



CPSC Staff's Statement on Westat, Inc.'s Report, "Observational Field Study of Seat Belt Use by Drivers and Passengers in Recreational Off-Highway Vehicles"¹

July 2015

The report titled, "Observational Field Study of Seat Belt Use by Drivers and Passengers in Recreational Off-Highway Vehicles," presents the findings of observational studies conducted by Westat, Inc., under Contract CPSC-D-12-0002, Task Order 0003. Westat conducted the observational studies to provide empirical data on front occupant seat belt use patterns in recreational off-highway vehicles ("ROVs"). Specifically, the study's primary objective was to determine whether the front seat passenger's seat belt use is closely associated with the ROV driver's seat belt use. In addition, the study noted helmet use of ROV occupants because it was easy to determine during observations.

Westat used naturalistic observational methods to study seat belt use of ROV occupants at locations in Ocotillo Wells State Vehicular Recreation Area (California), Imperial Sand Dunes Recreation Area (California) and at locations in and around Ocala National Forest (Florida). Two teams of two researchers observed ROVs on trails, in open riding areas, at trail heads and staging locations, and in campgrounds connected to recreational riding areas. At the California sites, one team of researchers made observations from an ROV, and the second team made observations from an SUV. In Florida, both teams of researchers made observations from SUVs. The SUVs afforded a higher viewpoint than the ROV, which was advantageous for determining seat belt use in passing ROVs. In California, particularly at sites within Imperial Dunes, there were many areas with soft sand that were inaccessible by SUV but were accessible to researchers in the ROV.

The primary research question answered by this study was whether ROV passenger seat belt use is closely tied to seat belt use by the ROV driver. If so, then any strategy that successfully increases seat belt use by the ROV driver may have safety benefits for ROV passengers as well. One hypothesis is that the ROV driver is effectively the "Captain of the Ship," and, as such, influences the passenger's decision about whether to use a seat belt. A testable prediction based on this hypothesis is that there is a very close, positive association between seat belt use by ROV drivers and ROV passengers. Based on all of the observations made in this study, Westat found this prediction to be true. Combining data across both states, the correlation between seat belt use by drivers and their passengers was strong and statistically significant. When the ROV driver was wearing a seat belt, the probability of the passenger wearing a seat belt was 94 percent. Even when accounting for the large differences in seat belt use between states, statistical modeling showed that the driver's seat belt use was a significant predictor of the passenger's seat belt use. These findings are consistent with the "Captain of the Ship" hypothesis.

¹ This statement was prepared by the CPSC staff, and the attached report was produced by Westat for CPSC staff. The statement and report have not been reviewed or approved by, and do not necessarily represent the views of, the Commission.

Contract # CPSC-D-12-0002

Observational Field Study of Seat Belt Use by Drivers and Passengers in Recreational Off-Highway Vehicles

Final Report



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1.1 Background

Recreational Off-highway Vehicles (ROVs) are motorized vehicles designed for off-highway use. These vehicles are characterized by having four or more pneumatic tires designed for off-highway use, bench or bucket seats for two or more occupants, automotive-type controls for steering, throttle, and braking, and a maximum vehicle speed that exceeds 30 miles per hour (mph). Although these vehicles lack the protection of a closed environment and other safety features, such as airbags, that are common in traditional on-road passenger vehicles, ROVs are equipped with rollover protective structures (ROPS), seat belts, and other restraints such as doors, nets, and shoulder barriers to protect vehicle occupants.

Although ROVs and All-Terrain Vehicles (ATVs) are similar in that both are motorized vehicles designed for utility and recreational purposes off-highway, ROVs differ significantly from ATVs in their overall vehicle design. ROVs have a steering wheel rather than a handle bar, foot pedals instead of hand levers for throttle and brake control, and bench or bucket seats rather than seating that requires the occupant(s) to straddle over top. Most notably, ROVs only require steering wheel input from the driver to direct the vehicle. Conversely, ATVs require riders to use both their hands and body to direct the vehicles and maintain the ATV's pitch and lateral stability.

Based on incident data, CPSC staff believes that ROV rollover and occupant ejection is a dominant hazard pattern that has potential for improvement (CPSC September 24, 2014 Briefing Package). Occupant restraint systems are designed to mitigate the effects of such incidents by preventing occupant ejection, impact with vehicle surfaces, and impact with the ground or environmental objects. Although occupants are encouraged to use seat belts and helmets, these safety features require an intentional act on the part of the user.

As of April 5, 2013, CPSC staff cited 550 reported ROV-related incidents that occurred between January 1, 2003 and April 5, 2013; of these there were 335 reported fatalities and 506 reported injuries related to the incidents (CPSC September 24, 2014 Briefing Package). Information from fatality and injury cases indicates that full or partial ejection is common and most victims are not

wearing seat belts at the time of the incident. Seat belt use rates and seat belt types used by ROV users are unknown, but the injury and fatality cases suggest the need for improved belt use rates.

CPSC has received public comments and obtained data from focus groups which suggests that the ROV driver often acts as “Captain of the Ship,” meaning that he or she explicitly or implicitly influences the seat belt use of passengers. If this is true, ensuring that ROV drivers wear a seatbelt may serve as a catalyst for seat belt use by all ROV occupants, including passengers. Additional empirical data are needed to support or refute this point. An observational study of seat belt use by ROV drivers and passengers could determine whether ROV driver and passenger seat belt use is, in fact, closely associated as predicted by the “Captain of the Ship” hypothesis. If many cases are observed with drivers buckled, but passengers unbuckled, this would be evidence against the “Captain of the Ship” hypothesis and would suggest a need to separately motivate ROV drivers and passengers to wear seat belts. One way to do this may be to implement speed limiter technology that is tied to both the passenger’s seat belt and the driver’s seat belt.

1.2 Objectives

The objective of this study is to provide CPSC with empirical data with regard to ROV restraint system requirements related to seat belt speed limiter technology. In particular, it is necessary to consider the potential safety benefits of a seat belt speed limiter that is tied to the driver’s seat only or to both the driver’s seat and front passenger’s seat. In order to accomplish this, CPSC must understand the seat belt use patterns of ROV occupants. What are the seat belt use rates for ROV drivers and passengers? It is especially important to determine if the front seat passenger’s seat belt use is closely associated with (predicted by) the driver’s seat belt use.

In contrast to ROV seat belt use, seat belt use rates for occupants of passenger vehicles in the U.S. are determined annually by the National Highway Traffic Safety Administration. The national estimate for seat belt use for vehicle occupants traveling on public roadways was 87 percent in 2014 (Pickrell & Choi, 2015). This is based on results from the National Occupant Protection Use Survey (NOPUS), which relies on field observations of drivers and passengers. The objectives of the present study on seat belt use by ROV occupants also were addressed by making field observations, although, unlike NOPUS, obtaining a nationally representative sample of ROV users was not feasible given the resources available for this project.

2.1 Study Design

This study was conducted using naturalistic observational methods. Observations of moving ROVs were made in California and Florida at heavily used riding locations. Teams of experienced researchers observed seat belt use of ROV occupants on trails, in open riding areas, at trail heads and staging locations, and in campgrounds connected to recreational riding areas. Researchers did not interact with ROV users. Seat belt use and seat belt type were recorded for the driver and for the outboard front seat passenger, if present. Helmet use was easy to determine during the observations so researchers recorded that data as well. When possible, other characteristics of ROV occupants (approximate age, gender) and the ROV configuration (2, 3, 4, 6 seats; utility bed) were also recorded.

2.2 Observation Locations

During three weekends in March and April, 2015, observations of moving ROVs were made between the hours of 9 am and 4 pm at various locations within Ocotillo Wells State Vehicular Recreation Area (California), Imperial Sand Dunes Recreation Area (California) and at locations in and around Ocala National Forest (Florida), including a private riding park for off-highway vehicles. Study locations and observation dates were chosen to maximize the number of ROV observations that could be obtained with the resources available for the project. Geographic regions of the U.S. with warm weather during the early Spring were selected with the expectation that more people would be riding off-road vehicles during mild weather. Another consideration for the choice of observation sites was to include a variety of terrain and riding conditions. Finally, it should be noted that locations and observation times were chosen to capture planned, recreational use of ROVs. ROV users observed in this study transported their ROV to the riding locations on a trailer or inside a truck or large recreational vehicle (RV). Some arrived in the morning and left in the late afternoon and others camped overnight.

2.2.1 Ocotillo Wells, California

Ocotillo Wells State Vehicular Recreation Area (SVRA) is a desert riding area about 2 hours east of San Diego. Observations were conducted throughout the south and central sections of this area off of California State Route 78, but no observations were made in the “Badlands” region in the northern section of the SVRA. The areas observed have a variety of groomed, hard packed, and sandy roads. Major trails through this area vary in width, but may be as much as 50 feet wide. They are mostly flat and level, with miles between points of interest. On the major trails some ROVs traveled at estimated speeds of 40 mph or more. Other trails require greater technical skills to navigate washes and ravines, and they also require keen attention to spot other drivers who may be approaching from other directions. There are some dune areas, small mesas and hills, and some trails that are much like ski moguls in character. In general, the major trails afford relatively long stretches of high-speed travel with good sight distance, leading to more technical riding near hills and other geological features with more limited sight distance due to curves and hills on the trails. Figure 2-1 provides a typical view of the surrounding terrain from the top of a hill.



Figure 2-1. View of Ocotillo Wells State Vehicular Recreation Area

2.2.2 Imperial Sand Dunes, California

Imperial Sand Dunes Recreation Area is a vast area of sand dunes in southern California that is open for travel by off-highway vehicles. There are no marked trails. Observations of ROVs were conducted outside of camping areas on Gecko Road, California State Route 78, and Wash Road, and throughout the interior dunes area bounded by these roads. As seen in Figure 2-2, most of this area is loose sand. The size and steepness of the dunes varies across the area. Sight distances are limited

when traveling through the dunes, and the terrain is uniformly colored, making it difficult to judge vertical curvature and slope angles. Also, there are many seemingly randomly distributed razor-back dunes that have a gradual, easily climbable slope on one side and a hazardous, steep drop-off on the other side. Some of the drop-offs are 30 feet deep. These drop-offs may not be visible to an approaching driver until the ROV is only a few feet away. Another hazard when riding on the dunes is the possibility of colliding with other off-highway vehicles. Nearly all vehicles observed had tall flags attached to enhance their visibility. These are required for ROVs at this location. ROVs observed on the dunes generally, but not always, traveled slowly in areas with limited sight distance.



Figure 2-2. Imperial Sand Dunes Recreation Area

2.2.3 Ocala National Forest Region, Florida

Although the terrain is generally flat, challenges of driving an ROV in the Ocala National Forest (ONF) region of Florida include limited sight distance due to vegetation along the sides of narrow trails and curves. Trails are mostly sandy, but mud and pools of standing water from frequent and heavy rain storms are also a feature of the terrain. ROV drivers may encounter fallen trees or other debris blocking trails after storms pass. Figure 2-3 and Figure 2-4 show typical riding areas within ONF.

Observations of ROVs were conducted at trailheads throughout the North OHV Trails section of the forest and at the Delancy Westat Campground. Other observations were made along Route 160 on the western edge of the forest, and in a private off-highway riding facility north of the forest (Figure 2-5).



Figure 2-3. Mixed-Use Trail for Off-Highway Vehicles, Ocala National Forest



Figure 2-4. Open Section of Trail, Ocala National Forest



Figure 2-5. Trail Entrance at Private Off-Highway Vehicle Park

2.3 Observation Methods

Two teams of two researchers observed ROVs on trails, in open riding areas, at trail heads and staging locations, and in campgrounds connected to recreational riding areas. At the California sites, one team of researchers made observations from an ROV and the second team made observations from an SUV. In Florida, both teams of researchers made observations from SUVs. The SUVs afforded a higher viewpoint than an ROV, which was advantageous for determining seat belt use in passing ROVs. In California, particularly at sites within Imperial Dunes, there were many areas with soft sand that were inaccessible by SUV but accessible to researchers in an ROV.

The off-highway riding areas visited for this study are expansive and at some sites ROVs were sparsely distributed. Researchers used a variety of techniques to observe ROVs. In some cases, popular trailheads were identified and researchers could remain parked at these locations to observe ROVs entering or exiting the trail. In other cases, such as on open terrain, ROVs were first spotted in the distance and then researchers maneuvered their own SUV or ROV into a closer position where seat belt use could be determined. Occasionally, binoculars were used by researchers to determine seat belt use at distances up to 80 yards, but the vast majority of observations were made without binoculars within 20 yards.

Two-person observation teams consisted of a spotter and a recorder. The spotter verbally reported seat belt use, helmet use, and other data elements for the ROV driver and passenger while the recorder marked this information on a pre-printed paper form (Figure 2-6). The use of spotter and

recorder teams parallels observational methods used for national studies of passenger vehicle occupant seat belt use (Pickrell & Liu, 2015). The time of the observation and location were also recorded on the page. Note that rare observations of 2-point (lap belt only) seat belts were not anticipated prior to starting the study. When encountered, these cases were recorded using the notes section. Also, rarely, ROVs with three bucket seats (Yamaha Viking) were observed. These were recorded in the notes sections. “DK” was marked for cases where the data element could not be determined. Also, a separate tally was kept of the number of moving off-road vehicles encountered by type of vehicle (ATVs, sand rails, motorcycles, etc.) to provide an indication of the relative numbers of ROVs present in the observation sites. These counts are given in Appendix A.

ROV TYPE 2-seat 4-seat > 4-seat	
UTILITY BED Y N	
DRIVER	FRONT PASSENGER Y N
Belt Use N 3-pt 4-pt DK	Belt Use N 3-pt 4-pt DK
Helmet Use Y N DK	Helmet Use Y N DK
Gender M F DK	Gender M F DK
Age <13 13-30 31-50 >50 DK	Age <13 13-30 31-50 >50 DK
NOTES:	

Figure 2-6. Section of Data Collection Form Corresponding to One ROV Observation

Care was taken to avoid duplicate observations. At each site, the two observation teams worked in widely separated areas and coordinated their movements to cover different trails, camping areas, etc. Researchers did not record any observation for an ROV that they remembered seeing earlier on the same day; however, it is possible that some observations made by one team at one location and time may have duplicated observations made by the other team at another location and time. It is also possible that some ROVs observed on one day were observed a second time, on the following day. Such observations are not strictly independent. However, researchers noted that a particular ROV

does not always have the same set of occupants when seen at different times. In the recreational settings observed, family members and groups of friends sometimes shared the use of ROVs. For the statistical analyses reported here, we have assumed that the ROV observations were independent.

3.1 Seat Belt Use

A total of 460 observations of ROVs were collected in this study. Table 3-1 shows the number of ROV observations obtained by state. A greater number of ROV observations was obtained in Florida, primarily due to the large number of ROVs observed in a private off-road vehicle park. Although the types of riding facilities visited in the two states differed (Federal, State, and private lands), the percentage of observed ROVs with a front seat passenger present was nearly identical in California and Florida, suggesting that this value may be typical for recreational, weekend use.

Table 3-1. ROV Observations by State

State	Total ROVs	ROVs with Driver Only	ROVs with Passengers	Percentage of ROVs with Passengers
California	102	33	69	67.6%
Florida	358	116	242	67.6%
Total	460	149	311	67.6%

3.1.1 Seat Belt Use Rates

Chi-square tests of independence were used to examine seat belt use (and non-use) as related to California sites versus Florida sites and to drivers versus passengers. A total of 21 observations where belt use was not determined were excluded from these analyses. As shown in Table 3-2 and Table 3-3, ROV occupants at the California sites were much more likely than ROV occupants at the Florida sites to use a seat belt. The differences observed in seat belt use rates between the two were statistically significant for both ROV drivers ($\chi^2(1) = 217.2, p < 0.0001$) and for ROV passengers ($\chi^2(1) = 180.6, p < 0.0001$). Also, among those occupants who did wear seat belts, researchers noticed that those in California were more likely than those in Florida to wear a harness with at least four attachment points as opposed to a 3-point shoulder belt or 2-point lap belt. Very few 4-point seat belts were observed in Florida.

Table 3-2. ROV Seat Belt Counts for Drivers and Passengers by Seat Belt Type and by State

	Drivers (n = 450)		Passengers (n = 300)	
	California	Florida	California	Florida
Total Belts in Use	75	25	62	24
<i>4-Point Harness</i>	32	2	23	1
<i>3-Point Shoulder Belt</i>	41	23	36	22
<i>2-Point Lap Belt Only</i>	2	0	3	1
No Belt Use	22	328	3	211
Total Observations	97	353	65	235

In Tables 3-3 and 3-4 seat belt use rates are provided by state for ROV drivers and passengers.

- In California, passengers had a higher seat belt use rate (95.3%) than drivers (77.3%) and this difference was statistically significant ($\chi^2(1) = 9.73, p < 0.01$). In Florida, the difference between driver seat belt use rates for drivers (7.1%) and passengers (10.3%) was not statistically significant ($\chi^2(1) = 1.81, p = 0.18$).
- In California, drivers with passengers had higher seat belt use rates (86.4%) than drivers with no passengers (58.1%). This difference was statistically significant ($\chi^2(1) = 9.63, p < 0.01$). In Florida, the difference in seat belt use rates for drivers with and without passengers was not statistically significant ($\chi^2(1) = 1.93, p = 0.16$).
- In both states, young passengers (less than 13 years old) appear to be more likely than older passengers to be wearing seat belts. However, estimating passenger age was difficult in both states. Helmet use in California was common and this made it particularly difficult to estimate a passenger's age. Passenger age estimates were not determined for 65% of passengers observed in California and 35% of passengers observed in Florida. Thus, the passenger seat belt use rates by age given Table 3-4 are based on small number of observations. For example, rates for California are based on observations of only 9 young children and 27 older passengers. The small number of observations of young children in each state was not sufficient to support valid statistical comparisons between seat belt use rates for young children and older passengers within states. However, if data are combined across the two states, the seat belt usage rate observed for young passengers in the study (46.7%) is significantly different than the seat belt use rate observed for older passengers (15.3%), ($\chi^2(1) = 22.48, p < 0.0001$).

Table 3-3. Observed Seat Belt Use Rates for ROV Drivers

	All Drivers	Drivers with no Passengers	Drivers with Passengers
California Sites	77.3% (75/97)	58.1% (18/31)	86.4% (57/66)
Florida Sites	7.1% (25/353)	4.3% (5/115)	8.4% (20/238)
All Sites	22.2% (100/450)	15.8% (23/146)	25.3% (77/304)

Table 3-4. Observed Seat Belt Use Rates for ROV Passengers

	All Passengers	Passengers Est. Age <13 years	Passengers Est. Age ≥13 years
California Sites	95.3% (61/64)	100% (9/9)	88.9% (24/27)
Florida Sites	10.3% (24/234)	33.3% (12/36)	5.1% (10/195)
All Sites	20.6% (85/298)	46.7% (21/45)	15.3% (34/222)

3.1.1 Relation Between Driver and Passenger Seat Belt Use

Across both states, a total of 298 observations were obtained in which an ROV passenger was present and both the seat belt use of the ROV driver and ROV passenger were determined. Table 3-5 shows how these observations were distributed by seat belt status of the driver and passenger. The correlation between driver and passenger seat belt use is strong and statistically significant ($\phi = .824$, $p < 0.0001$). This indicates an overall tendency for seat belt use to be the same for the driver and the passenger.

Table 3-5. Counts of ROV Drivers and Passengers Using Seat Belts

Driver Belted?	Passenger Belted?		
	No	Yes	Total
No	209	17	226
Yes	4	68	72
Total	213	85	298

For cases where ROV drivers were wearing a seat belt, the seat belt use rate for their passengers was high ($68/72 = 94.4\%$). Conversely, for cases where ROV passengers were wearing a seat belt, the belt use rate for their drivers was somewhat lower ($68/85 = 80.0\%$). This difference reflects the lower overall seat belt use rate for the drivers ($72/298 = 24.2\%$) as compared to their passengers ($85/298 = 28.5\%$).

Table 3-6 shows how observed passenger seat belt rates vary between cases where the driver was belted or unbelted. These passenger seat belt use rates are shown separately for California and Florida. Also, passenger seat belt use rates are shown for observations combined across both states

and across belted and unbelted drivers. In Florida as well as in California, passenger seat belt usage was higher when the ROV driver was belted. Some caution is warranted when interpreting the rates in Table 3-6 due to the small numbers of observations. In particular, the seat belt use rate for passengers with unbelted drivers in California is based on only 9 observations and the rate with belted drivers in Florida is based on only 17 observations.

Table 3-6. Passenger Seat Belt Use Rates by State and by Driver Seat Belt Use

State	Driver		
	Belted	Unbelted	Both
California Sites	100% (55/55)	66.7% (6/9)	95.3% (61/64)
Florida Sites	76.5% (13/17)	5.1% (11/217)	10.3% (24/234)
All Sites	94.4% (68/72)	7.5% (17/226)	28.5% (85/298)

A primary research question in this study was whether passenger seat belt use may be predicted by the driver's seat belt use. Based on the set of observations made in this study, the answer is yes. To answer this question, a logistic regression model was fit to the observational data using the GENMOD procedure within SAS 9.3 statistical software. The outcome variable was passenger seatbelt use (Yes, No). The primary predictor variable of interest was driver seat belt use (Yes, No). However, to control for the different rates of seat belt use between the states, the state (CA or FL) was added as a second predictor variable. A total of 298 ROV observations with passengers were included in this analysis. Table 3-7 shows the maximum likelihood parameter estimates for modeling the probability that the passenger was wearing a seat belt. Both State and Driver Belt use are statistically significant parameters in the model ($p < 0.0001$ for each parameter estimate). The positive values of the estimates for State = "CA" and Driver Belted = "Yes" may be interpreted as follows: Within the set of observations made for this study, passengers observed in California were more likely than passengers in Florida to be wearing a seat belt, and when controlling for the (large) observed difference between states in seat belt use, passengers were more likely to be wearing a seat belt in cases where their driver was wearing a seat belt, and they were less likely to be wearing a seat belt in cases where their driver was not wearing a seat belt.

Table 3-7. Statistical Modeling of ROV Passengers Seat belt Use.

Parameter	DF	Estimate	Standard Error	Likelihood Ratio	95% Confidence Limits	Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.9619	0.3101	-3.6310	-2.4038	91.24	<0.0001
State	CA	3.8245	0.7296	2.4925	5.4323	27.48	<0.0001
	FL	0	0	0	0	NA	
Driver Belted	Yes	4.2513	0.6299	3.1041	5.6204	45.56	<0.0001
	No	0	0	0	0	NA	

3.1.2 Seat Belt Use in Camp and on Trails

Another research question was whether ROV seat belt use depends on the purpose of the trip, such as transportation within a campsite or staging area, as compared to recreational riding on trails or open terrain. To address this question, observations were classified based on their location as either “Camp” or “Trail.” For this analysis, camp locations include riding inside camp grounds, within staging areas, near bathroom facilities, a camp store, etc. Trail locations include entering or leaving trails, riding on trails, or out in open terrain. Some of the ROV observations could not be classified in this way because they were missing precise location information. Chi-Square tests of association were used to determine whether the observed differences in seat belt use between Camp and Trail locations were statistically significant.

As shown in Table 3-8, in California the proportion of ROV drivers who were belted was significantly different in Camp and Trail locations ($\chi^2(1) = 7.94, p < 0.01$). ROV drivers observed on Trails were more likely to be belted than were drivers observed in Camp.

Table 3-8. ROV Drivers’ Seat Belt Use in California

	Belted	Unbelted	Total
Camp	29 (64.4%)	16 (35.6%)	45
Trail	46 (88.5%)	6 (11.5%)	52
Total	75 (77.3%)	22 (22.7%)	97

The proportion of ROV passengers who were belted in California is very high overall (Table 3-9) and appears to be slightly higher on Trails than in Camp. However, the very low number of unbelted observations resulted in a distribution of observations across cells does not satisfy a key requirement (expected values > 5) for conducting the Chi-Square test.

Table 3-9. ROV Passengers’ Seat Belt Use in California.

	Belted	Unbelted	Total
Camp	29 (90.6%)	3 (9.4%)	32
Trail	33 (100%)	0 (0.0%)	33
Total	62 (95.4%)	3 (4.6%)	65

Table 3-10 shows the counts of belted and unbelted ROV drivers observed on Trails and Camp locations in Florida. The proportion of ROV drivers who were belted was not significantly different in Camp as compared to Trail locations ($\chi^2(1) = 0.08, p = 0.78$). Also, the proportion of ROV

passengers who were belted (Table 3-11) was not significantly different between Camp and Trail locations ($\chi^2(1) = 0.90, p = 0.34$).

Table 3-10. ROV Drivers' Seat Belt Use in Florida.

	Belted	Unbelted	Total
Camp	14 (7.6%)	171 (92.4%)	185
Trail	11 (6.8%)	151 (93.2%)	162
Total	25 (7.2%)	322 (92.8%)	347

Table 3-11. ROV Passengers' Seat Belt Use in Florida.

	Belted	Unbelted	Total
Camp	13 (12.5%)	91 (87.5%)	104
Trail	11 (8.7%)	116 (91.3%)	127
Total	24 (10.4%)	207 (89.6%)	231

3.2 Helmet Use

Although the primary objective of the study was to determine seat belt use in ROVs, helmet use was easily observed during the study. Information on helmet use provides additional insight into the safety practices of ROV users. As of January 1, 2013, California law (CVC Section 38601) required ROV operators and passengers to wear a safety helmet. Effective on January 1, 2015 this law applies only to use of the ROV on public lands. The state of Florida does not currently have a law requiring adult ROV occupants to wear a helmet; however, on public lands, an ATV or ROV operator under 16 years of age must be supervised by a licensed driver and must wear a helmet and eye protection (FL Stat. §261.20(3)). It should be noted that the majority of ROV observations made for this study in Florida were obtained on private lands.

As may be expected from the differences in laws between the states, observed helmet use rates for ROV occupants were much higher at sites in California as compared to sites in Florida. The observed rates for ROV drivers and passengers are given in Table 3-12. ROV drivers and passengers in California generally showed good compliance with the helmet law. Passengers had the highest rate of helmet use (97.1%), while drivers without passengers had a lower rate (87.5%). Among the 7 cases where the ROV driver was not wearing a helmet, the majority of these (5) were observed in Camp settings rather than Trail settings. Note that the number of drivers with passengers differs slightly from the number of passengers included in this table due to undetermined helmet use for a passenger in Florida and a driver in California.

Table 3-12. Observed Helmet Use Rates for ROV Occupants

All Drivers	Drivers with no Passengers	Drivers with Passengers	Passengers
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California	92.9% (92/99)	87.5% (28/32)	95.5% (64/67)	97.1% (66/68)
Florida	0.0% (0/358)	0.0% (0/116)	0.0% (0/242)	2.1% (5/241)

Conclusions and Discussion

4

This study provides empirical data about seat belt use rates by ROV occupants at off-highway riding areas in California and Florida. These data were collected under natural conditions where the occupants did not know that they were being observed, and therefore, were not influenced by researchers in their choice to use or not use their seat belt. In contrast to survey or focus group methods where ROV users are asked to report on their seat belt use, this study inconspicuously observed whether ROV users actually chose to use seat belts.

Approximately 2/3 of all the moving ROVs observed had a driver and at least one passenger. This was consistent across observation locations. The close correspondence in this number across locations provides some evidence that the similar weekend observation times and recreational riding locations visited in the two states yielded similar, comparable samples of recreational ROV users.

In this study, many unbelted ROV drivers and passengers were observed, confirming the need to encourage seat belt use. However, the observed rates of seat belt use by ROV drivers and passengers were very different in the two states visited. Seat belt use rates were approximately 10 times higher at sites in California than at sites in Florida. We speculate that this difference may be due to several factors including:

- Possible differences in seat belt use when on private versus public lands - The vast majority of ROV observations in Florida were made at a privately owned off-highway vehicle park, while all observations in California were made on State and Federal lands. It is possible that ROV seat belt and helmet use rates on private property in California are lower than those observed in this study.
- Differences between locations in the perceived danger posed by the riding terrain - Florida trails are generally flat and level and may have been thought to be less hazardous to ROV users. The California riding terrain has many elevation changes and hazardous drops that are difficult to see. This speculation is supported by data which show that in California seat belt use was higher on the varied terrain of Trail locations as compared to Camp locations which

had generally flat terrain. In Florida, seat belt use rates were low and there was no significant difference for (flat) Trail and (flat) Camp locations.

- Differences in the local safety culture regarding ROV operation - It is possible that the difference in laws regarding helmet use by ROV operators contributes to differences in safety culture between the two states. In California, where helmets are required, both high helmet use rates and high seat belt use rates were observed. Researchers also noted that ROV occupants in California seemed to have more safety gear than ROV occupants in Florida. This included more ROVs equipped with 4-point and 5-point harness-type occupant restraints as opposed to 3-point seat belts, and more sophisticated off-road protective riding clothing worn by ROV occupants.
- Social influences - ROV seat belt use, especially in popular riding areas may be influenced by local norms. Individuals may wear (or not wear) their seat belt based on the behavior of other ROV riders. Thus, the minority of ROV occupants who chose to wear seat belts at the sites observed in Florida violated the local cultural norm, while others may have reacted to social pressure to conform to the cultural norm by not wearing their seat belt. Similarly, ROV occupants in California may feel social pressure to conform to their local norm; but in California the norm is to wear a seat belt.
- Differences in seat belt use for people when they are occupants in passenger vehicles - For example, state seat belt surveys found that in 2014, seat belt use in California (97.1%) was higher than the seat belt use in Florida (88.8%) (Chen, 2015). The tendency for ROV occupants to wear a seat belt for off-highway activities may be related to their on-road behavior in passenger vehicles.

The observational data show that ROV passengers' seat belt use rates are similar to, or higher than ROV drivers' seat belt use rates. Also, we observed that ROV drivers who carried a passenger tended to have higher seat belt use rate than drivers who were traveling alone.

The primary research question answered by this study was whether ROV passenger seat belt use is closely tied to seat belt use by the ROV driver. If so, any strategy that is successful in converting unbelted drivers to seat belt users may have safety benefits for unbelted passengers as well. One hypothesis is that the ROV driver is effectively the "Captain of the Ship," and as such, strongly influences the passenger's decision to use or to not use a seat belt. A testable prediction based on this hypothesis is that there is a very close, positive association between seat belt use by ROV drivers and ROV passengers. Based on all of the observations made in this study, we found this prediction to be true. Combining data across both states, the correlation between seat belt use by drivers and their passengers was strong and statistically significant ($\phi = .824, p < 0.0001$). When the ROV driver

was wearing a seat belt, the probability of the passenger wearing a seat belt was 94%. Even when accounting for the large differences in seat belt use between states, statistical modeling showed that the driver's seat belt use was a significant predictor of the passenger's seat belt use. These findings are consistent with the "Captain of the Ship" hypothesis.

Finally, some limitations of this study should be mentioned:

- The observations conducted for this study took place at times and in locations chosen to represent purely recreation use of ROVs. Seat belt use may be different when people are driving ROVs for utility purposes or when driving on their own property.
- Observations were conducted in only two states and only during the daytime.
- Naturalistic observational studies such as this one have limitations for providing causal explanations. Thus, although we can say that seat belt use by ROV drivers and passengers were closely associated, we cannot say for certain that when passengers wear (or do not wear) their seat belts it is because their drivers wear (or do not wear) their seat belts.
- The statistical analyses conducted for this study assume independent observations. Efforts were made to insure that ROVs were not observed more than once. However, it is likely that at least some ROV observations in the data set were made of the same ROVs at different sites and times. While these observations are not strictly independent, we also noted that for a particular ROV, drivers and occupants were sometimes different at different times of the day. Given the observation methods used, any multiple observations of the same ROV, if present in the data, would be a small proportion of all observations and would not affect the conclusions.

- Consumer Product Safety Commission’s “Proposed Rule: Recreational Off-Highway Vehicles (ROV).” <http://www.cpsc.gov/Global/Newsroom/FOIA/CommissionBriefingPackages/2014/SafetyStandardforRecreationalOff-HighwayVehicles-ProposedRule.pdf>. 24, Sept. 2014.
- Chen, Y. Y. (2015, May). Seat belt use in 2014—use rates in the states and territories. (Report No. DOT HS 812 149). Washington, DC: National Highway Traffic Safety Administration.
- Pickrell, T.M., & Liu, C. (2015, January). *Occupant restraint use in 2013: results from the NOPUS controlled intersection study*. (Report No. DOT HS 812 080). Washington, DC: National Highway Traffic Safety Administration.
- Pickrell, T. M., & Choi, E.-H. (2015, February). Seat belt use in 2014—Overall results. (Traffic Safety Facts Research Note. Report No. DOT HS 812 113). Washington, DC: National Highway Traffic Safety Administration.

Researchers counted the number and type of moving off-highway vehicles that they encountered while making ROV seat belt observations. The counts in Table A-1 give an indication of the relative number of ROVs present in the observation areas as compared to other types of vehicles. Full-size vehicles were not included in these counts unless they were being driven on trails or open riding areas. The ROVs with no data recorded generally were vehicles that were seen at distances too far to identify seat belt use and other characteristics of occupants.

Table A-1. Tally of Moving Off-Highway Vehicles Encountered During Observation Periods in California and Florida

	ROVs (Observations Recorded)	ROVs (No Data Recorded)	ATVs	Motorcycles	Dune Buggies & Sand Rails	Full Size 4x4 Vehicles
California	102	41	208	146	64	37
Florida	358	62	761	1	3	0
Total	460	103	969	147	67	37