H. CASE STUDIES

The following is a selection of case studies that illustrate application of the principles and thought process behind CSD/CSS. The case studies were assembled from materials and interviews conducted with pilot state representatives, as well as with other agencies contacted during the research project. The case studies are geographically diverse. They illustrate a wide range of project contexts, from rural roads to urban streets. They demonstrate that one can be context sensitive when dealing with a freeway, an arterial, or a local road. In one case, they show that the mission of a transportation agency can and should go beyond providing for safe and efficient transportation. They represent both small projects and substantial efforts.

Most of all, the case studies show how project success can be achieved by following the framework discussed here, and applying the right resources to solve a problem.
CASE STUDY NO. 1

MERRITT PARKWAY GATEWAY PROJECT
GREENWICH, CONNECTICUT

SETTING

The Merritt Parkway (The Parkway) was constructed in the 1930s and opened to traffic in 1940. The facility, a four-lane divided arterial highway, was originally designed and continues to function as an essential component of Connecticut’s transportation system.

The Parkway has long been recognized for its unique design features and scenic character. Its park-like setting, majestic bridges, and scenic landscaping make it a distinct and appreciated asset to the state. The bridge architecture utilizes motifs that were popular in the 1930s, including Art Moderne, Art Dec, Classical, Gothic, and Renaissance.

The Parkway was placed on the National Register of Historic Places in 1991, and in 1993, was designated a State Scenic Road. In 1996, it achieved designation as a National Scenic Byway.

When first constructed, the land use through which the Parkway was built was primarily rural, agricultural, and open space uses. Over time, the landscape has matured and changed. Development has occurred in the vicinity of the Parkway, bringing with it both increased traffic and residences near the Parkway.

Both the volume of traffic and its character and operations have changed over time. The Parkway now carries traffic in excess of 50,000 vehicles per day in some segments. Originally designed for speeds prevalent in the 1930s (35 to 40 mph), it now operates at speeds in excess of 60 mph, and with greater density of traffic. The Parkway has evolved into now serving as a commuter route.

Not surprisingly, the substantive safety history of the Parkway has become an increasing concern to the Connecticut DOT. Both the terrain and context, as well as the character of the original design, produce relatively high risk of severe roadside collisions with obstacles such as trees and rock outcropping. Shoulders are typically only 2 feet wide, and clear areas and offsets to fixed objects generally less than 6 feet. The narrow median was not originally designed with a physical barrier. The heavier traffic and speeds greater than the Parkway was designed for are also issues of concern.

From 1986 through 1990, there was one reported crash every 8 hours, one injury every 20 hours, one fatality every 52 days, and a guide rail struck every 36 hours along the 38-mile corridor. This alarming history of both frequent and severe crashes indicated a need for action.

PROBLEMS TO BE SOLVED

The problems to be solved were improving the safety and operational efficiency of the Parkway while maintaining its unique and valued characteristics. Related to these problems were resolving the long-term role of the Parkway relative to development and its attendant pressures, and with respect to other transportation system features in the area.

These problems were articulated in a series of questions and issues developed by a stakeholder working group that was convened by the Connecticut DOT.

- The Parkway’s future as it relates to its capacity to carry vehicles cannot be separated from the land uses allowed or encouraged by local zoning entities and towns.
• Pressures for an expanded transportation facility and the desire for increased local development are not separate and unrelated. The future of the Parkway was viewed as being inextricably driven by the land use decisions made by towns and others.

• A fundamental question to be resolved (a choice to be made) was stated simply – Is the Merritt Parkway a major transportation facility or is it simply a beautiful place?

The project in which these issues were addressed involved the development of guidelines for resurfacing, safety improvements, and enhancement projects for the Parkway. These guidelines would in effect provide firm direction for the scope, nature, and types of improvements considered appropriate for the Parkway over the long term.

STAKEHOLDERS
• Connecticut Department of Transportation
• Fairfield County, CT
• Merritt Parkway Working Group (comprised of DOT staff in engineering, traffic, landscape design, maintenance, construction and planning; outside experts in architecture and preservation)
• Local town officials
• General public

CSD/CSS APPROACH

Much work and many meetings were held to wrestle with the conflicting issues of providing for safety (and in particular, roadside safety) and maintaining landscaping and other visual features. Extensive research was conducted, including thorough site reviews and interviews with the original landscape architect, W. Thayer Chase, to fully understand and confirm his philosophies and intentions.

Deliverables to be used by the DOT included ‘Merritt Parkway Guidelines’ and ‘A Landscape Master Plan For the Merritt Parkway.’

DESIGN FLEXIBILITY AND THE APPLICATION OF DESIGN CRITERIA

The Connecticut DOT, through its Merritt Parkway Working Group, in effect established corridor-specific design criteria that reflected the consensus best efforts to balance safety and aesthetic considerations.

• The DOT chose a design speed of 60 mph for the facility, intending to post a 50 mph legal speed limit.

• The DOT chose not to view the Parkway as a route to be used for increasing through regional east-west capacity.

• The DOT chose to address the safety issue by focusing primarily on roadside crash severity. Design solutions (see attached typical sections) incorporated 4-foot shoulders and enhanced crash tested barrier systems that were visually less obtrusive than standard guiderail. Barrier or rail was placed in the median depending on the presence of mature trees, which for the most part were retained. Some rock outcroppings were selectively removed, but the general overall roadside character was retained.

Note that, were this a new freeway or expressway, or a similar route in a different context, the DOT would apply more stringent design criteria for the roadside. The AASHTO Roadside Design Guide suggests up to 30 foot clear as a target dimension from the edge of pavement, with mild slopes and free of obstacles. Such a design, or use of continuous barrier, was not considered appropriate for the context of the Parkway.

Part of the design process was the development of a new, aesthetic median barrier. To be acceptable, the barrier needed to pass vehicle crash tests based on criteria established in NCHRP Report 350, which specifies speeds, angles of collision, and vehicle types, as well as defines success or failure in the testing. The DOT also selected a steel-back timber guide rail system after researching many other systems. This unique system was also crash tested to assure conformance with NCHRP Report 350 criteria.
Finally, detailed studies of crash types and locations were performed. Based on these studies, selected high risk trees were removed, or identified for preservation, but with protection afforded them.

As projects have been implemented, the DOT has monitored their performance. A key measure, improvement in safety, has been successfully addressed. Although the frequency of crashes has not decreased, the severity has. In fact, this outcome could have been expected, as the placement of improved barrier systems is intended to address severity and not crash frequency.

STAKEHOLDER INVOLVEMENT

The Working Group recommended establishment of a Merritt Parkway Advisory Committee. This group would review actual design and other plans and assure their conformance with the guidelines and master plan. (It was noted that in some cases direction was vague, and in others contradictory. Location-specific interpretation required some discussion.) Issues of long-term roadside maintenance were reviewed and some changes made as a result.

Community involvement was extensive during development of the guidelines and master plan. Elected officials helped identify key stakeholders. Issues of invasive species, noise attenuation, visual effects, and loss of privacy were discussed. Techniques included development of renderings to illustrate design and landscaping concepts.

One group of stakeholders that in retrospect should have been included but was not initially was construction experts. The close working areas and special design features created unforeseen problems when the actual individual projects were implemented. Based on construction experiences, minor changes in design of curbing, rock outcropping removal, and other features were made for future projects.

Public information meetings and workshops were held to explain the vision and the approaches. These served to further highlight the attention of the general public on the Parkway, its future, and the need for improvements.

LESSONS LEARNED

This case study shows the importance of arriving at a vision or framework for problem solving before developing the solution. In the case here, articulating what the Merritt Parkway was (and was not) was necessary before beginning design investigations.

Another lesson learned was the importance of being flexible in the development and use of design criteria. Also, addressing a safety problem with specific actions is illustrated here. The key safety problem, severity of roadside crashes, was directly addressed through a series of treatments. Also note that a realistic view of what could be accomplished (a choice of aesthetics over safety) should be a part of overall thinking and solution development.

A final lesson learned was the importance of involving construction and maintenance staff in the development and evaluation of solutions.
MINNESOTA TH 61
NORTH SHORE SCENIC DRIVE

SETTING
Minnesota’s Trunk Highway 61 (TH 61), North Shore Scenic Drive, runs northeasterly along the rocky and heavily forested edge of Lake Superior, for more than 150 miles, from the regional trade center of Duluth to Canada. TH 61 is both a scenic highway and tourist destination, as well as a vital interregional and international trade corridor for northeastern Minnesota. As such, it passes through 19 small communities, large tracts of state and national forest resources and recreation areas, eight state parks, numerous rivers, streams, historic sites, markers and points of interest, many safety rest areas, wayside parks and campgrounds, an Indian reservation, and a national monument.

Visitors who travel along the North Shore Scenic Drive hope to experience the magnificent landscapes, the cascading rivers, the rugged shorelines, and the breathtaking vistas along with the other natural and cultural resources and history that abound along this Lake Superior region. The characteristics that draw visitors to this region are so unique that Minnesota’s TH 61 North Shore Scenic Drive was recently designated and distinguished as an “All-American Road” in the National Scenic Byways Program.

PROBLEM TO BE SOLVED
TH 61 required reconstruction to replace the pavement. The basic cross section of two lanes each direction of travel was sufficient, but an effort was made to upgrade the facility to modern design criteria.

The challenge in doing so was to develop an alignment that met the needs of both visitors to the area as well as local residents and business owners. Aside from being a tourist and recreational driving destination, within an environmentally challenging area, the North Shore Scenic Drive must provide adequate safety, mobility, and access for local residents, businesses, recreation areas, and commercial trucking while accommodating bicyclists, pedestrians, and rail crossings. Balancing transportation, community, environmental, and stakeholder needs along this corridor was a tremendous challenge.

STAKEHOLDERS
The overall project required coordination with 19 communities, state and national forests, eight state parks, and an Indian reservation. For this segment of TH 61 North Shore Scenic Drive, coordination with local residents and business owners, the community of Good Harbor Bay, and a state park was necessary.

CSD/CSS APPROACH
Minnesota’s approach to the project focused on stakeholder involvement to fully understand all issues, flexibility in application of geometric design criteria, a commitment to avoid rather than mitigate adverse impacts, and to look for opportunities to enhance the project given its unique characteristics.

The Minnesota Department of Transportation’s (Mn/DOT’s) reconstruction and realignment of TH 61 along Lake Superior’s Good Harbor Bay illustrates a context sensitive design approach that balanced transportation, community, and environmental needs without requiring exceptions to geometric
design standards. This project also illustrates context sensitive design that did not arise out of contentious public involvement and controversy but rather out of proactive project management and involvement of stakeholders.

**Design Flexibility and the Application of Design Criteria**

The project designers and stakeholders applied the flexibility already inherent in the AASHTO Green Book by selecting a 55 mile per hour (mph) design speed rather than a 70 mph design speed that was initially selected and used for preliminary alignment investigations. The lower design speed was considered appropriate for the project’s unique circumstances (transportation needs, terrain, land uses, valued resources, etc.) and maximized the flexibility to find the best roadway alignment balance point among the corridor’s safety, mobility, social, economic, and environmental goals.

Mn/DOT referenced both the AASHTO Green Book and the ITE Traffic Engineering Handbook as technical information supporting their selection of a lower design speed.

The specific effects of a lower design speed were to allow the highway alignment to be shifted and design flexibility to be accomplished without the need for exceptions to geometric design standards. Full lane widths and shoulder widths and appropriate roadside design for safety was possible for the alignment based on the lower design speed. Finally, the effect of the lower speed resulted in Mn/DOT saving considerable construction costs by avoiding extensive rock cuts.

**Stakeholder Involvement**

Mn/DOT’s District One staff made key commitments early in the project development process:

- To work closely with local communities and stakeholders to establish a highway corridor vision . . . a safe and aesthetic highway that enhances the local communities through which it passes.
- To make context appropriate design decisions along this corridor.
- To apply design flexibility to preserve historic, natural, and scenic corridor qualities.

Meetings and discussions with the stakeholders resulted in an articulation and common understanding of these transportation, community, and environmental stakeholder objectives:

- Improve roadway safety and traffic flow.
- Meet current and future transportation demands.
- Improve pavement quality.
- Improve an existing limited-use safety rest area facility.
- Minimize right-of-way and construction impacts and costs.
- Remain consistent with north shore corridor visioning and management goals.
- Enhance the scenic and visual qualities of the corridor.
- Preserve historic and traditional views and vistas from the highway.
- Preserve and enhance public access to the lakeshore.
- Avoid adverse impacts to residential and commercial property owners.
- Avoid adverse impacts to the environment and state parkland.
- Reduce erosion along the lakeshore and Cutface Creek.

"Above minimum design values should be used where feasible, but in view of the numerous constraints often encountered, practical values should be recognized and used."
Design Enhancements – Fitting the Context

The alignment shift enabled the design to avoid conflicts that would have required mitigation. Specifically, impacts to a state park and relatively high cost and visually obtrusive rock cuts were avoided.

Mn/DOT went beyond avoidance, though. Consistent with Mn/DOT’s context sensitive commitments and proactive stakeholder involvement, consensus was reached in determining project purpose and need to balance transportation, community, and environmental objectives. Specifically, a consensus was reached that selecting a lower design speed appropriate for the project characteristics would provide the flexibility to shift roadway alignment and balance project objectives without requiring exceptions to geometric design standards. As part of the overall project, given the vision of the stakeholders and importance of the route as a resource, Mn/DOT seized the opportunity to enhance the environment by the following actions:

- Alignment shift provided additional space to enable the expansion and reconstruction of the Cutface Creek Rest Area.
- Mn/DOT undertook the stabilization of a shoreline erosion problem.
- Cutface Creek bank stabilization was accomplished.

LESSONS LEARNED

This project demonstrates the importance of establishing key basic design criteria consistent with the context. It also demonstrates a not well understood principle, that lower design speeds in rural areas need not be considered less safe than higher design speeds.

Other lessons learned include the importance of working closely with stakeholders, and taking the opportunity to not only mitigate or avoid, but to enhance the environment as part of design and construction of a transportation project.

An overriding lesson learned was that proactive project management and stakeholder involvement, in combination with appropriate and context sensitive design flexibility, accomplished project benefits that might otherwise be foregone:

- Geometric standards for the design speed were met without exceptions.
- Safety and mobility improvements were added with the alignment shifts.
- Right-of-way impacts and costs were minimized.
- Unnecessary construction impacts and costs were minimized (rock cuts, disposal, etc.).
- The goals of the scenic north shore corridor vision were met.
- Original and valued vistas of Lake Superior were preserved.
- Public access to the lakeshore was preserved and enhanced.
- Improvements to the limited-use safety rest area were added.
- Eroding areas were stabilized along the alignment shift.
- State park impacts and rock cuts were minimized by the alignment.
- The alignment fit the land forms and context physically and visually.

The application of appropriate and context sensitive design flexibility during project development led to a successful balance of transportation, community, and environmental needs that are served by the constructed project. The constructed project also met four key measures of design excellence: 1) community acceptance, 2) environmental compatibility, 3) engineering and functional credibility, and 4) financial feasibility.
CASE STUDY NO. 3

MARYLAND ROUTE 108

SETTING

Maryland Route 108 is a two-lane major arterial in Olney, Maryland, a suburb of Baltimore. It is one of two major highways providing principal access to and through the Olney area. The roadway widens to a four-lane section between Homeland Drive and Hillcrest Avenue. Major signalized intersections within the corridor are at Olney Mill Road, Maryland Route 97, Prince Phillip Drive, and Doctor Bird Road. The existing right-of-way varies throughout the study area.

The existing land use in the study area includes both residential and commercial land uses. Three historic sites (identified as potentially eligible for the National Register) were identified along the project corridor. Portions of the project corridor are within the 100-year floodplain of the James Creek, affecting two existing structures and raising concerns about erosion, increased run-off, and water quality.

Significant land uses along the corridor include Montgomery General Hospital, an elementary school and a middle school, and commercial development centered around the intersection of Maryland Route 97 (Georgia Avenue) and Route 108.

By the mid 1980s, land development was rapidly occurring, and contributing to increased traffic and resultant congestion. Over 20,000 vehicles per day used the facility, with traffic forecasts indicating a potential for as much as 35,000 vehicles per day by 2010.

The highway network and land development within the general area are considered established. There were no plans for addition of other parallel or crossing facilities that would influence traffic patterns on Route 108.

PROBLEM TO BE SOLVED

Traffic already on the corridor exceeded the capacity of Route 108. Expected future traffic increases would further increase congestion. As a principal arterial, the function of the route was to carry such regional traffic. There were no opportunities to divert traffic to other parallel arterials. Olney and the surrounding area is suburban in character, with relatively low density development. The primary transportation mode for regional through traffic was and would remain the automobile.
The problem to be solved was to maximize the capacity (traffic-carrying capability) of Route 108 to enable it to carry out its function as an arterial serving the region. Solving the problem required consideration of the context of the area, including both land use along the corridor and other transportation needs.

Thus, the primary problem to be solved was to relieve congestion and provide through capacity.

Initial efforts to address the project focused on standard solutions. The general plan called for Maryland Route 108 to become a multi-lane arterial throughout the project length, with intersection capacity improvements at the major intersections. Two alternatives were developed for the project, incorporating both five-lane and divided roadway solutions (see exhibit). One design speed was assigned to the entire project. Implementation of the plan would require right-of-way along the corridor and relocation of one residence on a church property was needed.

STAKEHOLDERS
- Town of Olney Mill
- Montgomery County, Maryland
- Consultants
- Maryland SHA
- Olney Mill Community Association
- Olney Mill Chamber of Commerce
- Individual business and property owners (numerous)
- Local state delegate (legislator)

CSD/CSS APPROACH
This project was conducted as the Maryland SHA was developing their “Thinking Beyond the Pavement” (TBTP) approach. It is illustrative of the need for this approach, the process, and the benefits.

As the project moved ahead during the late 1980s, there were concerns raised about the impacts of the proposed solutions, the character of the road, the final appearance of the highway, and other aspects such as treatment of pedestrians. While the stakeholders were generally accepting of the need for the project, there was some dissatisfaction with the solutions proposed. Stakeholder concerns included preservation of natural and historic features (including large trees along the corridor, split rail fencing, historic properties), inclusion of provision for bicycles and pedestrians across and along the corridor, safety and access to businesses, and the appearance of the corridor (a desire for landscaping and other visual features was expressed). Individual business owners were concerned about effects on driveway access associated with widening and vertical alignment.

The SHA initially conducted a normal, routine public involvement process consisting of coordination with the local town, location and design meetings, and a public
hearing. The public hearing was held in June 1988, at which almost concerns and objections to the plan were raised.

In response to these concerns, the SHA committed to re-evaluate the proposed design. Staff re-evaluated the project’s history, justification, and commitments. The project was field reviewed and video-taped, with a focus on determining first hand which site features were significant. The re-evaluation looked at what was really needed, and questioned the scope of the improvements. Focus was placed on attempting to visualize the overall improvements.

The SHA demonstrated flexibility in criteria by accepting in spot locations variability in offset dimensions for the bike path relative to the roadway, and by varying the median treatment. Full standard lane widths were maintained throughout the corridor. Right-turn lanes were provided at high volume intersections to maximize capacity. Care was taken in the design of all landscaping to assure that intersection sight distance criteria were not violated.

Utilities were placed along the border area (not in the median as is typically done) to preserve the median for planting trees.

Given the urban context and design for speeds of 40 mph or less, landscaping with full-size trees in both medians and the roadside was considered acceptable from a safety perspective.

**Design Enhancements – Fitting the Context**

Different design challenges required different approaches in each of these zones to meet the character and local context. In the residential zone (northwest project limits) a less structured landscaping theme was developed (see photos), with the hiker/biker trail designed to meander.

**Design Flexibility and Application of Design Criteria**

It was decided that the standard template solution would not suffice throughout the 2.7-mile corridor. The corridor was segmented into three areas defined by the surrounding land uses – a residential zone, institutional zone, and commercial zone. The operating speeds and speed limits would vary by zone, as would treatment of the median.

The design approach also involved varying the alignment of the road through the corridor to better fit surrounding land uses and minimize conflicts.
In the commercial zone, the right-of-way and median are narrower, and design treatment more structured. Provision for left-turn lanes precluded the ability to provide treed landscaping, but plantings along the roadside in keeping with the commercial district’s environment were provided. In the institutional zone, the design focused on providing for a transition in view between the other two zones.

Stakeholder Involvement

The SHA and its consultants committed to working closely with the residents and community to address all concerns. The CSD approach relied on numerous meetings with town staff, elected officials, civic organizations and business owners, and the public. Plans were continuously reviewed, ideas suggested, and refinements made. Discussions about trees, split rail fencing, the location and design of bike trails, commercial area traffic patterns and access, and pedestrian safety were held over a series of months. Professional staff demonstrated a willingness to be flexible, propose different solutions, and strive for a consensus. Note, however, that the fundamental purpose was retained, the addition of through-carrying capacity.

In summary, Maryland’s CSD approach focused on active, field-involvement of their staff to visualize the project, work directly with local stakeholders, and strive for a tailored solution that addressed the problem but was designed to fit the local context.

LESSONS LEARNED

This project was initiated in the mid-1980s and continued through the mid-1990s. As such, it followed Maryland’s advance into TBTP and CSD. This project contributed greatly to Maryland’s knowledge base and advancement in CSD. A number of specific lessons were learned by Maryland’s staff:

- Early in the project, review and confirm the planning framework, including the functional classification for the project and speeds (design speed).
- Assess what is proposed, what is desired, and what is needed. Look beyond mere mitigation; and look beyond the right-of-way to assess how the project will relate to the area.
- Multidisciplinary teams, including specifically landscape architects, were recognized as being essential to project success.
- Project engineers should get out in the field to visualize the project.
- Develop the project with an emphasis on design principles, utilizing engineering principles to achieve desired safety and functionality.

"A standard design template approach will not allow, or usually doesn’t provide, the opportunity to address site-specific issues. This point is particularly important given what we perceive to be a trend toward having computers (CADD) design projects. Software programs should be used for engineering. Design requires more attention to detail, and is something that computers can’t do."

MD 108 RE-EVALUATION PROCESS REPORT BY DAN UEBERSAX AND JEFF SMITH
CASE STUDY NO. 4

MARYLAND ROUTE 355

SETTING

Maryland Route 355 was a two-lane highway in Montgomery County linking communities in the Gaithersburg/Germantown area. The arterial parallels Interstate 270. The route passes through Great Seneca Creek State Park. At the southeast project limit is one major signalized intersection with Maryland Route 124. Other signalized intersections along the corridor include Middlebrook Road, Maryland 118, and Maryland 27. The 2.6-mile route passes through residential areas, parks and open space, and commercial areas.

Significant regional traffic growth and localized development resulted in traffic increases along Route 355. The two-lane highway, originally designed as a rural road, became congested. Reconstruction of the route to accommodate existing and projected future traffic demand was apparent.

PROBLEM TO BE SOLVED

The identified problem was to provide enhanced mobility for those using the Maryland Route 355 corridor. Mobility issues included through traffic, intersection conflicts and bottlenecks, access management, and providing for pedestrians and bicyclists.

STAKEHOLDERS

• City of Gaithersburg
• Maryland National Capital Park and Planning Commission
• Maryland Department of Natural Resources
• Numerous utility companies (water, gas, cable TV, telephone electric)
• Community associations (Wheatfield Homeowners Association, Foxchapel Homeowners Association, Montgomery Village Foundation)
• Individual residential property owners
• Major employers (Lockheed Martin)
• Other business owners along the corridor (e.g., Holiday Inn, Aamco)

CSD/CSS APPROACH

Completion of this major project required a comprehensive approach involving design creativity, stakeholder involvement, and agency coordination. This project also illustrated well the importance of maintaining context sensitivity and flexibility all the way through construction. Staff from Maryland SHA noted that this project illustrated well that having good people involved who were flexible, who could “roll with the punches,” was a critical success factor.

While stakeholders recognized the need for the project and understood the proposed solution, they expressed concerns and desires about the execution of the design. Through numerous meetings, design revisions, and tailoring of the project, a context sensitive design solution was accomplished.

Design Flexibility and Application of Design Criteria

Fitting the desired cross section (a six-lane divided arterial with 12-foot lanes) into the corridor required design flexibility along the route. Three notable examples are illustrated in the following photos.

At one location, a special modular masonry retaining wall was constructed to retain parking areas and driveway access to commercial businesses. Special design was necessitated when a problem with design mapping was found; the solution retained the key functionality of the plan.
At another location, preservation of mature trees required special design due to widening and profile requirements. Rather than a concrete or masonry wall, special timber wall designs were used that blended into the surrounding area better.

Perhaps the most notable feature of the project is the design to accommodate the retention of a prominent, beautiful mature oak tree. Original plans for the widening showed the tree needed to be taken. Design staff from the SHA reviewed the alignment and cross section, inspected the tree and surrounding areas in the field, and committed themselves to preserving the tree through re-design. The cross section and horizontal alignment were adjusted to place the tree in the median of Route 355. The profile of one direction of travel was raised to create space for the tree's root system, and a special irrigation and monitoring system was designed. Steel-backed, timber-faced guardrail (meeting NCHRP 350 crash testing requirements) was used to shield the tree. (This more expensive guardrail system was used elsewhere on the project, including at Great Seneca Park, to blend into the natural surroundings.)

The design also demonstrated a commitment to enhance the mobility of pedestrians. An 8-foot-wide, multi-use (pedestrians and bicyclists) path was constructed, including brick splitter islands and special crosswalk treatments at intersections. Plantings were used at certain locations to protect bicycle riders from steep slopes at drainage structures. At a high volume bus shelter, the area for the multi-use pathway was expanded to accommodate both users and transit riders.
Design and Construction Enhancements – Fitting the Context

Design and construction staff made a concerted effort to minimize the adverse effects of this major widening project. At Great Seneca Park, the project included reforestation and provision for a parking area and access pathway into the park. At other locations, similar field changes were made to drainage swales, pathway location, and utility relocation to enable retention of large trees. During construction, field staff noted that changes in the grading plan would enable the retention rather than loss of a significant number of major trees along the right-of-way; the changes were made.

Application of Montgomery County’s stormwater management ordinance would have required taking of trees at one location. An alternative, use of a wetland bank, was agreed to by all stakeholders as the preferred solution.

Design enhancements even extended to individual property owners. SHA’s construction engineer, noticing a difficulty that would be faced by a resident using a reconstructed driveway, offered to construct a driveway T on the resident’s property to facilitate safely turning around and entering the arterial (rather than backing onto it).

Stakeholder Involvement

Tailoring of the design, resolving problems, and developing site-specific solutions required significant effort to work with individual stakeholders. The discussion above highlights some of this activity. There were many other examples of working with stakeholders to accomplish a finished design. For example, the SHA negotiated an Memorandum of Agreement with the City of Gaithersburg in which the city agreed to take responsibility for median and roadside plantings within city limits. In turn, SHA was able to commit to an enhanced landscaping plan above that they otherwise would have implemented.

Individual agreements with homeowner associations were also reached for plantings and aesthetic treatments. In one location, agreements were reached with property owners to include wood fencing on top of retaining walls for nose attenuation and improved privacy.

Extensive coordination with other governmental agency stakeholders also occurred. In addition to the design improvements at Great Seneca Park, parking and pathway improvements, use of timber faced rail illustrate concerns about the facility blending in with the Park.

Special plantings were used at stormwater ponds for neighborhoods, preserving the natural feel for the area. At another stormwater pond on the Lockheed-Martin property, an agreement was reached between the SHA and Lockheed-Martin for the use of the pond, and for replacement and additional plantings. Other field changes were made to accommodate plantings at a number of commercial and residential properties (Holiday Inn, Montgomery Village Apartments).
LESSONS LEARNED

A number of key lessons can be gleaned from this case study. First, CSD/CSS applies all the way through construction. Indeed, many of the long lasting positive features of the constructed solution were arrived at in the construction phase. Second, related to the above, effective CSD/CSS requires a local presence in the field. Third, active engagement with individual stakeholders is necessary to maintain context sensitivity. Solving problems one by one requires working on an individual basis. Fourth, paying attention to details is important. The cumulative effect of a long series of small, seemingly insignificant actions can have a measurable effect on the final product and on stakeholder perceptions of the agency (SHA).

Finally, a lesson learned is that bringing the right resources with the right sense of professional responsibility and environmental stewardship, who are flexible and able to deal with a number of unforeseen circumstances, is essential to project success. Converting a two-lane highway into a six-lane arterial in a built-up area, and doing so in a manner that the finished project fits with the surrounding area, is no small feat.
CASE STUDY NO. 5

WASHINGTON SR 99
INTERNATIONAL BOULEVARD

SETTING

The International Boulevard project is located within the City of SeaTac in King County, Washington (see Figure 1). King County, which includes the City of Seattle, is the most populous county in Washington. The City of SeaTac, incorporated in 1990, has an area of roughly 16 square miles and a population of about 23,000. Seattle-Tacoma (Sea-Tac) International Airport is located within the SeaTac city limits.

The newly incorporated City developed Comprehensive and Transportation Plans that established land use goals and proposed transportation facility improvements. The City was designated as an urban center under the State’s Growth Management Act and under that designation was identified for substantial increases in the development density along the City’s existing commercial corridor. This development follows the International Boulevard corridor. Existing land uses include some of the region’s largest motels, Sea-Tac International Airport, office towers, airport-related rental car and park-and-fly facilities, and other retail uses. The Transportation Plan proposed expansion of International Boulevard to increase traffic capacity and improve pedestrian access.

International Boulevard is a major north/south arterial that serves local and regional traffic within the City of SeaTac, Washington (see Figure 2). International Boulevard, is part of signed State Route 99 (SR 99) which spans three counties and over 50 miles from South Snohomish County to North Pierce County. Prior to the construction of the Interstate System, SR 99 was a major Pacific coast route spanning Washington, Oregon, and California. Today, that portion of SR 99 within the Puget Sound region serves as a regional link between cities and as a major route to Sea-Tac Airport, with access to the terminal and airport parking. It is also a part of the State’s urban arterial system, and has been designated as a National Highway of Significance, as well as an emergency evacuation route.

Average 1992 daily traffic volumes on International Boulevard varied from 31,600 vehicles per day (vpd) at South 170th Street to over 40,000 vpd at South 188th Street, with the highest daily traffic volumes (over 42,000 vpd) occurring directly adjacent to the airport entrance.

PROBLEM TO BE SOLVED

The project described in this case study is the first of these segments, from South 188th Street to South 170th Street. This section of International Boulevard fronts Sea-Tac Airport. Sea-Tac Airport and International Boulevard serve as a gateway to the United States and Puget Sound region for many visitors from around the world. International Boulevard has experienced significant traffic congestion, substantive safety problems, inadequate pedestrian facilities, and unsightly commercial strip development. Solutions to the transportation problems were sought that would promote and enhance re-development of the corridor as an attractive gateway.
The following is a summary of the transportation problems to be addressed:

**SAFETY PROBLEMS**

Accident rates for mid-block segments were as high as 4.9 accidents per million vehicle miles for the section between South 188th Street and the Airport Access. Approximately 55 percent of the accidents in the corridor are property damage only; the remaining 45 percent are injury accidents. There were two fatal accidents in the corridor during the period between 1990 and 1993. A number of the more serious crashes involved pedestrians. Other crash problems were associated with the lack of access control along the corridor and the strip commercial development.

**CONGESTION AND MOBILITY PROBLEMS**

The level of service (LOS) for the existing p.m. peak hour for five key intersections ranged from B to F in the project corridor. The corridor is well-served by transit. Prior to the project, there were ten transit stops within the project limits (five northbound and five southbound). Only three of the ten transit stops provided a shelter for transit users.

Significant design constraints included limited existing right-of-way (100 feet), and substantial underground and overhead utilities.
STAKEHOLDERS

- SeaTac Community Planning Department
- International Boulevard Committee
- Washington State Department of Transportation (WSDOT)
- King County/Metro Transit (Metro)
- Port of Seattle
- Puget Power
- General public

CSD/CSS APPROACH

Stakeholders were able to obtain funding for improvements to the corridor. The amount of the funding available for design, construction, and right-of-way was $7.3 million. Restrictions on the limit of funds were available meant that the project had a tight schedule, with an advertising for bids required within 15 months from beginning of the project development process.

Initial funding was based on a plan that envisioned widening International Boulevard to a seven-lane cross-section, including sidewalks. Concurrently, with initial planning, the City of SeaTac's Department of Community Development was working with a citizen and business advisory committee, the International Boulevard Corridor Advisory Committee, (IBC Committee), to develop a land use plan for the corridor, which also included urban design and transportation infrastructure considerations. The City assigned the IBC Committee a responsibility to review the development of the street design.

Other major stakeholders for the project included WSDOT, Metro, and the Port of Seattle. Each made financial contributions to the construction budget. WSDOT had partial jurisdiction for this project given their responsibility and authority for geometric design and safety for SR 99. WSDOT concerns focused on their recently adopted statewide Access Management Plan, which called for reconstruction projects along state routes to meet specified access management standards. Metro was concerned about the speed and reliability of transit services along SR 99. Because SR 99 is a primary access route to Sea-Tac Airport, the Port of Seattle was concerned about increasing the capacity of the roadway.

The schedule, number of stakeholders with different interests, and complexity of the project required close coordination and a comprehensive but focused planning process. The process was designed to identify issues and needs, develop alternatives, and evaluate and establish the preferred alternative. The alternative selected (presented in detail in the next section) included a center, raised median and other access management measures. Information on the planning work was provided at two open houses and in citywide newsletters. This initial effort was completed in May 1994 with the adoption of the plan at a City Council meeting.

Opposition to the plan surfaced after the City Council had acted to adopt it, when meetings were held with individual property owners to discuss right-of-way needs and property interface designs. The IBC Committee included some representatives from adjacent businesses.

A series of meetings with property owners and WSDOT was held over several months to develop solutions to property owner concerns regarding reduced access. Generally, the concepts developed consisted of various configurations for mid-block median breaks to enable partial or full access movements. Driveway consolidations were also considered, along with joint access between properties. Ultimately, a final public hearing was held to review the need for access management and the alternative access concepts that had been discussed with property owners throughout the summer, and to get City Council adoption of the access concepts that would be integrated into the final design. This hearing resulted in a majority consensus on acceptable access concepts, although a small number of property owners were not satisfied with the final plan.

Design Flexibility and Application of Design Criteria

The project design development process included consideration of three build alternatives and a no-build alternative. The alternatives included five-, six-, and seven-lane configurations for the roadway. The alternatives represented a spectrum of possible traffic improvements for International Boulevard. All alternatives provided sidewalks for pedestrians and widened curb lanes to accommodate bicycles and transit. Optional design features were also developed that could be incorporated into any one of the three build alternatives. The design options included either a raised, landscaped center median or a median consisting of a continuous two-way, left-turn lane. Alternative capacity improvements, HOV/transit treatments, access management measures, non-motorized mode options, signal system improvements, utility modifications, illumination concepts, and landscaping treatments were also developed.

Many of the design challenges on the International Boulevard project are described below, and discussed as to how they were accommodated.

Public and agency opinions regarding capacity needs ranged from reducing the number of lanes and emphasizing local access to widening the arterial to seven or more lanes provide additional regional capacity. Limited construction funding and right-of-way constraints made
cost-efficiency an important consideration. Decisions were made to add an HOV lane in the p.m. peak flow direction (southbound), add approach lanes at congested intersections, incorporate access management measures, improve the signal system, and enhance facilities for transit and non-motorized modes.

Treatments to improve the accessibility, speed, and reliability for transit and HOVs included the southbound HOV lane, new bus shelters, bus stop enhancements, and signal design to enable transit signal priority. New guidelines on arterial HOV lane signing and striping, recently established through a regional ad hoc committee, were incorporated into the design.

Pedestrian amenities included sidewalks, decorative lighting at bus zones, sidewalk linkages to adjacent land uses, and two mid-block signalized pedestrian crossings (one of these is combined with a new signalized driveway access). Because this roadway is currently the only north-south route for bicycle travel, Class IV Bikeway lanes were also provided.

All existing and new signals were furnished with NEMA-type controllers to allow integration with the rest of the City’s signal system. These signals were interconnected and controlled with an arterial master controller. In addition, the system included equipment to enable signal priority in the future.

The need to relocate utilities due to the road reconstruction and public concern regarding the poor aesthetics of overhead utility lines led to a decision to underground and reconfigure the utilities. Electrical power distribution lines and telephone and television cables were placed underground. Power transmission lines were relocated on new poles at greater spacing. The illumination system was improved to meet current lighting standards. To save money and improve construction coordination, this work was included in the roadway construction contract (ordinarily the utility companies construct these improvements).

Aesthetics were improved by planting trees along the sidewalks, special sidewalk paving patterns, a landscaped median, and landscaped transitions with adjacent properties.

The most controversial issue for this project involved implementation of raised medians for access control and safety. The combination of speed (45-mph speed limit), high traffic volume, and number of lanes led to an agreement to replace the center two-way, left-turn lane with a raised median; driveway controls and consolidations were also included. Compromises included the incorporation of U-turn designs into key intersections and the development of two mid-block median openings (one of these was signalized to provide consolidated driveway access).
STAKEHOLDER INVOLVEMENT

The plan reflected an active and ongoing effort to negotiate solutions and design compromises among the various stakeholders. The final plan included some concepts that did not meet WSDOT standard design approaches. Unusual features included U-turn median openings, provision for landscaping in the median, and a mid-block pedestrian signal. WSDOT was involved in the decision process and understood the required compromises. Landowners compromised as well, accepting access consolidation and the raised median in return for other amenities. The City of SeaTac submitted requests and justifications for several design exceptions to WSDOT and received approval to implement the adopted plan.

LESSONS LEARNED

This project illustrated well that dealing with multiple, conflicting stakeholders within a constrained budget and schedule is possible as long as the key stakeholders understand the problem, have a clear vision of the solution, employ an open and creative process, and commit themselves to compromise. The project also illustrated well that CSD/CSS represents a series of choices, not mandates. Issues of number of lanes, mobility for different users, different ways to treat access safety problems were all looked at from different perspectives.

Many design issues and constraints needed to be addressed during the course of planning and design of the project. The affected community and agencies were actively involved in the development and evaluation of alternatives, and negotiation of modifications to the design. Diverse views of the various community and agency stakeholders needed to be considered. The adopted design was a comprehensive solution to the conditions, and the design incorporated elements of transportation capacity, HOV/transit treatments, access management measures, non-motorized mode improvements, signal system improvements, utility and illumination enhancements, and landscaping improvements.

Specific lessons learned dealt with access management, which is generally the most difficult issue to address in built-up urban arterials. For the International Boulevard project, access management was the single most controversial and challenging aspect of the project.

- Access management is only one part of the design for reconstruction of an arterial street. Access management measures were integrated into the overall, comprehensive design. Access management measures alone would not have satisfied all of the conditions at hand, including the needs of the community and agency stakeholders.
- Use of raised medians within the arterial cross-section is only one of the access management tools to be considered. Access management should be considered as a solution to solve traffic safety concerns. Other measures such as driveway designs, controls, reductions, and consolidations should also be emphasized to address safety problems.
- Inclusion of medians on arterial reconstruction projects has some problems that need to be considered. These include change or reduction of access to some properties and generation of U-turn demand at intersections, which affects safety and traffic capacity. Therefore, it is likely that reconstruction to include a median may only be warranted under certain conditions such as high volumes (e.g. greater than 30 thousand vehicles per day), high speeds (e.g. greater than 40 miles per hour), and multi-lane cross-sections (e.g. greater than four lanes).
- Medians can provide other benefits (beyond vehicle traffic safety) for a comprehensive design solution. These include safety for transit, bicycles, and pedestrians. They provide opportunity for landscaping and aesthetic improvements. They can help reduce the amount of impervious surface and thereby reduce the amount of stormwater drainage and detention system requirements.
- Substantial public education and involvement is needed when considering access management as a part of a major arterial design solution. Business owners are almost always going to oppose these measures at the beginning of the design process. The community and agency stakeholders need to be brought along slowly, first understanding the issues and problems (such as accident problems), then looking at the solutions (which may include some access management measures).

While good technical guidance is important for agencies to employ, in actual application it is likely that compromises will be needed in order to get agreement to include any access management measures in a typical design problem. In the case of the International Boulevard project, if compromise breaks in the raised median were not identified and accepted, the project may not have been acceptable to the key stakeholders.
CASE STUDY NO. 6

COBBLESTONE STREET INTERPRETIVE PARK
BOONVILLE, MISSOURI

SETTING

Boonville, Missouri lies along the south bank of the Missouri River about 90 miles east of Kansas City. The Missouri Department of Transportation (MoDOT) was planning the construction of a new bridge over the Missouri River to carry traffic using U.S. Route 40.

As part of the site investigations and planning, a cobblestone street in Boonville was re-discovered. The street was believed to be the first paved street west of St. Louis. Its construction consisted of cut limestone curbs set about 50 feet apart with unmortared limestone cobbles of various sizes, Cobblestone drainage ditches extended the length of the street.

The cobblestone street represented a precious link to the days of steamboat traffic. From the 1830s to early 1860s, hundreds of steamboats docked at the Boonville wharf each year. Mulecarts and horse-drawn wagons carried freight up the steep slope of the river bank to the businesses at the top of the wharf. Boonville was a regional center of trade; with farmers and merchants shipping pork, flour, tobacco, and other products down river to St. Louis.

After the Civil War, railroads began to replace steamboats. The first railroad reached Boonville in 1869; busy steamboat traffic ended shortly thereafter.

Through the intervening years, the cobblestone street entered into disuse. Three to 4 feet of soil accumulated gradually over the northern block of the street. The southern block remained untouched until construction of the 1924 Old Trails National Highway Bridge.

In 1989, as the MoDOT began planning efforts for the new bridge, the Director of Friends of Historic Boonville called MoDOT’s attention to the wharf area and street. Wharf Hill had recently been placed in the National Register of Historic Places, and the Director wanted assurances that the historic property would be preserved and/or protected during bridge construction.
PROBLEM TO BE SOLVED
The problem was essentially to investigate the site and determine what measures would be needed to preserve the cobblestone street and other elements of the historic site.

STAKEHOLDERS
- Missouri Department of Transportation
- City of Boonville
- Friends of Historic Boonville
- Missouri Department of Natural Resources
- Missouri Historic Preservation Program Office
- Advisory Council for Historic Preservation
- Americans with Disabilities Act Project of Columbia

CSD/CSS APPROACH
The CSD/CSS approach combined active discussions among the stakeholders involving field investigations, negotiations, and the development of a plan to not only preserve, but indeed enhance the historic resource.

Archaeological investigations of the street showed that much of it was disturbed through portions, but other portions remained undamaged. There were difficulties in fully investigating the status of the street as an existing railroad bed crossed over the street.

Stakeholders (MoDOT and the Friends of Historic Boonville) agreed upon a plan wherein preservation of the street would be accomplished through development of an interpretative park. Preliminary design plans were developed and approved by the Department of Natural Resources and other state offices. It was agreed that upon completion of the park the City of Boonville would retain ownership.

Construction of the park required careful planning. Special rubber-tired equipment was used in removing the overburden to minimize possible damage to the cobblestones. Some areas were repaired, with cobbles and cut limestone curbing salvaged from damaged locations and replaced to resemble the original 1830s paving.

The design of the park itself involved collaboration among the many stakeholders. The park was designed to be ADA-accessible. Other objectives in planning the park included preservation of the street in its original location, incorporation of the Old Trails National Highway Bridge elements into the park, provision for interpretive stations to inform visitors of the history and importance of the site, and pleasing landscaping.

Eleven years after being informed of the cobblestone street, the interpretive park was completed and opened for all to enjoy. It has become a local landmark, and a source of pride within not only Boonville, but also the Missouri Department of Transportation.

LESSONS LEARNED
Local stakeholders are the key to identifying and preserving local historic and other cultural resources. A commitment to work with them can yield projects of great value and pride.

This project also illustrates that the job of a DOT goes beyond the mere provision of safe and efficient transportation. Seizing opportunities to preserve and enhance a community are what CSD/CSS is all about.
CASE STUDY NO. 7

U.S. ROUTE 6
BROOKLYN, CONNECTICUT

SETTING

U.S. Route 6 is the primary regional arterial carrying east-west traffic between Hartford, Connecticut and Providence, Rhode Island. U.S. Route 6 passes through the Town of Brooklyn roughly half way between the two cities. Route 6 is a major, principal arterial in rolling terrain operating with 8,000 to 10,000 vehicles per day at relatively high speeds on the approaches to the town. The Route carries substantial through truck traffic.

The Town of Brooklyn is typical of small Connecticut towns. The main road proceeds through the center of town. There are many historic and treasured features within the town, including the Town Hall, Unitarian-Universalist Church, the Town Green, an historic Well House, and a 150-year-old Copper Beach Tree. The Center of Brooklyn is designated as the Brooklyn Green Historic District and is listed in the National Register of Historic Places.


The existing road for Route 6 is narrow, with narrow or no shoulders in many places. The horizontal and vertical alignment reflect outdated design criteria, produce sight distance deficiencies, and create difficulties for drivers. For much of the project area, residences abut the highway. The difficult alignment and poor sight distance adversely affect drivers entering and exiting driveways.

Improvements to U.S. Route 6 were identified as necessary as far back as the 1950s. Planning studies were conducted in the 1970s to investigate the potential for developing an expressway facility on independent alignment parallel to U.S. Route 6. Environmental concerns and opposition to the expressway resulted in it being dropped from consideration in the early 1980s. At that point, it was recognized that improvements to existing east-west corridors, and in particular to U.S. Route 6, were necessary.

PROBLEM TO BE SOLVED

The 5-mile section of U.S. Route 6 was the last segment not upgraded. Problems to be addressed included replacement of the pavement that had deteriorated due to heavy truck traffic, improvements to the alignment to address safety problems, and improvements to the cross section to facilitate safe operations. The following specific traffic operational problems were identified associated with the combination of the geometry, traffic, and roadside conditions:

- Turning vehicles delay through traffic and create rear-end conflicts, and lack of shoulders limits the ability to perform emergency avoidance maneuvers
- Enforcement of speed limits is difficult due to lack of shoulders
• Driveway access and local mail delivery is a safety concern, due to poor sight distance and lack of shoulders
• Rock cuts, trees, drainage structures, and other objects represent hazards to drivers
• Poor pavement condition and inadequate drainage exists in many locations
• Four creeks cross U.S. 6 within the project limits

STAKEHOLDERS

• Town of Brooklyn (general public, adjacent landowners)
• Town Council
• Local wetland commission
• State Department of Environmental Protection
• U.S. Fish and Wildlife Service
• U.S. Army Corps of Engineers
• Environmental Protection Agency

CSD/CSS APPROACH

The Connecticut DOT looked at multiple alternatives to address the need to maintain and even upgrade the traffic carrying capability of U.S. Route 6. Among the alternatives considered was a bypass of the center of town. This would have meant running traffic through residential neighborhoods so focus was placed on improving the existing alignment.

Given the overall context, U.S. Route 6 was to remain a two-lane principal arterial. While residents of Brooklyn recognized the function of the highway, and also acknowledged their own concerns about its safety, they expressed strong preference for a design that did not adversely effect the character of the town, and specifically, the Green. Indeed, a concern of the town was the speeds of through traffic and conflicts with pedestrians and local business traffic in the town.

The project represented a design challenge. Improving the vertical alignment resulted in potential adverse effects on front yards, older trees, stone fences, and wetlands. Similarly, developing a functional, wider shoulder offered similar adverse impacts. It was necessary to select a design speed and execute a design that balanced the through-traffic carrying capability of the road with its impact on the community.

DESIGN FLEXIBILITY AND THE APPLICATION OF DESIGN STANDARDS

Connecticut DOT staff reduced the design speed from 55 mph to 45 mph on the approach to the town. This had the desirable effect of minimizing roadside impacts and facilitating driveway access. Emphasis in the align-
Some horizontal curve improvements were made, and intersection improvements (including closing of some minor intersections to eliminate conflict points) were included. Signal system improvements were also included.

Throughout the design process, Connecticut DOT staff worked closely with all stakeholders to avoid adverse effects. Some operational and safety features, most notably a proposed truck climbing lane, were eliminated to minimize adverse effects.

**Stakeholder Involvement**

Town of Brooklyn stakeholders were initially skeptical of Connecticut DOT staff. A long and contentious history related to studies of the proposed expressway was a legacy to overcome. It was necessary to work hard to establish a positive working relationship.

The relatively close right-of-way and frequent points of conflict represented challenges to the DOT staff attempting to explain design concepts, and to town residents concerned about effects on the Green, the church, and the Copper Beach tree.

Connecticut DOT staff used visualization techniques for one of the first times to help depict designs and discuss alternatives with the townspeople. Visualizations were particularly helpful in investigating alignment and intersection concepts through the Green.
CASE STUDY NO. 8

KENTUCKY PROPOSED I-66

SETTING

In 1997, the Kentucky Transportation Cabinet (KYTC) completed a study that concluded that the Southern Kentucky Corridor (I-66), previously identified as part of a priority corridor in the Intermodal Surface Transportation Efficiency Act (ISTEA) was feasible. The longer corridor was subdivided into segments with independent utility. The segment from Somerset to London was identified as a high priority corridor in the Transportation Equity Act for the 21st Century (TEA-21).

The Somerset to London segment of I-66 would provide an interstate-level connection between the Daniel Boone Parkway to the east and the Louis B. Nunn (Cumberland) Parkway to the west. There are two existing linkages, KY 80 and KY 192. KY 80, to the northern side of the study area, consists of two-and four-lane sections and has only partial access control. KY 192, to the southern side of the study area, is an older two-lane highway with two nine-foot-wide lanes and two-foot shoulders.

Both existing linkages experience both safety and emerging traffic operational problems typical for their age and design characteristics. Twenty eight percent of the mileage along KY 80 is considered to be “high accident” mileage, and fully 59 percent of KY 192 similarly high accident mileage. Existing traffic volumes are highly variable along both routes but are forecast to increase from 100 to 200 percent over the next 30 years. Current traffic operates at level of service (LOS) B to C, but will decline to LOS D/E/F conditions by 2030 if no action is taken in the Somerset to London segment.

The study area is home to many natural, scenic, and sensitive areas such as the Daniel Boone National Forest, the state designated wild river portion of Rockcastle River, Cane Creek Wildlife Management Area, Laurel River Lake, Lake Cumberland, Cumberland Falls State Park, General Burnside State Park, Levi Jackson State Park, and the Sheltowee Trace National Recreation Trail. These are areas of scenic beauty and biodiversity with numerous blue-line streams, natural wetlands, and, throughout the western portion of the study area, an extensive cave system.

In June 1999, KYTC presented an initially preferred corridor at public meetings in the two communities. An alternative that largely followed existing KY 192 was presented as the preferred alternative. Generalized corridors north and to the middle of the study area had been considered by KYTC staff but not carried forward. The southerly location of KY 192 offers the advantage of not crossing the wild river portion of Rockcastle River, of having less adjacent development that would require either acquisition or access roads, and of providing more accessibility to the tourism and recreation areas important to the region’s economy.

While many citizens who attended the public meetings favored improving KY 192 or at least supported the concept of constructing I-66, there was considerable opposition to the KYTC identified preferred corridor based on concerns with the environmental impacts along the corridor. Approximately two-thirds of those responding
favored I-66 but about half of those responding identified an alternative other than KYTC’s initially preferred alternative.

**PROBLEM TO BE SOLVED**

The problem faced by KYTC was how to:

- Address a priority corridor identified in TEA-21 and receiving considerable Congressional attention
- Prevent extensive LOS “F” as traffic volumes increased in a popular recreation area
- Reduce already high accident rates likely to increase as traffic volume increased
- Improve economic conditions in a traditionally higher unemployment/lower income area through improved transportation facilities
- Provide a revised process for corridor(s) evaluation that would involve stakeholders while yielding recommendations consistent with the project goals

**STAKEHOLDERS**

A wide range of stakeholders representing environmental, economic development, statewide, and local interests were involved in the project. Due to the sensitive nature of the study area, many resource and regulatory agencies were also directly involved.

- Cumberland Valley Area Development District
- Federal Highway Administration
- Kentuckians for the Commonwealth
- Kentucky Department of Fish and Wildlife
- Kentucky Heartwood
- Kentucky Heritage Council
- Kentucky Tourism Development Cabinet
- Kentucky Transportation Cabinet
- KICK 66
- Lake Cumberland Area Development District
- National Speleological Society
- Sierra Club Cumberland Chapter
- U.S. Fish and Wildlife Service
- U.S. Forest Service, Daniel Boone National Forest

**CSD APPROACH**

The planning phase of I-66 Somerset to London segment occurred about the same time that Kentucky was moving into the national forefront of the context sensitive design movement. While not yet in the final design stage where design flexibility is most appropriate, KYTC has been implementing the spirit of CSD/CSS on I-66 through their approach to public involvement, environmental considerations, and open decision making.

This approach was evident in the KYTC’s reaction to public input from the 1999 meetings. Following the June 1999 meetings, KYTC acknowledged the need to reexamine the criteria and process that led them to identify the initially preferred alternative.

The northern corridors, including the KY 80 corridor, that were previously not given detailed consideration in part because of the crossing of a wild river, were reexamined with a realization that use of the existing right-of-way would not constitute the same level of impact as the need for new right-of-way.

An alternative corridor was identified that would cross more National Forest land, but would cross through areas that have been extensively modified through logging and mining.

The level of information available to the public was expanded substantially. The data and decision making processes are well documented on the Internet as well as through more traditional media. The Evaluation Matrix explicitly shows the tradeoffs involved in this complex multi-disciplinary decision.

Through the new alternatives development process and active stakeholder engagement, KYTC staff determined that an overall better alignment solution was available. The selection of what is known as the N-4 Alternative as the preferred alternative kept open the door for ongoing refinements, particularly still greater use of the KY 80 corridor near Somerset.

In the planning stage, KYTC decided to use fairly typical AASHTO design criteria. However, even in a planning report KYTC acknowledges the role flexibility plays in highway design. Future phases of the I-66 corridor project may involve further geometric criteria and issues, at which point it would be appropriate to begin consideration of potential flexible design components. The purpose of flexible design methods is to aid designers in the design and construction of a roadway while preserving or enhancing scenic, historic, environmental and community resources in the vicinity of the project.

Current preliminary design efforts in the vicinity of Somerset include a stakeholder group that has developed criteria to evaluate alternatives. These evaluations will be part of the data reviewed by the project team as they make project decisions.

Public involvement near Somerset has resulted in refinement of preliminary alternatives so that they do not divide areas that are already developed.
LESSONS LEARNED

In one form or another, the I-66 project has been under consideration in Kentucky since the mid-1980s and is actively moving forward today. In some respects the project is one of the reasons Kentucky has not only embraced Thinking Beyond the Pavement and Context Sensitive Design, they have become a leader.

Public involvement needs to be a more significant part of the planning process than it has been in the past. Although Kentuckians are historically more receptive of new highway projects than citizens elsewhere, the level of dissatisfaction on this project threatened to stop what had the hallmarks of a popular and needed project.

Initial impressions of desirable features are not necessarily correct. In part, a southerly alternative was initially preferred in order to bring more traffic to tourist recreation areas. However, these areas are heavily used now and may not be able to accommodate significant increased traffic.

Although all of the corridor alternates pass through the Daniel Boone National Forest, more detailed review determined that there were major differences among the corridors with regard to the levels of impacts. Examining alternatives and highlighting the differences led to a different decision than was earlier made, but one that has appeared to garner more widespread support.
This page intentionally left blank
CASE STUDY NO. 9

TOWSON ROUNDABOUT
TOWSON, MARYLAND

SETTING

Towson, Maryland is a suburb of Baltimore, in Baltimore County, Maryland. Near the central part of the Towson business district, four major arterials converge at a single location. Joppa Road, York Road, Alleghany Avenue, and Dulaney Valley Road meet at a large, complex multi-leg signalized intersection.

Towson is the Baltimore County seat. A number of historically significant governmental buildings are near the downtown, including the Baltimore County Courthouse. The town is also home to a number of businesses and universities.

PROBLEM TO BE SOLVED

The transportation problem to be solved was relieving the congestion and improving the safety of the awkward, multi-leg signalized intersection. In addition, the business community and City of Towson believed that improvements to the economic viability of the downtown businesses were needed.

The project thus became a combination of congestion relief and local economic enhancement.

STAKEHOLDERS

- City of Towson
- Baltimore County
- Maryland State Highway Administration
- Towson Business Association
- Goucher College
- Individual business owners
- Utility companies

CSD/CSS APPROACH

The Maryland SHA took a proactive approach involving substantial public outreach to understand all problems and issues and to develop a plan for the intersection and surrounding street system that would enjoy widespread support. The project became more than just an intersection improvement project, but instead became a downtown Towson enhancement project.

After the decision was made to build the roundabout, plans to incorporate major streetscape improvements to the approach streets were developed and included in the project. The purpose of the streetscape program was to enhance the downtown, and promote the Towson businesses.

DESIGN FLEXIBILITY AND APPLICATION OF DESIGN CRITERIA

Original efforts by Maryland SHA staff to solve the traffic operational problem focused on traditional solutions – removing one or more legs of the intersection to simplify operations. These solutions, however, were not well received as they would have produced substantial changes to traffic patterns and would have disadvantaged many businesses. The SHA took another look at the project. A number of alternatives were developed. Eventually, a signalized roundabout emerged as the preferred solution. At the time this alternative was proposed (mid-1990s) roundabouts were relatively new to the U.S. The SHA engaged expert consultants to help development in analysis of roundabout solutions. SHA staff were open to considering a new and “untested” design solution for this difficult location.
STAKEHOLDER INVOLVEMENT

The many stakeholders required an intensive effort to engage and work with all groups. A task force was formed comprised of representatives of the SHA, Baltimore County, the community, and Towson Business Association. This 30-to 40-member group met monthly to keep informed, trade information, consider design issues, and deal with funding and local coordination issues. The Towson Business Association served as a conduit for individual businesses to raise questions or seek information about the project. Issues of importance ranged from policies on cost sharing of streetscaping, to on-street parking, utility coordination, maintenance of traffic, and business impacts during construction.

One of the colleges in the town has a special program for the disabled. A major concern was the accommodation of blind pedestrians in the downtown. There is also a large population of elderly in the area, many of which walk in the downtown area. Special outreach to this constituency was part of the stakeholder program.

The Maryland SHA and Task Force recognized that many citizens would be apprehensive about or not understand the new, unique design solution of the roundabout. An extensive public information and outreach campaign was developed to explain the project and demonstrate and educate how roundabouts work (driver behavior, pedestrian accommodation). Visualizations were used to show how the streetscape and roundabout would change the downtown atmosphere for the better. A special video was produced that explained how roundabouts worked. Given the nature of many of the constituents, it was necessary to hold many group meetings at churches, retirement centers, and other venues. There were many small group meetings held throughout the area during the project.

Stakeholder involvement was also viewed as critical during actual construction of the roundabout and streetscape program, due to the tight working areas and concerns of local businesses about adverse effects during construction. The SHA assigned an on site construction liaison, who was a day-to-day presence during construction. Problems were identified immediately and dealt with expeditiously during construction. Continual contact with stakeholders gave the business community a sense that their concerns were being addressed and everything was being done that could be to minimize adverse impacts.

FITTING THE CONTEXT – A SUCCESSFUL TOTAL SOLUTION

The roundabout and streetscape project are considered a major success. Traffic flow has improved greatly. After an initial 6-month ‘learning curve’ by drivers and pedestrians, crashes have reduced and their severity is less than before construction.

The roundabout itself and the improvements to the streets are a local source of pride. Moreover, addressing the traffic problems and improving the appearance of the downtown has been credited with re-vitalization of the local business community. A large retail building that was vacant prior to construction has since been acquired and opened by a major retailer. According to the Towson Business Association’s Year 2000 Business Directory, “The Roundabout has relieved traffic congestion in this busy area. Other improvements such as streetscaping and landscaping make Towson an even more attractive place for people to live, attend school, or take a break for a day of shopping.”

LESSONS LEARNED

This project illustrates the importance of understanding the entire problem and looking at traffic or congestion problem as more than just a traffic engineering issue. There is a relationship between congestion, safety, and livability.
Using the intersection project as a means of enhancing an important downtown business district is being context sensitive in the true sense of the term.

Other lessons learned include the importance of an intensive and tailored public involvement program that reaches all stakeholders in ways that fit their needs. Part of this effort includes the business community. Another part included the specific messages (what are roundabouts, how do they work, what should drivers and pedestrians do) as well as the different media used for delivering the messages. Maintaining constant stakeholder contact through construction is also viewed as critical to project success.

The Maryland SHA and Baltimore County also gained important experience in dealing with practical issues such as maintenance of streetscape and landscaping.

Investments in landscaping must be accompanied by a commitment from some entity to maintain the landscaping. SHA staff noted this was a lesson learned after they had completed this project; and it is one that helped shape their current policies with other communities.