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16. Abstract <p>The objective of this study was to present criteria and procedures for evaluation of Joint Development (JD) above, below, or beside state highways. Application of the procedures are illustrated over a wide range of joint development situations, both (1) for establishing state or local JD policy, and (2) for making decisions about JD projects in a more timely and comprehensive manner, and in a way that will contribute toward improving the quality of urban life or the enhancement of rural environments. The approach taken in the Guidelines is sequential, systematic, and interdisciplinary; that is, it uses a series of successively more detailed and comprehensive planning and evaluation procedures for JD decision making, relying on a wide range of specified physical, economic, social, and legal criteria. In use, the Guidelines envision a three-stage planning and evaluation process: (1) identification of the need or potential for JD projects; (2) comparison of project proposals against policies, criteria, and standards designed to avoid or minimize negative impacts and increase favorable impacts; and (3) refined definition of costs and benefits when warranted.</p>					
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PREFACE

Supervision of this project for the Washington State Highway Commission, Department of Highways, was the responsibility of the Assistant Director, Planning, Research and State Aid. General direction was provided by Willa W. Mylroie, Research and Special Assignments Engineer. Mr. Ray Dinsmore, Research Coordinator, and Mr. William R. Turner, Consultant Liason Engineer, were administrative and technical coordinators, respectively.

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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Section 1

GUIDELINE INTRODUCTION AND SUMMARY

Increasingly highway builders are becoming aware of their opportunities to respond to more than the community need for traffic service alone, through the concept and practice of joint development. This entails coordination of planning, design, construction, and land use selection processes to recognize and better satisfy the physical, economic, and social needs of areas that the highway serves. In the course of such efforts, problems associated with highway construction can often be obviated or reduced in magnitude.

Where joint development has occurred to date, it has for the most part been additive. That is, the highway facility has been designed and constructed to solve highway transportation problems, using criteria exclusive to highway planning and design, after which other uses are applied to the unused spaces. Better than this somewhat passive approach of blending the highway with its environment is the more active one of using the highway as a systematic instrument of beneficial change. This means that the highway element and all other joint development elements along a particular corridor or at a particular location are, to the extent feasible, planned, designed (or redesigned), and constructed in concert.

In brief, joint effort and cooperation in an atmosphere of joint respect and appreciation, culminating in joint participation and investment, are keynote to the concept of joint development.

1.1 NEED FOR JOINT DEVELOPMENT

Of the many arguments cited in Subsection 4.2 that support the joint development concept,* the following five are offered here as being sufficiently cogent to serve as prima facie reason for this Guideline.

* Subsection 4.2 also cites arguments that have been advanced in opposition to joint development.

URBAN DEVELOPMENT

With the pressure for urban development continuing, open space is diminishing and increasing in value. It follows that land resources in and near urban areas should be managed more carefully than has hitherto been the case. Joint development can contribute much to this management process by promoting the optimum use of land in and along highway rights-of-way, thus reducing the pressure for sprawl at the urban fringe and preserving agricultural and other open-space uses in their existing state. In short, development that would otherwise occur on undeveloped land can "double-up" on highway land.

COMMUNITY GOALS

Joint development can serve as a vehicle for realizing a community's planning goals. It offers major land availability for redevelopment, as well as for new development--land not otherwise obtainable in many cases, and very likely at lower overall land costs. The social benefits derived from such physical change can be considerable. Communities can achieve greater physical identity and can be strengthened socially by the redevelopment of, say, housing or community service facilities. Improvements are most needed in central city core areas, where decay of the physical and social fabric parallel each other.

COMPATIBILITY

The breadth of the joint development concept can range from a single purpose land use "joined" with the highway, to a complex series of varying, yet compatible land uses. In between these limits, there is vast opportunity for a wide array of complementary combinations. Joint development can minimize the otherwise disruptive barrier-like effect of highways by knitting together like or compatible land uses on either side of the highway by development within the right-of-way. Conversely, joint development can maximize the barrier effect by further separating unlike or incompatible land uses on opposite sides of the highway. This same knitting or separating (i.e., edge-forming) treatment provided by joint development can enhance physical and visual qualities in both urban and suburban areas. In central cities especially, this aspect of joint development may reverse a downward assessed valuation trend, or spur an upward one.

ACCESSIBILITY

Through joint planning and design, developments in or along the highway right-of-way can have excellent access, so that the function of the highway is itself strengthened and reinforced. Highway benefits often can be increased by providing more proximate destinations, thereby decreasing gross travel time. The highly accessible lands adjacent to

interchanges, as an example, can be made to satisfy both community goals and highway access controls by joint development of these often premium lands. Also, because of the inherently favorable access afforded by highway proximity, region-serving uses can be especially enhanced by joint development.

REVENUE GENERATION

Joint development can generate both lease and tax revenues on lands that would otherwise be off the tax roll. If the "joined" element is private, it can generate both lease and tax benefits directly. If it is public, it generates these indirectly by freeing up land for private use elsewhere.

1.2 GUIDELINE OBJECTIVE

The basic objective of this Guideline is to

- present practical and meaningful criteria, methods, and techniques for evaluating proposals for joint development (JD) above, below, or beside state highways

in a format that is

- readily usable for application to a wide range of potential problems and developmental differences inherent in the concept of joint development

in order that

- the establishment of policy related to this concept, or the making of decisions about a particular joint development project (JDP) can be made considerably easier, in a more timely and comprehensive manner, and in a way that will contribute toward improving the quality of urban life or the enhancement of rural environments consistent with the goals and objectives of the local community in which the project is located.

1.3 GUIDELINE USERS

The several sections of this Guideline were prepared particularly for use by the Department of Highways of the State of Washington--its planners, designers, right-of-way agents, legal counsel, legislative advocates, administrators, commissioners, and other decision-makers.

However, the manner of presentation and type of coverage are intentionally broad enough to make the Guideline of general use by similar staff of all other state highway departments.

Various sections of the Guideline should also be useful to other public and private agencies, organizations, and groups who may from time to time be involved with a state highway department regarding joint development on highway rights-of-way and/or adjacent properties. Typical of these would be:

- Federal departments and agencies
- State agencies
- Municipalities, counties, and regional governments
- Special purpose districts and authorities
- Private developers and professional design firms
- The public at large, especially motorists, truckers, cyclists, public transit patrons, recreational travelers, and residents and business interests located within highway corridors.

The interest and concern of the Federal Highway Administration, Department of Transportation, is apparent and is implicit throughout the entire Guideline without further mention.

The Guideline is by and large oriented towards fully or partially controlled access highways, in contrast to conventional (non-limited access) highways. This emphasis is necessary in part because of the reduced controls available for JD along conventional highways. In addition, a form of joint development has in a very loose sense, long been a reality for urban and suburban arterial highways--even if by consequence rather than design. This form of development has been perpetuated of course by the opportunities afforded by the interface between a free-access traffic facility and abutting land use activity. The simile to JD also holds for rural (state or county) roads, where adjacent land uses have historically been joined with such

Although the emphasis on limited access highways may be somewhat constraining for some readers, it can reinforce the usefulness of this Guideline by local-agency planners, engineers, and decision-makers when considering their access controlled expressway systems. Also, portions of the Guideline can be applicable to uncontrolled-access facilities, even if not specifically oriented to them.

1.4 GUIDELINE STRUCTURE

The Guideline is designed in a modular fashion so that each section (and most subsections) can be referred to separately by users who are not interested in other parts. Section and subsection headings were accordingly selected for ease of reference, and purpose statements are provided

frequently to orient the selective user. The general purpose and content of each section is summarized below.

- Section 2 - Precedent for Joint Development, illustrates the occurrence of joint developments to date, identifies some of their characteristics, and demonstrates that the concept of joint development has a substantial basis in fact. The first part (2.1) lists the known types of joint development projects and their characteristics; the second part (2.2) raises issues that aid in establishing a universal definition for joint development; and the final subsection (2.3) describes federal and State of Washington legislation, regulation, and policy authorizing or bearing on joint development.
- Section 3 - Joint Development Described, sets forth the joint development concept and classifies and illustrates the types of projects considered to be within the concept. The first part (3.1) defines the principles and scope of joint development and describes several of its functional and spatial relationships, and defines associated terms used in the Guideline, including types of related highway-oriented developments that are considered outside the definition of JD; the second part (3.2) arrays joint development types by function or purpose and describes each of eight major JDP classes and illustrates how each can relate to the highway and its surrounding area.

Further, a summarizing table in this section serves as a check list for the highway planner when considering new routes or for considering possible alternatives to JD projects proposed by others. (A worksheet is also included to assist in identifying JD applications or concepts and to provide a uniform data reporting and retrieval system.)

- Section 4 - Fundamental Considerations and Basic Policy, provides a first test as to whether a proposed joint development project should be further considered. Before the planner, designer, administrator, or other decision-maker considers the possibility of a joint development project, answers to certain fundamental questions must be sought. The first part (4.1) provides the basis for a CONSIDER/DON'T CONSIDER decision by raising a number of fundamental questions about JD proposals, which also can serve as a basis for establishing JD policy. A worksheet is included for recording responses to the suggested question set. The second part (4.2) enhances the basis for policy making by presenting arguments for and against joint development.
- Section 5 - General Criteria Analysis, contains criteria, constraints, and standards for evaluation of joint development projects that have passed the Basic Policy Analysis of Section 4 and are therefore believed worthy of further consideration. The General Criteria Analysis provides minimum safeguards toward the

capacity for the movement of people and goods, the health and safety of individuals, and the quality of life for not only all users of both the highway and joint elements, but also the neighborhood population surrounding the JDP. The section is divided into four parts--Physical Considerations (5.1); Economic Considerations (5.2); Legal Considerations (5.3); and Social Considerations (5.4).

A summary evaluation worksheet is provided for estimating the extent of compliance or non-compliance with the stated criteria, and accordingly, for reaching decisions that in some cases can be made upon this basis. The worksheet also provides a checklist for highway planners, engineers, architects, landscape architects, and other professionals charged either with the design of JD projects or with reviewing the adequacy of project plans and specifications prepared by others.

- Section 6 - Air Quality and Noise Considerations, supplements Section 5 by providing a more detailed account of vehicle emission (6.1) and noise generation characteristics (6.2), plus some suggestions for control or mitigation of air pollution and noise effects on JD. The intent is to provide a basic level of knowledge to assist the planner, designer, or decision-maker in better understanding potential air quality and noise effects in particular relationship to joint development. Selected references are also provided in Subsection 6.3 that discuss these subjects more completely than can be covered in the Guideline.
- Section 7 - Identification of Community and Neighborhood Goals, gives examples of social issues of the types with which JDP planners and decision makers should be concerned and explores alternative means of determining community and neighborhood goals and perception relative to joint development. Joint development offers exceptional opportunities to bring about beneficial change; however, it can create social costs as well as benefits. Accordingly, determining how its human or social impacts are perceived is a key step in evaluating joint development possibilities. The means of community interaction discussed (in Subsection 7.3) are public hearings, behavior observation, community group meetings, focus groups, contact with community leaders, non-structured or semi-structured interviews, questionnaires, professional panels, and documentary analysis.
- Section 8 - Comparative Display Procedure, contains a recommended procedure for evaluation of joint development projects that have been reviewed in terms of policy questions, criteria, and general guidelines in Sections 4, 5, 6, and 7. It should be used as a further refinement when a clear GO/NO-GO decision cannot be made on the basis of the evaluations described in these prior sections. The general approach is that of benefit/cost analysis, utilizing costable, quantifiable, and qualitative measures of benefits and costs. The described procedure is suitable for (1) projects that

entail only approval versus disapproval of a given JD proposal, and (2) projects of limited size or complexity that may entail alternative JD sites, uses or scales, but that can be resolved on the basis of relatively simple comparisons of project costs and benefits. A suggested worksheet is included, together with a discussion of sensitivity analyses, tradeoff considerations, and priority rating suggestions.

- Section 9 - Implementation, provides further explanation on the use of the Guideline and recapitulates the systematic approach to JD decision that is integral to the Guideline's sequential-section approach. This section also discusses JDP initiation, multidisciplinary teams, monitoring of implemented JD projects, and possible joint development legislation.
- Section 10 - New Concepts for Joint Development, presents a few ideas about joint development projects that may not be readily apparent from utilizing other sections of the Guideline. The intent of the section is to generally broaden the reader's viewpoint towards more visionary joint development possibilities--in effect, to serve as a "springboard" for the planner, designer, or highway official involved with the concept of joint development. The concepts covered are:
 - 10.1 Exclusive Bicycle Lanes and Parking Facilities
 - 10.2 Guideways for Small Automated or Semi-Automated Vehicles
 - 10.3 Short Haul Mini-Transit Facilities
 - 10.4 Park-n-Ride Plaza
 - 10.5 Urban Information Center
 - 10.6 Highway User Service Center
 - 10.7 Highway Freight Transfer Station
 - 10.8 Hill-Parks
- Appendix A - Access Determination Procedure, suggests a procedure for determining a joint element's need for vehicular access to the highway. A two-step method is proposed. The first step is qualitative, because unless a basic need for access can at least be shown, access to the highway should not be further considered. The second step is quantitative, and considers such factors as the functional classification of the highway, its importance in the state highway system, the character and amount of the traffic on the highway and between the potential joint development elements, the adjacent street system, the intended purpose of the joint element, topographic conditions, proximity of the joint element site to other highway connections, and so forth.
- Appendix B - Extended Evaluation Procedure, provides procedures, factors, and suggestions for an extended analysis of projects on which a recommended decision cannot be reached even in Section 8, or where a JD analyst desires a weighting and summing procedure for JD impacts, say, for comparison of complex multiple alternatives

(including the study of tradeoffs among or within alternatives). As well as a suggested worksheet, the Extended Evaluation Procedure includes a discussion on quantification of selected impacts, benefit/cost calculations, weighting procedures, and comparison and ranking of alternatives.

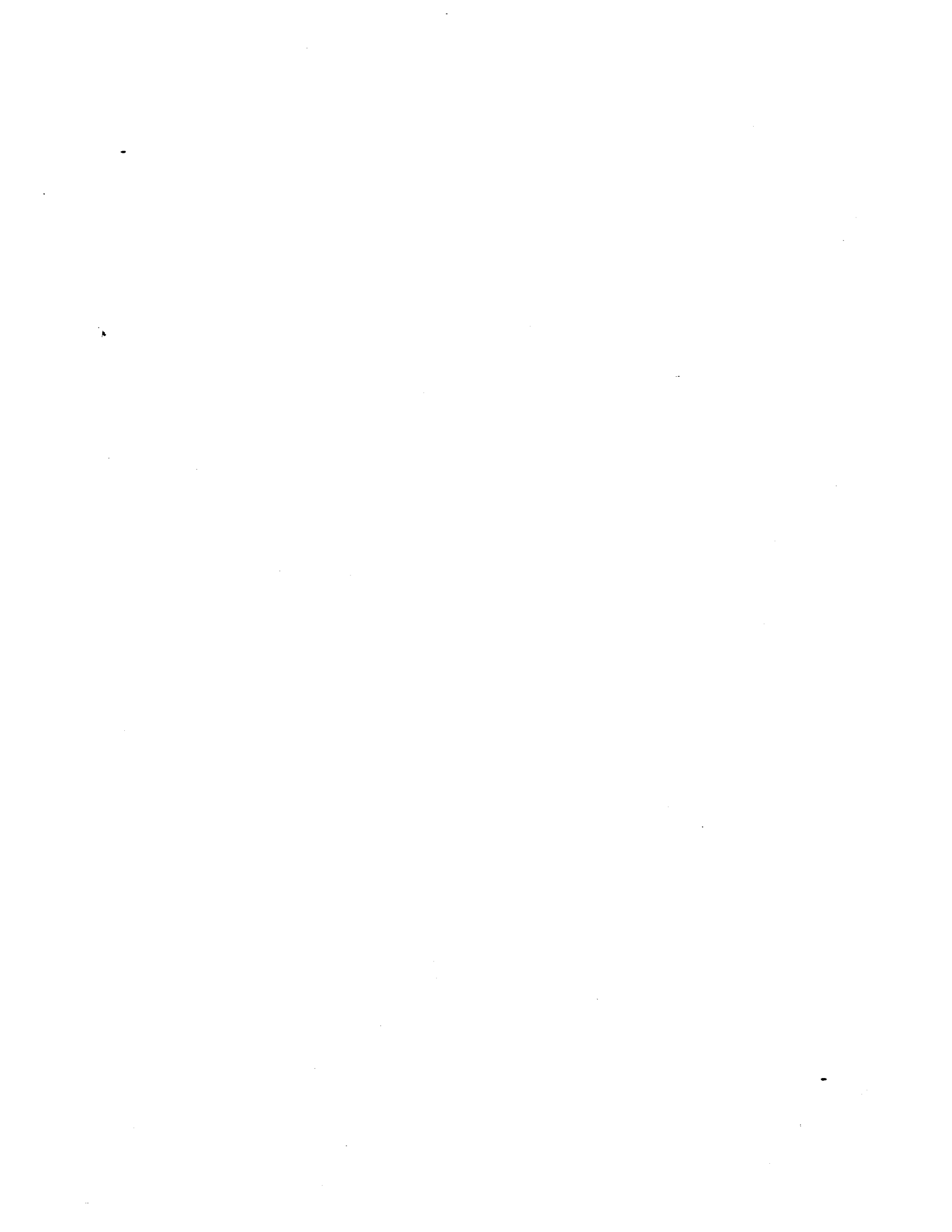
- Appendix C contains examples of two comprehensive model statutes for joint development.
- Appendix D contains the bibliography of source material used in the preparation of this Guideline.

1.5 GUIDELINE PRECEPTS

The following precepts and observations sum up the philosophy and approach that underlie this Guideline.

- The concept of joint development has been subject to varying points of view by both highway builders and the public, and will probably continue to be mislabeled on occasion by either overly simplistic or extremely complex notions about projects alleged to qualify as joint development. Hence it is important to clearly understand the JD precedents (both in a physical and legal sense) and definitions in Guideline Sections 2 and 3.
- Because of the infinite number of differing local situations, combined with the great potential for varying joint-use combinations, any attempt to set forth complete or all-encompassing guidelines about particular JD types for particular locational situations would not only be a herculean task but would have little overall validity. Realistic JDP evaluation can only be made on a case by case real-life basis. On the other hand, the more comprehensive, though sometimes generalized, knowledge that can be brought forth and the greater its dissemination, the greater the chance that a broader and more enlightened spectrum of joint development projects will be realized and their benefits experienced.
- Certain of the guidelines presented here are already standard operating procedure in some agencies, and all of them are believed to be generally acceptable practices. However, some recommendations will be impossible or inappropriate for some agencies, and several of them may become less applicable over time. Therefore, they can be modified to suit special needs; and as technology, design standards, human values, funding policies, social consciousness, and so forth change over time, periodic updating should be undertaken in order to keep this Guideline current.

- The criteria and methods presented are fundamental to decisions that yield sound joint development projects and should be used to establish their validity without regard to the magnitude, say, of federal-aid highway participation or other public or private contributions of funds. In other words, a project's fundamental soundness should first be independently determined without introducing a possible funding bias.
- Joint development, per se, will not answer fundamental questions having to do with highway needs, highway user requirements, or neighborhood effects normally associated with the location of highway facilities. Occasionally JD will simply be viewed as a compromise solution, or will be considered by some as only a first-aid treatment to accommodate certain adverse local situations. On the other hand, JD often will offer an additional dimension that can soften the impact of a highway's negative effects; or it can further enhance the positive effects associated with highway developments, such as capitalizing on a potential environmental improvement which would not otherwise be possible.
- Lastly, while for the most part, joint development will likely exhibit only a minimal impact on the highway system as a whole (either in a physical or financial sense), individual joint development projects can exhibit profound impacts on their own neighboring areas. For this reason, it should be anticipated that joint development projects will seldom be unanimously acceptable, especially when they negatively affect anyone in their neighborhood. If such disbenefits are serious, they should be avoided, or ameliorated even if at added expense.



Section 2

PRECEDENT FOR JOINT DEVELOPMENT

The purpose of this section is to illustrate the occurrence of joint developments to date, to identify some of their characteristics, and most importantly to demonstrate that the concept of joint development on the nation's highways has a substantial basis in fact. The first part of the section lists the known types of joint development projects and their characteristics; the second part explores the question "Are the examples currently regarded or proclaimed as JD really joint development?"; and the final subsection describes federal and state legislation, regulation and policy authorizing or bearing on joint development.

In effect, this section provides a basis and an understanding for the sections that follow, particularly for Section 3 in which standard definitions and classifications for JDP will be proposed to clarify the definitional confusion that presently exists. For example, some project types are reported as JD by one agency or author but not by others. Other reported projects have simply accommodated particular existing land use situations or local building configurations because of convenience or necessity, rather than because of the JD concept, per se.

2.1 JOINT DEVELOPMENT PROJECTS IN THE U.S.

Data Sources and Categories

The following surveys and compilation of joint development projects were utilized in this section (along with other but less comprehensive sources) for identifying the number of existing JD projects and the range of JDP types:

	<u>Name of Item</u>	<u>Source</u>	<u>Number of Projects Covered in this Section</u>
A.	Highway Joint Development and Multiple Use	Environmental Development Division, Bureau of Public Roads, FHWA; 1970	389 existing or under construction (plus 239 proposed)

(continued)

	<u>Name of Item</u>	<u>Source</u>	<u>Number of Projects Covered in this Section</u>
B.	Multiple Use of Lands Within Highway Rights-of-Way	National Cooperative Highway Research Program; 1968 (NCHRP Report 53)	726
C.	Characteristics of Selected Projects	Various sources; SRI, 1971	125
D.	Composite Listing	SRI, 1971	1122

Items A and B are surveys covering a wide range of joint development types; for example, study A, the more comprehensive and timely, lists 112 separate types. Study B provides valuable supplementation of project types that are generally, although not exclusively, associated with toll road facilities. Item C is a literature survey covering existing projects, conducted by SRI especially for this section to obtain more detailed information on the characteristics of selected joint developments. The selection of projects was based solely on the completeness (including photographs) of published information. Finally, item D is a composite listing of projects existing or under construction, utilizing the preceding sources but with double counting of the same project eliminated.

The broad array of projects compiled has been grouped into ten categories of similar types. These are:

BUILDINGS AND STRUCTURES--public buildings (federal, state and local offices, institutional and cultural); private buildings (commercial and industrial); and housing structures (apartment houses)

PARKS AND RECREATION--active and passive recreation areas; leisure time spaces; historical areas; waterfront parks and lake developments; wildlife and nature areas; and parks and lakes that have been developed on former borrow pit properties

PARKING--public offstreet parking; special purpose parking (associated with a particular land use); private parking (commercial); commuter parking; and roadside parking for recreation purposes

STORAGE--impounded vehicles; automobile and truck storage; materials depot and maintenance equipment; and commercial storage

TRANSPORTATION--lines, lanes, guideways, runways, terminals, and transfer points for mass transit, rapid transit, railroad, trucking, and aviation facilities; wharfage; and conveyors

UTILITIES--public and private lines, appurtenances, and other facilities for electrical power, sanitation, water, and communications

MULTIPLE USE COMPLEXES--multiple purpose land uses and/or multiple structures integrated under a single development plan, either linearly within a highway corridor or nodally at one location along a highway route

CONVENIENCE STOPS--information, view, and overnight areas; trail heads; and safety rest areas

PEDESTRIAN WAYS--malls, overcrossings, tunnels, decks, and walks

MISCELLANEOUS--projects not otherwise classified (see Table 2-2 for listing)

Distribution of JDP Types

Table 2-1 provides a comparative distribution of project types according to the above classification scheme. The percentage distributions shown in column (A-1) and (D) are distorted somewhat by the understatement of buildings in Source "A" and the unrealistic emphasis given convenience stops and transportation (particularly express bus operations) in Source "B."

The relative degree of alleged JD activity by category is readily seen from the table, although numbers alone are not a good guide to economic worth or community impact of the categories. For example, multiple use complexes probably have the highest cost and impact per project, even though they are least numerous.

Column (A-1) shows projects existing or under way and (A-2) presents the distribution of proposed projects (not then under construction) from the FHWA survey. Note that the number of building and park projects that were proposed nearly equals the number that were developed or started up to 1970. Column (D), the SRI composite list, contains all projects represented in the major categories of the three surveys without double counting but including estimates for certain joint development types. Therefore, even taken together the composite list cannot be regarded as 100 percent complete.

Table 2-2 provides a finer breakdown of the composite list in order to consider some reasons for the frequency distributions of types noted in Table 2-1. It is clear from Table 2-2, for example, that the numerical predominance of the convenience stops category is due to the large number of safety rest areas (269 out of 305 convenience stops). Other pronounced leaders are restaurant-gas stations in the buildings and structures category (122 out of 218), public offstreet parking in the parking category (125 out of 153), and express bus operations in the transportation category (175 out of 282).

Table 2-1

COMPARATIVE DISTRIBUTION OF
JOINT DEVELOPMENT PROJECT TYPES^a

	Basic (FHWA)		Supplemental		Composite SRI No. (%)
	Existing No. (%)	Proposed No.	NCHRP No.	SRI No.	
	(A-1)	(A-2)	(B)	(C)	(D)
Buildings and Structures	50 (13)	44	171	32	218 (19)
Parks and Recreation	108 (28)	99		48	110 (10)
Parking	143 (37)	49	10	6	153 (14)
Storage	12 (3)	6		6	15 (1)
Transportation	35 (9)	12	242	18	282 (25)
Utilities	9 (2)	2			9 (1)
Multiple Use Complexes	4 (1)	6			4 (<1)
Convenience Stops	14 (4)	13	293	11	305 (27)
Pedestrian Ways	6 (1)	2			6 (<1)
Miscellaneous	8 (2)	6	10	4	20 (2)
Total	389 ^b (100)	239 ^b	726	125	1122 (100)

^a Except for column (A-2), all projects indicated were either existing or under construction at the time of the respective surveys.

^b In the survey, 720 projects were identified. Of these, 628 (or 87 percent) were sufficiently described to be included. Twelve cases where the JDP was reported to be over or under city streets were also eliminated.

Table 2-2

COMPOSITE LIST OF REPORTED JOINT DEVELOPMENT PROJECTS
(Minimum Number Existing or Under Construction)

<u>Buildings and Structures</u>		<u>Parks and Recreation</u>	
Public/Institutional:		Land Oriented:	
Highway maintenance	29	Playgrounds	8
Highway patrol, State police	20	Mini-Park, Tot-lot	5
Federal office	2	Sitting, picknicking	4
CD fallout shelter	1	Athletic field	4
Post office	2	Linear park	6
City/County civic center	1	Regional park	5
City maintenance	1	Historical, Landmark, Monument	5
Court house	1	Trails, paths	3
Fire station	3	Not classified	18
Library	1	Water Oriented:	
Auditorium, Convention hall	1	Waterfront park, lake, pond	6
School (and Yard)	3	Lake development by impoundment	15
Religious	1	Boat launching ramps	9
Commercial/Industrial:		Small boat dock	1
Restaurant-gas station	122	Fishing platform	1
Restaurant only	1	Wildlife parks, Animal cross- ings, Conservation, and Nature areas	7
Retail market (food)	2	Borrow-Pit development: Park	2
Office	3	: Lake	11
Hotel	1	SUBTOTAL	110
General commercial	3		
Manufacturing	1		
Light industry, warehousing	12		
Housing:			
Apartments	5		
Relocation housing	2		
SUBTOTAL	218	<u>Storage</u>	
		Impounded vehicle	2
<u>Parking</u>		New car (commercial lease)	1
(See also "Storage")		Mail trucks	1
Public offstreet	125	Transit buses	2
Special purpose (school, church, hosp., etc.)	5	Materials depot, maintenance equipment	2
Private	9	Coal	1
Parking structure	3	Not classified	6
Roadside (for recreation)	1	SUBTOTAL	15
Commuter ("park-n-ride")	10		
SUBTOTAL	153		

Table 2-2 (concluded)

<u>Transportation</u>		<u>Convenience Stops</u>	
Mass Transit: (rubber tire)		Information	4
Bus station, terminal	2	Scenic overlook, photographic	19
Bus stop (on controlled access highways)	26	Overnight travel-trailer	7
Express bus operations-travel lanes	175	Overnight camping	2
Exclusive bus lane (peak hours only)	1	Safety rest area	269
Exclusive bus lane in median	1	Rest area with snack, souvenir shop	1
Transit company office/maintenance	1	Trailheads for camping, skiing, trails	2
Rapid Transit: Station	2	Historical monument with rest area	<u>1</u>
: Line	5	SUBTOTAL	305
Railroad: Mainline	2	<u>Pedestrian Ways</u>	
Spur	5	Overcrossing	3
Yard, switching	2	Tunnel	1
Aviation: Runway, taxiway	1	Deck	1
Heliostop	1	Walks	<u>1</u>
Wharfage (large boat)	3	SUBTOTAL	6
Trucking:		<u>Miscellaneous</u>	
Terminal area, loading docks	7	Grazing	1
Tandem-trailer make-up/break-up	30	Stock trail	1
Weigh station	12	Stock loading pens	2
Inspection station	2	Stock yard	2
Conveyor: Materials (coal, grain, gravel)	3	Crop production and harvesting	3
People (skylift, tramway)	<u>1</u>	Grass planting research	1
SUBTOTAL	282	Plant growing (commercial lease)	1
<u>Utilities</u>		Snow dump	1
Electrical substation	2	Pistol range	1
Sludge line	1	Ramp & retaining wall (for adj. housing)	1
Fuel line	1	Landscaping for adjacent housing	1
Sanitary sewage pump station	1	Car wash	1
Waterworks plant	1	Military grouping area	<u>4</u>
Radio transmitter and tower	<u>3</u>	SUBTOTAL	20
SUBTOTAL	9	<hr/>	
<u>Multiple Use Complexes</u>		<hr/>	
Gateway center (Massachusetts)	1	TABLE TOTAL	1122
Prudential center (Massachusetts)	1		
Crosstown Expressway (Chicago)	1		
I-65 (Indianapolis)	<u>1</u>		
SUBTOTAL	4		

Some other causes of dominance by the leading categories can also be surmised. For example, the large and increasing amount of activity in the parks and recreation category probably stems from the increasing demand during the last decade for open space preservation, leisure time, and neighborhood recreation opportunities. Parking is no doubt a dominant category because of its long history of legislative and regulatory sanction on highway rights-of-way.

Of significant is the very low activity involving utilities jointly developed with highways. It is, of course, explained (although not excused) when one considers that past design, maintenance, and operational practices have tended to restrict utility and highway facilities from occupying the same right-of-way, other than for simple crossings.

Other JDP Characteristics

Several project characteristics are of interest, including occurrence by type of highway; location in relation to the roadway and to the right-of-way; the character of surrounding development; orientation to highway users vs non-highway users; and sponsoring agencies. These characteristics will be covered in turn, utilizing different surveys or other sources as appropriate, but particularly the SRI survey of selected projects because of its greater detail.

Table 2-3 identifies projects according to type of highway and by location relative to the roadway. The two types used here are "Interstate" and "Other Highways." The latter category includes other state freeways, partially controlled-access facilities, and conventional highways.

Some observations from Table 2-3 follows:

- There has been over three times as much JD activity on the Interstate system as on other highways. The predominance of Interstate locations probably demonstrates the greater need and opportunity on freeways for conscious development of JDP. The even higher ratio of about five to one for parking projects (118 vs 25) can be attributed to the large number of elevated Interstate urban freeways with parking beneath the structure; the storage and transportation categories also show high ratios of Interstate to Other Highways for the same reason.
- The influence of elevated urban freeways can also be seen in the fact that 60 percent of all projects are under (or partially under) the roadway, which means predominantly under such freeways. Of these, parking constitutes about half of the total.
- The relatively low 9 percent of projects over the highway no doubt reflects the higher costs of such locations.

Table 2-3

BY TYPE OF HIGHWAY AND
BY LOCATION RELATED TO ROADWAY^a

	Projects	Interstate			Other Highways		
		Under	Over	Along- side ^b	Under	Over	Along- side ^b
Buildings and Structures	50	22	7	7	8	6	-
Parks and Recreation	108	31	3	44	3	-	27
Parking	143 ^c	108	2	8	20	1	4
Storage	12	9	-	1	2	-	-
Transportation	35 ^d	19	5	6	3	1	1
Utilities	9	3	-	5	1	-	-
Multiple Use Complexes	4	-	2	-	-	2	1
Convenience Stops	14	-	-	10	-	-	4
Pedestrian Ways	6	1	2	-	-	2	1
Miscellaneous	8	2	-	4	2	-	-
Total	389	195	21	85	39	12	37
Total by Highway Type		301			88		
Percent Distribution		77%			23%		
Total "Under"	234	(60%)					
Total "Over"	33	(9%)					
Total "Alongside"	122	(31%)					

^a Source: "Highway Joint Development and Multiple Use"; FHWA; February 1970.

^b Sidestrips, medians, ramp interiors, expanded rights-of-way, and adjacent properties.

^c Includes three parking structures.

^d Includes two bus station structures.

- Although the 31 percent of cases where JD occurs alongside the highway generally involve large, unassociated property areas, enough examples occur where sidestrips, medians, and ramp interiors are utilized to indicate the potential importance of such spaces for JDP.

Table 2-4 shows further details regarding the location of projects relative to the highway right-of-way, based the SRI survey of 125 selected projects. Slightly over one-half of these occupy space within the normally required right-of-way, whereas almost one-third of the projects required extension of right-of-way beyond what would be normally considered for the highway use alone. Of these two types, 40 of the projects, or about one-third of the total, were developed on space both within and adjacent to the right-of-way. Fifteen percent, primarily parks and recreation, abut the right-of-way without encroachment.

Table 2-5 presents data on the regional location and user orientation of the projects included in the SRI survey. The table would seem to indicate that JD to date has occurred almost as much in rural areas as it has in urban. However, as the distinction between urban and suburban is probably too diffuse to be meaningful, it is more likely that the joint development concept has been primarily urban oriented--as opposed to rural. By including the 128 known examples where parking has occurred under elevated freeways (from Table 2-3), this conclusion becomes even more evident.

Another conclusion that can be reached from examining Table 2-5 is that JD to date tends to be non-highway-user oriented. By including the examples of under-viaduct parking where reasonably direct highway access is provided, some shift in orientation towards the highway user can be expected. However, if safety rest areas and all the known service plazas were included in the analysis, emphasis would dramatically shift in favor of the highway user, as opposed, say, to the community at large. The point here then is one of definitional weakness (see Section 3).

The relation of JD projects to their sponsoring agencies is shown in Table 2-6. As might be expected, the predominant co-sponsors of JD projects are local agencies (cities and counties), with private developers next in magnitude. While it might logically be assumed that there must be two or more agencies (or entities) involved in the development of a joint project, Table 2-6 indicates that this has not necessarily been the case to date--14 percent of the projects samples involved only highway departments. The development of on-right-of-way highway maintenance stations and safety rest areas have been, of course, obvious examples of single sponsorship. On the other hand, can such developments rightfully be considered "joint" projects?

Table 2-7 summarizes data from the 1968 NCHRP study that distinguishes between sponsorship of joint development on controlled access highways by state highway agencies and by toll road authorities. It also provides supplemental information on safety rest areas, express bus operations,

Table 2-4

JOINT DEVELOPMENT PROJECTS
RELATED TO RIGHT-OF-WAY^a

	<u>Normal Highway ROW</u>		<u>Expanded ROW for JD Purposes</u>		<u>Abutting Normal ROW Only</u>
	<u>Wholly Within</u>	<u>Partially Within</u>	<u>Wholly Within</u>	<u>Partially Within</u>	
Buildings and structures	7	16	9	-	-
Parks and recreation	11	10	5	4	18 ^b
Parking	3	2	1	-	-
Storage	4	2	-	-	-
Transportation	7	2	9	-	-
Convenience stops	-	-	8	2	1
Miscellaneous	<u>1</u>	<u>2</u>	<u>1</u>	<u>-</u>	<u>-</u>
Total - 125	33	34	33	6	19
Group Total	67		39		19
Percent Distribution	54%		31%		15%

^a Source: SRI

^b Includes four projects on excess ROW not required for highway function (i.e., surplus property).

Table 2-5

JOINT DEVELOPMENT PROJECTS
BY REGIONAL LOCATION & USER ORIENTATION^a

	<u>By Location</u>			<u>By User Orientation</u>		
	<u>Urban</u>	<u>Sub-urban</u>	<u>Rural</u>	<u>Highway User Oriented</u>	<u>Non-Highway User Oriented</u>	<u>Both</u>
Buildings and structures	21	2	9	12 ^b	20	-
Parks and recreation	16	11	21	-	28	20 ^c
Parking	1	4	1	4	2	-
Storage	6	-	-	-	6	-
Transportation	9	6	3	5	12	1
Miscellaneous	1	2	1	1	3	-
Convenience stops	-	-	11	7	-	4 ^d
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Total (125)	54	25	46	29	71	25
Percent Distribution	43%	20%	37%	23%	57%	20%

^a Source: SRI

^b Three are highway maintenance stations and nine are gas station/restaurant developments (so-called "service plazas").

^c Where highway access was provided, includes parks, lakes, and historical areas that serve as rest areas to the highway user even though the JD may have been created for community or region-wide purposes.

^d Includes rest stops where associated picnicking, camping, fishing, or outdoor amphitheater facilities have been developed.

Table 2-6

JOINT DEVELOPMENT PROJECTS
RELATED TO SPONSORING AGENCY*

Dept. of Hwy Only	<u>Department of Highways Together With:</u>					
	<u>Other State Agency</u>	<u>Federal Agency</u>	<u>Special District</u>	<u>City/ County</u>	<u>Private</u>	
Building and structures	3	1	2	1 ^b	8	17
Parks and recreation	2	11	3	-	29	3
Parking	2	-	-	2 ^c	-	2
Storage	-	-	1	-	3	2
Transportation	2	2	-	5 ^d	5	4
Miscellaneous	-	-	-	1 ^e	-	3
Convenience stops	8	3	-	-	-	-
Total (125)	17	17	6	9	45	31
Percent Distribution	14%	14%	5%	7%	36%	25%

^a Source: SRI

^b Port Authority

^c Toll road Authority

^d Transportation Commission; Transit Authority; Transit District; etc.

^e Housing Authority

Table 2-7

JOINT DEVELOPMENT PROJECTS
BY CONTROLLING AUTHORITY ON CONTROLLED ACCESS HIGHWAYS

	<u>State Hwy Departments</u>		<u>Toll Road Authorities^b</u>	
	<u>Depts. Reporting</u>	<u>Number Reported</u>	<u>Auth's. Reporting</u>	<u>Number Reported</u>
Convenience Stops (293)				
Safety Rest Area	36	268 ^c	6	6 ^a
Scenic Overlook	19	19 ^a		
Transportation (242)				
Express Bus Operations	13	175 ^d		
Bus Stops	5	26 ^d		
Tandem-Trailer Make-up/ Break-up			4	29
Truck Weigh Stations	12	12 ^a		
Buildings and Structures (171)				
Service Plazas ^e	6	6 ^a	14	116
Highway Maintenance ^f	17	17 ^a	12	12 ^a
Highway Patrol; State Police	6	10	8	10
Parking (10)				
Commuter: "Park-n-ride"			6	10
Miscellaneous ^g (10)	4	7	2	3

Source: Multiple Use of Lands Within Highway Rights-of-Way; NCHRP 53; 1968

^a When actual number of projects was not stated, at least one project for each state or authority reporting is assumed.

^b Includes turnpikes, thruways, parkways, recreational tollroads, etc.

^c 134 pairs in seven-state sample.

^d Data included in Source refers in part to a 1963 survey.

^e Usually includes a restaurant and one or more gas stations.

^f Can include garages, shops, equipment and material storage facilities.

^g Includes two cases of hay production; two grazing; two cattle loading pens; and four military grouping areas, not reported in other tables.

restaurant/service station plazas, highway maintenance stations, highway patrol or state police facilities, and commuter park-n-ride areas.

Table 2-7 indicates three uses that appear almost exclusive to toll roads. These are the service plaza concept, the tandem trailer make-up/break-up area and the on-right-of-way commuter park-n-ride facility. The indicated 116 service plazas reflect, in part, the greater freedom that toll road authorities have in accommodating commercial activities within the right-of-way. The 29 tandem trailer areas are located primarily on three of the nation's interurban tollroads, occasioned for the most part because of vehicle length restrictions and/or the prohibition of tandem trailer combinations on state highways. The ten park-n-ride facilities occur at interchange areas where mode-transfer facilities are available and at ramp and toll booth locations where car-pooling may be carried out.

Express bus operations (175) consider the routing of busses on the travel-lanes of controlled access highways--either individual routes which make no stops along the freeway or trunk line routes which do make stops. Note that this reported use utilizes the same travel-lanes as all other highway vehicles (i.e., in the freeway traffic stream) and not "exclusive bus lanes," either in the median or on the sidestrips, as was reported in other surveys. The indicated bus stops generally occur adjacent to the freeway lanes, although physically separated by curbs or other raised structure.

Finally, a review of joint development on highway rights-of-way is compared with JD on street and railroad right-of-ways. The Buildings and Structures category is most common to these transportation ways and therefore is used for this comparison. Table 2-8 lists 269 projects of 25 types of buildings that have been joined with highway, city street, and railroad facilities.

Almost all of the types have been or are being constructed over or under state highways. Although the buildings over city streets and railroads are shown on the table more for illustration, these additional examples amplify the potential that transportation rights-of-way have in providing for certain types of property development, especially in the major, land scarce, metropolitan cities of the country.

2.2 REPORTED JOINT DEVELOPMENT TYPES--PRO'S AND CON'S

The purpose here is to raise issues that will aid in establishing a universal definition for "joint development" and therefore one which will serve as the basis for subsequent sections of this Guideline.

Table 2-8

BUILDINGS AND STRUCTURES
 COMPARING HIGHWAYS WITH CITY STREETS AND RAILROADS
 (Figure in parentheses indicates number of buildings)

	<u>State Highways</u>	<u>Toll Roads</u>	<u>City Streets</u>	<u>Railroads</u>
<u>Public:</u>				
Federal office	Wash. DC (2)		Wash. DC	
Post office	Chicago Baltimore ^a			
City/county/civic	Fall R., Mass		NYC	
City maintenance	Wash. DC			
Court house (Annex)	Milwaukee		San Diego	
Fire station	Seattle Orleans Parish Portland ^b			
Library	Hartford		Buffalo	
Museum			NYC	
Auditorium; Convention	Detroit		Houston	
Medical center			Birmingham	
CD fallout shelter	Seattle			
Highway maintenance	17 states ^c	12 auths. ^c		
Highway police	10 locations ^c	10 locations ^c		
Bus terminals	NYC Sunnyvale			

(continued)

Table 2-8 (Concluded)

	<u>State Highways</u>	<u>Toll Roads</u>	<u>City Streets</u>	<u>Railroads</u>
<u>Private:</u>				
Restaurant/gas station	6 states	116 locat's		
Restaurant only		Newton (Mass.)	Baltimore	
Retail Market (food)	Sacramento	Newtonville (Mass.)		
Bank			Sacramento	El Paso
Office	San Francisco	Boston NYC	Des Moines Ft.Worth(3) Wichita	Nashville Philadelphia NYC (3) Chicago (5) Cleveland Bethesda
Department store			Des Moines Ft. Worth	
General commercial	Sparks (Nev.)	Boston	Rochester Des Moines	NYC
Hotel	Wash. DC			Philadelphia NYC Cleveland
Manufacturing	Kansas City		Fort Worth	
Light industrial, warehousing	Minneapolis Chicago (9 others)		Wichita Albany(Cal)	
Apartment houses	NYC (5)		NYC (2)	Chicago (6) NYC (7) Philadelphia
Parking garages	3 locations			
	72	143	23	31

Sources:

Air Space Utilization; National League of Cities; March 1968
 Air Rights and Highways; Urban Land Institute Tech. Bulletin 64; 1969
 Multiple Use of lands within Highway Rights-of-Way; NCHRP Report 53, 1968

^a Building support footings provided in median

^b Fireboat station and mooring.

^c See Table 2-7.

Buildings and Structures

The obvious orientation to air space usage of this category and its types requires little additional comment in this section. It is noted, however, that several of the light industrial/warehousing uses noted in Table 2-2 existed prior to construction of the highway facility. Whether this situation is truly consistent with the concept of JD or not, many of the guidelines, criteria, and evaluation procedures contained in this Guideline are appropriate regardless of the joint development's origins.

Parks and Recreation

There should be little argument as to the appropriateness of this category or of most of the JDP types included therein. Two of the types are worthy of comment, however. Animal crossings (e.g., for deer, buffalo, horses, and cattle) are generally a matter of necessity within the normal highway planning process rather than an objective associated with JD planning. Where a highway creates a barrier to the natural migration or the pre-established grazing trails and movements of animals, the decision should simply be one of whether or not to provide a specific crossing in the design of the facility. It is no different than a decision as to whether a bisected local street or road should be dead-ended or whether provision should be made for an under or over crossing of the highway. Clearly, street and road crossings are not joint development.

Secondly, where an adjacent borrow pit is considered jointly with the development of the highway facility, a potential JDP may well be envisioned. On the other hand, if state-owned borrow pit properties are substantially set apart from the highway right-of-way or there is little if any developmental relationship to the highway, it could be argued that this would amount to nothing more than the development of state held property and not within the intent of JD.

Parking

The nature of this category and its types are almost traditional when considering joint development; no further comment appears necessary.

Storage

As this JDP category serves well where a need exists to maximize available space--especially in dense city centers--it appears without argument. As might be imagined, all reported examples occurred under elevated structures.

Transportation

- There should be little question that fixed mass transit facilities, including bus lanes in median or sidestrip areas, fits well within the concept of JD. However, referring to the use of normal travel lanes by rubber tired busses (express or otherwise) as a JD would seem contrary to the conventional concept of highway use and accompanying user charges; it is no more "joint" than automobile use.

The fixed facilities of transport methods such as rapid transit, railroad, waterway, conveyor, and commercial pipe line, are appropriate JD projects when joining highway development with these other modes of transportation. Simple crossings, however, required primarily because a highway facility creates a barrier, should be considered as a matter of necessity or convenience rather than as a joint development objective. Accordingly runways, taxiways, fixed rails, sky lifts, tramways, conveyors, and commercial pipe lines that merely cross highway rights-of-way are considered doubtful as joint development.

Also in this category, the commercial uses associated with truck terminal areas, loading docks, and tandem-trailer areas would clearly seem to qualify as JD. However, truck related weigh stations and inspection stations should be considered as a matter of necessity and inherent in the design process for certain highway locations.

Utilities

Two comments are appropriate. The minimal use to date of utility-oriented JDP--combining lineal type public utility and communication facilities with lineal type highway facilities--indicates that greater strides will have to be made in the future if this type of JD is to realize its fullest potential. Second, as with certain other JD types discussed previously, the simple crossing of a highway by utility or other service lines is highly questionable as joint development.

Multiple Use Complexes

This type of JD represents the epitome of joint development and needs no further comment here. (See discussion of lineal and nodal complexes at the end of Section 3.)

Convenience Stops

Except where commercial interests are developed in conjunction with rest stops, this entire category is open to question as JD. Non-commercial features developed or proposed for development on the highway system solely for the convenience and safety of the highway user, would seem to be more a matter of highway design adequacy, if not a measure of

design completeness. If the types shown for this category on Table 2-2 were in fact considered as JD, it would be necessary to include pull-off areas for drinking and radiator water, trash disposal stops, emergency-call telephones, and so forth--none of which would qualify as joint development.

Pedestrian Ways

It would seem that pedestrian ways, per se, should be categorically eliminated as a JD type. Crossings have already been discussed in general under "Transportation." Decks or wide structural platforms crossing over highway lanes are more likely to be viewed as park or mall areas incorporating activities other than solely pedestrian passageways. Walkways, as such, are clearly inappropriate on high speed highways; where located along non-controlled access highways or on bridges, they become part of the normal process of designing functionally safe highway facilities.

Miscellaneous

The 20 miscellaneous cases of JD types noted in this section are primarily agricultural in nature; they indicate, though, examples that can point the way to other imaginative types of land use or activities that might be jointly developed with highway construction.

2.3 LEGAL AND REGULATORY PRECEDENT

The concept of joint development as defined in this Guideline is a relatively recent one and thus the number of federal and state statutes having clear "joint development" significance is not large. As important as the statutes, however, are the regulations, in the form of memorandums promulgated by the Federal Highway Administration (formerly the Bureau of Public Roads), which detail the procedures to be followed in joint development and multiple use projects involving federal aid highways.

As there is considerable existing literature covering the results of legal search and legislative history, the purpose of this subsection is limited to tracing and commenting on only the highlights of pertinent statutes and regulations in support of the JD concept. It also comments on relevant legislative authority of the State of Washington.

2.3.1 FEDERAL AUTHORITY

Early Authority

The first major federal legal precedent for joint development is contained in 23 U.S.C. 111 (United States Code of Federal Regulation) as amended by Section 104 of the Federal Highway Act of 1961, and the 1962 implementing regulation IM (Instructional Memorandum) 21-3-62 of the Federal Highway Administration. While applicable only to the Interstate system, federal authority was clearly provided for airspace utilization providing the participating state had authority to utilize right-of-way airspace.

Section 111, 23 U.S.C., as amended in 1961, provided that, with respect to the Interstate system, agreements between participating states and the federal government may authorize a state or political subdivision thereof to use, or permit the use of, airspace above and below the established grade line of the highway for such purposes as will not impair the full use, free flow of traffic, and safety of the highway.* It stipulated however that such use should not require or permit vehicular access from the established grade of the highway.

IM 21-3-62, Use of Airspace on the Interstate system,[†] outlined the rules and controls pursuant to which the airspace may be used in accordance with Section 111. While this memorandum notes that the use of airspace would usually occur above a depressed section of highway or below an elevated viaduct, it provided for an agreement authorizing its use at any appropriate location above or below the highway. Criteria to be satisfied by a proposed airspace use were set forth although the emphasis at that time was clearly limited to protecting the safety of the highway user.

Significantly, this memorandum provided that title to the utilized airspace was to be retained by the State, and that the disposition of income from the airspace use was to be the responsibility of the State, despite the fact of predominate federal financing. The permitted uses were on a term or at-will basis, and subject to revocation for cessation of use or abandonment. This requirement in all likelihood inhibited commercial developers from participating in the program.

* 23 C.R.F. Section 1.23, carries out the statutory mandate by requiring approval by the Administrator after a determination that the use will not impair the free flow, safety, etc. of the highway; earlier, 23 C.R.F. 1.11 allowed non-highway use of right-of-way required for future use. Initially, only parking uses were allowed until expansion to other uses meeting specified conditions were allowed in June, 1961.

[†] IM 21-3-62 has now been superceded by PPM 80-5 and PPM 80-10.

Recent Authority

The next important legal milestone for joint development was contained in the Federal-Aid Highway Act of 1968, amending certain sections of Title 23, U.S.C., and two allied federal directives prepared during the same year (although issued in January of 1969). These are the amendments to Section 128(a), 23 U.S.C.; Policy and Procedure Memorandum 20-8; Interim Policy and Procedure Memorandum 21-19; and Instructional Memorandum 21-2-69.

Section 128(a), 23 U.S.C. requires public hearings to be held, or the opportunity for hearings to be provided, to consider (1) the economic and social effects of the proposed location of a Federal-Aid highway, (2) the location's impact on the environment, and (3) its consistency with the goals and objectives of such urban planning as has been promulgated by the community.

PPM 20-8, Public Hearings and Location Approval, implements the mandate of Section 128(a) by providing public hearings and other procedures to ensure consideration of social, economic, environmental and other effects of all Federal-Aid highway projects.

IPPM 21-19, Joint Development of Highway Corridors and Multiple Use of Roadway Properties, complements PPM 20-8 in providing for joint development reconnaissance to be undertaken concurrent with route location studies. The joint development reconnaissance provides the social, economic, environmental, and land-use planning information necessary for the public hearings on route location required by Section 128(a).^{*} Essentially, the purpose of this reconnaissance is to relate a proposed highway to the plans of affected jurisdictions, coordinate the development of the highway corridor, and provide a framework for discussion of alternative routes in light of the localities' stated goals. IPPM 21-19 also focuses on a mutual plan of development and action by communities and highway agencies.

IM 21-2-69, Federal Participation in the Development of Multiple Use Facilities on the Highway Right-of-Way, defines the extent of federal participation in joint developments on highway rights-of-way. This memorandum is notable for its statement that every encouragement should be given to afford optimum utilization of right-of-way for both public and private development. Briefly, IM 21-2-69 sets forth that multiple use facilities (1) must be in the public interest and be in conformance with an official land use plan; (2) must document the consideration of

* Section 136(b) of the Highway Act of 1970 imposes further requirements for anticipating and ameliorating highway impacts. Also the National Environmental Policy Act of 1969 has resulted in the requirement for Environmental Impact Statements by federal agencies.

environmental factors; (3) require an agreement between the user and the state highway department; and (4) will be maintained similar to all other highway projects.

It further provides a significant impetus to the joint development concept by authorizing, on right-of-way not needed for operational purposes, the use of federal highway funds to finance such improvements as (1) miniparks; (2) site preparation for open recreational facilities, including grading, drainage, minimum hard surfacing, lighting, fencing, and landscaping; (3) under viaduct lighting, fencing, curbing, landscaping, false ceilings, and minimum hard surfacing; (4) increased span length or other variation for structures or highway cross section; and (5) the use of structure instead of embankment. Although in some cases, demonstrations relative to safety or aesthetic needs, prevention of public nuisance, promotion of desirable uses, and/or conduciveness to better land utilization are required, the memorandum's significance is not diminished.

The theory underlying federal financing of such development of the right-of-way assumes that the work needed to make a highway conform to its environment in a reasonable manner is a part of the basic highway cost. The probability is strong that this philosophy as stated in IM 21-2-69 will be increasingly used to encourage the planning of future joint development projects.

Current Authority

Significant federal guidance for joint development is provided by Policy Procedure Memorandum 80-10, Use of Airspace, issued in 1971, which consolidated and replaced PPM 80-10.1 and 80-10.2. Also of current significance, although limited as to JDP type, are the statutes and federal directive concerning transportation corridor parking facilities. Their discussion follows that of PPM 80-10.

PPM 80-10 provides that applications for the use of airspace may be made by any individual, company, organization or public agency. This language seems to contemplate uses as broad in variety as the applicable zoning laws will permit. Further encouragement for the joint development concept can be found in its declaration that income received from the authorized use of airspace shall be the state's responsibility and credit to the federal interest is not required. If, however, any of the right-of-way is sold, a pro rata repayment of any Federal funds used in the original purchase will be required.

Also set forth in PPM 80-10 are control and safety provisions that supersede portions of Policy and Procedure Memorandum 80-5 of 1967. Those portions of PPM 80-5 providing for federal assistance in the acquisition

of rights-of-way with limited vertical dimension were unaffected, however.*

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Whereas both the 1962 and the 1967 directives (IM 21-2-62 and PPM 80-5, respectively) were no doubt sufficiently restrictive to retard JDP implementation, PPM 80-10 indicates an increasingly liberal federal position with regard to joint development. It evidences a growing awareness of the problems engendered by urbanization and the social benefits inherent in effective use of highway rights-of-way and should provide impetus to the growth of joint development projects.

Section 137, 23 U.S.C., as amended in 1970, provides for federal-aid assistance for the acquisition of land adjacent to rights-of-way outside central business districts, yet within an urbanized area, for the construction of publicly owned parking facilities (including the use of airspace above or below the highway). Such parking facilities are to be located and designed in conjunction with existing or planned public transportation facilities. The statute allows for inclusion of access roads, buildings, structures, equipment, improvements and interest in land. Significantly, it also provides that private interests may contact with the state to operate such parking facilities.

Section 142, 23 U.S.C., enacted at the same time as the 1970 amendment to Section 137, makes federal financing available for the construction of fringe and transportation corridor parking facilities to encourage development of public mass transportation systems in urbanized areas on federal-aid highways in order to increase the traffic capacity of the federal-aid highways.

PPM 21-20, Fringe and Corridor Parking Facilities Projects, was issued in 1971 and provides a framework for the application of the foregoing two statutes. It is important to note that fringe parking projects are limited to parking facilities which will serve bus or combination bus and rail systems. Perhaps the most legally significant aspect of PPM 21-20 is its definition of "adjacent," as used in Section 137. The term is defined to mean land sharing a common boundary with the roadway right-of-way. This definition contemplates federal assistance for the acquisition of land not within the traditional highway right-of-way, and therefore provides impetus for the participating state to expand the limits of its eminent domain powers, especially if they are strict in nature.

* The theory of limited vertical dimension has its greatest application in congested urban areas where, by acquiring an air corridor for the highway right-of-way, the participating state may minimize its cost of acquisition by permitting the utilization of the airspace above or below the highway.

Related Authority

- The Federal Housing Law of 1964 contains a provision relating to air-space rights-of-way and is therefore worthy of note. Section 1460(c)(1)(iv), 42 U.S.C. provides for the acquisition and development of air rights in selected areas such as those used for highways and bridge or tunnel entrances which have a blighting influence on the surrounding area. Such areas are to be developed for the elimination of the blighting influences and for the development of housing designed specifically for, and limited to, families or individuals of low or moderate income. Section 102 of the Demonstration Cities and Metropolitan Development Act of 1966 amended Section 1460(c)(1)(iv) to permit development of industrial or educational facilities in rights-of-way airspace after a determination by the local agency that the area was unsuitable for construction of low or moderate income housing. In 1970, Section 1460(c)(1), 42 U.S.C. was further amended with the addition of clause (v) which provided for the development of a variety of vacant, unused, and inappropriately or under used areas which lend themselves to development without full scale residential clearance activities for uses consistent with an emphasis on housing for low or moderate income families including the provision of such facilities, as schools, hospitals, parks, and other public facilities.

The availability of urban renewal programs as a vehicle for the development of rights-of-way space may well have played a role in the absence of legislation pertaining to joint development. The need to utilize more effectively highway right-of-way space is primarily an urban phenomenon brought about by the high population density of modern cities. The existing need for urban renewal can thus be easily combined with the advantages of joint development into an integrated plan. As a result, the need for a device to implement the development of highway rights-of-way can be fulfilled to a large extent by urban renewal in those areas where the utilization of right-of-way space is most likely to be desirable.

The absence of a more extensive federal legislation designed to implement joint development as a means of developing highway rights-of-way is not indicative of federal disapproval of such a program. Rather, the endorsement of airspace development in general as contained in the Federal Housing Act would suggest that where urban renewal is not feasible or appropriate, other federal agencies would be receptive to other programs--such as joint development--as an alternative means to carrying out the apparent policy favoring JD projects on state highway transportation ways.

2.3.2 STATE OF WASHINGTON AUTHORITY

Washington, like most states, has no statute which specifically authorizes joint development. However, the joint development concept, for the most part, appears capable of realization in the State of Washington by reason of a wide array of existing statutes, particularly those

in Title 47 (Public Highways) of the Revised Code of Washington that are referred to below.

Washington Constitution, Art. 1 and 16, Amendment 9 limits the state's inherent power of eminent domain by constitutional provisions which prohibit the taking of private property for a nonpublic use with or without just compensation. While the constitution declares that the question of whether a use is public or private shall be a judicial one,* it is well established in Washington that the use of land for highway purposes is a public use, and that the public interest requires the construction, operation, and maintenance of highways.† In support of this principle, RCW 47.12.010 and RCW 47.52.050 authorizes the Washington State Highway Commission to acquire by gift, purchase or condemnation, any lands necessary for a state highway right-of-way, limited access facility, or for any other highway purpose.

Basic to joint development is the authority of the State of Washington to sell lands not needed for highway purposes to private parties (RCW 47.12.60), cities and counties (RCW 47.12.070), or to the United States or any political subdivision of the state (RCW 47.12.080). Thus, where the state has acquired land for a right-of-way, a portion of which can be declared surplus, the sale of such surplus lands to private parties and/or governmental entities can apparently be used to implement joint development adjacent to the right-of-way that is in actual highway use.

RCW 47.12.120 and RCW 47.52.050 are perhaps the two most significant Washington statutes in the area of joint development. RCW 47.12.120 authorizes the state to rent or lease any lands, improvements, or air space above or below any lands used or to be used for highways, which are held for highway purposes but are not presently needed. It would seem, therefore, that subject to zoning regulations and other limitations, the state can permit the development of right-of-way spaces by private parties and/or political subdivisions. RCW 47.52.050 was amended in 1971 to permit the state, counties, cities, and towns to acquire a three dimensional air space corridor in fee simple when required for a limited access facility. Evidence of a growing awareness of highway right-of-way utilization for non-highway purposes is found in the language of the amended statute which provides that such a three dimensional air corridor can be acquired only if the permitted occupancy or use of the air space above or below the highway is not hazardous to the operation of the highway.

* For further discussion on judicial opinion, see Subsection 5.3.2, Qualification as Public Use.

† State v. Dawes (1965), 66 Wash. 2nd 578, 404 P. 2nd 20; State ex rel Sternoff v. Superior Court, (1958), 52 Wash. 2nd 882, 325 P. 2nd 300.

RCW 35.22.302 may be of almost equal importance. It provides that first and second class cities may, under certain conditions, convey or - lease, for public or private use, airspace above real property that is not dedicated to a public use.

RCW 47.32.160 authorizes the Highway Commission to adopt rules and regulations and issue permits for the construction of any approach road, facility, thing, or appurtenance upon state highway rights-of-way. By the proper exercise of the authority granted by RCW 47.32.160, the Highway Commission could facilitate the use of right-of-way space for joint development projects. It seems clear this statute permits the commission wide latitude to develop the guidelines necessary to implement joint development of highway rights-of-way--both land and airspace.

It appears that any lands and/or airspace held by the state for highway purposes, whether in present use or not, can be leased. While this would include land acquired in advance of actual construction (RCW 47.12.180; RCW 47.12.242), the state is compelled to commence construction on advance acquisitions within seven years of the date of acquisition (RCW 47.12.242). Joint development possibilities for such land may therefore be limited, except for short term types. On the other hand, land acquired as remnant parcels to minimize severance damages may have great value to overall JD planning, for the state is authorized to sell the portions lying outside of the normal highway right-of-way (RCW 47.12.160), or alternatively, to lease the remnants or the airspace above such parcels pursuant to RCW 47.12.120. The state, however, is prevented from condemning additional property adjacent to a right-of-way which it does not intend to devote to a public use, but rather it intends to sell as soon as the highway is completed.*

RCW 47.12.250 permits the acquisition of land adjacent to highways for preservation of natural beauty, historic sites or viewpoints, safety rest areas, or to provide a visual or sound buffer between highways and adjacent properties. To the extent that the airspace over the adjacent acquisition is not needed, it could possibly be leased pursuant to RCW 47.12.120 for joint development. The underlying purpose of the act poses a problem, however, because it requires the land surface beneath the airspace be devoted to scenic or recreational uses. An alternative possibility for joint development is provided by RCW 47.12.250 if the phrase "visual or sound buffer" is given a liberal interpretation. Such an interpretation might well permit the construction of public buildings on the land adjacent to the highways which, by their design or function, would act as a buffer between the highway and adjacent properties.

* Cf. State ex rel Chelan Elec. Co. v. Superior Court, 142 Wash. 270 253 P. 115.

Legislation* was enacted in 1971 that, in effect, permits the Washington State Department of Highways to acquire sufficient right-of-way, and to construct thereon, trails or paths within the highway right-of-way. This legislation is another example, along with RCW 47.12.250, of a piecemeal approach to joint development--i.e., limited authorization for a type of purpose or use that has become popular enough to receive legislative attention.

In summary, the State of Washington would appear to have sufficient existing statutory authority to permit many types of joint development of highway rights-of-way--perhaps more than most other states. Washington's legislation, however, is somewhat fragmented, and at present, it is difficult to accurately delineate the extent of its legislative authority as related directly to federal authority now existing for joint development. A specific legislative enactment for a general purpose joint development statute which is incapable of the varied interpretations inherent in the existing statutes is needed. Such a statute is discussed in Section 9, Implementation. Also refer to Subsection 5.3, Legal Considerations, which describes other legal issues that need to be faced by highway departments considering cosponsorship of joint development projects.†

* House Bill 1060, Chapter 130, Laws of 1971, 1st Ex. Session, August 9, 1971.

† As to adequacy of title to right-of-way that would affect joint development proposals, Washington's practice of gaining fee simple title (after title search and report) presents no problem.



Section 3

JOINT DEVELOPMENT DESCRIBED

The purposes of this section are to clearly set forth the joint development concept and to classify and illustrate the type of projects considered to be within the concept.

The first part of this section (3.1) defines the principles and scope of joint development and describes its functional limitations; sponsorship and action requirements; and spatial, land tenure, and timing distinctions. This is followed by definitions of associated terms used in this Guideline, including types of related highway-oriented developments that are considered outside the definition of JD. The second part of this section (3.2) arrays joint development types by function or purpose and describes each of eight major JDP classes and illustrates how each can relate to the highway and its surrounding areas.

A suggested worksheet (Worksheet 1) follows subsection 3.1 to (1) provide for identifying JD applications or concepts according to the distinctions covered in the subsection; and (2) provide a uniform data reporting system as well as a systematic filing procedure for future JDP data retrieval for reference or correlation analyses of implemented JD characteristics.

3.1 DEFINITIONS

- JOINT DEVELOPMENT

"Joint development refers to the joint use or occupancy of a specific limited land area for more than one purpose, such as, the use of highway right-of-way by non-highway type facilities, structures, structural elements, or activities. It may include public or private use over, under, or bordering the roadway limits and include utility installations, residential or commercial buildings, community facilities, recreational activities, etc. Similarly, other land within the highway corridor may offer an opportunity for joint development." (PPM 21-19, Draft, 1971; FHWA.)

- Although somewhat broad in scope, this definition serves well to describe the general principles of JD. However, the following clarifications are necessary in order to understand the concept of joint development as used throughout this Guideline.

Functional Limitations

The joint use or occupancy should not:

- be "highway" in purpose (see discussion following this subsection on why scenic highways, parkways, or similar facilities are not JD)
- be an element or activity that would ordinarily be provided in the design of functional and safe highways (see following discussion on why highway crossings and convenience stops may not be JD)
- purport to provide an activity that is normally considered within the conventional concept of highway use (e.g., transit bus operations; convertible lanes for periodic exclusive use by trucks, buses, or car-pooled autos; and so forth)
- be an element that provides controls for policing or operations (e.g., truck weigh stations; agricultural inspection stations; customs and immigration facilities; toll stations, surveillance stations; and so forth)

Joint Sponsorship Requirement

Joint development requires action jointly with the highway department of one or more of the following:

- Other state departments, divisions, or agencies
- Other governmental agencies (federal, county, borough, city)
- Special districts or authorities (utility, transportation, fire, etc.)
- Quasi-public entities (public corporations for purpose of property development, or similar entity)
- Private corporations, companies, and non-profit institutions
- Duly constituted private citizen groups, clubs or associations.

A highway department may on occasion act independently without co-sponsorship so long as there is an intent to ultimately convey, transfer, or otherwise shift authority and responsibility to others. This can be especially applicable where the "expanded rights-of-way" concept is utilized in order to implement certain JD projects (see land tenure classification III following).

Cosponsorship may also be unnecessary where it can be demonstrated that the joint element is capable of being sold, leased, or granted to others at a future time (i.e., highway maintenance stations; multi-modal transfer facilities).

Action Requirements

Joint development involves in varying degrees the following developmental activities. Also, as a general rule, JD must enhance the attractiveness, utility, or convenience of the lands or air space involved in a JDP proposal.

- Planning coordination
- Community interaction
- Design integration
- Construction accommodation
- Maintenance or operating agreement
- And, possibly, land acquisition coordination.

The following actions do not of themselves necessarily constitute joint development, though they may be associated with JD projects.

- Airspace lease
- Franchised operator's agreement (e.g., commercial)
- Issuance of franchise agreement (e.g., public utilities)
- Encroachment permit
- Sale of abutting surplus property
- Sale of abandoned right-of-way
- Development of other highway properties within the highway corridor

Spatial Designation

Four possibilities exist for denoting the spatial or locational relationship of JD projects with respect to the highway right-of-way. They are not necessarily mutually exclusive, and a single project may involve any or all of the relationships indicated. The distinction is important, though, in that any one possibility can offer unique design considerations (discussed in Section 5) that would be inappropriate for other spatial relationships. As examples: the use of median areas may immediately raise a design policy question relative to left-side "duck outs"; sidestrips may raise an initial concern over additional lane-side

obstructions; fears of dropped objects are suggested by over-the-highway locations; ramp interiors (near which the greatest amount of merge, - weave, acceleration, and deceleration movements occur) can raise special concerns over further degrading traffic flow where the project is proposed in these locations; and locations close to the roadway may appear less free from various constraints than off-right-of-way spaces.

The four suggested spatial designations are as follows:

- Airspace within the right-of-way (typified by space over or under elevated highways, or above highway pavements situated at any elevation)
- Ground space within the right-of-way (typified by median and sidestrip areas, ramp interiors, and possible ramp exteriors)
- Below-ground space within the right-of-way (space, generally not in view, below natural or finished ground level)
- Space abutting or adjacent to the right-of-way (either above, at, or below ground level).

Land Tenure Classification

Whereas spatial definition provides a basis for physically relating JD projects with highways, the land tenure of the joint element offers a more definitive legal classification. Joint development will normally require the joint element to occupy land areas (or vertical space) described by one or more of the following conditions:

- Within Normal Right-of-Way: Refers to land (or space) within the right-of-way normally acquired for accommodating the function, use, safety, and operation of the highway element. The right-of-way boundaries are those formally adopted and legally approved, regardless of the location of fencing, limited access lines, limits of encroachment, or other lines or barriers.
- On Contiguous Excess (Surplus) Highway Property: Refers to lands acquired incidental to purchase of the normally required rights-of-way, such as remnants, land-locked parcels, and other severance takings. This category also includes land originally acquired for highway purposes but subsequently declared surplus, say, due to design change.

- On Expanded Rights-of-Way for JD Purposes: Refers to lands in excess of the two preceding categories that are acquired (or will be acquired) by the highway department for the declared purpose of JD. The intent here would be to create, through the demonstration of public use,* joint development rights-of-way in lieu of solely highway rights-of-way.
- On Adjacent Public Property: Refers to lands acquired (or to be acquired) by other public or quasi-public agencies that because of their proximity to the highway are appropriate for JD.
- On Adjacent Private Property: Refers to all other lands adjacent to the right-of-way, but where the intended use, or uses, clearly requires joint planning and developmental coordination.

Table 3-1 summarizes the classes and suggests the type of controlling agency, possible physical orientations of the joint element to the highway, and examples of the JD projects in each of the land tenure types.

Timing Distinction

The following time-oriented distinctions can be useful.

- Permanent Use: Refers to long term projects where alternative future uses are not contemplated. (Projects having renewable short term leases or operating agreements may be considered a permanent JDP as long as the intention to renew is clear.)
- Temporary Use: Refers to short term projects where change in use, land reversion for highway expansion purposes, or abandonment of the project is expressly understood. (Interim use of highway rights-of-way prior to initial highway construction does not constitute joint development.)
- Pre-Construction: Refers to projects where the joint use or activity occurs prior to highway construction, but where the near term intention to commence construction is clear.
- Concurrent Construction: Refers to projects where construction of the highway and joint elements occur more or less simultaneously. (The full completion of both elements need not occur concurrently so long as the portions jointly affected are built or installed at the same time.)

* "Public Use" is discussed in Legal Considerations. See Subsection 5.3.2.

Table 3-1

JOINT DEVELOPMENT CLASSIFIED
BY LAND TENURE OF JOINT ELEMENT

Class	I	II	III	IV	V
Short title	Within normal R/W	On excess property	On expanded R/W	On adjacent public property	On adjacent private property
Control of tenure vested with:	Highway department	Highway department	Highway dept. with possibly other public agencies	Other public or quasi-public agencies	Private interests
Possible locations of the joint element:					
Over/under	*				
In median	*		*		
In sidestrip	*	*	*		
In ramp interior	*		*		
In ramp exterior		*	*		
Off - R/W		*		*	*
Examples of JD projects by type:					
AGRICULTURE	Stock pens	Experimental planting	Stock trails	n.l.	n.l.
BUILDINGS	Warehouse	n.l.	Municipal center	Public housing	Freight terminal
PARKS	Play courts	Mini-Park	Trails/paths	Game preserve	Marina
PARKING	Off-street	Park-n-Ride	Trailhead	Fringe parking	Parking garage
STORAGE	Corporation yard	n.l.	n.l.	n.l.	n.l.
TRANSPORTATION	Local transit station	n.l.	Exclusive bus lane	Rapid transit line	Helicopter
UTILITIES AND COMMUNICATIONS	Trunk water line	Sub-station	Multi-utility tunnel	Transmission line	Commercial pipeline
COMPLEXES	n.l.	n.l.	Transportation corridor	Urban renewal	Entertainment center

Note: Examples shown are not necessarily exclusive to the indicated class.

n.l. = not likely unless combined with other class or classes.

- Post-Construction: Refers to projects where the joint element's use or activity is commenced subsequent to highway completion (regardless of how long after completion).

Definitions of Associated Terms

- AIRSPACE/AIR RIGHTS - Airspace (a physical concept) might strictly be defined as space having horizontal and vertical boundaries above the ground surface; and air rights (a legal concept) as the attaching of rights to inclusive and undisturbed use and control of such designated space. In regard to joint development, examples would be the airspace use rights of projects situated between the ground surface and the underside of an elevated highway, or the space above a highway facility, whether depressed, on-grade, embanked, or structurally elevated. The terms airspace and air rights are often used interchangeably in the literature. Also, a somewhat broader definition for airspace is provided in PPM 80-10:

"...that space located above and/or below the highway's established guideline, lying within the horizontal limits of the approved right-of-way boundaries."

As a practical matter, neither the interchange nor the broader use of these terms offer any special problems to the joint development concept, as long as the basic distinctions are clear.

- ENVIRONMENT - Simply stated, environment relates to the surroundings that affect or otherwise act upon an ecological community. Ecology is defined with the reverse emphasis--the totality of relationships of man and other living beings to their environment. The term environment has sometimes been limited to the physical environment (viz., air, and water quality, noise and visual pollution), but a more current and broader viewpoint includes the integrally related, though possibly indirect, effects and relationships of social and economic environments (i.e., community disruption; cultural enhancement; social decay or betterment; economic disruption or timeliness; wildlife preservation; conservation of unique environments; and so forth). This Guideline considers the term in the broader context, for example, as used in the terms "environmental impact," "environmental statement," or other similar terms facing the JD planner.
- HIGHWAY - A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way. Such classifications as Interstate, freeway, federal-aid highway, expressway, throughway, parkway, arterial, turnpike, or scenic road are all relevant types within the meaning of "highway" as used in this Guideline, so long as they are part of a state highway system with controlling authority vested with the highway department.

- Conventional: a highway without access control.
- Limited Access: a highway upon which the rights to ingress and egress, light, view, and air are controlled by law.
- Fully Controlled Access: the control of access is exercised to give preference to through traffic by providing access connections with selected public roads only, and by prohibiting crossings at grade or direct private driveway connections.
- Partially Controlled Access: the control of access is exercised to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there may be some crossings at grade and some private driveway connections.
- HIGHWAY CORRIDOR - The highway right-of-way and the adjacent lands directly affected by the highway facility, either (1) by reason of access to, from, or across the right-of-way, or (2) resulting from the highway's environmental impact in terms of visual intrusion, or directly relatable noise or air pollution, or (3) a combination of these factors. The width of the corridor may vary according to the configuration (both horizontally and vertically) of the highway, the characteristics of the adjacent development, and natural features.
- HIGHWAY ELEMENT - That portion of a joint development project represented by the highway facility itself and all ancillary features necessary for the performance of its primary function.
 - JOINT ELEMENT - That portion of a joint development project represented by one or more land developments, physical features, or activities that constitute the additional use of the highway right-of-way or the integrated non-highway uses adjacent to the highway.
- HIGHWAY USER - Those that use the highway, either driver or other occupants of authorized highway vehicles.
 - JOINT ELEMENT USER - Refers to the user or participant of the joint element.
- MULTIPLE USE* - Synonymous with joint development.

* The Federal Highway Administration has recently elected to utilize only one term--Joint Development--rather than, as formerly making distinctions between joint development and multiple use.

- RIGHT-OF-WAY - The land, property, or interest therein, usually in a strip, acquired for or devoted to highway purposes. Unless otherwise noted, highway right-of-way is understood in this Guideline even when the word "highway" is omitted.
- ROADWAY - The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways.
 - Roadside: The area adjoining the outer edge of the roadway. (For some types, this area may extend beyond the highway right-of-way.) Extensive areas between the roadways of a divided highway can also be considered roadside.
 - Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.
- RELATED HIGHWAY-ORIENTED DEVELOPMENTS - To further provide definitional clarity and Guideline user understanding, the following highway-based developments per se are not considered within the meaning of joint development:
 - Scenic Highways: This is a type of highway and not a joint use. Compared to conventional highways, this type of facility generally carries less traffic, at slower speeds, over roadways of less rigid design standards, primarily for the pleasure, enjoyment, and recreation of its users. Accordingly, certain types of recreation, conservation, agriculture, and roadside parking features that might otherwise be viewed as JD are normally inherent in the design of a scenic highway. For example, acquisition of scenic easements adjacent to highway rights-of-way for purposes of insuring scenic amenity, preservation of view, aesthetic enhancement, and/or conservation of open space are considered part of the scenic highway concept and not joint development. On the other hand, some of the JDP types indicated in Section 3.2 may occasionally be appropriate for scenic highways, and therefore portions of this Guideline can be useful to their planners and designers. In such cases, the scenic highway would then be considered as the highway element.
 - Parkways: Again, this is a type of highway and does not constitute a joint use. Typical of this type are National Parkways, certain toll roads, and numerous examples of extensively landscaped urban highways and expressways. By and large, parkways are associated with a concerted design effort to visually enhance the roadway corridor by beautification, and are not necessarily associated with the development of multiple land uses in a joint, interrelated fashion. As with scenic highways, JD features could be added, in which case the parkway would then be considered as the highway element.

- Highway Crossings: Project features whose purpose is to merely provide accessibility from one side of the highway to the other, are not joint development. These include over-crossings, tunnels, tramways, conveyors, sky-lifts, and other devices for the passage or conveyance of pedestrians, animals, bicycles, carriages, materials, products, and freight. Other examples of simple crossings can be local streets and roads, railroads, waterways, channels and drainage ways, airport runways and taxiways, and utility and communication ducts, cables, pipes, tubes, conduits, and so forth.

Although often planned and coordinated similar to JD projects, highway crossings generally satisfy a requirement of design necessity, public convenience, or economic expediency rather than the true intent of joint development. JD features such as pedestrian plazas, office building corridors, restaurants, transit station platforms, loading docks, and so forth may serve as a highway crossing, though usually in an ancillary way. These types should be classified in categories that relate more to their JD purpose.

- Convenience Stops: Development of facilities that solely offer comfort, convenience (non-commercial), or safety to the highway user are not joint development. Rest, emergency, view, information, trash disposal, historic plaque, and drinking or radiator water stops are all driver-related features inherent in the design of certain highway types. A general rule that can be followed is that if the highway feature is not itself a destination, it is not likely to be a JD.

Some convenience-related types that can be JD are service stations; souvenir shops, trail-head parking and park-n-ride facilities; transit stations offering multi-mode opportunities; and overnight camping and travel-trailer areas. This is because (1) they can of themselves be a destination, or (2) they produce non-highway revenue, or (3) they offer extended stays through the night-time hours, or (4) good highway design practice wouldn't necessarily require their development along the right-of-way.

Worksheet 1

JDP PROPOSAL IDENTIFICATION FORM

Short Title _____ JDP classification(s) __, __, __.

Proposed Location _____

Originated by _____ Project No. _____
 (Applicant or highway department's originator)

<u>COSPONSORSHIP</u>	<u>DEFINITE</u>	<u>POSSIBLE</u>	<u>AGENCY OR CONTACT</u>
Federal	()	()	_____
Other State	()	()	_____
Local (inc. special district)	()	()	_____
Private	()	()	_____
Other	()	()	_____

ACTIONS REQUIRED (check as many as are believed to be applicable)

- | | | | |
|------------------------------------|-----|---|-----|
| Planning (physical) coordination | () | Airspace lease | () |
| Community interaction | () | Franchised operator's agreement | () |
| Design integration | () | Franchise agreement (utility) | () |
| Construction accommodation | () | Encroachment permit | () |
| Maintenance or operating agreement | () | Surplus property sale | () |
| Land acquisition coordination | () | Development of other state properties (within highway corridor) | () |

SPATIAL DESIGNATION (relation of joint element to the highway facility)

Airspace () Groundspace () Below-ground () Outside R/W ()

LAND TENURE CLASSIFICATION (joint element as related to highway right-of-way)

- | | | | |
|-----------------------|-----|--------------------------------|-----|
| I Within normal R/W | () | III On expanded R/W | () |
| II On excess property | () | IV On adjacent public property | () |
| | | V On adjacent private property | () |

TIMING DISTINCTION

- | | |
|-------------------------|------------------------------|
| Permanent joint use () | Pre-highway construction () |
| Temporary joint use () | Concurrent construction () |
| | Post construction () |

Use reverse side to enter additional information for JDP file purposes.

3.2 CLASSIFICATION AND DESCRIPTION OF JOINT DEVELOPMENT TYPES

Based on the project examples cited in Section 2 and guided by the foregoing definitions, Table 3-2 classifies JD types and subtypes according to functions or purposes and assigns code numbers to each subtype. It is anticipated that more than one code number would be specified when a JDP involves more than one use, even for the multi-use category "complexes."

The table also indicates selected "distinguishing characteristics" and "examples of type" for each JD subtype, so it can serve as a check list for the highway planner when considering new routes or for considering possible alternatives to JD proposals advanced by others.

The comments that follow the table serve to compare and further describe the eight major JD categories in Table 3-2, particularly the last category referred to as complexes. However, the locational characteristics noted in this subsection (including those given in Table 3-2) are qualitative in nature and only for purposes of general orientation and guidance. They should therefore be supplemented by Guideline Sections 4 through 8 for JD evaluation and decision-making purposes.

Agriculture

The agricultural use examples indicated on Table 3-2 as joint development are easily understood and can be readily accommodated with the highway. Livestock (A-1) must, of course, be restrained from wandering onto the roadway; stock pen or stock yard odors that may be offensive to the motoring public are also a consideration. Crops (A-2) must be chosen that are not particularly susceptible to damage by motor vehicle emissions; it is conceivable that some plant strains, perhaps yet to be developed, would find the environment adjacent to or under the highway element desirable for growth. The low cost of rural land (relative to urban prices) and its greater availability adjacent to the highway right-of-way can diminish the potential for joint development, however, of rural oriented JD projects of this type.

Buildings

B-1 Office

Office buildings are normally occupied during the day only; their tenants are for the most part continuously active and usually enclosed in air conditioned spaces--conditions appropriate for highway locations. They should be located, however, where the morning and evening peak demands for access can be accommodated, by both the highway element and the surrounding local street system. Because of their relatively high

Table 3-2
TYPES OF JOINT DEVELOPMENT PROJECTS

Basic Classification	Distinguishing Characteristics	Examples of Type
<u>AGRICULTURAL</u>		
A-1 Livestock	Medium to high activity (animal)	Stock pens Stock yards Grazing Trails
A-2 Crop production	Minimal to low activity (people)	Grain harvesting Truck farming Trees & plants (commercial) Experimental planting
<u>BUILDINGS</u>		
B-1 Office	High (people) concentration Access by peaks Moderate noise sensitivity	Governmental Private Maintenance/testing Public safety
B-2 Commercial	Moderate (people) concentration Access continuous Low to moderate noise sensitivity	Retail stores & shops Banks Restaurants Branch post offices Service stations Souvenir shops Sports arenas, stadiums, gymnasiums, auditoriums Visitor information center
B-3 Institutional/ cultural	Moderate (people) concentration Access intermittent High noise sensitivity	Schools Hospitals & clinics Libraries & museums Judicial Religious & ceremonial
B-4 Industrial	Low (people) activity Access by peaks Minimal to low noise sensitivity	Warehousing Fabrication Manufacturing Freight terminals/docks
B-5 Residential	24-hour population Very high noise sensitivity	Public housing Private housing Hotels/motels Nursing homes Juvenile homes
B-6 Parking structures	High (automobile) activity Least noise sensitive	Garages Decks (structural)

Table 3-2 (Continued)

Basic Classification	Distinguishing Characteristics	Examples of Type
<u>PARKS</u>		
P-1 Recreation-active	High (people) activity Low noise sensitivity	Tot lots Mini-park Play courts Play fields Rings, tracks, pools Lake development Ramps, piers, platforms
P-2 Recreation-passive	Low to moderate (people) activity Moderate noise sensitivity	Ornamental Sitting Mini-park Educational Historical & monument Picnic Camping/travel-trailer Zoological Horticultural
P-3 Lineal	Low (people) activity Low to moderate noise sensitivity	Pedestrian trails Equestrian trails Bicycle paths Ribbon park Buffer park
P-4 Conservation	Minimal (people) activity Varying (animal) activity Minimal noise sensitivity	Game preserve Wild life park Nature park Bird sanctuary Water conservation
<u>PARKING (open)</u>		
PG-1 Offstreet	Urban oriented Access from local street or road (may have indirect access from highway)	Public: free, metered, rental Semi-public: school, church, transport terminal, etc. Private: restricted, permit, employee
PG-2 Roadside	Rural/suburban orientation Direct access from highway (may have indirect access from local street or road)	Trailhead parking for fishing, boating, hiking, nature areas, skiing, and so forth Park-n-ride Car pooling Fringe (mode change) Tandem-trailer make-up/break-up

Table 3-2 (Continued)

Basic Classification	Distinguishing Characteristics	Examples of Type
<u>STORAGE</u>		
S-1 Vehicular	High mobility	Emergency vehicles: fire, ambulance, police, road service, road & snow maintenance Impounded vehicle Transport vehicles: bus, taxi Commercial vehicles: auto, truck, mobile equipment
S-2 Stockpiling	Non-mobile	Aggregate; sand Lumber; prefab forms Cable; wire Pipe; castings Non-mobile equipment
<u>TRANSPORTATION</u>		
T-1 Terminals/ stations	(See note on page 3-15)	Transit bus; U-drive Rapid transit; railroad Ferryboat; hydroplane STOL port; Hovercraft Heli-port, -pad, -stop
T-2 Fixed rail	Mechanical orientation with minimum human operation	Rapid transit; rail bus railroads
T-3 Paved lane	Equipment orientation, with some freedom of human operation	Bus lanes (exclusive) Bus turnouts and stops Exclusive bus ramps Bus-train lanes
<u>UTILITIES & COMMUNICATIONS</u>		
UC-1 Lineal	Corridor oriented Non-visual potential	Pipes, cables, conduits, ducts, tunnels, drainage channels (may include commercial pipelines)
UC-2 Nodal	Point oriented Visual likelihood varies	Substations Pumping stations Relay stations & towers Water storage tanks/ reservoirs "Packaged" treatment plants Wells (water, oil, gas, etc.)

Table 3-2 (Concluded)

Basic Classification	Distinguishing Characteristics	Examples of Type
<u>COMPLEXES</u>		
C-1 Lineal complexes	Elongated configuration	(See discussion following in this subsection)
C-2 Nodal complexes	Concentrated configuration	(See discussion following in this subsection)

Note: T-1 may often include buildings, parking, and vehicular storage; however it is classified as shown because of its special relationship to transportation.

income producing nature, office buildings are generally more economically feasible for over-the-highway locations than are other building types.

B-2 Commercial

Some commercial uses (e.g., gas stations, auto repair shops, cafes) are related directly to the highway user and accordingly are best situated where easy access to and from the highway element can be achieved. Others, particularly retail outlets and consumer services are not as closely related to the highway function, but may be good JDP candidates so long as they can be located centrally to their service area. Commercial recreation establishments typical of air conditioned bowling alleys are ideal projects.

B-3 Institutional/Cultural

The examples of this class of JD given on Table 3-2 should be clear. However, because of their very diverse purposes, each type must be viewed individually as to its appropriateness for a near-highway location, considering noise, motor vehicle emissions, safety, and especially, period of occupancy. Consideration might be given to the development of institutional uses within highway fills during construction of the highway that require soundproofing, protection from radio waves, or protection from, say, fire or explosion. Similar to other JDP types, institutional and cultural uses should be located where they are central to the areas they are intended to serve.

B-4 Industrial

Because of expansion flexibility and emission problems associated more with heavy industry, light industry is generally better suited as joint development. Ideally, industries exhibiting low employee ratios per gross area (e.g., warehousing) are generally more desirable than labor intensive industries introducing peak demands on access facilities. For large industrial complexes employing relatively high numbers of workers and generating considerable truck transport, it is important in JD location decisions for the JD planner to consider origin and destination patterns. In considering major industrial uses, the availability and location of worker housing is, of course, a "community" question; however, if the highway department is to participate in the JDP, even if only as a nominal sponsor, this type of social awareness on the part of the highway department is usually prudent.

B-5 Residential

Buildings with nighttime population (that is, used for sleeping or potential 24-hour occupancy) require the most protection from noise, vibration, and fumes. For consideration of this use, there should be a clearly demonstrated need for the housing; an example might be where replacement housing occasioned by highway construction should be

relocated within the same neighborhood in order to preserve the social ties and general well-being of resettled families (refer for details to Subsection 7.2, Social Consequences). Safe and convenient access to local schools, recreation facilities, shopping, and services are further locational considerations.

In-town townhouses or other row type housing might be a possibility for locations under an elevated highway having separated roadways. This allows air and light on both ends of the unit. Low-cost housing is not apt to be economically feasible over the highway unless subsidized. Low-income, single family housing may be suitable alongside the highway but may require earth mounding and/or considerable landscape planting as barriers. Space under relatively high bridges may offer advantages for considering houseboats or other over-water living units.

Hotels and motels, on the other hand, are strongly related to the highway user, have transient, or at least short term patronage, and if properly located along the highway route, can reduce traffic usage on local streets. Also because of their generally higher profitability, they can overcome any increased costs that may be associated with JD.

B-6 Parking Structures

Parking structures offer one of the best joint development opportunities in urban areas because:

- They are intrinsically related to the highway element, in that both accommodate the automobile and are functionally complementary--the roadway serves the automobile in motion, the garage serves the automobile at rest.
- They are vehicle destinations; the more closely located to the highway element, the less local streets are needed as intermediate facilities.
- Whether over, under, or beside the highway element, their spatial and structural characteristics and finish design requirements are harmonious with those of the highway element.
- Noise and highway-contributed fumes are not critical factors because of the in-and-out pattern of its users (though this does not apply to garage employees).

Parking structures as joint development elements can achieve their highest economy and use (1) where they are combined with other automobile service elements such as gasoline sales, automobile repair, wash, and service, (2) where costs per stall permit rates that are competitive with other nearby parking opportunities, and (3) where elevators, escalators, under street tunnels, overstreet covered connections, or other user accessways are provided.

Parks

P-1 Active Recreation

Although the noted examples sufficiently describe this JDP type, some locational considerations are worthy of comment. Active recreation parks will vary somewhat in their sensitivity to noise, but as a general matter noise need not be a consideration. However, intensive activity uses may raise the question of increased respiration rates and the deep breathing of motor vehicle exhaust pollutants (see discussion of air quality in Section 6).

The larger size of region-serving facilities provides greater planning and design flexibility than for the usually smaller local parks, and therefore can be more truly representative of the joint development concept. Also, regional parks tend to depend more on the automobile than on the foot as modus mobilia. Remember though that the smaller mini-parks and some playcourts are often ideally suited to remnant parcels, even if they were not considered as joint development per se.

Facilities such as clubhouses, park offices, equipment storage sheds, paved areas for game courts or associated parking are well-suited under elevated highways because of the difficulty of growing plants there and the visual qualities are less critical.

P-2 Passive Recreation

Because passive-type parks tend to be less developed and rely more on landscape planting, flora preservation, and natural scenery, they make excellent joint development elements in suburban and rural areas. They generally do not have, or require, the high people densities more appropriate to urban located active parks. Consequently passive recreation facilities, on balance, tend to be highway user oriented.

P-3 Lineal

This class of JDP is most often illustrated by lineal, park-like developments, but may include trails and paths for pedestrian hikers, equestrians, or bicyclists. Pedestrian ways are described below and bicycle paths are covered under New Concepts for Joint Development in Section 10. Hiking and equestrian trails which require little right-of-way space and only nominal improvement costs are generally appropriate when it can be shown that without joint development, the trail would likely not be developed, or that an existing trail would be severed. Otherwise the question regarding more totally natural locations (i.e., away from the highway) can be raised.

Lineal parks are possibly the best suited of all the park types, whether on urban, suburban, or rural areas because:

- They are highly desirable from the point of view of both the highway user and the abutting property owners.

- They are lineal in nature, paralleling the highway element rather than crossing it.
- They double-up on the use of landscape planting immediately adjacent to the roadway.
- They are able, in a positive way, to form boundaries to social units (i.e., neighborhoods), and give each a frame or 'edge' and enhance the sense of place or identity.
- They offer an excellent way of integrating the jagged right-of-way line often occasioned by severance acquisitions.

Lineal parks can be made into functional connectors linking nodal parks of a more active character. Also, they can embrace pedestrian and bicycle ways between neighborhoods, including the CBD, without traversing city streets that otherwise would be contributing to traffic conflict.

P-4 Conservation

This type of JDP envisions the integration of the highway with areas to be set aside as park reserves for the conservation of (1) exceptional scenic beauty, (2) large numbers of wild animals, birds, or unusual plant species, or of (3) areas of exceptional ecological fragility. In the joint development of conservation parks, all necessary steps must be taken to maintain existing natural conditions; i.e., ground water levels, animal mating/spawning areas, soil stabilization, and the like. A thorough study of the ecological considerations involved must be accomplished prior to the final routing of the highway element and designation of the conservation park. Obviously, subsequent highway design should be sympathetic to the purpose of the conservation area by minimizing the disruption that could be caused by alignment and grade.

Parking

PG-1 Offstreet

Parking lots are complementary to the highway element for reasons similar to parking structures (B-6). In addition, they are highly flexible in design terms--size, shape, land slope, spatial relationship to highway element and to abutting land uses, and so forth. From an aesthetic standpoint, they are best located under elevated highways, as has been traditionally the case. Where proposed for locations beside the highway, economic and highest-and-best use considerations may indicate the inappropriateness of this type of use. Also, where substantial grading would be required, all else being equal, it is doubtful whether surface level parking would be economical.

PG-2 Roadside

Whereas offstreet parking is usually always city-center based, roadside parking is oriented towards suburban or rural areas, and should offer the JD planner far more interesting possibilities for joint development than the more traditional offstreet facility has offered to date.

Well located roadside parking facilities for a variety of roadside recreational purposes can be instrumental in eliminating illegal and often unsafe roadside parking. As other agencies are most always involved in recreational activities proximate to the highway, cosponsorship shouldn't be difficult to find.

Fringe parking at roadside locations might logically be cosponsored by the local (suburban) municipality on the basis that street-side parking could be eliminated, thereby returning the street to its original design capacity. Roadside kiss-n-ride or carpooling facilities may find cosponsorship more difficult to arrange, but then, in this case, the direct effect of reducing the number of cars on the highways' traveled way is evident. Expanded rights-of-way (Tenure Class III) can be appropriate for roadside parking; also, the development of areas adjacent to interchanges, say, within ramp interiors, can be particularly well suited for this JDP type.

Storage

Storage is well-suited as a joint development element for under-highway locations as well as possible, on remnant parcels, freeing up other valuable lands for higher uses. The relative costs of highway-adjacent land is usually the determining factor, and therefore this type of JDP tends to only be appropriate in more dense urban centers. Storage of highly mobile items (S-1) have the advantage of quick clearance of the JDP site in the advent of fire. Conversely, some types of stockpiled storage (S-2) including underground fuel, unless carefully regulated in design and operation, increase the potential for fire. The availability of ready-made cover in areas of either heavy rainfall or extreme temperatures can be a locational advantage for under viaduct storage of certain types of materials.

Transportation

This class of JD is so closely interrelated with the purposes of the highway system, as well as the more current and broader people-moving concept that little further comment seems necessary about that indicated on Table 3-2. One observation relative to the development of mass transportation jointly with state highways, although not necessarily limiting, should be understood, however: Mass transit facilities are best located in corridors of non-automobile ownership; therefore joint use of the highway corridor, being, of course, automobile oriented, suggests the

possibility of joining such facilities to be fundamentally at cross purposes. Related points and exceptions concerning transit terminals follow.

T-1 Terminals and Stations

Terminals and stations are not particularly well suited as joint development elements because they are normally dependent upon high-density pedestrian traffic. Exceptions are, however:

- Where they are part of a large-scale planned land development which envisages a high-density node centered on the highway element.
- Where they are part of an automobile parking/mass transit interface, say, as with a local feeder bus or passenger ferry boat system.
- Where right-of-way acquisition for highway element and transit element can be substantially minimized and the concomitant stations cannot be located closer to destination points away from the highway.
- Where they exhibit a high land use economy and efficiency as a joint element when located on or under the ground floor of a high population office building or complex of buildings, not only central to the office space above but also (by convenient interconnections) to nearby service areas.

Locations should obviate conflict between different modes of transport and between pedestrian/vehicular conflict. Multiple-level, median, or sidestrip transit as joint development is generally unsuitable unless adequate horizontal movement across the highway element is provided. Consider, however, that station locations near highway crossings and interchange ramps present added traffic conflicts and therefore they are usually more suitable at locations away from interchanges.

Utilities and Communications

Utilities and communications lines and facilities are suitable for joint development because they have a lineal to lineal compatibility, and dual right-of-ways can be avoided. However, as with transportation, the locational efficiency of providing continuous and convenient utility service to its users (who for the most part bear little, if any, relationship to the highway corridor) at reasonable cost is probably the single biggest predeterminant for joint development of this type of project--rural oriented transmission facilities excepted. (Location considerations, along with other relevant factors, are discussed in Subsection 5.1.9, Utilities.)

Complexes

This class of joint development differs from other types in that (1) they are combinations of two or, usually, more joint development uses; (2) they are more complex both in their internal organization and in their relationship with the highway element; and (3) internal circulation is primarily by foot, although they may include mechanical people-movers such as moving belts, elevators, escalators, or possibly elephant trains. While complexes may not cover more ground than a comparable number of single uses, they tend to be more intense and make more use of the vertical dimension. Two spatial configurations characterize this JD class:

- Lineal Complexes (C-1) are characterized by joint development elements being organized in a linear manner, forming a relatively elongated unit.
- Nodal Complexes (C-2) are characterized by joint development elements being organized in a concentrated manner, forming a relatively coherent unit.

The most widely useful complexes, either lineal or nodal, are those that combine a variety of uses--commercial, residential, transportation, parks, etc.--into one interacting organism. This multi-use complex is most successful where the intra-dependence of its various elements is maximized, and where those elements satisfy deficiencies in the surrounding community uses. Lineal or nodal complexes can be developed through normal public and/or private channels, but might best be accomplished through legal machinery established especially for the purpose. Examples are special-purpose districts with their own taxing power, urban renewal districts, quasi-public development corporations, etc.

The physical determinants of the highway element itself will suggest various natural physical units:

- Interchanges lend themselves to nodal complexes adjacent and/or under highway interchange structures.
- Elevated highways lend themselves to lineal or nodal complexes located under and adjacent to raised highway structures
- Depressed highways lend themselves to lineal or nodal complexes over and adjacent to the roadway.
- At-grade highways offer broad locational choices, but suffer from not having the grade separation advantage that often may be the only apparent reason for considering what by some could be viewed as the more complicated way of developing highway adjacent lands

In some circumstances, the multi-use complex may not be an appropriate response to community needs; a more specialized complex may be called for. Some examples are:

- Transportation Complex: Typical features might include various combinations of (1) multi-mode transport ways, (2) inter-mode transfer stations, (3) freight terminals or trans-ship facilities, (4) warehousing, and (5) vehicle rental, storage, service, and parking.
- Public Service Complex: Typical features might include combinations of (1) walk-through utility tunnels, (2) police, ambulance, and fire lanes, (3) centralized heating, cooling, or ventilating systems, (4) utility stations, energy conversion and junction facilities, (5) communication linkages, (6) utility and public service buildings, (7) civil defense shelters, (8) first aid stations; and (9) highway patrol and licensing centers.
- Scenic-Recreation Complex: This joint development envisages the highway as forming the backbone of an open-space system where several JD possibilities are formed into a coordinated total program. Such a system can be anchored in the countryside by agricultural uses; i.e., crop-production, tree farming, and livestock trails. At the periphery of the urban area, the open space may take the form of permanent green belts, giving way to regional parks in the suburbs. In the city itself, the use may be intensive recreational, serving a maximum of people within a minimum travel range; perhaps a lineal park that provides an "air reservoir" through the heart of the downtown area; or a composite of open space, recreation, pedestrian ways, and selected commercial uses.

In considering complexes, the distinction between two kinds of questions must be made: (1) Where and when are complexes appropriate as joint development? and (2) After it has been determined to be appropriate, how can a particular complex proposal be judged? The first question can be answered by a rather straightforward functional approach of an objective nature; the second question cannot be answered as easily, because certain decision determinants are subjective in nature, based on taste, and vary among individuals. As to the first question, consider:

- Proximity to Existing Development: Complexes, as joint development, become progressively more compelling as one moves from the countryside through the suburbs to the urban core for all of the same reasons that justify joint development itself. In terms of development-oriented projects (in contrast to agricultural-or conservation-oriented uses), and where developable land is a diminishing commodity, it is generally better to go "up" and densify, than "out" in regard to building or rebuilding.

- Means of Movement: Complexes are exceptionally well suited to urban areas where optimum pedestrian interchange occurs not only internally, but between the complex and adjacent existing uses as well. This reinforcement is two-way: not only is the complex better assured of success, but the use of adjacent facilities is optimized as well.
- Economic Need: Complexes are appropriate as joint development elements when and where there is economic need based at least on demonstrated current land-use need (or positive near-future need); favorable benefit/cost ratio for public sponsored programs; and favorable profit/return projections for commercial or industrial based projects.

As to the second question relating to judging JD complexes, the evaluator should understand that as the interplay of the joint and highway elements becomes more functionally complex, the success of the JDP as a venture will depend more and more on the art of the arrangement of its numerous features. The criteria developed in the Guideline sections following can only be a start toward total evaluation when the subject is, say, something on the scale of a multi-block nodal complex with many interdependent joint development elements. Concerns at this point transcend criteria aimed at solely the functional and aesthetic interface between a highway and its directly associated land uses, because in a very real way, the whole becomes greater than the sum of the parts. That is to say, besides just considering the highway relationship to the types of land uses proposed, it can be equally as meaningful to raise questions relative to:

- The internal interplay of mass and void, with its concomitant relationship to external space.
- The ease of use and human response to the combination of internal circulation choices.
- The mood or feeling induced in the user by the whole complex of interrelationships based upon size and scale, light and shadow, texture and color, and other architectural elements.

This only goes to illustrate that as the complexity of lineal or nodal complexes increases, subjective or artistic criteria become more meaningful.

Finally, as the size of the complexes expand, the scale of development becomes so large that they literally become lineal or nodal cities. In this case, the highway element becomes but one of a vast array of normally independent public and private building programs that are combined into a single coordinated cohesive endeavor. Whereas lineal and

nodal cities might be viewed as the epitome of joint development, they might also be viewed as types that far transcend joint development of highway transportation ways and therefore are more applicable to the subject of "city building" or "community rebuilding." Because the highway element plays such a diminished total role in the scale here mentioned, the consideration of lineal and nodal cities are beyond the scope of this Guideline.

Considerations and Basic Policy

Section 4

FUNDAMENTAL CONSIDERATIONS AND BASIC POLICY

The purpose of this section is to provide a first test as to whether a proposed joint development project should be further considered. It raises a number of fundamental considerations for reviewing JD proposals as well as providing a basis for establishing JD policy, by presenting questions concerning policy and developmental objectives (Subsection 4.1) and arguments for and against joint development (Subsection 4.2). Note that policy, per se, is not established by this section; definitive directions concerning policy or developmental objectives are a matter of highway agency prerogative, subject to creation, amendment, and revocation over time and variation in geographic area. (Worksheet 2 is also included in this section, for recording responses to the question set.)

4.1 BASIC POLICY ANALYSIS (BPA)

Before the planner, designer, administrator, or other decision maker considers the possibility of a joint development project, answers to certain fundamental questions must be sought. The twenty-four question set that follows provides the basis for a Consider/Don't Consider decision. For ease in identifying each question, key word notation is provided; the key word also appears on Worksheet 2 for purposes of both referencing and indexing the questions that follow the worksheet. All questions require simply a "yes" or "no" response, except for a few questions that may be inappropriate or inapplicable for a particular proposal.

As the questions are not of equal weight, it should be clear that a negative answer to certain key questions would undoubtedly prejudice a favorable final decision. However, if a majority of the applicable questions can be answered affirmatively, sufficient basis would usually be established for considering the next step--compliance with general criteria for JD projects (see Section 5, General Criteria Analyses). On the other hand, if this is not the case, it should be considered highly doubtful whether the JDP would ever be implemented, and therefore time and effort will probably be saved by rejecting the project at the outset. In general, the greater the positive response, the greater the potential for realization of the project.

Certain considerations that have not been included in the BPA are:

- Whether the JD project is income producing or not, and if so, whether it would produce greater or lesser amounts than other types of joint development.
- Whether the JDP is cosponsored by a governmental agency as opposed to private interests.
- Whether the JDP is proposed for private financing, as opposed to public financing.
- Whether agreement has been (or can be) reached on procedural matters such as cost sharing, revenue allocation, construction scheduling, maintenance, or operation.

These more pragmatic matters are not considered fundamental to the first level decision, especially when compared to the broader policy issues implicit in the BPA. If a JD proposal can be sufficiently affirmed by the BPA, such matters should not otherwise be the basis for rejection--at least at this level of decision.

Worksheet 2

BASIC POLICY ANALYSIS SUMMARY

<u>Question No. and Key Words (Refer to Section 4 for full question and notations)</u>		<u>Yes</u>	<u>No</u>	<u>Not Applicable</u>
(conceptual)				
1	CONCEPT	()	()	
2	DEFINITION	()	()	
3	JDP TYPE	()	()	
4	FEDERAL POLICY	()	()	()
5	AUTHORITY	()	()	
(operational)				
6	TRAFFIC AND FUNCTION	()	()	
7	HEALTH AND SAFETY	()	()	
8	LIABILITY	()	()	
(community oriented)				
9	GOALS AND OBJECTIVES	()	()	
10	LOCAL NEED	()	()	
11	NEIGHBORHOOD COMPATIBILITY	()	()	
12	LOCATION	()	()	
13	ALTERNATE JD USES	()	()	
14	LOCAL APPROVAL	()	()	()
15	LOCAL APPROVAL (if #14 is negative)	()	()	()
16	PUBLIC OPINION	()	()	
(cosponsorship)				
17	COSPONSOR AUTHORITY	()	()	()
18	COSPONSOR FINANCIAL CAPACITY	()	()	
19	DEPARTMENT SPONSORSHIP	()	()	()
20	FUTURE COSPONSOR	()	()	()
(right-of-way)				
21	ORIGINAL PURPOSE	()	()	()
22	PUBLIC USE	()	()	()
23	PROPERTY RESTRICTION	()	()	
24	EXCESS PROPERTY	()	()	()
Total Affirmative		()		
Total Negative			()	



(Conceptual Questions)

- CONCEPT 1. Does the current policy of the Department actively (as opposed to reactively or passively) encourage the concept of joint development along its highway rights-of-way?
- DEFINITION 2. Does the proposed JDP fall within the definition of joint development? (Relates to Guideline definition or subsequent directive.)
- JDP TYPE 3. Does the current policy of the Department allow JD projects like or similar to the one being considered? (A negative answer here may not necessarily be a limiting response for decision purposes, but may only suggest the need for broadening existing policy.)
- FEDERAL POLICY 4. If federal highway funds will be (or have been) involved in the construction of the highway element, does the current federal policy allow JD projects like or similar to the one being considered? (Same notation as for question 3.)
- AUTHORITY 5. Is there sufficient enabling authority (legislative or otherwise) to allow the various features of the JDP to be implemented, or at least to allow them to be developed into a version acceptable to its sponsors that can be implemented?

(Operational Questions)

- TRAFFIC and FUNCTION 6. Is it clear that the JDP will not interfere with the free flow of traffic on the highway or unreasonably hinder traffic movements on the local street system, or otherwise impair their full use and function?
- HEALTH and SAFETY 7. Can it be said that, in general the health and safety of those persons directly or indirectly involved in the JDP will not be adversely affected and thereby become a basis for subsequent disapproval?*

* In answering question 7, it usually can be assumed that at least the normal safety precautions appropriate for the proposed uses can be incorporated in the design, construction, and operation of the JDP.

LIABILITY 8. Can it be reasonably assumed that increased exposure to personal liability and property damage claims against the state (possibly among others) due to the development of the joint element will be minimal, if any, and therefore not be the basis for subsequent disapproval?* (Response to this question should disregard "hold harmless" clauses even though such may be a normal requirement of State participatory agreements.)

(Community Oriented Questions)

GOALS and OBJECTIVES 9. Is the use or activity contemplated by the JDP reasonably consistent with the goals and objectives of the local community? (Relates to officially adopted planning maps, to local ordinances, or to other public declarations of local policy.)

LOCAL NEED 10. To the extent that a preliminary determination can be reasonably made, is there a community demand, or at least need, for the JD?

NEIGHBORHOOD COMPATIBILITY 11. Is the proposed project consistent with the type, density, and quality of existing land uses in adjacent areas?

LOCATION 12. Is it reasonable to assume that the proposed use or activity could not be implemented to the same or higher degree of advantage elsewhere in the neighborhood or community? (This is not necessarily a decision-limiting question but raises issues about (a) the availability of possibly more suitable lands, and (b) the competition, and therefore pricing structure, for land in the area.)

ALTERNATE JD USES 13. On a preliminary basis does it appear that other types of JD would not be more appropriate for the area (or space) to be utilized by the proposed joint element? (Note that even with affirmative answers to questions #9 through #12, a positive response to this question is not necessarily indicated.)

* In answering question 8, it usually can be assumed that at least the normal safety precautions appropriate for the proposed uses can be incorporated in the design, construction, and operation of the JDP.

- LOCAL APPROVAL =
14. Where local concurrence of a city, county, district, or other public entity is necessary, has approval of the proposed land use(s) been obtained? (This question also introduces the possibility that occasionally projects oriented only to the highway user may not require local approval.)
- LOCAL APPROVAL (cont.)
15. If the answer to #14 is negative, is it likely that approval can be obtained? (This of course assumes that the JDP in its presently proposed form was not rejected by the local agency.)
- PUBLIC OPINION
16. To the extent that it can be perceived, would it appear that the proposed JD is not contrary to current public opinion, i.e., is non-controversial?

(Cosponsorship Questions)

- COSPONSOR AUTHORITY
17. Where the joint element is sponsored by agencies, organizations, or groups other than the Department, has cosponsor authority been established? (Relates also to cosponsor accreditation; stature; license to proceed; and so forth.)
- COSPONSOR FINANCIAL CAPACITY
18. Does the cosponsor have the financial capacity to carry out the project--both in terms of initial and annual costs? (This relates as much to public agency cosponsors as to private ones, especially where the protection of public investment must be assured.)
- DEPARTMENT SPONSORSHIP
19. If joint development is proposed by the Department, is the Department the appropriate authority to originate and initially recommend the JDP? (This relates to the consideration of whether it may be better for initiation to stem from the local level, creating thereby a greater sense of local control over the JDP type and character.)
- FUTURE COSPONSOR
20. If the joint element is proposed by the Department (but not intended for ownership, operation, and/or maintenance by the Department), is there likelihood of favorable subsequent approval and acceptance on the part of either public agencies or private groups who may ultimately be involved?

(Right-of-Way Questions)

- ORIGINAL PURPOSE
21. Is it clear that the original highway purpose of an acquired right-of-way will not be jeopardized by the proposed joint use of the right-of-way?
- PUBLIC USE
22. If right-of-way is to be acquired by the Department in excess of that normally required for the highway element, for the express purpose of JD, can "public use" be demonstrated? (See 5.3.2, Qualification as Public Use.)
- PROPERTY RESTRICTION
23. Is it known that no conditions of title, deed, or act (i.e., litigation) exist that would preclude or otherwise restrict the JDP? (Relates primarily to property adjacent to the right-of-way.)
- EXCESS PROPERTY
24. Is it the current clearly-declared policy of the Department to actively pursue the return of remnant parcels and other highway lands declared surplus for higher and better public (or private) uses?

4.2 ARGUMENTS FOR AND AGAINST JOINT DEVELOPMENT

Section 1 stated in summary fashion the overall emphasis of this Guideline, offering both a positive viewpoint towards the subject and a motivation for policy and decision makers to proceed affirmatively with the JD concept. The following benefits further this viewpoint and motivation; however, the reader is cautioned that arguments can also be made against joint development, not necessarily as a concept but more as to possible consequences of particular JD types. Such arguments are listed under the second heading, "Problems." No significance is implied in the order in which the arguments are presented.

Benefits

Inherent in joint development is the capability for:

- Conserving land, especially in land-scarce urban areas, by creating "new land" and thereby reserving valuable urban space for possibly higher and better use, or for preserving urban fringe (viz., suburban) lands in their natural state.
- Assuring the integrity of the highway by providing compatible land uses nearby.
- Providing a degree of control over land development (especially adjacent to interchanges and other connections) that could otherwise threaten the workability of the highway facility or adversely affect its traffic load.
- Locating high intensity land uses at locations providing improved accessibility to highway transport.
- Creating more efficient urban forms that reduce the demand on heavily congested arteries--in effect reducing vehicle traffic through improved multimodal opportunities.
- Enhancing user convenience through a closer relationship of the total transport system.
- Preserving neighborhood continuity by developing joint uses over (or under) the highway--i.e., healing community severance.
- Reducing neighborhood disruption in cross-highway communication and mobility.
- Offering environmental improvement through coordinated planning of site and structure.

- Achieving functional relationships and visual continuity between land uses that otherwise might not occur.
- Providing opportunities to obtain unique views and visual prominence.
- Preserving historic sites, parks, open space, and other public amenities.
- Enhancing excellence of design.
- Covering, or otherwise concealing, particularly unsightly or noisy transport uses.
- Improving public acceptance of highways.

Regarding costs, revenues, taxes, and other economic values, joint development is capable of:

- Decreasing right-of-way costs through the sharing of land use.
- Reducing acquisition problems; i.e., remainder parcels and the negative (cost) effects of severance takings.
- Enhancing adjacent property values within the impact area of the highway facility.
- Offsetting tax losses to the local community that would otherwise occur.
- Fiscal savings through multiple operation.
- Demonstrating greater return (or total benefit) from public investment.
- Providing an economic boost to non-profitable but socially desirable land uses.

Problems

Adverse factors or developmental constraints that can be associated with JD are:

- Difficulties in coordination of multiple public and private development.
- Difficulties in reconciling varying lead time differences for accomplishment by multiple sponsors.
- Difficulties of pooling resources of multiple governmental agencies.

- Lack of clear jurisdictional authority can cause undue delays and lost time.
- Approval (and therefore implementation) delays due to multiple chains-of-command.
- Introduction of complications occasioned by the enlarged scope of a highway project with attendant increase in community relation problems.
- The fear by the local community of state intervention, even where assured of the right of approval.
- The possibility that the highway department's resulting role of landlord, property manager, or developer may conflict with its primary function.
- Possible increased highway construction cost, consequently causing greater difficulty in obtaining public funds.
- Construction costs and economic risks can make JD projects in airspace over highway more expensive than nearby land.
- Major change or modification to airspace structures can be difficult to achieve.
- Airspace structures can create adverse tunnel effects on highway users.
- Highway facility change or expansion will be less flexible.
- Expansion of the non-highway element may be prevented.
- Environmental problems of noise, vibration, fumes, and odors can be more difficult and more costly to deal with.
- Combined maintenance costs for JD can be greater than if each element were locationally separated.

One problem or constraint not listed is the argument that there is a lack of adequate standards and guidelines for the conceptualizing, designing, and implementing of safe, practical, and generally desirable JD projects. The use of this Guideline and corresponding follow-up action should eliminate the need for listing such a constraint.

Section 5

GENERAL CRITERIA ANALYSIS

This section contains suggested criteria, constraints, and standards for evaluation of joint development projects that have passed the basic policy analysis of Section 4 and are therefore deemed worthy of further consideration. For this purpose, a summary evaluation worksheet (Worksheet 3) is provided for estimating the extent of compliance or non-compliance with the criteria.

A second important purpose of this section is to provide a checklist for the planners, engineers, architects, landscape architects, and other professionals charged either with the design of JD projects or with reviewing the adequacy of project plans and specifications prepared by others.

The criteria (and, hence, Worksheet 3) are organized by general functional areas of related considerations, in no special order; that is, the last area listed can be, for the JDP in question, as critical as the first. The criterion or guideline itself, in the form of a statement, direction, or constraint, is preceded by a bullet (•) and is underlined. It is followed by explanatory comments and further guidelines where appropriate. Because of the complex nature of air quality and noise pollution effects of highway motor vehicles, criteria relevant to these effects have been covered separately in Section 6.

It is the aim of the General Criteria Analysis (GCA) to provide minimum safeguards toward the capacity for the movement of people and goods, the health and safety of individuals, and the quality of life for not only all users of both the highway and joint elements, but also the neighborhood population surrounding the JDP. The criteria are not intended to constitute restrictive measures beyond a reasonable interpretation of this aim. On the contrary, highway departments should use every means to encourage sound joint development plans. The criteria are presented to provide a basis for judgment relative to the physical, economic, legal, and social needs and requirements of a JDP within the joint development concept, considering JDP users, the local community, the highway department, and other sponsors. Moreover, since the basis for planning and design judgments change from time to time, the highway department should assure that pertinent changes in technology, standards of design, social consciousness, and so forth are incorporated in updating these criteria or adapting them to local needs.

Worksheet 3 lists (i.e., indexes) all of the criteria covered in this section and provides for entries by an evaluator to indicate the performance of joint development projects in relation to each criterion. The entries should be based on information provided from appropriate sources when the JD evaluator himself is not qualified to make the judgment implied by an entry; however, one person should be responsible for combining the results from different sources for summarization on the Worksheet. The four alternative ratings suggested for each criterion are:

- "A" The criterion is adequately met, hence no further analysis of characteristic is believed to be necessary.
- "Q" Some question exists as to whether, or how adequately, the criterion is met. The question can be briefly indicated in the "comments" column, together with any actions recommended to resolve the question.
- "U" The JDP performance is unfavorable or unsatisfactory in relation to the indicated criterion. Again, a brief explanation or recommended action can be indicated under "comments." An unfavorable rating does not necessarily rule out a given JD proposal, but the highway department should be clear on whether the unfavorable feature (1) is acceptable when weighed against other "favorable" ratings, (2) should be remedied in some way, or (3) requires further study, such as consideration of alternative locations, additional safety measures, etc.
- "NA" The criterion is not applicable to JDP being considered.

Although the GCA relies heavily on professional judgments in contrast to highly quantitative procedures, it can lead to APPROVE/DIS-APPROVE decisions in certain cases. In particular, for proposed JD projects of only nominal complexity, non-controversial in nature, and where costs to the highway department are minimal, if any, the results of the GCA should yield the following possibilities:

1. Where compliance is clearly indicated by the predominance of "A" ratings, without any key or critical "Questions" or "Unfavorable" responses being evident, approval of the JDP is indicated.
2. Where non-compliance is clearly indicated by the predominance of "U" ratings, disapproval is indicated.
3. Where compliance or non-compliance is unclear by reason of the predominance of "Q" ratings, either further analysis is required and Section 8 evaluation may be necessary, or a decision must await further detailing of the project's design features.

For proposed projects generally not of the nature as first above stated, or when simple approve/disapprove decisions cannot be made as noted in possibilities 1 and 2 above, the JD evaluator is referred to Section 8, Comparative Display Procedure.

5.1 PHYSICAL CONSIDERATIONS

5.1.1 FUTURE EXPANSION AND OBSOLESCENCE

- Joint Development should not restrict anticipated expansion of either the highway or joint element, nor, to the extent reasonable, limit future JD options associated with expanded transportation service, regardless of mode. Where future expansion is anticipated or where future requirements for additional modes of transportation can be reasonably determined, decision criteria and applicable design standards should reflect the configuration and function requirements of the enlarged element. (This assumes that the JD being considered is not temporary in nature.) Uncertainty about future highway, joint facility, or other transportation needs should not of itself restrict JD. In this case, the evaluator must be guided by other criteria and developmental impacts appropriate for the JDP under consideration.
- The design of the joint element should provide that it does not become functionally or structurally obsolescent before the highway does, or vice versa, unless land use change can be reasonably accommodated. This criterion considers the possible occurrence of highway blight (and therefore the negative impact on the highway system) due to the lack of use, the lack of maintenance, and/or the structural deterioration of the joint element.

5.1.2 TRAFFIC AND ACCESSIBILITY

- Joint development should not directly or indirectly interfere with the free flow of traffic on the highway, nor should it create traffic flows that exceed the design capacity of the highway system or neighboring streets and roads. While assuring the free flow of traffic, however, attention should be given to the desirable vehicle, pedestrian, animal, or cycle movements that enhance the functionality of the joint element and its surrounding neighborhood. Inasmuch as increases in traffic (vehicle, pedestrian, and/or animal) will normally occur with the development of a joint land use, location and design of JDP access points can be important regardless of whether or not a direct connection is proposed between the JD elements.

Where the joint element entails significant traffic requiring direct highway access, a traffic analysis of the affected highway section (including associated ramps or other connections) should be conducted. Appendix A provides guidelines for this purpose.

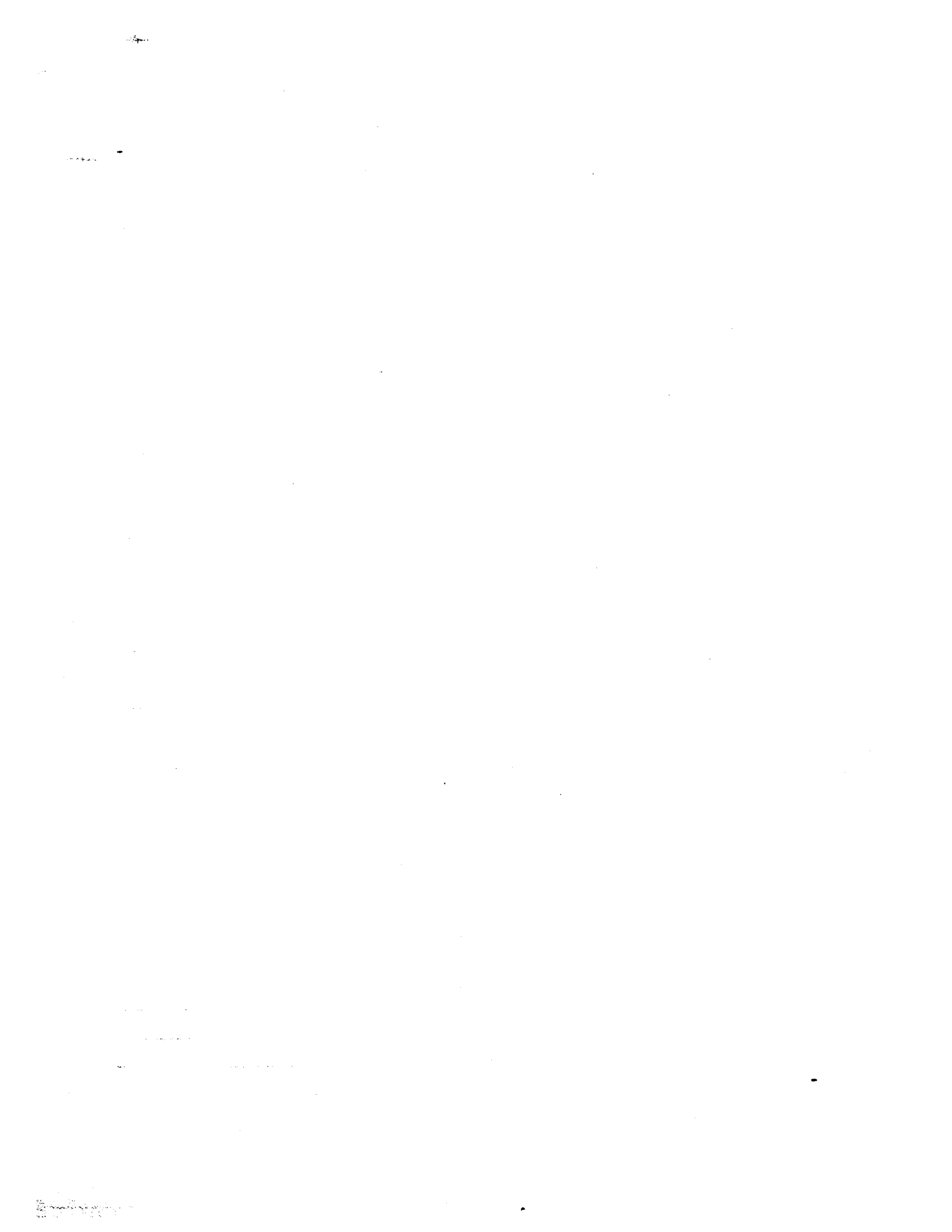
- Where direct traffic access between the highway and the joint element is warranted, connections should meet prescribed ramp spacing criteria for fully controlled-access highways, and intersection spacing requirements for partially controlled-access highways. On

Worksheet 3
GENERAL CRITERIA ANALYSIS SUMMARY

JD Project No. _____ Completed by _____ Date _____

<u>Subsection and Criterion Title</u>	<u>Rating*</u>	<u>Comments</u>
<u>5.1 PHYSICAL CONSIDERATIONS</u>		
<u>5.1.1 Future Expansion and Obsolescence</u>		
Expansion options	_____	_____
Obsolescence compatibility	_____	_____
<u>5.1.2 Traffic and Accessibility</u>		
Traffic interference and capacity	_____	_____
Access need	_____	_____
Access spacing and control	_____	_____
Ramp capacity when access is direct	_____	_____
Peak-traffic conflicts	_____	_____
Local street circulation patterns	_____	_____
Pedestrian conflicts	_____	_____
<u>5.1.3 Safety and Health</u>		
Safety impairment	_____	_____
Air quality control	_____	_____
Noise levels and sound control	_____	_____
Vibration	_____	_____
Public health aspects	_____	_____
<u>5.1.4 Structural</u>		
Lateral loads (seismic)	_____	_____
Highway vehicle impact	_____	_____
Subsurface load increases	_____	_____
Excavations and structural integrity	_____	_____
Highway structure attachments	_____	_____
Falling objects, spillage, side-casting and snow-melt	_____	_____
<u>5.1.5 Aesthetics</u>		
Physical scale	_____	_____
Visual amenity	_____	_____
Building appearance and siting	_____	_____

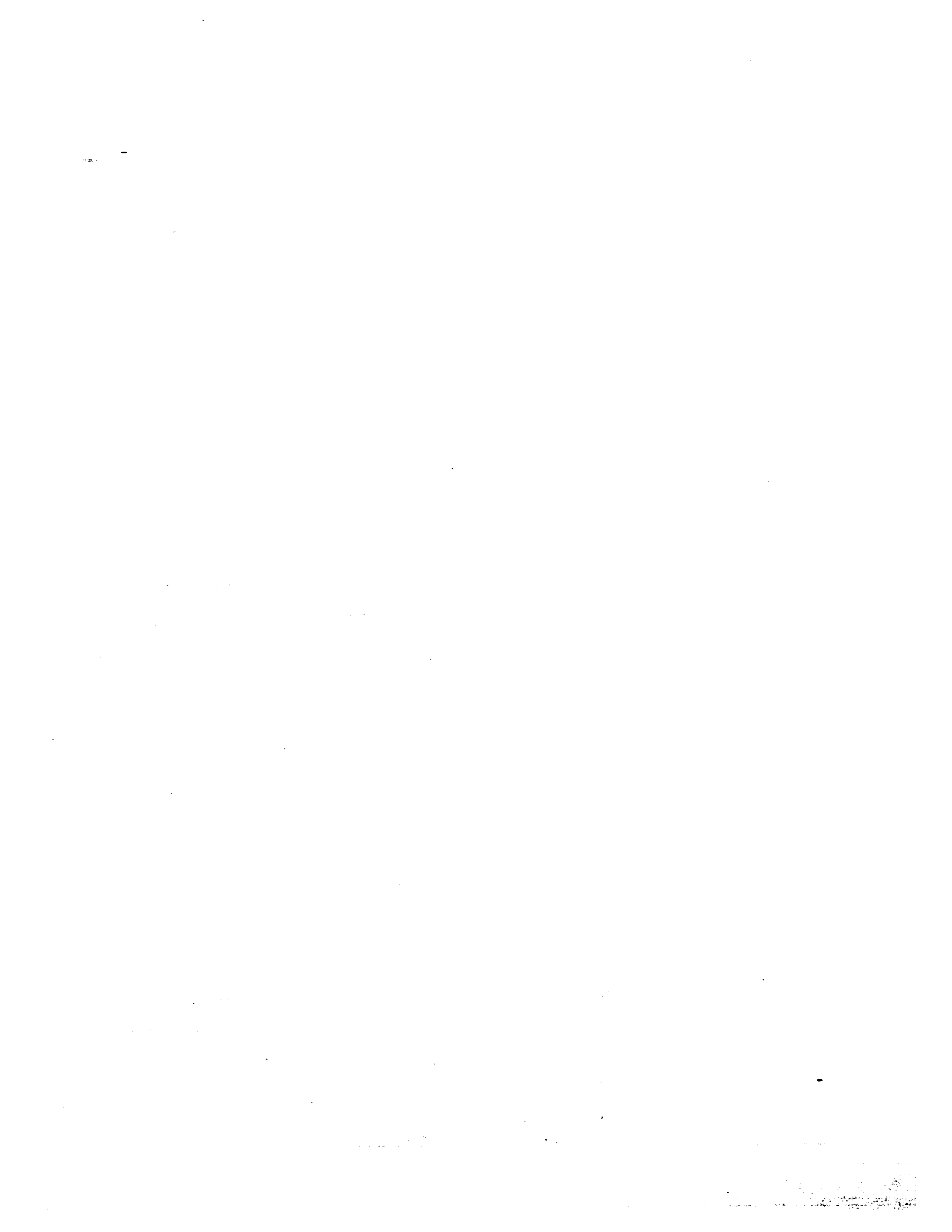
* Key to ratings on second page of worksheet



Worksheet 3 (Continued)

	Subsection and Criterion Title	Rating*	Comments
5.1.6	<u>Screening and Fencing</u>		
	Visual screening		
	Object retention or deflection (accidental or intentional)		
	Restraint fencing		
5.1.7	<u>Illumination</u>		
	Driver safety		
	Surveillance and crime		
	Aesthetics		
5.1.8	<u>Signing</u>		
	Demonstration of need		
	Design and location		
5.1.9	<u>Utilities</u>		
	Location and installation (JD projects)		
	Appurtenances ancillary to JD		
	Attachment to JD structures		
5.1.10	<u>Clearance</u>		
	Minimums by cognizant authority		
	Special JD considerations		
5.1.11	<u>Maintenance</u>		
	Impairment to highway element		
	Impairment to joint element		
	Hazardous conditions		
5.1.12	<u>Construction</u>		
	Construction coordination		
	Labor relations		
5.1.13	<u>Fire and Associated Protection (explosion)</u>		
	Protection of joint element		
	Protection of highway element		

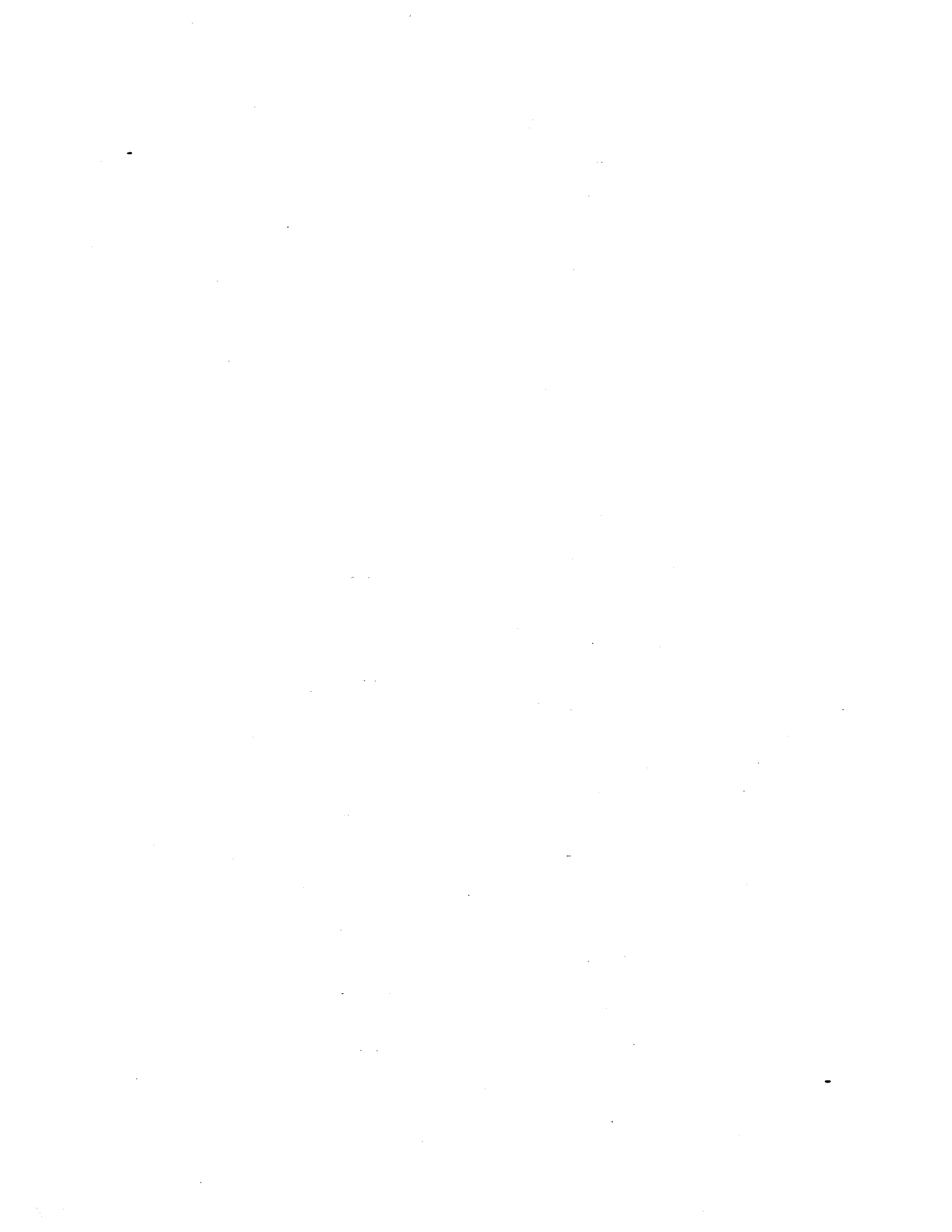
* Key to Ratings: A = Criterion is adequately met
 Q = Some question exists as to whether the criterion is met
 U = JD performance is unfavorable in relation to criterion
 NA = Criterion not applicable to this project.



Worksheet 3 (Concluded)

	Subsection and Criterion Title	Rating*	Comments
5.2	<u>ECONOMIC CONSIDERATIONS</u>		
5.2.1	<u>Evidence of Demand</u>		
	Public uses		
	Private uses		
5.2.2	<u>Alternative Sites, Uses, or Scales</u>		
	Site		
	Use		
	Scale		
5.2.3	<u>Site and Spillover Effects</u>		
	Local government costs and tax revenues		
	Property value changes		
	Employment		
	Employment versus unemployment		
	Personal and business income		
	Retail sales		
	Price quantity changes in low income housing markets		
	Relocation of businesses		
	Disruption		
5.2.4	<u>Appraised Value Determination</u>		
5.2.5	<u>Cosponsor's Financial Capability</u>		
5.3	<u>LEGAL CONSIDERATIONS</u>		
5.3.1	Land Use and Neighborhood Compatibility		
5.3.2	Qualification as "Public Use"		
5.3.3	Anti-diversion Amendment Prohibition		
5.3.4	Tortious Liability		
5.3.5	Sale or Lease Alternatives		
5.4	<u>SOCIAL CONSIDERATIONS</u>		
5.4.1	Community Needs		
5.4.2	Neighborhood Social Conditions		
5.4.3	Community Identity		
5.4.4	Family Relocation		

* Key to ratings on second page of worksheet.



highways without access control, it is usually wise to establish partial control of access (possibly up to one-half mile either side of the connection) for the reasons of safety to highway and joint element users and protection of any public investment associated with the JDP access facility.

- Where direct access to the joint element is allowed from the highway, the ramp or access lane should be designed to avoid vehicles entering the joint facility from "stacking-up" back onto the roadway. As an example, parking garages, sports stadiums, or transportation terminals should be provided with sufficient reservoir space to accommodate vehicles waiting to park, pay tolls, or otherwise enter the JDP.
- Joint development proposals should be evaluated in view of potential peak traffic conflicts, whether concurrent with local traffic peaks or not.
 - The location of multi-storied office buildings or large multi-level parking structures where peak-hour concentrations will occur coincident with local traffic peaks should accommodate these peak demands for access--both vehicular and pedestrian. Both the highway element and the local street system should be considered.
 - High (people) density commercial JD uses such as stadiums, sports arenas, and large multi-mode transportation terminals that create peak traffic conditions (although not necessarily coincident with local peaks) should be located where the resulting traffic concentrations can be accommodated, again, both on the highway and on the local street system.
- Where possible, the JDP should enhance the local street circulation by eliminating otherwise dead-ended streets, by widening or improving deficient streets, by providing additional fire accessways, and so forth. This should be viewed as a positive contribution offered by the JDP. The reverse situation would, of course, have a negative impact in JDP evaluation.
- Elevated or tunneled pedestrian ways should be considered for the JD where the magnitude of pedestrian movement within or into the JDP from the local neighborhood can be reasonably expected to cause problems of traffic conflict or congestion (even if not considered particularly hazardous). Safe and convenient access connections with adjacent streets and surrounding neighborhood areas should be provided especially where joint development involves unaccompanied children (i.e., grade schools, school bus stops, playgrounds and courts, public swimming pools).

5.1.3 SAFETY AND HEALTH

- • Joint development should not impair the safety of the highway user, nor should it create for the user of the joint element potential hazards resulting from the operation of the highway. Considerations are those of clearance and separation, barrier protection, illumination level, visibility interference, sight line or distance reduction, falling and thrown objects, hazardous liquid discharge, and so forth. Detailed physical criteria and guidelines affecting highway and joint user safety, are included in later subsections (Structural, Screening and Fencing, Illumination, and Fire Protection). Generally, however, it can be said that in considering the safety aspects of joint development, the JDP should not:
 - enhance the element of risk involving vehicle/pedestrian or vehicle/vehicle contact after providing reasonable precautions in the design of physical features;
 - create glare and undesirable reflections;
 - attract drivers attention for undue periods of time, nor introduce sudden loud noises, light flashes, or other disruptions of the non-warning type;
 - create adverse microclimatic conditions such as ice patches or wind troughs;
 - cause hazardous or unreasonably objectionable smoke, fumes, vapors, or odors resulting from the joint element to pass over, collect or settle on the highway element.
- • Joint development projects should provide for minimizing the effects on joint element users of air pollution, noise, and vibration that may result from the operation of the highway element. (Air quality and noise considerations are covered separately in Section 6.) Vibration effects will seldom be a problem in joint developments, but their possibility should be considered when a high proportion of heavy truck traffic is anticipated and JDP buildings of light frame, low-rise constructure (1) are in physical contact with a highway structure, (2) share a common substructure, or (3) are in close proximity to the roadway edge. In such cases, the first remedy should be to further isolate the structural elements of the highway and joint facilities. When this is impossible or undesirable, consider building added mass into the highway structure, the joint structure, or both.
- • Joint development projects should ensure adequate provision for such public health features as potable water supply, sanitary and other waste disposal, water pollution control, vector control, and so forth. In urban areas, evidence of adequate local agency services

is usually sufficient; in rural areas, the construction of new facilities may be required as part of the JDP. Note that this provision may be inappropriate for some JD types under consideration (viz., mono-rail, utility tunnel, etc.).

5.1.4 STRUCTURAL

The purpose here is to provide structural criteria to evaluate building systems associated with joint development projects. Criteria normally found in standard building codes, design standards, or those based on professional experience and judgment may not always be appropriate when applied to the same building as part of a joint development, since structural forces must be considered in light of the risk each joint element places on the other. Where joint development projects are contemplated to use space over, under, or immediately adjacent to the highway, there is an inherent extra risk involved that may not be present in other building or structural situations.

The catastrophic result of a JDP building or other major structure collapsing on the highway, or a highway structure falling on the joint element, requires special care in design and, perhaps, added structural strengths and/or members commensurate with the risk to human life and personal property. In the case of building failure over the highway, the ramifications of transportation service disruption are an added consideration.

- In areas of seismic activity, a comparison should be made of the lateral load standards for highway structures to those found in local building codes. The most restrictive criteria should be selected; or at least, increase in design loads should be considered in the light of the proposed occupancy of the joint element.
- The supporting sub-structure of a JDP building located over or immediately adjacent to the roadway should be designed to resist the impact of a highway vehicle. Consider also the probability of such an occurrence happening many times throughout the life of the building. Sub-structure protection by walls, guardrails, or other expendable features, is appropriate, however the added costs of their repair or replacement should then be included in evaluating JDP maintenance costs.
- Construction of one element subsequent to another should not increase subsurface loads beyond acceptable design standards.* Examples of cases where consideration must be given to the structural feasibility and possibly added costs of protection are:

* Acceptable design standards generally mean original design standards for the first element constructed.

- Increase in soil bearing pressures below existing footings where pressure bulbs beneath the original and new footings intersect, resulting in additive soil bearing pressure (however, allowable values may, on occasion, be increased if a substantial portion of the load has been on the soil for some time);
 - Increase in lateral loads on retaining walls or sub-structure elements constructed prior to the JDP;
 - Overloading of tunnels or other underground facilities constructed prior to the JDP.
- Excavations for a joint development should be viewed from the standpoint of their threat to the structural integrity of existing facilities. Where possible, excavations should not be allowed within the resisting pressure zone below existing footings or in front of retaining walls that rely on passive soil pressure for stability; where excavations are to be made adjacent to such structural elements, the added costs for maintaining the lateral support must be considered in JDP evaluation.
 - Attachments to existing structural members should not jeopardize structural integrity. Additional load occasioned by the JDP should be avoided unless the existing structural elements supporting it are within their design allowable loads, including the proposed additional loads. In many cases, such features as lighting fixtures, recreational equipment, or utility lines, direct attachment can be advantageous; the following criteria are appropriate:
 - Holes drilled in reinforced concrete members for expansion shields or grouted anchor bolts may be allowed where they do not significantly reduce the section or expose reinforcing steel to damage or corrosion;
 - Holes should generally not be drilled in prestressed concrete or columns unless it can be shown that such holes do not reduce the members effectiveness;
 - Welds of a minor nature usually may be permitted.
 - When one element is above another, the lower one must be protected from anything falling or spilling from the higher element. A building (or any other use for that matter) below a highway structure should be protected from falling vehicles, hub-caps, granular materials, spilled liquids, and so forth. Similarly, a building over a highway should be provided with a ledge or other such feature around the lowest part of the building to catch falling objects or deflect them off the traveled way. Drainage from buildings above should be intercepted and directed away from the traveled way, just as elevated roadway drainage should be intercepted and directed away from the JDP elements below. (See also Screening and Fencing, and Fire and Explosion Protection.)

- Side-casting of snow or the draining of ice-melt containing salt, calcium chloride, sand, or similar mixtures on to adjacent joint elements should be avoided. Such mixtures can be harmful to automobile finishes, blight plantings, and splatter-stain walls. Even where snow removal from the JDP area could be accomplished by truck haul, pavement icing can still prevail. The use of the more practical and efficient high speed snow plows aggravates the problem. Accordingly, various protective measures should be considered for either or both the joint and highway elements. Such might include the addition of roofs, overhangs, enclosures, screens, snow fences, gutters, troughs, heating coils, and combinations thereof depending on climatic severity and JDP type and location.

5.1.5 AESTHETICS

The subjective and personal values entailed in aesthetic judgments make decision criteria difficult, if not impossible, to establish. The following, then, provides only fundamental concepts to guide JDP evaluation, rather than precise standards for judging good or bad design.* Design features related to aesthetics are also discussed in the subsections for Screening and Fencing and for Signing.

- Avoid discordance in the physical scale and profile of JDP features, both within the project's own elements and between the JD and its surrounding area. "Scale" is the apparent size of a given element. For example, the scale of the highway changes with the number of lanes. Each additional pair of lanes creates a change in scale, not only in the lanes themselves, but in all of the structures and right-of-way treatment. The JDP may have a variety of scales--small to large elements in open spaces; small to large detail within buildings and structures; and so forth--and should therefore be designed to create harmonies or controlled transitions and sequences in scale.
- Create visual amenity wherever possible by considering how the JDP fits into the sequence of physical forms and natural views as they appear along the highway. For example: maximize pleasant vistas and block unpleasant ones; avoid the creation of canyon or tunnel-like effects; capitalize on long highway curves to unify and provide continuity to joint element features that might otherwise appear to "float" or to be spatially erratic. When appropriate,

* For further guidance, refer to references such as Appleyard, Lynch, and Myer's "A View from the Road," and "The Freeway in the City," by Rapuano, Halprin, et al.

capitalizing on repetitive highway features such as columns, piers, posts, supports, and railings can be effective in offering rhythm and visual life to some otherwise static JD types.

- In order to achieve the best possible aesthetic as well as functional solutions, the design of JDP buildings should be integral with that of the highway. By sensitive siting, material selection, and design, JDP buildings should enhance the visual appearance of both the highway and the surrounding area.
 - The color, texture, shape, and size of building materials and facade features should be coordinated with the materials and general physical features of the highway facility so that they tend to form one visual unit. On a related point, building materials should be selected to avoid glare or sun reflections on the roadway, generally avoiding mirrored glass, stainless steel, or similar surfaces. (Also, buildings should be oriented so that the early morning and late afternoon sun is not reflected onto the roadway.)
 - Buildings should not expose blank facades to the highway element. Windows should be considered on this exposure as they can offer interest to the highway user and views for the joint element occupant. Buildings with nighttime populations such as apartment houses, hospitals, or hotels, however, should be oriented so that headlights of on-coming traffic are not bothersome.
 - Buildings located under elevated highways should not present an unbroken facade coincident with the structure's edge, but rather should be articulated, both horizontally and vertically, with the highway structure.
 - Buildings located within interchange areas should visually relate to one another, be supported by substantial planting and/or be spatially connected with the highway element (i.e., not "floating" within the interchange area).
 - Where buildings are located alongside and somewhat below the highway, but within view of the highway user, avoid mopped-on or similar type roofing materials; roof ventilator, stack, flue, and hatch clutter; and aesthetically distasteful repetition of roof configuration.
 - Utility features appurtenant to JDP buildings (as well as utility type JD in general) should not jeopardize visual amenity by unsightly or locationally incongruous transformer banks, cooling towers, substations, water pressure tanks, utility poles and wires, or similar features.

5.1.6 SCREENING AND FENCING

- Screening can generally be considered of two types--(1) visual and (2) object retention, deflection, or constraint. Somewhat related are sound attenuation and air pollutant shielding types (see Air Quality and Noise Considerations in Section 6). Methods of screening are many and often can be imaginative, however they will generally revolve around the use of:

Plant covering of open-mesh or crawl-through fences

Solid fences, railings, and walls

Hedges or trees and shrubs of sufficient density

Earth mounding (usually related to the joint element)

Earth berms and slope banks (usually related to the highway element)

Buildings and building appurtenances

Roof and deck parapets

Close-mesh wire screens and/or deflectors (either vertical or horizontal)

- Visual screening of the joint facility should be required when (1) the JDP offers potential unsightliness to its neighbors or incongruity to its surroundings, or (2) the surrounding land uses offer unsightliness to the JDP. Examples of the former might occur for livestock pens, parking lots, roadside parking, bus or truck parking, open stockpiling, utility lines and appurtenances. Examples of the latter would be automobile graveyards and machine used parts areas, private developments that have been allowed to deteriorate, and so forth. Design criteria for visual screening is not particularly unique to JD, however a few standards follow:
 - The selection of screening types should result in as natural an appearance as possible commensurate with its surroundings. If this impossible, then it should be of a type which in itself is suitable--aesthetically, as well as functionally. Consider that some types of screens, such as earth mounding, berms, and "naturalized" landscaping can modulate land form and therefore can provide more interesting and pleasing results.
 - The effectiveness of plant screening will be dependent on the intrinsic density of individual plants, the distance between plants, and container size of the original planting. Plants should be chosen to respect their surroundings (i.e., in rural areas, native or naturalized plants; in urban areas, plants that blend and complement existing materials in the surroundings). They should be climatically appropriate and insect and disease resistant.

- As to screening heights, case by case evaluation is required. Consider that height can vary as a function of the angle between the viewer and the viewed, highway elevation differences, topography, and the distance between the joint element activity and the roadway (or neighboring land use).
- Certain screening types present unusual accessibility problems because of their height and location (i.e., on a slope bank, at zero set-back, cantilevered position, and so forth). Maintenance, repair, and replacement can thusly become a special problem.
- Screening for object retention or deflection should be required where the safety of the highway user or the joint element participant would be jeopardized without screening. Two situations can occur--(1) the accidental throwing, hitting, or rolling of balls or other accouterments of active recreation JD projects, or the accidental dropping of objects from any type of over-the-highway project, especially open areas where pedestrians, joint element users or others can congregate; and (2) the intentional or malicious throwing, hitting, rolling, or dropping of objects onto the roadway (viz., the missile-like effect and possible catastrophic aftermath of a relatively large object dropped from say a tenth floor elevation).
- Considering case (1), adequate screening can generally be provided by one or more of the types noted above. Its type, height, and general configuration should be commensurate with its intended purpose, aesthetically pleasing, and compatible (in the design sense) with other features of the JD, including the highway itself.
- Considering case (2), there probably is no practical method or device yet devised that can prevent a determined individual from dropping or throwing an object onto the highway. Judgments therefore about user safety and design adequacy should be based upon:
 - (a) The project's security posture as reflected by the degree of visual openness, illumination, and potential surveillance by JDP users, neighbors, and/or police patrol.
 - (b) The degree that other JD criteria outlined herein are followed (i.e., non-opening windows, set back and clearance distances, provision for and type of visual screening, etc.). Note that the act of screening from view reduces the ease of surveillance, and therefore a trade-off of impacts may be necessary.
 - (c) The type of users expected to occupy or participate in the joint element (i.e., adolescents, senior citizens, transients, permanent residents, the over-active, the ill, etc.).

- Total-restraint fencing should be considered where natural barriers or man-made obstacles would not normally prevent hazardous or unauthorized pedestrian movements onto the roadway and ramp areas or onto abutting properties. Where fencing would not normally be required for highway or abutting property purposes, and therefore necessary only because of the JD project, their additional costs should be considered in JDP analyses.

Total-restraint fences need be no higher than is necessary to perform their function and should be placed as inconspicuously as possible. Consider:

- The farther from the viewer, the least noticeable a fence will be.
- Planting either or both sides of a fence can effectively hide it from view.
- Fences located above or below the viewer's normal line of sight are less conspicuous (viz., on the top of a cut bank, bottom of a fill slope, ditch or ravine bottom).
- Wire-link fences should blend into the surroundings. The traditional galvanized cyclone fence achieves this to a degree upon weathering; the newer types designed to rust may be better in some cases. Aesthetic considerations should dictate color selection of plastic coated wire fences.
- Generally, fencing should respond to topography, not property lines, to avoid unnatural zig-zag or up-down patterns.

5.1.7 ILLUMINATION

- Joint development lighting should not create problems of safety, eye adaptation or confusion to the highway user, enhance a crime threat to the joint facility user, nor create for the neighboring community nighttime illumination that is aesthetically displeasing. Basically, the considerations are (1) driver visibility;* (2) surveillance and control of vandalism, theft, and other crime; and (3) compatibility of illumination between JD elements and between the JDP and its surrounding land uses. As with most other criteria

* Visibility denotes the ease of detection or recognition of road details by a driver, generally being influenced by the factors of size, contrast, brightness, and duration of observation (determined primarily by speed).

in this section, successful JD lighting recognizes the highway user, the joint element participant or visitor, as well as those in the surrounding neighborhood visually related to the JDP. Suggested guidelines are:

- Illumination of the joint element should not impair visibility for the highway user. Very large features such as buildings (over or adjacent), towers, mass transit equipment (stationary or moving), and so forth which could startle the highway user when approached at night, should be illuminated or else well separated from the traveled way. Similarly, joint element features that are too small to be seen under the normal highway illumination should be individually illuminated or be placed well away from the traveled way.
- Contrast between the background and joint element features should be pursued as much as possible. Also, lighting should not destroy an existing contrast between the background and a highway appurtenance such as a sign, median barrier, shoulder or bridge abutment.
- Where access ramps connect directly with the joint element, highway lighting should provide a smooth and pleasing transition between the level and quality of lighting of the two elements.
- Avoid glare, flashing lights, and arrays of light that could distract the driver or be unreasonably bothersome to JDP neighbors. Although very tall high intensity and widely spaced luminaires can have the advantage of greater efficiency and possibly less confusion (from a lighting standpoint), care must be taken to avoid light-spill or direct glare on to surrounding areas having 24-hour populations. Lighting on elevated highways may result in a similar effect on adjacent joint development projects.
- For projects planned for night time use, the level and type of illumination should be based not only on the area of the involved activity, but also the fringe or transitional spaces extending outward from its edge. The best lit handball court, rest room, or even office building should be considered deficient if connecting parking areas, pedestrian paths, bicycle stands, waiting areas, pedestrian paths, bicycle stands, waiting areas, etc., are clothed in darkness. Lighting should offer both physical and psychological security in order not to unnecessarily sacrifice the JD projects nighttime potential.
- Where nighttime use is not a normal function of the JDP, some illumination may still be required to discourage illegal activity after dark. This is especially true for under viaduct or roadside uses that may be "too well" screened. Normally, auto headlight glare, unshielded (full 360° pattern) highway lighting

fixtures, and large amounts of unscreened frontage open to surveillance are advantageous in cases where nighttime lighting is not contemplated.

- In addition to functional illumination, decorative lighting and ornamental fixtures offer wide choices depending on JDP type and desired aesthetic result and should not be discouraged. Such can add charm, gaiety, and attraction to joint development.

5.1.8 SIGNING

Signs for the purpose of joint development will not only be of the directional and warning type, typical of those described in uniform signing manuals, but often will be of the advertising and general information type. Somewhat related to the advertisement type is the sign used for the sole purpose of denoting the development of a JOINT DEVELOPMENT PROJECT (similar to what has been done by the Department of Transportation for the Interstate system, the Corps of Engineers, and the Department of the Interior, among others). Displaying of the fact of joint cooperation, financing, sponsorship, and/or community/state partnership, can have potential importance from a public information standpoint as well as the promotion of the concept of joint development.

- Except for legally mandatory signs, need should be demonstrated for any sign type. Because JD projects oftentimes present unique situations, published signing manuals or federal, state, or local rules may not always apply. Guidelines concerning signing need are:
 - Where the sign relates to the safety of JDP users.
 - Where the sign provides direction to emergency type JD projects such as hospitals, civil defense shelters, police facilities, and so forth.
 - Where the JDP is considered a major traffic generator and/or where the need for direct access has been demonstrated.*
 - As a general rule, directional or warning signs should provide (1) the highway user necessary instruction concerning the joint element, and (2) the joint element user required knowledge he should have about the highway.

* See Access Determination Procedure in Appendix.

- The need for advertising and general information signing relative to the joint element is inherent in joint development (except possibly for certain agricultural or conservation uses) and, thus, decision tends to be based only on signing design and locations.
- The design and location of any type sign should not detract from the visual amenity of the JD area by reason of size, style, type of illumination, prominence in the landscape, or excessive number. Suggested guidelines are:
 - Signing location should not create hazards for the highway user by causing confusion with highway directional signs or unduly distracting driver attention.
 - Avoid flashing, blinking, revolving, reciprocating, or otherwise moving types.
 - Avoid plastic, tin, distastefully colored or lettered, and lightweight/wind sensitive signs.
 - Avoid incongruity of sign type and size, both as to its surroundings and to other nearby signs (unless of course an upgrading of existing signing is intended).
 - Building mounted signs should be tastefully sized, colored, and lit, and be related to the scale and type of exterior lighting of the building.
 - Promotional type signs should be designed consonant with the character of the JDP it refers to, yet should ideally exhibit some degree of standardization so that identity as a "joint development project" can be more universally recognized.
 - Generally, signs exhibiting simplicity of design and indirectly lit are the more preferable.

5.1.9 UTILITIES

The first of the three following criteria in this subsection is primarily oriented to utility type JD projects, as they are defined in Section 3. The latter two criteria present guidelines affecting the consideration of all utility installations from a somewhat broader viewpoint due to the fact that so many other types of JD projects involve locating utility connections and service runs.

- Utilities should be located and installed so as to cause the minimum amount of inconvenience, disruption, hazard, unsightliness, and additional highway maintenance consistent with efficient utility operation and access. Guidelines are:

- Utility joint elements should parallel the highway element centerline as much as possible. The exception of this would be to avoid hazardous conditions, structural features, wet or rocky terrain, conflicts with other utilities or other features of the JDP, or where adequate protection cannot be provided.
- Where crossing of the highway element is necessary, it should be as near normal (90°) to the highway centerline as possible and should be marked at least at one end. Oblique crossings should be marked at both ends and parallel runs marked at approximate 500 foot intervals.
- Lines carrying transmittances which are flammable, corrosive, expansive, energized, of high pressure, or unstable, shall be covered and protected in accordance with appropriate industry standards and/or codes. Protection might consist of floating slabs, pipe encasement, tunnels, galleries, or other approved method; otherwise consideration should be given to rerouting the utility to a location capable of providing the required protection.
- Encasement or other protection systems should also be considered (1) when there is a high probability of future removal or replacement, and therefore future disruption to highway traffic; (2) where traffic density hinders maintenance or prohibits open trenches; (3) to convey leaked fluids away from the JDP, particularly volatile fluids and those considered noxious to the public; (4) to give added protection from possible superimposed external loads or shock caused from the highway element; and (5) for future expansion requirements.
- Where several utility services are combined in a single tunnel, gallery, or casing, attention should be given to isolating mutually hazardous transmittants (i.e., fuels and electrical energy) by compartmentizing or by auxiliary encasement of incompatible elements.
- Electrical and communication facilities that may interfere with radio transmission, electronic type operations, traffic signals, and other frequency or power sensitive equipment should be adequately shielded.
- Utility appurtenances ancillary to the joint element should be considered in the light of safety to JDP users and ease of (or freedom from) maintenance, and shall be appropriately marked or signed.
Guidelines are:
 - Venting should be provided for lines transmitting fuels, petroleum, gases, and other dangerous fluids. Vents should be set away from the highway element and from areas of human congregation, and kept open and free from brush, weeds, flammable materials, and so forth.

- Leaked fuels, petroleum, and other hazardous fluids requiring casings to carry them away from the highway element or the JDP site should be provided with special drainage filtration or entrapments to prevent their dispersal into surrounding areas. (See also Fire and Associated Protection.)
- All appurtenances shall be marked to indicate contents, size, pressure (if dangerous), owner, and emergency contacts.
- Manhole, junction box, or underground vault entries should never be located in the highway roadway, except possibly for low speed sections, say, under 35 mph. Generally, underground utility access ways should be located in sidestrip, median, ramp interior, or similar areas.
- Shut-off valves or other control devices should preferably be automatic, and should be installed at or near above ground structures (that is, minimize aboveground obstruction points), but away from unusual hazard areas unless the hazardous segments can be reasonably isolated by sectionalizing devices.
- Although aesthetically undesirable and generally to be avoided, overhead utility connections associated with the JDP must be located outside of the roadway clear area, satisfying applicable safety and clearance requirements.
- Utility type features required to utilize portions of above ground joint development structures should be concealed to the extent possible and designed so as to be compatible with the appearance of both the highway and joint elements. The JDP evaluator should consider the following:
 - Ensure, firstly, that with the addition of the proposed utility feature, the structural element can carry the additional load and generally accommodate the utility without compromising the function of the highway where the joint element is above the roadway, or the function of the joint element if located under an elevated highway, including reasonable ease of maintenance.
 - Wherever possible, the utility should be enclosed within sub-floor areas or suspended ceilings, in galleries, in "boxed" beam structures, or in underground tunnel encasements, say, in adjacent pedestrian areas. It should not inhibit access to any structural part that requires either periodic or emergency repair and maintenance.
 - Although less desirable, the utility may be supported by under-slinging, using acceptable hangers, rods, or rollers, but should be located higher than the lowest superstructure elevation and should not create a clearance problem to the highway element.

- In all cases, unless it is deemed impracticable, the locating of utilities on the external surfaces of a structure should be avoided for reasons of aesthetic appearance.

5.1.10 CLEARANCE

Issues concerning maximizing the use of space, spatial relationships between JDP features, safety oriented criteria relative to dimensional clearance, barrier protection, and other criteria in this section have raised the consideration of physical "clearance," although sometimes indirectly. Two summarizing criteria are presented here. The first acknowledges the jurisdictional or regulatory clearance requirements set forth by cognizant authority. The latter, however, recognizes the clearance issues that can often be more compelling to the concept of JD or to the evaluation of certain JDP types.

- Components of the joint element proximate to the physical features of the highway element should at least satisfy the minimum vertical and horizontal clear distances as either currently promulgated or as may be required from time to time by cognizant authorities. These include, among others, the Department of Highways, Federal Highway Administration, Federal Aviation Agency, American Association of State Highway Officials, American Railway Engineering Association, U.S. Army Corps of Engineers, and local flood control, transit, highway, and similar districts and agencies.
- Clear distances between components of the joint element proximate to the physical features of the highway element should be viewed in the light of "joint development" to ensure that either (1) authorized minimums should not be exceeded, or (2) in the absence of such minimums, adequate consideration has been given to the particular joint use or activity contemplated for the specific location proposed. The following types of considerations are suggested:
 - Maintenance Effects: For example, the spaces, both vertical and horizontal, between structural or other physical JD features or between a JD structure and the right-of-way line should either be (1) large enough for proper maintenance, or (2) eliminated by providing direct contact between the features--subject, of course, to applicable fire codes. This is to avoid inaccessible or constrictive narrow spaces where weeds, litter, or other clutter may collect adjacent to fences, walls, footings, columns; between roof top and bridge soffit areas; or along abutting property lines. Generally, a three foot minimum clear space should be allowed where human access is contemplated. Where scraping, brooming, lifting, or similar mechanical type operations are required, the type and size of the mechanized equipment would dictate clearance distance.

- Safety Effects: For example, lateral distances between the edge of an elevated highway structure and an adjacent building or other structure having sealed windows may be as little as 5 feet; however, where open areas potential for human occupancy are adjacent, clear distances of, say, 20 to 30 feet may be required to account for thrown or accidentally hurled objects from passing motor vehicles.
- Psychological Effects: Examples would be the effect of undue confinement (i.e., in a covered section or a roadside area bounded by many high concrete retaining walls) or where the "nearness" to potential danger is imagined (i.e., in a ramp interior or at the toe of a relatively low roadway embankment), even though prescribed minimum safety clearances would normally suffice.
- Startle Effects: An example could be where increased clearance from the roadway may be necessary to avoid potentially startling the driver of a highway vehicle by, say, the occurrence of an adjacent passing rapid transit vehicle, or by even a relatively faster moving bus on an exclusive bus lane.
- Aesthetic Effects: The human response to spatial relationships, size and scale, heights and widths, light and shadow (although subjective in nature), can be the cause for adverse individual physical reactions, as well as possibly concerted group actions. That is to say, often physical spaciousness may be more cost-effective than design features incorporating clear distances simply based on minimums.
- Other Effects: Clearances for JD are also a function of the joint element's location and activity. That is, clearance requirements can vary depending (1) on whether the JDP is located under or over the highway, alongside the highway lanes, or off the right-of-way, and (2) on differences in JDP activity (i.e., high people density versus, say, one requiring only periodic maintenance attention).

5.1.11 MAINTENANCE

Although maintenance considerations are often implied or specified in the criteria discussed in this section, the following serves as a single guideline for GCA check list purposes.

- The location, configuration, and accessibility of the JD should not (1) impair or overly complicate the work of highway maintenance crews or the use of maintenance equipment, (2) prevent the proper maintenance of the joint element, or (3) create a hazardous maintenance condition. Along with the more obvious highway oriented

requirements for pavement and bridge maintenance, snow and sand removal, weed and litter control, and plant watering, JDP evaluation must consider other possibilities. Examples are window washing and replacement; building washdown and painting; tree topping; track and signal repair and replacement; piping, ducting, venting, and circuitry maintenance.

Generally, maintenance should be the responsibility of each sponsor for their respective portions of the JDP. Consider also that maintenance by the cosponsor can often eliminate otherwise required maintenance by the highway department.

As a general rule, maintenance should be accomplished without requiring access to the traveled way. Where this is impossible or unreasonable, coordination with the highway department regarding appropriate requirements for lane closure would be necessary.

5.1.12 CONSTRUCTION

The relevancy of this consideration will depend much upon the prospect for potential interference: (1) whether the joint element is to be constructed prior, concurrent, or subsequent to the highway facility; (2) the spatial relationship of the joint elements; and (3) the type of JD project being considered (which can vary from heavy construction to nominal park and landscaping features). With this in mind, the following minimum guidelines should be considered where applicable:

- For purposes of construction coordination, a determination must be made to establish the division of participation and responsibility involved in the construction of the individual elements, especially where the JDP is to occur simultaneously. Typical guidelines are:
 - A coordination scheme for construction activities should be reviewed and updated by all JDP participants on a regular basis. JDP construction schedules should reveal any potential conflicting portions of work in order that these regular reviews can correct conflicts before delays and additional costs occur.
 - Supervisory personnel should seek to eliminate possible conflicts arising from either concurrent or sequential staging of the JD elements. This also includes responsibilities for safety and security during both the actual work period and periods of non-work by any of the parties involved. Generally, each sponsor's responsibility should be limited to work on its element and periods of non-work caused by its element. Any significant added construction costs imposed on one element of the project by the other should be borne by the responsible sponsor.

- Additional safety precautions for workers may be required due to the proximity of the joint element that may not otherwise be necessary; i.e., safety nets, walkways, railings, safety fencing, and so forth. Also, additional safety precautions may be required for the protection of highway users (or, depending upon timing, of joint element users) beyond those normally taken for similar projects separately constructed.
- Project transportation planning for joint development may require more circuitous public detour routes, longer periods of traffic disruption, materials truck movements that would not otherwise be necessary, etc. Additional factors for consideration are that joint projects constructed simultaneously may cause restrictions on the areas available to each contractor for the purpose of field fabricating, storage space for materials, job site mobility, worker parking space, and transportation of materials, labor and equipment conflicts.
- Particular segments of a JDP may require construction deviations from normal highway practices to ensure reasonable effectuation of the joint development. Construction routines may have to be altered to take account of the fact that they simply may not apply to non-highway type construction. Adjustment to, or at least allowance for, added or modified temporary structures such as cofferdams, shoring, bracing, bridging, and falsework may be necessary. Costs for such adjustments or additions should, however, become part of the JD evaluator's considerations of costs versus benefits (refer to Section 8).
- Labor relations must be agreed upon by the JDP sponsors to ensure reasonable project progress. The subject of labor relations should generally include (1) the effect of the interrelationship of various labor unions associated with each element as to, say, a strike by one labor union segment, or the crossing of striking union picket lines by non-striking union and non-union personnel; (2) working relations between union and non-union personnel; (3) compliance with federal, state, and local guidelines for minority hiring practices, minimum wage rates, and so forth.

In addition, the Civil Rights Act of 1964 prohibits discrimination against minority hiring in all federally funded projects. In light of the existing discrimination in the construction industry, care should be taken to employ minority workers to avoid unnecessary and expensive litigation and unfavorable publicity.

5.1.13 FIRE AND ASSOCIATED PROTECTION

- Joint development planning should provide for reasonable protection from fire and associated hazards that may arise from the proximity of the highway and joint elements. Such protection relates to both (1) the risk of fire, explosion, or spillage of hazardous materials in the joint element portion that spreads to or otherwise impacts the highway, and (2) similar events on the highway that could spread to or impact the joint element. Assuming that the size and complexity of joint development are going to increase in the future, coupled with expected greater numbers and capacities of hazardous material carrying vehicles, each JDP should be thoroughly evaluated commensurate with the magnitude of potential fire/explosion catastrophe, considering both the type of JD and the increases or changes in traffic characteristics.

This subsection includes a description of these hazards, their consequences, and suggestions for protecting the joint facility and the highway from events occurring on one element that may affect the other.

Types of Accidental Highway Events

Due to the spillage of fuel associated with motor vehicle accidents, fire and explosion potentially represent the most hazardous highway events, especially when a tank truck carrying fuel or other flammable liquids is involved. Some of the types of flammable liquids the JD planner should be familiar with follow:

GASOLINE--Beyond causing fires in its liquid state, gasoline vapors, being heavier than air, can flow downward onto joint uses at lower levels and create the potential for explosion.

LIQUEFIED PETROLEUM GAS (LPG)--Transported as a liquid under pressure, LPG is capable of volumetric expansion several hundred fold when released to the air and accordingly presents a catastrophic explosion potential.

CYROGENIC MATERIALS--Such materials include hydrogen, which is highly flammable as well as explosive under certain conditions, and oxygen, which would intensify combustion and explosion.

INDUSTRIAL CHEMICALS--These include materials that can start fires by chemical action with contacted materials or whose vapors can be explosive. Although not directly related to fire and explosion, chemicals which can liberate poisonous gases or can be harmful to human tissue, of course, should not be overlooked when considering the possibility of highway accidents in and around JD areas.

Joint developments may be subjected to hazards from the foregoing materials that are beyond the risk of similar developments along city streets or arterials because of the higher highway speeds involved and the consequent increase in probability of fire, explosion, and container ruptures from collisions. To date, the possibility of such hazards impacting joint development projects has not been widely acknowledged.

Consequences of Highway Fire and Explosion

1. Concussion resulting from an explosion on a highway may cause direct injury to an occupant of the joint element. More often, however, injury and death may occur by collapse of structural components of JDP elements. An example would be the collapse of a permanent highway closure due to fire in the enclosed section or of the JD structure above.
2. Containers of flammable materials, such as drums of paints, solvents, or fuel, can be projected over guardrails and burst on impact, splashing flammable liquids to cause or to spread fires. Flying debris, such as hurled cargo, parts of cars or trucks, or entire vehicles, can be another hazard associated with joint development projects, but also is the easiest to protect against.
3. Fire and explosion are both the event and the resulting danger to joint element users. Buildings conforming to local building codes have provisions for reasonably safe exit of the occupants in case of the typical building fire originating at a point source, then spreading throughout the building. Fires and explosions on highways caused by large amounts of highly flammable or explosive material may not allow enough time for exit. For this reason, the fire protection provisions in local building codes may not always be adequate for joint development projects.
4. Panic may conceivably follow a major fire or explosion affecting JD projects in which people concentrate in large numbers (i.e., schools hospitals, hotels, or auditoriums located proximate to a highway), quite apart from any direct danger to the structure or its occupants from the incident itself. For example the sight of flames emanating from under a building or overhead may cause hysterical reactions even though the structure was designed to withstand direct flame from that source.

Protection of Joint Element

Existing fire protection standards do not adequately consider fire protection from the standpoint of joint development. For example, fire protection provisions in most building codes provide for three basic considerations:

- A fire within a building is to be kept, as far as possible and practicable, at its point of origin. Therefore, floors and partitions are assigned various fire resistant requirements.
- The occupants of the building are to be provided reasonably safe passage out of the building in case of fire.
- A fire within a building is to be kept from spreading and endangering adjacent structures.

These provisions do not take into account the protection of a structure from fire originating outside of the structure; accordingly, the following needs are suggested:

1. Eliminating the source of potential fire or explosion on the portion of highway system that is associated with JD by restricting the transportation of hazardous materials. Routing bulk fuel trucks and vehicles carrying highly flammable/explosive chemicals around JD projects occupied by large numbers of people is the most direct, and in some cases, the simplest solution.
2. Shielding the joint element from exposure of the highway event can be effective if the shield is sufficient to stand the anticipated heat or blast. For joint elements over roadways, consider utilizing the underside of the elevated building by providing the soffit structure with additional fire resistance beyond that required by the building code, or possibly by providing an expendable energy absorbing explosion shield. Joint elements beneath elevated roadways may depend on the highway structure for shielding. In the case of adjacent joint elements, a separate shield may be provided if no suitable structure is planned as a part of the JDP.
3. Shielding or troughs can be utilized to contain spilled hazardous material so as not to endanger the joint element or other portions of the highway. In utilizing such a scheme, however, extreme care is necessary so as not to contain flammable material in such a manner as to cause a secondary explosion. For example, explosive fumes igniting in, say, a utilized storm sewer system may cause greater damage than the same fumes igniting above ground.
4. Providing for the escape of joint element users from the fire or explosion area once it occurs is a last but necessary resort. Adequate exit routes from buildings are usually sufficiently covered in building codes, but consideration must be given to the fact that in case of a fire on the highway portion of a joint development spreading to the joint element, safe exit means not only from the building but also away from the highway.

Protection of the Highway Element

1. Joint development above and/or below the gradeline of the highway should be fire resistant in accordance with the local building codes acceptable to the highway department and the FHWA.
2. Consideration should be given to using non-combustible building material throughout the joint element, even if adjacent to the roadway vis-a-vis over or under it.
3. Non-combustible material is acceptable within highway rights-of-way because it does not feed a fire; however such may exhibit two weaknesses. First, non-combustible material, although not on fire, may allow fire to spread past it from a combustible material on one side to combustible material on the other. Second, a non-combustible structural member may fail, even without burning, due to excessive heat. Both these weaknesses are usually overcome by using the hourly rated requirements adequately covered in building codes.
4. Combustible building material can be used, stored, or processed when isolated by adequate horizontal distance from the roadway or highway structure, say, from twenty to thirty feet.*
 - Hourly rated separations vary from one to four hours, depending on the estimated length of time the combustible material could be expected to burn.
 - Distance or hourly rated separations are intended to protect the highway element from heat only. Buildings or other structures whose collapse would endanger the highway should be of non-combustible material.
5. Flammable fluids within the highway right-of-way should be buried, encased, or otherwise isolated from the highway element or other joint elements in order to contain an explosion or fire. Note, however, that PPM 80-10 prohibits manufacture or storage of flammable material in a joint element and/or below the grade line of the highway.
6. Provision shall be made for a clear strip of sufficient distance, probably in the order of twenty or thirty feet between the traveled way and an agricultural crop that is subject to burning either on purpose or as a result of exhaust sparks or other causes.

* Twenty feet is from various portions of the Uniform Building Code; thirty feet is generally accepted by the Federal Government for the stated purpose.

7. In particular regard to JDP buildings, some suggested requirements for further consideration are:

- In the event the bottom of the highway structure forms the roof of the building, a one-hour fire-resistive requirement should apply as an absolute minimum to the bottom of the highway structure. (See also item 2, Protection of the Joint Element, for additional considerations.)
- Regardless of the type of occupancy, an approved automatic fire extinguishing system should be installed throughout each building.
- Floor areas should be limited to a maximum of 50,000 to 60,000 square feet between fire area separation walls. Separation walls should be of not less than non-combustible, two-hour fire-resistive construction with all openings therein protected by rated fire door assemblies.
- Clear access should be provided on at least two sides of buildings for fire fighting equipment.
- Extra hazardous type uses such as manufacturing and handling of explosives, flammable liquids, or liquefied petroleum gas should be avoided.

8. The physical layout of joint element features in relation to each other and to the highway can often be effective in protecting one element from the other from the standpoint of fire and explosion. For example, a joint element adjacent to a depressed highway is relatively safe compared to the same joint element adjacent to an elevated highway. However, alternative choices in such matters are not normally feasible after the highway is built, and the effects may not always be reciprocal.

5.2 ECONOMIC CONSIDERATIONS

This subsection presents several criteria of an economic nature for consideration of joint development proposals. Comprehensive economic evaluation of project costs and benefits appears, however, as part of the Comparative Display Procedure in Section 8.

5.2.1 DEMAND ANALYSIS

- There should be convincing evidence of demand for the proposed joint development. Evidence of demand can be of several types. Consistency with comprehensive community land-use or development plans for the area as suggested in criterion 5.3.1 is a necessary,

if rudimentary, type of demand check. Inquiries can also be made of the utilization of similar, related, or competing facilities in nearby or similar locations.

In cases involving large private investments, the joint sponsor will usually undertake a more ambitious study of prospective demand, even extending to projections of community population characteristics, employment and labor force aspects, competitive facilities, and revenue potential for the JDP. Such studies may also exist, or be conducted, for publically sponsored projects, and would lend strong support to estimates of demand for the proposed project. For example, demand studies for parking (either publically or privately sponsored) are best conducted on a community or area-wide basis and in view of both the desired future urban form and multi-mode transportation plans. Construction of large, permanent parking facilities in the absence of such a demand study commits an urban area to live with the results of possibly fragmented and opportunistic planning, which may or may not conform with future urban access and parking policies.

5.2.2 ALTERNATIVE SITES, USES, OR SCALES

- A determination should be made that alternative sites, uses, or scales would not be more appropriate for the proposed joint development. The various possibilities for a JDP may be summed up under the concepts of alternative sites, uses, or scales.* As to the question of alternative sites: Is there any other available location, either as a joint development or not, that would be better for the proposed use? An affirmative answer to this question is tantamount to a do-nothing decision for the proposed JDP site. Questions relative to alternative uses are: Are there any other present (or future) uses more appropriate to this site? and are there multiple uses, compatible with the JD proposal, that should be added to it? The question of scale is: Is the size of the proposed JDP appropriate or should it be larger or smaller? A related question is

* Of course, even a single joint development proposal without alternate choice possibilities consists of at least two courses of action--either (1) accept the proposed development or (2) reject the proposal, at least for the time being. The latter course is often referred to as the do-nothing alternative. Rejection of a JD proposal amounts, therefore, to approval of the do-nothing alternative, which in turn permits consideration of future use of the JD site either for other purposes or possibly for the same JDP but at a later and more appropriate time.

whether provision should be made for future expansion, such as through added structural strength for increasing the future height of a building, or through adding other parcels of land to the space that is being considered.*

The response of JD proposal reviewers to these questions, and hence to the above criterion, entails at least two separate steps. First is the search for alternative possibilities, which is largely a matter of imagination and ingenuity, but may also entail search procedures such as contacting other possible cosponsors of a JD at the site in question. Second, there is the question whether a given site, use, or scale alternative can be quickly dismissed as infeasible or unattractive for some reason, or should it be considered in more detail. Time and money should not be wasted in detailed studies when the results are already obvious, and the JD analyst can satisfy himself short of such studies that an alternative has been given due consideration by himself or the cosponsor. Remember, however, that it may not always be in the cosponsor's perceived interest to consider certain site, use, or scale alternatives once it is decided there is sufficient demand to justify the JDP at the proposed site and at its estimated cost from the cosponsor's own point of view.

Provision for comparing the costs and impacts of alternative JDP sites, uses, and scales is included in Section 8, should there be a need to do so.

5.2.3 SITE AND SPILLOVER EFFECTS

- Care should be taken in considering economic impacts to assure, (1) a favorable balance of site and spillover effects from the JDP, (2) the cognizance of all beneficial effects caused by the joint

* Another related consideration bearing on the question of using airspace over the highway is the cost of the supporting structure or deck. Obviously, land costs in an area must be equal to or higher than the added costs of such platforms (compared with building on bare land) before it becomes economic to consider the use of over-the-highway airspace. Minimum land values of \$15 to \$20 per square foot have been used as a rule-of-thumb for estimating when such construction should be considered. While this minimum will vary with local construction costs and the proximity (related to market demands) of alternate, lower-cost sites, it is clear that such values will only be encountered in or near the central business districts of medium to large-size cities.

element, (3) the minimization of adverse effects or costs, and (4) compensation for significant but unavoidable social costs. A variety of site and spillover effects, often economic in nature, may result from joint development.* Some examples are increases or decreases in the value of real estate in the area; changes in employment opportunities; changes in personal and business incomes and in retail sales; and quantity, quality, or price changes in housing markets. Quantification of such effects is provided for in Section 8 and Appendix B. At this point, it is suggested only that the JD analyst be aware of the nature and possibility of such impacts in order, to the extent feasible, to minimize adverse effects (costs) and accentuate favorable effects (benefits); thusly, indicating whether the above criterion has been adequately met.

Note that the effects in question are not always additive, but may represent different ways of measuring the same thing (e.g., property values, retail sales, and business income). Further, such effects may be merely transfers of effects that would occur elsewhere in the community or region even if the project were not located as proposed. Transfer effects can be presumed whenever the proposed project could in principle (and would probably in fact) be located elsewhere in the area if it is not approved at the proposed JD location. When the JD location is unique (that is, singular in nature) the associated consequences would not be transfer effects.

Comments on specific site or spillover effects follow:

- Local Government Costs and Tax Revenues: JD can have significant financial impacts on the public entities who are expected to provide police, fire, health, and other typical municipal services. On the other hand, JD can have significant effects on the tax base of the community, and therefore tax revenues can often be derived from a JDP. In the event that the state or participating public entities retain title to the acquired land or airspace of the joint element, the land may be removed from, or remain off of the tax rolls, although the loss of revenue may be offset by levy of a possessory interest tax on the users of the leased land. In the case of a publically sponsored JD use, in lieu payments may apply even though possessory interest taxes would cease to be a consideration. However,

* "Site effects" are the direct consequences of a JD project, such as tax payments by the JD cosponsor, and "spillover effects" are induced (or indirect) effects on the surrounding area or population, such as increased property values. They are considered here together because of their close relationship.

in either case, any increase in private property values in the area that result from the JDP will usually occasion increased property taxes, and these may well exceed any tax "loss" due to public ownership or use of the JDP.*

In the event of the sale of JDP land or airspace, the land or airspace will be returned to the tax rolls, and the increased property tax collection would constitute a benefit to the local community. These would not be transfer benefits, because non-joint sites would not have had the effect of returning property to the tax rolls.

- Property Value Changes: Most joint developments represent investments or improvements that will enhance the attractiveness, utilization, or convenience of nearby property, and hence will increase its value. Similar developments elsewhere in the community (if suitable sites are available) would usually have the same effect, so the increased property values may only be transfer benefits; they are still, however, important as a general indication of favorable effects.

One example of property value effects may result from the fact that, when a neighborhood is split by a major highway, the value of the property on either side will tend toward the established value of housing in the adjacent neighborhoods. These changes, either positive or negative, may be somewhat offset where a trans-highway JDP maintains the surface continuity of the area, thus permitting easier neighborhood interaction and reduced isolation of neighborhood segments.

- Employment: Where the proposed JDP increases the available sites for commercial or industrial development, the opportunity for additional employment may be provided within its borders that otherwise could locate elsewhere. This can be a net benefit for the area, although not necessarily for the region as a whole. If there are suitable alternative sites available nearby, employment opportunities generated by the JDP would merely represent a transfer from an alternative site and should not be counted as new economic activity for the area. Even so, such employment opportunities may represent an important redistribution effect in conformance with community goals.

* By way of a parallel example, it has been shown that the value of land removed from tax rolls due to construction of new highways is usually more than offset by increased property values in the highway corridor due to improved highway service.

- Employment Versus Unemployment: A large scale JD construction project under conditions of full employment in the area may result in price and wage increases in the local economy--a cost. However, if there is unemployment in the construction industry, the JDP may provide much needed jobs--a benefit. This may result in further effects in reducing costs of unemployment compensation and welfare costs. Or possibly, it may result in jobs for the hard core unemployed in the area.

- Personal and Business Income: The points noted for "employment" also apply to determining the effects of the proposed joint development on the net incomes of residents and business in the area. Care must be taken to avoid the problem of double counting these benefits, especially where increases (or decreases) in real estate values within the area affected by the JDP are estimated (at least in part) to represent the capitalized value of the added income.

- Retail Sales: Retail sales should probably not be included as a net benefit but as an important internal transfer. A commercial JDP may benefit some at the expense of other retail outlets in the area. Similarly, a central city may benefit at the expense of suburban areas while there is no net benefit for the region. Further, there may be temporary losses in retail sales by merchants whose stores front on construction work--with sales going to other outlets. However, the affected merchants should expect an offsetting increase in business when the project is completed.

- Price-quantity Changes in Low Income Housing Markets: Where the JDP requires demolition of housing units occupied by low and moderate income families, the costs of relocation should be considered part of the cost of joint development. These costs may include the provision of alternative low income housing, as has been required in some federal court decisions. Otherwise, removal of low income units may increase the shortage of housing in particular submarkets, thus inflating the price for existing units and thereby reducing the well being of those forced to live in higher priced units--a social cost. On the other hand, where the JDP itself provides for expanding the supply of low and moderate income housing that otherwise would not be available in the community, benefits can clearly be envisioned.

- Relocation of Businesses: As with housing, the JDP may require the relocation of business from the project area. The costs of relocation should include the cost of moving, the marginal cost of the replacement building, and the comparative profit or loss from doing business in the new location.

- Disruption: If the JDP results in the permanent or temporary disruption of a neighborhood causing loss of business, loss of amenity, congestion or introduction of atypical traffic, etc., such factors should serve to reduce the net benefits that may accrue to the surrounding neighborhood.

5.2.4 APPRAISED VALUE DETERMINATION

- An appraisal (or appraisals) of the value of the JDP site should be carried out as a basis for price or lease negotiations with cosponsors and for establishing opportunity costs for public uses. While the appraisal process is highly specialized and rules for valuation of air rights can be complex, it is important for the JD evaluator to understand several general aspects of the appraisal process:*
 - Different methods of appraisal are possible and acceptable, providing different results in some cases. The most common bases are: (1) the concept of highest and best use, which relates to the most profitable feasible use of the space rather than to its best use in any social or environmental sense (the "value" of the property may be based either on estimated market value or on the capitalized value of future net income producible by the property); (2) the value of similar nearby property (relates to comparable sales); and (3) where applicable, the value that is added to abutting property when the property in question is joined to it.
 - The appraised value is reduced appropriately due to any constraints or encumbrances on the free and clear use of the property (e.g., due to the proximity of the highway, to the lease of airspace only, to physical features that result in negative cost or site utilization effects, etc.).
 - The appraised value of property provides no direct guide to its value in public uses (such as public parks) which are inherently non-economic or non-income producing in nature. The appraised value does give an indication of the opportunity cost[†] were the

* Some further references on appraisal and valuation problems concerning air rights and other joint developments are: Cook, Tom Layden, "The Nature and use of Airspace," The Appraisal Journal, July 1971; American Institute of Real Estate Appraisers, "Case Studies in Air Rights and Subsurface Tunnel Road Easements," 1964; and Highway Research Board, "Valuation of Air Space," NCHRP Project No. 11-5 (not yet published as of this writing).

[†] Opportunity cost is the value of resources in alternative uses that has to be foregone because of their use in the chosen alternative.

property to be successfully adapted to private use, and hence suggests an upper limit to the value of the property. However, it does not necessarily follow that the appraised value should be recovered by the highway department when public JD uses are entailed. This is because the land was originally acquired for a public use (i.e., highways), hence there can be a presumption of continued dedication to public uses whenever feasible (see discussions of "Qualification as Public Use," Subsection 5.3.2, and "Priority Rating Suggestions for Equal JD Alternatives," at the end of Section 8).

5.2.5 COSPONSOR'S FINANCIAL CAPACITY

- The cosponsor, either public or private, must demonstrate reasonable financial capacity to provide and maintain the proposed joint development. Consideration should be given to the difficulties or financial losses that could occur if, after the highway portions of the JDP are constructed, a cosponsoring public agency fails to pass a bond issue or otherwise is unable to meet required joint development costs, or if a private developer's capacity to proceed as planned has been impaired. This is, of course, less of a problem when the highway department investment is not large. If a large highway department investment is entailed and significant risks of nonperformance by the cosponsor are anticipated, it may be wise to wait until the necessary cosponsor funds are in fact available before proceeding with the highway department's portion of the JDP.

5.3 LEGAL CONSIDERATIONS

The following subsection covers some fundamental legal issues especially applicable in the consideration of joint development. It does not purport to discuss legal aspects in detail as legal requirements for (or obstacles to) different JD projects vary considerably. Further, some projects will pose more serious legal obstacles than others and accordingly should be referred to legal counsel for review and opinion.

5.3.1 LAND USE AND NEIGHBORHOOD COMPATIBILITY

- Joint development should be in accord with local (and state if applicable) land use zoning laws; comprehensive development, general, or renewal plans; environmental protection laws or standards; and any other related laws and regulations. In the absence of such laws or regulations, it should have the concurrence of the local commission, council, board, or other authority having control over land use. Also, it should be acknowledged that occasionally rezoning or

variances to local ordinance may be necessary to accomplish joint development, and that this necessity should not of itself invalidate a JDP. For example, zoning change or variance may be very desirable where effective utilization of highway oriented space involves multi-story buildings in dense urban areas where such highrise construction is economically more efficient, but where height limitations may exist.

Joint development projects should be compatible with the land uses and functional relationships of the area surrounding the JD, including the consideration of effects on the physical environment. This would not only apply to existing conditions, but also to land uses and functions planned for the future where such can be reasonably determined. Generally, joint development should not divide neighborhoods or other functional units. Although JD can be used to reinforce social and/or functional units, it can also be used to separate incompatible areas.

Closely related to neighborhood compatibility are the possible restrictions that might be imposed as a result of the rather recent "environmental" consciousness. Projects which are out of keeping, say, in rural scenic areas may well receive opposition from conservationists, if not from certain governmental agencies charged with the protection of the environment. In addition, the growing awareness of needs relating to the physical environment has resulted in an increasing amount of legislation on both the national and state levels designed to preserve the environment (as example, the requirement for environmental impact statements). In this regard, joint development projects should be examined in light of any applicable existing or pending legislation.

5.3.2 QUALIFICATION AS PUBLIC USE

- Where condemnation of land and expenditure of public funds for a JDP of private cosponsorship is contemplated, a determination should be made as to whether or not the planned project qualifies as a public use. As condemnation and expenditure is expressly prohibited for a private use, this consideration can be especially significant, especially where joint development enabling legislation has not been enacted.* In the absence of enabling legislation, a finding of public use will rest to a large degree upon whether a deciding court adopts the so-called "broad" or "narrow view" of public use.

* See Section 9, Implementation, for suggested model legislation.

Public use is a general term which escapes precise definition. It has been described as anything that benefits or contributes to the general well being of society or a substantial number of its members. In defining public use, courts have deliberately been vague, wisely recognizing that public use is a changing concept which must remain flexible to fit the needs of an evolving society, preferring to decide the issue of public use on a case by case basis.*

In determining whether or not a particular use is public, the decisions of the courts may be classified as endorsing either a narrow or broad view of public use. The narrow view of public use contemplates a "use or employment of the public." The broad concept treats public use as public advantage, and anything which contributes to the welfare of the entire public qualifies as a public use.

In the case of the State of Washington, the courts would appear to have traditionally taken a somewhat conservative position on the scope of public use. However, in recent years they appear to have adopted a broader position. In a 1963 opinion,[†] the Washington Supreme Court found redevelopment to be a "public use" in spite of the fact that redevelopment involves a direct benefit to private developers while the benefits to the public are indirect.

In assessing the probability that a planned JDP will be found a public use, there are several factors to consider--(1) the flexible definition of public use, (2) the recognition (at least by the Washington courts) that the needs of society are constantly changing, (3) the increasing need for effective utilization of existing space, particularly in urban areas, and (4) the analogy to redevelopment as a public use. In the light of such factors, it would appear reasonable to assume that joint development projects contemplating participation of private cosponsors can more often than not be held a public use.

* The courts of Washington reflect this philosophy in their decision regarding public use. The leading case in Washington on the meaning of public use is *Carstens v. Public Utility Dist. No. 1*, (1941) 111 P. 2d 583, in which the Court stated: "The term 'public use' is one which has been examined innumerable times by the courts, but no concise, clear definition thereof has emerged from the mass of judicial language devoted to the subject. . . . Moreover, views as to what constitutes a public use necessarily vary with changing conceptions of the scope and functions of government, so that today there are familiar examples of such use which formerly would not have been so considered. As governmental activities increase with the growing complexity and integration of society, the concept of 'public use' naturally expands in proportion."

[†] *Miller v. City of Tacona* (1963), 61 Wash. 2d 374, 378 P. 2d 464.

5.3.3 ANTI-DIVERSION AMENDMENT PROHIBITION

- In the absence of enabling legislation or a specific determination defining joint development as a highway purpose, alternative or supplemental means of acquisition and/or construction financing must be sought. This, of course, assumes that such financing has been otherwise deemed necessary and/or desirable for the JDP being considered.

A majority of states, including Washington,* have a constitutional provision which designates certain state revenues that may only be used for certain specified highway purposes. This type of provision is generally known as an "anti-diversion amendment" and is designed to prevent taxes derived from highway users from flowing into the general state fund and subsequently being appropriated for projects and programs which bear no relationship to highways. Anti-diversion amendments are based on the theory that where a particular group is taxed on a specific activity, the proceeds of this tax should be used to confer some benefit on this particular class of taxpayers.

The anti-diversion amendment would become an important consideration when, in the absence of enabling legislation, the state attempts to either acquire laterally adjacent lands with highway funds and/or attempts to use said funds for construction of joint development improvements associated with the joint element. In Washington, the 18th Amendment to the State Constitution provides in pertinent part, that the Motor Vehicle Fund shall be used exclusively for highway purposes, which are specified to include the construction, reconstruction, maintenance, repair, and betterment of public highways.

Unless the joint element is found to be a highway purpose, the use of the Motor Vehicle Funds in acquisition and development would be prohibited beyond the use of those funds used solely for traditional highway purposes (i.e., roads, rest areas, and scenic viewpoints). As discussed in 5.3.2, the joint development might be sustained as a public use under the broad viewpoint. However, the Washington Supreme Court has held that the phrase "exclusively for highway purposes" was intended by the people to limit expenditures from the motor vehicle fund to those things which would directly or indirectly benefit the highway system.† It would appear unlikely to construe joint development as a direct benefit to the highway system, since the concept does not contribute to the primary function of the highway. However, qualification of a JDP as indirectly

* Wash. Const. Art. 2 §40.

† Washington St. Hy. Com'n v. Pacific N.W. Bell Tel. Co. (1961), 59 Wash. 2d 216, 367 P. 2d 605.

benefiting the highway, while not fully tested in the courts, might be based on (1) reduced right-of-way maintenance costs or other savings, (2) benefits resulting from putting otherwise wasted or unattractive highway related space to functional or aesthetic uses, (3) reducing undesirable side effects or social costs of highway construction, (4) providing "terminal" facilities in the form of garages and parking areas for highway users, (5) alleviating highway use (save-a-lane concept) and congestion by providing of alternative transportation facilities, and so forth.

5.3.4 TORTIOUS LIABILITY

- The possible liability of both public and private sponsors for tortious conduct in the construction and operation of joint development projects should be considered and provided for. In many states, (Washington being one) legislation has provided that the state, whether acting in its governmental or proprietary capacity, shall be liable for its tortious conduct to the same extent as if it were a private person or corporation.*

Initially, consideration should be given to those liabilities which might be incurred in the actual construction of the JDP. Both private and public sponsors may be responsible for personal injuries resulting to workmen and possible liability to bystanders and other third parties. Liability may also arise from damages that might result to adjoining land owners during construction--both for actual physical property damage and for loss of enjoyment of their property. Consideration should also be given to the various liabilities that might be incurred from breach of contract--with cosponsors, contractors, consulting design firms--and how this liability is to be apportioned.

Upon contemplation of the JDP, the legal responsibility of sponsoring participants for injuries arising due to the joint development will depend to a large extent on how title is held and the nature of the accident. Where the title to the occupied property (or space) remains with the state and with the cosponsor operating under a long term lease, injuries would probably result in liability for both parties.

* For the State of Washington, see RCW 4.92.090. Recent cases in other jurisdictions have held that a state may be liable for negligent maintenance of an industrial plant owned by it: *Buckeye Union Fire Ins. Co. v. State* (1970), 383 Mich. 630, 178 NW 2d 476; and that a state may be liable for damages caused by contamination of a lake by adjacent housing facilities at a State Park: *Perkins v. State* (1969), 281 NE 2d 30.

The joint development planner should also be aware of the liability that might be incurred if the joint element constituted a nuisance to surrounding properties. It should be noted that the legal meaning of "nuisance" encompasses legitimate uses of property which curtail the enjoyment or use of neighboring properties. As an example, under certain circumstances problems engendered by modern commercial/ industrial buildings may conceivably constitute a nuisance (i.e., excessive lighting at night, noise, dust, or lack of adequate parking).

A closely related problem, although not tortious in nature, is the concept of inverse condemnation. Inverse condemnation arises where the public use of a property so restricts or prohibits the existing use of neighboring properties that their value is impaired. This may result in an action by affected landowners compelling the state to pay compensation for the "taking" of their land.

5.3.5 LEASE OR SALE ALTERNATIVES

- Depending on the sponsorship of the JDP, a determination should be made as to whether ownership of the land and/or airspace of the joint element will (1) remain with the department of highways or other participating public agencies or be shared, or (2) passed to private cosponsors. As state retention of the fee title to airspace over federal-aid highways has been encouraged, it might follow that fee title to any lands laterally adjacent to and associated with the airspace should also be retained by the state to insure uniformity of controls. The following two viewpoints should at least be considered, however.

Retention of title by the state of the land and/or airspace in cases where joint element improvements are not traditionally public in nature would appear to bolster the public character of the project as well as insure strong public control over the intended use.

The use of leases in joint development projects can more effectively provide for operation and maintenance restrictions designed to not only minimize interference with the highway function, but also to enhance the physical appearance of the overall development on a continuing basis. Additional control features can be lease provisions governing forfeiture for abandonment or mis-use of the project premises. The flexibility of leasing as a device for conveying an interest in property is sufficiently great that each individual JDP may be tailored to meet the specific needs of the various sponsors.

While the sale of public acquired joint element land (or air space) and/or improvements might diminish the public character of a project, the conveyance of fee title to private interests will provide a more immediate recoument of public funds, and yet permit a measure of public control over the intended uses by the employment of traditional reversionary devices for abandonment and misuse. In addition,

it can create a wider (local) tax base by placing project lands and/or improvements in private ownership. Pro rata repayment of any federal funds used in the original right-of-way purchase is required after sale, however, which may tend to reduce the attractiveness of the sale alternative.

Reluctance to pass fee title to private developers participating in joint development may create financing problems for such private cosponsors. The FHWA's policy as presently outlined in their directional memorandum (see Guideline Subsection 2.3.1) contemplates long term leases to private developers. However, it is questionable whether institutional lenders will finance the private developers' share of the costs unless the security of a fee title is present. The result of this difficulty could pose a serious obstacle to an otherwise acceptable and desirable joint development project.

Leasing and conveyancing can be as complex, or as simple, as particular joint projects demand; counsel for the sponsoring participants, given knowledge of project details, can and should examine the particular advantages and disadvantages of each mode of transfer of interest.

5.4 SOCIAL CONSIDERATIONS

Many socially related issues have already been raised in the three prior subsections in connection with suggested criteria, constraints, and standards of physical, economic, and legal types. Some examples are those having to do with traffic congestion, driver and pedestrian safety, air and noise pollution, public health matters, visual amenity and aesthetics, crime and security measures, JDP demand, and land use and neighborhood enhancement considerations.

Social consequences of joint development should, therefore, already be present in the thinking and evaluation processes of JD planners, designers, or decision makers. Nevertheless, it seems well to supplement the foregoing subsections with certain specific social considerations that may not be apparent from the former considerations cited. Section 7 contains an amplification of some of these considerations, together with approaches to identifying community and neighborhood responses to proposed JD projects in cases where such responses are not readily predictable from past studies or statements of community goals and attitudes.

5.4.1 COMMUNITY NEEDS

- Joint development proposals should take the needs of the total community into consideration. Hence, housing, work, recreation, and cultural activities should all be considered as being potentially

affected by joint development. To assist in this consideration are the published or recorded community goals as set forth in master and general plans and community renewal, housing needs, and other special purpose studies. Where the cosponsor of the JDP is a governing or administrative body of the affected community, compliance with this criterion is generally ascertained by that body; for other cosponsors, they (or the highway department) should seek the review and approval of such bodies.

5.4.2 NEIGHBORHOOD SOCIAL CONDITIONS

- Joint development should be evaluated in relation to the social values, community norms, and mores held in the particular neighborhood of the JDP. Joint development can represent a significant opportunity for the betterment of social conditions through changes in the physical environment at the neighborhood level. This makes it imperative for JDP planners to gain some sense of nearby community values, norms, and mores.

Once it is clear that the neighborhood feels a particular way, or jointly shares a point of view, a particular JDP should be evaluated in that light. For instance, if a neighborhood views a proposed activity, such as parking in a primarily residential area, as "only for others," it may be considered an unwarranted intrusion. By the same token, if the neighborhood places a high value on commercial or recreational activities which enhance, say, family life, a JDP which allows this to take place will have a high value. The point then is that one must find out about the neighborhood from the neighborhood and not assume one knows already.

5.4.3 COMMUNITY IDENTITY

- Joint development should present an opportunity to enhance community cohesion and identity through community based groups working together in the development of the potential JDP. Identification and acceptance of neighborhood groups or leaders gives citizens the sense that their point of view is in fact being presented. The cohesion process begins when the community itself determines who these spokesmen are to be. The identity process is enhanced when the interaction between these representatives and the decision makers (either from the highway department or the cosponsors) continues and the spokesmen group are shown to play an important role in the process.

Again, where the cosponsor is a governing or administrative body of the affected community, this interaction may be led by that body with the highway department more in the role of an observer than direct participant, at least as to the joint element's portion of the JDP.

5.4.4 FAMILY RELOCATION

- Where joint development proposals necessitate the relocation of occupied housing units, a realistic relocation plan should be developed jointly with the community before final approval of the JDP. However, unless relocation is absolutely essential or sufficient compensating benefits are demonstratable, joint development projects involving such relocations should be discouraged.

On the other hand, adequate compensation of displaced residents for moving expenses and the creation or identification of improved replacement housing can offer a chance to upgrade substandard living conditions and generally provide decent housing in a range of prices for all people in the community. It must be clear that one is dealing with a total community, however, and plans must be made with and for this totality. Dispersing coherent neighborhood throughout a city, even to better housing, may have greater adverse effects than actually leaving them where they are as a group.

Section 6

AIR QUALITY AND NOISE CONSIDERATIONS

The purpose of this section is to supplement Section 5 criteria on control of air and noise pollution for joint developments by providing a more detailed account of vehicle emission and noise generation characteristics, plus some suggestions for control or mitigation of air pollution and noise effects. These two effects are treated in separate subsections (6.1 and 6.2).

The intention here, however, is not to replace the many studies and published reports that discuss these subjects far more completely than can be covered in this Guideline (selected references are provided in Subsection 6.3). Rather, the intent is only to provide a basic level of knowledge to assist the planner, designer, or decision-maker in better understanding potential air quality and noise effects in relationship to joint development projects.

6.1 AIR QUALITY CONSIDERATIONS

Air pollution has become a major U.S. problem, especially in large metropolitan areas, and the single largest contributor to air pollution is motor vehicle emissions. The problem from the viewpoint of joint development, however, is the air pollutant level and potential health effects in the immediate vicinity of the highway rather than the general level in the atmosphere. Therefore, matters such as the federal Air Quality and Clean Air Acts, the clean-air standards of the Environmental Protection Agency, various state standards for ambient air quality and motor vehicle emission control, the technological advancements of the engine manufacturers, and other potential sources for major broad-based solutions are outside the concern of the joint development planner except to the extent that they indicate a gradually declining level of pollutant emissions per vehicle.

6.1.1 VEHICLE EMISSION CHARACTERISTICS

The principal air pollutants originating with the motor vehicle have been identified as the exhaust emission of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NO_x), as well as lesser amounts of sulphur dioxide, lead compounds, and particulate matter.

In comparing gasoline powered vehicles to diesel powered trucks and buses, emissions from the latter of carbon monoxide are much lower; hydrocarbons, generally lower; nitrous oxides, generally higher; lead compounds, zero; and smoke and odor, considerably higher.

A decline in the production of all three major automobile pollutants is projected under present clean air and vehicle emission control standards. By 1980, for example, major emittants are estimated to be less than half the 1972 level per vehicle (on the average, using present survival rates for older vehicles); and by 1990, nitrous oxides are estimated to be about one-tenth, and HC and CO less than one-twentieth, of 1972 average levels per vehicle.

Briefly stated, the effects of air pollution on human health are the:

- (1) short term effects of discomfort and/or annoyance, and
- (2) longer term effects of actual physical injury.

The former are typified by eye and nasal irritation, odors, and similar complaints, though present levels of smog concentrations may also restrict athletic activities and cause breathing discomfort during heavy exertion. These short-term effects may or may not result in any permanent physical impairment, but are what affect the bulk of the population and therefore are the effects most likely to be the basis for public reaction.

The recognized cases of the second and more clinically serious category involve as yet only a small part of the population--generally those who are prone to (or already suffering from) respiratory problems--or special short term episodes of intense air pollution (e.g., in London; Donora, Pennsylvania; and more recently in New York). Although no reliable measures exist of injury effects on the rest of the population, this is not to say that none exist, especially over extended periods of exposure.

To assist the JD planner or evaluator in better understanding these individual pollutants and their health hazards, brief summaries follow.

Carbon Monoxide

Carbon Monoxide, a colorless, odorless, and tasteless gas, can be detected only by instrumentation. Characteristically the gas tends to rise and is diluted significantly upon its initial release into the atmosphere from the exhaust system. The diffusion of CO is much slower following its initial dilution. As there are no known significant chemical or photochemical reactions to alter its characteristics, CO can only disperse into the surrounding air and eventually escape to the general atmosphere.

The quantity of CO emitted to the atmosphere far exceeds any of the other pollutants; although it has not been shown to be proportionately serious, the distinct threat to human health must be faced.* Of major concern is the uncertainty about possible long term effects of continued exposure to carbon monoxide at concentrations below the clinically toxic level. Short term effects have been reported as headache, dizziness, mental dullness, physical tiredness, and nausea, however the commonness and multi-causal origination of such ailments make direct correlation difficult at best.

Hydrocarbons

Hydrocarbons, in contrast to carbon monoxide, have not been found to have any deleterious effects on health at atmospheric concentrations experienced to date. Though the evidence is inconclusive, it is possible that certain hydrocarbon derivatives may adversely affect lung tissue. The most serious consequence of hydrocarbon emissions are their indirect effect through participation in photochemical reactions which result in the formation of smog. The prevalence of smog characteristically results in eye and respiratory irritation, reduced visibility, and certain plant damage.

Nitrogen Oxides

Although nitrogen oxides are reaching atmospheric concentrations high enough to be of concern in themselves, their most significant effect currently is their reaction with hydrocarbons in the presence of sunlight

* In terms of its concentration in parts per million, studies have demonstrated that there is an average of 0.3 to 1.5 ppm CO concentration level for every 100 vehicles per hour. Reported total concentrations of 50 ppm are now common. Short period levels as high as 80 ppm have been recorded on some freeways in large cities. Instantaneous concentrations of 100 ppm have been found near areas of heavy and restricted traffic where the gas could not readily disperse. These data constitute significant levels as indicated by some recently promulgated standards for acceptable levels of CO concentration:

- The Conference of Governmental Industrial Hygienists recommends a limit of 50 ppm for average CO concentration during an 8 hour period for industrial workers.
- The state of California Department of Public Health has specified a limit of 30 ppm as an average 8 hour concentration of CO, or 120 ppm for 1 hour, as constituting a serious level of pollution.
- New York State has also set a 30 ppm, 8 hour maximum limit for CO concentration.

to form photochemical smog. Of the several oxides of nitrogen, nitrous oxide, nitric oxide, and nitrogen dioxide are known to be the most plentiful in the atmosphere. Nitrogen dioxide, a yellow-brown gas, is the most significant of these; it can reduce atmospheric visibility in even low concentrations. It is toxic to man but has not been identified as seriously damaging to health in the low concentrations that occur in the atmosphere. Further research is needed, however, to determine the public health significance of this pollutant.

Other Pollutants

The health hazard from the numerous types of particulate matter found in the atmosphere is even more obscure. Suffice to say, though, the motor vehicle is one of several major contributors--either through mechanical wear (i.e., tire or clutch wear) or by exhaust emission.

Lead oxide emission is identified with the automobile through the use of lead alkyl compounds in gasoline. Approximately two-thirds of the lead in gasoline (about 2 grams per gallon in leaded gasoline) is emitted into the atmosphere, with 25 percent to 50 percent of that amount becoming airborne. Lead compounds in general are known to be toxic to humans, but sufficient concentrations (either in the body or the atmosphere) have been identified to date only in isolated cases, not necessarily related to the automobile. Nevertheless, sufficient suspicion has occurred to cause the recent introduction of lead-free gasoline in many areas.

Although sulphur dioxide is one of the most noxious of air pollutants and ranks high in total emissions (considering all sources), its contribution from the motor vehicle is relatively minor.

6.1.2 CONTROL SUGGESTIONS

At the outset, three points are made: First, "control" of air pollution is an acknowledged overstatement--partial control or mitigation would probably be more apropos terms. Second, the following guides are envisioned for locations where air pollution levels either are a recognized problem or are reasonably anticipated to be a problem.* Third, the categorization scheme that follows is more for contextural clarity than for purposes of systemization, and tradeoffs with other JD criteria

* Research is currently underway on practical diffusion models for determining pollutant concentration levels near highways; in the absence of such models, judgment must be used in identifying potential problem locations.

are not explicitly considered. Accordingly, some overlaps or apparent inconsistencies will appear between (1) one control measure and others within this subsection, and (2) some pollution control measures and criteria stated elsewhere in this Guideline, such as certain functional vis-a-vis aesthetic viewpoints.

The first two categories of control discussed below are beyond the scope of this Guideline but are briefly presented in order to illustrate a total approach to air pollution control. Categories 3 and 7 are only partially applicable to JDP planning insofar as some degree of choice is possible.

(1) Control at Source

This type of control relates to the primary source of pollutants--the motor vehicle traveling on the highway element. Specifically, control is typified by:

- Legislating exhaust concentration standards
- Modifying the engine
- Requiring after-burner (or other exhaust reactor) systems
- Preventing evaporation from fuel tank and carburetor
- Allowing only the use of lead-free, low sulphur gasoline
- Seeking alternative propulsion systems
- Increasing average route speed* (viz., reduce the amount of slow and stop-and-start traffic)
- Reducing density of traffic (viz., increasing exhaust dispersion by providing greater space between vehicles)

(2) Control of Source's Location

This category relates to the source's location as reflected by the location of highway facility itself. Typical air pollution control measures of this type are:

- High (vehicle) density highways should not be located in high (people) density areas. At question is the amount of clean air available per capita for pollutant dispersion and/or foul air replacement.

* Especially applicable to carbon monoxide and hydrocarbon emission reduction. Oxides of nitrogen appear to show less variation with speed.

- Consider meteorological factors in highway location. Do not rely on the induced dispersion caused by moving vehicles, but rather strive for locations of high wind occurrence--either by reason of natural flow pattern or by turbulence effects occasioned by surface features.
- Consider topographical features in highway location. Ridges and hill tops offer better natural ventilation; valley bottoms should be avoided, especially where their sides are relatively steep.

Creating topographical change by elevating highways on embankment may offer aesthetic benefits to the highway user, but it may more likely reduce the natural air circulation (and therefore pollutant dispersion) in neighboring areas, or may possibly create a cold-air dam trapping pollutants in areas immediately adjacent to the roadway. On the other hand, the elevated highway viaduct not only avoids the dam effect but it can increase surface roughness and therefore turbulence effects. Remember, however, the increased air friction will reduce area wide mean wind speed.

(3) Control by Substitution of the Source

This type of air pollution control relates to the reduction of the number of "source" vehicles. The last two guides refer to the highway truck, although the emphasis here is on the private automobile--primarily because of the far less number of highway trucks, their more uniform hourly variation, and the fact they can more readily accommodate elaborate emission control devices.

It will be noted also that most of the following guidelines would have the secondary effect of reducing congestion on the local street system and thereby further reducing pollutant emissions from start-stop and slow moving motor vehicles.

- Substitution by public transportation vehicle (rubber tired); lowers the pollutant emission per highway user.
- Substitution by public transportation vehicle (fixed rail); lowers the emission per transportation system user.
- Substitution by other alternative public transportation mode (water or air oriented); lowers total emissions in corridor.
- Substitution by private alternative mode (2 and 3 wheeled cycles, carts, etc.); lowers total emissions in the corridor.
- Substitution by increasing the effectiveness of private motor vehicle (car pooling); lowers emission per highway user.

- Reduction of trucks on highway element by allowing tandem trailer equipment (duals and triples); reduces total emission per hauled ton. Associated tandem trailer make-up/break-up areas would likely be required at connection points with local streets and roads. Reduction of highway trucks on city streets may also be affected by providing terminals or transfer stations at appropriate highway locations.
- Reduction of trucks on normal highway lanes by providing exclusive truck lanes; reduces total emissions by increasing average truck speeds and practically eliminating peak hour stop-and-go driving. (Stop, go, and speed characteristics of the automobile may or may not be affected.)

(4) Control of Roadway Edge*

This category relates to the protection of the joint element user or participant, although it does not reduce the pollution level for users of the highway element. The fundamental guideline here concerns the blocking, dispersion, absorption, or other mitigation of the source pollutants before they enter the air environment of the surrounding area.

- Separate the JDP elements structurally by covering, enclosing, or otherwise tunneling the highway elements in the area of the JDP. If mechanical ventilation is required a special problem occurs--the concentration of pollutant load at localized discharge points. Discharge venting considerations include:
 - surrounding land use, population density, and day vs night activity characteristics
 - wind pattern, speed and other atmospheric dispersion characteristics
 - height above ground, number and emission rates of discharge vents
 - ambient level of pollution
 - the promulgated levels of standards considered safe
 - the degree of (if any) electrochemical cleansing of discharged wastes

A site by site analyses is required to establish the air pollution consequences associated with enclosing highways for the benefit of JD.

* "Edge" denotes the general fringe zone surrounding the roadway, both vertically and horizontally.

- Separate the JDP elements by open space, thereby creating "air reservoirs" alongside the roadway. This enhances not only the opportunity for increased atmospheric dispersion but, if planted, such a buffer may filter out certain particulate matter and absorb some gases--thus further reducing pollutant concentration escaping to the general atmosphere. The trees and shrubs necessary for this filtering and absorption process, however, form wind breaks and increase the surface roughness ratio, and, therefore, may adversely affect natural air flow patterns. As a general rule, grassy, low profile ground cover makes the best separator.

Other than to say "the wider the better," buffer width is a complex question and must be analyzed on a site by site basis. In this analysis, the following should be considered:

- wind speed, direction, and hourly variation
- traffic speed, density, and hourly variation
- distance between opposing lanes of traffic and between edge of traveled way and normal right-of-way line
- ambient level of pollution
- the promulgated levels or standards of concentration considered safe for the land uses in the neighboring areas.

(5) Control at JDP Site

This form of control relates to the site of the joint development itself. As with certain other criteria found in this subsection, several of the following will appear inconsistent, if not actually contrary to the basic concept of joint development. They are useful however to the JDP analyst or decision maker in weighing the degree of negative or positive value attributable to the project's elements and their configurations.

- Induce atmospheric dispersion by creating wind turbulence through the use of structures, plantings, and/or earth mounding. Whereas this enhances local (site) atmospheric dispersion, as mentioned previously, it will reduce average mean wind speed and therefore slow the rate of decline of area-wide pollutant concentration.
- Locate JDP buildings, internal roads, screen plantings, or otherwise alter the natural topography to create wind funnels, rather than wind blockages. Generally, wind "strike-angles" of 45 degrees or less are desirable.

- Locate the joint element on the (prevailing) windward side of the highway. Also avoid enclosing outdoor spaces on more than two sides.
- Avoid large human concentrations in outdoor spaces--at least during daily periods of peak pollutant level.
- Avoid athletic or other active recreation activities where increased human respiration rate and/or oxygen demand may occur.
- Avoid JDP's where high concentrations of slow moving, stop-and-go motor vehicles are apt to occur during periods of peak pollution level, thereby compounding local area air pollution (i.e., parking facilities, bus terminals, etc.).
- Where the JDP is considered in spaces below elevated highways, the free passage of air from one side to the other should be maintained without blockage by structure or planting (except where wind turbulence or funnel effects are sought as discussed above). Where one side is blocked, then total enclosure of the JDP should be considered.
- Where plantings are used, they should be leafy and perennial to provide maximum filtering effect on airborne particulates as well as of the type that can resist the deleterious effect of motor vehicle pollutants.

(6) Control Within JDP Buildings

This category includes control measures that can be considered for the buildings of the JDP.

- Provide internal circulation and treatment of the air within the building. Forced air circulation systems (as opposed to gravity or wind vane venting) with inflow and outflow ports located at the highest practical point above the building should be a minimum system. An effective air conditioning system is better, however, because of the reduced need to open windows and doors. Air treatment equipment offers the best form of control. Although carbon monoxide is generally difficult to remove, air treatment can reduce ozone, lead, and other particulate matter.
- The building design should provide for fixed window sashes and doors with automatic closures. Buildings should be oriented so that the openings that are required are located away from potential high pollutant concentrations, with prevailing winds generally paralleling the building face--as opposed to impinging on the openings. In the design of the air circulation system, a slight positive pressure should be maintained in vestibule areas.

(7) Control at the Community Level

This final category is noted because of the relationship to JD of certain community wide actions in regard to air pollution; it is not intended to elicit or otherwise imply Guideline recommendations. Some of the following are, of course, obvious approaches to air pollution control; others may be viewed as only probably, or even idealistic. Suffice to say though, to the extent that a community sets broad goals and objectives regarding air pollution, the extent that the joint development planner shall be guided is dictated.

- Promote working and shopping opportunities in residential areas (viz., enhance air pollutant dispersion through dispersion of urban activities).
- Promote "non-clean" industries to less dense suburbs, even if furthering urban sprawl (viz., relocate air pollutants).
- Alter working times of employees (viz., lower peak hour pollutant concentrations).
- Stagger business hours in different parts of the city (viz., alters buying and working patterns; affects peak hour concentrations).
- Promote mass transportation or other alternate transportation modes to the private motor vehicle (viz., reduce total pollutants).
- Restrict number of traffic routes into core area.
- Prohibit automobile traffic in core areas (viz., reduce total pollutants).

6.2 NOISE CONSIDERATIONS

The problems of traffic generated noise pose significant problems for the effective design of many joint development facilities. For example, Table 3-2 noted several types of joint development that are inherently sensitive to highway noise. However, to the extent that some increased costs and necessary enforcement procedures are acceptable, application of principles of noise control can go a long way towards assuring the JDP user adequate protection from adverse noise effects. Such principles are covered in this subsection.

6.2.1 NOISE CHARACTERISTICS

Sound is caused by energy imparted to air particles in the form of pressure or compression waves or vibrations. The human ear responds to the variable sound pressures as a transducer so long as the frequency of the sound is roughly between 20 and 15,000 Hz (Hertz, or frequency in cycles per second). Noise can be described as "unwanted sound" as subjectively evaluated by the observer. Highway noise is generally considered as the increase in noise level above the ambient or background level that existed, or would exist, without the highway.

Noise Measurement Scales

The physical response to noise can be measured in units of decibels (dB),* measured on a scale of 0 to 140. The A-weighted sound pressure level, or dBA, is the unit of sound level most used in traffic noise measurements, due to the reasonably close correlation it has with the subjective reactions of humans to this type of source. The A-scale covers a frequency range of 400 to 12,000 Hz. As a basis for reference, a 10 dBA change will correspond to a subjective judgment of doubling or having the noisiness of sound. Similarly, a 20 dBA increase of one sound over another would generally be rated four times as noisy. A change of 1 dBA is barely noticeable to a trained observer, and a 3 dBA change is noticeable to most persons.

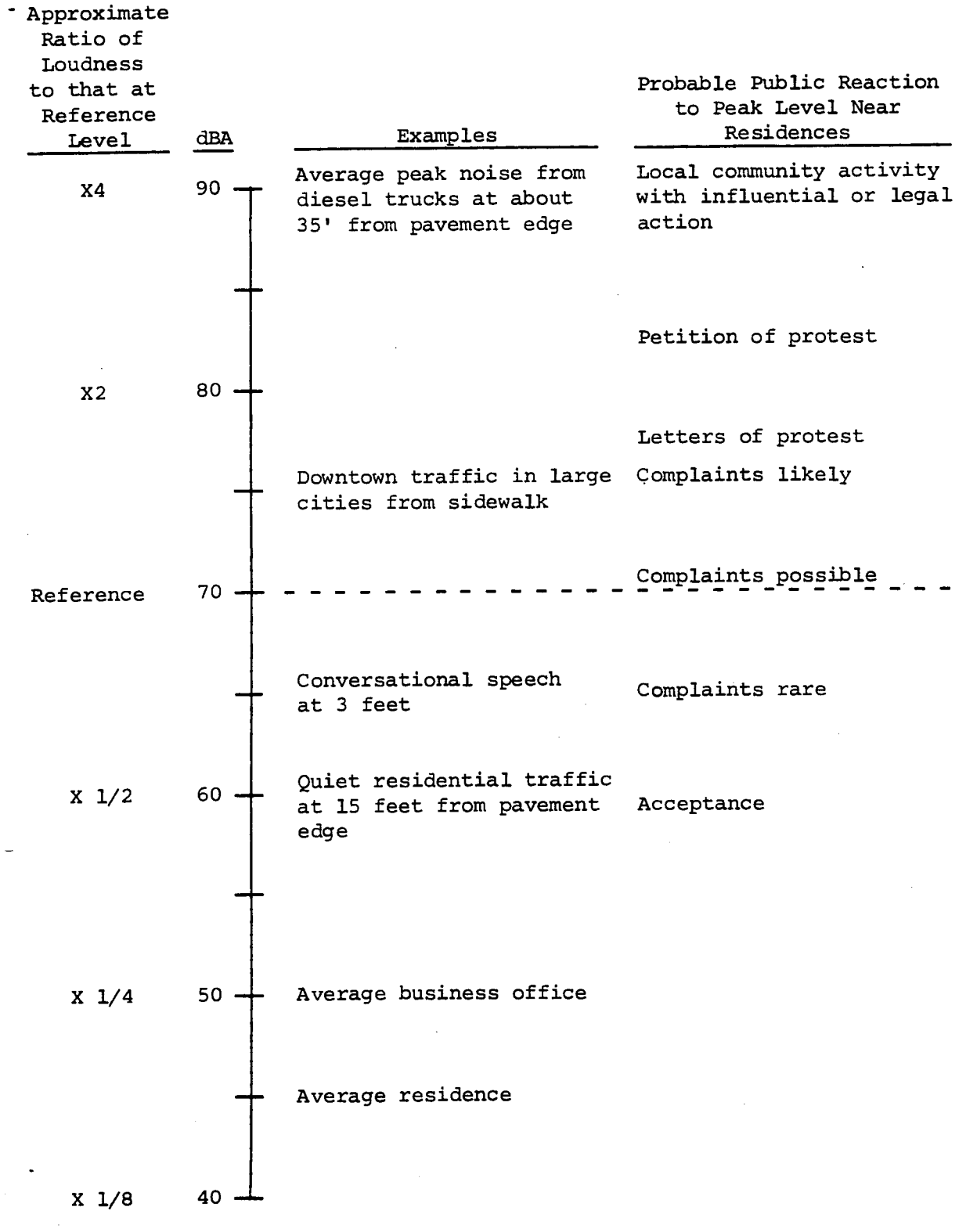
Figure 6-1 gives several examples of noise levels as well as an indication of probable public reactions to peak noise near residences.

Another common unit of sound measurement is Perceived Noise Decibels (PNdB). The perceived noise level method, using PNdB, is more precise (and more complex) than using the A-weighted scale. Perceived noise decibels are used more widely in aircraft sound analysis since they

* Mathematically, the decibel is defined as 10 times the common logarithm of the ratio of energy between two sounds. Given changes in decibels over different ranges do not, therefore, represent the same changes in sound pressure, energy, or power. For example, a 20 decibel change between 20 decibels and 40 decibels results in a pressure change of 0.018 dynes/square centimeter, while a 20 decibel change between 100 decibels and 120 decibels results in a pressure change of 180 dynes/square centimeter; i.e., 10,000 times the pressure change is required to go from 100 to 120 decibels than is required to go from 20 to 40 decibels.

Figure 6-1

ILLUSTRATIVE NOISE LEVELS AND CONSEQUENCES



Source: "Can Noise Radiation from Highways be Reduced by Design?" Beaton and Bourget, January 1968; and SRI.

correlate well with subjective responses to various aircraft sounds.* As with dBA measurement, a 10 PNdB change is equal in subjective judgment to halving or doubling the noisiness of sound, and a difference of one or two PNdB is not too noticeable by an observer.

Noise Variables

Some of the factors that can affect the noise environment of the joint element are:

- Distance from highway element--both horizontally and vertically
- Intervening features between highway and joint facilities
- Ambient noise level (without highway element)
- Traffic density and speed
- Traffic composition, including vehicle characteristics
- Nearness to acceleration/deceleration ramp approaches
- Highway grade and speed change needs
- Pavement surface texture, including jointing and cracking characteristics
- Roadway elevation with respect to JDP adjacent grade
- Climatic variation--air temperature, humidity and wind velocity

To further complicate the noise problem, the degree of annoyance from noise will vary not only with the sound level as affected by the above physical factors, but with the time of the day[†] and between individuals.[‡] Even though the extent to which noise can be termed "noise pollution" is a matter of subjective judgment, there are some observations that can be useful in guiding an analyst in evaluating joint development. These are:

- The louder noise is, the more disturbing it will be. Remember that while a 3 dB increase may be noticeable, a 10 dB increase corresponds to doubling the noisiness of sound.

* For many aircraft sounds, the perceived noise level is approximately 13 dB greater than the A-weighted sound level for the same noise environment. For other than common aircraft or vehicle spectra, the relationship between the perceived noise level and the A-weighted sound level may have to be experimentally determined.

† As an example, a truck producing 75 dBA sound level during the daytime, when the ambient noise is, say, 70 dBA, will likely produce few complaints. However, the same truck would be highly objectionable in the early morning hours when the background noise is near 50 dBA.

‡ For example, it has been found that the visual dominance of a highway, whether or not it has been screened by landscaping or some other beautification measure, affects the subjective noise response of various observers differently.

- The frequency (pitch) of noise has much to do with its effect on an observer; frequencies upward from 1,500 Hz are generally more annoying.
- The longer the exposure, the more distracting noise can be.
- The more unique a noise is in relation to usual or "natural" sounds, the more it will be noticed.
- The attitude and economic status of the observer can effect the response to noise.*
- The type activity of the observer affects his tolerance of noise (i.e., physical, mental, sleeping, etc.)
- The intermittent and irregular noises are more distracting than steady noises--for example, passing trucks (85 to 90 dBA) or accelerating motorcycles (90 or 95 dBA).

Maximum Noise Levels For Joint Development Projects

Generally speaking noise can be divided into the following three types. Whereas the first two can provide a basis for JDP judgment, anticipation of the third type would unequivocally suggest rejection without further consideration.

- (1) Noise which disturbs or otherwise disrupts sleep, learning (listening, speaking, studying), or other task interference.
- (2) Noise which causes annoyance, discomfort (psychologically-based), or nuisance.
- (3) Noise which causes physical discomfort, pain, or ear damage.

At JDP sites, one (or both) of the following approaches may be taken in relation to predicted noise levels of the first two types.

- Set upper limits of sound pressure level (dBA) that may not be exceeded for given JDP types.

* For example, interviews with more than 300 residents living within sight of a freeway in a Los Angeles County study, 70 percent of the highest socioeconomic class residents living in an area of little freeway noise expressed annoyance, while only half of the residents of a lower socioeconomic and more noisy area did so. Yet the second area was almost four times as noisy as the first.

- Provide for noise attenuation by "designing-in" certain sound control features in both the highway and the joint elements.

The second approach is the subject of the last part of this subsection, Sound Control. The first approach would require a degree of agreement on what constitutes tolerable noise levels. Such does not yet exist, but two examples of attempts to set noise standards are given. Table 6-1, the first example, gives maximum recommended mean noise levels (the average of measured peak noise levels) at property lines and inside structures for day and night land uses of different types. The second example is the study "Highway Noise, a Design Guide for Highway Engineers" (NCHRP Report 117, 1971) that provides detailed procedures for analyzing the variations in traffic noises with traffic parameters and location of observers relative to the facility. The procedures permit relating the amount of noise that is heard at any point near the facility to these parameters. The "statistical time distribution" of noise is considered through use of two measures, L₅₀ and L₁₀, to indicate levels that are exceeded, respectively 50% and 10% of the time.

One potential drawback of the noise criteria in NCHRP Report 117 that users should be aware of is the fact that noise levels can exceed even the 10 percent standards up to 10 percent of the time to an unlimited degree. Thus typical peak truck noise of 15 dBA above average automobile noise levels will not exceed the criteria unless the noise occurs more than 10 percent of the time. If the average duration of peak truck noise is about 10 seconds, this means that up to 360 seconds of truck noise per hour* could be tolerated by such a design standard (i.e., 30 trucks per hour, or one every two minutes). It does not require a vivid imagination to guess the consequences of such truck frequencies, or for that matter, even much lower frequencies.

Other means of allowing for variability in noise duration have been attempted. The most extreme approach short of counting the highest noise peak is to use the mean of representative peak noise occurrences. This approach, which is consistent with Table 6-1, is supported by evidence that individuals cannot adapt well to high level intermittent noises in comparison with their adaptability to continuous noise sources. No general agreement has yet been reached, however, on this or any other approach to quantifying the annoyance from varying peak noises. Perhaps the only truly safe position is that more research is required to take the effects of peak noise occurrences into account without "overcorrecting" for them.

* 3600 seconds in an hour.

Table 6-1

EXAMPLE OF RECOMMENDED NOISE LEVELS
FOR VARIOUS LAND USES

Land Use Activity	Time of Day	Recommended Maximum Mean Sound Pressure Level (dBA)	
		At Property Line	Inside a Structure
Residential (single and multiple family)	Day	70	65
	Night	65	55*
Business, Commercial and Industrial	All	75	65
Educational Institutions	All	70	60
Hospitals and Rest Homes	Day	60 [†]	55
	Night	50 [†]	45
Public Parks	All	70	55

* Air conditioning systems commonly operate at 55 dBA. For non-air conditioned residential structures it may be desirable to reduce this value by 5 dBA.

† Expected ambient noise level.

Source: "Threshold Noise Levels," Texas Transportation Institute, Research Report No. 166-1, December 1970.

Noise Prediction and Measurement

Figure 6-2 provides an approximate guide to average peak truck noise levels on freeways, using a discrete or point noise source model that results in 6 dB reductions in sound pressure level with a doubling of distance. This approach is appropriate for low-density truck noise. For high-density truck noise (more-or-less continuous), a line source model would be a better approximation, which would result in a 3 dB reduction per doubling of distance. In such cases, the distance figures on the horizontal axis of Figure 6-2 should be doubled.

In the event direct noise measurements are needed, relatively inexpensive equipment--such as hand held sound level meter, microphone, and recorder--can serve effectively for most documentation.* Generally, one of two methods are apropos:

- (1) Sound level (in dBA) determination by visual observation utilizing a sound level meter, meter calibrator, tripod, and wind screen; and
- (2) Sound level determination by chart recording using in addition to the above, a graphic level recorder and power inverter (for use of battery power), or a sufficiently long power cable for tapping local 110/220 volt sources.

Briefly, it can be said that method (1) offers the greatest mobility in reaching difficult locations. Method (2) is not as mobile, but offers a permanent record.

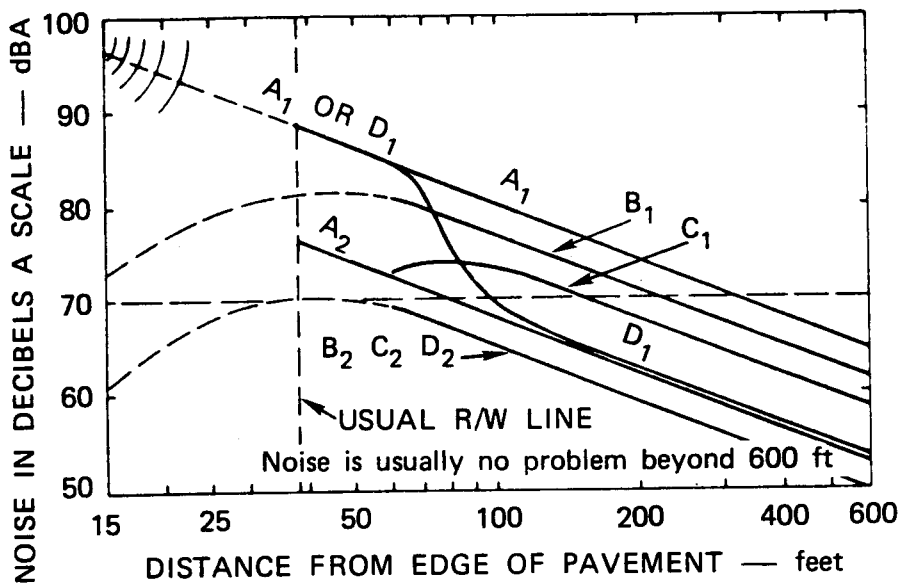
The joint development analyst can now be assisted by computer simulation programs that can predict the level of noise to be generated by various traffic mixes and site configurations. Such models can also evaluate the degree of sound attenuation and absorption to be realized by, say, proposed modifications to highway facility design features.†

* A description of the equipment and a Typical Procedure Manual for sound measurements is described in "Highway Noise Measurement for Engineering Designers," Texas Transportation Institute, Research Report 166-2, June 1971. Reference is also made to "Methods for Measuring Noise Levels"; Test Method No. California 701-A; October 4, 1971; Division of Highways, California.

† A description of one such computer simulation model is summarized in "Designing Highways with Noise Control," presented to Operating Committee on Roadside Development, AASHO, November, 1970.

Figure 6-2

NOISE COMPARISON CHART FOR DIFFERENT HIGHWAY DESIGNS



- A₁ = Flat section at grade
- B₁ = 20' elevated section on structure, or on narrow shouldered fill
- C₁ = 20' elevated section on fill with 36' shoulders
- D₁ = 20' depressed section
- A₂ = Flat section with 11' solid noise barrier
- B₂, C₂ and D₂ = same as B₁, C₁ and D₁, but with 8' solid noise barrier at edge of highway (or, for D₁, at ground level)

Source: "Can Noise Radiation from Highways be Reduced by Design?", State of California Highway Transportation Agency, January 1968 (later published in Highway Research Record No. 232).

6.2.2 SOUND CONTROL SUGGESTIONS

One viewpoint is that the most economical method of reducing noise is to control sound radiation at its source. It is generally believed that automobile originated noise is mainly due to tire/pavement interaction and truck originated noise is largely due to engine exhaust systems (faulty or otherwise). Tire/pavement interaction is a function of tire tread design, tire wear, tire loading, and pavement surface texture. Engine exhaust noise is a function of truck characteristics (particularly the muffler components), highway configuration (primarily grade), and traffic characteristics (especially the necessity for speed changes).

The opposing viewpoint is that it may take too many years to effectively reduce source noise (either through legislative delay or by the requirement for more time in the manufacturing process), and therefore it is more expeditious to shield the observer from the noise radiation--accomplished principally by (1) barrier shielding (earth-mass, structures, and/or planting) techniques for open spaces and (2) insulation techniques for buildings.

The Guideline does not advocate either viewpoint, but rather only presents applicable and manageable issues relative to joint development. In fact, by reason of the joint development concept of joint planning, design and, often, construction, JD projects will inherently benefit from any noise control measures--whether viewing the source or the observer. Specifically, the following measures should guide the JD planner or designer when considering joint development.*

Barrier Shielding

Sound levels can be reduced by methods utilizing the shielding effect of roadside wall and abutment structures, adjacent buildings, and landscaping. In this discussion, barriers include the shielding effects associated with elevated and depressed highways. The effectiveness of a sound barrier is dependent upon such factors as material, thickness, height, location relative to observer, the angle subtended at the observer by the unshielded portion of the highway, and sound frequency. To be effective, sound shields should have reasonable mass and be impervious to air flow.

* The consideration of new legislation to control vehicle noise is not included here, primarily because of its orientation towards total highway systems vis-a-vis joint development. Reference is made to the anti-noise laws of the states of California and New York, and the cities of Dallas, Dayton, Chicago, Minneapolis, and New York.

Material: Among the most effective barriers are those of dense concrete and masonry blocks (with cracks fully mortared). Though such walls offer a large degree of attenuation, they are poor absorbers and therefore reflect sound--contributing to the ambient noise level in the areas other than that of the JDP.* On the other hand, lightweight barriers made of such materials as porous cinder blocks, expanded shale blocks, or wood, are effective sound absorbers but offer little sound attenuation with respect to an adjacent JDP. (A stucco finish on the side of the joint element can reduce transmissibility, however.) Barriers built of metal are usually corrugated to not only increase stiffness, but also to increase its ability to reflect sound. Earth mounds can both absorb and attenuate sound energy. Trees or shrubs planted on these mounds increase their attractiveness but contribute little to their sound reduction qualities (see Landscaping, below, for details).

In selecting a material for a barrier, the joint development designer will need to measure the trade-offs between a material's ability to absorb and/or reflect sound. Such an evaluation should include the costs, weathering characteristics, maintenance ease, and aesthetics of the respective materials.

Frequency: The frequency of the source sound is important in considering noise control measures. Most construction materials have a lower transmission loss at low frequencies than at higher frequencies. Low frequency noises will bend over and around a barrier, while high frequency noises are blocked, resulting in a greater net reduction of higher pitched noise levels.

Height: Field measurements of noise reduction due to the construction of barriers have shown the effectiveness of barrier walls as a function of height. For example, it has been found that the erection of a 5 foot masonry wall can reduce noise levels by 5 dBA or more. Increasing the wall height to 6 feet has been shown to reduce source noise levels by 8 to 10 dBA. A 15 foot high barrier has reduced noise levels by 12 to 14 dBA--greater in total attenuation but at a lesser rate per foot of increased height.

Elevated Structures: Elevated highway sections are generally limited in the use of noise control features. However, consideration should be given to providing a noise control shield in lieu of an open-type railing. The effectiveness of such a shield would be largely contingent on the width of the pavement section, its height above the

* Computer simulation has demonstrated that a three foot lip on the top of a barrier wall, sloping toward the highway at a 45° angle can be effective in further shielding sound in situations where there may be a build up in sound echoes or reverberations.

section, and the distance above ground level. Also, minimize the use of expansion joints or provide smooth surfaces over existing joints.

Referring to the reductions that shielding can provide from Figure 6-2, impressive noise reductions are indicated in the areas near elevated highways structure. Such would tend to encourage the establishment of joint development facilities under such structures; however due to reverberation effects, one must consider the possibility of additional noise superimposed from other sources--noise from adjacent city streets exceeding that from the highway above.

Depressed Highways: This type of highway offers excellent sound control possibilities. Vertical wall design of depressed highways must consider both direct source sound and reflected sound (i.e., reverberations). Reflected sound can be deadened by facing the walls with an absorbent material, or less so by applying vegetation such as plants. Further attenuation can be gained by sloping the walls or by "zig-zag" configurations so as to control the direction of sound reflections. Full or partial "lids" of course offer an excellent, though expensive possibility.

Open cut sections offer advantages over vertical wall sections (from the standpoint of sound control) in that they have more extensive rights-of-way and generally have planted earthen slopes that are more effective sound absorbers than wall surfaces. For joint elements built over a depressed section, this latter factor can be significant, i.e., minimization of "sound trough" effects where attenuation can only occur vertically in the above air space.

Landscaping

As a means of sound attenuation, plantings generally offer little protection to joint facilities. Because they lack density and are porous to air flow, plantings possess little of the physical properties required of a good sound shield. The real merit of plantings of course is in improved appearance; however, such can on occasion seal off the view of the highway element, thus psychologically providing the impression that they are effective sound barriers.

To achieve some understanding of magnitude concerning sound attenuation through landscaping, it can be noted that even for the best plant-type buffers used alongside a highway, sound reductions levels of only 2 to 4 dBA might be experienced. It has been estimated that a solid, dense 100-foot band of trees, 15 feet high could reduce sound levels by only 5 dBA.

Further, the magnitude of sound attenuation attributable to plantings is affected by the change in seasons. Sound attenuation is less if, and when, trees drop their leaves, and more when the ground is covered with grass, crops, or snow.

Through unique interior or exterior landscaping techniques, distracting sounds are effective as one means of noise control. As an example, awareness of traffic noise can be distracted by the more soothing sounds from waterfalls or fountains. Similarly, a negative response to sounds transmitted through inadequate walls (from a sound-abatement standpoint) can be minimized by wall mounted flowing water arrangements.

Sound Control Through Building Construction

Sound control through building construction techniques offers the JDP designer excellent possibilities.* Noise transmission in such potential joint development projects as apartment buildings, hotels, motels, and office buildings can present serious design problems. By and large, today's conventional buildings suffer (from the standpoint of sound) from sub-standard acoustical design, lightweight construction, poor workmanship, high cost of sound-insulated construction, and lack of compulsory acoustical criteria and enforcement. The recent trend of sound-conditioning, especially in residential buildings, is gaining momentum through such influences as the noise abatement policy promulgated by the Department of Housing and Urban Development.

The general guidelines that follow are not necessarily for the purpose of go/no-go decision criteria, but rather more for providing a basis for discussion about sound insulation possibilities of joint development projects.

Sound insulation effectiveness for wall and floor assemblies is dependent upon such factors as mass, stiffness, discontinuity in construction and proper installation. In addition, the elimination of noise leaks around the perimeter edges of floors and walls and the use of sound absorbent materials in the construction cavities can add to the effective control of sound.

Double walls offer significantly better sound control than single walls. The use of sound absorbing material, such as mineral wool blankets in the air space, can reduce levels from 3 to dBA, depending on blanket thickness and the type of wall construction. Though sound insulation materials generally are only marginally effective for low sound frequencies, they are particularly effective at high frequencies, since they tend to reduce the sound energy buildup in reverberant wall cavities.

* Noise reduction through construction techniques alone however are not a panacea for controlling sound. JDP buildings will also be greatly enhanced in their effective control of sound through proper site selection, building and equipment orientation, and design of adjacent outside space.

Floating floors and ceilings are effective in dealing with sound problems. As a general rule, the degree of airborne and impact sound insulation of a floating floor depends on its mass, its decoupling from adjoining work, and the compliance of its resilient material. Likewise, ceilings which are isolated from floor structures and separated from adjoining load bearing walls are usually effective airborne noise insulators.

Lead sheeting, on a pound for pound comparative basis, offers an effective means of preventing sound transmission. The decision to use lead (as with any acoustical material) would, of course, include an analysis of the material, installation and maintenance costs versus effectiveness of performance. As a general rule, sound reduction through a wall will increase logarithmically with the weight of the wall and the frequency of the sound wave.

Sound absorbing materials such as acoustical tile, carpets (especially with felt pad underlayments) and draperies are effective as sound absorbers and reduce reverberations. These materials are, however, poor sound insulators. Therefore, acoustical tile materials, for example, should be used in and near areas of high noise levels but should not be used for the purpose of preventing sound transmission.

Finally, the treatment of window areas is of special importance in considering sound control techniques. Of all exterior surfaces, glass (and of course the opening itself) tends to be the most vulnerable to sound transfer. The following, or variations thereof, might be considered for JDP. In so doing, of course, the concomitant need for air conditioning is introduced:

- Keep movable windows closed.
- Add storm windows to closed or fixed windows.
- Use a minimum of 3/8 inch thick plate glass for large openings.
- Use double-pane windows for smaller openings. (As an alternative to manufactured double-glass, consider installing two 1/4 inch window panes separated by, say, 4 inches of air space.)

6.3 SELECTED REFERENCES

Air Pollution

The following references are offered on air pollution characteristics and control measures. The first reference listed also includes procedures for predicting the quantities of CO, HC, and NO_x emissions, in pounds per 1,000 vehicle miles.

"Procedures for Estimating Highway User Costs and Air and Noise Pollution Effects," National Cooperative Highway Research Program Project 7-8 (expected to be published late in 1972)

"Cleaning Our Environment - The Chemical Basis for Action," American Chemical Society, Washington, D.C. 1969

"Transportation Air Pollution," Department of Highways, Ontario, D.H.O. Report No. RR169, June 1971

"Air-Rights Potentials in Major Highways," Summary report by State of New Jersey, Department of Transportation, June 1969

"Air Purification for Buildings," Gas Purification Processes, G. Nonhebel (ed) London, Geo. Newnes Ltd., 1964, 760-789

"Ventilation of Underground Garages and Road Tunnels," French text - October 1969, French, Inc. Therm. Aeraul (Paris). No. 697: 515-520, October 1969, 4 refs.

"Clean Measurements for Dirty Air--A Key to U.S. Control Program," U.S. Dept. of Commerce News, Nat'l Bureau of Standards, September 22, 1971

Noise Control

Of the large amount of literature available on the subject of noise pollution and control, the following is a selected list that can be useful to the JDP analyst.

"Highway Noise, a Design Guide for Highway Engineers," Highway Research Board, Division of Engineering, National Research Council National Academy of Sciences-National Academy of Engineering, 1971

"Highway Noise, Measurement, Simulation, and Mixed Reactions," Highway Research Board, Division of Engineering, National Research Council, National Academy of Sciences-National Academy of Engineering, 1969

"Highway Noise Reduction by Barrier Walls," Texas Transportation Institute, Research Report No. 166-3, Draft, July, 1971

"Threshold Noise Levels," Texas Transportation Institute, Research Report No. 166-1, December 1970

"Noise and Vibration Control for Transportation Systems," Department of Highways, Ontario, Canada, October 1970

"Can Noise Radiation from Highways be Reduced by Design?" Highway Research Record No. 232, Beanton, John L. and Louis Bourget, 1968

"A Study--Insulating Houses from Aircraft Noise," The Technical Studies Program of the Dept. of Housing and Urban Development, FHA, Los Angeles, California, November 1966

"Traffic Noise," Traffic Quarterly, July 1969

"Toward a Quieter City," a Report of the Mayor's Task Force on Noise Control, New York 1970

"Interstate (Century) 105 Freeway," prepared for the California Division of Highways by Gruen Associates, December 1970



Section 7

IDENTIFICATION OF COMMUNITY AND NEIGHBORHOOD GOALS

The purpose of this section is to explore alternative means of determining community and neighborhood goals relative to joint development, as well as to raise examples of social issues of the types with which JDP planners and decision makers should be concerned.

Decisions with regard to highways, streets, pedestrian ways, buildings, and open space have in the past often been guided more by economic than human criteria, normally through a narrowly interpreted form of benefit/cost analysis. It is increasingly evident, however, that such physical developments have immediate consequences for beneficial changes in the everyday life of people. Because joint development can offer exceptional opportunities to bring about these changes, its human or social impacts are a key variable in evaluating joint development possibilities. Too often the full potential of a JDP is inhibited or destroyed because of a lack of consideration for human factors.*

7.1 DEFINITIONAL ORIENTATION

Community and Neighborhood

In general, there is no single community of interest in a given geographic area, but rather different groups of individuals and interest groups that can only arbitrarily be regarded as a "community." The concept of community is therefore not easy to define; the literature includes better than 90 major definitions.

For the purpose of this Guideline, "community" will be used to refer to all interest groups affecting or affected by a joint development, rather than a defined physical area. Hence the community affected by a joint development is not likely to have sharp physical boundaries, but rather would be represented by societal groups such as the business sector, the black sector, the poor sector, the Chinese sector, etc. For

* Refer also to Subsections 5.3.1, Land Use and Neighborhood Compatibility; 5.4.2, Neighborhood Social Conditions; and 5.4.3, Community Identity.

"neighborhood," the Guideline considers a more geographic concept, to include those people who are directly and physically affected by the proximity of a proposed joint development project. As an example, tennis courts may affect the broad community of tennis players, the local recreation department, the law enforcement agency (protection, congestion, parking, etc.), while the affected neighborhood might be no greater than four square blocks around the tennis court area.

Since strict definitions of these concepts are not feasible, it would be better when considering whether a person or group should be considered within an influence area of a particular JDP to err in the direction of including the person or group rather than excluding them.

Human Factors

There can be numerous social factors connected with the evaluation of joint development. For convenience though, these factors are divided into four classes--those that deal with:

- (1) ethnic, cultural or subcultural values, or shared beliefs about the world and the way one should or should not act in it
- (2) the political factors which determine who has the right to decide what changes will or will not take place, when and how
- (3) the social standing of individuals as related to their income, education and occupation
- (4) the patterns of every day living carried out by individuals, including their requirements for space and facilities for work, leisure, shopping, and so forth.

To assist the JDP evaluator in viewing and fully understanding community and neighborhood goals, examples of specific components of each group follow.

Cultural Values: Values are conceptions of what ought to be; they are rules or guidelines for behavior; they are abstract goals which function as ultimate factors which tend to shape to some extent all the other factors. People do not only consider the more absolute values (i.e., economic) as guides for behavior; for example, local places are often highly valued by residents because of the security they feel while they are there or the memories of past associations with particular places. A dominant value in our culture is individualism; people who most highly value individualism often prefer to live with more space around them. In contrast, some people may place higher values on convenient location and consequently will prefer smaller living spaces and mixed uses for open space.

Political Factors: If joint development projects are to lead to social development, they must be consistent with the preferences of the people who live in the community or neighborhoods affected. The right of the people to be involved in the development of their physical environment is vital and should be protected and strengthened--even if only by soliciting the opinions of concerned members of the community or the surrounding neighborhood. Local communities are usually organized in smaller groups on the basis of special interest, employment organization (unions), ethnic identification, religious activity, recreational activity, and so on. Methods for communicating to and soliciting response from relevant groups are discussed in Subsection 7.3.

Social Class: Social class, or social status, is usually measured by such indicators as income, education, and occupation. These socio-economic factors can be related to housing preferences or to judgments about living environments. Employment opportunity and home and leisure time activities are the primary wants of lower class residents. Middle or higher class residents take these for granted and therefore are more apt to seek aesthetic and pleasant environments surrounding their residence. Another example would be the preferences for recreational space that varies with socio-economic class (i.e., golf is associated with the higher status class while neighborhood visiting and less costly recreation are associated with lower socio-economic status).

Living Patterns: When, how, why, and where and with whom individuals live, work, play, and worship represents a highly complex network of activities that make up daily life. These activities are not carried out at random but are patterned by the state of one's life cycle, functions performed, and individual habits. The stage in the life cycle is an important determinant of activity patterns that must be considered in JD evaluation, because physical factors such as modes of transportation, proximity of various kinds of facilities, and type of open spaces vary with the life cycle. By way of illustration, three general age categories are noted.

- Families with children require certain characteristic environmental features, for example, direct access to the outside, which is not feasible, say, in high rise apartments. Also, they are more likely to favor greater distance from commercially oriented land uses than adults without children.
- Adults before and after raising children are more mobile and require less space for living and family activities, and are likely to prefer diversity in land use, community facilities, and services.
- The elderly represent a category of people who are more likely to find greater satisfaction with the "like-aged" people. They usually require easy accessibility to necessary facilities (i.e., shopping, medical care, etc.).

The pattern of everyday activities can also be related to how people familiarize themselves with the local area and individuals in the area and come to identify with a particular neighborhood. This is particularly true for low income and ethnic groups. Consequently a change in the physical structure or population of a local community may disrupt the feelings individuals have of "belonging" or their patterns of association. Neighborhoods are more than a collection of individuals living separately, since they include a network of extended family and friends representing the primary group outside of the immediate family with which an individual identifies. Consequently, if a JDP disrupts the association pattern between friends and relatives, it can change the way in which an individual associates with others.

7.2 SOCIAL CONSEQUENCES

Joint development can offer both social costs and benefits. Consequently, it is important to understand how social costs and benefits are distributed with regard to human factors and with regard to different groups of people. Some groups of people may benefit greatly--other groups may suffer greatly--while other groups may only indirectly benefit in some ways and suffer in others. Ideally, joint development should strive for greater benefits than costs for all groups in the community.

It is seldom that social impacts of joint development are completely neutral. Even when a JDP proposes to simply use a part of the land under a highway structure, say, for storage, the method of behavior observation* may show the area to have some limited (though assumed to be legal) use by residents of that community. Another example might be where a proposal for a parking lot under an elevated structure may increase the local traffic and make it more difficult for children to find places to play safely, even if the parking facility can be demonstrated to benefit the community by enabling people in the same neighborhood to shop easier.

On the other hand, a well designed JDP can upgrade (benefit) a community by, say, utilizing an unused vacant area, thus turning it into an orderly useful area; or it may help to reunite neighborhood segments that have been severed by the initial construction of the highway. JD projects also present an opportunity for establishing recreational areas which are beneficial to people in all stages of their life cycle. Children need playgrounds, youths need sports areas, and older people need outdoor rest areas where they can sit, chat, and generally interact with others.

* See 7.3, Identifying Human Responses.

Serious consequences (costs) can evolve where joint development requires relocation of people--whether individuals or families.* As mentioned earlier, the neighborhood and even the building in which people live acquire certain meanings to the people who live there. The friendships and human interactions can be disrupted. If JDP cannot avoid the displacement of people, relocation plans should provide for housing at generally the same monthly rental costs and with more or less the same conveniences with regard to shopping, etc. Where feasible, an attempt should be made to move people as a group in order to maintain established patterns of social interaction.

Finally, many of the criteria and guidelines given in Sections 5 and 6 relate to the social consequences associated with the health and safety of JDP users, its neighbors, and the community at large. Two additional points are worthy of comment in this connection:

- Consideration should be given to the possibility that a JDP may bring outsiders into what may well be a closely knit, yet precariously balanced neighborhood. The JD activity may throw off this balance, creating disequilibrium and resulting in social disorder. For example, if a joint development such as a boat launching area or a marina to be used by middle class and upper middle class people were to abut directly on low income or lower class residential areas, a problem of exposing luxury to people who cannot afford them can occur. The resultant psychological reaction may increase such police problems as vandalism or the physical safety of joint element users.
- Consideration should be given to the effects of space and architectural design on the mental health of human beings. For instance, if a residential building is contemplated as a joint development, windows or outside doors that cannot be opened because of highway proximity can have an adverse effect on human living. Early studies in this area suggest that the closing in of humans (thereby cutting off contact with the external environment) creates, or at least increases, tension. While much more research is needed, the JD evaluator should be aware of such possible human responses. The use of mental health specialists may be appropriate as part of the evaluative team, and certainly should be consulted when possible harmful effects are suspected.

* See also criterion related to Family Relocation (Subsection 5.4.4), where the possibility of both negative and positive effects is expressed.

7.3 IDENTIFYING HUMAN RESPONSES

For determining the possible social consequences associated with joint development, the following methods should be considered. They are not presented in any special order of importance, but generally move from methods currently used to those less commonly used:

- Public hearings
- Behavior observation
- Community group meetings
- Focus group meetings
- Contact with community leaders
- Non-structured or semi-structured interviews
- Questionnaires
- Professional panels
- Documentary analysis

Some of these techniques are established practices by highway departments, others are modifications of established practices, and some are rarely or never used at present. Which method (or combination of methods) should be used for specific projects will depend on the particular setting, the type of population within the neighborhood, the level and type of community groups, the type of joint development contemplated, and so forth. Actual decisions as to the methodological approach will depend on the particular situation. As a general rule, it is better to collect more data and have more interaction with the community than less, hence the evaluator should not reject a method simply because it might represent a partial duplication of effort.

Public Hearings

When using public hearings for consideration of JD proposals, it is of primary importance that all relevant interest groups in the community be notified of the hearing. When parts of the community consist of very low income groups, a notice in the local newspaper may not be seen by such groups. Furthermore, if a group of non-English speaking people live in the community they would probably not be able to read an English notice. Another factor to consider is that low income and certain ethnic groups may not feel welcomed at these meetings; accordingly, a special effort should be made to communicate that their presence is desired. The following procedures are suggested for communities with low income and/or non-English speaking groups:

- Contact leaders of the different ethnic community groups and inform them of the coming meetings and ask them to so inform the members of the community. This is best accomplished through personal contact rather than by letter. Possibly, notices might appear in the newsletters of different ethnic groups.

- Use announcements on radio stations oriented towards those elements of the community that should be communicated with (i.e., ethnic language stations).

Tools that can be included to enhance communication and audience response in general during the actual hearing are (1) large blow-up photography, showing the subject area as it currently exists and then, by overlaying the area, as it will appear after the JDP is completed; (2) disclosure of data derived from questionnaires or interviews to help in structuring the hearing into areas of needed discussion; and (3) the attendance of a graphic artist to illustrate any new ideas or concepts, such as design-related questions that may emanate from the audience.

Behavior Observation

The site for the joint development should be visited several times at different times in order to learn what goes on at that particular site. Do children play at the site? Do people use it as a much needed place for, say, parking? What types of people may be affected positively and negatively for development of the proposed JD use? Behavior observation can also be of help to discover the structure and leadership of the different community groups, through informal questioning of persons at or adjoining the JD site.

Community Group Meetings

In order to fully understand the desires of the community, it can be of help to meet with the different groups in the community to explain the plans for the joint development and to elicit their feelings about the proposal. This approach also helps to discover if their leader is representative of the group, as well as to discover other spokesmen in the community.

This is not a hearing, but rather an attempt to informally convey and receive relevant information. It should be accomplished early in the JDP planning process and should be kept as informal, but as informative as possible. In addition one should be aware of listening for the expression of feelings, since it is generally at this early stage the potential fears and anxieties of people are projected. Care should be taken to neutralize these feelings at this stage rather than allowing them to grow unchecked. Openness is the key stance to be taken by the highway representative.

Focus Group Meetings

As an addition (or in place of) the open community group meeting, consideration of focus group meetings may be appropriate. This technique uses a group of people who have a common background and interest and

explores with them a particular subject with which they are currently or made familiar. There is usually a discussion leader to guide the group and an observer who does not participate. When the leadership is effective the ideas and concepts will grow and a better understanding of the motivating factors behind individual points of view can often be obtained.

The focus group technique is an effective way to get at major issues. For example, if one were concerned about the joint development in a certain section of the city, it would be good to bring together a group of people who live in that section and who understand the subject area. By this process, one would attempt to determine the JD type that would be in harmony with the values of the people living nearby.

It would appear that the focus group technique might also be used effectively to formulate alternatives. Proper application can bring forth ideas and attitudes that would indicate alternatives that might not otherwise have been conceived and might be more in line with community values.

In addition to obtaining a better insight into the positions the group may take, the focus group approach can be used to develop a hierarchy of positions and the order of importance of various factors. However, one cannot measure values from a focus group with any statistical precision like that provided by attitude surveys (discussed subsequently).

Contact with Community Leaders

It can often be of crucial importance to contact the community, neighborhood, and interest group leaders. Besides helping to inform the community of the joint development, this approach is highly desirable for establishing rapport with the community leaders, and thus, enlist their cooperation and gain insights of the community. Accomplished early in the process, relationship is the important element here. While these contacts can take a great deal of time, in the long run they have a high level of pay-off for the effort expended. Also, contacts with leaders could serve as a prelude to broader surveys, either oral or written, if they are judged to be needed.

Non-structured or Semi-structured Interviews

In evaluating a JDP, one can interview, in depth, individuals or families from different types of groups, to get a feeling for who the people are, and what they want in and from their community. This method has the advantage of obtaining much greater information about the people interviewed by allowing them to bring up points that a structured questionnaire might not cover (as well as presenting an opportunity for a much longer and more differentiated answer). While the method entails some loss of control and comparability of the answers given by different individuals, the richness of the responses can more than make up for such shortcomings.

What is noted next about questionnaires relative to sample size and interviewee composition also holds for personnel interviews. Therefore, a consultant or staff sociologist trained in this particular method is necessary. The sheer magnitude and cost of this method restricts its use. However, if an adequate job in the area of dealing with communities is to be accomplished, this type of approach may on occasion be the only procedure to follow. Restriction of interviews to community leaders (see previous item) would be a cost-saving short cut, however, of less statistical reliability.

Questionnaires

Questionnaires should include basic demographic data (age, income, job, education, number of children, etc.) to give the highway department an idea of the kind of people who live in the subject area. This, in turn, can reveal preferences and desires they may have for developments in the community. Questionnaires (whether sent by mail, read to people over the phone, or conducted by face-to-face interviews) should reach members of all the different groups who live in the neighborhood. Where the community includes non-English speaking people, the questionnaires should be translated into the appropriate language and/or bilingual interviewers utilized. If the community includes a low income group, it may be that many members of the group would not have a telephone and would not fill out questionnaires and mail them back. Face-to-face interviews would then, of course, be necessary.

The cost of questionnaires can be high and the importance and influence of the joint development would usually determine whether or not this method should be employed. It should be noted that the field of human or community surveying is a highly complex field. The development of questionnaires, the structuring of samples as to size and composition, and the planning of field interviews are extremely important if the results are to have any meaning. By the same token, each survey situation dictates its own needs as to sample size, etc. Therefore a sociologist with survey capability should assist with this method.

Professional Panels

A professional group (e.g., sociologists, psychologists, and other behavioral scientist types) could make up a panel to review proposals for JD projects, thereby giving advice and counsel to those planning or evaluating joint development. Furthermore, the panel could rate alternate JD proposals on a value scale with regard to the human factors defined earlier. This method should not be used by itself but rather in conjunction with other suggested methods. The panel system adds an important dimension to JDP evaluation by raising those concerns best represented by the professional community. In addition, such a professional panel could aid in JD decisions by playing an integrating role in

regard to human and community factors, since they would most often be in a neutral position vis-a-vis the community dynamics involved.

Documentary Analysis

In order to learn of past feelings of the community or neighborhood towards highway planning projects in general, it is helpful to review minutes of meetings and records of former hearings (if any) relating to a particular community. Furthermore, minutes of meetings from different community groups may reveal information about the concerns of particular groups with their community. This will enable those responsible for the planning of joint development projects to better plan the strategy upon which they will enter the community. For instance, if the community has a history of disrupting public hearings, the best method might be to contact leaders in the community to tap the feelings indirectly, or to contact small groups, semi-formally, rather than follow the public hearing approach.

The other methods described above could also be enriched by having historical data of this kind. For instance, in developing a questionnaire, past attitudes as revealed in recorded statements would be helpful in structuring a meaningful series of inquiries.

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Section 8

COMPARATIVE DISPLAY PROCEDURE

This section contains a procedure for evaluation of joint development projects that have been reviewed in terms of policy questions, criteria, and general guidelines in Sections 4, 5, 6, and 7. It should be used as a further refinement when a clear approval cannot be recommended on the basis of the evaluations described in these prior sections. The general approach is that of benefit/cost analysis, utilizing costable, quantifiable, and qualitative measures of benefits and costs.

The Comparative Display Procedure described in this section is suitable for (1) projects that entail only approval versus disapproval of a given JD proposal, and (2) projects of limited scale or complexity that entail alternative JD sites, uses or scales, but that can be resolved on the basis of relatively simple comparisons of project costs and benefits. For the analyst desirous of a more quantitative analysis of particular JDP impacts, or a weighting and summing of JDP impacts, say, for comparison of complex multiple alternatives (including the study of tradeoffs among or within alternatives), an Extended Evaluation Procedure is included as Appendix B.

The Comparative Display Procedure is intended to be iterative when necessary--that is, one or more steps can be repeated in greater detail (or using modified assumptions) as a result of information developed in subsequent steps. For example, the entire first pass through the procedure could be made very quickly in order to identify any JDP impacts of particular importance to study in depth on a second iteration and those features that are well enough understood not to require further consideration.

Following the suggested worksheet included in this section is a discussion of sensitivity analyses, tradeoff considerations, and priority rating suggestions.

Identification of Relevant Interest Groups and Impacts

The first step is to identify (1) the relevant JDP interest groups that are either affected by JD actions or that influence JD decisions and (2) the effects or impacts of interest, both positive and negative. The following interest groups are considered relevant to JD decisions:

- A. The highway department
- B. Highway users exposed to or affected by the joint development

- C. Joint element users
- D. The neighborhood in the immediate vicinity of the joint development
- E. The surrounding community, including its local government
- F. The cosponsor or developer (other than the highway department)

The last category (cosponsors of JD projects) is mentioned for completeness but will not be considered further. This is because it is presumed that the cosponsor is responsible for determining the feasibility of the project from his own point of view, hence the highway department need not get involved with the aims, policies, revenue estimates, and cost accounting procedures of the cosponsor. In contrast, the Guideline does take the viewpoint of the other interest groups mentioned, since they are within a broad interpretation of the "public interest" (relative to the JDP) for which the highway department has some responsibility to protect.

The relevant impacts of the JD are more difficult to define in general terms than are the interest groups, since they will include a wide variety of benefits and costs that can affect differently each of the first five interest groups listed above. Benefits are defined broadly as any effects that create positive impressions. Benefits and costs can be usefully distinguished by the degree to which they are costable, quantifiable, or qualitative, according to the following definitions:

- Costable - effects which allow a definite dollar cost figure to be derived, e.g., engineering, construction, and highway user costs.
- Quantifiable - effects for which a definite cost figure cannot be ascertained but for which some cardinal measure can be determined, e.g., the number of families displaced or the number of jobs created. This category can be useful in comparing the effects of different alternatives.
- Qualitative (or nonquantifiable) - effects that can be neither currently costed nor quantified but that can be described and perhaps compared or measured on an ordinal scale, e.g., social and aesthetic values.

It is helpful to express as many benefits and costs in costable or monetary terms as possible, since the amounts can then be added to produce a single net benefit or cost. Yet many important effects can never, by their nature, be expressed wholly in costable terms. An example is the appearance or aesthetic impacts of a JDP that may be reflected in increased property values; they nevertheless demand separate consideration as a qualitative impact even considering that their exact effect on property values is difficult, if not impossible to predict. Another example is motor vehicle accidents, which are important to include in direct highway travel costs, but for which the number of deaths and injuries must be shown as a quantitative effect even if it is not in itself costable.

Quantifiable effects of the same type can also be added or subtracted, and this approach may be useful in comparing the effects of two or more JD alternatives. Qualitative effects can generally not be validly added or subtracted until they are made commensurable through a weighting scale based on the relative values attached to each type of qualitative effect considered. (Appendix B discusses such a weighting scale.)

Display of Interest Groups and Impacts

Worksheet 4 provides a format for listing JDP costs and benefits according to the interest groups affected, in the order of the five groups previously referred to. Minus and plus signs in parentheses indicate whether a cost or benefit is anticipated. The three columns for categories of benefits and costs are grouped under the heading "Incremental Effects," to indicate that only those benefits and costs due specifically to the proposed JDP are relevant. Solid lines are provided to indicate the most probable category for each effect, while dashed lines indicate a less probable but still possible category. The absence of any line indicates that a category is highly improbable, although this should not preclude entries in blank spaces when appropriate data are in fact available.

It is contemplated that the user will enter the following types of data in Worksheet 4, generally where solid lines appear under each heading:

- Costable effect: a dollar estimate of incremental cost or benefits, preceded by a - or + sign, respectively.
- Quantifiable effect: an estimate in quantitative units such as hours, acres, number of people affected, or jobs created. In this case, - or + signs should not be used since the value connotation of the quantity will vary (e.g., 100 more jobs is a benefit, but 100 more persons exposed to noise levels over, say, 70 dbA is an unfavorable effect or cost).
- Qualitative effects: a number between +2 and -2, based on the following ordinal rating scale for valuation of the effect.

+2 very favorable
+1 favorable
0 neutral*
-1 unfavorable
-2 very unfavorable

* This response means either that no significant effect is anticipated or that the interest group expects to be indifferent to the effect. It does not indicate "no opinion" on the part of the evaluator or interest group.

This rating scale can also be useful in cases where sufficient cost information is not available; that is, a lower order of quantification can be used initially by indicating +1 or +2 for a dollar benefit and -1 or -2 for a dollar cost. If the analysis is later judged sensitive to an item so marked, then further study or cost estimates are indicated. Otherwise, the indicated response may suffice.

Determination of Costs and Other Effects

Instructions for the completion of Worksheet 4 are provided below. If multiple alternatives are being compared, use a separate worksheet for each alternative.

Highway Department Section: Enter estimates for both initial and annual costs and benefits, as indicated. More detail is shown here than for other interest groups because of the predictable nature of the impacts and the need to assure that all relevant costs to the highway department are considered. Blank spaces are provided under "Costs to meet Worksheet 3 criteria" so that the evaluator can write in any type of cost entry needed, e.g., screening or sound barrier shielding. Most of the entries provided for are costable, and therefore assume the availability of a combined estimate of costs--both initial and annual. The exception is community goodwill, for which the most probable entry is indicated as qualitative.

Highway Users and Subsequent Groups: Only annual costs and benefits are shown (one-time effects are possible but unlikely). For purposes of this display the effects are shown as probably not costable; although desirable wherever possible, dollar estimates will usually be difficult to obtain and often speculative in nature. Due to the wide variety of costs and benefits that could be experienced by these interest groups, only a few of the more likely entries are specifically identified, with blank lines provided for inclusion of others.

The blank lines shown under the subhead "Effects of any unfavorable Worksheet 3 ratings" are to identify the effects of criteria from Section 5 that are not acceptably met (e.g., aesthetics, safety, or conformance with neighborhood compatibility). Certain Section 5 criteria, such as public demand for the JDP, can be considered a qualitative benefit when they are acceptably met. However it must be remembered that for the most part Section 5 criteria are intended to assure minimum acceptable levels of condition, and accordingly, their attainment does not necessarily constitute achievement of a benefit, but rather an avoidance of a cost.

The blank lines shown under the subhead "Other" will generally be used for plus items (benefits). The evaluator is referred to Subsection 4.2, "Arguments For and Against Joint Development," for indications of the type of benefits, chiefly qualitative in nature, that could be indicated.

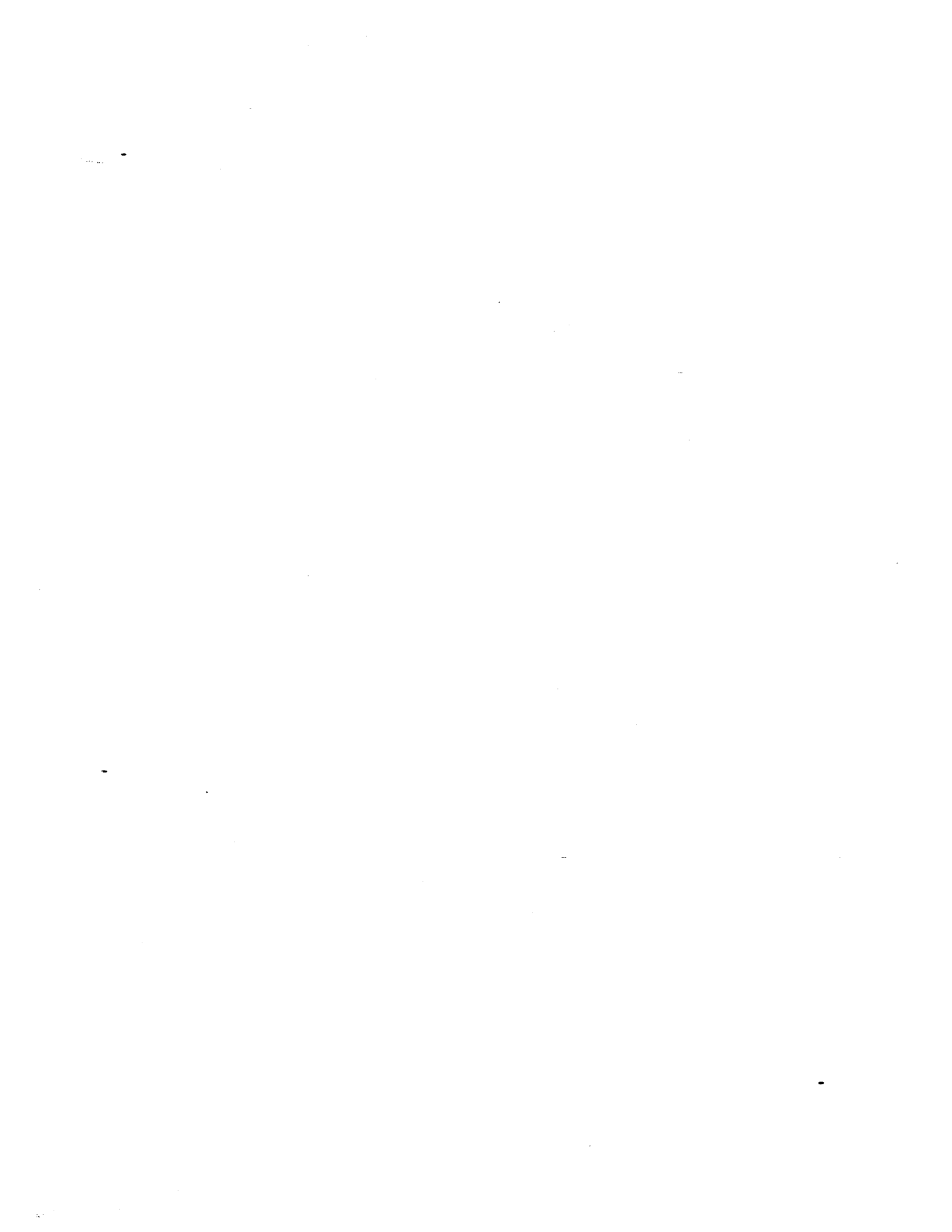
Worksheet 4

COMPARATIVE DISPLAY CHART

An Array of Costs (-) and Benefits (+) Due to a Proposed JDP

JD Project No. _____ Completed by _____ Date _____

<u>Type of Effect (By Interest Group)</u>	<u>Incremental Effects</u>		
	<u>Costable</u>	<u>Quanti- fiable</u>	<u>Quali- tative</u>
A. HIGHWAY DEPARTMENT			
(Initial costs and benefits)			
Planning, surveys, engineering (-)	_____		
Land acquisition (-)	_____		
Construction (-)	_____		
Costs to meet Worksheet 3 criteria (-):			
_____	_____		
_____	_____		
_____	_____		
_____	_____		
Relocation payments (-)	_____	-----	
Construction delays (-)	_____	-----	
Sale of land (+)	_____		
Other: _____	_____	-----	-----
_____	_____	-----	-----
TOTAL INITIAL COSTABLE EFFECTS (NET)	=====		
(Annual costs and benefits)			
Utility service (-)	_____		
Maintenance (- or +)	_____		
Lease revenues (+)	_____		
Community goodwill (- or +)			_____
Other: _____	_____	-----	-----
_____	_____	-----	-----
TOTAL ANNUAL COSTABLE EFFECTS (NET)	=====		



Worksheet 4 (Continued)

<u>Type of Effect (By Interest Group)</u>	<u>Incremental Effects</u>		
	<u>Costable</u>	<u>Quanti- fiable</u>	<u>Quali- tative</u>
B. HIGHWAY USERS			
(Annual costs and benefits)			
Effects of any unfavorable Worksheet 3 ratings (-)			
_____	-----	-----	-----
_____	-----	-----	-----
Access to joint facility (+)			
Other: _____	-----	-----	-----
_____	-----	-----	-----
C. JOINT ELEMENT USERS			
(Annual costs and benefits relative to other site locations outside the highway corridor)			
Effects of any unfavorable Worksheet 3 ratings (-)			
_____		-----	-----
_____		-----	-----
Noise (- or +)		-----	-----
Air quality (- or +)		-----	-----
Convenience (+)			-----
Economy (+)	-----		-----
Other: _____	-----	-----	-----
_____	-----	-----	-----
D. NEIGHBORHOOD			
(Annual costs and benefits)			
Effects of any unfavorable Worksheet 3 ratings (-)			
_____		-----	-----
_____		-----	-----
Buffer or connecting effects (+)			-----
Other: _____	-----	-----	-----
_____	-----	-----	-----

Worksheet 4 (Concluded)

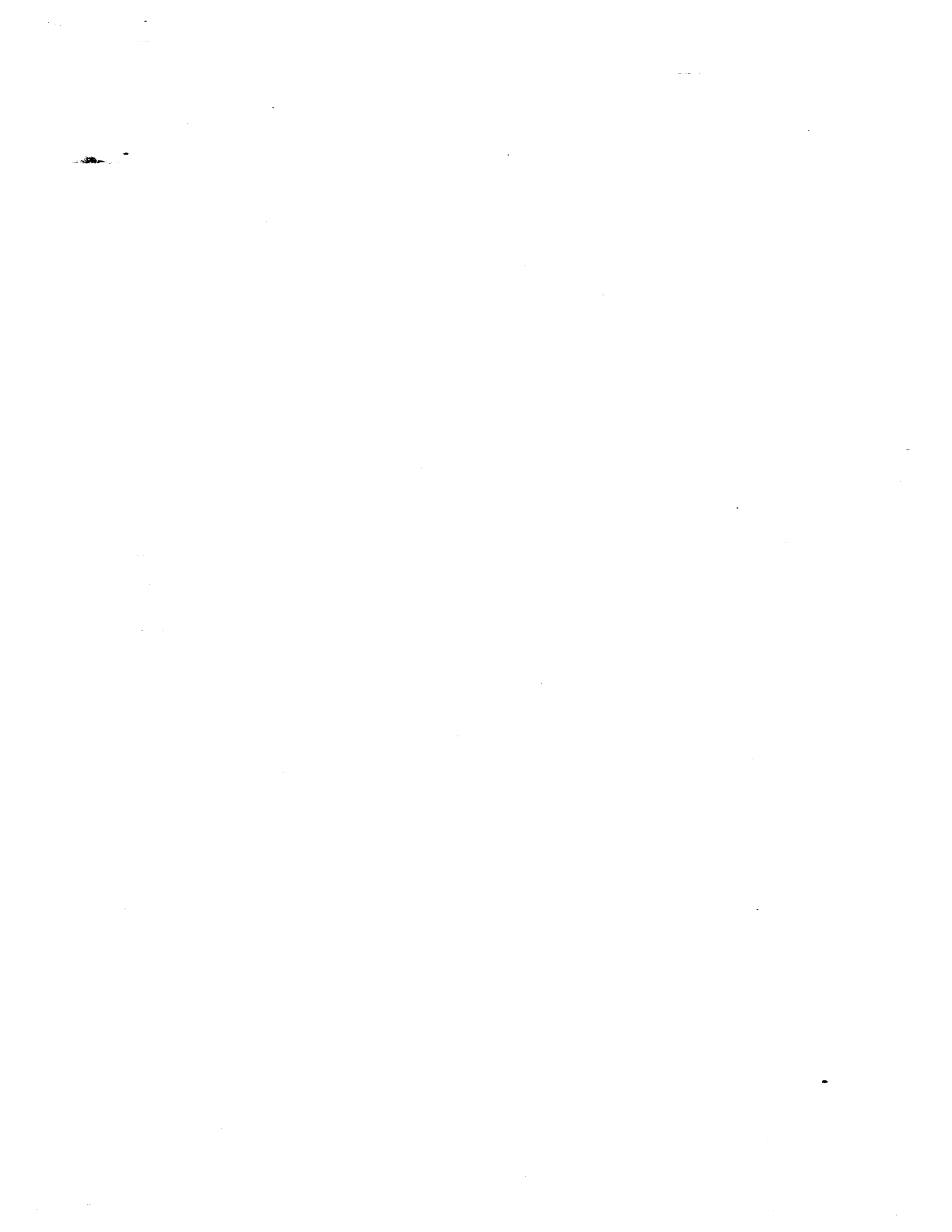
Type of Effect (By Interest Group)	Incremental Effects		
	Costable	Quanti- fiable	Quali- tative
E. COMMUNITY			
(Annual costs and benefits)			
Effects of any unfavorable Worksheet 3 ratings (-)			
_____		-----	_____
_____		-----	_____
Local government costs (-)	-----		_____
Local tax revenues (+)	_____		-----
Increased property values (+)	-----		_____
Employment (+)		_____	-----
Net personal and business income (+)	-----		_____
Retail sales (+)	-----		_____
Relocation costs in excess of relocation payments (-)	-----		_____
Other: _____	-----	-----	_____
_____	-----	-----	_____

Key

_____ Indicates most probable entry

----- Indicates less probable entry

(Blank) Indicates entry of low or zero probability



Note that for the interest group "Joint element users," only incremental costs and benefits relative to a site for the joint element outside the highway corridor are specified. This stipulation results from the assumption that the unique feature of the joint element is its juxtaposition to the highway and there would often be some advantage to be expected from this juxtaposition or it would be located elsewhere. For example, an important economy or convenience to joint element users would be created where land or airspace is only available to the joint sponsor at reasonable cost on or near the right-of-way or where the JD enhances the ease of carpooling. The stipulation also avoids the inclusion of transfer effects for projects that would be constructed elsewhere if not approved as a JDP (see 5.2.3, Site and Spillover Effects).

Individual entries for the "Community" section were discussed in Subsection 5.2.3, "Site and Spillover Effects." Note that such effects are not always additive; some may be simply shifted or transferred from another community (or from elsewhere in the same community). In such cases, notation should be made to indicate that the entries are non-additive.

Finally, the exact sources of these estimates of JD impacts will vary. The JD evaluator is encouraged to (1) obtain expert advice in any cases where he is unable to make a judgment or estimate, and (2) use a range of estimates when the exact effect is uncertain (to be refined or narrowed later if necessary). Interaction with the affected interest groups is also recommended, as discussed in Section 7, whenever necessary to confirm these estimates or to reduce the range of uncertainty in the estimates.

Reaching a Decision

The information summarized on Worksheet 4 should enable the evaluator to reach a go/no-go (approve/disapprove) recommendation in cases where favorable or unfavorable impacts clearly predominate. However, the worksheet information is presented in a highly synoptic form, so it should normally be accompanied by a narrative explanation of the important considerations that are displayed on the worksheet. Or, the worksheet itself can be kept in the JD project file, so that the decision maker or decision-making body receives only the narrative report and recommendations.

In cases where it is not possible to make a clear go/no-go recommendation because of uncertainty in some estimates, a relative balance of favorable and unfavorable impacts, the complexity of the results, or for other reasons, the evaluator may decide on (1) further study of certain JD impacts, or (2) the need to consider alternative JD sites, uses, or scales that have not yet been analyzed in detail.

The next two items can help in such cases; otherwise the evaluator is referred to the Extended Evaluation Procedure of Appendix B for more detailed analysis.

Sensitivity Analysis

The initial objective of sensitivity analysis is to determine the sensitivity of a decision to possible variations in assumptions or estimates. The derivative and more meaningful purposes are to identify, through this procedure (1) those variables about which more information is needed, in order to narrow a range of estimates and thereby reduce the uncertainty about the decision; (2) those variables or issues of highest significance, that most critically affect the decision; and (3) those variables of low or neutral significance, that can be ignored in reaching a decision and thereby simplify the process of reaching a decision.

The complexity of a sensitivity analysis can vary from a simple visual check of the results of an evaluation (such as that in Worksheet 4) for matters of high and low significance, to assigning different values to impact measures and observing their effect on the decision. When assigning different values, it is suggested that a range from low probability to high probability (e.g., between .10 and .90 on a cumulative distribution of probabilities) be used to be reasonably certain of covering the possible range of the variable.

Note that only a fairly general sensitivity analysis can be performed unless the values used for measuring each impact are commensurable. This does not usually happen unless a formal weighting scheme, such as that in Appendix B, is used. Then, it should be possible to identify the proportion of the total positive or negative points for a given JD that are caused by one or another impact and the changes in the balance of positive and negative points that are caused by assigning different values to given impacts. Otherwise, the evaluator must rely on his judgment in these matters.

Tradeoff Considerations

A similar observation may be made for tradeoff considerations, which entail improvement of one aspect or feature of a JD proposal at the expense of other features. Thus, a higher barrier wall may reduce the unfavorable traffic noise effects on users of a linear park, at the expense of the favorable aesthetic experience of highway users. Such issues should be raised by the evaluator, but it may be difficult to settle the issues without a common basis of valuation between the impacts and the affected interest groups. This common basis can either be provided by a formal scheme of weighting impacts or by the judgment of the evaluator. It should be noted that judgments in fact imply a subjective weighting scheme, and a formal "weighting" approach is certainly not justified when the results are obvious without it.

A search for tradeoff or improvement opportunities should be made among the unfavorable JD impacts and among the high-cost impacts on the highway department. It is difficult to achieve a number of diverse goals

simultaneously, and it should be understood that solutions which tend to "optimize" one goal by achieving high performance in one respect usually do so at the expense of other goals.

It may be useful to portray certain tradeoff considerations graphically. Figure 8-1 shows illustrative tradeoff charts for four hypothetical alternative highway noise barriers (A, B, C, and D) alongside a linear park. As shown on the bottom chart, the alternatives gradually increase both in cost and in their effectiveness as noise barriers. The top chart shows that Alternatives A, B, and D decrease in the favorableness of their impact on highway users, but C is both more pleasing to highway users and more effective in reducing park noise levels than is B. Since C only costs slightly more than B, it seems that B could be dropped from further consideration, making the choice between the surviving alternatives easier.

Means could also be sought to ameliorate or accept the negative effects of an otherwise desirable alternative on one group. For example, Alternative D could be reexamined to see if its adverse aesthetic features for highway users could be reduced or offset through landscaping, lighting, or surface treatment of the wall. It could also be concluded that (1) the unattractiveness to highway users is a small price to pay for the unusually quiet park conditions created by D, or (2) the uses of the park will not really require more than the noise reducing effects of C.

The main points here are that (1) tradeoffs should be explored consciously, not left to accident, and (2) graphical presentation of the tradeoffs may aid in presenting or considering the alternatives.

Priority Rating System for "Equal" JD Alternatives

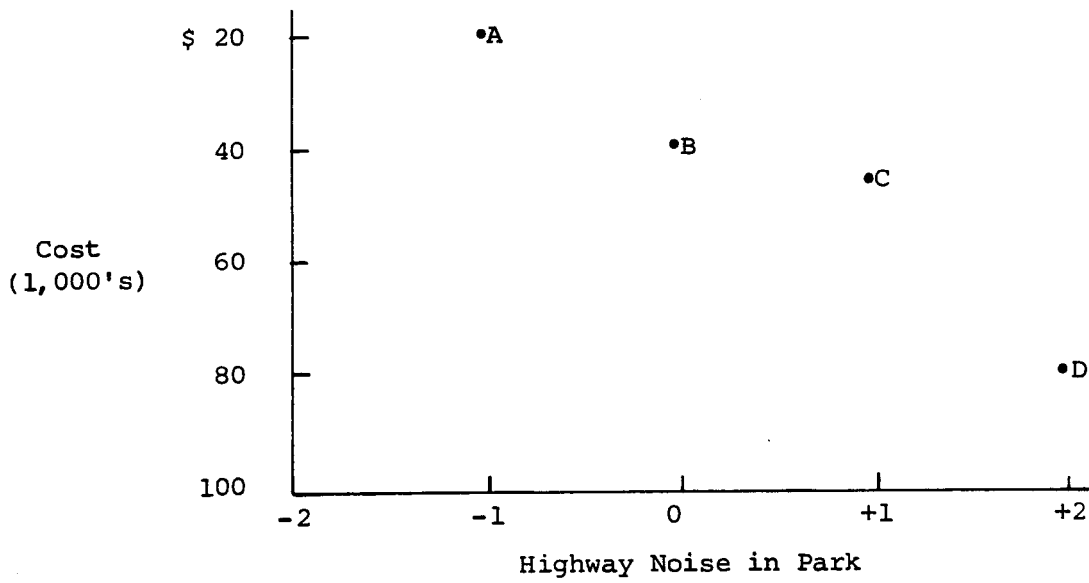
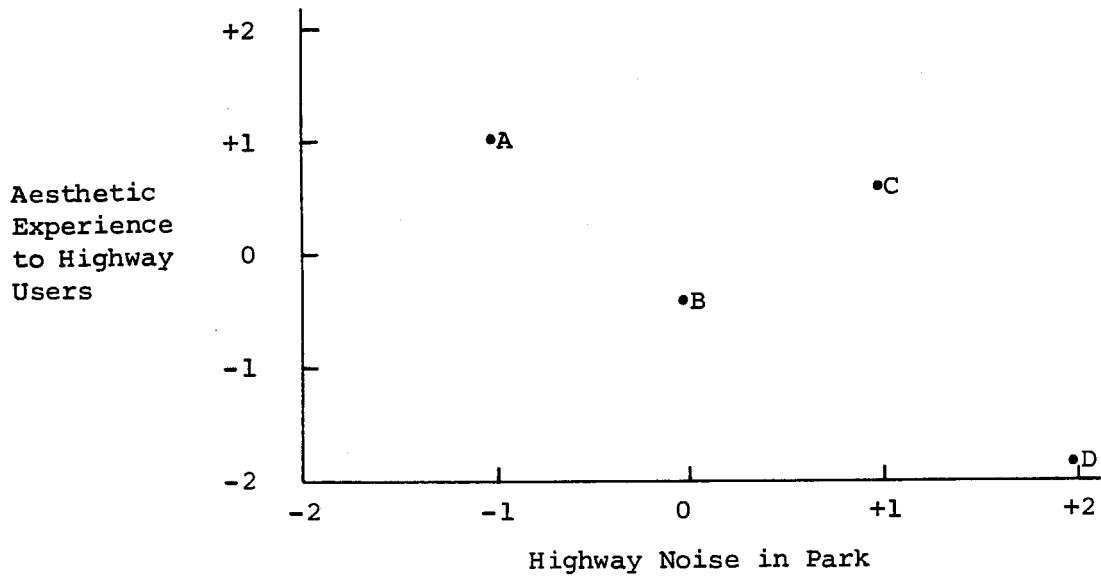
On occasion it may appear that alternative JD proposals for the same site present more-or-less equal advantages and disadvantages, as well as comparable consistency with basic policy. Or possibly a highway department may desire to have a policy position for go/no-go decisions on what appears to be equal opportunities.

It is believed that approximate equality will seldom occur, and even if it did, the summarization of relevant benefits, costs, constraints, legal considerations, and so forth will usually determine the direction for the decision maker. Nonetheless, the following priority set may be useful for those desiring such a policy.

- 1st JD projects that enhance the use of the highway or the safety convenience, or comfort of the highway user.
- 2nd JD projects that provide expanded transportation service (generally multi-modal) that enhances the overall transportation resources in the corridor.

Figure 8-1

ILLUSTRATION OF TRADEOFF CONSIDERATIONS



Preference Scale: -2 to +2; see text for explanation

- 3rd JD projects, usually sponsored by public agencies or community groups, that provide facilities or other betterments for the use or service of the public-at-large, and where public benefit is clearly demonstratable.
- 4th JD projects involving private buildings or other private developments where use by the general public is, or can be, restricted, but where public benefit is demonstrable.
- 5th JD projects where public benefit may not be clear, yet where there are no adverse effects on state or local interests or on the function, operation, and maintenance of the highway use.

The emphasis of this particular set is to rank as most favorable those JD proposals that are most consistent with the primary purpose of the highway element and to give preference to other public uses thereafter. It should be noted that from a purely revenue producing or cost saving standpoint, the ranking would likely be exactly reversed. However, the public orientation of highway agencies makes the suggested order somewhat logical--where land is taken for public purposes, it can be assumed reasonable to continue it in public use except where higher public benefits would result from private use.



Section 9

IMPLEMENTATION

The purpose of this section is to describe several considerations relating to implementation of the Guideline. These are (1) a recapitulation of the systematic approach to JD decisions as suggested by the Guideline structure, (2) organization and procedures for Guideline use, including the possibility of an interdisciplinary joint development review team, (3) the need for periodic monitoring of JD projects, and (4) the need for joint development enabling legislation.

9.1 RECAPITULATION OF GUIDELINE APPROACH

The general approach to joint development in the Guideline could be called sequential, systematic, interdisciplinary analysis, or simply a systematic approach to JD planning and decision. Its aim is to identify significant features, impacts, or requirements of JD proposals that could bear on their likelihood for consideration, approval, disapproval, or their modification.

The sequential aspect of the approach stems from the use of a series of successively more detailed and comprehensive review procedures. Section 2 serves as the precedent for the JD possibilities illustrated in Section 3 (and Section 10 illustrates a few additional conceptual approaches to JD). JDP review begins in Section 4 with a set of broad policy questions that serve as an initial filter for rejection of obviously inappropriate proposals. In Sections 5, 6, and 7, a comprehensive set of criteria, guidelines, and standards (including repetition in more detail of some general policy issues) is applied to the JDP proposal; in many cases, approve/disapprove decisions can be made at this point. If not, the reviewer passes to Section 8, which provides a comprehensive analysis procedure for displaying the proposal's estimated costs and benefits. Supplementing Section 8, Appendix B contains a procedure for weighting costs and benefits.

The interdisciplinary features of the approach are embodied in the wide range of physical, economic, legal, and social criteria specified. Professional judgment and techniques from fields such as civil engineering, environmental and urban planning, economics, sociology, and law, are contained in the Guideline; accordingly, similar disciplines may be necessary in the interpretation and application of its various sections (see next subsection for further comments on this point).

The approach also represents an integration of planning and evaluation techniques. Broadly speaking, the approach envisions a three-stage planning and evaluation process: (1) definition of the joint development potential, proposal, or need, as initiated either by the highway department or by others; (2) comparison of the proposal or proposals against policies, criteria, and standards designed to avoid or minimize negative impacts and increase favorable impacts (including consideration of any viable alternative sites, uses, or scales); and (3) refined definition of costs and impacts when warranted. The input of others, especially that of cosponsors and their professional advisors, as well as that gained from the interaction with affected neighborhoods or community groups or individuals (by techniques described in Section 7), are a fundamental part of this planning and evaluation process.

The indicated approach is consistent with principles of systems analysis in that it considers all significant interactions of a JD proposal with its environment, that is, all significant "inputs" of resources and "outputs" of impacts or effects on the several interest groups identified in Section 8. The approach is also believed to be consistent with the objectives of the National Environmental Policy Act of 1969: "a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment." Moreover, completion of the analysis procedure even if only through Section 5 should go far toward satisfying the five components of environmental impact statements required by the Act, namely:

- (i) the environmental impact of the proposed action.
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the proposed action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

9.2 ILLUSTRATIVE APPROACH TO JD PLANNING AND EVALUATION

The following represents one possible procedure for generating and evaluating JDP possibilities. It can be used by the advance planner where new highway routes are contemplated or by the design engineer where optimum use of highway rights-of-way are sought along existing facilities.

STEP I Determination of Study Area, Route, or Corridor for Consideration

Define the physical area to be studied--not so large that, say, potentially small scale, yet important, JD possibilities will be either overlooked or greatly subordinated by larger, apparently more attractive potential projects; and not so small as to create the impression, rightly or wrongly, of myopic vision on the part of the highway department.

STEP II Preliminary Data Collection, Field Observation, and Interviews

- A. Collection, review, and analysis of available reports, plans, studies, newspaper articles, and other published material that may be pertinent to the new or existing highway. Typical examples would be:
- General plans and specific community facility and private development plans
 - Recent demand analyses that may exist in regard to current land use and/or activity needs
 - Traffic analyses, existing and projected, within the study area
 - Minutes of applicable local public hearings
 - Any new federal, state, or local enabling legislation, regulation or authority relating to joint development
 - Any legal constraints such as anti-diversion of gas tax funds or need for qualification as "public use"
- B. Field inspection (land use and activity observation) of the spatial and aesthetic relationships of existing man-made structures and natural culture; driver and pedestrian behavior; peak-hour, off-peak, and weekend traffic characteristics; and other visual observance at appropriate locations such as:
- Along the proposed or existing route, generally within the right-of-way area
 - Along the proposed or existing corridor--possibly one or two blocks either side of the route
 - In the adjacent neighborhoods and districts potentially affected by either the highway or by new uses jointly developed with the highway

- C. Interviews by staff professionals in the study area with such typical groups or individuals as:
- Potentially affected public agencies, districts, and authorities, whether with or without direct decision making powers relative to potential JD proposals
 - Citizen groups (or at least the leaders of such groups) at the neighborhood and community levels
 - Private organizations, companies, and firms that may either be affected by JD or may affect proposed JD projects
 - Groups such as the Chamber of Commerce and other local business or manufacturing associations

STEP III Identification of Joint Development Possibilities

Based on the results of Step II:

- A. Identify likely opportunities to enhance local planning proposals, proposed public facility development, community cohesion, neighborhood values, and community norms held in particular neighborhood areas as they may relate to differing JDP characteristics. Consider the value of such features as connections over or under the highway to reduce barrier effects, screening, insulation devices, and so forth.
- B. Prepare a candidate list of JDP possibilities, classified by category or type and probable locations. Preliminary notations should be made as to probability of accomplishment considering any significant constraints exhibited by the geometrics or unique configurations of the proposed or existing highway.

STEP IV Preliminary Screening of Candidate List

Based on the results of Step III:

- A. Conduct an analysis utilizing the Basic Policy Analysis Summary (Worksheet 2). These questions associated with fundamental considerations and local policy serve the purpose of reaching consider/don't consider decisions about the candidate list. Generally, a majority affirmative response to the basic question set should be obtained to support further consideration of a particular JD proposal.

- B. Screen surviving projects against applicable physical, economic, social, and legal criteria in Section 5 to further test their likelihood of being implemented. This process can be completed by circulating the candidate list to (or discuss it with) appropriate staff groups within the highway department for their preliminary comments. It should be made clear that (1) this is only a tentative listing, so implementation approval is not expected at this time, and (2) additions to the tentative list, including alternate JD possibilities at the same site, are welcomed.
- C. Refine the candidate list based on the above procedures.

STEP V Field Test the Refined JD Candidate List

The following two public reviews should be considered in this step:

- A. Review and discuss the JDP candidates with appropriate public and private agencies and organizations that could be directly (or possibly even indirectly) affected. A reflection of such agencies' goals, needs, general concurrence (or nonconcurrence), and funding probability (in the case of potential cosponsors) would be considered at this time. The services of legal counsel (state and/or city) may also be necessary at this time to consider any legal aspects of the candidate possibilities.
- B. Test for community or neighborhood response to the JD candidates as each physically relates to the various locations along the highway route. Several techniques are suggested in Section 7; however, the final choice for gaining citizen interaction and participation will largely depend on the findings of Steps II-C and III-A and on the magnitude of the JD project (or projects) under consideration.

STEP VI Final Selection of Joint Development Projects to be Proposed

- A. Conduct a physical, economic, social, and legal consideration analysis on each of the surviving JDP candidates to judge Compliance/Noncompliance with specific criteria (see General Criteria Analyses Summary, Worksheet 3). This analysis should yield one of three distinct possibilities for each candidate JDP:
- A clear go/no-go decision
 - A conditional "go" decision provided certain design-oriented qualifications are met at the time of

implementation. (Qualifications can be stated and possible design solutions offered.)

- A clear decision cannot be reached; say, where two or more JDP alternatives for the same location exhibit more-or-less equal policy and criteria compliance.

- B. For potential projects that fall within the third category of decision, a benefit/cost analysis approach should be undertaken. This procedure (see Section 8 and possibly Appendix B) would essentially array all physical, social, economic, and environmental impacts of the alternate choices in costable, quantifiable, or qualitative terms. A value rating scale (Worksheet 4) and possibly an impact weighting scheme (Worksheet 5) would be used for such an analysis.

- C. It should be remembered that decisions concerning the use of highway land for JD purposes represent long-term commitments, so should be approached with care. For this reason, the highway department must see to it that (1) all feasible land-use possibilities for the site (within community goals and objectives) are considered; (2) lower priority land uses are accepted only if no higher priority land use can be reasonably incorporated at the proposed location; and (3) where less than "best-use" proposals are incorporated, the possibility for future flexibility (i.e., land use change) is considered.

9.3 ORGANIZATION AND PROCEDURES FOR IMPLEMENTATION

The best organization and procedures for implementing these guidelines will doubtless vary from time to time and from state to state, so only a few general comments can be offered here. (In regard to procedural matters involving basic JD policy and the roll of policy makers, the reader is referred back to the introduction of Section 4, Fundamental Considerations and Basic Policy, and to its subsections.)

At a minimum, use of the Guideline will require appointment of a JD coordinator at headquarters and/or district level with responsibility for controlling and monitoring the JD review process. One early task of the JD coordinator would be to establish the organizational review procedures and schedules: who should see the proposal, for how long,

and for considerations of what questions. Some considerations in establishing these procedures follow:

- All highway department units with expertise or interests in the areas covered by the Guideline should be represented in a JDP review. Probably a simple checklist should be devised showing the unit, location, deadlines for response, and portions of the Guideline assigned for consideration.
- Provision should be made for other concerned state, local, or federal agencies, especially those with planning and approval responsibilities, when necessary.
- For projects of large scale or complexity, or those with a high degree of social or political significance, a JD Project Leader should be designated for that particular proposal. When appropriate, it is possible that the JD Project Leader could be a member of the cosponsor group.
- The timing of JD considerations is important--the basic choices being between before and after actual construction of a highway has been initiated. Ideally, JD studies should be initiated at the stage of corridor planning. Often a joint development element needs as much lead time in planning and design development as the highway element. Construction phasing may be critical. And, the joint development element may require unique technical planning and design applications in the development of the highway structure itself. Admittedly, this raises the often difficult question of funding commitments (or even the availability of funds on a projected long range basis) when more than one agency or private group are involved in the joint endeavor. Even so, such a question reinforces the need for "timing coordination."

One potentially useful organizational device, especially for projects of large scale or complexity, or where JD considerations can be introduced at the stage of corridor planning, would be creation of a multidisciplinary JD planning and review team or committee.* Such a team could operate either (1) on a project-by-project basis, or (2) as a continuing body from which necessary subgroups of disciplines would be drawn upon as dictated by the scope of specific projects. Some suggestions for constituting such a body follow.

* The existence in some major cities of multidisciplined professional design commissions may serve this function, depending on the particular conditions and timing of the JD, and the location of the proposed corridor.

- The team would be advisory to the highway department--district, headquarters, or commission level. The team would conduct its business chiefly in periodic planning and review sessions, drawing on the highway department and/or cosponsor for providing needed information or analyses.
- The team should have responsibilities for originating proposals of its own as well as for reviewing externally proposed projects. Also, all highway construction projects that involve new routing or major reconstruction of existing routing could be reviewed by the team for JD possibilities.
- The team would generally have the responsibility of following this Guideline, but may propose specific alternative or supplementary standards and procedures.
- Team members having highway engineering qualifications (e.g., right-of-way, geometrics, design, transportation planning, cost analysis) should be employees of the highway department, but other members (e.g., architects, landscape architects, urban planners, economists, sociologists, pollution consultants, ecologists, etc.) could come from other public agencies or from the private sector, where such disciplines do not exist within the highway department.
- Candidates for consideration as to team membership would be:

Highway engineer	Regional planner
Transportation planner	Urban planner
Right-of-way agent	Pollution consultants
Economist	(air, water, noise)
Architect	Ecologist
Landscape architect	Artist (painter, sculptor, etc.)
Sociologist	Legal counsel

If the Committee is set up on a project-by-project basis, there is no need for all of the above disciplines to be represented. For instance, ecologists may not be needed if the project in question is entirely urban, and an architect may not be required if the link is through "natural" environments.

9.4 MONITORING AND REVIEWING IMPLEMENTED JD PROJECTS

Joint development projects that have been implemented should be monitored and reviewed on a periodic basis, in part to assure that their status has not changed significantly. Such a change could result from an inability to provide the benefits originally projected, or the emergence

of a significantly better project to replace* the existing project. The former result might be caused by any number of possible reasons--lack of adequate information initially (such as uncertainties that prevailed in the original decision making efforts) or poor management by the cosponsor(s) are typical suspects.

Periodic review of implemented projects perform two other useful tasks: (1) they provide new information to the analyst and decision maker that will assist in assessing similar or related projects; and (2) they provide a form of control over the cosponsor, assuring that the JDP is still operating within the context of the originally approved proposal.

Projects that have been rejected could also be reviewed as more information becomes available--information that might not have been available initially--or as the goals and objectives of the community or its interest groups change. Responsibility for initiating this type of review generally would lie with the cosponsor, or possibly with other interested parties.

9.5 JOINT DEVELOPMENT LEGISLATION

As indicated in Section 2.3, Legal Precedent, and Section 5.3, Legal Considerations, many states (including Washington) do not have a joint development statute. The prime advantage of such enabling legislation seems clear: The danger of litigation inherent when an attempt is made to justify some types of JD projects by a combination of unrelated existing statutes is largely removed by the passage of a broad, integrated enabling act.

Ideally, broad joint development enabling legislation should declare that joint development is a public purpose, and that in the furtherance of joint development, the state and participating public entities are authorized to acquire airspace as well as land laterally adjacent to the highway right-of-way. Such a statute should also expressly provide for joint participation with private cosponsors as well as public entities. This type of statute would obviate several public use problems that may exist when, without a statute, (1) an attempt is made to acquire airspace and/or laterally adjacent land for JD rather than solely for traditional highway purposes, and when (2) the planned JDP is not traditionally public in nature such as a park, library, courthouse, or other public offices.

* The feasibility of replacement would of course depend upon the JDP type and scale, and generally also on the conditions of the original JD agreement.

It is believed that the following two comprehensive model statute examples adequately achieve the foregoing objectives.

- Perhaps the most complete treatment of this subject is that of John C. Vance, Counsel for Legal Research for the Highway Research Board (NCHRP Research Results Digest 31, May 1971) entitled "Proposed Legislation to Authorize Joint Development of Highway Rights-of-way." This report outlines the problems and policy considerations and presents not only a proposed statute, but those of Connecticut and New York with comments on all three. Although the reader is advised to refer directly to Digest 31, this work is set forth, in pertinent part, as Appendix C-1.
- Another model act prepared by the Bureau of Public Roads (now the Federal Highway Administration) is more comprehensive as to the proposed legislation itself. It is especially significant in that it declares that all land or property acquired for any purpose authorized by the act, or in connection with the exercise of any powers which may be granted by the act, is declared to be needed or taken for a public use. This declaration would remove much of the threat of litigation that might be encountered by some types of joint development. A copy of this proposal is also included as Appendix C-2.

Section 10

NEW CONCEPTS FOR JOINT DEVELOPMENT

The purpose of this section is to present a few ideas about joint development that may not be readily apparent from utilizing other sections of this Guideline. Several of the concepts that follow are highly conceptual and totally untried, at least as they relate to state highways.

As the term "new" is relative to the passage of time, it is acknowledged that certain of the concepts, or the details within a concept, may not appear to be particularly original or unique. The intent here, however, is to generally broaden the reader's viewpoint towards more visionary joint development possibilities--in effect, to serve as a springboard for the planner, designer, or highway official involved with joint development planning and decision making. Reference is also made to the discussion on Complexes in Subsection 3.2, since they are as yet a little-used type.

Finally, discussions of the ideas that follow are clearly broad in scope, without detailed analyses of feasibility of design detail, and therefore they should only serve as the trigger for the further study of similar JD project types--either of lesser magnitude or more elaborate in scope.

The concepts in the order in which they appear are:

- 10.1 Exclusive Bicycle Lanes and Parking Facilities
- 10.2 Guideways for Small Automated or Semi-Automated Vehicles
- 10.3 Short Haul Mini-Transit Facilities
- 10.4 Park-n-Ride Plaza
- 10.5 Urban Information Center
- 10.6 Highway User Service Center
- 10.7 Highway Freight Transfer Station
- 10.8 Hill-Parks

10.1 EXCLUSIVE BICYCLE LANES AND PARKING FACILITIES

CONCEPT:

Provide for an exclusive-use, trip-oriented, bicycle mode of transportation within the highway corridor to reduce the number of daily trips by motor vehicle that would otherwise occur on the highway and its local

street connections. Bicycle paths for urban neighborhood use and bicycle trails for seasonal rural recreational use have already been noted in JDP type P-3, Lineal Parks (see Section 3), and therefore are not directly considered within this concept.

DESCRIPTION:

The features envisioned for this JD concept follow:

- Exclusive traveled lane separated from adjacent traffic by fencing, railing, or landscaping, or by complete spatial separation as would occur on elevated or depressed highways
- Exclusive ramps or other access connections (including over and under crossings) required to safely separate the bicyclist from highway users
- Supplementary signing, lighting, and traffic control devices oriented to bicycle usage, yet integrated with the highway element's normal control system (i.e., not a separate system that would require dual observation and understanding)
- Short term, parking, stopping and/or rest areas at periodic locations along the route, covered or otherwise shielded from inclement weather, yet sufficiently open to observation from the neighboring highway, local street, or other areas
- Exclusive parking garage (or exclusive ramp and space in public offstreet parking garage) providing features such as daily and monthly space rental, validation parking, security surveillance, air pumps, and possibly repair service

DISCUSSION:

1. The increased interest in bicycling, as evidenced in part by the increase in bicycle sales, the greater sophistication in their manufacture, and the upper shift in age of their users. The Bicycle Manufacturers Association reports that bicycles currently are produced at the rate of 7-1/2 million per year (up from 5 million in 1971) and that sales to adults have increased to approximately 20 percent of total volume from some 5 percent of the total five years ago.
2. The increased automobile congestion occurring in growing urban centers, and its possible reduction by partial substitution of the private motor vehicle by the bicycle. The degree of year-round reduction will depend on climatic conditions, but in good weather, the benefit of reducing environmental pollution (e.g., noise, air, visual, etc.) may become substantial.

3. Bicycles require less space per user of the transportation corridor--both as to lane width and to off-street parking.
4. Given the fact that the bicycle is currently meeting and will continue to meet some portion of the urban daily-trip requirements, the development of such features as described above should provide the following community benefits:
 - reduce the current hazardous conflict associated with mixing motor vehicle and bicycle traffic
 - reduce the adverse attitudinal conflict between the cyclist and the driver
 - reduce the ever increasing social problem of bicycle theft (applies mainly to the attendant operated bicycle garage feature)
 - clarify traffic control and traffic law compliance related to bicycling on traditionally (although not historically) automobile oriented transportation ways.

Arguments that can be presented against this concept are:

1. The likelihood of increased costs (e.g., construction, driver-time); associated cross and turning movement problems; ramp exits and entrance conflicts; signing, traffic control, and police surveillance; and so forth. Even in the case of bicycle lanes located under elevated highways, their discontinuity at street crossings would simply transfer these types of problems to the local street system.
2. Because of the absence of experience with the described types of features, demand can only be generally estimated, rather than be based on need in the more traditional sense. Reasonable determination of benefits and costs is therefore difficult, increasing the risk of unjustified public investments in facility development.
3. There could be a question concerning the expenditure of public funds for facilities that may not have sufficient year-round utilization due to rain, snow, pavement ice, dust storms, etc.

PRECEDENT:

- House of Representatives Bill 9369 (92nd Congress) to authorize construction of exclusive or preferential bicycle lanes recites in part "...to increase the (total) traffic capacity of the federal-aid system, sums . . . shall be available to finance the federal share of the cost of projects for the construction

of exclusive or preferential bicycle lanes, or paths, bicycle traffic control devices, and shelters and parking facilities to serve bicycles and persons using bicycles."

- The Oregon State Legislature in 1971 enacted law requiring that one percent of state gas-tax revenue be spent on development of bicycle trails and footpaths.
- The Washington State Highway Department in 1971 offered to build a paved, 10-foot bicycle-pedestrian path across the City of Tacoma along some 4 miles of highway corridor between Interstate 5 and the Narrows Bridge

10.2 GUIDEWAYS FOR SMALL AUTOMATED OR SEMI-AUTOMATED VEHICLES

CONCEPT:

Provide for Personal Rapid Transit (PRT) or similar systems within or adjacent to the highway right-of-way to create a trip mode competitive with the private automobile, and thereby reduce the number of daily trips by motor vehicles on the highway. The PRT vehicle would typically be (1) relatively small--4 to 12 passengers; (2) electrically powered; (3) at least partially computer controlled; (4) initially capable of speeds in the 20- to 30-mph range, but eventually of speeds of 60- to 70-mph; and (5) operated on exclusive guideways without intersections or other crossing conflicts.

DESCRIPTION:

The features envisioned for this JD concept follow:

- Guideways of either concrete trough or center "tee" rail type for bottom supported vehicles, or of stanchion-and-beam type for overhead suspended vehicles. Locations to consider would be (1) at-grade, in below grade cut, or underground tunnels in the median, sidestrip, or adjacent to the highway right-of-way, and (2) on elevated highways, either on a structurally supported median between the roadways, or cantilevered to the side. Unless an elevated highway is unusually high, use of the air-space below such structures is not likely due to the number of street crossings that would necessarily conflict with the non-stop feature of the automated system.
- Terminals or other facilities for PRT vehicle storage; maintenance and repair stations; or possibly freight terminals for, say, the automated conveyance of goods, mail, or baggage. Generally, passenger stations would be located on spurs extending for varying distances to each side of the highway, depending .

upon urban/suburban location, origin/ destination characteristics, and so forth, but they could conceivably include jointly developed sites with provision for parking, easy highway access, etc.

DISCUSSION:

1. Increased attention both by the public in general and the Department of Transportation is being given to the development of new transportation systems for congested urban areas.
2. The problem of increasing congestion associated with population growth and the greater demand for mobility strongly suggests the need for a vehicle mode truly competitive with the private motor vehicle, offering safe, quiet, pollution free, and possibly faster commutation service.
3. The PRT's adaptability to air space utilization, requiring minimal right-of-way width, possibly no more than ten feet, supports the feasibility of this concept.

PRECEDENT:

Although PRT-type systems have been proposed in several major U.S. cities, city proposals haven't advanced beyond the proposal stage.* On the other hand, the Urban Mass Transit Administration is currently providing for the demonstration of the concept (though not necessarily as joint development) for university service at Morgantown, West Virginia; for airport service at the Dallas/Fort Worth Regional Airport; and for prototype testing on Dulles International Airport lands.

10.3 SHORT HAUL MINI-TRANSIT FACILITIES

CONCEPT:

Provide fixed rail systems incorporated with the highway element for short haul, non-stop, limited passenger, bus-type vehicles for one origin/one destination in-city trips. Envisioned are median locations

* The PRT concept has been advanced in Europe, where it is called "automatic cabin taxis" (e.g., Munich and Freiburg, West Germany; Göteborg, Sweden; and London, England).

(on full access-controlled highways), cantilevered decks on nominal height elevated highways, or underslung tracks on higher structures.

DESCRIPTION:

This concept can best be described by considering the following example types, even though, as yet, none are known to exist jointly with a highway.

- Mini-Subway--the 3-minute rail-car trip connecting a 5000-car fringe parking lot with a central downtown location in Fort Worth, Texas.
- Single-purpose Mono-rail--typical systems would be Tokyo's airport-to-city center, and Seattle's city center to cultural center.
- Rail-Bus--provides for relatively fast and efficient travel of combination steel/rubber wheel vehicles for the "express" portions of their route systems.
- Bus-Train--same as Rail-Bus, except several buses would be tandemed and express-towed between major feeder route distribution points.

DISCUSSION:

In some respects, this concept proposes to use the JD concept to fill the void left after the demise of the historic intraurban rail-car that operated for so many years on exclusive rail networks, while at the same time fully realizing the need for improved low cost and acceptable (from a public tax standpoint) urban mass transit systems. Many of its JD features would be similar to those of the previous PRT concept, especially when lightweight vehicles permit a compact supporting structure for the track system.

10.4 PARK-N-RIDE PLAZA

CONCEPT:

Provide a park-n-ride JDP with design features sufficiently attractive to not only promote its greater usage, but also to enhance the demand for additional projects at other locations within the same urban area. The result--less peak-period vehicles on the highway element than otherwise would occur. The Park-n-Ride Plaza is envisioned for city center locations, say, under an elevated highway, as well as in the

urban fringe where ramp interiors and remnant or severance parcels offer excellent possibilities. Expanded rights-of-way for JD purposes (Tenure Class III) can also be appropriate.

Ramp interiors (which may have to be enlarged) are especially appropriate for accommodating the "return trip" because of the crossover advantage inherent in interchange structures.

DESCRIPTION:

- Paved parking area typical of the usual park-n-ride facility, ideally with vehicular access from adjacent local streets or frontage road for the "park" vehicle, and access from the highway (by deceleration, acceleration, and/or other auxiliary lanes) for the "ride" vehicle.
- Pedestrian accessways such as stairways, sidewalks or paths, under-ramp passageways (short and visually open) or similar features that provide for users that may arrive by walking, bicycle, or other means. Pedestrian accessways will also promote the "kiss-n-ride" concept.
- User convenience and comfort features include:
 - Shelter or other covered waiting stand
 - Benches and, possibly, bicycle stands (depending on the number of users not arriving by automobile)
 - Coin operated newspaper rack(s)
 - Message board and telephone booth
 - Possibly vending machines for coffee, cigarettes, soft drinks, and so forth.

DISCUSSION:

1. The benefit of increasing the occupants-per-highway vehicle ratio is clear. This concept not only allows for car-pooling, but actually promotes it. Therefore, care should be taken in providing landscaping or other beautification features not to screen the Plaza from highway view.
2. Although, in principle, the Park-n-Ride Plaza is work-trip oriented, it can also provide a community service by providing a mobilization area for special purpose needs such as military, ski, hunting, or cross country caravans; educational field trips; road rallies, or similar activities of highway-user orientation.
3. Because of the very strong relationship to the highway function, it is possible that the highway department may have to sponsor this type of project alone.

10.5 URBAN INFORMATION CENTER

CONCEPT:

Provide informational services for the highway traveler, either within the right-of-way or at a proximate location easily accessible from the highway, for the purpose of (1) reducing unnecessary city street "roving" and visitor confusion, and (2) providing in urban areas a composite answer to the traditionally rural rest, information, view, safety, and convenience stops. Depending on local need, the features envisioned for this JD concept can be numerous and imaginative. Although any one or two of the features indicated below might be desirable even if developed alone, joint development per se would not seem likely unless at least a majority were coordinated within a single comprehensive project.

DESCRIPTION:

Features envisioned for this JD concept are as follows:

- Informational features such as kiosks, booths, or small buildings, staffed by at least one person, for general information (e.g., city and regional geography; the highway access system and city street pattern; facilities such as the chamber of commerce and historical society; university student needs and directions; hotel/motel, restaurant, retail, and tourist guides). Other aids could include map displays, with detailed maps of the municipal center, business district, or other areas to be highlighted; limited commercial advertising; activity notices; direct line hotel/motel reservation phones; an emergency call box; and public telephones.
- Commercial features might include a coffee shop or take-out food service, souvenir shop, magazine/newspaper stand, guided tour agency, gas station, etc.
- Vistas or unique view points are ideal for incorporation in the Urban Information Center. Short time parking space, connecting paths, coin operated binoculars, viewpoint aiming devices, and descriptive plaques can be appropriate.
- Sanitary facilities are desirable, including the provision for clothes changing and, possibly, coin operated shower facilities. (In part, this will depend on what commercial features would be provided in the JDP.)

DISCUSSION:

In support of this concept, consider:

1. The substantial benefit to the first-time visitor to the city.
2. The economic benefit to the city (i.e., tourism) by bringing into the city the tourist that otherwise may not have stayed over.
3. The reduced "search-and-find" circulation on local streets by the uninformed driver.
4. The public information and public relations benefits that can accrue to the highway department.

PRECEDENT:

For the most part, precedent for individual features can be established from the rural, scenic, or historic highways within a state's total highway system. The numerous types of joint use displayed in Table 3-2 (Section 3) offer ample evidence of individual cases. The problem is more one of finding a cosponsor for integrating the several separate functions into a coordinated whole. Local chambers of commerce, municipalities, or hotel operator associations, possibly together with franchised private interests, offer possibilities.

10.6 HIGHWAY USER SERVICE CENTER

CONCEPT:

Provide highway oriented, commercial and non-commercial, services exclusively for the use and convenience of the highway user. Essentially, this type of project would be the state highway department's answer to the service plaza or oasis concept found on several of the nation's toll road systems. The Center's concept is broader in scope, however, especially in non-revenue features.

DESCRIPTION:

Typical features follow:

- Gasoline station with some auto repair capability; restaurant; take-out food service; small specialty store (e.g., recreational, tourism); recreation vehicle parts and repair shop.

- Motel (possibly with half-day rates); trucker's bunkhouse; overnight travel-trailer spaces and utility hook-up.
- Vehicle occupant conveniences such as road and trail maps and general information; picnic tables; children's jungle-gym or swings; dog run; travel-trailer waste disposal system; trucker shower-and-change facilities.

DISCUSSION:

1. The Highway User Service Center not only can provide added, if not unique, conveniences to the traveling motorist, but also revenues to the highway department and to the local community.
2. The primary function of tax supported highways is no different than those supported by tolls. However, as ownership and scope of authority differ considerably, implementation of this concept can be more difficult.
3. Even though gas station/restaurant/motel type facilities have for years been developed on properties abutting the highway (often for use solely by highway users), little if any control over service, quality, and pricing has been exercised. The Highway User Service Center concept can not only assure such control, but more importantly, can enforce user conveniences that otherwise may not occur.
4. Such a Center could be offered as a total program to private interests under appropriate public bid procedures. The bid-package would be based on a lease-design-build-maintain-operate program, with the usual safeguards of approval and inspection incorporated therein.
5. The arguments of "captive customer" and "unfair competition" should be disclaimed. The intent and purpose of the Center is explicitly for the convenience of the highway user; the customer is not provided for the convenience of the Center. Also, the competition is open to all who may desire to respond; the decision to undertake the program (i.e., to bid) is no different than any other risk/reward decision associated with the investment of venture capital in new facilities.

10.7 HIGHWAY FREIGHT TRANSFER STATION

CONCEPT:

Provide highway freight-related facilities for the purpose of keeping heavy highway trucks on the highway and consequently off local streets.

In essence, the purpose of this JD concept is to provide a highway oriented function similar to the traditional team track or commongoods shed of the railroad industry, or the public wharf of the shipping industry.

DESCRIPTION:

This concept envisions features as follows:

- Loading/unloading/transfer platforms, ideally, designed to separate the operational space of highway trucks from that of smaller local trucks.
- Truck parking and turn-around areas, again, with separation of highway and local truck access points and maneuver areas.
- Covered, short term storage area, including possibly temporary cold storage facilities, where appropriate and feasible.
- Enclosed storage building, not necessarily for the warehousing of freight, but more for purposes of 24-hour security.
- Stationmaster's house with telephone, radio phone, teletype, or similar communication means, and including a truckers' lounge.
- Landscaping and fencing or other security measures as appropriate.

DISCUSSION:

1. Community benefits gained by reducing (if not eliminating on some streets) the number of heavy, multi-axled trucks and truck-trailers on its street system are:
 - reduced traffic congestion in the city center
 - reduced parking, alley, and/or other loading spaces in premium downtown areas
 - reduced noise, vibration and odors
 - reduced potential for friction and frustration between drivers of both the passenger vehicle and the truck
 - reduced street geometric and pavement standards (and therefore improvement costs), especially in its neighborhood areas
2. Benefits to the commercial carrier should accrue due to in-city time savings and vastly improved turn-around times; avoidance of, or concern for local load limitations, truck-route restrictions, "no loading" prohibitions; and so forth.

3. Benefits to the shipper are not as clear. Reduced freight rates for customer pick-up and delivery at the Transfer Station are not apt to equal the additional costs of double handling of many transported goods. Incentives may have to be developed to sufficiently enhance the concept for the shipper. On a connected point, it may be that a city, because of public benefits received, should cosponsor the Highway Freight Transfer Station as a part of a future (and modernized) transportation service. Several cities are presently considering multi-modal freight depots of this type to handle and interchange rail, truck, and sometimes air or water freight.
4. The increased use of containerization should prove advantageous to the Transfer Station concept, especially for direct transfer of containers, say, between proximate locations of a highway and other freight modes.
5. Full-load shipment to single customers or company owned highway transport trucks are generally considered to be outside the potential of this JD type.

10.8 HILL-PARKS

CONCEPT:

Provide vertical relief by purposeful topographic change of otherwise flat terrains, using soil materials from roadway excavations. Generally, only spoil materials from unbalanced earthmoving operations are considered in this concept; however, it may be necessary to alter the roadway profile slightly to gain additional material.

DESCRIPTION AND DISCUSSION:

As the fundamental purpose here is to create man-made elevation, any of the traditional park types suitable to undulating land form can be incorporated in this JD concept. When the Hill-Park's size and shape is not spatially relatable to surrounding flat topography, its horizontal and vertical limits should be related to surrounding building masses, tree growths, artificial skylines, and to the needs imposed by the type of park selected.

As a general rule, the Hill-Park should be sufficiently large and high (1) to have the desired local visual impact, (2) to diminish the visual presence of the highway (possibly for several surrounding miles), and (3) to achieve the aesthetic or other environmental effect desired

for the particular highway's location, the neighborhood, and the function of the associated park use. Unless remnant or severance parcels or adjacent public lands are available, of sufficient size, and at the right location, it is anticipated that excess rights-of-way would be required to implement the Hill-Park concept.



Appendix A

ACCESS DETERMINATION PROCEDURE

A determination should be made relative to the joint element's need for vehicular access to the highway. The first step is qualitative. Unless a qualitative need for access can be shown, access to the highway should not be further considered.

The second step is quantitative. Here, such factors as the functional classification of the highway, its importance in the state highway system, the character and amount of the traffic on the highway and between the potential joint development elements, the adjacent street system, the intended purpose of the joint element, topographic conditions, proximity of the joint element site to other highway connections, and so forth, would be the basis for approval of an access connection.

One of the following access conditions will prevail:

- NO DIRECT ACCESS--The total prohibition of access by joint element vehicles or pedestrians.
- LIMITED CONNECTION--Access allowed for a predetermined service requirement (such as for maintenance service) having a negligible ADT volume,* or for accommodating a predetermined non-vehicular requirement such as for pathways, trails, etc. intended for use by pedestrians or animals.
- DIRECT TRAFFIC CONNECTION--Access by reason of the interaction by a significant number of vehicles between elements of the JDP. Direct access may be provided by conventional ramp systems, without restriction as to vehicular use, or access may be limited to a particular type of vehicle, such as for buses on an exclusive bus ramp or highway transport trucks to a make-up/break-up facility.

* A negligible ADT (average daily traffic) volume is considered to be less than ten.

Qualitative Highway Access Need

The following questions, when answered affirmatively, will generally indicate a qualitative need for highway access.

- (1) Does the joint element have a primary access need? Primary access need is established when it can be shown that the operation of the joint element is primarily dependent on the highway user, e.g., sports arena, service station, visitor information center, offstreet parking facility, park-n-ride facility, etc. Normally, facilities such as office buildings, restaurants, warehouses, manufacturing plants, parks, etc., would not be considered to have a primary need unless special circumstances can be shown. Non-highway oriented uses such as zoological, horticultural, educational, crop production, grazing, etc., clearly have no primary access need--that is, as related to the traveled lanes of the highway element. It does not imply however that use of the right-of-way (e.g., in sidestrips) is precluded.
- (2) Does direct access to or from the highway constitute the most reasonable method of arriving at the joint development location? The total lack of any other means of access is the obvious affirmative answer to this question.
- (3) Would access to the joint element alleviate traffic congestion on adjacent streets without seriously depreciating the level of service on the highway or conversely, would the lack of access to the joint element create traffic congestion on adjacent streets while not increasing the level of service on the highway?

When a qualitative need for direct access between elements of a joint development cannot be demonstrated, provisions appropriate to the type of highway under consideration should then be made to prevent inadvertent ingress and egress.

Where there is a qualitative need for a limited connection between elements of the joint development, the precise nature and magnitude of the vehicular and/or pedestrian interaction should be fully described and appropriate restrictions set forth. State laws pertaining to non-vehicular use* of the traveled way of the highway would, of course, be applicable. (Where use of highway element areas off the traveled way by non-vehicular traffic is proposed, such equipment as lawn mowers, jitneys, cranes, farm implements, etc., should not as a general rule be allowed within six feet of the edge of the traveled way.)

* For purposes here, a vehicle is defined to be an automobile or truck; a non-vehicle refers to all other types of conveyances, such as jitneys, bicycles, cranes, etc., not capable of normal highway speeds.

Connections for service and maintenance vehicles may require a paved pullout, including deceleration and acceleration lengths, clearance and/or barrier protections, etc., depending on the requirements of the particular class of highway affected. Encroachment across the right-of-way edge from an adjacent street or property may often be more appropriate and should be permitted where justified. In this case, sidestrip paving, gate locks (if R/W is fenced), warning signs, and possibly barrier protection should be considered.

Quantitative Highway Access Need

When a direct traffic connection is shown to have a qualitative need, the exact method of connection should be determined and approved on a more quantitative basis. Basically two types of connections prevail, (1) perpendicular, such as a driveway or intersection of roads, and (2) longitudinal, by on and off ramps with appropriate acceleration and deceleration lengths.

A traffic analysis should be made pertaining to the proposed access. The extent of this analysis shall be based on the magnitude of the access requirement. If the proposed element joint is a major traffic generator, a comprehensive traffic and access plan is necessary. A major traffic generator is defined here as having at least a one-way demand volume of 400 vehicles per day (VPD). If the access requirement is less than 400 VPD, then a condensed traffic analysis and access plan should suffice. A condensed analysis description follows the more comprehensive one now illustrated.

A comprehensive traffic analysis should include but not be limited to the following items:

- Determination of existing traffic volumes on the highway element. (If the highway element is not constructed at the time of the traffic analysis, a predicted traffic volume for the opening of the highway element must be estimated.)
- Determination of the projected traffic volumes for the highway element in the area influenced by the JDP.
- Determination of the amount of traffic that will utilize the proposed joint element at opening, at staged development periods (if appropriate), and at full development.
- Traffic diagrams as may be necessary to illustrate the above, indicating average daily traffic (ADT) and a design hour volume (DHV).
- Indication of the planned or desired location and geometric characteristics of all access points to the joint element.

- Determination of the vehicle trip distribution that is anticipated for the JDP, including the proposed access to the highway element.
- Capacity analysis of each appropriate section of the intertie between the two elements of the joint development (procedures are given in the "Highway Capacity Manual," Highway Research Board Special Report 87, 1965, including provision for analysis of merge sections, weave sections, and intersections).
- Signal warrants indicating where traffic signals may be required along the access facilities (these warrants are defined in the "Manual on Uniform Traffic Control Devices for Streets and Highways," American Association of State Highway Officials, 1970).
- All factors not specifically described above that bear on the traffic handling characteristics of the highway element and on the operation of the adjacent street system should be included in the traffic analysis.
- Comprehensive access plan indicating principal access features, and including drawings and/or a discussion of (1) roadway sections; (2) types of access control; (3) operational controls such as proposed fencing, definition of right-of-way limits and the limits of access, the general concept of illumination, and the use of signing or other control devices; (4) horizontal and vertical geometry indicating the workability of the plan; and (5) plan for any temporary connections and phasing of construction.

A condensed traffic analysis and access plan should include but not be limited to the following items:

- Either a drawing showing the exact type of access desired, or an indication of a standard road approach as defined in the "Highway Design Manual" (this refers to a manual prepared by the Washington State Department of Highways).
- Capacity analysis of access points, including warrants for required signal and/or control signing installations.
- Indication of pertinent access features, such as curbs, barriers, fences, lighting, site lines, general signing, and so forth.

Appendix B

EXTENDED EVALUATION PROCEDURE

This appendix contains procedures, factors, and suggestions for an extended analysis of projects on which a recommended decision cannot be reached in Section 8. Evaluators are cautioned that the procedures described here are still more of an art than a science, in the sense that few hard and fast rules can be given, so the approach requires considerable adaptation and interpretation in specific cases.

Two types of further quantification of the impacts recorded on Worksheet 4 may be useful. The first is to express more of the quantifiable and qualitative entries on Worksheet 4 in costable terms (as dollar impacts) or to express the qualitative impacts at least quantitatively. The second is to aggregate the costable effects over a period of years, reduce the results to equivalent uniform annual amounts (or present worths), and obtain a net balance of costable effects (or a ratio of benefits to costs). These two approaches will be discussed in turn. The approaches utilize Worksheet 5, which also contains space for the weighting procedure described later in this appendix.

Further Quantification of Selected Impacts

In the Highway Department section of Worksheet 5, enter on lines 1a and 4, respectively, the total initial and annual costable effects from Section A of Worksheet 4. For item 5, enter any qualitative Highway Department effects from Worksheet 4.

For highway users and subsequent groups, blank lines are provided to bring forward any qualitative or costable effects from Worksheet 4. Quantitative effects are ignored on Worksheet 5 as a simplification because they cannot be added to each other.

For costing of any effects on highway users such as traffic delays or slowdowns, evaluators are referred to the prospective NCHRP report for Project 7-8, "Procedures for Measuring User Costs and Air and Noise Pollution Effects," which contains detailed instructions and cost factors for such calculations. As a rule of thumb, however, the operating costs of motor vehicles can be approximated by 5.5¢ a mile to cover fuel, oil, maintenance, and a portion of depreciation that depends on miles driven. This figure does not vary significantly over a wide range of speeds and highway types, up to the point of queuing conditions. Therefore, operating costs can usually be ignored between JD alternatives,

and effects such as slowdowns can be reflected by the value of travel time (appropriate values of travel time at present range between \$2 and \$4 per vehicle hour for passenger cars, with \$3 constituting a reasonable average; \$5 is a more appropriate figure for trucks). If accident frequencies or frequency of stops (i.e., an additional signalized intersection) are occasioned by the JD, user costs for these changes should be calculated separately.

Regarding effects on joint element users, the same NCHRP report gives air pollution estimating procedures that can be used to develop figures for the pounds of vehicle emissions produced per 1000 miles of travel in given future years, but diffusion models are not yet available that would indicate the concentrations of pollutants in parts per million at given distances and elevations from a highway as a function of vehicle density and speed. For the "convenience" entry, estimates of any savings in time for joint element users can be translated into dollar values by using the unit values of travel time referred to previously.

For other effects on joint element users, and for all neighborhood effects, no reliable methods exist at present for converting qualitative ratings into dollars. However, space is provided for such entries on Worksheet 5 in case such methods become available in the future.

For community effects, the items listed on Worksheet 4 also appear on Worksheet 5 so that dollar amounts can be estimated where qualitative ratings were used before. Such estimates require usually a very detailed knowledge of JD plans and the probable effects of the types illustrated. However, there is not a sufficient statistical history of these effects at present--particularly on the effects on property values and local government costs--to offer further guidelines for their estimation. Accordingly, a major research effort may be necessary to obtain reliable figures. Again, evaluators are encouraged to use a range of estimates where a range will suffice in accuracy and where a range can be obtained with considerably greater ease and reliability than a single estimate.

Benefit/Cost Calculations

The conduct of a benefit/cost analysis first requires choices of discount or interest rates, study periods, and residual value assumptions. Evaluators are referred to standard engineering economy texts for a discussion of these matters.* It should also be noted that Worksheet 5 assumes that the level of annual costs and benefits for each item does not vary significantly over the study period. Where this assumption does not hold true, conversion of the unequal dollar flows

* e.g., Robley Winfrey's "Economic Analysis for Highways," International Textbook Co., 1969.

Worksheet 5

EXTENDED EVALUATION FORM

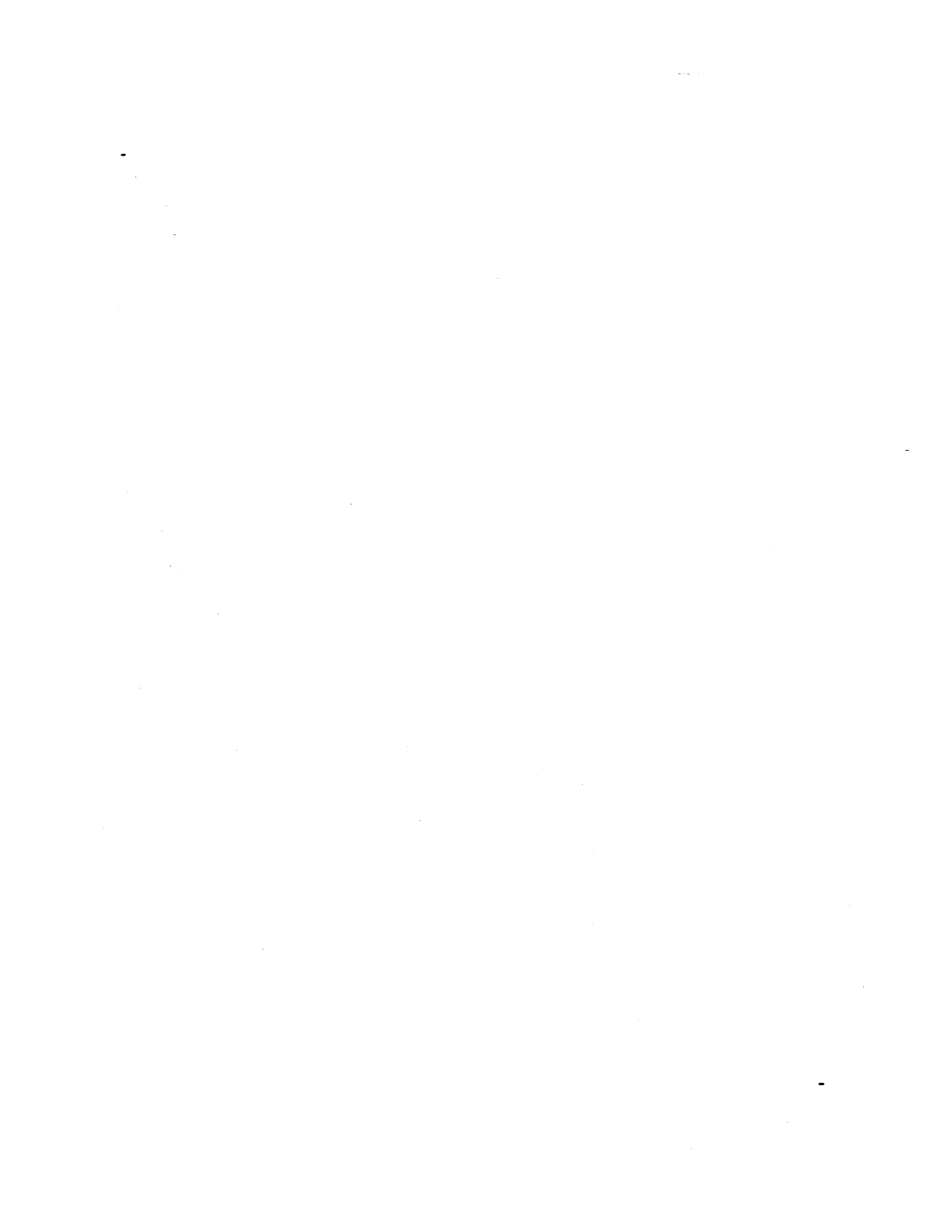
(Supplementary to Comparative Display Chart)

JD Project No. _____ Completed by _____ Date _____

	<u>Incremental Effects</u>		<u>Weighted Impact</u>
	<u>Costable</u>	<u>Qualitative</u>	
A. HIGHWAY DEPARTMENT			
1. Initial costable effects			
a. Total from Worksheet 4	_____		
b. Present worth of residual value, if any	_____		
c. Net effects (a - b)	_____	_____	
2. Capital recovery factor for ___ yrs. at ___%		_____	
3. Equivalent uniform annual amount (line 1 x line 2)		_____	
4. Annual costable effects (total from Worksheet 4)		_____	
5. Qualitative effects:			
_____		_____	_____
_____		_____	_____
_____		_____	_____
B. HIGHWAY USERS			
(Annual costs and benefits)			
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____

Worksheet 5 (Continued)

	<u>Incremental Effects</u>			<u>Weighted Impact</u>
	<u>Costable</u>	<u>Quali- tative</u>	<u>Weights</u>	
C. JOINT ELEMENT USERS (Annual Costs and Benefits)				
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
D. NEIGHBORHOOD (Annual Costs and Benefits)				
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
E. COMMUNITY (Annual Costs and Benefits)				
Local government costs (-)	_____	_____	_____	_____
Local tax revenues (+)	_____	_____	_____	_____
Increased property values (+)	_____	_____	_____	_____
Employment (+)	_____	_____	_____	_____
Net personal and business income (+)	_____	_____	_____	_____
Retail sales (+)	_____	_____	_____	_____
Relocation costs in excess of relocation payments (-)	_____	_____	_____	_____
Other: _____	_____	_____	_____	_____
_____	_____	_____	_____	_____



into equivalent uniform annual costs is recommended, through first multiplying each year's dollar flow first by the appropriate single payment present worth factor from a table of compound interest factors; next, summing the result; and then, multiplying the result by the capital recovery factor from the table.

For evaluating total benefits and costs, first enter on line 2 of Worksheet 5 the assumptions regarding the length of study period (in years) and discount rate (in percents); then select the appropriate capital recovery factor and enter the factor on the line provided in the "costable" column. Next, multiply line 1c by line 2 and enter the result on line 3; the result is the equivalent annual amount of the initial costable effects. (In the event a residual value is estimated, it should first be converted to a present worth through use of a single payment present worth factor, then entered on line 1b and deducted from 1a to give line 1c.)

Next, add lines 3 and 4 to obtain line 1 in Section F of the Recapitulation, the total annual costable effects for the highway department.

Next, add the costable effects for all other interest groups to obtain line 2 in Section F, total costable effects for other interest groups. If it has been possible to express the effects on these groups successfully in dollar terms, a sizable dollar benefit may be obtained.

Two economic indices may now be obtained; the first is net annual benefits and costs (line 3 of Section F) and the second is the ratio of benefits to costs (line 4 of Section F). These indices are useful as summary expressions of the purely economic consequences of the joint development proposal, or of the relative economic merits of competing proposals if two or more alternative JD proposals are being compared. However, even if costs exceed benefits and a benefit/cost ratio less than one is obtained, the question remains whether the qualitative results of the JD are worth the cost. For this determination, it is necessary to weight and sum the qualitative impacts, as next described.

Weighting Procedure

The JD decision-making process can be simplified for complex proposals and made more consistent by introducing a weighting function for the qualitative impacts--the evaluator or decision-maker then need not perform sensitivity analyses or trade-offs by guesswork between a large number of impact measures for each alternative considered. Instead, the trade-off relationships between impacts can be established initially and applied to a wide variety of alternatives in decision-making situations, reviewing the relationships on a periodic basis to assure that they reflect any changes in objectives of decision-makers or the interest groups.

The weighting process consists of assigning numerical values to relative preferences for each of several distinct items--in this case, the JD criteria or impacts specified in Worksheet 5. The numerical values assigned to the impacts are designated "weights" and indicate the relative importance of each impact as viewed by the decision-maker.* The weighting scheme recommended in this guideline allows for any integer or noninteger values between 0 to 10 to be assigned as weights to individual impacts--the importance of a specific impact increases in direct proportion to the relative increase in magnitude of the assigned weight. A weight of 0 assigned to an impact implies that the impact is not to be considered in the decision-making process. It is doubtful that any impact mutually exclusive of all others will ever be assigned a weight of 0 because of this implication. On the other hand, one or more impacts may be assigned the weight of 10, the maximum value allowed. Two or more impacts with the same weights are assumed to be of equal importance to the decision-maker, whereas an impact that has an assigned weight twice as large as the weight of another is assumed to be twice as important as the other, and so on.

Determining the Appropriate Weights

Weights will generally be assigned to similar types of impacts for a few broad categories of JDP, since they are independent of the specific project under consideration. However, where different types of JDP result in significantly wide ranges of impacts, improved decisions can be made if sets of weights have been determined for separate JDP categories, selected to reflect any extreme variations in impacts realized from the different JDP types.

Weights should be assigned by the decision-maker without knowledge of the specific JDP under consideration in order to avoid inadvertently reflecting the evaluator's +2 to -2 rating scale valuations previously assigned to the project. The preferred approach is to assign weights prior to identification of the joint development proposal.

Weights for the many different impacts can be determined most appropriately by performing a comprehensive review of the goals of the decision-maker or decision-making body. This should determine the relative preferences for each of the individual impacts to be considered--which can then be translated into the more analytical relative weights.

* Weights can be shown to describe a set of linear indifference curves for two criteria. If the ranges of criteria impact measures do not vary drastically, the linear indifference curves will be reasonably close approximations to the actual indifference curves. For a further discussion of weighting procedures and theory, see James R. Miller III, "Assessing Alternative Transportation Systems," RAND Memorandum RM-5865-DOT, April, 1969 (PB 185 167).

The review should also recognize variations in relative preferences between different decision-making bodies and should reflect these potential variations in different sets of weights as appropriate.

As an alternative to this process, weights can be determined readily by accepting as estimates the subjective preferences at an appropriate public policy making level, or by a professional multi-discipline design team. In any case, however, it will be necessary to periodically review the goals of the decision-maker and to update the sets of weights as necessary to reflect any changes in these goals, which tend to vary over time. Initially, the joint development decisions should also be reviewed often enough to provide feedback to the decision-makers, and thus to provide the opportunity for minor adjustments to the weighting scheme to ensure that optimal decisions are being made.

The strict determination of a weighting set requires the arbitrary assignment of a weight to a single impact of average importance. Such an impact is termed a "benchmark impact" and the weight so assigned, a "benchmark weight." Weights for all other impacts can then be determined by estimating the relative weight of each impact compared to the benchmark impact.*

Weighted Impact Values

The perceived weighted value of a JDP's effect on a specific impact--the weighted impact value--is the product of the rating (i.e., +2 to -2) assigned to the effect of the impact and the weight assigned to that impact. Quite obviously such calculations result in a set of impact measures weighted in terms of relative importance, and therefore since all weighted impact values have the same units of measure, they can be added directly to obtain the total weighted value of all impacts. This total weighted value will then represent the total incremental value of the impacts associated with the proposed JDP and can be used directly to determine the relative preference ranking of alternatives and hence the optimal alternative at a given cost.

Adding Weights to the Extended Evaluation Form

The Extended Evaluation Form (Worksheet 5) contains two columns at the right for the introduction of weights and weighted impact values associated with each impact. These values require a brief explanation

* If a weight so determined exceeds the maximum allowable weight (which is assumed here to be 10), then the assigned weights can be translated to the "10-scale" by normalizing all weights such that the largest assumes the maximum value 10. Normalization requires that all weights are divided by the largest value and then multiplied by the maximum value 10. Such a transformation is linear and preserves the relative preferences of the criteria.

since they were not considered previously in the Comparative Display Procedure.* The "Weights" column contains the weights assigned to each type of impact by the decision-maker. Weights are not specified for the costable measures, because costs can readily be added together.

The last column in the Extended Evaluation Form contains the weighted product for each impact, found by multiplying the qualitative rating by the assigned weights. These values represent the relative contribution of each impact to benefits or costs. Summing the weighted impacts then results in a net measure of total benefit or cost for the qualitative impacts.

In Section G of the Recapitulation on Worksheet 5, weights must also be inserted in column c for the different interest groups. It is suggested that these weights be selected to add up to a total of five, so that an equal weighting of groups would be specified by a weight of "one" for each interest group; although column c does allow for other relative weighting schemes. The positive and negative weighted impacts for each group are entered in columns a and b of Section G and then multiplied by these "group" weights. To obtain total positive and negative point ratings, add vertically columns d and e. Finally, ratios of positive to negative ratings are obtained as a benefit/cost index measure in the last column of Section G.

Reaching a Decision

Essentially the same procedure is involved in reaching a decision on the basis of Worksheet 5 as was suggested for Worksheet 4, except that the weighted impacts can now be used to consider sensitivity, tradeoffs, and the relative desirability of alternative JD sites, uses, or scale (see the discussion of these matters in Section 8). The problem remains that there is no way to tell what a given numerical rating justifies in terms of highway department costs; this will always be a matter for the judgment of the decision-maker, though it may be facilitated by the weighting procedure described above.

To illustrate the above conclusion, assume that JDP alternative A costs \$10,000 and has a weighted impact value of +100, while alternative B costs \$20,000 and has a weighted impact value of +300. Obviously, B is in a sense more cost-effective than A, because for the added \$10,000 expended, 200 added impact points are obtained in comparison with only 100 impact points for the \$10,000 cost of A. Of course, before choosing B, a judgment must be made that the \$10,000 expenditure for A would in fact be worthwhile on the basis of its performance; otherwise, it would not make sense to even compare B with A.

* Contained in Section 8.

Appendix C-1

EXAMPLE OF PROPOSED LEGISLATION AUTHORIZING
JOINT DEVELOPMENT OF HIGHWAY RIGHTS-OF-WAY

(From NCHRP Research Results, Digest 31, May 1971, in pertinent part)

§ 1. Legislative finding and declaration of purpose. The legislature hereby finds that it will assist in comprehensive land-use planning, aid in the relief of urban congestion, effect economy in public works construction programs, and produce revenues to utilize where feasible and practicable publicly owned lands acquired for highway purposes for joint development; and the legislature hereby declares it to be the intent of this Bill to stimulate and encourage the use of such land for such purpose. Provided, however, that no joint development project shall be undertaken except and unless the state highway department shall first find and determine upon an evaluation of all relevant factors that such project is adapted to and consistent with the social, economic, and environmental values and amenities of the community or areas wherein such joint development project is proposed to be located.

§ 2. Definitions. As used in this Bill the following meanings shall be ascribed to the following terms:

(2) The term "right-of-way" shall mean land or interests therein acquired for highway purposes by condemnation, purchase, exchange, gift, devise, dedication, prescription, or otherwise, including the air-space over the surface of the land, and the subterranean space lying thereunder.

(b) The term "joint development" shall mean cooperative action by the state highway department with federal, state, municipal, and other governmental agencies, and private individuals and organizations, in public or private development of the right-of-way, and land contiguous or adjacent thereto, in such manner as not to injure, damage, obstruct, impair, or impede the full, safe, and efficient use of the right-of-way for the primary purpose of movement of persons, vehicles, goods, and other lawful traffic.

§ 3. Authority to participate in joint development. The state highway department is hereby authorized and empowered to undertake and participate in comprehensive planning for the joint development of highway rights-of-way, and land contiguous or adjacent thereto, and in furtherance and implementation of such planning to cooperate, advise, consult and confer with federal, state, municipal, and other governmental agencies and instrumentalities, planning commissions, zoning boards, civic

associations, research organizations, educational institutions, and private persons, firms, corporations, and associations, and to enter into such contracts and agreements with such public and private agencies and entities as are reasonably necessary and required to affectuate and render feasible and practicable comprehensive planning for joint development. The department is expressly authorized and empowered to participate in a joint development project involving the acquisition and/or use of land contiguous or adjacent to the right-of-way, by a public agency other than the department, or by a private legal entity, to the end of permitting effective planning for lateral development outside of right-of-way boundaries, as well as vertical development within such boundaries.

§ 4. Authority to receive grants and gifts. The state highway department is hereby authorized to accept and receive in furtherance and implementation of a joint development project grants from federal, state, municipal, and other governmental agencies, and gifts from private individuals and organizations, and to enter into such agreements in respect to such grants and gifts as are reasonably necessary and required.

§ 5. Authority to employ personnel and expend funds to implement joint development. The state highway department is authorized to employ its own personnel, and to retain private architects, engineers, and other consultants to prepare designs, plans, estimates, and render such services as are reasonably necessary to the implementation of a joint development project. The department may expend such monies from the state highway fund as are reasonably required in support of a joint development project.

§ 6. Local zoning regulations and planning objectives. In planning for a joint development project the state highway department shall give full consideration to the zoning regulations and restrictions and planning and development objectives of the political subdivision having jurisdiction of the project area, but the department may recommend to the political subdivision such comprehensive zoning plan, or such changes in or amendments to existing laws, ordinances, codes, and regulations, as are deemed reasonable and suitable for the accommodation of the joint development project to the surrounding area.

§ 7. Authority to sell, lease, or otherwise dispose of real property for joint development. The state highway department is hereby authorized and empowered to grant, bargain, sell, convey, lease, let, or otherwise dispose of for joint development purposes, real property and interests therein acquired for highway purposes, including airspace over the surface of land and subterranean space lying thereunder, which space over and under the surface of land may be sold, conveyed, leased, or otherwise disposed of in blocks, parcels, levels, sections, and volumes separate and apart from underlying or overlying surface. The department may place such conditions and restrictions on the use of such land and space thereover and thereunder as will insure the safe and efficient use of the right-of-way for the primary purpose of movement of persons, vehicles, goods, and other lawful traffic. The department may place

such further conditions and restrictions on the use of such land and space thereover and thereunder as may be necessary and required to render the joint development project compatible with the social, economic, and environmental values and amenities of the community or area in which the project is located.

§ 8. Entry of property sold or leased for taxation. Real property and interests therein, including space over or under the surface of land, sold, leased, or otherwise disposed of for joint development purposes, together with buildings and structures thereunto appurtenant, shall be entered on the tax rolls and separately assessed. Provided, that no tax shall be levied or assessed against any federal, state, municipal, or other governmental agency, eleemosynary or other institution, exempt by law from taxation.

§ 9. Deposit of revenues in state highway fund. All revenues derived from the sale, lease, or other disposition of real property and interests therein for joint development purposes shall be paid to and deposited in the state highway fund.

Appendix C-2

POSSIBLE FORMAT FOR JOINT DEVELOPMENT STATUTE*

(To be modified by each State)

Section 1. Title.

An Act to authorize the State Highway Department, hereinafter referred to as "SHD," to participate in the joint development of highway corridors, to acquire and dispose of property, including airspace for such joint development, and for other purposes.

Section 2. Definitions.

As used in this Act.

(a) The term "joint development" means those activities leading to or aiding in the comprehensive use of a planned or existing highway corridor. Said term includes, but is not limited to, (1) preparation of plans with respect to the pattern and intensity of land use and the provision of private and public facilities, including transportation facilities, together with long range fiscal plans for such development, (2) coordination of all related plans and planning activities at intra-governmental and intergovernmental levels.

(b) The term "Comprehensive Highway Corridor Joint Development Plan" means a plan which considers, among other factors, the pattern and intensity of land use, the provision of public facilities and other governmental services, the effective development and utilization of human and natural resources, and all related plans and activities of State and local governments and other concerned agencies.

(c) The term "highway corridor" means the general path of any highway including the highway proper and its environs.

(d) The term "joint development team" means an interdisciplinary team of experts established by the SHD to determine how a highway corridor can best serve the social, economic, aesthetic and other environmental needs of the area it traverses.

* This draft bill was prepared by the Bureau of Public Roads (now the Federal Highway Administration).

(e) The term "right-of-way" means the land, or interest therein acquired for, or devoted to, a transportation purpose.

(f) The term "airspace" means that separate parcel over or under the surface of land, or over or under any highway structure located on the right-of-way.

(g) The term "multiple use" means the use of a highway right-of-way other than for a highway purpose.

(h) The term "highway" means that part of the right-of-way devoted exclusively to vehicular travel.

Section 3. Purpose.

The intent of this ACT is to authorize and encourage the joint development of a proposed or existing highway corridor. It is the declared purpose of the legislature that the SHD shall advise, encourage and cooperate with Federal, State, regional, county, and municipal planning boards, governmental agencies, civic organizations, corporations, and others charged or having a substantial interest in, the social, economic, aesthetic and other environmental effects of the development of a highway corridor.

Section 4. Authority to participate in joint development.

(a) The SHD shall cooperate with other involved agencies in determining that portion of the highway corridor suitable for joint development, and shall cooperate with these agencies in preparing a comprehensive plan for the area to be jointly developed. Such plan shall be based on studies of social, economic, aesthetic, and other environmental conditions and trends and shall take into account and seek to harmonize the planning activities of Federal, State, and local agencies within the area. The highway, as part of this plan, should be so located and designed as to allow the combined activities of all instrumentalities involved to make the maximum contribution to the well being of the area which the corridor traverses.

(b) The SHD may act as liaison to encourage coordination among all agencies and entities, governmental and private, having a responsibility or an interest in the area affected by the proposed highway. In so doing and in stimulating effective joint action among all interested parties the SHD shall:

- (1) Cooperate with and assist other departments and agencies or instrumentalities of Federal, State and local governments, as well as regional, municipal, and other planning commissions, in the execution of their planning functions with a view towards harmonizing their planning activities and programs for the joint development of any highway corridor.

- (2) Cooperate, confer with and supply information to interested governmental units, highway departments and agencies of other States.
- (3) Collect and distribute information relative to joint development and to the areas affected by the highway to public bodies, private organizations, civic groups and the public at large. Such information may include, but is not limited to, the plans, programs and activities of the instrumentalities involved as well as basic data such as economic data, transportation data, land use statistics, and zoning regulations. Where appropriate, a reasonable charge shall be made for services rendered to private businesses and individuals.
- (4) Seek the cooperation and advice of educational institutions, research organizations, business enterprises, civic groups and interested individuals.
- (5) Perform such other acts in furtherance of this subsection as are reasonable and proper.

(c) The officers or employees of any State agency may serve at the request of the SHD upon such advisory committees as the SHD shall create to carry out this Act. Services by such officers or employees shall not affect their status or office or any privilege or benefit arising out of such status or office.

(d) The SHD is hereby empowered to provide planning assistance and to perform planning work in the furtherance of this Act, including but not limited to surveys, transportation and land use studies, urban renewal plans, technical services, and other elements of comprehensive planning programs, and to conduct research into the social, economic, aesthetic and other environmental conditions and needs in any area affected by a planned or existing highway corridor. Compensation paid for the performance of such work shall be regarded as part of the cost of the projects for which they were made.

- (1) Employ consulting engineers, planners, architects, landscape architects, sociologists, economists, and other consultants, and may enter into contracts for consulting services with any qualified person, firm, partnership, or association. The tasks of such consultants may include, but are not limited to, the preparation of all or any part of surveys, research, transportation and land use studies, urban renewal plans, technical services, and comprehensive planning for areas affected by any planned or existing highway corridor. Such consultants may be joined in an interdisciplinary joint development team for the preparation of a comprehensive joint development plan.

- (2) Contract with regional, municipal, or other jurisdictions or with other State agencies having adequate staffs, and with planning agencies of other States, for the preparation of transportation and land use studies, and other reports or other parts thereof, and may pay any costs incurred from funds available to the SHD.
- (3) Employ engineers, planners, architects, landscape architects, sociologists, economists, and other experts as part of the SHD to perform work related to joint development. Such personnel may be supplemented by university students working individually or taking part in an established university program.

(e) In furtherance of its joint development functions, the SHD may apply for and accept and receive funds, grants, and services from the Federal government or its departments or agencies or from State or local governments and their departments, agencies or instrumentalities or from private sources. The SHD may agree to such reasonable conditions and requirements as may be necessary in connection therewith.

Section 5. Authority to acquire and dispose of property for joint development of highway corridors.

(a) The SHD is authorized to acquire, for joint development purposes, either by itself or in conjunction with other governmental instrumentalities, land and property of every kind, public and private, and any right, interest, franchise, easement, or privilege therein, by purchase, lease, gift, devise, condemnation, exchange, or any other legal means. The SHD in conformance with the comprehensive highway corridor joint development plan and the local zoning regulations of the community affected shall have the authority to sell, lease, convey, transfer or otherwise dispose of any such land or property, including the fee simple or any lesser interest in airspace or air rights above or below any highway, to any private, public, or quasi-public corporation, partnership, person, or legal entity, regardless of whether such land or property has been developed, altered, or improved and irrespective of the manner or means by which it was acquired.

(b) The SHD may acquire interests in property required for future highway purposes or for the future development of any highway corridor in advance of actual construction programming, with such funds as are available for rights-of-way acquisition, whenever the SHD determines such acquisition is necessary to facilitate long range planning or to prevent economic hardship or higher acquisition costs occasioned by the improvement of such property immediately prior to its acquisition for highway purposes. Revenues received from any rentals or leases of any property so acquired, from the disposition of any improvements thereon, or from the proceeds of the sale of any excess parcels of property so acquired may be used by the SHD for highway purposes including the joint development of any highway in accordance with this Act.

(c) All land or property acquired for any purposes, authorized by this Act, or in connection with the exercise of any of the powers which may be granted herein, is hereby declared to be needed or taken for a public use.

(d) In carrying out this Act, the SHD shall, to the extent determined practicable, comply with and conform to all plans, regulations and planning and development objectives including zoning of the political subdivisions having jurisdiction to the governing bodies of the several cities, villages and towns and other political subdivisions, whose jurisdictions are affected by any proposed highway corridor, a comprehensive zoning plan and such changes or amendments or additions to the laws, codes, rules, regulations, ordinances, and administrative procedures and practices as are deemed reasonable for the joint development of the highway corridor.

Section 6. Conveyance, transfer, or permit to use land or other property, including airspace, not needed for highway purposes.

(a) The SHD may convey title to or permit the use of any lands or property owned or controlled by the State and acquired or used for the State highway system or for the joint development of highway corridors, provided that the property or interest so conveyed or made subject to a permit to use is not needed by the State for highway construction, does not impair the free and safe flow of traffic on the highway, and is exchanged for reasonable compensation. Such conveyance, transfer, or permit to use may include areas or space, on, above, or below the surface of the highway corridor, and may include easements or other interests in land for access to or the support of buildings or structures so constructed.

(b) The SHD may use any revenues, acquired by sale of joint development property, as provided for in this Act, to establish and maintain a fund to be used for highway purposes including joint development.

Section 7. Taxation of estates, rights, and interests in airspace.

(a) Where the fee simple or any lesser interest in airspace is conveyed or transferred by the SHD under the provisions of this Act, such interest shall be an interest in real estate and may be assessed for taxation purposes separately from the surface of the land below or above it.

(b) For the purpose of taxation, airspace, and buildings, structures, and improvements constructed or erected within such airspace, pursuant to a lease or permit, shall be deemed to be real property and be liable to assessment and taxation.

Section 8. Severability.

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If any provision, clause or phrase of this Act, or the application thereof to any person or circumstance is adjudged invalid by any court of competent jurisdiction, such judgment shall not invalidate the remainder of this Act, and the application thereof to other persons or circumstances shall not be effected thereby.



Appendix D

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relating to air quality and noise considerations)

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