TRUCK STOP ELECTRIFICATION AND ANTI-IDLING AS A DIESEL EMISSIONS REDUCTION STRATEGY AT U.S.-MEXICO PORTS OF ENTRY

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INTRODUCTION

This report describes a concept for using anti-idling technologies—with a particular emphasis on Truck Stop Electrification (TSE)—to reduce diesel emissions at international Ports of Entry (POE) between the United States and Mexico. To ground the analysis in a particular case study, the report focuses on northbound truck travel at the Otay Mesa-Mesa de Otay POE (hereafter "Otay Mesa") between California and Baja California and a proposed new land port in the area, Otay Mesa East-Otay II POE (hereafter "Otay II"). As with other POE's along the border, trucks crossing at Otay Mesa face significant wait times to pass through Mexican and U.S. customs, security, and safety facilities before entering the United States. This congestion and idling time wastes fuel and money, produces greenhouse gases and other pollutant emissions, and burdens local traffic circulation.

The report analyzes how anti-idling and TSE (AI/TSE) approaches successfully applied in the U.S. and elsewhere may be adapted to POE's to save money and reduce emissions from idling trucks. AI/TSE approaches are, at their most fundamental level, strategies to encourage (or require) drivers to turn off their vehicles rather than idling at a stand-still or driving at very slow speeds. TSE technologies encourage anti-idling by providing alternative electrical power and communications connections to vehicles for air conditioning and other services while the engine is turned off.

This analysis was funded by the Environmental Protection Agency and conducted in cooperation with the San Diego Association of Governments (SANDAG). The project had the following objectives:

- Develop a concept for how AI/TSE strategies can be utilized at international POE's between the U.S. and Mexico to reduce diesel emissions and achieve other benefits;
- Analyze how the concept could be applied at the existing Otay Mesa and planned Otay II POE's to identify and understand key implementation issues;
- Test the concept with a range of key binational stakeholders to understand the opportunities they envision and their concerns; and
- Help identify what messages Border 2012 and other stakeholders should convey about anti-idling strategies at U.S.-Mexico international POE's.

After briefly describing the project's analytical approach, the document describes AI/TSE and outlines three approaches for applying the concept to border crossings. It then focuses on the Otay Mesa and Otay II crossings, describing key characteristics of vehicle traffic and procedures and making recommendations for what type of AI/TSE strategies would be most appropriate. Key stakeholder perspectives are presented next. The report concludes with a description of key findings, recommendations, and next steps.

ANALYTICAL APPROACH

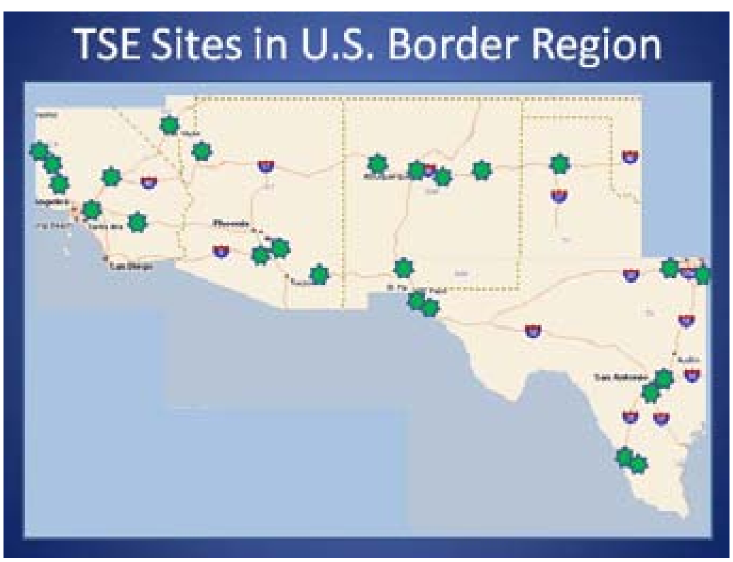
The analysis described in this report is based on the following:

- Analysis of current approaches to AI/TSE, including its application at truck stops in the United States and two planned or existing applications at international POE's between Canada, the United States, and Mexico;
- Discussion with TSE vendors in the United States, including discussion of how TSE technologies could be adapted to international POE's;
- Research into the Otay Mesa border crossing, including travel dynamics, wait times, areas of congestion and bottlenecks, and a range of characteristics that affect the viability and design of AI/TSE approaches; and
- Discussion of the AI/TSE concept and its advantages and disadvantages with a range of stakeholders, including 1) federal, state, and local air quality and transportation agencies in Mexico and the United States, 2) customs officials in Mexico and the United States, and 3) trucking associations and trucking companies operating at the Otay Mesa commercial POE (the list of stakeholders is included as an appendix).

TRUCK STOP ELECTRIFICATION AND ANTI-IDLING AT THE BORDER

What is Anti-Idling and Truck-Stop Electrification?

At the most fundamental level AI/TSE approaches seek to encourage truck drivers to turn off their engines instead of idling at a standstill or "creep idling" at slow speeds. The most extensive application of these strategies has been at truck stops along major highways, where long-haul drivers rest for periods of several hours. Hours of service rules in the United States require that these drivers stop and rest for a designated number of hours each day. To run air conditioning systems, heating systems, and communications and entertainment equipment, drivers often choose to leave their engines running while parked at truck stops. The typical U.S. tractor-trailer idles 1,800-2,400 hours per year (burning approximately one gallon of diesel fuel an hour) (Bubbosh, 2004). The TSE systems provide drivers with an appropriate resting environment, help them save fuel, and help them comply with anti-idling rules where they apply.



There are many truck stop electrification facilities located along major highways in U.S. border states, and more are anticipated. For example, the Arizona Department of Environmental Quality (ADEQ) recently received funding to provide grants and related outreach for the implementation of TSE facilities at POE's and/or along significant trade corridors near the border. ADEQ anticipates developing at least three sites through the program.

The main distinction between available TSE technologies is whether they provide heating and air conditioning through external HVAC technology connected to trucks by hoses ("off-board systems") or whether they provide electrical hook-ups to power on-board heating and air conditioning ("on-board systems"). Among current vendors contacted for this study, two provided off-board systems and one provided an on-board system.

Trucks turn off their engines at a TSE facility and hook up to external air conditioning and power systems...

..or use an external power supply to run on-board equipment

The cost of implementing a TSE site depends on the type of technology. Per-space installation costs for technology that provides external power to on-board equipment ranges from $4,500 to $8,500 while an off-board system can run from $10,000 to $20,000 per space.[1] The cost of on-board equipment required to use a TSE facility can range from zero (for systems that provide a simple window unit to access off-board technology) to $2,000 for a sophisticated on-board system. TSE facilities at truck stops typically charge a fee of $1.00-$2.00 an hour.

AI/TSE strategies can provide a range of benefits, including:

- **Reducing cost from fuel savings**. Every hour that a truck engine idles, it burns roughly a gallon of diesel fuel and adds an additional $0.50 to $0.95 an hour in maintenance costs.
- **Reducing emissions**. Each gallon of diesel consumed results in 22.2 lbs of CO2 released into the atmosphere. Diesel trucks also produce NO_x and particulate matter emissions, contributing to regional non-attainment with air quality standards. Carbon monoxide (CO) from idling trucks can cause headaches, nausea, and dizziness for truck drivers and border crossing personnel, affecting their health and performance. Diesel emissions have been linked to asthma and include over 40 cancer-causing substances that lead to other illnesses.
- **Providing amenities and rest for drivers**. Power supplies, communications, entertainment and truck stop amenities (e.g., restaurants, showers, etc.) increase the quality of life for drivers and increase safety by providing a resting environment.

IMPLEMENTING AI/TSE AT THE BORDER

Although AI/TSE strategies implemented at truck stops in the United States offer insights into implementing these strategies at POE's, there are a number of key characteristics of these ports that call for an adaptation of the approach. These characteristics include:

[1] This is the total installation cost per space including the TSE system, communications, and parking lot and electrical improvements. It does not include administrative or operating costs.

- Shorter idling times, which are driven by congestion rather than hours of service rules;
- "Creep idling" in which trucks slowly approach border crossings by starting and stopping and moving at slow speeds, which discourages drivers from turning their engines off as they wait to cross the border;
- Constraints on land availability and the need to work with existing infrastructure, roadways, and surrounding land uses;
- The need to work in coordination with customs and security procedures;
- A higher percentage of drayage vehicles (vs. long-haul), and
- Many of the same trucks making multiple trips each day.

Given these characteristics, three viable adaptations of the AI/TSE concept emerged through research and discussion with stakeholders.[2] Each is described below. All of these approaches provide alternatives so that trucks don't need to slowly creep idle in a queue to access border crossing facilities. The first involves using traffic signals on existing roadways to stop vehicles when POE's are congested and send them through the POE in "batches." The second two involve a staging area (with or without TSE technology) where trucks park with engines turned off and wait until they are signaled to cross the border through an appointment system.

Strategy A: Traffic Controls on Existing Roadways

This approach uses traffic controls on existing roadways to process trucks crossing in "batches." Traffic signals are used to stop vehicles, which are encouraged or required to turn their engines off, and drivers wait for a period of time while batches of vehicles in front of them cross the border and clear the roadway. The strategy is illustrated by Figure 1. In this example, vehicles proceed through the crossing normally at times of low congestion (top panel). When congestion backs up to a defined distance from the crossing, a signal light stops vehicles while the vehicles in front of them clear customs (middle panel). Stopped vehicles are required or encouraged to turn off their engines. Once the roadway in front of stopped vehicles is clear, the signal light turns green to allow the batch of vehicles to proceed through customs (bottom panel).

Many different configurations are possible, depending on existing infrastructure. This strategy would not include TSE technology, but could include amenities such as restrooms available to vehicles that are stopped.

[2] Other anti-idling strategies and technologies are available. However, many of these require the installation of expensive on-board equipment. Because many of the trucks crossing the border at Otay Mesa are older drayage vehicles, this analysis did not focus on technology that would require significant upgrades to these vehicles involving the purchase and installation of on-board equipment. More information on other anti-idling strategies is available from the Environmental Protection Agency's SmartWay program (see: http://www.epa.gov/smartway/transport/what-smartway/idling-reduction-available-tech.htm#truck).

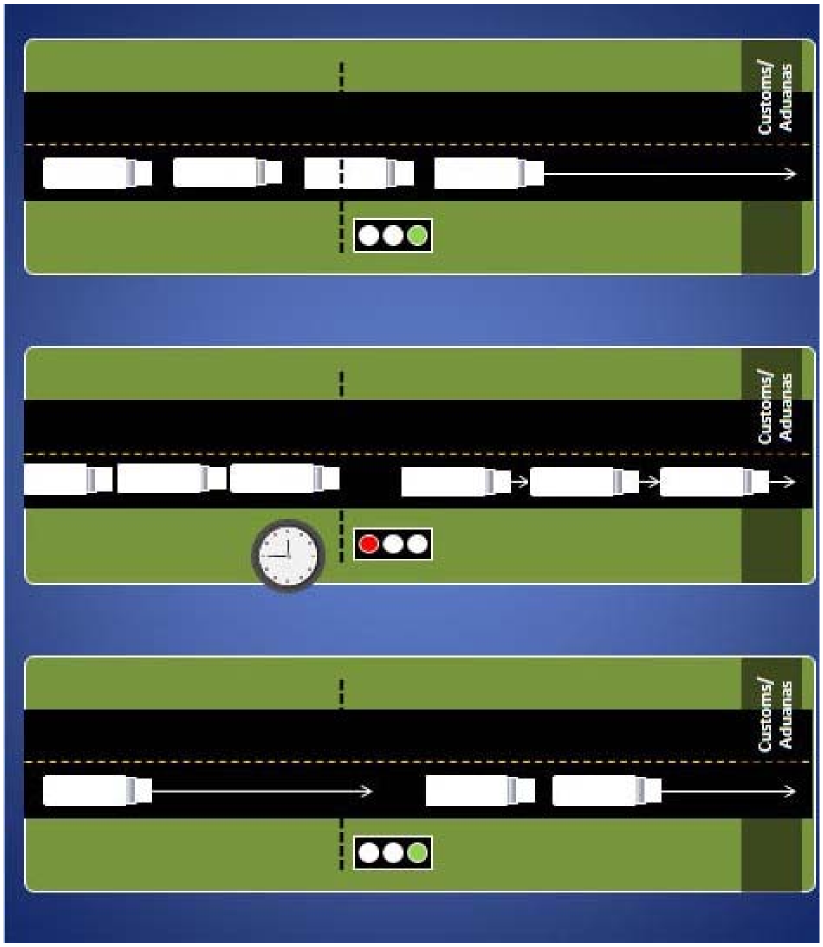


Figure 1: Strategy A: Traffic Controls on Existing Roadway

The pros and cons of this approach are as follows:

Pros:

- Requires little new infrastructure (as long as the roadway is sufficiently long to allow it to essentially double as a parking lot)
- No fees are charged to drivers
- Can apply to all vehicles using the POE
- Relatively easy and inexpensive to implement

Cons:

- Requires more dedicated lanes than currently exist at many POE's; this may create "competition" with dedicated lanes for special programs, such as the FAST program (which expedites crossings for pre-certified vehicles), or lanes to quickly process empty trucks
- Requires more road space to hold vehicles stopped at traffic signals, which may create or exacerbate congestion on adjacent roadways
- Does not necessarily involve a requirement that drivers turn off their engines (although this could be made mandatory), and extreme temperatures in the border region may encourage drivers to keep engines on
- Does not provide TSE facilities to drivers seeking external power for onboard equipment in cabs and/or for refrigeration units; if turning off engines is required, the lack of TSE facilities may cause problems for drivers in extreme temperatures.

A version of this approach for passenger vehicles is being implemented as a pilot project at the U.S.-Canada Peace Arch crossing. At this crossing, a single traffic signal is used to stop vehicles 250 meters in advance of the border crossing and hold back traffic until vehicles in front of them have cleared the roadway to customs (roughly 100 vehicles). The traffic light includes a countdown timer that lets drivers know how long they have to wait. Turning off engines is not mandatory, but many drivers do so. The arrangement only applies to regular lanes, not the NEXUS lane, which provides for a quicker crossing for pre-approved drivers (similar to SENTRI lanes between Mexico and the U.S.). Because the access road is 2.5 kilometers, there aren't concerns about creating backups beyond the border crossing roadways.

Strategy B: Mandatory AI/TSE Facility

This approach requires all vehicles accessing a POE to enter a parking area, turn off their engines, and wait for a signal to cross the border via an appointment system (see Figure 2). Some or all of the parking slots would have TSE equipment, and the facility could have amenities such as restrooms, resting areas, or restaurants. This approach is most applicable to new POE's (i.e., not yet built) and to a fee-based crossing system in which part of the crossing fee pays for the investment in a parking area and TSE technology.

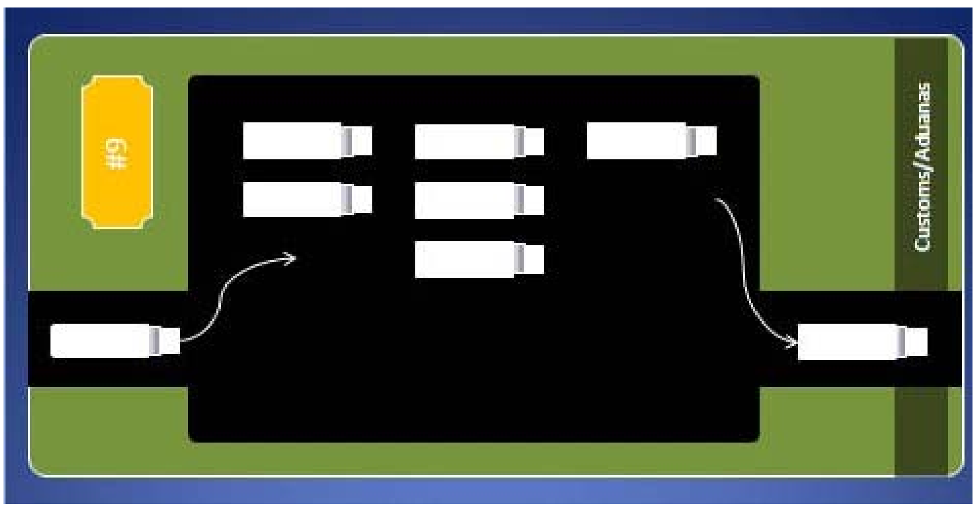


Figure 2 Strategy B: Mandatory AI/TSE

The pros and cons of this approach are as follows:

Pros:

- Can apply to all vehicles using the POE
- TSE costs can be paid through a single border crossing fee
- Provides TSE facilities to drivers seeking external power for onboard equipment in cabs and/or for refrigeration units.

- Cons:
  - Can require a large amount of land to hold all trucks using a POE, which makes it difficult to implement at existing POE's in urbanized areas
  - Cost for TSE equipment and land can be significant
  - Limited to fee-based crossings and to trucks willing to pay such fees (at least in cases where they have the option to use a free crossing)

A mandatory AI/TSE facility is planned for the northbound San Luis Rio Colorado crossing between Sonora and Arizona. At this planned 30-hectare facility, crossing fees will be charged and part of the fees would pay the costs of the TSE facility. All trucks accessing the facility would wait in a parking area for an appointment (via radio) to cross the border. Current plans are for 22 TSE spaces. Expected wait times are 25-30 minutes. The anticipated technology would provide an external power source but require on-board technology for heating, cooling, and other services. This crossing serves many refrigerated trucks that would be expected to use the facility as well. The project was offered by the Mexican Ministry of Communications and Transportation as a concession and will be developed by a private company (but managed by public agencies: Aduanas, Caminos y Puentes Federales). Including the AI/TSE component of the projects was a requirement for receiving funding from the North American Development Bank (NADBank)

Strategy C: Voluntary AI/TSE Facility

This approach is similar to Strategy B except that using the TSE facility is voluntary. Trucks accessing a POE would have the option to enter a parking area, with an appointment system, TSE equipment, and amenities (see Figure 3). Or, they could choose to use the traditional (congested) approach to the customs facility. A signal light or other device would control access to the customs facility, allowing trucks using the AI/TSE facility to reach customs at the same time (and possibly earlier) than they would using the traditional approach.

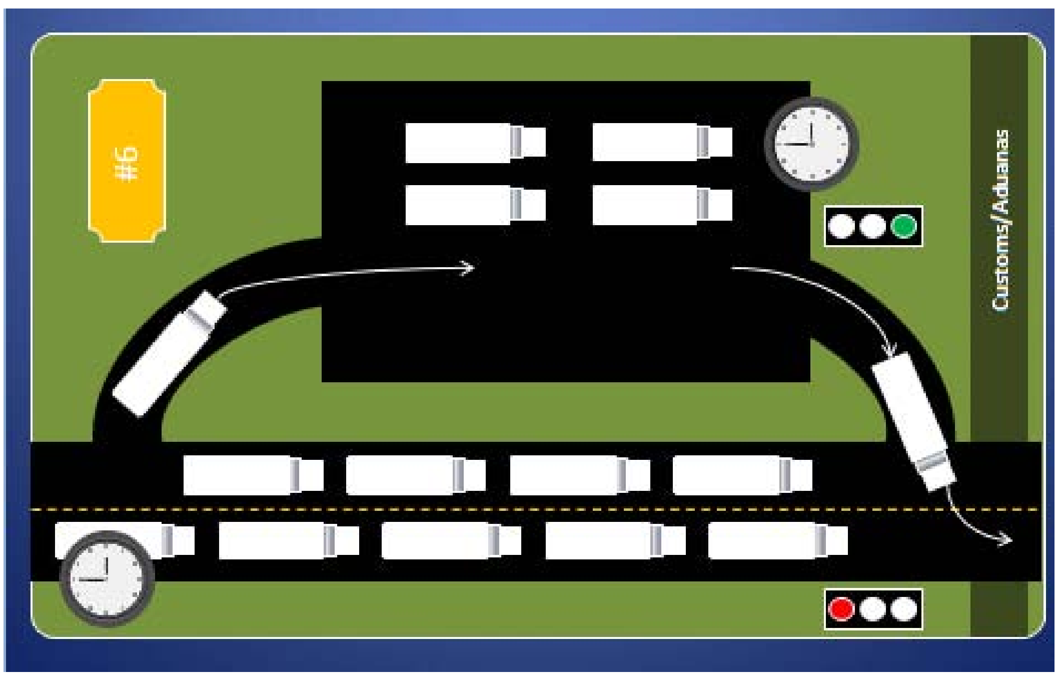


Figure 3: Strategy C: Voluntary AI/TSE Facility

Drivers would pay to use the facility in exchange for reduced fuel costs, a resting environment, use of amenities and possibly (depending on the procedures) a shorter wait time. This approach is most applicable at existing crossings seeking to retrofit with an AI/TSE strategy. Such a facility on the Mexico side of the Otay Mesa crossing, for example, could be built and operated privately with some coordination with Mexican (and possibly U.S.) Customs on an appointment system. Of the three options, it is the closest to the truck stop model used in the United States.

The pros and cons of this approach are as follows:

Pros:

- Gives truck drivers a choice of approaches
- Depending on the procedures and incentives, it can shorten wait times for drivers using the facility
- Does not need to be as integrated into POE infrastructure and processes as other approaches

Cons:

- Does not necessarily cover all vehicles using a POE
- Creates uncertainty about the level of utilization and the appropriate size and fee system
- Can require a large amount of land if a significant number of trucks using a POE choose to use the facility
- Cost for TSE equipment and land can be significant
- Truck owners and operators must be willing to pay a fee for the site (or pass it on to shippers) or the site must be publicly funded
- The process for channeling two flows of traffic (one from the TSE and one not) into a customs facility may create logistical challenges—especially to control any efforts by trucks to "cut into the queue" inappropriately.

The success of Strategy C hinges on providing sufficient financial and other incentives for truckers to use the facilities. According to some project contacts, experience has shown that the financial savings from using TSE facilities at truck stops in the U.S. are not, in and of themselves, sufficient to attract users. Substantial marketing, discounted rates, and operational streamlining (e.g., paying TSE fees at the gas pump) have all been utilized to boost use of TSE facilities. TSE vendors emphasized that travel plaza amenities (e.g., restaurants, showers, etc.)—not the TSE facility itself—are what really attracts users to the facilities.

What type of AI/TSE Approach is Most Appropriate for a Given POE?

There are a number of key considerations in deciding whether:

- Any AI/TSE approach is appropriate at a POE,
- Which type of strategy is most appropriate, and
- How to adapt a given option to a particular location.

The amount of congestion and the length of wait times. In general AI/TSE makes most sense in areas where congestion is high and wait times are long. This project did not estimate a "threshold" wait time beyond which AI/TSE is a viable strategy. However, trucking companies indicated that trucks waiting more than 20-30 minutes at a stand-still would likely prefer to turn off their engines.

Land availability. All of the AI/TSE options require land, especially the options that involve a parking area. 25 parked trucks occupy roughly an acre of land. Available land is most difficult to find at existing POE's built in urban areas and generally easier to find at new ports or at rural crossings. Where land is not available, an approach like Strategy A, which uses the existing roadway, is most viable.

Local climate. TSE is primarily used as a way to heat and cool truck cabs and for keeping produce or other perishables at desired cool temperatures. In some areas, the climate is temperate enough that heating and cooling is not required (e.g., in the Otay Mesa area). In these areas, TSE is not required as part of an AI strategy, except, perhaps, for trucks carrying produce.

New infrastructure vs. retrofitting existing sites for AI/TSE. In general, there are more options for AI/TSE at new sites, where land is more available and AI/TSE can be built into original infrastructure and border processes. Also, some new POE's in the border region charge fees, which can be used to pay for AI/TSE construction and maintenance.

Cost and willingness to pay. Strategy A is free to truck drivers and relatively low-cost for border facilities while Strategies B and C require significant capital. For these latter strategies, drivers would be charged a fee and/or the facility would be publicly funded. Given that many drayage companies are small and poorly financed, even small additional costs may push drivers (or shippers that contract for services) away from using a facility that charges a fee. While the facilities could be subsidized, there are significant public funding challenges for a facility built in Mexico. Large sources of U.S. State and federal transportation funding, such as Carl Moyer funds in California or federal Congestion Mitigation and Air Quality (CMAQ) funds, cannot be used for projects in Mexico. More research needs to be done on funding sources in Mexico, but past research on diesel emissions projects suggests few obvious sources.[3]

TRUCK STOP ELECTRIFICATION AT OTAY MESA AND OTAY II

To refine the concept of AI/TSE at international POE's and to inform solutions to real congestion and idling problems at a major port, the project focused on how AI/TSE could work at the current Otay Mesa POE and the planned Otay II POE. This section describes these ports, discusses the most appropriate AI/TSE design, and provides a rough quantitative estimate of some benefits and costs.

Description of the Otay Mesa POE

The Otay Mesa POE is the busiest commercial crossing in the California/Baja California border region. It accounts for the third highest dollar value of trade among all U.S.-Mexico border crossings (SANDAG, 2006). There are roughly 3,000 truck crossings per day from Mexico into the U.S. at the POE. Annual crossing data for trucks coming into the United States from 1997-2007 is shown in Table 1. Annually, these trucks carry more than $20 billion in trade, nearly all of it related to regional maquiladora manufacturing and agricultural industries (CalTrans, 2004).[4]

Table 1: Northbound Truck Crossing Via Otay Mesa--Volume and Value of Trade

Year	No. of Northbound Truck Crossings (in thousands)	Value of Northbound Trade (imports into U.S.)
1997	558,383	$7,132,119,378
1998	599,001	$8,717,899,856
1999	684,484	$9,448,834,750
2000	683,703	$10,649,827,179

[3] See "Strategy and Recommendations for U.S.-Mexico Border Diesel Emissions Projects" at: http://www.unep.org/pcfv/PDF/dieselrecomm-Eng.pdf.

[4] For more statistics about the crossing, see www.otaymesa.org/ab_otay/port_of_entry.html.

Year	No. of Northbound Truck Crossings (in thousands)	Value of Northbound Trade (imports into U.S.)
2001	700,453	$11,158,787,544
2002	725,710	$11,818,167,825
2003	698,228	$11,400,334,548
2004	724,903	$13,254,426,155
2005	724,572	$15,131,098,440
2006	752,981	$18,659,789,989
2007	738,765	$18,381,905,424

Data compiled by SANDAG from:

- Bureau of Transportation Statistics, Transborder Surface Freight Data, Annual Summaries, Port Reports, Individual Port Surface Trade by Value (1997-2007)
- Bureau of Transportation Statistics, Transborder Surface Freight Data, U.S.-Mexico Trade by U.S. Port or Customs District (2003-2007)
- U.S. Customs, Conveyance and Person Arrivals, 1997-2007. Data represents federal fiscal year.

Volumes of trade and the numbers of trucks crossing at Otay Mesa typically increase in late spring, corresponding to agricultural harvests, and early fall, corresponding to increased goods movement for the upcoming holiday season (CalTrans, 2004).

The vast majority—some sources say 100%—of the freight traffic at Otay Mesa is drayage vehicles (Ojah, 2002). These drayage vehicles typically operate between distribution centers located in Mexico and the U.S. near the POE. Drayage companies are usually hired by logistics companies that are contracted by maquiladoras to move goods across the border. The logistics companies typically take care of the paperwork and other "official" arrangements for the crossing. Many of the logistics and drayage companies have operations on both sides of the border.

On a typical northbound journey, drayage drivers pick up a load at a distribution center, collect export documentation and a manifest en-route to the POE, and then proceed through the crossing. On the U.S. side, they drop their cargo at a distribution center and then return to Mexico either with cargo or without cargo.[5]

The same drayage driver and truck may cross at Otay Mesa several times a day. For the TSE, this means there would potentially be many visits from "repeat customers" at the same facility, which is a somewhat different model than truck stop TSE's in the U.S., which cater to trucks passing through on long haul routes.

Border Crossing Process

Figure 1 illustrates the Otay Mesa Commercial POE and the various steps in the border crossing process. Typically, northbound trucks use local roadways (point N1) to enter the Mexican export facility (point N2) and go through primary Mexican Customs export inspection. From here, trucks either cross the border directly (point N3) or go to secondary Mexican Customs inspection before crossing the border. Trucks then proceed through the primary U.S. inspection facility (point N4). From there, they leave the facility to local roadways (point N5) or go to secondary U.S. inspection and then leave the facility. Figure 2 shows a labeled aerial photo of the current layout of the POE and the typical northbound traffic flow patterns.

[5] From the distribution centers in the U.S., goods are shipped to destinations throughout the country. CalTrans studies indicated that roughly 20% of goods stay within the two California border counties, 60% goes to other parts of California, and the remaining 20% is transported to other U.S. States or international destinations (Baza, personal communication).

Figure 1: Schematic of Otay Mesa Freight Crossing
(Source: Delgado, 2005)

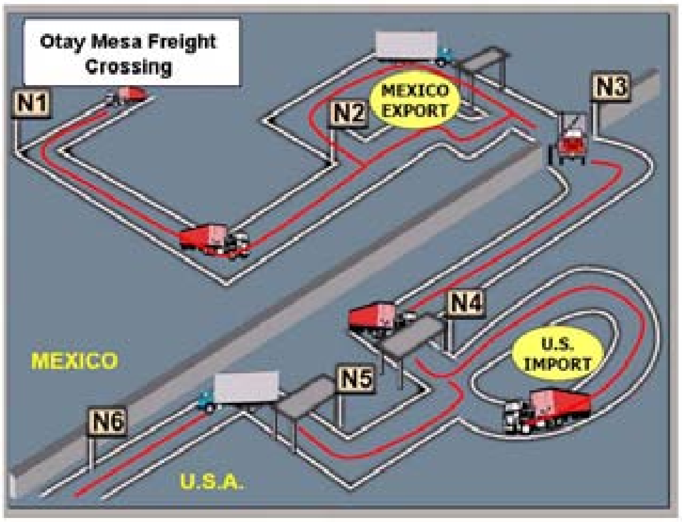
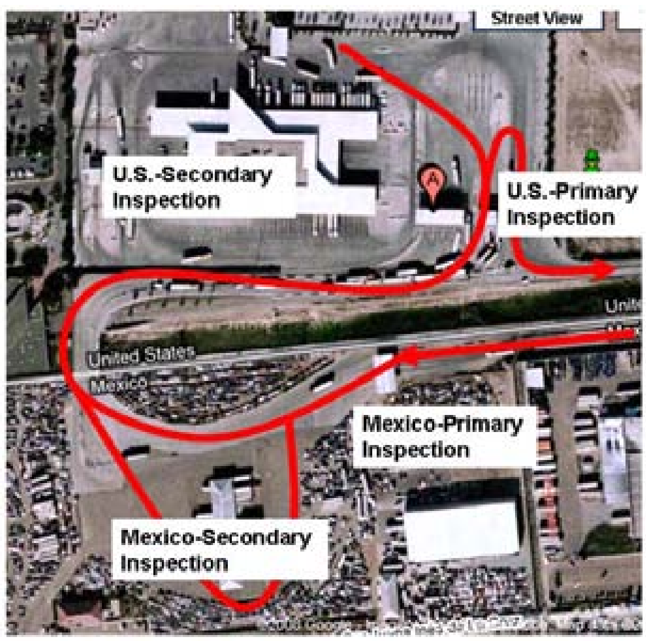


Figure 2: Aerial Photo of Otay Mesa Northbound Freight Crossing



Prior to arriving at the Mexican export facility, drivers meet with a Mexican customs broker in the vicinity of the facility. Drivers receive export documentation and a manifest from the broker (FHWA 2002). When trucks enter the primary Mexican Customs inspection facility, some (roughly 10%) are randomly selected to go to secondary inspection by Mexican Customs—mainly to make sure the appropriate duties and taxes are paid.[6] For trucks not going to secondary inspection, Mexican Customs checks export documentation before releasing trucks across the border.

Once in the United States, trucks proceed to primary U.S. inspection (operated by U.S. Customs and Border Protection, or CBP). Drivers present identification and a copy of the cargo manifest, which is matched with information previously provided to CBP by Mexican customs brokers and Mexican Customs. CBP often asks the driver a series of questions, and the truck often undergoes a brief physical inspection. Based either on the discretion of the customs officer or on a previously determined obligatory inspection, some trucks are selected to go to secondary U.S. inspection. At secondary inspection, a range of U.S. agencies—including CBP, USDA, FDA, DOT, and/or the National Guard—may inspect the vehicle. Once trucks leave the POE, they enter a separate Commercial Vehicle Enforcement Facility where the California Highway Patrol conducts a truck safety inspection (CalTrans, 2004).

Truck Congestion, Wait Times, and "Bottlenecks"

Congestion and idling for trucks waiting to cross the border are a fact of life at POEs. The "throughput" at a POE is largely determined by the speed at which customs agents in Mexico and the U.S. process vehicles. Although this often leads to congestion at Otay Mesa, there is no definitive data on average or peak wait times. According to SANDAG (2006), trucks at Otay Mesa typically wait an average of 2 hours per crossing. In discussions for this report, U.S. Customs and Border Protection personnel stated that the typical wait time is 90 minutes. Truck drivers report waiting 3-4 hours or more at busy peak times.

Some formal studies have been conducted on border wait times. Ojah et al (2002) provide some typical wait times for components of the border crossing process (note that these times are not specific to the Otay Mesa POE and do not include time waiting to enter the Mexican export compound):

- Time spent in Mexican export compound (from primary inspection to border crossing—does not include secondary Mexican inspection): a few minutes to half an hour;
- Secondary Mexican inspection: 30 minutes to several hours (note that trucks are probably parked and not idling for most of this time);
- Delays between departure from Mexican export compound and entry to primary U.S. inspection: 30 minutes to two hours;
- Processing time at U.S. primary inspection: 1-2 minutes;
- Secondary U.S. inspection: highly variable (again, trucks are probably parked and not idling).

A "Bottleneck Study" conducted at Otay Mesa in late 2003 and early 2004 provides some congestion information specific to the POE (CalTrans, 2004). The study concluded that, at Otay Mesa, "commercial vehicle volumes are consistently congested all day from 0600 to 1800 northbound and southbound, especially notable during the midday hour and before the port closes for the day." At maximum congestion, the study reported 150 trucks in the northbound queue in Mexico alone.

A study conducted in 2001 also examined wait times and congestion at Otay Mesa (FHWA, 2002). Because the study was conducted prior to September 11, however, its results do not reflect increasing border delays since that time from significant changes to border procedures

[6] The Secretaría de Hacienda y Crédito Público (Mexican Customs), is the main agency involved in inspecting freight entering and leaving Mexico. This section draws on a thorough description of the border crossing process in Ojah et al, 2002.

(SANDAG, 2006). The study calculated travel times for northbound trucks from the time they first hit congestion up until they reached the first inspection point on the U.S. side. It found that the average crossing time was 35 minutes, and the 95th percentile time was 64 minutes. Peak congestion periods were between 9:00 and 11:00 AM and 4:00 and 6:00 PM.

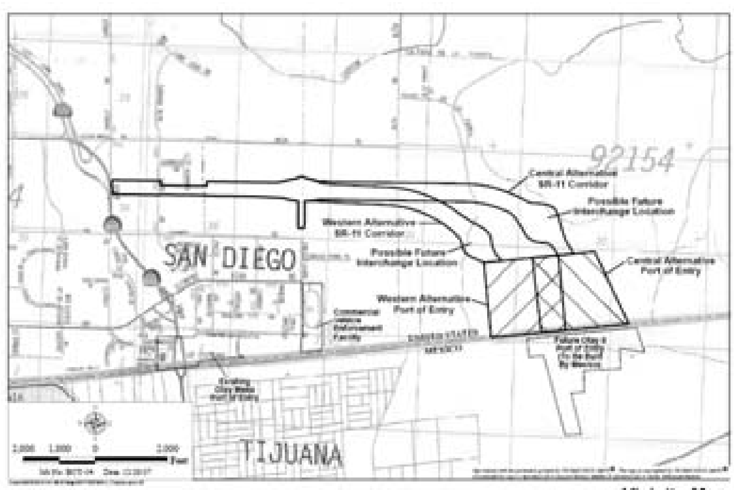
The Otay Mesa studies and discussions with stakeholders suggest that backups for northbound trucks typically extend along Avenida Internacional, a one-way four-lane road extending back from the Mexican export facility approximately 1.5 miles to a signaled intersection (see Figure 3) (FHWA 2002). Congestion can reach beyond this road into adjacent neighborhoods as well (Aduanas, personal communication). Most of the land use along Avenida Internacional is warehousing and logistics for cross-border trade.

Figure 3: Area of Typical Congestion Leading to Mexican Export POE Compound

Description of the Planned Otay II Facility

The proposed 100-acre Otay II POE would be located approximately two miles east of the current Otay Mesa Crossing (the U.S. facility would be located in the unincorporated community of East Otay Mesa). On the Mexican side, the port access road would be linked to the Tijuana-Rosarito corridor and to toll and free roads connecting Tijuana to Tecate and Ensenada. On the U.S. side, a new road, SR-11 would connect the port to the existing regional highway system (SR-905 and SR-125).

The Program Environmental Impact Report for the new port states that the facility is needed "because the capacities of the existing POEs in the region are currently being exceeded at peak times of the day and the year, causing excessive border wait times for those engaged in commercial and personal vehicle trips." (USDOT/CALTRANS 2008) As a measure of border crossing activity, the report states that over the ten-year period since 1996, inspections of commercial and non-commercial vehicles at Otay Mesa increased by



Vicinity Map
STATE ROUTE 11 AND OTAY MESA EAST PORT OF ENTRY PEIR/PEIS

over 80% and that inspections are expected to increase another 50 percent by 2025 (inspections at nearby San Ysidro and Tecate are expected to increase 25-30% as well). Part of the concept for Otay II is a guaranteed 30 minute crossing time.

The General Services Administration would be in charge of designing and building the Otay II facility in the United States, and the Mexican Government Secretariat of Communication and Transportation (SCT) would be primarily responsible in Mexico. The facility in Mexico would likely be built by a private concessionaire. If the concession required a TSE facility, building it would be one of the responsibilities of the concessionaire.

Trucks crossing in both directions through the Otay II crossing would pay a toll or user fee. The revenues from the toll or fee would finance most of the highway and POE infrastructure costs incurred in the United States and Mexico. On the U.S. side, these costs are estimated to be $715 million.[7]

What Type of AI/TSE Facility Would be Most Appropriate for Otay Mesa and Otay II?

As described above, the key considerations for determining what type of AI/TSE facilities are most appropriate for Otay Mesa and Otay II are:

- The amount of congestion and the length of wait times,
- Land availability,
- Local climate,
- New infrastructure vs. retrofitting existing sites for AI/TSE, and
- Cost and willingness to pay

The amount of congestion and the length of wait times. There is no definitive study of wait times at Otay Mesa. While Customs and Border Protection personnel report that typical wait times are ninety minutes, trucking companies and others describe peak delays of several hours. There is also no clear wait time threshold in the literature for when an AI/TSE facility makes sense, although the San Luis Rio Colorado facility is including TSE with anticipated wait times of 20-25 minutes. The widespread dissatisfaction with the congestion and wait times at Otay Mesa would suggest that some approach to AI/TSE at Otay Mesa is warranted. The level of current and expected cross-border trade—as well as the San Luis POE example—suggest that future congestion and wait times at an Otay II facility may also be sufficient to warrant an AI/TSE facility.

Land availability. There is very little available land on the Mexico side of the border at Otay Mesa and certainly not enough adjacent to the POE to accommodate a staging area of the size that would be needed for all 3,000 trucks crossing per day. This land, in a heavily populated and industrialized area of Tijuana adjacent to the border, is high value property and is likely to be prohibitively expensive for a land use such as an AI/TSE staging area. Viable solutions must either use the existing roadway (and possible some adjacent land) or consider a remote AI/TSE staging area with a dedicated roadway leading to the Otay Mesa POE. More land—potentially of sufficient size—may be available for an Otay II facility, although it is still in a heavily populated area of Tijuana.

Local climate. The climate at Otay Mesa is temperate enough that drivers would be unlikely to need (and unwilling to pay for) air conditioning or heating. This means that an anti-idling solution would not need TSE technology to be successful. The exception to this is the case of refrigerated trucks, which would need TSE to run refrigeration regardless of the external climate. More

[7] Bill Figge, CalTrans, personal communication, March 16, 2009.

research is needed into the volume of refrigerated trucks using the Otay Mesa POE. If TSE is not needed, Strategy A becomes a more viable alternative as does a non-TSE version of Strategy B or C (i.e., a “parking lot and a bathroom”).

New infrastructure vs. retrofitting existing sites for AI/TSE. Otay II would require new infrastructure while Otay Mesa would involve retrofitting an existing site. As discussed above, adding infrastructure at Otay II is much more viable than adding it as a retrofit to Otay Mesa. This would suggest a strategy at Otay Mesa that uses the existing roadway (i.e., Strategy A) and the viability of Strategies B and C at Otay II.

Cost and willingness to pay. Trucks currently using Otay Mesa pay no fee. Those that choose to use Otay II in the future will pay a fee. In discussions with trucking companies for this report, representatives said that the decision to use the fee-based crossing would be made by shippers willing to pay more for a faster crossing. (These trucking companies said that they would only pay the fee themselves if it would allow them to go from an average of two round trips per day to three round trips per day). When Otay II is operational, those unwilling to pay a border crossing fee will use Otay Mesa. This favors a free or highly subsidized solution for Otay Mesa.

Given all of these considerations, the most viable strategy for an AI/TSE facility in Mexico for northbound trucks at Otay Mesa is either:

- A mandatory on-road approach that uses traffic controls to “batch” trucks through the port using the existing access road and lanes (Strategy A, above), or
- A voluntary remote, off-site parking/TSE area that serves the port via a dedicated roadway (Strategy C, above). The amount of utilization of such a facility will be directly tied to the fee charged. Some stakeholders recommended that such a facility be secured and accept appointments pre-arranged by shippers. Such a facility could be shared with the Otay II crossing. Only some parking spaces would need TSE electrification.

Neither of these solutions is without issues to be resolved. Because the existing roadway is limited, Strategy A may exacerbate local congestion problems that already exist. For Strategy B, creating a dedicated roadway to the Otay Mesa customs facility presents a number of land use and logistical challenges.

For Otay II, the most viable strategy is a mandatory on-site parking facility in Mexico to serve northbound vehicles. This would be similar to the plan for the Mexico side of the San Luis Rio Colorado POE. In the staging area, some parking spots could have TSE and some not; trucks hooking up to TSE technology could be charged a higher crossing fee to cover the costs of the TSE. Because wait times at Otay II are expected to be less than 30 minutes, the viability of having an AI/TSE facility would hinge on expected future increases in congestion and wait times at the facility.

Preliminary Estimate of Fuel and Maintenance Savings, Emissions Benefits, Cost, and Land Use Requirements from AI/TSE

This section provides preliminary quantitative estimates of fuel and other savings, emissions benefits, facility cost and land use requirements for AI/TSE strategies. The preliminary numbers are intended only to give a general sense of the magnitude of benefits, costs, and requirements for AI/TSE—much more sophisticated analyses are possible and desirable.

To provide the basis for calculation, the analysis draws on data from Otay Mesa for its examples. Key data are:

- 3,000 truck crossings per day for 250 days per year.
- An average of 14 hours of operation per day, 5 days a week. (In reality, Otay Mesa is open for 8 hours a day on weekends, but volumes are much lower.)
- Average wait times of 90 minutes per truck per crossing, which the analysis uses as a mid-range value. (The low range estimate is 45 minutes, and the high range estimate is 180 minutes.)

Estimate of Fuel and Maintenance Savings and Emissions Reduction

The analysis of fuel and other savings and emissions reductions is based on the assumption that any of the three AI/TSE strategies will lead drivers to turn off their engines for 75% of their wait times. The remaining 25% allows for some time to access and exit parking areas (for Strategies B and C) or to move in batches through an on-road system (Strategy A).

Note that the analysis presented here does not take into account any emissions associated with generating the electricity provided through TSE equipment. A complete analysis of the net emissions benefits of TSE strategies should take into account such emissions.

The analysis uses the following factors:

- One hour of idling uses one gallon of diesel fuel (at a cost of $3.00 per gallon).
- One hour of idling creates $0.75 cents an hour in additional required maintenance (actual estimates range from 0.50 to 0.95 cents).[8]
- Burning one gallon of diesel fuel produces: 22.2 pounds of CO2[9]
- One hour of idling produces:[10]
  - 135 grams of NO_x per hour, and
  - 3.68 grams of particulate matter (PM) per hour

Table 1 presents the results of the analysis using three scenarios: a wait time of 45 minutes, a wait time of 90 minutes, and a wait time of three hours. These are average wait times and could represent either a consistent pattern of wait times over the course of the day or a pattern over the course of the day in which wait times rise to a peak that is longer than the average and then falls below the average at the end of the day. This latter scenario is more representative of the pattern at Otay Mesa.

Taking the middle case as an example, a 90 minute wait for each of 3,000 truck crossings per day burns around $3.4 million dollars of fuel each year and creates $800,000 in additional maintenance costs, for a total cost to truck owners and operators of $4.2 million dollars. Idling during this same waiting time produces over 11,000 tons of CO_2, 4 tons of PM, and 152 tons of NO_x. Cutting this idling time by 75% through AI/TSE strategies saves over $3 million dollars and reduces almost 8,500 tons of CO_2 emissions, 3 tons of particular matter, and 114 tons of NO_x compared to the baseline.

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[8] Estimate based on discussions with TSE vendors.

[9] See U.S. EPA. 2005. "Emissions Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel." Available at: http://www.epa.gov/oms/climate/420f05001.pdf. Visited 2/15/09.

[10] See U.S. EPA. 2004. "Guidance for Quantifying and Using Long Duration Truck Idling Emissions Reductions in State Implementation Plans and Transportation Conformity." Available at: http://www.epa.gov/otaq/smartway/documents/420b04001.pdf. The PM emission factor assumes that trucks are earlier than 2006 models. Note that emissions factors used are for long haul trucks, not the drayage vehicles commonly seen at border crossings. However, these emission factors are at the higher end of the range of trucks analyzed in one study of cross-border idling at crossings between El Paso and Ciudad Juarez (Zietsman, et al 2005).

Table 1: Annual Cost Savings and Emissions Reductions

	Low (45 minute wait)			Medium (90 minute wait)			High (180 minute wait)		
	Baseline	**TSE**	**Difference**	**Baseline**	**TSE**	**Difference**	**Baseline**	**TSE**	**Difference**
Fuel cost	$1,687,500	$421,875	-$1,265,625	$3,375,000	$843,750	-$2,531,250	$6,750,000	$1,687,500	-$5,062,500
Maintenance cost	$421,875	$105,469	-$316,406	$843,750	$210,938	-$632,813	$1,687,500	$421,875	-$1,265,625
Total	**$2,109,375**	**$527,344**	**-$1,582,031**	**$4,218,750**	**$1,054,688**	**-$3,164,063**	**$8,437,500**	**$2,109,375**	**-$6,328,125**
Emissions of:									
CO2 (metric tons)	5,663	1,416	4,247	11,327	2,832	8,495	22,653	5,663	16,990
PM (metric tons)	2.07	0.52	1.55	4.14	1.04	3.11	8.28	2.07	6.21
NO_x (metric tons)	76	19	57	152	38	114	304	76	228

The amount of these estimated benefits correlates to wait times. If wait times are shorter (e.g., 45 minutes), then baseline costs and emissions will be lower. In this case, AI/TSE strategies are of less benefit. If wait times are longer (e.g.180 minutes), then AI/TSE strategies lead to even greater benefits.

Estimate of Cost and Land Use Requirements

This analysis examines the cost and land use requirements for a TSE facility with a parking area (Strategies B and C). (Strategy A requires neither TSE equipment nor a parking area, assuming that existing roadways could be used). The analysis uses the following factors and assumptions:

- Each TSE parking space costs $6,500 for a pedestal providing power for on-board systems to $18,000 for a system providing off-board heating, cooling, power, and communications.
- One acre is required for every 25 parking spaces.
- The parking area will be full for the entire 14 hours of service each weekday and the wait times will be the same all day (in reality, there are peak times of congestion during the middle of the day.)

Table 2 compares the cost and land use requirements for a TSE parking area with 50, 100, and 150 spaces. Taking the middle case, a 100 space parking area would require 4 acres. Equipping each space with TSE equipment would cost between $650,000 and $1.8 million depending on the type of technology employed. (This does not include the cost of land or ongoing operations and maintenance.) The facility would accommodate over 1,800 trucks per day if each truck used the facility for an average of 45 minutes but less than 500 trucks per day if each truck used the facility for 180 minutes.

Note that it would take around 320 parking spaces (covering roughly 13 acres) to accommodate all of the 3,000 trucks using Otay Mesa each day if each truck used the facility for 90 minutes over the entire 14 hours of weekday service. The facility would need to be even larger to accommodate peak demands. Of course, a voluntary facility that was not built to accommodate all of the daily crossings could be much smaller.

Table 2: Acreage Requirements, Costs and Capacity for TSE Sites

	TSE Parking Area Size		
	50 Spaces	**100 Spaces**	**150 Spaces**
Acreage required	2	4	6
TSE Equipment Cost:			
Power pedestal only	$325,000	$650,000	$975,000
Off-board air, heat, etc.	$900,000	$1,800,000	$2,700,000
Trucks accommodated per 14 hr day:			
45 minute wait	933	1867	2800
90 minute wait	467	933	1400
180 minute wait	233	467	700

STAKEHOLDER PERSPECTIVES

A number of stakeholders offered their insights and opinions about the AI/TSE concepts described in this report. Much of this input is incorporated into the concepts and descriptions above. This section summarizes some of the key perspectives and issues raised by stakeholder groups. All stakeholder contacted are listed in an Appendix.

State and Local Air Quality Agencies. Contacts in state and local air quality agencies were generally supportive of the border crossing TSE concept. The air quality benefits of such a TSE align with these agencies' interest in meeting air quality standards in the region, and they recognize that POEs are a concentrated source of emissions affecting regional airsheds. However, agencies in the U.S. acknowledged that a project conducted in Mexico would not help them get "credit" for air quality improvements through programs such as the Clean Air Act's State Implementation Plan process.

Local Planning and Transportation Agencies. Contacts in local planning and transportation agencies were also supportive of the concept. Much of the planning on the U.S. side of the POE is focused on reinforcing border-related industry and commerce.[11] Efficient transit across the border reinforces these strategies. Planners must also take into account environmental impacts of development, and a TSE facility at the border crossing would help ameliorate impacts from increased truck-based trade. Planners and others saw the benefits to surrounding businesses and neighborhoods from reduced congestion on local streets and improved local air quality.

Customs Agencies. Representatives from U.S. Customs and Border Protection (which operates the U.S. POE facilities) and the General Services Administration (which owns the U.S. POE facilities) were mainly interested in how AI/TSE strategies would affect the border customs and inspections processes and security issues. Because the customs processes of these agencies largely determine the pace at which trucks cross the border, they were also understandably interested in assumptions about wait times and the justification for a facility that would reduce idling. The main security concern that U.S. Customs and Border Protection mentioned was avoiding having an unsecured overnight parking facility directly across the border in Mexico. The Mexican customs agency, Aduanas, provided much useful information about which agencies have jurisdictions over various aspects of the customs compound and access roads as well as the activities of trucks in the border crossing process. They emphasized the amount of congestion that routinely backs up into neighborhoods in Tijuana from the Otay Mesa crossing. They also illuminated the fact that any AI/TSE strategy needs to be a coordinated effort between many local and federal agencies, including Mexican Customs, U.S. Customs and Border Protection, local land use authorities, federal and state environmental agencies, and local traffic control agencies. No one agency has the necessary authority to implement AI/TSE on its own.

Trucking Associations and Companies. Trucking associations and companies focused on both the benefits and potential problems with an AI/TSE facility. They saw the benefits to drivers of reducing the need to creep idle at border crossings and instead have a resting environment and possibly amenities (e.g., restrooms). They also saw the benefits of reducing fuel costs and wear and tear on vehicles. Trucking representatives anticipated that shippers may see some benefits of potentially improving the predictability in crossing times (e.g., through an appointment system). These same stakeholders, however, cautioned that, to be viable, an AI/TSE solution must not increase crossing times for truck drivers, create new areas of congestion, or cost more

[11] The community of Otay Mesa is currently developing a master plan. The City of San Diego recently completed its plan.

to truckers and shippers than they save in fuel costs, reduced wear and tear on vehicles and more efficient logistics. Trucking representatives said that any substantial additional costs or operational changes required by AI/TSE would need to be acceptable to the shippers to whom trucking companies pass through costs and some logistics choices (e.g., whether to use a fee-based crossing or free crossing).

SUMMARY OF KEY FINDINGS

This section brings together the key findings of the project, drawing from insights provided by stakeholders and research into AI/TSE strategies.

1. The need for AI/TSE is driven by existing congestion at international POE's that causes trucks to idle for long periods of time as they seek to cross the border. Any strategies that either reduce idling time or reduce congestion are likely to produce air quality and other benefits. These strategies include AI/TSE, but are not limited to them (i.e., the same benefits may be accomplished by increasing the capacity or operational efficiencies of POE's to process trucks more quickly).

2. All stakeholders agree that the status quo at Otay Mesa and other ports with similar congestion problems is not optimal. There is much room for improvement, which would benefit:
    - Air quality, by reducing emissions;
    - Drivers, by reducing the need to creep idle at border crossings and instead have a resting environment and possibly amenities (e.g., restrooms) at AI/TSE facilities;
    - Trucking companies, to reduce fuel costs and wear and tear on vehicles, and to improve conditions for drivers;
    - Surrounding businesses and neighborhoods, to reduce congestion on local streets and improve local air quality;
    - Shippers, to potentially improve predictability in crossing times and possibly reduce costs; and
    - Shippers and customs officials, to alleviate persistent complaints about border wait times, congestion, and idling.

3. The important strategy is one that provides the opportunity for truck drivers to turn off their vehicles rather than idle; TSE technology is one anti-idling option, but electrification may not be necessary in all cases to discourage idling.

4. To be viable, an AI/TSE solution must:
    - Reduce idling time,
    - Not increase crossing times for truck drivers,
    - Avoid creating new areas of congestion,
    - Cost less for truckers and shippers than the potential savings in fuel costs, efficiencies, etc., and
    - Not reduce security.

5. The three most viable anti-idling strategies identified in this study (in order of complexity) are
    - *Traffic Controls on Existing Roadways (Strategy A)*, which uses traffic controls on existing roadways to process crossings in "batches" with vehicles stopped, engines turned off, and drivers waiting for a period of time while batches of vehicles cross the border and clear the roadway.

- *Mandatory AI/TSE Facility (Strategy B)*, which requires all vehicles accessing a POE to enter a parking area, turn off their engines, and wait for a signal to cross the border via an appointment system, or
- *Voluntary AI/TSE Facility (Strategy C)*, in which trucks accessing a POE have the option to enter a parking area, with an appointment system, TSE equipment, and amenities or use the traditional (congested) approach.

6. Key considerations to deciding 1) whether any AI/TSE approach is appropriate, 2) which type of approach is most appropriate, and 3) how to adapt a given option to a particular location are:
   - The amount of congestion and the length of wait times;
   - Land availability;
   - Local climate;
   - New infrastructure vs. retrofitting existing sites for AI/TSE; and
   - Cost and willingness to pay.

7. The most viable strategy for an AI/TSE facility in Mexico for northbound trucks at Otay Mesa is either: 1) a mandatory on-road approach that uses traffic controls to "batch" trucks through the port using the existing access road and lanes (Strategy A), or 2) a voluntary remote, off-site parking/TSE area that serves the port via a dedicated roadway (Strategy C). For Otay II, the most viable strategy is a mandatory on-site parking facility in Mexico to serve northbound vehicles (Strategy B).

8. The choices that truck drivers, trucking companies, and shippers make are vital to the success of AI/TSE strategies.

9. Any AI/TSE strategy needs to be a coordinated effort between many local and federal agencies: Mexican Customs, U.S. Customs and Border Protection, local land use authorities, federal and state environmental agencies, and local traffic control agencies. No one agency has the necessary authority to implement AI/TSE on its own.

10. Reasonable assumptions about wait times and utilization lead to a very preliminary mid-range estimate of over $3 million dollars in annual fuel and maintenance savings from an AI/TSE facility at a POE with Otay Mesa's traffic volume, congestion and hours of service. The facility would reduce 8,500 tons of CO_2 emissions, 3 tons of particular matter, and 114 tons of NO_x annually.

11. Similar preliminary estimates show that a 100 parking space AI/TSE facility would require 4 acres of land. Equipping each space with TSE equipment would cost between $650,000 and $1,800,000 depending on the type of technology employed. Such a facility would accommodate just under 1,000 trucks per day if each truck used the facility for 90 minutes for each crossing. A facility roughly three times larger would be necessary to accommodate the 3,000 trucks that use Otay Mesa each day.

RECOMMENDATIONS

Based on the key findings, the following actions are recommended:

Recommendation 1: All new POE's should consider strategies for reducing idling through infrastructure and border crossing processes in their planning. The BECC and NADBank should consider an evaluation of AI/TSE approaches as air emissions mitigation strategies. NADBank could leverage AI/TSE facilities through loans for new ports. Decisions not to have anti-idling should be justified by showing that approaches are not viable or that air quality benefits are not sufficient over the life of the facility.

Recommendation 2 : Existing POE's with congestion issues should evaluate options for retrofitting with anti-idling infrastructure and determine which model (with which adaptations) could work. Anti-idling retrofits will not be appropriate or feasible for all border crossings.

Recommendation 3 : For the Mexican side of the Otay Mesa border crossing, the U.S. and Mexico should jointly conduct a feasibility study to evaluate and compare the cost and effectiveness for: 1) a mandatory on-road AI approach that uses traffic controls to "batch" trucks through the port using the existing access road and lanes (Strategy A) and 2) a fee-based, voluntary, remote, off-site parking/TSE area that serves the port via a dedicated roadway (Strategy C). The study should involve extensive outreach with stakeholders, especially those in the trucking and shipping sectors to make sure that the strategy is consistent with patterns of drayage logistics at the POE.

Recommendation 4: For the Mexican side of the Otay II crossing, if congestion is predicted over the life of the facility, the project planning should include an AI/TSE facility that is incorporated into the port infrastructure so that all vehicles accessing the POE would use it (Strategy B). Otay II project planning should analyze options for using a portion of toll fees for the new port to cover the cost of the TSE facility. This facility should be evaluated as a possible staging area for access to the Otay Mesa POE as well, via a dedicated roadway.

FUTURE WORK

The following future work would help advance the understanding and deployment of AI/TSE at Otay Mesa and other POE's:

1. Hold additional discussions with stakeholders involved in AI/TSE strategies for Otay Mesa to better understand institutional jurisdictions and the feasibility of the recommended AI/TSE strategies. These stakeholders include: Mexico's Secretariat for Communications and Transportation, City of Tijuana (e.g. Sub Comite Binacional and local traffic enforcement) and the State of Baja California Secretariat of Infrastructure and Urban Development (SIDUE) and shippers/maquiladoras.

2. Further evaluate key aspects of the Otay Mesa and Otay II crossings, including:
    - What land is available for a dedicated AI/TSE parking area and the acquisition cost;
    - The length of the roadway needed to accommodate batching of trucks using existing roadways;
    - A more refined analysis of congestion and wait times that takes into account possible near-term congestion relief due to a new Otay II crossing and possible longer-term increases in commercial vehicle traffic at both POE's;
    - The impact on the viability of AI/TSE approaches if Otay II offers a service that guarantees a 30 minute crossing time; and
    - The demand impact on Otay II from an additional fee component to pay for the AI/TSE facility.

3. Evaluate other existing northbound and southbound truck and passenger vehicle border crossings for the need for, and viability of, AI/TSE strategies using consistent analytical approaches and/ or tools for evaluating when AI/TSE sites make sense, what type of AI/TSE strategy is most appropriate in a given location, and the costs and benefits of different approaches.

4. Evaluate existing and planned AI/TSE strategies at international POE's and elsewhere, including 1) the planned San Luis Rio Colorado Commercial POE's TSE facility and 2) the traffic controls at the U.S.-Canada Peace Arch passenger vehicle crossing. Other examples may be useful to monitor as well (e.g., using maglev technology to move trucks with their engines shut off through ports, as suggested by the Long Beach Port study, or the Universal Freight Shuttle concept developed by the Texas Transportation Institute[12]).

5. Develop more sophisticated approaches for quantifying potential emissions reductions from AI/TSE strategies at various levels of congestion and length of wait times, beginning with the Otay Mesa and Otay II crossings. These approaches should take into account the various emissions dynamics of creep idling, idling at a stand-still, starting and stopping, etc. The Texas Transportation Institute, for example, has done detailed analyses of emissions characteristics at POE's that could be used in such an analysis (Zietsman, et al, 2005).

6. Further analyze anti-idling options, including their staffing requirements and operations and maintenance costs.

7. Conduct outreach or educational campaigns with Mexican trucking and shipping companies and with drivers about anti-idling options that are available and their benefits.

8. Develop "model" approaches for deploying AI/TSE at new POE's.

9. Conduct pilot projects to test and evaluate AI/TSE strategies.

10. Share data and collaborate with global climate change planning efforts in both the U.S. and Mexico and incorporate the use of AI/TSE as a greenhouse gas and air pollution reduction strategy.

[12] For more information, see Steve Roop (undated), "Futuristic shuttle may transform freight transportation." Available: http://tti.tamu.edu/publications/researcher/newsletter.htm?vol=43&issue=4&article=8&year=2007

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APPENDIX A: STAKEHOLDER CONTACTS

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APPENDIX B: INFORMATION FROM TSE VENDORS

The model for a border crossing TSE draws on the experience of implementing similar technology and services in the U.S. This appendix summarizes information provided by TSE vendors on their technologies and costs. Information is current as of the time of interviews in the spring of 2008.

TSE Technology and Vendors

IdleAire

Formed in 2000, IdleAire operated approximately 131 TSE sites in 33 states at the time they were interviewed in the spring of 2008. It typically operates at existing travel plazas with staff on site to manage TSE operations. IdleAire has secured the sole right to establish TSE sites at certain travel plazas in California for fifteen years.

IdleAire provides a HVAC system consisting of a large, fixed overhead structure that runs the length of the TSE site. Each truck is provided with a window unit that supplies air conditioning and/or heating via a hose and a panel with electricity supply and connections for communications and entertainment.[13] Trucks must purchase a $10 adapter to secure the window unit to the cab's passenger window.

CabAire

CabAire had one operational TSE site in Connecticut with more under development in the spring of 2008. The company was working on a partnership with travel plaza concessionaire Marriott to begin providing TSE services at Connecticut travel plazas.

CabAire provides a HVAC system similar to IdleAire's, but it uses individual pedestals at each parking space rather than a large overhead structure. Each truck is provided with a window unit that supplies air conditioning and heating through hoses, electricity supply, and communications/entertainment connections. Due to the modularity of the pedestals, CabAire can install any configuration of spaces to optimize the available real-estate/ space constraints.

CabAire pedestals include sensors that detect whether or not trucks are idling. It has a system for monitoring the use of each pedestal and related emissions reductions. The system can be entirely automated and run off-site (people may need to be on-site initially to explain how the system works and help troubleshoot).

CabAire is part of a larger parent company that specializes in communications and monitoring technologies. In discussions for this paper, representatives described a number of ideas for incorporating such technology into a border crossing process. The parent company has experience working in Mexico.

Shorepower

Shorepower (formerly Shurepower) had five facilities in Oregon and Washington in the spring of 2008. Its focus area was the I-5 corridor. The company's business model is to have completely

[13] TSE operators typically contract directly with local utilities for power and communications technologies. None of the vendors were currently using alternative energy sources, although they were all open to the idea.

automated sites with no on-site staff. When truckers pull up to a site and want to plug in, they call an 800 number on their cell phones to get connected.

The company's system provides shorepower electrical and communications hook-ups. On-board technologies can range from an extension cord connected to an electric fan to a sophisticated built-in heating/air conditioning, communications, and entertainment system costing thousands of dollars.

Cost Comparison for TSE Technologies

Below is a table of current costs for installation and use of the systems offered by the three primary vendors based on TSE sites in the Unites States. The different types of systems have different implications for the distribution of costs between those providing the TSE infrastructure and the trucking companies using the services. Per space costs generally vary depending on the configuration and number of units installed. The vendors said they would consider a "per use" fee for service instead of a "per hour" fee for a POE TSE.

Table 2: Summary of TSE Technology Costs

	IdleAire	CabAire	Shorepower
Per space installation cost*	$16,000 - $20,000 50 space minimum	$10,000 (working to lower to $8,000) 10-20 space min.	$4,500 - $8,500 10-20 space min.
On-board truck technology cost	$10 window adapter	$0	Varies from $0 to $2000 depending on technology***
Fee for service	$1-2 per hour**	$1-2 per hour**	$0.75-1 per hour

*Total installation cost per space including system, communications, and parking lot and electrical improvements. Does not include administrative or operating costs.
** Cost for basic plug-in use (Internet access, movies, educational programming, etc. can cost extra).
***Trucks can use the service with only an extension cord hooked to an on-board electrical appliance (e.g., fan, heater, radio). Shorepower offers a basic hook-up kit called a Komfort Kit for $200. More extensive kits with additional services including on board heating and AC are offered up to $2,000.

Using Advanced Communications

Advanced communications could enhance the operations of a TSE by monitoring the site and reducing the need for on-site operational support and helping with a border crossing "appointment system.

Examples of communications solutions already in place (or being tested) for TSEs include:

- Reservation systems for drivers to allow trucks to call ahead and reserve a space rather than just relying on a "first-come, first-served" model;
- Automatically tracking use of TSE facilities and related emissions;
- Intercoms, communications screens, and cell phone technologies for communicating with drivers; and
- RFID technologies for, among other things, debiting usage fees through a credit account associated with each truck's RFID tag.

Advanced communications at a TSE site could be used in a variety of ways to streamline the border crossing and delivery process. For example, a TSE communication system could be used to send information about the presence of trucks waiting to cross the border, trucks' places in line, and estimated crossing times. It may even be possible to alert logistics companies or distribution centers of a truck's status in crossing the border.

Public vs. Private Financing of TSEs

TSE vendors differ in the extent to which they operate commercially or with public funds. IdleAire says that it has run mostly commercially (as has CabAire for its one site), while Shorepower has used government funding for a significant portion of its sites.

IdleAire says that more than 95% of its sites operate on purely commercial terms with revenue shared with travel plaza owners/operators. In cases where the travel plazas are publicly owned by states, revenues are shared with the state. For IdleAire's sites with some public investment, the company has had an 80/20 match through CMAQ funds and 50/50 matches through Texas state funding and EPA's Smartway Transport Partnership. These public funds have been used for marketing, purchase of window adapters for trucks, and to cover fee-for-service costs for first-time users.

All of Shorepower's current sites have been partially funded by outside resources including carbon offsets, Washington Department of Ecology grants, West Coast Collaborative grants, and Oregon business energy tax credits. Public funds have been used for a combination of 1) paying to lease space for the TSE, 2) subsidizing on-board technologies, and 3) reducing the per-hour fee. Shorepower has passed on some savings in infrastructure costs to truckers by providing free service for a month or two. Outside funding is also used to provide on-site marketing.

Personnel at California ARB said that all TSE facilities in California had some form of public funding, either covering some of the upfront costs of building the facility or providing a per-truck reimbursement to the vendor (Smith and Hawelti, personal communication). The most common approach, they said, was per-truck reimbursement for several years to pay off capital costs. Vendors also charged trucks a per hour rate directly.

TSE Vendor Business Models

TSE vendors described three basic business models:

1. Terminal model. In this model, the TSE vendor builds a site and turns it over to another company or facility to own and operate; the vendor may provide some limited ongoing maintenance and repair.
2. Travel plaza model. In this model, the TSE vendor builds and operates a site under a revenue-sharing agreement with the site owner/operator (often a travel plaza); land is generally leased from the travel plaza.
3. Owner/operator. In this model, the TSE vendor buys or leases land and builds and operates a TSE facility along with any other amenities (e.g., showers, restaurants, etc.) at a site.

Table 3 summarizes the three TSE vendors' experiences with these business models. Although none of the companies has adopted the owner/operator model, they all indicated they were open to considering it.

Table 3: TSE Vendor Business Model Experience

	Terminal	Travel Plaza	Owner/operator
IdleAire	yes	yes (preferred)	no
CabAire	yes (preferred)	no	no
Shorepower	yes	yes (preferred)	no