A smoothly functioning freight transportation network is part of the nation’s critical infrastructure and is essential to the U.S. economy. Transportation services deliver raw and intermediate materials to producers and final products to retailers and customers. Freight and its transportation are an integral part of supply chain management (see Figure 1, below).

According to the most recent U.S. Commodity Flow Survey, on average, 42 tons of freight worth $39,000 were delivered to every person in the United States in 2007. In terms of distances traveled, that approximates 11,000 ton-miles of freight per person. This is equivalent to carrying one ton of freight for every man, woman, and child in the United States 11,000 miles.

The shares of domestic ton-miles of truck and rail freight increased significantly between 1980 and 2007, as shown in Figure 2 (above, right). Associated with the increases were significant pieces of legislation that largely deregulated these industries—the Staggers Rail Act of 1980 and the Motor Carrier Act of 1980. Intermodal shipments also are growing, particularly for truck and rail, in terms of ton-miles, and for truck and air for higher-value and time-sensitive shipments.

In addition, the freight transportation system is a major employer. In 2008, 4.5 million people were employed in transportation and warehousing industries in the United States, a little more than 3 percent of total U.S. employment.

Conflicts in Land Uses

Population growth, rising incomes, and other aspects of economic growth have led to increased competition for the land resources around freight corridors and facilities. Competing and incompatible land uses in close proximity often interfere with each other, leading to conflicts—this has become a significant problem for freight transportation operations. The expansion of incompatible land uses, especially in America’s burgeoning megaregions, raises serious threats to the freight transportation system.

National Cooperative Freight Research Program (NCFRP) Report 16, Preserving and Protecting Freight Infrastructure and Routes, provides a perspective on the importance of the freight transportation system and presents tools and strategies to resolve or minimize conflicts that arise when nonfreight land uses...
are in proximity to freight corridors and facilities. The project also produced the EnvisionFreight website (see box, below), which provides detailed information on the tools and strategies. Table 1 (above) shows the conflicts that arise when various land uses are adjacent to freight corridors and facilities.

Causes of Conflict
The NCFRP project identified the following factors as underlying causes of conflict between freight and nonfreight land uses:

- Planning for freight is generally inadequate;
- Zoning approaches to freight are typically inadequate;
- Funding for planning, corridor preservation, and conflict mitigation is often lacking or insufficient; and
- Communication among stakeholders is lacking.

From the perspective of freight interests, conflicts with other land uses often impede economically effi-

### TABLE 1 Conflicts Between Freight and Other Land Uses

<table>
<thead>
<tr>
<th>Noise-sensitive uses</th>
<th>Dwelling units (residential, motels, etc.); educational (childcare, schools, colleges, etc.); libraries; hospitals and other residential health care providers; playgrounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-sensitive uses</td>
<td>Dwelling units; hospitals and other residential health care providers</td>
</tr>
<tr>
<td>Vibration-sensitive uses</td>
<td>Dwelling units; educational; vibration-sensitive industries (e.g., precision high-tech); buildings not constructed to withstand fatigue caused by rail vibrations</td>
</tr>
<tr>
<td>Pollution- and air quality-sensitive uses</td>
<td>Dwelling units; medical (hospitals and other residential health care providers); educational (childcare, schools, colleges, etc.); park and recreational facilities</td>
</tr>
<tr>
<td>Uses requiring potentially incompatible at-grade crossings</td>
<td>Dwelling units; educational; libraries; hospitals and other residential care providers; commercial; emergency services; park and recreational health facilities</td>
</tr>
<tr>
<td>Uses associated with the potential for dangerous trespass</td>
<td>Dwelling units; education uses (especially childcare facilities and schools); libraries; playgrounds; commercial</td>
</tr>
<tr>
<td>Time-sensitive uses</td>
<td>Nighttime-sensitive dwelling units; hospitals and residential care facilities</td>
</tr>
<tr>
<td>Traffic- and congestion-sensitive uses</td>
<td>Dwelling units; emergency services; residential health care facilities</td>
</tr>
<tr>
<td>Height-sensitive uses</td>
<td>Residential and commercial, with possible impact on flight paths at approach and landing</td>
</tr>
</tbody>
</table>

EnvisionFreight

**Online Information for a Range of Users**

The NCFRP project developed the EnvisionFreight website for a range of stakeholders working to prevent, consider, and deal with the conflicts that arise because of the proximity of incompatible land uses to freight facilities.

For planners and elected officials, the website explains the role of freight in the local, national, and global economy; the issues and impacts that may arise from land use conflicts; and the kinds of tools, scenarios, communication, and educational outreach that can improve freight planning and preservation.

For developers, the website assists in identifying freight activities that may affect and intersect with residential and other types of land uses, in choosing appropriate sites, and in incorporating construction and mitigation components to reduce conflicts.

For freight entities, EnvisionFreight provides education and assistance in land use planning and zoning processes.

For individual citizens or community groups, the website provides basic information about the various freight modes, the impacts of freight activity and proximity to incompatible land uses, and the tools available to plan for freight effectively.

For state legislators and staff, EnvisionFreight provides information and ideas for potential legislative changes to facilitate the integration of freight and land use planning.

cient freight transportation. In addition, barriers can arise from insufficient funding for the maintenance or expansion of freight facilities and corridors and from public policy decisions that impede or do not sufficiently accommodate the needs of freight transportation. Impediments include the following:

- Speed restrictions,
- Restrictions on hours of operation,
- Physical encroachment into freight corridors, and
- Impacts on transportation routing decisions.

Local jurisdictions have an incentive to maximize property and sales tax revenues. This can create pressure to change zoning designations to generate greater tax revenues. Demand for affordable land near city and downtown amenities has aggravated this issue, because many freight facilities—especially railroads and rail yards—historically are situated in these areas.

**Freight-Compatible Development**

The project developed the concept of *freight-compatible development* as a guiding principle for land use planning and development. The main objectives are as follows:

- Ensure that freight transportation-related services are not affected by, or do not affect, other land uses that are placed close to the freight corridor or facility;
- Reduce and minimize community impacts that arise from the proximity of sensitive land uses, including residences, schools, hospitals, and emergency services; and
- Incorporate the preservation and protection of freight facilities and corridors as a forward-looking component of general planning and economic development policies.

Tools for achieving freight-compatible development fall into four main areas: long-range planning,

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Tools to Achieve Freight-Compatible Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long-Range Planning</strong></td>
<td><strong>Zoning and Design</strong></td>
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<tr>
<td>State enabling acts</td>
<td>Zoning standards</td>
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<td>Regional visioning</td>
<td>Buffer areas</td>
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<td>Comprehensive plans</td>
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<tr>
<td>Freight facility inventories</td>
<td>Lot orientation</td>
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<tr>
<td>Official maps</td>
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<tr>
<td>Purchase and advance acquisition</td>
<td>Construction standards</td>
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<tr>
<td>Land swaps</td>
<td>Soundproofing standards</td>
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<td>Protective condemnation</td>
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<td>Permit development</td>
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<td>Access rights</td>
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</table>

Freight-compatible development ensures that rail facilities and residential or other community land uses can coexist successfully.
zoning and design, mitigation, and education and outreach (Table 2, page 47). The project’s analysis of these tools led to suggestions for preserving and protecting freight infrastructure and routes. Mitigation is often a final resort in resolving conflicts, and most mitigation activities are expensive to implement and have uncertain outcomes. In contrast, planning is a proactive tool that suggests actions for freight-compatible development.

New Planning Dialogue

Land use planning is the primary forum for avoiding conflicts between freight and other land uses and for helping in the preservation of freight corridors and facilities. In general, however, land use planning processes inadequately accommodate freight needs. Because the primary responsibility for land use planning lies with local jurisdictions, any planning for freight needs is piecemeal; most freight transportation corridors transcend jurisdictional boundaries. State and regional planning agencies typically do not have the land use planning authority to fill the gap in freight planning. For example, metropolitan planning organizations are not authorized to conduct transportation planning outside of their areas, and regional visioning exercises generally do not deal adequately with freight. This problem is often exacerbated by a lack of effective communication among freight and land use and transportation planning stakeholders.

No single entity at the federal level has responsibility for freight planning, financing, or project implementation. Multiple federal agencies oversee different aspects of the U.S. freight network, but none has authority over land use planning. Federal funding for freight preservation and protection activities has been sporadic; moreover, significant portions of the U.S. freight network are privately owned.

With the emergence of freight megaregions overlapping state and national boundaries, a new planning dialogue is necessary. Tools and strategies to minimize and resolve conflicts between freight and other land uses are needed in long-range planning, zoning and design, mitigation, and education and outreach.

Planning decisions in the next decade will be critical to future transportation system efficiencies and regional competitiveness. Local and regional freight planning will require highly skilled freight transportation planners, new planning strategies and tools, community support, longer-term regional visioning, and legislative authority.

A significant research effort is needed. Until the findings are put to practical use, the conflicts between freight and nonfreight interests will not subside.

Suggested Actions

1. Amend state enabling acts to require states, local jurisdictions, and planning agencies to account
for freight in transportation planning and land use planning.

2. Provide guidance to land use planners about planning and zoning practices that relate to freight. For example, zoning overlays and industrial protection zones can be put in place not only for the industrial areas serviced by freight, but also for linking corridors.

3. Accurately map freight facilities and corridors as part of the comprehensive planning process.

4. Include freight entities as key stakeholders—and make freight issues a focus—in cooperative regional planning and visioning efforts.

5. Through state and national associations, provide appropriate education and tools for city and county planners for freight planning and development.

6. Encourage freight entities to participate as stakeholders in local, regional, and state planning and visioning processes.

7. Encourage private-sector groups, including local chambers of commerce, to keep freight issues on the agenda and to gain buy-in from the business community when a preservation project is proposed.

8. Include the principles of freight activity in graduate and undergraduate curricula in planning, architecture, policy, engineering, business, and law, through partnerships between private-sector and governmental freight groups and educational institutions.

9. Encourage port authorities to quantify the congestion and noise impacts outside the immediate port area, in addition to tracking port-related job impacts throughout the region. Port master plans can illustrate affiliated congestion and chokepoints beyond the port properties. Other freight operations that cannot easily relocate can undertake similar activities.

10. Implement innovative funding practices—including public-private partnerships and rights of first refusal—for freight planning and preservation projects.

11. Include in real estate contracts—and in other documents provided to purchasers and lessees—discussions of the possible freight-related impacts that may occur as a consequence of living in proximity to freight activities.

Acknowledgments
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