

**HANDBOOK:
GUIDELINES FOR SUCCESSFUL LOCATION AND ACCOMMODATION
OF MAJOR DISTRIBUTION CENTERS ON TEXAS HIGHWAYS**

by

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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1. BACKGROUND AND OVERVIEW

Distribution centers (DC) have become more common in Texas over the past decade. As major generators of large truck traffic, DCs can increase design and maintenance requirements of Texas highway facilities. This handbook contains guidelines for use by Texas Department of Transportation (TxDOT) staff and others to help to successfully locate major DCs without adversely affecting Texas highways.

This handbook describes characteristics that are important to DC owners and developers. It contains guidelines on how TxDOT can assist DC owners, developers, or their agents in finding acceptable sites while avoiding the need for extensive improvements to state highways site selection. Also included are additional guidelines on related topics associated with DC location, design, and operation along state highways including geometric design of roadways, pavement selection, traffic impact studies, and site plan reviews.

BACKGROUND

Globalization of many parts of the economy has resulted in some fundamental changes in the supply chain for the goods people consume. Distribution and transportation have undergone major changes, especially for large retailers but also for manufacturers. Goods are often transported by container, carload, or truckload from across the country and the world to major distribution centers where the loads are broken down to less than truckload lots, combined with other goods to form truckloads destined for a single retail store, and then shipped as a full truckload to retail outlets.

Distribution centers are widely used in many types of businesses including retail, grocery, oil, motor vehicle, and manufacturing. They may serve several functions:

- Transportation – handles shipments into and out of distribution center;
- Repackaging – divides large quantities and repackages for individual stores;
- Value added – adds features to products before repackaging (e.g., apparel monograms); and
- Product dedication – may handle selected products, such as refrigerated products or tires (*I*).

The role of DCs in the supply chain is to receive bulk shipments and process the products for shipping to retail stores as efficiently as possible (2). Some DCs serve regional or other specialized roles or supply other distribution centers. While DCs may serve a short-term warehousing role, most DCs are not intended to serve a major long-term warehouse function. Many DCs are hubs for just-in-time delivery to retail stores. Hence, truck movements to and from a DC can be expected to exceed those at a similar-sized warehouse. Efficiency of access—both regional and local—is important for the successful site selection and operation of a DC.

DC site locations are usually sought and selected in privacy. Real estate brokers, consultants, or other agents are usually used to explore opportunities and sites. The owning companies usually maintain anonymity until a site is selected or until only a very small number of prime sites are being considered. Often competing sites are used to seek incentives for a DC to be located in a given location; local agencies often compete for the tax base and jobs associated with a new DC. Highway accessibility is one of the most important characteristics for a DC, and frequently access improvements are needed and become negotiation items for a new DC site.

SITE NEEDS

The locations of distribution centers are critical to their success in supplying goods to outlet stores and other facilities. Important site characteristics include:

- Site size – usually enough space for the DC building, loading bays along one of more sides, parking for tractors and trailers, an office, visitor parking, on-site drainage detention, and space for future expansion.
 - Location and proximity to area to be served – normally near the center of the area served by the DC. Many serve areas within a one-day round trip of stores served; some are within a one-day, one-way trip.
 - Access – most DCs are located along or within two miles of an interstate highway or another major freeway that connects to the interstate highway system. The DC may be located on a frontage road, a state highway, a city street, or a county road.
- Different companies have different location preferences. Most prefer to be away from other urban development; some locate in industrial parks set up for distribution

centers. Table 1 contains additional site location criteria often used by companies in locating DCs (3, 4).

Table 1. Selected Distribution Center Site Location Factors.

- Land/site
 - Tract size, fit
 - (Low) land cost
 - Taxes
 - Geographic location in proximity to:
 - Retail stores served
 - Suppliers
 - North American point of origin (near port, border, or other entry point)
 - Uncongested roadways to provide access (major or minor)
 - Other intermodal facilities (rail or air)
 - Free trade zone
 - Needed Utilities
 - Electricity (major transmission lines)
 - Telecom infrastructure
 - Gas
 - Water
 - Sewer
 - Waste disposal
 - Site access to interstate highway system and markets (some also need rail, air)
 - Access routes in good maintenance condition
 - No weight, height, noise or other restrictions affecting DC's shipments
 - Uncongested access routes
 - Needed improvements in place by DC opening date
 - Transportation costs
 - Local construction and building materials costs
- Workforce
 - Qualified/trained
 - Sized to fit DC function (sorting/repackaging or direct distribution)
 - Local amenities (housing, schools, shopping, etc.)
 - Commute time to site
- Incentives/Public Sector Partnerships
 - Short- or long-term tax abatements
 - Public subsidy/assistance with land purchase (sometimes donated)
 - Public commitment to share costs or pay outright for needed infrastructure improvements
 - Public provision of utilities or other financial incentives
 - Other incentives
 - Workable regulatory/permitting environment

- Utilities – most require the utilities listed in Table 1. For many DCs, extension of utility service out to candidate locations is a subject for negotiations.
- Labor force – most major DCs employ at least 500 people and some need 1,000 or more. An adequate supply of sufficiently skilled employees is critical. Some communities offer training programs to develop skills within the local labor force.
- Other – Some DCs have other needs specific to the businesses being served. Examples include additional modes (e.g., rail, seaport), special utilities, and other individual company preferences (e.g., no at-grade railroad crossings along access routes).

Each company usually has a list of location criteria.

LARGE DISTRIBUTION CENTERS IN TEXAS

There are over 60 distribution centers of over 500,000 square feet in Texas. Most are operated by major retail companies. Manufacturers operate some as do grocery chains. Table 2 lists many of the existing DCs. The largest concentration of DCs in Texas is around the Waco-Dallas-Ft. Worth-Tyler area as a result of being about one day's drive from the Mexico border, at the intersection of major east-west and north-south interstate highway corridors, and the state's largest concentration of consumers. However, another concentration exists around the Houston area, due to the proximity to the Port of Houston and another major concentration of consumers. Many DCs are located away from major metropolitan areas along interstate highways.

Table 2. Selected Texas Distribution Centers over 500,000 Square Feet.

Distribution Center ¹	Address	City	Size (sq. ft.)	Jobs	Site					Truck Access					Aerial Photo On File	TxDOT District	
					Urban	Fringe	Rural	Industrial Park	Free standing	Front Rd.	Distance to Interchange	State Hwy.	County Road	City Arterial/Collector Street			Local Street
Retailers																	
99 Cents Only Stores (Ex-Albertsons)	23623 Colonial Parkway	Katy	741,000	-		•			•		3 blks			•		Yes	HOU
Academy	1800 N. Mason Road	Katy	1,500,000	1400		•		•			5 blks			•		Yes	HOU
Blockbuster	3000 Redbud Blvd.	McKinney	818,000	1415		•			•		1 blk		•			Yes	DAL
Container Store	500 Freeport Parkway	Coppell	725,000	400	•			•			7 blks			•		Yes	DAL
Dillards	4501 N. Beach Street	Fort Worth	716,000	800	•			•			3 blks			•		Yes	FTW
Do-It-Best (u.c.)	801 Hewitt Avenue	Waco	500,000	-	•				•		0.6 mi			•		Vicinity	WAC
Family Dollar	3101 E. I-20	Odessa	907,000	500		•		•	•		2 blks					Yes	ODA
Home Depot (Ex-KMart)	2200 S. US Bus 45	Corsicana	1,453,000	250	small				•		1 mi.	•				Yes	DAL
Home Depot	6115 FM 1405	Baytown	755,000	350		•		•			7 mi.	•				Yes	HOU
Home Depot (u.c.)	8103 Fallbrook Drive	Houston	535,000	-	•				•		0.8 mi			•		Yes	HOU
Home Interiors	1649 W. Frankford Rd.	Carrollton	659,000	616	•			•			3 blks			•		Yes	DAL
JC Penney	1701 Intermodal Parkway	Haslet	1,200,000	517		•		•			2½ mi				•	Vicinity	FTW
Kohl's	1600 I-45	Corsicana	540,000	225		small			•		2½ mi	•				Yes	DAL
Lowe's	955 Lowe's Lane (I-30 W)	Mt. Vernon	1,100,000	-		small			•	•	Adjac.					Yes	PAR
Mervyn's (ex)	1600 Plano Parkway	Plano	533,000	-	•			•			¾ mi			•		Yes	DAL
Macy's (ex-Foley's)	2103 Ernestine	Houston	810,000	600	•			•			2 blks				•	Yes	HOU
M.J. Designs/Michaels	500 Airline Drive	Coppell	504,000	-	•			•			½ mi				•	Yes	DAL
Radio Shack ²	900 Terminal Road	Fort Worth	1,142,000	3337	•				•		7 blks				•	Yes	FTW
Rooms to Go	3500 S. Watson Road	Arlington	851,000	185	•				•	•	3 blks					Vicinity	FTW
Sears	2775 Miller Road	Garland	878,000	400	•			•			1 mile			•		Yes	DAL
Stage Stores	506 Beall Blvd.	Jacksonville	500,000	439	small				•		35 mi			•		Yes	TYL
Target	13786 Harvey Road	Tyler	1,630,000	950			•		•		1 blk		•			Yes	TYL
Target	4333 Power Way	Midlothian	1,350,000	750			•		•		5 blks				•	Yes	DAL
Toys R Us	3800 Railport Parkway	Midlothian	846,000	200			•		•		3 blks				•	Yes	DAL
Tractor Supply (exp. u.c.)	2801 Corporation Parkway	Woodway	654,000	-		•			•		300 ft.				•	Yes	WAC
True Value Hardware	2601 E. SH 31	Corsicana	775,000	185			•		•		2½ mi	•				yes	DAL
Walgreens	710 FM 664 (Ovila Rd.)	Waxahachie	650,000	750		small			•		Adjac.	•				Yes	DAL
Wal-Mart #7042	4554 E. Greenwood St.	Baytown	2,000,000	600		•		•			7 mi.				•	Vicinity	HOU

5

Table 2. Selected Texas Distribution Centers Over 500,000 Square Feet (Continued).

Distribution Center ¹	Address	City	Size (sq. ft.)	Jobs	Site					Truck Access					Aerial Photo On File	TxDOT District
					Urban	Fringe	Rural	Industrial Park	Free standing	Front Rd.	Distance to Interchange	State Hwy.	County Road	City Arterial/Collector Street		
Wal-Mart #6068	2120 N. Stemmons	Sanger	1,200,000	800			●		●		1 blk		●		Yes	DAL
Wal-Mart #7036	3162 Brast Road	Sealy	1,100,000	840			●		●		2 mi.	●			Yes	YKM
Wal-Mart #6036	14868 FM 645	Palestine	1,000,000	1,500			●		●		26 mi	●			Yes	TYL
Wal-Mart #6012	3100 N. Quincy Rd.	Plainview	1,000,000	1,500	small			●			2 blks		●		Yes	LBB
Wal-Mart #6016	3900 N I-35	New Braunfels	980,000	1,200			●		●	●	¼ mi.				Yes	SAT
Wal-Mart #7010	20131 Gene Campbell Road	New Caney	890,000	-			●		●		4½ mi		●		Yes	HOU
Wal-Mart #6083	9605 NW H.K. Dodge Loop	Temple	800,000	750		●			●		2 mi	●			Yes	WAC
Wal-Mart #6056	591 Apache Trail	Terrell	750,000	225		●		●			2 blks			●	Yes	DAL
Wal-Mart #6005	201 Old Elkhart Road	Palestine	660,000	350	small				●		35 mi			●	Yes	TYL
Manufacturers/Distributors																
Army-Air Force Exchange	1801 Exchange Parkway	Waco	625,000	-		●		●			0.4 mi			●	Yes	WAC
Bridgestone America	600 Gateway Parkway	Roanoke	608,000	180		●		●			2½ mi			●	Vicinity	DAL
Caterpillar (u.c.)	Exchange Parkway	Woodway	(750,000)	140-180		●		●			1½ mi			●	Vicinity	WAC
General Mills (u.c.)	4901 Henrietta Creek Road	Roanoke	670,000	-		●		●			4½ mi			●	Vicinity	DAL
Haggar Clothing Co.	5401 N. Riverside Drive	Ft. Worth	665,000	-	●			●			1 mi		●		Yes	FTW
Igloo Products ²	777 Igloo Road	Katy	1,400,000	1560			●		●		1/3 mi		●		Yes	HOU
LG Electronics	13700 Independence Pkwy	Haslet	500,000	-		●		●			1¼ mi			●	Yes	FTW
Mattel	501 Meacham Road	Fort Worth	1,000,000	120	●			●			1 blk		●		Yes	FTW
Michelin	8800 City Park Loop	Houston	663,000	50	●			●			2 blks			●	Yes	HOU
Orgill (u.c.)	7001 Elder Lake Road	Kilgore	530,000	300		●		●			2½ mi			●	Vicinity	TYL
Nestle	13600 Independence Pkwy.	Haslet	525,000	-		●		●			1¼ mi			●	Yes	FTW
Phillips Electronics	300 Freedom Drive	Roanoke	776,000	-		●		●			3 mi.			●	Vicinity	DAL
Solo Cups (ex-Circuit City)	3737 Duncanville Road	Duncanville	510,000	-	●				●		4 blks		●		Yes	DAL
Whirlpool (ex-GM Parts)	1101 Everman Parkway	Fort Worth	852,000	150	●			●			3 blks		●		Yes	FTW
Whirlpool	14900 Frye Road	Fort Worth	500,000	15	●			●			1½ mi			●	Yes	FTW
Grocery																
Albertsons	7550 Oak Grove Road	Fort Worth	1,030,000	600	●			●			4 blks		●		Yes	FTW
Aldi (u.c.)	2500 Westcourt Road	Denton	500,000	120		●			●		2 mi			●	Yes	DAL
Grocers Supply (Ex-Fleming, Safeway; not now DC)	2600 McCree Road	Garland	1,080,000	310	●			●			2 blks			●	Yes	DAL
Grocers Supply	3131 E. Holcombe Blvd.	Houston	959,000	-	●				●		2 blks		●		Yes	HOU
HEB	4710 N. IH-35	San Antonio	1,380,000	-	●				●	●	1 blk				Yes	SAT

Table 2. Selected Texas Distribution Centers Over 500,000 Square Feet (Continued).

Distribution Center ¹	Address	City	Size (sq. ft.)	Jobs	Site					Truck Access					Aerial Photo On File	TxDOT District	
					Urban	Fringe	Rural	Industrial Park	Free standing	Front Rd.	Distance to Interchange	State Hwy.	County Road	City Arterial/Collector Street			Local Street
HEB	2301 Hunter Road	San Marcos	~650,000	540	●				●		6 blks			●		Yes	AUS
Kraft	1006 Railhead Dr	Haslet	650,000	238		●		●			2 mi				●	Yes	FTW
Kroger	701 Gellhorn Drive	Houston	880,000	-	●			●			2 blks				●	Yes	HOU
McLane Southwest	2828 Industrial Blvd.	Temple	500,000	830		●		●			1.3 mi			●		Yes	WAC
Randall's	10700 Telge Road	Houston	646,000	-	●			●			1 blk			●		Yes	HOU
Randall's/Tom Thumb	743 Henrietta	Roanoke	1,260,000	440		●		●			4 blks				●	Yes	DAL

¹ u.c. – under construction

² Includes some manufacturing

Source: Texas Transportation Institute

TXDOT INVOLVEMENT AND CONSIDERATIONS

Access

The Texas Department of Transportation's (TxDOT) role results from the importance of regional highways to DCs. As described previously in this chapter, access and proximity to interstate highways are very important. Hence, whether it is obtaining access to a frontage road, state highway, or Farm-to-Market road, or whether it is requesting improvement of one or more state highway facilities, DC developers often involve TxDOT in the process of developing a new DC. Over the years, TxDOT has constructed a wide range of improvements to serve DCs, including road widening, intersection improvements, traffic signals, new roads, and new ramps and interchanges.

Design

Major DCs generate up to 1,000 truck trips per day, nearly all tractor semi-trailer combinations. With that volume of truck trips, geometric and pavement design are important. Driveways, intersections, ramps, and merge and weave sections serving DCs all need to be designed for those trucks—as do pavements. There are numerous examples along roads in Texas where pavements have been damaged because they have not been designed for the truck traffic that uses them. Figures 1 and 2 show examples.



Figure 1. Pavement Damage from Trucks Tracking Off Pavement at a Short Corner Radius.



Figure 2. Broken Pavement Edge Where Truck Tires Have Tracked over the Edge.

Even where roads generally appear adequate to meet DC access needs, TxDOT may be concerned with the adequacy of specific design characteristics when a DC is being considered.

Safety

Many DCs are located on rural two-lane roads, some without shoulders. Sight distance is very important for safety purposes, because truck turns to and from these rural roads may be at lower speeds and take longer than normal. Sight distances may need to be longer than normal. It may also be preferable to provide shoulders and turn lanes, especially where traffic is relatively heavy. Traffic control in the form of traffic signals at nearby intersections, signing, and pavement markings may also be needed. TxDOT will have the responsibility for these along state highways.

Traffic Impacts

Adding as many as 1,000 truck trips a day plus employee and service trips adds significant traffic to any road. In low volume rural locations, the traffic volumes themselves may not require improvements, although the addition of a high volume of truck trips may require special accommodations as previously described.

In urban areas or along rural roads already carrying significant traffic volumes, the added DC traffic may require improvements to intersections, ramps, shoulders, or other system components, or it may require widening, new ramps or interchanges, or other major improvements. A higher type of pavement design could also be needed. An assessment of anticipated traffic impacts can provide an objective review of needs that will result from the new DC.

Pavement Life

As previously mentioned, DCs generate major truck volumes. DC trucks rarely are overweight, but they do add to the wear and tear on highway pavements, especially on older highways that were designed and built several decades ago for loads that did not include high truck volumes.

Traffic impact reviews can include both pavement design and geometrics. Deficiencies in both can lead to accelerated pavement deteriorations. In calls to district maintenance engineers, the research team did not find evidence of major pavement deterioration near DCs but

did find several instances of pavement edge damage at highway and driveway intersections with short corner radii. There were also a few instances of pavement scour where high volumes of trucks have made short radius turns.

Funding and Timing of Improvements

By the time TxDOT becomes aware of the need for improvements to state highways, if improvements are major, there often is not sufficient time to use the normal programming process and still meet the desired opening date for the DC. Finding sufficient funding can be just as challenging. It is much easier if TxDOT becomes involved early in the site selection process so TxDOT can help avoid sites that will need major road improvements, and if improvements are needed, more time will be available to seek and secure funds, if available.

While on occasion, districts or TxDOT administration may have unallocated funds available, one way to ease time constraints and secure funding is through partnering with the DC developer and local agencies. If others provide some or all of the funding, TxDOT may be able to expedite the project. Even if the developer or local agencies front-end the cost and recover it later in a form of pass-through financing, the project may be able to be expedited.

Coordination/Collaboration

TxDOT can be more helpful if involved early in the site selection process, and if involved with the DC developer and other agencies in helping the developer to ready the facilities for opening. TxDOT can provide the most benefit if involved in:

- site selection;
- traffic impact/needs assessment; and
- site plan review (access and circulation).

TxDOT can help the DC developer or local agencies evaluate alternative sites for accessibility and help avoid sites that would need major transportation improvements. As site plans begin to be developed, TxDOT can also help to locate access where it will work the best and be subject to the least conflict with other traffic. This can occur if the local agencies (usually led by economic development agencies or departments) invite TxDOT in as a collaborator early in the process.

LOCAL AGENCY CONSIDERATIONS

Local agencies are usually anxious to attract new business, new tax base, and new jobs. All come with DCs. Hence, most local agencies that have sites for DCs find themselves working to attract DCs to their community. This can typically be in competition with other communities. Often the resulting competition causes the local agencies to offer incentives to try to entice the DC owner to select their community. That puts such local agencies in a different posture than TxDOT:

- the local agencies are trying to develop the most favorable offer and can receive tax and other economic benefits if they are chosen; while
- TxDOT provides a service and reaps no direct benefits from any site selection and stands to have to expend some of its resources if improvements are needed.

Some local agency considerations follow.

Economic Impacts

As previously described, local agencies can benefit economically from added tax base and more jobs. These strengthen the local economy. Local agencies need to be able to provide the right kind of labor force as well as a suitable site and services. There may also be land use compatibility considerations. The local community will also need to assess the economics associated with providing utilities and other facilities and services needed by the DC, much the same as TxDOT considers road improvement requests. Local agency costs are often balanced against future tax revenues.

Incentives

Because of the potential economic benefits to local agencies, and because the DC owners know of those benefits, the DC developers often pit one local agency and site against another and request incentives to entice the DC to a particular site. Incentives can take many forms, including expedited permit processing, tax abatements, subsidized land cost, utility extensions, outright grants, loans, and job training. Some have real dollar costs; some are more a matter of policy or paperwork.

TxDOT can be drawn into these incentive negotiations when access issues or improvements are involved. TxDOT can be (and has been) asked to contribute to the cost for

improvements or merely approve access in a form that it might not otherwise approve. These are cost-free to the local agencies if TxDOT provides funding. Local agencies often assume that TxDOT can secure the needed funds. That is another reason for TxDOT to get involved early—so the local agencies have a realistic understanding about what can and cannot be reasonably expected.

Impacts on the Road System

Local agencies have land development approval authority. TxDOT has none. As such, local agencies should consider the impacts a DC will have on the road system—local streets and roads as well as state highways—as part of their development review process. The local agencies usually have to address complaints if DC traffic impacts affect the local street system. They should also invite TxDOT to participate in the development plan review when adjacent to a state highway, whether or not the DC will have access from that highway. This will ensure that unanticipated impacts are avoided on state highways.

Interest in TxDOT Considerations

Most of TxDOT's considerations described previously also affect the local agencies, either directly or indirectly. Impacts to state highways affect the local community's travelers, businesses, and residents since they also use TxDOT highways. It is in the community interest to try to help keep an area's state highways as functional, efficient, and safe as possible. Having highway improvements in place when needed helps to alleviate unnecessary congestion or other problems. This is another reason to involve TxDOT early.

CONCLUSION

DCs not only help the local economy, but they also contribute to the state economy. For that reason, the Governor's Office of Economic Development (GOED) assists DC owners, developers, and their agents in locating DCs in Texas. Some could just as easily be located in adjacent states (and some have been).

One of TxDOT's goals is to support economic development. Hence, it is consistent with state policy for TxDOT to assist local agencies to attract and support DCs, within resources that are available. It is also in TxDOT's best interests to become involved early, to encourage DC

location in an already accessible site, and to avoid the need for state highway improvements that could be avoided by selecting another site or site plan.

TxDOT involvement can be most effectively and productively provided when it begins early in the site selection process and is accomplished in a collaborative manner with local agencies. The remaining chapters of this report describe how TxDOT can approach its involvement with DCs so it is helpful to the local agencies, consistent with TxDOT policy, and casts TxDOT in a role of positive contributor through the state highway system.

2. PURPOSE, BENEFIT, AND STRATEGY FOR TXDOT INVOLVEMENT

Responses from most interviews of TxDOT staff previously involved with accommodating major distribution centers indicated a need to get TxDOT involved earlier in the process. This could give TxDOT opportunities to provide input on site selection, site plans as they affect access, and on discussions about improvements to state highways. Moreover, it is state policy to attract new business to Texas, and the Governor’s Office of Economic Development involves TxDOT in assisting DC developers when transportation questions are raised.

However, TxDOT is often not involved until the site selection process is complete or far along, and often only when improvements to state highways become a need. Yet, as shown in Table 3, highway accessibility is, and has long been, at the top of the list of most important factors affecting both general and specific site selection for manufacturing facilities and DCs. Hence, it is to the benefit of both DCs and TxDOT for TxDOT to become involved early in site selection so TxDOT can assist DC owners and developers in selecting sites that will have the desired accessibility for the DC.

Table 3. Most Important Site Location Factors for Distribution Centers and Manufacturing Facilities – Annual Survey of Corporations and Site Consultants.

Corporations		Consultants
In Top 10 Each of Past 2 Years	In Top 10 Each of Past 6 Years	In Top 10 Each of Past 2 Years
1. Highway accessibility	1. Labor costs	1. Highway accessibility
2. Labor costs	2. Highway accessibility	2. State and local incentives
3. Occupancy, construction costs	3. Skilled labor availability	3. Skilled labor availability
4. Energy availability, costs	4. State and local incentives	4. Tax exemptions
5. Skilled labor availability	5. Occupancy, construction costs	5. Available land
6. Tax exemptions	6. Corporate tax rates	6. Labor costs
7. Corporate tax rates	7. Energy availability, costs	7. Energy availability, costs
8. State and local incentives	8. Tax exemptions	8. Proximity to major markets
9. Available land		9. Occupancy, construction costs

Source: Gambale, Geraldine, editor, *23rd Annual Corporate Survey and 5th Annual Consultants Survey*, Halcyon Business Publications, Inc., Westbury, N.Y., 2008, www.areadevelopment.com, accessed March 13, 2009.

DC owners often have additional preferences associated with location. Interviews conducted for this project identified other preferences that may be of interest to TxDOT for conversations involving the desirability of candidate sites and improvements needed to make a specific site viable. These additional factors included:

- area or roads designed for large trucks:
 - geometrics; and

- pavements;
- capacity to handle large number of additional trucks;
- availability of perceived safe and efficient access;
- location near interstate highways or regional freeways to limit amount of improvements needed;
- location in a compatible area, such as:
 - urban – accessible industrial park;
 - rural – away from other development, especially residential and schools;
 - avoid access routes crossing at-grade railroad crossings; and
 - avoid access routes experiencing recurring congestion;
- shipping rates for finished products and back haul opportunities;
- willingness of agencies to work with DC developer or agents; and
- funding for infrastructure improvements (often part of state and local incentives listed in Table 3).

BENEFITS TO TXDOT

It is also beneficial for TxDOT to be involved in the process and involved early in the site selection). Benefits to TxDOT reported in project interviews included:

- input into potential selection of sites along state highways and an opportunity to guide DCs away from locations that might cause congestion or require significant state (or local) highway improvements;
- early information to DC developers regarding access to state highways and lead time and funding options involved in making improvements to state highways;
- ability to affect site and access plans to avoid safety concerns and improve accessibility of the site without adversely impacting highway operations;
- help TxDOT avoid major surprises in the form of last minute requests for major highway improvements or major truck volumes on roads not intended for such use;
- greater opportunity for TxDOT to coordinate with local agencies for the benefit of the DC developers and the participating public agencies; and

- cast TxDOT in a helpful role as a valuable resource and facilitator in helping local and state economic development.

RECOMMENDED STRATEGIES

To become involved earlier in the process, TxDOT will need to provide DC developers, their agents, and local agencies and economic development entities reasons to involve TxDOT at or near the outset. Currently the posture of both DC developers and local agencies is to involve only a very few people and to minimize knowledge about site searches. Those that do participate are often pledged to maintain confidentiality. In such a situation, only those providing essential early value to the DC developer or agent are likely to be invited to participate early. Hence, TxDOT needs to be able to demonstrate it is providing an important value to the DC site selection process.

A two-part strategy is recommended to increase TxDOT attractiveness to DC developers to invite early TxDOT involvement:

- develop resources that will be of sufficient value to economic development interests and DC developers that they will regularly seek those sources out from the outset; and
- adopt a posture of trying to help the DC owners, developers, and agents to secure a site that has superior accessibility and will be fully ready on opening day without undue costs to either the DC owner, local agencies, or the state.

TxDOT already assists DC developers and agents through the GOED when asked. TxDOT additionally works with DC developers and agents on access permits and state highway improvements, although often late in the process when a site has been selected and the site plan prepared. While TxDOT normally tries to assist as much as possible within the limitations of its policies and available resources, sometimes the requests and proposed conditions are not consistent with what TxDOT can deliver and TxDOT is placed in a defensive posture. Earlier involvement and proactive efforts to assist with accessibility can help TxDOT avoid being put in a position where the DC developer will be disappointed. The following two sections more fully outline these strategies.

Providing Value to DC Site Selection Process

There are two parts to providing value:

- provide site location and accessibility information that will assist DC owners, developers, and agents as well as economic development agencies to easily find DC sites that are already highly accessible or will be shortly; and
- proactively communicate with economic development agencies through TxDOT district and area offices to offer assistance and provide helpful information.

Site Location and Accessibility Information

Table 1 lists the more common DC site selection criteria. While each company has its own criteria, the most important criteria for most companies are listed in Table 1. Several others also relate to highway accessibility:

- site access to interstate highway system and markets (also rail, air for some);
- access routes in good maintenance condition;
- no weight, height, noise, or other restrictions affecting DC's shipments;
- uncongested access routes; and
- needed improvements in place by DC opening date.

This and related information often sought in conjunction with searches for specific sites could be provided on the TxDOT public website (www.txdot.gov) and some in hard copy form. Table 4 shows information that could be included.

Table 4. Potential TxDOT Public Website Information of Interest to DC Interests.

Information That Could be Added to TxDOT Public Website to Support DC Site Searches and Selection
<ul style="list-style-type: none">• State highway and local road traffic volumes;• Congested locations or segments of state highways;• Programmed improvements (already shown on the “project tracker” on this website);• Planned improvements not yet programmed;• Access policies, design requirements, and permit procedures;• Procedures for requesting and obtaining state highway improvements; and• How and where to seek more information.

This is all information that is available within TxDOT. However, not all of it is directly or conveniently available to those outside TxDOT, nor would some of the users know the

terminology needed for the search. The information is also scattered in various places, some on TxDOT’s intranet, some on the TxDOT public website, and some in various files.

TxDOT could provide a commercial site location webpage containing the overview information and providing links to the more detailed information. The detailed information would need to be described on the website. User instructions would be needed if not obvious. The information could be provided by county, district, or statewide, depending on how it is organized and updated.

This information and its availability could be described in a brochure (electronic and hard copy) describing how TxDOT can help and who to contact for each type of information or assistance. Table 5 shows the information that could be included.

Table 5. Potential Information for Electronic/Hard Copy “TxDOT DC Site Assistance” Brochure.

Information to Encourage DC and Local Economic Development Interests to Invite TxDOT into Site Selection Process
<ul style="list-style-type: none"> • Data – list available data and where to find them (e.g., website, districts) • Finding a highly accessible site (request TxDOT help to identify highly accessible, uncongested areas along state highways; the intent would be to steer DC developers away from congested areas and conditions where access would not be granted or would require significant improvements); assistance could be made available on request; • Assessing site accessibility through a traffic access/impact analysis (TxDOT can provide guidelines); • Access permits – summary of what is required, website link for TxDOT’s access management policy and permit applications, driveway design details, who to contact for assistance or to apply; • Requesting a highway improvement – TxDOT process for processing requests, funding policy and procedures (including partnering); typical timeframes for improvements not already programmed; roles of other agencies and developers; who to contact; and • Other transportation assistance – who to contact for other transportation information.

This could all be completed under a “TxDOT is here to help” theme.

Proactive Communication – “TxDOT is Here to Help”

The “TxDOT is here to help” theme could be the foundation of the proactive communication program. Under this strategy, TxDOT, primarily through district and area offices but also through its participation with the GOED, could initiate a program of communication with economic development agencies and departments. The message would be that “TxDOT is here to help.” Help would be in the form described above but would be to help support the local economic development entity’s efforts to provide attractive candidate sites for

DCs. TxDOT would not be able to help the local economic development entity compete with other Texas locations but could help evaluate accessibility of local candidate sites and help avoid the need for undue improvements to state highways. Where improvements might be necessary, TxDOT could offer to help minimize them through providing advice in the site planning process and again during the development review, working in partnership with the applicable local agencies.

TxDOT could also offer its assistance by participating in meetings with the DC developer or agents about candidate sites or criteria for evaluating sites as well as discussions about timing for development of the site and supporting infrastructure. In addition to distributing a brochure and maintaining a helpful webpage, two additional methods to increase recognition of TxDOT's potential value to DC owners, developers, and agents are to:

- participate with presentations in the GOED briefings for site selectors, describing assistance that TxDOT can provide and potential benefits to DC interests; and
- present similar information in the periodic briefings that district engineers present to local officials and leaders.

A PowerPoint® presentation suitable for these types of briefings will be prepared as part of this research project. It is possible that TxDOT already performs most of these activities on a piecemeal basis. However, based on information obtained in this project's interviews, TxDOT is typically contacted late in the process. The recommended proactive approach is intended to help TxDOT get involved early—on a regular basis. It is possible that the total staff time will be similar to what is now expended, but that it will begin earlier and help avoid the need for some improvements as well as reducing time spent on requests that are difficult to fulfill (e.g., driveways that do not truly meet TxDOT criteria). This approach need not be limited to DCs. It is applicable for all major economic generators that often locate along or near state highways.

Adopting a Helpful Posture

Again, under the “TxDOT is here to help” theme, by getting involved early, TxDOT will find it easier to play a helpful role rather than one of review and disapproval or back-and-forth negotiation late in the process. TxDOT will also have a greater chance to respond to needs and requests in a timeframe that will satisfy the DC developer.

TxDOT can demonstrate its helpfulness through being involved early, such as:

- providing information described above to both the DC interests as well as local economic development entities;
- assisting in early discussions with DC developers and agents;
- identifying existing state highways and interchanges that may be underutilized and designed for large trucks and therefore provide opportunities for good access to a DC;
- suggesting a traffic access or impact analysis (TIA) to help identify access options and the best way to accommodate DC access as well as passing traffic in the vicinity of a candidate site;
- helping to evaluate sites for accessibility associated with state highways;
- identifying ways to provide safe and efficient access to candidate DC sites;
- discuss and compare state highway improvements needed for alternative sites and site plans and the costs associated with those improvements;
- providing information on timing, funding, and construction of state highway improvements;
- communicating within TxDOT to explore other questions or requests; and
- other input that may be beneficial in conjunction with a specific site.

The strategy here is to assist developers and agents and to avoid the role of merely being an agency that approves or disapproves requests. In the recommended role, TxDOT will have the opportunity to provide constructive help but also guide the DC interests toward what TxDOT can provide (or already exists) and away from costly, difficult, or lengthy improvements not in the current program.

3. BEST TXDOT PRACTICES FOR WORKING WITH NEW DCS

This chapter outlines a number of approaches and best practices that were found to have been used by TxDOT or other transportation agencies or that are recommended by the research team based on related experience. All recommendations are aimed at achieving successful DC access in locations where undue traffic impacts will not result and where the improvements needed to accommodate DC access will be nominal or reasonable. It is understood that locations of DCs are not solely based on highway accessibility and that other criteria will be important. For that reason, it is recommended that TxDOT work closely with local economic development and other agencies as well as DC developers and agents to find the site that best meets the DC owner's overall needs. This may mean that not all criteria will be fully satisfied.

BEST PRACTICES – TXDOT

This section contains a compilation of best practices for TxDOT to consider. A subsequent chapter lists common practices that DC developers and agents use or could follow. These will help TxDOT understand what DC developers and agents typically seek and why, and should help TxDOT better understand how DC developers and agents operate.

Work with the GOED

The Governor's Office of Economic Development handles initial responses from DC developer representatives. These usually come at the beginning of the site selection process. Inquiries may come after Texas has been selected as a site location or may involve consideration of sites in multiple states. Some inquiries are for basic information (demographics, state laws, regulations, policies, programs, labor force information), and some are for assistance to identify candidate locations meeting specified DC criteria. Some assistance requests extend to arranging visits to candidate sites or communities or to having the GOED request proposals from local agencies for specific sites. The GOED also receives requests for incentives. Inquiries may come from DC owners but frequently begin with real estate brokers, consultants, or developers.

The GOED's role is to attract business—including DC sites—to Texas. The GOED normally first contacts local economic development offices (LEDO) in areas of interest to the DC developer. The LEDO responds to specific needs and any requests for site proposals. The LEDO may involve other agencies but usually does this on an as-needed basis.

Current TxDOT Role

The GOED refers transportation requests to TxDOT. The TxDOT Government and Public Affairs Division (GPA) Community Relations Manager works directly with the GOED. The Community Relations Manager forwards requests to appropriate districts if the desired area is known. However, some inquiries are kept confidential at the request of the DC developer. Traffic, access, and road improvement requests are not normally received or handled at this level. That normally happens after a site has been selected (or tentatively selected) and is handled by a TxDOT district or area office.

Recommended Additional TxDOT Actions

TxDOT could become more proactive at this level by promoting use of TxDOT information and technical assistance. The following are several suggested ways to get TxDOT involved earlier.

- In support of TxDOT's goal to support economic development, increase the visibility of TxDOT support of economic development efforts by providing briefings to local economic development agencies and community leaders about TxDOT projects, plans, and how TxDOT can help.
- Present a "TxDOT is Here to Help" approach, consistent with agency policies and procedures.
- In response to each general or specific inquiry to the GOED, provide the "TxDOT DC Site Assistance Brochure" (<http://tti.tamu.edu/documents/0-5335-2.pdf>) This would be a start to increase the profile and support offered by TxDOT.
- TxDOT could also participate with presentations in the GOED briefings for site selectors, describing assistance TxDOT can provide and potential benefits to DC interests.
- When requests for transportation-related information come to TxDOT, instead of just providing a response, TxDOT could inquire about the areas where the DC company has an interest. The response could then trigger and offer to:
 - provide data for those areas (through the website or other sources);

- help identify accessible sites from among those under consideration; this might include locating existing state highways and interchanges that may be underutilized and therefore provide great opportunities for access to a DC;
- help evaluate sites for accessibility associated with state highways;
- identify ways to provide safe and efficient access to candidate DC sites;
- suggest a TIA to help identify access options and the best way to accommodate the DC and passing traffic in near a candidate site;
- discuss and compare state highway improvements needed for alternative sites and site plans and the costs associated with those improvements;
- provide information on timing, funding, construction of state highway improvements’ communicating within TxDOT to explore other questions or requests; and
- provide contacts to call for more information or to discuss questions or needs.

Calls should be directed to the appropriate district if the search is considering sites in only one district. If multiple districts are to be considered, TxDOT might select one as an interim coordinator or have GPA do the coordination until sites are reduced to a single district.

The important objective is to demonstrate that TxDOT can be an important asset to both the DC and local economic development interests. The TxDOT representatives to the GOED will need to play the lead role in demonstrating this value, both through the “TxDOT DC Site Assistance Brochure” and through discussions with GOED staff and with DC developers, agents, and other site selectors that contact the GOED.

Assist with Site Selection Criteria and Information

As mentioned earlier in the report, DC owners and developers have their own sets of site selection criteria. To assist DC developers in selecting a site that is highly accessible for minimal investment, TxDOT could issue its own site selection criteria, which could be included on the TxDOT public website as well as in the brochure.

Criteria that would be beneficial to DC interests as well as to TxDOT are:

- locations along major state highways with no recurring congestion and requiring access routes subject to little or no congestion;

- locations served by interchanges designed for 67-ft wheel base semi-trailer (WB 67) or larger trucks;
- locations served by underutilized interchanges designed for WB 67 trucks;
- locations where pavement is designed for 80,000-lb trucks;
- locations along routes not expected to be affected by major construction or major maintenance during at least five years after opening;
- sites not requiring access at-grade across railroad trunk lines;
- locations where access can be provided with adequate sight distance for safety;
- sites served by intersections designed for WB 67 trucks, especially 30-ft minimum corner radii for right turns;
- sites permitting driveway locations far enough from the closest intersection to permit queuing without blocking the site driveway;
- sites large enough to provide on-site queuing for both inbound and outbound trucks with the expected security measures; and
- locations (preferred for decreased maintenance) where both the access highways or roads are concrete to prevent pavement edge breakage or scouring in turning locations and rutting at intersections.

These criteria could be promoted for long-term functionality and lower cost and potentially less lead time to open the DC.

Improvement Process and Scheduling

One of the concerns frequently expressed by TxDOT staff, DC interests, and economic development entities is that it takes too long to complete TxDOT improvements to state highways. The long durations are not compatible with the typical DC opening 3 to 4 years after the site search begins and 1 to 2 years after site selection.

There are two related issues here:

- lead time needed for TxDOT to understand the requested or needed improvement; develop a design, cost, and obtain environmental clearance; programming funds; and construct the improvement. Depending on the improvement, minor projects might

take a year; major projects can exceed five years if there are environmental issues and funds are short; and

- TxDOT usually is brought in late in the process, delaying initiation of TxDOT's process. Often TxDOT is brought in just before DC construction begins, about a year or so before opening. This late entry of TxDOT unnecessarily delays improvements to state highways.

From the beginning of contacts with the GOED, DC interests should be advised to get TxDOT involved early. Project scheduling should be given as one of the primary reasons. The process should also be communicated but without being unnecessarily pessimistic. Many minor projects can be expedited. Partnering can also expedite some projects.

Funding

Funding of TxDOT improvements has become more difficult due to shortages in funds. Nevertheless, TxDOT still has an active improvement program, and economic development is still a TxDOT priority.

DC and local economic development interests need to be made aware that while improvements to support new economic develop-related investments may be desired, funding from TxDOT is less plentiful than before. However, in recent years, TxDOT has added several options in which DC developers and economic develop agencies can participate. Some options that have been used are:

- TxDOT funds, reprogrammed from other improvements;
- TxDOT unallocated funds (very limited);
- developer funds (through funding agreements with local agencies);
- local agency funds;
- developer or local agencies pay for right-of-way, engineering, or environmental work;
- special improvement or road district funding;
- Transportation Reinvestment Zone funding;
- Tax Reinvestment Zone funding;
- partnered funding (negotiated shares);

- pass-through funding, recaptured over time;
- developer front ends costs and recaptured through tax abatements;
- state economic development grants or loans; and
- combinations of the above.

Figure 3 shows a previously unplanned interchange that was constructed along I-45. A developer provided the right of way on one side and purchased and donated the right of way on the other side. The developer also provided early engineering services. Two improvement districts split half the construction costs for the interchange and TxDOT paid the other half. This is just one of the more complex partnered arrangements to improve access.



Figure 3. Interchange Added to I-45 Using Multi-Partner Funding.

There are numerous examples of other improvements ranging from 100 percent TxDOT paid to 100 percent developer paid. Developers usually pay for improvements for which they are the primary beneficiary. This ranges from interchange ramps to highway extensions and localized widenings, turn lanes, or traffic signalization. Larger improvements, or improvements benefiting a larger area, may have shared funding or even state funding. There is no present formula for shared funding, although for most projects local agencies are expected to provide right of way and/or at least 10 percent of the project cost. TxDOT should develop some general criteria for use with new DCs. These criteria could include one or more of the following:

- need for improvement within five years without DC;

- portion of benefit derived by DC and local street system;
- additional cost attributable to DC;
- consistency with long-range state highway plan (would improvement be needed anyway?); and
- other criteria that may also be applicable.

Scheduled Improvements

An existing site may not look very accessible, but a programmed state highway (or road) local improvement may greatly increase site accessibility. Such improvements could include a new or widened road, a new interchange or ramp, a new bridge, or any of many other possibilities.

TxDOT should make lists and maps showing programmed TxDOT improvements available directly, or through economic development entities, to DC developers and agents. Lists of such improvements are already available on the “Project Tracker” page of TxDOT’s public website (http://www.txdot.gov/project_information/default.htm). This website provides:

- information about current TxDOT construction projects;
- information describing studies of possible future improvements; and
- district and area office contact information.

To the extent that similar local agency information is available (e.g., from counties, cities, MPOs, other transportation entities), this information should be offered to the DC interests.

There are two principal reasons to make this information available:

- it will help DC interests find better sites more easily; and
- it will show sites with better access than some that are not programmed for improvements and which might need additional improvements for which funding is not currently available.

Making these improvements available in both map and descriptive form will be most helpful. These could be posted on the public website by county or district.

Underutilized “Truck Ready” Interchanges

Many DC owners prefer locations near existing interstate highway or major freeway interchanges. Some of the older interchanges were designed to former criteria and are not conducive to high volumes of large trucks.

TxDOT could identify underutilized interchanges with suitable geometrics and pavements for large trucks throughout regions that are popular for major DCs, such as the greater regions around Dallas-Ft. Worth, Houston, and San Antonio. This could be performed statewide, too, to provide broader coverage.

The intent of doing this would be to show where good interchange access already exists and is being underutilized—good candidate areas for major truck generators that would not need interchange improvements. As with other information, this could be placed on the TxDOT public website in map form, by county or district.

Assist in Locating “Mutually Beneficial” Sites

Sites may be available for potential use by DCs where a combination of the following conditions may make the beneficial to both the DC owner and to TxDOT.

- The site is highly accessible, needs little or no improvements, and site access can easily be provided in a safe manner.
- The site is highly accessible but with improvements that TxDOT has programmed to complete in the timeframe desired to open the DC.
- The site is in a good location but requires a major state highway improvement that TxDOT is considering but has not yet programmed; the program could be completed close to the proposed DC opening.
- The site is in a good location but a state highway improvement is needed. TxDOT will not have funding available in time, but the DC developer and local agencies are willing to pay for the improvement if it can be completed in time and if TxDOT repays a portion of the cost within a mutually-agreed time period, because TxDOT sees some benefit of the improvement to the highway system.
- The site will become highly accessible after a programmed improvement is completed, but that improvement is scheduled to begin well after the DC needs to open. TxDOT agrees (along with local agencies) to swap TxDOT improvements so

the one aiding the DC can be completed in time and the other improvement will be deferred.

The first condition is usually going to be most beneficial for everyone. No improvements are needed. No funding must be sought. No delays have to be considered. However, if improvements are needed, the remaining scenarios can also work for all parties.

What does not work is selection of a site where significant state highway improvements are needed, no funding is currently available, environmental clearance and right of way are needed, and a DC opening date is less than two years away. Those sites should be discouraged in favor of sites from one of the above scenarios.

Utilize Traffic Impact Analysis to Verify Needs

A TIA, sometimes called a traffic access study or traffic impact study, is commonly used by municipalities and some county, state, and other agencies to assess access requirements for a proposed development. The TIA usually also assesses impacts on traffic conditions in the area surrounding the proposed development and describes what must be done to maintain either the existing level of service or maintain a target level in a stated future year. TIAs usually also describe how much and where access should be provided, any changes needed to accommodate circulating and passing traffic, and any improvements needed to address existing and potential safety problems. Where transit, pedestrians, and bicycles will be present, proper accommodation of those modes is addressed.

TIAs are most commonly used to provide an objective analysis of the impact of a proposed development or zoning change. However, they are often used in response to access permit applications or environmental impact analyses, as well as to aid good development planning. The Institute of Transportation Engineers publishes a Recommended Practice describing TIAs. The latest edition is titled *Transportation Access and Impact Studies for Site Development*, 3rd edition (5). This document describes how a TIA should be conducted for most common types of development.

However, a DC is not a typical development. It has several unique characteristics. These are:

- very high percentage of large trucks that impact both access requirements and design characteristics of access routes;

- site traffic peaks outside the typical 7–9 a.m. and 4–6 p.m. weekday street peak hours;
- significant seasonal trip generation peaking that varies according to the product lines flowing through the DC; and
- pavement impacts different from most personal vehicle-dominated uses.

Trip Generation Rates

TIAs include estimates of the number of vehicle trips generated by a development. Table 6 shows the weighted average trip generation rates for seven DCs. Rates are shown for daily and peaks hours for weekdays, Saturdays, and Sundays. AM and PM street peak hours are between 7–9 a.m. or 4–6 p.m., respectively. AM and PM peak hours of generator occur between midnight and noon or between noon and midnight, respectively. Peaking characteristics are discussed below.

High Percentages of Large Trucks

Based on site traffic counts performed for this research, large semi-trailer trucks account for approximately 28 percent of all site traffic. Moreover, heavy truck traffic is usually limited to one or two access points. Employees and visitors, nearly all in personal vehicles, usually are limited to other access points. Hence, for capacity purposes, the truck access points accommodate almost all large trucks. Intersection capacity, queue space and driveway geometrics, and pavement design all need to accommodate high truck volumes.

Traffic Peaking

Traffic peaks vary by company. However, counts at several DCs indicate that daytime peak hours may occur anytime between 8 a.m. and 4 p.m. Monday through Friday. Volumes tend to be somewhat flat during those hours, although there are directional variations. Table 6 summarizes the findings of the research conducted as part of this project.

Table 6. Trip Generation Characteristics of Major Distribution Centers.

Period	Direction	Total Vehicles/ 1,000 Sq. Ft.	Percent Inbound	Percent Trucks
Weekday				
Daily	In+Out	1.580	50%	28%
AM street peak hour	In	0.096	59%	9%
	Out	0.029		
	In+Out	0.125		
AM peak hour of generator	In	0.120	96%	5%
	Out	0.042		
	In+Out	0.162		
PM street peak hour	In	0.071	42%	15%
	Out	0.158		
	In+Out	0.229		
PM peak hour of generator	In	0.109	42%	27%
	Out	0.088		
	In+Out	0.197		
Saturday				
Daily	In+Out	0.991	50%	18%
Peak hour of generator	In	0.060	92%	12%
	Out	0.039		
	In+Out	0.099		
Sunday				
Daily	In+Out	0.940	50%	16%
Peak hour of generator	In	0.093	93%	7%
	Out	0.014		
	In+Out	0.107		

Figure 4 shows the average daily variations in total trip generation (trucks, employees, visitors) for one typical retail merchandise DC that operates 24 hours per day, seven days per week (24/7). Truck volumes at this DC are at a steady peak between about 10 a.m. and 5 p.m. but enter and leave this DC at all hours. The most severe peaks occur in conjunction with shift changes. This chart is provided for general reference only; readers are cautioned that other DCs may operate under different shift schedules and therefore demonstrate different patterns of variations.

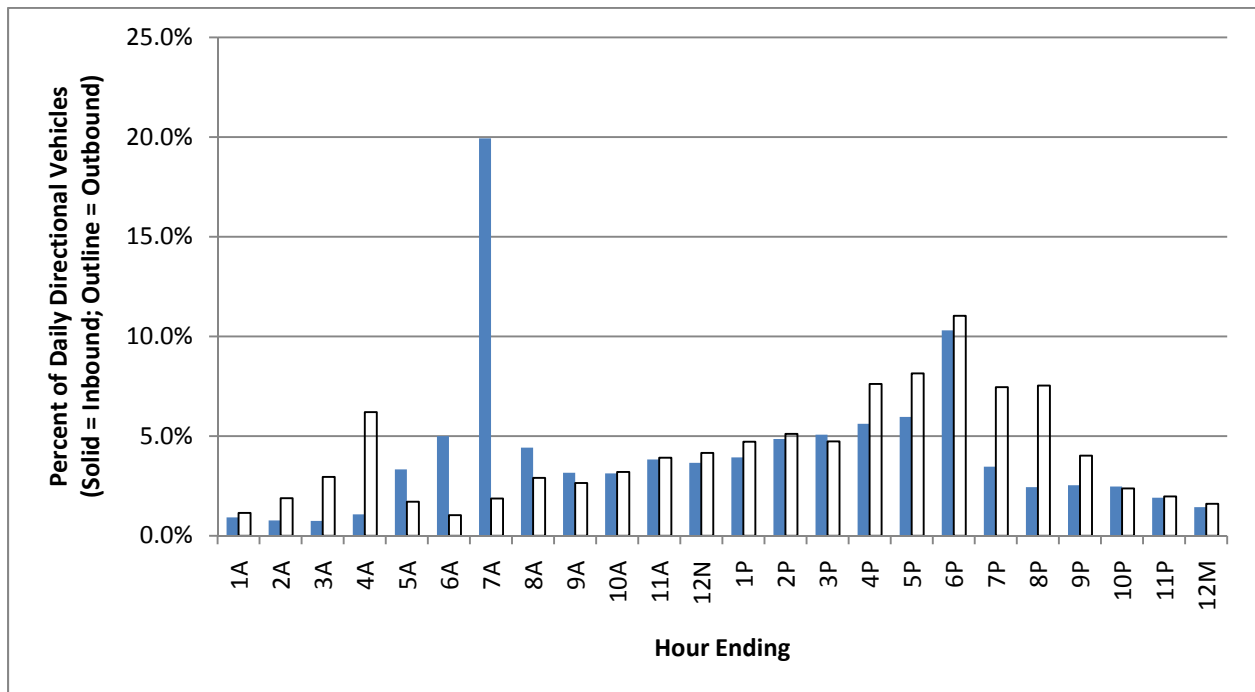


Figure 4. Hourly Trip Generation Variations – General Retail Merchandise DC.

Seasonal peaking varies by product line. Most major DCs serve retail stores. A year-long count of the same major distribution center showed the daily and monthly peaking patterns in Figures 5 and 6. Tuesday through Friday volumes are the highest on a daily basis for this 24/7 operation. The highest month of the year for truck traffic at this DC is November, which is about 16 percent above the monthly average. Employee/visitor traffic, which was available for only about six months of the year, was consistent each month with the high month being less than 5 percent above average.

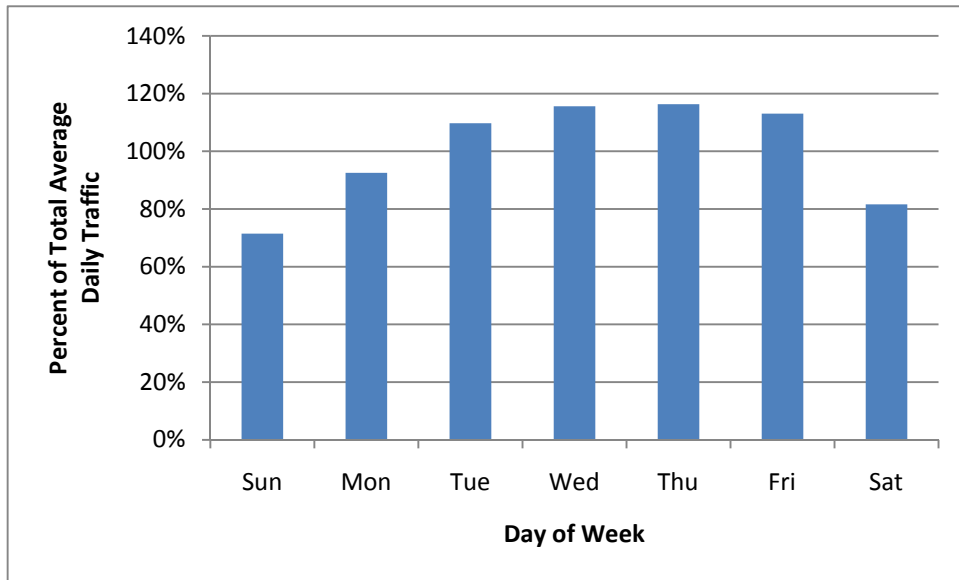


Figure 5. Daily Trip Generation Variations – General Retail Merchandise DC.

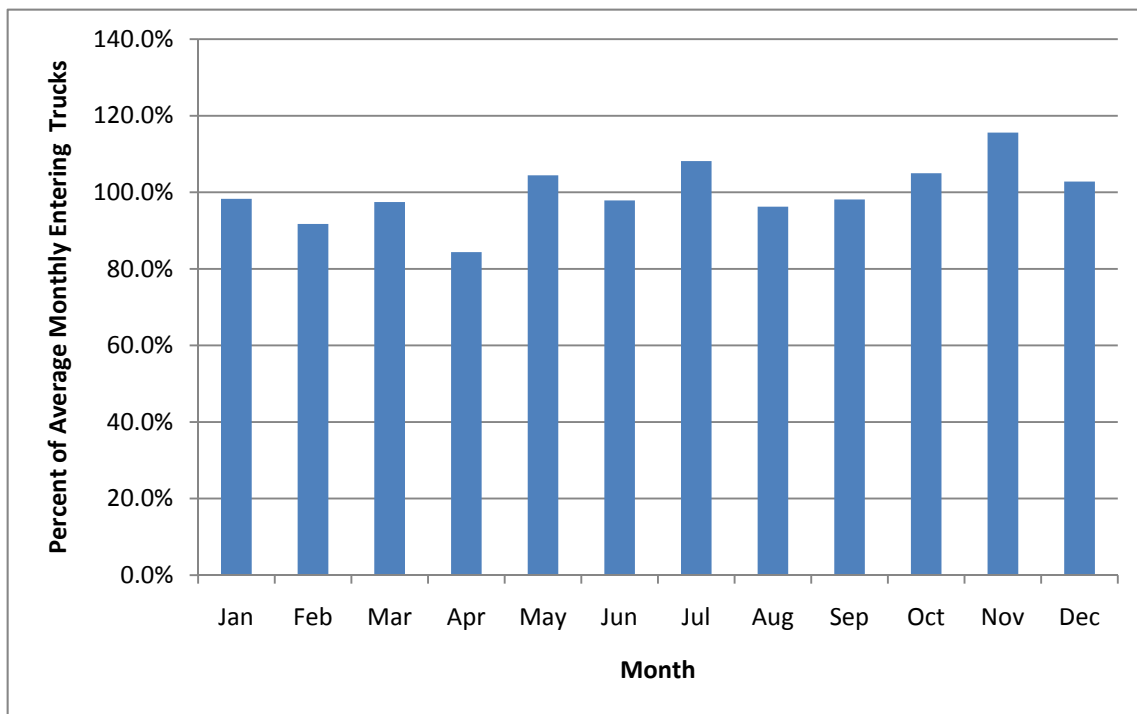


Figure 6. Monthly Truck Trip Generation Variations – General Retail Merchandise DC.

One DC that distributes outdoor and picnic products has its peak months between February and April with low months after the summer. Hence, the business type may affect seasonal peaking.

DC Traffic Access and Impacts

DC traffic impacts and access needs will be different from most urban developments. For one thing, DCs are often located in rural or peripheral areas, not in major urban business corridors. For another, impacts of large trucks are different than for personal vehicles. In recognition of such differences, a TIA checklist has been developed for use with DCs. The items listed are common issues or needs associated with DCs and their impacts. However, not all apply to every DC.

Table 7 contains the DC TIA checklist. This checklist was expanded from one used regularly by the TxDOT Ft. Worth District. TxDOT staff and other users are strongly advised to first conduct an initial meeting with the DC developer to determine what is being proposed, where, and with what size and site plan. After the proposal is understood, then the checklist should be reviewed and items selected for inclusion in a TIA. Depending on the questions, requests, and needs, a complete TIA may be needed. However, it is possible that with the questions needing answers or verification, only a limited TIA (or even none) may be needed.

In general, if all parties agree to provisions to be made in response to items included in the TIA, no TIA may be needed. However, if trip generation, access, numbers of lanes, off-site road improvements, or other traffic related issues are in question or need verification, a TIA should be conducted to produce the needed information.

Table 7. TxDOT TIA Staff Review Checklist.

NOTE: This form is intended to aid the reviewer in insuring that all required items are included in the Transportation Impact Analysis (TIA). A completed Form B does not represent acceptance or rejection of the TIA, nor is it a substitute for a thorough, objective review of the information contained in the TIA. The TIA must include the following items unless otherwise agreed in the initial scoping meeting and stated in the Memorandum of Understanding.

TIA Component		Page Number
Introductory Information		
1.	Title sheet including development name, local agency, case number, location, and preparer's name (company and person), telephone number, and e-mail address.	
2.	Executive summary describing briefly the site location, proposed development, findings, and recommendations. <i>Comments:</i>	
3.	Site location – area map showing site location, with all major and secondary thoroughfares identified (name and designation) within study area. <i>Comments:</i>	
4.	Completed and signed summary of all requirements and assumptions confirmed in initial scoping meeting between applicant and TxDOT reviewer. <i>Comments:</i>	
5.	Map illustrating study area boundaries and critical intersections and other locations to be analyzed. <i>Comments:</i>	
Proposed Development (Site and Area)		
6.	Narrative description of site which includes existing zoning, proposed zoning category(s) and allowable uses, planned land uses and intensities. <i>Comments:</i>	
7.	Area map showing existing and planned zoning for site according to comprehensive plan and existing zoning surrounding site. <i>Comments:</i>	
8.	Table identifying land uses and intensities of anticipated developments within the designated study area. <i>Comments:</i>	
9.	Area map showing locations of anticipated developments within the study area. <i>Comments:</i>	

TxDOT TIA Staff Review Checklist (CONT'D)

TIA Component		Page Number
Traffic		
10.	Area map showing existing traffic volumes on study area roadways including turning movement counts at all critical intersections and 24-hr directional volumes on roadways. Date and day of week of counts should also be shown. For TIAs involving major generators of truck traffic, vehicle classification counts should also be provided for anticipated access routes, and proper design vehicles should be designated. <i>Comments:</i>	
11.	Table showing historic traffic volume changes over minimum five year period. <i>Comments:</i>	
12.	Table showing estimated trip generation (for each analysis year) for existing and proposed zoning (or existing comprehensive plan land use, if to be evaluated). Table should include trip generation rate or equation used to calculate trips, trip generation source used, total peak hour and daily trips per land use, total trips per site and difference between existing and proposed total trips. <i>Comments:</i>	
13.	Narrative documentation justifying any reduction taken in site generated trips as a result of pass-by, diverted, or internally satisfied (mixed-use) trips, or any travel demand management program; state source and justification for reductions. <i>Comments:</i>	
14.	Table showing total peak hour(s) and trips generated for each anticipated off-site development within the study area. <i>Comments:</i>	
15.	Study area map showing percentages of directional distribution of site and anticipated off-site development generated traffic that use each approach/departure route. For distribution centers and other generators of major volumes of trucks, show directional distributions for trucks and other vehicles separately. If roadway changes affect trip distribution for different analysis years, show those different distributions. <i>Comments:</i>	
16.	Study area map showing site generated traffic volumes (peak hour) as assigned using the above directional distributions to area roadway system and critical intersections within study area for each horizon year. <i>Comments:</i>	
17.	Study area map showing estimated off-site development generated peak hour traffic volumes as assigned using the estimated directional distributions at critical intersections on area roadway system in study area for each analysis year. <i>Comments:</i>	
18.	Study area map showing projected total peak hour traffic volumes at critical intersections within the study area for each horizon year. <i>Comments:</i>	
19.	Documentation of method and assumptions used to project off-site traffic. <i>Comments:</i>	

TxDOT TIA Staff Review Checklist (CONT'D)

TIA Component		Page Number
20.	Summary sheets of data collected and analysis that resulted in modification of trip generation rates or equations used in report, if any. <i>Comments:</i>	
Roadway System		
21.	Narrative description of roadways within study area, which will provide primary access to the site. Description should include existing and future roadway conditions and any funded roadway improvements within the study area. This should also include a pavement types and condition assessment. <i>Comments:</i>	
22.	Study area map(s) illustrating existing roadway system including existing number of roadway lanes and shoulders, bike or transit lanes, intersection configurations, median openings, signal locations, driveway openings, and transit stops. For proposed distribution centers and other major truck generators, show pavement type, design, and condition as obtained from TxDOT or local agency of jurisdiction. <i>Comments:</i>	
23.	Study area map(s) illustrating planned roadway system for each analysis year including number of roadway through lanes, bike lanes, transit lanes, shoulder width, intersection configurations, median openings, signal locations, truck and mixed traffic driveway locations, and transit stops. Designate DC truck access routes. <i>Comments:</i>	
Site Plan		
24.	Scaled or dimensioned map of site showing driveway locations, truck service locations, building footprints, internal circulation patterns and general parking layout, proposed transit stops, and traffic signal and stop sign locations. Dimension distances between driveways, turn and speed change lane lengths, median openings and separations, distances between ramp gores and nearest driveways and intersections, and other important dimensions. <i>Comments:</i>	
Analysis and Recommendations		
25.	Narrative description of analysis techniques used in evaluation of adequacy of roadway segments and critical intersections, safety analysis, and geometric and pavement sufficiency. <i>Comments:</i>	
26.	Table showing level of service analysis results at all existing and proposed signalized and other critical intersections for existing conditions and for each analysis year, with and without the proposed development. <i>Comments:</i>	

TxDOT TIA Staff Review Checklist (CONT'D)

TIA Component		Page Number
27.	Narrative discussion and study area map identifying type and location of improvements necessary to provide for acceptable levels of service, queuing provisions, safety, geometric, pavement, or other purposes on area roadway system. Distinction should be made between improvements necessary to alleviate non-site traffic and improvements necessitated by site generated traffic. <i>Comments:</i>	
28.	(If requested) Intersection analysis worksheets for existing conditions and analysis year conditions with and without the proposed development. <i>Comments:</i>	
29.	Study area map showing recommended lane configurations and resulting levels of service for critical intersections and roadway links within the study area. <i>Comments:</i>	
30.	Study area map showing locations on major truck access routes needing pavement and improvements (pavement type and conditions). Include description of analyses performed to reach conclusions. <i>Comments:</i>	
31.	Analyses of intersection sight distance and stopping sight distance along state highways as proposed with improvements. <i>Comments:</i>	
32.	Evaluation of consistency of proposed conditions with current editions of: <ul style="list-style-type: none"> - Texas <i>Manual on Uniform Traffic Control Devices</i> (MUTCD) - TxDOT manuals (for TxDOT roads) <ul style="list-style-type: none"> - roadway design - pavement design - access management Include documented proposed deviations in deviation reports where applicable on TxDOT facilities in study area. <i>Comments:</i>	
33.	Table listing proposed improvements, estimated costs, and portions of needed off-site improvements attributable to the proposed development. Show basis for estimated contributions to needs. Where applicable, address improvements separately. TxDOT will assume applicant will undertake full funding responsibility if not otherwise stated. <i>Comments:</i>	
34.	Narrative description of conclusions and recommendations supported by study. <i>Comments:</i>	
Submittal Requirements (to TxDOT District Permit Office)		
35.	Four copies of report (and appendices if requested) for distribution signed and sealed by the experienced professional engineer registered in Texas, preferably with traffic engineering training and experience, who prepared TIA.	
36.	TxDOT access permit application (if requested at this time).	
37.	Filing Fee.	

Completed for TxDOT by: _____ Date: _____

EARLY INVOLVEMENT FOR LEAD TIME

Although it has been stated in this handbook several times, early involvement will increase lead time and give TxDOT, DC interests, local agencies, and all others more time to respond in a helpful manner. TxDOT and DC interests should make every effort to involve TxDOT early if there is any chance that the DC will need access on a state highway or need a state highway improvement.

At the district level, district engineers can encourage early involvement by discussing the benefits and advantages in their periodic briefings with local officials and leaders. The district engineers may want to have a concise presentation available for this purpose. A PowerPoint® presentation will be prepared as part of this research project.

FUNDING FOR STATE HIGHWAY IMPROVEMENTS

Suggested approaches were previously discussed for seeking DC sites so they will not require significant state highway improvements. Funding options were provided that could enable projects to be completed on time within TxDOT resource limitations.

However, what happens if there is no acceptable or available site that could be used without significant state highway improvements? What if time is (too) short to complete all the steps by the desired opening date? There are options that can work if the circumstances are right. What *might* they be?

There is no sure means to obtain funding when it is not available by conventional means. There is no sure way to complete a project quickly when many steps are required for TxDOT funding. Certain approvals will be required. However, TxDOT does have available some options that may help. Some may involve unconventional steps that may not be available except under unusual conditions. The following are a few of the unconventional steps that may help.

- *Unallocated funds.* Consider the use of unallocated district or statewide funds. The district engineer may have a small amount of funds that can be used. Additionally, TxDOT Administration may have some that could be used for economic development purposes. The GPA representative to the GOED may be the best person to begin with. However, only modest amounts of funds may be available.

- *Assemble or establish precedents.* If another example can be found in which some sort of funding has been used for an economic development or safety improvement project, it may be usable for the requested DC-related project. If an unconventional use can be justified, document it and use it as a precedent next time a similar need arises.
- *Encourage cost sharing and front ending.* TxDOT is prioritizing partnered or cost-share projects. TxDOT is also agreeable to cost recovery projects such as pass-through financing where there is benefit to the general traveling public. There are a multiple variations on cost sharing and pass-through financing. Several were previously mentioned. TxDOT does not have to participate financially on improvements to state highways, although TxDOT must approve all improvements. Some forms of cost sharing and front ending include:
 - partners each pay a portion;
 - developer or local agency provides right of way;
 - developer pays for engineering and environmental work;
 - developer pays and recovers costs through local tax abatements;
 - developer or local agency pays and recovers costs from TxDOT (pass-through or other agreement);
 - local agency establishes a special improvement or reinvestment zone that loans money to pay for the improvements;
 - TxDOT pays the costs but is repaid over time from local sources;
 - multiple local agencies pool funds to pay for the improvements;
 - local agencies sell general obligation bonds to fund improvements; or
 - local agencies pay and recover costs from the increase in property taxes collected from the DC.

Many of these can be done quickly as long as the participants in funding agree. Partners should include TxDOT in discussions so other requirements (e.g., environmental clearances) are accounted for in the cost and schedule discussions.

ACCESS MANAGEMENT

TxDOT recently adopted access management policy and guidelines. These should be used in locating access for DCs. Most DC owners limit truck access to one or two locations to limit access control and associated security. They also separate truck access from employee and visitor access. Major DCs have as few as two driveways, but researchers found DCs with as many as eight driveways. Most need one secured driveway for trucks and one to two unsecured driveways for employees, visitors, and service.

Truck driveways should be located as far from intersections as possible on the site. This maximizes queuing space for turn lanes as well as site distances for outbound left turns. Other driveways should meet the criteria contained in the TxDOT *Access Management Manual* or an adopted local agency access policy if more restrictive (6).

DESIGN ROADS FOR LARGE TRUCKS

Both roads and pavements will function better and last longer if properly designed for large trucks. Although very few deficiencies were reported by TxDOT district engineers and maintenance supervisors, two conditions merit discussion.

Geometric Design – Turning Paths

When designing driveways and locating DCs so access routes use existing intersections, corner radii and turning paths should accommodate WB 67 trucks. Problems observed were confined to short right turn radii and driveway and highway intersections. In general, corner radii should be a minimum of 30 ft for right angle intersections. Check the TxDOT *Highway Design Manual* or the American Association of Highway and Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets* for complete geometric requirements (7, 8).

Pavement Design – Intersections

Although not considered a major problem by TxDOT maintenance engineers and supervisors, researchers did notice broken pavement edges on short radius intersection corners and along narrow tangent sections. Figures 1 and 2 earlier in this report show examples of these conditions.

Many DC driveways are concrete. Some extend the concrete out to the edge of highway pavement. In those cases, the corner radii and concrete and edge breakage was not observed. Where concrete pavements intersect, the corner radii were always observed to be in good condition, even at short radii where truck tires were observed to have tracked off the pavement.

The research team's interviews with TxDOT maintenance engineers and supervisors found unanimous support for using concrete on all truck driveways and at all intersections under heavy truck use. Concrete was credited as a way to avoid scouring and rutting as well as broken edges.

The research team found one road where the DC developer replaced an asphalt road providing truck access with a concrete pavement. All driveways were also concrete. Researchers found another state highway intersection subject to heavy truck turns where corner pavement edge deterioration had been a problem. Rather than repave the entire intersection and approaches, flush concrete curbs were used to provide a reinforced concrete edge. Figure 7 shows this treatment and its effectiveness in holding an edge intact.



Figure 7. Flush Reinforced Concrete Curb to Resist Edge Deterioration under Truck Turns.

INCENTIVES

When DC site selection approaches its final stages, agencies associated with the finalist sites often compete with each other to try to have their local site selected. This usually involves local agencies but can also involve state economic development agencies and other agencies

empowered to offer grants and loans for economic development purposes. Access improvements are considered to be part of incentive packages, although at least one DC owner considers accessibility among those items necessary to make a site viable for a DC.

Financial and Site Improvement Incentives

In Texas, the GOED coordinates assistance available from state agencies. Table 8 lists some of the incentives available in Texas that can be attractive to DC developers.

Table 8. Selected State and Local Incentives Used for DCs in Texas.

Incentive Type	Definition
State Incentive Programs	
Texas Enterprise Zone Program	Refunds of state sales and use taxes, ranging from \$2,500 to \$7,500 per job created or retained.
Texas Capital Fund Infrastructure Program	Grant (\$50,000 to \$750,000) for public infrastructure (water, sewer, roads) needed to assist a business, in exchange for jobs created or retained in the community.
Tax Increment Finance District (TIFD)	Allows debts to be incurred to fund capital investments that will be paid back via future tax revenues generated by the new development.
Texas Capital Fund Real Estate Development Program	Grant (\$50,000 to \$750,000) for real estate development needed to assist a business, in exchange for jobs created or retained in the community.
Freeport/Foreign Trade Exemption	Exemption on taxation of merchandise, goods, etc., that are kept in the state for 175 days or less.
Texas Smart Jobs Program; Skills Development Fund	Job training grants for new employees.
Local Incentive Programs	
Local Property Tax Abatement	Reduction or exemption of taxes granted by local government (county, city, special district) on a piece of property for a specified length of time. Tax abatements have been granted for DC properties and for DC inventories.
Tax Credits/Rebates	Local tax credits can be awarded in various amounts, usually in exchange for local jobs created by the new business. Examples of such credits are job creation tax credits, property tax abatements, inventory tax abatements, and county tax abatements.
Section 380.001 of Municipal Code -- Loans and Grants	Under this code, municipalities can provide loans and grants of city funds, as well as low- or no-cost use of city staff, services, or facilities.
Goodwill Incentives	Varies, but can include discounted moving costs, discounted banking costs for DC company employees (managers, supervisors) moving into the community.

Sources: "Summary of State Incentives and Programs," Governor's Office of Economic Development, State of Texas, Austin, Texas, undated (distributed September 2007); *Economic Development Handbook*, Office of the Attorney General, Austin, Texas, 2006; project interviews.

Some examples of incentives received by Texas DC developers and owners as reported in interviews by the research team included:

- free site;
- 10-year property tax abatements (city, county);
- 10-year inventory tax abatements;
- utility extensions to site;
- drainage improvements;
- freeport zone designation;
- training grants;
- state tax abatements (site outside Texas);
- grants for funding utilities, power; and
- local tax rebate for hiring local residents.

Access Improvements

TxDOT's role in providing state highways and access from those highways also causes TxDOT to become involved in incentives, although some DC owners consider access improvements necessities to make a site functional for DCs. The previous incentives do not include access improvements.

Interviews conducted for this project found a number of access related improvements made to render a site more attractive and functional. The largest of these improvements for a single site included a new interchange, over a mile of new Farm-to-Market road, widening of a section of a second Farm-to-Market road to install a left turn lane, an intersection improvement, and signalization. Table 9 lists access-related improvements and other actions requested from TxDOT by DC developers or agents as reported in the interviews.

Table 9. Access Improvements Requested for DCs.

<p>Improvements requested by DC developers and owners</p> <ul style="list-style-type: none">• driveway permits;• access route improvements and extensions;• traffic impact analysis to determine needs;• deceleration lanes;• traffic signals;• moving up already-planned improvements;• new interchange or ramp; and• interchange modification. <p>Improvements requested by local agencies</p> <ul style="list-style-type: none">• add traffic signals to an intersection;• add or redesign ramps at existing overpass;• widen overpass;• add a grade separation;• add turn lanes at intersection;• improve intersection geometrics to accommodate heavy trucks;• reconstruct Farm-to-Market road connecting to the highway to accommodate heavy trucks; and• build new Farm-to-Market road to connect to the highway.
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Source: Project interviews.

These were funded in a variety of ways (see the previous section describing funding options). Such improvements may be requested by DC developers or agents as being necessary to make a site viable or by local agencies to make a site either viable or more attractive.

Use of TIAs to Verify Actual Needs

TIAs can be used to verify both need and the most effective types of improvements. These are often prepared by third parties as objective analyses of impacts and needs. It is recommended that TIAs be requested in conjunction with any major access improvement request. TxDOT and the applicable local agency should participate in the scoping of the TIA to ensure it covers the necessary elements (see checklist in Table 7) and should participate in interim meetings about tentative findings prior to completion of the TIA report.

The completed TIA will benefit all parties by determining at least:

- what access is needed;
- where the access would best be located;
- what improvements to adjacent and other off-site roadways are needed and how they should be configured;

- what traffic controls should be employed; and
- other conclusions or recommendations responding to issues or requests raised by the DC developer or participating agencies.

TxDOT should be involved in the TIA scoping and review if it is expected that an improvement or access to a state highway will be requested.

SITE ACCESS REVIEWS

DC site plans should be reviewed in conjunction with:

- access permit applications; and
- requests for any improvements or modifications to state highways.

It is recommended that a TIA also be requested in either case to assist the review of proposed access and/or improvements. The purpose of a site plan review is to ensure that the proposed access and on-site circulation will not cause backups at the access points or create any safety hazards. Table 10 contains a suggested site plan review checklist. It is supplemented by the sight distances shown in Table 11.

Table 10. Site Access Review Checklist.

Access – Truck Driveways
Traffic
<input type="checkbox"/> Applicant to provide estimates of peak hour inbound and outbound truck and light vehicle volumes by driveway
Width
<input type="checkbox"/> 30 ft minimum (with 30-ft radius for right turns)
Pavement
<input type="checkbox"/> Concrete recommended to edge of highway pavement
Inbound
<input type="checkbox"/> One 2-way driveway or two 1-way driveways unless additional driveways needed to serve separate areas
<input type="checkbox"/> Right turn radius from highway – 30 ft minimum
<input type="checkbox"/> Right turn deceleration lane – required on highways with 30 or more trucks making inbound right turns during inbound peak hour; see TxDOT <i>Roadway Design Manual</i> Tables 3-13 and 3-14 for length and taper
<input type="checkbox"/> Inbound left turn lane – See TxDOT <i>Roadway Design Manual</i> Table 3-11 for threshold volumes for left turn lanes; multiply truck volumes by 1.5 in using table; see TxDOT <i>Roadway Design Manual</i> Tables 3-13 and 3-14 for length and taper
<input type="checkbox"/> Queue distance between security gate/booth and right of way line to accommodate peak inbound peak hour queue (to be estimated by applicant)

<p>Outbound</p> <ul style="list-style-type: none"> <input type="checkbox"/> Two outbound lanes (one left turn, one right turn) recommended if 30 or more trucks making left turns per peak hour <input type="checkbox"/> Right turn radius at least 30 ft <input type="checkbox"/> Provide right turn acceleration lane if right turns exceed 25 trucks per outbound peak hour; see TxDOT <i>Access Management Manual</i> Table 2-3 for length and taper
<p>Access – Employee/Visitor Driveways</p> <p>Traffic</p> <ul style="list-style-type: none"> <input type="checkbox"/> Applicant to provide estimates of peak hour inbound and outbound truck and light vehicle volumes by driveway <p>Width</p> <ul style="list-style-type: none"> <input type="checkbox"/> 24 ft minimum; 30 ft minimum if to be used by large trucks (with 30 ft radius for right turns) <p>Pavement</p> <ul style="list-style-type: none"> <input type="checkbox"/> Concrete recommended to edge of highway pavement if to be used by large trucks <p>Inbound</p> <ul style="list-style-type: none"> <input type="checkbox"/> One 2-way driveway or two 1-way driveways unless additional driveways needed to serve separate areas <input type="checkbox"/> Right turn radius from highway – 30 ft <input type="checkbox"/> Right turn deceleration lane – see truck driveways if to be used by large trucks <input type="checkbox"/> Inbound left turn lane – recommended for peak hour left turn volumes of 10 or higher; see TxDOT <i>Roadway Design Manual</i> Tables 3-13 and 3-14 for length and taper. <input type="checkbox"/> Minimum distance between right of way line and first parking aisle – 30 ft (75 ft if to be used by tractor-trailer combination trucks) <p>Outbound</p> <ul style="list-style-type: none"> <input type="checkbox"/> Two outbound lanes (one left turn, one right turn) recommended if 30 or more left turns per peak hour <input type="checkbox"/> Right turn radius at least 30 ft <input type="checkbox"/> Provide right turn acceleration lane – see truck driveways if to be used by large trucks <input type="checkbox"/> Minimum intersection sight distance – See Table 11
<p>Access – Spacing Between Driveways</p> <ul style="list-style-type: none"> <input type="checkbox"/> See TxDOT <i>Access Management Manual</i> Tables 2-1, 2-2
<p>Access – Spacing From Ramps</p> <ul style="list-style-type: none"> <input type="checkbox"/> See TxDOT <i>Roadway Design Manual</i> Chapter 3
<p>On-Site Circulation</p> <ul style="list-style-type: none"> <input type="checkbox"/> All movements within and between on-site parking lots and service bays must be accommodated on site; no on-street circulation permitted <input type="checkbox"/> All on-site circulation should be able to accommodate WB 67 trucks (or larger if proposed by DC developer) through all turns and other movements on site without maneuvering or undue conflicts with other vehicles; there should be no likelihood of queues extending back into the adjacent highway
<p>Interchange Ramps</p> <ul style="list-style-type: none"> <input type="checkbox"/> Design for WB 67 minimum <input type="checkbox"/> Use concrete pavement on short radius loop or buttonhook ramps
<p>Adjacent Highway Intersections</p> <ul style="list-style-type: none"> <input type="checkbox"/> Right turn radii – design for WB 67 minimum; 30 ft radius minimum <input type="checkbox"/> Pavement – concrete within 200 ft of stop bar if trucks are to be stopped by traffic control <input type="checkbox"/> Turn lane storage per projected traffic volumes from traffic access/impact analysis

Safety

- In addition to sight distances, check for any high crash locations that may be affected by increases in large trucks
- Check necessary traffic control
- Check to confirm that all traffic signs and signals along access routes are adequately visible from behind or across from tractor-trailer combination trucks
- Check to see that emergency access will be available without creating undue congestion on a state highway

Table 11. Intersection Sight Distances for Combination Trucks – Left Turn from Stop to Two-Lane Highways.

Design Speed	Intersection Sight Distance (feet)		
	Left Turn		Right Turn
	No Median	With Median	
35	595	630	530
40	680	720	620
45	765	810	695
50	845	900	775
55	930	990	850
60	1015	1080	930
65	1100	1170	1005
70	1185	1255	1085
75	1270	1345	1160

Source: Calculated from *Policy on Geometric Design for Highways and Streets*, American Association of State Highway and Transportation Officials, 2004, based on 11.5, 12.2, and 10.5 seconds to turn, respectively.

4. BEST PRACTICES FOR DISTRIBUTION CENTER INTERESTS – STATE HIGHWAY ACCESSIBILITY

Most of the suggested best practices for TxDOT also apply to DC interests. However, several of these practices are worth repeating in one place. The following summary includes the most important of the recommendations that are applicable and useful to DC owners, developers, and agents.

INVOLVE TXDOT EARLY

If there is any possibility that either access to a state highway or improvement of a state highway will be needed, contact TxDOT at the outset to discuss the proposed DC and—in general—what access conditions are being sought. TxDOT has a policy of assisting economic development in Texas and is prepared to help with site selection for DCs. However, for TxDOT to be able to be of the most help, it needs to be involved early. That way TxDOT can help DC owners and developers avoid costly improvements or long waits until improvements can be completed. TxDOT, with its intimate knowledge of the state highway system and other major roads, can also help to find sites that are highly accessible without major improvements.

If in the initial stages of site selection and the site search covers a large portion of Texas, it will be advantageous to contact the TxDOT representative to the Governor’s Office of Economic Development. That person is:

Alicia Taliafero
Community Relations
Government and Public Affairs Division
Texas Department of Transportation
512-475-1395

The GOED website address for information related to site selection is:

<http://www.texaswideopenforbusiness.com/>

If specific sites are under consideration, contact the district engineer of the applicable TxDOT district. Districts include one or more counties. Counties and their corresponding districts are listed in Appendix A. District contact information is listed in Appendix B.

Request information from TxDOT, as applicable, about:

- access permits, access management policy, and driveway design requirements;

- process for requesting highway improvements:
 - requests;
 - approval process; and
 - funding options;
- information on highway conditions:
 - traffic volumes;
 - programmed improvements;
 - additional planned improvements;
 - locations of recurring congestion;
 - locations likely to undergo extended construction or maintenance;
 - underutilized interchanges capable of handling large volumes of large trucks; and
 - highways subject to weight, height, or noise restrictions;
- persons to contact in each district for information and assistance on specific roads or sites.

After specific sites are being considered, contact should be made with the local district office so local conditions and input can be obtained. TxDOT can assist in evaluating the general accessibility of candidate sites and also provide advice on what improvements may be needed or possible. TxDOT can also estimate the time needed to complete such improvements and the costs and other requirements that may be involved.

SITE SELECTION CRITERIA

While each company will have its own criteria, the following criteria are suggested in conjunction with site accessibility to reduce the need for additional access-related improvements.

- Locate in an area or along roads designed for large trucks:
 - geometrics and
 - pavements.
- Seek a site with access routes that have capacity to accommodate a large number of additional trucks.
- Evaluate the site for availability of perceived safety and efficient access.

- Locate near interstate highways or regional freeways to limit the amount of improvements needed.
- Locate in a compatible area, such as:
 - urban – accessible industrial park;
 - rural – away from other development, especially residential and schools;
 - avoid access routes crossing at-grade railroad crossings; and
 - avoid access routes experiencing recurring congestion.
- Consider funding needed for infrastructure improvements.
- Verify willingness of agencies to work with the DC developer or agents.

TRAFFIC ACCESS/IMPACT ANALYSIS

If any off-site roadway improvements are possibly needed or desired, DC developers should request a TIA. An experienced traffic engineer can usually prepare this within four weeks. The TIA can be used for several purposes but should only include items needed such as:

- comparing accessibility and/or improvement costs for alternative candidate sites;
- identifying the best access configuration for a site;
- assessing traffic impacts on nearby streets and highways;
- determining what roadway improvements are needed to maintain the current level of service;
- evaluating any traffic safety concerns or nearby high accident locations for potential impact on DC operations;
- developing and addressing effectiveness and feasibility of alternative improvements to accomplish improved access to a site;
- exploring funding strategies for requested highway improvements; or
- addressing other issues, needs, or options of interest to the DC developer or transportation agencies.

To initiate the TIA, the TIA preparer should meet with the DC developer to understand the proposed DC and candidate site(s) as well as any questions or concerns the DC developer may have regarding access. The preparer should also meet with local transportation agencies and TxDOT to determine existing conditions, programmed, or planned roadway improvements,

existing concerns, and requirements associated with any improvements that may be recommended.

TxDOT has a TIA checklist that should be reviewed by the preparer and TxDOT (see Table 7). TxDOT can also provide links to TxDOT manuals and policies that may be relevant.

After the preparer has completed the TIA analysis and has tentative conclusions and recommendations, it is suggested that a meeting be convened with the DC developer, local transportation agencies, and TxDOT (plus others that the DC developer may want to involve) to discuss findings. If options exist, these should be discussed. The agencies may find reasons why one or more options could be advantageous for the DC or agencies. For example, a particular option may take a year less to implement than other options. After the findings have been discussed, the final report should be prepared to serve as the basis for further discussions and commitments.

REQUESTS

Request for access and improvements should be made as early as possible. This will afford the responsible agencies time to confirm the needs and consistency with existing facilities, plans, and funding. It will also provide time to determine how best to fund and program improvements and who can best implement the improvements. This may involve partnering among two or more of the developers and agencies.

DC developers should keep in mind that public agencies have many competing needs. While they try to meet all needs, there is not always time or resources to meet all desired schedules. Hence, the more lead time that is available, the more likely assistance can be provided on the desired schedule.

TXDOT MANUALS

TxDOT publishes a set of manuals that will assist DC developers and designers to understand TxDOT's procedures, policies, and criteria. These manuals can be found at: <http://onlinemanuals.txdot.gov/manuals/>.

APPENDIX A. TEXAS COUNTIES AND CORRESPONDING TXDOT DISTRICTS



Source: TxDOT http://www.txdot.gov/local_information/

Figure A-1. TxDOT District Divisions.



Source: TxDOT http://www.txdot.gov/local_information/abilene_district/

Figure A-2. Counties in the Abilene District.



Source: TxDOT http://www.txdot.gov/local_information/amarillo_district/

Figure A-3. Counties in the Amarillo District.



Source: TxDOT http://www.txdot.gov/local_information/atlanta_district/

Figure A-4. Counties in the Atlanta District.



Source: TxDOT http://www.txdot.gov/local_information/austin_district/

Figure A-5. Counties in the Austin District.



Source: TxDOT http://www.txdot.gov/local_information/beaumont_district/

Figure A-6. Counties in the Beaumont District.



Source: TxDOT http://www.txdot.gov/local_information/brownwood_district/

Figure A-7. Counties in the Brownwood District.



Source: TxDOT http://www.txdot.gov/local_information/bryan_district/

Figure A-8. Counties in the Bryan District.



Source: TxDOT http://www.txdot.gov/local_information/childress_district/

Figure A-9. Counties in the Childress District.



Source: TxDOT http://www.txdot.gov/local_information/corpus_christi_district/

Figure A-10. Counties in the Corpus Christi District.



Source: TxDOT http://www.txdot.gov/local_information/dallas_district/

Figure A-11. Counties in the Dallas District.



Source: TxDOT http://www.txdot.gov/local_information/el_paso_district/

Figure A-12. Counties in the El Paso District.



Source: TxDOT http://www.txdot.gov/local_information/fort_worth_district/

Figure A-13. Counties in the Fort Worth District.



Source: TxDOT http://www.txdot.gov/local_information/houston_district/

Figure A-14. Counties in the Houston District.



Source: TxDOT http://www.txdot.gov/local_information/laredo_district/

Figure A-15. Counties in the Laredo District.



Source: TxDOT http://www.txdot.gov/local_information/lubbock_district/

Figure A-16. Counties in the Lubbock District.



Source: TxDOT http://www.txdot.gov/local_information/lufkin_district/

Figure A-17. Counties in the Lufkin District.



Source: TxDOT http://www.txdot.gov/local_information/odessa_district/

Figure A-18. Counties in the Odessa District.



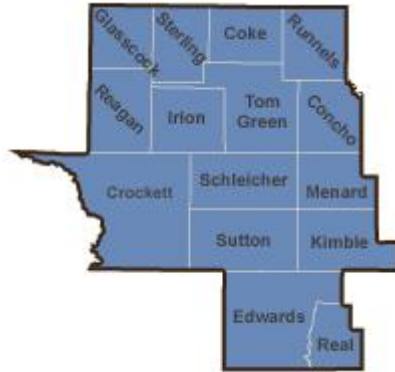
Source: TxDOT http://www.txdot.gov/local_information/paris_district/

Figure A-19. Counties in the Paris District.



Source: TxDOT http://www.txdot.gov/local_information/pharr_district/

Figure A-20. Counties in the Pharr District.



Source: TxDOT http://www.txdot.gov/local_information/san_angelo_district/

Figure A-21. Counties in the San Angelo District.



Source: TxDOT http://www.txdot.gov/local_information/san_antonio_district/

Figure A-22. Counties in the San Antonio District.



Source: TxDOT http://www.txdot.gov/local_information/tyler_district/

Figure A-23. Counties in the Tyler District.



Source: TxDOT http://www.txdot.gov/local_information/waco_district/

Figure A-24. Counties in the Waco District.



Source: TxDOT http://www.txdot.gov/local_information/wichita_falls_district/

Figure A-25. Counties in the Wichita Falls District.



Source: TxDOT http://www.txdot.gov/local_information/yoakum_district/

Figure A-26. Counties in the Yoakum District.

APPENDIX B. TXDOT DISTRICT OFFICE CONTACT INFORMATION

Table B-1. TxDOT District Office Contact Information.

District	District Engineer (as of August 2009)	Public Information Office Phone	Fax
Abilene	Lauren Garduno, P.E.	(325) 676-6806	(325) 676-6901
Amarillo	Howard Holland, P.E.	(806) 356-3256	(806) 356-3206
Atlanta	Robert H. Ratcliff, P.E.	(903) 799-1306	(903) 799-1229
Austin	Carlos Lopez, P.E.	(512) 832-7000	(512) 478-8243
Beaumont	Randall (Randy) Redmond, P.E.	(409) 898-5745	(409) 898-5805
Brownwood	Lynn G. Passmore, P.E.	(325) 643-0413	(325) 643-0306
Bryan	Bryan Alan Wood, P.E.	(979) 778-9764	(979) 778-9709
Childress	Terry L. Keener, P.E.	(940) 937-7288	(940) 937-7154
Corpus Christi	Russel W. Lenz, P.E.	(361) 808-2231	(361) 808-2462
Dallas	Bill Hale, P.E.	(214) 320-4480	(214) 320-4488
El Paso	Charles H. Berry Jr., P.E.	(915) 790-4341	(915) 790-4311
Fort Worth	Maribel P. Chavez, P.E.	(817) 370-6744	(817) 370-6787
Houston	Delvin Dennis, P.E.	(713) 802-5076	(713) 802-5075
Laredo	Albert Quintanilla, P.E.	(956) 712-7416	(956) 712-7401
Lubbock	Douglas W. Eichorst, P.E.	(806) 748-4472	(806) 748-4380
Lufkin	Dennis R. Cooley, P.E.	(936) 633-4395	(936) 633-4378
Odessa	Mike C. McAnally, P.E.	(432) 498-4746	(432) 498-4656
Paris	Bobby Littlefield, P.E.	(903) 737-9205	(903) 737-9226
Pharr	Mario Jorge, P.E.	(956) 702-6102	(956) 702-6110
San Angelo	Walter G. McCullough, P.E.	(325) 947-9205	(325) 947-9235
San Antonio	Mario G. Medina, P.E.	(210) 615-5839	(210) 615-6115
Tyler	Randy Hopmann, P.E.	(903) 510-9100	(903) 510-9158
Waco	Richard Skopik, P.E.	(254) 867-2705	(254) 867-2890
Wichita Falls	Larry Tegtmeyer, P.E.	(940) 720-7728	(940) 720-7848
Yoakum	Lonnie Gregorcyk, P.E.	(361) 293-4323	(361) 293-4372

APPENDIX C. SITE ACCESS EXAMPLES



Figure C-1. Aerial Photograph of DC with Separate Inbound and Outbound Access. One driveway each for truck and employee/visitor access; driveways well separated from nearest intersection. Truck driveway provides ample queuing space for inbound and outbound trucks to check in at security booth. Employee/visitor driveway provides queuing length for outbound vehicles during shift changes.



Source: Google™ Earth

Figure C-2. Aerial Photograph of DC along Frontage Road.

DC located along frontage road, but away from ramps and major intersections to separate truck turns to and from DC from other maneuvers at ramps and intersections.



Source: Google™ Earth

Figure C-3. Aerial Photograph of DC with Separate Outbound Access.

DC with relatively small building setback but driveway wrapped around employee/visitor lot to provide inbound queuing space for trucks checking in at security booth. Employee/visitor lot has separate access and queuing space for outbound traffic during shift changes.

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- 7 *Roadway Design Manual*. Texas Department of Transportation, Austin, Texas, March 2009, <http://onlinemanuals.txdot.gov/txdotmanuals/rdw/rdw.pdf>.
- 8 *Policy on Geometric Design of Highways and Streets*. American Association of State Highway and Transportation Officials, Washington, DC, 2004.

