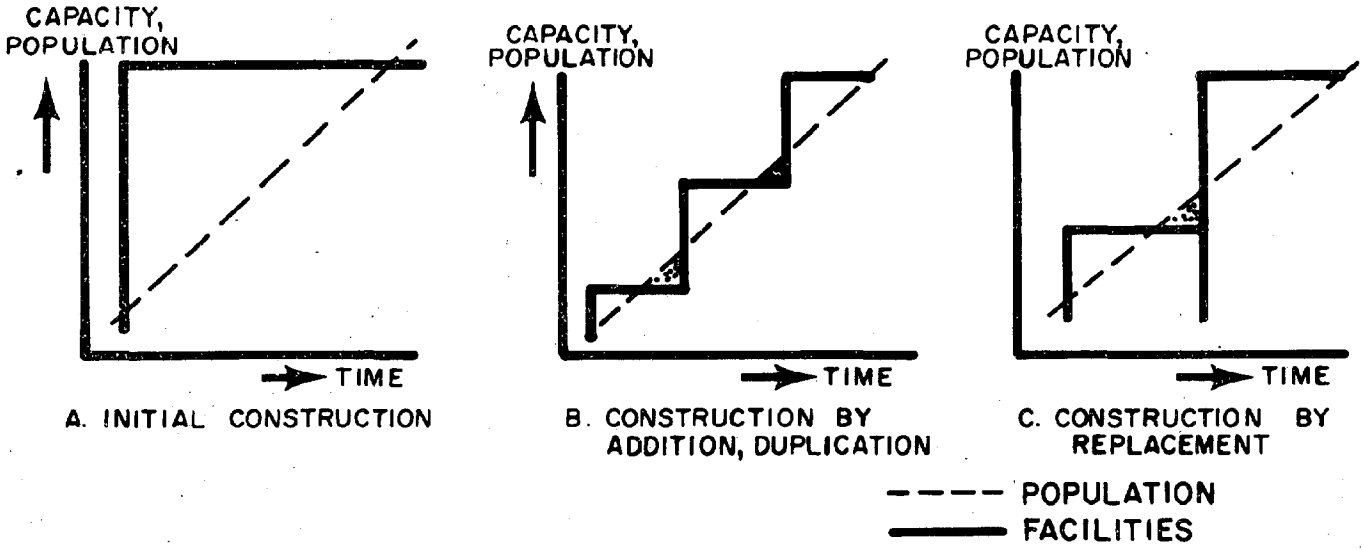
Incremental development by replacement is defined as the construction of facilities to replace existing facilities before the useful or economic life of the original facilities has been completely diminished. If a sanitary sewer is found to lack adequate capacity, and is replaced by a larger-sized pipe while the original pipe has useful economic life remaining, then replacement occurs.

The formula used to derive replacement costs is the same as for construction by addition.

In summary, various means of providing adequate public facility capacity to meet the demands of a growing population exist. The relationships described in the four alternatives are graphically depicted in Exhibit 7, which is similar to the generalized relationship expressed in Exhibit 6. In the case of initial construction, there is excess capacity provided in the original facility, so that the available capacity is initially greater than the needs of the public. In the case of both addition and duplication, capacity

is added in increments to the initial facility as population increases; in this case, closer correspondence may exist between capacity and demand, with fewer periods of excess or inadequate capacity over the years. With replacement, the capacity added by the increment of construction must not only equal the capacity of the original facility, but also must provide added capacity as well.

EXHIBIT 7: CAPACITY UTILIZATION -- ALTERNATIVE CONSTRUCTION MODES



3. Key Issues

There are several key issues with regard to capital expenditures alternatives:

a. Residual Capital Costs

As was mentioned above, for all alternatives involving incremental construction of facilities, it is necessary to adjust for the added, but unused economic life. If a facility with an economic life of 50 years is replaced by a similar facility at year 10, the total economic life that results is 60 years

(10 years of the original facility and 50 years of the replacement facility). In order to preserve comparability with initial construction (built in Year 1 to serve ultimate demand) it is necessary to subtract the value of the last 10 years of economic life of the replacement facility, so that both alternatives are comparable with 50 years of potential use.

The economic value that is attached to this residual capital cost is calculated as follows:

- Capital facilities are assumed to depreciate over time, and the simplest way to account for that depreciation is by a straight-line method.

- The average annual depreciation for a capital facility is assumed to be the total value divided by the design life or expected life of the facility; in the example above, the costs of initial construction and replacement construction would be divided by 50 to give an average annual expense.

- Since incremental construction results in additions to the initial economic life, that portion extending beyond the economic life of the original project must be subtracted. Again, in terms of the example, for the replacement alternative, annual average costs for years 50 to 60 must be taken out, so that comparability with the economic life of 50 years for initial construction is attained.

- Finally, all costs -- including those costs remaining after the initial economic life period has been completed -- are discounted back to present values.

The adjustment then requires the determination of the economic lives of incremental capital facilities, attaching some value to the residual beyond the initial capital economic life, discounting that value, and then subtracting it out.

This procedure creates certain problems. First, it is necessary to determine the economic life of a capital facility; although certain guidelines do exist, there is no general rule for precisely stating the length of time until structure utility is reduced to zero. Second, straight-line depreciation is assumed, for the sake of simplicity and clarity. The appropriate means of expressing decline in the value of public facilities is not well established. For purposes of this analysis, however, decline in economic value will be assumed to be constant, and economic lives will be based on engineering estimates. An alternative approach to the determination of residual capital costs would be to conduct an appraisal to determine value at any particular point in time.

b. Technological, Legal, or Functional Obsolescence

In the discussion thus far, the reasons cited for incremental development involve the failure to provide adequate capacity for a growing population. There are other reasons for additions, replacements, or duplications that must be mentioned. In these cases, incremental provision of capital facilities is reasonable and even mandatory. If technical advances, or governmental regulations occur which make the existing facility less efficient or acceptable, then either replacement or duplication might occur. Similarly, if original facilities are so old that structural deterioration occurs, and their economic lives are depleted, then replacement or duplication would be warranted. These cases must be distinguished from cases in which incremental development is required to provide additional capacity.

c. Incidence of Cost Considerations

One significant factor that pertains to the timing of capital expenditures for public facilities relates to who bears the cost. If facilities are constructed in a single increment, then the cost must be borne by present users (except as costs are deferred by debt financing). If facilities are constructed in several increments, the burden of cost is directly deferred, spread over a wider number of users,and the short-term burden per capita is lessened.

d. Disruption Costs

Incremental development can create additional cost due to the disruption that results from construction activity for addition, replacement or duplication. This cost would be in the form of traffic congestion and disrupted operations. Such costs are largely non-economic and difficult to quantify. Nevertheless, the effect of construction in areas where other facilities are already in place may have serious impacts and must be taken into account.

e. Inflation Effects

There is some question as to whether to compare costs of alternative means of providing capital facilities in constant or current dollars. Comparisons in constant dollars allow isolation of "true" differences in economic costs and focus on evaluation of the alternatives on a consistent basis. Comparisons in current (and therefore inflated dollars) introduce another factor in the evaluation that, while realistic, complicates comparison. Cities with fixed bonding capacities or a static tax base will be vitally concerned with inflation's effect on their ability to build at a future date, especially if the rate of inflation outstrips increases in tax revenues.

f. Economies of Scale

There is an implicit relation between the timing and phasing of capital facilities and the realization of economies of scale. Ideally, as capital facilities are planned and constructed, economies of scale will be deliberately considered and utilized wherever feasible. Therefore, as capital expenditure decisions are made, the question of building in a single larger increment to take advantage of economies of scale would be a part of the process, and would be evaluated as a possible offset to the costs of building increments at points further in the future. Similarly, if increments prove to be economical as a result of present value comparisons, then economically efficient sizes -- in terms of economies of scale -- would be sought for each phase of construction.

In reality, however, there is little opportunity for facility planners to take advantage of economies of scale. As was pointed out in the preceding chapter, many factors other than potential savings from economies of scale enter into capital expenditure decisions. The choices of facility sizes may be limited by the size of community. Larger communities can afford and in fact require larger facilities, and hence may benefit by economies of scale.

Similarly, regional combinations of communities may utilize such economies. But smaller communities may not have sufficient size to take advantage of scale economies. Also, the limited availability of capital may not permit constructing the most economical facility, and uncertainty regarding future growth may also dictate a less than optimal size.

C. ANALYSIS OF CAPITAL COST ALTERNATIVES

Presented below is a systematic analysis of the variation in costs incurred in constructing secondary schools and sanitary sewer pipelines according to different timing and sizing scenarios.

1. Case 1: Secondary Schools

In this analysis, the costs of building schools in a single increment versus building with additions are compared. The alternatives to be compared consist of the following:

a. In each use, a school to house a final pupil load of 1,500 is constructed.

b. Construction will take place according to two scenarios.

   (1) Initial construction for 1,500 pupils.

   (2) Initial construction for 900 pupils, with an addition in the fifth year of operation for 600 pupils.

c. Two assumptions regarding costs will be analyzed:

   (1) Constant dollars are assumed, so that only the effect of discounting on future expenditures is taken into account;

   (2) Inflated dollars are assumed, and future expenditures reflect both discounting and rates of inflation.

The comparison of costs is presented in Table 30. The expenditures incurred in Year 1 show neither the effects of inflation or discounting. At Year 5 expenditures are shown for construction by addition. Assuming no inflation, the construction cost was discounted

Table 30. COMPARATIVE COST ANALYSIS: SECONDARY SCHOOLS

Development Alternative	Initial Construction Cost (Year 1)	Increment Construction Cost (Year 5)	Total Cost
1. Initial Construction	$8,580,000	Not Applicable	$8,580,000
2. Addition Construction, No Inflation	$5,148,000	$2,450,448	$7,598,448
3. Addition Construction, Inflation	$5,148,000	$3,567,287	$8,715,287

Cost calculations derived as follows:

Development Alternative Assumptions

	Number of Pupils		Per Pupil Cost 1/		Discount Factor 2/		Inflation Rate 3/
	Initial	Increment	Initial	Increment	Initial	Increment	
1. Initial	1,500	N.A.	$5,720	N.A.	1.000	N.A.	N.A.
2. Addition, No Inflation	900	600	$5,720	$5,720	1.000	0.714	N.A.
3. Addition, Inflation	900	600	$5,720	$8,327	1.000	0.714	7.8 percent per annum

N.A. = Not applicable.

Notes:

1/ Derived from the school cost analysis presented in The Costs of Sprawl: Detailed Cost Analysis.

2/ Based on interest rate for general obligation bonds assumed in Chapter VIII of this report (7%); discount factor based on five years.

3/ Derived from construction cost index, Survey of Current Business, U. S. Department of Commerce, based on average annual inflation over last five years.

Source: Real Estate Research Corporation.

REAL ESTATE RESEARCH CORPORATION

at a rate equal to the interest rate paid by school districts assumed in Chapter VIII (7%). Inflated costs are based on a compounded rate of 7.8%, with a discount rate of 7%.

The total cost of construction by addition is more economical if constant dollars are used as the measure, with a difference of about one million dollars. On the other hand, initial construction is more economical if the effects of inflation are considered. It turns out, then, that as long as the interest rate of school bonds is below the rate of inflation, it will prove more economical to build in increments. This simplifies the economic decision as to how to phase construction of a facility, but many other factors must be considered -- including many of those mentioned previously.

This method does not account for the residual capital costs from the added but unused economic life in the incremental alternative. There is little agreement as to the duration of a school's economic life. One could argue either that an addition lengthens the economic life of the building; on the other hand, economic life of the entire facility may be limited by the age of the original building. In this analysis, for the sake of simplicity, it was assumed that the economic life is limited by the original building, so that in spite of the addition, the usefulness of the entire complex is depleted with the full depreciation of the original structure. The more complex alternative -- where residual capital costs are accounted for -- is presented in the next case.

2. Case II: Sanitary Sewer Networks

A more complete comparison of alternative means of providing capital facilities is found in the construction of sanitary sewer systems; the alternatives compared are as follows:

a. In each case, an ultimate pipe length of 5,000 feet with the same final capacity will be constructed; this assumes that the slope and flow characteristics will be the same for each alternative, so that the "outputs" are comparable.

b. Construction will take place according to four scenarios:

(1) Initial construction of 5,000 feet of pipe, with diameter of the pipe 18 inches.

(2) Initial construction of 3,000 feet of pipe, with diameter 18 inches, and an addition in the tenth year of 2,000 feet of pipe of the same diameter.

(3) Initial construction of 5,000 feet of pipe, but with diameter of 10 inches; replacement of that pipe with 5,000 feet of 18 inch pipe is required in year 10.

(4) Initial construction of 5,000 feet of pipe, with diameter 14 inches; duplication of that construction is required in year 10 with an additional and parallel pipe of 14 inches. (Because of the geometry of the pipes, two 14 inch pipes are required to roughly equal the capacity of one 18 inch pipe, while maintaining the same flow characteristics.)

c. In every case, the economic or design life is assumed to be 50 years.

d. Costs are analyzed according to constant and inflated dollars, as in the previous analysis of schools.

The findings from this analysis are summarized in Table 31. Costs include materials, installation, earthwork, catchbasins and manholes, and contractor's profit, overhead, and engineering fees; materials in each instance are vitrified clay pipe. No costs for disruption caused by more than one period of construction are assumed.

This comparison shows that construction by addition is least costly, in both constant and inflated dollar terms; construction by either duplication or replacement is considerably more costly. The higher cost for construction by duplication is due to the requirements of design, so that pipe capacities are comparable. Two moderately-sized pipes (14 inches) are compared with one larger-sized pipe (18 inches). As cited in Chapter IX on economies of scale, an increase in pipe size (and therefore capacity) results in a less than proportional rise in costs, so that greater unit flow per dollar occurs with larger-sized pipes.

Table 31. COMPARATIVE COST ANALYSIS
SANITARY SEWER NETWORKS

Development Alternative	Initial Construction Cost (Year 1)	Increment Construction Cost* (Year 10)		Total Cost	
		Constant Dollars	Inflated Dollars	Constant Dollars	Inflated Dollars
1. Initial Construction	$151,000	Not Applicable		$151,000	Not Applicable
2. Addition Construction	$ 90,600	$26,492	$ 56,141	$117,092	$146,741
3. Replacement Construction	$ 94,000	$66,229	$140,352	$160,229	$234,352
4. Duplication Construction	$119,000	$52,193	$119,190	$171,193	$238,190

Cost calculations derived as follows:

Development Alternative Assumptions

	Capacity Characteristics				Per Foot Cost 2/			Discount Factor 3/				
	Length		Pipe Size			Increment						
	Initial	Increment	Initial	Increment	Initial	Constant Dollars	Inflated Dollars	Initial	Increment	Residual	Inflation Rate 4/	Design Life
1. Initial	5,000	N.A.	18"	N.A.	$30.20	N.A.	N.A.	1.000	N.A.	N.A.	7.8% per year	50 years
2. Addition	3,000	2,000	18"	18"	$30.20	$30.20	$64.00	1.000	0.442	.017	7.8% per year	50 years
3. Replacement	5,000	5,000	10"	18"	$18.80	$30.20	$64.00	1.000	0.442	.017	7.8% per year	50 years
4. Duplication	5,000	5,000	14"	14"	$23.80	$23.80	$54.35	1.000	0.442	.017	7.8% per year	50 years

*Assumes incremental cost less residual cost (for years beyond 50) discounted back to year 1.

Notes:

1/ Assumes ten years out of fifty year design life are utilized; thus forty years (x $1,880 per year)are unused residual.

2/ Derived from the sewer capital cost analysis presented in The Costs of Sprawl: Detailed Cost Analysis.

3/ Based on interest rate for revenue bonds assumed in Chapter VIII of this volume (8.5%); discount factor based on ten years.

4/ Derivedfrom construction cost index, Survey of Current Business, U.S. Department of Commerce, based on average annual inflation over last five years.

Source: Real Estate Research Corporation.

The previous conclusion that the difference between the interest rate on public borrowing and the rate of inflation determines the most economical means of providing capital facilities must be amplified by another observation. The economics of facility construction depend on several other factors. The length of economic life and the point during that economic life at which incremental development occurs are also important. If incremental construction occurs near the end of the economic life of the initial facility, the costs will be considerably lower due to discounting. On the other hand, if replacement, duplication, or construction of additions occur relatively close to the initial construction, the closer the economic lives will be and the less the residual capital cost will be. Another factor that might be taken into account is the cost of disruption. Including such indirect costs would favor initial construction; on the other hand, uncertainty regarding potential growth in demand would favor replacement, duplication, or periodic additions to a small initial facility.

D. IMPLICATIONS FOR ALTERNATIVE DEVELOPMENT PATTERNS

1. Occurrence of Duplication and Replacement

In the discussion presented thus far, we have assumed that replacement, duplication, addition, or initial construction may all be commonly observed. However, some alternatives occur less frequently than others. Based in part upon the case study communities and in part upon a number of interviews with consulting engineers, architects, planning professionals, and governmental officials, the occurrence of replacement and duplication was found to vary widely.

a. Findings from Case Study Communities

As part of the assessment of planning practices and development results in the case study communities, the pattern of replacement and duplication was analyzed. In general, we found no clear pattern that distinguished planned from less planned development with regard to whether facilities had to be replaced or were duplicated. Replacement of facilities did occur in these communities, but they could not necessarily be related to development pattern, and rather were attributable to other factors. The variations in replacement and duplication that were observed are summarized in Table 32.

With regard to streets and roads, replacement and duplication were not necessary in any community for minor streets and interior circulation. For larger streets in the network, some replacement was required in all communities

Table 32. OCCURRENCE OF REPLACEMENT AND DUPLICATION CASE STUDY COMMUNITIES

Cost Category	Arlington Heights, Illinois	Park Forest South, Illinois	Town of Amherst, New York	Reston, Virginia	West Springfield, Virginia
Streets and Roads					
Minor Streets and Interior Circulation	No replacement or duplication.	No replacement or duplication.	No replacement or duplication.	No replacement or duplication.	No replacement or duplication.
Collector and Arterial Streets, Primary Roads	Extensive widening and upgrading occurred, and more needed.	Pre-existing roads need widening and upgrading.	Substantial upgrading and widening of inadequate rural roads is necessary.	Pre-existing roads outmoded and over capacity; no replacement as yet, but necessary.	Pre-existing roads outmoded and over capacity; replacement has occurred.
Utilities					
Water and Sewer					
Networks	Some lines replaced with larger mains; more necessary.	No replacement or duplication.	Need substantial replacement of water mains inadequately sized for urban densities; need replacement of sewer lines in older parts of town.	No replacement or duplication.	No replacement or duplication.
Plants	Several wells replaced by larger capacity wells; some pre-existing sewer lines and pumping stations replaced or eliminated with conversion to regional system.	No replacement or duplication.	Plans call for closing one secondary treatment plant and expansion of existing primary plant.	Limited number of septic tanks for industrial users; constructed at private cost with provision for conversion to public system.	Use of septic fields limited; present policy calls for capability to convert to public system.
Storm Drainage					
Networks	Major replacement of lines in older section of village; another major replacement planned.	No replacement or duplication.	Pipelines and ditches inadequate for volumes of runoff associated with urban densities; replacement or upgrading necessary.	No replacement or duplication.	Some replacement necessary.

Source: Real Estate Research Corporation.

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and ranged from minor modifications such as improving surfaces to major projects including widening, grading, and even realignment. Such thoroughfares as collector and arterial streets, however, are in existence before substantial development occurs, and although adequate for the smaller volumes of travel in early years, can become inadequate as growth takes place. Thus, there seems to be replacement required uniformly for pre-existing streets and roads. A different pattern was found for newly constructed streets and roads. In planned communities, major streets were often sized to adequately accommodate traffic volumes expected upon full development and therefore were oversized for early volumes. In less planned communities, streets were sometimes replaced as traffic volumes increased beyond anticipated levels.

Problems with utility networks necessitated replacement of facilities in two of the case study communities. In Amherst, undersized water mains designed to serve rural population densities were inadequate to serve new growth with acceptable pressure levels. Older sewer lines were replaced as maintenance problems increased. An open ditch storm drainage system could not handle increasing run-off volumes, and thus needed replacement with an improved drainage network. Replacement of older pipelines in mature sections of the village also occurred in Arlington Heights. Moreover, conversion to region-wide sewage treatment necessitated closing of some lines and pumping stations and constructing new facilities. Only in the case of Amherst's undersized water mains could replacement costs be attributable to poor planning that resulted from overlapping jurisdictional authority and inadequate financial resources. Replacement of older facilities that physically deteriorate with time is certainly not inefficient. A change in policy that fosters regional rather than community facilities exacts considerable costs, but in the long run is likely to result in more efficient and higher quality service delivery.

b. Other Findings or Conclusions

In general, replacement and duplication (as defined in this study) occur quite infrequently. There were a number of instances where construction projects were undertaken to replace existing facilities, but such instances involved changes in service levels, technological changes, or substitution for worn-out or out-moded facilities. Cases in which substantial usefulness in a facility was wasted were less common. Duplication of facilities was also uncommon.

With regard to school facilities, the decision as to sizing and timing of construction is tied closely to the prediction of pupil enrollments. In a situation where enrollments are growing rapidly and are expected to continue to grow, construction of larger facilities can be justified. If enrollments are tapering off and future needs are uncertain, then it may be more prudent to build in increments. If the costs of inflation are considered -- as seems to be a primary concern with school officials and facility planners -- then it may be more economical to build to excess capacity. It was stated that with uncertainty of future enrollments, there is a trade-off between rising costs due to inflation and the potential risks of not utilizing school capacities; there is also a trade-off between taxpayers desiring not to pay for excess capacity and building at present to avoid inflation.

2. Variations by Development Pattern

If it is possible in planned development to accurately project population increases (and therefore facilities requirements), then it is also possible to plan for adequate capacities at all times during the development period. Similarly, with adequate foresight, it is possible to take advantage of economies of scale that may be applied in providing facilities. And if needs can be accurately projected, then it is also possible to determine the alternative means of providing facilities that will result in the least cost. With planned development, therefore, planners may be able to solve the questions of timing, sizing, and adequacies of facilities. More specifically, they can determine the "breakpoints" where efficient and economical provision of facilities can occur and specify the size of the increment at those breakpoints. Such assumptions presume that accurate market absorption predictions can be made in large scale planned communities where development activity is controlled by a single entity. Market conditions may change; however, temporary inefficiencies in service provision could still occur.

The previous analyses, presented by way of demonstration, do not prescribe a precise formulation or a global answer as to how to provide capital facilities. The information is intended more to raise questions that typically are not asked in capital expenditure decision-making. A local government official could use the method to determine the least cost, most efficient strategy for the provision of capital facilities. It must be assumed that well planned communities would undertake such analysis of facility needs, as well as alternative means of supplying those needs. On the other hand, the same opportunity may not be as available in "sprawl" or less planned communities.

In summary, the provision of capital facilities is not a clear-cut situation where economic criteria necessarily prevail. Decisions on economic grounds depend on a number of factors -- relative rates for borrowing and inflation of costs, timing of expenditures, sizing of facilities, economies of scale and costs of capacity, and incremental phases of construction. In addition, non-economic factors intervene, so that availability of funding, likelihood of success of bond referenda, desired levels of service, technology, degree of physical obsolescence or deterioration all may prevent construction of facilities in the most economical or efficient means. In the final analysis, a case-by-case approach is required. But consideration of many of the factors stated here, combined with economic analysis of alternative means of providing capital facilities, is required in any case.

ADDENDA

APPENDICES

CASE STUDY SUMMARIES

Field research in the five case study communities was undertaken in the spring and summer of 1974. These summaries, and the conclusions derived from them, reflect conditions, practices, and policies as they existed at that time.

CASE A.

ARLINGTON HEIGHTS, ILLINOIS

Case Studies: Arlington Heights, Illinois

I. INTRODUCTION AND BASE DATA

Arlington Heights (estimated population of 73,000 in 1973) is largely a bedroom community for persons working in the City of Chicago or at major office/industrial complexes near O'Hare Airport. It is located approximately 30 miles northwest of downtown Chicago, in what was perhaps the most rapidly growing section of the metropolitan area during the sixties and early seventies. Its housing stock is still predominantly single family, although rental apartments and condominiums have increased in the last few years due to rising land and construction costs. It is a family oriented community of managers and professionals in the upper middle income range. However, Arlington Heights has been characterized as a somewhat transient community, a "way station" for young corporate executives on their way up.

Physically, the community now covers almost 9,200 acres, due to annexations over the years. It has a rather elongated, narrow shape, interspersed with pockets of unincorporated areas. The village is bisected by the Chicago and Northwestern Railroad (which provides excellent commuter transportation to downtown Chicago) and three major roads running from northwest to southeast. Only one north-south arterial crosses the full length of the community. There are no regional shopping centers or major industrial concentrations within the village, although major shopping and employment centers are found in the bordering communities of Schaumburg, Rolling Meadows, Mount Prospect, and Elk Grove Village.

The Village of Arlington Heights provides general government, police and fire protection and sewer and water service. It is closely linked to a library district with its own officials, whose finances are controlled by the Village. Parks and recreation services are provided by the Arlington Heights Park District, whose boundaries are roughly coterminous with the Village. Parts of Arlington Heights lie in five separate elementary school districts, with two of these covering the bulk of the area. All of Arlington Heights falls within High School District #214, which presently operates eight high schools, three of which are within the corporate boundaries of the Village. However, some Arlington Heights residents attend four of the remaining five schools. Sewerage treatment is provided by the region-wide Metropolitan Sanitary District of Greater Chicago.

The following table shows the growth in population and dwelling units between 1964 and 1973. During this decade, the Village's population grew by 85 percent and the number of dwelling units more than doubled.

Table A-1.

COMMUNITY GROWTH PROFILE
Arlington Heights, Illinois

	Population	Land Area (Acres)	Dwelling Units
1964	39,500	Not Available	8,800
1965	42,000	6,437	10,800
1966	45,000	7,020	11,538
1967	52,787	7,475	12,500
1968	56,000	7,770	14,870
1969	61,000	8,391	15,049
1970	64,884	8,729	15,228
1971	66,500	9,067	15,408
1972	69,204	9,178	16,052
1973	73,000	9,187	18,696
Change, 1964-1973		1965-1973	1964-1973
Number	+33,500	+2,750	+9,896
Percent	84.8%	42.7%	112.4%

Source: Village of Arlington Heights, Illinois

II. INCIDENCE OF COST

A. Introduction

The purpose of this section is to assess the contributions of private participants in the development process (developers, builders, homeowners, groups, etc.) to the cost of providing public facilities and services. These contributions can take many forms; those used in Arlington Heights are outlined below:

1. Mandatory installation of improvements as specified in a subdivision or P.U.D. ordinance.

2. Dedication of land for public rights-of-way, school sites, parks or other public uses.

3. Fees-in-lieu of dedication where the size, location, or nature of a development would not warrant provision of land.

4. Additional improvements required as a condition of annexation or rezoning, such as installation of traffic signals, road widening, etc.

5. Private facilities which are quasi-public in nature, such as recreation facilities within planned developments which are owned and operated by developers, homeowners' associations, or other private parties.

6. Quasi-public services provided by private parties, such as maintenance of private roads and utility systems within a subdivision.

The nature and extent of these private contributions varies for different cost categories. The experience of Arlington Heights in the last ten years is discussed below.

B. Developer Contributions to Capital Expenditures

1. Streets and Roads

The subdivision control ordinance of Arlington Heights requires that developers install on-site roads, alleys, curbs, gutters, sidewalks, street signs and landscaping of public areas in accordance with standards set forth in the municipal code. While dedication of these improvements to the municipality has not been mandatory, it was the common practice through most of the period in question. More recently, developers of large PUD's have proposed private retention and maintenance of these roads by homeowners' associations. Although this relieves the Village of the burden of maintaining these roads, Village officials fear that the design of the roads and their maintenance would not be in keeping with the Village's high standards. Thus, it is not likely to become common practice to retain roads privately.

Additional road improvements have been required as a condition of annexation, rezoning, or P.U.D. approval. In the case of one PUD approved in 1973, the developer was required to pay half the cost of a traffic signal (up to $20,000) and widen an existing frontage road alongside a limited access highway. In another instance, the developer was asked to dedicate land for widening an existing two lane arterial road on the side of the road abutting the site, with the Village paying the balance.

Additional road improvements related to growth may be paid for through a combination of public and private funds where substantial public benefit can be shown. The private share of these improvements is paid through special assessments. This type of cost allocation has been used for street lighting, street widening, sidewalk construction, and sewer and water main improvements undertaken subsequent to development. Thus, it has largely been used in mature areas of the community or for growth related projects which cannot be attributable to a specific subdivision.

2. Utilities

The Village's subdivision regulations also require that developers construct a water distribution system (including hydrants) and sewage system within his site and provide connections to the municipal system at the most advantageous point. An independent storm sewer system is also required; where connections to the Village system are not available, the developer must provide a means of disposing of the discharge.

Dedication of land for new municipal water wells has been required as a condition of annexation or plan approval in two instances, the first involving 0.5 acres (land and improvements valued at $5,000) and the second 0.2 acres, (land and improvements valued at $10,700). In addition, some developers have been required to provide retention ponds as a flood control device. Often these ponds are then used for water oriented recreation.

3. Schools

a. Elementary Schools

Elementary school districts serving Arlington Heights have received donations of land or fees-in-lieu of dedication for the purpose of providing school facilities. Arlington Heights does not have a precise formula to determine the amount of land or fees required from developers. Whether land or cash is offered depends on the demand projected by the school district for new facilities in a particular location. The amount dedicated depends on the proportion of the demand or need for the new school which can be ascribed to a given development. Dedicated facilities or contributions cover all or a portion of the land needed for the school site plus on-site improvements (utility connections).

In virtually all cases, the sites donated by developers in Arlington Heights constituted 100 percent of the site area needed for school construction. In many cases, school and park sites were combined. Where subdivisions were too small or otherwise did not warrant new school construction, fees were paid in lieu of dedications, to be set aside for future school improvements.

b. Secondary Schools

The high school district serving Arlington Heights received no dedications nor fees-in-lieu of dedication from developers during the period in question. All sites were purchased by the school district.

4. Parks and Recreation

The manner in which the Arlington Heights Park District has received dedications of land or monies from developers is similar to that for elementary schools. No official formula exists; requirements are informally determined based on the Park Districts' comprehensive plan and the demand for park and recreation facilities attributable to the proposed development. However, the Village's subdivision ordinance stipulates that no more ten percent of a subdivision's gross acreage can be taken for school and park purposes without compensation. As this limit applies to all subdivisions regardless of proposed density or population characteristics, it has not always been possible for the Park District to obtain all of the land it would need to satisfy its stated standard of ten acres per 1,000 population. In Camelot Park, a community park of 15 acres developed in 1967, the District received 9.4 acres as donations from two subdivisions and had to purchase additional land. The total value of land and improvements dedicated by developers between 1960 and 1973 was $1,053,765, while Park District investment (as reflected in bond issues) was $4,460,000. Thus, private investment represented 19 percent of total capital costs for open space and recreation in this period. In the past few years the Park District has preferred to exact cash donations from developers rather than dedications.

The Park District received additional assistance during this period through donation of surplus federal lands. Furthermore, when land acquisition funds dried up, park sites were leased from the Village, the school district, the electric utility company, and a local church.

In one instance a developer was required to put in a bicycle path as a condition of approval for his project.

Many large scale developments recently completed or presently underway in Arlington Heights have provided private recreation facilities and open space amenities that in some respects can be seen as "quasi-public"(or substitutes for publicly provided facilities) even though their use is limited to project residents. Included most frequently are club houses, swimming pools, play areas, and tennis courts. Full health clubs or golf courses are seen less frequently. These facilities and services are provided either by developers, homeowners' associations or private concessions, and are paid for through the purchase price or rental of housing, homeowners' association dues or user fees. A number of developments have small lakes.

5. Miscellaneous

The Village of Arlington Heights will, on occasion, require developers to provide fees-in-lieu of land for municipal improvements. Such fees were used in 1968 to purchase a 1.8 acre site for $209,000 for a cultural center, which as yet has not been constructed.

C. Operating and Maintenance Costs

1. Streets, Roads, and Utilities

The Village of Arlington Heights is responsible for maintaining road and utility systems to which it has received title from developers. Where internal rights-of-way are retained privately, such upkeep is normally undertaken by homeowners' associations and paid for through assessments or dues.

2. Schools

a. Elementary

Because there often is a time lag between a development's

occupancy and its appearance on the tax rolls, developers in Arlington Heights are now being required to make a "one-time only" cash contribution to the school districts based on the number of dwelling units. This is designed to help defray some of the costs of educating pupils from the project until the development begins generating tax revenues. However, this amount ($200 per housing unit was required in 1973) is not sufficient to cover the average annual expenses incurred for educating a child in the district.

b. Secondary Schools

The high school district has not received private contributions to the annual cost of school services.

3. Parks and Recreation

Private contributions to on-going costs of parks and recreation include maintenance and operation of private facilities operated by home-owners' associations or concessions.

III. TIMING OF CAPITAL IMPROVEMENTS

A. Introduction

The purpose of the annual capital cost analysis is to determine how Arlington Heights responded to population increases during the period from about 1960 to 1973. Considered in this analysis are the following:

1. When facilities and services were planned (e.g., several years before construction; immediately before construction).

2. When facilities and services were provided (e.g., before population increases occurred, along with population increases, or following these increases when existing facilities were totally inadequate).

3. The capacity and quality of new or improved services and facilities.

In most cases, evaluation of the Village's response to increasing demand for services and facilities is based on interviews with Village officials, who provided information on when and how effectively changes occurred. The rate of change in facilities is also compared with the rate of population increase to determine whether improvements preceded or lagged behind rising demand. Whenever possible, a national standard for per capita facilities is used to measure the Village's achievements. The standards are, however, used only to give a general idea of the community's success or failure in providing services.

B. Findings and Conclusions

1. Police

During the study period only one major capital expenditure was made for police protection. In 1962 a police station was constructed as part of the new municipal building. No enlargements

of this facility or additional stations were required. Other small capital expenditures were needed to purchase equipment such as patrol cars as the police force expanded and old equipment was replaced. Since this equipment must be continually replaced because of obsolescence, it is impossible to determine a pattern of expenditures caused by service expansion alone.

2. Fire

Arlington Heights provided its citizens with adequate fire protection throughout the development period by adding new fire stations before areas grew too large or densely populated to be served by existing stations. Between 1960 and 1973, three stations were constructed. One was built in 1962 to replace an existing station in the old municipal building.

The number of stations required to serve the area was affected by not only population increases, but also the Village's street pattern and railroad facilities. Because only one north-south thoroughfare runs the length of the Village and this route is frequently blocked by trains moving east-west through the centrally located downtown, two fire stations are needed to serve the downtown area and points immediately north or south. The third and fourth fire stations were constructed in 1968 and 1970 when new development in the Village's northern and southern fringes was no longer adequately protected by downtown stations.

3. Library

Until 1968 when a large municipal library was constructed, the Village of Arlington Heights was served by a small library facility with few books. The new municipal library, however, provided the area with excellent facilities. To improve library services, a bookmobile was purchased in 1973. Expansion of the library building is also planned.

4. Recreation/Open Space

The park district, which has boundaries roughly conterminous with those of Arlington Heights, did not obtain enough land to satisfy the Village's rising needs. Over the development period the per capita acreage of parks decreased rapidly as population increased. The following pattern of land acquisition occurred:

a. From 1964 to 1969 the park district rapidly acquired land; however, population also increased rapidly during that period, so park acreage continued to lag behind the community's need (as expressed by the standard of 10 acres per 1,000 population).

b. Very little land was acquired between 1969 and 1972 despite rapid increases in population during that period.

c. In the last year of the development period, 1973, the park district had fewer acres per capita than at any other time. Moreover, much of the land it held had not been improved for active recreation.

The Village's 1974 Recreation Development Plan recognizes this situation by stating:

> "While the residential and commercial facets of Arlington Heights' growth have intensified at a rapid rate during the past decade, development of recreation facilities has not kept pace." (p. 1)

5. Streets and Roads

Most Village expenditures for street improvement or construction were made during the early 1960's. Although the area's population increased rapidly over the entire development period, the Village's

costs of constructing and improving streets declined after 1964. One possible explanation of the declining costs despite population growth is the Village's limited role in providing new streets. Since private developers usually paid for all streets necessitated by population growth and residential expansion, the Village's major expenditures were for upgrading or repairing existing streets. Although maintenance and upgrading are affected by increases in population and usage, they are always needed and only the period of time between repairs is changed. The Village therefore made expenditures on streets during the early 1960's probably as part of a cyclical need to repair obsolescent and deteriorating streets -- in this case streets constructed during the 1950's -- and not to upgrade streets in anticipation of population growth. Even maintenance and upgrading was not entirely the responsibility of the Village government. The State of Illinois and Cook County improved many roadways in the area, especially those with increasing volumes of through traffic.

6. Utilities

a. Water Wells

Over the period 1966 to 1973, the Village of Arlington Heights generally increased the capacity of its water supply system in response to population increases. The capacity to pump water for consumption and fire flow needs was, however, never significantly below the Village's needs; rationing was required only occasionally during summer months of the early 1970's when large quantities of water were used for lawn sprinkling. Excess capacity existed in the Arlington Heights' water supply system only during the early years of the development period, prior to 1966. After an eighth well was added to the system in 1962, an adequate water supply was available for four years despite rapid population increases. Another well with greater

pumping capacity than well number eight was added in 1966, yet the system's capacity remained far below its earlier standard. Capacity increased briefly following construction of a well in 1968; however, this improvement was soon offset when a well was taken out of operation. By 1971 capacity per capita was far below the standard of the early 1960's and four new wells were required between 1971 and 1973 to provide an adequate water supply.

b. Water Pipelines

The Village made three major capital expenditures for water pipelines during the development period. These expenditures were made in 1970, 1971, and 1972 primarily to enlarge and improve existing mains in old sections of the Village. No major public expenditures were made to construct lines in growing sections of the Village, since the cost of providing water lines in these areas was paid mainly by private developers. Major water trunk lines to areas of new growth were provided in small increments.

c. Sanitary Sewers

The costs of constructing sanitary sewer facilities are presently paid primarily by the Metropolitan Sanitary District of Greater Chicago (MSD), which constructs interceptor sewer lines and treatment facilities in the area. Before 1968, however, all sewer facilities except minor sewer lines within subdivisions were paid for by the Village. Public costs included the construction of major sewer lines, lift stations and treatment plants. When the Village changed from local treatment facilities to the MSD interceptor system it incurred some costs to construct a gravity out-fall system that could be linked to the regional system. The Village also constructed major sewer lines to serve new growth areas on the south side

in 1968 and on the north side in 1970. In each case, sewer expansion preceded housing construction by only a brief period.

d. Storm Sewers

Only one major storm sewer project was constructed during the development period. In 1963 inadequate storm sewers in old residential areas were replaced with larger facilities. As in the case of water pipelines, storm sewers in other parts of the Village were paid for by private developers. Only some major trunk lines were provided by the Village, and these were constructed in small increments as necessitated by new growth. Substantial portions of the Village still lack adequate storm sewer service.

7. Schools

a. High Schools

High School District 214, which serves Arlington Heights and the surrounding areas of Buffalo Grove, Wheeling, Mt. Prospect, Prospect Heights and Rolling Meadows, planned carefully for growth in the area. As early as the 1950's the school district purchased seven land sites for schools constructed during the 1960's and early 1970's. Between 1960 and 1973 six high schools were constructed with an average capacity of approximately 2,700 students and space for expansion. Because the district purchased land and built schools in anticipation of population and enrollment increases, the high schools were never overcrowded. Also, the cost of these facilities was somewhat lower than it would have been had land been required later during Arlington Heights' development, when land became less readily available and more expensive.

Although High School District 214 responded to growth by adding facilities at six different points during the development period, these schools were planned and construction was begun long before rising enrollments caused significant

overcrowding and were designed for a large number of students. Presently, two schools built before 1960 and the six schools built after that time adequately serve the area. Since the rate of increase in high school enrollment is leveling off, no new facilities are planned for the near future. Should another school be required, however, one of the seven sites purchased during the 1950's remains to be developed.

b. Elementary Schools

The elementary school districts serving Arlington Heights planned for growth much less effectively than the high school district. School District 25, which serves most of Arlington Heights and on which much of our analysis is based, did not construct facilities in anticipation of enrollment increases but only after crowding occurred. Between 1960 and 1973 seven new schools were built; however, as originally constructed they did not long satisfy the area's needs. Only two of the seven new schools require no additions of classrooms and other facilities, while two to six additions were made to other schools in the district. The numerous small additions were made whenever rapidly rising enrollments required expansion of facilities. Because the number of elementary and junior high school pupils is now rapidly declining according to demographic trends, in recent years the school district has been better able to meet the area's needs.

IV. TIMING OF OPERATING AND MAINTENANCE SERVICES

A. Introduction

The purpose of this analysis is to show how annual operating costs and the level of public services responded to growth in Arlington Heights between 1964 and 1973. The conclusions presented here must be considered in light of the following constraints:

1. Operating costs for many public services will automatically respond to additions to physical facilities (capital costs) and thus do not show their own unique pattern.

2. Data on actual operating and maintenance costs were derived from numerous manipulations of information presented in financial reports. These manipulations were needed to remove capital expenditures financed out of current revenues or to eliminate debt service costs shown as current expenditures. Costs then had to be adjusted to 1973 dollars to eliminate the effects of inflation over time.

3. The pattern of cost increases or decreases over time was often erratic; in some cases, looking at cost data alone in absolute amounts or on a per capita basis gave no indication of the nature of the Village's response to growth pressures or the extent to which service level increases were anticipated or planned for. In those instances, it was helpful to look at measures of service level -- pupil/teacher ratios, police and fire personnel per 1,000 population, etc. If these indices are stable over time, it can be concluded that the Village was able to keep pace with growth. This does not imply that compliance with national standards occurred -- only that the Village did not fall behind the levels it had been able to achieve in the past. When the indices show fluctuation year by year, adequate planning for population increases probably did not occur. Where increases in service levels are shown, the community was able to improve its services in spite of growth pressures.

Presented below are the findings of our research in Arlington Heights.

B. Findings and Conclusions

Operating and maintenance costs for public services in Arlington Heights showed a variety of patterns of change as the community grew, with some cost functions increasing consistently (in 1973 dollars) over time, others remaining relatively stable, and yet others exhibiting erratic patterns of increase and decrease. Service levels (expressed as ratios of patrolmen, firemen, teachers, etc. to population) showed considerable upgrading during the period 1964 to 1973, but an analysis year by year shows an irregular pattern of fluctuations in per capita service levels as the Village tried to keep pace with growth. The nature of the Village's response to growth for various cost functions is analyzed below.

1. Government Regulation and Administration

Costs in constant 1973 dollars for general government in Arlington Heights (including public works, planning, engineering, and public health) showed an erratic pattern between 1964 and 1973, the reasons for which are not clear from interviews or financial report data. No anticipation of or response to growth can be inferred from this pattern.

2. Police and Fire Protection

Both police and fire protection service costs show a steady upward trend between 1964 and 1973, reflecting increased professionalization of the fire department, provision of paramedical, and an increased number of police patrolmen and firemen needed to service a rapidly increasing area.

The number of full time firemen per 1,000 population increased dramatically, from .28 in 1964 to .88 in 1973. During this time period two new fire stations were opened (1968 and 1970); manpower increased significantly in the same years. Although police services did not show as dramatic cost increases as did fire protection, additional manpower has been provided to service newly developing areas in the northern part of the Village.

It would be a safe conclusion, based on our interviews with public officials and developers in Arlington Heights, to state that the police and fire departments responded well to the rapid growth in Arlington Heights. Neither department's manpower lagged behind growth in population. Moreover, the departments were able to upgrade service levels through increased use of full time staff.

3. Library

The costs of library services in constant dollars increased only slightly between 1964 and 1966, and increased moderately between 1968 and 1969. The first full year of the new library facility's operation (1969) resulted in dramatic cost increases which continued up to 1973.

Prior to the opening of the library facility, the library district showed some difficulty in maintaining its service level in terms of the number of books per capita (an indication of service level). While there were 1.22 books per capita in 1966, this dropped to 1.00 in the following year, only to increase again to 1.25 in 1968. A steady increase up to 1973 (with more than 2.0 books per capita) is observed.

Thus, the library district had some difficulty keeping up with growth in the community prior to 1969. After that year, an improvement in the service level has occurred.

4. Parks and Recreation

Annual operating costs for parks and recreation services were available only for the period 1967 to 1971, and do not show a pattern which can be reasonably related to improved facilities or service levels. The park district's response to growth as it affected site acquisition and per capita park acreage was discussed previously under capital costs.

5. Streets and Roads

Maintenance costs for roads are not treated as separate line items in the Arlington Heights budget; they are included generally as public works costs under general government. Moreover, much major road maintenance in Arlington Heights is performed by the State and County. Thus, no conclusions can be made as to how road maintenance service responded to growth.

6. Water and Sewer

Water and sewer operating costs between 1964 and 1973 show an erratic pattern from which it is difficult to determine the nature of the community's

response to growth. It should be noted that the greatest increase in costs occurred between 1967 and 1969, when the Village acquired and began to operate a number of small private utility systems. Total operating costs have remained fairly constant between 1969 and 1973 despite an increasing service area; some operating economies of scale may have been achieved.

It must be remembered that Arlington Heights no longer provides its own sewage treatment, but is part of a large regional system. Thus, most of its operating costs will be for water pumping and conveyance.

7. Schools

a. Elementary

Examination of pupil/teacher ratios over the study period in all of the elementary school districts serving the community is a good indication of how school operations have reacted to growth. Between 1964 and 1967, the pupil teacher ratios ranged from a high of almost 28 pupils per teacher to a low of 23. In 1968, the class size dropped markedly and remained between 16 and 17 pupils per teacher through 1971, representing a "catch-up" period after the rapid growth of the mid-sixties. In 1972, however, the ratio had climbed again to almost 24 pupils per teacher, probably due to rapid residential development in the northern part of the Village -- an area served by School District #21.

b. High Schools

High School District #214 fared far better in meeting the demands of growth than did the elementary districts. Their success in early site acquisition has been mentioned previously. Pupil/teacher ratios have remained stable over the development period -- between 18 and 20 pupils per teacher. No student had to attend school on double shifts. As new facilities are built and as the locus of growth changes direction, school boundaries have been altered to eliminate overcrowding, which has been only short term.

C. Summary

Overall, it can be said that general government and special districts' on-going services responded well to growth, and anticipated needed increases in personnel

and service levels for police and fire protection, and secondary education. Library services lagged behind demand prior to the opening of the main library; since that time the library has not only kept pace with growth but increased its service levels. Water services and elementary schools were faced with problems of inadequate physical facilities which affected operating costs, and indicated fluctuation in quantitative indices of service capacity when examined on a year by year basis.

V. FINANCING OF MAJOR PUBLIC IMPROVEMENTS

Under the Illinois Constitution, Home Rule Units (general governments with populations from 25,000 to 500,000) may be limited in the amount of outstanding debt payable from ad valorem property taxes to one percent of assessed valuation without a referendum. As of April 30, 1973, Arlington Heights' ratio of bonded debt to assessed valuation was 0.99% for the village itself. General obligation bonds were used to construct the library and purchase books, as well as construct the municipal building and certain sewer and water improvements. While revenue bonds were used for most sewer and water system expansions, the Village is relying increasingly on utility tax funds for current improvements, as well as for construction of new wells or major road projects. Installment notes were used to finance two new fire stations.

The Arlington Heights Park District has relied on general obligation bonds for funds used to make park improvements. Most park sites were acquired either through developer donation or federal assistance. Revenue bonds were issued for the Forest View Tennis Club (which houses the District's offices) and are being retired with funds generated through court fees and proceeds from concessions. The District, at present, has reached the maximum outstanding general obligation debt allowed without referendum. A proposed bond issue was defeated by the voters in 1973. The District's director does not anticipate any expansion of facilities other than through donations given voter reluctance to approve further bond issues.

High School District 214 has issued almost $37,000,000 in general obligation bonds since 1962, which were used in the construction of five high schools built during the period, and for limited site acquisition. Interest rates have shown considerable variation based on market conditions at the time of sale.

Elementary School District 25 issued approximately $10 million in general obligation bonds for school construction between 1960 and 1969. The interest rates ranged from 3.0 to 6.5 percent; no information on the terms of the various issues could be obtained.

The following table lists long term debt issued by various governmental bodies in Arlington Heights and offers information on interest rates and terms of the obligations.

Table A-2 FINANCING OF MAJOR CAPITAL IMPROVEMENTS
Arlington Heights, Illinois
1960 - 1973

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
Municipal					
Construction of Village Hall	1961	General Obligation Bonds	3.75%	20 years	$350,000
Water and Sewer System Improvements and Extensions	1962	General Obligation Bonds	3.125 to 3.25%	20 years	$1,600,000
	1962	Revenue Bonds	2.0 to 4.0%	35 years	$1,900,000
	1968	Revenue Bonds	5.0 to 6.0%	30 years	$1,500,000
Fire Station Construction (Station #3)	1968	Installment Note	4.75 %	21 years	$190,000
(Station #4)	1970	Installment Note	6.0%	21 years	$285,000
Construction of Library	1966	General Obligation Bonds	4.0 to 5.0%	20 years	$1,425,000

Table A-2 FINANCING OF MAJOR CAPITAL IMPROVEMENTS
Arlington Heights, Illinois
1960 - 1973
(continued)

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
Library Book Purchase	1969	General Obligation Bonds	5.0%	10 years	$145,000
	1970	General Obligation Bonds	5.0%	10 years	$355,000
Park District					
Park Improvements	1962	General Obligation Bonds	3.0 to 3.4%	20 years	$395,000
Land Acquisition	1965	General Obligation Bonds	3.0 to 3.875%	15 years	$465,000
Park Improvements	1968	General Obligation Bonds	3.0 to 5.0%	20 years	$1,300,000
Park Improvements	1969	General Obligation Bonds	5.8 to 6.4%	20 years	$1,500,000
Construction of Tennis Club/Offices	1973	Revenue Bonds	6.8%	20 years	$800,000

Table A-2 FINANCING OF MAJOR CAPITAL IMPROVEMENTS
Arlington Heights, Illinois
1960 - 1973
(continued)

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
High School District #214					
High School Construction	1962	General Obligation Bonds	Variable	20 years	$4,900,000
High School Construction, Two Site Acquisitions	1964	General Obligation Bonds	Variable	20 years	$6,000,000
High School Construction, Site Acquisition	1966	General Obligation Bonds	Variable	20 years	$6,800,000
High School Construction	1969	General Obligation Bonds	Variable	16 years	$8,750,000
High School Construction	1971	General Obligation Bonds	Variable	12 years	$10,500,000

Table A-2 FINANCING OF MAJOR CAPITAL IMPROVEMENTS
Arlington Heights, Illinois
1960 - 1973
(continued)

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
Elementary School District #25					
Elementary and Junior High School Construction	1960	General Obligation Bonds	3.7 to 3.8 %	*	$400,000
	1961	General Obligation Bonds	4.0%	*	$800,000
	1962	General Obligation Bonds	3.2%	*	$600,000
	1963	General Obligation Bonds	3.0%	*	$550,000
	1964	General Obligation Bonds	3.2%	*	$667,000
	1965	General Obligation Bonds	3.3%	*	$800,000
	1966	General Obligation Bonds	3.5 to 4.4%	*	$1,652,000

* Information Not Available.

Table A-2 FINANCING OF MAJOR CAPITAL IMPROVEMENTS
Arlington Heights, Illinois
1960 - 1973
(continued)

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
Elementary School District #25 (continued)					
Elementary and Junior High School Construction (continued)	1967	General Obligation Bonds	4.1%	*	$894,000
	1968	General Obligation Bonds	5.6%	*	$590,000
	1969	General Obligation Bonds	4.95 to 6.50%	*	$3,039,000

Table A-3 SUMMARY OF PUBLIC FINANCIAL PRACTICES

Type of Improvement	Type of Financing	Terms of Obligation
Water and Sewer Improvements	Revenue Bonds	30 - 35 years
Fire Station	Installment Notes	21 years
Village Hall	General Obligation Bonds	20 years
Library Construction and Books	General Obligation Bonds	20 years for facility, 10 years for books
Parks and Open Space	General Obligation Bonds	15 - 20 years
Major Recreation Facilities	Revenue Bonds	20 years
School Construction	General Obligation Bonds	12 - 20 years

CASE B.

PARK FOREST SOUTH, ILLINOIS

I. INTRODUCTION AND BASE DATA

The Village of Park Forest South is located in Will County at the extreme southern part of the urban fringe of the Chicago metropolitan area, 30 miles south of down-town Chicago. At the time of its incorporation in 1967, Park Forest South included 500 acres of land, 250 homes and a population of 1,000. The only development which had occurred in the Village up to that time was a small subdivision called Wood Hill which was begun in the early 60's but was never completed. In 1963, Lewis and Nathan Manilow began purchasing extensive quantities of land in the area surrounding the Wood Hill subdivision. Mr. Manilow's plans originally called for a new community encompassing 8,000 acres and over 100,000 people. In 1970, Manilow's proposed development-Park Forest South New Town-was certified by HUD a new community under Title VII of the New Communities Act.

The 1974 population of Park Forest South is about 4,900 persons, with plans presently envisioning 50,000 - 75,000 residents. The majority of the resident population are professionals, half of whom work in Chicago and half of whom work in other suburban areas. The average family income is estimated to be $15,000 to $20,000 per year. The Village presently includes a large industrial park, an upper-division state university and a convenience shopping area. Multi-family dwelling units (mid-rise apartments, condominiums, and townhouses) outnumber single family homes (which include zero lot line styles).

The Village of Park Forest South is organized under a council-manager form of government. The responsibilities of Village Government include police protection, fire protection, recreation, building inspection, street maintenance, and planning and zoning. Utilities services are provided privately by the Park Forest South Utility Company which is controlled by New Community Enterprises, the developers' organization. In addition, a library district has been created. School services are provided by district #201-U of Will County, the Crete-Monee School District. This district provides both elementary and secondary schools.

II. INCIDENCE OF COST

A. Introduction

Because of the nature of Park Forest South as a planned new community and because of its anticipated rapid growth, many of the public facilities and services which are normally provided by local governments have in this case been provided by the developer, New Community Enterprises (composed of the Manilow Organization, and subsidiaries of U.S. Gypsum and Illinois Central Industries). Annexation agreements between the developer and the local government (which was in existence prior to the start of development) have led to the provision by the developer of equipment and buildings necessary for the performance of basic public services. A number of these items have been provided on an interim basis, with costs to be paid back to the developer by the local government once fiscal stability has been established. The specific contributions of the developer and other private organizations within Park Forest South to the costs associated with development are discussed below.

B. Developer Contributions To Capital Expenditures

1. General Government

Capital facilities presently existing in Park Forest South include a structure which houses a fire station as well as the general offices of the municipality. This building was constructed by the developer, New Community Enterprises, pursuant to an annexation agreement which stipulated that the Village must begin to purchase the building or pay rent to the developer in 1974. Tentative arrangements for payment have not been worked out as yet, however. Village officials feel that they lack the fiscal resources to begin paying for the building within the near future.

2. Police Protection

The Village of Park Forest South has its own Police Department, which is presently housed in an old frame structure being used by the Police

Department at no cost, courtesy of the developer. It is not anticipated that this will be a permanent police station. The developer also provided funds for purchase of one police car early in the development period. This car is now used for general municipal purposes.

3. Fire Services

As was mentioned previously, the Park Forest South Fire Department shares its facilities with the Village government. Presently it has only this one fire station; a site has been reserved for a second station. The Village has three pumper trucks and currently has a platform truck on order which is necessary to service the five-story apartment buildings now occupied and planned buildings which will be over that height. Two of the pumper trucks were purchased by the developer. The third is leased to Park Forest South by the neighboring Village of Park Forest at a cost of only $1 annually. It is undecided how the truck presently on order will be paid for. The Village also has an ambulance (provided by the developer) which is capable of use in emergency rescue work.

In the future, New Community Enterprises is unlikely to continue its past history of providing specific equipment and buildings for the Village government. It is anticipated that the policy of the developer will be to sell sites at cost for police and fire stations or other municipal buildings. They may also make available to the local government loans at market interest rates for use in constructing facilities or purchasing equipment.

4. Library

The Village of Park Forest South presently has a library which shares facilities with the local Interfaith Council in a building which is provided for them by the developer. It is not expected that this will be a permanent facility. Library volumes have been donated or have been purchased through fines, contributions and gifts. The Library opened in June of 1971.

5. Parks and Recreation

The developer has been responsible for all of the land and facilities presently in the Village for park and recreation purposes. In some cases these sites have been donated to the Village and in other cases they have been retained by private neighborhood associations; yet others have been retained by the developer. Facilities which have been donated to the village include a three-acre public park which has football fields, tennis courts, a baseball field and swings, and a seven and a half acre youth facility at Riegel Farm of which two acres is developed. This includes a miniature zoo for the use of young children as well as a youth center with pool tables, basketball courts and a dance hall. All other recreational services are presently provided privately.

There are two neighborhood lodges which charge private membership fees for residents. These lodges include swimming pools, game rooms, and meeting halls. In addition the developer has provided a private lake with fishing permitted and has an ice rink which is privately owned and operated by an outside concession. Also, the developer owns and operates a golf course.

The neighborhood associations and the developer also hold extensive open space areas which can be used for passive recreation. It is anticipated that 11 to 16 percent of the area in the fully developed town would be in open space.

The future policy of the developer with regard to open space and recreation, as was expressed by the planning director of New Community Enterprises, is likely to be that they encourage the provision of green way systems and tot lots by community associations. The financing mechanism would be that the developer would improve the land and then turn over the facilities to the community associations and be paid back at a later date. Special recreation complexes, if any, would probably have to be provided by outside concerns or by the developer. Plans for such things are still unclear. It is hoped that most of the remaining parcels designated as open space will be purchased by the Village from the developer with funds to be obtained through grants from the state or from the federal government.

6. Streets and Roads

Thus far all streets and roads in Park Forest South have been put in by the developer. The future policy of the developer is likely to be that he will cooperate and participate in major road improvements with the Village, the state, the county or other local bodies who would have jurisdiction over a given road improvement. The developer would take sole responsibility only for minor arterial roads and collector streets. Builders of homes within Park Forest South would be required to put in local access roads.

7. Utilities

a. Water and Sewer

Water and sewer services are provided by the private utility company owned by the developers of Park Forest South. All improvements for water supply, sewerage treatment and pipeline extensions have been paid for and provided by the developer. It is expected that this practice will continue; acquisition of the utility company by the Village is not anticipated.

b. Storm Sewerage

A storm sewer system, not part of the private utility system mentioned above, has been provided by the developer within Park Forest South in those areas needing storm sewerage. All costs thus far have been borne by the developer.

8. Schools

The one existing elementary school within Park Forest South was built and paid for by the developer. It is on the open classroom style; all elementary school pupils within Park Forest South presently attend school there. Prior to the opening of the school in 1971, the children were bused to school in the nearby Village of Crete. The school district is in the process of buying the school from the developer. The ten acre site was donated by NCE.

The junior high school currently under construction has been financed somewhat differently. The developer donated 3.5 acres out of the 20 acre site for recreation purposes. 16.5 acres were purchased by the school district at below market prices.

No high schools are currently found within Park Forest South. It is hoped that construction of a high school would be part of a multi-use public service center to house village government, a permanent library, and social services. Financing arrangements have yet to be worked out, however.

The future policy of the developer is likely to be that he will continue to donate 10 acre sites for elementary schools and to sell other sites for junior high schools and high schools to the school district at cost. It should also be mentioned that the developer donated 200 acres to the State of Illinois for the construction of the Governor State University.

C. *Operating and Maintenance Costs*

The developer has been responsible to a large extent for the subsidization of a number of Village operating functions. For example, with regard to public works maintenance, the developer has assisted the local government by providing a limited amount of maintenance equipment. Although the Village technically has responsibility for maintenance including snow plowing, salting, and repair of roads which have been donated to it, it presently lacks sufficient manpower and equipment to undertake these responsibilities; thus they are still being provided by the developer. It is expected that this will change within the next few years. Storm sewers are also currently being maintained by the developer because the Village does not have the equipment to clean out construction debris which periodically clogs the system.

The same can be said for the operation and maintenance of recreation facilities that have been dedicated to the village by the developer. Thus far the developer is still responsible for their maintenance because the village does not have sufficient maintenance staff.

In addition, the developer agreed to underwrite the salaries of the Village Manager and the Village Planner so that they can be secure in their positions subject to receipt of federal and state monies which are assisting the Village in payment of salaries. Prior to the hiring of the Village Planner, the developer paid the cost of consulting services for planning, engineering, and architectural design of facilities. Pursuant to annexation agreements in 1968, the developer reimbursed the Village on a short-term basis for inspection expenses prior to tax receipts; offered a ten dollar per dwelling unit flat fee to be used by the Village for its operations; paid $25,000 in advance for building permit fees; and donated $2,000 to set up a municipal budgeting and accounting system. Between 1970 and 1972, the NCE provided $3,000 per month for operating subsidies used in employment of police and firemen, and provided a subsidy of $625 a month for Village staff. The developer's planning director also stated, in an interview, that he feels NCE has contributed substantially in providing planning services for the school district, including enrollment projections and site location strategies.

The developer has also provided operating subsidies for the two private recreation clubs located within subdivisions because these clubs have operated at a deficit. Moreover, the developer subsidizes a bus company which currently provides transportation to the nearest commuter train station.

III. TIMING OF CAPITAL IMPROVEMENTS

A. Introduction

The analysis of annual capital costs for Park Forest South, includes both public and private costs; this is due to the fact that most improvements and services in the new community have thus far been provided by New Community Enterprises. The purpose of this analysis is to determine when and how effectively services and facilities were provided in the new community.

One unique characteristic of Park Forest South which must be considered in this analysis is that as a planned new community, it is expected to provide better than average facilities and services early in the development period. Often dissatisfaction with service levels is caused by these high expectations rather than lags in providing facilities; in other cases facilities or services cannot be provided as quickly as hoped because of fiscal and financial constraints. As will be discussed, police, fire, and library facilities in Park Forest South are better than those in many communities with comparable population sizes or in similar stages of development. Only in the case of schools has the provision of needed facilities lagged substantially behind demand.

B. Findings and Conclusions

1. Police

Park Forest South has had its own police force since it was incorporated in 1967. The force, composed of 3 full-time patrolmen, a sergeant, a chief, and six part-time special police, is located in an old farm house owned and presently provided free of charge by the developer. Although the Village's desired 1.2 policemen per 1,000 people has not as yet been attained, the new town has a higher level of service per capita than do other communities like Arlington Heights, in similar stages of population growth. Park Forest South, however, has the disadvantage that its force must protect a very large service area that is significantly more

expensive than those of most incorporated areas with similar populations. When compared to small incorporated areas protected by county police forces, Park Forest South has adequate police protection for its residents.

2. Fire

The Park Forest South fire station is located in a building which it shares with the Village government. This building was built by the developer during the early years of development and rented to the Village with an option that the Village later purchase it.

As in the case of police protection, fire protection must be provided to scattered areas within the Village including residential development on the eastern side, industrial development on the western edge, and several old farms throughout the Village. Although the Village presently has only one fire station to serve this large area, the station is well equipped with three pumper trucks and operated by a full-time fire chief and 35 to 40 volunteers. In addition, a ladder truck is now on order which will provide better protection for five and six story buildings in the area. The Village already has a very good ambulance service and emergency medical technicians, a service which many incorporated areas do not have until much later stages of growth.

3. Library

Park Forest South's public library is temporarily located in a small building that it shares with the Interfaith Council. Formerly the developer's sales office, this building was provided by the developer during the second year of development. The library district presently pays rent to occupy the building. Although the location is small and facilities are limited, Park Forest South has an advantage over most communities of comparable size which usually have no library facilities.

4. Recreation/Open Space

Only two small neighborhood parks are presently owned by the Village. These parks, a three-acre public park with playing fields, tennis courts, and swings and a seven and a half acre youth facility, were improved and donated to the Village by the developer during the early stages of the development.

The Villages of Park Forest South and Park Forest, Will County, and the Department of Conservation are also negotiating for Federal funds to purchase a large tract of land, Thorn Creek Woods, which can be used as passive recreational land by Park Forest South and other area residents.

Although publicly owned parks and open space are small and not centerally located, the Village does not now lack open space and recreation facilities. Two neighborhood lodges with swimming pools, game rooms, and meeting halls, and numerous tot lots and passive open space areas are controlled by neighborhood associations. In addition, the residential development is now surrounded by vast areas of open space. Village officials, however, express concern that not enough open space is controlled by the Village and that later in the development period (after significant residential, commercial and industrial development has occurred)there will be insufficient or inadequately located public open space.

5. Streets and Roads

The Village of Park Forest South incurred no costs of constructing or upgrading roads during the study period. All streets, both minor streets and arterials, necessitated by development in the area were, however, constructed or improved by the developer before development occurred. Only major repairs of old township roads lag behind development. Maintenance and upgrading of these roads, which are the responsibility of the Village, has been delayed for several reasons, not the least of which is lack of public funds. Other reasons

cited by village officials are the uncertainty of the developer's plans which continually change streets designated as major thoroughfares, and the constant deterioration of roads caused by traffic of heavy construction equipment. Until the developer's plans are confirmed and most construction activity is completed, village officials believe that improvement of township roads will usually provide only expensive temporary benefits and require costly changes later.

6. Utilities

a. Water and Sanitary Sewer

Both the water and sanitary sewer systems are privately owned and operated by a subsidiary of New Community Enterprises (NCE). The existing facilities are the result of several major enlargements and improvements of the small Wood Hill facilities that served the area prior to NCE's development. Changes in the Wood Hill facilities were made early during the development period in anticipation of population growth.

Major truck lines for each utility were also constructed during the first years. These pipelines now extend across large undeveloped areas. Although the early provision of utility truck lines was in part anticipation of growth, it was also required for the community's scattered development. Because the original Wood Hill facilities are located near the old subdivision and new residential development on one side of the Village(while industrial development is located near an interstate highway on the opposite edge), utility lines had to be installed across large, undeveloped areas connecting the two locations.

Unless a special water user such as the proposed hospital complex or another large water-using industry locate in Park Forest South, the existing water supply and sewerage treatment facilities should adequately serve developing residential areas for the next ten years. Seven shallow wells have been drilled, only five of which are in use, and no water shortages are envisioned. The tertiary sewerage treatment plant which is

one of the best in the State of Illinois, is also expected to adequately serve the area after some improvements are made. The developer feels that it is too expensive to build and operate treatment plant additions before more capacity is actually needed.

b. Storm Sewer

Storm sewers have generally been provided in anticipation of growth along with sewer and water lines. These facilities, constructed by the developer, were usually installed before residential areas were occupied. When omitted in places, it is because natural drainage areas are adequate to handle storm run-off.

7. Schools

School construction has lagged behind population increases in Park Forest South. The elementary school, which was built by the developer and purchased by School District 201U, was opened two years after the first residents arrived. Not until 1973 were a cafeteria and gymnasium added to the building. No other additions have been made; but already the school is nearly filled to capacity and another elementary school is planned. A junior high school is under construction, but junior and senior high school students are still bused to schools in Crete. Only inchoate plans have been made for a senior high school multi-use complex, although Crete's high school is overcrowded and operating on double shifts. A study prepared by the Education Facilities Laboratory entitled The Imperative of Planning Together: Educational Planning In New Communities documents a history of poor communication between the developer, the school district, and the Village in planning for school facilities, resulting in a substantial backlog in providing needed facilites.

IV. TIMING OF OPERATING AND MAINTENANCE SERVICES

Expenditures by the village for operation and maintenance of public services and facilities have been very low because of fiscal and financial constraints on the village government. In many instances the developer has had to not only provide facilities but also pay for operation and maintenance. Since the developer's role in operating services and facilities is discussed in the section on incidence of cost, this aspect of the operating cost analysis is discussed only briefly here.

Although the Village of Park Forest South has few sources of revenue and little bonding capacity, the village's public facilities are usually well maintained because of continuing support from New Community Enterprises. Everything from the government's administrative costs to road repairs has been underwritten by the developer. Salaries of village officials, policemen and firemen, for example, are guaranteed by the developer who loaned the governments funds for this purpose when Federal 701 Planning funds were temporarily delayed. Other expenditures by NCE have been actual subsidies.

As discussed in the annual capital cost analysis, the Village has been unable to make major repairs of old township roads. When minor repairs were required which the village could not afford, however, the developer paid for them.

The Village employs one full-time and one part-time maintenance man to maintain about 52 miles of streets, all storm sewers, several access of park land, the police and fire stations, and the municipal offices. This 1.5 man crew with little equipment can not adequately serve the village. Occasionally, outside firms must be hired for snow removal. All facilities are, however, well maintained with the help of the developer's maintenance crew, which performs many of the Village crew's duties along with its other responsibilities. Other aid comes from homeowner's associations that care for small neighborhood parks and open space areas.

In some instances the Village has not provided the levels of services that officials and residents would like. The Village's six part-time police, for example, have never been trained, and the only full-time fireman is the chief. The Village officials would like more funds to hire and train men for these services, but the growth in its tax base has, up until this time, been insufficient to meet the demand of residents for extensive high quality services.

Privately owned facilities such as the utilities and small-scale bus service are well maintained and operated by NCE's subsidiaries.

V. FINANCING OF MAJOR PUBLIC IMPROVEMENTS

At this stage in the development of Park Forest South, virtually all capital investment has been financed by the developer. As a Title VII New Community, the developers of Park Forest South were able to issue in 1971 $30 million of government - backed 20-year debentures yielding 7 percent interest annually. Proceeds from this issue have been used to finance land acquisition and site development.

No bonds have been issued thus far by the Village of Park Forest South. The Crete-Monee School District issued bonds in 1969 and again in 1972. Proceeds from the first issue were used to reimburse NCE for $800,000 spent in construction of Hickory School, as well as other improvements. The 1972 issue covered the construction of a junior high school within Park Forest South as well as facilities for other schools in the district and provision of a cafeteria and gymnasium at Hickory School. The terms of those issues are summarized below:

Type of Improvement	Year Approved	Type of Financing	Interest Rate	Term	Amount
School construction, site acquisition	1969	General Obligation Bonds	4.05+%	10 year	$2,250,000
School construction, additions	1972	General Obligation Bonds	4.40+%	8 year	$3,000,000

CASE C.

TOWN OF AMHERST, NEW YORK

REAL ESTATE RESEARCH CORPORATION

I. INTRODUCTION AND BASE DATA

The Town of Amherst, New York is a primarily residential suburb located northeast of Buffalo. Amherst has an elected Town Council, and a Town Supervisor is the chief administrative officer. It is now the most rapidly growing town in the Buffalo metropolitan area. Historically, Amherst has been a residential suburb, composed of single family homes on relatively large lots. Unlike the Town of Tonawanda (directly to the north of Buffalo), Amherst did not develop a significant industrial or commercial tax base.

The Town covers 54 square miles, and contains within it the Village of Williamsville, which is located in the southern portion of the Town and has been almost completely developed for many years. Other older sections of the Town, while not incorporated as distinct villages, maintain their own identities (Snyder, Eggertsville).

Until the present, most new development within Amherst consisted of small single-family subdivisions located along existing rural roads. New subdivisions have appeared in a "leapfrog" manner to the north of the older settled areas. Undeveloped areas remaining in the southern part of the Town are unbuildable for single-family houses due to shallow bedrock conditions. Much of the land to the north falls in 15 or 100 year flood plains, but the only major limitation on growth has been an inadequate sewer system, with plants operating in excess of design capacity, and a water system whose mains are inadequately sized. This does not seem to have constrained the pace of development and population growth, as indicated in the following table.

As of the last land use survey taken in 1972, only 50 percent of the acreage within the Town could be considered developed. Residential uses accounted for 42.5 percent of the developed acreage, with commercial and industrial uses using only 6.3 percent. While recreation and open space accounts for over 12 percent of the developed area, much of this is in golf courses, either private or publicly owned. Rights-of-way and utility properties are also significant consumers of developed land (24.3 percent).

At the time of this study, the Town of Amherst was facing the impact of a number of major developments now underway. These include:

1. Construction of a new campus of the State University of New York at Buffalo (SUNYAB), which is projected to ultimately serve 20,000 students. In addition to on-campus student housing, the private market will be faced with the demand for commercial facilities and off-campus housing to serve students, faculty, and staff. A number of classroom buildings are already in operation.

2. Development of the Audubon New Community by the New York State Urban Development Corporation. Almost 10,000 housing units are utimately envisioned, with the first 24 townhouse units completed in the summer of 1974. 1800 acres have already been acquired. Because of UDC's currently uncertain future, the status of Audubon is unclear.

3. Development of the Ransom Oaks Planned Development, encompassing about 1500 acres. Over 300 condominium and single-family homes were already occupied when we made our field visits with 300 townhouse and rental apartments scheduled for summer 1974.

These major development proposals, destined to significantly affect the character and pace of future growth within Amherst, created an impetus for more thorough planning and review by the Town. The Town Planning Board was established in 1949 and published its first master plan in 1955, with an update in 1961. The Comprehensive Department Plan of 1968, prepared in response to announcements of the SUNYAB development, outlined a number of problems faced by the Town in coping with rapid growth (which has actually outstripped the 1968 plan's projections). There was no ordinance limiting or controlling flood plain development. Both Audubon and Ransom Oaks are located in areas which have experienced flooding problems. The Town's zoning ordinance was last revised in 1969. Approval of a PUD ordinance was pending; however, a special "new community district" procedure has already been devised and used for the Audubon project.

A multiplicity of jurisdictions provides services to residents of the Town of Amherst. General government functions (planning, zoning, building inspection, legal services administration) are provided by the Town except within Williamsville, where they are Village functions. Police protection is also a Town function, while fire protection (using volunteer fire fighters) is offered by ten small districts. In the older parts of the Town (Eggertsville, Snyder, and Williamsville), fire districts are separate taxing bodies. In the growth areas, they receive Town funds.

The Recreation Commission of the Town of Amherst provides park and recreation facilities; it is a quasi-independent agency which thus far has been responsible for its own planning. Its last plan was prepared in 1961. Town libraries are part of the Erie County library system; a Town Library Board oversees library planning within the Town. Three school districts (Amherst, Williamsville, and Sweet Home) serve the Town. The locus of new residential growth is in the latter two districts and especially in the Williamsville District. All three districts provide both elementary and secondary schools.

The responsibility for roads and utilities is somewhat complicated by the multiplicity of jurisdictions involved. The Town, Erie County, and New York State all share some responsibility for road construction and maintenance, depending on the location of the road in question. Water is presently provided to the growth areas of the Town by the Erie County Water Authority (ECWA). The ECWA sells water to individually metered users at retail rates; it is responsible for maintenance and operation of facilities. Coordination is complicated by the fact that Amherst has 12 individual water districts, each of which has its own service contract with ECWA. Four of these operate in the northern growth area.

TABLE C-1

Community Growth Profile
Town of Amherst, New York
(excluding Village of Williamsville)

	POPULATION	DWELLING UNITS
1960	56,521	N.A.
1965	68,397	20,564
1966	72,558	21,634
1970	87,094	26,000
1972*	93,000	29,294
1974**	100,000	32,715
Change, 1965-1974	+31,603	+12,151
Percent	+46.2%	+59.1%

* Town of Amherst Estimate

** RERC Estimate

Sources: U. S. Census, Town of Amherst, and Real Estate Research Corporation

The Town provides sanitary sewer service; it operates two plants presently, one offering secondary treatment, the other primary treatment only. The Town is also responsible for storm drainage and flood control. Most of the Town is served by ditch systems; underground storm drainage exists in only a small portion of the Town.

Annual population counts are not available for Amherst for years other than 1965, 1966, 1970 and 1972. The greatest building boom in Amherst occurred during the late fifties, during which time population growth rates exceeded 10 percent per year. Average annual increase during the sixties was 5.4 percent, while growth in population in the seventies approximates 4 percent per year. However, the rate of increase in the number of dwelling units has been 5 to 6 percent annually since the mid-sixties reflecting construction of a higher proportion of apartment units with fewer occupants per unit. While these growth rates may not seem very high, they become meaningful within the context of overall growth in the Buffalo metropolitan area. Erie County's population grew on the average less than one percent per year since 1960.

II. INCIDENCE OF COST

A. Capital Costs

1. General Government

The government of the Town of Amherst shares a two-story facility (18,180 square feet) with the Village of Williamsville; the brick structure was built in 1966, and forms part of a complex of Town and Village facilities located along the Town's Main Street which also includes a library and police station. The costs for both land and structure were paid by the local governments.

2. Police Protection

The police department of the Town of Amherst services both the Town and the Village of Williamsville. The police department building was built in 1964, with the cost of both land and building provided by the Town. No branch or precinct stations are presently planned.

3. Fire Protection

As mentioned previously, the Town is serviced by 10 separate fire protection districts. Three of these are responsible for their own finances, and directly levy their own taxes to pay for capital expenditures; they are located in the older, built-up areas of Williamsville, Eggertsville, and Snyder. In the growth areas, funds for station construction and equipment have come from taxes levied by the Town, as well as special assessments and fund raising events. In some instances, land has been donated for construction of small substations in growth areas, but these contributions are strictly voluntary; there are no statutory requirements for contribution of sites for fire substations. A station already exists to service the Audubon site; a substation may be needed in Ransom Oaks for which the developer indicates he would donate a site.

4. Library

The Town of Amherst is part of the Erie County library system. Under this system, the Town provides the land, builds library structures, and maintains them. The County provides the books and the staff. The Town presently has three libraries. Part of the site of one of these libraries was donated; all other library sites were purchased by the Town. In the future, it is likely that the developers of Audubon and Ransom Oaks will donate sites should the Town Library Board and the County determine that there is a need to locate libraries within these two areas. The developer of Ransom Oaks mentioned that he

would also be willing to construct a library facility and lease it to the Town; however, the Town Library Board and the County have yet to decide whether to accept his offer.

5. Parks and Recreation

Sites used by the Town for public park and recreation purposes have been acquired in a variety of ways: Outright purchase by the Town, long and short-term leases, federal grants, and donations (both by developers and private benefactors). Although developers have been required to provide land for public open space, or pay fees-in-lieu of land, it is apparent that these requirements have been administered rather haphazardly in most conventional subdivisions. No formula exists to serve as a guideline for determining the amount of land to be dedicated or fee to be paid. Moreover, it is clear that a number of dedicated sites were unsuitable for recreation purposes, and could not be improved. One developer of a single-family subdivision of approximately 250 acres said he was required to donate 10 acres for recreation (4 percent of his site area). The town planning director estimated the current fee-in-lieu of land to be $25 per lot.

In most multi-family housing developments in Amherst, private recreation facilities (pool, tennis courts, green areas) are being provided by developers as a marketing vehicle. If such facilities are provided, the developer does not have to dedicate land or pay fees. The Town no longer accepts dedicated recreation sites under ten acres, because it feels that such sites are limited in utility and are difficult to maintain. Thus, tot lots and small neighborhood parks are retained by the homeowners' associations or owners of apartment complexes. Additional open space in Amherst is found in many golf courses located in the Town, two of which are owned and operated by the Town; the others are private.

Thus far, all recreation facilities and open space within Ransom Oaks are being retained by neighborhood and project-wide associations, except for the golf course, which is operated by the developer. UDC plans to dedicate a 40-acre site within Audubon very shortly. On-site improvements will be made by the Town. Dedication of an additional 100 acres is envisioned in the future. This is in addition to open space and recreation facilities which will be retained by the Resident's Association, such as tot lots, tennis courts, a community building, and a pathway system.

The proposed Planned Residential District ordinance, which would cover developments of 100 acres or more, requires that 25% of the total residential land area must be retained as open space, with 70 percent of this area in public, common, or private ownership open to the

public. 40 percent of the open space must be dedicated to the Town or other local jurisdictions. The same proportions of open space are required of UDC in its contract agreement with the Town.

6. Streets and Roads

The provision of on-site streets and roads including sidewalks and lighting is the responsibility of the developer, regardless of project scale. In the case of conventional subdivisions, widenings or extensions of major roads necessitated by growth are paid for by the Town, County, or State, depending on which governmental body has authority over a certain road. In some cases, developers have given land for construction of new arterials. The developers of Audubon and Ransom Oaks indicate that they will have to bear the cost of new on-site arterials, while widening of existing roads will be paid for publicly.

7. Utilities

a. Water

The policy of the Erie County Water Authority (ECWA) with regard to extension of improvement of water mains is that they should be provided by the Town's local water districts. In the past, the Water Authority sold revenue bonds to finance main extensions and improvements; they refuse to make further investment in water lines for Amherst, despite the fact that they collect all of the water system revenues. Thus far developers have put in on-site improvements (and paid tap-in fees), while the Town has occasionally installed small lines along arterial roads. UDC offered to pay for water main improvements in its area if ECWA were to reimburse it at a later date, but ECWA refused.

b. Sewer

Developers are responsible for on-site sewer construction, while the Town's sewer districts provide trunk lines. Where a proposed subdivision is located at a considerable distance from an existing branch sewer line, the developer must pay the cost of extending a branch line to his property.

The two existing sewage treatment plans were built on land purchased by the Town and constructed with Town funds. A federal grant for major expansion of one plant, and upgrading of treatment levels, is pending. Prior to the construction of the second treatment plant in the early sixties, developers put in their own package plants in growth areas where tap-ins were not available.

c. Storm Drainage

The Town's drainage districts are responsible for construction of major drainage facilities, while developers must pay for necessary on-site improvements. Retention ponds are increasingly being provided by the developers on a voluntary basis -- they are used for aesthetic or recreation purposes or as a supplementary water supply source during dry periods.

A special agreement between the Town and UDC stipulated that UDC will pay 40% of major off-site drainage facilities in addition to the on-site improvements typically required. Major drainage is defined as retention basins and ditch systems, many of which already exist but will need extensive improvement to service Audubon. The remaining 60% will be paid by a special drainage district covering 2/3 of the town. Its revenues will include tax dollars from properties in Audubon.

8. Schools

Thus far, there have been no developer contributions for school construction. By agreement with both the Sweet Home and Williamsville school districts, which service the Audubon site, UDC would donate any school sites necessary within its boundaries. These sites will be turned over to the school districts when they have floated bonds for construction; building must commence within eighteen months or title to the site would revert to UDC. Ransom Oaks will either donate school sites or sell land to the Williamsville District at cost. Moreover, the developer offered to construct one school and then lease it to the District. Final arrangements for school cost allocations have yet to be made.

B. Operating Costs

The only operating costs of a public nature which are borne by private parties are for on-site road and utility systems which are not dedicated, and for recreation and open space retained by developers or community and neighborhood associations. The developers of both Audubon and Ransom Oaks indicated that it will be necessary for them to subsidize these associations from the time they take title to facilities to the point of which their populations are large enough to be self-supporting.

III. TIMING OF CAPITAL IMPROVEMENTS

A. Police

The Amherst police department serves both the Town and the Village of Williamsville from one main station located in Williamsville. No substations have been required, and the town expects that in the near future patrols can adequately protect the growing community without use of substations. Plans for a government center, housing policy, library, fire alarm, and administrative facilities, call for replacement of the existing main police department with another large, centrally located station.

Amherst had a uniformed force of 119 in 1973. Although this was somewhat below standards set by the International Association of Chief's of Police for areas of Amherst's geographic size and population, officials and citizens of the town believe that service is adequate and the community is well protected.

B. Fire

Each fire company has recruited and trained volunteers, purchased equipment and materials, and constructed new substations in response to growth. Although insurance ratings in Amherst's fire districts presently vary from as high as AA to as low as CC, the difference between district ratings is based more on the adequacy of the water distribution system than the quality of equipment and volunteers within districts.

In recent years as rapid development (especially of multi-family housing) has occurred, districts have had more difficulty providing high quality service; for instance, the district serving the new SUNYAB campus has not obtained equipment to protect high rise buildings there. The University feels, however, that its buildings are fireproof and no hazards exist. Other town officials also seem well satisfied with protection offered by the volunteer departments even in rapidly growing areas.

C. Library

Three public libraries presently serve the Town of Amherst. These facilities are part of the Erie County library system, which determined their locations with the help of Town officials. The Snyder Library (built in 1962) and the Williamsville Library (built in 1968) are located in the densely populated southern sections of town where development first occurred. The Clearfield Library (built in 1968) is located in an area that grew in the eastern section of Amherst during the 1960's. Residents near

the town's western boundary have access to libraries in Tonawanda. Only residents in the newly developing northwest sections of Amherst do not presently have easy access to public libraries. A site for construction of a new library to serve this area has been purchased.

Library facilities appear to have been constructed as population increases in an area required, without significant lags between population growth and library expansion. In the past no additions have been needed for existing library buildings, although some enlargements are now planned. No bookmobiles have been used to serve growing areas in recent years.

D. Parks and Open Space

In 1973 the Town of Amherst had approximately 2,146 acres of public and private open space and recreation, (including school recreation areas). More than 50% of this land, however, was used for golf courses and was inaccessible to the general public. In that year, the Town controlled, through ownership or long-term lease, 667.5 acres of land, including two public golf courses which take up 67 percent of the acreage. More than two-thirds of this land was acquired before 1965 prior to the area's most rapid development.

Over the years, the Amherst Recreation Commission's policy has been to purchase and quickly improve a number of small sites, although the current feeling is that parcels under 10 acres are undesirable. As was mentioned previously, very little has been received from developers in terms of public dedications. A number of parcels dedicated to the park district in recent years have been very poor quality land and of little use even as passive open space. One parcel, for example, is in a very low, wet area; while another has been stripped of valuable top soil and most vegetation. Fees paid in lieu of land donation are not sufficient to purchase quality sites at current prices.

Most of the land owned by the Town has been developed for active recreation, such as tennis courts, playing fields, swimming pools, and golf. Moreover, in recent years developers, especially those constructing multi-family housing, have provided an increasing amount of land and facilities for active recreation to be used by residents of particular developments. Meanwhile, the purchase and development of areas for passive recreation have been neglected. The Town has only two areas of sufficient size to be considered community parks. There is less than one acre of publicly owned passive park area per 1,000 Amherst residents. The only improvement which occurred between 1965 and 1973 was due to the gift of a 40 acre site not associated with real estate development.

As multi-family dwelling units have begun to account for a larger portion of housing constructed in the area, the need for more open space has increased. At the same time, multi-family developments with privately owned recreation facilities have somewhat diminished the demand for public active recreation facilities. Presently, the park district plans to acquire more land for use as passive open space. The table presented below illustrates the history of recreation and open space land acquisition in Amherst.

TABLE C-2
Open Space Recreation Acreage - Town of Amherst

Year	Total Town-Controlled Open Space/ Recreation Acreage*	Total Acres Per 1,000 Population	Acreage Per 1,000 Excluding Golf Courses	Passive Open Space Acres Per 1,000
1965	445.2	6.5	1.7	0.6
1966	445.2	6.1	1.6	0.5
1970	573.2	6.6	1.4	0.5
1972	648.0	7.0	2.1	0.9
1974	667.5	6.7	2.2	0.8

* Excludes School recreation areas

E. Streets and Roads

While on-site streets have usually been provided by developers along with or in anticipation of housing development, major improvements or construction of roads installed by the Town, County, or State have often lagged behind development. No new roads have been constructed by the town in recent years. The County and State made road improvements only after congestion had already occurred. Where new arterials are needed, as in Ransom Oaks or Audubon, the developers have chosen to put some of these roads in themselves rather than wait for the public authorities to do it.

F. Utilities

1. Water

As residential development has occurred in northern sections of Amherst, the existing water distribution system has not been able to adequately supply new areas. Major new transmission lines are adequate only for rural densities. Instead of providing new main pipelines, the Erie County Water Authority has allowed developers to tap into inadequate existing lines. As a result, main transmission lines have become more and more overburdened as development has occurred in the north; and water pressure in expanding areas has become threateningly low.

The limited efforts of the Town of Amherst have not improved the situation. The Town, which receives no revenues from the water system, has installed some small pipelines along main roadways to serve new housing as it developed there. While these lines are not large enough to transmit water between large subdivisions, in many areas they are used for exactly this purpose since major pipelines are otherwise inaccessible.

In recent years the poor water distribution system has caused developers, including the Urban Development Corporation, great concern and has even contributed to delays in development of Audubon. Residents have been obliged to limit or curtail lawn sprinkling; and as water pressure has decreased the threat of inadequate water for fire protection has grown.

2. Sanitary Sewer

The Town of Amherst presently has two sewage treatment plants, (numbers 1 and 16) which frequently must treat more sewage per day than they are designed to handle. Sewer District 1, an old residential area now experiencing very little growth, is served by one plant constructed in 1925 and later expanded in 1949 as development occurred. This plant, which provides the Town's only secondary sewerage treatment, does not adequately meet the area's needs. Designed to handle 3.5 million gallons per day (mgd), it receives about 7.0 mgd during dry weather months. Effluent from the plant empties into Ellicott Creek and constitutes about two-thirds of the Creek's dry weather flow. When infiltration of storm water into the sanitary sewer system raises sewerage flows received by the plant above 8.0 mdg, all flows above this level are pumped directly into Ellicott Creek. In addition to problems with inadequate treatment

facilities, the district has old cracked pipes that are often too small and are infiltrated by storm water. In recent years the Town's only major sewer line replacements have been in this district where extensive realignment and improvement have been required.

Although the plant serving District 16 was not constructed until 1962, the facility was not designed to adequately serve the population now existing in the area and was built to provide only primary treatment. In 1967 the plant's 3.5 mgd capacity adequately treated the area's 2.0 mgd dry weather flow; however storm water infiltration into the system often increased flows to 10.0 mgd. By 1972 the plant was required to treat about 6.2 million gallons per day in dry weather and much larger amounts during wet weather. With chemical treatment, however, the plant can process 8.0 mgd without increasing the load on the receiving stream.

In 1966 the State of New York ordered the Town to abate the pollution of surface streams. In compliance with the order, the Town initiated a study of sanitary sewer facility needs in the area and now plans to expand the District 16 plant up to 16 to 24 mgd with possible future expansion to 48 mgd, if necessary. This expansion will begin with enlargement of the primary facility to 12 mgd and continue with the addition of secondary and tertiary treatment capacities. When the first expansion of the District 16 plant is complete, District #1's plant will be phased out; it will be used only as an overflow catchment and pumping station. A major interceptor sewer and a trunk sewer will also be constructed to serve the developing eastern section of Amherst. When completed this system is expected to serve all future growth in the Town.

3. Storm Sewers

Because a large portion of Amherst is located on a 15 or 100 year flood plain, a highly effective storm sewer system is required in the Town. Prior to rapid growth during the late 1960's, most development occurred in the Town's southern section where elevation is about 100 feet higher than in northern sections and flooding problems are less severe. Old residential areas of the southern section are all served by a storm drainage system, however, the system is often connected to the sanitary sewer system; which suffers from excess infiltration and is already operating above capacity.

As growth occurred in the northern section, developers were required to provide on-site storm drainage systems. The systems, however, often consisted of untiled ditches that often clogged with debris. Few retention ponds were provided during the first stages of rapid growth in Amherst, so most on-site drainage systems were connected to ditches alongside major roads. Since these publicly provided drainage systems were often equally inadequate for the area, overflows frequently occurred.

In recent years storm sewer pipelines have been required in new developments and some retention ponds have been provided by developers; however, many pipelines still drain into inadequate roadside ditches.

Audubon has attempted to design a drainage system that will control flooding in an area much larger than the new community itself. Although some housing in Audubon is already built in areas without severe flooding problems, the new system is expected to be completed before housing is built in other areas. Assistance from the Corps of Engineers is expected.

G. Schools

The Town of Amherst is served by three school districts, Amherst Central in the southwest, Sweet Home Central in the northwest, and Williamsville Central in the east. Since only the Sweet Home Central and Williamsville Central districts are located in developing areas, these districts alone will be discussed in this report.

1. Sweet Home Central School District

The Sweet Home District, one-third of which is in Tonawanda and two-thirds in Amherst, had to respond to rapid pupil increases during the late 1950's and early 1960's. During that time the district planned for expansion by purchasing all of its present school sites in Amherst. Of the six sites purchased, two are presently undeveloped; however the district's officials anticipate no future need for additional schools in Amherst.

Only two schools were built in the Sweet Home District between 1965 and 1973. Both were elementary schools, constructed in 1966 and 1971. During the study period, additions to two existing elementary schools, renovation of one elementary school, and two additions to the original senior high school also increased the district's pupil capacity.

Despite additions and new construction, the district was unable to keep up with population increases, especially in rapidly growing areas. Officials had to continually shift school boundaries to solve the problem of inadequately located schools, a problem which still causes difficulties. As in the rest of Amherst, extensive busing is now and traditionally has been used to evenly distribute pupils among the various schools. Because busing has been effective, overcrowding in particular schools has usually occurred for only a year or two; no double shifts have been needed; mobile units have been added to only one elementary school.

Although elementary schools were overcrowded during the 1960's, pupil loads in these schools have been decreasing in recent years. Presently, overcrowding is occurring in the high schools. Since these pupil loads are also expected to decrease in coming years, however, no new high schools are planned.

2. Williamsville Central School District

The Williamsville School District, located in the most rapidly growing sections of the Town, has had the greatest difficulty planning for or keeping up with population increases in recent years. No additions or renovations were required between 1965 and 1973, however six new schools (including three elementary schools, two intermediate schools and one high school) were constructed. Sites for three of these schools were purchased during the late 1950's, while others were purchased just prior to construction.

As in the Sweet Home District, the major problem has been the location of facilities as opposed to the district's overall pupil capacity. Schools have generally been constructed rapidly enough to handle increasing pupil loads; however, these facilities have not always been located in the areas of most rapid growth, and extensive busing has been required. The high schools were on split shifts at the time of this study.

The district now has four undeveloped school sites, all of which are located in the northern section of town. A third high school is under construction; this site includes sufficient space for elementary and middle schools should they be needed.

IV. TIMING OF OPERATING AND MAINTENANCE SERVICES

A. General Government

Data on the response of costs for general government to growth in Amherst is presented in the 1968 Comprehensive Development Plan. Financial data indicate that during the period 1961-65, costs for general government functions increased at about the same rate as population growth, but began to grow at a faster rate after 1966. Increasing professionalization, as exemplified by the hiring of a planning staff may be one reason for the cost rise. Considerable planning activity occurred subsequent to announcement of proposed SUNYAB construction in 1967; two plans have been prepared since that time, the zoning ordinance revised, and new planned development ordinances proposed in anticipation of major construction.

B. Police and Fire

Expenditures for police and fire protection in Amherst increased at roughly the same rate as population until 1965; after that date, costs for these functions increased more rapidly than population. Police expenditures increased at an average of 13 percent per year (adjusted for inflation) between 1968 and 1972, while the number of patrolmen grew 4-5 percent per year. The Department had 109 full-time police in 1972, 119 in 1973, and approximately 130 in 1974, an average of 9 percent growth annually during those years.

Fire districts continued to be staffed with volunteers; a large portion of their operating costs is for their central communications system. Town allocations for fire protection purposes (largely confined to districts serving growth areas) increased an average of 14 percent per year between 1968 and 1972. This occurred despite the fact that the districts have not professionalized their staffs.

C. Sanitary Sewerage

Operating and maintenance costs for sewer systems and sewage treatment increased at an average annual rate of 16 percent between 1968 and 1972, substantially in excess of the rate of population or dwelling unit growth. Much of this high level of expenditure increase can be attributable to:

(1) Overloaded treatment facilities, which are presently working at twice the design capacity during rainfalls.

(2) Disrepair of pipes in older areas of the Town, which has caused costly sewer collapses.

D. Schools

1. Sweet Home School District

Total budgets for the Sweet Home School District increased at an average of 15 percent per year between 1968 and 1973, but the rate of increase is now declining. Operating cost data available for 1966–71 indicate (in constant dollars) an average annual increase of 4.3 percent in the per pupil cost of education. Pupil population during the same time period (1968-1973) increased 4 percent per year on the average. This would indicate that per pupil costs are just about keeping pace with recent population growth, when the effect of inflation is eliminated. Historical data on pupil-teacher ratios were not available.

2. Williamsville School District

Costs per pupil in the Williamsville District increased an average of 3.3% per year, after adjusting for inflation, between 1967 and 1971. Data on enrollment increases were not obtained.

V. FINANCING OF MAJOR PUBLIC IMPROVEMENTS

The Town of Amherst uses general obligation bonds to finance its major capital improvements. Town bond issues typically cover a wide range of road, utility, recreation, and drainage improvements. The Sweet Home and Williamsville School Districts have used general obligation bonds to finance site purchases and facility construction or remodeling. No revenue bonds have been issued by the Town; however, the Erie County Water Authority issues revenue bonds to finance water system improvements throughout the County.

In addition, the Town often issues short-term obligations. "Bond anticipation notes" carry five-year maximum terms, and are used to pay for "front-end" costs for major improvement projects. "Capital notes" are issued for a maximum of two years; their proceeds are used for minor improvement projects and equipment purchases, when these costs are not paid out of the current monies. Interest rates are closely tied to current money markets.

TABLE C-3
Financing of Major Capital Improvements
Town of Amherst, New York

1964-1973

Type of Improvement	Date of Issue	Type of Financing	Interest Rate	Terms of Obligation	Amount
Town Capital Improvements	1964	General Obligation Bonds	3.25%		$2,895,000 Total
1. Golf Course				7 years	
2. Roads				7 years	
3. Storm Drainage				26 years	
4. Sanitary Sewerage				26-27 years	
5. Water Supply				30 years	
Town Capital Improvements	1967	General Obligation Bonds	3.75%		$4,048,000 Total
1. Sanitary Sewerage				27 years	
2. Roads				3-6 years	
3. Senior Citizen Bldg.				13 years	
4. Storage Bldg.				27 years	

Table C-3
(continued)

Financing of Major Capital Improvements
Town of Amherst, New York

5. Police Bldg.				26 years	
6. Golf Course Land				13 years	
7. Water Supply				27 years	
8. Storm Drainage				25-26 years	
9. Land Acquisition				27 years	
10. Park Improvements				16 years	
Town Capital Improvements	1970	General Obligation Bonds	6.50%	Variable	$4,175,000
1. Parking Lot				7 years	
2. Storm Drainage				12-13 years	
3. Master Plan				1 year	
4. Roads				6-11 years	
5. Sanitary Sewer				23-25 years	
6. Water Supply				25 years	
Town Capital Improvements (Truck purchase, roads, sewer, water, storm drainage, library)	1971	General Obligation Bonds	5.60%	25 years	$2,970,000
Town Capital Improvements (Recreation Center, roads, sewer, water, storm drainage)	1973	General Obligation Bonds	5.25%	24 years	$3,928,250
Williamsville School District					
School Construction (2 elementary, 1 middle school)	1965 (2 issues)	General Obligation Bonds	4.00-5.00% (estimate)	29-30 years	$5,474,000
School Construction (High School), Site Purchase	1967	General Obligation Bonds	4.00-5.00% (estimate)	28 years	$3,278,400

Table C-3
(continued)

Financing of Major Capital Improvements
Town of Amherst, New York

School Construction (high school, 1 middle, (2 1 elementary school) issues)	1969	General Obligation Bonds	4.00-5.00% (estimate)	27-29 years	$7,950,000
Athletic field renovations	1971	General Obligation Bonds	4.00-5.00% (estimate)	10 years	$ 670,000
Sweet Home School District					
School Construction (1 Elementary school addition to existing school), kitchen bldg.	1966	General Obligation Bonds	3.70%	28 years	$2,005,000
Addition to Sr. High School	1967	General Obligation Bonds	3.60%	19 years	$ 750,000
School Construction (1 new elementary school, renovation, addition to Senior High), bus service center, athletic field	1971	General Obligation Bonds	5.40%	25 years	$8,025,000

CASE D.

RESTON, VIRGINIA

REAL ESTATE RESEARCH CORPORATION

Case Studies: Reston, Virginia

I. INTRODUCTION AND BASE DATA

A. History of Development in Reston

Reston, Virginia is located in a rapidly growing sector of suburban Washington, D.C. In 1961 development of Reston began with the purchase of 6,750 acres in Fairfax County, Virginia by Simon Enterprises. Robert Simon's dream of a cohesive community with mixed land uses and extensive open spaces was approved by the Fairfax County Board of Supervisors in 1962, and working drawings of the first con-construction area (Lake Anne Village) were ready by 1963. From 1963 to 1967 development proceeded slowly with construction of shops, townhouses and apartments in the Lake Anne Village Center, some single family houses in Hunters Woods Village and two plants in the Reston Industrial Division. The John Hancock Mutual Life Insurance Company was convinced that the new town would be successful and in 1965 invested a considerable sum of money for permanent financing of development.

However, a larger financial commitment was needed. In 1967 the Gulf Oil Corporation formed a subsidiary, Gulf Reston, Inc., to take over planning, construction, financing and sales of the development. After control of the development passed to Gulf Reston, Inc., development proceeded within the framework of Simon's original master plan, only more rapidly than before.

Between 1967 and 1972 Reston grew as a viable new community. Industries and educational facilities located in the town, open space and recreational areas were developed and deeded to the residents, commercial activity increased rapidly, and housing sales and rentals soared.

In 1969 the Metropolitan Life Insurance Company further guaranteed the project's financial feasibility, when it signed a long-term mortgage agreement for existing income producing properties. Most rapid growth occurred during the early 1970s when a large number of people, including a number of low-income families, moved to the area. By 1973, the town's population was over 20,000 and residential housing starts were over 2,100 for the year. About 8,500 dwelling units had been built in the first decade of Reston's growth.

Table D-1. COMMUNITY GROWTH PROFILE
RESTON, VIRGINIA

Year	Population	Dwelling Units
1964	440	116
1965	492	131
1966	1,793	549
1967	2,472	703
1968	3,673	1,046
1969	5,205	1,523
1970	7,083	2,129
1971	10,200	3,218
1972	14,800	4,756
1973	20,700	6,801
1974	26,100	8,667
Increase 1964-74	+25,660	+8,551

Source: Gulf-Reston Corporation and U.S. Census.

B. Provision of Government Services

Virginia is a "Dylan Rule" state in which the only form of government below the state level is either the city or county. Cities and counties exist as independent entities and neither jurisdiction has power over the other. Under this system, counties (which are composed of towns as well as rural areas) may have five forms of government: county board, county, manager, county executives, or urban county. In each form, counties derive authority from the Commonwealth of Virginia, and have no powers that are not specifically delegated by the state. As an agent of the state, a county may collect taxes, pass and enforce laws, and provide services.

Services and facilities provided to all unincorporated areas within a county include public works, law enforcement, education, health care, libraries, passive and active open space, fire prevention, sanitary and storm sewers, solid waste disposal, and governmental administration.

Of the services and facilities considered in this report, only two are not provided by the general purpose county government. These are street and road maintenance which is the responsibility of the Virginia State Highway Department, and water service which is provided by the Fairfax County water authority.

Because Fairfax adopted the urban county form of government in 1966, no additional town or cities may be incorporated within it. This form of government was adopted in an effort to provide services equally to all parts of the county. Election districts with equal populations were established so that densely populated areas could obtain more urban services than less developed areas.

The urban county form of government has important implications for rapidly growing areas such as Reston and West Springfield (see Case E). These areas are part of a very large jurisdiction which must respond to the needs of older neighborhoods, urbanizing communities, and rural interests at the same time. Thus, neither Reston nor West Springfield is directly able to control how facilities and services are provided in response to growth. As will be seen later this does not mean that incentives (such as land dedication) provided by the developer cannot encourage the early scheduling of needed improvements.

II. INCIDENCE OF COST

A. Capital Costs

1. Police

The Fairfax County police department does not have a district station located in Reston. Like many small communities within the county, Reston is served by one of the five district stations and the main station in the City of Fairfax. The developer has not made any contributions of land, buildings or equipment toward police protection.

2. Fire

Reston is presently served by one fire station. This facility was built on one acre of land donated by the developer. Funds for the station's construction were loaned to the county government with an arrangement for repayment. No fire protection equipment was donated by the developer.

3. Library

Reston presently has two branch public libraries. One occupies approximately 1,200 square feet of space in the Lake Anne Village Center. The facility, which was constructed by Gulf-Reston, Inc., is rented by the Fairfax County government for $1 per year. The other library, located in Hunters Woods, was provided in a similar arrangement. It occupies about 5,000 square feet of building space rented from Gulf-Reston, Inc., at $4 per year. The level of rent in both libraries is below the prevailing market rate, so that Gulf-Reston in effect provides a subsidy for library services.

4. Open Space and Recreation

All land and facilities for parks and open space in Reston have been provided by the developer, Gulf-Reston, either directly or indirectly through builders obliged to honor covenants in land

purchase agreements with the developer. Both passive and active open space have been donated to the Reston Homeowners Association (RHOA) for community-wide use, and to townhouse cluster associations where appropriate for neighborhood use. Although no public parks or open space have been donated to Fairfax County, Reston has more than adequate land for these purposes; and much land controlled by RHOA or Gulf-Reston may be used by all county residents.

By 1972 approximately 12 percent of the 3,400 developed acres in Reston had been dedicated as passive and active open space. Improvements on this land included seven swimming pools, 18 tennis courts, a 166-acre public golf course, woodland pathways, seven ball fields and playgrounds, and a riding stable and pony barn. It should be noted that because there are no governmentally-owned open space or recreation facilities in Reston, those lands are assessed and taxed, contributing to Fairfax county revenues. As development has continued since 1972, additional open space and recreation facilities have been provided to maintain the community's high standards. When completed the development is designed to have 22 swimming pools, 70 tennis courts, two golf courses and over 937 acres of open space, as well as other recreational facilities.

Because open space was provided along with residential and other types of development, this land is conveniently located for all village residents.

A variety of community facilities were also provided by the developer and the Reston community organizations before 1972. These included a marina, a community center, a nature center, a music center. Lake Anne Hall, a day care center, a coffee house, five community activity rooms and a fleet of small boats for rent on Lake Anne.

5. Schools

Three elementary schools have been constructed in Reston on a total of 35 acres of land donated by the developer. The cost of the first elementary school constructed in Reston was paid by the

developer, who was then reimbursed by the county. Since the developer only charged its costs, the county saved on the purchase of the building the amount that typically would have gone for developer/builder profit.

Land donations or price discounts have also been made for intermediate and high school sites, but no definite construction plans have as yet been made. The intermediate school sites were donated by the developer, while the high school site was sold to the Fairfax County government at a below market price.

6. Streets and Roads

All new construction of streets and roads within Reston, regardless whether it has been minor, collector, or arterial has been built by the developer or builders. Within large tracts purchased from Gulf-Reston, the builder has provided streets. In all other areas, Gulf-Reston has paid for the construction of new transportation arteries. All such streets or roads are built, however to Virginia Department of Highway standards, and are carefully inspected before being accepted by the Department. Upon completion of construction, minor streets and parking areas within cluster residential areas are dedicated to a particular cluster association. All other streets and roads are dedicated to the state.

Improvements to pre-existing roads -- which traversed the Reston areas prior to development and which still remain -- are the responsibility of the Virginia Department of Highways. As will be noted below, there are problems in getting the State Department to expedite such improvements and the demand for highway facilities will outpace the capability of the state to complete them. The developer has considered assisting the state by providing financing and/or land dedications in order to speed projects that will enhance traffic flows over major roads in Reston. The response from the State to this proposal was yet to be indicated.

In a similar vein, Gulf-Reston paid the cost of an access ramp toward Dulles Airport, since such a facility would not have been provided otherwise. Although automobile access onto the same

highway toward Washington is not permitted, Gulf-Reston paid for an access ramp that is used by commuter buses. Another improvement that is under discussion for provision by the developer is a second bridge over the Dulles Access Highway, providing another link between northern and southern sectors of the community.

7. Utilities

a. Water and Sanitary Sewer

Water and sanitary sewer lines within Reston itself are provided by the developer. In 1972, 62 miles of sewers and 64 miles of water lines had been constructed in the area. In addition to this on-site construction, the developer financed the construction of five miles of main trunk sewers and water lines connecting Reston with existing trunk line sewers in Fairfax County. Fairfax County authorities will repay Gulf-Reston, Inc., for the cost of these trunk lines as development occurs along the lines.

b. Storm Drainage

As in the case of water and sanitary sewer lines, storm sewers are provided on the development site by Gulf-Reston, Inc., or by individual builders who purchase land there. The expense of constructing retention ponds or holding areas is borne by the developer, who has used such areas as recreational or visual amenities.

B. Operating and Maintenance Costs

The operating and maintenance costs for most facilities in Reston are borne by Fairfax County. Operating costs for schools, libraries, police and fire services are part of the county budget. There is a policeman that has been hired by the Reston Homeowners Association to specifically patrol the commercial area in Lake Anne Village Center. This is very similar to private patrols hired to serve commercial areas elsewhere in the U.S., and should not be viewed as a private contribution toward provision of government services.

Since all open space and recreation areas, other than those areas adjoining school sites are privately held, the county expends no funds for maintenance of parks and open space in Reston. Private open space areas are maintained by cluster associations or the Reston Homeowners Association if they have been dedicated to them by the developer. If dedication has not been completed, Gulf-Reston maintains such areas.

Similarily, once street and road construction is completed and dedication takes place, Gulf-Reston does not maintain the streets and roads. In the areas dedicated to cluster associations, maintenance is provided privately; all of the other streets and roads are the responsibility of the Virginia Department of Highways. At times, when the load of work of mowing or snow removal is too great for the Department of Highways, Gulf-Reston has acted to provide such maintenance.

Once sanitary sewer and water trunk lines have been completed and are in operation, the responsibility for the operation and maintenance of the sewer and water system shifts to the Fairfax County authorities. Maintenance of storm drainage facilities, pipelines within roadways become the responsibility of the Virginia Department of Highways. All lakes and retention areas remain the responsibility of Gulf-Reston until construction is completed, and then the responsibility shifts to the Reston Homeowners Association. In the case where the cluster association has difficulty in taking up its burden of operating and maintenance costs, Gulf-Reston has assisted temporarily by subsidizing the association with funds or services; such arrangements are short-lived, and most associations take up the full burden in time.

III. TIMING OF CAPITAL IMPROVEMENTS

A. Police

As stated in the previous section, police stations are now located or will be located at five places in the county, with the Reston area eventually slated to receive one of the sites; other governmental functions will be provided from a multi-use service center. The County attempts to provide a level of service to rural areas of two cars in the vicinity at all times. This is inadequate service to Reston, where the demands of increasing population would warrant additional service.

B. Fire

The fire station in the northern sector of Reston was completed in 1972. Previous to that time, service was provided from adjoining communities at a distance of three to four miles or more. At present, service to the northern part of Reston is adequate, but because of only one route to the southern sector, across the Dulles Access Highway, the response time is longer than would be desired.

The construction of the existing station was financed by the developer, who also donated the site. The combined incentive of the land donation and the construction loan allowed construction of a facility earlier than might have otherwise been.

C. Libraries

The initial facility in Reston was opened in rental commercial space in the Lake Anne Village Center in 1964; a second facility in rental space was opened in 1974 in the Hunters Woods Village Center. The space for the two facilities is not considerable, totaling only 6,200 square feet, but it does provide service close to Reston residents. Planning for construction of a larger facility to replace the Lake Anne library is underway, with a construction date not yet established.

The level of service from the two libraries was not determined, but it is known that demand is great since Lake Anne had the highest circulation to floor area ratio in Fairfax County. Considering however,

that the main branch of the library at Fairfax and a branch in Herndon are within 20 minutes driving time, adequate facilities seem to be available.

Reston seems to have done relatively well in terms of library services compared to other areas of the county, especially since library services were given lower priority than schools, police, fire and other services in the view of the county. Hence because of Reston's demand for library services and the subsidized space made available by the developer, Reston seemed to enjoy relatively better service and was able to gather perhaps a disproportionate amount of scarce library resources to itself.

D. Open Space and Recreation

The general impression of when recreation and open space areas are developed in Reston is that it varies with the type of area. Major reserves of open space, such as the nature center, that will remain largely undeveloped are presumably available to residents from the outset of occupancy. Access to such areas might be improved, but the status of the areas themselves will not change. Open space site improvements are either already complete -- such as golf courses -- or are completed as development takes place. Smaller areas of improved open space requiring facilities -- such as swimming pools or tennis courts -- are completed as the surrounding residential components are completed. The schedule for completion of development of recreation areas may be summarized as follows:

Table D-2. TIMING OF RECREATION IMPROVEMENTS RESTON, VIRGINIA

Type of Area or Use	Examples	Timing
Unimproved open space	Nature Center	Completed early, preserved during development period
	Open space between housing clusters	Completed and preserved on same schedule as clusters
Improved open space	Lakes and dams	Completed early
	Golf courses	Completed early
	Parks	On same schedule as housing clusters
Recreation facilities	Tennis, swimming	On same schedule as neighborhood areas
	Bikeways, hiking trails	Paced somewhat ahead of residential development.

Acreage donated to open space and recreation in Reston exceeded recommended national standards in 1974, and is expected to continue to do so as it approaches completion. Another significant aspect of this recreation development is the accessibility to open space and recreation. Through planning and design, all areas are readily accessible to most residents and all areas are linked by walkways or bike trails. Another dimension to Reston's open space recreation quality is the variety of recreational uses available.

The rapid pace of open space and recreation development can be attributed to the functions such areas serve as part of the marketing strategy of the planned community or large scale development.

Where the potential buyers in the market are attracted by the type and level of a community's recreation amenities it is often necessary to create such attractions early, so that they will enhance residential sales. At the same time, a large scale development corporation that controls a large tract and has planned the most appropriate areas for recreational uses can preserve recreation sites -- especially critical areas -- more easily than a smaller project or proliferation of numerous developers.

E. Schools

There are at present three elementary schools serving the Reston community. They were built without additions to their present size in the years 1966, 1969, and 1971. A fourth elementary school is scheduled for opening in the fall of 1974. A comparison of the increase in elementary pupils with the capacity of school structures, as follows, shows

1. a rapid increase in the number of pupils

2. a similar rapid increase in school capacity

3. and basically a rate of pupil increase greater than school capacity, although each new building substantially narrowed the gap.

Table D-3. SCHOOL FACILITY CAPACITIES RESTON, VIRGINIA

Year	Pupil Load (elementary)	School Capacity
1966	273	600
1967	563	600
1968*	724	600
1969	1,233	1,590
1970*	1,792	1,590
1971	2,404	2,580
1972*	2,646	2,580
1973*	2,946	2,580

* Indicates year in which enrollments exceeded capacity.

Although, another elementary school is scheduled for occupancy for the fall of 1974, it may be close to two-thirds full at that time to absorb the excess pupils in the three Reston schools, as well as 250 Reston pupils bused to schools not located in Reston. Although a valiant effort was made to keep up with the demands of the increased pupils loads, the rate of increase from Reston taxed the ability of Fairfax County School Board to provide elementary schools.

The intermediate and high school that serve Reston are located in the neighboring community of Herndon, Virginia. Herndon Intermediate School was constructed in 1972, with four subsequent additions to reach its present capacity of 1,200 pupils. In the last five years the school has been operating over its capacity every year. Herndon High School opened in 1967 and has been over capacity since 1970. Although it was estimated in 1972 that Reston pupils constituted roughly one-third of the pupils in the Herndon schools, it is impossible to determine whether the number of pupils bused from Reston was an increasing or a constant proportion of the total. It is likely that the rapid increase in the number of elementary pupils was paralleled by a rapid increase on the intermediate and secondary levels as well, and that Reston-generated pupils contributed to the shortage of secondary school capacity in recent years. There have been no double shifts in Reston schools or in Herndon. There has been a limited amount of busing over longer distances and between schools to relieve pressure for space in schools but again it was of temporary nature. Two sites are available in Reston for high school and intermediate school complexes, but construction depends on funds from future bond issues. Site preparation for one complex is scheduled for 1975 or 1976.

F. Streets and Roads

Because of the conflicting interests and responsibilities of the Virginia Department of Highways and Gulf-Reston, a somewhat disjointed pattern of streets and roads has emerged in Reston. As stated in the previous section, the Virginia Department of Highways is responsible for upgrading all existing roads, as well as maintaining all publically dedicated streets and roads, once construction is completed. The developer is responsible for construction of all new roads within Reston.

The Virginia Department of Highways tends to upgrade highways and roads only when the traffic volume across a particular stretch of highway or street becomes extremely congested, and therefore it reacts to the demands of development, rather than anticipates such demands. This practice seems to result from a variety of factors. With limited funds available for highway improvement, the areas of greatest need are assigned the highest priority in the allocation process. Funding for for improvements of a particular stretch of roadway is allocated over several years in partial increments; work proceeds only when 60 percent of the funding is available, and such allocations are based on each year's priorities. Because the allocation of funds on a statewide basis for secondary roads is according to a formula that does not directly reflect population or traffic demands but only roadway length, urban areas in the state tend to receive less funding on a proportional basis.

On the other hand, because of comprehensive planning in Reston, the developer has attempted to construct roads and streets in the appropriate size and location to accommodate traffic flows not just for the present, but for the community upon maturity. The pattern that emerges then is that streets provided by the developer are large enough -- up to four or more lanes with medians; pre-existing roads that connect to such streets are smaller -- largely two-lanes, and follow the curving, rolling path of the agricultural roads in non-urban areas.

Although the developer had constructed by 1972 over 43 miles of streets and roads in Reston (which were dedicated to the Virginia Department of Highways) the pattern of roadways consists of adequately sized minor, collector, and new arterial streets emptying into outmoded and over-utilized pre-existing arterial streets.

It should be noted that the county transportation plans calls for phased up-grading of major roads, but that the lack of funds allocated by the state have prevented these plans from being implemented. Gulf-Reston has provided dedicated right-of-way to the state as an incentive for road up-grading, and in some instances has offered to finance construction if it would expedite completion of street and road improvements; such financing would then be repaid to the developer over a period of time.

G. Utilities

1. Sanitary Sewers

There seems to have been adequate sanitary sewerage treatment capacity to accommodate the growth of Reston, so that until the present time the limitations on sewage treatment capacity or quality have not hampered development in Reston. In terms of the sewer networks required to serve the community, all minor and secondary sewers have been phased with residential development and with development village clusters, since site improvements must precede construction of housing. In terms of trunk sewers, because of the need for adequate sewer capacity for development, trunk sewers have been constructed ahead of or along with other aspects of development. Trunk sewers to serve Reston have apparently been built by the county, paid for by Reston, and then the developer is compensated by the hook-on or availability charge rendered against all subsequent users ot the trunk line.

2. Water

The same arrangements that operated for sanitary sewers were used for the provision of water services.

3. Storm Drainage

Because of the master plan developed prior to construction, retention ponds with recreational and aesthetic value, as well as usefulness for capturing storm water runoff, were constructed early in the development period. Similarly, other aspects of the storm drainage system were planned and put into place somewhat before other development activities commenced. Overall, the orientation toward storm drainage was dictated by the desire to retain in the community all excess run-off, so that the net downstream water volume was not increased.

IV. TIMING OF OPERATING AND MAINTENANCE SERVICES

From data presently available from Fairfax County, it is impossible to determine precisely how the County responded to growth-induced demand for ongoing public services. Expenditures for functions, such as police and fire protection, libraries, and schools are not broken out so that a pattern could be established for Reston's services alone. Because many Reston residents use schools and other public facilities located outside the community's boundaries, service level indicators (such as patrolmen per 1,000 population or pupil/teacher ratios) directly applicable to services received by Reston cannot be established.

After adjusting for inflation, per capita on per pupil expenditures for police, fire, libraries, and elementary schools in Fairfax County showed a real dollar increase of anywhere from 10 to 56 percent between 1969 and 1973. Police protection showed the largest jump, reflecting the increased needs of an expanding population in a rapidly urbanizing area. The fire department switched from volunteers to professional staff during this period. New schools were opened and expanded educational programs offered. However, an analysis of the County-wide expenditure pattern offers no clues as to how much of the County's increased operating outlay was attributable to the growth-induced demand for services in Reston and other developing areas of the county. Nor does it indicate to what extent upgraded service levels caused the rise in expenditures.

V. FINANCING OF MAJOR PUBLIC IMPROVEMENTS FAIRFAX COUNTY

Under the delegated authority of the Commonwealth of Virginia, Fairfax County has the right to issue bonds for the construction of public facilities. General obligation bonds have been used by the county to construct or improve facilities throughout the county. Improvement of water and sewer facilities, however, has usually been financed by utility fees. Only one sewer bond issue has been passed in recent years in an emergency effort to improve the overburdened sewer system. The Fairfax County Water Authority, an independent agency, issues its own revenue bonds and collects no ad valorem taxes from county residents. Data on Fairfax County bond issues from 1966 to 1973 are shown in the following table. However, we could not determine what proportion of the bond proceeds were used for improvements within Reston or its neighboring communities.

Table D-4. FINANCING OF MAJOR CAPITAL IMPROVEMENTS FAIRFAX COUNTY, VIRGINIA - 1966-1973

Type of Improvement	Date of Issue	Type of Financing	Amount
Schools - Construction, Renovation and Planning for Renovation	1968	General Obligation Bonds	$65,000,000
	1971	General Obligation Bonds	$22,500,000
	1973	General Obligation Bonds	$26,800,000
Parks and Open Space - Land Acquisition and Improvement	1971	General Obligation Bonds	$35,000,000
	1973	General Obligation Bonds	$28,000,000
Libraries - Construction, Expansion, and Site Acquisition	1966	General Obligation Bonds	$ 5,160,000
Public and Government Centers	1966	General Obligation Bonds	$ 500,000
	1973	General Obligation Bonds	$ 4,700,000
Fire and Rescue Services	1971	General Obligation Bonds	$ 7,659,000
Storm Drainage	1971	General Obligation Bonds	$11,000,000
Wastewater Treatment and Sewers	1970	General Obligation Bonds	$30,000,000

CASE E.

WEST SPRINGFIELD, VIRGINIA

REAL ESTATE RESEARCH CORPORATION

I. INTRODUCTION AND BASE DATA

West Springfield is primarily a residential suburb located in the southeastern portion of Fairfax County. Only 13 miles from Washington, D. C. it has developed as a conventional "bedroom" community with a large professional population.

Edward R. Carr, is credited with the beginning of development in West Springfield. Initially investing in land in unincorporated Springfield in 1947, Carr foresaw the advantages of also buying 2,100 acres in the area now know as West Springfield. Waiting for water and sewer services to be assured as well as for the main commuter road (I-95) to be constructed closer to his land, Carr then considered developing his land. In 1959 he built three to four thousand homes around a country club in West Springfield. This spurred other developers so that within the ten-year span of 1964 to 1973, the population increased over five times. Seventy-three percent of all the housing presently in West Springfield has been built since 1965. Most housing units are in subdivisions of single family homes built on quarter-acre lots. More recent subdivisions have followed an alternative pattern of smaller lots allowing for common open space. There are a number of planned unit developments in the area, in addition to the more traditional sub-division/tract development.

Commercial and industrial development in West Springfield is minimal. There are a few commercial establishments located on bordering highways and residents have access to a sizeable shopping center in Springfield.

The base data on the following page shows that the present population of West Springfield is 22,300 persons. The community occupies about 5,960 acres of which half still remains vacant and 40 percent residential. The 1970 census indicates that over seventy-five percent of the working population are professionals with over one-half of all workers classified as government workers. The median family income is $17,646.

West Springfield, along with Reston, also relies on Fairfax County to provide its essential public services. As mentioned in the introduction of the report concerning Reston, as an urban county, Fairfax County must provide libraries, parks and recreation, fire prevention, police protection, education, sanitary and storm sewerage and general governmental services. County facilities in West Springfield include several stream valley parks, one neighborhood park and three elementary schools.

Table E-1 COMMUNITY GROWTH PROFILE

West Springfield, Virginia

Year	Population	Dwelling Units
1964	3,375	837
1965	4,021	1,007
1966	4,191	1,130
1967	4,784	1,290
1968	6,399	1,751
1969	9,763	2,742
1970	11,153	3,139
1973	22,300	6,179
Net Change 1964-1973	+18,925	+5,342

Source: Real Estate Research Corporation. Compiled from census subtract data.

II. INCIDENCE OF COST

A. Capital Costs

Developers opearting in West Springfield have dedicated no land other than for open space/recreation, schools, streets, and utility networks. Land and building for libraries, police stations and other facilities were purchased by Fairfax County.

1. Parks and Open Space

Developers have been required to dedicate land for parks or open space in West Springfield. Because there is no formula in the subdivision ordinance for determining the quantity of land to be dedicated, the amount of land donated depended on the county's bargaining position when granting subdivision approval. Even when large quantities of land were donated, however, they were usually of inferior quality and could be used only for limited purposes, such as passive open space. Most land dedicated in West Springfield is located along stream beds that may flood periodically; this land is not usually improved by the developer. Other smaller park sites have been purchases by the county, which provided improvements. Private recreation facilities (such as golf courses or swimming clubs) add to the recreational opportunities.

2. Schools

Some elementary school sites have been donated by developers in West Springfield. The county school system has purchased sites for all intermediate and high schools, and paid for construction of all schools in the area including elementary schools. Since no cash payments were accepted by the county in lieu of land dedications, elementary school sites were only donated by large developments with sufficient land available for dedication.

3. Streets and Roads

The subdivision ordinances of Fairfax County require that developers install all on-site streets and related improvements, such as

sidewalks, curbs and gutters. These facilities must meet the rather high standards of the Virginia Department of Highways, so that less maintenance is necessary over time. This shifts some of the burden of costs of maintaining streets from the motorists that use the streets eventually to the homeowners that pay for the added cost of high wuality construction through their initial lot cost.

In addition to constructing minor and other on-site streets, developers are occasionally required to contribute toward improvements of other streets and roads adjacent to or traversing their projects. If eventual widening is planned by the Department of Highways, the developer is usually required to dedicate the land and sometimes must bear the cost of the improvements required along that stretch of road or street. If there are no existing connector streets from the subdivision to the existing arterial, the cost of the connector is borne by the developer; such roads are constructed to Department of Highways standards and sized for capacities of expected, not current, traffic volumes. In one instance, in order to obtain zoning changes and project approval a developer was obliged to contribute land for realignment of a major roadway, and to pay for construction of the road, including a needed bridge.

4. Utilities

In West Springfield, as in the rest of Fairfax County, developers are required to provide all on-site water, sanitary sewer, and storm sewer lines, and occasionally to contribute money for construction of off-site utilities necessitated in part by the development. Off-site dedications and requirements for construction of facilities vary from case to case. In some instances, developers must bear the entire cost of trunk extensions from existing facilities to the subdivision; this is particularly true in the case of sanitary sewers. In other instances, the cost of trunk line extensions are split between public authorities and the developers; this is more the case with water services. The difference among cases seems to lie in the availability of services and the difficulties of extending such services to subdivisions. The developer must pay an availability charge and a connection charge; the former is a pro-rata share of the total cost of treatment facilities and major trunk lines; the latter is a pro-rata share of the cost of connector sewers or water lines. If services are not available, it is not uncommon for the

developer to pay at least a portion if not all of the costs of constructing sewer and water lines to his development.

According to current Fairfax County policies, all sanitary and storm sewers must be adequately sized to handle volumes not only from the development site, but also from all development that has occurred or is expected to occur at a higher level in the watershed. In many cases, the developer is required to install utilities with greater capacity than the subdivision itself warrants, so that the county will not have to replace sewer lines when later development occurs. Developers of subdivisions that later utilize the excess capacity of utility lines must pay fees to the County that are used to reimburse the original developers. Since West Springfield is located mid-way in a watershed, the practice of sizing utilities adequately to accommodate not only flows resulting from West Springfield itself, but also flows upstream from West Springfield, is observed.

Septic tanks are permitted only on large lots: on 20,000 square foot lots when public water is available, and on 40,000 square foot lots when public water is not available. In the future the county plans to require installation of "dry" sanitary sewer lines along with septic tanks which can later be hooked into public services when available.

The off-site provision of storm drainage facilities also varies on a case-by-case basis. Fairfax County is currently preparing a comprehensive storm drainage and watershed plan. When completed, the policy of sizing to accommodate both expected future developers. At present, however, off-site improvements of storm drainage facilities are largely undertaken by the county. The situation in West Springfield is further complicated by the fact that major portions of the community fall in an area in which federal funds are being used to assist in construction of a number of dams for flood control. The costs of these projects are borne by the county and the federal government.

B. Operating and Maintenance Costs

In terms of the ongoing costs of operation and maintenance of public facilities, developers provide little in West Springfield; their contri-

butions are limited to maintenance of facilities until dedicated, either to governmental units or to private homeowners associations.

1. Streets and Roads

The State of Virginia is responsible for maintaining all public streets and roadways within unincorporated areas in the state, including West Springfield. As stated previously, because the State requires high standards for road and street construction, the maintenance costs over time are somewhat lessened. When streets and roads are not dedicated to the county, maintenance is the responsibility of the developer or homeowners associations. In recent years the number of privately owned and maintained streets has increased, but has yet to represent a large portion of all roadway in West Springfield.

2. Utilities

Fairfax County is responsible for maintaining water, sanitary sewer, and storm sewer systems to which it has received title from developers. Few utility systems are owned and maintained by developers or homeowners associations. The costs of operating and maintaining water and sanitary sewer systsms are borne by public authorities through direct service charges to consumers rather than taxes.

C. Summary

It is clear that the contributions of developers in West Springfield toward the costs of providing public facilities and services are far smaller than those of Gulf-Reston (see Case Study D) operating in the same county. This is especially true for capital costs, where Gulf-Reston donated land or sold it at cost for many types of facilities, offered extensive recreational amenities, provided library space at reduced rents, and constructed the first school for later sale to the county at cost. By contrast, a small subdivision in West Springfield might merely provide land for open space; a PUD in West Springfield would be required to provide an elementary school site as well. It should be noted that most contributions made by Gulf-Reston were voluntary - that is, they were not a condition of approval for a rezoning or building permit. Rather, these contributions acted as incentives for the early government provision of facilities and services that would assist Reston in marketing land and residential units. As will be seen in the next section, West Springfield still lacks many of the government facilities and recreational amenities enjoyed by Reston, al-

though crowded schools is a problem common to both communities. On the other hand, the provision of roads and utilities seems to follow the same rules in both Reston and West Springfield.

III. TIMING OF CAPITAL IMPROVEMENTS

A. Police

There is at present no police station located in the West Springfield area, and police patrols operate from the Annandale sub-station, located at a distance of five miles. It is envisioned that a governmental sub-station, which will include a police branch, will be located in the West Springfield area, but final plans have not been completed. Although future plans call for service to this rapidly growing area, there is inadequate local service at present.

B. Fire

Fire services to the West Springfield area are presently provided from the volunteer companies located in the nearby communities of Burke and Springfield. The entire area falls short of being within a five-minute response time from those two companies, and the commercial development in the center part of the community is over three miles from either company; thus the service level in the area is inadequate. A station to serve the area is slated for construction in 1975, with completion by summer of that year.

C. Libraries

West Springfield residents utilize the facilities of the neighboring branch libraries in Burke and Springfield; there is currently no branch library in the West Springfield community itself, nor is there one scheduled for construction in the countywide five year development program. Since the county standards for library planning do not recommend the establishment of a branch library until a base population of 50,000 persons has been reached, it will not be necessary to establish a library in West Springfield for some period of time.

D. Open Space and Recreation

There is considerable amount of land devoted to open space in West Springfield, but the types of uses or facilities afforded are not necessarily those desired by residents of an increasingly urbanizing area. In terms of

public open space, most of the land is located along the two streams that traverse the area and consists of undeveloped flood plains that are unsuitable for active recreation. There are several community parks and one neighborhood park. Some private facilities (in golf courses, private clubs, or PUDs) supplement publicly provided space. Overall, adequate amount of land exists in passive open space, but there is perhaps a shortage of active recreation facilities. The capital improvements plan for the county calls for improvements to the land (especially in stream valleys) in future years, as well as acquisition of additional land.

It was not possible to determine when existing improvements to recreation areas were undertaken, but the impression exists that such expenditures tended to accompany or lag behind demand. Acqusition of lands accompanied development, by and large, since they were often dedicated by developers. There were definite incentives for early completion of such dedications, since the transfer of ownership of park areas to a public authority relieved the developer of the obligation to pay taxes on those areas. Improvement by the county, if undertaken at all, tended to follow after a considerable gap in time.

E. Schools

There were six elementary schools serving West Springfield at the time of our field visits, with a seventh scheduled for operation in the fall of 1974. There were three schools in operation in 1964 and three new schools built in 1966, 1967, and 1968. Additions were built for two of the three new schools in 1970, and for one of the three older facilities in 1968. A comparison of the increase in the number of elementary pupils with the expansion of school capacity is presented below:

Table E-2. SCHOOL FACILITY CAPACITIES
WEST SPRINGFIELD, VIRGINIA

Year	Pupil Load (elementary)	School Capacity
1964	972	1,530
1965	1,196	1,530
1966	1,692	2,130
1967	2,345	2,460
1968	3,218	3,180
1969	3,573	3,510
1970	3,638	4,110
1971	3,930	4,110
1972	3,923	4,110
1973	4,064	4,110

These data show that overall school capacity was adequate for West Springfield elementary schools in every year except 1968 and 1969. The increase in numbers of pupils tapered off or declined during later years and the pace of school construction allowed school facilities to catch up with demands for space.

What is more striking, however, is how pupils were distributed across West Springfield. In areas of higher growth, there were short-term situations in which schools were operated over capacity. Even with a declining rate of increase in pupils loads, three of the six schools were operating at greater than rated capacity in 1973. Although there may have been overall capacity to accommodate the pupil load in the elementary schools, temporary shortages in more rapidly developing areas did exist.

The intermediate and high school that presently serve West Springfield pupils are located in the community. The intermediate school was completed in 1960, with an addition in 1966. The high school was completed in 1967. It is difficult to analyze the intermediate and secondary schools' response to growth in the community, because in earlier years a number of pupils from outside the area also attended schools in West Springfield; in recent years school pupil loads have been predominantly from the West Springfield area. The high school has been consistently over crowded since 1968, but the intermediate school was under capacity in three out of four years prior to 1973. No new schools are slated for the area in the current five-year capital improvements program.

F. Streets and Roads

The pattern of street and road construction in West Springfield reflects the policies and priorities of the Virginia Department of Highways, in many instances, and also reflects the presence or absence of development. That is, where a developer seeks to improve a large plot of land adjacent to a road, the roads will often require upgrading. Thus, stretches of improved street or roadway will run alongside areas under development. However, roads serving the adjacent property, which may not be under development, will not be improved. What results then in many areas of West Springfield are many bulges of improved roads separated by stretches of narrow two-lane road.

There are areas in West Springfield where major road upgrading is underway, but in terms of traffic volume, such improvements are seemingly long overdue. Such construction is financed and undertaken by the State Highway Department. Although other stretches of road are slated for improvement and have been part of the transportation plans for a period of time, no action by the state department is apparent.

New construction of roads and streets within subdivisions is up to standards and seems to have been completed in timely fashion, roughly in pace with residential development. Since this construction is undertaken by developers and is necessary for project completion, it seems to have been expeditiously undertaken.

G. Utilities

1. Sanitary Sewers

In contrast to many areas in Fairfax County at present, there seems to have been adequate sewage treatment plant capacity to deal with growth and development in West Springfield. In earlier years, all sewage was pumped into the adjoining watershed in Springfield, but facilities were later built in the Pohick watershed to serve the western parts of the West Springfield area.

In terms of sanitary sewer networks or pipelines, major trunk systems were constructed along the watershed, and seem to have been completed in a timely fashion, so that no development delay occurred nor were inadequate capacities experienced while such facilities were constructed.

All minor and lateral sewers have been phased with residential construction, and seem to have been adequate over time to provide needed service.

2. Water

Water, which is obtained from the Fairfax County Water Authority, has been available in adequate quantities, and the pipelines required to serve the West Springfield community have been installed in timely fashion.

3. Storm Drainage

The experience of development of storm drainage facilities has been mixed. Because large areas have been retained for open space in stream valleys, the natural contours of the land have been utilized as part of the storm drainage system. Where facilities have been constructed as part of subdivisions, adequate sizing and timing in pace with residential development has largely been the rule. It is not clear, however, what the record has been for connecting such facilities from subdivisions into a larger and more areawide storm sewer system. We stated previously that developers may be responsible for construction of facilities adjacent to or connecting with their projects, but that this responsibility was determined on a case by case basis. In practice, the county must undertake most such projects, and since the county has been consistently behind schedule and overwhelmed with needed improvements to the areawide storm drainage system, it may be concluded that off-site storm drainage facilities have been largely inadequate. Increased demands on the storm drainage system resulting from new development are difficult to handle. In light of current county policies, comprehensive planning efforts, use of Federal funds for planning and flood control projects, and increased regulation and exaction from developers, it seems that the countywide system will improve.

H. Summary

As mentioned previously, the provision of facilities and services in West Springfield lagged behind that of Reston. West Springfield still lacks adequate storm drainage, active recreation facilities, a library, and a fire station, all of which are now available within Reston itself. This is not to say that West Springfield receives fewer benefits from the county, but in some cases residents must go beyond the boundaries of the community to use public facilities. Response times of emergency services may be slower. In the case of schools and needed road improvements, neither community has enjoyed an adequate response to pressing growth-induced needs.

IV. TIMING OF OPERATING AND MAINTENANCE SERVICES

As mentioned previously for Reston (see Case Study D), it is impossible to infer a pattern of service delivery to one section of a large county such as Fairfax from county-wide expenditure data or personnel ratios. As was the case in Reston, West Springfield residents must go outside the community for some services; in other instances, neighboring subdivisions rely on facilities (and staff) located in West Springfield.

While the rate of population growth in West Springfield between 1969 and 1973 exceeded the rate of increase in expenditures for police and fire protection, this does not mean that West Springfield was inadequately served. The higher demands of growing sectors of the county were somewhat offset by stable populations elsewhere. Also, some economies of scale may have been achieved by serving a larger total county population.

However, the absence of police and fire stations in West Springfield results in a lower level of service than would be desirable. The need for improved service is recognized by the county's plans to construct and staff such facilities. While no information on pupil/teacher ratios was available for West Springfield schools, facilities that operate in excess of design capacity will also show larger class sizes or double shifts. Usually these situations are corrected, either by new school construction or a leveling off in enrollment increases.

V. FINANCING OF MAJOR PUBLIC IMPROVEMENTS

Like Reston, West Springfield is a part of Fairfax County. As an urban county, Fairfax issues general obligation bonds to cover the cost of schools, sewers, and park improvements in West Springfield, although no county bond issues can be attributed specifically to the needs of West Springfield alone. The same can be said for the Water Authority's revenue bonds. For more information on the bonding practices of Fairfax County, see Section V of the report on Reston, Virginia (Case Study D).

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