Socioeconomic Considerations of Road Impact Fees

ARTHUR C. NELSON AND THOMAS W. SANCHEZ

Unsophisticated applications of road development impact fees have adverse socioeconomic impacts. This occurs when road impact fees are not calibrated to account for variation in household commuting trip lengths by household income proxied by house size in square meters, or when such fees do not account for the variation in work trip generation rates by house location with respect to transit station distance. The purpose of this study is to indicate in what ways unsophisticated fees have adverse socioeconomic effects and pose reasonably straightforward ways in which to correct for those effects. Failure to make these adjustments could lead to inequitable and inefficient road impact fee programs that may result in more fiscal harm than good.

Development impact fees are one-time charges assessed against new development to generate new revenue to pay for new or expanded facilities to accommodate this new development. By some estimates, more than $1 billion annually is collected from transportation facility development impact fees (*1*).

To pass judicial muster, development impact fees should be consistent with several criteria (*2*). First, local governments must be able to reasonably associate new development with the need to expand facilities. Second, the cost of new or expanded facilities needed to accommodate new development must be reasonably estimated. Third, the share of such cost that may be financed from extrajurisdictional sources and locally dedicated or available funds must be accounted for. The result of these steps is the impact cost associated with new development. A final step estimates the present value of the stream of past and future tax payments that may be made by new development to help finance new or expanded facilities. These "credits" are subtracted from the impact cost to yield the impact fee level that should be assessed.

In the context of road impact fees, defensible impact fees are driven by the following general formula:

$$\text{Fee}_i = [(\text{Trips}_i)(\text{Trip Length}_i)(\text{Cost/Trip km})] - \text{Credits}_i$$

where

Trips_i = peak hour or average daily new trip generation by land use i,
Trip length_i = average new trip length by land use i,
Cost/Trip km = cost per trip kilometers of highway capacity, and
Credits_i = revenue credit per trip km by land use i.

A critical factor in this formula is the nature of the land use being assessed. Impact fees for nonresidential land uses are typically calibrated by the size of development, usually in units of floor area. For instance, as new trips and trip lengths vary by kind and size of shopping centers, so should the impact fees levied.

For residential impact fees, the situation is entirely different as fees are usually calculated on a purely per unit basis, although the type of residential use may be categorically differentiated as being single family or multifamily. When road impact fees are calculated in this manner, two important socioeconomic impacts are possible:

- House size regressivity
- Mode split inequity.

HOUSE SIZE REGRESSIVITY

Consider single family detached homes. The standard road impact fee formula is based on the trip generation and trip lengths for the average single family home within a community. Obviously, this means that certain types of single family homes that generate more trips or longer trip lengths than average are subsidized by single family homes that generate fewer trips or shorter trip lengths than average. This could mean that larger homes located farther away from work centers are subsidized by impact fees paid by smaller homes located closer to work centers. Moreover, homes located away from transit facilities—typically larger and more expensive homes—are likely to generate more and longer trips than homes located closer to transit facilities—typically smaller and less expensive homes. In effect, road impact fees based only on the average size of a single family unit are regressive because lower valued homes occupied by lower income households with smaller road impacts pay proportionately more than higher valued homes occupied by higher income households with greater road impacts.

We tested these general assertions using the 1985 *American Housing Survey* (AHS). The 1985 AHS national sample is the most complete source of information on household socioeconomic characteristics and commuting behavior. Although the 1990 *Nationwide Personal Transportation Study* and the 1990 *Detailed Census of Population and Housing* are more recent and larger samples, neither of these data sources can be used to correlate total household commuting distance to house size. The 1985 AHS is also decomposable into reasonably small geographic units. For this example, we selected those 1985 AHS records representing owner-occupied housing units located within the urbanized portions of metropolitan statistical areas but outside central cities. These households represent the urbanized suburbs.

Four variables are used: (1) total household commuting distance, which is the sum of each respondent's estimated commuting distance by household; (2) total household income; (3) house size in

A. C. Nelson, Georgia Institute of Technology, Atlanta, Ga. 30332-0155.
T. W. Sanchez, Iowa State University, Ames, Iowa 50011-3095.

TABLE 1 Commuting Distance and Socioeconomic Relationships

Dependent Variable	Independent Variable: House Size, Square Meters	Household Income	House Value
Total Commuting Distance	1.2087 (t = 1.722) (n = 6,217)		4.3297 (t = 9.127) (n = 6,475)
House Size, Square meters		32.8868 (t = 28.808) (n = 8,458)	49.5017 (t = 40.845) (n = 8,616)
Household Income			16277.401 (t = 43.202) (n = 8,865)

Source: *American Housing Survey 1985*, national sample of owner-occupied households in urbanized areas of metropolitan statistical areas outside of central cities. Includes multiple wage earner-commuter households. Independent variables were transformed to natural logarithms.

square meters; and (4) self-assessed house value. Table 1 shows the following relationships.

We found that:

- Household income is positively associated with house value.
- Household income is positively associated with house size in square meters.
- House size in square meters is positively associated with house value.
- Total household commuting distance is positively associated with house value.
- Total household commuting distance is positively associated with house size in square meters.

Suppose a local government has a peak hour–based road impact fee of $60 per trip km, the average one-way commute trip is 27.4 km, and the peak hour trips generated per home is 1.0. This is just slightly less than the 1.02 reported by the Institute of Transit Engineers (*3*). Table 2 demonstrates the regressive effect of such a fee basis. It also shows what a fee should be if based on single family house size.

MODE SPLIT INEQUITY

It is almost axiomatic that the closer a home is to transit the more likely that it will use transit. It is equally axiomatic that such a home is less likely to generate automobile trips. Most road impact fee programs do not consider the rate of public transit use with respect to transit station distance. Thus, single family homes constructed near transit stations are not credited for their reduced impact on roads.

Table 3 illustrates this relationship for one urban county, DeKalb County, Georgia, which is served by the Metropolitan Atlanta Rapid Transit Authority's (MARTA) heavy rail system. Data are from 323 block groups as defined for the 1990 Census. The dependent variable is the percent of total work trips generated by households using nontransit modes. The independent variable is the distance of block group centroids from the nearest MARTA heavy rail transit station. This is easily measured using Atlas*GIS, a desktop geographic information system (GIS), with census TIGER files for DeKalb County and geocoded MARTA transit stations. Figure 1 shows block group proximity to transit stations as measured with the GIS. Table 4 applies these trip generation adjustment factors to transit station distance. There is an apparent relationship between transit station accessibility and automobile-related work trip

TABLE 2 Subsidy Gains and Losses by House Size

House Size in Square Meters	Trip Km	Standard Impact Fee	House Size-Based Impact Fee	Subsidy Gain (Loss)
50	7.3	$1,650	$438	($1,212)
100	14.7	$1,650	$882	($828)
150	22.0	$1,650	$1,320	(330)
200	29.3	$1,650	$1,758	$108
250	36.7	$1,650	$2,202	$552
300	44.0	$1,650	$2,640	$990
400	58.7	$1,650	$3,522	$1,872
500+	73.4	$1,650	$4,404	$2,754

TABLE 3 Automobile Work Trip Reduction Associated with Transit Distance

Regression Measure	Result (natural log)	Result (linear)
Constant	0.83537	0.85316
Standard error	0.09411	0.09814
R-Squared	0.2108	0.1417
Observations	323	323
Coefficient (km to station)	0.0555	0.0171
Standard error	0.0059	0.0015
T-ratio	9.261	7.280
Significance	< .0005	< .0005
Mean dependent variable	.906	.906
Mean independent variable	1.267	4.910
0 km from MARTA Station	83.5%	85.3%
1.5 km from MARTA Station	85.8%	86.9%
3.0 km from MARTA Station	89.6%	88.5%
4.5 km from MARTA Station	91.9%	90.1%
6.0 km from MARTA Station	93.5%	91.7%
7.5 km from MARTA Station	94.7%	93.4%
9.0 km from MARTA Station	95.7%	95.0%
10.5 km from MARTA Station	96.6%	96.6%
12.0 km from MARTA Station	97.3%	98.2%
13.5 km from MARTA Station	98.0%	99.8%
15.0 km from MARTA Station	99.0%	100.0%

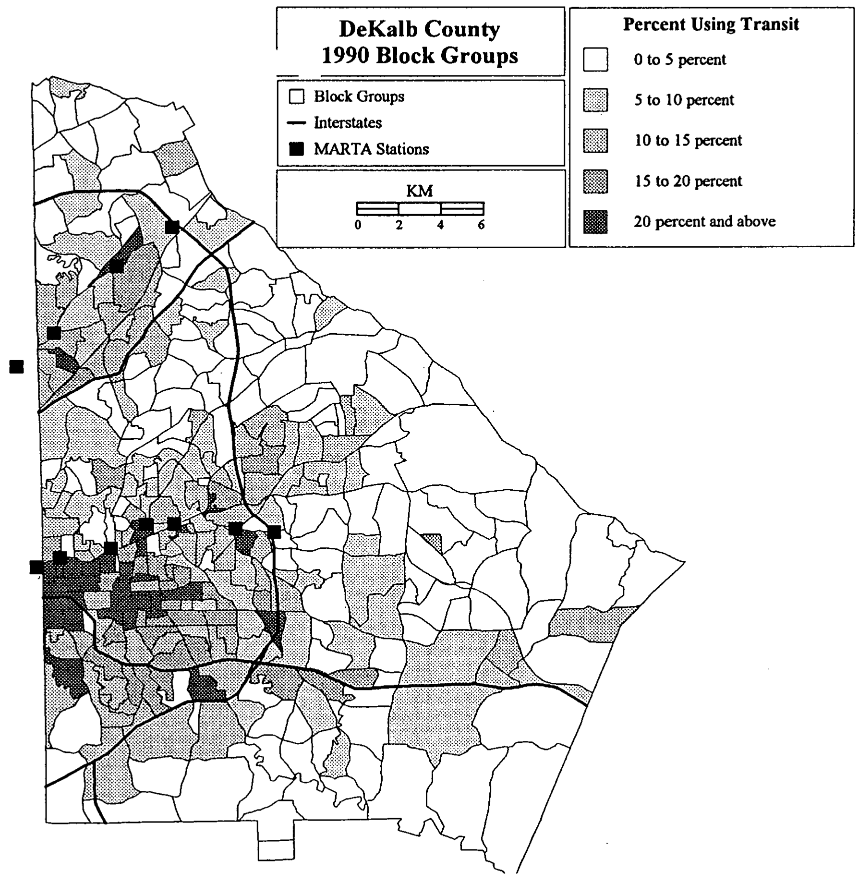

FIGURE 1 Block group proximity to MARTA transit stations.

TABLE 4 Effect of Transit Station Distance on Road Impact Fee

Block Group Distance	% Above Ave. Auto Work Trips Generated by Home	Standard Impact Fee	Distance to Station-Based Impact Fee	Subsidy Gain (Loss)
0 km	-7.0	$1,650	$1,534	$116
1.5 km	-5.0	$1,650	$1,571	$79
3.0 km	0.0	$1,650	$1,634	$16
4.5 km	1.0	$1,650	$1,671	($21)
6.0 km	3.0	$1,650	$1,698	($48)
7.5 km	4.0	$1,650	$1,718	($68)
9.0 km	5.0	$1,650	$1,735	($85)
10.5 km	6.0	$1,650	$1,749	($99)
12.0 km	7.0	$1,650	$1,761	($111)
13.5 km	7.0	$1,650	$1,772	($122)
15.0 km	8.0	$1,650	$1,782	($132)

generation, which is then logically related to the road impact fee level that should be assessed.

COMBINING SOCIOECONOMIC FACTORS

The coefficients of a bivariate regression equation can be used to refine road impact fee calculations to account for the effects of house size and house distance from public rail transit stations on road impacts. The formula would be:

$$\text{Fee}_i = (\text{Square meters}_i * 0.1468 * \text{Cost/Trip km}) * \{0.835 + [\ln(\text{Transit Station distance}_i) * 0.0555]\}$$

For example, the impact fee for a 100-m^2 house located 1.5 km from a transit station would be:

$$\text{Fee} = (100 * 0.1468 * \$60) * [0.835 + (.4055 * 0.0555)] = \$755$$

The impact fee for a 400-m^2 house located 12 km from a transit station would be:

$$\text{Fee} = (400 * 0.1468 * \$60) * [0.835 + (2.48 * 0.0555)] = \$3{,}427$$

POLICY IMPLICATIONS

Standard road impact fee methodologies do not account for the effect of house size variation or transit station access variation on road impacts. The result is that most road impact fees are regressive with respect to house size and inequitable with respect to access to public transit. This further results in smaller homes built for lower income households located near transit stations subsidizing larger homes built for higher income households located farther away from public transit stations.

Road impact fee methodologies should be adjusted to reflect at least these two socioeconomic considerations. In addition, impact fee credit calculations should also account for variations in tax contributions (sales, gasoline, and property) by household type and location. These adjustments are relatively easy to make, as demonstrated in this study. It is possible that in the absence of such adjustments, road impact fees in certain situations may contribute to urban fiscal disparities already witnessed by many metropolitan areas in the United States.

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