

# *The Costs of Sprawl*

## **Executive Summary**

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This executive summary is based upon a report,  
*The Costs of Sprawl: Detailed Cost Analysis*

prepared by

Real Estate Research Corporation

for

the Council on Environmental Quality;  
the Office of Policy Development and Research,  
Department of Housing and Urban Development;  
the Office of Planning and Management,  
Environmental Protection Agency

The data, analyses, and opinions presented do not necessarily reflect  
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Local officials are being faced with increasingly difficult decisions about how land should be used and how much and what type of development should be allowed. They are being presented proposals for new types of development that they may not have dealt with before; clustered single family housing, townhouses, walkup apartments, and high rise apartments are appearing in communities even out to the urban fringe.

At the same time, there is increased concern about the impacts of new development on the community. This has been limited mostly to economic impacts of the development—whether the added tax base would compensate for the added costs that the new residents imposed on the community.

In recent years these economic concerns have been joined by environmental and other concerns. What will the development do to air pollution, water pollution, wildlife, and open space? What is the impact of development upon energy consumption? On water consumption? How will the development affect the lives of the people who live in it? Of those who live near it?

The purpose of *The Costs of Sprawl* is to help the mayor, the city manager, the planning board, and other concerned local officials and citizens answer such questions. There has been no recent effort to assess all the economic costs associated with different types of development; nor until now has there been a document that attempted to integrate the various economic, environmental, natural resource, and social costs of these developments.

*The Costs of Sprawl* seeks to help fill this information void that has made local decisionmaking so

difficult. The study attempts to summarize what is known about the different costs as they apply to different neighborhood types and to different community development patterns, and it indicates whether the costs are incurred publicly or privately. Table I lists the types of costs that have been included. These are not all the costs associated with residential development, but they are among the most important ones. *The Costs of Sprawl* should give the local decisionmaker a strong start in dealing with many of the very difficult decisions that he has to face.

## STUDY METHOD

This study is an analysis of prototype development patterns, not of actual developments, although many of the data were obtained from empirical studies undertaken by others. Here the approach was to assume typical site conditions and an absence of any existing infrastructure (roads, sewers, etc.) at the site and then, using standard unit cost figures, to estimate the costs of building alternative types of development.

The various costs were first estimated for different *neighborhood types*, each neighborhood being composed of 1,000 dwelling units of one of the following housing types:

- single family homes, conventionally located
- single family homes, clustered townhouses
- walkup apartments (two stories)
- high rise apartments (six stories)

Because many environmental and some economic

TABLE I  
TYPES OF COSTS ANALYZED

Economic Costs (capital and operating)	Environmental Effects
Residential (capital only)	Air Pollution
Open Space/Recreation	Water Pollution, Erosion
Schools	Noise
Streets and Roads	Vegetation and Wildlife
Utilities (sewer, water storm drainage, gas, electric, telephone)	Visual Effects
Public Facilities and Services	Water and Energy Consumption
police, fire, solid waste collection	Personal Effects
library, health care, churches, general government	Use of Discretionary Time
Land	Psychic Costs
	Travel Time
	Traffic Accidents
	Crime

costs cannot be clearly identified on such a small scale, neighborhoods were aggregated into different *communities*, each of which contained 10,000 dwelling units (corresponding to a population of 33,000). Six community types were analyzed, each containing a mixture of the various neighborhood housing types but differing in the amount of community “planning” (used here to mean a general compactness of development) and in the average development density.

Whereas different neighborhood types were assumed to require different amounts of land for the 1,000 dwelling units, all six communities were assumed to contain the same amount of land—6,000 acres, with a mix of neighborhood types. The neighborhoods also differed slightly in population, depending upon the housing type, whereas the communities all were assumed to contain the same population.<sup>1</sup> The specific land use, housing, and population characteristics of the different *neighborhood types* and *community development patterns* are summarized in Table II.

The results of the study depend strongly upon some of the assumptions underlying these basic cost analyses. Therefore, for critical parameters such as population, acreage developed, etc., additional analyses were carried out to illustrate the sensitivity of the results to the assumption that was made.

## RESULTS OF THE ANALYSES

In a study as complicated as this, it is difficult to summarize the results briefly and in a readily comprehensible form. This Executive Summary, in order to provide an overview, must necessarily avoid most of the details. On the back cover of the main report there is a guide to more detailed results.

### Community Analysis

This summary refers to three of the community types analyzed: the “low density sprawl,” the “combination mix,” and the “high density planned” communities. They may be defined as follows:

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<sup>1</sup> The assumption of constant population underlying the community analyses was made to emphasize the differences among community development patterns. The actual populations could differ quite substantially from those assumed, with corresponding impacts on costs.

- Low density sprawl: The entire community is made up of single family homes, 75 percent sited in a traditional grid pattern and the rest clustered. Neighborhoods are sited in a “leapfrog” pattern with little contiguity. This represents the typical pattern of suburban development.
- Combination mix: This community consists of a housing mix of 20 percent of each of the five types of dwellings, half located in planned unit developments, half in traditional subdivisions.
- High density planned: In this community, housing is composed of 40 percent high rise apartments, 30 percent walkup apartments, 20 percent townhouses, and 10 percent clustered single family homes. All of the dwelling units are clustered together into contiguous neighborhoods, much in the pattern of a high density “new community.”

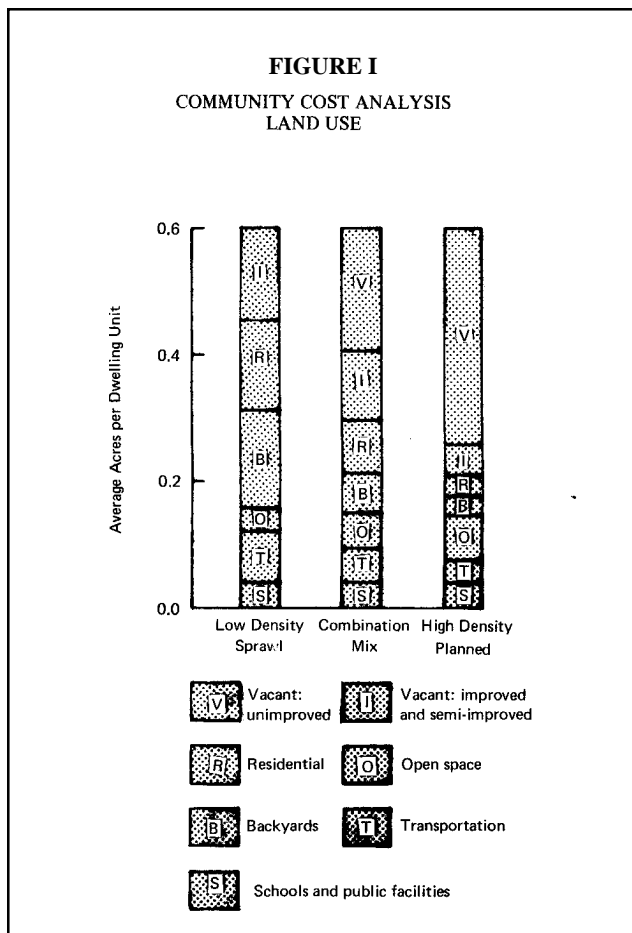
The following briefly summarizes the study’s findings in terms of land use, economic costs, environmental costs, energy and water consumption, and some personal costs.

**Land Use:** Although all the communities cover the same area, over 50 percent of the land in the high density planned community remains completely undeveloped, whereas all the land is at least partially developed in the low density sprawl community. On the other hand, the low density sprawl community has more land that is improved but vacant, an indication of the amount of leapfrogging that occurs there.<sup>2</sup>

Figure I shows how these communities differ in land use. Although four times as much land is used for residential purposes in the low density sprawl community as in the high density planned community, only two-thirds as much is dedicated to public open space. However, if backyards, which are also a form of open space, are included, the low density community has twice the public and private land *dedicated* to open space as the high density community; it must be remembered, however, that in the high density planned community, over one-half of the land is not developed.

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<sup>2</sup> “Improved” here means that the land has been provided with at least some infrastructure such as streets and sewers.



The amount of land used for schools and other public buildings is the same in all communities, but the high density community uses about half as much land for transportation as the low density community.

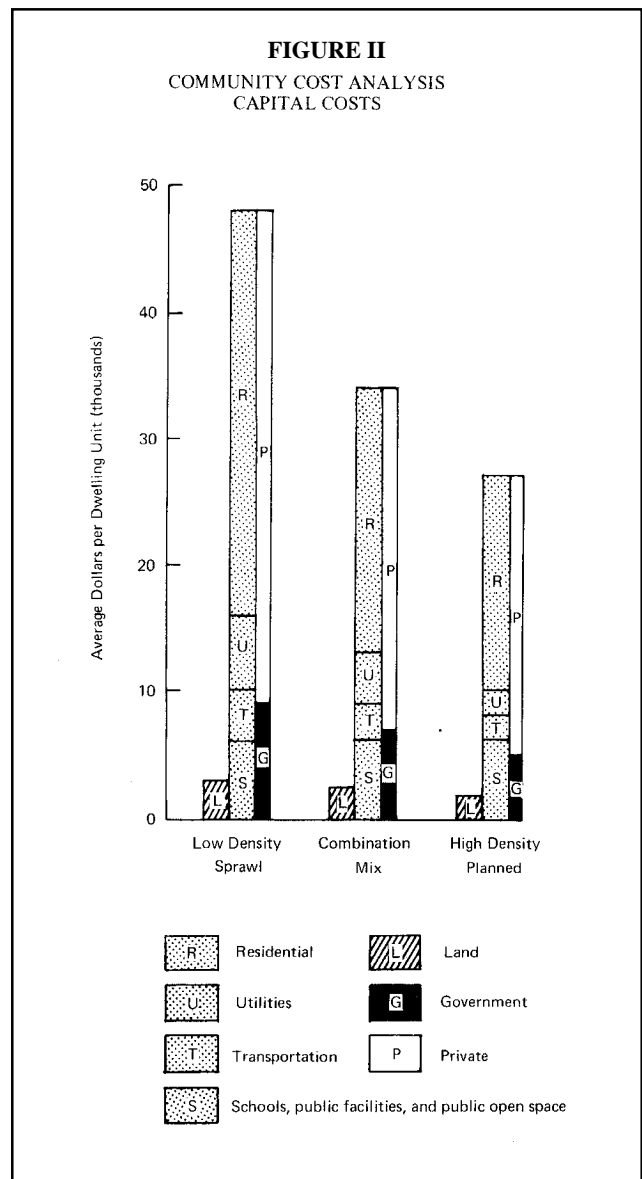
**Economic Costs:** In terms of total investment costs, the high density planned community is distinctly lower: 21 percent below the combination mix community and 44 percent below the low density sprawl community. Most of these savings result from differences in development density—savings of about 3 percent of total development costs result from better “planning,” whereas those from increased density amount to 41 percent.<sup>3</sup> The largest cost savings are in construction of residential

<sup>3</sup> Throughout this study “planning” is used in a very limited sense to mean increased clustering or compactness of development. Good planning includes much more than just clustering, and may well result in more significant costs savings than those indicated here.

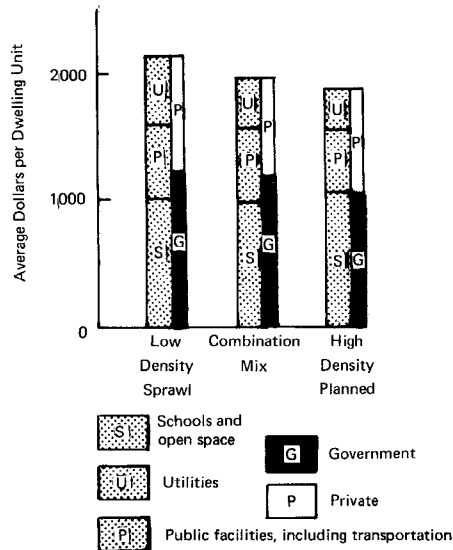
dwellings, although important savings are attributable to reduced costs for roads and utilities, which are about 55 percent lower in the high density than in the low density community.

Figures II and III summarize these investment and operating costs for the three communities. The total investment costs do not include costs of the land; they are indicated separately on Figure II. The operating and maintenance costs do not include the cost of maintaining the residential structures (although the operating costs for utilities comprise a substantial portion of this cost), the financing costs for the capital investments that have been made, or the costs of operating automobiles.

Figure II also shows the difference in investment costs which are borne privately (initially by the developer) and publicly. Not only does the high density



**FIGURE III**  
COMMUNITY COST ANALYSIS ANNUAL  
OPERATING AND MAINTENANCE COSTS



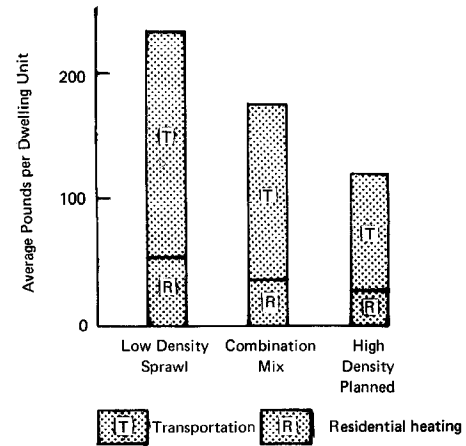
planned community cost less to construct, but a lower proportion of the costs is likely to be borne by government.

The difference in operating and maintenance costs is less noticeable than the difference in investment costs because O&M costs are related more to the population being served than to the pattern of development. However, the higher density communities are again somewhat less costly in terms of the total operating and maintenance costs and in the costs paid by government.

**Environmental Costs:** Air pollution has two major sources: automobiles and residential heating. Higher density developments require less energy for heating, and higher density and better “planned” communities stimulate less automobile use. Thus the high density planned community generates about 45 percent less air pollution than the low density sprawl community. Although “planning” has no effect upon the amount of pollution resulting from residential heating, it can reduce the amount from automobiles by 20 to 30 per-

4 Sanitary sewage pollutants indicated are those remaining after tertiary treatment of the sewage. With only secondary treatment, which is more common, the volume of pollutants would be increased 5 to 10 times.

**FIGURE IV**  
COMMUNITY COST ANALYSIS  
ANNUAL AIR POLLUTION EMISSIONS

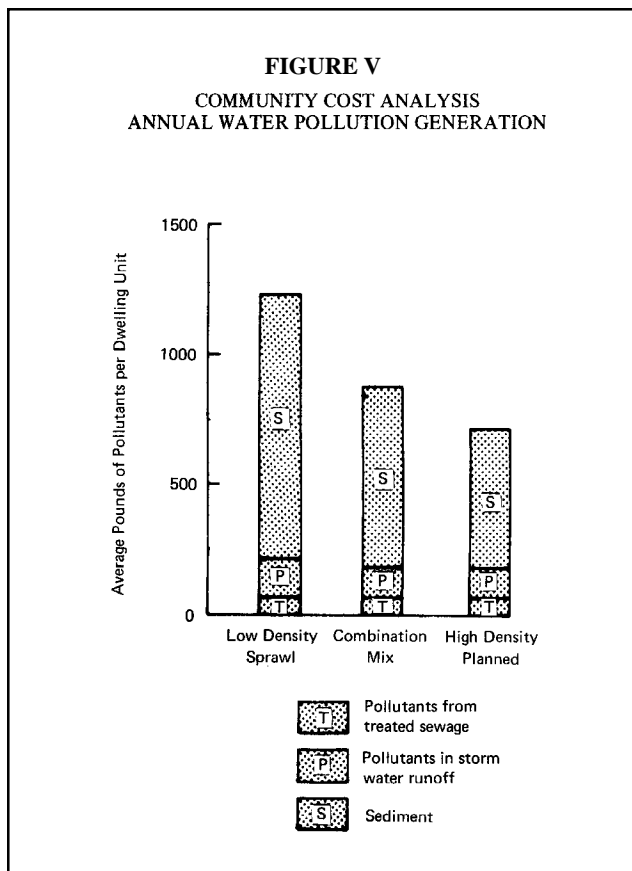


cent. The amounts of air pollution generated by the different communities are shown in Figure IV.

Figure V indicates a similar pattern of water pollution generated by the different development patterns. The type of development has no effect on the amount of sanitary sewage generated because this is a function only of population.<sup>4</sup> However, it does affect the important problems of storm water pollution and sediment. The less paved area there is, the less storm water runoff there will be. This is important not only in terms of water pollution problems but also in terms of downstream flooding. More clustered communities have somewhat less pavement than sprawl communities, but again the significant savings come from increasing density.

For both air and water pollution, it is important to note that although the higher density community generates less pollution, it does so in a smaller area, resulting in a higher amount of pollution generated per acre developed.

In terms of other environmental factors, planning is the key to eliminating noise problems, preserving valuable wildlife and vegetation, and creating a visually attractive development. For a given developed area, increased density allows the planner greater flexibility in accomplishing these goals. However, the increased density does concentrate noise-generating activities and puts added demands on the designer to create aesthetically pleasing developments.



**Energy and Water Use:** Energy consumption is determined primarily by residential heating and air conditioning requirements and by automobile use. Heating and air conditioning requirements are related primarily to the type of dwelling unit—denser developments have lower demands than single family units. Transportation demands are affected both by the degree of clustering and community planning and by density. “Planning” alone can save nearly 14 percent of total energy consumed, but “planning” combined with increased density can save up to 44 percent.

Water consumed in cooking, drinking, etc., is not affected by either planning or density. However, water for lawn watering is affected by both. Clustering alone can save 6 percent of total water consumption, but the high density planned development can save 35 percent over low density sprawl development.

Figures VI and VII indicate the variations in consumption of these two valuable natural resources.

**Personal Costs:** Some personal costs were also assessed in the study. These are more difficult to estimate. In general, “planning” and increased density reduce the amount of time that family members spend

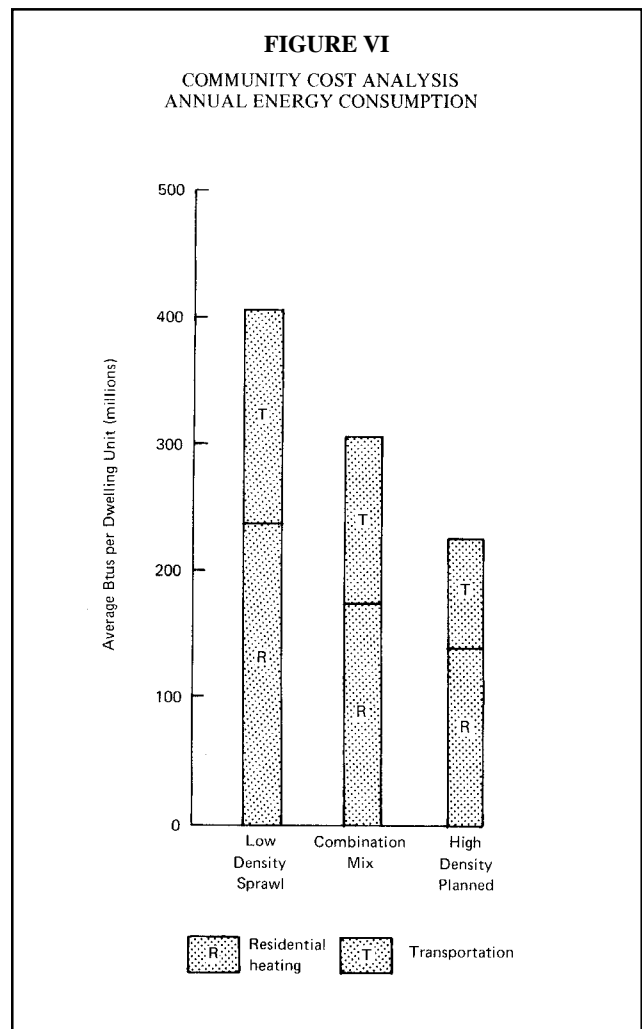
traveling to work, school, etc., and higher density developments typically take less of the residents’ time to clean and maintain. There are likely to be fewer traffic accidents with better planning, but crime may increase with higher densities, as will various psychic costs which are particularly dependent upon design and planning details.

These are the costs estimated for the different community development patterns. More details may be found in the summary Tables III through VII.

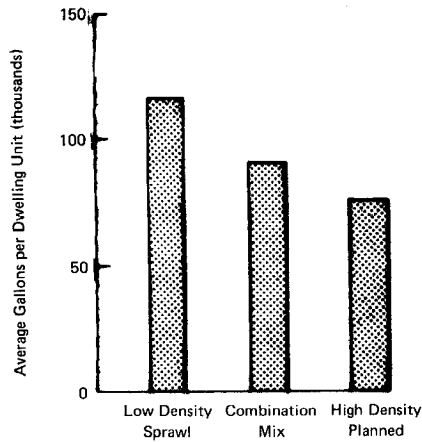
### Neighborhood Analysis

Few officials face a decision about what kind of development pattern is best for a community of 33,000. Rather, the decisions regard individual subdivision proposals. For these decisions, the neighborhood cost analyses, which pertain to only 1,000 units, may be more useful than the community analyses.

Most of the neighborhood costs are similar to the community costs, and the same conclusions—that bet-



**FIGURE VI**  
**COMMUNITY COST ANALYSIS**  
**ANNUAL WATER CONSUMPTION**



ter “planning” and higher density result in lower economic, environmental, natural resource, and, to some extent, personal and social costs—apply as well to the neighborhood. Some of these costs, however, are more difficult to identify on the neighborhood level, and some depend to a great extent upon how the neighborhood is integrated with the community.

Nevertheless, for the local official it is helpful to review the results of some of the neighborhood analyses. Figures VIII and IX indicate the investment and operating costs per dwelling unit for the five neighborhood types analyzed. As in the community cost analysis, increased density is less expensive in terms of total costs and even more so in terms of that portion of total costs typically borne by government. Walkup apartments are the least costly type of dwelling unit to construct (looking only at residential costs). For streets and roads, utilities, and particularly schools, however, the high rise apartment is less expensive, and these cost savings more than compensate for the higher residential costs. The cost savings associated with higher densities are reduced if the higher density units are assumed to have the same living area or contain the same population as the lower density units.

### Site Analysis

All of the above results pertain to the costs of providing a given number of dwelling units. The study also

includes an analysis of the costs of developing a given parcel of land. In this analysis, the number of dwelling units constructed on the site increases with the higher density neighborhood types. Because there are more dwelling units, total costs associated with development of the site tend to increase with the higher density development patterns even though the cost per dwelling unit decreases.

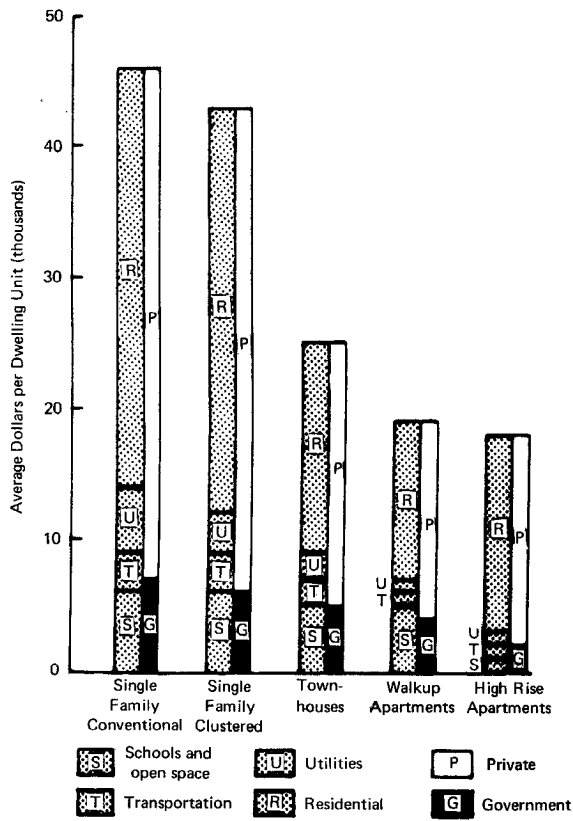
Total capital costs are highest for high rise apartments, and capital costs borne by government are highest for high rise and townhouse developments. Operating and maintenance costs are highest for walkup apartments, both in total and in that portion borne by government. These relationships are indicated in Figures X and XI. The air and water pollution emissions from a given site are also higher for higher density developments.

### CONCLUSION

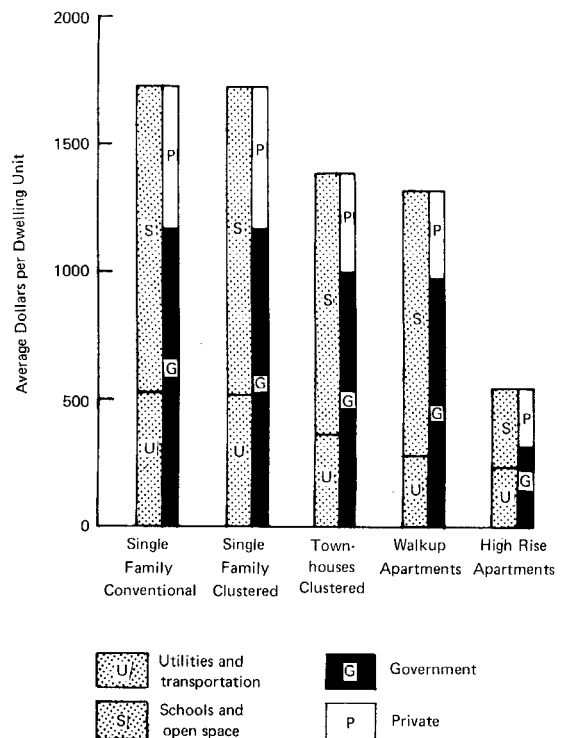
The results of the study, presented in more detail in the tables that follow, show a surprising consistency: “planning” to some extent, but higher densities to a much greater extent, result in lower economic costs, environmental costs, natural resource consumption, and some personal costs for a given number of dwelling units. These results do not necessarily hold for the development of a given land parcel.

The results are not directly applicable to any specific development, either existing or proposed. The features of a particular site or community substantially affect the magnitude of any of the costs. Nor **should the results be** interpreted as recommending one type of development over another. There are too many costs and benefits which have not been included, particularly those associated with questions of personal preferences and the revenues generated by different development types. But the analyses should provide local officials with a better information base about the impacts of different development patterns, allowing them to make better informed decisions about the future form of their communities.

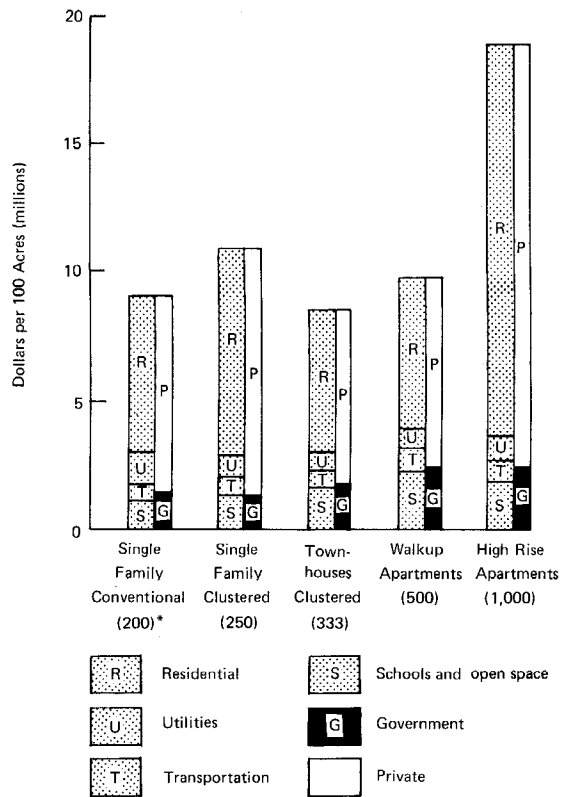
**FIGURE VI**  
NEIGHBORHOOD COST ANALYSIS  
CAPITAL COSTS



**FIGURE VI**  
NEIGHBORHOOD COST ANALYSIS  
ANNUAL OPERATION AND MAINTENANCE COSTS

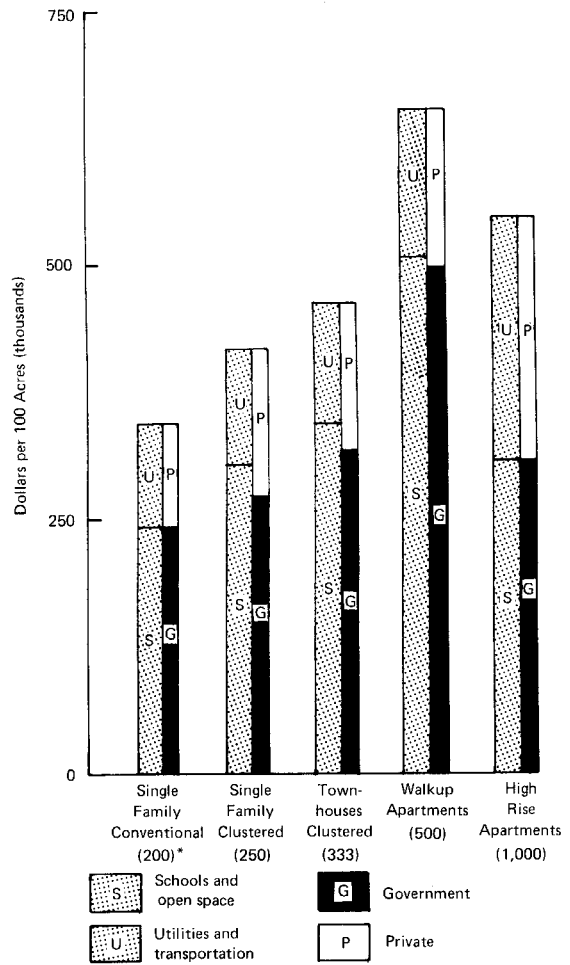


**FIGURE X**  
SITE ANALYSIS  
CAPITAL COSTS



\*Number of dwelling units on a 100-acre site.

**FIGURE XI**  
SITE ANALYSIS  
ANNUAL OPERATING AND MAINTENANCE COSTS



\*Number of dwelling units on a 100-acre site.

**TABLE II**  
**NEIGHBORHOOD AND COMMUNITY CHARACTERISTICS**

NEIGHBORHOOD AND COMMUNITY COST ANALYSIS

	<u>Neighborhood Housing Types</u>					
	<u>A</u> <u>Single-Family</u> <u>Conventional</u>	<u>B</u> <u>Single-Family</u> <u>Clustered</u>	<u>C</u> <u>Townhouses</u> <u>Clustered</u>	<u>D</u> <u>Walk-Up</u> <u>Apartments</u>	<u>E</u> <u>High-Rise</u> <u>Apartments</u>	<u>F</u> <u>Housing Mix</u> <u>(20% Each A-E)</u>
<u>Dwelling Units</u>	1,000	1,000	1,000	1,000	1,000	1,000
<u>Average Floor Area</u> <u>Per Unit (square foot)</u>	1,600	1,600	1,200	1,000	900	1,260
<u>Total Population</u>	3,520	3,520	3,330	3,330	2,825	3,300
<u>Persons per Unit</u>	3.5	3.5	3.3	3.3	2.8	3.3
<u>School Children</u>	1,300	1,300	1,100	1,100	300	1,100
<u>Total Acreage</u>	500	400	300	200	100	300
<u>Residential</u>	330	200	100	66	33	145
<u>Open Space/ Recreation</u>	45	90	90	73	32	66
<u>Schools</u>	29	29	26	26	15	26
<u>Churches</u>	5	5	5	5	5	5
<u>Streets and Roads</u>	75	60	45	30	15	45
<u>Vacant</u>	16	16	34	0	0	13
<u>Residential Density</u>						
<u>Units per Gross Acre</u>	2	2.5	3.3	5	10	3.3
<u>Units per Net Residential Acre</u>	3	5.0	10.0	15	30	6.9

	<u>Community Development Patterns</u>					
	<u>I</u> <u>Planned</u> <u>Mix</u>	<u>II</u> <u>Combination</u> <u>Mix (50%</u> <u>PUD, 50%</u> <u>Sprawl)</u>	<u>III</u> <u>Sprawl</u> <u>Mix</u>	<u>IV</u> <u>Low</u> <u>Density</u> <u>Planned</u>	<u>V</u> <u>Low</u> <u>Density</u> <u>Sprawl</u>	<u>VI</u> <u>High</u> <u>Density</u> <u>Planned</u>
<u>Dwelling Units</u>	10,000	10,000	10,000	10,000	10,000	10,000
<u>Housing Types<sup>1/</sup></u>	20% - Type A 20% - Type B 20% - Type C 20% - Type D 20% - Type E	Same as I.	Same as I.	75% - Type B 25% - Type A	75% - Type A 25% - Type B	10% - Type B 20% - Type C 30% - Type D 40% - Type E
<u>Total Population</u>	33,000	33,000	33,000	33,000	33,000	33,000
<u>School Children</u>	11,000	11,000	11,000	11,000	11,000	11,000
<u>Total Acreage</u>	6,000	6,000	6,000	6,000	6,000	6,000
<u>Residential</u>	1,450	1,450	1,450	2,333	3,000	733
<u>Open Space/ Recreation</u>	660	530	400	660	400	660



TABLE IV

COMMUNITY COST ANALYSIS  
OPERATING AND MAINTENANCE COSTS

COST CATEGORY	Community Development Pattern (10,000 Units)															
	I			II			III			IV			V		VI	
	Planned Mix Cost	Percent of Total Cost		Combination Mix 50 Percent PUD, 50 Percent Sprawl	Percent of Total Cost		Sprawl Mix Cost	Percent of Total Cost		Low Density, Planned Cost	Percent of Total Cost		Low Density, Sprawl Cost	Percent of Total Cost	High Density, Planned Cost	Percent of Total Cost
			(in thousands)													
<u>Open Space/Recreation</u>	\$ 360	2%		\$ 320	2%	\$ 260	1%	\$ 380	2%	\$ 260	1%	\$ 380	\$ 260	1%	\$ 380	2%
	(146% of III)		(123% of III)					(146% of V)				(146% of V)			(146% of V)	
<u>Schools</u>	\$ 9,643	50%		\$ 9,652	49%	\$ 9,737	50%	\$ 9,643	47%	\$ 9,737	46%	\$ 9,643	\$ 9,737	46%	\$ 9,643	51%
	(99% of III)		(99% of III)					(99% of V)				(99% of V)			(99% of V)	
<u>Public Services</u>	\$ 5,103	26%		\$ 5,296	27%	\$ 5,405	28%	\$ 5,165	25%	\$ 5,575	26%	\$ 5,164	\$ 5,575	26%	\$ 5,164	28%
	(94% of III)		(98% of III)					(93% of V)				(93% of V)			(93% of V)	
<u>Transportation - Streets and Roads</u>	\$ 260	1%		\$ 260	1%	\$ 261	1%	\$ 354	2%	\$ 396	2%	\$ 209	\$ 396	2%	\$ 209	1%
	(100% of III)		(100% of III)					(89% of V)				(53% of V)			(53% of V)	
<u>Utilities</u>	\$ 3,987	21%		\$ 3,988	20%	\$ 3,989	20%	\$ 5,130	25%	\$ 5,141	24%	\$ 3,335	\$ 5,141	24%	\$ 3,335	18%
	(100% of III)		(100% of III)					(100% of V)				(65% of V)			(65% of V)	
<u>Total Year Ten Operating Costs</u>	\$ 19,373	100%		\$ 19,516	100%	\$ 19,652	100%	\$ 20,672	100%	\$ 21,109	100%	\$ 18,731	\$ 21,109	100%	\$ 18,731	100%
	(99% of III)		(99% of III)					(98% of V)				(89% of V)			(89% of V)	
<u>Cumulative Ten Year Operating Costs</u>	\$125,265			\$117,299		\$109,489		\$133,186		\$116,827		\$120,919	\$116,827		\$120,919	
<u>Present Value</u>	\$ 95,526			\$ 88,860		\$ 82,377		\$101,567		\$ 87,804		\$ 92,212	\$ 87,804		\$ 92,212	
Present Value at 5%	\$ 74,913			\$ 69,210		\$ 63,710		\$ 79,651		\$ 67,822		\$ 72,315	\$ 67,822		\$ 72,315	
(Comparison of Results at 10%)				(109% of III)		(100% of III)		(118% of V)		(118% of V)		(110% of V)	(110% of V)		(110% of V)	
<u>Incidence of Cost - Year Ten</u>																
Government/Private (%/%)	55%/45%			60%/40%		61%/39%		51%/49%		57%/43%		55%/45%	57%/43%		55%/45%	
<u>Cost to the Household - Year Ten</u>																
Service Charges/Taxes (%/%)	49%/51%			44%/56%		43%/57%		52%/48%		46%/54%		48%/52%	46%/54%		48%/52%	

Note: Residential operating and maintenance costs are not estimated.

Source: Real Estate Research Corporation.

**TABLE V  
COMMUNITY COST ANALYSIS  
ENVIRONMENTAL AND PERSONAL EFFECTS**

	Community Development Pattern (10,000 Units)			
	Planned Mix 50 Percent PUD, 50 Percent Sprawl	Sprawl Mix	Low Density Planned	High Density Planned
<b>Air Pollution</b>				
<p><b>Pollutants from Private Automobiles (CO, HC, NO<sub>x</sub>)</b></p> <p>70% of emission levels in Community III; differences result from variation in auto patterns among development patterns.</p>	<p>83% of emission levels in Community III.</p>	<p>81% of emission levels in Community V.</p>	<p>50% of emission levels in Community V.</p>	
<p><b>Pollutants from Residential Natural Gas Consumption (Particulates, SO<sub>x</sub>, CO, HC, NO<sub>x</sub>)</b></p> <p>100% of emission levels in Community III.</p>	<p>100% of emission levels in Community III.</p>	<p>100% of emission levels in Community V.</p>	<p>57% of emission levels in Community V; differences reflect housing mix and variation in energy use by housing type.</p>	
<b>Water Pollution and Erosion</b>				
<p><b>Volume of Sediment from Erosion (average annual)</b></p> <p>Slightly greater than III due to land budget variation in developed acreage.</p>	<p>Virtually 100% of III.</p>	<p>89% of V; difference results from variation in developed acreage.</p>	<p>60% of V; difference results from variation in developed acreage.</p>	
<p><b>Pollutants from Sewage Effluent (BOD, CO<sub>2</sub>, N, P, S.S., PCB)</b></p> <p>No variation by housing type or development pattern. Sewage treatment function of population, and its resulting pollutants a function of treatment level. Sewage volume is approximately 4.5 billion liters per year.</p>	<p>Same as I.</p>	<p>Same as I.</p>	<p>Same as I.</p>	
<p><b>Pollutants from Storm Run-Off (BOD, CO<sub>2</sub>, N, P, S.S., PCB)</b></p> <p>99% of III; small difference results from more paved area (road length) in III.</p>	<p>Same as I.</p>	<p>93% of V; difference results from variation in amount of paved area.</p>	<p>Run-off and its resulting pollutants are the lowest in this category. Volume is approximately 7.1 billion liters per year.</p>	
<p><b>Pollutants from Sanitary Landfill Leachate (BOD, N, P, PCB)</b></p> <p>No variation by housing type or development pattern. Solids are more dispersed of in landfills; a function of population, amount of pollutants is largely a function of soil characteristics and quality of operation.</p>	<p>Same as I.</p>	<p>Same as I.</p>	<p>Same as I.</p>	
<b>Noise</b>	<p>A less efficient traffic pattern than in I, but as compared with I, noise buffering of noise can be expected, although some homes may be located along busy arterials.</p>	<p>Where buffers and setbacks are present, high level of noise intrusion is likely.</p>	<p>Lower density means more auto use and hence more auto noise impacts. However, noise impacts are spread over a larger area.</p>	<p>High density causes concentrated traffic flows which may be compensated for with buffers and setbacks.</p>
<b>Vegetation and Wildlife</b>	<p>Less species disruption whose significant tracts of land are preserved as permanent open space. Degree of adverse effect depends on ability of species to adapt to human proximity.</p>	<p>Similar to I. Lessfore developed pattern less only small pockets of undisturbed area.</p>	<p>Low density development land preserved in open condition. Careful planning can protect areas of special significance as species habitats - i.e., woodlands, swamps.</p>	<p>Least adverse effect through special planning to conserve special habitats through high density development which preserves large tracts of undisturbed land.</p>

Note: Abbreviations as follows: CO (carbon monoxide), HC (hydrocarbons), NO<sub>x</sub> (nitrogen oxides), SO<sub>x</sub> (sulfur oxides), B.O.D. (biological oxygen demand), COD (chemical oxygen demand), N (nitrogen compounds), P (phosphorus compounds), S.S. (suspended solids), PCB (fecal coliform bacteria).

TABLE V (Continued)

COMMUNITY COST ANALYSIS  
ENVIRONMENTAL AND PERSONAL EFFECTS

	Community Development Pattern (10,000 Units)			
	II	V	V	VI
	Planned Mix	Low Density Planned	Low Density Sprawl	High Density Planned
<b>Visual Effects</b>	Development controls for retention of visually pleasing natural features and careful building design are likely to occur.	Similar to I.	Similar to II.	Similar to I.
<b>Water and Energy Consumption</b>				
Water Use (gallons per year)	Same as III. Water consumption is largely a function of household size, housing type, and lawn sprinkling demand.	94% of V; difference reflects varying needs for lawn sprinkling.	Approximately 117 million gallons per year - greater sprinkling and household use than in III.	65% of V; difference reflects variations in consumption and sprinkling uses by housing type.
Energy Use (billion BTUs per year)	86% of III; difference reflects variation in gasoline used for auto travel. Natural gas and electricity consumption a function of housing type, with apartment units consuming less than single-family homes.	92% of V; difference reflects variation in gasoline used for auto travel.	Approximately 4,060 billion BTUs per year.	56% of V; difference reflects variations in residential power consumption by housing type and auto use in high density planned areas.
<b>PERSONAL EFFECTS</b>				
<b>Travel Time</b>	Auto travel time is estimated at 62% of III. Greater time in bicycle travel or walking. Travel time is largely a function of better planning and location of facilities and services.	Time spent in auto travel is 33% greater than in I due to lower density but is 20% less than in V due to better planning of facility and service locations.	Similar to III, with slightly greater travel time due to longer travel distances and greater likelihood of auto use.	Auto travel time is 57% of V, due to decreased auto use, more walking. Somewhat less than I due to greater density of development and increased proximity of facilities and services.
<b>Traffic Accidents</b> (per year, both fatal and non-fatal, intersection and non-intersection)	64% of III; difference results from variation in total vehicle miles traveled, lengths of road, street widths.	80% of V; 33% greater than I due to increased auto use and road length.	743 accidents per year, 7% more than in III due to greater auto use and road length.	47% of V; difference reflects decreased auto use, shorter road length, wider road widths in high-density areas.
<b>Crime</b>	Same as III; no variation by development pattern. Differences are a function of housing type.	Same as V; no variation by development pattern. Differences are a function of housing type.	1,300 crimes per year, 5% of which are crimes to persons.	20% more crime than in V, due to higher density.
<b>Psychic Costs</b> (Design, natural features, leisure facilities and services, socio-economic status, investments)	More varied design, safer vehicular circulation pattern; emphasis on preserving open space; wide variety of community activities encouraging group participation. Residents are willing to bear the cost of higher quality services, community associations, and recreation facilities provided by community associations. Likely to have a wide range of housing prices and a heterogeneous population.	Housing shows little design variation; land development pattern is more homogeneous than in I due to no direct costs to individuals. Leisure activities oriented around home and family. Likely to be homogeneous with regard to race, income, education.	Same as III.	Same as I.

Source: Real Estate Research Corporation.

TABLE VI

NEIGHBORHOOD COST ANALYSIS  
CAPITAL COSTS

COST CATEGORY	Housing Pattern (1,000 Units)											
	A		B		C		D		E		F	
	Single-Family Conventional	Single-Family Clustered	Townhouse Clustered	Walk-Up Apartment	High-Rise Apartment	Housing Mix	Percent of Total Cost	Percent of Total Cost	Percent of Total Cost	Percent of Total Cost	Percent of Total Cost	Percent of Total Cost
Open Space/Recreation	\$ 220	\$ 274	\$ 274	\$ 252	\$ 203	\$ 245	0%	1%	1%	1%	1%	1%
Percent of A	-	125%	125%	115%	92%	111%	-	1%	1%	1%	1%	1%
Schools	\$ 5,354	\$ 5,354	\$ 4,538	\$ 4,538	\$ 1,646	\$ 4,538	11%	17%	21%	8%	14%	14%
Percent of A	-	100%	85%	85%	31%	85%	-	17%	21%	8%	14%	14%
Transportation - Streets and Roads	\$ 3,080	\$ 2,661	\$ 2,111	\$ 1,464	\$ 801	\$ 2,064	6%	8%	7%	4%	6%	6%
Percent of A	-	86%	69%	48%	26%	67%	-	8%	7%	4%	6%	6%
Utilities	\$ 5,483	\$ 3,649	\$ 2,369	\$ 1,579	\$ 958	\$ 2,782	11%	9%	7%	5%	8%	8%
Percent of A	-	67%	43%	29%	17%	51%	-	9%	7%	5%	8%	8%
Subtotal	\$ 14,137	\$ 11,938	\$ 9,292	\$ 7,833	\$ 3,628	\$ 9,629	29%	34%	37%	18%	29%	29%
Percent of A	-	84%	66%	55%	26%	68%	-	34%	37%	18%	29%	29%
Residential	\$ 32,146	\$ 31,724	\$ 16,263	\$ 11,766	\$ 15,188	\$ 21,417	66%	60%	55%	79%	65%	65%
Percent of A	-	99%	51%	37%	47%	67%	-	60%	55%	79%	65%	65%
Total Exclusive of Land	\$ 46,283	\$ 43,662	\$ 25,555	\$ 19,599	\$ 18,796	\$ 31,046	95%	94%	92%	91%	94%	94%
Percent of A	-	94%	55%	42%	41%	67%	-	94%	92%	91%	94%	94%
Land	\$ 2,628	\$ 2,596	\$ 1,704	\$ 1,683	\$ 1,900	\$ 2,042	5%	6%	8%	9%	6%	6%
Percent of A	-	99%	65%	64%	72%	78%	-	6%	8%	9%	6%	6%
Total Capital Costs	\$ 48,911	\$ 46,258	\$ 27,259	\$ 21,282	\$ 20,696	\$ 33,088	100%	100%	100%	100%	100%	100%
Percent of A	-	95%	56%	44%	42%	68%	-	100%	100%	100%	100%	100%
Incidence of Cost	15%/85%	15%/85%	20%/80%	25%/75%	13%/87%	18%/82%	-	20%/80%	25%/75%	13%/87%	18%/82%	-
Government/Private	-	-	-	-	-	-	-	-	-	-	-	-
Cost to the Households	83%/ 3%/ 14%	38%/ 43%/ 19%	38%/ 43%/ 19%	13%/ 62%/ 25%	16%/ 71%/ 13%	46%/ 37%/ 17%	-	38%/ 43%/ 19%	13%/ 62%/ 25%	16%/ 71%/ 13%	46%/ 37%/ 17%	-
Capital Cost/Service Charges/Taxes	-	-	-	-	-	-	-	-	-	-	-	-

Source: Real Estate Research Corporation.

TABLE VII

NEIGHBORHOOD COST ANALYSIS  
OPERATING AND MAINTENANCE COSTS

COST CATEGORY	Housing Pattern (1,000 Units)											
	A		B		C		D		E		F	
	Single-Family Conventional	Single-Family Clustered	Townhouse Clustered	Walk-Up Apartment	High-Rise Apartment	Housing Mix	Cost	Percent of Total Cost	Cost	Percent of Total Cost	Cost	Percent of Total Cost
Open Space/Recreation Percent of A	\$ 30 2%	\$ 41 137%	\$ 41 137%	\$ 41 137%	\$ 30 100%	\$ 37 123%						
Schools Percent of A	\$1,168 68%	\$1,168 100%	\$ 989 85%	\$ 989 85%	\$ 270 23%	\$ 989 85%						
Transportation - Streets and Roads Percent of A	\$ 37 2%	\$ 28 76%	\$ 18 49%	\$ 11 30%	\$ 6 16%	\$ 19 51%						
Utilities Percent of A	\$ 484 28%	\$ 483 100%	\$ 340 70%	\$ 278 57%	\$ 243 50%	\$ 365 75%						
Total Operating Costs Percent of A	\$1,721 100%	\$1,720 100%	\$1,388 81%	\$1,319 77%	\$ 548 32%	\$1,410 82%						
Incidence of Cost Government/Private	67%/33%	67%/33%	72%/28%	74%/26%	57%/43%	71%/29%						
Cost to the Household Service Charges/Taxes	35%/65%	36%/64%	33%/67%	30%/70%	52%/48%	34%/66%						

(In thousands)

Note: Residential operating and maintenance costs are not estimated.

Source: Real Estate Research Corporation.