

Summary of result: November 17, 2005 Truck Rodeo

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1. The objectives for the truck rodeo are:

- a. To validate the geometric design of the intersection of 9th and Mercer for truck turn movements – westbound right turn and southbound left turn. The streets are to function as Major Truck Streets, and the design is intended to accommodate the movement of a street-legal (75 foot) truck. The design was based on computer turn simulation
- b. To review opportunities to enhance the design for truck movement and/or non-motorized movement
- c. To determine if proposed designs can actually accommodate a safe and smooth movement for trucks and other modes.

2. Design Intersection

Mercer and 9th Ave N, design as proposed in the Mercer Corridor Project, with bike lanes on 9th Ave N, sidewalks on both streets, and crosswalks across all approaches. While parking would generally be provided on Mercer Street, it will be restricted on the north and south sides of Mercer east of 9th Ave N. The intersection is designed based on industry standard vehicle turn simulation software using WB-67 as the design vehicle. See attached Figure 1 for dimension of the design.

3. Test Movement

- a. Westbound on Mercer right turn to northbound on 9th Ave N – Vehicles were directed to turn right from the curb lane on Mercer Street, if possible, and use as much of the space between the curb and centerline on 9th Ave N, including the bike lane, as needed.
- b. Southbound on 9th Ave N left turn on eastbound Mercer – Vehicles were directed to turn left from the outside left-turn lane, avoiding the cones representing the outside sweep of a second vehicle in the inside left-turn lane, and using as much of the remaining eastbound lanes on Mercer, including the *no parking zone*, as needed.

4. Methodology

- a. The field demonstration was held on the parking lot of the Port of Seattle's Terminal 90 and 91. The grade of the parking lot is generally flat and is similar to the terrain at Mercer and 9th Ave N.
- b. The proposed intersection design of 9th Ave N and Mercer Street was laid out using GPS technology with traffic marking tape (for lane lines, curb lines and cross-walk lines). Low height cones were placed to simulate curb lines and the right side sweep path of a Single Unit design vehicle turning left on the inside lane of 9th Ave N. The latter was done to verify that the design provides room for a WB-67 truck turning left from the outside left-turn lane, while a Single Unit truck is turning left from the inside lane. A bicycle was placed at the beginning of the bike lane on 9th Ave N north of Mercer Street. See attached Figure 2 for the layout.
- c. Test vehicles were mounted with GPS equipment and performed right and left turns through the intersection. The simulating scenarios were: stop and right turn, rolling right turn, stop and left turn and rolling left turn. The GPS equipment recorded vehicle tracking for both the front right and left of the tractor and the left and right of the rear axle of the trailer outside (overhang) dimensions. The GPS data was later analyzed and were plotted on the computer vehicle turn simulation worksheets.
- d. Observers took field notes and video to document any encroachment onto the lane lines and curb.
- e. Vehicle operators were asked to turn at a safe operating speed for rolling turns. They noted and reported the speed when performing rolling turns. Operators were interviewed and provided comments of the intersection design.

5. Test Vehicles

There were seven vehicles participating in the truck rodeo. Four of them with GPS equipment mounted. See the attached Table 1 for the truck dimensions.

6. Result

a. Test Vehicle A - Trident Seafood

Vehicle A was a WB-67 vehicle provided by Trident Seafood. GPS units were mounted on the front left and right bumper and the left and right side of the rear axle. The following runs were performed:

Run	Description	Result
1	Stop and Right turn	No Cones were hit GPS data shows that front of vehicle crossed the center-line of 9 th Ave N.
2	Stop and Right turn	No Cones were hit

		GPS data shows that front of vehicle crossed the center-line of 9 th Ave N.
3	Stop and Right turn	No Cones were hit GPS data shows that front of vehicle crossed the center-line of 9 th Ave N.
4	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks matched the computer turn simulation
5	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that front of vehicle crossed the center-line of 9 th Ave N.
6	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that front of vehicle crossed the center-line of 9 th Ave N.
7	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
8	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
9	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
10	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
11	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
12	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims

Summary of interview with Robu L Traipos (Vehicle operator)
 "Good intersection. Easy to drive. If we can make all intersection like this in Seattle, there will be no problem with any truck making that turn."

b. Test Vehicle B - Gordon Trucking

Vehicle B was about the same length as Vehicle A with a different axle arrangement. It had a wider sweep path. It was provided by Gordon Trucking Company. GPS units were mounted on the front center bumper and left and right of the rear axles. The following runs were performed:

Run	Description	Result
1	Stop and Right turn	No cones were hit
2	Rolling Right turn	No cones were hit Driver reported speed - 7 mph
3	Rolling Right turn	No cones were hit Driver reported speed - 10 mph
4	Rolling Right turn	No cones were hit Driver reported speed - 10 mph
5	Stop and Left turn	Cones simulating SU sweep path (inside left-turn path) were hit due to vehicle trying to avoid using the no parking area on the south side of Mercer. GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
6	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
7	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
8	Rolling Left turn	No cones were hit Driver reported speed - 12 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
9	Rolling Left turn	No cones were hit

		Driver reported speed – 13-14 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
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Summary of interview with Jeffrey Wold (Vehicle operator)

“When you go through the right turn, there is adequate room there, and I was able to go through with different speed and able to maintain lane control. Going through the left turn, when you do not use the “no parking zone”, I am not able to stay in my lane, the rear of my trailer tracks into the other lane. By having that no parking zone, I am able to go out farther into my turn and not cross over the other lane. So that is very helpful and keeps us from having to stop and let cars go or keeps accident from happening. I like this intersection very much.”

c. Test Vehicle C - Nelson Trucking

Vehicle C was a 96' long triple articulated flat bed truck provided by Nelson Trucking. GPS units were mounted on the left and right front bumper and the center of the rear axles and the center of the second last rear axles. The City of Seattle issues special or annual permits for this type of truck with restricted operating hours from 6 am to 9 am and from 3 pm to 7 pm. Other requirements may also apply, such as an escort vehicle. The following runs were performed:

Run	Description	Result
1	Stop and Right turn	No cones were hit GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer
2	Stop and Right turn	No cones were hit GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer
3	Rolling Right turn	No cones were hit Driver reported speed – 10 mph GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer
4	Rolling Right turn	No cones were hit Driver reported speed – 10 mph GPS data shows that vehicle tracks

		encroached to the adjacent through lanes on Mercer
5	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer.
6	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
7	Stop and Left turn	No cones were hit GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
8	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
9	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims
10	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims

Summary of interview with Tom Newell (Vehicle operator)

"Good intersection with lots of room both on the right turn and on left turn. Truck encroaches to my immediate lane, next to me when turning right. Left turn utilize the no parking zone. 10 mph turning speed is typical for operating speed for this type of intersection."

d. Test Vehicle D - Nelson Trucking

Vehicle D was an 89' long triple articulated flat bed truck provided by Nelson Trucking. GPS units were mounted on the front left and right bumper and left and right at the rear axles. The City of Seattle issues special or annual permits for this type of truck with restricted operating hours from 6 am to 9 am and from 3 pm to 7 pm. Other requirements may also apply, such as an escort vehicle. The following runs were performed:

Run	Description	Result
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1	Stop and Right turn	No cones were hit GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer and also southbound left turn lanes on 9 th Ave N.
2	Stop and Right turn	No cones were hit GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer and also southbound left turn lanes on 9 th Ave N and the bicycle lane.
3	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer and also southbound left turn lanes on 9 th Ave N.
4	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer and also southbound left turn lanes on 9 th Ave N.
5	Rolling Right turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to the adjacent through lanes on Mercer and the bicycle lane on 9 th Ave N.
6	Stop and Left turn	Cones simulated SU sweep path were hit. GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on Mercer Street
7	Stop and Left turn	Cones simulated SU sweep path were hit. GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on Mercer Street
8	Rolling Left turn	Cones simulated SU sweep path were hit. Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on

		Mercer Street
9	Rolling Left turn	Cones simulated SU sweep path were hit. Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on Mercer Street
10	Rolling Left turn	No cones were hit Driver reported speed - 10 mph GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on Mercer Street
11	Stop and Left turn	Cones simulated SU sweep path were hit. GPS data shows that vehicle tracks encroached to NB LT SU-turn sims and the parking area east of the no parking zone on Mercer Street

Summary of interview with Tom Newell (Vehicle operator)

"This run is a little bit difficult with this truck. I have to take up a quite little bit more lane, both on the right turn and the left turn. And on the left turn I could not... I think one time I make it without encroach into the inside left turn lane. I think only one time I didn't hit the cones there."

e. Fire Engine

The fire engine is similar to a single unit truck provided by City of Seattle Fire Department. No GPS units were mounted. The following runs performed:

- 1 Stop and Right turn
- 2 Rolling Right turn
- 3 Right turn simulating emergency response
- 4 Stop and Left turn
- 5 Rolling Left turn
- 6 Left turn simulating emergency response

No cones were hit on all runs.

Summary of interview with Lt. A.J. Gamino (Vehicle operator)
 "Works fine! Plenty of clearance for this rig and for this intersection.
 Pretty Good layout for responding as well."

f. Charlie's Produce

This is a single articulated truck and is 65' long, provided by Charlie's produce. No GPS units were mounted. The following runs performed:

- 1 Rolling Right turn
- 2 Rolling Left turn
- 3 Stop and Right turn
- 4 Stop and Left turn

No cones were hit on all runs.

Summary of interview with Dean Peterson (Vehicle operator)
 "From this vehicle, there was plenty of room. There is no problem leaving a couple of feet at the back of trailer, the front I took as wide as I could. I thought that was good layout, I use all the space available and it turns out really well. Left turn is actually easier than the right turn. In this situation I have plenty of room turning left."

g. Seattle City Ice

This is a single articulated truck and is about 55' long, provided by Seattle City Ice. No GPS units were mounted. The following runs performed:

- 1 Stop and Right turn
- 2 Rolling Right turn
- 3 Stop and Left turn
- 4 Rolling Left turn

No cones were hit on all runs.

Summary of interview with Raphael (Vehicle operator)
 "It is pretty good, we have plenty of space. I don't see there should be any problem at all. Both side we have lots of clearance and good speed. I don't think we have any problems at all. 10 to 13 mph for rolling and is a typical speed for this type of intersection."

7. Conclusions

- a. The field tests verified the design layout and the turn simulation software used in the design. Note: the intersection was designed to accommodate a WB-67 vehicle (Test Vehicles A and B).
- b. Test Vehicle A was on or across the center line of 9th Ave N for most right turns, but it appeared to have enough room on the inside of the turn. After observing this, cones were placed on the center line. Test Vehicle B did not cross this line. The cones appear to have made the driver more aware of the center line location, similar to the situation with a vehicle present in the southbound lane of 9th Ave N.
- c. For the southbound left turn, the test vehicles encroached on the (design-simulated) path for a northbound left-turning vehicle (This path was not marked in the field test). Based on our analysis of the GPS tracking data, the test vehicles would have been able to avoid the northbound left-turn track if it had been laid out in the field.
- d. The GPS tracking output was affirmatively verified with field observations and review of video footage.
- e. All vehicles used the *no parking zone* along the south side of Mercer Street for the left turn. The *no parking zone* allows a WB-67 vehicle to make the left turn from the outside left turn lane at the same time that a Single Unit truck is turning left from the inside lane.
- f. Test Vehicle C and D were able to navigate through the intersection in both directions, but this required utilization of additional westbound lanes on Mercer and crossing the center line on 9th Ave N for some right turns. This is acceptable for these vehicles. They represent over-size vehicles and require special or annual permits, along with other restrictions.
- g. Test Vehicle D encroached into the *parking zone* on the south side of Mercer Street further east of 9th Ave N. Test Vehicle D could have utilized the southbound through lane on 9th Ave. N and/or the southbound inside left turn lane on 9th Ave N. to make the left turn without encroaching on the *parking zone* on Mercer Street. Test Vehicle D is not the design vehicle for this movement.

8. Recommendations:

- a. Modify the crosswalk and median design to improve the left turn maneuver. Further design analysis will review the layout of the north and south sidewalks on each side of intersection. It is anticipated that both crosswalks will be adjusted further from the intersection to achieve these goals. This will:
 - Provide additional separation between the two left-turning vehicles.

- Provide greater separation between the northbound and southbound left-turning paths.
- b. Include appropriate signage and pavement markings to delineate the *no parking zone* on the south side of Mercer near 9th Ave N.

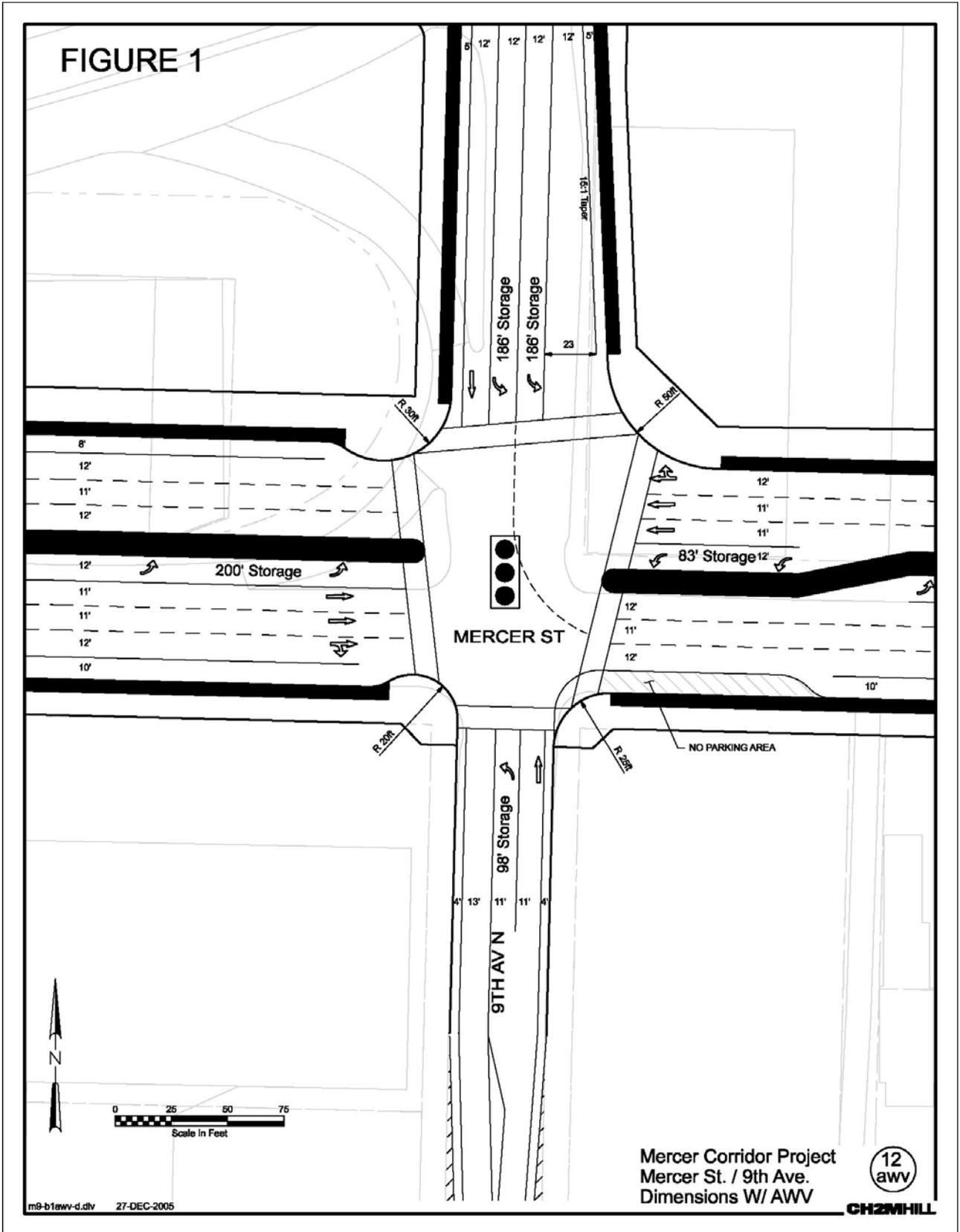
Table 1: List and information of Test Vehicles

 <p>A white semi-truck with a long trailer. The trailer has the Trident logo and the slogan "From the Source to the Plate".</p>	<p>Test Vehicle A Provider: Trident Seafood Length: 73.5' Wheel-base: 19.5' - 43.5' No. of Axles: 5 Legal/Overlegal: Legal GPS Equipment Mounted?: Yes</p>
 <p>A blue semi-truck with a white trailer. The trailer features the WSP logo and the slogan "PROMOTE HIGHWAY SAFETY".</p>	<p>Test Vehicle B Provider: Gordon Trucking Length: 72.5' Wheel-base: 20.5' - 45' No. of Axles: 7 Legal/Overlegal: Legal GPS Equipment Mounted?: Yes</p>
 <p>A white semi-truck with a yellow sign on the roof that reads "OVERSIZE LOAD". Two people are standing near the front of the truck.</p>	<p>Test Vehicle C Provider: Nelson Trucking Length: 96' Wheel-base: 19' - 18' - 33' - 18' No. of Axles: 9 Legal/Overlegal: Overlegal GPS Equipment Mounted?: Yes</p>
 <p>A white semi-truck pulling a long trailer. The trailer is carrying a large piece of equipment.</p>	<p>Test Vehicle D Provider: Nelson Trucking Length: 89' Wheel-base: 19' - 62' No. of Axles: 5 Legal/Overlegal: Overlegal GPS Equipment Mounted?: Yes</p>

Table 1: List and information of Test Vehicles (Continue)

	<p>Fire Engine Provider: City of Seattle' No. of Axles: 3 Legal/Overlegal: Legal GPS Equipment Mounted?: No</p>
	<p>Charlie's Produce Provider: Charlie's Produce Length: 65' No. of Axles: 5 Legal/Overlegal: Legal GPS Equipment Mounted?: No</p>
	<p>Seattle City Ice Provider: Charlie's Produce Length: 55' No. of Axles: 4 Legal/Overlegal: Legal GPS Equipment Mounted?: No</p>

Figure 1: Dimension of Designed Intersection (Mercer Street & 9th Ave N)



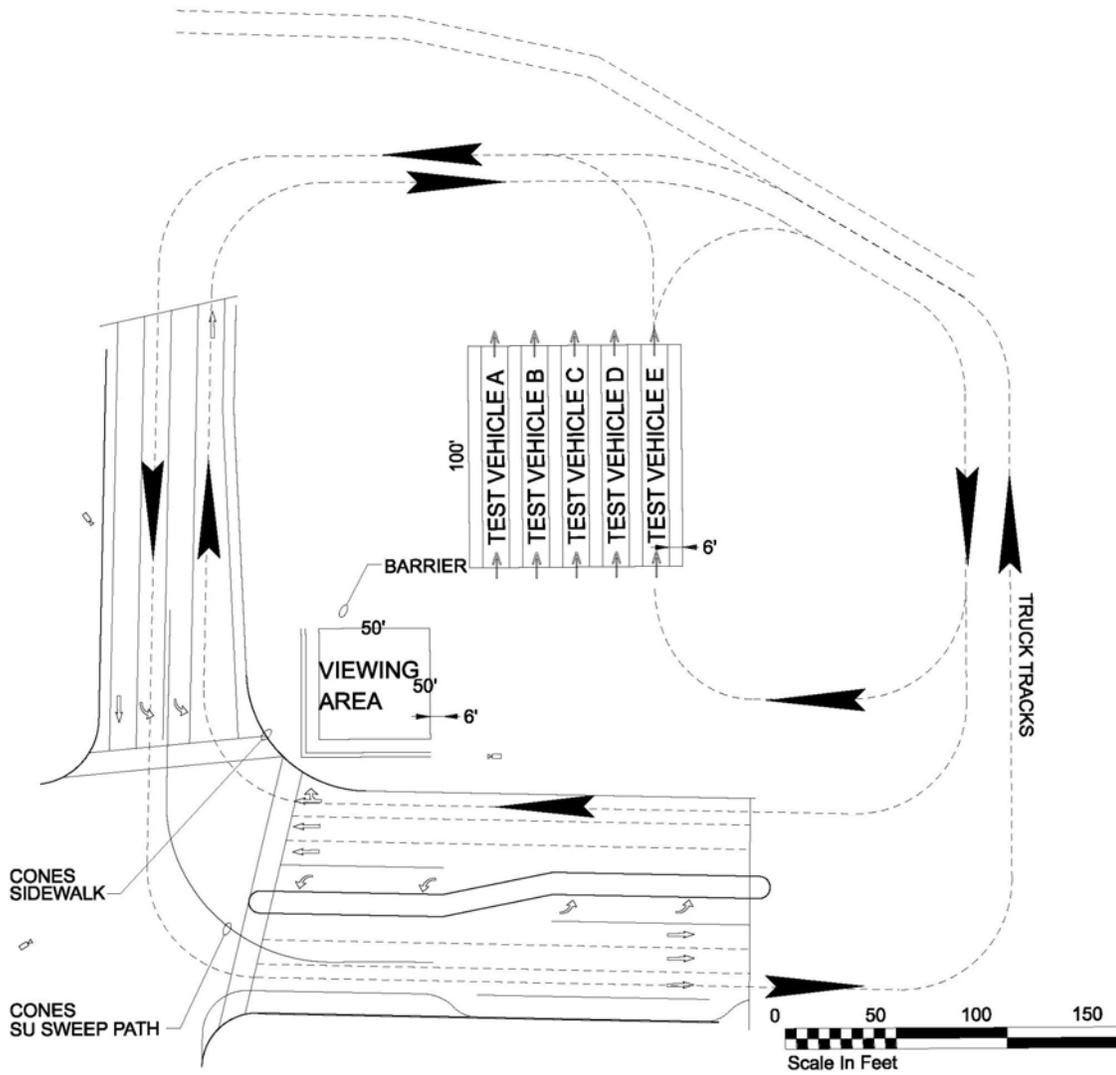


Figure 2: Truck Rodeo Layout