Visual Prioritization Process

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As part of the design of every roadway or other corridor construction/reconstruction project, environmental concerns about the visual resources of the corridor need to be considered. Visual management guides for mitigation of the visual resources in corridor design vary with each governmental entity. Existing guidelines cover only planning, with little or no guidance for implementation. The result is often a final design consisting of an even distribution of mitigation measures over the entire corridor. The guides give little consideration to the design engineer being able to understand the process and the decisions made for the final design. There are variations in the significance of visual elements along a corridor. Available funding can be more wisely used and environmental concerns better met by varying the amount of mitigation in various sections along the corridor according to the visibility of proposed impacts. Numerical values based on formulas would not only help determine the variations between the sections but would also bridge the communication and understanding gap between the landscape architect and the engineer. This became the basis for the preliminary development of the Visual Prioritization Process (VPP). VPP is a planning and implementation guide for prioritizing units and visual elements along a corridor for mitigation and funding.

In 1988, Joanne Gallaher, a landscape architect with Wheat-Gallaher and Associates, was hired by the Coronado National Forest in Tucson, Arizona, to conduct a visual analysis and design the mitigation for the reconstruction of the nearby Mt. Lemmon Highway project (see Figure 1). Gallaher had experience with many visual resource management guides that were strong in planning the necessary level of mitigation for the area, but offered no guidance in the implementation of the mitigation. During the first phase of the project, she developed the Visual Prioritization Process (VPP) as a planning and implementation guide based on the Forest Service Visual Management System (VMS) (*1*) and other agency visual management guides for design. VPP recognizes that, within a visually managed area, variations of visual resources occur. Because of this, different levels of mitigation can achieve the same visual management objective. This approach is more cost-effective than a blanket or uniform mitigation treatment. VPP makes it easier to express the need for the mitigation to the design engineer and others in a manner they understand through the use of numerical scores to represent the variations.

After completion of the first phase of the Mt. Lemmon Highway, VPP was the recipient of a National Endowment of the Arts Federal Design Achievement Award and many requests were received for more information on the process. In 1989, Gallaher applied for Coordinated Federal Lands Highway Technology Implementation Program (CTIP) funding from the U.S. Department of Transportation, FHWA. VPP needed further refinement and distribution. The CTIP committee recognized that road construction and reconstruction projects are under ever-increasing scrutiny and criticism of aspects of environmental impacts and costs (see Figure 2). Providing measures in road projects to mitigate environmental concerns, including visual quality objectives, often threatens the economic viability of needed projects—especially in visually sensitive terrain. VPP was considered a means of achieving the necessary mitigation in a cost-effective manner. Based on this, VPP was chosen as a CTIP study. The study was to be conducted by an interagency task force of the CTIP agencies. CTIP agencies are U.S. governmental agencies that manage federal lands and highways, such as the National Park Service, Forest Service, FHWA, Bureau of Land Management, and Bureau of Indian Affairs. The Forest Service San Dimas Technology and Development Center (SDTDC) was chosen to manage this project.

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PROCESS REFINEMENT

For the CTIP study, Gallaher originally proposed to refine, develop, and distribute associated publications and visual aids, including videos, to facilitate use of VPP under a broader range of conditions by highway design agencies. As a start, further work was needed to refine the process to accommodate conditions not handled by the original formulas. Refinements relating to distances, angles, and rankings within the models were required. Gallaher stated that through the use of other publications—including FHWA's *Visual Impact Assessment for Highway Projects* (*2*)—comparisons and possible alterations could be made.

The following were the specific objectives to be met through the CTIP study:

1. Review VPP development, background, and use.
2. Review, redefine, analyze, and revise factors as needed to equalize the values. Add adjacent land use, such as campgrounds, trails, and residential development, as well as topographic analysis and "seen areas" to the matrix.
3. Review, analyze, and revise rankings, formulas, and calculations to standardize and validate the process. Investigate and develop the capability of weighting the various factors.
4. Ensure the applicability of VPP to other linear projects with visual management impacts, such as roads, trails, and utilities.
5. Develop a package for technology transfer of VPP, such as a publication, computer program, or slide/tape presentation to be distributed to CTIP agencies and others that may request it.

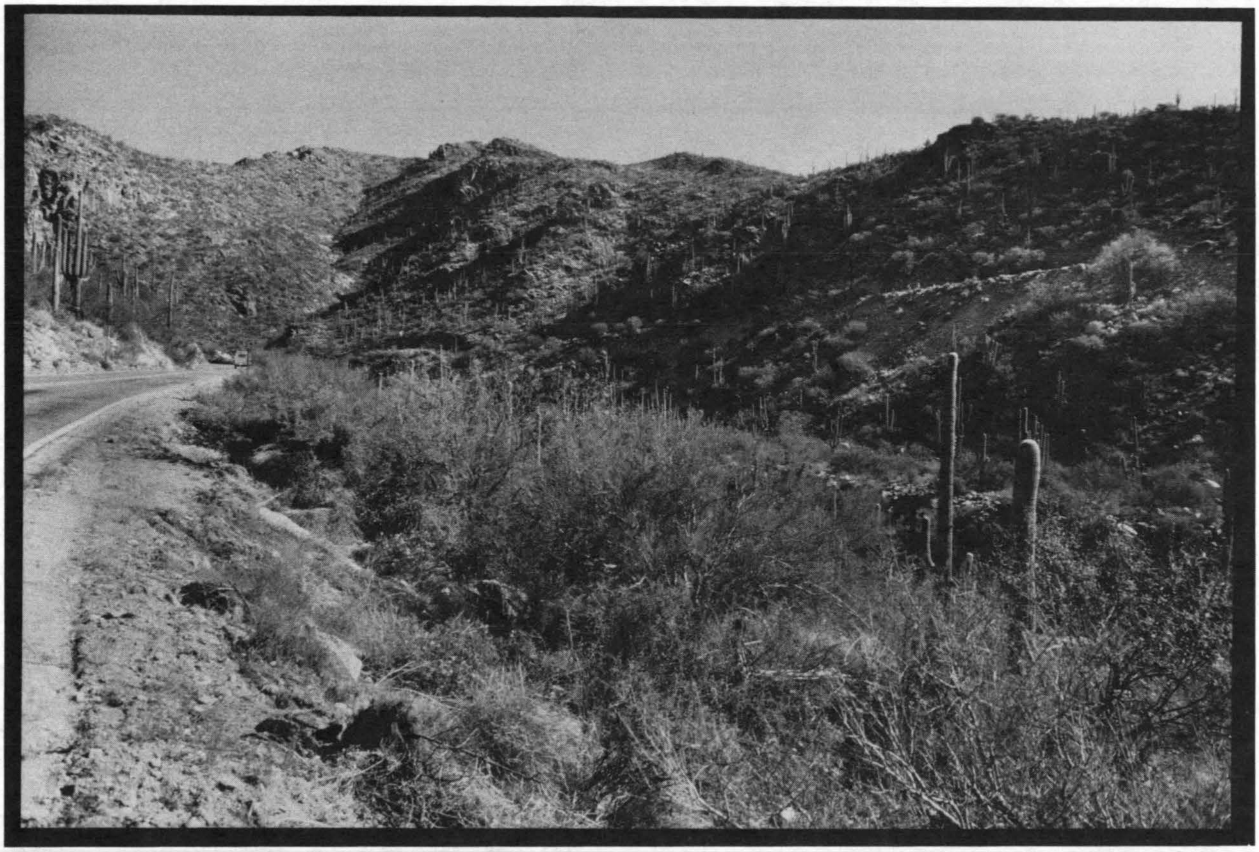

FIGURE 1 Mt. Lemmon Highway, Tucson, Arizona.

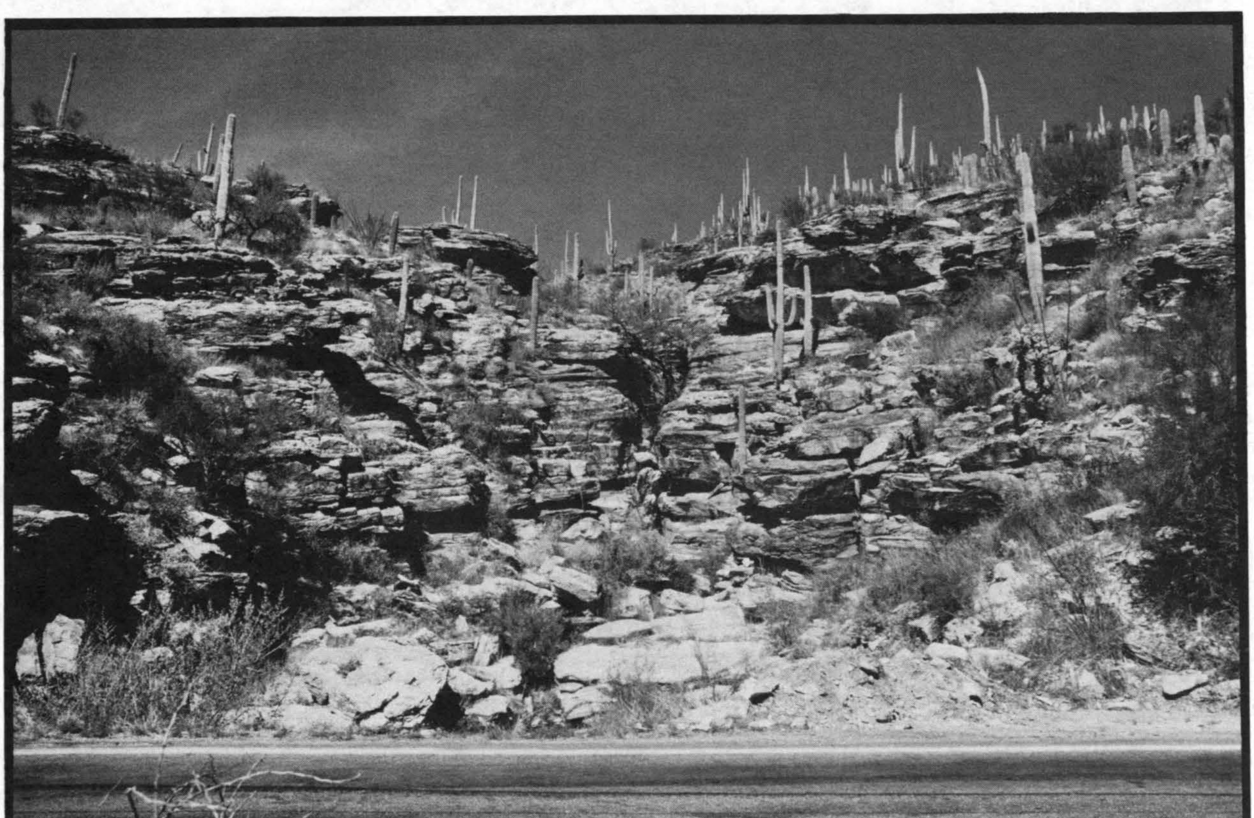

FIGURE 2 Mt. Lemmon environment, possible impacts.

FIGURE 3 Najavo bridge project.

VPP has been used on six different projects (see Figure 3). Landscape architects and civil engineers agree that VPP gives direction to a reasonable and effective mitigation approach. VPP gives guidance on distributing mitigation fairly by showing areas that need more mitigation and those that need only the minimum level. Other guides only help to determine the visual objective, resulting in a homogeneous mitigation. This often results in excessive mitigation in some areas and under mitigation in other areas. At the design level, VPP results in varying mitigation levels that are balanced between the visual objective and the funding available. At the planning level, VPP is used to guide the project's alternative selection and preliminary design, which also leads to less required mitigation. VPP successfully links land management planning to project design and implementation and construction. Because VPP uses numerical scores, it is much easier to communicate where the mitigation is needed and why.

KEY POINTS OF CONCENTRATION

The initial step of the study was to form an interagency task force. Those who were requested and agreed to become members of the original task force were

- Joanne Gallaher, Landscape Architect, Coronado National Forest;
- Mark Taylor, Civil Engineer, FHWA;
- Tom McGovern, Civil Engineer, McGovern, MacVittie, Lodge & Dean;
- Jill Easley, Landscape Architect, Colorado Highway Department;
- Gary Johnson, Landscape Architect, National Park Service;
- Steve Galliano, Landscape Architect, Forest Service-Southeastern Region;
- Bill Makel, Forester, SDTDC; and
- Lola Mason, Civil Engineer, SDTDC.

The original one-page description of VPP has been developed into a user's guide (*3*) (unpublished data) with four accompanying case studies in mountain, urban, and rural United States settings. The task force concentrated on enhancing VPP in four key areas.

1. The formulas used in VPP. By incorporating standard formulas, VPP would become easier to understand and develop into a software package. In addition, design engineers might be able to use this numerical approach.
2. The use of references to other visual management manuals. It was important for agencies to feel comfortable using VPP and references for how VPP can be used with other processes.
3. The use of VPP nationwide. It was important to concentrate on incorporating the southern and eastern areas of the United States. Most visual resource manuals are based

on conditions found in the West, which can be very different from the East in terms of visual management.

4. The need to incorporate all the steps of corridor planning. Originally, the description of VPP concentrated on the variables and values used to prioritize the visual elements and units during design. The guide had to cover all the steps from area-wide planning to corridor construction.

The draft of the user's guide will be sent to landscape architects and engineers in various agencies throughout the United States for peer group review. The comments will be incorporated into the final publication.

VPP USER'S GUIDE

The initial work of the CTIP project was to enhance the process and write a user's guide. The guide needed to be written so that it could either be incorporated into other agencies' visual resource management guides or be used as is. To meet this need, the manual would cover both planning and implementation.

The planning process was developed in accordance with the Forest Service VMS (*1*). Like many other agency guides, VMS is a large-scale visual inventory and management process. It is used to inventory and analyze existing visual resources and then determine management objectives (see Figure 4). The frustrating aspect for landscape architects and engineers is that these agency guides result in an overall objective but no guidance on implementation. The design becomes a single mitigation measure for the entire corridor without taking into account that the visual resources are not homogeneous. This typically results in a cost-prohibitive design.

VPP incorporates the planning process to determine a visual management objective based on existing funding resources. It also can be used to inventory and analyze proposed visual resources based on the engineer's proposed design. What sets VPP apart from other visual management systems is that it can be applied to the project-level implementation stage. It is a means of numerically showing and comparing the proposed impacts to the importance of visual resources within units along the corridor.

Units are sections making up the corridor that consist of similar significant visual resources. Priority levels can be assigned to the proposed visual elements within units, based on the numerical values. Mitigation measures can then be varied, based on the priority levels, yet still guarantee that a minimum level of mitigation is always met (see Figure 5). In this manner, the visual objective can be achieved with varied levels of distribution, resulting in a cost-effective design that meets the visual goals of the project. As stated in the user's guide,

> The project level implementation phase of VPP allows the designers (i.e., civil engineers, planners, and landscape architects)

FIGURE 4 Various existing visual resources.

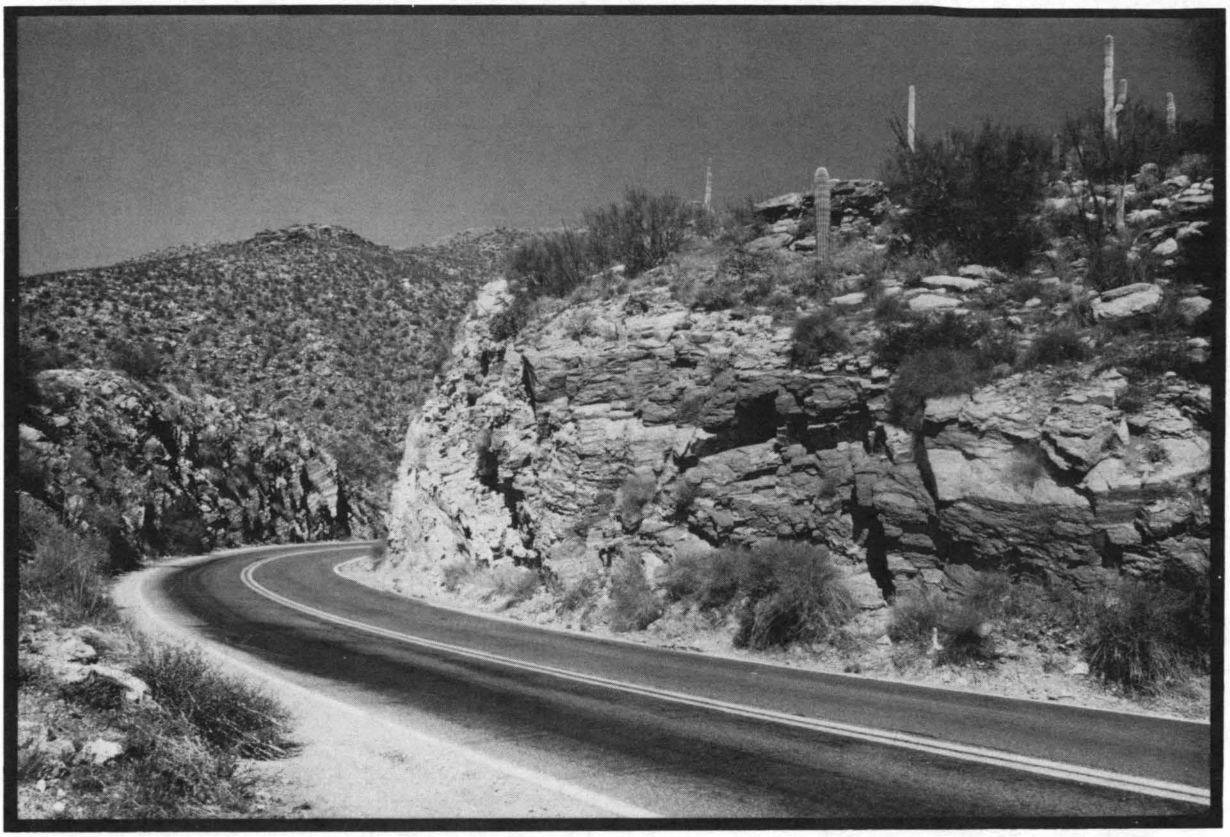

FIGURE 5 Mitigation measures for specific area.

to assess their design in regards to visual resource impacts, modify the design, and incorporate mitigation measures to lessen the impact. By prioritizing areas along the corridor, the designer can allocate the budget proportionately for mitigation measures based on highest importance per dollar. VPP creates a design process which balances the work of the civil engineer with that or the landscape architect and the objectives of aesthetics with those of safety and cost.

The manual is written in three sections based on the process phases. The phases are area-wide planning, corridor- or project-level planning/design studies, and project-level implementation. The manual also includes four case studies. The first case study is the Mt. Lemmon Highway, located in the mountainous, arid region of the southwestern United States. It is an example of how VPP can be used only to prioritize mitigation for cuts and fills, the most significant visual impacts on the project. The second case study is the Navajo Bridge, located in the high plateau, arid southwestern region of the United States. It is an example of how VPP can be used for all visual impacts proposed on the project. The third case study is River Road located in Tucson, Arizona. It is an example of how VPP can be used for all visual impacts on a project in an urban area. The fourth case study is the Natchez Trace, located in the southeastern region of the United States. It is an example of how VPP can be used to compare two alternatives, a bridge and an at-grade road.

For all the case studies, VPP gave much more insight than traditional guidelines on where highly sensitive visual units were located. This helped during discussions with the engineer on various proposed designs and specific changes that would benefit the project visually. VPP was extremely helpful in deciding between alternatives. It measures the proposed impact on existing visual resources, as well as the addition of proposed new visual resources. It was also extremely helpful in determining the impacts on possible funding reductions. The numerical values of each section quickly and easily displayed why the mitigation funding was necessary to meet visual management objectives. Mitigation varied in line with natural variations of each area. As a result, the trade-off from a reduction in mitigation funding could be evaluated.

PHASE 1—AREA WIDE PLANNING

The initial phase of VPP is the area-wide planning and determination of the visual management objective or the visual goals for the project area (see Figure 6). Many times, this phase is completed with no planned corridor project but with the possibility of future projects in mind. The four steps in this phase are directly from the Forest Service VMS. Other agency systems have very similar steps, which are in the user's guide. The steps encompass determining the natural, cultural, and historical resources of the area; defining the uniqueness of the visual elements; defining the concerns of the user; and defining the management objective for the visual resources.

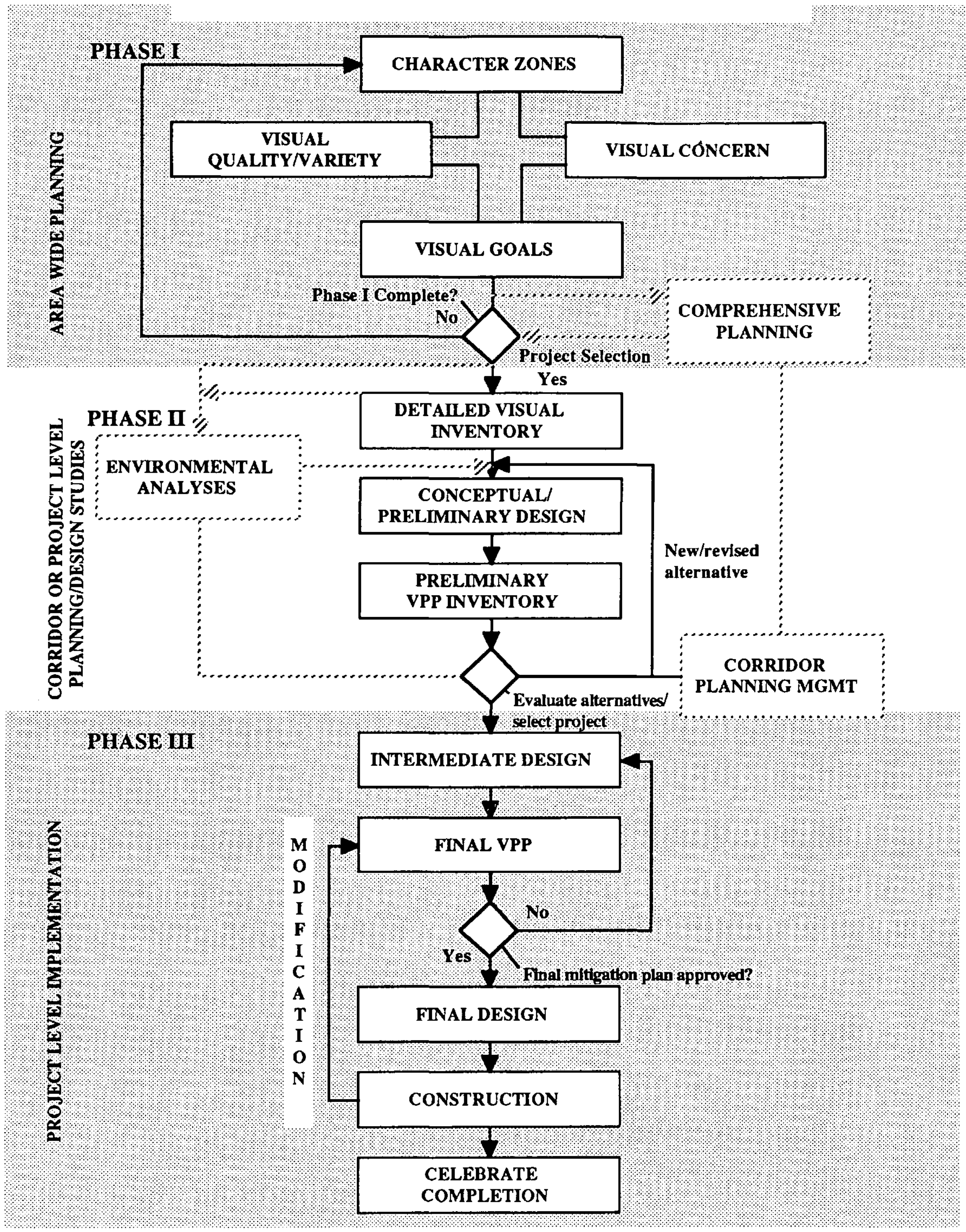

FIGURE 6 VPP flowchart.

As part of the first phase, the comprehensive planning for the area would be considered; this would include management zoning, land management planning, and any capital improvement programs. Other resource inventories previously performed for the area would be considered. This phase is a part of most visual management guides for design and must be completed to successfully accomplish the remainder of the process.

PHASE II—CORRIDOR OR PROJECT LEVEL PLANNING/DESIGN STUDIES

The results of the first phase—the definition of the existing visual resources and visual goal—are used in the second phase, called the corridor- or project-level planning/design studies (see Figure 6). During this phase, designs of route alternatives are considered and compared. Typically, for corridor designs, the visual analysis is not adequately considered until after the engineering design alternative is chosen. The visual analysis performed during this phase could be valuable input to the engineering design and potential alternatives and mitigation costs derived later. The evaluation of the alternatives could then be based on the necessary mitigation and funding for the visual management as well as for the corridor design. During this phase, it is critical that a strong communication link be maintained between the landscape architect and engineer. Each party must understand the other's analysis and design of each alternative.

During this phase, input from the environmental assessment (EA) or environmental impact statement (EIS) would be included. An EA or EIS is a report covering an investigation into the effects of a construction project on the environment in that area. It is a requirement for all U.S. governmental agencies to document environmental concerns to determine that all environmental rules and regulations will be met. There are three steps in this phase: determining the site-specific resource inventory; designing the preliminary designs or route alternative; and determining a preliminary inventory, which is the basis for the numerical scores.

The preliminary inventory is used to determine the prioritization and estimated costs for the units along the corridor, based on the new visual elements and loss of existing visual resources resulting from each preliminary design or route alternative being considered (see Figure 7). There are 10 tasks that basically cover the completion of several forms and the validation and use of the forms' numerical scores. The tasks begin with listing the significant resources and defining the variables and values for the numerical scores (see Table 1). The variables are determining viewing distances (see Table 2 and Figure 8), calculating visual element sizes, determining horizontal and vertical viewing angles, calculating length of viewing time, and determining visual element backgrounds.

At this point, forms are used to list each visual element and its variable values, which are totaled to determine Visual Priority Levels (VPLs) and Unit Totals (UTs). These values are then field verified (see Figure 9). From the unit totals, the Total Visual Change (TVC) and the Net Visual Change (NVC) are calculated. Mitigation measures are designed and distributed throughout the project according to combinations of some or all of the following factors:

- Units where TVC and NVC are highest;
- Units where significant positive and neutral visual elements that will be lost are highest;
- Units where detrimental new visual elements are highest;
- Units where highest visibility will occur (highest VPLs per negative element), where opportunities for enhancing positive elements and views remain, and where increasing visual quality and variety are greatest;
- Units where visual concern is highest; and
- Each element or unit's importance/cost with the ranking (total unit value) being the importance. The higher the importance/cost, the wiser the use of funds.

The level of mitigation measures distributed shall not be less than the minimum level required to meet visual goals. The tasks are completed with a preliminary cost estimate and evaluation of the overall mitigation plan.

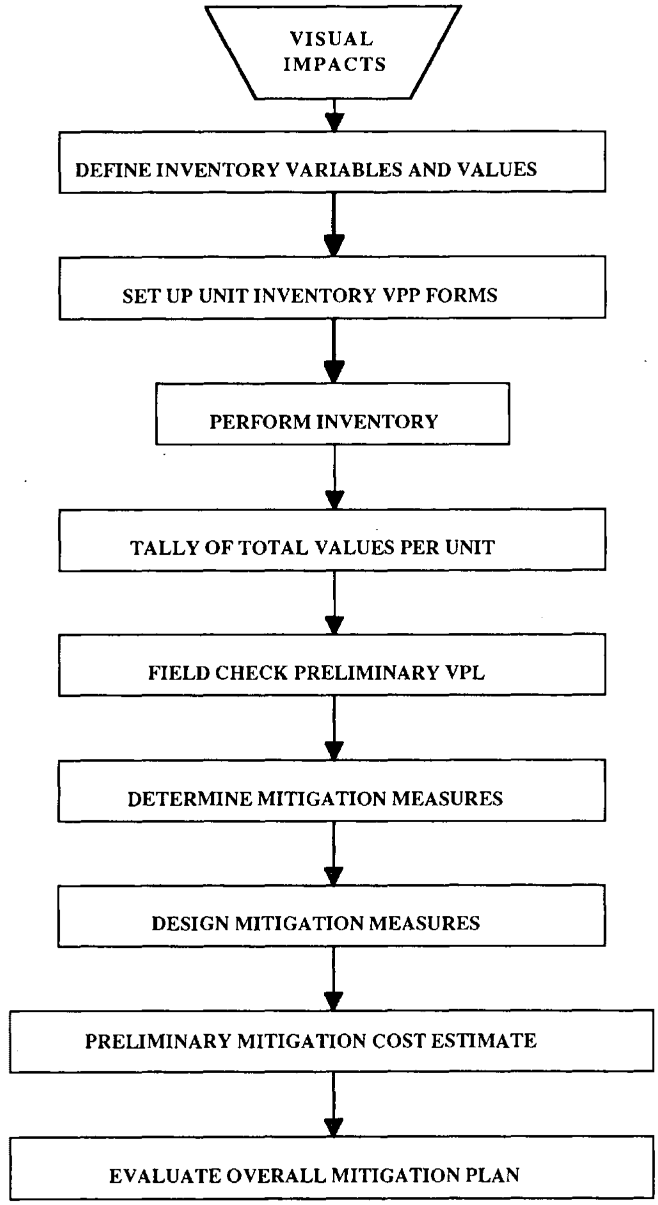

FIGURE 7 VPP preliminary inventory flowchart.

This completes the second phase. Before going on to the third phase, the alternatives need to be evaluated and a design or route alternative selected. The EA or EIS should be complete and included in the evaluation. During the evaluation, the decision may be made to design a new alternative or revise an existing one. As part of the evaluation, the planning and management of the corridor will need to be considered. This includes planning the road system or utilities and future routes on the corridor.

PHASE III—PROJECT LEVEL IMPLEMENTATION

After an alternative is selected, the third phase, project-level implementation, begins (see Figure 6). There are five steps, beginning with the detailed work on the chosen alternative. The design engineer and landscape architect need to work

TABLE 1 Inventory Variables and Numerical Scores

INVENTORY VARIABLES	NUMERICAL SCORE
1. Distance from the viewer:	N/A
Foreground: up to 660' (1/8 mile)	
Middleground: 1/8 mile to 3 miles	
Background: 3 miles and greater	
2. Magnitude:	
0 - 600 sf	1
600 - 4,000 sf	2
4,000 sf+	3
3. Angle of the view:	
46 degrees - 90 degrees	1
16 degrees - 45 degrees	2
0 degrees - 15 degrees	3
4. Duration of the view:	
0 - 7 seconds (less than or equal to 300')	1
7 - 12 seconds (300' - 500')	2
12+ seconds (500'+)	3
5. Silhouette condition:	
No silhouette	0
Background is vegetation	1
Background is sky	2
6. Aspect:	
Angles flat to away from viewer	1
Angles 45 degrees to flat	2
Angles vertical to 45 degrees	3

closely through this step so that each has a chance to determine design and funding changes that will result from the other's design changes. The phase continues with the final determination of the prioritization of the units, which is the basis of the final mitigation measures and is similar to the third step of the second phase.

The final mitigation plan goes through approval. The approval is mainly based on evaluation of the mitigation costs and how well the goals are met. At this point, the fine tuning between the engineering design and visual management concerns should occur. The final design, which incorporates the concerns of engineering and visual management, is completed and is now ready for construction. Construction impacts are evaluated with the understanding that new field conditions may arise that may not have been addressed previously. New decisions can be made to ensure that the goals are being met consistently. Modifications may need to be made, which could be based on the previous inventory.

SUMMARY

VPP is a means of meeting a corridor area's visual management goals, while targeting project mitigation and funding by

TABLE 2 Determination of Distance Zones

DESIGN SPEED (mph)	FOCUSING DISTANCE (ft)	ANGLE OF VISION (degrees)	PERIPHERAL ANGLE (degrees)
30	800		
40	1,100	37	60
50	1,400	29	55
60	1,800	20	45

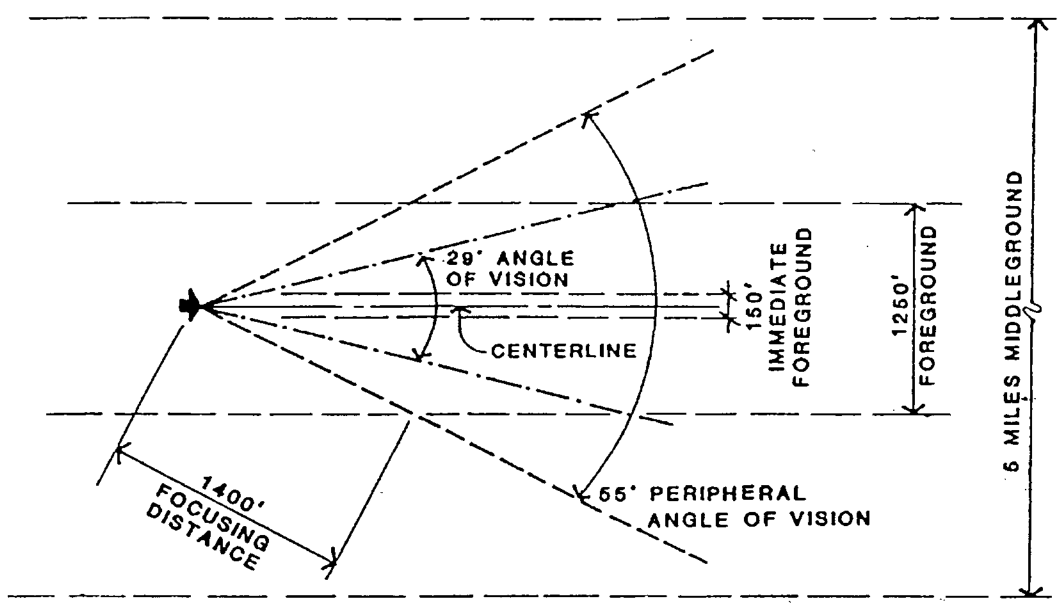

FIGURE 8 Determination of distance zones.

UNIT VPP INVENTORY—NEW VISUAL ELEMENTS

UNIT NO. A, B

STATION	MAGNITUDE				ANGLE HORIZONTAL				ANGLE VERTICAL				DURATION/ VISIBILITY				SILHOUETTE				ASPECT				SUB TOTAL	TOTAL/ ELEMENT
	I	F	M	B	I	F	M	B	I	F	M	B	I	F	M	B	I	F	M	B	I	F	M	B		
CUTS																										
A1 1 + 00 - 2 + 00	1	2			1	1			2	2			3	2			2	2			3	3			24	
A2 2 + 25 - 3 + 50		2	3	1		3	1	2		3	2	3		1	3	3		2	1	3		3	3	3	42	
B1 4 + 00 - 4 + 50	1	1			2	1			1	3			1	1			1	2			1	1			16	82

VISUAL PRIORITY LEVELS—NEW ELEMENT RATINGS

CUT RANKINGS			FILL RANKINGS			BRIDGE RANKINGS			WALL RANKINGS			STRUCTURE RANKINGS			VIEW RANKINGS		
SCORE	SPECIF AREA	VPL	SCORE	SPECIF AREA	VPL	SCORE	SPECIF AREA	VPL	SCORE	SPECIF AREA	VPL	SCORE	SPECIF AREA	VPL	SCORE	SPECIF AREA	VPL
42	A2	1															
24	A1	2															
16	B1	3															

UNIT TOTALS

UNIT	SPECIF AREA	CUT	VPL	FILL	VPL	WALLS	VPL	BRIDGE	VPL	NAV COMM AREA	VPL	STUCTURES	VPL	CUMULATIVE UNIT TOTAL NEW	LOSS
A	1	24	2												
	2	42	1												
UNIT TOTAL		68												68	
B	1	16	3												
UNIT TOTAL		16												16	

FIGURE 9 Three forms for determining priorities.

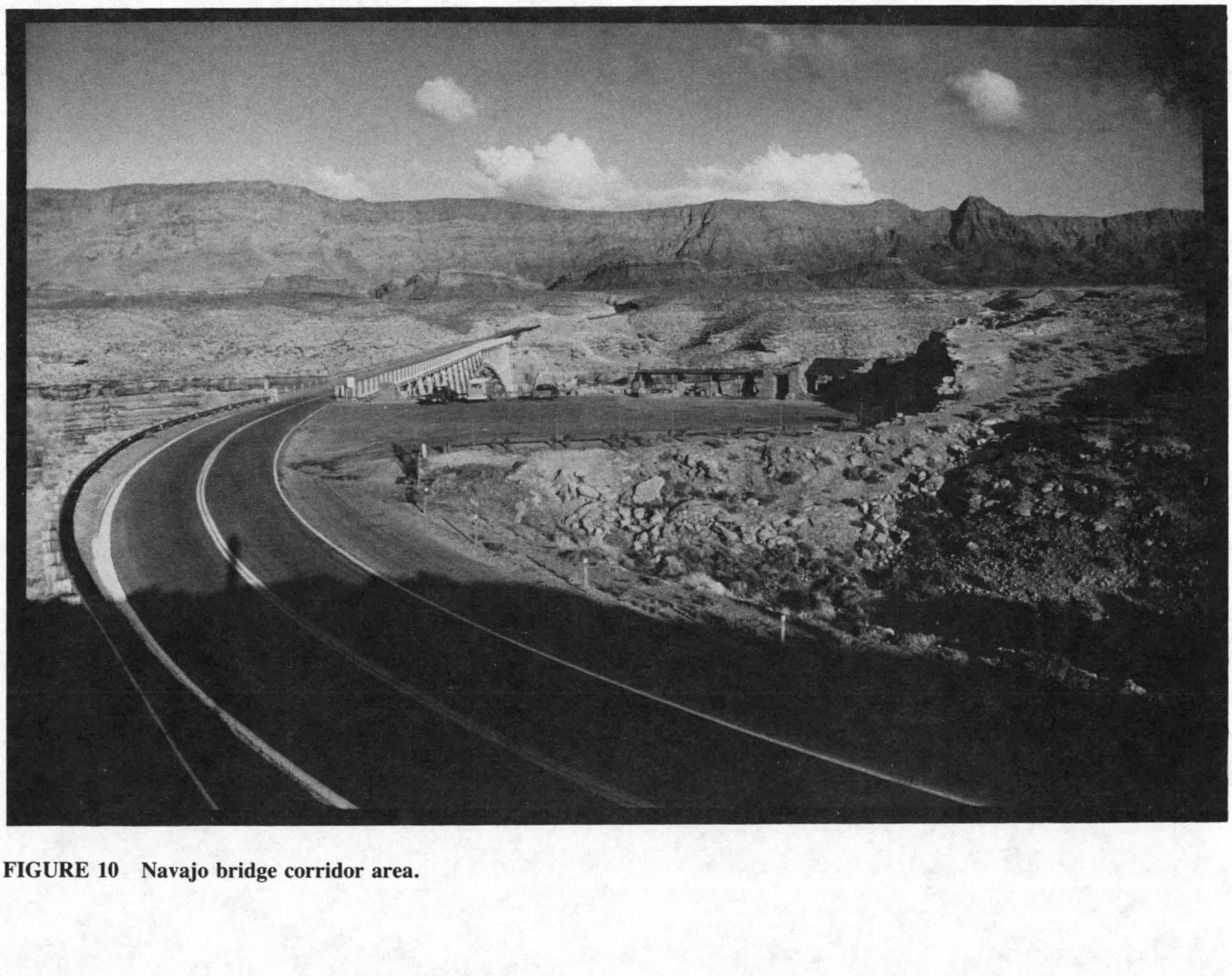

FIGURE 10 Navajo bridge corridor area.

recognizing variations in resources within the corridor area (see Figure 10). VPP is also a means of increasing communication and understanding of the design engineer concerning the visual management concerns along a project corridor. VPP is broken down into three phases, which cover the entire process of a corridor project. Phase I is the area wide planning, which documents the area's visual resources, visual management concerns and objectives, and the public's concerns. Phase II is the corridor- or project-level planning/design studies, which detail corridor alternatives, significant new elements, and lost resources to determine preliminary design mitigation and cost estimates. From this information, alternatives are evaluated and the best, considering engineering and visual management concerns, is chosen. Phase III is project-level implementation, which is the completion of the engineering and landscape architect design for construction, including any possible modifications during construction. VPP can be completed in its entirety or only through the initial phase, with the others completed later. VPP can be an excellent tool in completing any corridor project from both the engineering and visual management aspects. Various government entities may want to consider including VPP as an addition to their visual management guides for design.

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