1976

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The Journal of Legal Studies, Vol. 5, No. 1 (Jan., 1976), 147-163.

Stable URL:
http://links.jstor.org/sici?sici=0047-2530%28197601%295%3A1%3C147%3ASEACE%3E2.0.CO%3B2-R

The Journal of Legal Studies is currently published by The University of Chicago Press.

SUBDIVISION EXACTIONS AND CONGESTION EXTERNALITIES

*RICHARD P. ADELSTEIN and NOEL M. EDELSON**

THE rapid growth of suburban communities in recent years has led to increased congestion and greater physical burdens upon the public facilities of those communities. The purpose of this paper is to examine these problems in the specific case of public parks and recreation areas and to demonstrate that the full complexity of the issues has not yet been grasped even by those legislatures and courts that have considered the problem of congestion externalities. We begin with a simple model of congestion externalities and public recreational facilities, and then review the judicial approach to statutes attempting to mitigate these effects. Finally, we present a model for internalizing the principal effects of suburban growth upon public recreational areas, and offer some guidelines for an efficient legislative solution to these difficult problems.

I. CONGESTION EXTERNALITIES: A BASIC MODEL

Residential purchases are, in general, "tied goods," for along with the home itself the buyer receives a specified plot of outdoor space, a set of local public goods, and a property tax liability. Capitalized into the price of a home, therefore, is the value of these community services less the property taxes assessed the owner. Virtually all community services are "congestible" in that additional users cause a decline in the quality of services for all unless the capacity of the facilities is augmented. Because of such external effects associated with an influx of newcomers, the density of new housing in a community is a matter of concern to persons already residing in the municipality.

We use the term "externality" here in its usual economic sense to connote an action taken by one individual that affects the utility of another. For purposes of analyzing the fiscal impact of newcomers on established residents, it is useful to distinguish between "real" and "pecuniary" externalities. A pecuniary externality is said to exist when an individual's action redistributes income among the members of a group without changing the total income available to all, while a real externality refers to an action by a

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single person which either increases or decreases the total income of the group.

Consider, for example, a public park, financed by a community sales tax, which generates maintenance costs related to usage of the park. Suppose now that ownership of a particular home changes hands, and the new family does less of its shopping in the community while using the public park just as frequently as did the previous residents. In order to maintain the same level of park quality the sales tax rate must be raised, so the new family imposes a pecuniary externality. Total expenditures on and satisfaction from the park have remained constant for a group defined to include both the newcomer and existing residents, but the distribution of the burden of upkeep costs has been altered.

A real externality would exist if the new family valued the park at more than its share of sales tax but less than the maintenance costs attributable to its use of the recreation facility. In that case the new family would have a financial incentive to enter the community, but the net value of the park (the imputed value of services less maintenance costs) could be increased by denying access to the newcomers. Moreover, if the new family used the park more intensively or paid less sales tax than the previous owners, existing residents would suffer a negative pecuniary externality. If, on efficiency grounds, newcomers were denied access to the park but nevertheless paid sales taxes, existing residents would benefit from a positive pecuniary externality.

Economists tend to focus their attention on real externalities, for questions of resource allocation can be dealt with in terms of "objective" efficiency criteria. While we shall limit our analysis to problems of this kind, it should be kept in mind that pecuniary externalities are of no less importance to those affected than real externalities because they involve "merely" redistribution of income.

Proper pricing is required to encourage efficient usage of a congestible facility, that is, to ensure that real externalities are internalized. Suppose that there exists a scarce natural resource, say a lake or park and recreation space, which is capable of providing recreation services that diminish in quality with the size of the sharing group, but for which the useful recreational capacity can be enhanced by increased maintenance expenditures. Thus, the quality of per capita recreation services, q, is given by

$$q = f(E, N; K)$$

where

$E =$ maintenance expenditures per period;
$N =$ size of the sharing group;
$K =$ natural resource (fixed in amount).

Because maintenance expenditures can be expected to enhance the recreational quality of the facility, we have $\frac{\partial f}{\partial E} \equiv f_E > 0$, while the decline in such quality caused by increased congestion implies that $\frac{\partial f}{\partial N} \equiv f_N < 0$. Holding the endowment of natural resources constant, we assume that the "marginal productivity" of maintenance expenditures decreases with increments of E $\left(\text{that is, } \frac{\partial^2 f}{\partial E^2} \equiv f_{EE} < 0\right)$, and further that the marginal decline in the quality of recreational services increases with congestion $\left(\frac{\partial^2 f}{\partial N^2} \equiv f_{NN} < 0\right)$. Since the effect of additional congestion on the marginal productivity of maintenance expenditures is not *a priori* evident, we do not stipulate a sign for the cross-partial derivative $\frac{dq^*}{\partial E \partial N} \equiv f_{EN}$.[1]

Assume now a continuum of individuals who are potential patrons of the recreational facility. Due either to differences in personal preferences with respect to recreation or to differences in income, individuals place varying monetary valuations on recreational services. Let $V(q, i)$ denote the value the i^{th} individual places upon per capita recreational services q and, for simplicity, suppose that if $V(q, i) > V(q, j)$ for some level of q, then $V(q, i) > V(q, j)$ for all q.[2] Then the population of potential users can be ordered with respect to their valuations of q such that $\frac{\partial V}{\partial i} < 0$; thus, the smaller the index number i, the larger the individual's valuation of recreational services.

Let us suppose that maintenance expenditures are fixed at some arbitrary level E and that N persons are permitted to use the recreational facility. Then it is clear that in order to maximize the total value placed upon the resulting level of per capita services, $q = f(E, N; K)$, each person in the

1 This model is similar in form and spirit to the theory of clubs, James M. Buchanan, An Economic Theory of Clubs, 32 Economica 1 (1965); and Edelson's version of the Pigou-Knight road congestion problem, Noel M. Edelson, Congestion Tolls Under Monopoly, 61 Am. Econ. Rev. 873 (1971). Note our assumption that congestion depends only on the aggregate number of users, implying that expected use is the same for all potential members of the sharing group.

2 Without this assumption, the composition of the sharing group might differ for different values of q. Suppose that individual i is much wealthier than individual j. $V(q; i)$ might exceed $V(q; j)$ for high quality recreation services, but the wealthier person, having better private alternatives, might offer less than j for a congested park. This raises the possibility of multiple equilibria—a spacious park used by a few wealthy persons as opposed to a crowded park used by many poor persons. For an example of this phenomenon, see Edelson, *supra* note 1.

user group must have a larger $V(q, i)$ than every person not in the user set. Thus, every person in the user set will be accounted for by index numbers $i = 1, \ldots, n$. The total valuation placed upon recreational services, then, is simply the integral, over the set of users, of $V(q, i)$:

$$\text{Total Value} = \int_0^N V(q,i)di = \int_0^N V\,[f\,(E, N;\, K), i]di.$$

From an efficiency point of view, the problem is to choose a group size N^* and a level of maintenance expenditures E^* which maximize the total value of recreational services less maintenance costs:

$$\int_0^N V[f(E, N;\, K), i]di - E. \tag{1}$$

Note that this objective function does not specify how the maintenance costs are to be allocated among members of the user group, and thus only real external effects are considered here. The ultimate resolution of the pecuniary externalities associated with distributing these costs within the user set is, at base, an ethical issue, and we shall not pursue this aspect of the problem.

An optimal pair (N^*, E^*) is determined by maximizing the objective function of expression (1) with respect to group size and maintenance expenditures. Setting the first partial derivatives of (1) with respect to N and E equal to zero, we have

$$f_{E^*}\int_0^{N^*} V_q(q^*, i)di - 1 = 0, \tag{2}$$

and

$$V(q^*, N^*) + f_{N^*}\int_0^{N^*} V_q(q^*, i)di = 0,^3 \tag{3}$$

[3] Let the gross value of recreational services be

$$\int_0^N V[q(E, N)\,;\, i]di \equiv G[N, q(E, N)].$$

Then the objective function is

$$G[N, q(E, N)] - E.$$

Differentiating with respect to E gives:

$$\frac{\partial G}{\partial q} \cdot \frac{\partial q}{\partial E} - 1 = 0$$

or

$$f_{E^*}\int_0^N V_q(q;\, i)di - 1 = 0$$

where $q^* = f(E^*, N^*; K)$. The interpretation of these conditions follows directly. Equation (2) indicates that E is increased until, at E^*, the last dollar of maintenance expenditures is just offset by a dollar increase in the total quality of services enjoyed by members of the user set.

Equation (3) states that, in equilibrium, the last person admitted to the sharing group values recreational services to a degree just equal to the quality decline he imposes upon the pre-existing group of users. Substituting from (2), (3) can be rewritten as

$$\begin{aligned} V[q(E^*, N^*; K)] &= -\frac{f_{N^*}}{f_{E^*}} \\ &= \left.\frac{dE}{dN}\right|_{q = f(E^*, N^*; K)}. \end{aligned} \tag{3'}$$

Thus, the total quality decline imposed upon the established users of the facility equals the increase in maintenance expenditures required to keep q equal to $f(E^*, N^*; K)$ if an additional person were admitted to the sharing group. Moreover, by taking a total differential of the first-order condition for E it can be shown that the larger the group size, the larger will be the optimal level of maintenance expenditures.

If exclusion of nonmembers from the recreation area were possible, a freely transferable membership fee of $V(q^*, N^*)$ would ration the scarce natural resource to individuals 0 through N^*. For $0 < N < N^*$, member N receives a consumer surplus of $V(q, N) - V(q^*, N^*) > 0$, while consumer surplus is negative for $N > N^*$. Of course, if the sharing group began with a membership $N < N^*$, a membership fee of $V(q^*, N^*)$ would overstate the decline of service quality caused by an additional user. When there is uncertainty about the optimal group size, a membership fee that varies with current group size ensures that each new entrant will value recreational services no less than the negative externality he imposes. If, at some later time, the sharing group expands to a size N where $V(q, j) < -f_N \int_0^N V_q(q, i)di$ for some member $j \epsilon N$, individual j can realize a net gain by selling his mem-

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which is equation (2). Differentiating with respect to N, we have

$$\frac{dG}{dN} = \frac{\partial G}{\partial N} + \frac{\partial G}{\partial q} \cdot \frac{\partial q}{\partial N} = 0$$

or

$$V[q(E^*, N^*); N] + f_{N^*} \int_0^{N^*} V_q(q; i)di = 0$$

which is equation (3). The postulated partial derivatives of $f(E, N; K)$ and the definition of $V[q(E^*, N); i]$ guarantee that the equilibrium pair (N^*, E^*) is unique.

bership to an individual, say k, whose V(q, K) exceeds the price of entry. The fact that at N^* some members may have joined for less than $V(q^*, N^*)$ is purely a pecuniary matter.[4]

Although a membership fee is capable of internalizing a congestion externality, the price mechanism is generally considered an inappropriate means to ration demand for public parks and playgrounds. In all but the smallest facilities (a swimming pool, for example) there would be significant costs of excluding nonmembers, not the least of which is compromising the "openness" of open spaces. The absence of admission charges implies that the intensity with which individuals patronize a recreation facility is limited by the time and money costs of travel. Since most consumers of park and playground services are children and elderly persons, the value placed on such facilities should decrease sharply with distance from the user's residence.

Homes situated closer to public recreation areas will, in general, have larger V(q, i) capitalized into their prices, but average benefits bear no

[4] A further complexity arises if $\frac{dq^*}{dN^*} \neq 0$: in fact, it seems reasonable to expect that $\frac{dq^*}{dN^*} < 0$ despite the positivity of $\frac{dE^*}{dN^*}$. For q^* to be independent of N^*, we require that $\frac{dE^*}{dN^*} \equiv \frac{-f_N}{f_E}$ or, using (2), that

$$\frac{f_{EN}\, M(q,N) + V_q\,(q;i)}{-f_{EE}\, M(q,N)} \equiv -f_N\, M(q,N),$$

where

$$M(q,N) = \int_0^N V_q(q;i)di.$$

Since $-f_N\, M(q,N) < V(q,N)$ for $N < N^*$, a necessary condition for $\frac{dq^*}{dN^*} < 0$ is that

$$\frac{f_{EN}}{-f_{EE}} < V(q;i) - \frac{V_q(q;i)}{-f_{EE}\, M(q,N)}$$

If all individuals are identical, V_q/M is simply 1/N.

$$\frac{dq^*}{dN^*} < 0 \text{ implies that } \frac{dE^*}{dN} < \frac{-f_N}{f_E} = \left.\frac{dE}{dN}\right|_{q\,=\,\text{constant}}$$

$= -f_N \int_0^N V_q(q;i)di$, which, in turn, implies that the additional maintenance expenditure induced by an increase in group membership is less than the membership fee, if the fee equals the negative externality. Hence, the owners of K will earn, over and above maintenance costs, a return representing rents imputable to the scarcity of the natural resource.

necessary relationship to marginal congestion costs. Capitalization of V(q, i) does promote an efficient allocation of the housing stock among potential homeowners, in that only those with an exceptional demand for the recreation area will be willing to pay the proximity premium. Without an explicit access charge, however, the housing market cannot be expected to assure an efficient sharing group size.[5] A supplementary mechanism is required to achieve N*, and developer exactions and fees can be regarded as a means to that end.

In proposing and regulating such exactions and fees as devices to correct this market failure, state legislatures and courts have generally taken somewhat simplistic approaches which often overlook the subtler aspects of the problem of congestible facilities. For example, we have seen that questions of efficient allocation, such as finding the number of users and level of upkeep costs which maximize the net value of recreational services, are distinct from issues of equity, such as determining the extent of income redistribution between developers, new users of recreational facilities, and established community residents. But, as will become clear, the failure to identify and distinguish real and pecuniary external effects has often led policymakers to confuse these issues and set forth exaction or fee policies that are neither efficient nor equitable. Moreover, because newcomers may use existing local facilities and established residents may enjoy facilities provided by developers, reciprocal external effects, largely ignored by the courts and legislatures, may be of potentially critical importance.

II. Legal Approaches to the Exaction Problem

Recent cases dealing with the problem of subdivision exaction have most commonly arisen under state enabling statutes or municipal enactments authorizing municipalities to condition approval of subdivision plats upon the dedication of parcels of land within the subdivision for public use as parks or recreational facilities.[6] The legality of such exactions has turned principally on their constitutionality under the Takings Clause of the Fifth Amendment[7] or equivalent provisions of state constitutions. In *Pioneer Trust*

[5] This point is made in James M. Buchanan & Charles J. Goetz, Efficiency Limits of Fiscal Mobility: An Assessment of the Tiebout Model. 1 J. Pub. Econ. 25 (1972).

[6] It is not our purpose here to analyze in detail the often confusing and contradictory case law in this area. For more comprehensive discussion of these issues, see Ira Michael Heyman & Thomas K. Gilhool, The Constitutionality of Imposing Increased Community Costs on New Suburban Residents Through Subdivision Exactions, 73 Yale L.J. 1119 (1964); John D. Johnston, Jr., Constitutionality of Subdivision Control Exactions: The Quest for a Rationale, 52 Cornell L.Q. 871 (1967); Annot., 43 A.L.R.3d 863 (1972).

[7] The specific language at issue is that part of the Fifth Amendment which guarantees that "private property [shall not] be taken for public use without just compensation," applied to the states in Chicago, B. & Q.R.R. v. Chicago, 166 U.S. 226, 241 (1897).

and Savings Bank v. Village of Mount Prospect,[8] an early decision invalidating an ordinance compelling the dedication of land within a subdivision, the Illinois Supreme Court held that such exactions were confiscatory unless it could be demonstrated that the need for them was "specifically and uniquely attributable to the addition of the subdivision."[9] Moreover, there is language in the opinion which suggests that costs due to increased congestion in existing public facilities may not constitutionally be imposed upon the subdivider.[10]

The realities of explosive suburban growth and its attendant problems of municipal finance, however, have caused even those courts which have accepted the *Pioneer* standard to interpret it broadly in favor of the legality of subdivision exaction. Thus, in *Billings Properties, Inc. v. Yellowstone County*,[11] the Montana Supreme Court, arguing that "if the subdivision creates the specific need for such parks and playgrounds, then it is not unreasonable to charge the subdivider with the burden of providing them,"[12] upheld an enabling statute authorizing mandatory dedication, reading *Pioneer* to require only a demonstrated relationship between the need for enhanced facilities and the costs imposed upon the subdivider.[13] Even this qualification was relaxed in *Jordan v. Village of Menomonee Falls*,[14] in which a simple showing that, in the past, the population increase occasioned by the creation of subdivisions within the community had made necessary the expansion of park and playground facilities was held by the Wisconsin Supreme Court to be sufficient to find the requisite nexus between municipal need and the entry of new subdivision residents.

While the courts have in recent years tended to look favorably upon compulsory land dedication as a means of meeting costs imposed by incoming

[8] 22 Ill. 2d 375, 176 N.E.2d 799 (1961).

[9] *Id.* at 381, 176 N.E.2d at 802. The court interprets Ayres v. City Council of Los Angeles, 34 Cal. 2d 31, 207 P.2d 1 (1949), as suggesting this rule, but that reading of *Ayres* was expressly rejected in Associated Home Builders, Inc. v. City of Walnut Creek, 4 Cal. 3d 633, 641, 484 P.2d 606, 615 n. 13 (1971), *appeal dismissed*, 404 U.S. 878 (1971).

[10] While acknowledging that new residents will "aggravate" the need for schools and parks, the court framed the issue in *Pioneer* as whether "a mandatory dedication of the land *without cost to the public* may be sustained," 22 Ill. 2d at 381, 176 N.E.2d at 802 (emphasis added). In holding that it could not, because the need for such facilities was generated by the growth of the community as a whole rather than specifically by the newcomers, the court seems to imply that were there to be no compulsory dedication, the public would bear no costs which could properly be imposed upon the subdivider.

[11] 144 Mont. 25, 394 P.2d 182 (1964).

[12] *Id.* at 33, 394 P.2d at 187.

[13] *Id.* at 34-35, 394 P.2d at 188. See also Frank Ansuini, Inc. v. Cranston, 264 A.2d 910 (R.I. 1970); Jenad, Inc. v. Village of Scarsdale, 18 N.Y. 2d 78, 218 N.E.2d 673 (1966); Heyman & Gilhool, *supra* note 6, at 1136.

[14] 28 Wis. 2d 608, 137 N.W.2d 442 (1965), *appeal dismissed* 385 U.S. 4 (1966).

subdivision residents, statutes providing for the payment of fees to the municipality in lieu of dedication have encountered some judicial resistance. Despite the impracticality of dedication in certain cases[15] and the apparent superiority of fees as a device for equating the exaction and the social cost generated by the subdivision,[16] the characterization of equalization fees as a kind of tax has led courts to subject such statutes to searching examination,[17] often with apparently anomalous results. In *Aunt Hack Ridge Estates, Inc. v. Planning Commission of Danbury,*[18] the Superior Court of Connecticut considered an ordinance empowering the city to require land dedication within a proposed subdivision or, at the discretion of the planning commission, the collection of fees to be applied to the city treasury for general recreation purposes. The court held the dedication provision valid but nevertheless struck down the fee provision on the ground that the ordinance did not require that all moneys so collected be spent specifically for the "direct benefit" of the affected subdivision[19] but rather allowed the city to use the funds for the acquisition of park land for use by residents of the city generally.[20] If this "direct benefit" limitation is read as requiring that the moneys be spent so as to provide the residents of the subdivision with some special facility or service not available to the rest of the community in general,[21] then the validity of the dedication provision may be called into question. This anomaly rests on the perhaps common assumption that fees assessed the subdivider are reflected in higher prices for subdivision lots and thus passed on to incoming residents. Insofar as this assumption is valid (and we argue in the next section that it generally is not), the effect of equalization fees is identical to special assessments imposed directly upon the newcomers. Should these fees then be used to construct a playground at the edge of the subdivision, the "benefit" of the playground, while falling primarily upon the subdivision residents closest to it, is presumably available

[15] As, for example, when separate subdivisions are too small to permit substantial park land to be set off. See Jenad, Inc. v. Village of Scarsdale, 18 N.Y. 2d 78, 84, 218 N.E.2d 673, 676 (1966).

[16] See, p. 17-18, *infra.*

[17] See, *e.g.,* Jenad, Inc. v. Village of Scarsdale, 18 N.Y. 2d 78, 218 N.E.2d 673 (1966) (dissenting opinion); Heyman & Gilhool, *supra* note 6, 146-54.

[18] 27 Conn. Supp. 74, 230 A.2d 45 (1967).

[19] *Id.* at 77-78, 230 A.2d at 47.

[20] But see Jenad, Inc. v. Village of Scarsdale, 18 N.Y. 2d 78, 218 N.E.2d 673 (1966); Jordan v. Village of Menomonee Falls, 28 Wis. 2d 608, 137 N.W.2d 442 (1965) (approving equalization fees applied to general recreational purposes).

[21] This reading of the direct benefit requirement is apparently supported by the dissenters in Jenad, Inc. v. Village of Scarsdale, 18 N.Y. 2d 78, 218 N.E.2d 673 (1966). See also Stuart v. Palmer, 74 N.Y. 183, 188-89 (1878); Marion Bond Co. v. Johnson, 29 Ind. App. 294, 64 N.E. 626 (1902); City of Boston v. Boston & Albany R.R., 170 Mass. 95, 49 N.E. 95 (1898).

to all residents of the community, both within the subdivision and without. While the collection of fees might thus be illegal under the direct-benefit test, a similar playground constructed on land near the boundary of the subdivision dedicated to the city would, under the holding of *Aunt Hack,* pass constitutional muster.

Certainly the most probing analysis of the problems of contemporary subdivision exaction is that of the California Supreme Court in *Associated Home Builders, Inc. v. City of Walnut Creek.*[22] There the court sustained the constitutionality of a state enabling statute[23] which authorized municipalities to condition the approval of a subdivision map upon the dedication of land or the payment of fees to be used for park or recreational purposes. Associated, arguing broadly for the principle that where public facilities are enjoyed by all residents of a community rather than only by residents of a subdivision, all taxpayers ought to share in the cost of these facilities,[24] first asked the court to adopt the *Pioneer* standard that only those costs specifically attributable to the incoming subdivision population may be assessed in the form of fees or dedications. After denying that an earlier decision involving compulsory dedication, *Ayres v. City Council of Los Angeles,*[25] required such a holding, the court emphasized the growing need to preserve the state's open lands in the face of a burgeoning population, and found in the "general public need for recreational facilities caused by present and future subdivisions"[26] a sufficient basis for the statute's dedication or fee requirements under the police power. Having established the legitimacy of internalizing congestion costs through exaction as an issue of public concern, the court clarified its view as to the extent of permissible response in answering Associated's claim that assessments of this kind cannot be justified unless the "contribution will necessarily and primarily benefit" the subdivision.[27] While it is clear that the language of the statute itself obviates this issue,[28] the

[22] 4 Cal. 3d 633, 484 P.2d 606 (1971).

[23] Cal. Ann. Bus. & Prof. Code § 11546 (West Supp. 1974). It should be noted parenthetically that courts have not hesitated to void municipal dedication or fee payment requirements when these have been found to exceed authority granted under enabling statutes. See, *e.g.,* Gordon v. Village of Wayne, 370 Mich. 329, 121 N.W.2d 823 (1963); Admiral Development Corp. v. City of Maitland, 267 So.2d 860 (Fla. 1972).

[24] 4 Cal. 3d at 637, 484 P.2d at 610.

[25] 34 Cal. 2d 31, 207 P.2d 1 (1949).

[26] 4 Cal. 3d at 638, 484 P.2d at 610.

[27] *Id.* at 640, 484 P.2d at 611-12.

[28] Cal. Ann. Bus. & Prof. Code § 11546(c) (West Supp. 1974) provides: "The land, fees, or combination thereof are to be used only for the purpose of providing park and recreational facilities to serve the subdivision . . ." § 11546(e) provides: "The amount and location of land to be dedicated or the fees to be paid shall bear a reasonable relationship to the use of the park and recreational facilities by the future inhabitants of the subdivision. . . ."

court, citing *Ayres* for the proposition that the fact that the public will also benefit from the use made of dedicated land is not a ground for holding an exaction invalid, argues for a broad concept of social cost in the consideration of the propriety of exactions. First, the court points out that the constitutionality of the exaction will not turn on whether others besides the subdivision residents will derive benefit from the facilities provided by the exaction.[29] Further, and more importantly, the court suggests that exaction *may* be justified under the police power even if the fruits of the contribution are realized *not* by the subdivision residents but by the public at large:

> If, for example, the governing body of a city has determined . . . that a specific amount of park land is required for a stated number of inhabitants, if this determination is reasonable, and there is a park already developed close to the subdivision to meet the needs of its residents, it seems reasonable to employ the fee to purchase land in another area of the city for park purposes to maintain the proper balance between the number of persons in the community and the amount of park land available. The subdivider who . . . develops land close to an already completed park diminishes the supply of open land and adds residents who require park space within the city as a whole.[30]

The principal virtue of *Associated Home Builders,* and one not to be minimized, lies in its recognition and approval of the notion of congestion externalities as a basis for subdivision exactions. We argue in the next section, however, that the court's constitutional analysis overlooks some subtle but important aspects of the problem, and we suggest that case-by-case consideration of exaction problems may be a more appropriate device for the internalization of the costs generated by the creation of subdivisions than specific exaction formulae of general applicability.

III. Subdivision Exaction and External Effects: Reconciling Private and Public Interests

A. *Modelling the Problem*

From an efficiency perspective, three points are at issue:

(1) Do developers, in maximizing profits, tend to build too densely, that is, admit too many new households into a community?

(2) Do developers, in maximizing profits, set aside sufficient lands for parks and playgrounds in their developments?

(3) In those cases where developers build too densely or reserve insufficient land for recreational purposes, should communities regulate developer behavior by requiring dedication of recreational land or the payment of fees in lieu of dedication?

29 4 Cal. 3d at 640, 484 P.2d at 612 n. 5.

30 4 Cal. 3d at 640-1, 484 P.2d at 612 n. 6.

A simple model of land subdivision illustrates the conflict between developer and community interests.[31] Let the developer have a landholding of fixed size L, which he partitions into N equal-sized plots after setting aside an amount Z for public recreation. The type of housing built on each plot presumably depends upon plot size, but we assume that expected family size per plot is constant. Thus, total population of the development is proportional to the number of plots, so N is a proxy for the demands which will be placed on a public recreation area.

Suppose further that the development is small enough so that the developer is a price-taker. The price of an individual plot is given by $P(s, q; H)$, where

$s \equiv \frac{L-Z}{N}$ = size of an individual plot,

$q \equiv f(Z, N)$ = per family recreation services from a development of N plots given recreation facilities of area Z,

$H =$ a set of exogenous community characteristics, such as property tax rate, public school expenditures, public recreation facilities at other sites, etc.

We have $P_s > 0$ and $P_q > 0$, since private space and public recreation services are desirable, and it seems reasonable to assume that these are substitutes, that is, $P_{sq} = P_{qs} < 0$.[32] The second-order condition for a maximum is assured if we make the reasonable assumption that $P_{ss} < 0$ and $P_{qq} < 0$.

For purposes of simplification, we disregard the fact that the costs of providing utilities like streets and sewers depend upon the number of plots. With all costs fixed, the developer seeks a pair (N, Z) which maximizes total revenue, R, where $R = N \cdot P[s(N,Z), q(N,Z); H]$. First-order conditions are obtained by setting $\frac{\partial R}{\partial N}$ and $\frac{\partial R}{\partial Z}$ equal to zero:

$$P - sP_s + NP_q f_N = 0; \tag{4}$$

$$NP_q f_Z - P_s = 0. \tag{5}$$

Equation (4) requires that marginal revenue from an additional plot be zero, when the needed land is taken from N existing plots. The recreation area can be expanded, holding N constant, by taking a little land from each plot; according to equation (5), decreasing plot size reduces the price per plot by

[31] For a fuller exposition of this model, see Noel M. Edelson, The Developer's Problem, or How to Divide a Piece of Land Most Profitably, 2 J. Urban Econ. 349 (1975).

[32] It is apparent that the appropriate type of recreation facility depends on s. If each residence has a large yard containing, say, a swing set and outdoor cooking equipment, the public park that best complements private facilities is one consisting of wooded areas and playing fields. Smaller private plots shift the emphasis toward picnic areas and playground equipment.

the same amount as the value of additional recreation services to the N homeowners.[33]

In general, the profit-maximizing housing density and recreation area will diverge from the socially optimal (N, Z) pair. This is because the developer's objective function does not account for external costs and benefits: given Z, the greater the number of new residents, the more likely it is that they will overflow into other recreation areas, imposing congestion costs on established community residents;[34] given N, the larger Z is the more likely it is that established community residents will shift some of their demand for recreation services to the development's park facility.[35] The presumption, therefore, is that from an efficiency point of view the developer's choice of N will be too large and his choice of Z too small.

The existence of these external effects expands the relevant social welfare function from $R = NP(s, q; H)$ to $W = R - C(N, Z; H) + B(N, Z; H)$. $C(N, Z; H)$ represents congestion costs falling upon established residents, and $B(N, Z; H)$ the value of recreation services supplied to established residents by the development's facility. We define $C_N > 0$, $C_Z < 0$, $B_N < 0$, and $B_Z > 0$. Then the first order conditions associated with maximization of W are

$$\frac{\partial R}{\partial N} - (C_N + |B_N|) = 0 \tag{4'}$$

$$\frac{\partial R}{\partial Z} + (|C_Z| + B_Z) = 0 \tag{5'}$$

[33] Differentiation of (4) and the implicit function rule permit us to write

$$\frac{dN}{dZ} = \frac{-\left[P_q f_Z + s\left(\frac{P_{ss}}{N} - P_{sq} f_Z\right) + Nf_N\left(P_{qq} f_Z - \frac{P_{qs}}{N} + \frac{P_q f_{NZ}}{f_N}\right)\right]}{2P_q f_N + s\left(\frac{sP_{ss}}{N} - P_{sq} f_N\right) + Nf_N\left(\frac{P_q f_{NN}}{f_N} + f_N P_{qq} - \frac{sP_{qs}}{N}\right)}$$

Assuming that $f_{NZ} = f_{ZN} > 0$ and $f_{NN} < 0$, the denominator of this expression is unambiguously negative, but the numerator cannot be signed *a priori*. Thus, we cannot be sure that a larger public recreation area will render denser development more profitable, and so we have no reason to expect that the developer will act on his own to provide more park or recreational facilities.

[34] Of course, the larger is N given Z the smaller will be q. The associated decrease in $P(s, q; H)$ reflects both greater congestion in the development's park facility and increased travel costs for those who switch some of their visits to other community facilities. It is only this latter effect which constitutes a burden to established community residents. The *average* quality of alternative recreation facilities, less extra travel costs, determines the decline in $P(s, q; H)$ for those who switch, but it is marginal congestion costs which are relevant for efficiency. As a result, unless residents are sufficiently immobile, the social costs of increased density will not be fully internalized.

[35] The benefits in this case include both the increased recreation services accruing to established residents who shift and the reduced congestion experienced by those who do not.

From a purely formal viewpoint, the change in first-order conditions from (4) and (5) is trivial; (4′) is obtained by adding $-(C_N + |B_N|)$ to (4) and (5′) by adding $(|C_Z| + B_Z)$ to (5). Since $(C_N + |B_N|) > 0$, (4′) indicates that the developer must stop expanding the number of plots while $\frac{\partial R}{\partial N}$ is still positive, and thus $(C_N + |B_N|)$ may be regarded as a tax on increased density. Similarly, the positivity of $(|C_Z| + B_Z)$ in (5′) allows the developer to increase park space beyond the point where $\frac{\partial R}{\partial Z} = 0$, so that $(|C_Z| + B_Z)$ appears as a subsidy for increased recreation space. Note that it is marginal, not average, externalities which are relevant for efficiency, and that a congestion charge must be imposed even if actual resources are not expended in enhancing existing community facilities.

Because $|B_N|$ enters symmetrically with C_N in (4′), and B_Z with $|C_Z|$ in (5′), they are, from an efficiency standpoint, equivalent. But while it might be considered appropriate to penalize a developer for C_N and repay him for C_Z, since increments of N and Z have these effects on outsiders whether they approve or not, $-B_N$ and B_Z are more problematic entries in the social cost calculation, for they represent incremental costs and benefits that would not exist if established residents did not freely choose to use the development's recreation area. Thus, it might well be argued that the fact that an increased number of plots reduces benefits to "free riders" by more than it raises developer profits is a less compelling justification for taxing density than increased congestion at other community facilities caused by the development. On the other hand, a subsidy for B_Z, the benefits accruing to established residents due to increased park space in the development, might appear as equitable as a subsidy for C_Z.

These arguments, however, are based on the supposition that such subsidies and taxes are borne by the developer, and through him, by the ultimate purchaser of a development home. This may well not be the case. Capital theory teaches that the price of land equals the present value of net rents from the most advantageous use to which it can be put. If those net rents are altered, whether by land exactions, fees, or subsidies, the price of land should adjust accordingly. Therefore the owner of land at the time such regulations are promulgated (who may not yet be the developer and who almost certainly will not be the home buyer) will receive the capital gain or loss.[36]

[36] A uniform tax or subsidy on all buildings would probably be borne, in the short run at least, by owners of physical capital rather than land. See Peter Mieszkowski, The Property Tax: An Excise Tax or a Profits Tax?, 1 J. Pub. Econ. 73 (1972). There is little likelihood, however, that a tax or subsidy to internalize externalities will be neutral between developments.

An example may help to clarify this argument. Suppose a development is planned in a community having no statute compelling dedication or payment of fees. If finished homes will sell for $30,000 each, and total production costs of the homes are $20,000, then the developer is able to purchase land for the subdivision from its current owner for no more than $10,000 per plot. Assuming many competing subdividers, the land will be sold to the one willing to share the greatest part of his $10,000 per plot profit with the present owner of the land.

Now suppose an exaction law is passed that decreases lot size in the development and reduces the selling price of finished homes to $28,000, leaving production costs unchanged. Then it is clear that the impact of the law is principally on the present owner, since no developer will be able to pay more than $8,000 per plot for the land.[37] The burden of the exaction may be shifted to the homebuyer by setting the purchase price of finished homes at $30,000 but this will generally result in no homes being sold, since few buyers will pay $30,000 for a home worth only $28,000.[38] Internalization of the $2,000 external cost thus falls on the current owner of subdivision land.

The developer may receive a net capital gain or loss if a community statute is vague as to the tax and subsidy formulae, as for example, when a statute mandates "adequate" recreation space without more specific definition. After the land is purchased and a plat submitted, the community may determine that "adequate" recreation space is a greater or lesser amount than the developer had anticipated. If developers are sufficiently risk averse, it may pay them to obtain a preliminary ruling before purchasing the land; this procedure removes uncertainty, but the result of the ruling will presumably be capitalized into the purchase price of land. Whether or not such a preliminary ruling is sought, the developer has an incentive to invest some legal resources in achieving an interpretation closer to his profit-maximizing values for N and Z.

B. *Toward an Efficient Solution*

It is unlikely that an unambiguous formula can be devised to cover land exactions, fees, and subsidies. At the outset, it must be determined whether externalities exist, for the development may be situated so far from existing community recreation areas that there is no likelihood of reciprocal usage.

[37] This assumes that the supply of land for residential subdivision is inelastic within the relevant range, *i.e.*, if put to alternative uses, the land is worth less than $8,000.

[38] The only way the purchase price can be made to include the exaction is if *every* possible option for homebuyers includes such internalization of external effects. Since very few exaction statutes apply to residences outside subdivisions, these costs can generally be avoided by purchasing a home outside the development.

In that case, given competitive conditions, there is no efficiency rationale for interfering with the developer's choice of N and Z.

Given the existence of external effects, the difficulty is not with formulating a model but with implementing it. Internalizing congestion costs and benefits to outsiders requires two controls, as equations (4′) and (5′) make clear; by themselves, neither a tax on density nor a subsidy to recreation space can be expected to guide a developer to the socially optimal (N, Z) pair.[39] Moreover, both $-(C_N + |B_N|)$ and $(|C_Z| + B_Z)$ are likely to be nonlinear in N and Z, since the incentive to use recreation areas operates through $q = f(N, Z)$. Thus, a constant tax per unit of N and subsidy per unit of Z, a type of formula which is easily communicated and understood, is unlikely to be optimal.

The fungibility of fees in lieu of land dedication argues for their superiority to land exaction. A developer can be counted on to provide the recreation space his purchasers are willing to pay for. These concerns, and the possible nonlinearities of external effects, argue for a system of fees based on density which reflects marginal congestion costs, with the community purchasing additional recreation space at a convenient location. There is no reason for the revenue from fees to equal the cost of supplementary land purchases, since the price of this land needn't bear any relationship to the external costs

[39] Suppose, for example, that the community requires a developer to dedicate m units of recreation space per plot. The developer then faces a constrained maximization problem:

$$\underset{N,Z}{\text{Maximize}} \quad N \cdot P(s, q; H)$$
$$\text{Subject to } mN \leqslant Z$$

Forming the Lagrangean, $L = NP(s, q; H) + \lambda\,(Z - mN)$, we have these first order conditions:

(1) $P - sP_s + NP_q f_N - \lambda m = 0.$

(2) $NP_q f_Z - P_s + \lambda = 0.$

(3) $Z - mN \geqslant 0.$

If the constraint is binding, *i.e.*, if $\lambda > 0$, the developer will choose a smaller number of plots than in the absence of the dedication requirements. Letting $\hat{N}$ denote the constrained density, we have $\hat{Z} = m\hat{N}$. Equation (1) tells us that $\hat{Z}$ exceeds the recreation space which the developer would freely choose at $\hat{N}$.

It is conceivable, however, that $\hat{Z}$ may be smaller than the unconstrained value for Z: this can occur if the elasticity of N with respect to m is large enough, since $\frac{d\hat{Z}}{dm} = \hat{N} + m\frac{d\hat{N}}{dm}$, and $\frac{d\hat{N}}{dm} < 0$. In any case, even if the community sets m so as to induce the developer to select the socially optimal density, there is no assurance that m multiplied by that density will equal the socially optimal value for Z.

represented by the fees, and thus it would be better not to earmark receipts in a special fund. Nor, as we have seen, is there any presumption that it is efficient for the additional recreation space to be reserved exclusively for development residents.

This scheme is not completely optimal, for it does not credit the developer directly for recreation space provided: given N, a development with larger Z will induce fewer of its residents to use existing community facilities. Nor is compensation paid *directly* to existing residents, whose utility from community facilities is diminished by increased density of development. Rather than trying to implement the full system of fees and subsidies, a realistic compromise would be to apply different formulae for density fees depending on how far the development was situated from existing recreation areas. Although the development's residents have a greater need for recreation space the more distant their location, it is in the developer's interest to respond to that need; the density fee schedule should be *lower* in that case, owing to the lesser likelihood of external benefits and costs.

A Final Remark

It is useful to note the relationship between the analysis presented here and two other classes of common "externality" problems. The first concerns situations where the external effect is the actual degradation of the physical environment itself, as in the case of air pollution. The fixed nature of resource involved and the problems of forming an optimal sharing group of users with conflicting purposes suggest a conceptual approach along the lines of the model of Section I.

A second class of problems involves the provision of more critical local public services, such as public schools.[40] Here, as is also true of the first class of problems, analysis is made somewhat easier by the absence of reciprocal externalities, that is, effects of the kind we have called "benefits to outsiders" arising from the influx of new residents. Difficult issues are raised, however, by the relative importance of pecuniary externalities in these cases resulting from the greater public expenditures involved, and by the sometimes tenuous relationship between benefits conferred and taxes paid. Moreover, when families respond to tax prices rather than the resource costs of extending services to them, optimal location becomes as important an issue as optimal group size.[41]

[40] A substantial literature has arisen dealing with the question of whether property taxes paid on private homes cover the costs of extending local public services to the occupants. See, *e.g.*, Ruth L. Mace & Warren J. Wicker, "Do Single Family Homes Pay Their Own Way?" (Urban Land Institute, Res. Monograph No. 15, 1968).

[41] See, *e.g.*, Noel M. Edelson, Budgetary Outcomes in a Referendum Setting, in Property Taxation and the Finance of Education (Richard W. Lindholm, ed. 1974) [also available as Discussion Paper No. 244, Economics Dep't, Univ. Penn., 1972].