

FULL COMPENSATION IN URBAN ROADWAY CONSTRUCTION: A NECESSARY AND PRACTICAL OBJECTIVE

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For there to be full compensation to all individuals and groups, all costs and benefits must be disaggregated and distributed accurately by geographical location, by social class, and over time. Full compensation for those displaced is possible, or very nearly possible, because of recent changes in legislation, in particular, the Relocation Assistance Act of 1970 and the Highway Act of 1970. But full compensation for people and institutions not displaced but disrupted cannot now be funded by federal or state highway building programs. Voids in existing knowledge of impact should be filled by (a) research in specific problems that might be called "consequential" research, (b) research in how communities (urban regional subareas) function and in what the effect of change is on members of communities, (c) research in regional function and regional change, in particular, in differential effects of differential accessibility, and (d) accurate records keeping on the impact of highway construction. Helpful legislation includes (a) creation of an impact zone within which "negotiated takings" are permissible; (b) payment of "consequential damages" for specified takings particularly in the impact zone; (c) investment of modest costs in the healing of the roadway-community edges; (d) requirement that scarce resources be replaced in kind; (e) provision of community planning money as part of the highway location and design process; and (f) distribution of the major share of Highway Trust Fund moneys directly to the states and directly to the major Standard Metropolitan Areas that generate them, with wide discretionary powers in the allocation of those funds, particularly the local matching shares.

•THAT expropriation practices do not provide full payment for "taking" is generally recognized. According to Allard (1),

...verdicts (by juries) are usually higher than the value of the taking as estimated on the basis of fair market value.... If the verdicts which have been rendered by juries in land-condemnation cases are an accurate measure, then another method to properly measure just compensation, aside from the fair market value concept, must be found.

In an excellent, pragmatic description of this problem sponsored by the Highway Research Board, Vance (2) cites *Monongahela Naval Company v. United States*, "Just compensation, it will be noticed, is for the property, and not to the owner." He goes on to list 9 specific losses to displaced persons (2):

The "payment for property taken" rule, as set forth in *Monongahela*, has been interpreted to deny payment for incidental losses or expenses incurred by property owners or tenants as a re-

sult of the taking of real property. Thus in the absence of a statute expressly so providing and authorizing, the courts have consistently denied recovery for, inter alia, the following losses and expenses:

1. The cost of moving personal property and the cost of disconnecting, dismantling, and re-installing structures, machinery, and equipment.
2. Transportation costs and other expenses incurred in moving a displaced family to replacement housing and the expenses incurred in searching for replacement housing or other types of property.
3. Expenses incidental to the transfer of title to real property required by the Government, such as recording fees, clerk fees, transfer taxes, etc.; penalty costs for prepayment of a mortgage and real property taxes paid to a taxing entity which are allocable to a period subsequent to the transfer.
4. Loss of going concern value, goodwill, or livelihood, where a business cannot relocate without a substantial loss of its patronage; or the loss incurred due to business interruption.
5. Loss of employment due to the relocation or discontinuance of a displaced business.
6. The increased cost necessary to acquire a substitute home, farm or business, or the increased cost of rent for a substitute dwelling or other property.
7. The loss of rental or other income between the time of announcement of a public improvement and the time of taking.
8. Loss of home ownership because of inability to obtain financing within the financial means of the displacee, or the loss of opportunity to continue in business.
9. Loss due to less favorable financing in acquisition of replacement housing.

See: *Mitchell v. United States*, 267 U. S. 341, 69 L. Ed. 644 45 S. Ct. 293 (1925); *United States ex. rel. T.V.A. v. Powelson*, 319 U.S. 266, 87 L. Ed. 1390, 63 S.Ct. 1047 (1943).

Vance cites *Mitchell v. United States*, "States not infrequently directed the payment of compensation in similar [loss of business as a result of taking] situations," and *Joslin Manufacturing Company v. Providence* (a crucial case to impact legislation), which ". . . is significant in firmly establishing the constitutionality of state legislation which authorizes the recovery of consequential damages."

Justice Holmes (then Chief Justice of the Massachusetts court) spoke of the inequities of compensation law in his much-quoted instruction: "It is not forbidden to be just in some cases where it is not required to be by the letter of paramount law" [*Earle v. Commonwealth*, 180 Mass. 579, 582-83, 63 N. E. 10 (1902)].

CASE FOR FULL COMPENSATION

Full compensation, which is not now a public objective, is necessary, by definition, for fairness. It is also necessary for good transportation network design and construction. When part of the project costs are carried by individuals and groups displaced and disrupted, rather than included in project budgets, network analysis and design will be flawed.

If inaccurate cost calculations will distort networks, they will also distort modal distribution. Therefore, those concerned not with a single mode but with transportation in the large will be particularly concerned that full compensation be achieved.

Similarly, people, whose central concern is not transportation as transportation but those urban land uses that urban transportation exists to serve, will be concerned that inaccurate transportation cost calculation does not distort land development.

An important side benefit of full compensation policy is that it creates the tools for, and the atmosphere for, open and continual discussion of roadway alignments and design with the people most directly affected. Such continual communication is, in fact, necessary to implement full compensation designs.

The East River Drive, one of the most technically difficult highways ever built, is a demonstration of the effectiveness of full compensation in eliciting community consent to public construction that includes expropriation (3). All design and condemnation decisions were discussed with affected owners (the one house that was taken was rebuilt brick-by-brick over the East River Drive, 5 of Miss Anne Morgan's 6 poplar trees

were saved, and she was given 2 Oriental plane trees for the sixth). Little old ladies painted water colors of the highway construction, gave teas for the engineers, and generally behaved differently from the people in the pathway of today's urban Interstate extensions. The experience of the author of this paper is not quite that idyllic. But the record of a large number of public meetings suggests that a direct relation exists between the usefulness of the meeting and the extent to which technicians could promise that all costs would be paid.

The principle is stated succinctly by the American Association of State Highway Officials (4, p. 24): "Agreement can be reached by having representatives of each group participate in the various stages of planning, location and design." Such negotiation and such planning, however, are useless if the objective is simply to determine the "least bad" highway.

It is reasonable to believe the AASHO policy is sound and that most of the problems can be made to disappear if each problem is negotiated with the person or group affected and if it is clear that the objective is full compensation.

RECENT LEGISLATION AND POLICY CHANGES

Full compensation is not only necessary but also operationally practical, and much of the groundwork for policy changes has been laid. This groundwork has been largely initiated by the Federal-Aid Interstate Highway Program, and it may eventually be seen that the Interstate System's considerable technical achievement is exceeded by its contribution to environmental design.

Full compensation for people and institutions displaced is the implied objective of recent court cases and legislation. The Uniform Relocation Act of 1970 and the Highway Act of 1970 would seem to make it possible to compensate all displacees (with the possible exception of small, marginal businessmen and certain tenants).

But the problem of impact on the persons and institutions not displaced but disrupted remains. To compensate for disruption requires that the law define "goods" other than real property and recognize that society is gradually coming to believe that the taking of such goods, both public and private, also should be compensated.

Legal literature is increasingly concerned with compensation. Michelman, in a classic monograph (5), opens his case for "fairness" with an austere dictum from Hobhouse, "... a rational social order cannot base the essential happiness of forty million of men on the misery of one," and a quote from Holmes, "... a government ought not be called civilized if it sacrifices the citizen more than it can help." He decides the 2 positions are commensurate.

Michelman makes the conventional assertion that a government can take property when "... the society is acting rationally in the sense that the new condition of resource employment will produce a greater amount of 'welfare' than the old one did..." and measures a greater amount of welfare by efficiency tests, defining a proposed change as efficient if "... after negotiated compensation has been promised by those who stand to gain from the proposal to those that stand to lose from the proposal, the proposal can win unanimous approval." He, of course, recognized that unanimity is a goal that can be approached but never attained, but he also recognizes the principle of unanimity to be the essential foundation of just compensation.

To define "taking," he first defines "goods": "... all of these land uses are productive of goods which are part of society's sum total of goods: the foundry manufactures are such goods; so is household shelter; so is the use of a neighboring gathering or play space; so is the serenity which emanates from a quiet, shaded street."

FULL COMPENSATION IS PRACTICAL BY DISAGGREGATING BENEFITS AND COSTS

Although the aggregate benefit-cost analysis of networks is important, such aggregate analysis has masked the fact that both costs and benefits are unevenly distributed and that for many individuals and groups the costs are very much larger than the benefits. Therefore, for full compensation, all costs (and benefits) must be disaggregated and distributed accurately by geographic location, by social class (6, 7, 8, 9, 10, 11, 12), and over time (13).

With regard to geographic location, costs will be concentrated within the right-of-way and along the neighborhood edge. Similarly, benefits, such as increases in value of underdeveloped land, will be concentrated near the highway. (But one of the few "value premises" about which there can be no debate is the proposition that any system element that improves the regional transportation system will at the same time reduce average land values in the region.)

Many sources document the distributional effects, by social and economic class, of transportation improvements. That displacement costs bear more heavily on low-income families than on high-income families also is confirmed by their different views of the discount rate. And any transportation element that improves private automobile transportation without at the same time improving public transportation rather automatically increases the transportation costs for all public transit riders in the region.

With regard to time, Wingo states (13):

A plan begins to accrue costs and benefits from the first moment that it influences the behavior of a firm or individual. The total time stream of cost and benefits must be summed up in some fashion and the abandonment of conflicting goals appraised....For the critical question is not only how much the community is prepared to give up to realize the goals implicit in the master plan but who gives up how much so that the fruits of the plan can be realized—quite frequently by others. This perspective has led the uncritical liberal to the implicit conclusion that the importance of the social goals realized by the planned transportation of urban environments always outweighs the current individual and group values which must be foregone. It is by no means obvious that this is the case.

The following is a simple and common example: The taxpayer whose tax rate increases when the right-of-way takes land off the market is often not the same taxpayer who gains, later on, if and when the highway increases the city tax base. A straightforward solution to this tax problem would lend money to communities equal to taxes lost each year by right-of-way taking, the interest and principal payments to begin when the highway is completed.

Full compensation, which requires double-entry bookkeeping in public accounting, also requires institutionalized procedures for calculating and paying disaggregated costs and for calculating and assigning disaggregated benefits. There is a consensus that such accurate accounting is difficult. But it is a basic premise of welfare economics (or of any investment policy) that no investment be made that will not bring a return, in dollars or other benefits. Therefore, a rational society requires that the large number of investors in small amounts of gasoline and excise taxes should show a clear profit on their investment in highways. It is important that this be done. It is even more important that the larger investors—the people investing in homes, businesses, or a way of life—should show a profit on their investments.

Equation 1 given below expresses a basic premise of benefit-cost analysis: The benefits must be larger than the costs to justify the investment.

$$\sum (B_u)_n / \sum (C_u)_n = 1.0 + (P)_p \quad (1)$$

where

- (B_u) = user benefits,
- (C_u) = user costs,
- (P) = profit rate, and
- $()_p$ = a probability coefficient.

Aggregation is necessary because n is very large; it is reasonable because the individual (B_u) and (C_u) are small.

This discussion includes nonuser benefits (B_{nonu}) and nonuser costs (C_{nonu}) , and the second basic equation becomes

$$[(B_{nonu})_n / (C_{nonu})_n = 1.0 + (P)_p] \quad 1, 2, 3, \dots, n \quad (2)$$

Disaggregation of nonuser accounts is possible because the nonuser n is relatively small; it is necessary because the (B_{nonu}) and the (C_{nonu}) are in many cases very large.

For full compensation to obtain, then, in Eqs. 1 and 2, the rate of profit (P) must be a positive number. [It is common when Eq. 1 is used to require that (P) be relatively large, because $(\)_p$ is likely to be low. However, in Eq. 2, with careful administration of appropriate legislation, $(\)_p$ is likely to approach 1.0 and (P) can be relatively small.]

This is the basis for that more rational public policy that would require, at the minimum, all individuals or groups displaced or disrupted to be "made whole." In fact, they should be overcompensated.

It is apparent that the seemingly utopian view—that displacement should be seen not as a problem but as an opportunity (14)—is rooted in rationality.

The rest of this discussion examines (a) disaggregated costs and benefits by category of impact, using Michelman's more inclusive definition of "taking" and of "goods" [the categories are taken from Section 136(h) of the Highway Act of 1970], and (b) legislation aimed at full compensation. The Highway Act requests information on "the costs of eliminating or minimizing" 17 effects of highway construction. To eliminate or minimize these effects it is necessary, for each category and for each individual and group, first, to determine the magnitude of the effect; second, to calculate the costs incurred and the benefits derived; and, third, to pay the costs (and to collect the benefits) in dollars or in compensation in kind, or to eliminate or minimize the costs through careful and imaginative design.

NECESSARY RESEARCH AND LEGISLATION

These 3 tasks are not easy, but they are far from impossible. The necessary work has been outlined in existing research, most of it either influenced or sponsored directly by the U. S. Department of Transportation, in particular the Federal Highway Administration, and most of the research has been developed in detail.

The straightforward task of abstracting this existing impact research is an activity from which, for small investments, the Department of Transportation would reap large returns. A too cursory summary of this research is (with the direct experience of the author) the foundation on which this paper is built.

The voids in completed, necessary research fall primarily into the following categories:

1. Research on specific problems that might be called "consequential" research. For instance, the distribution of pollutants around a transportation artery generating those pollutants is not well understood. However, methods for attacking this problem exist and are straightforward.
2. Research on how communities function and on the effect of functional change on members of communities (communities being broadly defined as subsectors of urban regions). This fundamental social and environmental research would have significance far beyond transportation planning.
3. Research in regional function and change and, in particular, in different effects of different regional accessibilities. For instance, the differential effects on regional growth of 2 different mixes of private vehicular and public transportation modes is a subject on which much has been said but about which little is certain. As with research in community function, such research would be useful far beyond transportation planning.
4. Research that involves keeping accurate records on the impact of highway construction and other forms of public investment. In fact, such records are essential to most research. There should probably be an independent agency charged with recording impact of the work by the Departments of Housing and Urban Development, Transportation, and Interior and other government agencies. Complete records on the history of displaced homeowners, for instance, would be part of this undertaking.

Table 1 gives a summary of the research necessary to "determine the cost of eliminating" the categories of impact described in the Highway Act.

Although recent legislation has been effective in closing the gap between partial and full compensation for displaced individuals, at least the legislation given in Table 1 by

Table 1. Impact research necessary to determine costs of eliminating or minimizing impacts.

Impact	Research				Legislation					
	Category 1	Category 2	Category 3	Category 4	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
Pollution										
Air	X	-	-	-	X	-	X	-	-	X
Noise	X	-	-	X	X	X	-	-	X	X
Water	-	-	-	X	-	X	X	-	X	X
Destruction or disruption of										
Man-made resources	-	X	-	X	X	-	X	X	X	X
National resources	-	X	-	X	X	-	X	X	X	X
Aesthetic values	X	X	-	X	X	-	X	X	X	X
Community cohesion	X	X	-	X	-	-	X	X	X	X
Availability of										
Public facilities	-	X	-	X	-	-	-	X	X	X
Services	-	X	-	X	-	-	-	X	X	X
Adverse employment effects	X	X	X	X	-	X	-	-	-	X
Tax losses	X	X	-	X	-	X	X	-	-	X
Property value losses	X	-	-	X	-	-	X	-	-	X
Displacement of										
People	-	X	-	X	X	X	-	X	X	X
Businesses and industries	-	X	X	X	X	X	-	X	X	X
Farms	-	-	-	X	X	X	-	-	X	X
Disruption of desirable										
Community growth	-	-	X	X	-	-	X	X	X	X
Regional growth	-	-	X	X	-	-	-	-	X	X

X = research necessary to clarify impact or legislation necessary to correct or pay for impact.

categories that are discussed below is necessary to make full compensation possible for individuals not displaced but disrupted. [It can be seen from the first legislative proposal (suggesting "negotiated takings") that it may be essential to make impact legislation operational, so that full compensation for displaced owners will be possible.] The objective of all such legislation should be identified as being full compensation of all consequential damages; that is, all public project costs should be carried not by individuals and groups displaced and disrupted but as part of project budgets. The legislative categories are described in the following.

1. An "impact zone" should be recognized that bears a relation to disruption that the right-of-way bears to displacement. It might be defined in various ways: a fixed distance from the pavement edge, say $\frac{1}{2}$ mile, or different fixed distances for different impacts (noise, air pollution, visual environment, second order traffic impact, or community cohesion). The impact zone might be set in each case by the highway building agencies and the community planning agencies. The real "zone" clearly will vary with the impact. For most impacts, a practical zone would include only properties adjacent to the right-of-way (16).

Matheson (16) describes 3 types of excess condemnation authority:

...depending upon the situation of the land and the purpose of the condemnor: (1) protective, (2) remnant, and (3) recoupment. In protective condemnation, the condemnor acts to protect the utility, safety, and beauty of an improvement by taking adjacent land, often for resale to private persons on condition that future owners refrain from injurious uses of the property. In remnant condemnation, the condemnor needs only a portion of a parcel for an improvement, but takes the entire parcel to avoid leaving a useless remnant or the payment of severance damages. In recoupment condemnation, the condemnor takes land benefited by the proposed improvement to recoup the value of such benefits through resale to private persons.

He states that the definition of "public use" is becoming more inclusive:

...as the need for governmental involvement in private activities began to expand, many courts began to accept as "public" any use which substantially contributed to the general utility and facilitated the achievement of public purposes, even though private interests might incidentally benefit from the process. [In *Redevelopment Agency v. Hayes*] ...the court appeared to accept the proposition that the beneficial effect of the taking rather than the actual use of the property after taking might justify condemnation.

...in accordance with the present thinking of California courts on the general problem of public use, it would seem that excess condemnation is valid where the public will derive such a benefit from the contemplated private use, or from the taking itself, that any private benefit can be regarded as "merely incidental."

Matheson recommends single, uniform provisions for protective and remnant takings:

The protective section should provide for: (1) protective taking authority for all condemners without distance limitation, (2) judicial power to inquire into the necessity of all protective takings for the purpose of resale, and (3) a right of first refusal by the condemnee on dispositions of excess land by the condemner. The remnant section should provide for: (1) remnant-taking authority for all condemners for physical and "financial" remnants and in all other cases where "excessive" severance or consequential damages are threatened, (2) a post-verdict election for condemners between the taking of the entire parcel or only the part needed, (3) a post-verdict election for condemnees to avoid the taking of the entire parcel through the waiver of any "excessive" damages, and (4) judicial power to inquire into the necessity of all remnant takings for the purpose of resale.

Legislation should permit negotiated takings of real property, with all relocation benefits, within the impact zone; that is, if the owner wants to be taken, he should be taken. Such action has several times been upheld by courts (15). According to Strobin (15):

It is to be noted, however, that statutory provisions expressly or impliedly requiring the consent of the owner to the excess condemnation have been recognized to be within the power of the legislature. In the following cases [5 such cases are listed], the right to take an amount of property admittedly not needed for the particular improvement was looked upon with approval by the court where either the statute expressly or impliedly required consent to the taking, or the owner manifested such consent....

It is the advantage of the "negotiated taking" rule that the question of impact would be settled by the owner; if the assertion is correct that, given the will to do so on the part of the agencies, displacement can be fully compensated, the informed owner (16) is bound to break even. The highway building agencies, in turn, would be able to take advantage of the increase in values that the highway brings to the property; if there is a decrease, the losses will be put on project budgets where they belong. Given this form of compensation, the exact limits of the impact zone are not critical, and "a fixed distance from the pavement edge" would probably be a useful definition.

2. Specific consequential damages to persons and properties, whether displaced or not displaced but left in the impact zone, should be paid. Such legislation should list damages and include administratable formulas for paying them. A way of paying for compensation for loss of goodwill, for instance, is described in the Harvard Journal of Legislation (17).

Goodwill itself is by definition the extra income a business receives over and above the return that would be expected on its physical assets. In compensation for the loss of goodwill, the object should be to replace the loss with a similar stream of income. This stream of income can only be replaced by compensating the owner with a lump sum which will return an amount of interest equal to the loss.

The Act suggests formulas for compensating both owners who permanently discontinue business and owners who continue. It establishes maximum payable damages.

It would be an unreasonable hindrance to eminent domain proceedings to permit an injured business with negligible physical assets to receive damages under this act in excess of ten times its average earnings prior to the taking. On the other hand, it would be unreasonable to limit an injured business with considerable physical assets and relatively small average earnings to a recovery less than an amount equal to the value of its physical assets. By establishing a maximum this section protects the interests of the condemning authority; by making the maximum the greater of ten times the average earnings of the injured business or an amount equal to the value of the physical assets of the injured business this section protects the interests of the injured business.

And a lump sum settlement, say 5 percent of "fair market value," should be awarded to all residential properties abutting the right-of-way, but within unacceptable noise zones or unscreened from the highway. [Joslin Mfg. Co. v. Providence, 262 U. S. 668, 67 L. Ed. 1167, 43 S. Ct. 684 (1923) authorizes recovery for various consequential damages, including "damages due to the decrease in value of lands not taken, but contiguous to lands taken"; (15).]

3. Section 319 of the Highway Act should be implemented and made operative in urban areas to heal the "aesthetic" problem of the roadway and community edge; that is, up to 3 percent of construction costs should be provided out of the Highway Trust Fund for environmental design (dense tree masses, strip parks, parcel remnants, extended takings, walls, earth mounds, irrigation, and the like). Design procedures and specific designs should be developed and applied automatically in the same way that street trees are planted along city streets. Useful models exist including those for early urban freeways such as the George Washington Parkway, the Merritt Parkway, certain California urban freeways, and standard design elements of the Chicago Cross-town Expressway.

4. Scarce commodities displaced should be replaced in kind. The definition of a scarce commodity (housing in a tight housing market, parks in densely built-up neighborhoods, or historic landmarks) should be made by the Secretary of Transportation. Related legislation should permit owners of private property as well as of public property to have the option of payment in (a) fair market value or (b) a "functionally equivalent replacement," as termed by Allard (1, p. 355), who states, "...jurors are more conscious of the various elements of damage inflicted... [and] although they are instructed by the courts that fair market value is the measure of just compensation, jurors apparently consider replacement value as a more accurate measure." This principle is, for taking of public property, well established by recent court decisions [United States v. Certain Properties in the Borough of Manhattan, 403 F 2d 800 (1968), and State Road v. Board of Park Commissioners, West Virginia, S. E. 2d 919 (1970)]. The Certain Properties decision states that when a public facility is taken the public agency is entitled to "... the cost of a functionally equivalent substitute ... [if] ... structure is reasonably necessary for the public welfare. . .," and the State Road decision asserts "... where undisputed evidence showed that Board of Park Commissioners was required to acquire substitute land in order to operate park as it was operating before taking, Board of Park Commissioners was entitled to recover cost of replacement land."

5. To determine the "... costs of minimizing or eliminating... disruption of desirable community and regional growth. . .," transportation planning moneys should go directly to city and regional planning agencies to develop community planning frameworks for all transportation projects. Such costs are currently provided in various ways but on a somewhat random basis. The practice should be institutionalized.

6. A small percentage (say 10 percent) of the Highway Trust Fund should each year be set aside for discretionary use. The rest should be returned directly to that state and to that Standard Metropolitan Area that generated it. The Trust Fund should be continued indefinitely on this basis, and matching shares should be used by the "taxing unit" (state or SMA) with wide discretionary powers, particularly the matching shares.

Payment and design decisions will always vary somewhat, depending on the administering agency. The very different objectives of rural and urban roadway planning are likely to be best implemented by engineers and planners directly responsible to the political representatives of the "user" and "nonuser" clients of the roadways, that is, to state agencies in the case of rural roads and urban agencies in the case of urban roads.

Responsibility for the community participation and approval process would then also fall where it belongs: on those urban political bodies representing the communities.

COSTS OF FULL COMPENSATION

A concern of administrations charged with managing the large public investments in urban highways must be with specific costs of full compensation. Although a number of recent projects suggest that the costs can be very high, the data are fragmentary, often privileged, and controversial. But an instructive case study was the subject of a research project (18) conducted by a group of advanced post-graduate students in the Harvard University Graduate School of Design, with the assistance of professors of urban design, transportation engineering and traffic, planning, and law, and with important help from the Massachusetts highway agencies. The work has been described by this author (19):

...Two Boston Corridors, one about two miles from the center of the city and one about five miles from the center, connecting two radial expressways (the Massachusetts Turnpike and the Route Two Extension) about two and a half miles apart, were assumed as given. It was assumed that network efficiency would be insensitive to exact highway location and design within each corridor and that therefore the selection of a best alignment within each corridor was purely a community planning and investment cost problem.

It was the objective of this study to determine the full compensation costs of each alignment and, if possible, community benefits.

The inner corridor A is bordered on the east and south by the Charles Basin. Massachusetts Institute of Technology lies along the basin and is separated from an industrial zone to the northwest by a railroad. Neighborhoods are fine, dense, stable, low and middle income areas. Commercial properties are located primarily on two east-west arterials.

The western corridor B is bordered by the Charles River on the south. A vacant arsenal and large vacant industries and land fill lie north of the Charles, then several thriving industries, scattered small, stable ethnic neighborhoods, then somewhat higher income, low density neighborhoods, then Fresh Pond Reservoir surrounded by open land and, to the north of Fresh Pond, scattered commercial, open land and land fill.

Costs beyond conventional costs included in corridor accounting: tunnelling under the Charles Basin, moving and lowering the subway for depressed alignments, because of a tight housing market house reconstruction on a one to one basis, replacement of all institutional takings, compensation for homes left in noise zones, reconstruction of arterials with added traffic loadings, special job retraining and compensation costs for highly skilled elderly workers, disruptions costs for businesses and homes during highway construction, special costs for special highway design, costs of replacement parkland, joint development costs where such costs are compensation for takings.

A development model was prepared [this work was done by David Betanger of the Harvard Graduate School of Design] to calculate minimum and maximum added development values and minimum and maximum added tax gains (or losses). It was recognized that this would partly measure only a redistribution of investments within the urban region. But the calculations give a first approximation of tax gains to the communities most directly affected by the highway, and of large increases in private value due to the public investment. These private "windfalls" might be further taxed—the other side of the "full compensation" coin.

Four alignments, A1, A2, A3, and A4, with many variations, were analyzed in the eastern (inner) corridor. One alignment, B1 with variations was analyzed in the western (outer corridor).

Data describing A2 (the "best" inner alignment) and B are as follows:

<u>Community Costs and Benefits</u>	<u>Alignment A2</u>	<u>Alignment B</u>
<u>Costs</u>		
Homes taken	114	130
Jobs taken	7,350	345
Dollar cost	\$151,000,000	\$74,000,000
<u>Benefits</u>		
<u>Development gains</u>		
Minimum	\$ 27,000,000	\$140,000,000
Maximum	\$223,000,000	\$400,000,000
<u>Direct tax gains</u>		
Minimum	\$1,000,000	\$5,000,000
Maximum	\$6,000,000	\$13,000,000

In this bookkeeping the full value (as calculated by these investigators) to the owners of the homes taken (as calculated by the investigators) and the full value of the jobs taken are included in "dollar cost." The costs are the aggregate cost of the link; benefits are disaggregated. Therefore, they are not directly comparable. "Tax gains" assume a discount rate of 10 percent. Clearly the local benefits of alignment B are very high.

Several related outcomes of this analysis are instructive:

1. The costs, while approximate, suggest that the price of full compensation in dense urban areas is very high. The cost of the only acceptable inner alignments is so great (about \$60,000,000/mile) that the system benefits from this link must be very high to justify its construction under any circumstances. [Earlier professional studies of the inner cor-

ridor were hobbled by inflexible constraints on "fairness," with predictable results: the "best" highway as judged within such constraints was opposed by individuals and communities unfairly treated. But these early studies laid the problems bare and therefore prepare the way for their solution.]

2. Full compensation has, in this case, a dramatic effect on the network design, pushing the first circumferential far away from the Central Business District. This can be expected; because the area further away from the center is less densely built up, right of way and other compensation costs are reduced; because there is more undeveloped and underdeveloped land, the development potential, in this case, is greater.

This analysis supports professional studies suggesting that full compensation costs are very high, probably \$40 to \$50 million a mile for 8-lane expressways in dense urban areas. If these figures are accurate, grade-separated freeways in densely built-up areas are likely to be among the "marginal" links in any regional transportation network. Incremental network benefits must be large to justify these link costs.

The discrepancy between payments for displacement and disruption and true value may explain why a society involved in a passionate love affair with the private automobile is at the same time incensed by the construction of urban expressways. Highway engineers and other urban technicians have taken the brunt of this anger. But it is the institutional structure that is out of kilter, and it is this institutional structure that must be remodeled. A beginning to this remodeling has been a major contribution of the urban highway building process. The Interstate Highway Acts and the 1970 Relocation Assistance Act have done much to correct inequities in expropriation law.

But much remains to be done. Michelman, in a classic legal monograph states it succinctly: "... any measure which society cannot afford... or is unwilling to finance ... under conditions of full compensation, society cannot afford at all."

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