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16. Abstract Rail Corridor preservation and planning for the purpose of reducing or restricting incompatible development is an area of growing importance. This report provides an overview regarding encroachment and the elements that contribute to potentially incompatible development along rail corridors. The report reviews the legal tools that currently exist within Texas for corridor preservation and provides recommendations for new legislation, including draft legislation. The report then reviews the state of practice of corridor planning and preservation with mitigation against encroachment both in Texas and in selected other states around the country. The report pays special attention to incidents in which rail corridors are envisioned to host both freight and passenger services and the implications on land use. Finally, the report provides a review of costs associated to deal with encroachment, whether by planning, preservation, collaboration, or mitigation.					
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Protecting and Preserving Rail Corridors Against Encroachment of Incompatible Uses

Lisa Loftus-Otway
C. Michael Walton
Lynn Blais
Nathan Hutson

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Center for Transportation Research
The University of Texas at Austin
3208 Red River
Austin, TX 78705

www.utexas.edu/research/ctr

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Project Engineer: C. Michael Walton
Professional Engineer License State and Number: Texas No. 46293
P. E. Designation: Research Supervisor

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Chapter 1. Executive Summary

The concept of transportation corridor preservation to reduce or restrict incompatible development has gained interest over the past twenty years, with numerous studies reviewing options and activities to preserve existing and proposed highway corridors. These studies have reviewed and promoted concepts of inter-jurisdictional coordination, the use of official maps or other comprehensive planning studies to delineate future corridors, and changes to access management to protect existing transportation corridors, as well as the traditional land use planning tools used (mainly) by cities and some counties of zoning, overlay districts, and other specialized tax mechanisms to encourage specific types of growth in targeted areas. Most corridor preservation efforts have focused exclusively on highway corridors. A list with current links to these studies can be found in the 0-5546-P1 guidebook on its accompanying CD-ROM. Given the private ownership of the freight railroads in the United States, it was neither appropriate nor useful for state departments of transportation (DOTs) to actively plan rail corridor preservation strategies. However, a number of developments in recent years have begun to change this opinion. The first factor is a general recognition that without greater public involvement, there is a strong possibility that railroads will not be able to keep up with the needed growth for freight capacity with their traditional investment patterns (Wilson, 2005). Railroads must already re-invest a high percentage of total revenues on capital expenditures. In the past 10 years, the American Association of Railroads estimates that the railroads spent an average of 17.2 percent of total revenues on capital expenditures with \$9.4 billion in capital expenditures planned for 2007 (Logistics Management, 2007). The second, and related, factor was the acquisition or adoption of certain abandoned rail corridors by state or municipal governments, which led to a greater awareness of corridor preservation and planning issues.¹ Finally, there was a growing recognition that the current status and location of rail corridors, with numerous at-grade crossings, inadequate siding lengths, and antiquated signaling systems, was having a detrimental impact on quality of life in urban areas, and that without better planning, the cities and the rail companies would essentially be on a collision course. A series of high-profile derailments in Texas and other accidents expedited this recognition and focused public attention onto rail activities and cargos carried through communities.

Most of the cities surveyed in the course of this study were actively trying to anticipate future changes in the transportation network and link these to land use planning to create greater citywide connectivity and less incompatible development. They are no longer sitting back and waiting for the status quo to re-emerge. For example, in most cities where rail transit was being proposed, Transit-oriented Development overlays, which use incentives to encourage property owners to develop their property using transit-oriented design principles, were being implemented to permit cities to structure compatible development around these anticipated new systems (Envision Utah).² Even cities that have hitherto not utilized zoning or other land use planning tools are beginning to see merit and benefits in corridor planning. For example,

¹ An example would be the 2001 acquisition by the Texas Department of Transportation, and their lease agreement with Grupo Mexico, of the northern portion of the old South Orient Line (now Texas Pacifico) from San Angelo to Presidio, Texas. Metropolitan areas have also discovered that freight rail corridors, if retrofitted for passenger use, can be substantial economic generators and can have significant impacts on the local tax base.

² Definition of TOD overlay district from
<http://www.envisionutah.org/resourcesfiles/22/South%20Salt%20Lake%20TOD%20Code.doc>

Houston, notwithstanding its lack of zoning authority (which has sometimes complicated corridor preservation efforts) is actively beginning to develop strategies and policies to direct land use and develop the best mix of uses along its major corridors. This *pre-positioning*, so to speak, educates the public, and establishes linkages between stakeholders in non-confrontational relationships that will be necessary for developing sound policies and plans in the future. Long term, this pre-positioning will be one of the tools that will reduce incompatible development beside commuter and light rail systems.

At present, many cities (and some counties) are actively involved—often with TxDOT guidance—in the analysis and review of freight rail relocation, or freight rail improvements. Houston, Dallas, Fort Worth, Austin, and San Antonio (along with the surrounding counties) provide good role-model examples of lessons learned and best practices in dealing with their respective problems vis-à-vis incompatible development beside the railways. The railroads have also been proactive partners in this process. As long as this initial momentum can be sustained, and provided that the railroad relocation fund is capitalized, the role for TxDOT in the rail corridor planning process could be extensive. However, as discussed earlier, the cities noted that the biggest obstacle to reducing incompatible development on both existing and proposed corridors lies in the ability to fund the Texas Railroad Relocation Fund. Without this funding, currently envisioned projects may languish and the impetus to champion these projects will diminish. The longer projects are delayed, the harder it will be to maintain a critical mass of public interest. Furthermore, each delay results in the need to re-educate newly elected or appointed officials who are new to the process, and allows incompatible land-use activities around corridors to flourish.

This report is broken down into nine main areas: Chapter 1 is an executive summary that discusses the reports overall findings. Chapter 2 provides an overview regarding encroachment and the elements that contribute to potentially incompatible development/encroachment. Chapter 3 then turns to review existing corridor protection strategies. Chapter 4 reviews existing legal tools for corridor protection. Chapter 5 reviews the state of practice of corridor planning and preservation within Texas including practices that are being used to mitigate encroachment. Chapter 6 reviews rail corridor planning and preservation practices throughout the U.S. It provides a series of case studies to highlight the success of such practices. Chapter 7 provides a review of costs associated to deal with encroachment, whether by planning, preservation, collaboration, or mitigation. Chapter 8 then turns to look at mitigation practices that are used throughout the U.S. because of pre-existing encroachment on rail rights-of-way. Such mitigation techniques are also instructive for planners developing new rail systems. Finally, Chapter 9 provides conclusions and recommendations for planners and partners involved in rail development.

The report is also accompanied by a guidebook (on CD-ROM) that highlights the researcher's findings and recommendations and provides links to zoning ordinances, case study items, and agreements procured during the duration of this study.

Chapter 2. Overview of Potentially Incompatible Encroachment

Factors that constitute potential or actual incompatible encroachment differ between freight and passenger rail. In many cases, the differences are dramatic. These factors and differences were revealed during the course of discussions with Class I, II, and Short Line railroads in the U.S. as well as the American Association of Railroads (AAR). These discussions focused on evaluating land use or development activities that have the potential to effect rail operations (and vice-versa) and to identify measures that the railroads have undertaken to mitigate these potentially incompatible uses. Cities, counties, and transit operators were also interviewed to gain their perspective on land uses in the proximity of rail right-of-way/ rail corridors.

Railroads noted that any form of residential or multi-family housing is potentially incompatible with nearby freight rail right-of-way. Representatives of Union Pacific (UP), Burlington Northern Santa Fe (BNSF), and Norfolk Southern (NS) noted that this is primarily due to noise, vibration, and rail yard activities (loading and the formation of trains). Safety and legal considerations also exist, namely the propensity for trespass and other torts to occur on railroad property (Kearns, Olson & McCulley, 2007). Railroads also noted that height (vertical) encroachment was becoming an issue as bridges were replaced and jurisdictions sometimes did not take into consideration the current or future need for double-stack clearance. The cities and counties surveyed noted that mixing this sort of development with rail operations should be actively discouraged through ordinance and zoning around future corridors. However, cities also noted that in many instances they were dealing with old systems that had been in place for many years and could not be moved.

Freight railroads identified additional land uses that are incompatible with nearby rail operations:

- Schools
- Daycare facilities
- Playgrounds
- Hospitals
- Emergency services—fire, ambulance, police
- Light commercial activities, hotels, motels, etc.
- High-precision manufacturing operations

This list was echoed by the cities and counties interviewed, forming one area of common ground. Many stakeholders commented that, “hindsight being 20/20,” cities and counties would have planned differently had today’s situation “been revealed in a crystal ball” to previous generations.

The typical problems as a consequence of incompatible development near rail corridors include air quality, noise, odor, dust, and vibration for residents. The freight railroads noted that commercial and industrial uses were not incompatible with railroad activities and did not pose serious problems for them. The main issue that commercial development raised was the potential for at grade crossings to affect the flow of traffic to businesses. Zoning categories used by Texas jurisdictions delineate two types of industrial land use: light and heavy industry. Transportation terminals and railroads are usually classed as heavy industry

In evaluating the types of land use that are incompatible with passenger rail, representatives from the Trinity Rail Express (TRE) and Dallas Area Rapid Transit (DART) as well as city officials from Plano, Richardson, Carrollton, Dallas, and Fort Worth were interviewed as these systems were the most developed in Texas. Incompatible land uses around transit were listed to include industrial/commercial activities and hazardous material manufacture and transport. In many instances these cities had implemented Transit-oriented Development (TOD) ordinances and had re-zoned areas around the transit rail for downtown, mixed, residential, and light commercial uses. Importantly, these discussions revealed that passenger rail was being used as a mechanism to stimulate growth and encourage specific land use around stations and corridors. Eric Slaterger, City of Fort Worth (Planning Manager for Comprehensive Planning and Head of Urban Village Department), noted that the urban village concept was being used to stimulate investment around corridors and that the city would try to get “land use to match the zoning category if not already a match.” DART also noted that—as it had originally used Federal Transit Administration (FTA) funds to purchase extra land around its corridors—the FTA, due to a change in law, asked DART to create a TOD implementation fund to generate compatible uses, and make infrastructure improvements around the new transit corridors to facilitate these new uses.

2.1 Problems Caused by Incompatible Encroachment

Incompatible encroachment can cause problems from a legal, financial, or political context. In fact, sometimes all three of these elements are involved. From the legal perspective, nuisance, trespass, and specific environmental violations, including environmental justice issues and personal injury, are the most common types of problems that arise. Hugh McCulley of Crady, Jewett & McCulley LLP (Legal Counsel used by UP and BNSF) noted that over the years there had been many cases brought by the railroads and individuals regarding these events. For example, homeowners have brought suit due to nuisance (noise/vibration) after purchasing homes close to railroad corridors, and railroads have brought suit over trespass to their property.

A review of case law and also anecdotal off-the-record quotes from various stakeholders showed that all parties fought vigorously to protect their rights. For example, a few years ago BNSF and the City of Houston fought over the building of a new route in Houston, with BNSF winning at Court of Appeal. While this confrontational stance is not courted by either side, it has long been seen as a fact of life.

Financial issues deriving from incompatible development include the loss of private property value due to the rail corridor’s proximity to residential development that occurs without the existence of a specific legal infraction or culpable party. Financial losses of this type can sometimes occur over a long period of time and be recognized only long after the fact. Another common financial cost arises from the need to subsequently rectify an encroachment issue so that a corridor development project can go forward.³

³ Craig Rockey of the American Association of Railroads noted that, in general, the Class I railroads were not actively looking to buy new property as they haven’t really built new rail routes in 80 years and traditionally have had more capacity than needed. AAR also noted that railroads would not want to be actively involved in rail-banking or other acquisition activities because they already have excess lines not currently being used. Rockey also noted that the railroads were finally coming back to profitability and would prefer to spend resources on existing network improvements. The research team asked the Class I’s if they had considered the use of acquisition to provide buffer zones along their ROW. The response was that this was expensive, and would increase their property and commercial tax bills. BNSF noted that most of the ROW they now owned stretched 50–100 feet and that this

Finally, political problems regarding encroachment and/or incompatibility can arise when disparate interest groups seek to prevent a corridor development initiative fearing legal or financial ramifications. Political problems thus often impact the development of future corridors even if no legally defined incompatibility yet exists.

2.1.1 General Incompatibility Concerns

The list of incompatible uses articulated by various railroad interests indicates mutual and overlapping concerns among the railroads. Moreover, several of the conflicting uses implicate the same type of incompatibility. The most commonly cited aspects of incompatibility are noise; vibration; lights from rail yard activity; the need for at-grade crossings; and the potential for hazardous trespassing. These incompatibilities generally fall into the following types of incompatible uses:

- **Noise Sensitive Uses:** Dwelling units (residential, motels, etc.); educational uses (childcare, schools, colleges, etc.); libraries; hospitals and other residential health care providers; playgrounds.
- **Light Sensitive Uses:** Dwelling units (residential, motels, etc.); and hospitals and other residential health care providers.
- **Vibration Sensitive Uses:** Dwelling units; educational uses; vibration sensitive industries (such as precision high-tech industry); all buildings not constructed to withstand the fatigue caused by rail vibrations.
- **Uses Requiring Potentially Incompatible At-grade Crossings:** Dwelling units; educational uses; libraries; hospitals and other residential health care providers; commercial uses; emergency services requiring quick ingress and egress.
- **Uses Associated with the Potential for Dangerous Trespass:** Dwelling units; education uses (especially childcare facilities and schools); libraries; playgrounds; commercial uses.

2.1.2 Particular Incompatibility Concerns of Freight Rail

Representatives from the freight railroads that were interviewed noted that the closer development occurs to railway right-of-way, the greater the impact will be. Some cities have begun to actively encourage inner-city high-density use and gentrification of neighborhoods. New zoning codes in some areas encourage the development of high-rise apartments on land that was previously zoned as industrial. Sometimes these residential developments are close to existing freight-lines proposed to be relocated in the future. Where gentrification is taking place in many cities and replacing existing neighborhoods with modern denser developments, it is creating a new set of encroachment problems that will have to be dealt with. In one example, UP and BNSF representatives noted the development of high-rise condominiums near the UP line in downtown Austin. One development was within roughly 10 feet of the rail right-of-way. While there are efforts and plans underway to relocate UP's through-freight from this track, some freight trains would still remain to provide service to local customers and five to six freight trains daily will likely remain. These will be scheduled in off-peak hours to make local deliveries. It was posited that disputes could arise based on noise, vibration, and environmental factors as freight trains roll past newly developed properties at inhospitable hours.

was considered sufficient to offset any incompatible uses. All the freight railroads commented that if the public wants buffer zones, then cities (or counties) need to either zone for this or purchase land.

Shortline railroads in rural areas have fewer incompatible uses to contend with. However, they are still concerned by large residential developments that have been proposed near their areas of operations. Shortlines also noted that there were issues regarding clear signage and visibility at grade crossings on the network (Perkins, 2006).

Railroads noted that environmental justice issues were becoming more prevalent. Despite the fact that alignment of the rail lines through neighborhoods has often been fixed in place for over a century, there are many cases in which the real or perceived incompatibility between uses has increased. This occurs, for example, when rail companies use existing track more intensively or when increased traffic congestion and increased roadway usage makes rail-related delay at grade crossings comparatively more costly. Another factor that must be considered alongside the growth in urban population within Texas has been the general de-industrialization of cities, which has lowered the threshold of tolerance amongst the population for exposure to heavy industrial activity. For this reason, even in cases when the railroad lines and yards have not become noisier or dirtier in recent decades, their presence is felt more strongly as most of the surrounding industries that remain have become substantially quieter and cleaner.

A common assumption amongst some policymakers is that, given sufficient funding, almost any rail facility could be removed and relocated. However, in many cases, shifting to alternative track is impossible because railroads still need to make deliveries to key local customers. Furthermore, while almost all existing routes have some issues with incompatible use, it is very difficult to develop new routes that would not have equally significant incompatibility issues. In cases when the railroads have rerouted or used other mitigation efforts, they are often accused of assisting affluent communities at the expense of poorer communities, given that affluent communities are the most vociferous in complaining about the nuisance.

Schools, daycare facilities, playgrounds, hospitals and emergency services (fire, ambulance, and police) are all land use activities that are incompatible with freight operations. The first three uses constitute serious safety issues. Facilities with young children pose the potential for trespass as well as issues of at-grade crossings that must be traversed to reach the facilities. Class I railroads, the Association of American Railroads, and Federal Railroad Administration (FRA) have spent millions of dollars in public outreach activities highlighting the dangers of rail lines in an effort to prevent accidents. Craig Rockey, Vice President of Economics and Policy for the AAR, noted that \$220–\$250 million per year was spent on safety programs (awareness programs and infrastructure improvements). This effort has resulted in better safety, with a reduction in the number of people killed at grade crossings (Rockey, 2007). However, it was noted that maintaining awareness was a constant effort and, therefore, education programs must be kept in place continually. This issue is growing as urban development creates cities bisected by existing railroad infrastructure. This causes particular problems at grade crossings when emergency responders are stuck waiting for trains to pass. City officials in Houston, San Antonio, and Dallas/Fort Worth all commented on the problems associated with at-grade crossings and the costs and challenges of addressing them.

2.1.3 Particular Incompatibility Concerns of Passenger Rail

Passenger rail is by definition integrated into the communities it serves, creating a different set of considerations from that of freight rail. Cities have used zoning or overlay districts to ensure that development occurring along these facilities is compatible with rail service. Eric Slateger, City of Fort Worth (Slateger, 2007), noted that on the Trinity Rail Lancaster Corridor area the city used an overlay to accommodate its vision for the area. The city

was exceptionally strict with regard to land use near the corridor and stations. For most of the stations along the route, cities didn't need to rezone areas around stations as they were already classified as "H zoning" (downtown and mixed-use), a use compatible with passenger rail systems.

The issues of the use of TOD overlay zoning around passenger rail stations was discussed with city officials. TOD overlay zoning around passenger rail stations is being actively implemented throughout Texas cities that have either already built light or commuter rail systems or are proposing such systems. TOD overlay zoning encourages mixed use, usually within a half- to one-mile area around transit stations. However, if the track or right-of-way used by these transit systems shares trackage rights with freight rail, there is still the potential for land use incompatibilities. While this is not currently a problem, with the current planning push to relocate freight rail—or shift the through usage—off existing lines, there is concern that this may be a problem in the future if right-of-way is not adequately protected. TRE staff had noted that as this commuter rail shares trackage rights with Fort Worth and Western Railroad (FWWR), some mitigation options were required. This included building sound walls in some places and shifting freight traffic to the middle of the day. Although many shortline railroads around the country have seen a drop-off in business and revenues, some of the surveyed shortlines noted that their business was growing as the Class I's were actively encouraging them to take on more activities. Shortline managers expressed some concern that as throughput on these lines grows, TOD-type developments or other zoning activity could create potential conflicts in the future

2.1.4 Legal Issues Raised by Incompatible Uses

Depending on the type and severity of incompatible land use at issue, and the particular type of incompatibility implicated by the proximity of the land use and the railroad, different legal concerns become salient. In particular, railroads could reasonably be concerned about nuisance liability and liability under the doctrine of attractive nuisance. In practice, however, the risk of liability under either doctrine is relatively limited.

One might expect that, as incompatible uses encroach on rail corridors, the noise, light, and vibrations associated with rail traffic and rail yard activities may give rise to nuisance liability. In general, any action that results in a substantial nontrespassory interference with landowner's interests in the use and enjoyment of their real property will constitute a nuisance and give rise to liability. In Texas, an interference is considered substantial if it causes unreasonable discomfort or annoyance to persons of normal sensitivity. The noise, light, and vibrations generated by certain types of rail activity may be substantial enough to constitute a nuisance in some circumstances. In addition, vibrations at certain frequencies for a sustained period may cause actionable property damage to buildings if the vibrations are not mitigated and/or the buildings are not constructed to withstand the vibrations. However, courts have consistently held that state common law nuisance claims are pre-empted by the Interstate Commerce Commission Termination Act, which states that the Surface Transportation Board has exclusive jurisdiction over transportation provided by rail carriers, and that "the remedies provided under this part with respect to regulation of rail transportation are exclusive and preempt the remedies provided under Federal or State law." See *A. & W. Properties, Inc., v. The Kansas City Southern Railway Company*, 200 S.W3d 342 (Tx.App.—Dallas 2006).

Similarly, railroads may face liability if their proximity to certain land uses is considered an inducement to potentially dangerous trespass activity. In general, landowners are not liable for injuries suffered by trespassers unless the landowner has acted willfully, wantonly, or with gross

negligence toward the trespasser. See *Texas Utilities Elec. Co. v. Timmons*, 947 S.W.2d 191, 192 (Tex.1997). However, trespassers on railroad property face two types of risk—the risk that they will be hit by a train while trespassing on tracks, and the risk that they will be injured by railroad equipment or improvements while trespassing in or around a rail yard or rail equipment—and Texas law incorporates an exception to the general no-duty rule to apply to each of these types of risks.

First, Texas law imposes a duty of reasonable care on railroads to avoid collisions with any person who is on railroad tracks, regardless of whether they are trespassing. See *Houston and T.C. Railroad and Co. v. Sympkins*, 54 Tex. 615 (1881). Because this risk and the attendant duty are longstanding and not unique to the issue of encroachments of incompatible uses, further clarification of the risk is beyond the scope of this project.

Second, like most jurisdictions, Texas recognizes an “attractive nuisance” exception to the general “no duty to trespassers” rule. See *Banker v. McLaughlin*, 208 S.W.2d 843, 847 (Tex. 1948) (initially embracing the attractive nuisance exception). This exception was crafted in response to cases in which young children were injured while playing on railroad turntables, and it applies whenever a landowner “maintains a device or machinery on his premises of such an unusually attractive nature as to be especially alluring to children of tender years”—*Timmons*, 947 S.W.2d 191, 193-94 (1997). In such circumstances, the landowner owes the trespassing child the same duty as it owes an invitee, which is to use ordinary care to reduce or eliminate an unreasonable risk of harm created by a premise of which the owner is, or reasonably should be, aware.

As stated in the Restatement (Second) of Torts section 339, a landowner is liable for injuries caused to a young trespasser by artificial conditions on the landowner’s property if:

- (a) the place where the condition exists is one upon which the possessor knows or has reason to know that children are likely to trespass, and
- (b) the condition is one of which the possessor knows or has reason to know and which he realizes or should realize will involve an unreasonable risk of death or serious bodily harm to such children, and
- (c) the children because of their youth do not discover the condition or realize the risk involved in intermeddling with it or in coming within the area made dangerous by it, and
- (d) the utility to the possessor of maintaining the condition and the burden of eliminating the danger are slight as compared with the risk to children involved, and
- (e) the possessor fails to exercise reasonable care to eliminate the danger or otherwise to protect the children.

While the risk of liability to railroads under the attractive nuisance doctrine is real, the actual extent of potential liability is somewhat limited for several reasons. First, the Texas Supreme Court has admonished lower courts to apply the doctrine “with caution” and “only when the controlling facts bring the case well within such rules and principles” (*Banker*, 208 S.W.2d at 850). Lower courts seem to have taken this caution to heart, and are not generous in carving exceptions to the no duty rule. Second, the doctrine applies only when the danger created by improvements is hidden, concealed, or latent, as in *Entergy Gulf States, Inc. v. Isom*, 143

S.W.3d 486, 491 (Tex.App.—Beaumont 2004). Many, if not most, of the dangers inherent in rail yards and rail equipment are likely to be considered obvious. Finally, the doctrine applies only to children who are too young to appreciate the *general* nature and/or extent of the risks presented by the artificial conditions on the property. See *Brownfield v. Missouri Pacific R. Co*, 794 S.W.2d 773 (Tex.App.—Houston [14th Dist.] 1990). Courts generally credit children over the age of ten with the intelligence and maturity to appreciate a vast array of general risks. Indeed, “the great majority of cases that have applied to the attractive nuisance doctrine have involved children of less than 10 years of age [*Id.*, at 779 (Draughn, J., dissenting)].

Chapter 3. Survey of Effective Corridor Protection Strategies

In order to evaluate the adequacy and effectiveness for addressing incompatible encroachment concerns of the existing legal authorities in Texas, it was necessary to survey some of the most effective protective strategies. While a comprehensive evaluation of state of the art protection strategies for Texas is presented in Chapter 4, this chapter outlines the most advanced and effective corridor preservation activities used at the state and local level, with respect to both rail and highway corridors.

3.1 Discussion

The development and sophistication of strategies to prevent encroachment along rail corridors vary greatly from state to state. Most of the academic literature focuses on acquisition of the actual right-of-way used for transportation corridors, and not on strategies to prevent encroachment of incompatible land uses. Furthermore, there is little to no empirical data available on the success of these strategies.

Most successful corridor protection strategies rely on early, consistent, and clear corridor planning. In addition, many DOTs and local governments have express statutory authority to engage in corridor preservation and management, not simply right-of-way acquisition. The Federal Highway Administration (FHWA) has identified three general categories of state programs to preserve transportation corridors: formal, informal, and limited (FHWA, 2000). Legislation typically provides the framework for formal programs by authorizing DOTs to actively pursue corridor management and often providing funding.⁴ States with informal programs may lack state-wide planning regimes, but instead work aggressively with localities to encourage corridor management through the use of local planning tools such as zoning and permitting.⁵ States with limited programs have no formal state level regime and most corridor management is initiated and implemented by localities without state involvement.⁶

These categories do not most accurately characterize the range of strategies employed by state and local governments in combating incompatible encroachment, but they are useful in understanding the various state statutory schemes and the level of state government involvement. Many of the same management strategies are used by formal, informal, and limited state programs alike. This section does not organize methods of corridor management in terms of these categories, but instead discusses each of the most common strategies in turn.

3.1.1 Advance corridor approval and official mapping prevent future problems with encroachment by reducing developer uncertainty and providing earlier public notice of state transportation plans.

One of the primary methods advocated for protecting highway corridors is to seek corridor location approval as soon as planning activities demonstrate a need for the project

⁴ As of 2000, states with “formal” programs were Arizona, California, Connecticut, Delaware, Iowa, Kansas, Maryland, Michigan, Missouri, Nebraska, New Hampshire, North Carolina, Oregon, South Dakota, and Wisconsin

⁵ As of 2000, states with “informal” programs were Alabama, Arkansas, Colorado, Florida, Kentucky, Maine, Minnesota, Mississippi, Montana, New Jersey, North Dakota, Oklahoma, Utah, and Wyoming.

⁶ As of 2000, states with “limited” programs were Hawaii, New York, Pennsylvania, Texas, Virginia, West Virginia, and Washington.

(Perfater, 1989). In some states, advance planning and approval of transportation corridors does not require a change in statutes or regulation. However, such corridor approval would require environmental analyses to determine and confirm corridor location. Local land use controls, such as those discussed in this memorandum, can then protect the corridor right-of-way and adjacent land from inconsistent development. This type of advance planning allows local governments and private parties to better plan developments while more land is vacant, minimizing social, economic, and environmental impacts (Perfater, 1989).

Advance planning can provide notice to citizens, property owners, and developers through adoption of an official thoroughfare protection map (CUTR, 1996). Official mapping requires state or local statutory authority, such as Florida's 1995 corridor management legislation. The Florida Transportation Plan calls for designation of corridors in local comprehensive plans consistent with Florida's growth management policy. The law encourages local governments to designate corridors, adopt corridor management ordinances, and create official corridor maps that are then filed with local and state agencies authorized to permit development activities.

3.1.2 Protective condemnation limits encroachment through acquisition of more land than is necessary for future transportation needs.

Some transportation experts suggest that a transportation corridor should not only include the right-of-way necessary for realized and future transportation needs, but also all land deemed to be *impacted* by the transportation corridor at full capacity (Freilich & Chinn, 1987). This strategy of public acquisition through eminent domain, often referred to as excess condemnation, involves acquiring more property than is directly 'needed' for a public project (CUTR, 1996). One particular method of excess condemnation often used to prevent encroachment along highway corridors is known as *protective condemnation*

Protective condemnation involves condemning land adjacent to a transportation corridor in order to control its use (Freilich & Chinn, 1987). The land can then be held or resold with development restrictions. Although excess land adjacent to a public improvement may be taken in some instances to prevent undesirable development or activity in the project's vicinity, protective condemnation is generally prohibited. A strong safety or operational justification may be required to employ protective condemnation (*People ex rel. Dept. of Pub. Works v. Lagiss*, 223 Cal. App. 2d 223, 35—approving condemnation of land adjacent to right-of-way to improve appearance of highway).

Nebraska has legislative authority to preserve 300 feet on either side of a transportation alignment. The state department of transportation then relies on permitting processes to prevent incompatible land use within the protected area (FHWA, 2000). The State of Florida has specifically authorized the Florida Department of Transportation to “condemn all necessary lands and property including rights of access, air, view, and light, whether public or private, for the purpose of securing and utilizing transportation rights of way, including, *but not limited to*...areas necessary for management of access” (Florida Statutes Annotated § 333.27).

3.1.3 Setback standards provide buffers between identified transportation corridors and future development.

Establishing setback standards for new construction along transportation corridors provides an alternative to outright condemnation. *Setbacks* are required distances from the street, right-of-way line, property lines, and building lines within which development or construction is

not permitted without a variance CUTR, 1996). Setback standards that promote the public welfare by mitigating safety concerns, increasing visibility at intersections, and buffering against noise and traffic are considered proper in purpose and require no compensation of landowners [*White v. Johnson*, 148 S.C.488, 488 (1929)], allowing condemnation of adjacent land in order to prevent construction of structures that might obstruct the vision of travelers and *Kamrowski v. State*, 31 Wis 2d 256, 267 (1996) upholding the use of excess condemnation to preserve a scenic corridor along a parkway). Setbacks provide similar benefits with respect to preventing incompatible encroachment as do other buffering strategies, such as frontage roads, without the added cost of building additional roadway (Kockelman et al., 2002).

Under its statutory authority, the Wisconsin Department of Transportation (WisDOT) has established setbacks for the purposes of corridor preservation and compensated landowners for this restriction of their property rights (WisDOT, 1994). Payment was made in anticipation of future minor widening of existing two-lane roadways. WisDOT has the authority to apply building setback standards along state highways with subdivisions and setbacks were established in 1994 at 50 feet from the edge of the right-of-way. Orange County, Florida provides another example of the establishment of significant setback standards. The county mandates absolute buffer zones of at least 150 feet between principle arterials and residential areas. In contrast, North Carolina uses a “transitional setback” that allows development within the setback area, but any such development must be removed at the expense of the property owner when the land is needed for transportation purposes (Williams and Frey, 2003). While most setback requirements are currently used in highway corridor preservation, they would be equally effective in preserving rail corridors from encroachment.

3.1.4 Joint development and informal negotiations with the private sector discourage incompatible land use by encouraging compatible development.

Joint development employs private-public partnerships to develop land adjacent to transportation corridors (Freilich & Chinn 1987). Public-private partnerships can direct development by favoring compatible use and discouraging incompatible use. Joint development is essentially a preemptive strike on incompatible land use by developing the adjacent land in a compatible way. However, this strategy usually requires, as one might imagine, actual development of the land in question. At a minimum, using this strategy to prevent incompatible land use entails having a plan for development and an identified funding source.

Prime examples of public-private development along rail corridors are DART’s station development efforts. DART, a quasi-governmental agency, works with the private sector in developing mixed use along portions of its commuter and light rail corridors (LightRailNow.org). DART projects such as Mockingbird Station near downtown Dallas encourage compatible commercial and high-density residential development in the near-vicinity of the light-rail system.

The State of Virginia, working with local businesses and counties, established the Route 28 Highway Transportation Improvement District in 1985. Although its primary purpose was to generate revenue for roadway improvements along Route 28, the improvement district had the secondary effect of preventing incompatible land use (VDOT, 2001). By favoring commercial and industrial development, the district is able to restrict residential use to appropriate areas further from the corridor.

San Jose, California, taking a more informal approach, has had success working with developers in preserving right-of-way and preventing encroachment of incompatible land uses

(Rivkin, 1993). City of San Jose staff reported in a 1993 study that informal negotiations routinely led to successful agreements with developers to locate structures outside transportation corridors and setback areas. Incentives, such as allowing zoning transfers from proposed right-of-way and adjacent land to property further from the corridor, are used when developers initially refuse to cooperate.

3.1.5 Development permitting allows states and localities to review and evaluate land use proposals along transportation corridors.

In conjunction with legislatively authorized mapping powers, several states utilize a development review and permitting process to ensure compatible use within and along transportation corridors. Corridors are typically prioritized and filed with all applicable permitting agencies. When a developer files a permit request, it is then forwarded to the DOT for approval. The DOT then typically has a set period of time in which to approve or deny the request (the period of time can vary by state for example, Iowa requires 30 days, Nebraska 60 days and Missouri 120 days) . This procedure may also involve negotiations with developers to ensure compatible land use if the permit is approved (FHWA, 2000). If the DOT denies the application, typically the statutes require the state to purchase the land.

North Carolina is a good example of a state with significant permitting and encroachment prevention procedures authorized by state law. The state's procedures require land owners within and adjacent to identified transportation corridors to apply for permits and variances in order to develop their land (NCDOT, 1998). Development along the corridor can be delayed up to three years, but after such time the state must negotiate an agreement with the developer or buy the property.⁷

The Florida Department of Transportation (FDOT) requires adjacent landowners within 1000 feet of a transportation corridor to submit development proposals to the department. The impacts of the proposals are assessed and the state and municipalities can then work with the developers to explore alternatives for avoiding encroachment. If an agreement cannot be reached with a developer, FDOT can use the power of eminent domain to acquire the property or attempt to use other incentives to persuade the developer to avoid incompatible land use. These incentives may include joint development partnerships, flexible zoning, transfer of development rights and sometimes tax incentives.

3.1.6 Flexible and cluster zoning give developers incentives to minimize incompatible encroachment.

Flexible zoning releases developers from conventional lot dimension requirements and encourages aggregating density and clustering structures in order to work with the natural features of a site. Streamlined approval processes in Florida facilitate development consistent with public policy goals (Williams and Frey, 2003). Developers are allowed to cluster structures using reduced setback standards within individual developments and altering other site design

⁷ Compare North Carolina's three-year development moratorium with New Hampshire's statutory scheme which allows the state DOT to delay development along an identified transportation corridor for up to ten years. N.H. REV. STAT. ANN. §§ 21-L:12-a (1997), 230-A:12 (1993); *see also* David A. Thomas & Robert S. Payne, *Long-Range Highway Corridor Preservation: Issues, Methods and Model Legislation*, 13 BYU J. Pub. L. 1, 16-17 (1998) (explaining New Hampshire's highway corridor permitting process). Due to population loss in certain areas, New Hampshire has many highways that are no longer used. New Hampshire law maintains public right-of-way over abandoned highway by giving such land special status after five years without public investment

requirements. Flexible and cluster zoning allows local governments to minimize development near the transportation corridor, thus avoiding encroachment of incompatible land use.

3.1.7 Allowing the transfer of development rights encourages corridor and adjacent landowners to forego development on the land closest to the transportation right-of-way.

Another popular zoning strategy involves allowing landowners to transfer development rights from one area to another. Transfer of development rights programs are established by forming a sending area and a receiving area (Williams and Frey, 2003). Typically, the sending area is established around the transportation corridor in need of protection from development. The receiving area for the development rights may be an area intended for higher density uses or clustering. After the transfer, the property owner may then develop at higher densities in the receiving area or sell those development rights on the open market. This leaves the land closer to the transportation corridor free of development.

3.1.8 Overlay Zoning

Overlay zoning adds special requirements to an existing zoning district and is especially popular for managing transportation corridors. Overlay districts are typically applied to either side of a transportation corridor whenever right-of-way preservation or prevention of incompatible land use is warranted. The width of overlay zones vary by local ordinance, but the Florida Department of Transportation recommends that local governments use overlay provisions for projects within 1,000 feet of a transportation corridor (Williams and Frey, 2003).

Overlay zones can encompass the range of strategies discussed in this chapter, including setbacks, transfer of development rights, and cluster zoning.

3.2 Conclusion

The states with the most advanced transportation corridor preservation programs tend to use a combination of most, if not all, strategies outlined in this chapter. While many of the more effective strategies seem to require state statutory authorization, there are a number of methods that states, working closely with city and county governments, can employ through informal means. More comprehensive statutory schemes, like those in Florida, Nebraska, North Carolina, and New Hampshire, provide greater control at the state level. This ensures state-wide uniformity and may be necessary for larger transportation corridors that extend through several localities.

Chapter 4. Existing Legal Tools in Texas for Implementing Effective Rail Corridor Protection Strategies

4.1 Overview

The research team then reviewed the existing legal tools available to Texas jurisdictions for implementing corridor protection strategies. Because rail corridors and potential rail corridors pass through many political subdivisions—each of which may have separate and/or concurrent legal authority to protect the corridor from the incompatible encroachments—this chapter discusses all of the possible political entities that might have such powers in Texas, evaluates the existing range of their authority to protect rail corridors from incompatible encroachments, and provides recommendations that could improve their authority.

4.2 State Authorities: The Texas Transportation Commission and the Department of Transportation

As noted in Chapter 2, because rail corridors pass through many political subdivisions, the most efficient and effective mechanism for protecting corridors from incompatible encroachment requires a statewide planning and regulatory program. Ideally, a regulatory entity with statewide powers would conceive, plan, and implement corridor protection regulations that coherently and comprehensively prevented encroachment for the entire length of a rail corridor, using an overlay district methodology. Currently, however, no regulatory entity in the State of Texas possesses statewide land use regulatory power that can be used to protect rail corridors in this manner. TxDOT is the most likely candidate for this type of authority. This chapter discusses the limitations on TxDOT's powers to protect corridors via statewide land use regulatory action.

In 2005, the Texas Legislature transferred to TxDOT all the powers and duties of the Railroad Commission that relate to railroads and the regulation of railroads. These include the power to acquire property and to enforce mitigation measures during the environmental review process. They do not, however, include general land use regulation powers.

4.2.1 The Power to Acquire Property

TxDOT is expressly authorized to acquire land for a rail right-of-way, as well as to acquire a property interest in land “determined to be necessary or convenient for the department’s acquisition, construction, maintenance, or operation of rail facilities.” This includes land that is determined to be necessary for mitigation of environmental impact and buffer zones for scenic or safety purposes. Except for its power to acquire property outside the right-of-way to mitigate environmental impacts of a rail project, or to provide buffer zones for scenic or safety purposes, it is not clear that TxDOT has authority to acquire title or an easement to real property for purposes of protecting the corridor from encroachment by incompatible land uses. While one can argue that protection from incompatible land uses is “necessary or convenient” for the “operation of rail facilities,” and that protection from incompatible uses provides a buffer zone for safety purposes, the department’s power in this regard is not well established.

With respect to its authority to acquire property for the right-of-way, for mitigation, and for buffer zones, the department is authorized to use any method to acquire the property interest, including voluntary purchase and condemnation. Of course, because the acquisition of title or easement rights is expensive and often politically sensitive, TxDOT is likely to prefer alternative, less costly, and/or more generally accepted methods for protecting rail corridors from encroachment. Nonetheless, because this authority is so extensive and powerful, its reach will be discussed in the following section.

The statutory procedures for the acquisition of right-of-way of state highways and roads are applicable to the acquisition of right-of-way for rail facilities. In addition, the statute also authorizes the department to purchase land along alternative potential rail routes.

The statute establishes that the department's preferred acquisition procedure is to acquire fee simple for the right-of-way, and an easement for land not included in the right-of-way proper that is ancillary to the right-of-way (i.e. it may be adjacent to the right-of-way).⁸ The department may either acquire the land itself, or request that the city or county acquire the land. In the latter case, the department would reimburse the city or county. Several acquisition tools are available to the department, as outlined in Figure 4.1.

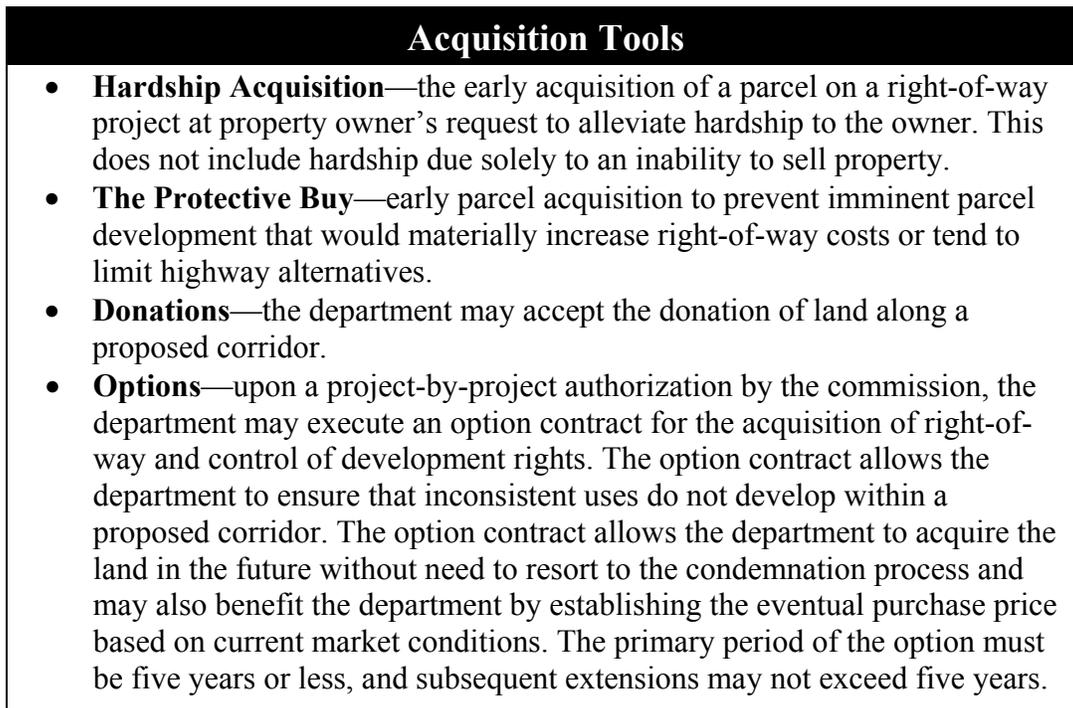


Figure 4.1: Acquisition Tools Available to TxDOT

TxDOT can also acquire right-of-way prior to the identification of the exact corridor location, and before the environmental review under the National Environmental Policy Act (NEPA) takes place. However, if the project is to be federally funded these acquisitions – while permissible – are considered to be ‘at-risk’ in that they may not be incorporated into the federally

⁸ Fee simple refers to the acquiring the highest bundle of rights available for a particular property. Easements, by contrast, refers to a right to use land in a particularly specified way (or prevent its use in another way) without owning the land outright.

funded project if the environmental process chooses a different alignment or if the no build alternative is chosen. . Any land acquired in advance must be obtained and be in accordance with the Uniform Relocation Assistance and Real Properties Acquisition Act of 1970. Under 23 C.F.R., these acquisitions must also not influence the NEPA review of the project and ownership should not be considered an element in the determination of the preferred alignment.

Early acquisitions (which do not involve federal authorization or agreement covering these activities), must be contrasted with the hardship or protective acquisitions, discussed in Figure 4.1, which may utilize federal funds for the transactions under 23 CFR 710.503 and 771.117(d)(12). These acquisitions do not require FHWA NEPA review at the time of acquisition, but will require FHWA scrutiny and oversight to ensure that they do not influence the choice of routes in the subsequent environmental review. This will be the case whether the State DOT seeks subsequent credit or reimbursement by satisfying the early acquisition conditions in 23 CFR 710.501 (b) or (c) (U.S, DOT, FHWA: Texas Division, 2007)

Suggested action: TxDOT should be given authority to acquire property by purchase or eminent domain for purposes of protecting the rail corridor from incompatible land uses.

4.2.2 Mitigation as Part of the Environmental Review

As part of the rail construction process, the department must conduct an environmental review. The department is authorized to acquire and maintain property in order to mitigate the environmental impact of a rail facility. It may do this through payment of an amount of money to governmental or private entities to maintain the property in a way that mitigates the environmental impact. Authority to acquire mitigation land is not dependent upon a determination of the need for mitigation on a particular process. In theory, this approach could be used to establish the desired buffer zones along the rail right-of-way.

4.2.3 The Power to Require the Cooperation of Political Subdivisions

Chapter 91 of the Transportation Code relates to the authority of TxDOT over the state's rail system, and provisions of this chapter require political subdivisions within Texas to cooperate in the department's efforts to establish and protect rail corridors. Section 91.006 states that "[w]ithin available resources, an agency or political subdivision of this state shall cooperate with and assist the department in exercising its power and duties under this chapter." That includes the acquisition of property, or other interest in real property, that is necessary and convenient for the provision of rail facilities. Furthermore, the governing bodies of political subdivisions within the state may, without advertisement, "convey title to or a right in property determined to be necessary or convenient by the department under this chapter."

This statute authorizes TxDOT to direct the efforts of cities and counties to ensure that they aid the overall rail project. However, it is relatively general in its requirements, and given its inherent limitation of "within available resources," it may not impose enough direct obligations on political subdivisions to ensure that TxDOT can rely on their cooperation. Moreover, since some of the relevant political subdivisions do not currently have the land use regulatory powers necessary to protect rail corridors, requiring them to assist TxDOT in this effort will be meaningless.

Suggested action: TxDOT needs authority to require political subdivisions to take particular actions, as identified by TxDOT, to aid in the planning and protection of rail corridors.

4.2.4 The Lack of Power to Adopt Land Use Regulations

TxDOT does not have general zoning authority or any other use restriction power. While the department can condemn land for easements for specific uses (for drainage or highway use for example) the department does not appear to have the authority to condemn an easement to prohibit incompatible land uses beside a rail corridor (i.e. restricting a landowner's interest in developing the property, so that it is left undeveloped or is developed in a specific fashion). And unlike the situation of roads and highways, in which the department's access management authority is a powerful planning tool, access management is not particularly relevant to rail facilities. This leaves the department with few options to aid in corridor protection aside from purchasing a fee simple property interest in land that it wishes to see undeveloped which can be expensive and often politically sensitive.

Suggested action: TxDOT needs authority to engage in corridor planning and protection using overlay maps and traditional zoning powers.

4.3 Regional Transportation Authorities

In the absence of statewide regulatory authority, the next best mechanism for protecting rail corridors would be through the use of regional authorities empowered to regulate land use surrounding rail corridors in logically delineated areas of the state. There are a number of special districts that are potentially relevant for purposes of rail corridor protection at the regional level. Unfortunately, none of these regional authorities currently possesses land use regulatory powers. This lack of general zoning powers renders these authorities relatively unhelpful for protecting corridors from encroachment of incompatible land uses.

Three types of regional transportation authorities are created by adjacent provisions of the Transportation Code, and they all enjoy essentially the same range of powers to provide for public transportation in the applicable region. The powers of these authorities are highlighted in Figure 4.2. The major differences between these three regional transportation authorities are in their locations and compositions, rather than in their respective regulatory powers.

4.3.1 Metropolitan Rapid Transit Authorities

Metropolitan Rapid Transit Authorities are authorized in Chapter 451 of the Texas Transportation Code. Originally, these entities could be created only by cities with a population of 1.2 million. These "principal cities" had to have created an authority by the end of 1985. In 1993 the statute was amended to allow adjacent, "alternate cities" within the metropolitan area of the "principal city" to create authorities in areas not previously covered by an authority. Currently principal cities can no longer create a Metropolitan Rapid Transit Authority, though there do not appear to be any municipalities of 1.2 million or more that do not have a rapid transit authority.

4.3.2 Regional Transportation Authorities

Regional Transportation Authorities, authorized by Chapter 452 of the Transportation Code, are similar to Metropolitan Rapid Transit Authorities, except that they can be created in less populous areas. Regional Transportation Authorities can be created by principal municipalities having a population of 350,000 or more, or by the county in which a principal municipality is located, or both.

4.3.3 Coordinated County Transportation Authorities

Finally, the Commissioners Courts of counties that are adjacent to a county with a population of one million or more, and are not otherwise part of a Regional Transportation Authority, may create a Coordinated County Transportation Authority.

Powers of the MRTAs, RTAs, and CCTAs

- May acquire, construct, own, and operate a transit authority system. Possess all powers “necessary or convenient” to operate a transit authority system. This includes the authority to exercise eminent domain to condemn property.
- Powers limited to mass transit, defined as the transportation of passengers. Includes any means of mass transport, including rail, but does not include of freight rail.
- No express authority to engage in land use regulation. Given that they are limited governmental entities, it is unlikely that any of these three special districts is authorized to impose protective land use regulations.

Figure 4.2: Powers of Transit Authorities

4.4 Regional Mobility Authorities

In addition to the regional authorities contemplated in the Transportation Code, counties may form Regional Mobility Authorities, or RMAs, to undertake particular transportation projects contained in state and local transportation plans. These authorities have powers similar to their counterparts discussed earlier. Any county or group of counties can apply to create an RMA. County-members need not be adjacent to each other to form a single authority. Moreover, a county may be a member of more than one RMA simultaneously. Petitions for creation of an RMA are submitted to TxDOT and are approved by the Transportation Commission after review and public hearing. The addition of counties and the withdrawal of county-members are also subject to TxDOT review and approval.

While the statute authorizing creation of RMAs was motivated by the desire to facilitate the construction and operation of toll roads, RMAs are also authorized to undertake passenger or freight rail transportation projects. RMAs have the same powers as the transportation commission in acquiring property in connection with a transportation project. Moreover, an RMA’s authority to acquire property and construct a transportation project is not limited to counties within the RMA, provided that the county into which the project extends grants its approval and is given the opportunity to join the RMA.

RMAs are authorized to give a property owner a percentage of revenue generated from a transportation project in lieu of payment for property. This gives RMAs greater flexibility to fund the acquisition of property, especially for buffer zones. However, this provision was created with toll roads in mind. Rail facilities are less likely to generate sufficient revenues to pay for the land needed to protect its corridors. RMAs are also authorized to use excess revenues from one project to fund another transportation project, but again this provision is not likely to substantially enhance an RMA’s purchasing power.

Despite some of the flexibility afforded RMAs with regard to formation, projects undertaken, and project funding, these authorities are not given any land use restriction powers.

Consequently, to aid in rail corridor preservation RMAs would need to purchase property, or an interest in real property, to protect against inconsistent use encroachment.

4.5 Freight Rail Districts

Freight Rail Districts are authorized by Chapter 171 of the Transportation Code. These districts can only be created in a county of 3.3 million or more and its adjacent counties. Freight Rail Districts are authorized to exercise the transportation project powers of a RMA for a project that is a freight rail facility. Thus, these districts are most relevant and narrowly tailored to the provision of freight rail facilities. And, as with RMAs, the lack of land use regulatory power limits the effectiveness of these authorities in protecting rail corridors from incompatible land uses. The FRDs are also authorized to exercise the power of an Intermunicipal Commuter Rail District.

Currently the only such district in Texas is the newly formed Gulf Coast Freight Rail District in Houston and the surrounding counties.

4.6 Intermunicipal Rail Districts

The 72nd Texas Legislature provided for the creation of Intermunicipal Commuter Rail Districts (ICRD) in 1991. ICRDs were created to provide commuter rail service between two municipalities if they have a population of more than 450,000 and are located not farther than 100 miles apart. An ICRD is a public body and political subdivision of the state.

ICRDs are authorized to acquire, construct, develop, own, operate, and maintain intermodal and commuter rail facilities inside or connected to political subdivisions within their district. They are authorized to condemn through eminent domain proceedings any land that is necessary for the provision of commuter rail facilities. This includes land in fee simple as well as an interest less than fee simple, including right-of-way and easements. This is, however, subject to the provision that the district shall to the extent possible use existing rail or intermodal transportation corridors for the alignment of its system. The statute does not confer land use regulatory powers on ICRDs.

Currently there is one ICRD: the Austin-San Antonio ICRD. However, the Gulf Coast Freight Rail District has the option to add an ICRD should they chose to do so. The 80th Texas Legislature also authorized the lower Rio Grande Valley to create an ICRD.

4.7 Rural Rail Transportation Districts

Finally, the Texas Legislature provided for the creation of Rural Rail Transportation Districts (RRTD) in 2001. RRTDs can be created as a single county district as well as by any group of two or more counties that constitute a contiguous geographic area. These districts are intended to help protect against abandonment of existing rail facilities. Thus, in order for a county to be eligible to form a RRTD, there must be a rail facility located within the county that is in the process of being abandoned through bankruptcy court or Surface Transportation Board proceeding, or that carries less than 3 million gross tons per mile per year. As a result of this focus on saving endangered rail facilities, RRTDs will be of little help in protecting planned or future corridors from encroachment.

RRTDs are authorized to plan, acquire, construct, own, and operate rail facilities. They are authorized to condemn through eminent domain proceedings any land that is necessary for the provision of rail facilities. This includes land in fee simple or an interest less than fee simple,

and includes the right-of-way and easements. The statute does not confer land use regulatory powers on RRTDs.

Suggested action: Regional Transportation Authorities (for example, RTA's RMA's, FRD's, ICRD's, and RRTD's) should be empowered to undertake rail corridor planning and protection using traditional zoning power.

4.8 Municipal Land Use Authority

Given the lack of statewide or regional zoning authority in Texas, the next best option for protecting rail corridors and planned corridors from encroachment of incompatible land uses is to seek the cooperation of those political subdivisions that do possess general zoning powers. In Texas, the political subdivisions that possess the most extensive zoning powers are municipalities, with the notable exception of the City of Houston. Municipalities are political subdivisions of the state (*Boozier v. Hambrick*, 846 S.W.2d 593 (Tex. App. – Houston [1st Dist.] 1993 no writ)), and their sovereignty is dependent on that of the state (*City of Irving v. Dallas/Fort Worth Int'l Airport Bd.*, 594 S.W.2d 456 (Tex. App. – Fort Worth 1995)). There are two types of cities in Texas: general law and home rule cities. General law cities have many of the same powers as home rule cities, but their powers are limited rather than absolute (*Tex. Dep't of Transp. v. City of Sunset Valley*, 146 S.W.3d 637 (Tex. 2004)).

4.8.1 Home Rule and General Law Municipalities

The Texas Local Government Code divides general law municipalities into three types: A, B, and C. The differences are based primarily on the size of the community at the time the municipality was incorporated. The distinction allows the legislature to pass laws that affect only a certain class of municipalities. General-law municipalities are creatures of enumerated powers and possess those powers and privileges that the State expressly confers upon them. Home rule cities have the full power of local self-government. Their powers are derived from the Texas Constitution. As such, one must look to acts of the legislature, not for grants of power, but for limitations on the powers of home rule cities (*City of San Antonio v. City of Boerne*, 111 S.W.3d 22 (Tex. 2003) the Legislature can limit the powers of home rule cities). Home rule cities have all powers of the state not inconsistent with the Texas Constitution, the general laws, or the city's charter (*Proctor v. Andrews*, 972 S.W.2d 729 (Tex. 1998)).

Notwithstanding the substantial theoretical distinctions between home rule and general law municipalities, they generally enjoy the same powers with respect to the provision of transportation facilities or the protection of rail corridors. For instance, Texas Local Government Code Chapter 211, which creates and defines the zoning powers of municipalities, is applicable to all municipalities—both general law and home rule.

Municipal Powers and Obligations

- **Property Acquisition:** All municipalities are authorized to hold, purchase, or convey property located in or outside the municipality, if doing so carries out a municipal purpose. Providing for a transportation project would safely fall under the heading of municipal purpose.
- **Land Use Regulation (Zoning):** The general power of a municipality to enact zoning regulations within municipal boundaries is established by statute, and is applicable to both general law cities and home-rule cities. The purpose of zoning is to promote the “public health, safety, morals, or general welfare,” as well as protect historical and cultural areas of importance.
- **Metropolitan Planning Organizations:** Under federal law, every urbanized area must designate a metropolitan planning organization (MPO) to coordinate transportation planning of all modes in a metropolitan area. The MPOs enter into a planning contract with the state department of transportation, outlining responsibilities of the MPO. It is the MPO’s responsibility to coordinate planning amongst TxDOT and transit operators. The MPO must also approve a metropolitan transportation plan. MPOs have little or no substantive authority, in particular no land use regulatory powers. But as a coordinating body, the MPO can encourage its members, namely the municipality, to use all their available powers to further the transportation plan.
- **Extraterritorial Jurisdiction:** extraterritorial jurisdiction (ETJ) of a municipality is the unincorporated area contiguous to the boundaries of the municipality. The size of the ETJ varies based on population of the municipality and ranges from one half mile to five miles. A municipality may impose some zoning-type regulations on subdivisions within its ETJ. And when the regulations of the municipality conflict with those of the county, the more stringent provisions prevail. However, these powers are much more limited than the municipality’s zoning powers within its municipal boundaries. In particular, municipalities may not impose land use or restrictions on subdivisions within their ETJs.

Figure 4.3: Municipal Powers in Texas

4.8.2 Zoning Authority

The power to regulate the use of land is likely to be the most effective power for protecting rail corridors from encroachment. Zoning is the division of land into various districts and the regulation of permitted uses within those districts (*City of Brookside Village v. Comeau*, 633 S.W.2d 790 (Tex 1982)—Recognition of zoning as a tool for community planning). The basic matters regulated by most zoning ordinances include the height and size of buildings, percentage of a lot that may be occupied, size of yards and other open spaces, population density, and the location and use of buildings for business, industrial, residential, or other purposes. The three primary components of a zoning system in a municipality are the comprehensive plan, the zoning ordinance, and the zoning map, which visually reflects the zoning structure.

Zoning is a recognized tool of community planning, and as such, could be used to protect encroachment of inconsistent uses on an existing or proposed rail corridor. To protect a rail corridor the city could amend its comprehensive plan to provide for rail corridor district or districts. This would typically be a type of overlay district. The most common type of overlay district is the historic district, but an overlay district would work just as well for a rail corridor. Overlay districts are often used to assist in implementing Transit Oriented Development projects

There are two limitations on the effectiveness of municipal zoning programs for rail corridor protection: (1) zoning is primarily a proactive power, and to the extent that current land uses abutting existing or planned rail corridors are incompatible with the railway usage, cities have limited authority to require landowners to change uses (*Harrington v. Bd. of Adjustment*, 124 S.W.2d 401, 403–06 (Tex. Civ. App.—Amarillo 1939, writ ref’d)—Invalidating board of adjustment’s grant of variance as usurpation of municipalities legislative power); and (2) zoning powers are limited to the municipal boundaries of a city and to a limited extent its extra-territorial jurisdiction (*Board of Adjustment v. Stovall*, 218 S.W.2d 286 (Tex. Civ. App.—Fort Worth 1949, no writ)—Municipalities power to determine permissible uses is nondelegable).

4.9 County Powers

Texas includes vast areas of land that fall outside of incorporated municipalities and their ETJs, and substantial portions of most rail corridors will pass through land of this nature. This land is subject to the regulatory authority of the relevant county, and counties in Texas have notoriously limited land use regulatory powers, making it difficult for TxDOT to work with counties to protect rail corridors from encroachment in these areas.

4.9.1 The Power to Acquire Property

Unlike municipalities, Texas counties do not enjoy the general power of eminent domain to serve the public welfare. Rather, eminent domain powers are assigned to counties to serve particular purposes. There is no direct grant of authority to condemn property for purposes of acquiring a railroad right-of-way or protecting an existing or proposed rail corridor. The most general grant of eminent domain power, is found in Local Government Code section 261.001, which provides that “[a] county may exercise the right of eminent domain to condemn and acquire land, an easement in land, or a right-of-way if the acquisition is necessary for the construction of a jail, courthouse, hospital, or library, or for another public purpose authorized by law.” It is possible that this provision can be interpreted to convey eminent domain power for purposes of protecting rail corridors when read in conjunction with certain provisions of the Transportation Code.

Section 91.002 of the Texas Transportation Code establishes the “acquisition, financing, construction, operation, and maintenance of a rail facility” as a “public and governmental function, exercised for a public purpose and matters of public necessity.” This section suggests that actions taken to establish a rail corridor by the county would be considered a valid public purpose. The question, then, is whether this action is “authorized by law.”

While most of Chapter 91 of the Transportation Code relates to the authority of TxDOT over the state’s rail system, counties are implicated by the operation of two statutes. Section 91.006 states that “[w]ithin available resources, an agency or political subdivision of this state shall cooperate with and assist the department in exercising its power and duties under this chapter.” That includes the acquisition of property, or other interest in real property, that is necessary and convenient for the provision of rail facilities. Furthermore, counties may “convey title to or a right in property determined to be necessary or convenient by the department under this chapter.”

The structure of these sections may be read to support an argument that may assist in the acquisition of land, both right-of-way and buffer zones, along a proposed rail corridor. It is unclear, however, whether a county may act of its own volition in acquiring property for a rail corridor. Both 91.006 and 91.094 seem to limit the participation by political subdivisions to

situations where TxDOT has taken the lead by coordinating the corridor project. A county that seeks to acquire property for a rail corridor without the consultation of TxDOT may open itself to a legal challenge on the grounds that it is not acting within a power expressly granted by the Texas Constitution or by statute.

4.9.2 The Power to Regulate Land Use

Texas counties are much more constrained in their ability to regulate land use than are municipalities. As with general law cities, counties lack the broad grant of police power authority enjoyed by home rule cities. Thus, any zoning powers a county claims must be expressly authorized by statute.

A county's land use regulatory power arises primarily in connection with its platting authority. Local Government Code § 232.001 requires owners of a tract of land outside the limits of a municipality, to prepare a subdivision plat before they may subdivide the land. The subdivision may not occur unless the commissioner's court approves the plat, and that approval is contingent on conformance with the county's subdivision requirements. These typically include right-of-way width requirements, provision of drainage, and notice to prospective buyers of the provisions of water and sewer utilities. By and large, these requirements are limited to spacing and density. Counties are not authorized to impose land use restrictions on owners seeking approval of a subdivision plat.

It is during the plat approval process that counties typically impose exactions on the developer. Exactions are additional requirements imposed on developers to install specific improvements, construct public facilities, or dedicate land for public purposes, on which plat approval is made conditional. Imposing these conditions is a long recognized practice (*Crownhill Homes v. City of San Antonio*, 433 S.W.2d 448 (Tex. Civ. App.—Corpus Christi 1968, writ ref'd n.r.e.)—Authorization of exactions prior to approval of subdivision plats). Traditionally, exactions have related to internal subdivision requirements, such as installation of water and sewer systems, dedications of utility and drainage rights-of-way, installation of street light and sidewalks, and installation of street signage and traffic control devices (*Hill Farm, Inc. v. Hill County*, 436 S.W.2d 320 (Tex. 1969)—Power to prevent public nuisance). Less common exactions include dedications of land for parks, schools, water towers, or public facility sites such as fire and police substations.

More recently, in the face of rapid growth, attempts have been made by municipalities to pass along the cost of public infrastructure to a subdivision through exaction. The exactions require developers to pay for streets running along the perimeter of the subdivision and connecting the subdivision to the nearest major thoroughfare, as well as the cost of utility approach mains. These exactions evolved into requirements that developers set aside land for infrastructure facilities, such as water and sewer treatment plants, or pay a fee in lieu of dedication. Some municipalities developed master land use and utility component plans, and required developers to dedicate land identified on these instruments. Faced with the problem of allocating the costs of facilities among various developers, the Texas Legislature enacted Chapter 395 of the Local Government Code. This created a method for implementing impact fees aimed at recovering the cost of public infrastructure provision to new subdivisions.

This brief history of exactions can be relevant to rail corridor protection. It is only a small step from requiring dedications for perimeter and approach streets and utilities, to requiring dedications of land for rail facilities, both right-of-way and buffer zones. This could be done in reference to an official rail corridor planning instrument.

There are some problems with this approach for counties. First, most of the off-site infrastructure exactions were imposed by municipalities. And as stated, municipalities are given broader authority to regulate land use. Absent a change in the law, counties would not be authorized to impose similar exactions. Second, street and utility infrastructure more clearly and directly benefit a residential subdivision than does a rail line that may, or may not, bring freight or passengers to a county in general, much less a particular subdivision.

To reiterate, platting approval of subdivisions is not typically seen as a form of use restriction. Counties are given limited use restrictive powers in the context of junk salvage yards and slaughterers. They also share regulatory power over other types of facilities with the city, such as sexually oriented businesses, correction facilities, and homeless shelters.

4.9.3 Authority over Public Roads and Highways

The most relevant county power for corridor protection arises out of a county's authority over public roads and highways. The commissioner's courts have the power to exercise general control over all roads, highways, ferries, and bridges in a county. A county may lay out and establish, change, discontinue, close, abandon, or vacate public roads and highways. Counties may establish set-back lines on public roads in the county. However, the size of the set-back is constrained by statute.

It is not clear whether the authority of counties to control public roads extends to rail corridors. The answer depends on whether rail facilities are public roads within the meaning of the statutes. The Texas Constitution states that, "[r]ailroads heretofore constructed or which may hereafter be constructed in this state are hereby declared public highways, and railroad companies, common carriers." This would suggest that railroads are encompassed in the statutes relating to county roads. However, no court has interpreted this provision to extend a county's authority to regulate public roads to cover regulation of railroads. The cases that do make reference to this section have historically been about the power of the State to regulate railroads, and the duty of railroads as common carriers to not discriminate. Thus, counties should be wary of trying to assert power over railroads based solely on their authority to regulate public roads and highways.

4.9.4 The Limited Expansion of County Zoning Powers

Unlike cities, counties generally do not have zoning authority. However, some Texas counties have been granted limited zoning power in limited situations. These powers are authorized by specific grants from the state legislature and, to date no grants of zoning powers have been given to counties in connection with transportation planning. The zoning authority is typically given in connection with a recreational area, a military base, or the protection of lake front areas. For instance, in areas of Padre Island outside of a municipality but within two miles of a public park or beach area, the commissioner's courts of Cameron and Willacy Counties may establish more extensive spacing and density rules, and use restrictions not otherwise available to counties. The counties can establish a zoning commission and establish a Comprehensive Plan, just like a municipality.

Additional authority is given to the commissioners courts in certain urban and suburban counties to adopt rules to provide for the "safe, orderly, and healthful development of the unincorporated area of the county." However, this additional authority explicitly does not include use or area restrictive powers. It is generally limited in establishing rights-of-way widths, lot

frontages and set back lines. Comal County is an example of a county using this limited zoning power.

While these examples of regulatory powers exercised by counties may not be directly relevant to transportation projects, they do act as a guide. If counties were provided the power to “zone” around transportation projects, these established county powers could serve to deflect any reaction that extending regulatory power to counties would be unworkable.

Suggested action: Counties should be empowered to undertake rail corridor planning and protection using traditional zoning powers.

4.10 80th Texas Legislative Update

The 80th Texas Legislature introduced three bills to address corridor and land use issues. House Bill 1857 would require the identification and administration of land located in a future transportation corridor of a county. Under this bill TxDOT and a county may enter into an agreement that identifies future transportation corridors within the county. The corridors identified in the agreement must be derived from existing transportation plans adopted by the department or commission, the county, or a metropolitan planning organization. TxDOT is required to publish in the Texas Register and in a newspaper of general circulation in the county with which the department has entered into an agreement a notice that states that the department and the county have entered into the agreement, and provide information on where copies can be obtained. Section 2 of HB 1857 provides that the county *may refuse* to record the plat if it does not show that it is located within a future transportation corridor. The county may also refuse to approve the plat for recordation if all or part of the subdivision is located within the area of the alignment of a transportation project as shown in the Record of Decision granted after NEPA review. Finally, the bill requires that each purchase contract or lease between the sub-divider (developer) and a purchaser or lessee of land in the subdivision must contain a conspicuous statement that the land is within the future transportation corridor.

Senate Bill 542 would also allow counties to regulate land development in an unincorporated area of the county by requiring a buffer zone between land use for purposes specified within the sub-section and residential areas as follows: (1) at least 1,000 feet for heavy industrial or quarry use; (2) at least 750 feet for light industrial use; and (3) at least 500 feet for commercial or other business use. However, the section is explicit in that it stipulates that it does not authorize a county to adopt zoning regulations. The sub-section also notes that the county regulation under this subchapter does not apply to: (1) a platted residential subdivision in existence on the date the regulation takes effect; (2) a tract of land devoted to agricultural use; or (3) an activity or a structure or appurtenance on a tract of land devoted to agricultural use.

Finally Senate Bill 1688 would allow cities and counties beside the SH 130 corridor to create a transportation district granting land use powers and authority over land use planning and platting to address the phenomenal and unstructured growth that is occurring beside this new tolled route.

Other bills that were laid before the legislature regarding rail included HB 2510 which related to the creation, powers, duties, and operations of a US-Mexico border commuter rail district including granting the power of eminent domain. HB 3747 which added projects that reduced air pollution by relieving congestion through rail relocation as eligible infrastructure projects that the Texas Commission on Environmental Quality could consider. HB 160 related to funding certain rail relocation projects under Section 386.109 Health and Safety code. Finally, HB 3711 which related to the repeal of obsolete statutes regulating railroads and providing that a

railroad corporation may acquire property by condemnation if the corporation and owner cannot agree upon the terms of the sale if this for the required purposes of operating or transacting railroad business as well as for the purpose of obtaining new or additional right-of-way.

As the 80th Texas Legislature drew to a close in May 2007, SB 542 and SB 1688 were left pending in committee. However, House Bills 1857, 2510 and 3711 were passed by the Senate and House and signed by the Governor and passed into law on September 1, 2007. HB 160 was signed by the Governor on June 14, 2007 and was effective immediately.

Chapter 5. The Texas Rail Context

5.1 Overview

As noted in Chapter 2, existing rail corridors (as well as potential rail corridors) pass through many political subdivisions with varying levels of authority to protect corridors from incompatible encroachment. The research team reviewed current strategies and activities used by Texas communities, developing two main sub-sections: existing rail corridors and proposed rail corridors. This chapter reviews corridor studies that have been developed, tools used by Texas communities to reduce incompatible development, or, conversely tools used to encourage specific development around rail transit stations and intermodal facilities and planning.

5.2 Current Authority

In the past, Texas communities have sometimes been criticized for not considering land use when developing new transportation networks. As Chapter 4 found, the power to control land use has been limited to state institutions for specific purchasing power and to the cities to develop comprehensive plans and land use controls. The freight railroads noted in interviews that in many instances incompatible developments have been encouraged around rail lines by governmental entities as a means to spur economic development.

For many years the freight railroads often had what could be termed the upper hand in relationships with cities and counties. This was because they owned large tracts of property as well as railroad right-of-way (ROW) and were also able to utilize their dual powers of condemnation, including the common law right to use the public doctrine of convenience and necessity for system development. Where cities opposed the development of new routes, the railroads often sued and won on these common law rights.

As Texas's population has increased and as congestion has become a major issue for the metropolitan areas, the acknowledged role of rail has become more complicated. In cases where current rail activity is seen as impeding the optimal development of cities, rail lines can no longer be confident that they will prevail in challenges based on common law rights. Yet, at the same time, city planners have begun to appreciate the utility of rail corridors for improving the long run sustainability of cities due to the corridors' ability to aid congestion mitigation, provide network connectivity, and also serve as an economic driver. This realignment of attitudes began with the deregulation of the freight railroads under the Staggers Act in 1980. Since deregulation, the Class I railroads merged into seven major units (five in the U.S. and two in Canada). As the mergers occurred, the Class I railroads abandoned unproductive and duplicative systems. This allowed cities and the state to purchase—and take over—freight rail ROW to use for passenger rail development and rail-to-trail activities. The Class I railroads also became proactive in partnering as they were requesting new permits for new merged lines and other activities that took place in the mid 1990s. This afforded the Class I's opportunities to open dialogue with cities and counties on rail issues. In Texas, this new dialogue culminated in the 2005 separate Memorandums of Understanding between UP and BNSF and the Governor regarding rail studies and possible Class 1 relocations of certain lines in Texas. Cities are also now beginning to deal with incompatible use effects through the use of 'quiet-zone' designations, re-zoning activities where appropriate, reduction of at-grade crossings, and other safety and design structure

elements. However, many of the groups interviewed noted that retroactively dealing with the problem of incompatible development along rail corridors, as well as preservation of the system was a very difficult process, requiring political astuteness, the willingness to partner or compromise, and the ability to find funding to procure mitigation options.

Over the past 10 years a slew of rail corridor studies have been completed. Some of these have looked at relocation options and others are New Start studies for commuter or light rail on existing or abandoned freight rail lines.

Currently within Texas' communities there are significant plans and policies being developed to:

- Inventory and analyze the networks within city/county jurisdictions
- Determine the feasibility of relocating existing freight railroads
- Construct new commuter rail and light rail lines
- Assess the feasibility of various types of rail development
- Review land use activities surrounding existing rail networks for rezoning purposes in comprehensive planning updates
- Implement TOD land use zoning

This chapter provides an overview of current planning activities within the larger metropolitan areas of the state. County, city, Metropolitan Planning Organization (MPO), other ad-hoc public and private entities, and Regional Mobility Authority (RMA) land use powers and activities were reviewed, and, where appropriate, current comprehensive neighborhood and land use plans are divided into freight and passenger rail activities for ease of reference.

5.3 The Texas Rail Network

Figure 5.1 shows the 2005 Texas Class I, II, and shortline network in Texas.

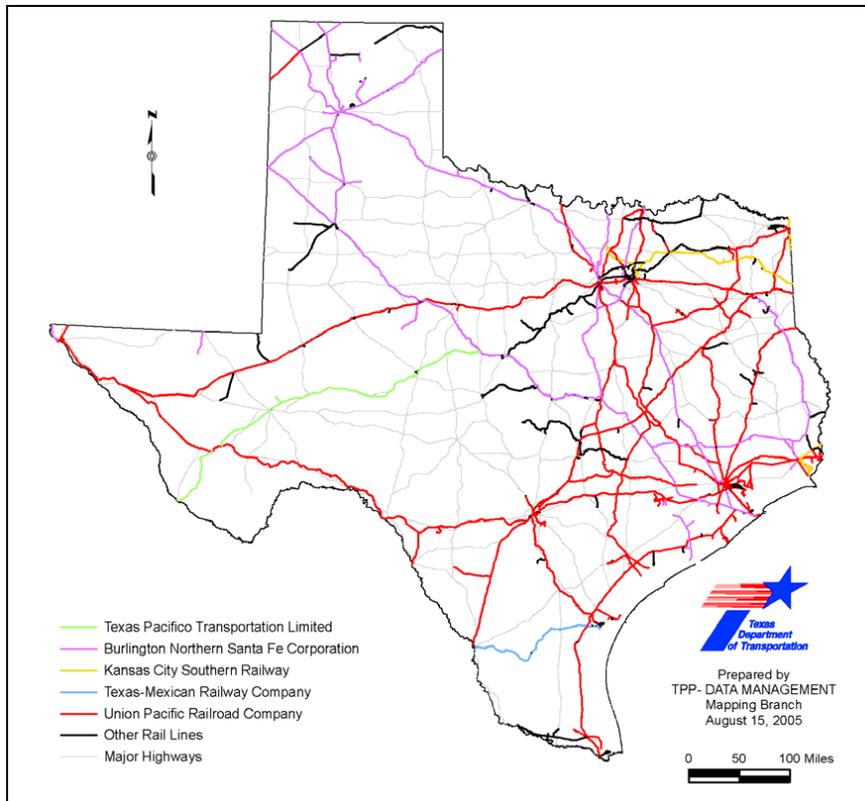


Figure 5.1: Texas Rail Network⁹

5.3.1 Passenger Rail

The passenger rail network in Texas, utilizing abandoned or shared freight rail track, is modest. Interstate rail services are run by Amtrak on three lines: the Sunset Limited, the Texas Eagle, and the Heartland Flyer. The Trinity Railway Express (TRE) runs commuter rail services between Dallas and Fort Worth on the old Cottonbelt Line. It runs 25 eastbound and 25 westbound trains per day. Annual ridership on this system is currently over two million passengers per year. Austin’s Capital metro plans to begin service on a commuter line running from Leander to downtown Austin in late 2008. Furthermore, Houston is currently examining at least three potential commuter rail options. Texas also has two intra-city light rail systems: the DART rail system, which began service in 1996, and Houston Metro’s light rail line (METRORail), which opened in 2004.

There are several other systems proposed, including a commuter rail service linking Austin to San Antonio, extensions to Metro and DART systems in Houston and Dallas, and two federally designated high-speed rail corridors. The Trans Texas Corridor plan also proposes new freight, passenger, and high-speed rail systems. Finally, the Texas T-Bone system, which would add a route from Houston through College Station to the Fort Hood complex at Killeen, has been

⁹ The Texas-Mexican railway is considered the only extant Class II railway in Texas although it operates as a subsidiary of a Class I, the Kansas City Southern

proposed to address perceived shortcomings in the federally designated high-speed corridors and to connect military deployments from Fort Hood to the Port of Houston.

5.4 Freight Rail

5.4.1 Corridor Preservation

In the course of performing the literature review for this project, the research team found no incidences in which active freight rail corridor preservation had occurred in Texas prior to TxDOT's 2001 acquisition, along with the Grupo Mexico operations agreement, of the South Orient (Texas Pacifico) railway, which runs from West Texas to the Presidio-Ojinaga border crossing. Prior to the changes enacted by the Texas legislature in House Bills 3588 and 2702, in 2003 and 2005 respectively, freight rail was owned, conducted and operated exclusively by private industry. The Texas freight rail network had been in existence for over 150 years and neither TxDOT nor local jurisdictions were given statutory authority to purchase, build, or operate freight rail.

Most cities within Texas, however, had developed comprehensive plans regulating land use and outlining future transportation corridors. Dallas' 2006 comprehensive plan envisaged a series of implementation measures to ensure that its goals are met. For freight these include:

- Work with the North Central Texas Council of Governments to evaluate the strategic importance of rail and road freight corridors within Dallas and develop strategies to ensure their continued viability.
- Evaluate specific freight corridors within the context of area plans. Implement land use and transportation measures to support these corridors while mitigating their impacts on neighborhoods.

Fort Worth's 2006 comprehensive plan included proposed capital improvement plans for railroad projects including establishment of quiet zones, pedestrian tunnel/overpass construction, and grade separation projects, and installation of new railroad signals and gates under the Federal Railroad Signal Program (City of Fort Worth, Railroad Factsheet). In some instances, however, there are noted discrepancies regarding zoning designations on the zoning map and land uses that are being promoted in comprehensive plans (City of Fort Worth, 2006). Several commercial areas downtown, in the stockyards, and the medical district are zoned industrial, but are designated as mixed-use growth centers in the comprehensive plan. Such discrepancies will need to be redressed to ensure that compatible uses are promoted as rail relocation and other development plans move forward.

5.4.2 Zoning and Land Use Planning

Many of the cities noted that because the freight railroads had been a part of their city's landscape for such a long time, with pre-existing development surrounding them, retroactively zoning these areas was undertaken only as circumstances dictated or changes were allowed to occur. For example, Dallas officials noted that they will rezone around the old and well established freight lines if the route changes, or if new regulations (for example sound regulations) are established. The city noted that as these lines are 'so old' they have long-term contracts with the railroads that regulate sound. However, as the city commented, in many

instances the freight railroads do not often relinquish land, so rezoning is not a regular occurrence.¹⁰

5.4.3 Mitigation Activities

Noise Reduction

The research team's discussions with the railroads found that the railroads try to avoid dealing with what they termed "quality of life" issues such as noise. This is left to the cities or other jurisdictions when these problems arise. This was especially true in the case of shortlines who often lease their routes from the Class I's or the transit authorities. For example, the FWWR and the Dallas, Garland & Northeastern Railroad (DGNO) noted that they do not build any kind of sound barriers on their routes, parts of which are leased from DART, UP and others.

Noise, however, is being included for analysis as part of the project process for proposed rail studies, rail initiatives, and relocation projects. Chandra Carrasco, former manager of the Tower 55 study for NCTCOG, for example, noted that this project will be reviewing sound and vibration effects once the National Environmental Policy Act (NEPA) review begins (Carrasco, 2007). Currently the project is analyzing delay, emissions, and accidents.

On some of the shared route networks, the research team found instances where the transit authorities had installed sound barriers. For example, Fort Worth noted that sound barriers where TRE shares line with freight were put in place due to neighborhood concerns regarding noise. The city noted, however, that this was not a strict policy used on every project.

Quiet Zones

The Federal Railroad Administration (FRA) has recently revised and in some cases simplified the rules for cities to create "Quiet Zones" in which trains are not required to sound their horns at controlled crossings. The establishment of a quiet zone is a key strategy for mitigating the negative impacts of a freight rail corridor operating near residential areas, particularly when the need to serve a local customer base means that the rail line cannot be re-routed.

The City of Richardson conducted a study in 2001 on its automated wayside train horn warning system at the quiet zone it created on the Kansas City Southern railroad at Custer Parkway. The automated horn was directed toward the approach roadway and, therefore, excess noise into the neighborhood was reduced. Sound measurements taken before and after showed a consistent reduction in sound levels within the adjacent neighborhood (PB Farradyne, 2001).

In May 2005 the City of Fort Worth also began developing a new railroad program that created quiet zones to minimize train noise. The FWWR noted that Fort Worth's program seemed to be a success thus far with 6 quiet zones established through 2006 and 20 more planned throughout the city. In January 2007 Fort Worth area cities also called for establishing quiet zones at 15 crossings that run through Fort Worth, Halton City, Watauga, Keller, and unincorporated Tarrant county (Kirsch & Nettles, 2007). Arlington was also waiting on approval from Union Pacific to establish quiet zones throughout the city, and noted that it expected to break ground during the latter part of 2007 on seven zones.

¹⁰ For example, city officials noted that UP was "hanging on to all its own lines and will not relinquish land." They felt that this was so that UP could continue to exert control over its assets and also because of liability issues.

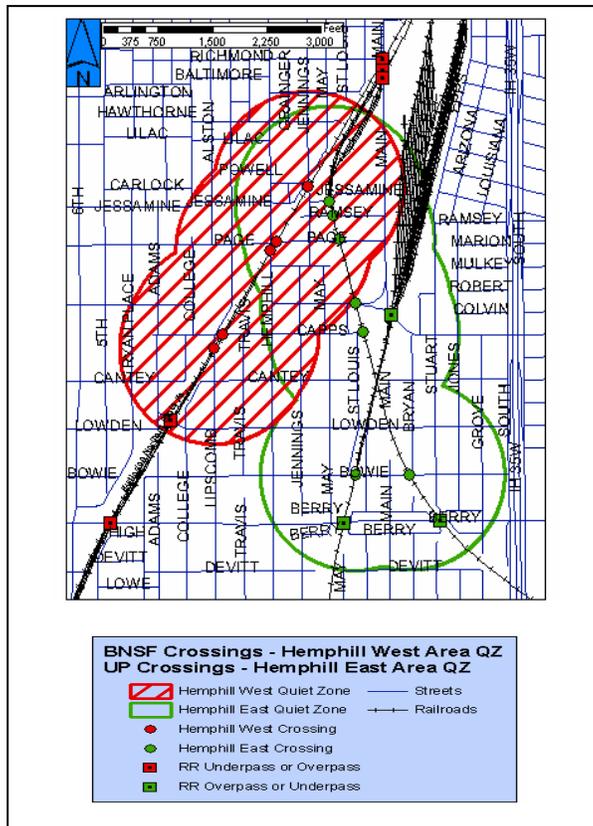


Figure 5.2: Hemphill West and East Quiet Zones Project
 Source: City of Fort Worth

In 2006 the cities of Houston, Bellaire, and West University were preparing to finalize the first quiet zone implementation at 14 crossings. Mayor White noted that the agreement between the cities met two of its priorities: safety and improvement of neighborhoods. Through an interlocal agreement signed between the cities Houston made the application to the Federal Railroad Administration for the implementation and ongoing maintenance of the quiet zone safety improvements. In early 2007, another group of residents in the First Ward of Houston petitioned for the creation of a quiet zone (Friedberg, 2007).

Grade Separation

Another way that incompatible residential and commercial use along rail corridors can be mitigated is through the use of grade separation. TxDOT is charged with administering federal and state funds designated to improve grade crossing safety and it uses a federally mandated model to index and select candidates. The passage of State Proposition 14 in 2003 also allowed TxDOT to issue up to \$3 billion in bonds against Fund 6 (gas tax) receipts. Twenty percent of the bonds (\$605 million) were earmarked for safety projects that included grade separation projects. Rockey (Rockey, 2007) noted that the DOTs at the federal and state level decide which interchanges to separate, which helps protect the railroads from a liability standpoint. Once the grade separation takes place the railroads are obligated to maintain new separated interchanges. Shortline railroads noted that this was a problem from a fiscal standpoint, with many operations running on tight profit margins. The shortlines also noted that in some instances crossings had

been closed (for construction projects, for example) and then subsequently re-opened years later without consulting the railroads. This was frustrating as in many cases the surrounding community had found new routes and the railroad now had to maintain another crossing site. The Angelina and Neches River Railroad, for example, noted that they hired a full-time signal inspector to keep up with the ever-changing federal, state, and local regulatory field.

Re-Location

The cities of Brownsville and Harlingen, the Cameron County MPO, along with the RMA and the City of Matamoros, and the state of Tamaulipas in Mexico have worked in partnership with the railroads to develop the West Rail Relocation Project. The project will relocate railroad traffic to a new international bridge located west of Brownsville and it will eliminate rail traffic out of the city centers of Brownsville, Harlingen, and Matamoros, and allow trains to travel at faster speeds. A presidential permit was issued by the U.S. in 2004 and investment is being done on a 50/50 match with Mexico providing \$20 million dollars to the project. Mark Lund, Planner at the MPO (Lund, 2007), noted that the new location of the re-routed rail posed little problem vis-à-vis incompatible land use. The new route will have minimal roadway or at-grade crossings. One side of the railroad ROW is a wildlife refuge and Mark Lund noted that the county had said that it will buy enough ROW to provide a buffer zone of approximately 500 feet. Mr. Lund noted that as the city and county were putting parcels together, only 2 or 3 out of 100 property owners had issues that needed to be addressed. For example, one property would be cut in half so the county is building a collector road to ensure access. The city indicated that it won't stop development outside of the Buffer zone, but that it was considering rezoning activities to ensure incompatibility does not arise again. Mr. Lund noted that in this case public outreach had worked well and that communication was *key* to keeping the community and the private stakeholders 'on-board' and 'in support' of the project.

Cleaner Locomotives

Grants provided by the Texas Emissions Reduction Plan (TERP) have allowed freight railroads to replace "road switcher" class locomotives, which can be more than fifty years old, with new low emissions models that are also much quieter than the engines they replaced. UP recently took delivery of 50 low emissions locomotives manufactured by *Railpower* for use in the Houston area. Emissions, noise, and vibrations caused by idling locomotives are key concerns for Houston area residents. Newer locomotives have the ability to be more easily stopped and started. UP has also acquired a smaller fleet of hybrid electric locomotives for yard operations that are able to operate silently when their batteries are charged. Improvements and modifications to the locomotive fleet operating in urban areas can significantly improve the impact of intracity freight rail operations even without making expensive modifications to the overall track network. Senate Bill 12 expanded funding for the TERP program, thereby increasing the likelihood that more rail operators will apply for and receive locomotive modernization grants through the State of Texas.

Other Activities

Other activities were also discovered through the literature review and interviews with various stakeholders. For example, many of the railroads noted that reductions in speed often assisted in allaying community concerns regarding the railroad. The reduction in speed offset noise, vibration and made great inroads into safety at grade crossings. The AAR also noted that

new locomotive braking systems were not creating any new sound/noise issues since their inception.

The railroads have on occasion been involved in activities to reduce community concerns. As an example, the former Santa Fe Railroad (now part of BNSF) undertook a dust abatement project in El Paso to deal with concerns regarding the environment and public safety.

According to the AAR and the Federal Railroad Administration (FRA), public outreach represents one of the most significant partnering activities yet to protect rail corridors, deal with incompatible development, and provide enhanced safety. The FRA's Highway-Rail Crossing Safety and Trespass Prevention Program has used what it calls the *Three E approach* (education, enforcement, and engineering) for reducing fatalities at highway-rail crossings (FRA, 2007). For example, working in partnership with Operation Lifesaver, the FRA has conducted outreach efforts at schools, workplaces, and communities throughout the United States.

In some cities the railroads provide information to real-time systems that advise emergency services of any rail stoppages or other incidents on tracks that could impact emergency service routing. College Station and the city of Sugarland both have such systems.

5.4.4 Partnering

Partnering activities were also found between various jurisdictions, stakeholder cities, and railroads. Recent studies, analyses, and evaluation projects that are currently taking place (or have recently taken place) have involved all of these partners. For example, Harris County's rail studies have been conducted with cooperation from UP and BNSF. The Class I's also noted that they have delegates who represent them with the NCTCOG and H-GAC MPOs in Texas. Dennis Kearns of BNSF noted that he traveled at least once a year to other major metro MPOs, e.g., El Paso and San Antonio. Several shortlines, on the other hand, noted a paucity of communication with the local jurisdictions in which they operate. The shortlines noted that transit projects that use existing right-of-way are often in the advanced stages of implementation before they are notified. Sometimes these studies have very little analysis undertaken about the freight activities that will continue to exist on this right-of-way.

Railroad Efforts to Work with Jurisdictions to Prevent Encroachment or Incompatible Development on Railroad Corridors

As an example of partnering to prevent incompatible development, BNSF is working with Harris County to try to find ways to ameliorate incompatible uses that are occurring beside its Orr Siding at Mile Post 81.2 on its single-track Dallas-Houston mainline just north of Houston and South of Tomball. This is in an unincorporated area of Harris County and sub-divisions are rapidly being built along the siding at Gleannloch Farms. BNSF has communicated with the residents of the sub-divisions in this area and in a temporary short-term solution moved trains back on the siding away from the current development. Sidings, however, have limited length, and shifting train locations within such limits is impractical in the long term. The research team reviewed the Google Maps aerial view of this area and found that four new areas have been clear-cut and made ready for new sub-divisions to go in (see Figures 5.3 and 5.4). The research team also conducted a site visit and found that additional developments are also being planned. As this new residential growth continues along this route, the opportunity for more incompatibilities will arise. BNSF officials are anxious to advise public officials of the predicament and initial meetings with county officials reveal that lack of zoning powers leave few future options (Harris County, April 2007). Relocating the siding elsewhere on a corridor

may not fit within the railroad’s operating plan but railroad officials are willing to consider a move if public funding would bear the cost. However, any move could be futile if zoning laws are not enacted to keep residential or other incompatible development away from the new siding location. One potential zoning requirement would mandate that developers establish buffer zones beside the track to diminish the noise and vibration that occurs when trains are held on the siding. Figure 5.3 gives a satellite overview of the Orr Siding and proximity of development to this route.



Figure 5.3: Orr Siding at Mile Post 81.2 on BNSF Single-track Dallas-Houston Mainline

Figure 5.4 provides a greater overview of development (clear-cutting of sites) that is continuing north and south on this rail line. Proposed developments have been circled. As the picture shows, development is occurring right up to the BNSF ROW.

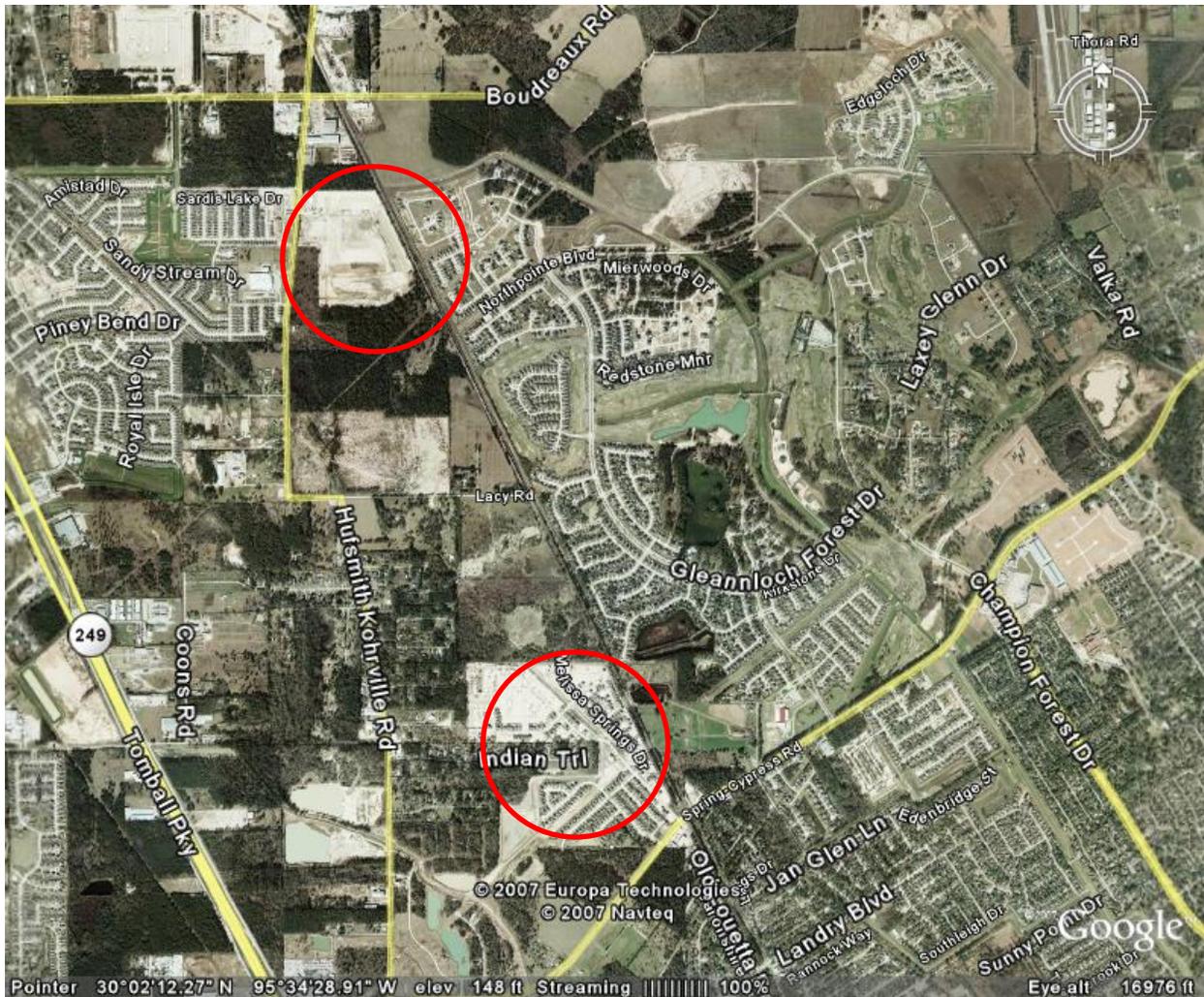


Figure 5.4: Overview of Two Proposed Developments North and South of Orr Siding at Lacy Road

5.4.5 Freight Rail Studies

Dallas/Fort Worth

The Dallas/Fort Worth region suffers from serious intermodal bottlenecks. The Tower 55 area has been called the worst freight bottleneck in the United States. Fort Worth currently has over 60 crossing projects underway (including signal crossing upgrades, surface projects, quiet zone projects, and grade separations). The Regional MPO NCTCOG has been actively involved in freight rail planning with the various cities, counties, and intermodal facilities in the region.

Tower 55 Study

Tower 55 has had three major studies conducted since 1992. The latest study is called the “Rail Reliever Study” and is expected to be released in late 2008. The technical group for this study is made up of staff from TxDOT, UP, BNSF, FWWR, Fort Worth Transportation

Authority, Tarrant County, City of Fort Worth, and NCTCOG. Carrasco noted that NCTCOG has hired a consultant to begin work on the NEPA review process. The project is being funded by the FHWA, the cities of Arlington and Fort Worth, and the TRE, as well as the Class I's. The study area for the project is expansive and the consultant is reviewing land use around the Tower 55 area. Costs have been estimated from \$100 million to \$800 million to bring this project to fruition. NCTCOG estimates the most likely figure is \$300 million. The near-term options for the project include on-site options of at-grade capital improvements; a FWWR bypass; a north-south trench, tunnel, or flyover; and an east-west trench, tunnel, or flyover.

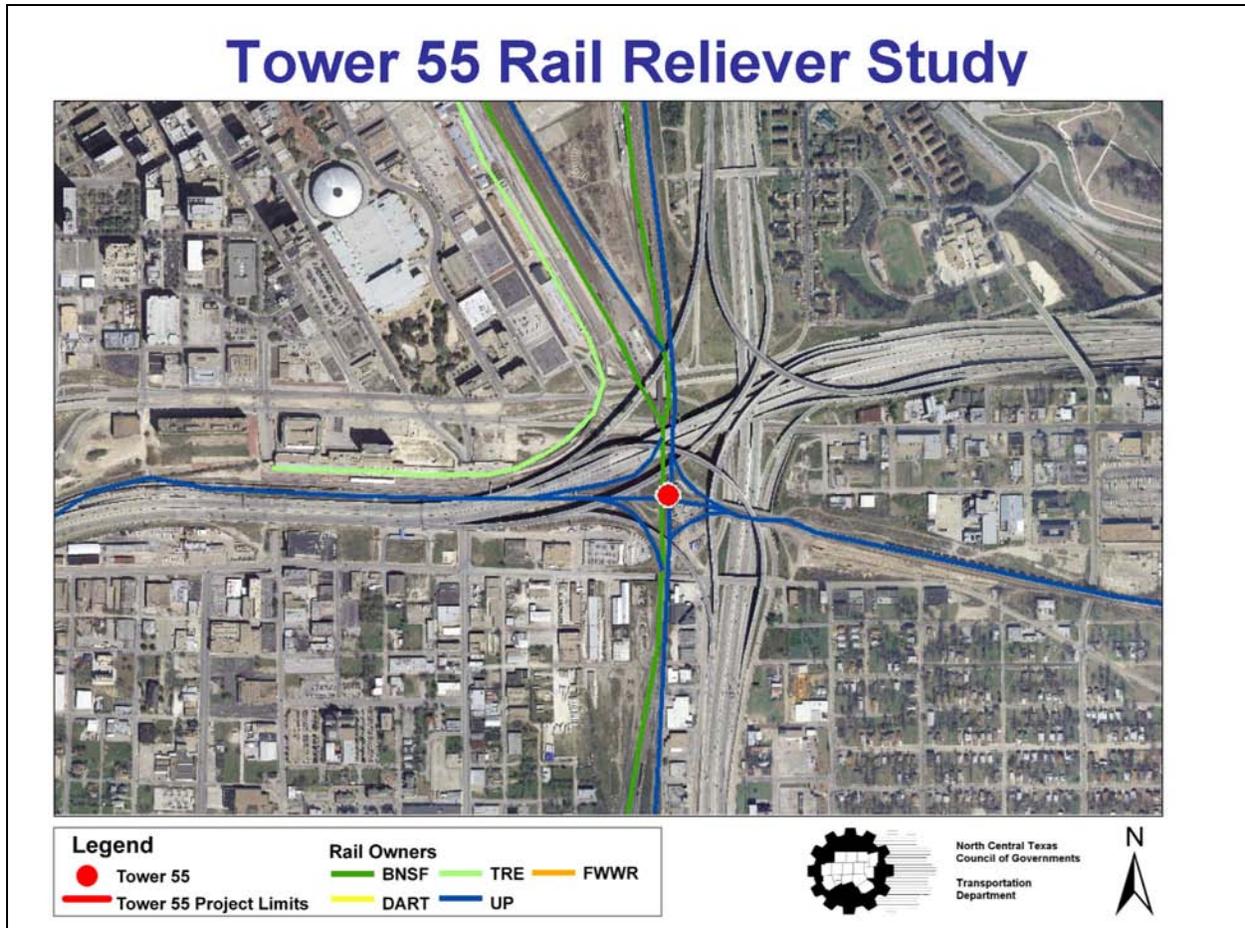


Figure 5.5: The Tower 55 Area in Fort Worth
Source: NCTCOG

Freight Bottleneck Study

The freight bottleneck study was begun in 2002 in conjunction with TxDOT's Trans Texas Corridor evaluation. The study's key activities included establishing partnerships with railroads and trucking firms, touring key facilities, and coordinating with the Regional Rail Corridor Study being conducted to review transit in the DFW area, in addition to the collection of data and model development. The study's results will be incorporated in a future Mobility Plan Update, according to NCTCOG.

City of El Paso

El Paso, like Houston, is a city in which freight rail lines and rail traffic are ubiquitous. However, unlike Houston, most of the rail traffic that moves through El Paso does not originate or terminate in the city but rather moves through to other destinations. El Paso is the gateway for the UP's southern transcontinental route, which links the Ports of Los Angeles and Long Beach to Chicago. Furthermore, according to Chuck Kooshian of the City of El Paso (Kooshian 2007), there are three cross-border (north-south) trains per day from Mexico, which connect primarily to BNSF. While El Paso has temporarily sought relief from rail congestion by placing restrictions on when trains can operate, the longer term solution is to shift the north-south traffic to alternative corridors that do not run through the city. This is being accomplished in coordination with the City of Juarez in Mexico.

SAFETEA-LU specifically calls for a new rail crossing at Santa Teresa to ease congestion; however, the realization of this federal mandate is dependent in large part on full participation by Mexico (Camino Real Border Improvement Plan, EIP MPO). The El Paso MPO reports that for a project of this sort, funding from the Mexican side will be allocated across different entities with 25% coming from each of the following: federal, state, local, and the private rail company (Ferromex). To add to the complexity of the process, the line will be relocated onto the territory of New Mexico, which means that the New Mexican side must also be a full participant. According to George Pinal at the El Paso MPO, Texas has so far taken a more passive role in the process when compared with either Mexico or New Mexico. While El Paso representative Silvestre Reyes spearheaded the effort to secure \$14 million of federal money to fund the study and preliminary engineering for the project, the New Mexico DOT (Rolmo, 2006) has taken a more active role in planning due to the comparatively simpler process of acquiring the necessary right-of-way and the potential direct economic benefits that would accrue to New Mexico. It is estimated that the relocation of UP facilities to Santa Teresa could add up to 545 jobs to southeast New Mexico (Associated Press, 2006). For the leaders of El Paso and Ciudad Juarez, the relocation is a prime opportunity to remove rail congestion that is hampering connectivity in their cities. One unique consideration in El Paso's relocation effort is that the new corridor will primarily be located in another state (New Mexico) on land that is partially owned by the federal government (Bureau of Land Management). The addition of a new intermodal facility and ramp near Santa Teresa is expected to generate significant numbers of jobs for New Mexico and is actively being planned by the New Mexico DOT. If cross border projects such as these can be realized they have the potential to provide benefits to all sides.

Christina Valles of the City of El Paso stated that the city currently had very limited ability to alleviate problems caused by incompatible land uses. Many of the encroachments in El Paso are located in older neighborhoods that were constructed prior to the establishment of the current zoning regime. Citizens groups in El Paso have often petitioned the city to develop grade separation projects, primarily along the BNSF line, in order to ease traffic congestion. The City's general approach has been to discourage these efforts for fear that grade separations would subdivide communities. At present El Paso has identified no reliable funding source for realizing grade separations. The City has thus far identified 17 potential at grade crossings that could be targeted for federal funding; however, El Paso has not performed a cost-benefit analysis or ranking of potential grade separation projects analogous to Houston (Valles, 2007).

Chuck Kooshian described the unique characteristics of rail planning in El Paso given the role of Mexican and New Mexican policies. For example, El Paso benefits from a policy to allow north-south trains connecting to the BNSF only at night; this policy was initiated and enforced

by Ciudad Juarez. The military, which may construct a rail spur to support expansions at Fort Bliss, also operates as yet another independent actor whose decisions impact the City's overall plan.

Houston-Galveston Area

The structure and function of the Houston rail network is fundamentally different when compared with most of the other intracity rail networks that exist in Texas. Freight rail lines permeate every area of Houston and serve to connect a multitude of local industrial clients. In total, the network handles an average of 270 trains daily, 50% of which are local cargo or yard trains and only 5% of which are through traffic that does not stop in Houston (Lileikis, 2007). The Houston rail system, which was originally built by 11 separate rail operators, "arose without a focused development strategy or a long-term plan to provide an optimum service pattern to its customers. Rather, it is the result of a series of railway mergers and acquisitions that took place as opportunities presented themselves between strong and weak railroad competitors" (Harrison, 2006).

The 2006 Houston Region Freight Rail Study covered eight counties in the Houston region as part of TxDOT's Statewide Freight Corridor study program. Projects under this study are divided into short-term and longer-term implementation proposals. It revealed incompatible land-uses, and cited candidates for crossing closures and improvements to separate pedestrian traffic from railroad traffic, especially where these lie close to schools and residential developments.

Harris County's Public Infrastructure Department developed two previous studies related to freight rail in 2004 and 2005 respectively. The first reviewed freight rail grade crossings in Houston's East End neighborhoods and the second developed a regional freight rail improvement proposal. The grade crossing study inventoried and evaluated existing railroad/roadway crossings and surveyed existing conditions. Problematic areas were identified and the project developed conceptual solutions to resolve the projected system inadequacies. The study ranked grade crossings with regard to their potential cost and public benefits and produced a list of priority projects—with funding estimates placed at \$195 million dollars to grade separate nine locations. After completion of the project Harris County assessed that grade-separations would have to be conducted with other improvements to existing rail infrastructure, rail yard relocations, and new freight corridor construction to improve mobility in the region. With this scope in mind Harris County then undertook the 2005 Regional Freight Rail Improvement Study.

The 2005 freight rail improvement study was jointly funded by the Class I railroads, Fort Bend County, the Port of Houston and the City of Houston. The proposed master plan consisted of consolidation of rail traffic onto fewer lines, enhancement of operating speeds on these lines through grade separations or the removal of crossings, the relocation of yards, and the potential facilitation of directional running (one subdivision handling eastbound and the other westbound traffic) on the Glidden and BNSF Galveston subdivisions (HGAC, 2007). Each improvement has specific benefits including improved mobility for vehicles, increased safety, decreased levels of pollutants and noise and potential for economic growth. For example, projects would decrease the number of trains that block traffic on major streets or isolate neighborhoods and would also reduce the time trains spend idling in the area, as well as improve air quality, noise, and vibration around the targeted neighborhoods.

However, this study also still required significant detailed operations modeling and cost-benefit analysis to identify the most cost-effective improvements for the Houston system

5.5 Passenger Rail

5.5.1 Corridor Preservation

The Research Team found a few instances in which various jurisdictions, including transit authorities in Texas, had been actively involved in preserving rail corridors for use as future transit corridors. This was accomplished through two mechanisms: purchase and banking. For example, trackage rights over existing freight routes, as well as the purchase of abandoned or duplicative freight routes, in Dallas formed the backbone of DART's service routes.

As old freight lines were abandoned after deregulation and subsequent mergers, DART began purchasing these parcels in the early 1980s in preparation for putting commuter and/or light rail on this ROW. According to Cheri Bush, DART made multiple purchases of land and railroad rights-of-way as well as negotiating inter-local cooperative agreements for trackage rights. This provided DART with the ability to create a viable system and preserve railroad right-of-way for future transit use. For example, in 1986 DART acquired land for the West Plano Transit Center, the North Carrollton Transit Center, and the South Irving Transit Center. In 1988 DART purchased 35 miles of railroad right-of-way from Southern Pacific, and additional land for station development. In 1989 DART completed a formal agreement with Union Pacific to acquire nearly 80 percent of total operating rights/rights of way needed for its planned system. This included over 3 miles of ROW and operating rights between Dallas and Fort Worth along what was originally called the Railtran Corridor. In 1991 DART acquired 54 miles of railroad from St Louis Southwestern Railway for transit use after 2010. Recently DART has purchased extra ROW from DFW to Oak Cliff. This extra land is a combination of non-track land pieces as well as pieces next to the tracks. Originally the Federal Transit Administration (FTA) gave DART funding to purchase some of the parcels of land that they now own beside their rail corridors. FTA has also just given them permission to be able to sell land purchased with FTA grants and allow the city to keep the revenue (DART, History).

Similarly, Houston's METRO purchased property under proposals generated from the METRO Solutions comprehensive transit plan which was adopted in 2003. The plan extends through 2014 and uses part of the one-cent sales tax revenue for mobility projects in Harris County and Houston-area cities. Staff noted that METRO also was given authority by voters to issue up to \$640 million in bonds to fund projects including ROW acquisition. METRO has also, in a similar fashion to DART, begun to purchase property to hold for development beside its rail line. This is not without complications though. County tax officials recently stipulated that METRO will have to pay taxes on property it plans to buy and hold for private development (Sallee, 2007).

Cities often require developers to provide or dedicate land for future highway corridors. For example, according to Bill Burman, City of San Antonio Senior Planner, the IH 10 East Corridor Perimeter Plan lists parcels needed to be acquired for future transportation needs and developers are required to dedicate this land for future corridor use.

Financial and Other Mechanisms Used for Acquisition and Development of Rail

Many of the cities that were contacted noted that while they are permitted to use land banking, they do not do so because the transit agencies (DART for example) already own large tracts of land for rail development, including right-of-way and land around transit stations. Cities also noted that land banking to preserve corridors or provide buffer zones was expensive and

there were often budgetary constraints on using this type of policy. Fort Worth, when asked about using land banking to preserve corridors or provide buffer zones, noted that they did not use this as there were not enough funds in their budget program. The City of Dallas noted that DART already owns large tracts of land which it is holding onto for future re-development—so the city feels there is no need for it to rail bank as well. City staff noted that NCTCOG’s sustainable development funding plan and program regulates land banking and provides an 80% grant. Land banking, according to the program rules, is intended to facilitate acquisition or assembly of property for sustainable development in the future near transit. No more than 20% of total available funding can be dedicated to land banking projects with a dollar cap placed at \$8.1 million for any project. The City of Richardson noted that it has not used land banking thus far because it is a new concept, funding is always an issue, and public opinion is unknown. The city also noted that there is public concern about using eminent domain for land acquisition for transportation projects.

Some cities have used land swaps and have dedicated infrastructure improvements to generate compatible development around transit stations. According to Planning Director Phyllis Jarrell, the City of Plano owned half of Eastside Village property (adjacent to the station) and partnered with DART to get the other half of the property. DART gave the city extra land it had left over in exchange for \$1 million in infrastructure improvements. The city traded the land it owned for gaining 100 dedicated visitor parking spaces, and this encouraged Abicus Partners to lead the development of Eastside Village.

Carrollton has begun to look at land banking as a mechanism to parcel lots together around proposed stations. They hired a contractor to assist them in identifying parcels as well as prioritizing these sites for an acquisition timeline. City officials noted that while they may own the land they did not intend to develop it themselves due to inexperience. They will either sell land or use a public private partnership type arrangement for example, granting a long-term lease to a developer, to encourage development of the land. Currently the parcels around the stations are empty, green distressed properties unprepared for new uses. In the downtown area these are small parcels of land that will need to be joined together to form a viable property. This parceling has become part of the reason the city is considering land banking as its method of choice to preserve areas along the proposed DART corridor.

Austin requires developers to dedicate ROW based on an areas adopted long-range plan. This will either fall within the Capital Area Metropolitan Planning Organization (CAMPO) 2030 plan (outside jurisdiction but inside ETJ) or the city’s 2025 comprehensive plan. Austin mostly acquires land through ordinance requirements and does not currently use land banking to acquire ROW or extra parcels to offset incompatible development. Ordinances can require dedication up to 150 feet. This is usually done when the developer is initiating a new development or requests a zoning change. The city uses bond packages to buy land, but this has been done very infrequently and the city felt it would probably only happen if there was a large threat to future expansion of a pivotal corridor. Teresa Calkins, Travis County Planning and Development (Transportation and Natural Resources), noted that Travis County does not do any land banking for future transportation corridors in the county.

Other cities have used, and are planning to implement Tax Increment Reinvestment Zones (TIRZ), or Transportation Improvement Funding Districts (TIF) to recruit development around transit. For example, Dallas actively used TIFs to develop neighborhood improvements around DART stations. However, the city council is now politically against TIF funding bills and is trying to use economic incentives as the mechanism to recruit developers interested in mixed-

use projects. Currently the city is seeking developers for Westmoreland Station, which is an end of line station currently but will be in the mid-network area after future line expansions. The city is reviewing the redevelopment of the parking lots surrounding this station for potential TOD. This project will be led by DART. The City of Carrollton put in a TIRZ in 2006. This zone is being put in place around future transit stations and will support denser land use.¹¹ San Antonio, according to Bill Burman, has looked at the potential use of TIFs. In 2004 they developed guidelines and criteria for communities looking to utilize TIFs. The use of TIFs is to encourage inner city revitalization in support of San Antonio's comprehensive plan and is limited to specific areas within the city.

Comprehensive Plans

Most cities in Texas have comprehensive plans in place to regulate current land use activities and promote future land use activities. In many instances, these plans have been developed after public input and meetings. For example, the City of Dallas released its comprehensive plan "Forward Dallas" in 2006. It was created in conjunction with public input through a series of meetings and public workshops. Forward Dallas has developed a series of policy initiatives as well as recommended implementation measures to ensure that the region achieves its goals. For example, Forward Dallas's section on land use notes that it:

"focuses on the regulations, investments and other tools needed to achieve the forward Dallas Vision. Building blocks used to create that Vision identify city characteristics Dallas residents want. Land use regulations follow the Guiding Principles to ensure the buildings that make up Dallas work together with public infrastructure to create these critically important places."

Forward Dallas envisions a series of implementation measures to ensure that its goals are met. For transit these include:

- Amend the Development Code to provide for market-tested mixed-use districts, urban design standards for walkability, and urban parking standards. Proactively apply these new zoning tools in combination around transit centers and multi-modal corridors through the Area Planning process, to encourage transit-oriented development at a variety of densities in a manner that is sensitive to the character of adjoining neighborhoods.
- Use economic incentives to encourage transit-oriented development catalyst projects.
- Monitor zoning capacity and development activity around transit centers and multi-modal corridors to inform land use and transportation decisions.

Dallas and the surrounding cities have focused and capitalized upon TOD implementing zoning ordinances to strengthen the development of the light rail system in Dallas and the surrounding cities. Policy 1.14 of Forward Dallas continues this focus, as well as noting that the high-density mixed use development around these nodes improves air quality, and uses land resources efficiently. The policy notes that development near stations and along multi-modal

¹¹ Tax levels in 2006 will form the baseline. Up to 65 percent of any tax increases generated by the change in land use will be placed into the TIRZ.

corridors should respect the character of surrounding neighborhoods. Implementation measures for this policy include:

- Maximize development opportunities around DART stations.
- Initiate Area Plans to identify and evaluate land for high density mixed-use development near transit centers. Coordinate public investment and land use regulations with development activity. Include area business leaders as well as neighborhood stakeholders when creating Area Plans.
- Use existing and historic buildings when possible to retain the character of surrounding neighborhoods, to build neighborhood identity and to provide opportunities for mixed-use development.
- Use land use regulations to define the appropriate mix and density of uses and appropriate transitions to adjacent areas. The range of regulatory measures should reflect the need for various scale and densities in transit centers.

NCTCOG is also actively involved in developing plans, policies, and strategies, including a regional rail plan and a sustainable development plan to address future transportation needs of the city and the region.

Finally, no review of corridor preservation or land use planning activity in Texas can ignore the City of Houston. Houston is not a zoned city and development is governed by codes to address how property may be subdivided. These codes do not, however, specifically empower the city to regulate land use. The City of Houston has been able to establish a certain degree of influence over land use by means of deed restrictions, although this tool is incomplete as not all areas within Houston are deed restricted. The City's code of ordinances Chapter 33, Section 33-22 mandates that the City Planning Commission shall adopt a comprehensive plan in conformance with Texas Code. Section 33.25 also mandates that the Planning commission will prepare a major thoroughfare and freeway plan each year. According to Chapter 33, maps developed as part of the city's survey, monumentation¹², and mapping program are official maps. However, the City has not adopted a comprehensive plan or land use map since 1929.

5.5.2 Zoning and Land Use Planning

In Texas the bulk of land use regulatory power resides with cities. While counties can zone and regulate land use more formally, very few undertake this activity. However, many cities are putting in place comprehensive plans that outline future transportation corridors and are adopting sustainability strategies to ensure that the quality of life for cities and citizens is improved.

Zoning Changes

Several Texas cities have begun to enact zoning changes directing development around corridors and around transit stations. For example, Dallas has created three zoning categories for urban corridors (UC-1, UC-2, UC-3). Primary uses along these corridors are office, retail and personal service, and multi-family. Setback along the front are 0' urban form, and at the side and

¹² Monumentation is intended to establish a permanent marking of the lines and to fix the corner positions so that the location of the surveyed lands may always be definitely known. In many instances monuments are used to provide a marker. In other instances US Geo Survey discs are placed into the pavement at corner junctions to provide a permanent fixed marker of a longitudinal and latitudinal point.

rear are 0' adjacent to central area, multiple commercial or urban corridor districts, 10' next to single family, townhome, duplexes or clustered housing, and 5' for all other uses. Heights range from 30-55' for UC-1 to 55-100' for UC-3.

According to Dee Sarver, City of Plano Planning Department, the areas around DART stations were rezoned "downtown business government" (BG) in 2003. This means that there is commercial on the ground floor and residential above. Phyllis Jarrell, City of Plano's Planning Director, noted that the BG ordinance was modified when light rail came. The zoning encouraged multi-family development at 100 units/acre. Plano city staff noted that there were no local ordinances or zoning that discouraged TOD. In fact the city has expanded its BG classification. However, Parker Station (currently the last station on the route) has proved to be a challenge for rezoning. In 2003 a Transit Overlay District change was put before the city council but did not pass. Staff felt this was because it was too early in the timeline, from a regulatory standpoint. The city council also felt that this was moving too fast given that there was no developer interested in the property. The city still owns some of the land around the station and has bought another 4 acres adjacent to the line. Collin County also owns one of the parcels as well as DART. There are also three vacant lots in the area around the station. Currently the city has not let any development occur on these parcels. Plans are now in place to use a standalone TOD overlay. The Parker area also has a TIF, which has been in place since 1999. The TIF however, has not been used to provide funding for early acquisition to acquire corridor parcels or for land banking according to City officials.

Keith Krum, City of Richardson Planning and Zoning Department, noted that there has been mixed success with changes to zoning ordinances along the rail corridor within its jurisdiction.

San Antonio has been actively developing new zoning standards surrounding corridors. For example, according to Bill Burman, Article III of the city's code has created urban corridor districts zoning regulations delineating the types of activities that can occur beside these corridors. The code also created buffer zones for roadways but has not applied this to the TOD overlay ordinances that the city can utilize for transit activities created within the 2006 Unified Development Code. The I-10 East Corridor Perimeter Plan, which is a major thoroughfare plan, has articulated parcels needed to be acquired for future transportation needs. Developers are required to dedicate any land include in this plan for future corridor use. According to Burman, San Antonio depends on the developer to build (in the new developments) and dedicate roadways. Part of the goal of this corridor plan is to prevent industrial uses from dominating the corridor and to encourage residential use. The city then proposes to rezone these areas.

According to Teri McMillian of the City of Austin Long Range Planning Department, Austin has been performing roadway corridor studies to encourage different patterns of land use. It has not yet embarked on any rail corridor studies but has been actively involved in developing station plans for the commuter rail line that will open in 2008. The city has also designated a series of roadways as *core transit corridors*, and city council adopted *corridor design standards*, that have a new zoning overlay which allows for differing densities. In January 2007 mixed used design standards were also adopted for these corridors. The goal is to promote compatible development around the commuter line stations and along commuter routes. Austin has incorporated within its 2025 plan the Austin-San Antonio Commuter Rail Project. The city considers that this project has a "realistic chance of happening." The project is proposed to be linked to the Seaholm Station Master Plan, which will have a large downtown station in Austin. If the route occurs it is possible that a TOD overlay district would be placed around this station.

This would depend on the political situation in place at the time. For example, some current council members are very supportive of new urbanism concepts and TOD.

Other cities have also put in place other zoning standards for transit stations, rail facilities, and urban corridors. For example, El Paso adopted a Transit Station Ordinance. This requires set backs of 100 feet or more to offset the transportation terminal activities. The ordinance also requires lighting, screening, and perimeter setbacks as well.

Eric Slaterger, City of Fort Worth, noted that the city is utilizing the urban village concept to stimulate investment around corridors, often by promoting new land uses and rezoning if necessary. The city is using \$4.5 million from its federal transportation fund to promote the urban village redevelopment. Urban villages promote mixed use zoning (commercial with some residential), and urban villages are designated as Neighborhood Improvement Zones (NIZ). The City does acquire extra property from foreclosures or by re-parceling old city property. In these instances they will rezone to a desired use around transportation corridors. Slaterger also provided information on the city's activities surrounding the TRE corridor. The city is planning to redevelop the areas around stations to a mixed use format. This will include downtown high rises, condominiums, parking, and retail. These are all considered compatible uses beside commuter rail. Around the Lancaster Corridor area the city is using an overlay to accommodate the city's vision for the area. This is strictly adhered to in terms of what development is allowed. They also created a TIF district for this corridor. The city was also fortunate that they did not have to rezone around these areas because it was already zoned H (downtown, mixed use).

Transit-oriented Development Zoning

Many Texas cities have also enacted TOD zoning standards around stations on light rail and commuter routes. Cities along the DART system provide excellent examples of these ordinances as well as case studies for the success of the use of TOD. The Dallas area is noted nationally for the innovative development that took place around DART stations. Mockingbird Station, Addison Circle, and Plano are hailed as best practices nationwide regarding Transit-oriented Development. The accompanying CD-ROM Guidebook provides a model TOD type ordinance. Figure 5.7 shows TOD developments on DART's rail system in the Dallas/Fort Worth area.

Art Lomenick (Lomenick, 2007), President of Trammell Crow's High Street Residential subsidiary, noted that in TOD developments the buildings are usually given a greater amount of soundproofing, especially in the windows and in trim due to their proximity to transit. Triple-glazing, for example, was used in the Eastside Development in Plano.

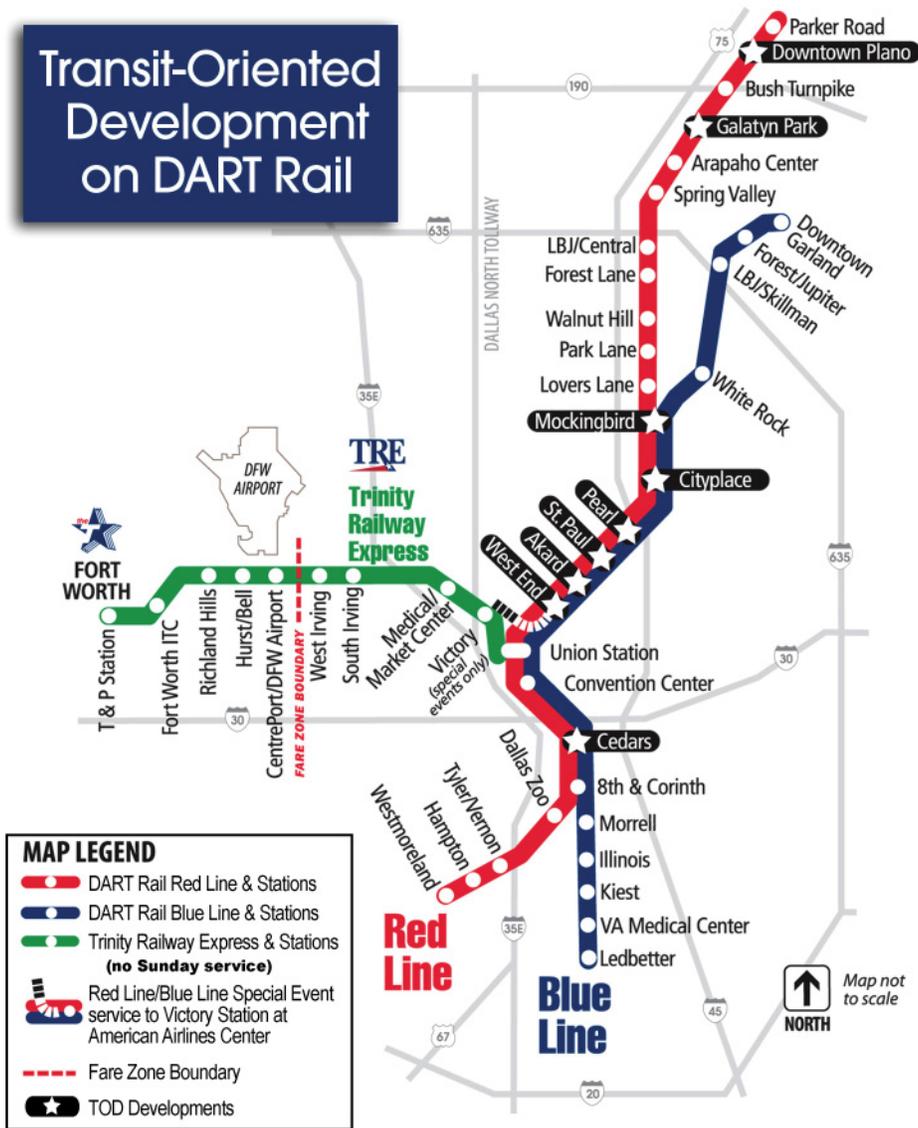


Figure 5.7: TOD Development on DART Rail
Source: DART

*Forward Dallas*¹³ examined the use of TOD overlays to allow mixed use along transportation corridors in the future. The city is reviewing different types of TOD overlays including low density, mid density, and downtown. The ultimate goal is to coordinate and design the overlay zones so they are diverse and flexible. According to David Schleg, City of Dallas Planning Department, the city opted to develop these new measures due to the fact that the Mockingbird and West Village Station TODs were extremely hard to develop due to zoning issues that were unfriendly to mixed use. The main problem that the city faces now is catching up with development. The timeline for completion of the development of the new TOD overlays

¹³ The city's comprehensive long range plan which incorporates land use, transportation and economic development considerations into defining where the city envisions growth and development to occur.

was the end of 2007, with a goal to first adopt a general plan and then adapt this overlay to each station proposed in DART's extension plans.

Many other Texas cities are also implementing TOD ordinances. Within the Dallas/Fort Worth area, Carrollton, Plano, and Richardson have all used or are planning to use TOD. Carrollton, for example, has been working since 2000 to put in place new TOD ordinances. These were finally passed by the city council in 2005 as a Transit Center Zoning District ordinance.

The city of Richardson, according to Keith Krum, first looked at using TOD in 1999 around the southernmost three stations. At the time of the report, there were not any local codes or zoning activities that actively discourage TOD but the city doesn't have any dedicated funding for TOD implementation. Spring Valley station was rezoned in 2004 for mixed use and there have been two amendments (November 2006 and January 2007) at the request of the developer. The January 2007 rezone was done to accommodate the incoming Greenville apartment redevelopment around the station. The west side of Spring Valley station has so many owners that the city felt it would be hard to redevelop to more conforming uses in the short-term. Arapaho Station does not have any zoning for mixed use because the property owners were worried about existing nonconforming uses. However, the city is looking at possible redevelopment of land owned by DART around the station. The northern stations have only one or two main property owners so the City does not feel that it has to dedicate TOD type ordinances for redevelopment of the surrounding area by the rail corridor. According to Krum the city plans to work with the individual owners to achieve the land use activities that are compatible with passenger transit.

Figure 5.8 shows the Richardson's light rail corridor and land uses within $\frac{1}{4}$ to $\frac{1}{2}$ mile radii of stations as designated in the 1999 urban land institute study (Urban Land Institute, 2000).

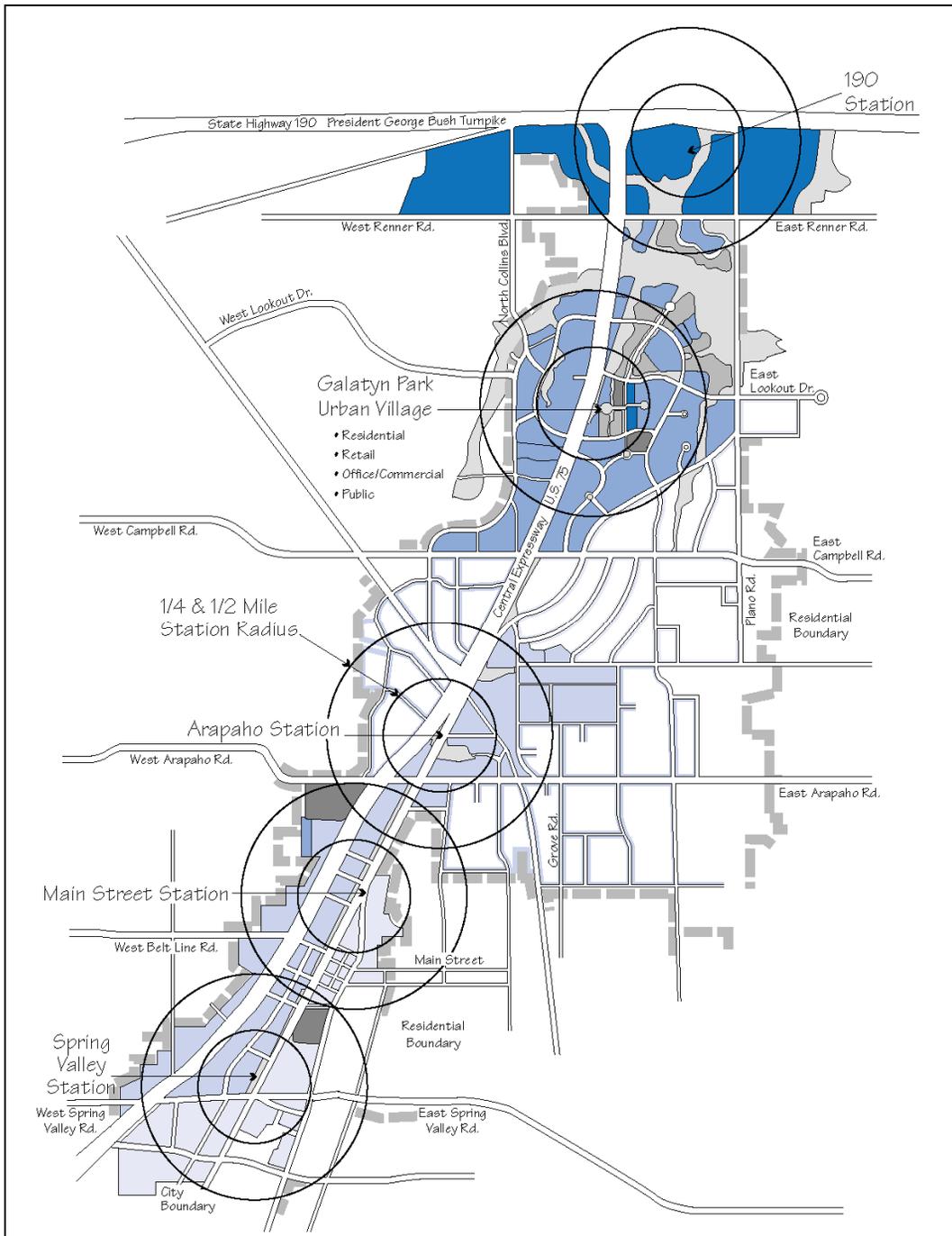


Figure 5.8: Richardson's Light Rail Corridor
Source: City of Richardson

Austin, Cedar Park, and Leander have also adopted TOD ordinances for areas around the stations on the commuter line that will open in 2008. According to Sónya Lopez, City of Austin TOD Coordinator, changes have been occurring in Austin zoning to encourage TOD around the new commuter rail. Austin did not have TOD zoning until 2005.

According to López, after the commuter rail proposal was passed by voters, Austin put in place interim ordinances in the stations plans. This was because the city needed further time to

develop the ordinances and this was a way of keeping out the most incompatible uses around the proposed stations—for example, industrial and heavy commercial. Austin has applied for a FHWA Transportation Communication and System Preservation Grant so it can conduct the second round of station planning. The city also noted that if CAMPO develops a policy that is friendly to growth then there may be more funding for TOD development in the future around the rail transit corridors. Developers have also begun to plan for mixed use development around the commuter rail stations. In 2006, Pacific Summit Partners announced plans to build a mixed use TOD development with up to 3000 homes and 150,000 square feet of neighborhood retail on land adjacent to Lakeline Station (Miller Morton, 2006). This came just after Simmons Veder announced its plans for 1.5 million square foot mixed-use TOD development of apartments, offices, and shops adjacent to the rail line. Figure 5.9 highlights the positioning of the two proposed developments (Robertson, 2006). As of the writing of this report, the Simmons Veder development has broken ground.

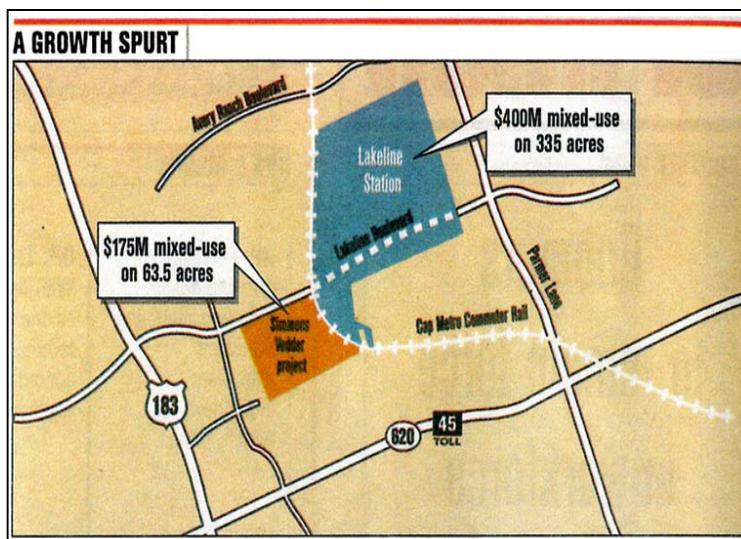


Figure 5.9: Proposed TOD Developments around Lakeline Station
 Source: SimmonsVedder.Com

While these are private sector activities, thanks to the placement of interim TOD ordinances by the City of Austin land-use will be controlled—to a certain degree—around the station and corridor areas near to the stations.

Transit Agencies are also beginning to provide real estate and promote TOD development. DART, for example, is starting to devote funding to encourage TOD around stations. Cheri Bush noted that FTA requested that DART create a TOD implementation fund. The fund would be used to provide infrastructure improvements around the transit stations. For several parcels that Dart owns beside the corridors, the agency will take the lead as the property owner and will deed land but will control use by permitting only TOD uses within the deed. The process will utilize a review mechanism that focuses on best use as opposed to highest bid. Properties will be sold based on their TOD potential.

According to Curvie Hawkins, Planning Department, The T (Fort Worth’s transit provider) has not had a major role in revitalization of station areas or helping to promote specific uses around the corridors. However, he noted that it is in their strategic plan to focus on TOD

development in the future. This may include some forms of land banking (i.e., purchase more land than a station will actually need) as a long-term goal includes development of more commuter rail.

The research team asked if there were any concerns about the freight/transit mix in terms of incompatible uses because of the move to TOD-type development around the corridors. DART noted that while it does share some ROW with freight, this is segregated due to FRA rules involving the mix of freight and light rail. For example, where the blue line shares ROW with DGNO Railroad they run parallel to each other, with clearance approximating 25 foot (from the center line), and with the occasional at-grade intersection. Cheri Bush also noted that there is a chain-link fence between the two rail lines, which reduces the number of trespass incidents.

5.5.3 Mitigation Activities

DART added safety and other design elements to its light rail system when requested by cities. For example, in 1994 it added median crossings that were requested by the community surrounding Lancaster Road and the city of Dallas. Public hearings were also held throughout 1994 to hear community concerns regarding the planned rail system.

The Cotton Belt Line in Dallas is an existing freight line that the city is reviewing for use as a regional commuter rail line. It is proposed that the line will still run freight traffic as well as the commuter rail. However, issues have arisen surrounding the project plans as residents do not want diesel engines. The line runs beside very expensive developments and the neighborhoods have asked for sound buffers. Schleg said that the city is supportive of the installation of “reasonable technology” like sound buffers and it is also supportive of electric versus diesel engines. Schleg said that the city would pay for the sound barriers.

The City of Carrollton is also a partner in the Mercer Yard (railroad yard) relocation. The yard is in the way of the new proposed light rail line. Currently a short line railroad company uses the tracks but they are willing to move if funds can be found. The city is working with NCTCOG and DART on this project.

Eric Slaterger also noted that Fort Worth established quiet zones in neighborhoods as a response to the problem of freight railroads being an incompatible use beside residential neighborhoods. For example, the TRE allows freight to use the line in off-peak periods. This line is owned in conjunction with DART. The NEPA review undertaken as this line was developed reviewed the effects of sound and vibration on surrounding communities. Under the terms of the ROD, they had to mitigate the situation with local residents. This took the form of running freight trains in the middle of the day to avoid noise and vibration at night. In some areas sound barriers were also built to mitigate resident’s complaints.

5.5.4 Partnering

According to cities that the research team interviewed, many of them partner with transit authorities and the area MPOs in developing their transportation and land use plans. For example, according to city officials in Plano, area cities actively partner with DART and NCTCOG. The feeling was that DART has realized that TOD creates riders, and while it does not lead activities it will partner with cities when requested. Plano officials also noted that in their own partnering activities with NCTCOG they provide the MPO with copies of any new city ordinances. This provides NCTCOG with an overview of how land use planning is controlled in the various jurisdictions within its member’s areas.

Partnering also runs to developing parcels with Transit Agency assistance, either through swaps or outright purchase. Plano partnered with DART and private entities to kick-start its TOD development, for example. Plano owned half of the Eastside property adjacent to the station and they partnered with DART to acquire the other half of the property. DART also gave the city extra land it had left over in exchange for \$1 million in infrastructure improvements. Plano was then able to trade the land it owned for gaining 100 dedicated visitor parking spaces which, in turn, encouraged Abicus Partners to lead the development of Eastside Village.

Many of the cities interviewed in the Dallas/Fort Worth area also noted that they will work with individual land owners to ensure land use activities will be compatible with passenger rail. The City of Richardson, for example, noted that it will work with individual owners to achieve land use activities that are compatible with passenger transit as stations come on-line and developments are proposed (Krum, 2007).

5.5.5 Transit Rail Studies

There have been many transit rail studies undertaken over the past ten years. Recent studies have taken place in Dallas/Fort Worth, Houston, and Austin/San Antonio. Some of these studies and initiatives are described in the following sections.

Dallas and Fort Worth

NCTCOG 2005 Regional Rail Corridor Study

This study identified ten corridor segments, including the Trinity Railway Express. Each segment was analyzed regarding line ownership, trackage rights, average trains, crossings, jurisdictions, industrial sidings, and corridor issues. The goal of this study was to review, inventory, and assess the DFW-area transit needs and provide data and recommendations to regional transportation decision makers. The recommendations were then included in Mobility: 2025, The Metropolitan Transportation Plan, which was amended in 2005. The study made recommendations for preservation of specific corridors; for example, the locally preferred alternative for access to DFW International Airport recommended preservation of a corridor that connected the Trinity Railway Express Corridor to the 13th Street Station. Figure 5.10 provides a view of the proposed transit rail corridors.

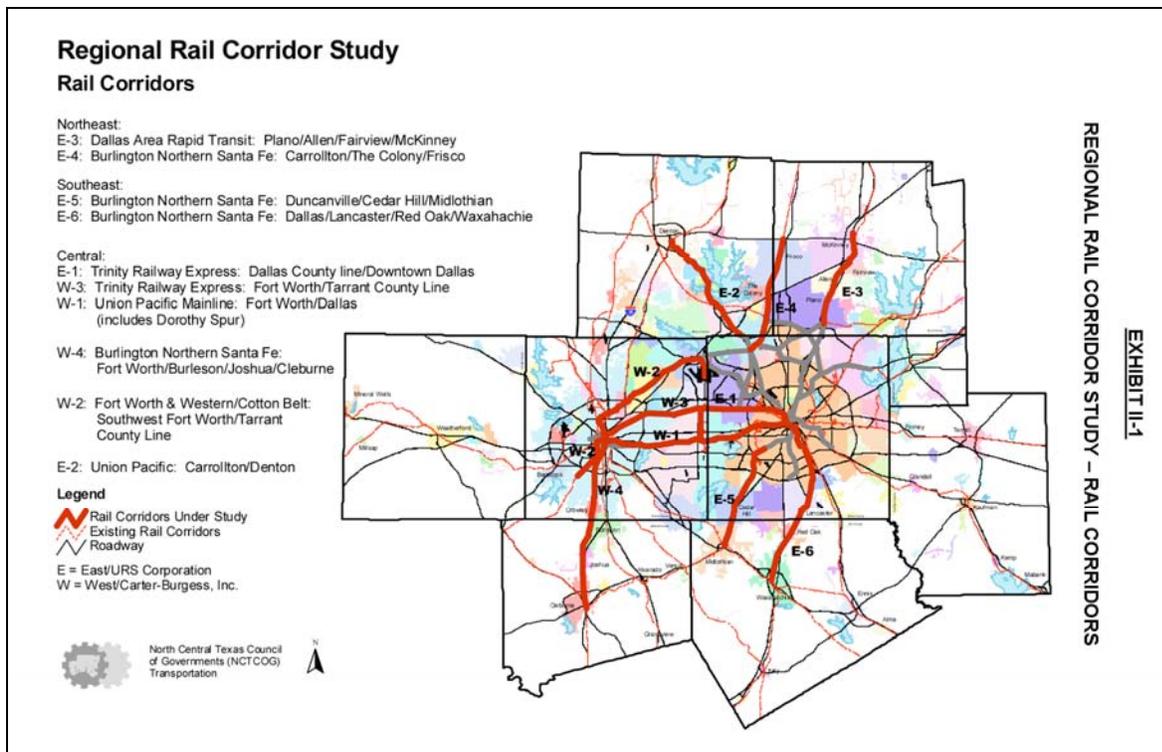


Figure 5.10: North Central Texas Regional Rail Corridors

Houston-Galveston Area

The City of Houston is seeking to develop a set of new standards to shape neighborhoods and commercial areas along its urban transit corridors.¹⁴ In August 2006 an inaugural workshop was held that began to produce options and alternatives to protect existing neighborhoods as well as preserve urban transit corridors that were being changed by growth, increased density, rapid transit, and new road construction (Urban Corridor Planning, 2006). This workshop was the first in a planning process that focused on neighborhoods and commercial areas in six transit corridors. According to Carol Lewis (Lewis, 2007), the rationale behind this new development was a realization that the city needs to plan ahead given the light rail and bus rapid transit corridors that are being proposed in both existing and new rights-of-way. The focus is on creating an economic climate so that development occurs in a positive way given the fact that Houston does not zone. According to Dr. Lewis, the city hired a consultant to continue the work and conduct subsequent workshops planned for 2007. The consultant will continue to utilize the Main Street Coalition's outputs, which included adopted community plans, area and corridor plans, and a series of revised development regulations that support transit/pedestrian oriented use. The consultant will provide a series of recommendations for areas of detailed planning and urban design for transit-oriented development along the six transit corridors, including Metro's Phase II light rail development. The work will parallel system design and environmental procedures that are currently taking place.

¹⁴ This initiative continues the work of what is known as the Main Street coalition, which was formed in 1999 to foster appropriate redevelopment along the major urban spine in central Houston

Main Street Corridor Strategic Plan

In 1998 the Main Street Corridor Coalition, comprising 75 stakeholder partners, was created to foster greater stakeholder input into corridor planning and development in Houston. The coalition's goal was to create a signature transit- pedestrian-oriented corridor along 8.5 miles of Main Street. The key feature of the project was Metro's light rail transit line, which runs through the heart of the corridor. The coalition's focus was to leverage funding to maximize returns, prevent duplicative efforts, and coordinate plans of the various stakeholders. This collaborative public private partnership generated a Master Plan to guide future development within the corridor. A Strategic Plan Framework document was also created to guide the implementation of the master plan's vision. The Strategic Plan developed eight fundamental strategies including shorter-term corridor strategies and design guidelines for public right-of-way, enhancing Main Street and the light rail alignment to create an integrated corridor, and linking adjacent neighborhoods to the corridor with high quality pedestrian districts. The longer term strategies included attraction of high-impact joint-use development and developing long-term redevelopment projects in key areas of the corridor.

Inner Katy Transit Oriented Development Study

Throughout 2001 and 2002, the City of Houston developed the Inner Katy Transit Oriented Development Study. The report assessed the feasibility of placing high-capacity transit in the corridor along I-10 between Silber Road and Downtown Houston. The report utilized a model to estimate development potential, as well as land use mix and density of development that could occur if the project was implemented. The project found that the corridor could best sustain retail use, followed by office and finally residential development. This was in part due to the abundance of underutilized land. The study noted, however, that for TOD to occur *tools to entice the desired type and quality of development would be required including regulatory mechanisms for guiding land use*. Special districts, often used in Houston to leverage private and public partnerships, were recommended as an opportunity to achieve, without zoning, a greater mix of land uses and higher densities than comparably regulated cities.

US 290 Commuter Rail Analysis

The Houston-Galveston Area Council (H-GAC) conducted this study reviewing the feasibility for commuter rail along US 290 and SH 249, releasing its final report in December 2003. The project's objectives were to identify the need for high capacity transit, analyze the physical feasibility of operating rail transit in UP's ROW, prepare preliminary passenger rail plans and operating costs and identify/evaluate impacts on freight rail activities. The project also identified locations for transit center stations. The project's recommendations found that passenger rail service was feasible, with exclusive operation being the preferred operation of any passenger rail service.

San Antonio-Austin Area

San Antonio is currently engaged in developing a rail master plan for the city in conjunction with TxDOT. Burman stated that this master rail plan should take about 18 months to complete (Burman estimated it was at month seven in March 2007). According to Burman, San Antonio is also beginning to review the placement of stations in the CBD for the proposed Austin-San Antonio Intercity Commuter Rail District (ASA-ICRD) project. This is part of the

relocation plan for the UP line running up to Austin. Currently some board members (city of San Antonio officials) are requesting that the ASA-ICRD evaluate the use of an eastern route through San Antonio. San Antonio city staffers opined that the reason the city supports the use of the east line route for this commuter rail is because they *feel it is the more prudent route because activity is already on the route*, according to Burman. However, other ASA-ICRD board members are interested in a western alignment because it would link into San Antonio International Airport and a planned westside multimodal center.

Austin city officials noted that they are moving forward with plans to integrate the commuter rail into the proposed downtown Seaholm Station Master Plan as part of the city's 2025 Austin City Plan (McMillan, 2007 and Schulze, 2007). The Seaholm Station Master Plan has gone through environmental work at this juncture. Austin city officials noted that the ASA-ICRD plan is not contained within CAMPO's plan but can be found in San Antonio/Bexar County MPO's 25-year plan. This is because the project can only be listed in one TIP plan according to federal law.

5.6 Future Corridors

Most of the issues discussed thus far have dealt with protecting existing corridors from incompatible uses as opposed to the preservation of future corridors. The issues regarding the protection of future corridors are distinct yet often related. While little future corridor planning has been undertaken by TxDOT specifically for rail, most of the mechanisms used for corridor preservation for roads would be applicable to rail corridor preservation, yet may need to be altered to better fit the needs of a rail corridor master plan. For example, the "option to purchase," has been used for highway corridor preservation in the past and is envisioned as a key technique for the TTC. "Option to purchase" periods are limited to a maximum of five years (Keep Texas Moving, ROW Acquisition Process). It is not yet clear whether this time frame would be sufficient for rail corridor preservation/relocation given that the lack of clear precedent for such activity may increase the time needed to successfully define and develop new corridors. Presently, the most substantial discussion of a full-scale relocated corridor in the state is parallel to the I-35 corridor and as such is being actively investigated by the cities of Austin and San Antonio, whose proximity to each other enhances the need for coordination. Curvie Hawkings, at The T's Planning Department (Fort Worth), noted that it was very difficult to see how the Trans Texas Corridor would impact them at this point. While the regional vision for the TTC rail lines envisions lines starting at the DFW airport and going out to Grand Prairie and Arlington, they were not sure if this matches the TxDOT view of the area.

5.6.1 Austin San Antonio Inter-municipal Commuter Rail District

In 1997 the rise in congestion on I-35, freight rail safety concerns and the growth of population led the 75th Texas Legislature to pass SB657, creating the Austin-San Antonio Inter-municipal Commuter Rail District (ASA-ICRD), which was codified as VTCS Ch. 13, 6550c-1. TxDOT undertook an initial feasibility study in 1999 to assess the viability of creating commuter rail services between San Antonio and Austin. The ASA-ICRD officially formed in February, 2003. In 2004 ASA-ICRD commissioned a team to provide an update to the TxDOT feasibility study, develop a ridership model, and also document other changes that could impact the viability of this proposed commuter rail. The project is part of a three-step strategy to reduce congestion on IH 35, improve freight mobility, speed NAFTA trade between Laredo and Dallas, and spur economic development in the Austin-San Antonio corridor. The major underpinning for

project realization is the re-routing of UP’s through-freight trains. Figure 5.11 shows a map of the proposed commuter rail service route.

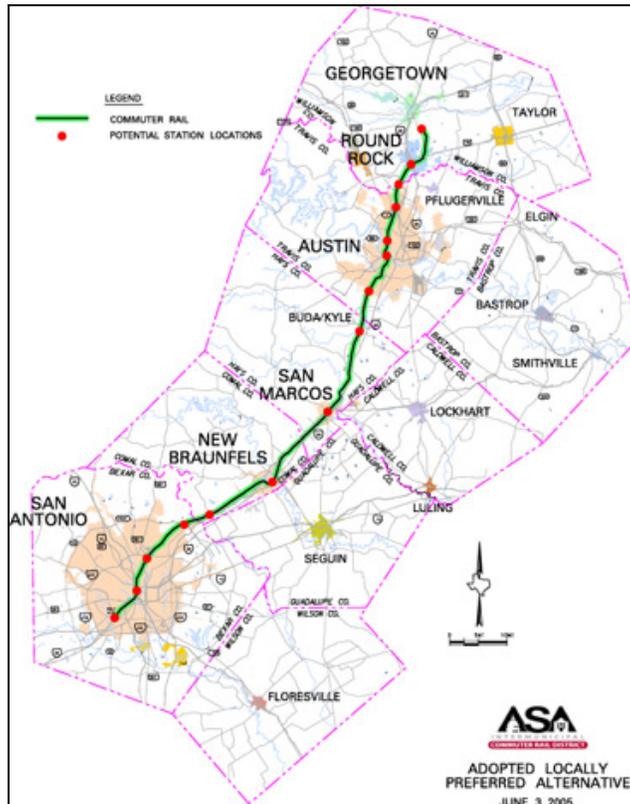


Figure 5.11: Austin San Antonio Inter-municipal Commuter Rail District Service Map

The proposal would relocate UP through-traffic to the edge of town in San Antonio, although 20% of this is local so it would run on the existing route in off-peak periods. ASA-ICRD would control timing and dispatch of trains. There has been some opposition regarding route choice, with some groups preferring an eastside route in San Antonio. ASA-ICRD has agreed to study the eastern route during the environmental process. The project is now listed in only one MPO plan (San Antonio) because it was considered “double-dipping” when it was put into both Austin and San Antonio’s MPO plans. ASA-ICRD will encourage the cities along the route to pass TOD ordinances, but cannot dictate terms. There are plans to connect this system to Capital Metro’s commuter rail route plans, although ASA-ICRD was cognizant of the gap that exists between the Capital Metro’s commuter rail line and ASA-ICRD’s route. Apparently, Capital Metro will be doing a connectivity study between the commuter stations and the Seaholm Station site. ASA-ICRD does not have any authority to do any land banking, or advance purchase for stations. This will be a city-led endeavor and will depend upon “who it works best for—public or private,” according to Schulze.

5.6.2 Federal High-speed Corridors

Currently there are two rail corridors in Texas that have received federal designation as future high-speed rail corridors: the South Central and Gulf Coast. According to the Texas Rail

System Plan, SCHRC serves essentially the same major cities as Amtrak’s Texas Eagle and Hartland Flyer services, while the GCHSRC would serve cities located on a portion of the Sunset Limited route. The Texas High Speed Rail Corporation (THSRC), an advocacy group consisting of local transportation and elected officials from multiple areas of the state¹⁵, also advocated for inclusion of the Brazos Express Corridor extension to the South Central high-speed rail corridor. The Texas Rail System Plan noted that TxDOT requested FRA funding for the proposed Brazos Express Corridor Extension running from Killeen/Temple through Bryan/College Station to Houston.¹⁶ This was denied by FRA. The THSRC has not abandoned their lobby efforts. They continue to support the Brazos extension, re-branding this extension as the Texas T-Bone.

Some of the cities and transit groups interviewed noted that the current political climate is not really ready for high-speed rail in Texas, and no money has been provided for the past four years. Many of the interviewees noted that the only way for the T-Bone project to proceed would be if a legislator earmarks or uses a block grant for this project in order to designate the Waco Houston corridor as a federal high-speed corridor. However, this would still then have to find funding to support its development. The Texas T-Bone system’s proposed route can be seen in Figure 5.12.

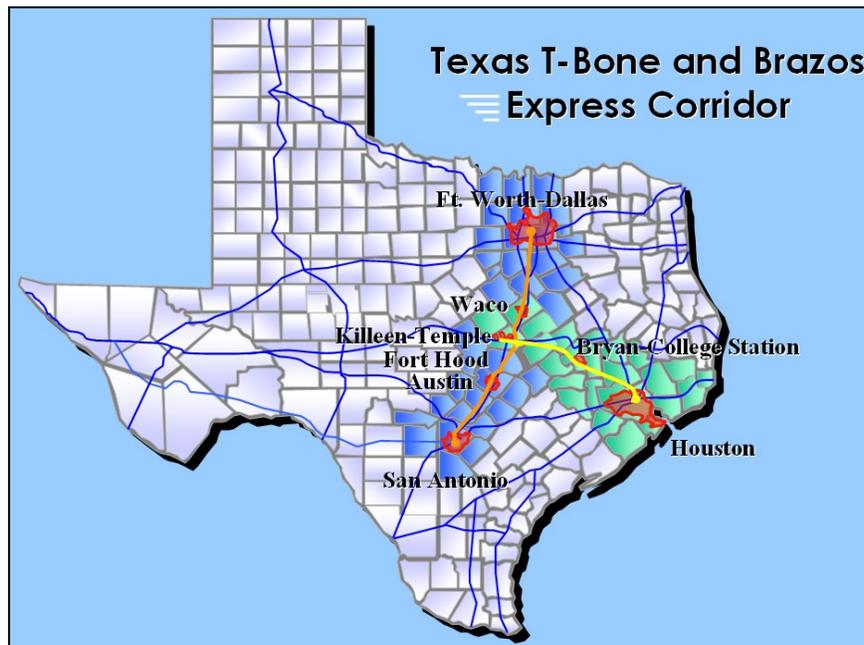


Figure 5.12: Texas T-Bone System

5.6.3 Challenges for Future Corridors

The research team assessed the opportunities for ASA-ICRD and analogous organizations in other cities to take advantage of the potential Rail Relocation Fund. Schulze noted that the rail

¹⁵ THSRC is a grassroots, collaborative effort to promote the development of a high-speed passenger rail system and multi-modal transportation corridor in Texas.

¹⁶ This group was also, according to TxDOT Transportation Planning and Programming staff, the political force behind this request.

relocation fund has not yet had any appropriations. If and when the fund is capitalized, there will still be fierce competition for priority funding given the high cost and complexity of bringing relocation projects to fruition. The Tower 55 project, along with proposed projects for Houston, would compete along with Austin and San Antonio for any monies that become available.

There are a number of questions regarding Texas' plans for developing new rail corridors that have yet to be fully resolved. Some of the most important questions regard the role that the private sector would play in construction of alternative rail facilities, whether Class I operators would use these new facilities in lieu of their own, and the proper niche for an existing corridor in a future scenario where alternative extra-urban corridors exist. The direction of the Rail Relocation effort, or at least its conception, changed rather significantly with the announcement of a Cintra proposal to build an alternative grade separated rail route from the Dallas-Fort Worth area to the Texas-Mexico border in March of 2006. This concept, which TxDOT representatives have presented to the Surface Transportation Board, has been described as a project that could be developed in the medium term, i.e., at least 5-10 years in the future (Transportation Commission, 2006). At a Transportation Commission meeting in September of 2006, Amadeo Saenz indicated that the strategy for such a project would start by resolving intra-urban issues such as Tower 55 through the construction of new tolled facilities, the revenue from which could then be re-directed to constructing interurban corridors.

If intra-urban issues such as Tower 55 or the various grade separations must be resolved prior to intercity corridor solutions being undertaken, it becomes more difficult to envision when active acquisition, construction, and operation of freight corridors along I-35 might actually begin, particularly if land values and development continue to increase. One advantage noted by ASA-ICRD regarding the likelihood of a near- to medium-term implementation was that the Austin and San Antonio options were "more planned out" than other projects and there were other activities occurring in-tandem with their analysis. For example, under the Memorandum of Understanding with UP signed in March 2005, a study to develop a Benefit/Cost analysis for both sides was planned as well as the studies TxDOT is undertaking on this planned relocation.

Chapter 6. U.S. Rail Corridor Practices

Deregulation of the rail industry under the Staggers Act in 1980 allowed DOTs and transit agencies to purchase routes for future transit use as well as gain access through shared track arrangements to corridors for commuter rail transit. At this juncture, there is a growing understanding of the importance of preserved rail corridors to the economy, environment, and social fabric within urban areas. According to Pett (Pett, 2006):

“Preserving corridors for transportation infrastructure in the nation’s increasingly dense urbanized areas is an issue of growing concern for the states leaders. The costs of providing transportation are escalating, with right-of-way costs at times representing the single largest expenditure. Yet the costs of not preserving corridors for future transportation purposes are equally disquieting: unless infrastructure improvements come on line as planned, existing systems will fail to function and quality of life will deteriorate. How we will deal with the X million additional residents projected to reside within our state’s borders... is being asked by state and local leaders throughout the nation, and particularly in the western United States where people with visions of wide open spaces are relocating at a dizzying rate. Planning for growth is top of mind for community leaders concerned about where and how this growth should be accommodated.”

Highway corridor planning is a long-standing and daily activity for cities and counties under their police power activities (see North Carolina DOT, 2004; USDOT, May 2000; Williams & Frey, 2003; USDOT, 1994). This includes comprehensive planning, or the use of official maps to designate and delineate the types of land use activity within cities and counties for future decades, as well as specific zoning and overlay zoning activity to prescribe or procure certain development standards within zones. However, planning for rail is a new development. Partnering between and within jurisdictions on rail issues is just beginning to be realized and is often a slow and cumbersome process that requires commitment and compromise. Brake (1999) argued:

[B]ecause we have codified our automobile-dependent land use patterns into zoning ordinances and embedded...regulations and investment programs with hundreds of automobile-directed subsidies and policies, it is much more difficult for transit [sic] options to be offered.

Andrews (Andrews, 1999) noted that rail planning and community livability ought to be compatible. However, new operations, increased operations, and transit operations brought multiple headaches in the early to mid 1990s. A Western Governor’s Task Force reported in 1998 that a survey of 126 communities and rail and transportation officials found that the biggest issue surrounding rail was poor communication. There were also three major areas identified in this study:

“(i) inadequate funding for improvements, (ii) obstruction, and safety at grade crossings, and (iii) adverse environmental impacts—noise, property maintenance, and air quality—caused by railroads”. (Andrews, 1999).

The tide is turning, however, and according to Pett (Pett, 2007) “it’s appropriate and smart for State Departments of Transportation cities and counties to partner on transportation corridor preservation because there are meaningful benefits and synergies to partnering.” Pett stated that the days are over when agencies contemplating highway planning don’t consider a transit component as part of this process.

The researchers identified many cases around the country in which public agencies have preserved abandoned or declining freight corridors in their entirety through acquisition or opened up new services for commuters along existing corridors through arrangements for shared trackage or shared right-of-way. Corridor acquisition and preservation efforts sometimes occur with a specific near-term future use already solidified. In other cases, public agencies choose to acquire corridors to serve a not-yet-realized future demand, sometimes using the corridors for an interim purpose such as a recreational trail. The rail banking and rails-to-trails programs are well established in many areas of the country. The success or failure of preservation programs was found to be most strongly correlated with 1) a streamlined process that minimized the time the public agency needed to solidify the deal and 2) the presence of a clearly identifiable funding source. In other instances states that were actively involved in what might be termed ‘the rail business’ to protect corridors, specifically rural, from abandonment, began to undertake a divestiture process and return commercially viable corridors back to the private sector. Michigan provides an excellent example of this process. The team also reviewed new initiatives for high-speed rail projects, including the Ohio to Erie Hub.

The team also reviewed some of the best practices that are highlighted in ‘corridor’ planning literature to review whether these were successful. The team looked at North Carolina’s preservation and permitting process; Florida’s official mapping process; and Nebraska’s ability to condemn parcels adjacent to the right-of-way.

Many cities and counties are also actively looking to the use of zoning, specifically Transit-oriented Development (TOD) type zoning, as a mechanism to ensure that compatible development occurs around stations and rail corridors. While some might argue TOD is primarily an economic growth vehicle, the benefits accruing from TOD from a land use control perspective cannot be understated. TOD developers were also, in multiple instances, mindful of the effect of TOD around rail corridors. Many were actively involved in partnering to implement quiet zones (DeWald, 2007), as well as creating developments that included stricter design elements and building materials that would offset what might be considered the adverse elements of rail: specifically noise and vibration from rail activities (Lomenick, 2007).

This section touches on examples throughout the country, including federal high speed rail corridor planning. It also includes practices highlighted throughout the literature as exemplar case studies, paying particular attention to the following case studies, which were chosen to reflect the breadth of the issue at hand.

1. Indiana’s rail corridor planning initiatives to identify state-wide rail needs.
2. New Jersey’s freight rail and land use planning inventory activities.
3. The Commonwealth Mainline Rail Relocation project near the Port of Virginia in which new freight rail track is being constructed in a preserved corridor as a part of the Heartland corridor project.
4. The Utah Transit Authority’s acquisition of a shared corridor for commuter rail operations along an active freight rail corridor
5. The New Mexico DOT’s acquisition of an active but declining freight corridor running between Albuquerque and Santa Fe for use by commuter trains

6. The North Carolina DOT's statutory authority to preserve corridors.
7. Arizona's efforts to establish commuter rail service on an expanded UP mainline between Tucson and Phoenix
8. Colorado's Front Range Relocation Project (in conjunction with UP and BNSF) and Denver's Transit-oriented Development Initiatives.
9. The State of Washington's plan to rail bank a corridor that will be abandoned by BNSF linking Renton to Woodinville, and the current debate over how to best retain its potential for transportation and recreational opportunities.
10. Florida's official mapping process.

Finally, the review of activities provides lessons learned that are applicable for TxDOT to consider as it continues rail planning and implementation activities.

First, as corridors become available agencies must be ready to act politically and financially to acquire these corridors. The Utah Transit Agency's purchase of UP's corridor in Salt Lake City and the New Mexico's DOT purchase of BNSF corridor from Albuquerque to Santa Fe were projects that suddenly came onto the radar-screen and were aggressively pursued by the requisite agencies charged with implementing rail-transit options. In these two instances the agencies showed commitment to the projects and dedicated critical staffing time to ensure their successful fruition.

Second, the backing of political leaders is critically important for projects to shift to fruition. The Salt Lake, New Mexico, and Heartland Corridor (Virginia) projects have all benefited from political backing. In the former cases Governors in Utah and New Mexico offered financial support and the 'full-faith-and-credit' of the State as the sweetener to induce the freight railroads to continue with negotiations.

Third, having a good relationship with the railroads—especially the Class I railroads—provides a mechanism to outline and deal with issues as they arise. It also puts the DOT, as was seen in the case study of North Carolina, in the position of being the first agency called if the freight railroads are looking to divest themselves of property. This gives the DOT a tremendous boost in providing transportation options.

Fourth, long-term planning, including undertaking an inventory of assets at the state and local level is critical for rail preservation and development. Successful projects have often begun life as part of an inventory plan. Once states and localities are aware of potential rail corridors it is much easier to then review land use activity surrounding corridors, in the same fashion as New Jersey, and to develop constructive working plans for revitalizing corridors.

Finally, as in most projects, the ability to find adequate sources of financing is critical, for preservation and acquisition options. The Class I railroads will not negotiate sales, or access rights unless they are assured that the "*dollars are available, and on the table*".

6.1 Rail Inventories and Planning Activities

The development of an inventory of routes that are currently used for freight and passenger services, along with current information on traffic volume and demand, is the first step in effective corridor planning. A theme that was reflected in every component of this analysis was the importance of timing. While rail corridor planning is a long-term endeavor, the most critical predictor of success is the ability of a public agency to react quickly when an opportunity to preserve a corridor or protect a corridor from a looming encroachment emerged. Therefore, it is important for the DOT to maintain an up-to-date dynamic inventory of rail activity that is cross

referenced with patterns of urbanization and land use. Such an inventory can allow the DOT to predict when corridors become candidates for either abandonment or divestiture and help to determine which of these corridors will have the most compelling public benefits. North Carolina's DOT (NCDOT), which will be treated in detail later in the report, has maintained a significant inventory of freight activity. NCDOT's Rail Division holds quarterly meetings with Norfolk Southern (NS) and periodically with CSX in order to update the maps to reflect the current strategic thinking of the railroads (Williams, 2007). Due to the fact that NS and the DOT have already successfully negotiated several corridor transfers following abandonment, NS now routinely informs NCDOT about planned abandonments before formally notifying the Surface Transportation Board. NCDOT receives a significantly longer window to determine whether the corridor should be preserved.

6.2 Legislation before the U.S. Congress Regarding Rail Development

There are currently multiple acts introduced and pending in Congress regarding rail infrastructure, including Amtrak's Fiscal Year 2008 allocation recommendations, security improvements on passenger and freight lines, railroad crossing and hazardous materials transport, and railroad safety improvement. The most important of these bills from a rail planning and funding perspective is the Freight Rail Infrastructure Capacity Expansion Act of 2007 (S.1125), introduced by Senator Trent Lott in the 109th Congress as (S.3742). On April 17, 2007, Senator Lott re-introduced this legislation to the 110th Congress. The bill is bipartisan and is aimed to encourage investment in freight rail expansion. The bill proposes to amend the Internal Revenue Code of 1986 to provide incentives to encourage investment in the expansion of freight rail infrastructure capacity. The Act would give a business credit equal to 25 percent of cost for rail property placed into service during a taxable year. A taxpayer may elect to treat any amount paid or incurred for the acquisition, construction, or erection of qualified freight rail infrastructure property as an amount not chargeable to capital account. This would allow the amount incurred to be treated as a deduction for the taxable year. The bill is currently referred to the Senate Finance Committee. Supporters of this bill include the AAR, Virginians for High Speed Rail, and the Class I railroads.

6.3 High-Speed Rail Corridor Planning

The Federal Railroad Administration (FRA) has designated ten high-speed rail corridors within the United States as of 2002. Designation allows a corridor to receive targeted funding for highway-rail grade crossing improvements, and it also recognizes the corridor as a potential center of high-speed rail activity (FRA, 2005). Figure 6.1 shows the corridor designations and how these high-speed rail projects connect to the existing Amtrak service within the U.S.

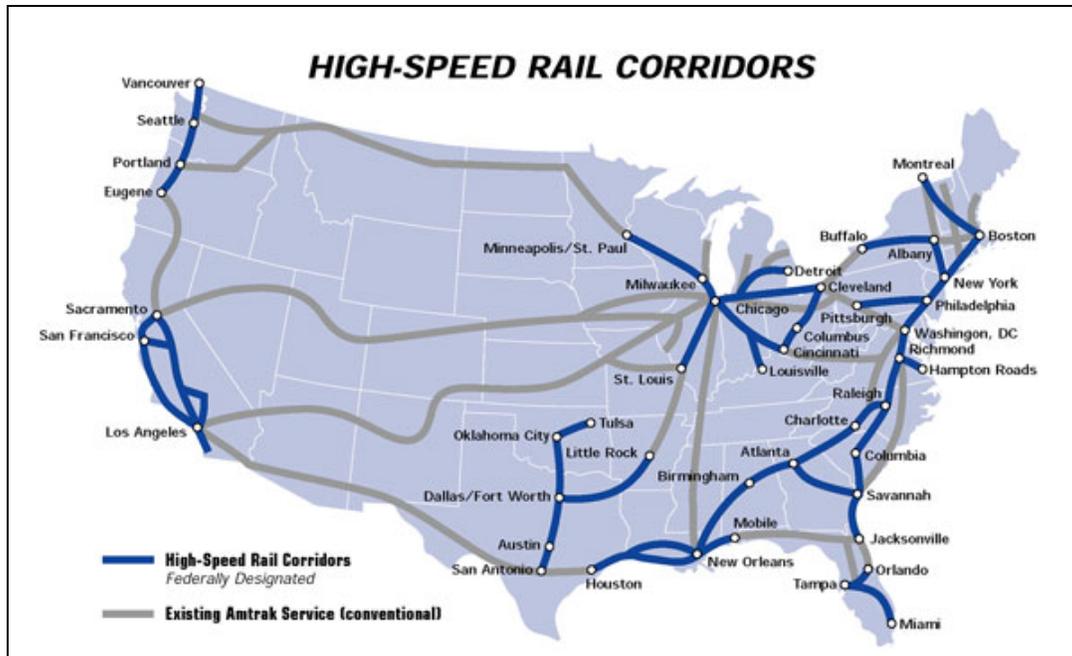


Figure 6.1: High-speed Rail Corridors and Amtrak Service in the U.S.
Source: TTI

According to the former General Accounting Office (now Government Accountability Office) January 1999 report on high-speed rail projects in the United States, many *projects were ambitious in scope in terms of ridership forecast*, and had also not determined funding sources (GAO, 1999). Ten out of the 11 corridor projects had preliminary cost estimates ranging from \$315 million to \$ 4 billion. The report noted that most corridors will use an incremental approach to developing high-speed rail networks.

6.3.2 Florida High-Speed Rail Network

Florida provides an illustrative example of the complexities in planning for high-speed rail and the importance of maintaining continued ‘political’ support. Florida was actively developing plans for high-speed rail on the federally mandated corridor between Tampa and Orlando. In November 2000 voters approved an amendment to the state constitution mandating construction of a high-speed system for the state. The objective was to link the five largest urban areas in the state with construction to begin by November 1, 2003. The amendment also required the use of technologies that will allow trains to operate in excess of 120 miles per hour. In 2001 the Florida Legislature enacted the Florida High Speed Rail Authority Act, which created the Florida High Speed Rail Authority (FHSRA). In 2002 FHSRA issued a request for proposal to design, build, operate, maintain, and finance the first phase of the project from Tampa to Orlando. Proposals were received in early 2003, and Fluor/Bombardier was selected in October 2003 as the winning consortia. FHSRA at this stage began to review the preferred alignment and entered into negotiations with Walt Disney World and the Orange County Expressway Authority for the preferred route that would begin in the Tampa CBD (along I-275, travel towards I-4 and continue in the median of I-4 to SR 417 in Orlando and onto Orlando International Airport (FHSRA –Factsheet). Figure 6.2 shows the FHSRA’s vision for high-speed Rail.

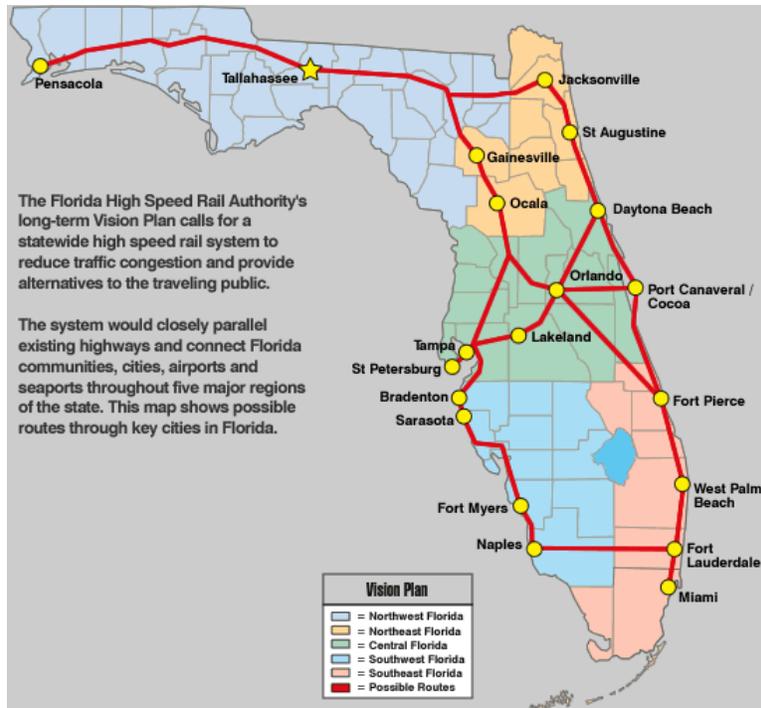


Figure 6.2: Florida's Planned High-speed Rail Network
Source: FHSRA

However, high-speed rail was dealt a blow in 2004 when voters passed an amendment to repeal the 2000 state constitutional amendment supporting high-speed rail. At the same time FHSRA determined that satisfactory progress had not been achieved on progress with Walt Disney World and the Orange County Expressway Authority regarding route choice. FHSRA re-designated a portion of the preferred route at this time from the Central Florida Greenway to the Beeline (SR 528), which eliminated the need to negotiate with the two entities. In 2004 the FRA approved the Final Environmental Impact Statement, but no action has been taken since regarding the Record of Decision. The authority since 2004 has not been authorized or allocated any further state funding and has been running on earmarks previously granted through the U.S. Congress as well as surplus funds.

6.3.3 South East High-speed Rail Corridor

The South East High Speed Rail Corridor (SEHSR), which will run from Washington, D.C. to Charlotte North Carolina (Figure 6.3), began life in 1992 after the USDOT designated five high-speed corridors, including the SEHSR corridor. In 1992 a USDOT report identified this corridor as the most “economically viable proposed high-speed rail corridor in the country.” In 1998 Virginia’s DOT, NCDOT, the FHWA, and FRA signed a Memorandum of Understanding to jointly develop environmental documentation for this corridor. This was extended south to Macon, Georgia, later that year (SEHSR, History). The Tier I Environmental Impact Statement identified nine alternatives for the corridor and throughout 2000 multiple public workshops were conducted. SEHSR is currently conducting fieldwork for the Environmental Impact Statements for various portions of the route (SEHSR). The Richmond-to-Hampton Roads portion of the

study is currently undergoing modifications based on FRA comments, and the Charlotte, North Carolina-to-Macon, Georgia study is evaluating suitability and cost estimates at present.

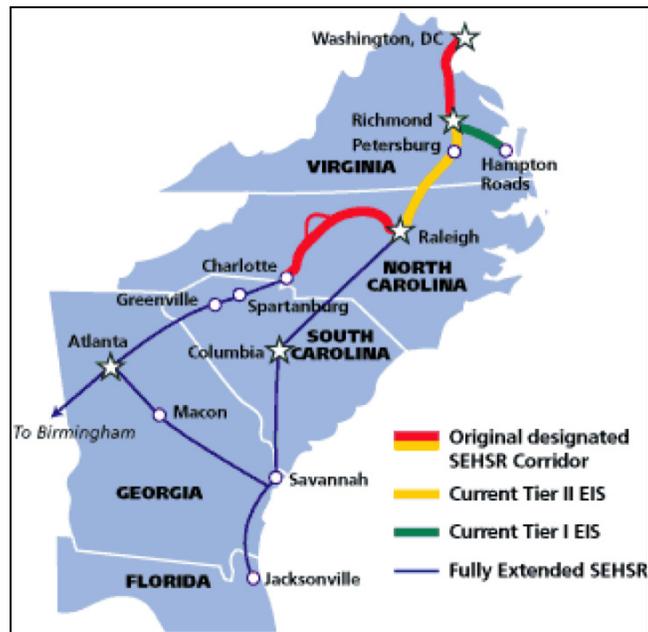


Figure 6.3: South East High-speed Rail Corridor
Source: SEHSR

This project is probably the high-speed route that is closest to achieving fruition. It is an example of the importance of multiple states committing time, resources, and political support to achieve a stated goal. Even with this continued support the project still has a series of goalposts and milestones to achieve. The Final Tier II EIS is only expected to be completed by the end of 2010 with ROW acquisition beginning at the end of this year. The route expects passenger service to begin over the preferred alternative between 2013-2015 dependent, of course, upon funding availability.

6.4 Amtrak Rail Planning

In 1970 the Rail Passenger Act created Amtrak to provide intercity passenger service because the existing railroads found this service unprofitable. Amtrak operates a 22,000-mile network providing service to 46 states. This is primarily run over freight railroad tracks although Amtrak owns 650 miles of track in the Northeast Corridor between Boston, Massachusetts, and Washington, D.C. Amtrak’s Northeast Corridor is the business railroad in North America with over 1,700 trains operating over the Washington-Boston route daily.

Amtrak has been the subject of much criticism over the years and a 2003 GAO report noted that compared to current levels of funding, substantially higher federal investment will be required to stabilize and sustain Amtrak’s existing network (GAO, 2003). Amtrak’s funding requests, the report found, did not cover future needs for service enhancement or the development of further high-speed rail corridors. However, since 2004-05, Amtrak has seen a turnaround in terms of ridership numbers and the success of its Acela Express Service on the corridor between Boston and New York. Two other corridors also had ridership that topped a

million passengers: the Pacific Surfliner Service from San Diego-Los Angeles-San Luis Obispo, and the Capital Corridor Service from San Jose-Oakland-Sacramento-Auburn (Amtrak, National Facts). In 2005 Amtrak put together a Strategic Reform Initiatives Package; this included development of corridors including partnering with state-led corridor initiatives as part of its long-term strategic objectives (Amtrak, 2005). Other parts of this strategic plan reviewed the possible addition and elimination of certain national long distance routes based on performance thresholds and a new initiative to work with the freight railroads to address congestion and bottlenecks.

6.5 Arizona

Arizona has been comparatively slower at identifying rail corridors for preservation or commuter conversion. In part, this is due to the fact that the rail connecting Arizona's major north-south city pair of Phoenix and Tucson is actually a link in the principally east-west Union Pacific Transcontinental route, which is already running near capacity.

The Southwest Rail Corridor Coalition envisions using a section of rail that was converted to inactive status by the Southern Pacific around the time of the SP-UP merger as the spine for an east-west commuter rail corridor that would improve options for passenger service between Phoenix and Los Angeles. Two options envisioned are using the existing Amtrak routes but improving the efficiency for higher speed operation, or shifting to a more regular commuter service. Importantly, the line would serve the rapidly growing region to the west of Phoenix including the master planned city of Buckeye.

The third option for establishing commuter service in Arizona would be to acquire access to BNSF that runs from Phoenix to the northwest part of the state. The advantage of this option is that the line is currently in a natural state of decline for freight traffic, analogous to the situation that New Mexico faced when it successfully acquired the line connecting Albuquerque and Santa Fe. The disadvantage of this option is that, while an economic justification could potentially be made for commuter rail given the rapid growth in the Phoenix area, almost of all of the political capital thus far invested in Arizona commuter rail has been placed on first establishing a connection between Phoenix and Tucson. Therefore, it would be difficult to propose establishing a connection to the comparatively under-populated region northwest of Phoenix before a commuter line to Tucson has been constructed.

Jay Smyth is the coordinator of the Southwest Rail Corridor Coalition and has been a vocal advocate for commuter rail in Arizona for 20 years (Smyth, 2007). According to Mr. Smyth, the state of Arizona has still not achieved the proper balance of popular and legislative support to convince the Union Pacific that the state is committed to establishing a commuter rail system. This is one of the key differences, he felt, between the experiences of Arizona thus far and New Mexico. New Mexico's Governor Richardson made it clear that trains should be running by the time he left office. The other difference, which is probably even more salient, is the fact that a ROW envisioned to handle commuter traffic on the Phoenix-to-Tucson corridor is in high demand for intermodal freight. As currently envisioned a commuter line would be constructed in the UP right-of-way as a third track. The UP is already planning to double track the entire Sunset Limited corridor; however, this new capacity will be needed exclusively for freight carriage. For this reason, commuter rail interests will likely propose building a third line that is capable of handling freight as well as commuter trains but would principally be used for commuters. The UP will be permitted to use the third track on occasion, for example, to allow a fast intermodal train to pass a slower bulk carrier. In exchange, the UP would allow the third line

to be built in its right-of-way. Other incentives that the state could provide to UP were also mentioned. These included providing state-owned land or ROW that the Union Pacific could use for new rail yards and helping to finance grade crossings that would benefit vehicular traffic as well as train efficiency.

All of the commuter rail options being examined for Arizona would be operated with diesel rather than electric locomotives. The Phoenix-to-Tucson run, however, is cleared for double stack trains, which likely means that there would not be height restrictions for catenary cables. Triple tracking may also carry benefits in reducing the amount of train idling and associated emissions, noise, and vibration.

Establishing commuter services between Phoenix and Tucson will still likely be a more costly venture than the comparative experience of New Mexico or Utah. The option of buying out the corridor and relocating freight trains outside of the urban areas has thus far not been seriously discussed.

6.6 Indiana

Indiana has been active at both the State and DOT level in reviewing options regarding its rail network and in developing rail plans.

At the state level, in 1995 the Indiana State Legislature created the Transportation Corridor Planning Board (P.L. 40) to examine the most beneficial use of abandoned rail corridors. In 1999 Indiana further amended its code regarding the acquisition of abandoned rights-of-way. Title 8 Article 4.5 Section 4.2 of the Transportation Code created a transportation corridor planning section. This allowed the Indiana Department of Transportation to determine whether the state should acquire a railroad's interest in a corridor proposed for abandonment. The DOT is required to hold public meetings in any county through which the railroad passes to ascertain their views on potential acquisition. Five main criteria are to be reviewed when considering acquisition of a railroad's interest in a corridor, including:

1. The potential for present or future use for freight or passenger travel, including the potential need for use of the railroad's interest as well as costs to maintain such interest in the interim period and any potential interim uses.
2. Preservation of a transportation corridor if it is to be abandoned.
3. Preservation for communications or utility service usage or feasibility and value for recreational uses.
4. Acceptability of proposed recreational or service use, including railroad interest in the corridor and property owners adjacent and community at large, as well as the existence of 'a willing person', whether public or private, to operate the railroad's interest in the corridor for the proposed recreational use.
5. Existence of funds to acquire the railroad's interest in the corridor.

At the DOT level, in 2002 the Indiana Department of Transportation's (INDOT) rail department conducted a rail planning process to identify rail needs in the state (INDOT, 2002). The Railroad Section at INDOT coordinates the transportation planning board activities and in 2003 developed a scope of services for the completion of a Rail Corridor Master Plan. This rail corridor preservation and development plan developed a framework to allow the board to prioritize the future use of abandoned corridors (INDOT 2003). The plan also recommended further developing state legislation revising the acquisition process for rail corridors to include three elements:

1. Give INDOT a right of first refusal on abandoned rail corridors,
2. Authorize INDOT to engage in negotiations with railroads for purchase of active and abandoned rail corridors.
3. Give INDOT means to acquire corridors through eminent domain if the purchase could not be negotiated.

In 2007, further rail activities were developed by the State Legislature. Senate Bill 105 (SB105), which passed out of the 2007 General Assembly session, allows the development of rail utilizing public-private partnerships (PPPs). SB105 added passenger and freight railroad systems to the definitions of projects that could utilize PPP financing. Under the legislation INDOT can enter into PPP for passenger or freight railroad system subject to review and appropriation by the general assembly. However, INDOT is not precluded from conducting preliminary studies or issuing RFQs or RFPs for such projects (Indiana General Assembly, 2007).

6.7 New Jersey

While the researchers found that many states perform a “rail inventory,” not all are sufficiently detailed to be useful in preservation efforts. The inventory developed by New Jersey was notable for its completeness. The New Jersey inventory was led by transit interests and established a ranking system that looked at the potential for various right-of-way options to serve future transit demand. The New Jersey plan received attention from the academic press in 1997 with an article in the *Transportation Research Record*, which explained the methodology the state had used in evaluating and ranking all of the corridors in the state. The study was mandated by the New Jersey state legislature in December 1994. Given that the ultimate purpose of the analysis was to judge the feasibility of corridors for commuter service, the screening process began with a fatal flaw analysis that eliminated the corridors that could not be used for future service due to various types of encroachment or a lack of ROW integrity (multiple owners of ROW). This screen eliminated 64 out of 178 potential corridors. Once this fatal flaw screening was complete, the remaining corridors were ranked accord to three criteria: (1) the density of surrounding developments, which was seen as positively correlated with transit demand, (2) the length of the corridors (corridors that were too short in length received lower scores), and (3) the Journey to Work (JTW) flows along the corridor.

The New Jersey State Rail Planning Process also includes a freight oriented rail plan that has been maintained and updated annually since 1975. The planning process establishes an eligibility and ranking system for rail assets that may justify one or more forms of state assistance for service retention or expansion. State assistance can take the form of a temporary acquisition and transference to state operation if the property is identified as part of the State Core Rail System. Other forms of state assistance are rehabilitation assistance and facility construction assistance (Kolluri, 2007). The latter two forms of assistance are intended to be one-time occurrences. For FY 2008, 17 projects were approved by New Jersey for state assistance. Projects included conversion from jointed to welded rail and construction of new sidings.

In December 2002, South Jersey Transportation Planning organization (SJTPO) released a regional rail study and environmental and infrastructure analysis project (SJTPO, 2002) that had been conducted over the previous two years. The goal of this study was to evaluate four existing rail corridors for infrastructure condition, environmental constraints, and required improvement costs:

- Corridor 1 - Atlantic City to Mays Landing
- Corridor 2 - Winslow Junction to Cape May Court House
- Corridor 3 - Winslow Junction to Vineland–Bridgeton
- Corridor 4 - Glassboro to Vineland–Millville

From this project the South Jersey Rail Committee would recommend to SJTPO the most feasible and cost effective opportunities for potential reactivation of passenger rail service. The project conducted field investigations, and reviewed existing rail reports, GIS mapping, and aerial photography of the corridors to ascertain urban land use activities. The study's overall conclusions were that the corridors all show some level of merit for consideration of passenger service reactivation and that no fatal flaws were found on any corridor that would eliminate it from moving to a next phase of study (SJTPO, 2002). However, there were problems regarding missing right-of-way on corridor one, and environmental challenges for corridors two and three. The project assessed the corridor's viabilities based on three areas: stations, track passing sidings and ROW, and shops and yards. For track and ROW the requirements assumed 14' track centers for double track with no station, 18' center platforms, 12' side platforms, 3' of ballast outside the ties, and a 2' drainage channel. For shops and yard locations the requirements reviewed proximity to terminal, available land, *minimal residential impact*, good highway access, and labor supply. The study identified 15 stations, some common to more than one corridor, availability for park-and-ride service, ADA compliance, and the ability to be regional transfer centers. A minimum of three stations was recommended by the study for start-up service, with stations assumed to be built around a platform length of 230'. The project found that there were not enough stations in corridors two and four to be capable of attracting ridership to warrant the sizeable capital investment required to initiate service.

A regional non-profit group congratulated the SJTPO in a position statement released in 1999 regarding the study's aspirations, commenting that "transportation officials should be congratulated for departing from 'business-as-usual' and creating a rare opportunity to affect regional and use patterns" (Brake, 1999). However, no further work has been conducted by the SJTPO on rail since this study was completed, and New Jersey Transit, which operates rail routes throughout the state, has not opened any new routes into this southern region.

New Jersey has also seen attempts by the legislature to pass a rail transit site preservation and reservation fund. The last attempt occurred in 2004 in the 211th legislature, with the introduction of A.1161, The Rail Transit Vital Site Preservation and Reservation Fund, which would appropriate \$30,000,000. The fund would be established in the General Fund as a separate non-lapsing fund and would be used to finance the advance purchase of rights-of-way and related facility sites identified by the New Jersey Transit Corporation and deemed essential for the construction and operation of proposed passenger rail transit services. The bill did not pass out of this session.

6.8 Ohio and Lake Erie Regional Rail Project

The Ohio and Lake Erie Regional Rail Project is a plan to upgrade existing freight service and introduce passenger rail on routes that connect Ohio to surrounding states. The project envisions a rail system with 1,244 miles of intercity and interstate passenger rail service with 46 stations. There would be 7 rail corridors that would connect 12 major metropolitan areas as well as smaller cities and towns. The stations would be located in downtown areas, major suburban areas near interstate highways as well as at major international airports. It would utilize

existing rail tracks and stations in many instances. Figure 6.4 outlines the vision of an interconnected regional rail network (ORDC, 2007a).



*Figure 6.4: Ohio and Lake Erie Regional Rail Project
Source: ORDC*

The project is part of a state initiative led out of Ohio's DOT to expand transportation capacity and improve the rail system for passenger and freight. The Ohio HUB portion of the project is being led by the Ohio Rail Development Commission (ORDC). The ORDC spent much of 2004 and 2005 seeking input from multiple states and stakeholders including the cities of Toledo, Lima, Cincinnati, Springfield/Clark County, Dayton Cleveland, and Columbus, regarding this initiative. The project has also had participation and input with the two Class I railroads in this area—Norfolk Southern and CSX (ORDC, 2007b). The initial study on this project was released in 2004 and a feasibility study and economic impact report was released in 2007. The Ohio HUB portion of the study is an 860 mile "Cleveland Hub" with four lines that radiate out of Cleveland to Cincinnati, Detroit, Pittsburgh, and Toronto. Figure 6.5 outlines the preliminary system plan within Ohio's HUB.

While the project is still in the conceptual stage, it is the first step towards creating a regional vision for rail. The initial project feasibility studies have incorporated critical assumptions into their financial analyses including compensation to the Class Is for use of their land and facilities and how these expenses will be incorporated into capital and operating cost estimates. Part of the feasibility study has reviewed the need to preserve freight railroad right-of-way and identified specific local projects where such preservation was needed. The multiple workshops that were held also began to identify partnership arrangements that could be implemented as well as other resources including access to former studies on commuter rail, and also MPO staff also noted that providing maintenance on freight right-of-way could qualify the project for tax credits (ORDC, 2007c).



Figure 6.5: Ohio and Lake Erie (Ohio HUB) Regional Rail Preliminary System Map
 Source: Ohio DOT

6.9 Washington

Freight corridor planning is a topic of critical importance in Washington State. The Freight Action Strategy for the Seattle-Tacoma (FAST) corridor project is an attempt to improve the ability of Washington State and in particular the ports of Seattle and Tacoma to facilitate the movement of containerized cargo to inland destinations. The goal is to move the freight more efficiently out of urban areas and onto mainline railroads so it does not clog the urban transportation system or hamper the port's ability to grow. This is viewed as a critical priority for Washington State since one out of five jobs is related to international trade (FAST, 2006).

Rail is important for Washington's patterns of trade growth given that over 70% of the trade that comes into the ports of Seattle and Tacoma moves out of state and is therefore rail competitive. Figure 6.6 shows the freight rail capacity in Washington. FAST was set up to address system gaps in which no single entity "owned" the problem (McDonald, 2003). The FAST master plan is a series of incremental improvements, principally grade crossings that are designed to produce operational enhancements for existing corridors. As such, the FAST master plan does not produce any new double-stack capable corridors. With most of the FAST projects nearing completion, the State of Washington is considering a more ambitious tunneling project that would open up the east-west corridor from the Port of Tacoma to double stack and thereby relieve congestion that currently must move through Portland. Intermodal trains are currently unable to access the Stampede Pass corridor due to height restrictions. A recent study commissioned by the Washington State Transportation Commission—the Washington State Rail

Investment Plan—recommends crown cutting Stampede pass to enable directional running on the Stampede and Stevens Corridors (WSTC, 2006). The upgrading of the Stampede pass corridor would also require the lengthening of sidings and the construction of new track from Lind to Ellensburg (WSTC, 2006). This tunneling arrangement would therefore have a similar impact on the intermodal connections for the Puget Sound ports that the Heartland Corridor will have for the Port of Norfolk in Virginia.

Washington’s State Transportation Commission held a series of ‘regional listening sessions’ throughout 2006 to accompany the report on Washington State’s Rail Capacity and System Needs (WSTC, 2006). Sessions were held in Vancouver, Seattle, Tri-Cities, Spokane, and Central Washington throughout April and May 2006. Over 300 stakeholders were in attendance at these meetings, ranging from ports, county and city officials, MPOs, media, transit agencies, the military, and private companies.

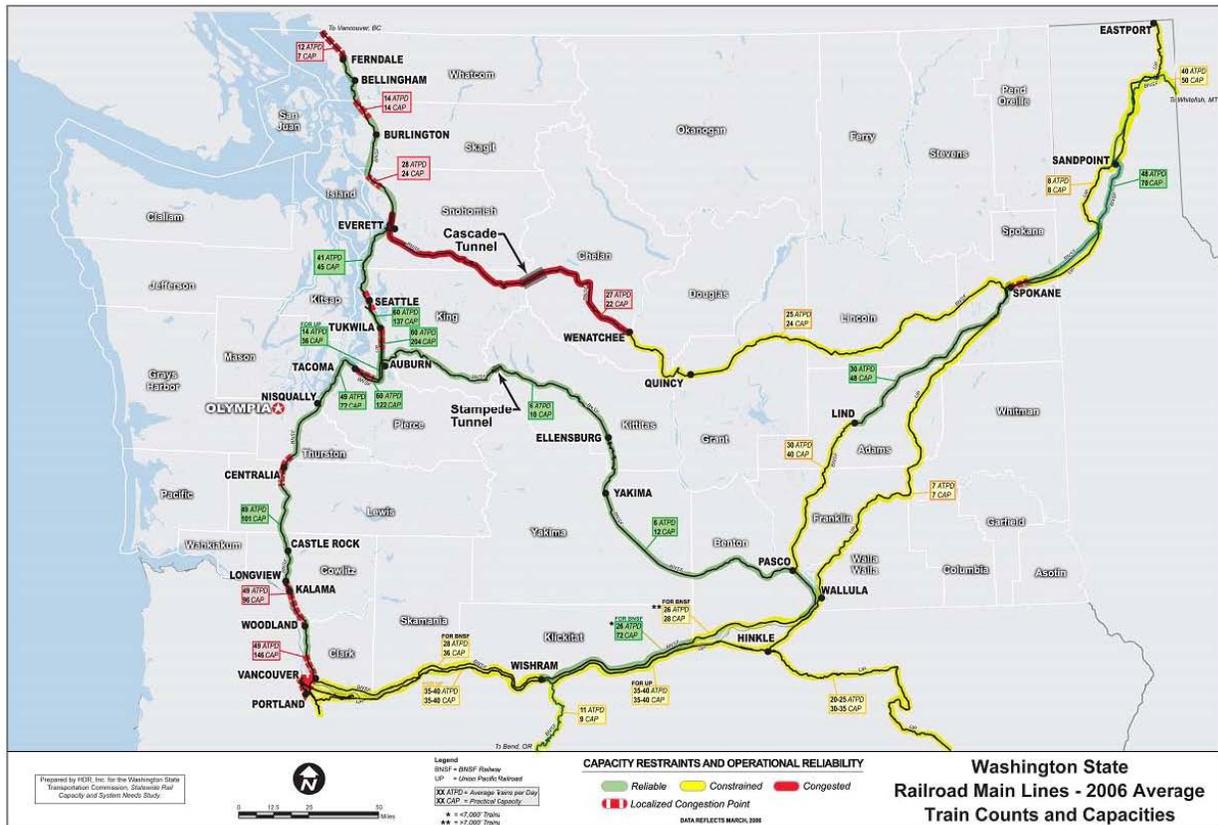


Figure 6.6: Washington Statewide Rail Capacity
Source: Statewide Rail Capacity and System Needs Study

6.10 Rail Corridor Preservation

Multiple states have undertaken preservation projects. Some of these have been initiated at the state level and others have been undertaken by local jurisdictions. Preservation is undertaken in multiple guises: rails-to-trails or rail banking, advance acquisition or purchase, shared corridor projects, and new start projects (mostly light rail projects in central cities).

6.11 Rail Banking

The concept of *rails-to-trails*—in which an underutilized or abandoned freight line is converted to recreational trail use—has sometimes received a lukewarm reception from transportation planners who feel that some of these corridors may again be needed in the future to handle elevated freight demand. *Rail banking*, in which a corridor is converted temporarily for trail use with the written understanding that freight or passenger operations could be re-established in the future, is a compromise solution that can, at least in theory, address the need for recreation and future transportation demand.

Federal legislation for rail banking was first created in 1983, spurred in large part by the high rate of abandonments by freight carriers (Rails to Trails Organization). In a rail banked line, it is possible to remove the obsolescent rail components such as old rail and ties that may interfere with trail activity but keep in place the more permanent structures such as bridges and trestles. An application to restore service on the line must be made through the STB. The protocol for abandonment and acquisition is complex since each rail corridor has a different pattern of ownership. The rails-to-trails conservancy describes the average rail corridor right-of-way as a “hodgepodge of conflicting ownership claims” with the rail lines owning some property outright (fee simple) while holding easements on other parcels. The heterogeneity of agreements for corridors is reflective of their age. The legal language used in assembling the corridors, many of which date from the 19th century, is arcane and sometimes imprecise, which can lead to challenges from land owners (Lathrop, 1998). A reversionary easement means that the land will revert back to the original owner if use as a rail corridor is discontinued.

6.11.1 Washington’s Eastside Rail Corridor

A significant rail banking initiative is currently being developed in Washington State as BNSF is in the process of transferring ownership of its Woodinville subdivision (Eastside line) in northern Washington to public ownership. In this case, it was the railroad that made first contact with the state DOT. The process is now in its fourth year; the initial overture was made in 2003 (Puget Sound Regional Council, 2007). The WSDOT went through a series of steps in order to determine whether sufficient public interest existed to preserve the corridor for transportation or recreational use. Given that the corridor was entirely located within two adjacent counties, authority for negotiating with BNSF was transferred to the Puget Sound Regional Council. The researchers spoke with Sean Ardussi (Ardussi, 2007), a planner who has worked with several of the corridor initiatives related to the FAST project. Mr. Ardussi stated that the BNSF example was the clearest case of true corridor preservation in the state.

This railbanking case is unique for a number of reasons. The first is that PSRC was able to commit itself to preserving the corridor even prior to determining the specific future use from the corridor. Options considered for future use included everything from a pure hike and bike trail to high-speed commuter trains. Another unique factor was the role of the federal government in financing an analysis of potential future uses for the corridor, and the Port of Seattle in offering a tripartite land swap in which the Port of Seattle purchases the right-of-way from BNSF and gives the corridor to King County. The county would then hand over an aviation facility (Boeing Field) to the Port of Seattle (which also manages the Sea-Tac Airport). Further adding to the complexity, the deal that BNSF, at the time of this report, was attempting to negotiate with King County would also allow for the construction of a new rail yard in the Tacoma area to serve growing intermodal volumes (Ervin, 2007).

The fact that BNSF initiated the idea of corridor transfer and was therefore ‘on-board’ from the beginning of the process allowed WSDOT and PSRC a significant amount of breathing space to meticulously plan the process. The five-year timeline from BNSF’s initial overture to the present day allowed the PSRC to gain a much better understanding of how the corridor will advance the public interest before allocating public funds. In addition, there is no pressing need for rail service that is being set back by working through the process given that the alternatives analysis deduced that regular rail service, for either freight or passenger, would only be potentially valuable for the corridor at some point after 2020. The only regular user of the line affected by the delayed transfer of the corridor to King County has been the “Spirit of Washington Dinner Train,” which has run a regular tourist train along the line but will be forced to discontinue the service at the end of July, 2007, principally because the line is still owned by BNSF. In addition, BNSF has agreed to allow the WSDOT to demolish a trestle currently used by the dinner train in order to expand IH 405 near Bellevue, Washington (Roe, 2007).

There is a continuing debate among stakeholders in Washington about whether the arrangement to retain the corridor “for future rail use” is realistic. An alliance called All Aboard Washington has argued that, in practical terms, once a rail corridor has been given over to trail use it is almost impossible from a political standpoint to re-establish rail use on the corridor in the future. The researchers spoke with Lloyd Flem (Flem, 2007), who is the Corporate Affairs Director for All Aboard Washington. Mr. Flem, who spent his career as an urban planner and formerly lobbied on behalf of Burlington Northern Santa Fe, argued that the belief that this commuter line would not work (because it did not connect existing town centers) relied on outdated concepts of commuting that do not recognize the recent preference of large employers for locating in suburban or greenfield areas. In essence, Mr. Flem believes it is important in a railbank arrangement to keep the physical rail structures in place even in cases when there is no active rail service because the public will, psychologically, continue to regard the corridor as a rail corridor that is being used as a trail rather than as a purely recreational facility. Louis McGrody, head of the Bicycle Alliance of Washington who advised PSRC on the corridor evaluation, stated that the alliance had no objection in theory to a shared rail/bicycle corridor given that the ROW was of sufficient width to accommodate both uses (McGrody, 2007). It should be noted that a shared ROW for a bike and commuter trails is planned for implementation in Dallas and Santa Fe.

As an example of why a long-term focus might be necessary in this case, Mr. Flem cited the example of the Stampede Pass line that runs through the Cascade Mountains. Usage of the corridor was deactivated in 1983 by the Washington Central Railroad (acquired by BNSF after Staggers Act deregulation) due to high maintenance cost and low usage. By 1990, the BN was considering abandoning the line in order to convert it to a trail. The State of Washington, aware of the future utility of the corridor for freight, approved \$5.2 billion to purchase the corridor from the BN, however, the BN decided to retain the corridor for itself rather than sell it to the state, which could eventually be seen as a competitor. Mr. Flem, along with three state senators and officials from the WSDOT lobbied BNSF in 1991 not to break up the corridor for use as a trail or other non-transportation related function.

6.12 Short Route Acquisitions

6.12.1 Michigan

In 1976 Michigan began an active role within the freight rail business “in response to the Federal Government’s attempt to restructure bankrupt railroads in the northeast and midwest regions of the United States” (MDOT). Michigan was in jeopardy, as a consequence of the federal program of losing, mostly through abandonment, approximately 1,100 miles of track: almost 35 percent of Michigan’s rail network. Most of this loss would be concentrated in rural areas, which would cause serious economic harm according to the DOT, not only on the rural areas of the state but on Michigan’s overall economy. Ramifications included curtailment of industrial expansion and economic development; increased energy consumption; increased food and merchandise costs for urban and rural consumers; and the elimination of numerous railroad, industrial, and agricultural jobs.

Michigan opted to protect the public interest by implementing a comprehensive railway program that was geared towards providing and maintaining an adequate and ‘efficient’ network. Out of 1,100 miles originally proposed for abandonment by the United States Railway Association, Michigan determined that 900 miles was worth retaining. Some of these lines were leased and some were purchased by the DOT (MDOT, 2007). The major objectives of this program were to retain all needed rail service; monitor and conduct an assessment as to the overall viability of subsidized rail lines; and assist in administrative and operational realignment of those rail lines worthy of service retention. The DOT is now in the final phase of returning these properties to the private sector as the DOT has decided that the objectives of the program have been addressed. Legislation enacted in July 1998 required MDOT to divest four defined rail segments. The objective was to return commercially viable rail operations to the private sector and minimize state involvement where it is not necessary to the State's transportation goals. The divestiture is accomplished using a competitive bid process. The criteria for sale is that the bidder who exhibits the greatest potential for providing continuous, efficient, and reliable rail service which, when coupled with an offer of compensation, represents the highest value to the State (MDOT). The first sale took place in November 2000 for the Lenawee County Railroad System. The state is now in the process of closing on a sale for the second rail segment (Hillsdale County Rail System) and proposes to offer the remaining two segments (Ann Arbor and Northwest Michigan Systems) at a later date (MDOT).

6.12.2 North Carolina

North Carolina has particularly broad enabling legislation for railroad corridor preservation through acquisition. The North Carolina General Assembly, in legislation passed in 1998, considered “preservation of rail corridors, through...state acquisition of strategic corridors, [to be] in the public interest and is an integral and necessary part of a balanced transportation system.” (North Carolina. General Statutes Annotated (NCGSA) § 143B-361). NCGSA § 160A-498 provides that:

A city or county may acquire property, by purchase or gift, to preserve a railroad corridor established by the Department of Transportation. A city or county that acquires property to preserve a railroad corridor may lease the property or use the property for interim compatible uses until the property is used for a railroad

According to Shirley Williams, Director of Planning and Environment for the Rail Division in North Carolina's Department of Transportation (NCDOT), the legislation was created at NCDOT's behest (Williams, 2007). The rationale behind its development was the emerging pattern of abandonment and the loss that these critical linear corridors could have on economic development statewide. The DOT needed to inventory and evaluate their importance for the local community as well as create a strategy to preserve these linear corridors because they are difficult to re-assemble once they are abandoned. There is no specific funding source for these activities: the general fund is used for corridor purchases. Table 6.1 shows purchases to date.

Table 6.1: North Carolina DOT-Owned Rail Corridors (in order of acquisition)

Corridor	Location	Date acquired	Length in miles	Cost
Murphy Branch	Andrews to Murphy	7-18-88	14.23	\$650,000
Franklin county	Franklin to Louisburg	11-2-90	9.6	\$162,108
Piedmont & Northern (Charlotte)	Charlotte	11-27-91	0.77	\$186,000
Piedmont & Northern (Mt. Holly)	Mt. Holly to Gastonia & Belmont	12-5-91	11.6-main 3.0-spur	\$481,221
Maiden Branch	S. Newton to Lincoln co. Line	4-13-93	6.93	\$130,000
Wilmington & Weldon	Wallace to Castle Hayne	8-4-94	27.1	Donation from CSX
Durham & South Carolina	Durham NC 54	8-18-95	5.07-main 3.07-spur	\$2,875,000
Durham & South Carolina	Chatham Wake Co. line to New Hill	8-18-95	7.35	
Lincolnton (C&NW)	Lincolnton	1-27-97	0.61	\$144,000
Durham & South Carolina	Fayetteville Street to Chatham Wake Co. Line	8-6-98	6.34	\$425,000
Warrington Lead	Fourth Street to McRae Street	6-12-02	0.25	\$1
Nash County	Morreyer to Spring Hope	11-2-05	4.3	*
Forsyth County	Downtown Winston-Salem	12-2-06	2.0	* ¹⁷
Total			102.22	

Source: NCDOT

¹⁷ Data not supplied for these two acquisitions

NCDOT is authorized, pursuant to NCGSA § 136-44.36A, to preserve rail transportation corridors and permit interim compatible uses of such corridors. NCDOT has used this statutory authorization to craft a rail corridor preservation policy. While most of the policy is focused on interim uses *within* the delineated rail corridor, it does pay cursory attention to the issue of development of property *adjacent* to the corridor:

Residential development along a corridor shall not interfere with the ultimate purpose of the corridor. Commercial and industrial development along a preserved corridor shall not adversely impact the corridor. NCDOT will coordinate with local planning agencies to encourage land development which will be harmonious with the development of the preserved rail corridors and future transit options.

According to Williams (Williams 2007), the statutory authority allows the DOT to coordinate with counties and cities in discouraging encroachment of incompatible land uses.

There is concurrent authorization for cities, regional public transportation authorities, the North Carolina Turnpike Authority, and the state DOT to adopt transportation corridor official maps (NCGSA § 136-44.50(a)). After a transportation corridor official map has been filed, building permits cannot be issued for any structure or subdivision within the corridor until the Secretary of Transportation (or his designee) has approved the request (NCGSA §136-44.51(a)). Delay of issuing permits is limited to three years from the date of original request.

In 1988 the North Carolina General Assembly passed the Corridor Preservation Act. This provided the North Carolina Department of Transportation (NCDOT) with authority to purchase railroads and preserve rail corridors for future rail use and interim compatible uses. The legislation declared that it was a public purpose for NCDOT to reassemble critically important lost portions of rail corridors by condemnation (NCDOT).

According to Williams (Williams, 2007), the Rail Division does not have strict criteria for evaluating corridors. They are identified based on their importance to existing business and their potential for future transit use as well as how near-term the projects appear taking public use considerations into account. Pam Davis (Davis, 2007) noted they look at highest and best use, the functioning use and density, as well as freight service and commuter needs and economic development opportunities. According to the DOT they are not necessarily striving to achieve a contiguous service, the review is undertaken project by project and, also, as and when abandonment arise.

According to Williams, the reasons for declining purchase of a corridor include the corridor's location in a residential area that won't have industry or economic development, or if it is a small piece that is not viable. NCDOT also does not get involved in the day-to-day activities or provide funding for rails-to-trails according to Davis (Davis, 2007). However, NCDOT is fully aware that the "safest thing to do is to take a rail-trail and put it into an interim use which will then convert back to commuter rail when the jurisdictions are ready." NCDOT is well aware that this protects them from adjacent property owners who often imply that they want the ROW to revert back to them if it is abandoned. An example is the American Tobacco trail, where they have left the rails down, and designed the trail around it. This leaves the options for future use open.

While they don't actively work on rails-to-trails, they will work with local communities and provide technical assistance to see if they are interested in preserving corridors. According to Williams, the state legislation helps local cities develop a framework to advance efforts and it

has facilitated interest and coordination between the various jurisdictions since its inception. For example, occasionally, cities approach the DOT regarding preservation. A recent example cited by Williams and Davis was the city of Greensborough. The city approached the DOT about a rail line that may be abandoned or considered for abandonment by Norfolk Southern. The city wants to encourage this and use the route for a rail trail. The rail division met with the city and provided technical assistance. The DOT, however, will let the city take a lead role in this. One of the reasons that the DOT will review rails-to-trails activity if asked by localities is the possibility for future commuter rail. The Greensborough rail route, for example, has had some preliminary work done regarding commuter activities by the division. The DOT also recommended to the city that they talk to the regional planning agency to see if this falls within their long range plan.

In other instances Norfolk Southern and shortlines have also approached the DOT first regarding a potential abandonment before making inquiries for filing with the Surface Transportation Board (STB). According to Williams, while they don't necessarily have a system for projecting potential abandonment, they meet quarterly with NS with whom they have an excellent relationship. NS keeps the DOT up-to-date regarding their business strategies as well as providing information about routes that are potential candidates. It takes approximately one year from time of notice to abandonment, so having a good relationship with the Class Is and shortlines is critical to ensuring success.

The research team asked if there were any limitations on the amount of ROW the DOT would consider purchasing. Williams noted that they usually buy only what they need, although on some occasions they might buy extra parcels for park-and-ride lots, maintenance, and other upkeep facilities.

North Carolina's rail corridor preservation policy represents the only explicit language in any state statutory, administrative, or guidance scheme directed at incompatible use along rail corridors.

6.13 Shared Track Arrangements

As rail is being viewed more and more as a critical component to reduce congestion and increase capacity, passenger rail becomes increasingly important as an option for providing mobility in many urban areas. However, because of the shortage of readily available ROW in urban areas and especially in densely populated areas, the use of existing freight corridors often provide the only alternative for developing passenger service. This requires the public agencies to negotiate with the freight railroads to share track. However, given the constrained capacity of the national freight rail system, and the necessity of providing transit service with minimum headways during peak periods, this often puts the two parties (public party and private operator) into conflict (Prozzi et al., 2006). As Prozzi, et al. noted, there is no single best shared use agreement that serves all situations. The freight railroads also want to provide their customers with a reliable service, making the most profitable use of their ROW and track. So they will only allow use of the rail track for passenger service under specific conditions. These include assurances of safety, no expectations of cross-subsidization of passenger rail services (i.e., the freight railroads are reimbursed for costs incurred), no negative impact on freight service, and that liability issues can be resolved in *good faith* with liability held at a *manageable* level (Prozzi, et al., 2006).

As will be noted in Section 8.15 on corridor purchases, these issues do not disappear if the route is bought *in fee*; consideration for the freight rail service activities will be negotiated and included within the negotiated agreement.

6.13.1 New Jersey River Line

The New Jersey River line is an example of a successful shared used corridor that resulted from the divestiture of track by the Norfolk Southern to a commuter rail operator who continued to allow a limited number of freight trains to use the track. The route is approximately 30 miles and runs from Camden to Trenton, NJ. Diesel powered commuter trains currently depart every 15 minutes during the AM and PM peak periods and every half hour for the rest of the day. Freight usage of the line remains minimal and is restricted to night operation.

Craig Lewis, Vice President of Norfolk Southern, cited the River Line in order to illustrate the potential difficulties that can be encountered in transitioning a rail line from exclusive freight use to dual use. Despite heavy political support in New Jersey, the River Line plan suffered from multiple delays tied to resistance from freight clients and the FRA. Given that the line was significantly under capacity, the introduction of passenger service was seen as a way to justify retaining the line as an operational freight carrier. The FRA, however, initially denied the right for the line to operate both services simultaneously. A compromise was reached in which freight trains would only be allowed access to the line at night. This restriction further alarmed freight interests who felt that the limitation would hamper the competitiveness of the line. Despite significant cost overruns in its construction, the ridership on the River Line has exceeded expectations and there have been no significant reports of problems for the freight customers on the line due to the nighttime deliveries.

6.13.2 Washington State Activities

Washington State's involvement with rail corridor preservation/enhancement is multifaceted. The FAST program, which is principally a grade separation project, is treated separately in the report. The majority of the state's corridor acquisitions have been for the purposes of preserving underutilized shortlines for agricultural use, or preserving corridors in rail banking arrangements for recreational or future transportation purposes. In the eastern part of the state, corridor acquisition of abandoned lines has been treated principally as a form of support for agriculture. In the western part of the state, acquisition has been geared toward future commuter use or recreation.

As an example of acquisition activities on the eastern side of the state, the DOT acquired a series of shortlines near Spokane that feed BNSF or UP. A shortline at Hooper, which carries wheat, had fallen into disrepair due to decades of deferred maintenance and was being abandoned in favor of trucking by shippers. The acquisition was first proposed in 2002 and completed in 2007. The cost to the state was approximately 20 million dollars for the acquisition and an additional 7 million for rehabilitation. After rehabilitation is complete, the line will be operated by a third party. The primary goal for the DOT was not to dramatically improve the usage of the line in the short term but rather to hold the line to serve projected agricultural growth in the region. This area of eastern Washington is expected to produce a significant amount of soy biodiesel in the next decade.

Another state acquisition that was a noted success story was a 30-mile shortline acquired in the early 1990s by the state near Yakima. The Yakima nation built a timber processing plant on the line and it now runs regular freight.

The use of shared track for commuter rail has also developed in Washington with the Sounder commuter train operating between Tacoma and Everett along the active BNSF mainline. Sound Transit negotiated the track sharing agreement with BNSF in 2000. The deal required Sound Transit to pay \$285 million to BNSF in track improvements as well as a \$4 million annual usage fee (Railway Age, 2000). The agreement gave the Sound Transit the right to run up to four trains a day on the BNSF line. Trains started running in 2003 and Sound Transit has been slowly increasing service levels and ridership, yet ridership figures are still below initial projections.

6.14 Linear Corridor Purchases

6.14.1 Colorado

In 1998, the Colorado Legislature instructed the Colorado Department of Transportation to purchase the 121-mile Towner Railroad Line in Southeastern Colorado from the Union Pacific Railroad. The state contribution to this purchase was \$10.2 million. The purpose of the statute authorized by the legislature was to ensure the continued operation of rail service on the line by a financially responsible railroad operator. In December 1999, pursuant to agreement with the State of Colorado, the Towner Line was leased to and operated by the Colorado, Kansas & Pacific (CK&P) Railway Company. The operator went into default in 2001 and there is currently a new RFP in process to obtain a new operator for the line. CDOT is currently in negotiations with V & S Railway Inc. to purchase the Towner Line. The final terms of the agreement may impact operations with the K&O. However, at this time the terms are not finalized, and therefore the researchers cannot specifically report on the potential impact.

6.14.2 New Mexico Rail Runner

The example of the New Mexico Rail Runner is notable due to the speed with which the DOT was able to negotiate and purchase the corridor from BNSF and convert the line from an exclusive freight carrier to a line that is predominantly passenger. The BNSF line New Mexico acquired had been identified by the DOT as a prime candidate for conversion due to the declining volumes of freight that were being carried over the line and the fact that alternative routing existed. The researchers interviewed Chris Blewett, Director of Transportation and Planning for the Middle Region Council of Governments (MR-COG), who led the negotiations with BNSF on behalf of the state of New Mexico (Blewett, 2007).

Despite the fact that freight had declined on the BNSF line, there is no indication that BNSF was seeking to divest of ownership for the foreseeable future absent a compelling offer from the state. Chris Blewett stated that his initial overtures to BNSF were repeatedly rebuffed. The principal concern of BNSF, it appeared, was that the state of New Mexico would not follow the deal through to fruition. BNSF had a certain amount of justification in this concern given that the attitude toward a commuter rail connection between Albuquerque and Santa Fe had long been lukewarm. According to Blewett, for decades the state had been financing rail feasibility analyses to demonstrate that commuter rail would not be a cost effective solution.

Although establishing the commuter rail had been a key part of the Governor's agenda since 2003, the attitude of the railroad began to change when New Mexico committed to put a significant amount of its own money into the concept rather than electing to wait for an uncertain federal allotment. The seriousness of the New Mexico position was further enhanced by a 2005 report stating that the establishment of commuter rail service between Albuquerque and Santa Fe

was the locally preferred alternative for enhancing corridor capacity (MRCOG, 2007). Once the railroad had agreed to the deal in principal, it took an additional six months for Mr. Blewett and others to negotiate the technical details of the transfer, including the final acquisition cost of \$76 million dollars, which included not only the corridor to Santa Fe but also a number of future miles to the north.

The initial stretch of commuter rail, which operates from Albuquerque to Bernalillo, uses the existing BNSF track. The extension to Santa Fe, however, will rely on a hybrid of three different corridors: the acquired BNSF mainline; new track construction through a preserved corridor (Community District Corridor) that parallels I-25 to the east; and the local Santa Fe Southern in order to access downtown Santa Fe. The Community Corridor was chosen over an alternative route that had pre-existing track but was significantly less direct and slower. The final section of rail that services the downtown requires substantial upgrading in order to be suitable for passenger use. For example, the current rail is jointed rather than continuously welded (New Mexico Rail Runner, 2007). As the researchers learned from Professor Barkan (Barkan, 2007), the use of jointed rail is almost certainly a non-starter for commuter rail operations due in large part to noise considerations. Another complication in the use of the Santa Fe Southern rail corridor is the existence of a hike and bike trail along certain portions of the track.

6.14.3 Utah's Transportation Corridor Activities and Funding

Utah has seen multiple activities regarding corridor preservation and rail corridor preservation and planning activities. Most importantly, in 2001 the State of Utah created a Transportation Corridor Preservation Revolving Loan Fund. In 2005 the state legislature passed Senate Bill 8, which allowed respective county governments to impose a fee of up to \$10 per vehicle registration for the purposes of corridor preservation. These funds are to be used in the county in which they are generated and are to be held by Utah Department of Transportation (UDOT) on behalf of the local governments. The county council of governments has the duty, under the legislation, to prioritize the use of these funds for the purposes of corridor preservation, provided that the corridor to be preserved is first identified in the Regional Transportation Plan adopted by the Salt Lake/Ogden regional MPO, The Wasatch Front Regional Council (WFRC). The fund authorized counties to create a fund for the explicit purpose of preserving *transportation corridors of regional significance* (WFRC Corridor Factsheet).

UDOT has ultimate responsibility for the Corridor Preservation Revolving Loan Fund, which can be used for the acquisition of properties within a corridor that have the potential to substantially impair the viability of the transportation corridor for transportation purposes. These financial resources are made available for hardship and pre-emptive acquisitions only if there is a willing seller. Eminent domain cannot be used for corridor preservation property acquisition. Under the terms of the original 2001 Act, UDOT established procedures for the administration of the fund, including the application process for fund monies; procedures for the award of monies by the Transportation Commission; repayment conditions; and establishment of a corridor preservation advisory council committee (Utah Administrative Code R926-6). Under these rules any land acquisition projects must fall within the WFRC's Regional Transportation Plan. UDOT and the WFRC are responsible for working cooperatively in providing local governments with specific corridor information, the criteria used for prioritizing the use funds from the Revolving Loan Fund, as well as information on the use of planning tools and techniques.

The WFRC created a corridor preservation committee after the Revolving Corridor Fund Act was passed. This committee (along with the regional growth committee) is tasked with

responsibility for regional corridor preservation. However, both of these committees provide advice to the MPO and make recommendations for future preservation. The Committee's primary responsibilities include:

1. Provide recommendations on corridor preservation techniques and evaluate problems and issues as they arise;
2. Provide educational opportunities to local jurisdictions on specific corridor location and preservation tools information;
3. Provide recommendations on the Region's priorities on specific corridors for which preservation actions should be taken; and
4. Make recommendations to the Advisory Council on the use of Corridor Preservation Funds for acquisition of properties in the Region.

According to Barbara Thomas, Planner at WFRC, the corridor fund is split into two funds (Thomas, 2007). One uses a vehicle registration fee for corridor preservation. The other fund uses sales taxes levied by individual jurisdictions. Salt Lake County Council and the Weber and Davis County Commissions, for example, all levied a \$10 vehicle registration fee to fund local transportation corridor preservation. However, the State Legislature, under Senate Bill 69 (SB69) that passed in 2007, mandated that Tier 1 counties (there is only one in Utah) could only use the fund for highway preservation projects (Thomas, 2007). SB69 mandated that 70% of the Salt Lake County registration fee will go toward corridor preservation for the Mountain View Corridor (only), effective July 1, 2007. SB69 also required that a priority list of transportation projects for corridor preservation should be created. Under the Revolving Fund both UDOT and local areas can apply for funds. Appendix A shows the application form for the local corridor preservation fund. According to Thomas, the fund has not been used for any rail projects since its inception. However, two other counties are proposing to put sales tax propositions on their ballots for late 2007 for highway and transit projects. Both are ¼ cent sales tax increases. One will be split 75/25 percent for highway/transit; the other county is opting to use a 65/35 percentage split for highway/transit projects (Thomas, 2007). For corridor projects that have been reviewed Thomas noted that zoning changes have not taken place thus far. However, a proposed highway corridor project that runs through agricultural land is expected to be rezoned by the different jurisdictions as a consequence of the highway development.

The Salt Lake area also saw a large rail corridor acquisition project take place in September 2002. According to Kathryn Pett, counsel for Utah's Transit Agency (UTA) (Pett, et al., 2006), the purchase of 174 miles of rail corridor presented an opportunistic approach to corridor preservation. The project is instructive for the purposes of this study for a number of reasons (financial, operational, and contractual), and as a case study in how much effort is required from multiple parties to bring an acquisition process to fruition.¹⁸

After the Union Pacific (UP) merger with Southern Pacific (SP) in 1995, WRFC commissioned a feasibility report and alternatives analysis on the merger's implications for public transportation in the region. This was followed up in 1998 when WRFC undertook a study regarding the possibility of freight and passenger rail coexisting and sharing track. At the same time UTA (a political subdivision of the state whose jurisdiction covered the six-county region that comprises the Wasatch Front) organized an interdisciplinary team (comprised of planners,

¹⁸ This section has been adapted from Kathryn Pett and Denise Drago's article in NR&E – Transportation Corridor Planning and Preservation in an Urban Environment and from a telephone interview with Ms Pett by the research team.

engineers, environmental consultants, railroad operation specialists, and real estate appraisers) to study the possibility of acquiring rail corridors in the Salt Lake region. The team concluded that the UP/SP merger “created a unique opportunity to preserve 175 miles of corridor for future transportation purposes” (Pett, 2006 & 2007).

According to Pett, the backbone of the undertaking was the purchase of the 120-mile mainline corridor from UP. At the time UP was running about 60 trains a day. Purchase of the real-estate took three distinct ownership forms but was mostly an ‘in-fee’ ownership pattern. The three forms of ownership are (1) shared corridor by UTA and UP (blue segments on Figure 3.2), (2) UTA operating over UP track (green segments), and (3) UP operating over UTA track (red segments). Total costs for acquisition were \$185 million. UTA also purchased three yards, an intermodal facility, maintenance facility, and transfer yard. They also acquired parcels for park-and-ride facilities. Purchasing the excess corridor capacity also ensured that UTA would not suffer potential capacity constraints as UP’s business activities grew and shared trackage rights would need to be renegotiated in light of this. This meant that UTA could maximize trips and provide comprehensive service (Pett, 2007).

The project is quite remarkable in the fact that the agreement took only thirty-three months to negotiate once funding was in place. The project required separately negotiated agreements relating to construction, operation, and maintenance in the corridor for each segment of track. Notwithstanding the short time frame surrounding this purchase, there were obstacles that had to be addressed. According to Pett, these included funding, environmental cleanup costs, operating concerns of parties, creating a regional system of permitting that covered 42 separate governmental entities, assuaging fears about loss of land use control, reversing the disparity of project understanding in the various jurisdictions, and dealing with fear of jurisdictional tax loss.

Figure 6.7 shows the rail corridor.

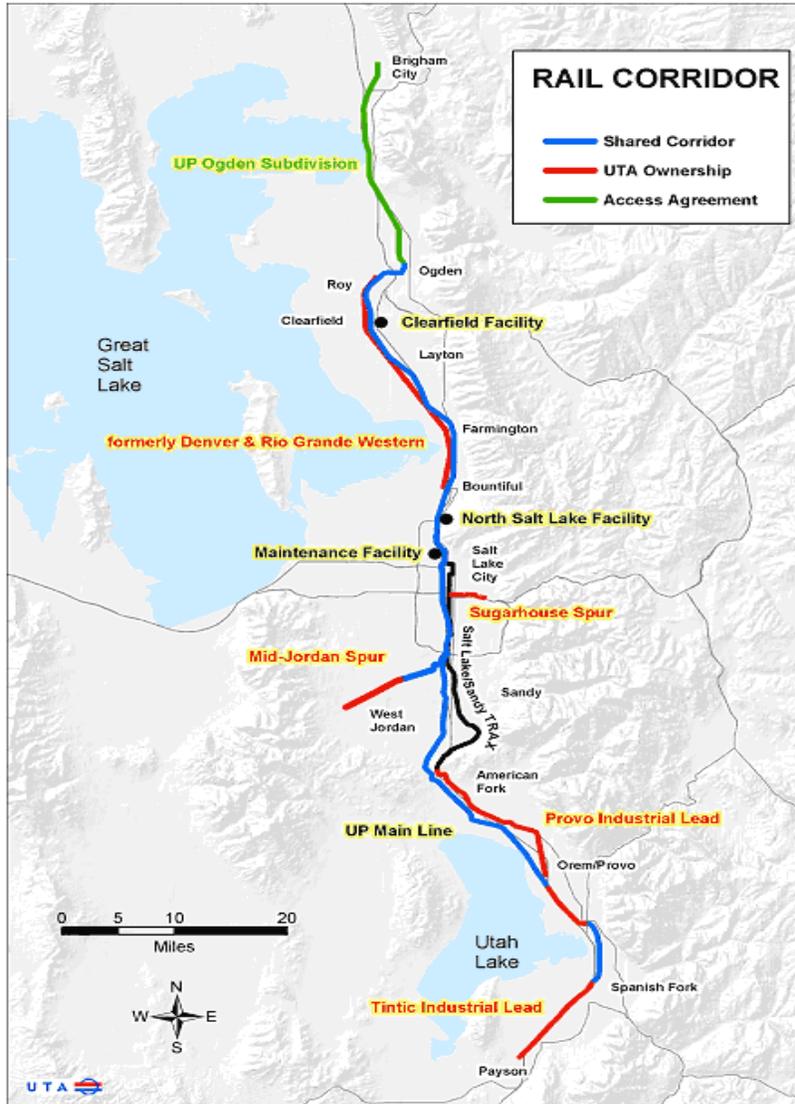


Figure 6.7: UTA Rail Corridor in Salt Lake Area
Source: UTA

Funding

Funding for this project was a critical component. When UTA began this process funding wasn't available for a capital purchase expected to be in excess of \$100 million. UTA as a political subdivision had two routes it could take to raise funds. It had authority to ask voters to approve either an additional sales tax increase (Utah Code Ann. §59-12-502) or it could levy a tax not exceeding .0004 per dollar of taxable property (Utah Code Ann. §17A-2-1044). UTA decided to levy a sales tax increase and proposed putting this forward for voter approval in November 2000. However, in the meantime, UTA had to find a way forward to keep UP 'at the table' and demonstrate sufficient financial capacity to complete the transaction. This came in the form of a pledge from the Governor to UP. The legislature also declared its intent during the 2000 general assembly to guarantee funds necessary to close the transaction if the sales tax

referendum failed. In November 2000 voters authorized by 55 percent the sales tax increase to fund the project.

Operating Concerns

Once funding was secured, the concerns regarding operational issues regarding the track began to be addressed. Unfortunately, as the negotiations began, the UP/SP system experienced serious and significant service problems nationwide. This changed the playing field somewhat in that UP took a position that they would not sell off excess line capacity because it could compromise their ability to deal with future service disruptions. UTA, according to Pett, had assumed that there would be a shared track operation with UTA purchasing slots to run passenger services over the tracks—which was (and still is to a certain degree) the national model in operation at the time. As a result of these changes UTA changed tactics and looked to purchase ‘excess corridor capacity’—approximately twenty feet. This was considered viable given that the bulk of the corridor is 100 feet wide and on the mainline between Ogden and Provo the right-of-way is 200 feet. This was considered sufficient to construct and operate a separate dedicated passenger rail system. UTA undertook an engineering study that took its concept to a 30 percent design and was able to ‘establish to UP's satisfaction’ that a parallel option was feasible. UTA purchased the easterly 20 feet of ROW along portions of the route. UP insisted that spacing between systems should be a minimum of 25 foot apart from the centerline of track. For the most part this was achieved, although according to Kathryn Pett there were a few pinch-points at which the spacing went down to fifteen feet. According to FRA regulations, spacing between systems can go as low as 12 feet from the centerline if FRA-compliant equipment is used (which would be the case for the UTA commuter rail system). Another reason for taking the ROW, according to Pett, is that this was easier to administer from an operational standpoint when maintenance or improvement work was needed. If the corridor was shared, or the systems any closer, UTA would have had to provide “flaggers” every mile each time they undertook maintenance or other work on the line (Pett, 2007).

Interlocal Agreement

Because this project was a regional project in scope and magnitude it would have multiple effects upon the citizens of multiple jurisdictions. The UTA purchase traversed through thirty-seven municipalities, five counties, and three unincorporated county areas, with an additional twenty municipalities located adjacent to the corridor. Regional planning and land use control did not exist and many communities were fearful of the change that this project would bring, as well as concerned about loss of tax revenues. There was no state policy regarding multi-jurisdictional developments, and as the agreement with UP neared fruition, UTA had three options to move the project forward and establish legal rights to construct/operate this system:

1. stand firm on the concept that local planning in such a corridor was preempted
2. undertake local permitting in each jurisdiction and hope for consistency
3. try to negotiate a single intergovernmental agreement to establish uniform policies and procedures for all affected entities.

UTA opted for the third option for two reasons. Firstly, federal law expressly preempts local or state regulation of railroad activities, and a Supreme Court ruling indicated that a transit system may not be able to enjoy the same federal privileges regarding land use policy. UTA was concerned, according to Pett, that litigation could arise if this stance was taken. Secondly, hoping

for consistency in permitting and in obtaining agreements was not guaranteed and could consume considerable amounts of staff time. Pett noted that UTA had encountered inconsistent obligations on another project—one city wanted billboards on transit, another city said no billboards could be on trains—and she counseled UTA that even though the concept of a single agreement with 62 jurisdictions participating was overwhelming, it was necessary for this project given its scope. Another reason for undertaking a single agreement with jurisdictional input was the legacy of litigation surrounding the Legacy Parkway (Pett, 2007). UDOT had paid a significant penalty to the private sector group who had won a bid for the design-build contract, which had been let and was then the subject of protracted litigation by community activists who succeeded in obtaining an injunction to stall the project.

The interlocal agreement (i) estimated costs of the system and identified system related costs that UTA would bear; (ii) established the legal right of UTA to construct and operate the system within the communities; (iii) established the parameters of the exercise of communities' police powers through their zoning, planning, and regulatory agencies; and (iv) established the extent of the communities participation in the planning, design, construction, and operation of the system. In order to bring the parties to the table, UTA also had what Kathryn Pett described as a 'back-up-legislative-strategy' in play. For the purposes of this project, the legislature indicated that it would impose a regional land use planning organization if jurisdictions did not come to the table and negotiate. Another reason for undertaking this agreement, according to Pett, was that it would allow jurisdictions to unite their land use powers, and would authorize UDOT to exercise its eminent domain power on behalf of UTA for corridor projects. The main sticking point (Pett, 2007) was the concept of compromise, i.e., communities giving up some authority. However, she noted for large linear projects to be timely and cost effective every community needs to 'give a little'. She also noted that it helped on this project that there was the threat of the legislature setting up a 'regional authority' that would have land use and planning oversight. This was not a popular option with the jurisdictions and she felt this was a successful leverage point that underscored the whole negotiation process and 'focused minds.' A copy of the Interlocal Agreement can be found on the CD-ROM Guidebook accompanying this report.

The research team asked if there had been zoning changes around the corridor after the agreement was signed. Pett did not think so. The only change that had occurred was the City of Salt Lake had tried to get round the contractual clause in the interlocal agreement that stipulated that jurisdictions could not require concessions from UTA that they did not require other developers to pay. Salt Lake had tried to circumvent this by requesting railroad betterments out of UP and UTA jointly. This had not succeeded apparently. Pett also noted that there were no TOD ordinances yet, but she expected to see this happen now that UTA has been successful in passing an additional local sales tax (passed in 2006) that will support their entire 2015 acquisition program. This will allow them to build out the entire network of 125 miles of rail within this period. The first phase of the commuter rail alignment will extend from Weber County to Salt Lake City and lies on the east side of the existing Union Pacific (UP) Railroad mainline tracks. The alignment will extend 44 miles, contain 38.15 miles of exclusive right-of-way, share 5.87 miles of track with UP, have 43 at-grade crossings, and a 2,043 foot bridge over the Ogden rail yard.

6.15 Rail Relocation

There are now some notable examples of rail relocation projects throughout the United States. The Alameda Corridor Project in Los Angeles and the Reno ReTrac project were without

doubt the ‘trailblazing’ projects that have lead the way for rail relocation initiatives in the United States. Two new case studies are presented: the Heartland Corridor, which is both an example of preservation and relocation, and the Colorado Front Range Relocation Project, which is an example of consolidation and relocation. The Heartland Corridor Project is now at the stage of implementation, whereas the Colorado Front Range Relocation is still in the investigatory and environmental planning stages.

6.15.1 Alameda Corridor

The Alameda corridor project is probably the most widely cited rail relocation project in the United States. As noted, the project is a series of bridges, underpasses, and street improvements that separate freight trains from street traffic along Alameda Street with its signature project being the mid-corridor trench, which is an open trench 10 miles long, 33 feet deep, and 50 feet wide between State Route 91 in Carson and 25th Street in Los Angeles. The project opened in April 2002 after five years of construction and twenty years of planning. The project was funded through a unique combination of public and private sources.

Alameda has been classed as a corridor initiative best practice within the United States. However, it was beset with a series of issues; the most notable of these were lawsuits surrounding environmental justice issues filed by cities along its route. The Southern California Association of Governments in 1985 created the Alameda Corridor Task Force (ACTF), a core institution that worked on institutional arrangements, funding, and developing consensus on project aspects. This group included members from cities along the route, the Los Angeles Counties Metropolitan Transport Agency, the Ports Advisory Committee, the California Public Utilities Commission (a vital body that provides permits for multiple activities in California), as well as staffers from the San Pedro Ports of LA and Long Beach and representatives from the Class I railroads. The ACTF successfully brokered agreements between what were then the three major railroads—Santa Fe, Union Pacific, and Southern Pacific—to consolidate and use a single route instead of four separate routes (Agarwal et al., 2004). However, the ACTF was not without controversy: most notably for its handling of environmental justice issues and complaints of cities along the route. A report by the Office of Inspector General Audit Division of the FRA in 1999 noted that while the financial plan identified sufficient funding it had not identified two specific funding risks: (i) a consent decree requiring the Los Angeles County Metropolitan Authority (MTA) to purchase 248 additional buses within thirty days per a court ruling on September 24, 1999, which could affect MTA’s ability regarding its project funding commitments; and (ii) whether ACTA had accepted an inherent risk that user fee revenues and port contributions may be insufficient in later years to cover debt repayments (OIG, 1999). Callahan (Callahan, 2002) describes ACTA as “a story of cooperation emerging out of the politics of structural choice.” ACTA also suffered from considerable conflicts from the beginning of the project around issues of representation on the governing board (the board’s initial composition was made up of representatives of the eight Alameda corridor Cities and the ports and regional agencies) as well as environmental justice issues. The mid-corridor cities continually expressed concerns regarding the ‘local’ effects of construction activity, increased rail traffic, and other negative impacts upon their communities. They argued that they bore the brunt of these environmental justice impacts, while the project’s benefits would be dispersed nationally and regionally. They argued that the external costs and adverse impacts were focused primarily on their local economic benefits and that ACTA did not give enough primacy to their development needs. As the conflicts between board-members became more antagonistic, the San

Pedro Ports proposed an amendment to the ACTA's Joint Powers Agreement that transferred financial powers to a finance committee that was comprised of Los Angeles County Transportation Commission, the Ports, and the cities of Los Angeles and Long Beach. ACTA voted for this amendment and the mid-corridor cities (Vernon, Lynwood, Compton, and South Gate) then filed a lawsuit against ACTA's actions in June 1995 (Kanter, 1996). Suit was dismissed in 1996 (ACTA, 1997). According to Kanter (1996), Vernon funded the entire legal battle and spent over \$700,000 on attorney, lobbyist, and consultant fees. Once the ACTA board was reduced in composition size, there were still concerns regarding the dissenting cities that had *control* over construction permits and were *required* to approve design elements. Another lawsuit was filed by the City of Lynwood regarding the FEIS in late 1996 and was dismissed by superior court on June 6, 1997 (ACTA, 1997). Because a disenfranchised city could cause serious delay to the project, ACTA, in a gesture aimed at assuaging the mid-corridor cities, negotiated a series of settlements and memoranda of understanding with these cities. They received significant monies for mitigation measures as well as receiving 25 percent of the engineering permit fee up-front. Alameda's private party contractors were also hit with lawsuits alleging discrimination (the main contractor was ordered to pay judgment of \$2 million for disenfranchisement of disadvantaged business participation) and a further lawsuit was filed against the main contractor Tutor Saliba Group (Engineering Record, 2002), by Condon Johnson & Associates Inc., alleging that the design-build contractor for the 10.5 mile trench, designed and supplied concrete that did not meet project specifications (allegedly non-specification concrete was used for the structural cast-in-hole shafts that support the trench walls) and that the sub-contractor (Condon-Johnson) had not been paid for the remedial work it had undertaken to the damage pile at the behest of Tutor Saliba. This case was finally settled in 2005.

The main lesson that can be learned from Alameda is controversy will arise on 'mega-projects' and that public relations fallout can severely hamper the ability to keep projects on time and within budget. For any agency undertaking such a project it is imperative to review environmental justice impacts arising from rail relocation and project construction as well as impacts once the project is opened.

6.15.2 Reno ReTRAC

In November 2005 the city of Reno, Nevada, opened its downtown depressed rail trench ReTRAC (Reno Transportation Rail Access Corridor). This ReTRAC project began life as traffic congestion and safety issue for residents of Reno and took ten years to bring forward. Hundreds of planning meetings were held as the project progressed. The project depressed just over two miles of train track that ran directly through downtown Reno. It is a 54-foot-wide, 33-foot train trench. The costs for the \$265 million dollar project were paid through a hotel room tax, special downtown assessment district, a sales tax increase, city bond, and \$17 million in Union Pacific and federal grants. It was completed on time and under-budget.

6.15.3 Virginia's Commonwealth Mainline Freight Rail Relocation Project and the Multi-State Heartland Corridor Project

The Commonwealth Mainline Rail Relocation Project is a critical component of the larger Heartland Corridor project that will improve intermodal access for trains traveling between the Port of Norfolk and Chicago. The Heartland Corridor is not a completely new rail corridor. Rather its completion involves the upgrading of an existing corridor to accommodate double stack trains, principally by means of expanding tunnels in West Virginia. The

Commonwealth Railway Mainline Safety Relocation Project (CRMSRP) is one of three key components of the Heartland Corridor Project and is the one component in which completely new track will be laid through a corridor that has not seen train traffic before. In addition to the CRMSRP, the other two components of the corridor are the Central Corridor Double Stack initiative and the construction of three intermodal yards in Virginia, West Virginia, and Ohio.

The Heartland Project is described twice in *Public Law 1095-59, The Safe, Accountable, Flexible, and Efficient Transportation Act: A Legacy for Users* (SAFETEA-LU). In 2006 Memorandums of Agreement were signed. The first was among the West Virginia Department of Transportation, Virginia Department of Transportation, and the Ohio Department of Transportation. The memo was signed to establish roles and responsibilities between the various DOTs, the USDOT and the Federal Highway Administration, Eastern Federal Lands Highway Division (EFLFHWA) (EFLFHWA Agreement, 2006). The second Memorandum of Agreement was between the FHWA, EFLJD, and Norfolk Southern Corporation (EFL/NS Agreement, 2006). Figure 6.8 shows the route of the Heartland Corridor Project.

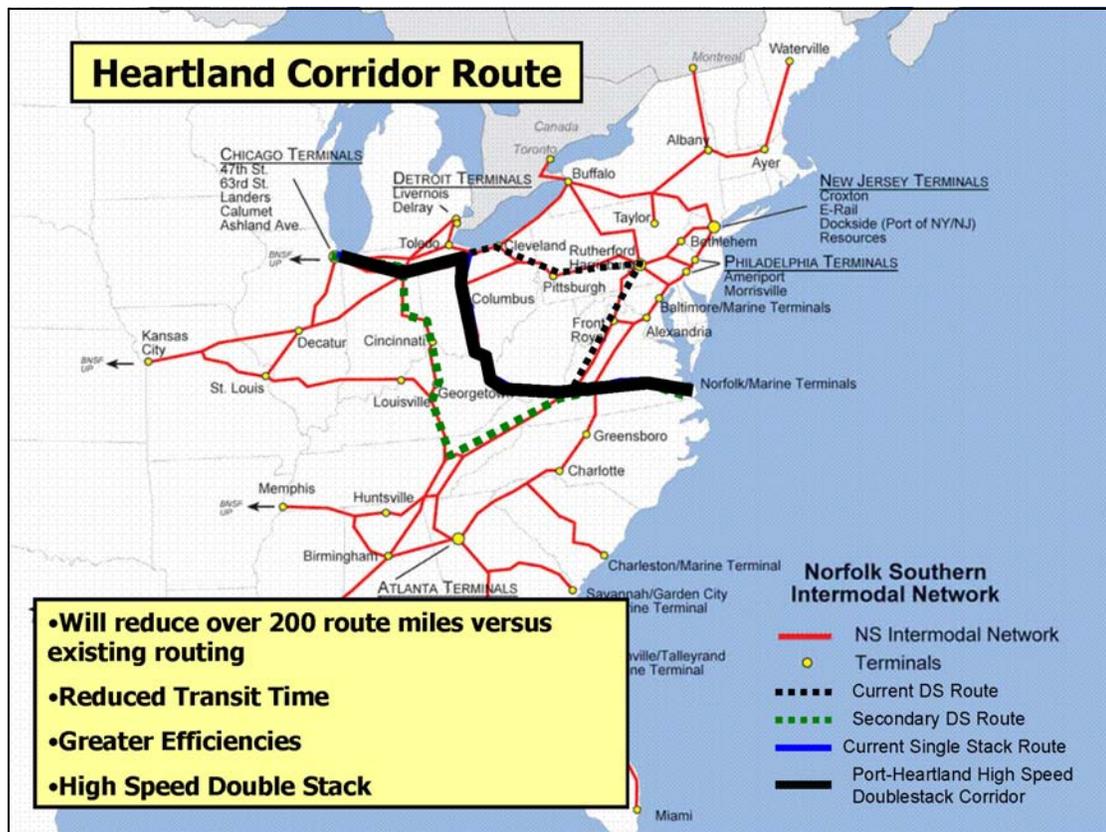


Figure 6.8: Heartland Corridor Project
Source: Virginia Ports Authority

The parcel of land set aside for the CRMSRP will connect the future APM container terminal with the Norfolk Southern Mainline. The researchers spoke with Alan Tobias at the Virginia Department of Rail and Public Transportation regarding the history of this corridor preservation effort. The corridor, which runs in the median of State Highway 164, was first preserved at the time of the highway's construction in the early 1980s. Sufficient space for a

double tracked rail corridor was left within the median principally to serve the expected traffic from the proposed Craney Island container terminal. Despite the fact that the Craney Island terminal was not developed as envisioned, the Virginia DOT elected to retain the rail corridor's integrity in order to fill a future need, as opposed to using the right-of-way to widen SH 164. For this reason, when Maersk announced plans to build a major container terminal not on Craney Island, but on the mainland near the island, the ROW for the future rail service was already in existence. The Port of Virginia now intends to develop Craney Island for a container terminal when and if the planned Maersk terminal exceeds capacity. Rail cargo from this facility would also use the newly constructed CRMSRP corridor. Figure 7.9 shows this portion of the route. The existing rail corridor leading out the port facilities at Portsmouth and Chesapeake, which currently only handles two to three trains a day, has fourteen at-grade crossings and is therefore not suitable for the substantial increase in service level that will be required after the terminal is opened. After the opening of the CRMSRP, the existing rail corridor will be abandoned.

Construction on the line began July 9, 2007, and is expected to be completed by December 31, 2009. Given that the APM terminal is slated to begin operations significantly before this date, APM traffic will be seen on the existing line for a period of approximately two years. This traffic is estimated by Virginia Port Authority Engineering at 4-6 trains per day in the interim period. At \$60 million, the cost of the CRMSRP is approximately 15% of the total cost of the Heartland Corridor project. SAFETEA-LU provided \$140 million for the Heartland Corridor. Of this, \$15 million was provided for the CRMSRP project. The other principal sources of funding are the Governor's transportation funds in the sum of \$15 million (VPA, 2006). The double-stack trains leaving the APM terminal will be a maximum of 2300 feet long. These trains will be linked at the new Suffolk marshalling yard that is located to the west of where the CRMSRP joins the Norfolk Southern Mainline. The assembled trains will be up to 7000 feet in length.

The principal justification for the State of Virginia's unprecedented level of investment in the Heartland Corridor and in particular the CRMSRP, according to Alan Tobias (Tobias, 2007), is the potential to shift onto rail the cargo that would otherwise move by truck. If the envisioned mode shift benefits are not realized, the State has the option to withdraw a percentage of its investment in the project. The goals for mode shift and methodology for measuring the results were worked out in conjunction with Norfolk Southern. Craig Lewis, Norfolk Southern VP for Operations, noted that the idea of tying the State of Virginia's commitment to the amount of congestion mitigation was a way of clarifying what the Heartland Corridor could and could not do (Lewis, 2007). When the project was envisioned, estimates in the media on the number of truck shipments that would be diverted to rail were, according to Lewis, "not realistic." Therefore, before agreeing to the project, Norfolk Southern hired an independent consultant to perform an analysis of the likely mode shift under build and no build scenarios.

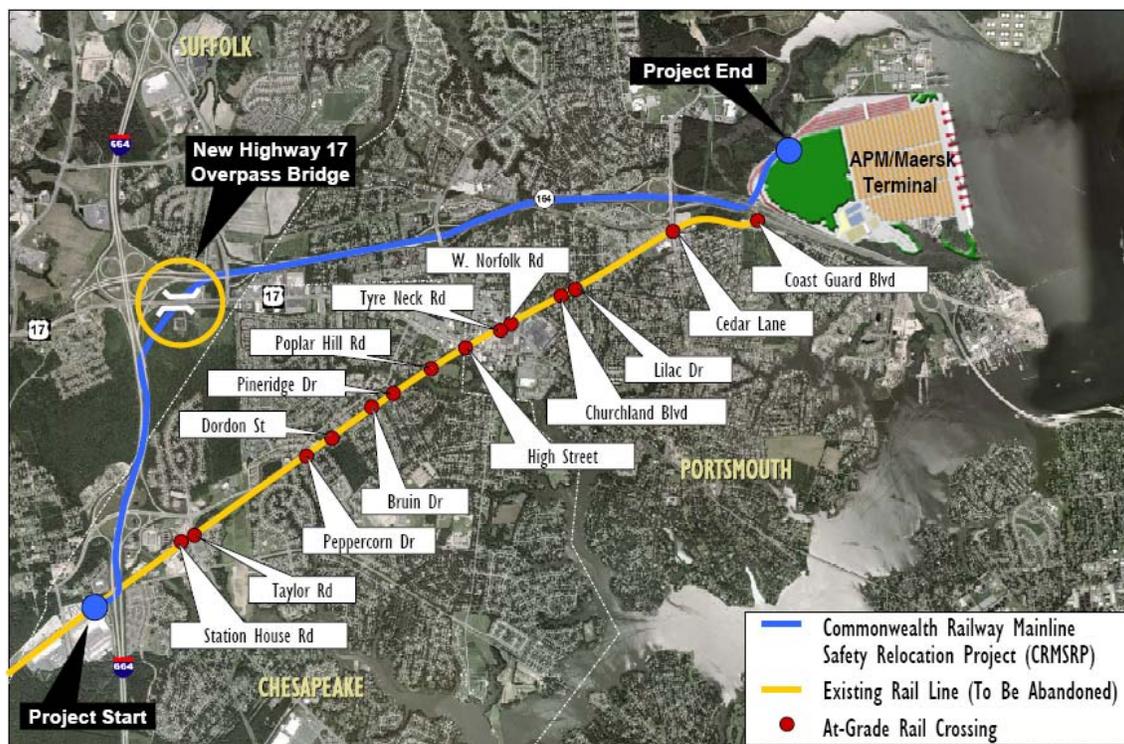


Figure 6.9: Heartland Corridor—Virginia Section
 Source: Virginia Port Authority

Once the CRMSRP project is completed, the rails and ties from the existing corridor will be conveyed to the State of Virginia; the final use and purpose of this corridor has not yet been determined. There are no plans to utilize this abandoned corridor for freight or transit projects currently within the cities along the portion of the route. This may be because there is essentially no setback from the residential neighborhoods it traverses as well as multiple grade crossings.

6.15.4 Colorado’s Front Range Railroad Infrastructure Rationalization Project

In Colorado the Front Range Infrastructure Rationalization project has been envisioned for a few years. Colorado’s DOT (CDOT) was approached by BNSF and UP with the recommendation for a series of infrastructure projects that would relocate certain aspects of the Class I’s business activities, reducing bottlenecks in the downtown Denver area by removing the majority of freight through traffic. Figure 6.10 shows the proposed relocation route for the front-range that is outlined in the Denver Regional Council of Governments’ 2030 Metro Vision.

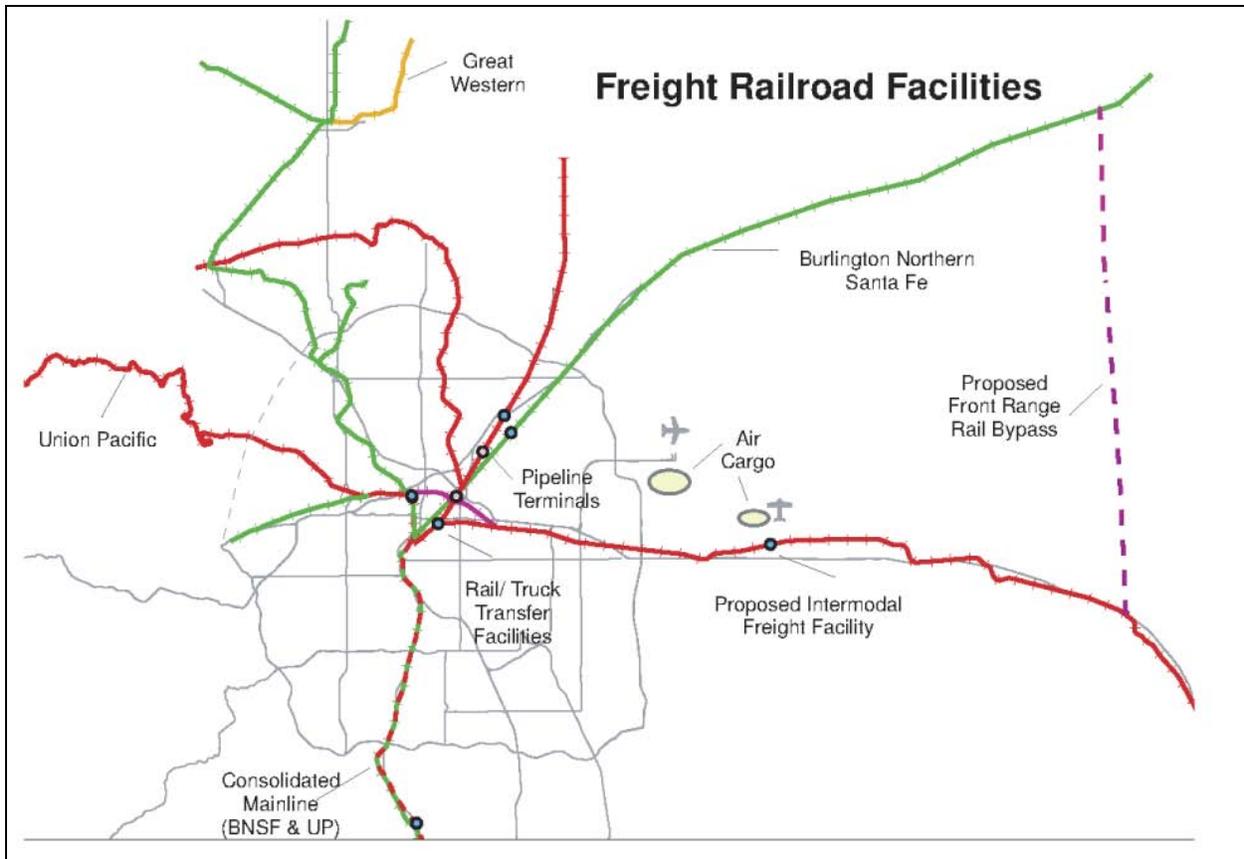


Figure 6.10: 2030 Metro Vision Freight Railroad Facilities and Front Range Bypass
 Source: Denver Regional Council of Governments

A cost-benefits analysis was initiated in 2002. It projected the growth of freight movement throughout Colorado. The initial study projected the capital costs for this project in 2004 dollars:

Table 6.2: Front Range Relocation Project Capital Costs (2004 dollars in billions)

Low Scenario	Medium Scenario	High Scenario
\$1.05	\$1.17	\$1.52

Source: CDOT Costs and Benefits Study

A key prerequisite for the relocation of the line is the removal of a major yard that currently operates in the Denver area to the Fort Lupton area. The existing switching facility would be used by the regional transportation district for the development of the Fastrack's commuter/light rail system. Now that the dust has settled, so to speak, given the political changes in Colorado a study is now being performed to evaluate the environmental implications of the relocation and is expected to be completed in November of 2007 (CDOT, 2007).

The study assumed the project would be developed over a four-year period starting in 2006 and completing in 2009 with operations beginning in 2010 (Executive Summary 2005). However, due to the election of a new Democratic Governor in Colorado the project has seen a slight delay (Norris, 2007). According to railroad staff everyone was waiting to see what the new

head of CDOT (who would be appointed by the new governor) would propose regarding this project. It wasn't certain that the support would continue so the project sat in a form of 'limbo' for a few months while the new head of the DOT came on-board and reviewed department activities. Now that the new head of CDOT is fully on-board and supportive of continuation, the project will move forward.

6.16 Land Use Planning Activities

Some states have begun to require that developers obtain state as well as local government approval for projects. This allows the state to limit the impact of development and reduce side-effects that occur when development runs adjacent to transportation infrastructure. According to Weinberg, Vermont was the first state to adopt such an approach in 1970 (Weinberg, 2000). Oregon and New Jersey, while leaving land use decisions up to individual local governments, require that municipalities meet minimum threshold requirements in their states' land use plans. While in some instances such activities have often been introduced to reduce the impact of suburban sprawl, they often have secondary effects that have lead to a reduction in conflicts of incompatible land uses. Some of the statutory authority and local zoning ordinances have been drafted with highways specifically in mind, but there is no reason why these ordinances cannot be amended (or transferred) for rail projects. Some states will withhold funding for noise and other mitigation projects if land use planning is not in place. Other specific ordinances are being developed to ensure specific types of development occur around transit routes. Often known as TOD zoning, there are multiple examples throughout the U.S. of such land use zoning. Finally, some states require cities and counties to encapsulate a review of land use activity impacts within their long range plans. California, as noted in chapter seven, requires their long-range plans to review the impacts of land use activities on transportation infrastructure and to plan to mitigate for any adverse effects.

The North Carolina Railroad (NCR) has also begun to address the issues of encroachment by notifying real estate offices and real estate offices about their duty to notify prospective clients. NCR sends letters to real estate offices that have signs for property that appear to encroach into our rail corridor on the basis that, under regulations set out by the State Licensing Agency for Real Estate Brokers, real estate agents have a duty to disclose information¹⁹ they know about a property they are listing for sale, or that they are showing a buyer in a Buyer Agency relationship, even if it is negative (Burnell, 2007).

The Federal Railroad Administration is also beginning to look at encroachment issues and land use planning activities around rail corridors (Cook, 2007). A meeting was held between the FRA (Cook, 2007), Union Pacific (Hill, 2007) and the research team on July 25, 2007, to discuss corridor encroachment issues and mitigation options including land use planning, official maps, and zoning activities.

¹⁹ In North Carolina's Real Estate Manual (Modern Real Estate Practice in North Carolina: Chapter 6 - Real Estate Brokerage and the Law of Agency - Under the Duties and Liabilities of Agents, and disclosure, it explains what the agent must do with information they know about a property, and even if they should know certain facts about the property, and their responsibility to disclose the information. Note this extends to responsibilities to third parties as well.

6.17 Official Mapping, Comprehensive Planning and Land Use Controls

6.17.1 Use of Comprehensive Plans

California's government requires comprehensive planning (CA code 65103) by cities and counties. These comprehensive plans have to include an assessment of how the zoning activities—if the plan is built-out—will create noise or vibration. Under California's Government Code (Section 65300-65303.4), the state requires that each planning agency shall prepare and the legislative body of each county and city shall adopt a comprehensive, long-term general plan for the physical development of the county or city. Section 65302 notes that the general plan shall consist of and include a land use element that includes standards of population and building intensity as well as zoning ordinances to implement its provisions. California's Regional Planning law notes that the state has a positive interest in the preparation and maintenance of a long-term general plan for the physical development of each of the state's urban areas.

6.17.2 Use of Official Maps

Florida

Florida once had perhaps the most comprehensive transportation corridor management legislation, but it has been somewhat constrained by the Florida courts (Williams et al., 2003). The Florida experience, however, demonstrates the need for statewide legislation to enable (or even mandate) local control. Legislation passed in 1988 authorized the Florida DOT and local governments to designate transportation corridors for protection. Local governments were required to withhold development permits within the mapped corridors for five years. This blanket moratorium on development could be extended to ten years. Then in 1990, the Florida Supreme Court, in *Joint Ventures v. Florida Department of Transportation* 563 So.2d 625, 626 (Fla. 1990), ruled that these right-of-way preservation measures were unconstitutional takings that violated due process. The court took issue with the automatic nature of the development freeze and the statute's stated purpose of controlling land values in anticipation of condemnation.

In 1993, the Florida Supreme Court once again weighed in on the state's corridor management scheme, this time with very different results. In *Palm Beach County v. Wright*, 641 So.2d 50, 53–54 (Fla. 1994), the court upheld the constitutionality of a county's thoroughfare plan map, distinguishing it from the state corridor map considered in *Joint Ventures*, reasoning that: (1) the plans helped ensure adequate transportation facilities; (2) the county's map was mandated by state comprehensive plan legislation; (3) these efforts represented invaluable planning tools that provided for future growth in accordance with state statutory objectives; and (4) the ability of local governments to amend their plans twice a year provided enough flexibility to mitigate hardships experienced by property owners. The court found the mapping scheme satisfactory because it “only limits development to the extent necessary to ensure compatibility with future land use.” Thus, a state can coordinate locally implemented corridor preservation maps without unconstitutionally depriving a landowner of substantially all beneficial use of the land.

In response to these decisions, the Florida legislature amended the state planning law in 1995 to expand the role of local governments in corridor management, while increasing coordination between local and state planning efforts (Williams et al., 2003). The Wright

opinion, which seemed to approve of state-coordinated local corridor management, greatly influenced these amendments. Instead of strictly limiting development, these amendments focus on providing for compatible use “within and adjacent to...corridor[s] to promote orderly growth” (Florida Statutes §163.3164). In addition, state law as amended still requires that localities have comprehensive growth management guidelines, most of which contain corridor preservation plans (§ 163.3167). Some municipalities are more active than others in corridor management (FHWA, 2000).

The Florida experience demonstrates corridor management with adequate mitigation measures for hardship, while mitigating against automatic development restrictions. The length of time that right-of-way is reserved in a transportation corridor must be reasonable and based on a state or local government’s desire to purchase the right-of-way in the future. Statewide initiatives should emphasize the need for corridor management and protection from incompatible use in order to avoid the appearance of government taking for taking’s sake.

Nebraska

Nebraska has had corridor protection laws since 1974 (FHWA, 2000). The DOT may use its mapping power to preserve 300 feet on either side of an alignment.²⁰ The DOT files the corridor maps with all permitting agencies in the state (Nebraska Revised Statutes § 39-1311.01). When a local agency receives a permit for construction over 1,000 feet along a protected alignment, it must submit the permit to the DOT for approval (§ 39-1311.03). The DOT then has 60 days to approve or deny the request. If the permit is rejected, the DOT must acquire the property within 180 days.

North Carolina

There is concurrent authorization for cities, regional public transportation authorities, the North Carolina Turnpike Authority, and the state DOT to adopt official transportation corridor maps. After an official transportation corridor map has been filed, building permits cannot be issued for any structure or subdivision within the corridor until the Secretary of Transportation (or his designee) has approved the request. Delay of issuing a permit is limited to three years from the date of the original request. Variances from the official map may be granted by the DOT. An effected landowner may petition the filer of the map for acquisition of the property in the event of an imposed hardship. Any property that is found to be subject to hardship must be acquired within three years or the restriction must be removed. According to Williams no litigation has arisen regarding this process.

While the DOT has not used official maps as a matter of routine for rail, Williams noted a recent example of where they had used the official map to delineate a specific rail project. Around the proposed Wilmington Station on their commuter route, property values were increasing and a developer wanted to put condos on a specific parcel that is slated to be the new station. They needed to protect this parcel from the increased values so it was put on the official map. According to Williams, this requires the city to refuse a permit for any building as long as they start the environmental document within a year of designation on the map. This parcel was delineated by NCDOT on the map, and Williams noted this will save them money because they will not have to purchase the value of a developer’s improvements. According to Davis, NCDOT

²⁰ No statutory mandate for the 300 feet setback dimension was found. It appears that the 300 feet setback is a DOT standard. No published cases were found discussing highway setbacks.

also tries to work within the NEPA process and listen to communities to gauge what they need. They work to achieve win/wins for everyone on projects. The legislation, according to Davis, doesn't necessarily buy you a lot, but is useful as it allows them to do the mapping. As for other corridors within the state, the DOT has not created its own official maps. For example, for the South East High Speed Rail from Petersburg to State Line the DOT does not have track but does have ROW outlined within local official plans. The DOT will depend on local governments to keep them informed so they can work with the DOT on permits and land use issues surrounding these proposed corridors. The DOT also noted that where they need ROW they will also work with cities to acquire this.

Wisconsin

Wisconsin also empowers municipalities to create official maps that delineate, among other things, the location of highways and railroad right-of-way (Wisconsin Statutes § 62.23(6)(b)). A "subdivision" is a division of a lot, parcel, or tract of land by the owner thereof or the owner's agent for the purpose of sale or of building development, where: (a) The act of division creates 5 or more parcels or building sites of 1 1/2 acres each or less in area; or (b) Five or more parcels or building sites of 1 1/2 acres each or less in area are created by successive divisions within a period of 5 years (Wisconsin Statutes § 236.02 (12)). As with official maps in Florida and North Carolina, developers who wish to build within the boundaries of the official maps must apply to the city for a permit (§ 62.23 (6)(e)). However, WisDOT does not participate in the permitting process; it is up to the city to grant or deny a permit that effects highway or railroad corridors.

6.17.3 Encouragement of Corridor Compatible Adjacent Land Use

Encouraging compatible land use beside rail corridors can take multiple policy forms: strict zoning, county and city long-range planning; push-and pull type policies that promote land use planning through the use of sanctions or reduced reimbursements; and statewide policies regarding land use. The following section provides a snapshot of these various policies.

Anaheim

The City of Anaheim has enacted under its municipal code—Title 18 Zoning §18.04.060.020 (adopted under Ordinance 5920 1 (part); June 8, 2004)—that lots adjacent to railroad rights-of-way must have minimum setbacks. The requirements are for single-family lots adjacent to transportation ROW:

Single-family residential lots adjacent to all arterial highways or railroad rights-of-way shall have a minimum depth of **one hundred twenty (120) feet** and shall not take vehicular access from the arterial highway.

Anaheim's planning department has also created mitigation monitoring plans for TOD projects. For example, the Crossing at Anaheim had detailed planning specifications that were placed within the environmental report that were timed for approval prior to project plan approval. These included, for example, measures to make sure all residential units had weather-stripped solid core exterior doors and exterior wall/roof assemblies free of cut outs and openings, all windows of residential units shall be sound-rated assemblies with a minimum sound transmission class rating of 35, all exterior walls require a sound transmission class rating of 46,

with stud spaces to be filled with insulation bats and joints caulked to form airtight seals (The Crossing at Anaheim, 2006).

Denver

The Denver Regional Council of Government's 2030 Metro Vision regional transportation plan, developed in conjunction with CDOT, local governments, the public and the Regional Transportation District, declared a number of strategies for its multiple rail transportation corridors. By creating 'corridor visions' the plan strives to provide definition, and guide prioritization and design attributes of future transit projects. It created a series of policies and action strategies. For example, policy number four aims to continue to preserve ROW in newly developing or redeveloping areas. Policy number 11 encourages open space preservation in conjunction with major transportation facility development (2030 Metro Vision).

The 2030 Metro Vision plan has also identified four primary types of transit service that will occupy three corridor system tiers. The tier one corridors are a base rapid transit system that comprise light rail, commuter rail, and bus rapid transit. This will cover the major urban areas and will serve at least 18 urban centers. Tier two corridors will comprise regional and intercity corridors, currently identified as 70 miles of corridors. Tier three corridors are 'conceptual preservation corridors' (blue lines on the official map). These are rapid transit corridors mostly located along major highways or freight railroad lines covering about 115 miles. ROW, according to the plan, will be preserved *to the extent possible* for future transit use (2030 Metro Vision, p 50 Chapter 4). Figure 6.11 shows the Rapid Transit System corridors.

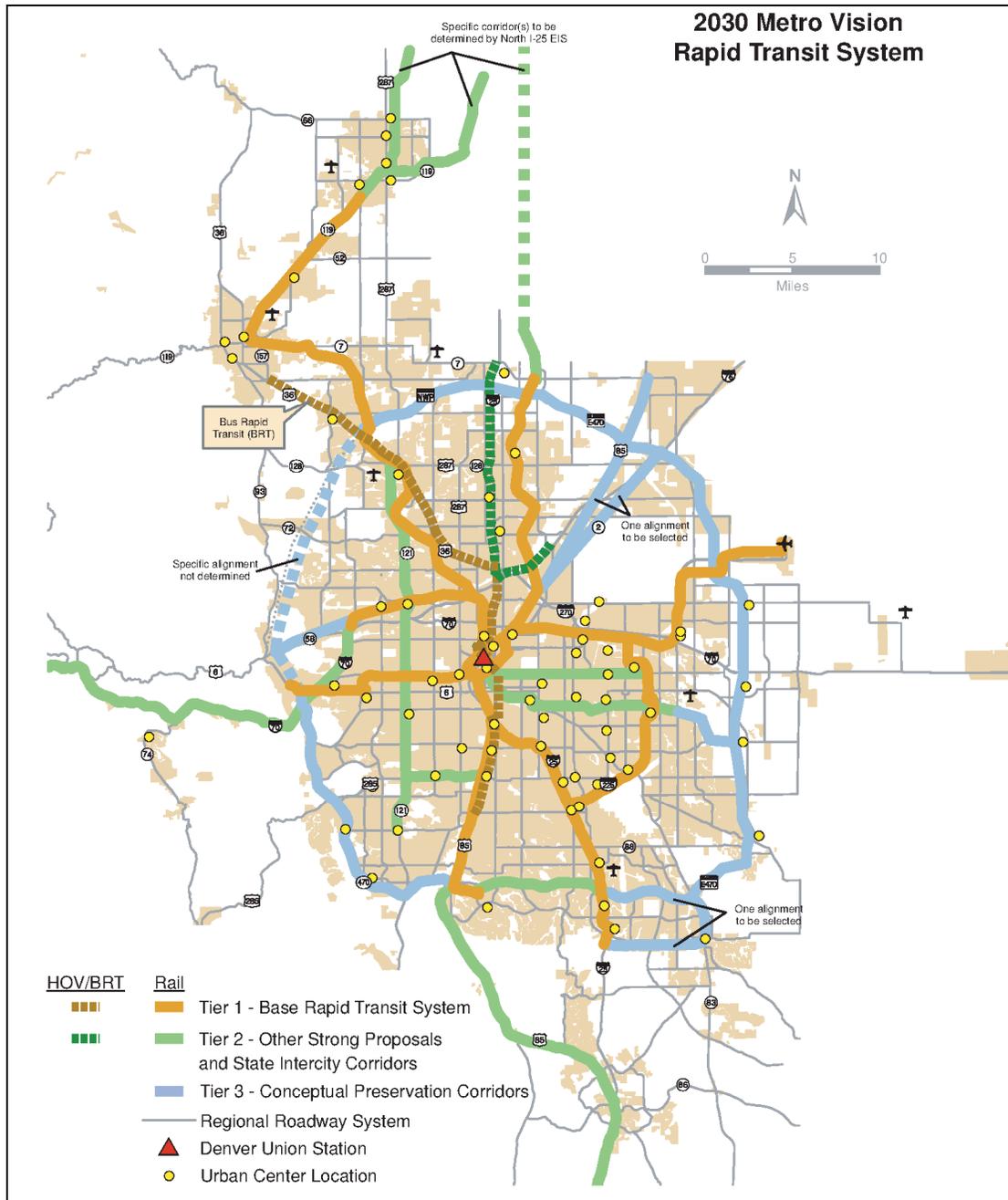


Figure 6.11: 2030 Metro Vision—Rapid Transit System Corridors
 Source: Denver Regional Council of Governments

The city and county of Denver and the Regional Transit District created land use planning guides for development around their multiple transit routes and specifically around station areas. In 2002 the city and county of Denver released their long range plan “Blueprint Denver: An Integrated Land Use and Transportation Plan” (Blueprint Denver, 2002). It comprised two key concepts regarding land use activity and transportation infrastructure: ‘areas of change’ and ‘areas of stability’. The rationale was that the areas of change would absorb most of the project growth till 2030, and many were situated around transit hubs. The blueprint is

currently being revisited because the City’s Blueprint Denver Committee found in 2006 that zoning capacity had a slight mismatch between the vision of Blueprint Denver and what the current zoning allows within the areas of change (Blueprint Denver Committee, July 2006). Consultants hired by the city found that Denver’s current zoning does not broadcast the blueprint vision, and that transit station areas were not being rezoned properly for TOD.

To give an example of one of the planning guides for transit stations, in 2003 the City and County’s Community Planning and Development and Public Works section released the Colorado Station Area Framework Plan (Colorado Station Plan 2003). The plan outlines basic goals within its guiding principles regarding development, including redevelopment that creates a mixed use development for the area within ‘the wedge’ parcel of land directly adjacent to the station. The goals emphasize residential uses as well as the use of density to support and promote transit use. The use of planning zoning and innovative partnerships are classed as *incentives to initiate station area development that reflects the guiding principles*. The Colorado Station area is identified as an area of change. Denver implemented a mixed-use zoning district including residential mixed use and commercial mixed to use as a framework to establish and encourage a compact mix of land uses that align with transportation uses. This particular station plan adheres to Blueprint Denver’s land use concepts (shown in Figure 6.12).

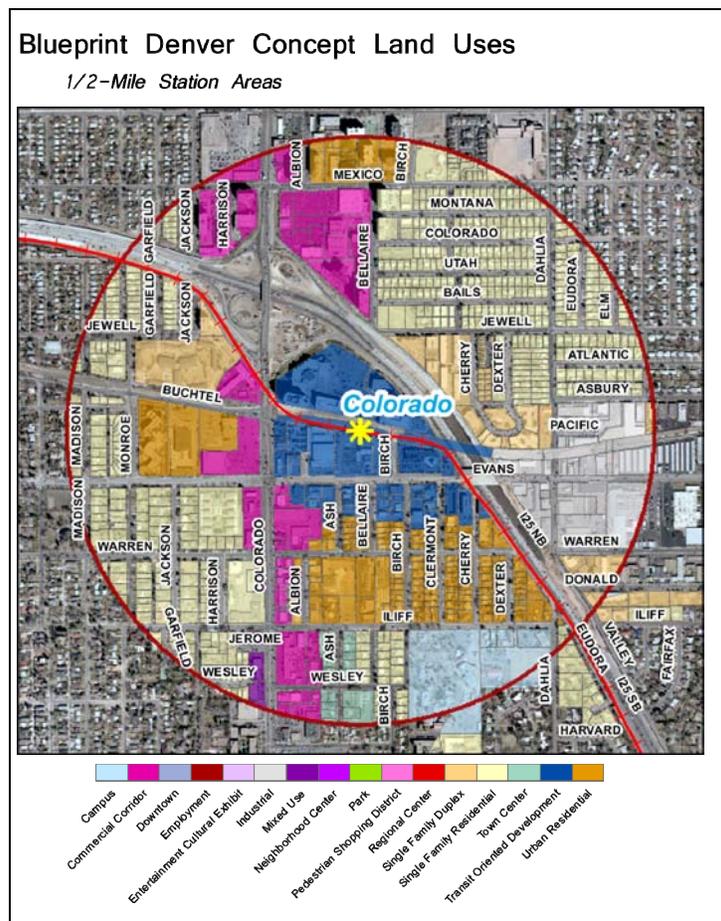


Figure 6.12: Blueprint Denver—Concept Land Uses
Source: City of Denver

As a consequence of the Blueprint Denver Committee’s 2006 findings, in February 2007 Denver created a new station typology to guide land use development around its transit corridors see Figure 6.13 (Denver, 2007). The typology works with the new TOD ordinance passed by Denver and structures the development, including setbacks, design criteria, offsets, buffering, and scale of density that the city requires around various stations and corridors. Eight station area typologies were created, and these are discussed in more detail in the TOD section later on in this chapter.

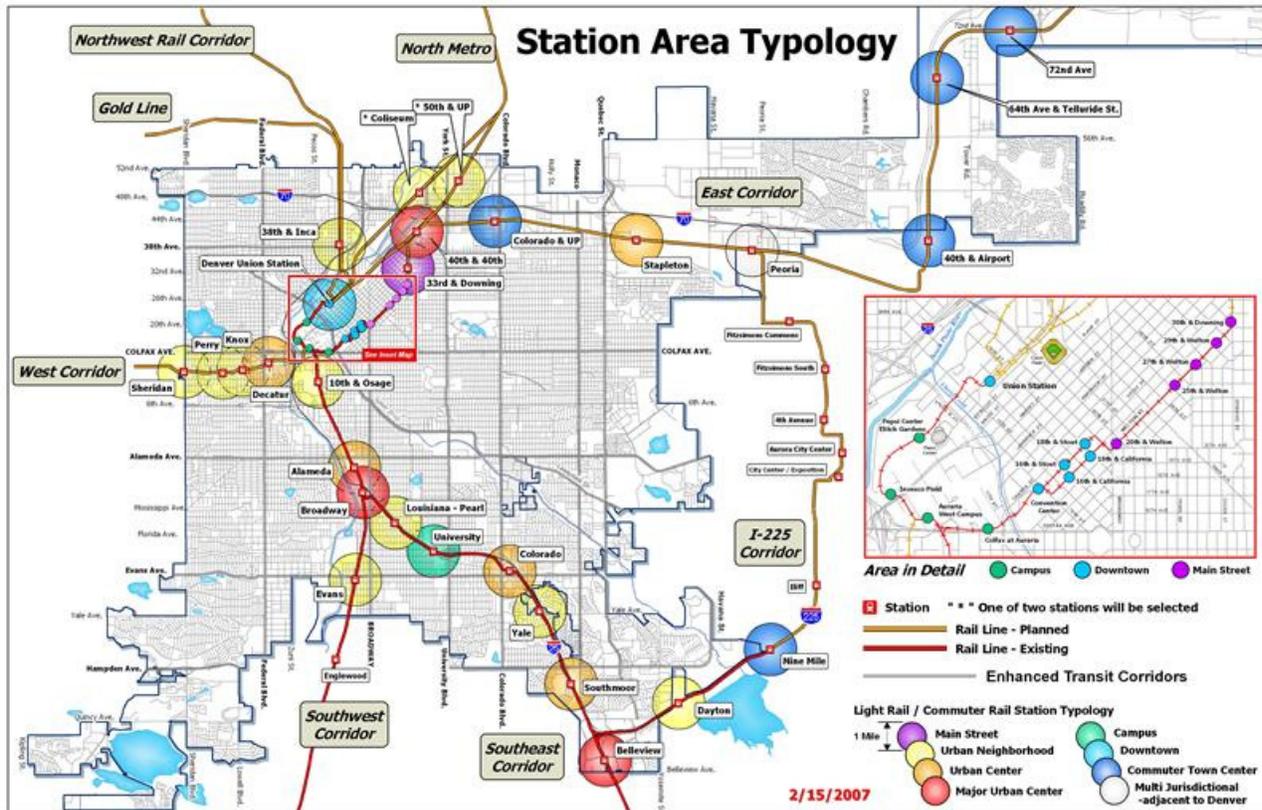


Figure 6.13: Station Typology for Land Use Planning
Source: City of Denver

Michigan

Michigan, under the Noise Abatement Policy adopted by its transportation commission in 2002, stipulates that if cities and counties do not have land-use regulations in place they will NOT be eligible for MDOT noise mitigation assistance for highway projects (Michigan Government Noise Packet). According to Michigan’s policy, cities and counties have the power to control development by adoption of land-use plans and zoning, and by subdivision, building, or housing regulations. The Commission encourages those who plan/develop land, and local governments controlling development or planning land use near known freeway locations, to exercise their powers and responsibility to minimize the effect of highway vehicle noise through appropriate land-use control. Where such land-use regulations are not in place the commission will not consider projects as being eligible for financial assistance (Michigan Government Noise packet).

Oregon

Oregon is known throughout the United States for its land use planning activities. Portland specifically is known for the Urban Growth Boundary. In 1973 Oregon passed Senate Bill 1000. This program enacted a statewide land use planning process and 19 statewide planning goals are encapsulated within its statutory mandate. The bill created a partnership in planning between the state, its 241 cities, and 26 counties. It sets baseline standards for local plans, and created an agency The Land Conservation and Development Commission (LCDC) to administer the plans and monitor the implementation of the state's land use program. In 1991 the LCDC created the Transportation Planning Rule. This defines characteristics of acceptable plans and requires linkages between local land use and the transportation planning process. In 1995 the Oregon State Legislature amended state legislation to promote higher-density residential and mixed-use developments near transit facilities. The Core-Area Tax Exemption includes TOD developments (LCDC, 2007).

Portland's TriMet Transit Agency released a Community Building Sourcebook in August 2005 to provide guidance on land use and transportation initiatives in the Portland area (TriMet, 2005). The guidebook provides advice on integrating land use with transportation planning, as well as providing case studies for review. One of the success stories within Portland is the TOD projects along its light rail line (Blue Line). This was achieved through a partnership between the state, cities, counties, and transit agencies. For example, the Westside Station Area Planning Program, created by the cities of Beaverton, Hillsboro and Portland along with Metro, TriMet, ODOT, and Washington County came together in 1993 to update city and county comprehensive plans, and develop regulations and capital improvement plans for TOD around the light rail areas. By 1998 this group had created new development regulations for almost all the light rail station areas on the route (City of Beaverton).

Wisconsin

The Wisconsin DOT has statutory authority (Wisconsin Statutes § 236.02 (12)) to require setbacks along highways, but only with respect to adjacent *subdivisions*—no other developments are covered according to a recent Wisconsin court of appeals decision (Wisconsin Builders Association v. Wisconsin Department of Transportation, 2005 285 Wis. 2d 472, 479 (Wis. App. 2005)). According to this ruling, setback requirements for subdivisions do not constitute a Fifth Amendment taking. Prior to this decision, Wisconsin DOT had previously interpreted its statutory authority as allowing it to establish setbacks for all development along highways. The setbacks are generally 110 feet from the highway centerline or 50 feet from the right-of-way line, whichever is more restrictive (WisDOT, Business Rules).

6.17.4 Buffer Zones

Many cities have standardized zoning for creating a buffer between incompatible uses. For example, the City of Portland has a buffer zone overlay typology that can be used between nonresidential and residential zones. This zoning can be used when the base zone standards do not provide adequate separation between these uses. The separation restricts motor vehicle access, requires increased setbacks and additional landscaping, and restricts signs. In some instances it also requires proof of mitigation for uses that can cause off-site impacts and nuisances. This is marked on official zoning maps with the letter 'b'. The zone is applied along the edge of the nonresidential zone abutting or located across a street from a residential zone.

Within industrial zones any classification of street can be considered; in commercial zones the street must be a local service traffic street. The setback required in commercial zones is 10 feet with landscaping required along all lot lines that are across a local service street or abut the rear-lot line for residential zoned land. Figure 7.14 shows how this is applied in practice. In employment and industrial zoned areas the setbacks are required to be 20 feet and landscaped along all lots lines within the overlay zone. Figure 6.15 shows how this zoning should be applied in practice.

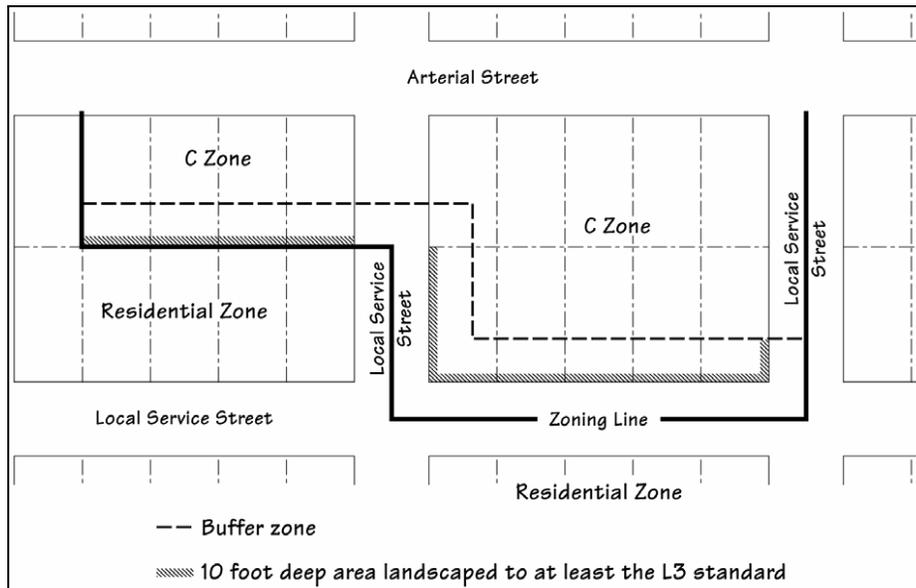


Figure 6.14: Buffer for Commercial Zoned Areas

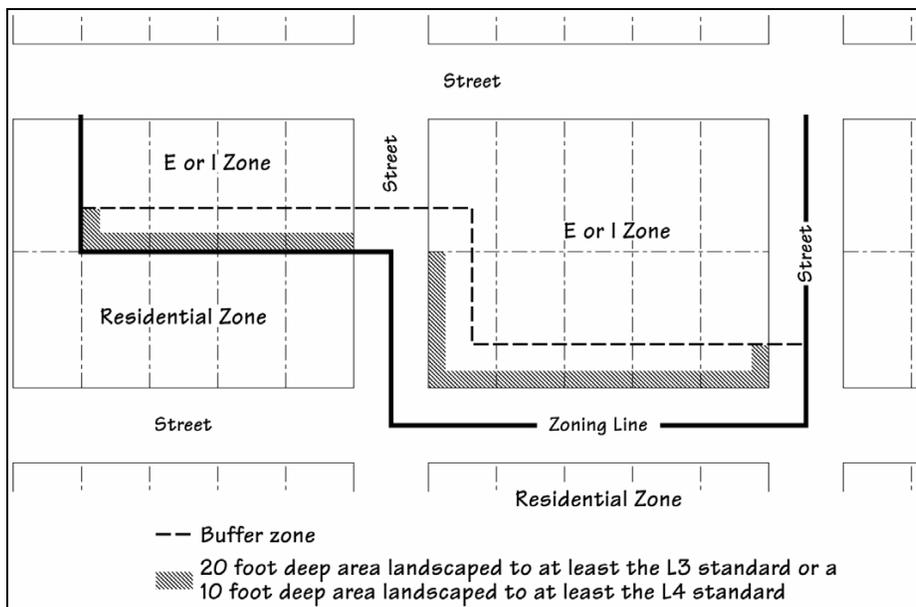


Figure 6.15: Buffer in Employment and Industrial Zones
Source for 6.15 and 6.16: City of Portland

However, buffer zones are not always a perfect solution for every problem. California's Air Resources Board (ARB) reviewed various options for using 'generic buffer zones' around rail yards and port facilities (Tuck, 2004). Cindy Tuck of the California Council for Environment and Economic Balance (CCEEB), in a review session for the ARB, noted that community residents and businesses have an interest in ensuring that local governments do not create incompatible land uses in the future through today's land use control practices. CCEEB reviewed the option of using buffer zones for different land use source categories based on worst-case assumptions. However, Tuck noted that determining an appropriate distance limitation in light of site-specific factors presents multiple challenges and outcomes. Most importantly, using overlay generic buffer zones around specific land uses based on worst-case assumptions can lead to zoning that is more stringent than required, wastes land, limits tax revenues, and takes land away from needed social and economic purposes (Tuck). The case of the Salt Lake City rezoning application that will be discussed in chapter 7, for example, provides an illustrative example of dealing with odd-shaped parcels close to transportation infrastructure given the conflicting viewpoints and desires of the developer, railroad, DOT, city, and residents.

Solano County in California, in its general plan, reviews the use of zoning elements as well as unit design specifications within a chapter devoted to reviewing and abating for noise. These include the use of setbacks, barriers, and also site design to reduce the effects of incompatible uses. The plan notes that buildings can be placed upon a site to shield other structures and reduce noise level caused by reflections—for example, carports or garages—or residential units placed to shield one another can be useful reduction measures close to transportation infrastructure. The plan also notes that site design should review options to use a commercial or storage zoning category between a noise source and a sensitive use area (County of Solano, 2007).

Buildings close to rail ROW can also be designed to mitigate for the rail activities. For example, the placement of interior dwelling unit features can help to reduce conflicts; for example, bedrooms, living rooms, and family rooms should be placed on the side of the unit farthest from the rail use (or noise source). The County of Solano recommends that bathrooms, closets, stairwells, and food preparation areas that are relatively insensitive to exterior noise sources should be placed on the noise side of residential dwelling units.

6.18 Zoning Changes and Activities as a Consequence of Rail Development

6.18.1 City of Minneapolis, Minnesota

The City of Minneapolis adopted new land use recommendations for the Nokomis East Light Rail Transit Station Area in January 2007. This forms part of the city's Corridor Housing Strategy, which has several initiatives including early and comprehensive planning, rezoning, and site acquisition of critical sites on transit corridors (City of Minnesota, 2007a). Eight corridors were initially selected to participate in this initiative. In some instances the rezoning activity covers only a small portion of property but is critically important for mitigation options, for example to act as a buffer and in some instances to create an open space area between contrasting land uses. For example, the Hiawatha light rail line runs at-grade adjacent to Old Hiawatha Avenue (a frontage road adjacent to Hiawatha Avenue Highway). Between 52nd and 50th Streets, residential uses front Old Hiawatha, adjacent to a sound wall. A proposed new land use at this area would be a pedestrian promenade (marked dark green on Figure 7.16) fronted by

residential family development, as opposed to the commercial use that is currently zoned for this area. The Transit Station Area Plan land use recommendations form part of an urban strategy and are intended to serve as a reference for future land use and zoning designations within this area. The city has scheduled a hearing on the recommended land use rezoning activities for late 2007. Figure 6.16 shows an area view of the light rail and the recommended land use descriptions in the updated station plan.

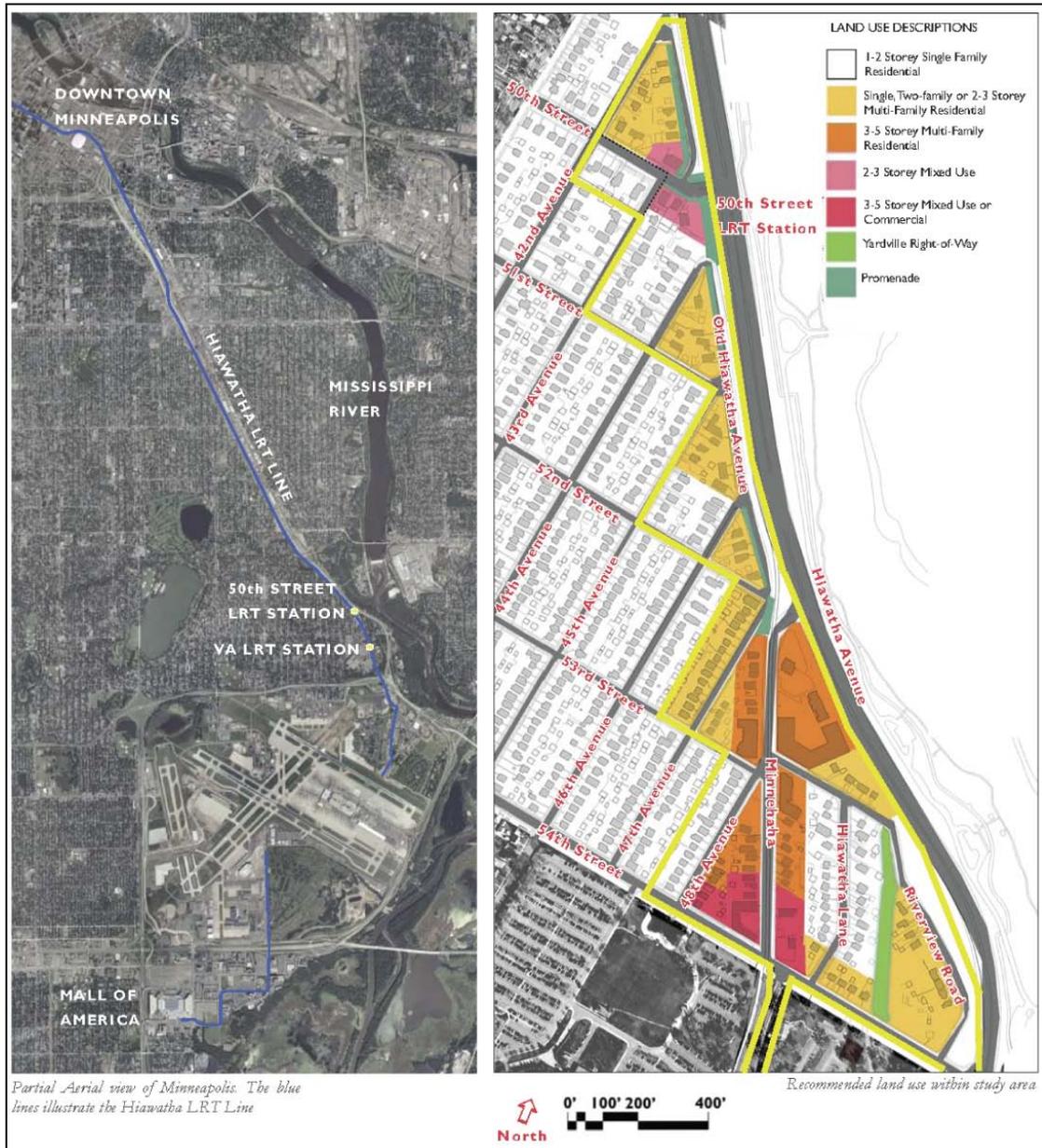


Figure 6.16: Recommended Land Use Descriptions
 Source: Nokomis East Light Rail Transit Station Area Plan

6.18.2 City of Portland, Oregon

The City of Portland, Oregon is currently undertaking a rezoning exercise around its light rail corridors. The project is looking at corridor stations locations and the surrounding ¼ mile area. In the interim it enacted a light rail transit station overlay zone to encourage a mixture of residential, commercial and employment activities within identified light rail station areas. This zoning allows for more intense (and efficient) use of land at increased densities. According to the City, the overlay zone's purpose is for the 'mutual reinforcement of public investments and private development. The zoning standards are designed 'to encourage a safe and pleasant pedestrian environment near transit stations'. This is done by encouraging an intensive shopping area and also the use of amenities such as benches, kiosks, and outdoor areas. The zone is shown on official zoning maps with a 't' symbol (City of Portland online).

6.18.3 City of Reno, Nevada

While the structure of Reno was without doubt shaped by the east-west railway that cut through its downtown area, the city now has an opportunity to review adjacent railroad properties that the city received as part of the trenching project. In 2006 as the project was opened, the city initiated a corridor study to evaluate opportunities to join its properties to the cities' ongoing planning and revitalization efforts to grow the viability of its downtown area. The project is currently holding workshops with stakeholders, designers, city staff, and the community to provide detailed recommendations on land use activities and to develop a series of priorities for action. It is anticipated that a series of TOD projects will take place throughout the corridor's route as well as other changes to land use activities within the downtown Reno area (City of Reno).

6.18.4 City of San Mateo California

In 2000 the City of San Mateo, California, implemented a study of land use and transportation issues around the Caltrain corridor between Hillsdale and Hayward Park Cal Train Stations. In January 2001 it created a Citizen's Advisory Committee to advise on the potential implementation of TOD along this corridor. The committee met monthly from February 2001 through December 2003. They assisted in developing a public review draft plan that was released in February 2004, and was finalized in June 2005. This is known as the San Mateo Rail Corridor TOD Plan. In 2007 the City formally adopted the plan into its general plan and revised its municipal code and drafted a new ordinance (Ord. 2007-3 § 2, 2007). Part of the rationale behind implementing TOD was to concentrate higher intensity projects in areas with access to rail stations to reduce congestion on city streets and create higher value developments surrounded by *supported* amenities (City of San Mateo, Corridor Plan, 2007). One specific project within the land use program—the Bay Meadows Specific Plan Amendment—is a redevelopment of an 83.5 acre area. The area was rezoned for mixed use development and will include office use, 1250 multi-family residential units, retail, public parks, and open space. Caltrain, the developer, and the city are working in conjunction to create this mixed use TOD.

6.19 Transit-oriented Development Initiatives

In many instances TOD has a two-fold rationale behind it. In many instances it is used as both an economic driver within a region, and also as a vehicle to encourage compatible uses around transit corridors. The Federal Transit Agency is also encouraging TOD. TOD is defined

within its Joint Development Guidance as projects that are undertaken in concert with transit facilities. The Joint Development Projects policy was announced in 1997 and can be found at 49 U.S.C. 53096 (a)(1) (FTA, Planning & Environment). FTA funds can be used to facilitate development that enhances transit but cannot be used for purely private development such as construction or financing costs for purely retail, residential, or commercial revenue producing entities. FTA in its resource Innovative Financing Techniques for America's Transit Systems (FTA, 1998) laid out a joint development decision tree that provided greater leeway for transit agencies to use land held within their possession—and financed with federal money—to be utilized for TOD.

Under this guidance:

Transit-oriented joint development can be accomplished through a sale or lease of federally funded property, or through direct participation of the transit agency in the development e.g., as a general partner, depending upon the needs of the project. To qualify as a "transportation project," the transit agency must retain sufficient continuing control over the property to ensure its continued physical or functional relationship to transit. This control may be exerted through any number of legally enforceable contractual arrangements, ranging from a simple easement to ensure unimpeded access between the development and the transit facility by transit patrons, to a covenant, or perhaps some form of reverter clause to take effect in the event access becomes unreasonably curtailed. Any legally enforceable arrangement between the transit system and the developer which preserves the defined physical or functional relationship between the development and the transit facility should satisfy this requirement. As long as such control is maintained, the transit agency may retain all revenues from such joint development as program income. (FTA, 1998)

6.19.1 Denver

Denver has been actively implementing TOD ordinances as it has built out its rail system since the early 1980s. Projects within the metro have taken very different shapes and forms, ranging from infill development, what could be considered new greenfield type projects, to the rehabilitation of a disused mall in Englewood as a civic center and transit rail yard (Loftus-Otway et al., 2004). The City and County of Denver have created a matrix to guide planners and developers regarding what they want to see as the desired land use mix around stations at different areas within the city and county. The matrix is accompanied by a TOD ordinance that outlines the scope and scale of projects. For example, it delineates heights, setbacks (often minimal in TOD developments), floor area ratios, and other architectural functionalities including mitigation measures that are required regarding interior/exterior noise. Table 6.3 shows this Typology Matrix.

Table 6.3: Denver TOD—TOD Station Typology Matrix

TOD Typology	Desired Land Use Mix	Desired Housing Types	Commercial Employment Types	Proposed Scale	Transit System Function
Downtown 	Office, residential, retail, entertainment, and civic uses	Multi-family and loft	Prime office and shopping location	5 stories and above	Intermodal facility/transit hub. Major regional destination with high quality feeder bus/streetcar connections
Major Urban Center 	Office, retail, residential and entertainment	Multi-family and townhome	Employment emphasis, with more than 250,000 sf office and 50,000 sf retail	5 stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus
Urban Center 	Residential, retail and office	Multi-family and townhome	Limited office. Less than 250,000 sf office. More than 50,000 sf retail	3 stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus
Urban Neighborhood 	Residential, neighborhood retail	Multi-family, townhome and small lot single family	Local-serving retail. No more than 50,000 sf	2-7 stories	Neighborhood walk-up station. Very small park-and-ride, if any. Local and express bus connections
Commuter Town Center 	Office, retail, residential	Multi-family, townhome, small lot single-family	Local and commuter-serving. No more than 25,000 sf	2-7 stories	Capture station for in-bound commuters. Large park-n-ride
Main Street 	Residential, neighborhood retail	Multi-family	Main street retail infill	2-7 stories	Bus or streetcar corridors. District circulator or feeder transit service. Walk-up stops. No transit parking
Campus/Special Events Station	University Campus, Sports Facilities	Limited multi-family	Limited office/retail	varies	Large Commuter destination. Large park-n-ride

Source: City of Denver

6.19.2 Maryland

The Maryland Department of Transportation has actively supported and promoted TOD (MDOT TOD Factsheet). The DOT's Office of Real Estate has been involved in joint and transit-agency development as well as working with private partners, specifically in the Baltimore-Washington Corridor. The DOT has a website—the TOD Open Opportunities Page—that lists opportunities existing for Joint/Transit-oriented Development. The DOT notes that Maryland's strategy and goals for TOD are as follows:

Maryland has built extensive transit infrastructure, which continues to expand. The State is promoting transit-oriented development to increase the number of riders and get a better return on this public investment. The goal is to surround stations with vibrant neighborhoods where people can live, work and shop or eat out, all within a safe and pleasant walk to trains, subways, and buses. TOD is not just good fiscal policy. It also helps relieve road congestion by making it easier for people to leave their cars at home. Putting a variety of land uses around transit stations can improve quality of life and access to jobs, stimulate community reinvestment, and boost property values. Maryland's TOD strategy is built around several goals:

- To ensure that station areas are “market ready” for development;
- To build state agencies' and local jurisdictions' understanding of TOD and their ability to carry out TOD projects;
- To strengthen public support for TOD throughout the Baltimore and Washington metropolitan areas; and
- To enhance the potential for federal funding to expand transit in the Baltimore area by showing that development patterns can support transit. (MDOT, Real Estate)

Eight projects are currently being implemented. The largest is the Owings Mills Metro Station development. This is a mixed use development of 46 acres of transit agency land plus other segments of state-owned land. The project has 1.2 million square feet of office space, 495 residential units, 225,000 square feet of retail space, a public library, community college, hotels, five parking garages providing 11,130 spaces, and multiple restaurants all centered around the station. The projects estimated value is \$500 million (Brown Enterprises, 2007).

6.19.3 New Jersey

New Jersey and specifically New Jersey Transit (NJT), which runs the state's transportation system, was one of the first agencies in the nation to develop an active TOD culture. In 1994 NJT developed a handbook: Planning for Transit-Friendly Use in New Jersey. The handbook was designed to assist elected officials, planners, consultants, and community representatives about improving the relationship between land use planning and transit (NJT: Transit Friendly Land Use). In 1999 NJT created a community planning assistance pilot program that ran until 2002. The program was created with funding from the FHWA and NJT partnered with nonprofit consultant partners who specialized in urban design, transportation planning, downtown revitalization, and community outreach. These teams assisted competitively selected municipalities to develop community-based visions for transit-friendly development surrounding rail stations. Communities that participated in this initial pilot included Bayonne, Hackensack, Hillsdale, Hoboken, Rutherford, and Trenton. This led to NJT hosting a statewide conference on transit-friendly land use visioning, planning, and development known as “Building Better

Communities with Transit: Smart Growth Designs and Planning Strategies” in March 2002. This was attended by over 100 municipal, county, and state officials along with developers, community activists, consultants, and private citizens. In 2002 NJT released a CD-ROM of the activities. It identifies universally applicable, transit friendly land use best practices and lessons learned from the pilot program.

6.19.4 Pennsylvania

In February 2005 the State Legislature passed a Transit Revitalization Investment District (TRID) Act to spur TOD across the State (Act 238 of 2004). Modeled on the New Jersey initiatives, specifically the Transit Village Initiative, Pennsylvania’s TRID establishes state-level budgetary and technical resources to help communities develop vacant, underutilized, or otherwise redevelopable land located within a half-mile radius of a transit station. The state made \$2 million in grants available for counties and communities wanting to implement a TRID through its Land Use Planning and Technical System Program based in the state’s Department of Community and Economic Development (Governor Rendell, 2006). Municipalities can initially team with the transit agency to undertake a TRID Planning Study. They develop the rationale for developing the district and will also set out and establish the boundaries that the district will encompass. A TRID management authority, appointed by municipal officials, will then oversee the development of an implementation plan and will ultimately be responsible for soliciting requests for proposals and then awarding projects to selected developers.

Two TOD projects in Philadelphia and Pittsburg have utilized the TRID mechanism to begin putting projects together. The borough of Marcus Hook, which is located southwest of Philadelphia on the SEPTA Northeast Corridor R2 rail line used a \$60,000 grant to build upon a TOD study completed in 2003. The borough plans to determine tax revenues, formulate a financial plan, and then prepare an agreement with SEPTA to create the TRID management authority. The borough is currently evaluating a developer’s proposal to build a 120 unit mixed use facility, with a mix of rental and for-sale units, as well as some commercial on a vacant plot located about 100 yards from a rail station (Transit Friendly Development, 2006).

6.19.5 Portland Oregon

Portland and its surrounding cities have been actively involved in developing TOD. The city of Gresham, for example, has created a property tax exemption to encourage TOD supportive housing. A 26.9 percent discount is available as an incentive to local new development in a TOD district. In 1996 Portland, following the State’s lead, implemented a local option discount program to encourage TOD. This was followed by Portland creating a TOD Implementation Program to assist in the construction of TOD projects through the use of site control, financial participation and other joint-development tools. As of 2005 Portland was working on nine projects with financial participation ranging from \$50,000 to \$2 million (TriMet, 2005).

6.20 Partnering

Finally, it should be noted that partnering is without doubt the most critical factor in rail projects. Without successful partnering it is impossible to create a regime to ensure that encroachment issues are reviewed, and where possible resolved early-on, that compatible development takes place and that parties adhere to a rational and realistic approach in developing

rail projects. Partnering is also critical to foster regional coordination, which is not provided by local zoning laws (Weinberg, 2000). For example, the City of Anaheim's 2004 state of the city speech noted that the sound wall that was about to be installed could not have come to fruition without getting all the parties to the table. As Kathryn Pett noted, getting multiple parties to the table requires tact, determination, and willingness to compromise. The Massachusetts Bay Transit Agency also noted in its Greenbush Project that it was important to conclude mitigation agreements that addressed issues of local concern with the various jurisdictions along routes. Pett noted that it is appropriate and smart for DOTs, cities and counties to partner on corridor preservation because there are meaningful benefits and synergies that accrue from partnering. She noted that partnering on environmental assessments under NEPA has been successful across the U.S., has streamlined the process, and led to better mitigation. She felt similar benefits would accrue in rail corridor projects by teaming across jurisdictions.

Similarly, what might be termed the 'big-ticket' freight rail/transit projects such as the New Mexico Rail Runner, the purchase of UP's corridor in Salt Lake, the Alameda Corridor Project, Chicago's CREATE project, Washington's FAST project, Reno's ReTRAC, and the Heartland Corridor all require multi-stakeholder partnering, financial input, and amendments to land use activities. Without this support, projects will languish on the back-burner and critical issues surrounding land use impacts may be overlooked. As noted by NCDOT, it is also important for DOTs and other local jurisdictions to develop relationships with the Class Is and shortlines that operate in their states. At the Texas Transportation Forum held in July 2007, all the speakers in a session on commuter rail stipulated that it is important to involve the Class Is from *day one* as any projects are being contemplated (Skoropowski, Blewett, and Blaydes, 2007). Without their "buy-in," projects will not be successful. Pett and Blewett also both commented that dedication and in some instances multiple meetings at the Class Is' headquarters will have to be undertaken by transit agencies and local jurisdiction officials. One off-the-record comment was "you'd better get your game on when undertaking a project with the Class Is and multiple parties." The various agencies and individuals that the research team interviewed noted that partnering required all agencies to take a long-term outlook over the projects and that a strong leadership role was required to ensure that parties stayed on track. Given the multiple-year time frames that these projects occupied, it also required politicians and other elected officials to be consistently educated about the project to ensure continuity. The Alameda Project, Reno's ReTRAC, Washington's FAST, and Chicago's CREATE projects are all considered excellent examples of the benefits of partnering to ameliorate inter-jurisdictional issues in relocation and grade separation projects.

The West Coast Corridor Coalition (WCCC) is another example of states partnering to advocate for collaborative solutions (WCCC Fact sheet). This coalition is represented by the States of Alaska, California, Oregon and Washington. Its objectives are to:

- Develop and mutually support a roster of "projects of corridor significance" that serve the nation and the region.
- Share "best practices" in order to optimize the capacity and performance of the existing corridor system.
- Encourage joint effort and effective cooperation among West Coast state, regional, and local governments and the private sector.
- Advocate for financing options to fund transportation system improvements serving the interests of the Coalition, including both additional funding and regulatory changes.

Another way that agencies could collaborate to protect and preserve rail corridors is by collaborating to create information sites regarding the issues of encroachment, preservation, land use planning, and other issues. A useful example of such a site is the Railway/Municipality Proximity Issues Information Base website. Created by The Railway Association of Canada, the Federation of Canadian Municipalities, and the Canadian Railroads, this site provides information on encroachment (titled proximity) and develops materials that can be used to assist localities and the railroads with encroachment, preservation, and planning issues. This can be found at <http://www.proximityissues.ca/english/index.cfm>. The site also contains regular reporting updates, facts on proximity issues and details on its members.

Many of the agencies that the research team communicated with over the course of the research noted that the use of Quiet Zones was one of the best tools that could help in mitigating the encroachment issue. Russell Wiles of the City of Fort Worth noted that two developers had been actively involved in the planning and implementation of quiet zones around their developments—and in fact funded the crossing improvements entirely (Wiles, 2007). In California John DeWald, owner of Dewald and Associates, noted that the implementation of a quiet zone as part of the development process undertaken in his Encinitas mixed-use project not only had the potential to add a premium to property values but was also an excellent marketing tool (DeWald, 2007) for the city and the developer in promoting TOD projects.

Finally, it has also been noted that involving the public through the use of public meetings, surveys, and focus groups in feasibility and alternatives analysis can diminish opposition to rail projects and in some instances, bring local elected officials to the table. For example the BeltLine TOD project in Atlanta, Georgia, was initially proposed to local residents. The developers visited local churches and neighborhood groups and generated ‘buy-in’ for the project. The developer’s also used community meetings to hear residents concerns regarding the proposed high-density residential changes that would occur around this disused rail line (Springer, 2007). The project proposed taking 22 miles of underused lines to run a commuter rail system that connected 45 Atlanta neighborhoods. The city’s planning teams used the various outreach meetings to gather information on what communities wanted out of such a system. Community groups were invited to use Lego bricks to build model projects, and these forums provided opportunities for communities to air their fears and ask questions. This also allowed planning staff to incorporate these concerns into the long-range plans, publish newsletters regarding project progress, and hold multiple open-house sessions. As of early 2007 the project had moved forward for purchase and implementation.

Chapter 7. Costs

This chapter provides an overview of costs associated with acquiring and preserving railroad corridors, costs of procuring planning studies and costs associated with mitigation options. The examples cited will probably not be sufficient to predict the likely cost of any future project envisioned for Texas. However, they will give some guidance in estimating the potential complexity based on the type of acquisition being proposed and the legal context surrounding it. The major acquisition categories include fee simple acquisition, shared track, and shared corridor arrangements. In some cases, such as Utah, a combination of these strategies was used. Mitigation activities covered include sound/vibration mitigation construction activities and the establishment of quiet zones. This section also briefly reviews transit-oriented developments (TOD) revenue generation capabilities, as TOD-generated new tax and sales tax revenues have the potential (from a PR standpoint) to be used to offset the cost of mitigation activities.

7.1 ROW Preservation and Purchase Costs

The costs associated with preservation and purchase of rail is substantial. Project planning costs alone, including public outreach, can run into the higher six figure sums. Although substantial variation exists in ROW purchase costs, many of the institutions and individuals contacted throughout the course of this study noted that a rough average figure for corridor purchase was \$1.2 million per mile. Despite the fact that the fee simple acquisition is generally assumed to be the most expensive option, in the cases examined, the costs between acquiring fee simple ownership were comparable to the costs of shared track or corridor access rights. One logical reason for this is the corridors that are sold in their entirety to public agencies by railroads are generally of lower value than the corridors in which shared track arrangements are established.

7.1.1 Corridor Planning Costs

The first step in preservation and purchase is establishing a rail corridor plan. The Federal Railroad Administration provides grants under 49 U.S.C §26101 for corridor planning assistance. Section 26101 provides assistance up to 50 percent of publicly financed costs associated with eligible activities. No less than 20 percent of the publicly financed costs must come from state and local sources. In some instances multiple parties will also provide funding for planning activities. Harris County's rail plans, for example, had financial support from UP, BNSF, KCS and the Port Terminal Railroad Association as well as the City of Houston, Port of Houston Authority, and Fort Bend County. When projects are deemed of national importance, the federal government can provide a substantial share of total corridor planning costs. For example, in 1997 Michigan's DOT was awarded funding to embark on a Chicago-Detroit high-speed rail corridor plan. The overall planning costs were \$289,500 with the federal funding comprising \$118,695, and the balance of \$170,805 provided by the states of Michigan and Indiana, Amtrak, and other in-kind contributions (FRA, 1997).

Idaho's Corridor Planning Guidebook (Idaho, 2006) notes that there are six main variables that will affect preparing a budget for conducting a corridor planning process as well as writing the corridor plan document. These include

1. Length and Complexity of Corridor

2. Generation of New Data
3. Transportation Forecasting and Analysis
4. Mapping and Graphics
5. Printing Costs
6. Public Participation Process

The Houston rail plan is a comparative analysis of improvements to rail corridors in the greater Houston area, principally through grade separations. The plan was also intended to lay the groundwork for future rail uses such as commuter rail. The Houston rail plan involved work by the Texas Transportation institute and several consultants. It should be noted that the cost of the analysis was borne prior to any capitalization of the Texas Rail Relocation Fund which would enable many of the projects to be realized.

Washington's DOT (WSDOT) in 1999 issued a RFP for on-call rail planning and public involvement. Initial costs were estimated for a two to three year evergreen type contract at \$2.8 million. The RFP stipulated consultants were to develop a freight rail plan, passenger rail plan, and economic plan and to engage in public involvement and education, including planning and outreach activities (WSDOT, 1999).

Washington State's Sound Transit estimated costs for its planning study on the BNSF Corridor from Renton to Snohomish is estimated at \$16 million (SoundTransit, 2007). This project will evaluate potential for high capacity transit as well as integration with a proposed bicycle and pedestrian trail.

7.1.2 Rail Banking

Rail banking is the federal mechanism that allows rail corridors to be preserved as trails. Per 49 USC 1654 (f) (2), rail banking allows the acquisition of an interest in a rail right-of-way sufficient to ensure its provision for future rail service. Under this program (administered by the Surface Transportation Board) the trail sponsor will assume managerial, financial, and legal responsibility for the right-of-way.

The concept of *rails-to-trails* allows for an underutilized or abandoned freight line to be converted to recreational trail use and, in the case of railbanking, retained for future rail use either by freight or passenger services. Depending on the complexity of the pre-existing arrangement, the legal costs to rezone an area can be considerable, especially if the banking occurs in an urban area. For example, New York City planned to commit over \$43 million for the rezoning and redevelopment of the High Line on Manhattan's West Side. The city and state joined together to put in the legal filing to the Surface Transportation Board to transform the High Line into a public space through the rail-banking program. The rezoning was to be a collaborative process with landscape architects and a steering committee to create a high rise garden in the sky (City of New York).

7.1.3 Corridor Upgrade Costs

Situations in which state-level initiatives were being organized to upgrade an existing corridor to handle double-stack container traffic were described in both the Virginia and Washington State case studies. The Heartland Corridor Project, which in its central portion will undertake a double-stack clearance project, is projected to cost \$151 million. Of this, \$95 million was authorized under SAFETEA-LU, but is still subject to obligation. The Virginia Rail Enhancement fund will provide \$9.75 million. Ohio, which will also benefit from the corridor

upgrade, has also become involved in the funding process with its Ohio Rail Development Commission Grant providing \$836,355, and the balance being funded by Norfolk Southern Railroad. The total cost for the entire Heartland Corridor is currently estimated at \$266 million (Virginia Ports Authority, 2005).

7.1.4 Rail Relocation

Rail relocation costs run into the millions and billions of dollars. The Alameda corridor, for example, was established at a total cost of \$2.4 billion. Costs were borne by a blend of public and private funding, and user fees paid by railroads per container will be used to retire the debt. The fees are slated to increase over the 30 year period of the bond life between 1.5 and 3 percent per year (subject to inflation). Reno's ReTRAC project, finished in 2005, cost \$265 million dollars. The project is being paid for utilizing a hotel room tax, special downtown assessment, sales tax increase, and \$17 million from UP and federal grants.

As noted in previous sections, there are other potential rail relocation projects currently being studied in Texas. These include the possibility of relocating through-freight traffic currently using the UP line between Austin and San Antonio; the potential Tower 55 major grade separation and the associated rail relocation discussions for the Dallas-Fort Worth region; the Houston Freight Rail Study; and relocation projects in and around El Paso. The total cost of implementing all of the projects associated with the Houston Rail Plan, for example, has been estimated at \$4.5 billion dollars.

In Colorado, the Front Range Infrastructure Rationalization project has been envisioned for several years. The project has proceeded through several exploratory phases. BNSF and UP came up with initial estimates of costs for relocation. Colorado DOT's scope of work study looked at three build-out scenarios (in 2004 dollars). A further feasibility study was completed at a cost of \$2.2 million. The study involved DMJM Harris and HDR. Estimated capital costs for the relocation project in this study were approximately \$1.1 billion in 2004 dollars. Table 7.1 shows comparisons between the BNSF/UP estimates and the study team's estimates.

Table 7.1: Front Range Relocation Cost Summary Comparison

Description	BNSF/UP Estimate	Study Team's Recommended Estimate
New Track (95 miles)	\$287,967,000	\$288,600,667
New UP Freight Terminal	\$208,024,000	\$208,024,000
New BNSF Freight Terminal	\$259,280,000	\$259,280,000
UP Limon Subdivision Track Improvements	\$144,223,000	\$150,568,000
Various Front Range Improvements		
Utah Junction	\$43,832,000	\$51,042,000
North Yard to Belt Junction	\$30,000,000	\$39,000,000
Utah Junction to Belt Junction	\$40,193,000	\$41,836,000
DRI Line	\$78,204,000	\$92,828,000
Sand Creek	\$15,546,360	\$15,882,000
Greeley Subdivision to DRI	\$7,983,000	\$8,036,000
Utah Junction to Prospect Junction	\$6,679,000	\$6,980,000
Omar to Union	\$5,293,000	\$5,293,000
Sidings, etc., South Denver to Palmer Lake	\$20,000,000	\$0 (removed as improvements are for commuter rail. Considered outside the scope of the Study.
Sidings, etc., Palmer Lake to Pueblo	\$79,526,000	\$0 (removed as improvements are for commuter rail. Considered outside the scope of the Study.
TOTAL	\$1,226,750,360	\$1,167,369,667

Source: CDOT Costs and Benefits Study

Virginia's Commonwealth Mainline Freight Rail Relocation Project and the Multi-State Heartland Corridor Project

The Commonwealth Railway Mainline Safety Relocation Project (CRMSRP) is one of three key components of the Heartland Corridor Project and is the one component in which completely new track will be laid through a corridor that has not seen train traffic before. At \$60 million, the cost of the CRMSRP is approximately 15% of the total cost of the Heartland Corridor project. SAFETEA-LU provided \$140 million for the Heartland Corridor. Of this, \$15 million was provided for the CRMSRP project. The other principal sources of funding are the Governor's transportation funds in the sum of \$15 million and DRPT rail enhancements funds in the sum of \$25 million (VPA, 2006).

7.1.5 Fee Simple Purchase

Anecdotal comments made by many of the parties interviewed during the course of the research noted that a ballpark figure for corridor purchase was running approximately \$1.2 million per mile. A review of costs for system purchase roughly mirrors this back-of-envelope type extraction.

New Mexico provided one of the most significant examples of a fee simple purchase of a rail corridor for future public use. The initial capital cost for corridor development from Belen to Bernalillo was \$135 million; however, this figure includes \$75 million for purchase of cars and locomotives, design and construction of stations and track and signals. The state gave \$50 million for purchase of track and rights-of-way from BNSF. The BNSF agreement with the New

Mexico Department of Transportation is structured in three phases that involve the purchase of nearly 300 miles of rail line from Belen, New Mexico, to Trinidad, Colorado, for \$75 million.

- Phase One of the agreement, which was effective January 2006, included the \$50 million purchase of 51 miles of mainline track between Belen and Bernalillo for commuter rail service.
- Phase Two involves the \$20 million purchase of 48 miles of mainline track between Bernalillo and Lamy, New Mexico. This agreement went into effect January 2007.
- Phase Three involves the \$5 million purchase of 200 miles of mainline track between Lamy, N.M., and the Colorado Border (to Trinidad, Colorado). This agreement will go into effect December 5, 2008.

As part of the agreement, the state of New Mexico permits BNSF to run a limited number of trains per day along the track now owned by New Mexico. BNSF pays the state a usage fee for each train. The right-of-way costs were only a fraction of the total expenditure for the state of New Mexico. Also included were substantial costs for track rehabilitation, bridge enhancements, and new track construction.

7.1.6 Shared Track or Corridor Access Costs

In some examples, transit systems have shared trackage rights with freight rail. Utah Transit's (UTA) purchase of 174 miles of UP track, which was a mixture of fee-simple purchase as well as shared corridor and shared trackage rights, ran \$185 million dollars. UTA purchased not only fee simple corridor ROW but also access to the ROW via the transfer of easements and, on the northern part of the line between Ogden and Provo, they purchased the easterly 20 feet of ROW along portions of this route. This allowed UTA to run a parallel system in the same corridor ROW. Originally UTA had assumed they would purchase slots on the bulk of the system (which was the national model in operation at the time). However, due to UP experiencing serious service problems nationwide at the time, UP did not want to give up access to the corridor, and wanted the flexibility to be able to continue service. As a consequence this allowed UTA the opportunity to purchase a share in the use of the corridor ROW and the purchase of the easterly 20 foot of ROW along portions of the route.

Washington's Sounder transit commuter train is another example of an arrangement in which the agency compensates the Class I railroad for usage in addition to providing for modest capital improvements that may aid the operation of the existing freight services in addition to the commuter services. Under the initial Sounder arrangement, negotiated in 2000, Sound Transit was required to provide for \$285 million in track enhancements in order to upgrade the lines to simultaneously handle freight and commuter traffic. In addition, Sound Transit agreed to pay the BNSF an annual usage fee of \$4 million. On the eastern side of the state, WSDOT acquired a series of shortlines near Spokane that feed BNSF or UP. The acquisition was first proposed in 2002 and completed in 2007 at a cost to the state of approximately \$20 million for the acquisition and an additional \$7 million for rehabilitation.

7.2 Mitigation Costs

There are now some notable examples of rail relocation projects throughout the United States. The Alameda Corridor Project in Los Angeles and the Reno ReTrac project were without doubt the 'trailblazing' projects that have lead the way for rail relocation initiatives in the United

States. According to the FTA's Manual on Noise and Vibration cost is an important consideration in deciding how to undertake mitigation measures:

Cost is an important consideration in reaching decisions about noise mitigation measures. One guideline for gauging the reasonableness of the cost of mitigation is the state DOT's procedures on the subject. Each state has established its own cost threshold for determining whether installation of sound barriers for noise reduction is a reasonable expenditure. The states' cost thresholds range from \$15,000 to \$50,000 per benefited residence, with a cost-weighted average of \$24,000 per residence. Several airport authorities have placed limits on the costs they will incur for sound insulation per residence for homes that are impacted according to Federal Aviation Administration criteria. These costs range from \$20,000 to \$35,000 per residence (2002 dollars). As a starting point, FTA considers the midpoints of these ranges—\$25,000 to \$30,000 per benefited residence—to be reasonable from the standpoint of cost. It should be noted, though, that higher costs may be justified depending on the specific set of circumstances applying to a project. (FTA, 2006)

7.2.1 Sound Walls

The FTA guidance manual estimates that sound walls will cost approximately \$25 to \$35 per square foot of installed noise barrier at grade (not counting design or inspection costs).

Phil Hooser, Product Manager for Industrial Acoustics Company (IAC) (Hooser, 2007), noted that for *most* rail jobs \$60 per square foot “should” cover the costs of design, panels, foundation work, and installation. However, the final cost was also determined by underlying soil conditions and whether other remedial work was needed to put sound walls in place. This estimate does not include costs for any landscaping or other elements that may be required post-installation. Phil Hooser noted that some projects they were currently working on came in at about \$42 a square foot.

From the case studies reviewed throughout this research it became apparent that noise barriers are extremely expensive with many project costs ranging in the millions of dollars for very short stretches of right-of-way. For example, WSDOT undertook an analysis of proposed noise wall mitigation work to be undertaken on highway projects in 2003 and 2006. The average cost per square foot rose from \$34.60 per square foot to \$59.47 when taking into account engineering and construction. While this was attributed to extra seismic studies that had to be undertaken, cost factors had also risen due to the price inflation of construction material such as concrete and steel.

Notwithstanding criticism and arguments that noise barrier efficacy comes down to a subjective judgment, many rail corridors have had barriers erected to offset noise. For example, a large-scale sound wall project was completed within the BNSF ROW in the city of Anaheim in 2006. This project had taken nearly twelve years to come to fruition after a neighborhood group, in conjunction with elected officials and BNSF, first began lobbying for this barrier in 1992. The project costs were underwritten by FHWA who issued authorization in 2003. Total project costs for this 2.44 mile stretch were \$13 million (City of Anaheim, 2003). The cities of Anaheim and Yorba Linda supplied \$2 million to finish construction of the sound wall and a park-like earthen berm that was also built to deflect and absorb train noise. Specifications for the sound wall included absorbing the noise of nearly 100 trains a day, and keeping it from ricocheting into the Yorba Linda neighborhood on the other side of Route 91. The sound wall's average height is 16

feet above the railroad rail, but varies along the length from 16 feet to 3 feet and is hung on steel uprights (Hooser, IAC).

The Alameda corridor project is probably the most widely cited rail relocation project in the United States. While sound walls were built in some sections there are continuing efforts to install further sound walls (due to community action and environmental justice concerns). The city of Carson, for example, authorized \$200,000 in May 2006 to prioritize community outreach and the finalization of a study reviewing a Soundwall to be placed close to Alameda Street due to the replacement of Schuyler Bridge which will result in increased truck volumes to the sections of Alameda Street (City of Carson, 2007). This sound wall will be an 8 foot high berm with landscaping with a 6 foot high masonry wall erected on top of the berm.

7.2.2 Station Improvements and Station Siting Projects

For many transit projects, improvements to stations and other buildings is another way to mitigate noise and vibration and reduce costs. For example, the Gold Line to Pasadena issued an RFP in February 2007 for the purchase of an automatic train arrival information system with electronic message boards to reduce noise at three stations from the overhead announcement system. Pasadena City Council authorized a recommendation placed before it to implement the train arrival information system with electronic message boards as a noise reduction project (City of Pasadena, 2007). This is because an independent study conducted in 2004 found that sound levels at three Gold Line stations (Lake Avenue, Allen Avenue, and Sierre Madre Villa Avenue) are above acceptable dBA levels. The City Manager issued a report in January 2007 outlining a plan to address the noise issue after the recommendations of the consultant hired to review the noise issue became prohibitively expensive and were also not authorized for use on state transportation facilities. The City Manager recommended this new option because it was not only cheaper and would immediately address the noise issue but also because in the long run the ITS component would provide congestion mitigation options for other parts of the system and grade-crossings (City of Pasadena, 2007). The total cost for the system at all six Gold Line stations would be approximately \$500,000 to \$1,000,000 with operations and maintenance running at approximately \$2,000 per year. The City Manager also noted that the opportunity to extend this system to new stations would not be cost-prohibitive, particularly when compared to costs of approximately \$5.3 million to construct sound walls at three stations, including demolishing existing barriers, installing a foundation system and new barrier, and then installing clear sound wall panels atop the new barrier at the three stations.

7.2.3 Residential Sound Insulation

In some instances sound insulation in private residences can be used, as often occurs in developments close to new commuter rail and light rail lines. Experience with sound insulation of buildings has been undertaken as part of noise mitigation undertaken by local airport authorities and the Federal Aviation Administration (FAA). Based on FAA experience, a typical single-family home can be fitted for sound insulation for costs ranging from \$25,000 to \$50,000 (FTA, 20067). The city of Carson, for example, is considering the possible establishment of a zoning overlay district which would mandate certain design standards such as requiring the development of 2 story residential buildings that abut one another and would serve as sound barriers around the Alameda Corridor (City of Carson, 2007).

7.2.4 Berms

There were a few examples of berms being used for mitigation around railways. Where berms occur they have often been in place for many years so figures were not available. One berm that is currently being created is in the City of Yorba Linda in California. It will be completed in September 2007. The costs for the berm and landscaping with 550 trees are being provided through a \$1.3 million SAFETEA-LU grant, along with contributions from the cities of Anaheim and Yorba Linda. The berm is being built to reduce the visual and noise impacts of a Soundwall built by City of Anaheim as well as address other noise impacts from Anaheim's soundwall. This will be a block wall and landscaped berm adjacent to a railroad track. The berm will be three feet high with a wall extending six feet above the top of the berm (City of Yorba Linda).

7.2.5 Quiet Zone Implementation

According to the Federal Transit Administration, the cost of establishing a quiet zone varies considerably, depending on the number of intersections that must be treated and the specific SSMs, ASMs, or combination of measures that are used. The FRA gives a cost estimate of \$15,000 per crossing for installing two 100-foot-long non-traversable medians that prevent motorists from driving around closed gates. A typical installation of a four-quadrant gate system is in the range of \$175,000-\$300,000 per crossing. Deciding who will pay for the installation of modifications can become a major consideration in a decision to pursue a quiet zone designation, especially in cases where noise from pre-existing railroad operations has been a sore point in the community. In cases where a quiet zone would mitigate a severe impact situation brought about by the proposed transit project, the costs would be borne by the local transit agency and FTA in the same proportion as the overall cost sharing for the project (FTA, 2006). Norfolk Southern and Union Pacific estimate the following costs to implement a quiet zone:

- Four-Quadrant Gate Systems: \$300,000 to \$500,000
- Basic Active Warning System: \$185,000 to \$400,000
- Basic Inter-Connect: \$5,000 to \$15, 5000
- Annual Maintenance: \$4,000 to \$10,000.

However, recent reports of quiet zone implementation have shown that costs are increasing. According to recent news reports regarding two downtown San Diego quiet zone projects—original estimates do not nearly match the revised implementation figures. The original 2005 estimate for adding new arms at 12 railway crossings and 7 street light configurations was \$3.5 million. This figure was revised in November 2005 to \$7 million, and current estimates are now being put at \$16.7 million (Steel, 2007). According to city officials, costs have grown because of “spiraling construction costs nationwide.”

The city of Oceanside in California is looking to implement a quiet zone that will comprise five signal modifications. The city has also undertaken a survey to establish citizen interest level regarding “the reduction of railroad horn noise” alongside the Oceanside North County Transit District mainline rail west of Interstate 5. They held community meetings in July 2007 regarding this project. The city proposed a potential source of funding from the creation of an assessment district. This would be a 20-year tax-exempt, non-rated assessment bond (City of Oceanside, 2007). This would be applied to 1,000 benefiting units, and the city-estimated approximate costs can be seen in Table 7.2.

Table 7.2: City of Oceanside Annual Costs for Quiet Zone Implementation Per Unit

Funding Amount	Annual Cost	Annual City Share	Annual Cost for Each Unit
\$9 million	\$725,000	-	\$725
\$7 million	\$570,000	-	\$570
\$9 million	\$725,000	\$250,000	\$475
\$7 million	\$570,000	\$250,000	\$320

Source: City of Oceanside

Private developers will often be willing to pay for the cost of implementing a quiet zone. John De Wald (DeWald, 2007), the developer of Pacific Station in Encinitas, California, is currently working with city officials to develop a quiet zone near this TOD development. This project has 50 residential units planned within the 105,000 square foot development. The project backs onto a relatively busy rail track with Amtrak, two commuter lines, and three to four freight trains a day running over it. John DeWald has directed the planners and architects involved in this project to structure the development to include the use of absorptive building materials as well as reviewing residence design layouts. He noted that the benefit of implementing the quiet zone will be increased value and satisfaction with the development. Other cities along this route have also considered assessing property owners to raise the \$7–9 million required to establish quiet zones at five other crossings.

Another way to reduce noise is to implement the use of Wayside Horns, which are used instead of locomotive horns. Wayside systems are estimated for a railroad highway grade crossing at approximately \$50,000 per system.

7.3 Other Mitigation Options

The FTA in its manual on noise and vibration notes that wheel treatments can be effective in reducing noise and vibration. For example, resilient wheels are estimated to run at approximately \$3000 per wheel compared to \$700 for standard wheels. Costs for damped wheels add approximately \$500 to \$1000 compared to the normal \$700 for each steel wheel. Maintenance by truing the wheels is estimated at \$60 per wheel set. Spin-slide control systems, which reduce wheel flat incidence which are a major noise contributor, run at approximately \$5000 to \$10,000 per vehicle. Regular track grinding is another option for reducing noise related to rail operation. For example, BART in San Francisco continuously grinds its tracks each night. In 2006 it ordered a new custom-designed grinder railcar for \$3 million. According to Gordon (Gordon 2006), BART’s track crews may pass over one piece of track a dozen or more times to ensure the track is “just right.” BART rail grinding costs approximately \$1,500 per pass-mile (MIG, 2006) (a *pass-mile* is one pass by the rail grinder over a distance of one mile). The crews smooth about one mile of track each night over the 104 mile system and it is estimated that it takes a little over six months to grind the whole system. While this may seem like a small amount this is because grinding only takes place at night and because the grinding causes sparks it cannot be undertaken during fire season Rocha, 2007). San Francisco’s Municipal Transportation Agency’s capital improvement plan project budget for FY2008-2027 estimates that rail grinding a system that consists of 71.5 track miles for light rail, 5.4 miles for the new Third Street line, 6.6 miles of subway, and 8.8 miles of cable car will cost \$3.84 million (SFMTA, 2007). When faced with numerous complaints tied to rail operation, Los Angeles

County Transportation officials spent over \$500,000 experimenting with everything from equipping trains with noise-muffling skirts to grinding and polishing rails to *truing* (grinding down flat spots on its wheels).

In 2003 the City of Littleton along with the Regional Transit Agency in Colorado, installed experimental padding under ties after UP's freight line was shifted 100 feet to accommodate a light rail line and community complaints grew about vibration. The padding installed was an elastic polymer mat. The installation of these pads cost \$250,000 for the 1,000 feet of track north of Mineral Avenue. UP installed the padding as well as new continuous welded tracks (Stoppolecamp, 2007).

7.4 Costs of Inaction

Largely absent from most discussions of rail corridor encroachment, preservation, and enhancement are the opportunity costs of inaction. As difficult as it is to determine the likely cost of a rail enhancement activity, accurately estimating the cost of not taking the action is even more precarious. As a general rule, the costs of ROW acquisition were found to be escalating rapidly as were the costs of mitigation activities such as sound walls and quiet zones. On the other hand, there is some indication that the acquisition process is becoming more streamlined as more states successfully complete negotiations which hopefully should drive down the administrative cost of future acquisitions. As an example, the Utah case study was actively examined by planners in New Mexico and aided New Mexico in streamlining their negotiations with the BNSF. Now, in Arizona both the New Mexico and Utah cases are proving instructive. Economies of scope could also be gained by the Class I railroads by negotiating several agreements that would impact their total system simultaneously.

7.5 Transit-oriented Development

States have begun to require that developers obtain state as well as local government approval for projects. This allows the state to limit the impact of development and reduce side-effects that occur when development runs adjacent to transportation infrastructure. The establishment of transit-oriented developments, considered a key strategy for boosting ridership and usability of rail transit systems, can have multifaceted economic impacts. In some cases, such as in Portland, property tax abatement has been used to encourage the establishment of residential development in areas which would otherwise favor exclusive commercial use. It should be noted that residential TODs may produce more reliable property tax income than commercial developments in some instances.

In 2005, research by the Center for Economic Development and Research at the University of Texas at Dallas assessed the financial impact of transit-oriented developments in Dallas with reference to increased property and sales taxes. The total taxable value impact of transit-oriented developments in the Dallas region was found to be \$3.3 billion. The impacts on local property taxes are relayed as follows.

Table 7.3: Impacts on Local Property Taxes

Local Property Tax Rates and Revenues Generated by Transit-Oriented Development				
Entity	Total Value	Taxable Value	Tax Rate	Property Tax Revenue
Municipalities	\$ 3.3 billion	\$ 2.8 billion	0.7292	\$ 20,418,000
County Entities*	3.3 billion	\$ 2.8 billion	0.553934	\$ 15,510,000
School Districts	3.3 billion	\$ 2.8 billion	1.50264	\$ 42,074,000
Total				\$ 78,002,000

*Rate includes community college tax, hospital district tax, and school equalization tax in addition to general county tax. Sources: Dallas Central Appraisal District, Authors' estimates.

Source: Dallas Area Rapid Transit

Chapter 8. Mitigation for Encroachment Alongside Rail Activities

Several state and local governments have installed wide-ranging policies to mitigate rail impacts. California's Environmental Protection Agency's Air Resources Board, for example, signed a railroad statewide agreement on particulate emissions from rail yards with BNSF and UP in 2005 (ARB, 2005). Oregon has implemented minimum thresholds that must be achieved by municipalities in land use planning. While localities are free to control land use, they must conform to state-enacted goals (Ore. Rev. Stat §§ 197.005-740). The City of Portland has initiated multiple reviews of land use and zoning activities around its rail corridors, including the creation of the interstate light rail corridor zoning project and the corridor advisory group. The interstate light rail corridor zoning project, for example, aims to revisit the zoning patterns along the corridor and propose changes to ensure that new development is consistent with the city's transit-supportive policies as well as the community's vision for the station areas (City of Portland, Interstate). California requires cities and counties to review and undertake noise and other environmental impact assessments in their long-range comprehensive plans. In some instances cities have worked with developers to ensure that designs reflect proximity to noise and vibration. For example, the Vasona/Capital/Tasman-East Light Rail Project's acoustical consultants worked with the developer's architects to ensure that the roughly 150 affected units were assessed for projected noise in each living space in the unit. This enabled the architect to use certain categories of window and door replacement products that would ensure the project met interior noise level goals (Mo'c Group).

The impact of noise and vibration on personal property is a principal catalyst driving community opposition to current and planned railroad activity. For example, community opposition has arisen in California with the plan to link Union City in the East Bay area with Redwood City. Community concerns regarding noise in the second phase of the environmental impact study (Albach, 2006) have been raised at public meetings. Sam Trans bought this corridor in the late 1980s and, according to news reports, has run into repeated issues regarding what are termed 'eco-concerns' by the community, including noise, vibration, air quality issues, and freight usage.

In another extreme example, plaintiffs in California filed a nuisance action against UP for allegedly causing needless train noise and fumes beside their property. The plaintiffs alleged that UP's employees deliberately parked trains beside their home and sounded their horns needlessly. UP moved for summary judgment on the plaintiffs' action and the trial court granted this on the grounds that the plaintiffs' action is federally preempted by the Surface Transportation Board (STB), Interstate Commerce Commission Termination Act (ICTTA), federal Noise Control Act (NCA) and Federal Railroad Safety Act (FRSA) and was barred by Civil Code section 3482 and the Federal Constitution Commerce Clause. On appeal, however, the court found that there were triable issues of fact that existed regarding whether plaintiff's action was federally preempted, especially if UP's alleged conduct was not in furtherance of necessary railroad operations or committed for safety reasons [Jones v. Union Pacific Railroad, 79 Cal.App.4th 1053 (2000)].

It isn't always private communities and individuals that can derail a project. In Oceanside, California, the North County Transit Board voted against increasing the budget for the over-budget Sprinter light rail line until certain amenities—including landscaping and sound walls—were restored to the project. These had been cut by the San Diego Association of

Governments to cover costs for a managed land project. The various city representatives who sit on the board made it clear that they would vote against continuing this project unless they could obtain “*a firm commitment*” that the transit district would construct protective sound walls between the tracks and “several” residential neighborhoods (Sisson, 2006). City of Oceanside Representative Sherri Mackin was explicit regarding the project’s proposed budget increase “*my direction from my council, and from the citizens who have called me, is to not include this unless the betterments are included*” (Sisson 2006).

The FRA, Federal Transit Administration (FTA), Environmental Protection Agency (EPA), Department of Housing and Urban Development (HUD), and the Federal Aviation Administration (FAA) have all developed and established noise and vibration criteria for various land use activities. Guidelines for incorporating mitigation activities for affected communities have also been developed. In most instances, these are to be used as part of environmental analyses of new routes that are undertaken under the provisions of NEPA. There are also examples of existing railroads implementing mitigation measures for noise and vibration after community complaints. For example, in Littleton, Colorado, a freight line was moved 100 feet to the east to accommodate a new light rail line. This led to community complaints that the freight line now produced excessive vibration near a school and in specific residences. After multiple commissioned studies drew differing conclusions, the regional transportation district (RTD) authorized the installation of an experimental padding material that could mitigate the vibration.

In other communities, the construction of new rail transit systems has spurred opposition based on noise and vibration concerns and the potential impact on property values. This has been a key issue for Sound Transit in Washington State, which is attempting to build new corridors for light rail through heavily populated areas. At community workshops held in 2007, stakeholders expressed concerns that the effect of noise and vibration from the East Link route would create reduced property values. Similar concerns regarding decreased property values were raised in California over the Union City-Redwood City link described earlier (Albach, 2006). A study undertaken in Montreal in 2000 (Julien & Lanoie, 2002) found that a strong correlation did exist between noise abatement and increased property values. When sound barriers were placed by a community, the impacted properties increased in value by up to ten percent. So for many communities, the fear that additional noise/vibration may not only lower their quality of life but may also burden them financially is not wholly without justification.

The other principal issue recurrent throughout the literature concerns grade crossings as related to both traffic and safety. As is the case with noise, mitigating the potential negative externalities associated with at-grade crossings will often require a solution that is tailored to the situation. The type of rail associated with the grade crossing is important. Light rail systems often introduce ‘certain risks’ (Irwin, 2003) that may not be effectively mitigated with traditional vehicular traffic control devices, given the close interaction between pedestrians. For example, TriMet, upon opening its WestSide MAX rail line in Portland, Oregon, experienced incidents with pedestrians at crossings. TriMet developed new procedures and safety criteria for light rail pedestrian crossings. Ironically, one of the criticisms of light rail is that it is sometimes too quiet and can catch distracted pedestrians unawares.

Researchers reviewed activities currently underway at the state, city, and transit authority level to reduce or mitigate railroad noise and vibration. Costs for mitigation activities are included where possible. However, it is very difficult to provide exact costing on products or services used for mitigation activities because these have been implemented on a case-by-case basis over many years and have used technologies that have consistently improved over the

years, while construction material costs have in general gone up. What can be asserted with certainty is that retrofitting ROW for noise or vibration impacts of railroads is very expensive. From the case studies reviewed for this chapter, it is apparent that noise barriers are extremely expensive with many project costs ranging in the millions of dollars for very short stretches of right-of-way. For example, WSDOT analyzed proposed noise wall mitigation work done on highway projects in 2003 and 2006. The average cost per square foot rose from \$34.60 per square foot to \$59.47 when taking into account engineering and construction. While this was attributed to extra seismic studies that had to be undertaken, cost factors had also risen due to the price inflation of construction material such as concrete and steel. Figure 8.1 shows WSDOT’s comparison of average costs per square foot as well as individual project construction cost comparisons.

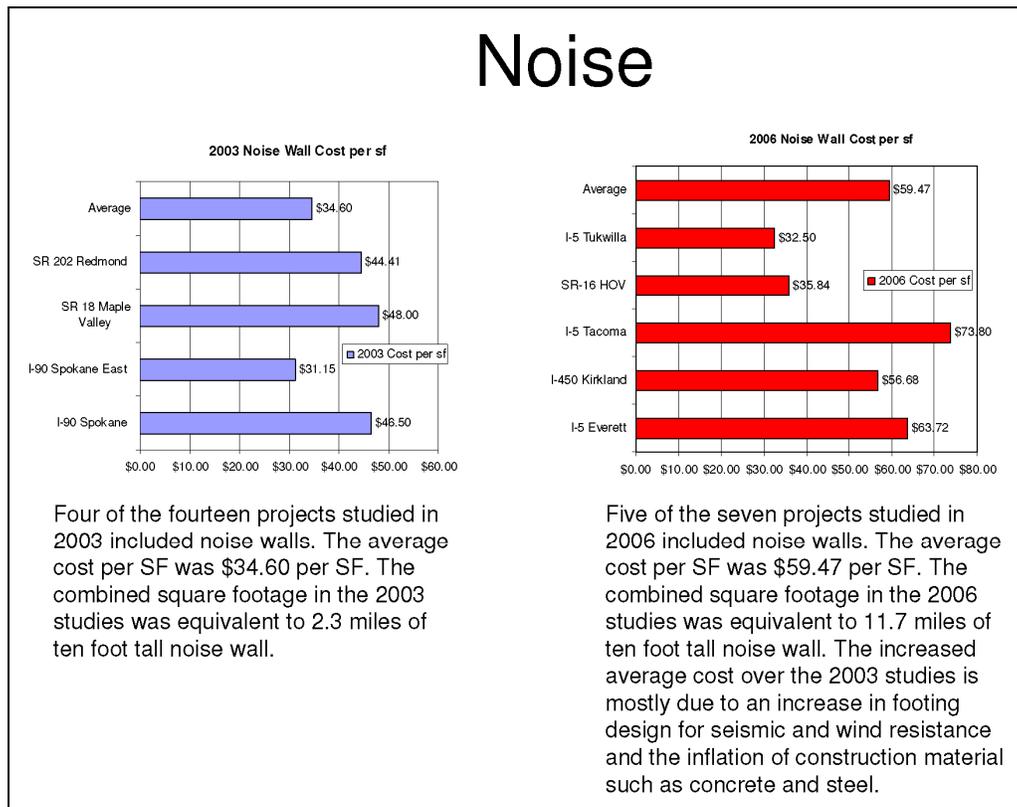


Figure 8.1: WSDOT Noise Cost Comparisons
Source: WSDOT

The research team’s interviews and email correspondence with acoustical engineering consultants and sound wall manufacturers found that costs for sound walls were project-specific with very few consultants wanting to specify absolute rule-of-thumb numbers without project-specific facts. For example, Lance Meister, Principal Consultant with Harris Miller Miller Hanson (Meister, 2007), noted that costs can vary depending on any number of factors. Phil Hooser, Product Manager for Industrial Acoustics Company (IAC) (Hooser, 2007), noted that for *most* rail jobs \$60 per square foot “should” cover the costs of panels, foundation work, and installation. However, the final cost was also determined by underlying soil conditions and

whether other remedial work was needed to put sound walls in place. He noted that some projects they were currently working on came in at about \$42 a square foot.

According to transit agencies, railroads, and consultants the team interviewed, the benefit-cost ratios of sound wall projects were not always positive and in some instances did not provide the anticipated benefits or reduction in noise or vibration.

The website www.Railway-Technology.com provides a list of companies and institutions that undertake analysis and assessment as well as provide materials and installation for noise and vibration mitigation and abatement.

Finally, it should be noted that sensitivity to encroachment issues is dependent upon community culture and experience around rail activity. For example, Craig Lewis, VP Corporate Affairs, noted that Norfolk Southern Railroad (NS), which operates in both the Northeast and the South, found that communities in the Northeast were far less likely to launch complaints against rail noise because rail for freight and passengers had been a characteristic of life for a long time and the culture has been, in some sense, inured to noise and vibration from rail activities: the “relationships and the environment is such in the north east that these issues were addressed many years ago” (Lewis, 2007).

8.1 Overview of Noise and Vibration

8.1.1 Noise

All transportation systems generate noise, and each mode of transport produces a different mixture of innocuous and potentially burdensome sounds. However, the precise impacts of noise are subject to continuing debate. Nearby residents can be very sensitive to and at the same time remarkably adaptable to noise depending on context. According to the FRA, in a large number of community surveys, transportation noise is ranked as the most significant cause of community dissatisfaction.

Noise in the environment has three main characteristics: loudness, pitch, and time variation. Most noise is measured in A-weighted decibels (dB(A)). The A-weighting is the summation of the sound levels across frequencies. The summation de-emphasizes the levels at different frequencies and corresponds to the way that humans hear. The accumulation metrics for sound are called *equivalent levels* and these represent 1 hour symbolized as $[L_{Aeq,H}]Leq(H)$ or L_{eq} if a time period is specified. For a 24 hour period—known as the day-night average sound level—DNL or L_{dn} are the commonly used symbols. The DNL includes a weighted penalty of 10 dB for sound occurring between 10:00 p.m. and 7:00 a.m.

According to the EPA, cumulative sound exposure below 55 dB(A) poses minimal risk of “*adverse effects on human health*” (TR News Sept-October 2005). Figure 8.2 compares several typical maximum sound levels.

The FAA considers that residential land uses are not compatible with noise environments where L_{dn} is greater than 65 dB(A).

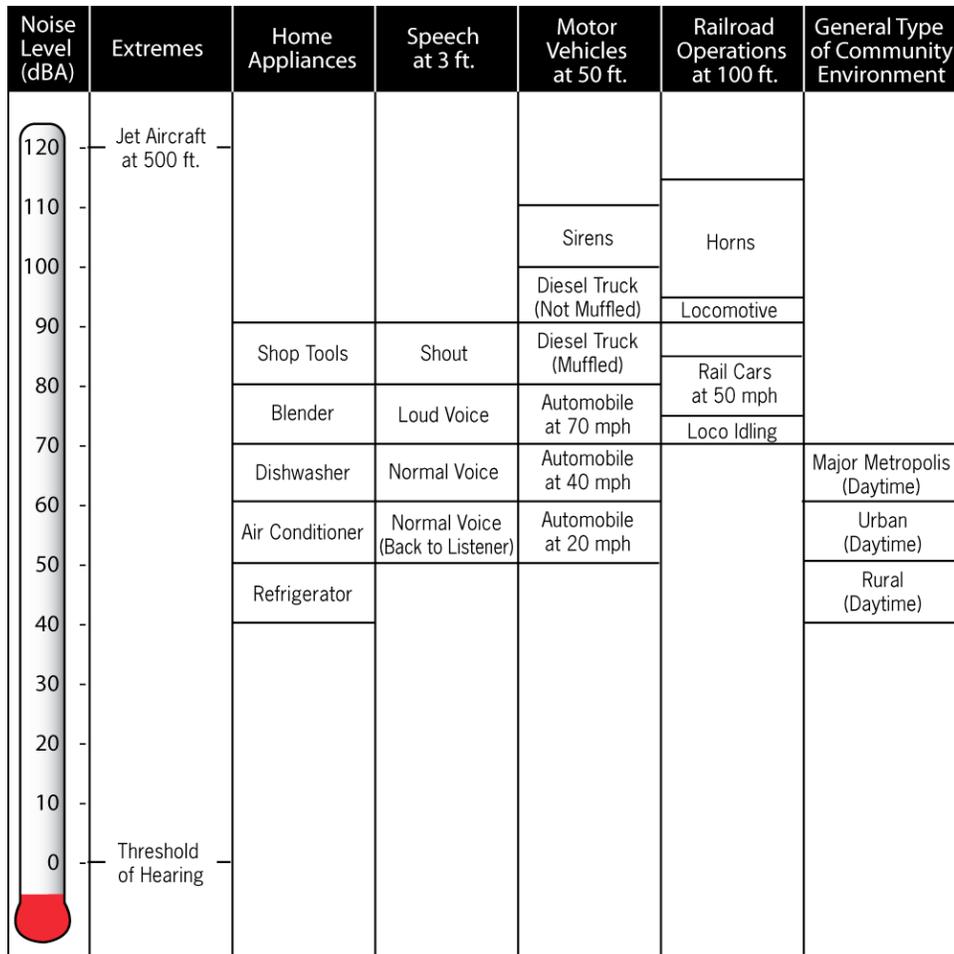


Figure 8.2: Typical Maximum Sound Levels
 Source: Federal Railroad Administration

The FTA and FRA use the DNL metric to determine the impacts of rail noise on residential structures and identify two levels of impact—impact and severe impact—for proposed rail projects based upon land categories. The three types of land categories are

- **Category 1**—lands require quiet but are used mainly during day; sound is measured in $L_{eq}(h)$
- **Category 2**—lands include residences; DNL is metric.
- **Category 3**—lands have institutional uses with daytime and evening activities that are deemed to be less sensitive to project noise (by 5dB) than land in categories 1 or 2.

Table 8.1 shows the DNL for different types of commuter trains at 50 feet from track.

Table 8.1: DNL for Train Types 50 Feet from Track

Type of Train	Speed mph	Number of Trains Per Hour		DNL at 50 feet
		Day	Night	
4-car rapid transit	50	20	2	65dB
4-car rapid transit	20	20	2	60dB
8-car, 1 locomotive commuter	60	1	0	55dB
8-car, 1 locomotive commuter	20	1	0	50dB

Source: TR News 2005

Freight railroad operations generate a number of noise impacts and a general list of these can be seen in Table 8.2.

Table 8.2: Typical Noise Impacts from Freight Rail

Type of Infrastructure	Impacts
Locomotive	Power unit, roof exhaust, cooling fans, air compressors Bogies, brakes, couplings Warning horns
Rolling Stock	Bogies, brakes, couplings, Bodywork flex
Wheel/rail interface	Running noise along rail Passing over switches (points), crossings, track joints and sharp curves (“squeal”)
Structures	Re-radiated noise and vibration from bridges and tunnels
Level Crossings	Warning horns or bells
Terminals	Machinery, Vehicle movements (road/rail) Warning horns or bells
Infrastructure	Construction Maintenance

Source: Network Rail UK

One other source of train noise is whistle (or horn) blowing. The use of quiet zones is one way that communities alleviate noise from train whistles. According to the FRA, the introduction of train horn noise can create two undesirable effects.

1. An increase in noise levels beyond those that communities have become accustomed too. This is known as the *relative noise impact*.
2. Interference with community activities, independent of existing noise levels. This is called the *absolute noise impact* because it is expressed as a fixed level not to be exceeded and is independent of existing noise levels. For example, it may be too loud to sleep normally with introduction of train horns.

Figure 8.3 from the FRA shows how these two effects—relative and absolute—are combined into criteria for assessment of noise impacts of rail systems on different land use activities.

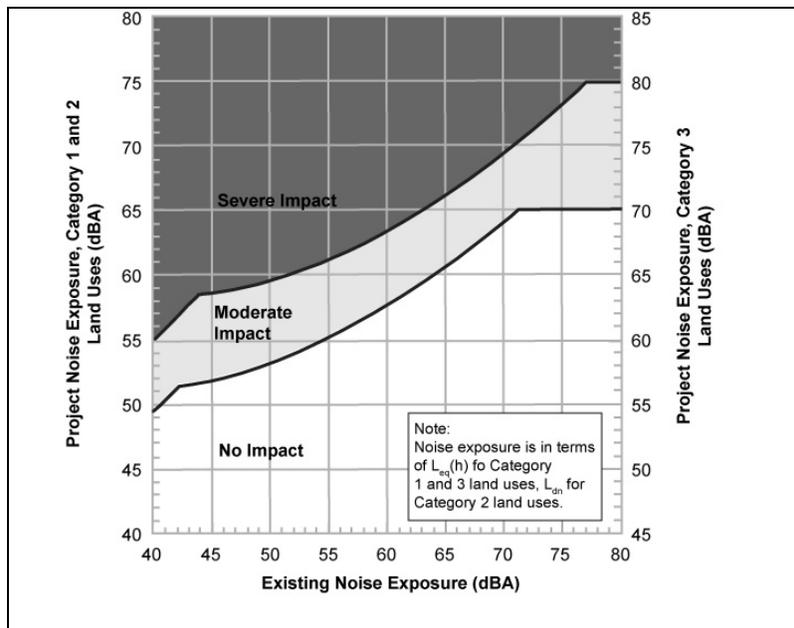


Figure 8.3: Noise Impact Criteria by Land Use

Noise that is generated is commonly expressed under the conceptual framework of source-path-receiver—as can be seen in Figure 8.4 from the FRA guidebook. Rail generates sound that propagates along a path to a receiver. Sound can be attenuated by distance, intervening obstacles (e.g., berms, walls, trees), and other factors. Finally the noise reaches the receiver who will perceive the sound contextualized against other noise events that create a background sound level. The degree and impact of rail noise will depend upon the sensitivity of the receiver and any relative increase in cumulative noise exposure (event + background noise versus background noise on its own).

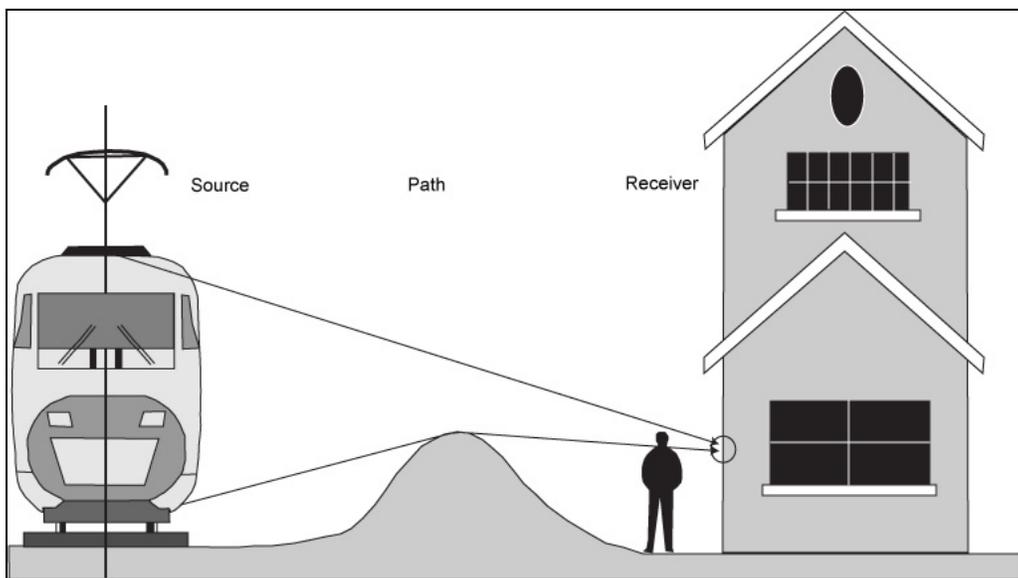


Figure 8.4: South-Path-Receiver Framework for Noise

8.1.2 Vibration

Vibration is an oscillatory motion of the earth, and is described in terms of displacement, velocity of acceleration. Vibration uses two main forms of measurements. *Peak particle velocity* (PPV), the maximum instantaneous positive or negative peak of the vibration signal, is used to measure stresses experienced by buildings. PPV, however, is not suitable for evaluating human response because it does not take into account the time for the human body to respond to vibration signals.

The main factors that influence ground-borne vibration are very similar to the factors underlying noise and include the track, the railroad vehicle (suspension, wheel, locomotives, and carriages), and speed. Table 8.3 shows FTA guidance on factors affecting ground-borne vibration.

Table 8.3: Factors that Influence Levels of Ground-Borne Vibration and Noise

Factors Related to Vibration Source	
Factors	Influence
Vehicle Suspension	If the suspension is stiff in the vertical direction, the effective vibration forces will be higher. On transit cars, only the primary suspension affects the vibration levels, the secondary suspension that supports the car body has no apparent effect.
Wheel type and condition	Use of pneumatic tires is one of the best methods of controlling ground-borne vibration. Normal resilient wheels on rail transit systems are usually too stiff to provide significant vibration reduction. Wheel flats and general wheel roughness are the major cause of vibration from steel wheel/steel rail systems.
Track Surface	Rough track or rough roads are often the cause of vibration problems. Maintaining a smooth surface will reduce vibration levels.
Track support system	On rail systems, the track support system is one of the major components in determining the levels of ground-borne vibration. The highest vibration levels are created by track that is rigidly attached to a concrete track bed (e.g. track on wood half-ties embedded in concrete). The vibration levels are much lower when special vibration control track systems such as resilient fasteners, ballast mats, and floating slabs are used.
Speed	As intuitively expected, higher speeds result in higher vibration levels. Doubling speed usually results in a vibration level increase of 4 to 6 decibels.
Transit Structure	The general rule-of-thumb is that the heavier the transit structure, the lower the vibration levels. The vibration levels from a lightweight bored tunnel will usually be higher than from a poured concrete box subway.
Depth of Vibration Source	There are significant differences in the vibration characteristics when the source is underground compared to surface level.
Factors Related to Vibration Path	
Factors	Influence
Soil Type	Vibration levels are generally higher in stiff clay-type soils than in loose sandy soils.
Rock layers	Vibration levels are usually high near at-grade track when the depth to bedrock is 30 feet or less. Subways founded in rock will result in lower vibration amplitudes close to the subway. Because of efficient propagation, the vibration level does not attenuate as rapidly in rock as it does in soil.
Soil layering	Soil layering will have a substantial, but unpredictable, effect on the vibration levels since each stratum can have significantly different dynamic characteristics.
Depth to Water Table	The presence of the water table may have a significant effect on ground-borne vibration, but a definite relationship has not been established.
Factors Related to Vibration Receiver	
Factors	Influence
Foundation type	The general rule-of-thumb is that the heavier the building foundation and its coupling to the soil, the greater the loss of dB as the vibration propagates from the ground into the building.
Building construction	Since ground-borne vibration and noise are almost always evaluated in terms of indoor receivers, the propagation of the vibration through the building must be considered. Each building has different characteristics relative to the structure-borne vibration, although the general rule-of-thumb is the more massive the building, the lower the levels of ground-borne vibration.
Acoustical absorption	The amount of acoustical absorption in the receiver room affects the levels of ground-borne noise.

Source: FTA

The FRA and FTA have also developed criteria to be used in assessing ground-borne vibration levels and these can be seen in Table 6.4. In general, human response to vibration is not

significant unless vibration exceeds 70 VdB. The criteria that have been developed on ground-borne vibration and noise take into account not only the land use categories but also the frequency of events, which differ quite dramatically between different types of transit projects and freight rail. These criteria were developed based primarily on passenger rail experience, with freight rail characteristics playing a secondary role. The vibration events underlying freight versus passenger train traffic are divergent, with passenger trains typically producing events that last less than 10 seconds, while most freight trains take at least two minutes to pass.

Table 8.4: Ground-borne Vibration and Ground-borne Noise Impact Criteria Used in General Assessments Regarding Land Use Impacts

Land Use Category	GBV Impact levels (VdB re 1 micro-inch/sec)			GBN Impact Levels (Db re 20 micro Pascals)		
	Frequent Events ¹	Occasional Events ²	Infrequent Events ³	Frequent Events ¹	Occasional Events ²	Infrequent Events ³
Category 1: Buildings where vibration would interfere with interior operations	65 VdB ⁴	65 VdB ⁴	65 VdB ⁴	N/A ⁵	N/A ⁵	N/A ⁵
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA
<p><i>Notes:</i></p> <ol style="list-style-type: none"> 1. <i>Frequent Events</i> is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category. 2. <i>Occasional Events</i> is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations. 3. <i>Infrequent Events</i> is defined as fewer than 30 events of the same kind per day. This category includes most commuter rail branch lines. 4. The criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors. 5. Vibration sensitive equipment is generally not sensitive to ground-borne noise 						

8.2 Planning and Regulatory Activity Regarding Noise and Vibration

8.2.1 Federal Regulations

For federally funded transportation projects, the Environmental Protection Agency (EPA) is charged with regulation of railroad noise under 42 USC Chapter 65 §4916 and this is enforced by the FRA. These standards are national in scope and individual states are expressly preempted

from varying these standards unless the Administrator, in consultation with the Secretary, deems the changes necessary. The FRA and FTA have developed guidance and instructions for noise and vibration analysis and assessment for rail system development for use by DOTs, cities, counties, and transit agencies.

8.2.2 State Activities

Some states have implemented statewide noise guidelines that cities and counties are required to adhere to. A survey undertaken by the Noise Pollution Clearing House website in 1997 found that 11 states had comprehensive statewide noise regulations.

For example, California, adopted noise control laws in 1972 (Noise Control Act 1972 as amended).²¹ The Act requires noise to be reviewed when cities and counties update their general plan elements. Noise is one of seven required elements that must be prepared by the cities and counties under Government Code Section 6530–General Plan Guidelines. Under the general plan guidelines, review of noise is undertaken to provide a basis for comprehensive local programs to *control and abate* environmental noise and protect citizens from excessive exposure as land use activities change. Local governments are required to analyze and quantify noise levels and assess the extent of noise exposure through measurement or use of modeling. The guidelines outline the rationale and fundamental goals for undertaking noise assessments, which are:

- To provide sufficient information concerning the community noise environment so that noise may be effectively considered in the land use planning process. In so doing, the necessary groundwork will have been developed so that a community noise ordinance may be utilized to resolve noise complaints.
- To develop strategies for abating excessive noise exposure through cost-effective mitigating measures in combination with zoning, as appropriate, to avoid incompatible land uses.
- To protect existing regions of the planning area whose noise environments are deemed acceptable and also those locations throughout the community deemed "noise sensitive."
- To ensure compliance with the State Noise Insulation Standards. These standards require specified levels of outdoor to indoor noise reduction for new multi-family residential constructions in areas where the outdoor noise exposure exceeds CNEL (or Ldn) 60 dB.

The California Department of Health Services (DHS) Office of Noise Control studied the correlation of noise levels and their effects on various land uses. As a result, the DHS established four categories for judging the severity of noise intrusion on specified land uses. Figure 8.5 provides the planning guidelines for review and approval of development applications in terms of compatibility of land uses with existing *and future* noise development (City of Palm Springs, 2007). The table also provides for conditionally acceptable uses that will require extensive analysis of noise reduction requirements as well as needed noise insulation features that must be incorporated into the design of the project.

²¹ This is implemented through California's Health and Safety Code, and under its Government Code General Plan Guidelines

Land Uses	CNEL (dBA)					
	55	60	65	70	75	80
Residential-Low Density Single-Family, Duplex, Mobile Homes	Yellow	Green	Green	Blue	Blue	Purple
Residential-Multiple-Family	Yellow	Green	Green	Blue	Blue	Purple
Transient Lodging: Hotels and Motels	Yellow	Green	Green	Blue	Blue	Purple
Schools, Libraries, Churches, Hospitals, Nursing Homes	Yellow	Green	Green	Blue	Blue	Purple
Auditoriums, Concert Halls, Amphitheaters	Green	Green	Green	Blue	Blue	Blue
Sports Arena, Outdoor Spectator Sports	Green	Green	Green	Blue	Blue	Blue
Playground, Neighborhood Parks	Yellow	Yellow	Yellow	Blue	Blue	Purple
Golf Courses, Riding Stables, Water Recreation, Cemeteries	Yellow	Yellow	Yellow	Blue	Blue	Purple
Office Buildings, Businesses, Commercial and Professional	Yellow	Yellow	Yellow	Green	Green	Purple
Industrial, Manufacturing, Utilities, Agricultural	Yellow	Yellow	Yellow	Green	Green	Purple

Explanatory Notes:

- Yellow** **Normally Acceptable**-With no special noise reduction requirements assuming standard construction.
- Green** **Conditionally Acceptable**-New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features included in the design.
- Blue** **Normally Unacceptable**-New construction is discouraged. If new construction does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in design.
- Purple** **Clearly Unacceptable**-New construction or development should generally not be undertaken.

SOURCE: GOVERNOR'S OFFICE OF PLANNING AND RESEARCH. STATE OF CALIFORNIA GENERAL PLAN GUIDELINES, 2003 ADAPTED FROM THE CALIFORNIA OFFICE OF NOISE CONTROL. GUIDELINES FOR THE PREPARATION AND CONTENT OF NOISE ELEMENTS OF THE GENERAL PLAN. FEBRUARY 1976.

Figure 8.5: California Noise and Land Use Criteria

Some states have reviewed noise barriers and other abatement and mitigation methods. However, the majority of these have been for highway projects. In many instances, draft environmental impact reports are requiring the use of mitigation measures such as sound-walls and other treatments. For example, Michigan's DOT completed its Detroit Intermodal Freight Terminal Feasibility Study in 2001. Part of the environmental impact study included a review of noise and vibration on surrounding neighborhoods and the recommendation that a barrier wall be constructed around the consolidated site (MDOT, 2007).

8.2.3 City and County Activities

Many cities have been actively involved with their communities and with freight railroad and transit agencies to analyze, assess, and lobby for mitigation dollars. Some cities also utilize noise and vibration analysis as they develop their comprehensive land use plans.

California cities and counties, for example, are required to either measure or model for noise activity when they undertake general plan updates. The City of Palm Springs, in its

comprehensive plan “2007 Palm Springs General Plan” (PSGP), conducted environmental analysis including noise and vibration impacts on the proposed build-out contemplated under the PSGP (Palm Springs, 2007). Part of the noise review looked at proposed land uses and railroad noise and vibration. The environmental analysis found that build-out of the PSGP would expose new residential uses to groundborne vibration from UP operations. While vibration is dependent on specific site and track conditions, the analysis found that geology would play a factor in development because soil conditions affect groundborne noise. Palm Springs is underlain by loose sandy soils that can amplify vibration. Section 5.11.4 of the PSGP analysis requires analysis and mitigation (at developer’s expense) if development of vibration-sensitive land uses occurs beside UP.

Palm Springs does not have any specific limits or thresholds for vibration. They follow FTA and American National Standards Institute guidelines. The environmental analysis undertaken by the city took a series of measurements for current noise and vibration levels—during the peak rush hour—to provide benchmarks for developers to incorporate into analysis they undertake for development occurring in proximity to transportation infrastructure. The PSGP also undertook modeling activities using the FRA’s horn model to ascertain noise levels (and train horn noise levels) for the 52 trains per day that pass through Palm Springs on the Yuma Line. This was estimated to fall within acceptable parameters at a distance of 1,470 feet from the centerline.

In 1995 the City of Denver undertook a noise survey to establish typical noise levels where Denver’s Noise Control Ordinance had set maximum noise limits. By providing a baseline it was proposed that the city could resurvey at regular intervals to find how land use activity—and specifically transportation activities—had affected noise levels (Denver, 1995).

Cities have also closely reviewed rezoning applications for properties that lie adjacent or tangential to railroad activities for noise elements. For example, Salt Lake City Council received an application in October 2004 to rezone property from residential to commercial neighborhood (City of Salt Lake, 2004a). After a year of discussion between the city, developer, neighborhoods associations, and UP (regarding land use activity, noise, and vibration) the city council finally agreed to rezone the property to neighborhood commercial in November 2005. Figure 8.6 shows the site proposed to be rezoned (colored yellow). It is adjacent to Interstate 80 and UP tracks.

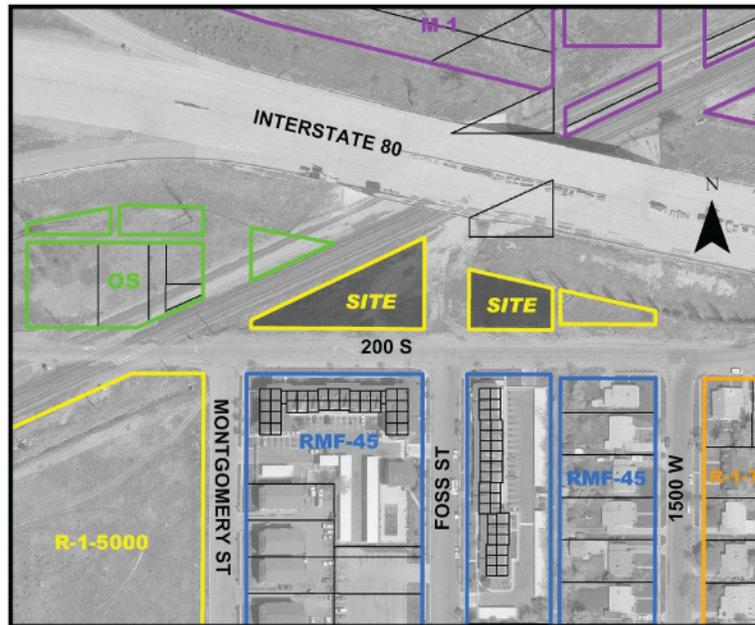


Figure 8.6: Proposed Rezoning Site

Part of the issue surrounding this property was a concern that residential properties built close to the railroad would suffer from noise and vibration. There was a 100-foot setback from the railroad track that could be used for open space or for parking behind a commercial development but the railroad had indicated that the easement for this setback was on a lease and terms could not be agreed to regarding a mutually acceptable lease arrangement for this portion of railroad ROW. There were also other concerns that commercial activity would be limited at this site because it was a dead-end street. An idea was put forward by city council members to purchase the area as residential and then rezone as parkland. However, planning staff noted that the railroad had reservations about certain types of usage close to the ROW. The planning commission noted at council meetings that they wanted to find a zone that was more palatable for the neighborhood without putting residents in a dangerous situation. The planning commission noted that the lesser commercial zone was suitable for this area and could include convenience stores, a small gas station, laundry facility, or a garden center (City of Salt Lake, October 2004b). At the next council meeting, the proposed rezoning was tabled again but this time for residential multi-family and again the city council deferred making a decision on the application. This was based upon concerns regarding noise, the irregular lot shape, setbacks, and other encumbrances, the railroad's stance regarding incompatible uses and another proposal for the creation of a quiet zone in this area. The petition was referred back to the Planning Commission to consider rezoning the property to residential multi-family RMF-45 (now requested by the developer) so that the development would be consistent with adjacent condominium use in the area (City of Salt Lake, October 2004c). The zoning petition came back to City Council again in November 2005 (City of Salt Lake 2005d and e) and the property was rezoned to neighborhood commercial. In the intervening year, the city planning officers and the developer had multiple meetings with the railroad, community, and the planning commission and it was considered that the petition would revert back to the original rezoning application that the developers had submitted for neighborhood commercial.

8.2.4 Transit Agency Activities

A review of Environmental Impact Reports showed that communities actively review noise and vibration impacts of new rail system activity and system expansion. In most of these cases some noise abatement is being undertaken. Expansions of rail systems often require proposed noise and vibration mitigation including the use of sound walls, berms, and in some instances the use of noise dampening materials and composites in station re-development plans.

For example, Massachusetts Bay Transport Authority undertook noise and vibration analysis for the proposed upgrade to the Charles/MGH station project on its Red Line. Residents in nearby Beacon Hill historic district had complained about noise and vibration impacts when the trains transitioned from underground to aboveground operations. Residents were located, in some instances, adjacent to the track alignment and had direct contact with the portal/tunnel structure. Typical noise levels ranged from 82 to 93 dBA during trains arrivals and departures. The existing station had no acoustical treatment, with walls consisting of masonry in the station head house and wooden halls with Plexiglas windows surrounding the platform area. None of these materials provided any ‘significant’ sound absorption according to the 2002 draft environmental assessment (MBTA, 2002). The EIA proposed numerous mitigation activities including the use of 10-foot-high noise barriers on the elevated structure on both sides of track at the portal opening. The station design evaluation report (Design Summary Report, 2003) noted that the physical form of the station could begin to control rail noise. For example, enclosing more of the track along the curve and covered platform access could begin to address and control rail noise (MBTA, 2003).

Transit agencies are also undertaking remediation work at their maintenance facilities to reduce impacts on communities. Caltrain (a tri-county partnership of San Francisco Municipal Railway, San Mateo County Transit District, and Santa Clara Valley Transportation Authority) recently broke ground on a new maintenance facility in San Jose in 2004. Part of the project included demolition of unused buildings, relocation of existing tracks and building a community sound wall to mitigate the noise of maintenance activities in this new facility (Caltrain, 2004). Caltrain created an oversight committee comprised of community residents throughout the duration of the project’s construction to review construction activities and complaints.

As an example of a typical question-and-answer fact sheet, Appendix F presents MBTA’s FAQ page for the Greenbush Rail Project.

8.2.5 Freight Railroad Plans

Many of the Class I railroads have recently announced new enhancements that they will be undertaking along their facilities and at intermodal rail yards including public community outreach activities. For example, BNSF in May 2007 announced an enhancement program for its Southern California International Gateway facility at the ports of LA Long Beach. The project has been created with input from major stakeholders including port officials, community leaders, and residents. At completion the project will plant an urban forest to improve air quality and aesthetics, and BNSF proposes to fund construction of a sound wall to diminish current freeway noise. The location of the sound wall will be determined after consultation with local residents (BNSF, 2007).

Union Pacific announced that it planned to invest up to \$400 million in its Intermodal Container Transfer Facility in Los Angeles. The project will double the capacity of the facility and proposes to improve the environmental impact of this facility. This includes the use of high-tech electrical powered equipment; replacement of ten diesel-powered cranes with 39 specially

designed electric-powered, rail-mounted cantilever cranes; and the use of alternative fuel sources in truck-tractors. The plan calls for a unique process of stacking containers to reduce the area required for container storage and alleviate the need to increase the facility's size. This will also allow UP to create a large buffer zone between the rail yard and the surrounding community (UP, 2007). UP also plans to reduce the impact of the facility by introducing a new 'hooded' lighting system that will direct light towards operations throughout the 24 x 7 hours of operations and away from adjacent neighborhoods. The modernization plan also calls for noise-reducing measures by replacing or eliminating noise-generating equipment.

8.2.6 FRA/FTA Guidance

The FRA and FTA have produced manuals that provide instructions on how to measure noise and vibration. They also provide guidance on noise mitigation options that are available to transit operators and communities. For example, Figure 8.7 shows FTA guidance on how different types of barriers deflect noise from commuter rail activity. A noise barrier reduces sound levels to the receiver by breaking the direct line-of-sight between the source and receiver with a solid wall. Sound energy reaches the receiver only by bending (diffracting) over the top of the barrier and this diffraction reduces the sound level at the receiver. (FTA manual pp. 2-11 and 2-12)

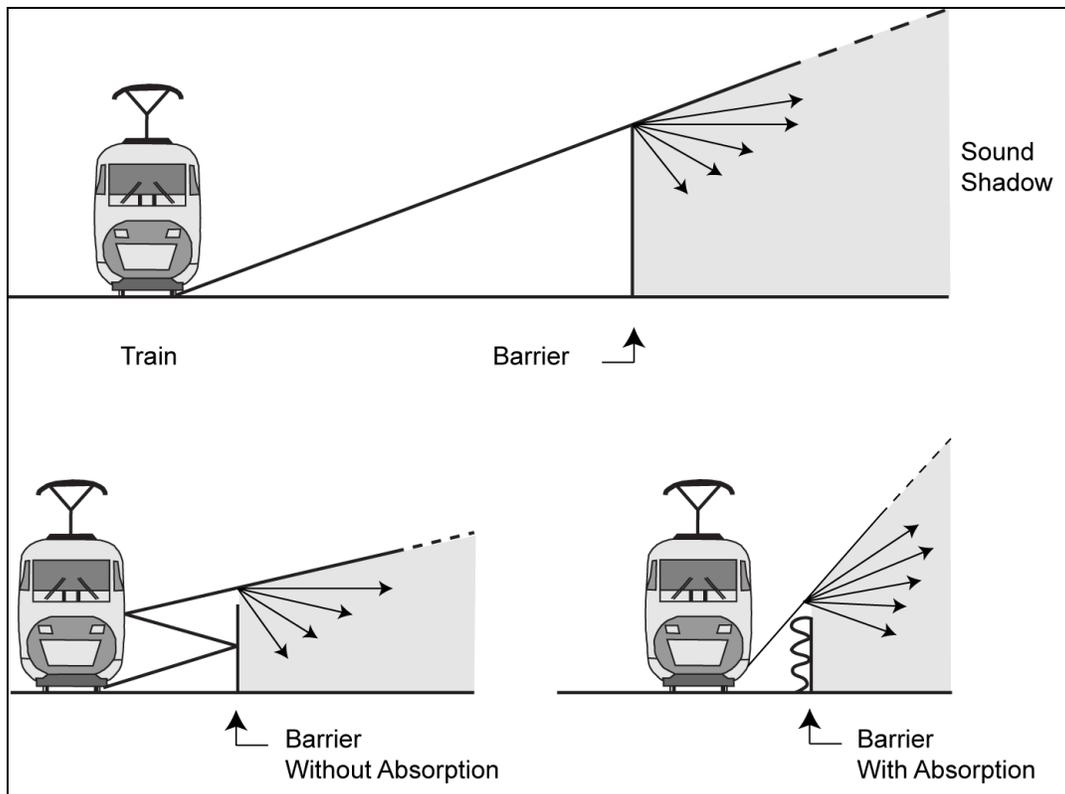


Figure 8.7: Barrier Deflection of Noise and Vibration
Source: FTA

8.2.7 Sound Walls

For many rail projects, sound walls are installed to reduce and deflect noise. However, the efficacy of noise barriers has been subject to much debate. During the 1980s a major critic of noise barriers was Professor Hemond of the University of Hartford's College of Engineering. Hemond argued that even if a noise barrier produced a 10-decibel reduction in noise at the row of receptors closest to the barrier, the remaining noise may still be loud enough to interfere with sleeping and conversation (Farazzo, 2006). Los Angeles County Transit also preferred to use rail and track modification elements because sound walls and other acoustical treatments were prohibitively expensive and were not a one-size-fits-all solution (Stein, 1992) for the entire network. Solano County, California, in its general plan update, noted that the use of sound walls could be an effective method for shielding noise and that for maximum effectiveness barriers must be continuous and relatively airtight along their length and height (Solano County, 2007). According to Meister (Meister, 2007), "generally once a noise barrier reaches 4 lb/sq ft density, the materials don't matter. The decision is usually left up to the agency or community and is based on cost and community preference."

Notwithstanding criticism and arguments that noise barrier efficacy comes down to a subjective judgment, many rail corridors have had barriers erected to offset noise. For example, a large-scale sound wall project was completed within the BNSF ROW in the city of Anaheim in 2006. This project had taken nearly twelve years to come to fruition after a neighborhood group, in conjunction with elected officials and BNSF, first began lobbying for this barrier in 1992. The project costs were underwritten by FHWA who issued authorization in 2003. Total project costs for this 2.44 mile stretch were \$13 million (City of Anaheim, 2003). The cities of Anaheim and Yorba Linda supplied \$2 million to finish construction of the sound wall and a park-like earthen berm that was also built to deflect and absorb train noise (Sidhu, 2005). The location of this sound wall can be seen in Figure 8.9. Specifications for the sound wall included absorbing the noise of nearly 100 trains a day, and keeping it from ricocheting into the Yorba Linda neighborhood on the other side of Route 91. The sound wall's average height is 16 feet above the railroad rail, but varies along the length from 16 feet to 3 feet and is hung on steel uprights (Hooser, IAC). A close-up photo of the built sound wall can be seen in Figure 8.8.



*Figure 8.8: Close-up of Sound Wall at Anaheim
Source: Phil Hooser*

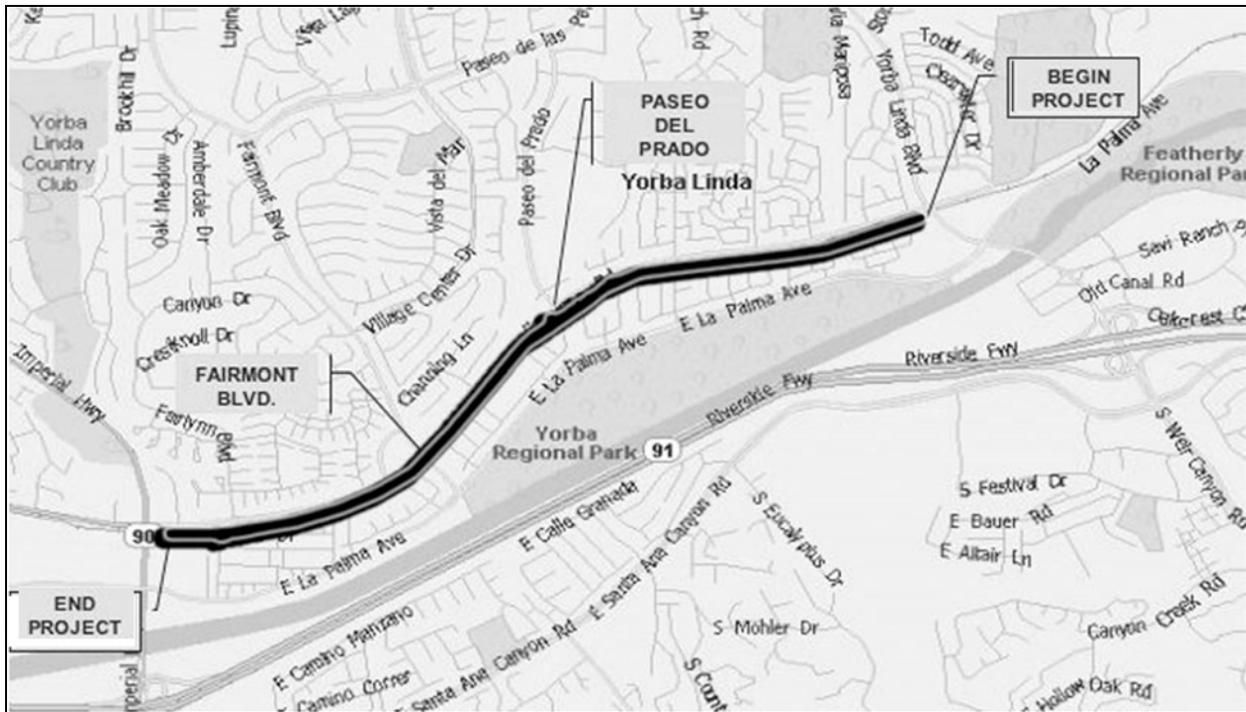


Figure 8.9: Map of Sound Wall Placement Area
 Source: City of Anaheim

The sound wall project has allegedly led to other problems, however. At a City Council meeting in April 2007, community members and the Fairmont Hills Community Association of 496 homes and approximately 1300 to 1500 residents noted that there were still concerns with the wall, including aesthetics and effects on property values. Some residents argued at the council meeting trees would have absorbed the sound just as well. Some residents on the Anaheim side of the wall also allege that the wall has not alleviated vibration, which is leading to physical damage to homes. Community residents asked the city to undertake a “post assessment” environmental impact report and see what the actual effects of this wall have been on the community and what the City Council can do about it (City of Yorba Linda, April 3, 2007).

New Jersey Transit (NJT) constructed a new rail station and park and ride in Ramsey, New Jersey, in 2004. The project realigned tracks and also constructed new high level tracks into the new station. Part of the project included construction of a 750-foot-long sound wall between the new station building and Route 17 to address community concerns regarding train noise. The sound wall consists of 600 panels that are 20 foot high. They were developed to absorb train noise before it enters the neighborhood (New Jersey Transit).

The Los Angeles Gold Line running out to Pasadena is also having sound walls put in at the request of communities along the route. Figure 8.10 shows visuals of the sound walls that have gone into Phase I of this transit extension. According to Hooser (Hooser, 2007), work on Phase II will begin in late July 2007.



Figure 8.10: Sound Wall on LAMTA Gold Line—Pasadena
Source: Phil Hooser

8.2.8 Wheel/Track Modifications

There are a few case studies that highlight how freight and transit rail impacts have been mitigated in response to community complaints. This has mainly been through the use of mitigation activities applied to either the wheels or tracks. The spread of continuously welded rail (CWR) has reduced the aggregate amount of noise in many areas. About half of the rail mileage used by the major class I carriers at present is CWR (Blaze, 2007). These noise abatement impacts are a side effect rather than the primary rationale for making the upgrade. CWR is installed primarily to lower the probability of a derailment and to prevent failure of the joints, CRW does not do as much to address the most problematic noise element (other than horns), which is wheel chatter and wheel squeal.

Squealing is a sign of poorly maintained track and poorly maintained wheels. The probability of squealing can be reduced by lubricating the curves and turning the wheel sets more often. Squealing also occurs when the rail head is uneven with the flange. Performance of a rail transit system is governed by the interaction between the rails and wheels. Sacramento Regional Transit (SRT) undertook a wheel/rail interface study in 2001 to find ways to minimize wayside noise on tangent and curved track (Saurenman et al., 2000). The system, which had been operated over 36 miles for 15 years, was due to be expanded. However, before the Regional Transit Board would commit to approve sound walls on the extensions, they required SRT to commit to bring the existing system into compliance with FTA noise guidelines, owing to the use of federal money for the expansion. SRT hired a consultant to assist them in deciding which of two approaches would be most cost-effective: (1) install sound walls for communities where FTA noise guidelines were exceeded; or (2) reduce wheel/rail noise system wide—which, based on experience of other light rail systems, could comprise a four-decibel reduction through optimizing the wheel/rail interface. While option two would not be sufficient to eliminate the need for sound walls to bring the existing system into compliance, it was assessed that it could reduce the number of sound walls required by approximately 50%. It would also provide other added benefits such as reducing wear and tear and improving the ride quality for passengers. After undertaking a review of the system, the consultant team recommended grinding the two different rail profiles into different sections of the tracks so that the wheels could see each rail profile for similar lengths of running.

Track Bed Designs

In some instances, the track bed itself is reconfigured with different types of material to offset noise and vibration effects.

For example, the track bed under the Newark Elizabeth Rail Link light rail extension was modified after it was found that the newly built New Jersey Performing Arts Center (NJPAC) would be affected by ground-borne vibrations (and therefore noise) from the light rail system (Carman et al., 2003). The consultants hired by New Jersey Transit (NJT) reviewed methods of isolating the light rail vibration through special rail support systems, ballast mats, and a floating slab. NJT finally chose to use an 840-foot floating slab adjacent to the NJPAC site.

A floating slab track (FST) system is comprised of springs and masses that isolate vibration arising from the interaction of wheel and rail and also decrease its transmission through the surrounding track system. Carman indicates that FSTs are mainly used for heavy rail transit and subway tunnels. There are only a few instances of FST systems being used in North America for light rail systems and these can be found in San Francisco, Buffalo, and Toronto. This is because light rail usually shares track with other vehicles and this imposes practical design constraints on the FST. According to Carman the amount of isolation necessary for noise reduction depends upon the amount of vibration reduction required and other circumstances, including:

- Sensitivity of the affected structure and its response to ground vibration speed
- Rail roughness and dynamic interaction between the vehicles and rail system
- Response of soil underlying the track and ease of propagation of vibration through the soil

Figure 8.11 depicts a typical cross-section of a generic floating slab track system.

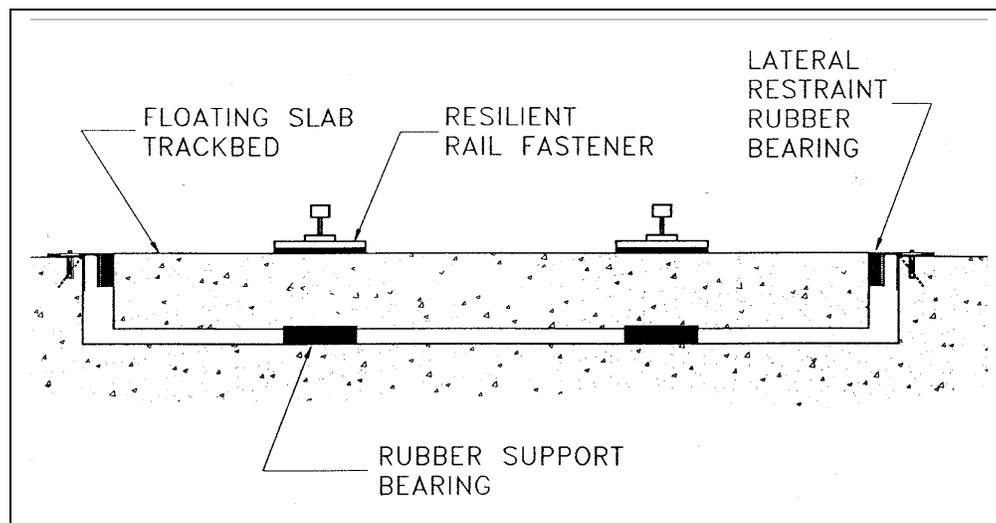


Figure 8.11: Floating Slab Trackbed Design

Source: Carman, et al.

Many projects have also included the use of vibration-absorbent materials in their track beds.

Grinding

Heavy trains create waves and pockets on the rail, making it more uneven and noisier. Grinding evens the rail and thereby reducing the contact area where the wheel and rail meet, ensuring smooth contact. Grinders abrade the rails on their sides and on the top (Taubert, 2005). This essential maintenance aids in system longevity, produces a smoother ride, reduces fatigue failures, and also, as a byproduct, contributes to reducing noise. Most railroads and some transit authorities undertake grinding operations. For example, BART in San Francisco continuously grinds its tracks each night. In 2006 it ordered a new grinder railcar—a custom-designed \$3 million machine from Loram Rail Equipment in Hamel MN. According to Gordon (Gordon 2006), BART's track crews may pass over one piece of track a dozen or more times to ensure the track is 'just right'. BART rail grinding costs approximately \$1,500 per pass-mile (MIG, 2006) (a *pass-mile* is one pass by the rail grinder over a distance of one mile). The grinding machines complete about 0.1 miles of track per night. San Francisco's Municipal Transportation Agency's capital projects budget for FY05-FY08 estimates that rail grinding will cost \$3.56 million (SFMTA, 2006).

Trackside Friction Modifiers

A trackside friction unit applies a lubricant or friction modifier to the rail. Wheel squeal is caused when lateral creep in curves become subject to roll-slip oscillations because of the friction in the interface layer between the wheel and rail. These oscillations are amplified in the wheel web and lead to squeal (Eadie et al., 2005). Remington (1985) identified three categories of mitigation methods: (1) change the rail/wheel surface conditions; (2) change track layout and bogie design or (3) damp the wheels to overcome the negative damping introduced by lateral friction forces. According to Eadie, while there is literature regarding wheel squeal, there is little objective comparative data on alternatives for abatement (Eadie, 2003) in terms of damping the wheels. According to Eadie, by providing a thin film of material between the wheel and rail—with positive friction characteristics—the magnitude of oscillations can be dramatically reduced.

The Port Authority of Allegheny County, which operates a light rail network in Pittsburgh, includes sharp curves and gradients of up to 9%. Wheel squeal was a particular problem for this system and the Port Authority tried to solve the problem by using sound absorbing blankets, as well as a water spray system which then caused corrosion (IRJ, 2004). Finally the port authority undertook a series of tests of wayside application. The automated wayside system was finally chosen because it provided the best results.

Multiple companies provide these services. Wayside application devices may be manual applicators or in some instances are mounted to the tracks. According to Judge (Judge 2007), some of these delivery systems contain sensors for monitoring a number of critical attributes, or a communications package directly inside the lubricator which can use cellular, satellite, or direct line hookup through a railroads' existing network of fiber optic lines (Judge, 2007). Figure 8.12 shows one of these products.



Figure 8.12: Trackside Friction Modifier Applicator Source: Portec Rail

The applications provide a thin film over the top of the wheel or the gauge face as Figure 8.13 highlights. As the wheel contacts the rails, lubricants are transferred to the wheel and to the gauge corner. Some of the products are biodegradable, using soy-based products that have been found to provide the same anti-wear characteristics as petroleum-based products.

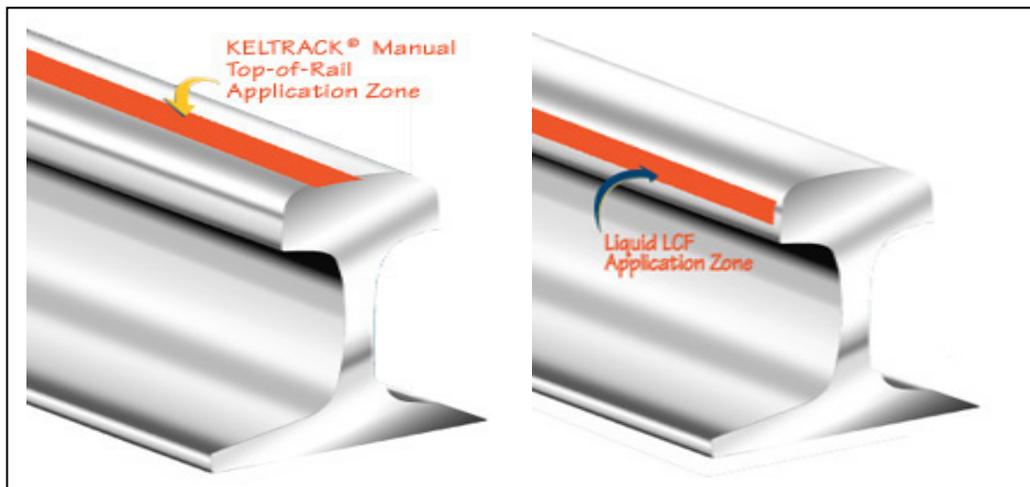
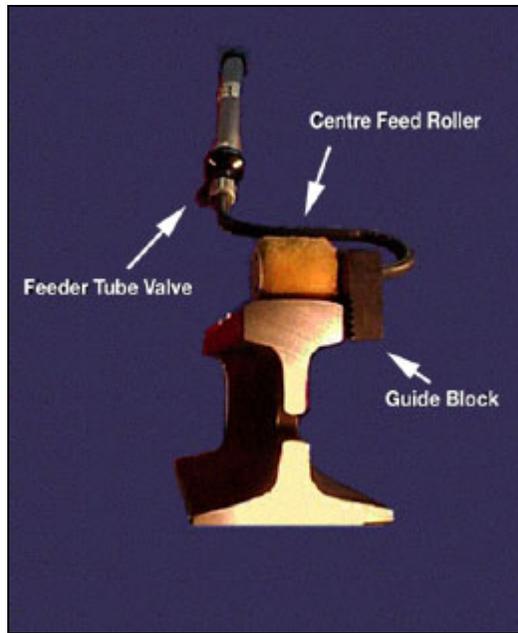


Figure 8.13: Lubricant Application Areas Source: Portec Rail

Figure 8.14 shows a manual applicator for friction modifying lubricant applications.



*Figure 8.14: Manual Applicator for Applying Friction Modifying Products
Source: Portec Rail Products*

Other options include using bespoke systems devised by consultants for rail corridor asset management and maintenance.

8.2.9 Station Improvements and Station Siting Projects

For many transit projects, improvements to stations and other buildings is another way to mitigate noise and vibration. For example, the Gold Line to Pasadena issued an RFP in February 2007 for the purchase of an automatic train arrival information system with electronic message boards to reduce noise at three stations. Pasadena City Council authorized a recommendation placed before it to implement the train arrival information system with electronic message boards as a noise reduction project (City of Pasadena, 2007). This is because an independent study conducted in 2004 found that sound levels at several Gold Line stations (Lake Avenue, Allen Avenue, and Sierra Madre Villa Avenue) are above acceptable levels at approximately 84–88 dBA. The City Manager issued a report in January 2007 outlining a plan to address the noise issue after the recommendations of the consultant hired to review the noise issue became prohibitively expensive and were also not authorized for use on state transportation facilities. The City Manager recommended this new option because it was not only cheaper and would immediately address the noise issue but also because in the long run the ITS component would provide congestion mitigation options for other parts of the system and grade-crossings (City of Pasadena, 2007). The total cost for the system at all six Gold Line stations would be approximately \$500,000 to \$1,000,000 with operations and maintenance running at approximately \$2,000 per year. The City Manager also noted that the opportunity to extend this system to new stations would not be cost-prohibitive, particularly when compared to costs of approximately \$5.3 million to construct sound walls at three stations, including demolishing existing barriers, installing a foundation system and new barrier, and then installing clear sound wall panels atop the new barrier at the three stations.

Train station siting can also become a critical component in reducing other ancillary effects of new corridor development. For example, when Portland was building its Interstate Max light rail line, studies as well as a traffic assessment showed that relocating a station three blocks to the south of its proposed situation would alleviate Union Pacific concerns regarding intermodal yard traffic (Ryan, et al., 2003). As this route was being developed, UP noted that it was concerned about the potential for trucks entering its intermodal yard to block light rail traffic on Interstate Avenue and could also interfere with the modifications it was currently making to alleviate queuing resulting from train blockages at five grade crossings. Figure 8.15 shows the crossing closures that UP was implementing in conjunction with the Albina Street grade-separation overpass project.

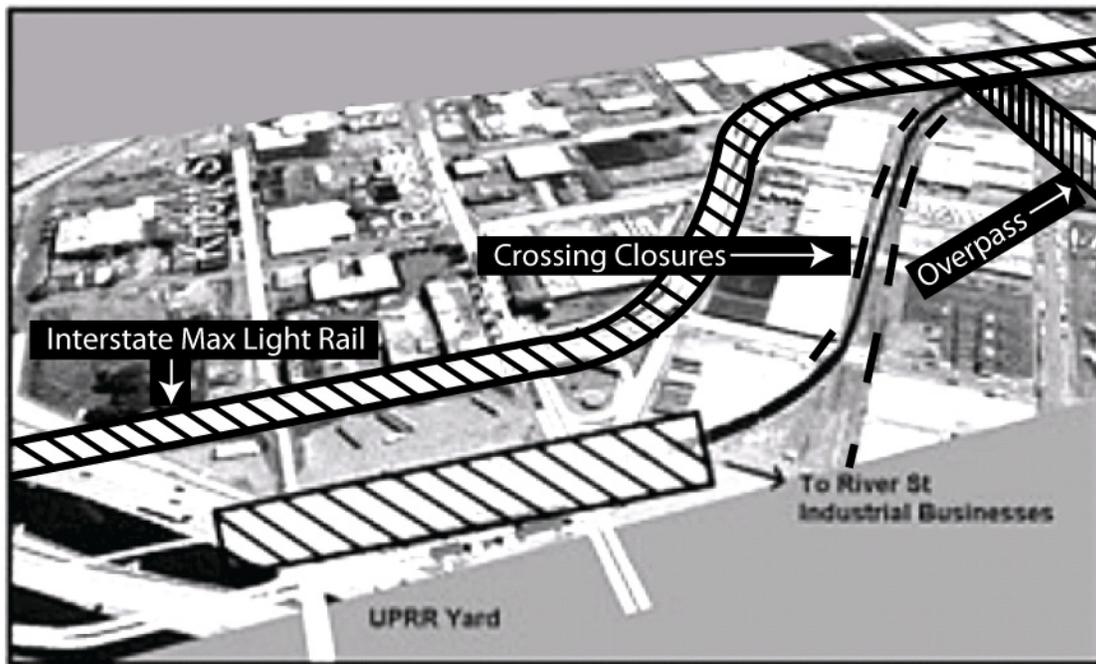


Figure 8.15: Interstate Max Alignment and UP Crossing Improvements at the Albina Overpass
 Source: 9th National Light Rail Conference Papers

TriMet amended the traffic simulation model it had created for the preliminary engineering of the project to incorporate new truck traffic data. As a consequence of this analysis four project modifications were made:

- (i) relocating of a light rail station stop;
- (ii) dedicating a double right turn lane to minimize queuing into the intermodal yard;
- (iii) reprogramming a traffic signal to accommodate long truck queues; and,
- (iv) shifting the light rail critical path to incorporate an overpass construction project.

8.2.10 Berms

Some communities construct berms to screen railroads and also reduce and deflect sound. For example, in Yorba Linda, California, construction of a landscaped berm and wall designed to screen views of the railroad and sound wall along Esperanza Road was expected to begin in July 2007 and last about six months. In California a three-foot-tall earthen berm will be built on the

northern side of the railroad right-of way (City of Yorba Linda, Spring 2006). The project was proposed by the City of Yorba Linda in response to the construction of a third set of railroad tracks by the Burlington Northern Santa Fe Railroad and a large sound wall by the City of Anaheim, projects over which Yorba Linda had no direct jurisdiction. The primary goal of the berm/wall project is to reduce the visual impact of the railroad and sound wall. Noise issues were addressed by requirements that Anaheim's sound wall be built of materials that absorb, not reflect, sound. The shrubs and trees to be planted will be similar to those already in place along the north side of Esperanza. Costs for constructing the berm and wall are being paid for by a \$1.6 million grant from the federal government and \$600,000 each from the cities of Anaheim and Yorba Linda.

8.2.11 Grade Separation Treatments

Grade separation projects continue to be developed to reduce incompatibilities that arise when freight rail lines pass through city centers and cross multiple city streets at grade. The most well-known of these are the Alameda Corridor in California, and the ReTRAC Project in Reno, Nevada. However, many smaller cities are actively involved in dealing with grade separation projects, including upgrades to crossings and closure of crossings.

The American Public Works Association awarded a 2006 Project of the Year Award for mitigation to the cities of Bellflower and Paramount for their West Santa Ana 29 At-Grade Crossings Closure Project (Wilmer Group Factsheet). This project involved the closure of 29 at-grade crossings and the upgrade of two crossings, including placing a pedestrian bridge over tracks close to Paramount High School and the construction of a new connection between the West Santa Ana Branch and the Harbor Branch of UPRR. The project ran through ten cities and had an immediate effect on eliminating congestion, and improving safety. The project consultant secured the agreements with all ten impacted cities as well as Los Angeles and Orange Counties and assisted in securing funding, including UP's contribution of 20% of project costs as lead agency.

Alameda Corridor

The most widely cited grade separation project in the United States is the Alameda Corridor in LA, which runs out of the ports of Long Beach and LA 20 miles downtown to Los Angeles. The project is a series of bridges, underpasses, and street improvements that separate freight trains from street traffic along Alameda Street. Figure 8.16 shows the location of the Alameda Corridor.

Its signature project is the mid-corridor trench, which is an open trench 20 miles long, 33 feet deep, and 50 feet wide between State Route 91 in Carson and 25th Street in Los Angeles. Figure 8.17 shows pictures of the 10-mile trench. The project opened in April 2002 after five years of construction and over twenty years of planning. The project cost \$2.4 billion, and was funded through a unique combination of public and private sources. Part of the revenue is generated through user fees per rail-car type: (i) 20-foot TEU container, (ii) empty container, and (iii) other types of loaded rail cars. The fees are on a yearly escalator that runs between 1.5–3 percent (depending on inflation). As of January 2007, the fees were \$18.08, \$4.57, and \$9.13 for the three types of use, respectively.



Figure 8.16: Map of Alameda Corridor
 Source: Alameda Corridor Transportation Authority



Figure 8.17: 10-Mile Trench in Alameda Corridor
 Source: Alameda Corridor Transportation Authority Reno Transportation Rail Access Corridor—ReTRAC

In November 2005 the city of Reno, Nevada, saw the first train roll through its downtown depressed rail trench called ReTRAC (Reno Transportation Rail Access Corridor). This ReTRAC project began life as traffic congestion and safety issue for residents of Reno and took ten years to bring forward. Hundreds of planning meetings were held as the project progressed. It was the largest public works project ever undertaken in Northern Nevada. The project depressed just over two miles of train track that ran directly through downtown Reno. It is a 54-foot-wide, 33-foot train trench. The costs for the \$265 million dollar project were paid through a hotel room tax, special downtown assessment district, a sales tax increase, city bond, and \$17 million in Union Pacific and federal grants. It was completed on time and under-budget. Figure 8.18 shows the ReTRAC facility.



Figure 8.18: ReTRAC System
Source: City of Reno

According to the city of Reno, *“The change in Downtown Reno is astounding. No more train/car/pedestrian accidents in the ReTRAC area, traffic flow is greatly improved, emergency vehicle access is enhanced, property values of buildings adjacent to the trench have significantly increased and there are even various environmental benefits”* (City of Reno).

Norfolk Southern Grade Separation Projects

According to Craig Lewis at Norfolk Southern (Lewis, 2007) in New Jersey, train length became an issue for Norfolk Southern (NS) when an inactive line was revitalized with an intermodal facility at Coxtan Yard in northern New Jersey. The Coxtan rail yard was split into two pieces by a highway with a grade crossing. This wasn't a problem for a long time because NS didn't use the smaller piece. However, with the increasing shipments of ethanol in the North East, NS activity in this yard grew. At the same time major economic development activity had occurred proximate to the at-grade crossing at this site, so there were now more vehicles on this highway causing problems with traffic, noise and vibration. The state, according to Lewis, at the urging of NS and with their cooperation, implemented a grade separation project scheduled to open in August 2007 (Lewis, 2007).

8.2.12 Grade Crossing Attenuation and Treatments

Santa Clara Valley Transportation Authority (VTA) had to undertake a major noise attenuation project at its at-grade crossings on the Santa Clara Valley light rail system between downtown San Jose and downtown Campbell. This system shares ROW with freight and is therefore subject to the FRA horn rule. At certain junctions the light rail reaches 55 miles per

hour (Christina Jaworski, 2007). According to Jaworski, the rail runs in close proximity to adjacent residences and there are numerous at-grade crossings along this route.

VTA had installed various noise mitigation options along this corridor with over 5000 feet of sound walls and acoustical doors and windows at 500 residences, which are mostly apartments and single family type residences. However, over 40 complaints were received regarding the bell noise and many of these came from second-, third-, and fourth-tier receptors to the ROW and not the first tier right beside the ROW. The complaints fell, according to Jaworski, into three main categories:

- Bells too loud and too long
- Sleep deprivation and psychological distress
- Decrease in property values and rental income. One apartment complex had many long-term residents leave due to noise.

VTA adjusted the bell volume from 85 to 75 Dcb and in October and December 2005 established a quiet zone under the FRA rule between West San Carlos Street in San Jose and Kennedy Avenue in Campbell (City of Campbell, 2005). However, notwithstanding the implementation of the quiet zone they still were receiving complaints from residents and apartment managers. In an effort to gain additional insight into this problem, VTA hired ATS Consulting to develop additional measures to address the noise.

ATS first reviewed California Public Utilities Commission (CPUC) General Order 75-C – crossing bell regulation. This order provides schematics and drawings to illustrate crossing bell design/placement to see if they could move the bells to reduce the noise. ATS also looked at AREMA guidelines, which state that strikes per minute by the clapper can range from 100 to 325, to see if there were opportunities to purchase new bells. Mitigation options that were placed on the table for review included:

- Reduce bell volume
 - Reduce strike rate—100 strikes per minutes
 - Lower bell height
 - Gate down bell variance (GDBV) *
 - Remove bell *
 - Acoustic shrouds
- (* there was a low possibility of getting these)

Options that were finally reviewed were the use of acoustic shrouds around the bells in use on the Pasadena Gold Line. The shroud effects an increase in dB directly in front of the bell and reduces by 5 dB noise at around 90% of shroud. ATS also undertook a noise analysis taking measurements at different places along the route because they noticed some bells on some of the gates had inconsistent volumes, some had different volumes at each different use. As a result, the ATS finally recommended the following changes to the VTA.

- Replace bells to gain consistent volume and reduce the ring rates.
- Lower bell height and request a variance for this from CPUC.
- Install acoustic shrouds at some of the bells

Christina Jaworski noted that there were some important lessons to be learned from VTA's efforts. Firstly, take grade crossing noise seriously. In Glendale and Sacramento there had

been protracted litigation around grade-separation and noise from locomotives and trackside warning systems. VTA made the political and monetary decision to deal with the problem outside of the litigious context. The FRA guidelines may not be capturing the true annoyance of these bells to communities, she noted, as communities have different sensitivities to noise and vibration effects. Discrimination is needed in design of crossings because once a bell is placed at a specific junction it is difficult to remove. Obtaining a variance from a regulating agency is a time-consuming process with the potential for refusal. Finally, Jaworski noted that agencies should think about the specifications in bell procurement. She recommended close review of manufacturers and their referenced case studies as well as checking references. This was because some manufacturers have better supplemental choices that give the flexibility to play with the bell output (noise and strikes for example). This flexibility was missing from the bells that VTA originally procured and the retrofit was not only expensive but in the ensuing time-gap a community became hostile to the light rail system (Jaworski, 2007b).

8.2.13 Light Rail Safety for Pedestrian Crossings

One of the biggest issues that light rail projects face is teaching pedestrians and, also drivers, about interaction with the at-grade rail. Houston's Metro, for example, was noted for the multiple vehicle train incidents that occurred in the first few months of service. This required retrofits and new signage to be developed to educate drivers about trains and intersections.

Portland, Oregon developed a light rail crossing safety design criteria handbook for use in planning, design, and construction of future TriMet light rail facilities after a series of accidents occurred between pedestrians and the light rail when the Westside Max extension opened in 1998 (Irwin, 2003). The project added 18 miles to TriMet's system and increased the number of at-grade crossings two-fold to 159. TriMet added multiple safety treatments including additional signage, swing gates, channeling, and detectable warnings. These included visual and audible signage; for example, tactile concrete pads were placed close to crossings. TriMet monitored the installation of these new treatments to gather before and after data to assess the efficacy. From this assessment and monitoring they were able to develop a pedestrian crossing application chart which categorizes application treatments based upon speed and crossing conditions. The criteria were applied to TriMet's extension projects and improvements. TriMet also created a Rail Change Rail Control Committee to evaluate new system designs.

8.2.14 Quiet Zones

Quiet zones are another way that noise from transit and freight rail activities can be offset. Private developers will often be willing to pay for the cost of implementing a quiet zone. John De Wald (DeWald, 2007) the developer of Pacific Station in Encinitas, California, is currently working with city officials to develop a quiet zone near this TOD development. This project has 50 residential units planned within the 105,000 square foot development. The project backs onto a relatively busy rail track with Amtrak, two commuter lines, and 3-4 freight trains a day running over it. John DeWald has directed the planners and architects involved in this project to structure the development to deal with the noise, to include the use of absorptive building materials as well as reviewing residence design layouts. He noted that the benefit of implementing the quiet zone will be increased value and satisfaction with the development. Other cities along this route have also considered assessing property owners to raise the seven to nine million required to establish quiet zones at five other crossings.

Chapter 9. Concluding Points

In this report, the researchers provide a detailed assessment of corridor planning initiatives and practices both in Texas and in other states. While the cases that were examined varied substantially, certain themes were recurrent in a variety of disparate scenarios. These lessons, in the view of the researchers, will be useful as a checklist both for aiding specific preservation activities and in formulating and refining the general strategy for preservation within the state.

First, agencies must be ready to act politically and financially to acquire corridors as they become available. The Utah Transit Agency's purchase of UP's corridor in Salt Lake City and the New Mexico DOT's purchase of BNSF corridor from Albuquerque to Santa Fe were examples of projects that suddenly arose and were aggressively pursued by the agencies charged with implementing rail-transit options. In these two instances the agencies showed commitment to the projects and dedicated critical staffing time to ensure their successful fruition.

Second, the backing of political champions is often important for projects to come to fruition. The Salt Lake, New Mexico, and Heartland Corridor (Virginia) projects all benefited from the advocacy of one or more political leaders who were able to keep the flame burning on a particular project through multiple terms. For example, the Governors in Utah and New Mexico offered financial support and the "full-faith-and-credit" of the State as inducement for the freight railroads to continue with negotiations.

Third, regular and meaningful contact with the railroads—especially the Class I railroads—provides a mechanism to outline and deal with issues as they arise. An open line of communication also puts the DOT in the position of being the first agency called if the freight railroads are looking to divest themselves of property, as seen in the case study of North Carolina. This gives the DOT a tremendous boost in providing transportation options.

Fourth, long-term planning, including an inventory of assets at the state and local level, is critical for rail preservation and development. Successful projects have often arisen from an inventory plan. Once states and localities are aware of potential rail corridors, it is much easier to then review land use activity surrounding corridors, in the same fashion as New Jersey, and to develop constructive working plans for revitalizing corridors.

Finally, as in most projects, the ability to find adequate sources of financing is critical for preservation and acquisition options. In many cases, the Class I railroads will not negotiate sales or access rights unless they are assured that the "*dollars are available and on the table.*"

References

- Alameda Corridor Transportation Authority. Alameda Corridor Transportation Authority Environmental Impact Study Upheld in Federal court. November 24, 1997. Available at: http://www.acta.org/Releases/releases_27.html. Accessed: December 6, 2006.
- Albach, B. Rail Project Hits Snags. Palo Alto Daily News, November 17, 2006. Available at: <http://www.paloaldailynews.com/article/padn/2006-11-17-mp-rail>. Accessed April 9, 2007.
- American Jurisprudence, 71 AM. JUR. 3D *Proof of Facts* 97, §9 (2006).
- Amtrak. Amtrak National Fact Sheet. Available at: http://www.amtrak.com/servlet/ContentServer?c=am2Copy&pagename=Amtrak%2Fam2Copy%2FTitle_Image_Copy_Page&cid=1081442674300. Accessed: January 15, 2007.
- Amtrak. Amtrak Strategic Reform Initiatives and FY06 Grant Request. (April 21 2005) <http://www.amtrak.com/pdf/strategic06.pdf> Accessed: January 15, 2007.
- City of Anaheim. The Crossing at Anaheim – Mitigation Monitoring Plan. August 2006. Available at: http://anaheim.net/images/articles/1288/Vol1_InitialStudy/5_Mitigation_Monitoring_Plan.pdf. Accessed: May 20, 2007.
- City of Anaheim. Anaheim’s BNSF Corridor Soundwall Project. Press Release: December 224, 2003. Available at: <http://www.anaheim.net/administration/PIO/news.asp?id=329>. Accessed: June 12, 2007.
- Andrews, James H. Freight: Are America’s Communities being Railroaded? Planning, Volume 65 Issue 9, September 1999.
- Telephone Interview with Sean Ardussi – Planner – Puget Sound Regional Council. July 6, 2007.
- Agarwal, Ajay., Giuliano, Genevieve., Redfearn, Christian. The Alameda Corridor: A White Paper. Prepared for The Alameda Corridor: A Blueprint for the Future Symposium. February 10, 2004. Available; at: <http://www.metrotrans.org/pdfs/AlamedaCorridorWhitePaper.pdf> Accessed: June 2006.
- Association of American Railroads: Railroad Facts 2006 Edition. Available at: http://www.aar.org/PubCommon/Documents/AboutTheIndustry/RRState_Rankings.pdf. Accessed: March 2007.
- Association of American Railroads. AAR Says Major Freight Railroads to Spend \$9.4 billion on Improvements in 2007.
- Associated Press Newswires. Railroad Bringing Jobs to Southern New Mexico. 6 October 2006

- ATS Consulting Group. Featured Projects: Metro Gold Line Light Rail Transit System. Available at: http://atsconsultingllc.com/project_1.html. Accessed: April 9, 2007.
- Benoit, J., and Lanoie, P. The Effect of Noise Barriers on the Market Value of Adjacent Residential Properties. September 2002. École des Hautes Études Commerciales (HEC), Montréal. Available at: www.hec.ca/iea/cahiers/2002/iea0207_pl.pdf. Accessed: May 15, 2007.
- Bentley Group. Bentley Optram™: Rail Corridor Asset Management. Available at: ftp://ftp2.bentley.com/dist/collateral/Web/Civil/OPTRAMtrifold_web.pdf. Accessed: June 20, 2007.
- Interview with Robin Bergeron, Manager Marketing & Sales, Dallas, Garland & Northeastern Railroad and Texas Northeastern Railroad. March 2007.
- Blaydes, Lonnie. Commuter Rail in Texas. Presentation to Texas Transportation Forum. July 20, 2007. Available at: <http://www.dot.state.tx.us/ttf/assets/SpeakerPresentations/Session%20VIII%20Blades.pdf>
- Telephone Interview with Chris Blewett – Director of Transportation and Planning Services, New Mexico Rail Runner Express MRCOG, New Mexico. June 12 2007.
- Blewett, Chris. New Mexico Rail Runner Express. Presentation to Texas Transportation Forum. July 20, 2007. Available at: <http://www.dot.state.tx.us/ttf/assets/SpeakerPresentations/Session%20VIII%20Blewett.pdf>.
- City of Burbank. Community Development Department General Plan Review. City Council Agenda, Item 10. October 30, 2001. Available at: http://www.ci.burbank.ca.us/agendas/ag_council/sr103001_10.html. Accessed: June 18 2007.
- Telephone interview with Bill Burman, City of San Antonio Senior Planner, March 2007
- Telephone calls and emails with Chuck Burnell, Vice President - Real Estate, North Carolina Railroad Company, November 2007.
- Telephone interview with Cheri Bush, Dallas Area Rapid Transit, February 2007.
- Bonnett C.F., Jikpson. T.A., Sharpe D.J., Taylor, R., Sadler N.L, Humphries, E.F., Bueket, J., Webley, J.F., Maschner, E., Cope, G., Ridley, T., and Rogers, R. Track for Lightweight Railways: discussion. ICE Proceedings: Transit. Vol. 100. Issue 3. August 1993.
- Burlington Northern Santa Fe Railroad. BNSF Railway Enhances Proposed Southern California International Gateway. News Release. May 8, 2007. Available at: <http://www.bnsf.com/media/news/articles/2007/05/2007-05-08a.html>. Accessed: June 11, 2007.

- Brake, Diane. Planning for a 21st Century Transportation System. March 1999. Available at: <http://www.planningpartners.org/positions/transportation/sjlr1199.html>. Accessed: December 5, 2006.
- David S Brown Enterprises Ltd. Metro Center at Owings Mills. Factsheet. Available at: <http://www.davidsbrown.com/commercial/commercial-upcoming/metro-centre.html> Accessed: July 2007.
- Telephone interview with Teresa Calkins, Travis County Planning and Development, Transportation and Natural Resources, March 2007.
- Callahan, R. (2002) The Politics Of Structural Choice : New Public Agencies, Regional Projects And Cooperation In Political Environments. PhD Dissertation. Los Angeles, CA: School of Policy, Planning and Development, University of Southern California.
- Caltrains. Caltrain Breaks Ground on New Maintenance Facility. Newsheet, 11-4-2004. Available at: http://www.caltrain.com/news-2004_11_4_new_maintenance_facility.html. Accessed: April 9, 2007.
- City of Campbell. Council Meeting, Authorization to Designate Quiet Zone for Vasona Corridor (Minute Item 22 for Resolution 10535). June 21, 2005. Available at: <http://www.ci.campbell.ca.us/AgendasMinutes/2005/cm06212005.pdf>. Accessed: February 20, 2007.
- Carman, Richard, A., Smoluchowski, Peter., and Berliner Harvey L. Floating Slab Trackbed Design to Control Ground borne Noise from Newark-Elizabeth Rail Link Light Rail Transit. Transportation Research Board 9th National Light Rail Transit Conference, November 16-18 2003. Available at: [www.Trb.org](http://www.trb.org). Accessed: October, 10, 2006.
- City of Carson. Development Summary (Long Range Projects) 2007. Available at: http://ci.carson.ca.us/content/files/pdfs/planning/Development_Status_Report_2007.pdf. Accessed; June 2007.
- Telephone interview with Chandra Carrasco, in charge of Tower 55 study, North Central Texas Council of Governments, February 2007.
- Telephone interview with City of Carrollton, Planning Department. January 2007.
- Center for Transportation Training and Research. Entering the Quiet Zone: Noise Compatible Land Use Planning. Prepared for Federal Highway Administration. May 2002. Available at: www.fhwa.dot.gov/enviroment/noise/quietzone/index.htm Accessed February 5, 2007.
- Center for Urban Transportation Research (CUTR). Managing Corridor Development: A Municipal Handbook. (1996). Available at: <http://www.cutr.usf.edu/pdf/corridor.pdf>. Accessed: October 2006, March 2007.
- Chen, H.M. Vibration-attenuating Egg Shaped Rail Fasteners used by Washington Metropolitan Area Transit Authority. Transportation Research Record, 1981.

- Colorado Department of Transportation. Colorado Rail Relocation Project. Available at: <http://www.dot.state.co.us/railroadstudy/about/default.asp>. Accessed: June 17, 2007.
- Colorado DOT. Public Benefits and Costs Study of the Proposed BNSF/UP Front Range Railroad Infrastructure Rationalization project. May 18, 2005. Available at: <http://www.dot.state.co.us/railroadstudy/ExecutiveSummary/ExecutiveSummary.pdf>. Accessed: June 27 2007.
- City of Commerce. Report to the People. May 2005. Volume 46, No. 5. Available at: <http://www.ci.commerce.ca.us/pdf/MAY2005RTTP.pdf>. Accessed: June 22, 2007.
- City of Commerce. Report to the People. September 2005 Volume 45. No. 10. Available at: <http://www.ci.commerce.ca.us/pdf/SEPTEMBERRTTP2005.pdf>. Accessed: June 22, 2007.
- Controlling Wheel Squeal on Rapid Transit Systems. International Railway Journal (IRJ). Volume 44 Issue 4 (October 2004) p30
- Meeting with Carolyn E. Cook, Regional Manager Highway-Rail Grade Crossing Safety and Railroad Trespass Prevention. US Department of Transportation Federal Railroad Administration. July 25, 2007.
- City of Dallas, 2006 Comprehensive Plan: Forward Dallas. Available at: <http://www.forwarddallas.org/>. Accessed January 5, 2007.
- Dallas Area Rapid Transit. Economic Development TOD Fact Sheet. Available at: <http://www.dart.org/about/economicdevelopment/DARTTODImpact.asp> . Accessed: July 2007.
- Telephone Interview with Pamela Davis, Rail Freight Coordinator Environmental and Planning Branch, North Carolina Department of Transportation Rail Division. July 6, 2007.
- City and County of Denver. Blueprint Denver: An Integrated Land Use and Transportation Plan. 2002. Available at: http://www.denvergov.org/Default.aspx?alias=www.denvergov.org/blueprint_denver
Accessed : April 8, 2007.
- City and County of Denver – Community Planning and Development and Public Works. Colorado Station Area Framework Plan. September 2003. Available at: <http://www.denvergov.org/ports/144/documents/colorado%20station.pdf> Accessed: April 8, 2007.
- City of Denver. Transit Oriented Development – Station Typology – One Size Does not Fit All. February 2007. Available at: <http://www.denvergov.org/TOD/StationTypology/tabid/395260/Default.aspx>. Accessed: July 1, 2007.

City of Denver. Blue Print Denver Committee. Meeting Summary, July 12, 2006. Available at: <http://denvergov.org/Portals/81/documents/Committees/BlueprintDenver/2006/BLUEPRINT-07-12-06.pdf> Accessed: June 20, 2007.

Denver Regional Council of Governments. Metro Vision 2030. January 29, 1005 (amended January 2007). Available at: <http://www.drcog.org/documents/WebMetro%20Vision%202030%20plan%20final%201-05.pdf>. Accessed: January 10, 2007.

City of Denver. Denver Department of Environmental Health Environmental Protection Division. Denver Noise Survey 1995 and Analysis of the Denver Noise Control Ordinance. Available at: <http://www.denvergov.org/DEQ/HomePage/tabid/384379/Default.aspx>; and <http://www.nonoise.org/library/denver/survey.htm>. Accessed: April 9, 2007. The Denver Noise Survey can also be found at http://www.denvergov.org/surveys/eh_citizen_noise_survey.htm

Telephone Interview – John DeWald, DeWald LLC – Private Development Group, Encinitas CA. June 6, 2007

Eadie, Donald T., Santoro, Marco., and Powell. W. Local control of noise and vibration with KELTRACK™ friction modifier and Protector® trackside application: an integrated solution. *Journal of Sound and Vibration* 267 (2003) 761-772.

Eadie, Donald T., Santoro, Marco., and Kalousek, Joe. Railway noise and the effect of top of rail liquid friction modifiers: changes in sound and vibration spectral distributions in curves. *Wear* 258 (2005) 1148-1155.

Eastern Federal Lands Highway Division – Federal Highway Administration. Memorandum of Understanding Between State of West Virginia West Virginia Department of Transportation, Commonwealth of Virginia, Virginia Department of Transportation and State of Ohio, Ohio Department of Transportation. June 2006. Available at: http://www.efl.fhwa.dot.gov/special_projects/heartland-corridor-clearance-project/Heartland-Corridor-MOA-States.pdf. Accessed: June 24, 2007.

Eastern Federal Lands Highway Division – Federal Highway Administration. Memorandum of Understanding Between Norfolk Southern Railway and the Department of Transportation Federal Highway Administration Eastern Federal Lands Highway Division. For the Environmental Planning, Design and Construction of the heartland Corridor Project. Available at: http://www.efl.fhwa.dot.gov/special_projects/heartland-corridor-clearance-project/Heartland-Corridor-MOA-Railroad.pdf. Accessed: June 24, 2007.

City of El Paso. 2007 Comprehensive Plan, Chapter 20 Transportation. Available at: http://www.ci.el-paso.tx.us/development_services/_documents/CompPlan/Ch.%202007%20-%20Transportation%20-%20pages%2069%20to%2082.pdf. Accessed: January 5, 2007.

Engineering News Record. Look at the Contractors. June 17, 2002. Available at: <http://www.enr.construction.com/opinions/lettersUpdates/archives/020617.asp>. Accessed: October, 10, 2006.

- Ervin, Keith. Rail-to-trail Plan Sparks Debate over Eastside Line. Seattle Times. January 30, 2007. Available at:
http://seattletimes.nwsourc.com/html/localnews/2003547239_railline30m.html. Accessed: June 1, 2007.
- Federal Highway Administration, Transportation Corridor Preservation: A Survey of State Government Current Practices (2000), http://www.fhwa.dot.gov/realestate/cp_state.htm. Accessed February 2007.
- Federal Railroad Administration. Horn Noise Questions and Answers Fact sheet. Available at: www.fra.dot.gov/us/content/1174. Accessed May 1, 2007.
- Federal Railroad Administration. Railroad Corridor Transportation Plans: A guidance Manual. July 8, 2005. Available at: http://www.fra.dot.gov/Downloads/RRdev/corridor_planning.pdf
- Federal Railroad Administration. Final Environmental Impact Statement: Interim Final Rule for the use of Locomotive Horns at Highway-Rail Grade Crossings. Washington: DC, December 5, 2003. Available at:
http://www.fra.dot.gov/downloads/rrdev/horns_feis_master.pdf. Accessed: March 2006.
- Federal Railroad Administration. Detroit-Chicago High-Speed Rail Corridor Planning Grant (September 1997). Available at <http://www.fra.dot.gov/us/content/661>. Accessed: April 2007.
- Federal Transit Administration. Transit Noise and Vibration Impact Assessment. May 2006. Available at: http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf. Accessed: June 2007.
- Federal Transit Administration. Guidelines and Standards for Assessing Transit Supportive Land Use. May 2004. Available at:
http://www.fta.dot.gov/documents/FTA_LU_Contractor_Guidelines_FY04_complete1.pdf. Accessed: May 2007.
- Telephone interview with Lloyd Flem - Corporate Affairs Director for All Aboard Washington. July 9, 2007
- Florida Department of Transportation, Model Ordinance: Protection of Corridors and Rights-of-Way. Available at: http://www.accessmanagement.gov/pdf/FL_Model_Ordinance.pdf. Accessed February 2007.
- Florida High Speed Rail Authority. Project Overview Fact Sheet. Available at:
http://www.floridahighspeedrail.org/1_overview.jsp. Accessed: January 10, 2007.
- City of Forth Worth. Transportation & Public Works Department. Railroad Projects Update. Available at:
[http://www.forthworthgov.org/uploadedFiles/Transportation_and_Public_Works/About_Us/Divisions/Traffic_Services/hemphill%20west%20purpose%20and%20scope%202006_12_21\(1\).pdf](http://www.forthworthgov.org/uploadedFiles/Transportation_and_Public_Works/About_Us/Divisions/Traffic_Services/hemphill%20west%20purpose%20and%20scope%202006_12_21(1).pdf) Accessed: March 27, 2007.

- City of Fort Worth, Transportation & Public works, Railroad Projects Factsheet. Available at: www.fortworthgov.org/tpw/info/default.aspx?id=4454&ekemensel=1274_submenu_5... Accessed: March 27, 2007.
- Freight Action Strategy for the Seattle-Tacoma Corridor. Fast Corridor Brochure. April 2006. Available at, <http://www.psrc.org/fastcorridor/index.htm>. Accessed: June 6, 2007.
- Freilich, Robert H. & Stephen P. Chinn, Transportation Corridors: Shaping and Financing Urbanization Through Integration of Eminent Domain, Zoning and Growth Management Techniques, 55. Iss. 2 UMKC Law Review 153 (1987).
- Telephone interview with Lucy Gailbraith, Capital Metro, Austin Texas, March 2007.
- Genesee Transportation Council. Regional Rights-of-Way Preservation Initiative Factsheet. 2002 (a). Available at: <http://www.gtcmpto.org/Projects/FactSheets/Regional%20ROWS%20Preservation.pdf>. Accessed: April 10, 2007.
- Genesee Transportation Council. Regional Rights-of-Way Preservation Action Plan Abandoned Railroads. February 2005 (b). Available at: http://www.gtcmpto.org/Projects/Details/RegROW/Action_Plan.pdf Accessed: April 10, 2007.
- Genesee Transportation Council, Rochester, NY, Action Plan Narrative. February 2005 (c) Available at: http://www.gtcmpto.org/Projects/Details/RegROW/ActionPlan_Narrative.pdf. Accessed April 10, 2007.
- Telephone interview with Steve George, President Fort Worth & Western Railroad & / Texas Short Line Railroad Association. March 2007.
- Gordon, Rachel. Softening the Screech along Bart Rail System: Nightly Grinding Reshapes Tracks to Lesson Noise. San Francisco Chronicle. September 10, 2006. Available at: www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2006/09/10/BAG0CL2UIU1.DTL&typ... Accessed: June 15, 2007.
- Grimes, George. A., Barkan, Christopher P.L. Cost-Effectiveness of Railway Infrastructure Renewal Maintenance. Journal of Transportation Engineering. August 2006.
- Harris Miller Miller & Hanson Inc. High-Speed Ground Transportation Noise and Vibration Impact Assessment. Final Report October 2005. Prepared for the U.S. Department of Transportation: Federal Railroad Administration. Available at: http://www.hmmh.com/rail_manuals.html. Accessed April 30, 2007.
- Telephone interview with Curvie Hawkings, Planning Department, The T, Fort Worth's. February 2007.
- Interview with Mike Heiligenstein, Executive Director of CTRMA, Austin, March 2007.

Meeting with Dale R Hill, Manager Industrial and Public Projects. Union Pacific Railroad. July 25, 2007.

City of Houston. Mayor White Press Release. Mayor White and Council Members Collaborate to Establish Rail Quiet zones in Residential Areas. Available at:
<http://www.houstontx.gov/mayor/press/20060711.html>. Accessed December, 8, 2006.

Interview with City of Houston, Planning Department. January 2007.

City of Houston. Urban Corridor Planning Workshop. August 2006. Available at:
http://www.houstontx.gov/planning/Urban/urban_cor.html. Accessed October 2006.

Hanson Wilson Incorporated. Available at:
http://www.hansonwilson.com/proj_results.asp?u_projects=Yards. Accessed, February 9, 2007.

Harrison, R. Hutson, N., Resor, R., and Blaze, J. Planning for Container Growth Along the Houston Ship Channel and Other Texas Seaports: An Analysis of Corridor Improvement Initiatives for Intermodal Cargo. Available at:
http://www.utexas.edu/research/ctr/pdf_reports/0_5068_1.pdf.

Hooser, Phil. Product Manager Acoustic Treatments. Industrial Acoustics Company. Personal calls and emails with Lisa Loftus-Otway, June 27, July 9 2007, July 10, July 11 2007.

Town of Huntersville, NC-73 Transportation/Land Use Corridor Plan,
http://www.huntersville.org/planning_8.asp. Accessed, February 2007

Idaho Department of Transportation. Corridor Planning Guidebook (8/204). Amended December 2006. Available at
http://itd.idaho.gov/planning/corridor/2006plans/CorridorPlanning_2006_December.pdf
Accessed: April 2007.

Indiana Rail Plan. Prepared by Parsons for the Indiana Department of Transportation (INDOT). October 2002. Available at: http://www.state.in.us/dot/pubs/train_plan/index.htm.
Accessed: May 2, 2007.

Indiana Department of Transportation (INDOT). Indiana Rail Corridor Preservation Study. February 2003. Available at: <http://www.state.in.us/dot/modetrans/train/pdf/tri-fold.pdf>.
Accessed: October 10, 2006

Indiana General Assembly: 2007 Session. Senate Bill 105. Available at:
<http://www.in.gov/apps/lsa/session/billwatch/billinfo?year=2007&session=1&request=getBill&docno=0105&doctype=SB>. Accessed: June 4, 2007.

Industrial Acoustics. Com. Good Walls Make Good neighbors in Anaheim. Press Release: June 8, 2004. Available at: http://www.industrialacoustics.com/usa/news/anaheim_barriers.asp.
Accessed: June 26, 2007.

- Industrial Acoustics. Com. From Coast to Coast IAC Soundwall Systems Keeping the Peace. Press Release, July 22, 2005.
http://www.industrialacoustics.com/usa/news/soundwall_keeping_the_peace.asp.
Accessed: June 26, 2007
- Irwin, Don. Safety Criteria for Light Rail Pedestrian Crossings. Transportation Research Board 9th National Light Rail Transit Conference, November 16-18 2003. Available at: www.Trb.org. Accessed: October, 10, 2006.
- Telephone interview with Phyllis Jarrell, City of Plano Planning Director. February 2007.
- Jaworski, Christina., and Dennis, Zack (a). Noise Reduction Strategies for At-Grade Crossings. Transportation Research Board Annual Meeting, January 2007. Session 592 – Wayside Rail Noise. Tuesday, 23 January 2007.
- Personal conversation with Jaworski Christina (b). Transportation Research Board Annual Meeting. January 23, 2007.
- Johnson, Gary P., *The Effect of the Public Use Requirement on Excess Condemnation*, 48 TENN. L. REV. 370 (1981).
- Judge, Tom. Reduce Friction, Boost Savings: To improve wheel and rail wear, operating efficiency and fuel economy, rail lubrication suppliers are upgrading friction modifiers and delivery systems. Railway Track and Structures. February 2007, p 25.
- Kanner, Gideon, *Recent Developments in Eminent Domain Law*, A.L.I. Land Use Institute: Planning, Regulation, Litigation, Eminent Domain, and Compensation (2001).
- Kanter, Larry. Vernon Takes on the Giants – California. Los Angeles Business Journal. November 11 1996. Available at:
http://findarticles.com/p/articles/mi_m5072/is_n46_v18/ai_19028688. Accessed: may 10, 2007.
- Interviews and meetings with Dennis Kearns, Legislative Counsel State Government Affairs, Burlington Northern Santa Fe Railway Company, February – July 2007
- Keep Texas Moving Org. “Right Of Way Acquisition Process”, Available at:
http://www.keeptexasmoving.org/pdfs/projects/ttc35/master_development_plan/Chapter_1_1_Approach_to_ROW.pdf. Accessed: March 2007.
- Kirsch, J., and Nettles. A. Cities Hope to Create Quiet Zones at 15 Railroad Crossings. Star-Telegram. January 10, 2007. Available at:
<http://dfw.com/mld/dfw/news/local/16425950.htm>. Accessed, February 5, 2007.
- Kockelman, Kara M. et al., Frontage Roads: An Assessment of Legal Issues, Design Decisions, Costs, Operations, and Land-Development Differences. Available at:
http://www.ce.utexas.edu/prof/kockelman/public_html/TRB02FrontageRoads.pdf.
Accessed, March 2007.

Kolluri, Kris – Commissioner of Transportation - State of New Jersey. State of New Jersey FY 2008 Update Report of the New Jersey State Rail Planning Process. July 1, 2007. Available at:
<http://www.state.nj.us/transportation/community/meetings/documents/2008staterailplanupdate.pdf> Accessed: June 8, 2007.

Telephone interview with Chuck Kooshian of the City of El Paso, March 2007.

Telephone interview with Keith Krum, City of Richardson Planning and Zoning Department. February 2007.

Lathrop, Wendy. Railroads – Easement of Fee Simple. Professional Surveyor January/February 1998. Available at:
<http://www.geomatics.ifas.ufl.edu/courses/wwwusers/sur4403/Lectures/Fee-vs-Easements-PS1998.doc>. Accessed: June 6, 2007.

Joe Leleikis, HNTB Group. February 12, 2007. Available at:
http://www.hgaccommuterrail.com/docs/021207Final_presentation.pdf. Accessed: February 12, 2007

Telephone interview with Carol Lewis, Director, Center for Transportation Training and Research, Texas Southern University, December 2006.

Telephone interview with Craig Lewis - Vice President of Corporate Affairs - Norfolk Southern Railroad. June 25, 2007.

Light Rail Now. *Dallas Light Rail Sparks Development Boom*. April 18, 2000. Available at:
http://www.lightrailnow.org/features/f_000003.htm. Accessed: February 17, 2007.

Loftus-Otway, Lisa, Bricka, Staci., Fagan, Jill., Li, Xin., and Rogers, Theresa., Englewood a Case Study in Transit Oriented Development. Paper for Transit Oriented Development Class Community and Regional Planning School, University of Texas at Austin. May 5, 2004.

Email(s) with Art Lomenick, President of Trammell Crow's High Street Residential Group, April 2007.

Telephone interview with Sónya Lopez, TOD Manager, City of Austin, March 2007.

Lund, Holie., Cervero, Robert., and Wilson, Richard. Travel Characteristics of Transit Oriented Development in California. Available at:
<http://www.csupomona.edu/~rwwillson/tod/Pictures/TOD2.pdf> Accessed May 10, 2007.

Telephone interview with Mark Lund, Planning Manager, Brownsville MPO. March 2007.

Maryland Department of Transportation. Office of Real Estate. About TOD Factsheet. Available at: <http://www.mdot-realestate.org/tod.asp?#Strategy>. Accessed: June 3, 2007.

- Maryland Department of Transportation. Office of Real Estate. What Joint/Transit Oriented Development Projects are Under Development? Available at: <http://www.mdot-realestate.org/tod.asp?req=dev>. Accessed: June 4, 2007.
- Massachusetts Bay Transportation Authority. Charles/MGH Station Draft Environmental Assessment Report. Prepared in 2002. Available at: <http://www.mbtta.com/uploadedFiles/documents/DraftEnvironmentalAssessment.pdf>. Accessed: June 13, 2007
- Massachusetts Bay Transportation Authority. Charles/MGH Station Design Summary report. Prepared in 2003. Available at: http://www.mbtta.com/uploadedFiles/documents/CharlesMGH_design_summary_report.pdr. Accessed: June 13, 2007.
- Interview with Hugh L McCulley, Attorney at Law & General Counsel for UP/BNSF in Texas. Crady Jewett & McCulley LLP, February 2007.
- McDonald, Doug. Freight Action Strategy for the Everett-Seattle-Tacoma Corridor. February 2003. AASHTO Available at: http://freight.transportation.org/doc/McDonald_FAST.ppt#259. Accessed: June 4, 2007.
- Telephone interview with Louise McGrody, Bicycle Alliance of Washington regarding BNSF corridor project in Washington State. July 9 2007
- Telephone interview with Teri McMillian City of Austin Long Range Planning Department. March 2007.
- Meister, Lance. Principal Consultant Harris Miller Miller Hanson Acoustical Engineers. Personal emails with Lisa Loftus-Otway. July 2007.
- Michigan Department of Transportation. Detroit Intermodal Freight Terminal Environmental Impact Study. Available at: http://www.michigan.gov/mcot/0,1607,7-151-9621_11058_26215---,00.html. Accessed June 8, 2007.
- Michigan Department of Transportation. MDOT Rail Divestiture History. Available at: http://www.michigan.gov/documents/MDOT-Rail-Divestiture-history_55900_7.pdf. Accessed: April 10, 2007.
- Michigan Department of Transportation. State Transportation Commission Policy of Noise Abatement (Guidance Document 10136). July 31, 2003. Available at: http://www.michigan.gov/documents/mdot_noisepacket_74617_7.pdf. Accessed: April 18, 2007.
- Mid Region Council of Governments. Albuquerque and Santa Fe Transportation Corridor Alternatives Analysis. Prepared by URS. October 26, 2005. Available at: <http://www.mrcog-nm.gov/images/Documents/Alternatives%20Analysis/Alternatives%20Analysis%20Executive%20Summary.pdf>. Accessed: May 7, 2007.

- Miller Morton, K. Large Mixed-Use Development Planned for Northwest. Austin American Statesman. July 17, 2006.
- City of Milpitas. Weekly Engineering Updates. Available at:
http://www.ci.milpitas.ca.gov/citydept/engineering/237_880weekly_field_report010305_.pdf.
Accessed: May 28, 2007.
- City of Minneapolis (a). Higher Density Corridor Housing Program. Available at:
http://www.ci.minneapolis.mn.us/cped/docs/corridor_hsg_prg.pdf. Accessed: April, 9, 2007.
- City of Minneapolis (b). Minneapolis Corridor Housing Strategy. Available at:
http://www.ci.minneapolis.mn.us/cped/corridor_housing_strategy.asp#P18_715. Accessed: April 9, 2007.
- City of Minneapolis. Nokomis East Light Rail Transit Station Area Plan. Available at:
http://www.ci.minneapolis.mn.us/PLANNING/Executive_Summary.pdf. Accessed, April 9, 2007.
- Minnesota Department of Transportation, Access Management Annotated Model Ordinance,
<http://www.oim.dot.state.mn.us/access/resources.html#ordinance>. Accessed: February 2007
- Mo'c Physics Applied Group. Selected Projects of Recent Years Factsheet. Available at:
http://www.mocpa.com/projects_start.html. Accessed: April 9, 2007.
- Moore Iacofano Goltsman, Inc (MIG). West Oakland Community Based Transportation Plan (Executive Summary). Prepared for Alameda County Congestion Management Agency. May 2006. Available at:
http://www.accma.ca.gov/pdf/comm_base_tran_plan_final/wocbtp_exec_summary_5_5.pdf Accessed: June 15, 2007.
- Nelson J.T. Wheel Rail Noise Control Manual. Report 23. Transit Cooperative Research Program. Available at: http://gulliver.trb.org/publications/tcrp/tcrp_rpt_23_pdf. Accessed January 10, 2007.
- New Jersey Transit. Capital Improvement Program: Rail and Bus Facilities Improvements. Ramsey Regional Park & Ride Fact Sheet. Available at:
http://www.njtransit.com/an_cp_project065.shtml. Accessed: June 26, 2007.
- New Jersey Transit. Transit-Friendly Land Use Factsheet. Available at:
http://www.njtransit.com/tm/tm_servlet.srv?hdnPageAction=TransitFriendlyTo. Accessed: December 5, 2006.
- New Mexico Rail Runner. Albuquerque to Santa Fe Commuter Rail Project Overview and Status of Project Elements. July 5, 2007. Available at:
<http://www.nmrailrunner.com/PDF/LFCCRSFALBS070507.pdf> Accessed July 10, 2007.

- New South Wales Government. Department of Planning. Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects. April 2007. Available at: <http://www.environment.nsw.gov.au/resources/07187rninfra.pdf>. Accessed, May 2, 2007.
- City of New York. Mayor and city council Announce Three Major Milestones in Effort to Transform the High Line. October 6, 2004. Available at: <http://www.nyc.gov/html/dcp/html/about/pr100604.shtml> Accessed June 2007.
- North Carolina Department of Transportation. Corridor Preservation Methods. July 2004. Available at: http://www.ncdot.org/doh/preconstruct/tpb/shc/PDF/US64-NC49_Corridor_Preservation_Report.pdf Accessed: October 2006.
- North Carolina Department of Transportation, Rail Corridor Preservation Policy (1998), <http://www.bytrain.org/corridor/pdf/cormanual.pdf>. Accessed February 2007.
- North Carolina Department of Transportation, Strategic Highway Corridors, U.S. 64-N.C. 49 Corridor Study (2005), http://www.ncdot.org/doh/preconstruct/tpb/shc/PDF/US64-NC49_Corridor_Study_Report_chapter10.pdf. Accessed February 2007.
- North Carolina General Statutes – annotated. West Publishing, 2006 and 2007.
- Interview and email correspondence with Cathy Norris, Legislative Counsel State Government Affairs: Colorado. Burlington Northern Santa Fe Railway. July 2007.
- City of Oceanside. Quiet Zone Survey Information. Available at: http://www.ci.oceanside.ca.us/quietzone_surveyform.asp. Accessed: July 2007.
- Office of Inspector General (OIG) Federal Railroad Administration. Review of the Alameda Corridor Project (Report Number TR-2000-004). October 22 1999. Available at: <http://www.oig.dot.gov/StreamFile?file=/data/pdfdocs/tr2000004.pdf>. Accessed: May 2, 2007.
- Ohio Regional Development Commission. Ohio Hub Study 2007 Report. 2007a Available at: <http://www.dot.state.oh.us/ohiorail/Ohio%20Hub/Website/ordc/theproject.html> Accessed: June 20, 2007.
- Ohio Regional Development Commission Ohio Hub Economic Impact Study Draft Report 2007b. Available at: http://www.dot.state.oh.us/ohiorail/Ohio%20Hub/OHIO_Economic%20Analysis05.23.07_FINALDRAFT.pdf Accessed: June 20, 2007.
- Ohio Regional Development Commission . Public & Agency Outreach Study. 2007c Available at: http://www.dot.state.oh.us/ohiorail/Ohio%20Hub/Website/ordc/Public_&_Agency_Outreach/3_Public_and_Agency_Feedback.pdf. Accessed: June 20, 2007.
- Interview with Ron Olson, Special Representative Government Affairs, Union Pacific Railroad. February 2007

- Oregon Department of Land Conservation and Development. An introductory Guide to Land Use Planning for Small Cities and counties in Oregon. January 2007. Available at: www.oregon.gov/lcd/docs/publications/introductory_guide_top_land_use_planning_in_oregon.pdf Accessed: June, 10, 2007.
- City of Pasadena – Office of City Manager. Agenda Report: Amend the Capital Improvement Program to Define a Train Arrival Information System as a noise Reduction Project for the Pasadena Gold Line Stations. Available at: http://www.ci.pasadena.ca.us/councilagendas/2007%20agendas/Jan_29_07/7A1.pdf. Accessed: May 14, 2007.
- City of Palm Springs. Palm Springs General Plan Update. January 2007. Available at: <http://www.psplan.org/docManager/1000000247/Ch%2005-11%20N.pdf>; and http://www.psplan.org/Content/10005/General_Plan_Documents.html. Accessed: April 2007.
- P.B. Farradyne Inc. City of Richardson, Texas. Automated Wayside Train Horn Warning System Evaluation. May 2001. Available at: www.railroadcontrols.com/ahs/automated_wayside_train_horn_warning_systems-evaluaton_richardson_tx.pdf. Accessed, December 6, 2006.
- Perfater, Michael A., Highway Corridor Preservation: A Synthesis of Practice (1989). Available at: <http://ntl.bts.gov/DOCS/perfat.html>. Accessed: October 11, 2006
- Telephone interview with David Perkins, CEO, Angelina & Neches River Railroad, March 2007.
- Pett, Kathryn., and Dragoo, Denise. Transportation Corridor Planning and Preservation in an Urban Environment. Natural Resources and Environment (a publication of the American Bar Association). Fall 2006.
- Telephone interview with Kathryn Pett, Ballard, Spahr, Andrews & Ingersoll LLP & Counsel for Utah Transit Authority. June 29, 2007.
- Telephone Interview with George Pinal, Planner, El Paso MPO. March 2007.
- Portec Rail Group. Friction Modifiers Fact Sheets. Available at: <http://www.portecrail.com/Lubrication/tor.htm>. Accessed: July 9, 2007.
- City of Portland. Interstate Light Rail Corridor Zoning Project. Available at: <http://www.portlanonline.com/planning/index.cfm?c=edcga> . Accessed December 8, 2006.
- City of Portland Online. Light Rail Transit Station Zone. Chapter 33.450. Available at: <http://www.portlandonline.com/shared/cfm/image.cfm?id=53353>. Accessed: April 4, 2007.
- Prozzi, Jolanda., Pinjari, Abdul R., Bhat, Chandra., and Resor, Randolph R. Public Support of Passenger Rail Sharing Freight Infrastructure. Report for the Texas Department of Transportation 0-5022-1. Available at: http://www.utexas.edu/research/ctr/pdf_reports/0_5022_1.pdf. Accessed: July 15, 2007.

- Puget Sound Regional Council. BNSF Corridor Preservation Study. May 2007. Available at: <http://www.psrc.org/projects/bnsf/finalreport.pdf>. Accessed: June 11, 2007.
- Queensland Rail. Code of Practice: Railway Noise Management. Available at: http://www.corporate.qr.com.au/Images/ENV_RD_2700_NSE_tcm15-3103.pdf. Accessed: January 20, 2007.
- Rails to Trails Organization. RTC Factsheet. Available at: http://www.railtrails.org/resources/documents/resource_docs/RTC_FactSheet_Railbanking.pdf. Accessed: May 24, 2007.
- Railway Age. June 2000. [Sound Transit, BNSF reach agreement](#). Available at: http://findarticles.com/p/articles/mi_m1215/is_6_201/ai_63859125. Accessed: April, 16, 2007.
- City of Reno. Rail Transportation Access Corridor Website Information. Available at: <http://www.cityofreno.com/gov/retrac/>. Accessed: May 10, 2007.
- Remington, P.J. Wheel/Rail Squeal and Impact Noise: What do we know? What don't we know? Where do we go from here? *Journal of Sound and Vibration* 116 (1985) 339-353.
- Governor Ed Rendell. Governor Rendell Says Land Use Development Planning Investments will Benefit Communities Statewide. Governor of Pennsylvania Press Releases. August; 10, 2006. Available at: <http://www.state.pa.us/papower/cwp/view.asp?A=11&Q=455374> Accessed: April 10, 2007.
- Robertson, J. Calif. Company plans \$400M site: Mixed-use Planned in Northwest Austin. *Austin Business Journal*, June 23, 2006. Available online at: http://www.simmonsvedder.com/projects/lakeline/ABJ_6-23-06.pdf. Accessed: July 17, 2006.
- Rocha, A. Bart goal: Stop Screech!, *San Francisco Examiner* October 25, 2007. Online and available at: http://www.examiner.com/a-1009094~BART_goal_Stop_SCREEECH_.html. Accessed May 19, 2008
- Roe, Amy. [Dinner train makes tracks to Tacoma; Spirit of Washington - Woodinville-Snohomish route had been focus of talks; backers unhappy](#), *The Seattle Times*, June 14, 2007. Available at: http://seattletimes.nwsourc.com/html/localnews/2003747175_dinnertrain14e.html. Accessed: June 14, 2007.
- Rene Rolmo. Railroad Places a Big Bet on Southern N.M. ; Terminal Planned For Santa Teresa. *Albuquerque Journal*. 6 October 2006.
- Rivkin Associates, Corridor Preservation: Case Studies and Analysis of Factors in Decision-Making (1993).

Interview with Craig Rockey, Vice President Policy & Economics, Association of American Railroads, Washington, D.C. January 2007

Ryan, Jennifer., Karlsson Rabiner, Karin., and Trumbull, John. Resolving Union Pacific Railroad Intermodal Concerns from TriMet's Interstate MAX LRT Line. Transportation Research Board 9th National Light Rail Transit Conference, November 16-18 2003. Available at: [www.Trb.org](http://www.trb.org). Accessed: October, 10, 2006.

Sallee, R. Metro can't hold proxy tract tax-free officials say. Houston Chronicle. April 6, 2007. Available at: www.chron.com/disp/story.mpl/metro/4692720.html. Accessed April 6, 2007.

City of Salt Lake (a). Council Staff Report: Petition to Rezone Property from Residential to Commercial. October 1, 2004. Available at: <http://www.ci.slc.ut.us/council/agendas/2004agendas/2004reports/October/1005C-2.pdf>. Accessed: June 22, 2007.

City of Salt Lake (b). Council Meeting Minutes. October 5, 2004. Available at: <http://www.slcgov.com/council/minutes/2004%20Minutes/10052004.htm>. Accessed: June 22, 2007.

City of Salt Lake (c). Council Meeting Minutes. October 12, 2004. Available at: <http://www.slcgov.com/council/minutes/2004%20Minutes/10122004.htm>. Accessed: June 22, 2007.

City of Salt Lake (d). Council Meeting Minutes November 1, 2005. Available at: <http://www.slcgov.com/council/minutes/2005minutes/11012005.htm>. Accessed: June 22, 2007

City of Salt Lake (e). Council Staff Report: Petition to Rezone Property from Residential to Commercial October 7, 2005. Available at: <http://www.slcgov.com/council/agendas/2005agendas/2005reports/October/101105A5.pdf>. Accessed: June 22, 2007

City of San Mateo. Ordinance Number 2007-3 Amending San Mateo Municipal Code by Adding Chapter 27.90 Establishing a TOD District, Reclassifying Properties and Amending Chapter 27.72 Regarding Nonconforming Buildings and Uses. Available at: http://bayside.ci.sanmateo.ca.us/downloads/government/ordinances/ordinance_2007_3.pdf. Accessed July 25, 2007.

City of San Mateo. Rail Corridor Plan. Available at: http://www.cityofsanmateo.org/downloads/planning/corr_current_plan/Approval/050606_res66_adpt_rc.pdf. Accessed: July 18, 2007.

City of San Mateo. Bay Meadows Phase II Design Guidelines. December 12 2006. Available at: http://www.cityofsanmateo.org/dept/planning/bay_meadows/bmdg.html. Accessed: July 18, 2007.

San Francisco. Municipal Transportation Agency. FY 2008-2027 Draft Short Range Transit Plan: Transportation Infrastructure Capital Improvements Program. October 2, 2007.

Available at: <http://www.sfmta.com/cms/rsrtp/documents/13Chapter8-InfrastructureProgramaccessible-FY08PublicDraftforMTAB10-2.pdf> Accessed: December 14, 2007.

Santa Clara Valley Transit Authority. Vasona Light Rail Line: Answers and Actions: Train Horns December 2005 Update. Available at: http://www.vta.org/projects/vasona/bells_and_horns_update.html. Accessed: January 30, 2007.

Telephone Interview with Dee Sarver, City of Plano Planning Department. January 2007.

Secretary of Transportation Report to US Congress. Preservation of Transportation Corridors. November 3 1994. Available at: <http://www.environment.fhwa.dot.gov/guidebook/vol2/doc5a.pdf> . Accessed: November 21, 2006.

Telephone Interview with David Schleg, Current Planning, City of Dallas, February 2007.

Telephone Interview with Alison Schulze, Planner at Austin San Antonio Intermunicipal Commuter Rail District, March 2007.

Sela, Erez., Resor, Randolph. R., and Hickey, Thomas R. Shared Use Corridors: Survey of Current Practice and Recommendations for the Future. Transportation Research Board 9th National Light Rail Transit Conference, November 16-18 2003. Available at: www.trb.org. Accessed: October, 10, 2006.

Harry Sidhu, Anaheim City Council Member. Electronic Newsletter. Volume 1, Issue 3, May 20 , 2005. Available at: <http://anaheimgov.com/newsletter.asp?idnewsletter=20>. Accessed: June 18, 2007.

Sisson, Paul. Sprinter Budget Inflates to \$440 million. North County Times. Available at: http://www.nctimes.com/articles/2006/06/16/news/coastal/22_11_126_15_06.prt. Accessed: April 9, 2007.

Skoropowki, Eugene. Capitol Corridor Joint Powers Authority. Presentation to Texas Transportation Forum. July 20, 20007. Available at: <http://www.dot.state.tx.us/ttf/assets/SpeakerPresentations/Session%20VIII%20Skoropowski.pdf>

Telephone interview with – Eric Slateger – Planning Manager Comprehensive Plan, Head of Urban Village, City of Fort Worth, February 2007.

Telephone interview with – Jay Smyth, Coordinator, Southwest Rail Corridor Coalition. June 27, 2007

County of Solano. General Plan Update. Adopted 2005, Confirmed March 2007. Available at: <http://www.solanocountygeneralplan.net/documents.htm> &

- http://www.solanocountygeneralplan.net/Background%20Docs/12_Noise.pdf Accessed: April 9, 2007.
- Sound Transit: East Link Light Rail Route & Station Workshops Summary. June 5, 2007. Available at: http://www.soundtransit.org/Documents/pdf/projects/eastlink/EL_WorkshopSummary_AppendicesA-E.pdf. Accessed June 15, 2007.
- Sound Transit. HCT: Planning Study of BNSF Corridor from Renton to Snohomish – Project E32 & N 46. May 2007. Available at: http://www.soundtransit.org/Documents/pdf/st2/st2_final/E32_N46_HCT_Planning_Study_of_BNSF_Corridor.pdf. Accessed: June 2007.
- South Dakota Department of Transportation. Assessment of Techniques for Corridor Preservation in South Dakota. Study SD2001-11-F. Prepared by Dye Management Group. March 2002. Available at: <http://www.environment.fhwa.dot.gov/guidebook/vol2/doc5a.pdf>. Accessed: November 12, 2007.
- South Jersey Transportation Planning Organization (SJTPO). South Jersey Regional Rail Study. December 2002. Available at: <http://www.sjtpo.org/SJRail-Final%20Report.pdf>. Accessed: February 5, 2007.
- Springer, Nate. Listen Up: Lessons from Three Cities Suggest Ways of Managing an Effective Planning Process. Planning. May 2007. American Planning Association. Washington: DC.
- Steele, Jeanette. Development Agency Remains Bullish Despite Readjustments. April 9, 2007. Available at: <http://www.signonsandiego.com/news/metro/20070409-9999-1m9overrun.html> Accessed: May 2007.
- Stein, Mark, A. Horns of A Dilemma: Rail Officials Try to Figure Out how to Reduce Train Noise Levels. Los Angeles Times. November 23, 1992. Available at: <http://www.mtwashington.org/projects/blue-line/latimes-hrns-dilemma.htm> Accessed: April 9, 2007.
- Telephone interview – Henry Stoppelcamp – Engineering Technical Services Manager. Denver Regional Transit District. July 18, 2007.
- Taubert, Marcel. High-speed grinding: a new rail grinding technique developed by Stahlberg Roensch promises to speed up the eradication of railhead flaws. International Railway Journal. December 2005. V.45 Issue 12 pp 40.
- Texas Department of Transportation. Texas Rail System Plan. October 2005. Available at: http://www.dot.state.tx.us/services/transportation_planning_and_programming/rail_plan.htm Accessed December 5, 2006.
- Texas High Speed Rail and Transportation Corp. Fact Sheets. Available at: <http://www.thsrct.com/default.asp> Accessed December 7 2006.

- Telephone interview – Barbara Barbara Thomas – Planner Local Corridor Preservation Fund Program. Wasatch Front Regional Council. July 18, 2007.
- Thomas, David A. & Robert S. Payne, Long-Range Highway Corridor Preservation: Issues, Methods and Model Legislation, 13 BYU J. PUB. L. 1 (1998).
- Telephone interview– Alan Tobias – Rail Passenger and Projects Manager, Virginia DRPT, Virginia. May 4 2007.
- TR News. Transportation Noise: Measures and countermeasures. September- October 2005 Issue Number 240. Transportation Research Board of the National Academies, Washington: DC.
- Transit Friendly Development. Newsletter of Transit Oriented Development and Land Use in New Jersey. April 2007, volume 3, Number 1. Available at: <http://policy.rutgers.edu/vtc/tod/newsletter/vol3-num1/> Accessed: May 2007.
- Transit Friendly Development. Newsletter of Transit Oriented Development and Land Use in New Jersey. May 2006 , volume 2, Number 1. Available at: <http://policy.rutgers.edu/vtc/tod/newsletter/vol2-num1/> . Accessed: May 2007.
- Trimet County Metropolitan District of Oregon. Community Building Sourcebook: Land Use and Transportation Initiatives in Portland, Oregon. August 2005. Available at: www.trimet.org/pdfs/publications/community_sourcebook05.pdf Accessed: May 10, 2006.
- Tuck, Cindy. California Council for Environment and Economic Balance – Presentation to California Air Resources Board. October 4, 2004. Available at: www.arb.ca.gov/ch/presentations/cceeb.pdf Accessed: April 4, 2007.
- United Kingdom Network Rail. Noise Fact Sheet. Available at: <http://www.networkrail.co.uk/freight/about/issues/noise.htm> Accessed: March 6, 2006.
- Urban Land Institute. Richardson, Texas: A Plan for Transit-Oriented Development. June 2000. Available at: <http://www.cor.net/ULIReport/Homepage.html>. Accessed: December 2006.
- Center for Urban Transportation Development, University of South Florida, Managing Corridor Development: A Municipal Handbook (1996), <http://www.cutr.usf.edu/pdf/corridor.pdf>. Accessed: September 10, 2006
- Utah Administrative Code. Rule R926-6 Transportation Corridor Preservation Revolving Loan Fund. Available at: <http://www.rules.utah.gov/publicat/code/r926/r926-006.htm>. Accessed: February 8, 2007.
- United States Department of Transportation Federal Highway Administration (FHWA). Transportation Corridor Preservation: A Survey of State Government Current Practices (2000). Available at: http://www.fhwa.dot.gov/realestate/cp_state.htm. Accessed: January 2007.

- United States Department of Transportation Federal Highway Administration. Transportation Corridor Preservation: A Survey of Current Practice by Local Government Planning Departments. Available at: http://www.fhwa.dot.gov/realestate/cp_local.htm. Accessed February 19, 2007.
- United States Department of Transportation: Federal Highway Administration-Texas Division. Letter to Ms Dianna Noble, Director Environmental Affairs Division. December 6, 2007. (provided by TxDOT)
- United States Department of Transportation Federal Transit Administration. Innovative Financing Techniques for America's Transit Systems. September 1998. Available at: http://www.fta.dot.gov/planning/metro/planning_environment_3530.html Accessed: October 2006
- United States General Accounting Office. High Speed Rail Projects in the United States. January 1999. Available at: <http://www.gao.gov/archive/1999/rc99044.pdf>. Accessed: May, 10, 2007.
- United States General Accounting Office. Issues for Consideration in Developing an Intercity Passenger Rail Policy. Available at: <http://www.gao.gov/new.items/d03712t.pdf> Accessed May 10, 2007.
- Interview with Christina Valles, City of El Paso Planning Department, March 2007.
- Virginia Department of Transportation, Press Release, VDOT Selects Private Proposal to Improve the Route 28 Corridor (May 3, 2001). Available at: <http://www.28freeway.com/press-releases/2001-05-03/2001-05-03.html>. Accessed: October 2006.
- Virginia Department of Rail and Public Transportation. State Rail Agencies Throughout the U.S. October 2005. Available at: http://freight.transportation.org/doc/rail/drpt_railreport.pdf Accessed: October 10, 2006.
- Virginia Ports Authority. Heartland Corridor Project. August 2 2005. Available at: http://www.vaports.com/Media_Room/2005/heartland.pdf Accessed: March 2007.
- VPA Engineering. Heartland Corridor Project. September 20 2006. Available at: http://www.vpa-engineering.net/rail_project/pres.htm. Accessed: April 10, 2007.
- Wasatch Front Regional Council. Local Corridor Preservation Fund. Available at: http://wrfc.org/cms/index.php?option=com_content&task=blogcategory&id=18&Itemid=39. Accessed: March 21, 2006.
- Washington State Department of Transportation (WSDOT). Notice to Consultants - On-Call Rail Planning and Public Involvement Request for Proposals. Available at: http://www.wsdot.wa.gov/consulting/Ads/Rail/RFP_RFQ/1999oncallrailplanning.htm Accessed: June 2007.

- Washington State Department of Transportation. Construction Update Fact Sheets. Available at: http://www.wsdot.wa.gov/NR/rdonlyres/81ADC6F8-D9EE-4164-9F93-2F285E02D3AC/0/2006_ExecutiveSummary.pdf. Accessed: June 22, 2007.
- Washington State Transportation Commission. Statewide Rail Capacity and Systems Needs Study – Technical Memorandum. Prepared by Cambridge Systematics. December 2006. Available at: http://www.wstc.wa.gov/Rail/TM10_2_WashStateRailInvestPlan.pdf. Accessed: May, 24, 2007.
- Washington State Transportation Commission. State Rail Capacity and System Needs Summary - Regional Listening Sessions Meeting Summary. June 2006. Available at: <http://www.wstc.wa.gov/Rail/RegionalListeningSessionSummary.pdf>. Accessed; July 24, 2007.
- Watson, D. Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs. Final Report 572 prepared for Arizona Department of Transportation. November 2006. Available at: http://www.azdot.gov/TPD/ATRC/publications/project_reports/PDF/AZ572.pdf. Accessed: June 21, 2007.
- Weinberg, Philip. Control of Suburban Sprawl Requires Coordination Not Provided by Local Zoning Laws. New York State Bar Association Journal. Vol. 72. No 8. October 2000. pp 44.
- West Coast Corridor Coalition (WCCC). Fact Sheets. Available at <http://www.wsdot.wa.gov/NR/rdonlyres/017FDFA1-B0AE-4F01-A79E-54AF9D74899C/0/WCCCBylawsAdoptedAugust162006.pdf>. and <http://www.sandag.org/index.asp?projectid=315&fuseaction=projects.detail> Accessed: June 12, 2007.
- Presentation by Gil Wilson to University of Texas Civil Engineering Students, 2005
- Wildan Group. UPRR West Santa Ana 29 At-Grade Crossing Closures Factsheet. Available at: <http://www.willdan.com/News2006.htm#apwa>. Accessed: April 9, 2007
- Email correspondence with Russell Wiles. ITS Manager and Railroad Projects Manager City of Fort Worth Public Works Department. June 2007.
- Williams, Kristine., and Frey, Robert. Corridor Preservation Best Practices: Hillsborough County Corridor Study No. 23. (2003). Available at: <http://www.cutr.usf.edu/pdf/BestPracticesreport.pdf>. Accessed: September 30, 2006.
- Williams, Kristine., and Seggerman, Karen. Effective Strategies for Comprehensive Corridor Management. Prepared for Florida Department of Transportation. October 2004. Available at: http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_PL/FDOT_BD544_06_rpt-web.pdf. Accessed, November 12, 2006.

Telephone Interview with Shirley Williams, Director of Environment and Planning, North Carolina Department of Transportation Rail Division. July 6, 2007.

Wisconsin Department of Transportation (WisDOT), Corridor Preservation and Access Management Guidance (1994), Available at: <http://ntl.bts.gov/DOCS/amg.html>. Accessed: October 2006, June 2007.

Wisconsin Department of Transportation. Rules Permits and Licenses - Subdivisions Along the State Highway System, Available at: <http://www.dot.wisconsin.gov/business/rules/trans233.htm>. Accessed: March 2007.

City of Yorba Linda. Esperanza Berm and Wall project. Available at: <http://ci.yorba-linda.ca.us/residents/newsandinfo/Esperanza%20berm.php> Accessed April 2007.

City of Yorba Linda. Imperial Highway Grade Separation Factsheet. Available at: <http://ci.yorba-linda.ca.us/residents/newsandinfo/Imperial%20grade%20sep.php> Accessed: June 18, 2007.

City of Yorba Linda. Community News, Spring 2006. Available at: <http://www.ci.yorba-linda.ca.us/residents/newsandinfo/newsletter/Spring%2006.pdf>. Accessed: June 18, 2007

City of Yorba Linda. City Council/Redevelopment Agency. Joint Meeting Minutes, April 3, 2007. Available at: http://www.ci.yorba-linda.ca.us/government/agendaandminutes/city_m_200734.pdf. Accessed: June 18, 2007.