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Moving Communities Forward:

How Well-Designed Transportation Projects Make Great Places

THE AMERICAN INSTITUTE OF ARCHITECTS

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Well-designed transportation projects demonstrate the potential to shape a community in ways that go far beyond the project's original purposes. Anecdotal evidence and advocacy exist on behalf of the benefits of well-designed transportation projects on communities. Yet there is little organized quantifiable or qualitative data. Nor is there a comprehensive guide for communities to maximize or integrate the diverse benefits that well-designed transportation projects can bring.

Recognizing this lack of data about the role of design in transportation, Congress authorized a study in the 2005 Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU). *Moving Communities Forward: How Well Designed Transportation Projects Make Great Places* seeks to achieve two goals: (1) beginning to measure how well-designed transportation projects can bring multiple enhancements to communities in terms of economic development, health and the environment, visual identity and design, public participation and public safety; and (2) providing communities, designers, transportation officials and policymakers a set of principles and practices to adapt to their unique situations and needs.

The *Moving Communities Forward* research team employed a case study-based approach, analyzing nearly 30 transportation projects that represent a broad spectrum of regions, demographics and project types. Although a specific design feature or process works in one kind of transportation project, in one kind of community, it will not necessarily succeed somewhere else. But the broad principles and practices that designers employ can be repeated, in modified forms, across a wide array of transportation-related projects. The research team identified key *principles and practices* that designers and others can use – in the context of their unique situation and environment – to realize multiple enhancements to their communities.

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How Well-Designed Transportation Projects Make Great Places

Report #1 in the Series:
Moving Communities Forward

Final Report

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Preface

Well-designed transportation projects demonstrate the potential to shape a community in ways that go far beyond the project's original purposes. Anecdotal evidence and advocacy exist on behalf of the benefits of well-designed transportation projects on communities, yet there is little organized quantifiable or qualitative data, nor is there a comprehensive guide for communities to maximize or integrate the diverse benefits that well-designed transportation projects can bring.

Recognizing this lack of data about the role of design in transportation, Congress authorized a study in Section 1925 of the 2005 Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to achieve two goals: (1) begin to measure how well-designed transportation projects can bring multiple enhancements to communities in terms of economic development, health and the environment, visual identity and design, public participation, and public safety; and (2) provide communities, designers, transportation officials, and policymakers a set of principles and practices to adapt to their unique situations and needs.

The *Moving Communities Forward* research team employed a case study-based approach, analyzing nearly 30 transportation projects that represent a broad spectrum of regions, demographics, and project types. The research team identified key principles and practices that designers and others can use—in the context of their unique situation and environment—to realize multiple enhancements to their communities.

Funding for the study was derived from a grant to the American Institute of Architects (AIA) from the Federal Highway Administration (FHWA), authorized by Congress in SAFETEA-LU. In 2006, the AIA selected the Center for Transportation Studies (CTS) at the University of Minnesota to conduct the pioneering research study.

To address the interdisciplinary issues raised by the study, CTS assembled a research team drawn from multiple fields. Research was allocated to five research projects; a sixth project synthesized the study's key findings into a single document highlighting major themes and recommendations:

1. Promoting Economic Development
2. Improving Health and the Environment
3. Designing Great Places
4. Fostering Civic Participation
5. Making Communities Safer
6. Study Synthesis

Results of this research are available in a series of reports on the *Moving Communities Forward* Web site: www.movingcommunitiesforward.org. The site also includes a summary report submitted by the FHWA to Congress in September 2007. The Web site is part of a coordinated outreach effort designed to share the research findings and recommended practices with transportation and design professionals, policymakers, and the public.

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ABOUT THE AMERICAN INSTITUTE OF ARCHITECTS

The American Institute of Architects (www.aia.org) is the voice of the architectural profession and the resource for its members in service to society. As AIA members, more than 80,000 licensed architects in over 300 state and local chapters express their commitment to excellence in design and livability in our nation's buildings and communities. Members adhere to a code of ethics and professional conduct that assures the client, the public, and colleagues of an AIA-member architect's dedication to the highest standards in professional practice.

ABOUT THE CENTER FOR TRANSPORTATION STUDIES

The Center for Transportation Studies' (www.cts.umn.edu) mission is to serve as a catalyst for transportation innovation through research, education, and outreach. CTS works with University of Minnesota faculty in over 25 disciplines to advance knowledge in a variety of transportation-related research areas. In 1997, CTS first became involved with transportation and urban design issues in its leadership of a major interdisciplinary effort, the Transportation and Regional Growth Study, which produced new understandings of the relationship between transportation and growth in the Twin Cities area. CTS has also worked closely with the Minnesota Department of Transportation and local governments in advancing Context Sensitive Design/Solutions practices through the development of training courses and web resources, which have helped Minnesota to be recognized by FHWA and AASHTO as a leading state in applying Context Sensitive Design/Solutions.

Contents

EXECUTIVE SUMMARY 1

INTRODUCTION

Beyond Access and Connectivity 7

What Makes Good Design? 10

BENEFITS TO COMMUNITIES

Promoting Economic Development 12

Improving Health and the Environment 22

Designing Great Places 28

Fostering Civic Participation 35

Making Communities Safer 40

A WHOLE GREATER THAN THE SUM OF PARTS 44

CASE STUDIES: PRINCIPLES AND PRACTICES IN THE REAL WORLD 48

Washington Metro, Arlington, County, Virginia 48

Bridgeport Way, University Place, Washington 52

Virginia U.S. Route 50 54

Emerson Park MetroLink Station, East St. Louis, Illinois 56

Barracks Row, Washington, DC 58

Fruitvale Transit Village, Oakland, California 60

APPENDIX: FEDERAL, STATE AND LOCAL CONTEXTS FOR ENHANCEMENT BY DESIGN 62

Executive Summary

Well-designed transportation projects demonstrate the potential to shape a community in ways that go far beyond the project's original purposes. Anecdotal evidence and advocacy exist on behalf of the benefits of well-designed transportation projects on communities. Yet there is little organized quantifiable or qualitative data. Nor is there a comprehensive guide for communities to maximize or integrate the diverse benefits that well-designed transportation projects can bring.

Recognizing this lack of data about the role of design in transportation, Congress authorized a study in Section 1925 of the 2005 Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to achieve two goals: (1) beginning to measure how well-designed transportation projects can bring multiple enhancements to communities in terms of economic development, health and the environment, visual identity and design, public participation and public safety; and (2) providing communities, designers, transportation officials and policymakers a set of principles and practices to adapt to their unique situations and needs.

The *Moving Communities Forward* research team employed a case study-based approach, analyzing nearly 30 transportation projects that represent a broad spectrum of regions, demographics and project types. Although a specific design feature or process works in one kind of transportation project, in one kind of community, it will not necessarily succeed somewhere else. But the broad principles and practices that designers employ can be repeated, in modified forms, across a wide array of transportation-related projects. The research team identified key *principles and practices* that designers and others can use—in the context of their unique situation and environment—to realize multiple enhancements to their communities.

The research also shows that better validated metrics of results across a broad array of economic, environmental, visual and community participatory approaches can help communities frame their approaches to enhancement. The case studies demonstrate how strong design with good planning aspires to and can create a whole greater than the sum of its parts. The measures presented in the research outline the shape of the complex but potentially rich opportunities, especially economic, that transportation projects offer to communities. Although not all measures can be expressed in economic terms, the research finds other measurable, as well as less tangible, values that arise from well-designed transportation projects. For example, visual qualities can be assessed by experts and non-experts alike, while citizen participation, sometimes difficult to budget, can be discerned as a value, particularly after a project is brought to a successful conclusion. The recent emergence of biological and hydrological objectives associated with sustainable design demonstrates the value of integrated design approaches in enhancing the environment. Integrated design that addresses the full spectrum of community values underpins transportation's potential to help communities move forward with confidence.

What Makes Good Design? In the context of transportation projects, design is not simply a final *product;* it is also the *process* that lets the product take shape. What precisely is meant by "well-designed transportation projects" must be explored before measuring how they strengthen communities.

Design is a holistic process that involves many players: architects, landscape architects, planners, engineers, specialized transportation experts, contractors, government and elected officials, community leaders, the media and—most importantly—the public. Good design seeks to address the wide array of challenges a project will face and meet a community's every goal. In recent years, the design community has embraced the concept of **integrated design**, which enlists a multi-disciplinary team to identify seemingly unrelated aspects of design and integrate them into a solution that achieves multiple benefits.

The cases studied here show design processes that are in a process of dramatic change, caused partially by the need to solve ever-bigger and more complex problems with shrinking budgets; and by new tools, both technical and operational, including visualization tools like Building Information Modeling (BIM) and web-based Geographic Information Systems (GIS) tools. A design team that seeks to enhance a community via a transportation project must rely on a process and principles that explore issues beyond the traditional scope of a transportation project and use new tools in creative and inclusive ways. The ability to achieve this may determine whether the project's impact goes well beyond its immediate footprint or whether it misses opportunities to create a whole that is greater than the sum of the parts.

PROMOTING ECONOMIC DEVELOPMENT

Transportation facilities can be designed in ways that integrate, support or trigger economic activity to benefit the community—by reorganizing land use, increasing land value and tax revenues, by attracting capital and providing jobs and increased incomes while also supplying well-located, needed services to the community. Well-designed transportation projects promote community economic development in two ways: by providing increased access to jobs, services and shopping areas; and as a catalyst for economic development.

Each transportation-related development project takes place within a specific geographical setting. The characteristics of both the site (the footprint of the facility) and the situation (its relative location and characteristics of surroundings) affect not only how the project is planned, designed and executed, but whether it succeeds in promoting economic development. Honest assessment of a well-designed community transportation project looks at its impact on the balance sheet and on net cash flow simultaneously. The economic research team analyzed case studies in three different kinds of environments: catalytic redevelopment in inner-city communities, redevelopment in outer-city and inner suburb neighborhoods and outer suburban settings seeking to create places or relieve congestion.

Principles and practices for promoting economic development include:

- Short- and long-term finance matters.
- Designing sites as origins and destinations enhance the chances of success.
- Situation defines potential for success.
- Coordinate and synchronize regulatory processes.
- The best visions are both flexible and well-tended.
- Sustained leadership leads to sustainable projects.

IMPROVING HEALTH AND THE ENVIRONMENT

Good transportation design that enhances communities includes positive impacts on the environment and on the health of people who use the projects. Recent years have seen a dramatic increase in interest in sustainable development. Today there is recognition that sustainability is not just about the environment and natural resources, but also represents a balance between environment, economics and equity.

Because two of the largest emitters of carbon into the atmosphere are the built environment and the transportation sector, the design of transportation systems not only results in health and environmental impacts from the projects themselves but from the transportation patterns established by development. Much of the focus of sustainable design activity in the recent past has been on individual buildings. But now the design community is paying increasing attention to sustainability at the community scale. And in the future, as the most advanced projects in this research demonstrate, design and infrastructure will be united in a seamless sustainable approach.

Conducting research on the health and environmental benefits of transportation projects on their communities presents several challenges, not the least of which is the fact that the field of sustainable development is constantly evolving. Three categories of transportation projects are addressed in this study: development (community) scale, building (facility) scale and infrastructure scale. The

researchers reviewed state-of-the-art environmental assessment methods, rating systems and guidelines at each of the three scales. They then analyzed case studies in each of the three categories that illustrate a range of project types and approaches.

Principles and practices for improving health and the environment include:

- Integrated design is critical to achieve a range of sustainability goals across resources on transportation projects.
- Transportation design can and should address regional and community scale ecological issues.
- Make environmental performance outcomes explicit during the design process regardless of the scale of the project.
- Measuring outcomes must continue during operation and occupancy.
- Transportation buildings and facilities should be built to existing national guidelines, such as LEED or Green Globes.

DESIGNING GREAT PLACES

Every community aspires to be a great place: visually interesting, vibrant and eminently livable. Transportation projects can help make that happen by building a sense of community identity, improving appearance and scenic quality and adding cultural value. These critical characteristics of community, while difficult to measure and even more difficult to cast in terms of monetary costs and benefits, can be assessed by various techniques.

This study sought to measure the impact of transportation projects on community appearance and identity via six distinct tools: an *audit* that creates scores for key urban design qualities; an *inventory* to measure in precise amounts urban design elements; *visual assessments* via photography, showing contrasts in colors, forms, textures, scales and spaces; *mapping* of the communities to analyze and compare basic structure and patterns of streets and blocks; *workshops* involving design professionals who are familiar with—and in some cases helped to design—the community; *focus groups* with community leaders discussing what works and what doesn't about their communities. These different strategies provide a rounded and multi-faceted view of the design qualities of each place.

Principles and practices for designing great places include:

- Appreciate that planning and developing great places takes time.
- Program spaces for a variety of uses and users and a variety of times.
- Use zoning to increase diversity.
- Invest in maintaining spaces.
- Design at a human scale.
- Use design to increase safety.
- Create connections between spaces.
- Design sidewalks and crosswalks for appropriate pedestrian use.
- Create spaces for bicycles and bike parking.
- Integrate transit and transit facilities into the urban pattern.
- Do not forget, but do not overemphasize, car movement and car parking.

FOSTERING CIVIC PARTICIPATION

Few dispute the importance of engaging the public in planning processes. But policymakers and community leaders may not realize the value of an engaged public process carried all the way through design. Participation can bring benefits to the community that go far beyond the basic improvements of mobility and access provided in a transportation project itself. The projects examined in *Moving Communities Forward* illustrate the many benefits of engaging the public in planning and design processes for transportation projects: citizens gain knowledge and expertise that they apply to other community issues; the broader community gains credibility and pride in its accomplishments; and the design and transportation professions gain, as those involved challenge conventional approaches to planning and design.

For this study the research team evaluated outcomes gleaned from prior research by documenting public involvement in the planning and design processes for six transportation projects via interviews of key participants. Principles and practices for fostering civic participation include:

- Use multiple methods of participation.
- Identify a local champion.
- Maintain a clear sense of the desired outcome.
- Identify and engage political leadership.
- Bring professional design expertise to the table—early.
- Visualization is critical for public support.

MAKING COMMUNITIES SAFER

Safety is always the top priority in transportation facility design. But can well-designed transportation projects actually make communities safer than what was there before, protect not only those who explicitly use the project but those who come into casual or indirect contact with it throughout the community?

This research asked how, and to what extent, safety issues are treated in transportation projects, particularly those that prioritize other enhancements such as CSS/CSD projects. Ideally, safety issues should be an explicit and quantitative component of design decision-making. Although quantitative safety prediction can be done for certain design elements, science-based prediction for the type and scope of design activities for CSS/CSD is much more difficult. This is especially true for predictions related to pedestrian safety, and it produces a gap between the design ideal and the as-built project. Because genuine experimental research is rarely possible in road safety, each project should be treated as a research opportunity.

Principles and practices for making communities safer include:

- Include experts in observational research on the design team.
- Include safety audits as part of the design process for projects where reliable quantitative safety prediction is not yet feasible.
- Conduct measurements of safety once the project is operational and compare to the results of the safety audit conducted during the design phase.

A WHOLE GREATER THAN THE SUM OF PARTS

The case studies clearly suggest that the success of transportation projects requires integrating transportation design with all social, economic and cultural resources. The previous sections of this report showed how transportation projects lead to five types of enhancement in broader community values.

But communities want to achieve enhancements across the spectrum of social, economic and political issues. Some case studies in *Moving Communities Forward* were chosen to explore how design practices aimed at the creation of one kind of value (e.g., economic enhancement) augmented those of another, such as sustainability, citizen participation or safety. This study has sought to identify those principles and practices that bring about a multitude of community benefits and provide a toolkit of ideas for communities that wish to do the same.

The case studies show a rich toolkit of creative practices and processes that have been guided by design *principles* that transcend the individual projects:

- Transparent decision-making
- Consensus-building
- Sustainable design
- Resilience
- Designing in context

Using these five principles, designers can then employ practices that will bring the greatest level and variety of benefits to the community:

- Integrated design from the outset of a project helps address the full spectrum of challenges.

- Participatory processes and structures build constituencies for design solutions.
- Visualization tools provide critical support and add transparency to the citizen engagement process.
- Human-scaled structures and spaces give intense, multimodal development a sense of place.
- Clearly marked and connected transportation modes make multimodal systems easier to use.
- Durability and flexibility create places that are sustainable and meet future challenges.

Beyond Access and Connectivity

The transportation network is the largest designed system of public and publicly used space in the United States. By their very nature, transportation projects—from highways and rail lines to multi-modal corridors and intermodal transit facilities—provide greater mobility and safety of movement. But they also connect people and places, and communities that are enhanced by these projects often become destinations in their own right. The transportation infrastructure shapes the values and aspirations of America's communities.

Transportation projects can create and enliven communities; or they can tarnish them. Transportation projects can bring economic prosperity and environmental vitality to our country's cities and towns; or they can sap precious resources and impoverish neighborhoods. In a time of limited resources at every level of government, communities need to ensure that the transportation projects in which they invest not only increase connectivity and access, but bring about a wide array of community benefits.

Well-designed transportation projects demonstrate the potential to shape the future of a community in ways that go far beyond the project's original purposes.

Well-designed transportation projects demonstrate the potential to shape the future of a community in ways that go far beyond the project's original purposes. A sizable amount of anecdotal evidence exists about the benefits of well-designed transportation projects on communities. Yet in spite of laudable academic work on the values of planning for certain kinds of transportation-related projects, such as transit-oriented developments (TOD), there is little systematic quantifiable or qualitative data on the values of design.[1] Worse, there is no comprehensive guide to tools that maximize the benefits that well-designed transportation projects bring; communities must "go it alone" in designing transportation projects without the benefit of useful information or best practices.

Recognizing this lack of data, Congress authorized a study in the 2005 Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to begin to answer these questions. The result of more than 18 months of research, *Moving Communities Forward* has two goals:

- to begin measuring how well-designed transportation projects can have multiple positive impacts on communities; and
- to provide communities, designers, transportation officials and policymakers a set of guiding principles and best practices they can apply to their unique situations and needs.

Moving Communities Forward consists of five separate research studies, each exploring how well-designed transportation projects enhance communities in different areas:

- Economic
- Health and the environment
- Visual identity and design
- Public participation
- Public safety

Highlights of each of these studies can be found on pages 12–43 of this report.

[1] See, for example, Robert Cervero, Christopher Farrell and Steven Murphy, Transit-oriented Development and Joint Development in the United States: A Literature Review. Transit Cooperative Research Program Report 52, 2002; Michael Dumbaugh, Overcoming Financial and Institutional Barriers to TOD: Lindbergh Station Case Study, *Journal of Public Transportation*, vol. 7, no. 3, 2004.

In addition, the research team performed a sixth study, identifying those design choices that have multiple, cross-cutting benefits on their communities, such as increasing economic prosperity while simultaneously improving safety; in other words, projects where the whole became much greater than the sum of its parts. Highlights of this research can be found on pages 44 – 47.

Moving Communities Forward employed a case study-based approach. The research team analyzed nearly 30 transportation projects from every region of the country. Some are in urban areas; others in suburban or rural communities; some were built in communities that already were thriving, and some are located in places that face significant challenges. The designers of each project sought to improve their host communities in various ways; some projects have succeeded beyond their community's wildest expectations; others have yet to realize their full potential. But each project carries with it powerful lessons and, as the research shows, means for communities across the nation.

Several different project types were studied, but the majority fall into one of two categories:

Transit-Oriented Development (TOD) is urban intensification around the immediate vicinity of a transit station, along with related services. From a community perspective, well-designed TOD can add economic, environmental and visual benefits in the forms of new combinations of synergistic land uses, buildings and urban spaces while also encouraging a commitment to shared community visions through participation. From a transportation perspective, the projects presented in this study sought to provide enhanced accessibility to and from communities while also creating needed services in proximity to station areas. One transportation premise of the intensification in TOD is the increased efficiency of trip-making, because multiple purposes are served and congestion and vehicle miles traveled (VMT) are reduced, sometimes significantly.

A specific design feature that works in one kind of transportation project, in one kind of community, will not necessarily succeed somewhere else.

Context Sensitive Design and Solutions (CSD/CSS) includes transportation projects in which sensitive community resources, both natural and cultural, have been conserved and, often, enhanced through strategies that may include pedestrian-friendly features, traffic-calming devices, and streetscapes on a more human scale. Context Sensitive Solutions (CSS) demonstrate the results of a public-private partnership led by the Federal Highway Administration (FHWA) and including the National Park Service, the Federal Transit Administration, the American Association of State Highway and Transportation Officials, the National Association of City Transportation Officials, the Institute for Transportation Engineers, Project for Public Spaces, and Scenic America. At the state and local levels, departments of transportation, communities of all types, designers and planners have been engaged on the ground in CSD/CSS projects. http://www.fhwa.dot.gov/csd/index.cfm For further information and a listing of projects, some which are addressed in this study, see also http://www.contextsensitivesolutions.org/content/reading/fhwa_csd_website/.

PRINCIPLES AND PRACTICES: NO ONE-SIZE-FITS-ALL-APPROACH

A specific design feature that works in one kind of transportation project, in one kind of community, will not necessarily succeed somewhere else. But the broad principles and practices that designers employ can be repeated, in modified forms, across a wide array of projects.

The *Moving Communities Forward* research team identified key **principles and practices** that designers and others can use—in the context of their unique situation and environment—to realize multiple benefits to their communities.

These principles and practices show that well-designed transportation projects create opportunities not only for improved access and connectivity, but for broader

community values as well. The research has shown that in many cases, a small change in the design process, or the addition of relatively inexpensive or less intrusive design strategies, can reap large rewards. With transportation budgets stretched thin, the lesson may be that—if applied right—less can be more.

At the same time, the research shows that better validated metrics of results across a broad array of social, cultural, economic and environmental parameters are required. Some benefits are easily measured; others less so. But even benefits like economic growth, which can easily be monetized, need to take into account a wider range of factors, such as whether a transportation project that increases economic activity is simply taking business from somewhere else.

This dearth of measurable outcomes is especially true in the case of sustainable design that seeks to conserve natural resources and address larger issues like climate change while continuing to provide transportation and economic benefits to communities.

The promise of good transportation design and the reality of limited funding demand evidenced-based knowledge. Simply put, we are not at the culmination, but at the outset, of our understanding of how transportation design truly impacts communities.

To read the full research reports prepared for this study and to find more information about well-designed transportation projects, visit www.movingcommunitiesforward.org.

What Makes Good Design?

Integrating principles and practice to solve problems

When most people think of a project's design, what comes to mind is the physical form: the materials, shapes, colors, textures, and so on. But design is not simply a final *product*; it is also the *process* that lets the product take shape. What precisely is meant by "well-designed transportation projects" must be explored before measuring how they strengthen communities.

Design is a holistic process that begins long before the first sketches are made, and lasts beyond when the ribbons are cut. Transportation design problems are complex and specific to communities, and even project types, and they involve multiple jurisdictions, funding sources, publics, and clients. They take time and they require coalescent leadership. They involve many players: architects, landscape architects, planners, surveyors and mapping professionals, engineers, specialized transportation experts, contractors, government and elected officials, community leaders, the media and —most importantly—the public.

Photo Top: **Ann Forsyth**
Bottom: **New visualization tools like Building Information Modeling (BIM) and web-based GIS programs have expanded the ability of designers to show their clients the possibilities their designs may achieve. Image: Google Earth**

Design and planning play an integrated, "tag-team" role in guiding these processes. Sometimes design leads planning, but often comprehensive land use planning precedes design. Planning anticipates the overall coherence of a community when transportation changes are on the horizon. It often helps to set legal and public financial frameworks in place. Design, including engineering, becomes both a test and the means of realization of planning.

Architecture and other design disciplines integrate ideas across a multiplicity of issues. Design is both discovery and decisionmaking. Good design seeks to address the wide array of challenges a project will face—cost, safety, pollution, the impact on vulnerable populations—and meet a community's every goal—economic development, a healthier environment, enhanced safety and efficiency, and a more livable, desirable community. Good design requires a large toolkit of activities—from surveying and

studies, to public meetings and planning charrettes—that enable the design team to give form to the best ideas and solutions.

In recent years, the design community has embraced the concept of **integrated design**. The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy defines integrated design as a "process of design in which multiple disciplines and seemingly unrelated aspects of design are integrated in a manner that permits synergistic benefits to be realized."[2]

NEW TECHNOLOGIES, NEW CHALLENGES

The cases studied in *Moving Communities Forward* show design processes that are rapidly changing to achieve higher levels of integration. This revolution is caused partially by the need to solve ever-bigger and more complex problems—demographic shifts, climate change, security threats, and, of course, finite sources of money.

Integrated design as a public process offers a way to coalesce the diverse issues that arise when transportation shapes the main purpose and need of a project. As demonstrated in the research, the ability of a design team to find that best process may determine the bottom-line effects of the project. A design team that seeks to enhance a community economically and environmentally and build community beyond the footprint of the transportation project must rely on a process, principles and tools that bring issues to a solution greater than the sum of its parts.

Design is also being transformed by new tools, both technical and operational. Understanding how to use which ones will be a matter of producing better-validated measures of enhanced outcomes across a broad array of societal imperatives. At the foundation of transportation planning lie the premises that maximize the relationship of transportation investments to land use decisions. Projected integration of community aspirations with such diverse issues as access to new technologies, educational and health services, jobs and retail services—all made possible by transportation-related facilities—can partially be embodied in a spreadsheet analysis of data or a map. But it can also take the form of something more visual and synergistic. The design or redesign of buildings and spaces that raise transportation projects to the highest levels of enhancement are captured in the visualization of new three-dimensional syntheses of community aspirations.

New visualization tools like Building Information Modeling (BIM) and web-based mapping and geographic information systems (GIS) tools, some with increased three- and even four-dimensional capabilities, have expanded the ability of designers to show their clients the possibilities their designs may achieve, but they also have increased the level of sophistication about those projects. The transparency of these tools—their accessibility and the level of three-and four-dimensional information that can be brought to the public discussion when combined with other data—can also provide reality checks.

Design is a holistic process that begins long before the first sketches are made, and lasts beyond when the ribbons are cut.

Integrated design as a public process offers a way to meet head-on the diverse issues that arise when transportation shapes the main purpose and need of a project. A design team that seeks to enhance a community economically, environmentally, and so on via a transportation project must rely on a process and principles that explore issues well beyond connectivity and access.

As demonstrated in the research, the ability of a design team to find that ideal process may determine whether the project's impact goes well beyond the footprint of the transportation project, or whether it misses opportunities to create a whole that is greater than the sum of the parts.

2 http://www.eere.energy.gov/buildings/info/design/integratedbuilding/

Promoting Economic Development

In this era of shrinking transportation dollars, communities naturally think about economic development when planning transportation investments. Transportation facilities of many kinds can be designed in ways that integrate, support or trigger economic activity to benefit the community—by reorganizing land use, increasing land value and tax revenues, providing jobs and needed services to the community, and by attracting capital.

Well-designed transportation projects promote community economic development in two ways: by providing increased access to jobs, services, and shopping areas; and as a catalyst for economic development. The two work hand-in-hand: access to jobs means income for residents, which in turn spurs further economic development, including the potential for home ownership. And building a stronger economic base adds value to future projects.

MEASURING ECONOMIC BENEFITS

Each transportation-related development project takes place within a specific geographical setting. The characteristics of both the site (the footprint or location) and the situation (its relative location and characteristics of surroundings) affect not only how the project is planned, designed, and executed, but whether it succeeds in promoting economic development.

At the same time, the economic impacts of projects extend far beyond the immediate site. A project may be deployed within a specific physical setting (a building, a block, a neighborhood), but each setting in turn exists within a series of ever wider spatial

Left: **In Arlington County, Virginia, redevelopment planning began in the 1970s as the population dropped and the tax base languished. By focusing redevelopment efforts on Metro stations, growth is accommodated without disrupting established residential areas or adding to traffic. Photo: Ann Forsyth**

Right: **In Dallas, DART works contractually with municipalities and private developers to plan and develop land adjacent to stations, such as Mockingbird. City members of DART levy a one-percent extra sales tax, which yields $320 million for DART; cities outside the DART compact use their one percent for economic development. Photo: Ann Forsyth**

frameworks (e.g., city, county, metro area, state) to which it is intimately linked.

There are two ways to evaluate the economic impacts of well-designed transportation projects. One occurs during the design *process* itself:

- Did it consider how economic impacts unfold over time—immediate (less than a year), short-term (2–5 years), longer term?
- Did it consider the economic impacts across a range of *spatial* frameworks or scales—local, neighborhood, citywide, metro-wide, regional?
- Was the cost-benefit analysis of the project comprehensive, including all direct and indirect costs and benefits?

The other relates to measurable *outcomes*, ways in which the project promotes community economic development after it is built and operating, considered over the short and longer term:

- Employment changes
- Changes in land use
- Changes in property values and property tax revenues
- Reduction in the demand for government services after the property is redeveloped

The design process is a continuous, sustained, and iterative activity. During each phase of the process the design team uses the knowledge and tools that are available, but it cannot anticipate all consequences or changes in external environments that will affect expected outcomes. Furthermore, design proceeds while the environments that they help to shape change as a result of earlier phases of the design process itself.

For example, planning, design and deployment of the Bay Area Rapid Transit (BART) system got underway decades ago, with lines and service expanded and plans updated as the Bay Area itself grew larger and more complex. In Arlington County, Virginia, more than four decades of land use and transportation planning continues today in anticipation of and in response to the planning, construction, and use of use of heavy rail and TOD along the Rosslyn/Ballston Metro Corridor.

RESEARCH APPROACH AND MEASURES

Every transportation project exists at a specific location (a local site), and within a wider geographical context (a situation). Attributes of site and situation regulate the degree to which a project yields positive economic benefits for communities. Profiles of diverse cases illustrate how site and situation influence economic development. For example:

Transportation facilities of many kinds can be designed in ways that integrate, support, or trigger economic activity.

Regarding *Site*:

- Does the project use undeveloped land or is it a redevelopment?
- Does the design of the project provide appropriate access to users?
- Does the design of the project direct patron traffic to the associated businesses?

Regarding *Situation*:

- What are the metropolitan area's population and economic *growth* rates?
- What conditions and trends exist in neighborhood population size and composition, disposable income, wealth position, land prices and development densities surrounding the project?
- How does the project improve neighborhood *accessibility* (number of opportunities available within a certain distance or travel time) and the *mobility* of local residents (ability of residents to move between different activity sites)?

There are several identifiable contexts in which the case studies selected for this research exist, including:

- Metropolitan growth rate: (a) fast-growing metro areas (e.g., Atlanta, Dallas); (b) metro areas with moderate growth (e.g., Los Angeles, Minneapolis-St. Paul); and (c) slower growth areas (e.g., Chicago, St. Louis)

- Age of prior site development: (a) redevelopment vs. new development: inner-city (Chicago, Oakland, East St. Louis, Salt Lake City), outer city (Atlanta, Dallas), inner-suburban (Arlington County), and outer suburban (Minneapolis-St. Paul); and (b) old free-standing centers engulfed by suburbanization (Arlington Heights, Plano)
- Socioeconomic character of the adjacent residential setting, distinguishing between (a) upper-middle-class, (b) middle-class and (c) working-class

To assess a project's economic development prospects, transit authorities, development specialists and financiers consider population size and growth trends in the project's neighborhood, household income and wealth positions (with housing values as a wealth surrogate), the relative ranking of the income and wealth position of the neighborhood compared with the metro area of which it forms a part and whether that ranking is rising, holding steady or declining over time.

Each of these measures is available from the Bureau of the Census and may be supplemented from local sources such as records of real estate sales and property assessment records. Tables of data by census tract and maps of the local area displaying census measures at the census-tract scale portray the economic situation of the project. For example, decennial census data illustrate how neighborhood incomes and neighborhood housing values form part of the economic base influencing success of TOD.

In census tracts surrounding Atlanta's Lindbergh Station, with the exception of a nearby low-income neighborhood (tract 94.02, which contains the station), average family incomes typically were well above the MSA median in 1989 and rose during the 1990s from 24 percent to 109 percent (Table 1). Meanwhile, wealth effects from escalating housing prices—up 85 to 98 percent during the decade—provided an additional economic base to encourage continuing development at Lindbergh City Center. In other words, whether reckoned in terms of household income or housing wealth, the ranks of these tracts compared with others in the MSA rose briskly in the 1990s. This provided attractive opportunities for continuing real estate development (encouraging the pushing out of lower-income retailing in favor of expanded upscale shopping and steadily replacing older low-income housing and with higher-priced apartments and condos) and redeveloping relict industrial land with housing and commercial activity.

The Lindbergh MARTA Station supports Lindbergh City Center and adjacent offices and commercial development, and these developments in turn support patronage at the MARTA station. Meanwhile the increasing absolute and relative prosperity of households living in tracts surrounding the station support both.

Census-tract data for Emerson Park in East St. Louis, IL, tell a contrasting story of life and development prospects at the opposite end of the income and wealth spectrum (Table 2). Median family income levels in 1989 were only a fraction of those near Lindbergh Station, from a low of $5,294 to a high of $21,982. Although rising briskly in percentage terms during the 1990s, they remained at or below poverty levels by 1999. The same is true of housing values. Taken together, the commercial development prospects for the area around the Emerson Park MetroLink station are challenging.

Census data for tracts that include or are adjacent to Leimert Park in Los Angeles generally reported modest income levels—between the extremes of Lindbergh and Emerson Park—but accompanied expensive housing that was increasing in value (Table 3). The single high-income tract had a level of owner occupancy exceeding 80 percent in both census years, but the others had rates as low as 16 percent.

What difference does owner-occupancy make? In tracts where owner-occupancy rates are high during a time of increasing real estate values, resident owners enjoy a significant wealth effect, which can sustain neighborhood commercial life, promote reinvestment in the housing stock, and promote citizen involvement by stakeholders protecting their assets. But if housing is owned disproportionately by absentee landlords, the wealth effects accumulate elsewhere and are unlikely to yield sustained local citizen

Photo: MARTA

TABLE 1–FAMILY INCOMES AND HOUSING VALUES COMPARED WITH METRO AVERAGES, 1989/1990 AND 1999/2000, IN TRACTS SURROUNDING LINDBERG MARTA STATION, ATLANTA, GA

Census Tracts Surrounding Lindbergh Station	A: Median Family Income 1989 ($)	A÷E	B: Median Family Income 1999 ($)	B÷E	C: Median Value Owner Occupied Housing 1990 ($)	C÷E	D: Median Value Owner Occupied Housing 2000 ($)	D÷E
9100	69,121	1.66	85,951	1.45	245,200	2.73	461,400	***3.41***
9200	46,429	1.12	64,688	1.09	123,200	1.37	230,500	***1.70***
9300	51,069	1.23	106,672	***1.80***	171,300	1.91	339,300	***2.51***
94.01	61,464	1.48	83,710	1.41	157,900	1.76	291,800	***2.16***
94.02	26,786	.64	31,023	.52	150,000	1.67	No Data	
9600	58,440	1.40	93,906	***1.58***	190,700	2.12	372,100	***2.75***
City Wide	25,173	.60	37,231	***.64***	71,200	.79	130,600	.97
County- Fulton	36,582	.88	58,143	***.98***	97,700	1.09	180,700	***1.34***
County-DeKalb	41,495	1.00	54,018	.91	91,600	1.02	135,100	1.00
Atlanta-Sandy Springs-Marietta, GA MSA (E)	41,618		59,313		89,800		135,300	

Note: The ratios report tract values compared with metro medians (E). Ratios in ***bold italics*** are higher in 1999 and 2000 than corresponding entries in 1989 and 1990, which indicates a relative increase in tract rank during the decade. Lindbergh Station is in Tract 94.02. Source: U.S. Census Bureau.

involvement in neighborhood improvements, whether focused on transportation or other projects. Meanwhile the prospect of becoming owner-occupants becomes more elusive as housing prices rise faster than incomes.

THE CASES

INNER-CITY CATALYTIC REDEVELOPMENT

These three cases are redevelopments situated in aging inner-city neighborhoods. Fruitvale and Emerson Park have light-rail transit stops with park-and-ride facilities, while the Los Angeles Neighborhood Initiative (LANI) used small bus-oriented projects to stimulate economic development.

Fruitvale BART Station
Oakland, CA

The San Francisco-Oakland metro area population grew steadily in the 1990s at 11.4 percent, comparable to Chicago, Los Angeles and Minneapolis-St. Paul. Fruitvale Village, in Oakland, lies at the intersection of a major northwest-southeast thoroughfare (International Boulevard) and northeast-southwest Fruitvale Avenue link to Alameda. In earlier decades, this transit intersection was the major outlying retail center in Oakland. The Fruitvale Village development adjoins the Fruitvale light-rail stop, situated within a medium-density inner-city neighborhood with a large, stable, working-class population and significant disposable income. The complex

Top: **The downtown Plano, Texas, DART station and surrounding development have created a "home" destination for Dallas commuters with both housing and commercial activity. It is both a destination in itself and a mode transfer point. Success of the first phase of development stimulated plans for additional phases. Photo: Dallas Area Rapid Transit**

Right: **The Emerson Park transit station and park-and-ride lots in East St. Louis serve new low- and moderate-income housing developments, a community center, and a charter school. The light-rail station now links low-income and unemployed residents with job opportunities in the Greater St. Louis area, enhancing prospects for home ownership. Photo: Ann Forsyth**

includes condominiums, rental housing, and small business ventures centered on a plaza that is used for festivals and civic events. The Village is bordered by the light-rail tracks on one side and a major commercial thoroughfare on the other. The real estate development provides steady cash flow to BART from land rents, so other investors are able and willing to join BART and invest in the Village, tapping part of the neighborhood market that otherwise would go elsewhere.

Emerson Park MetroLink Station
East St. Louis, IL

The Emerson Park MetroLink transit stop and park-and-ride lots are sited on the north side of Interstate 64, which bisects the neighborhood. New low- and moderate-income housing developments, a community center, commercial services, and a charter school are served by the light rail, and a highway overpass was constructed to improve safety and auto and pedestrian access across the highway. The light-rail station links low-income and unemployed residents with job opportunities in the Greater St. Louis area, thus enhancing prospects for home ownership.

Los Angeles Neighborhood Initiative (LANI)
Boyle Heights, Leimert Park, and North Hollywood, CA

The LANI is "a catalytic program dedicated to jump-starting community-driven neighborhood revitalization and improving transit access in challenged Los Angeles communities." The three LANI neighborhoods studied (Boyle Heights, Leimert Park, and North Hollywood) are auto-oriented areas with some transit-dependent populations. The LANI engaged community organizations in a process of upgrading bus shelters, associated landscape elements, and façades for local businesses, all to increase transit ridership, spark further interest in local investment and build community capacity for attracting local economic development. Associated improvements include upgraded bus shelters, small parks developed around transit stops, decorative trash receptacles and improved trash collection, and enhanced lighting. Each neighborhood has capitalized on the identity of its residents for place-making: Working-class Latinos in Boyle Heights, middle-class African-Americans in Leimert Park, and an arts community in North Hollywood that is close to Universal and Warner Brothers studios. New housing is being developed around the Red Line light rail station, a terminus with the Bus Rapid Transit (BRT) Orange Line.

All three of these cases show vivid evidence of progress in promoting economic development. That progress, however, stimulates land speculation that raises land prices and in turn can slow the rate of development. To compound the difficulties facing neighborhoods like Boyle Heights, where most residents are recent arrivals, rates of home-ownership are low. In the eight census tracts comprising the neighborhood in 2000, rates varied from a low of 8 percent to a high of 32 percent; in five tracts it was 15 percent or less while housing prices were advancing steadily. In situations like this, with low incomes and minimal local home-owner wealth effects, promoting economic development presents a big challenge.

OUTER-CITY/INNER SUBURB REDEVELOPMENT: ENHANCED RENT AND TRANSIT RIDERSHIP

Lindbergh City Center MARTA Station
Atlanta, GA

Lindbergh Station is situated north of Atlanta's Central Business District (CBD), in the most prosperous sector of the city—the 18th-fastest-growing U.S. metro area in the 1990s, and ranked first in population added between 2000 and 2005 (+670,000).

Lindbergh is an ambitious 47-acre TOD project in the central city, which had not been a focus for major real estate development for many years. It is located near an old industrial complex, adjacent to an aging shopping mall, with low-income housing to the east and high-income neighborhoods to the west and north. Land development around Lindbergh Station taps commuter demand and local purchasing power. The Metropolitan Area Rapid Transit Authority (MARTA) chose to locate its headquarters here as Bell South planned to consolidate its office activity on the site.

A well-designed community transportation project improves the community balance sheet while increasing the flow of net benefits.

Recently the low- and moderate-priced housing east across the thoroughfare has begun being displaced to make way for upscale housing, and older, low-ticket retail is being replaced by an upscale shopping center as the area continues to gentrify, replacing railroad-based and industrial land uses with high-rent residential, commercial, and office activity.

Intense demand for land for development and redevelopment is driving the process at Lindbergh. The development that follows creates a destination (offices, shopping), which stimulates additional rounds of development nurtured by Atlanta's overall growth and by Lindbergh's location in trendy north Atlanta. This intense upscale development around Lindbergh Station would not occur in the lower-income sectors of the Atlanta metro area.

TABLE 2–FAMILY INCOMES AND HOUSING VALUES COMPARED WITH METRO AVERAGES, 1989/1990 AND 1999/2000, IN TRACTS SURROUNDING EMERSON PARK METROLINK STATION, EAST ST. LOUIS, IL.

Census Tracts Surrounding Emerson Park Station	A: Median Family Income 1989 ($)	A÷E	B: Median Family Income 1999 ($)	B÷E	C: Median Value Owner Occupied Housing 1990 ($)	C÷E	D: Median Value Owner Occupied Housing 2000 ($)	D÷E
5004.00	11,533	.30	24,306	***.45***	22,200	.32	38,200	***.38***
5006.00	11,506	.30	19,688	***.36***	20,800	.30	33,500	***.34***
5012.00	21,982	.58	37,281	***.69***	27,400	.39	43,200	***.43***
5021.00	N/A		31,481	.58	31,200	.45	44,900	.45
5024.03	N/A		In 5021 in 2000		37,500	.54	N/A	
5041.00	12,035	.32	In 5045 in 2000		19,500	.28	N/A	
5042.01	9,063	.24	29,375	***.54***	15,800	.23	27,900	***.28***
5044.00	5,284	.14	In 5045 in 2000		20,000	.29	N/A	
5045.00	N/A		15,783	.29	N/A		31,000	.31
City of St. Louis	15,975	.42	24,567	***.45***	26,400	.38	41,800	***.42***
County of St. Clair	31,939	.84	47,409	***.88***	55,500	.79	77,700	.78
St. Louis, MO-IL MSA (E)	38,146		54,113		70,000		99,400	

Note: The ratios report tract values compared with metro medians (E). Ratios in ***bold italics*** are higher in 1999 and 2000 than corresponding entries in 1989 and 1990, which indicates a relative increase in tract rank during the decade. Emerson Park Station is in Tract 5042.01. Source: U.S. Census Bureau.

Mockingbird DART Station

Dallas, TX

This is an upgraded Dallas Area Rapid Transit (DART) rail station with adjacent upscale chain-store development and housing, about 4 miles north of the Dallas CBD along fashionable Peachtree Ridge, at the intersection of Mockingbird Lane, a major east-west arterial, and the Central Expressway (US75), in the most prosperous city-suburban sector of the metro area. The station includes a park-and-ride to downtown Dallas. In the 1990s, median family income in the Dallas metro area rose 42 percent; in the city of Dallas it rose 28 percent, but in the six tracts adjacent to Mockingbird it rose from 65 to 80 percent. Dallas was the 36th fastest growing U.S. metro area in the 1990s (29.3 percent); ranked second in population added between 2000 and 2005: (+658,000).

DART works contractually with the City of Dallas, 12 other municipalities, and private developers to plan and develop land adjacent to stations. DART, its member cities, and developers coordinate activity to provide the densities needed to make rail transit work. City members of DART levy one percent in extra sales tax, which yields $320 million for DART; cities outside the DART compact use their one percent for economic development. DART does not initiate land development at stations, but works with developers and municipalities to make development work to support DART and the communities. Cities in the Dallas area increasingly recognize advantages of light-rail access, place-making and walkable communities. By the end of the 1990s, residential and office properties as well as land price premiums near DART stations were appreciating much faster than those farther away.

TABLE 3–LEIMERT PARK, LOS ANGELES, CA

	MEDIAN FAMILY INCOME ($)		MEDIAN VALUE OF OWNER-OCCUPIED HOUSING ($)		OWNER OCCUPIED (%)	
Leimert Park Census Tracts	1989	1999	1990	2000	1990	2000
2343.00	28,885	46,709	184,600	218,100	24	21
2345.00	25,597	39,550	118,500	144,900	47	47
2361.00	25,536	22,384	189,800	188,900	16	16
7032.00	58,336	82,536	290,200	289,800	83	81
Los Angeles-City	34,364	39,942	244,500	221,600	39	39
Los Angeles County	39,035	46,452	226,400	209,300	48	48
Los Angeles-Long Beach-Santa Ana CMSA	41,132	50,645	211,700	203,300	54	45

Source: U.S. Census Bureau

Arlington County, VA

Arlington is a first-ring Washington suburb of 200,000, across the Potomac River from Washington, DC It grew steadily in the 1920s and 1930s but was aging 50 years later. Growth in the Washington, DC, area in the 1990s was 15.8 percent. Redevelopment planning began in the 1970s as local population dropped and tax base languished. Arlington left its former Euclidean[1] zoning code in place while creating a new policy overlay that offered developers a choice: (1) follow the old zoning regulations and restrictions, or (2) negotiate with the county for more density in exchange for doing what the county wants. Arlington planners focused redevelopment efforts on TODs at five Orange Line Metro stations.

By focusing redevelopment efforts on TODs at Metro stations, part of the Washington area's growth continues to be attracted to Arlington and is accommodated without disrupting established residential areas or adding to traffic on county arterials, levels of which remain modest. This is a 50-year planning and development effort, facilitated by Arlington County's unified government with no municipalities. All county board members are elected at large, minimizing parochial concerns that might trump long-term county-wide goals.

OUTER SUBURBAN SETTINGS: PLACE-MAKING AND CONGESTION RELIEF

Downtown DART Station and Eastside Village
Plano, TX

Plano lies about 30 miles (40 minutes) north of downtown Dallas, a first-ring suburb centrally located in Dallas's most prosperous northern sector. It is part of the Dallas Metroplex, the 36th fastest growing U.S. metro area in the 1990s, and captures part of the area's continuing growth. A redevelopment plan was reinforced when DART decided to build a full-service, "destination" platform downtown without park-and-ride facilities. DART and the city worked together to strategically locate the platform to bring the entire downtown business/government district within a quarter-mile of the platform, and facilitate the city's first major redevelopment project.

The downtown Plano DART station and surrounding development were upgraded to create a "home" destination—meant for Dallas commuters. Eastside Village, which added housing and commercial activity, is a transit village adjacent to the DART station. Moderate-price housing is steps from the transit line. Downtown Plano was upgraded and housing added. It is both a

[1] Derived from the U.S. Supreme Court case that established the constitutionality of municipal zoning. (*Village of Euclid v. Ambler Realty Co.*, 272 US 365 (1926)), this system encourages local governments to separate similar land uses into small geographical areas known as zoning districts.

destination in itself and a mode transfer point. Success of the first phase of development stimulated plans for additional phases, which will support downtown redevelopment and transit usage for Plano as both an origin and a destination.

Arlington Heights METRA Station
Arlington Heights, IL

A commuter rail suburb of 80,000 about 25 miles northwest of Chicago's CBD, Arlington Heights is an old village being engulfed by sprawling suburban growth. Metropolitan Chicago population grew only 11.2 percent in the 1990s, but outer suburbs captured a significant share of that growth as some activity relocating from other older parts of the metro.

The village undertook a major revival and renewal of its downtown, next to the METRA commuter railroad station. Only 17 percent of downtown residents use the train to commute, but the station relocation and rebuilding and the downtown redevelopment plan formed part of a successful unified TOD plan. High-density mixed-use development today surrounds the station, including high-rise housing. A historic image was capitalized in a new station building. Increased ridership followed. Transportation and land use plans unfold over decades. A vision for redevelopment, a Tax Increment Financing (TIF) plan and cooperation with developers set the stage. A new round of planning began in the 1970s, with a TIF district established in the 1980s and downtown redevelopment commencing in 1983. The relocated train station broadened its impact and supported downtown redevelopment. The village relaxed some density rules in exchange for developer cooperation.

Southwest Transit Station
Eden Prairie, MN

This integrated pedestrian and bus-transit-oriented development offers express bus service to the Minneapolis CBD, the University of Minnesota, and other central city destinations. The station is located at the flourishing southwest edge of the most prosperous residential-commercial sector of the Minneapolis-St. Paul metro area.

Availability of a park-and-ride transit station and development adjacent to it provides positive reinforcement in both directions–the station supporting nearby commercial and residential activity and the land development supporting transit use by locals and park-and-ride patrons. Chain development was added in along with those facilities, plus parking for non-commuters. A hotel is part of the development, so it is not only a boarding point but a destination in itself. The project, which is still unfolding, will anchor a BRT transitway to downtown Minneapolis in the future.

PRINCIPLES AND PRACTICES

Well-designed transportation projects can promote community economic development and real estate investment, but a project's success will depend on the local context, namely the circumstances of its site and situation. Such projects can provide access to jobs, services, and shopping areas for transit-dependent communities. Well-designed projects can also be a catalyst nurturing economic development by bringing unused and underused resources into full productivity.

Every place is different, and change is constant, so projects must be tailored to the circumstances, needs and opportunities that each unique place presents. In the context of economic returns on design and planning efforts, the key findings point to generalized practices that will have project-specific components:

Short- and long-term finance matters. Recognize both the need for short-term capital and operating financial needs to get a project off the ground, and the need for long-term financing to sustain the project once completed.

Designing sites as origins *and* destinations enhance the chances of success. Content of the project site, with adjacent facilities permitting it to develop both as an *origin* (housing, park-and-ride) and a *destination* (offices, shopping, recreation), with access from all directions, makes a difference.

Situation defines potential for success. Align project content with nearby population size and composition, income and wealth position, and growth prospects for the metropolitan area.

Coordinate and synchronize regulatory processes. Business and government (including transit authorities and local zoning authorities) interests must converge to meet mutual needs, neither of which can succeed without the other.

The best visions are both flexible and well-tended. Coherent planning that engages and inspires the range of stakeholders, serves community and business interests by providing a roadmap to motivate joint efforts of all participants.

Sustained leadership leads to sustainable projects. Projects take decades to unfold. Sustained support by local government leaders enhances prospects for successful economic development.

Improving Health and the Environment

Good transportation design that enhances communities includes positive impacts on the environment—the air, water, soil and biodiversity that are the life-support systems for human society—and on the health of people affected by physical and psychological aspects of both outdoor and indoor environments.

Recent years have seen a dramatic increase in interest in the concept of sustainable development, defined by the 1987 United Nations' Brundtland report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[1] Today there is recognition that sustainability is not just about the environment and natural resources, but instead represents a balance between environment, economics and equity.

Two of the largest emitters of carbon into the atmosphere are the built environment (approximately 48 percent in the U.S.) and the transportation sector (27 percent).

Because two of the largest emitters of carbon into the atmosphere are the built environment (approximately 48 percent in the U.S.) and the transportation sector (27 percent)[2], the design of transportation systems not only results in health and environmental impacts from the projects themselves but also from the transportation patterns that are established by development. Much of the focus of sustainable design activity in the recent past has been on individual buildings. But the design community is paying increasing attention to sustainability at the infrastructure, development and community scales.

Environmental issues are not new in transportation projects. TOD and CSD embody many of the principles of sustainable development. What is new, however, is the growing recognition that problems are more extensive and more urgent than previously recognized. Design professionals and the scientific community believe that there must be a deeper understanding of the connection between planning, design and construction decisions and the resulting impacts. Well-designed transportation projects in the future must necessarily include a major change in design practices in response to these issues.

MEASURING HEALTH AND ENVIRONMENTAL BENEFITS

Conducting research on the health and environmental benefits of transportation projects on their communities presents several challenges, not the least of which is the fact that the field of sustainable development is constantly evolving. The key questions are:

- What are the critical environmental outcomes to be measured?
- What are appropriate strategies to achieve those outcomes?
- What is an effective process to measure success?

Environmental assessment methods, rating systems and guidelines have played an important role in advancing sustainable development and building design in the United States. Generally, these methods and tools include prescriptive best practices, performance standards and processes that enhance or ensure compliance and improved outcomes. The drawback of rating systems is that they combine these different types of measures into a

1 United Nations. 1987. "Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, 11 December 1987.
2 Architecture 2030, http://www.architecture2030.org/current_situation/building_sector.html
3 California Department of Transportation, "Statewide Transit-Oriented Development Study: Factors for Success in California," May 2002. p. 5.
Link: http://transitorienteddevelopment.dot.ca.gov/PDFs/TOD%20Study%20Exectutive%20Summary.pdf

Left: **A design process that made sustainability a priority transformed the Fruitvale transit site in Oakland, California, to increase pedestrian access and mass transit usage, encourage bicycling and provide open space. Photo: Ann Forsyth**

Bottom: **The Rapid Central Station in Grand Rapids, Michigan, is located on a reclaimed brownfield; it features a green roof that reduces stormwater runoff and maintains temperatures in the building. This project used LEED guidelines and was the first LEED-certified transit facility in the country. Photo: Chuck Heiney Photography. Courtesy Progressive AE.**

point-based rating as a surrogate for actual performance. Wherever possible, actual outcomes should be determined, but this information is not tracked consistently.

Three categories of transportation projects are addressed in this study: development (community) scale, building (facility) scale and infrastructure scale. The first part of the research consists of a review of state-of-the-art environmental assessment methods, rating systems and guidelines at each of the three scales.

- At the *development scale*, specific outcome measures include impacts on vehicle miles driven and associated energy use and emissions from cars, including greenhouse gasses. For example, TOD can reduce rates of greenhouse gas emissions by 2.5 to 3.7 tons per year for each household, according to a Caltrans study.[3]
- At the *building scale*, measurable outcomes typically include energy use savings of 30–50 percent with associated greenhouse gas emission reduction.
- At the *infrastructure scale*, outcomes include the preservation of species contributing to an ecosystem as illustrated by the Wilson Bridge project in Maryland and Virginia or the Florida Greenway wildlife crossing bridge. At all three scales, sustainable design can also be assessed through an inventory of best practices in areas that are not easily measured and documentation of the process of sustainable design.

The *Moving Communities Forward* research team then selected and analyzed case studies in each of the three cat-

egories that demonstrate a range of work that addresses a diversity of scales and types as well as approaches to application of the sustainable design principles. Case study information came from literature, analysis of project documents and interviews with project team members.

THE CASES

SUSTAINABLE DEVELOPMENT CASE STUDIES

Prairie Crossing
Grayslake, IL
A 667-acre residential development located 40 miles northwest of Chicago, Prairie Crossing includes single-family homes and condominiums close to a regional trail system and a commuter rail station. The project is a landmark example of sustainable land use and restorative development, comprising restored prairie, wetlands and working farm fields. There has been some monitoring of environmental outcomes, particularly in the area of water quality.

Highlands Garden Village
Denver, CO
Highland Gardens Village, located ten minutes from downtown Denver, is a mixed-use development consisting of green single-family homes, townhouses, affordable senior and multifamily apartments, office and retail. The project includes a city bus plaza on site. Residents can work and shop all within a minute's walk from their home, and the project offers a car-share program with one electric and two natural gas-powered vehicles.

Fruitvale BART Station
Oakland, CA
An intermodal transit hub where ten local and regional bus lines converge, the Fruitvale BART station creates highly integrated modal access adjacent to an active, retail-lined transit village and to International Boulevard, the neighborhood's primary retail artery. BART estimates that 300 to 600 new daily trips have been generated since the project opened. There is a taxi stand and bike station that allows cyclists to store their bikes and also offers basic services and repairs.

Top: **A 52.5-foot-wide overpass that joins two halves of the Marjorie Harris Carr Cross Florida Greenway enables wildlife to cross the highway through native vegetation on the sandy soil they are used to. Among the bridge's innovative features are a built-in irrigation system and a 16-foot-wide trail for bicyclists, pedestrians, and horseback riders. Photo: SkyPrints Aerial Photography**

Bottom: **The Salt Lake City Intermodal Hub employs daylighting systems and controls, high efficiency HVAC systems, an efficient thermal envelope, and water-saving landscaping and irrigation. Using LEED guidelines, the project achieved a LEED Certified level. Photo: ajc architects**

SUSTAINABLE BUILDING CASE STUDIES

Rapid Central Station
Grand Rapids, MI
This transit facility is used for public and regional bus transit. It is located on a reclaimed brownfield and has an extensive green roof that reduces storm water runoff and other energy and water-saving design features. This project used LEED guidelines and was the first LEED-certified transit facility in the country.

Salt Lake City Intermodal Hub
Salt Lake City, UT
The Salt Lake City Intermodal Hub is a 23,500 square-foot terminal that provides light-rail, commuter rail, transcontinental rail and bus, car pool, local bus, taxi and bicycle connections. The design team employed water-saving landscaping, daylighting systems and controls, high-efficiency HVAC systems and an efficient thermal envelope. This project used LEED guidelines and achieved LEED certification.

Pentagon Metro Entrance Facility
Arlington, VA
The Pentagon Metro Entrance provides access for more than 35,000 employees commuting daily by public transportation. The project's designers estimate it will reduce energy costs by 20 percent compared to a similarly sized facility. An environmental team established sustainability goals at the outset. The project used LEED guidelines and received LEED certification.

McDonald's Cycle Center
Chicago, IL
The McDonald's Cycle Center provides parking for 300 bikes in Chicago's Millennium Park, along with bike rental and repair services, changing rooms, showers and lockers. It not only promotes energy-saving bike use, but also was designed to be energy efficient itself; its glass walls allow for natural light and ventilation, and the roof uses arrays of photovoltaic collectors that shade the building and generate energy.

SUSTAINABLE INFRASTRUCTURE

These case studies have been selected focusing on specific sustainable design strategies used in infrastructure from the field of "road ecology," which is an emerging area integrating the concern for the environment with good transportation design.

The Marjorie Harris Carr Cross-Florida Greenway Land Bridge
Marion County, FL
This 52.5-foot-wide bridge lies inside a strip of the Marjorie Harris Carr Cross-Florida Greenway that crosses Interstate 75, rejoining two halves of the greenway split by the interstate years ago. Wildlife crosses the highway through native vegetation. Hikers, cyclists and horseback riders enjoy an uninterrupted tour of the greenway, an ecological corridor that enhances the state's hydrological resilience and biological diversity.

Woodrow Wilson Bridge Project
Potomac River, MD and VA
The replacement of the existing bridge connecting Maryland and Virginia has had major environmental implications for communities on both sides of the Potomac River. The project has implemented $65 million worth of environmental mitigation programs, including the creation of a permanent 84-acre bald eagle sanctuary in Maryland and innovative strategies to reduce construction noise and other impacts on wetlands and wildlife near the bridge.

PRINCIPLES AND PRACTICES

The overall purpose of this study is to identify the health and environmental benefits of good design and best practices to achieve it. At this early stage in the evolution of sustainable design practice, it is important to identify emerging best practices and processes, even if they are not thoroughly reflected in available case studies of transportation projects. The following summarizes a review of the state-of-the-art environmental assessment methods, rating systems and guidelines at each of the three scales.

Right: **The design team for Prairie Crossing, a 667-acre residential development located 40 miles northwest of Chicago and linked to a regional trail system and a new commuter rail station, brought in environmental experts at the earliest stages to inform the project. Photo: Prairie Crossing**

Bottom: **The McDonald's Cycle Center provides space for 300 bikes in the heart of Chicago's Millennium Park. Photo: Nathan Kirkman**

By changing transportation use and patterns at the **city or development scale**, there are impacts on vehicle miles driven and associated energy use and emissions from cars, including greenhouse gasses. Transportation design can facilitate greater densities and mixed-use development patterns, and also has effects on regional and community-scale ecology (soil, stormwater and biodiversity). There are also potential reductions in congestion and time spent commuting, and safety can be enhanced by reducing the number of vehicles on the road. Green development guidelines are emerging nationally (e.g., LEED for Neighborhoods) and regionally or locally (e.g., the Florida Green Development Guidelines). Many older TOD development projects do not explicitly address pre-existing guidelines or measure environmental impacts, but they include many of the strategies associated with sustainable development. Some newer developments do follow guidelines that include sustainable principles, although the issues addressed can vary widely and actual performance metrics often are not available or tracked.

At the **building scale**, sustainable design principles can have impacts on site ecology (soil, stormwater, biodiversity, heat island effect and light pollution); water consumption, treatment and management; operating energy and embodied material impacts (fuel depletion, global warming, air quality, water quality, resource depletion and waste); and health within facilities. In individual transportation facilities, owners and designers are beginning to consciously address sustainable design issues. In these cases, design teams apply emerging national guidelines (e.g., LEED and Green Globes) to transit facilities. Sustainable guidelines reflecting regional and local issues and innovative approaches are also applied (e.g., the New York City High Performance Building Guidelines and the Minnesota Sustainable Building Guidelines). Housing and other buildings within larger TODs follow sustainable guidelines as well (e.g., LEED for Homes and NAHB Green Building Guidelines).

In many cases, strategies are employed without any explicit connection to measurable outcomes. Actual outcomes are only partially determined during design, although guidelines with third party certification tend to enforce compliance.

RATINGS SYSTEMS AND GUIDELINES FOR SUSTAINABILITY

Numerous governmental and private-sector entities have developed ratings systems and guidelines that help facility owners, designers, builders and users create a more energy-efficient and sustainable built environment. These tools include:

Leadership in Energy and Environmental Design (LEED). Developed by the U.S. Green Building Council, the LEED Green Building Rating System seeks to promote a whole-building approach to sustainability by recognizing performance in five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. For more information, visit www.usgbc.org.

Green Globes. The Green Globes system, which is administered in the U.S. by the Green Building Initiative, includes an assessment protocol, rating system and guide for integrating environmentally friendly design into commercial buildings. For more information, visit http://www.thegbi.org/gbi/.

Energy Star. Energy Star is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to promote energy efficient products and practices, including energy-efficient building design through an energy performance rating system. For more information, visit http://www.energystar.gov/.

Infrastructure scale projects, such as roads and bridges, include impacts on site ecology (soil, stormwater, biodiversity, heat island effects and light pollution). Life-cycle assessment can also be applied to embodied material impacts (fuel depletion, global warming, air quality, water quality, resource depletion and waste). Guidelines on sustainable infrastructure are emerging at the local level (e.g., the New York City High Performance Infrastructure Guidelines). Infrastructure projects such as roads incorporate CSD but do not consistently address overall life cycle impacts of the construction. Newly emerging road ecology design principles are changing practice by focusing on the impact of transportation infrastructure on biodiversity.

The key practices and principles that emerge from these three scales, therefore, include:

Integrated design is critical to achieve a range of sustainability goals across resources on transportation projects. Integrated design identifies a broader range of sustainability issues early in the process and addresses them with an interdisciplinary team approach.

Make environmental performance outcomes explicit during the design process regardless of the scale of the project. To achieve sustainable goals, designers need tools and methods, such as an "environmental balance sheet," that begin to close the gap between what we want to know and what is currently measurable.

Transportation design can and should address regional and community scale ecological issues. The impact on soil and stormwater can be alleviated, even enhanced, by the use of "green infrastructure" strategies like permeable pavements and bioswales.

Transportation buildings and facilities should be built to existing national guidelines, such as LEED or Green Globes. Sustainable guidelines reflecting regional and local issues and innovative approaches can also be applied and send a clear message to the community about the value and necessity of sustainable development.

Measuring outcomes must continue during operation and occupancy. This will also provide a feedback loop for continuous improvement within the project and collective information to the profession as a whole.

Don't forget about biodiversity. Wildlife experts say the approximately 3.9 million miles of public roads that criss-cross the United States impact animals in at least three ways: roadkill, habitat loss and habitat fragmentation.

Designing Great Places

Every community aspires to be a great place: vibrant, attractive, interesting and eminently livable. Transportation projects help make that happen by building a sense of community identity, improving appearance and scenic quality and adding cultural value. These characteristics are difficult to measure, more difficult to quantify and even more difficult to cast in terms of monetary costs and benefits. Nevertheless, the ability of a transportation project, even a small one, to create a livable attractive community cannot be overlooked.

In order to capture important details and reflect a range of potential definitions of good design, *Moving Communities Forward* measured good design in six distinct ways: using a short audit rating tool and a longer inventory, eliciting the opinions of design experts and some of the users and creators of the spaces, using standardized drawing and mapping techniques to compare designs and by assessing photographs.

The six approaches to measuring design converged on a similar overall picture of each of the case study areas. However, at a more specific and detailed level, the different assessment techniques each provided a slightly different lens with which to view these pictures. Some provided inventories of what was in each place—densities of businesses or urban design features. Others gave a sense of the history and use of the areas. Together they provide a more rounded and multi-faceted view of the design qualities of each place.

WHAT MAKES A COMMUNITY A GREAT PLACE: TOWARD A MULTI-METHOD APPROACH

This is not the first study to look at visual issues related to transportation. The fields of environment and behavior, environmental psychology and urban design have created a number of urban design assessments to measure qualities of place (Nasar 1998). Such assessments have recently received a surge of new interest from those concerned with measuring environments for walking and cycling (Moudon and Lee 2003).

These inventories and measures vary along a number of dimensions:

- They vary in level of ***detail and complexity***.
  - Checklists measure the presence or absence of different elements.
  - Rating scales quantify design characteristics.
  - Holistic assessments of complete environments are more qualitative but potentially more comprehensive (e.g., tours, videos, workshops).

- They also vary in terms of ***who does the rating***.
  - Participatory/educational approaches have users and other lay people do the rating and assessment.
  - Designer-oriented approaches have design experts as raters and evaluators.
  - Field-based checklists and surveys may be used by a variety of people including users, design experts and trained raters.
  - GIS-based and automated measures and simulations typically require a high level of expertise and are conducted by trained raters or experts. However, some simulations are used as the basis of participatory approaches.

- There are several ***levels of assessment or evaluation***.
  - Identifying features: identifying and articulating visual or place character.
  - Measuring features: quantifying or counting features of the place in some way.
  - Evaluating features: adding an evaluative component either in comparison to other scenes and places or creating some kind of scoring system.

Left: **The area around Oakland's 12th Street/City Center BART station has spaces for people to stop, gather and interact, giving it a stronger sense of place and a more human scale. Photo: Ann Forsyth**

Bottom: **Design professionals discuss the Fruitvale Transit Village and 12th Street/City Center projects at a *Moving Communities Forward* design workshop in Oakland in March 2007. Photo: Andrew Goldberg**

- The ***time*** at which the assessment is done also varies.
  - Prospective evaluations analyze interventions before they occur and involve simulations or models of the future. This might involve drawing or computer modeling for visual assessment.
  - Retrospective evaluations are conducted on a completed project.

Different approaches have different strengths. For example, an inventory that checks for the presence or absence of a feature such as a street tree is likely to be easy to replicate but does not say much about how a space is used. A technique that asks people to evaluate whole scenes may be able to distinguish between places that are more or less liked, but it may be difficult to tell why; is it the vegetation or the street lamps, or instead a personal characteristic of the rater?

The Methods in This Study

This report acknowledges the different strengths of various methods and seeks to integrate them. *Moving Communities Forward* has relied on six in particular: two kinds of checklists (an audit tool and an inventory), two participatory assessments and two primarily graphical techniques.

A. Audit Tool. The Urban Design Score Sheet was developed to assess commercial and main street type environments like those found in many TOD and CSD projects (Ewing et al. 2005, 2006). The audit creates scores for the urban design qualities of imageability, or how memorable a space is; enclosure, or how much a street feels like an outdoor room; human scale; transparency, or the visibility of activities beyond the street edge, such as

through windows; and complexity or visual variety. Its strength is in creating scores for these dimensions allowing comparison.

B. Inventory. The Irvine Minnesota Inventory is an urban design inventory (Day et al. 2006; Boarnet et al. 2006). Although the inventory is very long, it is quick and easy to fill out and is thus highly reliable. Developed for measuring urban design elements related to walking, it is the most comprehensive of published instruments on features of streets. It has strengths and weaknesses compared with the Urban Design Score Sheet. Unlike the score sheet it does not have a built-in evaluation component. Rather, individual researchers need to develop composite scores from the raw answers. This allows flexibility but adds additional work.

C. Design Workshop. The design workshop is a participatory evaluation technique. Design experts, led by a researcher, participate in a workshop that takes a few hours. Depending on the number and complexity of sites dealt with, this technique requires one to two weeks of additional work prior to the workshop to prepare background maps, graphics and briefing materials. It provides a holistic or comprehensive assessment of the places—what is good about them and what can be improved. It relies on people who are already very familiar with the places in question and can delve deeply into complex issues such as community character.

D. Participation/Community Representatives. There are many different participatory techniques to elicit opinions about visual issues. For this report researchers used a similar process to the design workshop, engaging representatives of cities, community groups, transit users, police, transportation workers and other professionals. This allowed the team to elicit opinions without burdening members of the general public. However, if working on an actual project it would be important to seek input from a larger variety of audiences to gain input, opinions and build expertise of users of environments.

E. Mapping. In work comparing environments, it is useful to compare physical scale and pattern. The *Moving*

Communities Forward research team used variations on figure ground mapping, including measures of street patterns and intersections, to create maps of each of the case study environments. With the advent of online mapping, and particularly of Google Earth, it is now relatively inexpensive to prepare maps to scale. In addition, the research team developed analysis from geographic information systems (GIS) mapping. These included measures of mixed use.

F. Visual Assessment: Photography. Assessing visual impacts has a long history. The research team modified a method produced for the Bureau of Land Management in the 1970s (Shepphard and Newman 1979). It focuses on six issues: color contrast, form contrast, line contrast, texture contrast, scale contrast, scale dominance and spatial dominance. The original method focused on the potential impacts of proposed projects; however, the method used for this project assesses the overall contrast of an existing scene.

Each of the methods used to assess these environments has different strengths:

- The urban design audit produces scores for key urban design concepts of relevance to commercial streets.

Left: **The access ramp to the Delmar Loop MetroLink Station in University City, Missouri. One *Moving Communities Forward* workshop participant commented: "There's this idea that a transit station has to be hard, it has to be concrete, it has to be stone . . . but take the Delmar Station. It's landscaped all the way up to the platform . . . and there's a nice kind of comforting feeling about being able to experience that when you are getting ready to take something that's so industrial as a train."**

Bottom: **Dallas' Mockingbird Station features pedestrian-friendly design at a human scale within the context of intense development and a variety of transportation modes that converge there. Photo: Ann Forsyth**

- The inventory provides great detail on the character of places and can be used in a wide variety of environments.
- The design workshop provides a focused but comprehensive view of design quality.
- Various participatory techniques both elicit information and build capacity among members of the public to debate issues of design.
- Mapping provides an understanding for the basic structure of streets and blocks and can be expanded to examine other topics such as destinations.
- The visual contrast worksheet allows a quick assessment of photographs focused on visual variety.

THE CASES

The *Moving Communities Forward* project examined cases in three regions: in Washington, DC, and Northern Virginia; in Missouri; and in Northern California. Several of the cases include affordable housing development near station areas. Others involve revitalized shopping streets often reached from a train station. Some have major office development. A number of them preserve historic landscapes and buildings. All of them demonstrate the capacity of well-designed transportation infrastructure to enhance a sense of place.

Arlington Metro Stations
Arlington, VA

Arlington County centered its land-use planning along the Rosslyn-Ballston corridor and the five Metro stations that opened there in the 1970s. Since then, the initial visions of the corridor generally have been followed, providing a model to other communities of how to develop and adhere to a plan. Thanks to that plan, each station opens into a community with unique characteristics and a strong sense of place.

Barracks Row
Washington, DC

The Barracks Row project was an effort to reverse economic and social decline by creating an attractive and comprehensive streetscape on Capitol Hill that encourages investment while protecting the area's rich history. Using CSS methods, the joint efforts of transportation planners, engineers and landscape architects working with a neighborhood organization, business owners and residents have helped to transform the area into one of the city's most vibrant neighborhoods.

Boonville, MO

A former steamboat hub on the Missouri River, Boonville is home to the first paved street west of the Mississippi. When the street was rediscovered during excavations for a new bridge, the community worked with designers to create a new Cobblestone Street Interpretive Park, balancing modern transportation needs with a community's desire to preserve its history and core identity.

City Center/12th Street BART Station
Oakland, CA

Covering 12 city blocks around a busy BART station in downtown Oakland, the City Center TOD project seeks to turn a "9-to-5" neighborhood of office buildings into

a 24-hour community with shopping and nightlife, with accessible connections to nearby Chinatown and the Old Oakland historic district.

Davis, CA

The city of Davis enjoys a well-earned reputation as a leader in supporting and encouraging bicycle use, becoming in 1966 the nation's first city to institute bicycle-only lanes. Since then, the city has pioneered innovative street designs that allow bikes, cars and pedestrians to co-exist, all while supporting economic development and maintaining the small town's high quality of life.

Delmar Loop MetroLink Station
St. Louis, MO

The Delmar Loop is a shopping corridor stretching from the Delmar MetroLink Station in a redeveloping part of St. Louis westward to an established section of University City. The station intermodal plaza were designed to "connect the dots," by coaxing development down the block eastward towards the St. Louis side. Development on the far side of the station, to the east, is also starting to emerge.

Emerson Park MetroLink Station
East St. Louis, IL

Emerson Park is an example of TOD used to spark redevelopment in one of the nation's most economically challenged cities. The collaboration between MetroLink, the Emerson Park Development Corporation and local governments led to the location of the transit station and park-and-ride in a section of the city that is now home to single- and multi-family housing, walkable streets and common spaces.

Fruitvale BART Station
Oakland, CA

The Fruitvale Transit Village beside the Fruitvale BART station grew out of a community design symposium between BART and community leaders in which both worked towards a common solution to their respective problems. The result is a colorful and vibrant mixed-use project—featuring affordable housing, neighborhood retail and public spaces for community interaction—that has helped to spur the revitalization of the surrounding neighborhood, a center for Oakland's Latino community.

Route 50
Loudon and Fauquier Counties, VA

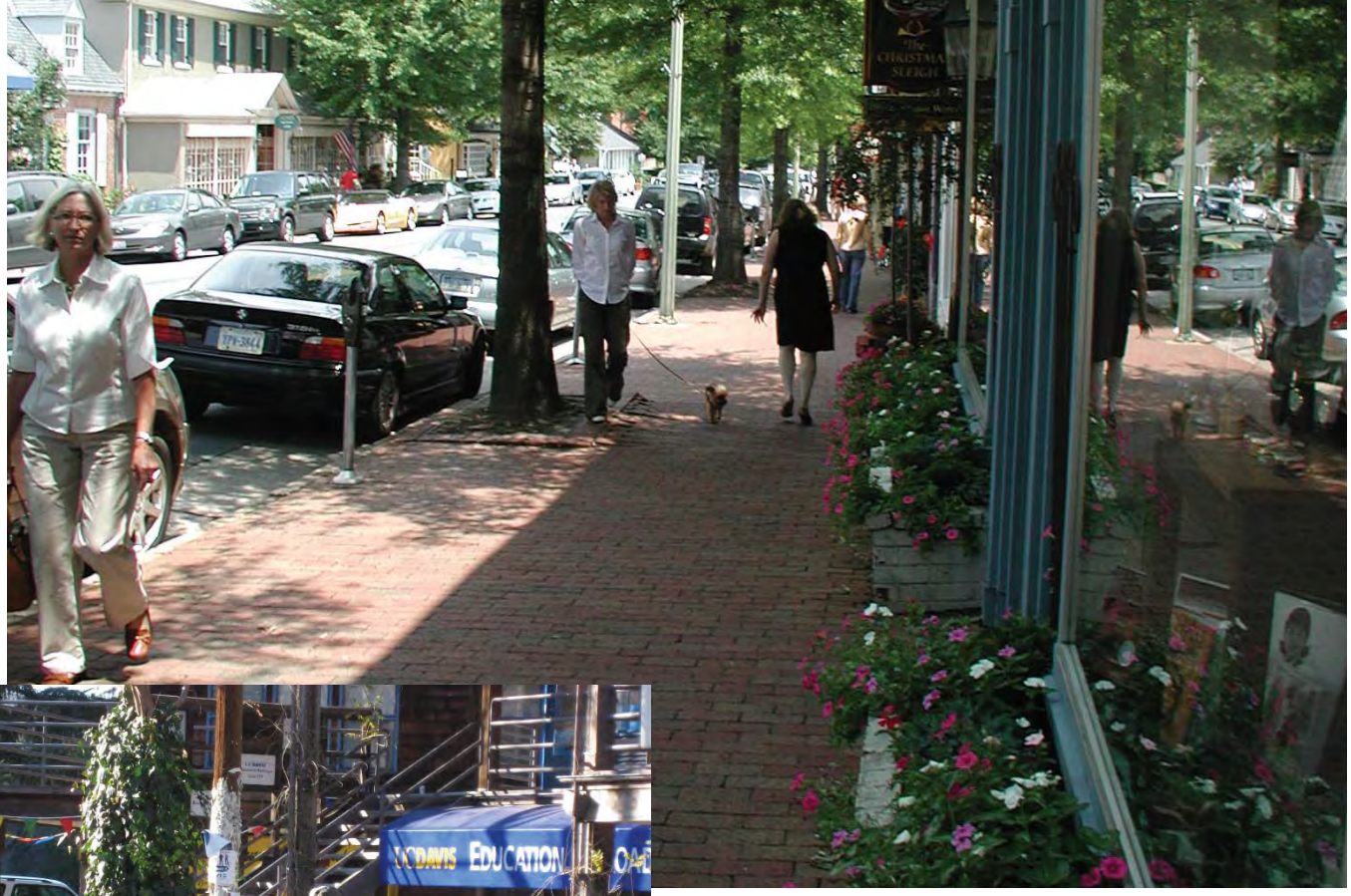
A 24-mile long portion of Route 50 west of Washington, DC, was redesigned by a multidisciplinary team working with the state DOT, local officials and citizens according to CSS principles to provide for traffic-calming while protecting the bucolic nature of the road and the small towns that populate it. The project was launched with federal and state funds as a demonstration project that could inspire and inform future road redesign efforts in similarly changing rural corridors at the edges of American metropolises.

PRINCIPLES AND PRACTICES

One-size-fits-all solutions to design problems certainly do not fit all, as the tastes and needs of varied users are rarely the same, and are sometimes even in direct conflict. Instead, it is perhaps better to think of a good design toolkit—a set of good, though not necessarily "best," practices, each with particular effects in particular situations. Selecting from different parts of the toolkit, people responsible for the design of places can mix and match solutions to problems. Good design, then, is not as much a *product*, but a *process* of assessing, selecting and implementing of a wide number of individual design interventions.

Appreciate that planning and developing great places takes time. Many of the best-loved places in the world are the product of decades, if not centuries, of development and redevelopment. It is virtually impossible to jump start a development from nothing to a fully built place in a few years. What sometimes looks like fast development is often misleading, as the development is merely the physical culmination of years of planning.

Program spaces for a variety of uses and users. . . Public spaces—where people can stop, sit and gather—are often ignored in transportation projects, where the emphasis is on moving people from place to place. Good public



Top: **Virginia's Route 50, pictured here running through Middleburg, is a context-sensitive solution that takes into account the needs of both vehicles and pedestrians in rural and small-town settings. Photo: Ann Forsyth**

Left: **The City of Davis, California, has a well-earned reputation as America's leader in supporting and encouraging bicycle transportation. Photo: Ann Forsyth**

spaces are ones where people like to stop and sit to read a newspaper, eat lunch or meet friends. They also provide places for people from different groups to interact or stake out territory without overly bothering others.

. . . and a variety of times. Successful places have appropriate activities occurring at different times of the day, week and year. Not all places need to have constant activity, but appropriate programming can increase use, safety and a sense of place.

Use zoning to increase diversity. Local zoning regulations tend to make areas uniform, which inhibits visual variety and a diversity of uses. Strategies to overcome this include allowing mixed-use land use strategies and providing flexible design guidelines

Invest in maintaining spaces. High levels of maintenance are noticeable and can make streetscapes appear more attractive. Too often paths, trails and other pedestrian and biking facilities are installed without long-term maintenance plans. In addition, wear and tear increases as places become popular, adding to the maintenance burden.

Design at a human scale. The foundation of creating a great place is designing spaces that contain elements of similar size to parts of the human body and are designed to be viewed by people at walking pace. This does not preclude places with tall buildings and intensive development, but stresses that design of the areas that people inhabit—such as sidewalks, plazas and transit stations—should be scaled to be usable and interesting to people moving at walking speed.

Use design to increase safety. Personal safety is at the base of successful public spaces. Specific design strategies—such as lighting, delineating public and private space, ensuring visibility and limiting the potential for entrapment—can not only improve safety but also the *perception* of safety and thus make the spaces more likely to be used.

Create connections between spaces. It is vital to create great places but it is just as important to connect them. Well-connected street patterns with clear signage and wayfinding are relevant to their locations and relatively small blocks allow multiple options for movement. Buildings and transportation facilities that fail to connect to the outdoors and sidewalks create confusion or a lack of a sense of place, particularly for pedestrians and cyclists.

Design sidewalks and crosswalks for appropriate pedestrian use. Creating spaces that encourage walking depends upon proper design of spaces reserved for pedestrians, as well as on places where pedestrians intersect with other users, especially motorists. From sidewalks to crosswalks, successful places have appropriate facilities.

Create spaces for bicycles and bike parking. A variety of non-motorized transportation users helps to create a sense of community at a human scale; the design process must account for bicyclists.

Integrate transit and transit facilities into the urban pattern. A transit facility is a transition point between various modes, as people park cars and bikes and walk before heading on to mass transit. People also transfer between routes or types of transit. Modern transit facilities, especially in the case of TOD, add to this mix shoppers, workers and residents, creating an even more diverse set of demands and expectations on transit facilities. These challenges also bring opportunities. Transit naturally brings people together a key goal of urban designers seeking to promote street life. Transit can also serve as the impetus for economic or community development in a place, as investments in transit offer a chance to pursue other, complementary goals.

Do not forget, but do not overemphasize, car movement and car parking. A number of design elements for streets can be used to create more walkable places, while simultaneously making the urban or suburban environment safe for drivers. Many of these entail slowing down or restricting traffic to a more suitable level for the areas through which they pass. Reduced levels of service can be compensated for, such as by enhancing traffic capacity on parallel or nearby streets.

Fostering Civic Participation

Few dispute the importance of engaging the public in planning and design processes, including for transportation projects. But policymakers and community leaders may not realize that a vibrant public process can bring benefits to the community that go far beyond the project itself.

While there is general agreement about the importance of participation in planning processes (Burby 2003, Bickerstaff and Walker 2001, Innes 1992), there is little consistency in its application or effects. The *Moving Communities Forward* project has sought to develop a common base of information to guide the development and organization of planning and design processes for transportation facilities and provide a consistent methodology for evaluating process outcomes. The study outcomes include principles and practices for public involvement in these planning and design processes.

The study places a particular focus on the criteria for effective participation and the techniques used to engage the public, as well as the implications of public involvement on type, location, design and program for transportation projects. In addition, the research identifies broader community benefits associated with effective participation processes. The study includes an additional focus on understanding the role of professional design experts in participatory processes.

The cases examined here illustrate the range of benefits achieved by engaging the public in planning and design processes for transportation projects. These benefits are captured by members of the public as they gain knowledge about planning and design processes and expertise on community issues that they take away from the participation process. Benefits are also gained by the broader community as it gains credibility and pride in its accomplishments.

For example, with its innovative approach to traffic-calming, West Palm Beach, FL, became a national model for streetscape design and pedestrian planning. The Emerson Park neighborhood gained a reputation for being organized and capable, overcoming the limitations of the East St. Louis, IL, political system and rallying a struggling neighborhood around a common goal of transportation access and redevelopment. In Arlington County, VA, the Clarendon sector planning process drew together varying perspectives from the community's vast civic infrastructure in a coordinated process. This participatory planning effort facilitated a community conversation about what is unique about the community and refined its evolving conception of what it means to be an "urban village."

Community members take part in a walking tour organized by design professionals to identify key design issues and challenges. Photo: Ann Forsyth

Right: **In Emerson Park, Illinois, groups conducted "knock and talks" to engage community members about relocating the transit station and its potential effects on the community. While the community compromised on some details related to station design and pedestrian access, it held to its position that the station be moved and key neighborhood streets remain open. Photo: Ann Forsyth**

Bottom: **For Bridgeport Way, Washington, the City of University Place sponsored a design charrette and brought in pedestrian planning consultants, who changed the perspectives of staff, elected officials, and the public about roadway design options for the corridor. Photo: Carissa Schively**

The benefits of public involvement also are reflected in the design of the transportation projects themselves. In each of the cases examined in the study, the participants influenced the design outcomes. While in some cases the initial project design or the original community vision was altered, in each case the process of engaging around the design and planning of a transportation project brought the community together.

One of the most compelling findings in these cases is how those involved challenged conventional approaches to transportation planning and design. To allow these design challenges to succeed, it was essential that public involvement, and in some cases community organizing, occur. In the Barracks Row project in Washington, DC, community involvement led to a streetscape design that revitalized a commercial corridor that meets the needs and reflects the diverse perspectives of those in surrounding neighborhoods. For the Bridgeport Way project in University City, WA, public involvement resulted in scaling back an initial proposed design, but ultimately brought the community together in agreement on important safety and amenity features on the town's "Main Street." In West Palm Beach, early public interest in neighborhood traffic-calming helped to institutionalize alternative street design approaches in the city, which continued forward in larger projects on state highways and in downtown and major redevelopment projects. With the Clarendon station area planning process, a sophisticated and highly engaged public helped the city move forward in refining its vision for development and redevelopment, pointing to specific criteria for both public spaces and private development in the station area. In the Emerson Park neighborhood, extensive public involvement led to the relocation of a proposed transit station and construction of new housing, setting the stage for ongoing redevelopment in a struggling neighborhood. Finally, in Oakland's Fruitvale, a neighborhood organization tapped into one of its most important assets, the community, to achieve an alternative approach to TOD that has informed transit agencies, designers, planners and developers across the nation.

RESEARCH APPROACH AND MEASURES

This study is informed by previous research on the criteria and outcomes of effective participation in planning

and design processes. The literature points to criteria related to the organization and structure of the participatory aspects of the processes, the timing of participation efforts, the overall level of participation, participation methods (e.g., steering committee, public hearing), types of participants and use of communication efforts. Some of the criteria for effective participation identified include:

- Using visualization methods (Al-Kodmany 2000)
- Including a wide variety of stakeholders (Lowry et al. 1997)
- Supporting participants with information and access to expert knowledge (Innes and Booher 2004)
- Providing diverse sources of information (Enserink and Monnihkof 2003)
- Engaging participants as co-designers (Van Herzele 2004)
- Designing a forum that promotes trust and communication (Jackson 2001)
- Recognizing informal methods of participation (Laurian 2004)

In addition, the research discusses the outcomes of participation. Outcomes relate to decision-making processes, organizations, individuals, communities and projects. The outcomes of greatest interest in this study were the physical design of the transportation project and associated development and the broader social impacts at the individual and community level. They include:

- Sensitive design solutions (Crewe 2001)
- Agreement on a shared definition of the problem (Lowry et al. 1997)
- Ability of participants to engage in future processes (Tuler and Webler 1999)
- General acceptance of participation processes and their outcomes (Reich et al. 1996)
- Shared knowledge (Innes and Booher 1999)
- The general public becoming more supportive of change (Al-Kodmany 2000)

In this study, the criteria and outcomes described above were evaluated using a case study method, documenting public involvement in the planning and design processes for six transportation projects. The measures of effective participation were operationalized in a series of questions delivered through interviews of key participants in each of the cases. Interviewees included both those managing the participation processes and participants themselves, with an intent to capture the broadest range of perspectives on the conduct and outcomes of the planning and design processes. Elected and appointed officials, representatives from relevant agencies and non-governmental organizations and the general public were among those interviewed. Professional architects, planners, landscape architects and engineers also were included in the study.

THE CASES

The criteria and outcomes of effective participation were evaluated in the context of six transportation project cases. These cases were selected from two contexts: TOD and CSS. The research team selected cases to achieve a wide variation in terms of geographic location, neighborhood context, site conditions and issues (e.g., transportation, planning and design). For the CSS cases, the team focused on identifying cases at a variety of scales. For the TOD cases, the team identified cases that had varied participants and neighborhood characteristics.

CSS CASES

Barracks Row
Washington, DC
Barracks Row is a six-block streetscape redesign project on Capitol Hill. Public participation occurred throughout the planning and design process, from early visioning efforts through design implementation and construction. The collaboration between designers, agency staff, private consultants, Marines and Navy staff, business owners and public participants produced a redesign that has revitalized the area using the reorganization of the 8th Street right of way to accommodate the needs of pedestrians, cyclists, and vehicle drivers and parking near the Eastern Market Metro Station.

Bridgeport Way
University Place, WA
This 1.5 mile highway redesign project, located in a suburban community in the Seattle-Tacoma region, involved a roadway improvement from a five-lane rural highway to a four-lane divided highway. The roadway design evolved as a result of public and business concerns about proposed roundabouts, business access and right-of-way acquisition, leading to a design that all stakeholders can support.

West Palm Beach, FL
Responding to concerns about livability, the city implemented various traffic-calming efforts throughout the city's neighborhoods, downtown and along major arterials. The city placed a significant focus on working directly with neighborhoods that were concerned about high speeds, cut-through traffic and safety. Participation often included city staff meeting with residents on the street, examining possible alignments and amenities. The city also worked with county and state transportation staff to incorporate traffic-calming on major roadways in the city.

TOD CASES

Clarendon Metro Station
Arlington, VA
One of five Metro stations in Arlington that were the focus of long-term TOD efforts, the area around the Clarendon station has been transformed since the rail system opened in the 1970s, with an increasing number of businesses and residential units. The most recent planning process, the 2006 Clarendon Sector Plan Update, included extensive public participation that reflected the mature governmental structure and institutionalization of a wide range of county advisory committees.

Emerson Park MetroLink Station
East Saint Louis, IL
The Emerson Park MetroLink station was developed in 2001, with significant intervention by the Emerson Park Development Corporation (EPDC). The EPDC lobbied MetroLink and local officials to relocate the proposed station to a more accessible site. The EPDC organized extensive community participation, worked with planning and design students from the University of Illinois and staged protests. As a direct result of this effort, the EPDC has been able to secure additional grant money and funding for the neighborhood, build a community charter school and provide the neighborhood with much-needed infrastructure improvements and social capital.

Fruitvale BART Station
Oakland, CA
Originally proposed as a parking garage, the land adjacent to the Fruitvale BART station was transformed into a transit village thanks to the efforts of the Unity Council, a neighborhood-based non-profit community development corporation. The Council led the planning and design of the transit village, including a mix of housing, retail and office space. The Council's strong connection to neighborhood residents and businesses was essential in organizing public support for the proposed alternative to the parking garage. The final project represents the design character of the neighborhood and has stimulated further revitalization in the neighborhood.

PRINCIPLES AND PRACTICES

Extensive research into the cases, coupled with the results of the interviews with a wide range of participants in each of the projects, points to some important principles and

Right: **For Barracks Row in Washington, DC, landscape architects and traffic consultants built on an early community vision for the streetscape in order to design a project that met the needs of automobiles and pedestrians alike. Photo: Carissa Schively**

Bottom: **An American Institute of Architects-sponsored community design charrette in Northampton, MA. Photo: AIA**

practices that may be considered by designers, planners, engineers and others involved in transportation project planning and design. These principles and practices encompass many of the criteria and outcomes of effective participation identified in the early part of the study. They also provide information about how to organize participation, who should be involved, understanding the purpose of participation and the importance of engaging design experts early in the process.

Rather than functioning as prescription, the principles and practices identified here may be considered as components in a framework that can help local decision makers assess the context in which the transportation project will be developed.

Use multiple methods of participation. A range of different types of participation techniques, in addition to traditional public meetings or hearings, reach diverse interests at different points during the participation process.

Identify a local champion. Champions maintain interest, recruit and motivate participants, secure funding, navigate political challenges and coordinate with decision-making authorities.

Maintain a clear sense of the desired outcome. While compromises on small design details are often inevitable, projects succeed when participants have a clear sense of the most important outcomes—and fight to preserve them.

Identify and engage political leadership. Political leadership is essential when planning and design phases hit roadblocks that participants cannot overcome on their own. Engaging political leaders early in the process ensures that those leaders will be willing and able to intervene down the road.

Bring professional design expertise to the table—early. Design experts play indispensable roles in engaging the public in planning and design processes and communicating alternative design outcomes.

Visualization is Critical for Public Support. Visualization efforts help articulate alternative design visions, convince project opponents and lend credibility to community preferences for transportation project design.

Making Communities Safer

Transportation systems that move people from one place to another are designed, primarily, to accomplish this quickly and efficiently. But any project that neglects to ensure the safety of the people who use it is sure to fail. But can well-designed transportation projects actually make communities safer than what was there before, and protect not only those who explicitly use the project but those who come into casual or indirect contact with it throughout the community?

Moving Communities Forward explored how, and to what extent, safety issues are treated in transportation projects, particularly CSS/CSD activities. Ideally, safety issues should be an explicit and quantitative component of design decision making. This would entail making numerical predictions of the safety effects of different design alternatives a fundamental part of how those alternatives are evaluated.

Advances in our ability to accurately predict the safety effects of design alternatives will have to come from observational studies of the effects of actual projects.

Although "safety" can encompass a wide range of issues, from crime control to homeland security, this study focused on the pedestrian safety and its relation to traffic-calming design elements.

MEASURING SAFETY ENHANCEMENTS

Although quantitative safety prediction can be done for certain design elements, such as installation of a traffic signal at an intersection or removal of roadside obstacles, science-based prediction for the type and scope of design activities for CSD is much more difficult. This is especially true for predictions related to pedestrian safety, and it produces a gap between the design ideal and the as-built project. It is therefore recommended that measurement of safety effects be included as part of CSD projects, to expand the knowledge base on which a future prediction capability can be built.

This knowledge gap has led to a major effort on the part of the Federal Highway Administration, the Association of American State Highway and Transportation Officials and the Transportation Research Board to develop the first edition of a *Highway Safety Manual* (HSM). This document, similar in spirit to the *Highway Capacity Manual*, is aimed at providing transportation engineers with tools for explicitly predicting the changes in crash frequency expected from different roadway design components.

The basic method employed by the HSM is to first generate an initial prediction of what the crash frequency would be in the absence of the design feature under consideration, and then apply an empirically-determined crash reduction factor (CRF) to the predicted crash fre-

quency to predict the change in frequency due to the design modification. The initial prediction could be based on historical crash experience of an existing roadway, or it could be computed using a regression-type model fit to data from similar roadways. The CRF should ideally have been computed from one or more well-designed before-after studies.

The HSM methods clearly rely heavily on historical crash experience. For those design features for which an adequate database exists or can be assembled, the HSM methods should, at least after iteration, lead to useable and empirically defensible evaluation tools. For example, several well-conducted studies have estimated crash modification effects for vehicle crashes of installing traffic signals at intersections, in part because crash frequencies at intersections tend to be high enough that reliable estimates can be made with reasonably-sized data sets.

For crash types that tend to be infrequent or spatially diffuse, the HSM method encounters limits. These limits are perhaps most apparent when attempting to assess the costs and benefits of roadside improvements, because road-departure crashes tend to be locally infrequent. For example, on one-mile segments of two-lane rural highway, the frequency of road-departure crashes over, say, three years tend to equal zero for the majority of segments, one for a few and more than one for a very small number.

The most sophisticated tool for this task is the Roadside Safety Analysis Program (RSAP), developed by the Texas Transportation Institute for the Federal Highway Administration. In RSAP, the frequency and trajectories of road-departures on a highway section are predicted using departure rates and distributions over trajectories taken from earlier studies. The expected frequency of collisions between vehicles and roadside obstacles on the section under design is then computed, and this expected frequency is used to assess the value of different changes in the section's roadside. The data needed to apply the RSAP method consist primarily of traffic volumes and distribution of speeds on the road section under consideration, along with physical specifications of the section's roadside. Crash data are not needed.

When turning to vehicle/pedestrian crashes and their relation to traffic-calming actions, it would seem that, at least in principle, both the HSM statistical modeling approach and the RSAP simulation modeling approach ought to be applicable. A major limitation, however, is that both the HSM and RSAP approaches require measures of exposure in the form of measured or predicted traffic volumes. Vehicle traffic volume estimates for many roads are routinely made by state and local transportation agencies, and ad hoc traffic counts can be readily obtained using automatic, portable counters. This requirement therefore has not limited the application of these methods to vehicle crashes. However, at present few, and perhaps no, agencies routinely monitor pedestrian volumes. Although progress is being made in extracting pedestrian data from video images, a technology for automatic, portable pedestrian counters is still in the future.

An initial state DOT plan called for expanding Virginia's Route 50 to four lanes and bypassing two of the towns through which the highway runs. A volunteer citizens' group countered with a proposal to keep the highway at two lanes, but to use traffic-calming measures to address safety concerns while maintaining a desired rural character and tourist-friendly environment. Photo: Ann Forsyth

Facing problems with speeding, cut-through traffic, and safety, the City of West Palm Beach worked with concerned neighborhoods to develop traffic-calming solutions, including paved intersections, landscaping, bollards, curb bump-outs, and improved signage. Photo: Carissa Schively.

In the absence of pedestrian exposure data, more limited analyses are possible. An RSAP-type simulation approach to ranking residential streets as to their potential traffic hazard to pedestrians has been described in Davis, Sanderson and Davuluri (2002). Here, a design vehicle/pedestrian encounter involving a child pedestrian running into the street without looking at traffic was specified, and the probability of such an encounter resulting in a collision was computed using speed and headway data collected on the streets. The streets could then be ranked according to these collision probabilities, and the probabilities of collisions leading to serious or fatal injuries. In essence, this approach estimated the probability of a collision but did not estimate the frequency with which such street entries occurred.

An interesting alternative simulation approach was employed by the Road Accident Research Unit at the University of Adelaide, Australia, to assess the effect of speed limit policies on fatal collisions between vehicles and pedestrians (McLean et al 1994). In this study, fatal pedestrian collisions were investigated in detail and then reconstructed in order to estimate features such as the vehicle's initial speed and location prior to the collision. Simulation was then used to estimate how the vehicle's speed at collision would have changed had it been traveling at a different speed, and then how the probability of a fatal outcome would also have changed. This then allowed the research team to estimate the number of actual fatal collisions that would not have occurred, other things being equal, had vehicle speeds been governed by alternative speed limit policies. An extension of this approach is also described in Davis et al (2002).

THE CASES

Bridgeport Way
University Place, WA
Bridgeport Way originally consisted mainly of two lanes for traffic for each direction, separated by a two-way left turn lane. Pedestrians unable or unwilling to travel to the rather widely separated intersections were forced to cross five traffic lanes. Designers separated the directional lanes by a landscaped median, which pedestrians could use as a refuge, and provided several mid-block crossing points, all of which made the community more walkable and attractive.

Route 50
Loudon and Fauquier Counties, VA
An initial Virginia DOT plan called for expanding the highway to four lanes and bypassing two of the towns through which the highway runs. A volunteer citizens group countered with a proposal to keep the highway at two lanes but to use traffic-calming measures to reduce vehicle speeds and address safety concerns, while maintaining a desired rural character and tourist-friendly environment. After obtaining federal support, VDOT decided to follow the citizens group's recommendations and to commission a multidisciplinary team to create design standards for the highway.

West Palm Beach, FL
The case involved a major re-design of a downtown area, accomplished in several projects carried out over a decade. The effort is notable for its scope and uniqueness, especially its focus on radically altering the automobile-pedestrian mix in the congested downtown area as a strategy to improve pedestrian safety.

PRINCIPLES AND PRACTICES

For the long term, because genuine experimental research is rarely possible in road safety, advances in our ability to accurately predict the safety effects of design alternatives will have to come from observational studies of the effects of actual projects. In other words, each project should be treated as a research opportunity. Although it is not yet possible to provide a recipe for how such research should be carried out, it is safe to say that having someone skilled in observational research involved in the design process should increase the likelihood of usable findings.

In the shorter term, for projects where reliable quantitative safety prediction is not yet feasible, one alternative is to include safety audits as part of the design process, using a team of reviewers selected for expertise in important safety aspects. Interestingly, it can be argued that some of the participation activities characteristic of CSD inject a safety audit-like dynamic into the design process. In the absence of a formal safety audit, by explicitly including as participants experts who would normally be part of a safety audit team, it may be possible to realize at least some of the benefits of a more formal audit.

The key practices and principles, therefore, include:

Include experts in observational researchon the design team. This would increase the likelihood of usable findings.

Include safety audits as part of the design process for projects where reliable quantitative safety prediction is not yet feasible. A team with expertise in safety issues can review a project's plans, highlight possible safety issues and make suggestions concerning mitigation.

Conduct measurements of safety once the project is operational and compare to the results of the safety audit conducted during the design phase. This is perhaps the best way to expand the knowledge base on which a future prediction capability can be built.

A Whole Greater Than the Sum of Parts

Design Principles and Practices that Reap Multiple Benefits

The case studies explored in *Moving Communities Forward* clearly suggest a crucial overarching principle: the success of transportation projects requires integrating transportation design with all social, economic and cultural resources. The time for looking at transportation projects through the single lens of mobility, or even of simple access and connectivity, is long gone.

The previous sections of this report showed how transportation projects lead to five types of enhancement in broader community values: economic, health and environmental, visual identity and architectural design, public participation, and public safety.

The time for looking at transportation projects through the single lens of mobility, or even of simple access and connectivity, is long gone.

But communities do not seek to improve their economic outlook without regard to public health. Nor do they assume that creating a strong sense of community identity matters if it is not accompanied by enhanced public safety. Communities want to achieve enhancements across the spectrum of social, economic and political issues.

Some case studies in *Moving Communities Forward* were chosen to illustrate specific community benefits. Others asked the question, How are design practices aimed at the creation of one kind of value (e.g., economic enhancement) augmented by those of another, such as sustainability, citizen participation, or safety?

For example, the Rosslyn-Ballston Corridor projects in Arlington, Virginia, demonstrate how economic enhancement arose out of visual enhancement and robust civic participation. The designers of the Fruitvale Transit Village used political leadership to create a vibrant community that also reduces greenhouse gas emissions by increasing mass transit ridership.

The sixth and final part of the *Moving Communities Forward* project seeks to identify those principles and practices that bring about a multitude of community benefits and provide a toolkit of ideas for communities that wish to do the same.

PRINCIPLES AND PRACTICES

The case studies show a rich toolkit of creative practices and processes that have been guided by design *principles* that transcend the individual projects. Here are five principles that stand out:

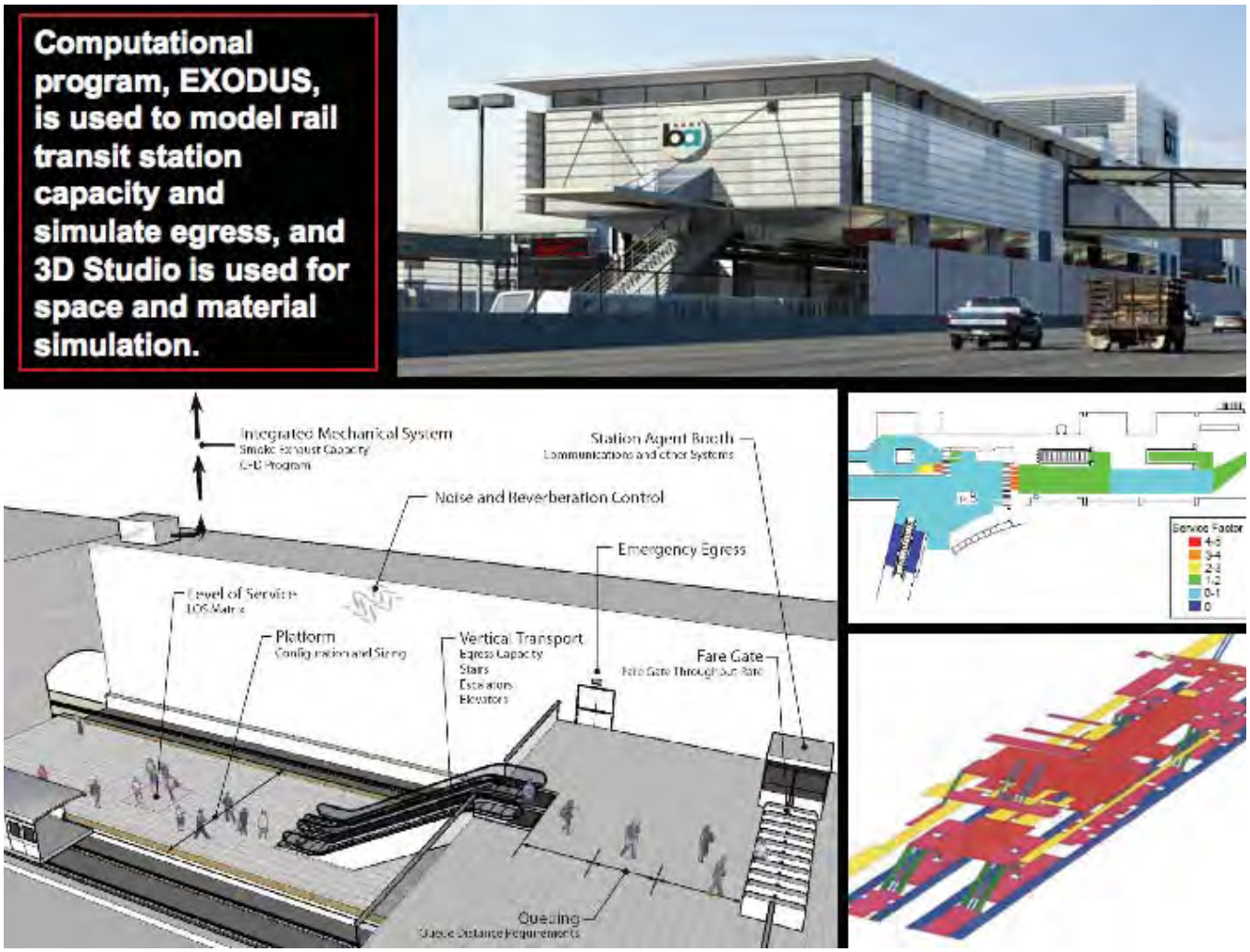
Transparent decision-making. The complex public nature of a transportation-focused community project demands transparent design decisions. Not only must there be frequent, clear communication—without jargon—in a variety of forms, but the design team must also commit itself to complete openness and a willingness to listen to multiple and at times contradictory voices.

Consensus-building. The most vibrant communities are those that are borne of multiple visions. Still, not every project will make everyone happy. The project leadership that consistently explores all alternatives and works toward participant consensus has the best odds of successful implementation. These kinds of projects have the best chance to inflect institutional design and planning protocols when combined with rigorous audits of results.

Sustainable design. The best transportation projects identify all values of key natural and man-made resources—even if at first glance they seem to be outside the scope of the project—and keeps them at the heart of the design process.

Top: **The Rosslyn-Ballston corridor Metro projects in Arlington, Virginia, demonstrate how economic enhancement arose out of visual design efforts and robust civic participation.**
Photo: Ann Forsyth

Left: **The designers of the Fruitvale Transit Village in Oakland, California, used political leadership to create a vibrant community that also reduces greenhouse gas emissions by increasing mass transit ridership. Photo: Ann Forsyth**



Resilience. Resilience is an integrative measure of the sustainability of any organization—especially communities—or structures, including artificial constructions like highly connective transportation networks. When a roadway or a transit facility is built, for example, it increases not only connectivity but capacity, which in turn can drive growth. Economic growth will increase the net resilience of a community. However, at the same time, increased economic capacity can lead to increased demand on the transportation system. Structural and environmental systems are vulnerable to increased demand, which in turn can place net economic gains of the community at risk. The resilience of the best projects illustrates the value of addressing these issues in design, from the outset.

Designing in context. Architects and other designers transform communities and shape change. Transportation projects can be as intrusive as they are enhancing if they are not well-programmed for existing and projected uses or miss the economic and environmental capacity of the community to maintain them. Every community is different—economically, politically, culturally, ecologically—and therefore requires different kinds of design. A subtle intervention that pays close attention to the local context can be as transformative as the addition of a new destination or the work of a widely-known architect. Good design transforms communities in ways that are appropriate to the community's core identity and vision.

With these five principles in hand, designers can then employ *practices* that will bring the greatest level and variety of benefits to the community:

Integrated design from the outset of a project helps address the full spectrum of challenges. The "Purpose and Need" statement for a transportation project and

Left: **Transportation agencies, including BART, are increasingly using 3D and 4D computer modeling to address an array of issues—from sustainability to safety —in an integrated design process. Image: Bay Area Rapid Transit**

Top: **Designers use sophisticated visualization and simulation tools to maximize creative citizen involvement, understanding, and buy-in—and ultimately, stewardship—for a project, such as for the Salt Lake City Intermodal Hub. Image Courtesy of Utah Transit Authority**

the programming for an architectural or other design project should address the broadest possible array of design goals, not simply those directly related to transportation issues.

Participatory processes and structures build constituencies for design solutions. Participatory organization requires the project architect and other design leaders to help stakeholders identify and prioritize issues in relation to key items of the scope and their budgetary and environmental constraints, pace the project in such a way as to inform the public about design alternatives including their implications to the best of their abilities, and create a project vision that meets both transportation and community needs via an equitable process that taps creative potential in participants without burning out the stakeholders.

Visualization tools provide critical support and add transparency to the citizen engagement process. Designers use three and four-dimensional visualization and simulation tools to maximize creative citizen involvement, understanding, and buy-in—and ultimately, stewardship—for a project. The precision and scale of visualization must fit the issues to be resolved.

Human-scales structures and spaces give intense, multimodal development a sense of place. Intensive development or redevelopment creates a concentration and, usually, compactness, measured by the number of opportunities (activities, jobs, places to live, or combinations) located within a given geographic space. This intensity requires careful attention to the human scale and how people move from one place or activity to another, and even how they interact at walking pace with transportation modes that move at much higher speeds.

Clearly marked and connected transportation modes make multimodal systems easier to use. In highly developed areas, people will increasingly need to transfer from one mode of transportation to another. Clear, understandable links with easily legible signage and directions improve predictability, efficiency and safety for all users.

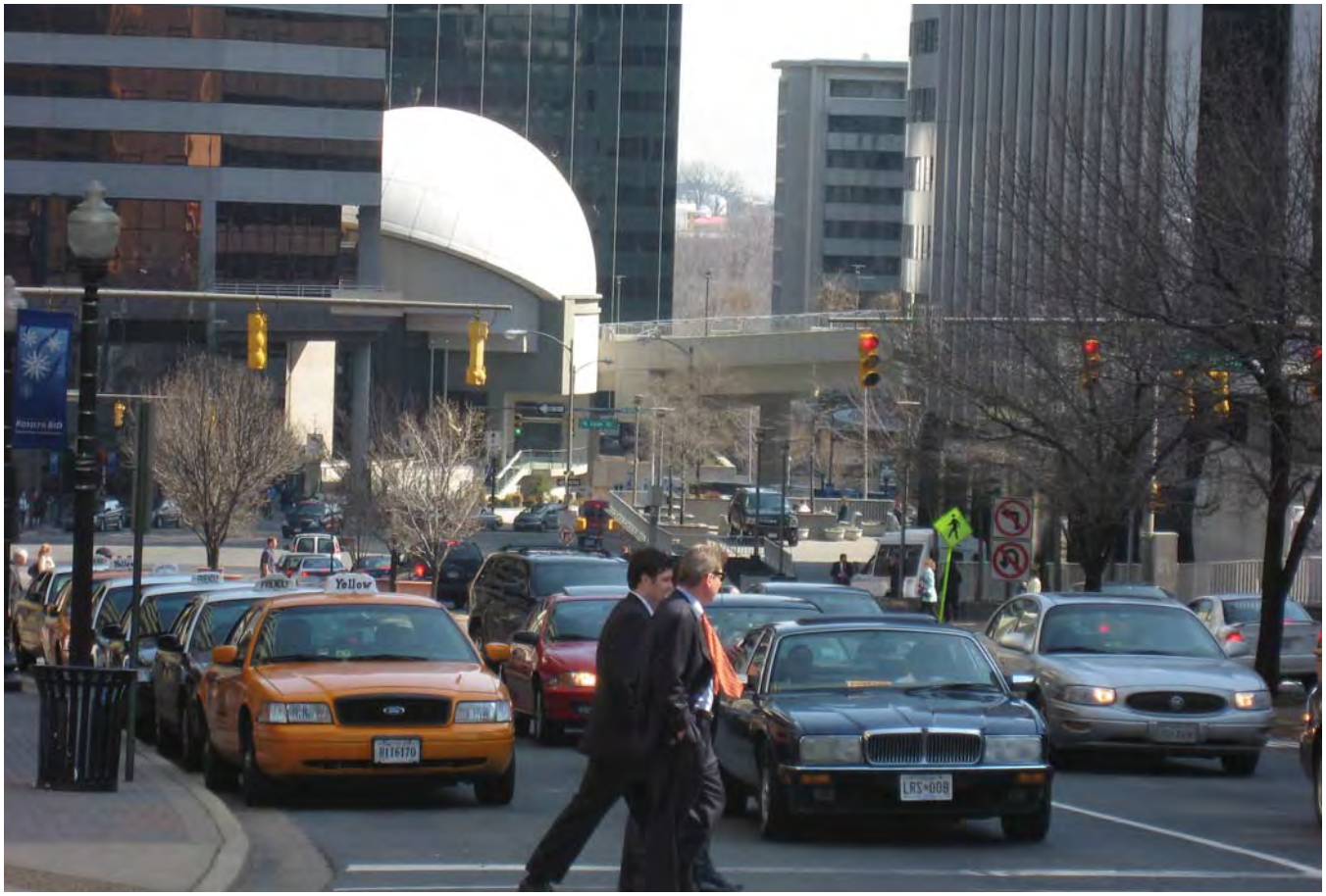
Durability and flexibility create places that are sustainable and meet future challenges. Transportation projects in the 21st century embody one of the most demanding challenges to design: the physical structures must be durable and safe in order to last over long periods while also providing the flexibility to adapt new power sources and changing demographic, economic and cultural needs.

Case Studies: Principles and Practices in the Real World

Nearly 30 projects across the nation were studied as a part of *Moving Communities Forward*. This section focuses on six that were analyzed in multiple parts of the research and highlight the key design principles and practices that enabled them to provide multiple benefits to their communities.

Arlington's Rosslyn neighborhood, one of a number of communities enhanced by transit-oriented development around Metro stations. Below Photo: Ann Forsyth

Washington Metro/Arlington County, Virginia



Arlington County's transit-oriented development around Metro stations is a textbook example of how to make a plan and stick with it. Arlington combined an engaged populace, a unified county government and the underlying infrastructure of a commercial corridor to develop a 50-year plan for community development centered along a transit system. Instead of extending Metro along an interstate, the County chose to run it through established communities, accelerating economic growth for the entire county while allowing the neighborhoods to retain their unique identities. Fostering a sense of place at the Metro stops has in turn strengthened the capacity of community groups to advocate for their neighborhoods. Today, Arlington is one of the most sought-after locations in the Washington Metro area for both businesses and people seeking a place to live.

ROSSLYN

Designing transportation for context: **The confluence of transportation modes in Rosslyn adapts to the pre-existing streetscape and environment, protecting Rosslyn's urban identity while enhancing connectivity and access.**

Left Photo: Ann Forsyth/Top Photo: Lance Neckar

Remembering the human scale: **Clearly defined transitions from the Metro to regional and local bus routes, including angled bays, signage and street furniture, help pedestrians navigate what would otherwise be a disorienting introduction to the neighborhood.**

Top Photo: Ann Forsyth/Right Photo: Ann Forsyth

CLARENDON

A transparent process: **A series of planning processes with heavy citizen participation has helped the Clarendon station area evolve in a way that combines traditional and new design elements to drive economic growth while preserving Clarendon's identity.**

Left Photo: Carissa Schively/Top Photo: Carissa Schively

Adapting for change: **Development in Clarendon, including new shopping centers and accompanying multimodal transportation amenities, has preserved the pre-existing townscape and street pattern.**

Left Photo: Ann Forsyth/Top Photo: Ann Forsyth

BALLSTON

Building a consensus for change. **Reinvestment and infill development around the Ballston station have evolved over time. A planning process that engaged the public from the start gave the community the time to develop at its own pace; without citizen buy-in, the plan could have been altered or abandoned.**

Photo Left: Ann Forsyth/Photo Above: Katie Thering

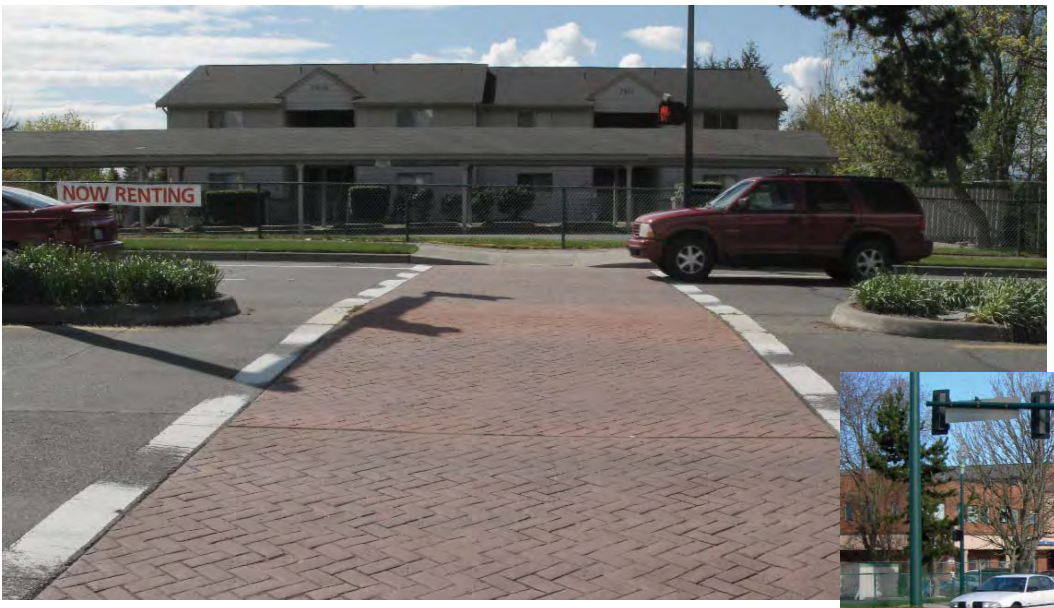
Mixing intense development with human-scaled spaces: **In Ballston, urban design allows commercial office space and complex transportation connections to co-exist with spaces that allow for human interactions, maintaining a sense of community.**

Photo Above: Katie Thering/Photo Above Right: Ann Forsyth/ Photo Right: Ann Forsyth

Bridgeport Way. University Place, Washington

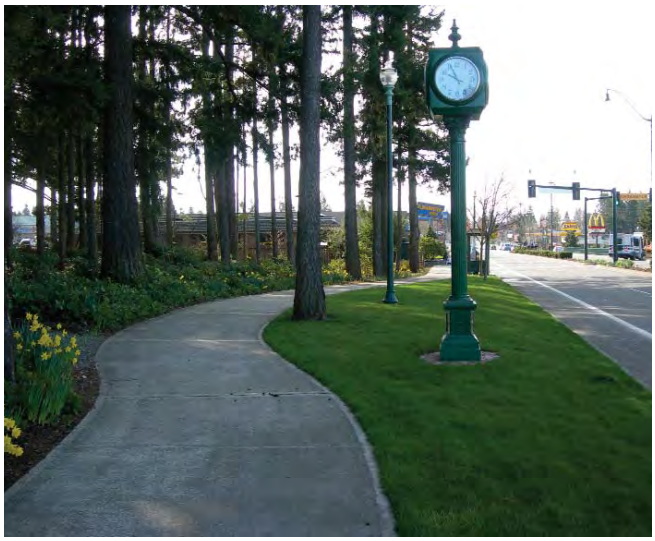
This 1.5 mile highway redesign project, located in a suburban community in the Seattle-Tacoma region, asked the question of how a community can re-invent a major thoroughfare to achieve a host of seemingly unrelated benefits. The City of University Place sought to improve pedestrian safety and access to businesses along the roadway, while maintaining it as a key transportation corridor. They employed a range of strategies to gain the trust and support of the community, including using an integrated deign team and developing visualization tools to show various options. The result is a design that achieves the goals the community established at the outset.

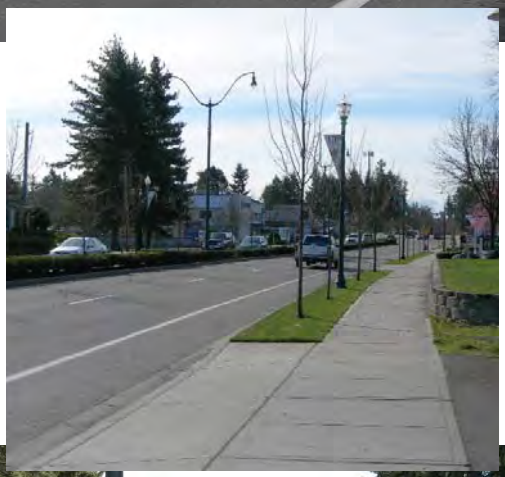
Photo: Carissa Schively



Visualizing a better future: **The creation of this design with clearly marked lanes and crosswalks to break long blocks arose out of visualization tools that design professionals used to identify a range of options for the community to discuss and debate.**

Photo Left: Lance Neckar/Photo Below: Carissa Schively





Integrating multiple benefits in a single design strategy: **In addition to improving pedestrian safety and access to retail, the new street design makes it possible for the newly-incorporated city to have a civic center and a central park. It also provides for access from a less-traveled thoroughfare and preserves a large stand of trees.**

Photo Above: Carissa Schively/Photo Above Right: Carissa Schively/ Photo Right: Lance Neckar

Virginia U.S. Route 50

Faced with the challenge of increased congestion along a highway that passes through some of Virginia's most beautiful scenery, a team of transportation officials, designers and community members forged a solution that many hope will be a model for other context sensitive solution projects across the country.

The redesign of Route 50 utilizes a series of design strategies that achieve multiple benefits, including safety, aesthetics and the preservation of historic elements. The result is a road that enhances the economic and cultural fortunes of the region while addressing congestion and vehicle safety needs.

Photo: Ann Forsyth

Enhancing safety within context: **The multimodal street design of the Washington Street section of Route 50 in Middleburg uses on-street parking, striped crosswalks and sidewalk spatial delineation with trees and brick pavements to achieve safe, clearly defined spaces for all modes. This avoids excessive signalization that would detract from the town's rural atmosphere.**

Photo Left: Ann Forsyth

Design elements that do double duty: **The historic Civil War markers help maintain the road's heritage and attract tourism while also performing as traffic-calming elements.**

Photo Above: Ann Forsyth

Adapting to new modes of transportation: **Instead of building modern safety barriers, designers preserved historic stone walls lining the roads, which reinforces the open natural landscape. Preservation of the two-lane roadway without widening the shoulder or adding curbs and gutters preserves a rural small town appearance while also encouraging adherence to posted speed limits.**

Photos Right, Top to Bottom: Ann Forsyth

Emerson Park MetroLink Station, East St. Louis, Illinois

The Emerson Park transit stop and park-and-ride lots were initially planned to be built across Interstate 64, making them inaccessible for the neighborhood. Community activism led to the design of a station that not only helps reduce congestion on the interstate but also spurs redevelopment in one of the nation's most chronically disadvantaged communities. Today, new low- and moderate-income housing developments—the first to be built in the neighborhood in over 30 years—give homeowners access to the entire St. Louis area transit system. Passengers disembarking at Emerson Park see new development in the form of affordable housing, fostering a greater sense of community. And the community's advocacy for the station has given it the experience and credibility to fight for further community enhancements, providing benefits to Emersion Park that go way beyond the transit stop.

Photo: Ann Forsyth

Designing through consensus: **The location of the park-and-ride at the Emerson Park MetroLink Station was the result in part of the community's wishes to keep key streets open and make a wider range of transit options available for the community.**

Photo Left: Ann Forsyth

Marrying economic development and sustainability to achieve a sense of place: **New single- and multi-family infill development has been built at transit-served densities in neighborhoods adjacent to the station, encouraging public transit use and providing access to employment.**

Photo Left, Above Left and Above: Ann Forsyth

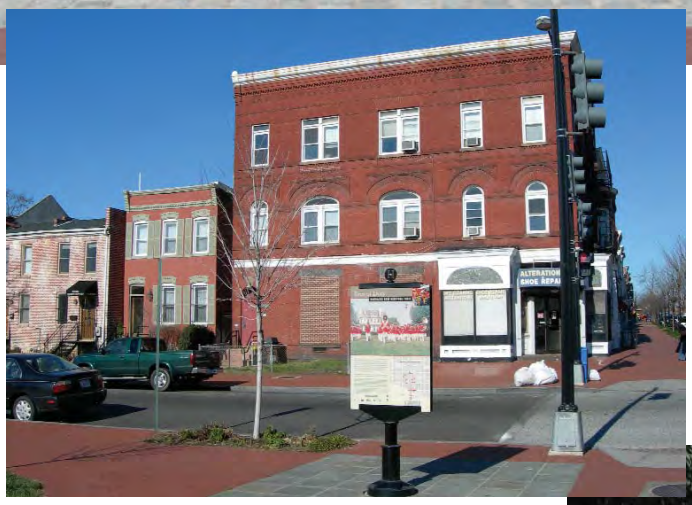
Barracks Row, Washington, DC

Named for the U.S. Marine Barracks that stand along it, Barracks Row has gone through many iterations in its long history, from one of the capital's first commercial neighborhoods to serving as witness to economic and social decline in the 1980s. Making Barracks Row a vibrant 21st Century community while maintaining its 19th century architectural and cultural heritage took an integrated effort by local officials, transportation planners and design professionals. Most of all, it required the commitment and involvement of community leaders who demanded that the redesign balance economic growth with pedestrian safety and preservation of a cultural treasure.

Photo: Ann Forsyth

Using design to convey a sense of place: **The traffic signals, traditional streetlights and specialty paver crossings were part of the project's design strategy to keep faith with the street's historic identity. The bricks in the sidewalk complement the brick architecture of the historic Marine Barracks.**

Photo Left: Ann Forsyth/Photo Below: Carissa Schively



Participatory processes that do not end when the project does: **The Barracks Row Main Street community organization, along with Cultural Tourism DC and the Capitol Hill Restoration Society, created the city Heritage Trail, a program of interpretive plaques on 8th Street. The plaques continue to be maintained, and most merchants along the street make a printed guide available.**

Photo Left: Carissa Schively

Safety and commerce working hand-in-hand: **Angled parking slows traffic and increases on-street parking capacity, benefiting the retail along the street. At the same time, elm trees along the curb create protected space for pedestrian movement.**

Photo Above: Carissa Schively/Photo Right: Ann Forsyth

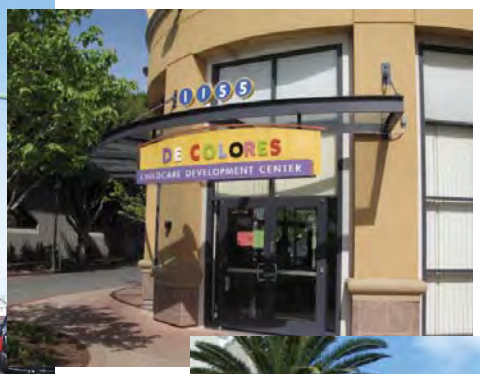
Fruitvale Transit Village, Oakland, California

Once the site of fruit orchards and a thriving fruit canning industry, the Fruitvale Transit Village was initially slated to become a parking garage when the community, led by the Unity Council, intervened. Their efforts led to the development of a 257,000 square-foot "transit village" that leads from the East Bay's fourth busiest BART station. The Council worked to find a design solution that married economic development, community identity, pedestrian safety and sustainability in a single project, stimulating further revitalization throughout the Fruitvale neighborhood.

Photo: Ann Forsyth

Strong leadership maintains community identity: **The project design was guided by the participatory processes organized by the Unity Council, for whom preserving the character of the community was a top priority. Regional construction techniques and artist-built street elements complement and coordinate with pedestrian crossings and boulevard median street furniture and plantings.**

Photo Above and Above Left: Lance Neckar



Integrating a variety of needs into a single project: **The transit village was a former BART parking lot that was converted to pedestrian space with mixed-used commercial service, retail and residential buildings and spaces close to BART and International Boulevard. Among the services in the station area that benefit the wider community are the Cesar Chavez branch library, a childcare center and La Clinica de La Raza, a health clinic, bringing more people to the village and making it more of a destination.**

Photo Above: Ann Forsyth/Photo Above Right: Lance Neckar/Photo Right: Carissa Schively

Transparent decision-making leads to transparent transportation design: **Reflecting the community's desire for easily accessible public spaces linked to mass transit, designers created a paseo (promenade) that connects to the transit plaza, including an intermodal bus station, BART parking and bike storage and repair.**

Photo Left: Ann Forsyth/Photo Far Left: Carissa Schively

Appendix

Federal, State and Local Contexts for Enhancement by Design

The complexity of transportation design and planning projects has spawned a comparably complex apparatus of frameworks and support functions across all levels of government and the non-profit private sector. Transportation projects often have interconnected federal, state and local jurisdictional and funding frameworks.

Some of the governmental resources that may be available to designers, policymakers and citizens interested in using transportation projects to enhance their communities include:

FEDERAL FRAMEWORKS

SAFETEA-LU: Solutions for Access. The 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) provides funding for highways, highway safety, and transit. To promote more efficient and effective federal surface transportation programs, SAFETEA-LU addresses transportation issues of national significance—including environmental stewardship—while giving state and local transportation decision-makers more flexibility to solve transportation problems in their communities.

Section 5307(d)(1)(K) of SAFETEA-LU stipulates that an urban area with a population of at least 200,000 must submit certification that it will expend not less than one percent of the amount it receives via the Act each fiscal year for transit enhancements, as defined in section 5302(a).

Eligible projects that have particular architectural and other design applications include:

- Historic preservation, rehabilitation, and operation of historic public transportation buildings, structures, and facilities (including historic bus and railroad facilities)
- Bus shelters
- Landscaping and other scenic beautification, including tables, benches, trash receptacles, and street lights
- Public art
- Pedestrian access and walkways
- Bicycle access, including bicycle storage facilities and installing equipment for transporting bicycles on public transportation vehicles
- Transit connections to parks within the recipient's transit service area
- Signage
- Enhanced access for persons with disabilities to public transportation

Visualization in Planning and Project Design. New changes to SAFETEA-LU require state agencies and metropolitan planning organizations, to the maximum extent practicable, employ visualization techniques to describe the proposed affects of a project. The Atlanta Regional Commission's mapping and data reports on their website have been cited by FHWA as a model of regional visualization. Another somewhat more simplified set of tools can be seen in the simulations for the Woodrow Wilson Bridge project.

National Historic Preservation Act of 1976, Section 106. Federally-funded projects are required to undergo review for compliance with the National Historic Preservation Act. This cultural resource evaluation process determines what impacts, if any, to properties eligible for the National Register of Historic Places are attributable to the scope of a transportation project. Working through state historic preservation offices, project mitigation strategies are arranged to protect, conserve, mitigate impacts on, or document threatened architectural and other cultural resources.

STATE AND LOCAL FRAMEWORKS

Other researchers have documented transportation-focused land use policy and planning approaches that integrate design. Several states have model CSD/CSS protocols, especially for cultural resources.

Florida: Environmental Streamlining. In Florida the state DOT has instituted an Efficient Transportation Decision-Making (ETDM) process. ETDM provides other government agencies, as well as the public, with early access to project plans and information about the projects' potential effects on the state's resources. These findings frame the technical studies performed by the DOT. An Environmental Screening Tool (EST), an internet-based GIS tool, allows agencies and the public to review maps of proposed projects and enter comments. This is a locally-specific approach to projects intended to provide greater planning and design transparency. Each of Florida's seven geographic FDOT Districts has an ETDM team.

Washington: Sustainable Transportation Planning. *Building Projects that Build Communities* (2003), the community planning guidelines and handbook produced by the Community Partnership Forum with WSDOT, is one of a series of tools for communities produced by that state's model environmental and community-oriented department. (http://www.wsdot.wa.gov/ biz/csd/BPBC_Final/) Reader-Friendly Environmental Impact Statements (EIS) are part of a new effort by WSDOT to make more transparent and legible the environmental planning and design issues subject to federal and state review guidelines and performance standards relative to large projects.

Local Planning Approaches. Metropolitan planning organizations (MPOs) are sometimes the lead agencies for the planning of transit projects and often are delegated some authority by the state for other transportation planning. The principal objective has been to build the connection between transportation and land use, and, in some jurisdictions, resources such as water.

Researchers have articulated the need for planning-based approaches to encourage multi-modal, especially transit, solutions at the metropolitan and local levels. These include:

1. *Growth Boundaries or Regulatory Controls.* States and metropolitan areas that have integrated policies around sustainability have created regulatory controls on growth in the interests of curbing sprawl.

2. *Planning and Zoning.* An area's comprehensive land use plan and resulting zoning for greenfields shape the location, mix, and intensity of new development. Master and neighborhood plans, and especially zoning, generally reflect relationships to transportation systems as they establish intended uses and intensities of use. A major planning consideration is highway, street, and pedestrian network layout, typically enforced at the local level through design standards and land subdivision controls.

3. *Building Codes, Subdivision Ordinances and Site-Specific, Flexible Zoning Strategies.* At a site level, building codes, subdivision ordinances, and site-level zoning requirements such as planned unit developments and overlay zones often have provisions that impact land use, density, building envelope, and parking, and, therefore, on transportation options and travel behavior. Simple measure such as on-site parking requirements, often part of zoning codes, can be a powerful tool in designing for greater pedestrian activity and water resource protection. Reduced building setbacks move parking to the rear or sides of buildings and improve street continuity and access for pedestrians and bike and transit users.

4. *Incentives and Fees.:* In the context of transportation projects, government investment in infrastructure or programs can also entice development to particular areas. Pricing mechanisms, including tolling, may be applied to alter existing conditions in the marketplace that act as development signals.

5. *Congestion/Capacity Ordinances.* Local jurisdictions have adopted ordinances that regulate the pace of new development to ensure adequate capacity and performance of existing and new public facilities, particularly if new development will increase traffic congestion beyond a specified threshold.

6. *Joint Development in TOD.* This tool has been a critical aspect of the DART approach to building ridership in Dallas by fostering mixed-use destination development. In Oakland, BART played a critical role in the land deals on park-and-ride lots that they owned that made the Fruitvale plan possible.

7. *Innovative Financing for Multimodal Projects.* The best-known example of this is the $1.67 billion Denver T-Rex project, which opened in November, 2006. It has provided 17 miles of Rapid Transit Denver LRT service along the reconstructed and widened right-of-way of Interstate 25.