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Cover Page Footnote

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DRIVER vs. MANAGER PERCEPTIONS OF COMMONLY USED SAFETY PRACTICES IN COMMERCIAL MOTOR VEHICLE OPERATIONS

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ABSTRACT

This research investigated the perceptions of Commercial Motor Vehicle Operators and Safety Professionals regarding 35 commonly implemented practices used to improve operating safety. Several differences were found in how drivers of different backgrounds rated various practices, and between the drivers and safety managers. These differences were found to be persistent even when combined with measures of safety performance and experience. Managers tended to overvalue (relative to drivers) practices related to hiring, while drivers tended to overvalue (relative to managers) practices related to company support and reward systems. Motor Carriers, insurers, and regulators could consider areas of agreement with respect to high value practices as actionable for increased investment of resources. At the same time, resources allocated toward areas of low perceived value could be reduced.

INTRODUCTION

Motor Carriers spend a significant amount of resources on activities and programs designed to improve the safety of their operations. Large truck accidents have a tremendous impact on society (US Department of Transportation, 2006). Motor vehicle accidents directly affect and disrupt the lives of the victims as well as their families and friends, especially when injuries or fatalities occur.

Accidents have declined quite significantly since the 1980's, however accidents continue to claim lives and to have serious consequences for individuals and society, along with negative economic consequences for the economy. One estimate of the average cost of an accident involving a truck with one trailer is $97,574 with the cost of a fatal accident estimated to be $3,833,721 (Pacific Institute for Research and Evaluation, 2006). Indirect costs such as the disruption of the supply chain and delays in shippers' cargo further increase the costs associated with an accident. These costs affect the motor carriers involved. Higher insurance rates, lawsuits, environmental cleanup costs, and loss of corporate and consumer trust result when trucking firms fail to operate safely (Cantor, Corsi, and Grimm, 2006). Carriers that incur these costs will find it difficult to succeed in a highly competitive environment. Consequently, motor carriers must enact practices that have a direct and positive impact on the safety performance of their firm (Corsi and Fanara, 1988; Corsi, Fanara, and Jarrell, 1988; Mejza and Corsi, 1999; Monaco and Williams, 2000; Crum and Morrow, 2002; Baxter, 2003; Mejza et al., 2003; Melton and Van Dyne, 2004).

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With respect to assessments of the effectiveness of safety practices, most of those efforts have concentrated on the firm or the firm's safety manager (Brock et. al., 2007; Corsi and Fanara, 1988; Knipling, Hickman and Bergoffen 2003; Mejza and Corsi, 1999; Mejza et. al., 2003; Short et. al., 2007). This is not surprising, as the safety program manager would be presumed to be the subject matter expert on the practices used. Many of these studies have found a high degree of agreement between safety managers and other safety professionals on two dimensions: first, what programs they are using; and second, their confidence in those programs (Knipling, Hickman and Bergoffen 2003, 2004.

While previous studies have focused on the perceptions of safety program managers as the unit of analysis, it could also be posited that the driver of the commercial motor vehicle may be equally- if not more- capable of assessing the value of safety practices. The purpose of this research was to explore the perceptions of value related to safety practices in common use by North American motor carriers from the perspective of the drivers, and to compare these perceptions to those of the safety program managers. Three related hypotheses follow from the overall research question:

H1: Perceptions of value of safety practices differ between drivers and safety professionals.

H2: Perceptions of value of safety practices differ between types of drivers:

a. based on driving experience.
b. based on type of driving performed.

H3: Perceptions of value of safety practices differ among drivers and managers, based on safety competence.

METHODOLOGY

The first phase of the study (building the instrument) sought to identify some of the most common safety practices in current use. A parallel effort consisting of both a review of the literature and open-ended surveys was conducted.

The literature review included the cataloguing of the results of other national level surveys (mentioned above). An initial list of common practices was developed (Corsi and Fanara, 1988; Baxter, 2003; Mejza et. al., 2003; Knipling, Hickman and Bergoffen 2003, 2004). This list of practices was then reviewed by a panel of subject matter experts (small groups of safety professionals and "million miler" professional drivers; 3-5 in each cohort; about 20 total).

The open ended survey of practices in use was sent to members of the state transportation association listed as "safety managers" or with a "safety" related job title. This survey asked respondents to list and describe the practices they were currently using at their firms by both "importance" and "value."

The results of the open ended survey (49 responses out of 287 total) were then combined with the results of the literature review to come up with a combined list. A second round of development took place in an attempt to validate and refine the list. Two groups (drivers and managers) were surveyed for their opinions on the "Importance" and "Value" of the programs. The first group consisted of professional drivers (independent owner-operators) under contract with a large general freight carrier. The second group included a subset of the safety professionals who were members of the state motor transportation association. While small numbers of safety professionals (fewer than 30) limited the results of this phase, the programs list was modified once again to capture the most common practices. Also, the results allowed the practices to be classified in logical categories that seemed to be consistent across the different types of motor carriers represented. As a result of this pilot testing, the research identified a total of 35 specific practices; and the practices fell

TABLE 1
INDIVIDUAL PRACTICES WITH CATEGORY AND VARIABLE CODES

Code	Safety Practice
AW1	Safety awareness posters/bulletin boards
AW2	Regularly scheduled driver safety meetings
AW3	Post-accident/incident information to drivers
AW4	Safety awareness newsletters
AW5	Safety messages (e-mail, Qualcomm, etc.)
CS1	Operations/safety alignment (safety mgr is a supervisor)
CS2	Certification of company safety professionals
CS3	Fatigue management programs
CS4	Coordination/cooperation between operations & safety
CS5	Improve driver/fleet manager communication
CS6	Training of safety professionals
H1	Pre-hire criminal background checks
H2	Minimum driver qualification requirements
H3	Pre-hire employment history checks
H4	Pre-hire Moving Violations Reports – analyzing reports of tickets from law enforcement
H5	Pre-hire experience requirements (e.g., 1 year) vs. hiring brand new drivers
MA1	SAFER/SafeStat analysis (federal database of company safety performance)
MA2	Periodic driver safety reviews/evaluations
MA3	Log audits & analysis
MA4	Post-accident/incident review boards
MA5	Random alcohol/drug testing
R1	Cash incentives for driver safety performance
R2	Public recognition for driver safety performance
R3	Driving competitions
R4	Individual driver safety awards (i.e., monthly, yearly)
R5	Million Mile Program
TC1	Global Positioning System GPS data (i.e., Qualcomm)
TC2	Electronic logs
TC3	On-board data recording devices
TC4	Vehicle speed governors
TR1	Driver safety training, prevention, during initial hiring or orientation
TR2	Driver check rides, recurring
TR3	Driver check rides, initial hiring
TR4	Driver safety training, prevention, after hiring (recurring)
TR5	Driver safety training, post-accident/violation

into seven categories (see Table 1). The seven overall practice categories included:

- Training (TR)
- Monitoring and Analysis (MA)
- Hiring (H)
- Company-Wide Support (CS)
- Rewards (R)
- Technology (TC)
- Awareness (A)

Categories and items within categories were randomly sorted for the final instrument, to prevent bias as a result of "block responding" leading to an overestimate of internal validity in the analysis phase. The items were presented in a "Likert Scale" format, with respondent choices ranging from 1 "Lower Value" to 7 "Very High" value. Blank lines were included for respondents to add any practice they felt was missing from the list. See Table 1 for a list of all practices, with their variable identifiers by category.

The next phase of the study (data collection) included three different types of drivers in addition to the safety professionals. The driver types surveyed included:
NOTR: New Over the Road drivers, at the conclusion of a 10-wk training program
EOTR: Experienced Over the Road drivers, rotating through the major operations center
LOCL: Generally experienced short-haul (waste disposal) local drivers
The investigators chose to administer the survey instrument to the drivers in a face to face setting, based on previous experience. It is believed that the ability to explain the research, answer questions, and build trust with the respondents improves the reliability of the data collected. Random sampling was therefore not possible. A small cohort of participating firms were identified to serve as the basis for a sampling proxy. Firms were chosen to represent each of the three categories NOTR, EOTR, and LOCL. Drivers were then asked to participate in the survey as they rotated through the operations centers for training or administrative reasons. Based on the high career mobility of the drivers, and the pseudo-random nature of their arrivals at the operations center, it is proposed that the drivers captured could represent a proxy for random sampling. Under this protocol, the participation rate of the drivers exceeded 95%.

Safety program managers (MGRS) were surveyed from among members of the state motor transportation association mailing list as described in the pilot testing phase. The list was examined for members identified as having safety related job titles or duties. An effort was made to validate the list by making email or telephone contact with each individual. The frame resulted in 309 total safety managers identified for survey administration. An iterative process of respondent contact was used, consisting of an initial postcard notification, a letter of support from the state motor transportation association asking for participation in the research project, the survey itself, a reminder postcard, and follow up email or phone reminders (Dillman, 2007). A total of 68 surveys were returned, for a 22% response rate.

During the follow-up contact, the non-respondents were asked to identify a reason for not responding. Anecdotally, the two most popular answers given (exact counts were not recorded) were either "Too Busy" or a response indicating they felt participating in the research would expose their firms to litigation risk. In depth discussion of this concern with non-respondents found this belief to be very strong, and the perception to be widely held among safety professionals. In general, it was believed that participation in safety research involving the use and value of safety practices would be "discoverable" during litigation and could reflect poorly upon the firm. The researchers found this perception to be interesting in and of itself; perhaps meriting further investigation under a more rigorous process. Early vs. late responses were compared, and no significant differences were found beyond a potential bias for larger companies to respond earlier than smaller

companies. It could be suggested therefore that a non-respondent bias may favor the larger (generally better performing; Corsi and Fanara, 1988, among others) firms. However, the final respondent list showed only 9 out of the 68 firms could be considered "large" (over 100 power units) with the remainder being much smaller.

Two surveys were unusable due to incomplete information provided. The final usable sample of drivers included 531 NOTR, 102 EOTR, and 93 LOCL. The final sample of safety professionals (MGRS) included 66 responses, for a total data set of 792 respondents.

ANALYSIS AND RESULTS

In an attempt to simplify the analysis, Exploratory Factor Analysis (with and without rotation) was performed on the 35 variables (SPSS v. 15.0). While the practices were organized rationally according to categories, as validated by the pilot testing, the response data provided by the drivers did not support the use of categories as an empirical proxy for individual practices. Cross-loadings were significant; the variance between individual practices was larger than the variance shared among practices within a category. We can infer from the analysis that the perceived importance of individual practices is at least statistically more significant than the perceived importance of logical categories of practice.

For the purpose of illustration, factors were created representing the categories using the mean values of the variables within the category. Reliability assessment was performed on the pseudo-factors (categories) and the results are presented in Table 2. Using the benchmark of Cronbach's Alphas of 0.7 or greater as an acceptable level of reliability (Nunnally, 1978; Hinkin, 1998 among others), items within the categories of Awareness (AW), Company Support (CS), Monitoring and Analysis (M & A), and Rewards (R) all displayed acceptable reliability without remediation. Items were dropped from factors Hiring (H), Technology (TC), and Training (TR) based on an examination of the individual practices in each group for semantic consistency and loading/ cross loading scores. The final constructs included the following items within each category of Hiring (H 1, 3, 4), Technology (TC 1, 3, 4), and Training (TR 1, 3, 4, 5).
Next, biserial correlations were performed between each of the seven pseudo-factors (Table 2). Significant correlations were found among all seven categories (all statistically significant at $p < 0.01$ or better). Correlation R^2 values range from highs of 0.766 (AW-CS) and 0.765 (MA-TR) to lows of 0.381 (R-H) and 0.449 (TC-R). These results suggest that while caution must be used in presuming that the categorical pseudo-factors represent the underlying practices, they capture enough of the variance between the practices to serve as proxies for the specific individual practices. However, due to the cross-loadings detected during EFA and the correlations between categories, differences in value perceived by the respondents will be very difficult to detect. An argument could be made that any analysis would be biased against the detection of contrasts. Any statistically significant contrasts that do appear in spite of these difficulties would need to be interpreted in context.

Comparisons Between Categories of Practice

As previous research has generally focused on the assessments of the safety managers, the research looked at the opinions of drivers vs. the opinions of managers (see Tables 3-5). Multiple pairwise comparisons were performed, with a significance threshold of 0.05 (two-tailed). Categories of practices were listed from "Most Valuable" to "Least Valuable," and designators (A, B, etc.) assigned based on whether they could or could not be separated at this level of confidence.

First, the perceptions of the managers were compared to the perceptions of drivers based on the 3 categories of drivers (NOTR, EOTR, LOCL; see Table 3). It was interesting that the

TABLE 2
PRACTICE CATEGORIES AS FACTORS

	Aware	CoSup	Hiring	M & A	Reward	Techno	Trng
Aware	**0.838**						
CoSup	0.766	**0.843**					
Hiring	0.546	0.523	**0.722**				
M & A	0.735	0.692	0.655	**0.768**			
Reward	0.653	0.672	0.381	0.551	**0.784**		
Techno	0.596	0.534	0.506	0.644	0.449	**0.698**	
Trng	0.747	0.753	0.615	0.765	0.533	0.563	**0.808**
All correlations are significant at the <0.01 level (2-tailed).Factor reliability scores (Cronbach's alpha) given on diagonal							

range of perceived values (difference between highest and lowest) was much greater for the managers than the drivers. Both groups scored "Hiring" as most valuable (5.638 vs. 5.8611); the local drivers scored Technology lowest (4.7616) while the managers scored Rewards lowest (3.8393).

It was also noted that the order of value for LOCL drivers vs MGRS was very similar; differing only in the preferred ordering of the bottom three categories (R, AW, TC for drivers vs. AW, TC, R for managers). The LOCL drivers rated the top practice categories lower in general, and were unable to distinguish between the top four. Overall, there was substantive agreement in relative value between the local drivers and the safety program managers. This differs from the "Over the Road" (long distance) drivers. The over the road drivers tended to rate Company Support slightly higher than the local drivers and managers. Another interesting split is found between the emphasis placed on "Hiring" practices. Due to the independent nature of long-distance drivers, perhaps they see less value in the screening function; local drivers and more experienced over the road drivers may appreciate the impact that hiring practices have. The effect of experience level in perceived usefulness of the seven categories of safety practices required further investigation.

Next, the drivers were grouped according to their level of experience for comparison to the safety managers (see Table 4). For this analysis, drivers were coded as "Experienced" if they had either more than one year or over 100,000 miles of professional driving experience (218 drivers) and "Inexperienced" if they had less time or miles behind the wheel (466 drivers). While this classification criteria is somewhat arbitrary, it is in line with the judgment of the senior safety managers with the firms involved in the study based on informal discussions.
This contrast provides more noticeable differences. For example, as experience increases for drivers, the value placed on Hiring increases (while value of Rewards decreases); compared with the absolute highest (Hiring) and Lowest (Rewards) value ranks. The value placed on Company Support decreases with experience, falling from highest value for inexperienced drivers to second rank for experienced, and 4th for managers.

The third set of pairwise comparisons was conducted between managers and drivers based on the safety record of the drivers (see Table 5). Drivers reporting "None" for involvement in Safety Events (moving violation, preventable or non preventable accident, near miss, etc.; a total of 507 drivers) were compared against those drivers experiencing at least one safety event in the last year (219 drivers).

TABLE 3
MEAN PRACTICE CATEGORIES BY SOURCE

Notr			Eotr			Locl			Mgrs		
CoSup	5.9474	A	Trng	5.9069	A	Hiring	5.6380	A	Hiring	5.8611	A
Trng	5.9333	A	CoSup	5.8779	A	Trng	5.6308	A	Trng	5.7121	AB
M & A	5.7997	B	Hiring	5.7958	AB	M & A	5.4783	A	M & A	5.4992	B
Reward	5.6818	C	M & A	5.6373	BC	CoSup	5.4774	A	CoSup	5.0674	C
Aware	5.5899	D	Aware	5.5176	CD	Reward	5.1901	B	Aware	4.5553	D
Hiring	5.5794	D	Reward	5.3725	D	Aware	5.1582	B	Techno	3.9596	E
Techno	5.3402	E	Techno	5.0065	E	Techno	4.7616	C	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

When grouped by safety event, the relative value assessments are almost identical to the assessments when grouped by experience. It could be expected that there would be significant overlap between "experience" and involvement in a safety event within the last year. Therefore, a second analysis was performed, sorting by involvement in safety event, after filtering out the responses of inexperienced drivers (see Table 6).

The relative assessments of value of categories of safety practices for experienced, safer (134 respondents) and experienced, less safe (86) drivers can now be compared against those of the managers. When the inexperienced drivers are filtered from the analysis, no additional contrast between "more safe" (no safety events) and "less safe" (some safety events) can be detected. The relative category values differ only within the ability of the pairwise comparison test to detect differences. The original differences noted between drivers and managers are not contradicted by this comparison.

Summary of Comparisons Between Categories of Practice

Pair-wise comparisons of means of the assessed values of the categories of practice were performed within various groups of respondents. The assessments of drivers were categorized

TABLE 4
MEAN PRACTICE CATEGORIES BY EXPERIENCE

< 1yr and 100k			>1yr or 100k			Mgrs		
CoSup	5.9740	A	Trng	5.7320	A	Hiring	5.8781	A
Trng	5.9649	A	CoSup	5.6886	AB	Trng	5.7313	AB
M & A	5.8147	B	Hiring	5.6208	AB	M & A	5.4679	B
Reward	5.6618	C	M & A	5.5630	B	CoSup	5.0664	C
Hiring	5.6198	C	Reward	5.4137	C	Aware	4.5261	D
Aware	5.5978	C	Aware	5.3571	C	Techno	3.9141	E
Techno	5.3348	D	Techno	4.9106	D	Reward	3.8058	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

according to type of driving, experience level, and involvement in safety events. Driver opinions from within these groups were compared to the opinions of safety professionals. In general, Training practices are rated very highly by all driver and manager groups. The relative importance of Hiring practices increases from NOTR through EOTR, LOCL, and MGRS groups, while the perceived value of Company Support decreases over the same groups. The relative value of Rewards decreases with experience through driver groups and ends up valued least for managers. The relative value of Technology is consistently low across all groups. The values of Monitoring and Analysis, and Awareness, fall in the middle/lower middle range for all respondent groups.

Comparisons Between Individual Practices

Similar comparisons were made for assessments of value for individual practices. Many differences were detected; some contrasts are reported here. Three sets of contrasts will be reported here: the most highly valued quartile of practices, the least valued quartile of practices, and the practices with the greatest degree of disagreement between groups.

Mean value assessments were calculated for all practices by source of respondent. The eight

TABLE 5
MEAN PRACTICE CATEGORIES BY SAFETY PERFORMANCE

No Events			Some Events			Mgrs		
CoSup	5.9193	A	Trng	5.8813	A	Hiring	5.8611	A
Trng	5.8950	A	CoSup	5.7806	AB	Trng	5.7121	AB
M & A	5.7637	B	M & A	5.6707	BC	M & A	5.4992	B
Reward	5.6796	BC	Hiring	5.5556	C	CoSup	5.0674	C
Hiring	5.6440	C	Aware	5.3456	D	Aware	4.5553	D
Aware	5.6020	C	Reward	5.3342	D	Techno	3.9596	E
Techno	5.2860	D	Techno	5.0647	E	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

TABLE 6
MEAN PRACTICE CATEGORIES BY SAFETY PERFORMANCE, EXPERIENCED DRIVERS

Exp, No Events			Exp, Some Events			Mgrs		
CoSup	5.7296	A	Trng	5.7711	A	Hiring	5.8611	A
Trng	5.7034	A	CoSup	5.6187	AB	Trng	5.7121	AB
Hiring	5.6144	AB	Hiring	5.6145	AB	M & A	5.4992	B
M & A	5.5678	AB	M & A	5.5380	B	CoSup	5.0674	C
Reward	5.5476	B	Aware	5.2428	C	Aware	4.5553	D
Aware	5.4280	B	Reward	5.1904	C	Techno	3.9596	E
Techno	4.9104	C	Techno	4.8855	D	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

most highly valued practices are listed for each respondent source category in Table 7. All driver sources rated TR1 (Driver safety training, prevention, during initial hiring or orientation) as the most valuable individual safety practice, while the managers rated MA5 (Random alcohol/drug testing) as the most valuable practice. MA2 (Periodic driver safety reviews/ evaluations) shows up in the top eight for all respondent categories. R1 (Cash incentives for driver safety performance), shows up in the driver top eight practices, but not the managers.

A similar comparison can be made at the opposite end of the perceived value scale. The eight least valued practices are listed for each respondent source category in Table 8. Some similarities and differences exist in the ratings of the least valued practices between respondent categories here as well. TC2 (Electronic logs) are rated at or near the bottom for all respondent classes. R3 (Driving competitions) is also listed in the bottom eight for all respondents. MA3 (Log audits & analysis) and TC4 (Vehicle speed governors) are listed in the bottom eight for all drivers, but not managers. CS3 (Fatigue management programs) and TC1 (Global Positioning System GPS data i.e., Qualcomm) are listed in the managers bottom eight, but do not appear in any of the driver respondent categories bottom eight practices. It should also be noted that there is more agreement between the "Local" driver respondent category and the managers than between the managers and any other driver category.

The next phase of assessment involved looking for the practices that displayed the greatest amount of disagreement between all categories of drivers against the safety program managers (see Tables 9 and 10). For this analysis, practices were ranked by mean value. Differences in ranks between drivers and managers were calculated. The greatest 10 differences were calculated for both cases where drivers ranked the practice higher, and where managers ranked the practices higher.

The ranks and mean values for those practices where managers valued the practice much higher than drivers are shown in Table 9. Rank differences as well as the results of the one-way ANOVA test for significant differences between the means are also shown. The previously noted contrast between Hiring practices in general is affirmed here. With the exception of H1 (Pre-hire criminal background checks), drivers and managers disagree strongly about the relative value of hiring related practices. Two of the Monitoring and Analysis (MA3 Log audits & analysis, and MA5 Random alcohol/drug testing) practices resulted in disagreement. Two of the Training (TR2 Driver check rides, recurring, and TR4 Driver safety training, prevention, after hiring recurring) practices resulted in disagreement as well. Disagreement was also strong on the individual practices AW2 Regularly scheduled driver safety meetings and TC4 Vehicle speed governors.

The ranks and mean values for those practices where drivers valued the practice much higher than managers are shown in Table 10. Rank differences as well as the results of the one-way ANOVA test for significant differences between the means are also shown. The results shown appear less "mixed" across the practice categories; more consistent within categories than the disagreements where managers rated the practices more highly than drivers. The greatest disagreement was over R1 Cash incentives for driver safety performance. Also, Rewards R4 Individual driver safety awards (i.e., monthly, yearly) and R5 Million Mile Program exhibit great disagreement between drivers and managers. This could be ascribed to the drivers preferring cash incentives personally, aside from their honestly reported perception of value.

The drivers also rated Company Support practices (CS2, CS3, CS4, CS5, CS6) much higher than managers. Oddly, they did not disagree on CS1 Operations/safety alignment (safety mgr is a supervisor), which recognizes the implicit conflict between "safe operations"

TABLE 7
TOP 8 PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
TR1	6.260	A	TR1	6.320	A	TR1	5.980	A	MA5	6.270	A
R1	6.210	AB	CS4	6.110	AB	MA5	5.930	A	H4	6.220	AB
CS6	6.160	AB	CS6	6.040	B	MA2	5.790	A	H3	6.140	AB
CS5	6.130	B	MA2	5.990	B	AW2	5.760	A	TR1	6.140	B
MA5	6.060	BC	CS5	5.950	B	H3	5.750	A	H5	5.910	BC
MA2	6.000	C	H1	5.950	B	CS2	5.720	A	CS4	5.770	C
CS4	5.960	C	TR5	5.950	B	R1	5.700	A	H2	5.720	C
TR5	5.930	C	R1	5.910	B	H4	5.670	A	MA2	5.720	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

TABLE 8
BOTTOM 8 PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
MA3	5.350	A	AW4	5.150	A	R3	4.950	A	CS3	4.010	A
H2	5.260	AB	TR2	5.010	AB	MA3	4.920	A	TC1	3.950	A
TR2	5.250	B	MA3	4.960	AB	AW4	4.910	A	AW5	3.840	A
TC4	5.070	B	TC3	4.680	ABC	TC4	4.620	AB	AW4	3.760	A
TC3	5.050	B	TC4	4.630	BC	TC1	4.580	AB	R5	3.340	AB
R3	4.740	C	H5	4.550	BC	R5	4.440	AB	TC3	3.310	AB
TC2	4.480	D	R3	4.320	C	AW5	4.350	B	TC2	2.690	BC
H5	4.440	D	TC2	3.080	D	TC2	4.140	B	R3	2.490	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

and “productive operations” anecdotally noted by many respondents. Safety managers rated this higher (relative to driver preferences) than the other Company Support practices.

Individual disagreements also were discovered. Drivers rated TC1 Global Positioning System GPS data (i.e., Qualcomm), MA4 Post-accident/ incident review boards, and TR5 Driver safety training, post-accident/violation practices much higher than the safety managers. Overall, an argument could be made that drivers tended to rate those safety practices that involved them personally, or were “closest” to their actual job duties, were rated as more valuable. Unsurprisingly, they did not seem to value practices that they would not personally or directly participate in.

Summary of Comparisons Between Individual Practices

As with the practice categories, significant disagreements were noted between classes of respondent for perceived value of individual safety program practices. When considering the most valued practices by driver sub-group, all

TABLE 9
MAXIMUM DRIVER VS. MANAGER DISAGREEMENT, MANAGER PREFERRED

Pract	Drivers Mean	Drivers Rank	Mgrs Mean	Mgrs Rank	Rank Diff	Sig
H5	4.536	34	5.906	5	29	0.000
H2	5.330	27	5.720	7	20	0.099
H3	5.552	24	6.136	4	20	0.006
H4	5.645	20	6.220	2	18	0.003
MA3	5.238	29	5.577	11	18	0.112
AW2	5.521	25	5.348	16	9	0.382
TC4	4.953	32	4.323	23	9	0.017
TR2	5.229	30	4.197	25	5	0.000
MA5	6.021	5	6.273	1	4	0.199
TR4	5.747	13	5.646	9	4	0.581

TABLE 10
MAXIMUM DRIVER VS. MANAGER DISAGREEMENT, DRIVER PREFERRED

Pract	Drivers Mean	Drivers Rank	Mgrs Mean	Mgrs Rank	Rank Diff	Sig
R1	6.103	2	4.023	27	-25	0.000
CS2	5.810	10	4.286	24	-14	0.000
CS3	5.735	15	4.008	28	-13	0.000
R4	5.815	9	4.555	22	-13	0.000
TC1	5.688	17	3.946	29	-12	0.000
CS6	6.066	3	5.455	14	-11	0.000
R5	5.631	22	3.345	32	-10	0.000
MA4	5.800	11	4.766	20	-9	0.000
CS5	6.039	4	5.532	12	-8	0.004
TR5	5.880	8	5.453	15	-7	0.014

driver sources rated TR1 (Driver safety training, prevention, during initial hiring or orientation) as the most valuable individual safety program practice. Managers rated MA5 (Random alcohol/drug testing) as the most valuable practice. MA2 (Periodic driver safety reviews/ evaluations) shows up in the top eight for both drivers and managers. R1 (Cash incentives for driver safety performance), shows up in the driver top eight practices, but not the managers.

When considering the least valued practices by driver sub-group, TC2 (Electronic logs) and R3 (Driving competitions) are rated at or near the bottom for all respondent classes. MA3 (Log audits & analysis) and TC4 (Vehicle speed governors) are listed in the bottom eight for all drivers, but not managers. CS3 (Fatigue management programs) and TC1 (Global Positioning System GPS data i.e., Qualcomm) are listed in the managers bottom eight, but do not appear in any of the driver respondent categories bottom eight practices.

When considering the practices exhibiting the greatest relative disagreement between managers and drivers, additional notable patterns emerged. For those practices highly valued by managers and less valued by drivers, managers value hiring related practices much higher than drivers do. Also rated more highly by managers were

two practices within the Monitoring and Analysis and Training categories.

For those practices highly valued by drivers and less valued by managers, specific practices within the Rewards category (R1, R4 and R5) were rated very highly by drivers when compared against managers. Also, five out of six practices within the Company Support category (CS2, CS3, CS4, CS5, CS6) were highly valued by drivers.

Safety Performance Weighted Perceptions of Value

Additional investigation was performed exploring the role of safety performance (competence) in altering the relative perception of safety practice value (see Tables 5 and 6). For these comparisons, safety competence was constructed as a "weighting factor" to be multiplied by the value scale for each respondent and category/practice variable.

The drivers were asked to self-assess their own safety competence relative to "The average commercial driver on the road" using 5 questions on a 7-point Likert scale addressing:

- Safety record
- Adherence to company safety policies and recommendations
- Setting the example for other drivers to follow in terms of safety practices
- Adherence to all Federal, State and Local safety regulations
- Track record of compliance for inspections and enforcement

Drivers were also asked to self-report any involvement in "safety events" during the previous year. Safety Events included "near miss" situations not resulting in accidents, preventable accidents, non-preventable accidents, moving violations, inspections resulting in "out of service" determinations, and a write-in "Other" category. If the driver chose "none" a value of 0 was assigned. If no events were checked (including "none") then the response was counted as a missing value and the weight was not calculated. The aggregate safety competence score or weight was calculated as the average of the 5 Likert scale questions (value 1-7) minus the number of Safety Events (value 0-6). Actual values for the weights ranged from a low of 0 to a high of 7, with a mean of 5.29.

The safety performance/competence weight for the safety managers was calculated on the firm level. Federal Motor Carrier Safety Administration safety statistics (the "SAFESTAT" database; FMCSA 2009) were used. It must be noted that the "SAFER/ SafeStat" system has been replaced by the CSA 2010 system. At the time this research was conducted, stability and reliability problems in the newer CSA 2010 system prevented the use of the newer metrics. Statistics used to evaluate firm safety performance on a relative (to other firms) percentile basis include the Driver and Vehicle Safety Evaluation Area Scores (SEAS). SEAS statistics take on values between zero (the highest rated firm; better than 100% of all other firms) and 100 (the worst performing firm; better than 0% of all other firms). This research created a composite SEAS safety performance value using the following formula:

(1) Firm SFac = [(200 - DSEAS + VSEAS)/ 200]*7 (from FMCSA SafeStat database)

The composite weighting factor added the driver and vehicle SEAS and inverted the scale by subtracting from the maximum possible value of 200. A relative value between 0-1 was created by dividing by the maximum score, and this relative value was centered to take on final values between 0-7 in an effort to make it at least comparable to the driver calculated safety performance weights. The final firm level weighting factor took on values between 1.20 and 6.94, with a mean of 3.85. Firms for which SEAS data were incomplete were not assigned a safety performance score. The final safety performance weighted subsample included 380 NOTR, 101 EOTR, 91 LOCL, and 52 MGRS respondents.

Comparisons were now run using the safety performance weight multiplied by the perceived value for each category of practice (Tables 11 and 12) and individual practice (Tables 13 and 14).

Table 11 represents the same analysis as Table 3, except that the categories of practice used were the "safety weighted" categories. For the NOTR and EOTR classes of driver, the order of perceived values are identical to those found in Table 3. For LOCL drivers, the order of mean values are slightly different, but the order changes do not exceed the statistically significant grouping indicators. For the MGRS, the order is identical to the unweighted order, with minor differences in grouping indicator boundaries. Overall, the safety performance weighted safety practice category perceived values differ, and differ between the driver and manager groups. The way these perceived values differ is quite similar to the way the non-safety performance weighted values differ.

The analysis was continued for the practice categories by experience level. Table 12 is analogous to Table 4, except that in Table 12 we use the safety performance weighted categories. The MGRS group is unchanged from Table 11, but the driver groups are now divided into two groups based on miles/year driven. For the more experienced drivers, the order of perceived value is identical to that found on Table 4 (unweighted). The order changes slightly for the less experienced drivers, but the order changes again do not exceed the statistically significant grouping indicators. As in the previous analysis, the way these perceived values differ is quite similar to the way the non-safety performance weighted values differ.

Next, the top eight (Table 13; analogous to Table 7) and bottom eight (Table 14; analogous to Table 8) individual practices were examined. In Table 13, we see that significant differences in perceived value exist for all classes of drivers and managers. However, these differences are quite similar to those shown on Table 7 for the unweighted values. For driver cohort NOTR, the top eight practices are identical, differing only in the individual order of CS6-R1 and TR5-CS4. Results are similar for group EOTR. For groups LOCL and MGRS, the unweighted vs. weighted perceived values are again similar; however, two other differences exist. For LOCL drivers, the practice R1 leaves the list of top eight and AW3 enters. For the MGRS, MA2 leaves the list and AW3 enters. This would suggest that as safety performance increases, the perceived value of AW3 "Post-accident/incident information to drivers" increases in perceived value.

Similar results were found for the perceived value of individual practices at the lower end of the value order (Table 14). For the NOTR and EOTR classes of drivers, the bottom eight practices are the same, with only minor differences in order for the NOTR group. The same is true for the LOCL drivers and managers, with two individual exceptions. For the LOCL drivers, the practice H5 fell into the bottom eight practices, and R3 rose in value out of the bottom eight. For the MGRS, AW1 dropped into the lower eight, and AW5 rose out of the bottom. We conclude that differences in relative rankings of safety-weighted safety practices exist and are significant; and differ only slightly from those differences shown for the unweighted practices.

Safety Performance vs. Perceived Value

A final investigation of the relationship between safety performance and perceived value of safety practices was conducted. For this analysis, bivariate correlations were conducted between the individual respondent "safety performance score" and their rating of perceived value for safety practices and categories of practice. The effort was to assess if levels of safety performance covaried with the value placed on practices. Sample size becomes an issue here, as the final safety performance weighted subsample included 380 NOTR, 101 EOTR, 91 LOCL, and only 52 MGRS respondents.

The first analysis (Table 15) captured the relationship between safety performance and the value of categories of safety practices. Due to the small number of datapoints, none of the correlations were statistically significant for the MGRS. For the driver groups, all correlations between safety performance and categories of practice were statistically significant for NOTR, and most were significant for EOTR and LOCL. Sample size may have been an issue with the two smaller driver groups as well. A positive relationship indicates that as safety performance increases, the relative perceived value increases as well. While this might not be practically significant in an absolute sense (safer drivers tend to rate all safety programs as being more valuable in general), the relative magnitude of association may suggest a means of comparison between programs (higher R^2 means a closer tie between performance and perceived value). A higher correlation would suggest increased perceived value by respondents with higher safety performance scores. For this data, correlation coefficients ranged between 0.2-0.3. When compared to the mean perceived values and safety weighted mean perceived values, the correlation strength metric suggests a different order. For example, the NOTR drivers rank "Awareness" as being fairly low with respect to the other categories, while it is the highest rated using a correlation measure.

The second analysis captured the relationship between safety performance and the value of individual practices (Table 16). The reduced sample size creates greater problems here. None of the MGRS relationships were statistically significant. Fewer than half of the EOTR and LOCL relationships were statistically significant, and three of the practices were not statistically significant for the NOTR group. Three findings are worth noting. First, the order based on strength of association does differ substantively from the order based on perceived value. This is similar to the finding for categories of practice. Second, most of the practices are positively related to safety performance, again suggesting that drivers with higher safety performance tend to rate safety practices higher than drivers with low safety performance scores. Third, there is a statistically significant exception to this: for LOCL drivers, practice R1 "Cash Incentives for Driver Safety Performance" is negatively related to safety performance. This suggests that the worse performing drivers value cash incentives higher than safer drivers, and safer drivers value cash incentives lower than worse performing drivers. This was the only statistically significant negative relationship between safety performance and safety practice found in this data set. While this is an interesting result, it may be an artifact of the problems with sample size in this category.

TABLE 11
MEAN SAFETY WEIGHTED PRACTICE CATEGORIES BY SOURCE

Notr			Eotr			Locl			Mgrs		
CoSup	33.0150	A	Trng	28.7187	A	Trng	29.4536	A	Hiring	22.7112	A
Trng	32.9225	A	CoSup	28.6501	A	Hiring	29.2648	A	Trng	22.1290	A
M & A	32.2947	B	Hiring	28.4528	A	CoSup	28.6694	A	M & A	21.1538	B
Reward	31.5312	C	M & A	27.5408	B	M & A	28.5728	A	CoSup	19.4299	C
Aware	31.2677	C	Aware	27.1009	BC	Aware	27.0940	B	Aware	17.7273	D
Hiring	31.1567	C	Reward	26.4064	C	Reward	27.0172	B	Techno	14.9632	E
Techno	29.5341	D	Techno	24.3993	D	Techno	24.9678	C	Reward	14.6096	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

TABLE 12
MEAN SAFETY WEIGHTED PRACTICE CATEGORIES BY EXPERIENCE

< 1yr and 100k			>1yr or 100k			Mgrs		
CoSup	32.8900	A	Trng	29.2957	A	Hiring	22.7112	A
Trng	32.7886	A	CoSup	28.9805	AB	Trng	22.1290	A
M & A	32.1136	B	Hiring	28.7110	AB	M & A	21.1538	B
Hiring	31.2057	C	M & A	28.5402	B	CoSup	19.4299	C
Reward	31.1103	C	Reward	27.6950	C	Aware	17.7273	D
Aware	31.1083	C	Aware	27.5083	C	Techno	14.9632	E
Techno	29.4220	D	Techno	25.0753	D	Reward	14.6096	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

TABLE 13
TOP 8 SAFETY WEIGHTED PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
TR1	34.6299	A	TR1	30.7059	A	TR1	31.4764	A	H4	24.1426	A
CS6	34.2228	AB	CS4	29.8455	AB	MA5	30.8852	AB	MA5	23.7762	AB
R1	34.0928	ABC	CS6	29.5558	BC	AW2	30.5676	AB	H3	23.7537	AB
CS5	33.8107	BC	TR5	29.1357	BC	CS2	30.3862	AB	TR1	23.7224	AB
MA5	33.7861	BCD	MA2	29.1158	BC	MA2	30.1546	AB	H5	22.8915	BC
MA2	33.2200	CD	H1	28.9889	BC	H3	29.9283	B	H2	22.3748	BC
TR5	33.0718	D	CS5	28.9646	BC	AW3	29.5415	B	AW3	22.3358	C
CS4	32.9825	D	R1	28.7701	C	H4	29.4572	B	CS4	22.1059	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

SUMMARY OF FINDINGS

The purpose of the research was to explore the perceived value of a set of popular practices used by commercial motor carriers to improve the safety performance of their operations. Three hypotheses were investigated, and can now be addressed directly.

> (H1) Perceptions of value of safety practices differ between drivers and safety professionals.

This hypothesis is strongly supported by the data. The hypothesis was supported across all types of contrasts investigated. The difference between drivers and safety managers is lowest between managers and local drivers, and greatest between managers and over the road drivers. Tables 9 and 10 summarize the "degree of disagreement" between drivers and managers. This was supported for both categories of practices and individual practices.

> (H2a) Perceptions of value of safety practices differ between types of drivers based on driving expertise

This hypothesis is only weakly supported by the data. While the data show clear preference differences based on experience, the relative preference between less and more experienced

TABLE 14
BOTTOM 8 SAFETY WEIGHTED PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
MA3	29.8318	A	AW4	25.6062	A	H5	26.0636	A	CS3	15.1836	A
H2	29.0015	AB	TR2	24.3229	AB	MA3	25.8275	A	TC1	15.1747	A
TR2	28.8496	B	MA3	24.1323	AB	AW4	25.4710	A	AW1	15.0659	A
TC4	27.8836	B	TC3	22.9520	ABC	TC4	24.0725	AB	AW4	14.8617	A
TC3	27.8519	BC	TC4	22.4616	BC	TC1	24.0644	AB	R5	13.3353	AB
R3	26.2714	C	H5	21.9574	BC	R5	23.9716	AB	TC3	12.6627	AB
H5	23.9809	D	R3	21.2796	C	AW5	23.0933	B	TC2	10.3289	BC
TC2	23.7535	D	TC2	15.1208	D	TC2	21.4151	B	R3	9.6457	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

drivers were similar. Differences were discovered between "new" and "experienced" over the road drivers, but experience was not a discriminator by itself.

> (H2b) Perceptions of value of safety practices differ between types of drivers based on type of driving performed.

This hypothesis was strongly supported by the data. Contrasts were revealed between newer and more experienced over the road drivers, and between both classes of over the road drivers and local drivers. The differences were apparent for both categories of safety practices and individual practices.

> (H3) Perceptions of value of safety practices differ among drivers and managers, based on safety competence.

This hypothesis was investigated using three different approaches. The first approach (Tables 5 and 6) used a binary discriminator for drivers, based on involvement in "safety events." Significant differences were found between categories of practice; however, these differences were not sensitive to involvement in safety events. The second approach created continuous variables representing safety performance or competence, and looked for differences in safety performance weighted perceived value (Tables 11-14). Contrasts were found between safety weighted practices for all driver and manager cohorts. These differences were only slightly divergent from the unweighted perceived value scores, lending only weak support to the hypothesis. The third type of contrast was to correlate the perceived value of safety practices against the safety performance score (Tables 15 and 16). Data were insufficient to directly address the hypothesis. The evidence showed that safety performance was correlated to the perceived value of safety programs in general (safer drivers place higher value on safety practices). In addition, the strength of the correlation (as a ranking metric) provided different results from using the perceived value directly. We conclude that the hypothesis is weakly supported, and merits additional investigation.

MANAGERIAL IMPLICATIONS

Different classes of drivers and safety program managers share perceptions of the value of some safety practices and categories of practice. In general, practices falling within the Training category were highly rated by all categories of drivers and safety program managers. In particular, the practice TR1 Driver Safety Training, Prevention during Initial Hiring or

TABLE 15
CORRELATIONS; SAFETY PERFORMANCE AND CATEGORIES OF PRACTICE

Notr			Eotr			Locl			Mgrs		
Aware	0.3425	0.0000	Reward	0.3163	0.0013	Aware	0.2844	0.0063	Techno	0.1377	0.3404
M & A	0.2990	0.0000	Aware	0.3152	0.0013	Techno	0.2681	0.0102	Trng	0.1055	0.4566
Techno	0.2679	0.0000	Hiring	0.2746	0.0054	M & A	0.2669	0.0105	Hiring	0.0360	0.8000
CoSup	0.2661	0.0000	CoSup	0.2251	0.0236	Trng	0.2616	0.0122	Reward	0.0114	0.9359
Hiring	0.2524	0.0000	M & A	0.2068	0.0380	CoSup	0.2500	0.0169	Aware	-0.0227	0.8728
Trng	0.2480	0.0000	Trng	0.1247	0.2140	Reward	0.1676	0.1123	CoSup	-0.0583	0.6814
Reward	0.2197	0.0000	Techno	0.0835	0.4063	Hiring	0.1227	0.2467	M & A	-0.0806	0.5702

Correlations organized by variable, Pearson's moment, and significance
$p > 0.05$ shaded

Orientation was identified as being valuable. At the other end of the assessment scale, the Technology category was uniformly rated as being less valuable. This applied to most of the technology practices (TC2, TC4 showed up on bottom eight list for all; TC3 showed up on the bottom eight list for all but LOCL drivers). These areas of agreement suggest that firms and safety program managers align resources and attention accordingly. In addition, risk management firms and regulatory agencies should incentivize firms to spend significant emphasis in developing and improving training activities, and provide less incentive for technology based practices.

Different classes of drivers and safety program managers disagree on their perceptions of the value of some safety practices and categories of practice. These areas of disagreement suggest that safety program managers may not have considered the opinions of drivers in organizing their safety efforts. Particularly in the categories of practices associated with Company Support and Rewards, drivers perceive a much higher value than safety professionals. R1, R4, and R5 are particularly valued by drivers (and not managers) in the Rewards category. CS2, CS3, CS5, and CS6 were similarly valued by drivers under Company Support.

The areas of agreement and disagreement could be considered "actionable" by firms, regulators, and risk managers. As already mentioned, the areas of "high value" agreement could be recognized for increased emphasis, incentives and support. The areas of "low value" agreement could be recognized for decreased attention. The areas of disagreement may not be immediately actionable; additional investigation should be performed. However, where warranted, those practices valued highly by drivers should be given consideration for increased attention or effort. The Company Support practices may not fall under the organizational purview of safety program managers alone; and therefore an integrated effort within the firm may be needed to support the safe operating decisions of the drivers. The same would be true for the practices involving rewards for safe driving behavior. Attention from regulatory or risk management organizations could perhaps provide incentive in this regard.

SUMMARY AND FUTURE RESEARCH

This research investigated the perceptions of commercial motor vehicle drivers and the managers of company safety programs regarding 35 commonly implemented practices used to improve operating safety. The discrete practices fell into seven categories, including Hiring, Safety Awareness, Training, Monitoring and

TABLE 16
CORRELATIONS, SAFETY PERFORMANCE AND PRACTICES

Notr			Eotr			Locl			Mgrs		
AW1	0.3085	0.0000	R4	0.4396	0.0000	CS2	0.3852	0.0002	TR3	0.2383	0.0921
H3	0.2884	0.0000	MA1	0.4274	0.0000	AW2	0.3773	0.0003	TC4	0.1997	0.1735
MA1	0.2854	0.0000	AW1	0.3546	0.0003	TR1	0.3009	0.0044	TC3	0.1512	0.3272
AW4	0.2647	0.0000	AW5	0.3488	0.0005	R5	0.2941	0.0073	R5	0.1456	0.3344
AW2	0.2531	0.0000	R2	0.3477	0.0005	TR5	0.2927	0.0054	R3	0.1251	0.3919
AW5	0.2503	0.0000	H3	0.2706	0.0062	TC1	0.2585	0.0150	TC2	0.0989	0.5231
AW3	0.2439	0.0000	AW4	0.2536	0.0122	MA3	0.2542	0.0156	R1	0.0951	0.5068
CS2	0.2376	0.0000	CS2	0.2480	0.0138	CS4	0.2466	0.0191	TR2	0.0895	0.5451
MA3	0.2360	0.0000	R5	0.2437	0.0173	AW5	0.2363	0.0249	TR4	0.0825	0.5647
TC4	0.2341	0.0000	CS1	0.2153	0.0323	R2	0.2360	0.0260	CS1	0.0776	0.5883
MA4	0.2325	0.0000	CS3	0.1947	0.0547	CS1	0.2341	0.0310	H1	0.0710	0.6168
TR5	0.2304	0.0000	H4	0.1944	0.0538	R3	0.2235	0.0353	AW3	0.0643	0.6504
CS1	0.2296	0.0000	H1	0.1930	0.0556	CS6	0.2209	0.0375	H3	0.0488	0.7313
H4	0.2230	0.0000	TR5	0.1504	0.1395	AW1	0.2163	0.0395	AW5	0.0297	0.8431
TC1	0.2146	0.0000	AW2	0.1451	0.1539	TR4	0.1988	0.0589	MA2	0.0246	0.8627
R4	0.2103	0.0000	AW3	0.1361	0.1770	MA2	0.1968	0.0660	H2	0.0179	0.8998
TR1	0.1990	0.0001	CS4	0.1319	0.1930	AW3	0.1885	0.0769	AW1	0.0051	0.9711
R2	0.1978	0.0001	CS6	0.1225	0.2371	TC3	0.1660	0.1245	TR5	-0.0069	0.9621
CS3	0.1963	0.0001	TR4	0.1178	0.2431	TC4	0.1573	0.1387	CS5	-0.0070	0.9617
TR3	0.1855	0.0003	TR1	0.1178	0.2408	TR2	0.1565	0.1455	TC1	-0.0115	0.9400
CS6	0.1851	0.0003	R1	0.1162	0.2571	MA5	0.1357	0.2047	R2	-0.0154	0.9156
CS4	0.1806	0.0004	MA4	0.1129	0.2659	MA4	0.1280	0.2372	MA4	-0.0187	0.8975
MA5	0.1768	0.0005	TR2	0.1102	0.2853	MA1	0.1276	0.2474	CS2	-0.0215	0.8834
TC3	0.1722	0.0009	MA5	0.1079	0.2827	H3	0.1271	0.2300	H5	-0.0412	0.7762
MA2	0.1661	0.0012	R3	0.1043	0.3066	H4	0.1182	0.2644	TR1	-0.0500	0.7251
TR4	0.1652	0.0013	MA2	0.0841	0.4031	H2	0.1057	0.3270	AW4	-0.0518	0.7237
R3	0.1446	0.0050	TC3	0.0716	0.4834	CS3	0.0850	0.4286	H4	-0.0584	0.6811
CS5	0.1395	0.0066	TC1	0.0635	0.5279	CS5	0.0836	0.4388	R4	-0.0665	0.6463
R5	0.1375	0.0079	TC4	0.0625	0.5386	AW4	0.0570	0.5956	MA1	-0.0769	0.5958
H5	0.1282	0.0134	CS5	0.0582	0.5674	H1	0.0538	0.6143	CS6	-0.0858	0.5452
H1	0.1132	0.0277	TR3	0.0362	0.7238	R4	0.0531	0.6191	MA3	-0.0910	0.5253
TR2	0.1043	0.0462	TC2	0.0308	0.7655	TR3	0.0281	0.7948	CS3	-0.1045	0.4749
R1	0.0751	0.1458	MA3	0.0064	0.9497	TC2	-0.0079	0.9427	AW2	-0.1074	0.4487
H2	0.0731	0.1575	H5	-0.0187	0.8582	H5	-0.1155	0.2810	MA5	-0.1470	0.2984
TC2	0.0333	0.5204	H2	-0.0609	0.5537	R1	-0.2214	0.0349	CS4	-0.1768	0.2100

Correlations organized by variable, Pearson's moment, and significance
p > 0.05 shaded

Analysis, Company-Wide Support, Rewards, and Technology. Almost 800 surveys were analyzed from subgroups including both new and experienced over the road and local drivers, and safety program managers. Comparisons were made between subgroups on the individual practices and categories of practice. While much agreement was found on the importance and usefulness of practices in general, notable differences were found in how drivers of different backgrounds rated various practices, and between the drivers and safety managers.

The logical next step must certainly include an attempt to explain and resolve the differences. For practices and categories of practice where drivers and managers disagree, the potential exists for program managers to achieve better safety program results by realigning their resource allocations in accordance with the drivers' assessments. Of course, the drivers' assessments could be inaccurate; in which case, such a reallocation would decrease safety program performance. Given this reason these findings must be approached with caution. The effectiveness of these practices and categories of practice must be measured in some objective way. Obviously, the effectiveness of motor carrier safety practices has already been investigated (for some related summaries see Corsi and Fanara 1988, Knipling, Hickman and Bergoffen 2003, Mejza et. al. 2003, Brock et. al. 2007, among others). However, none of the previous studies have explicitly surveyed the drivers themselves for their opinions on the effectiveness of safety practices. Using the firm as the unit of analysis for these assessments of practice effectiveness limits the inference that can be drawn, due to confounds that are inherent in studies of these types. It is suggested that only by reviewing the effect of these practices on the individual driver can an appropriate assessment be made. For example, in order to assess the effectiveness of a certain type of training, one should investigate before-after attitudes and behaviors of individuals undergoing the training treatment- in lieu of comparing the performance of firms using that type of training vs. firms that don't.

This approach is obviously not possible for all practices evaluated here. The effects of mandatory drug testing are moot- the testing is required regardless of effectiveness. "Hiring Practices" are also not tractable to an analysis based on an experimental design evaluation of treatments at the individual level. However, an evaluation of hiring practices could be conducted as a pseudo experiment, where safety event involvement is correlated with the various pre-hiring practices in use. For example, a screening process that would deselect a driver above a certain threshold of past failed vehicle inspections could be correlated with future behavior based on driving records. No single approach to evaluating the various practices should be used; however, this research suggests that using the individual driver as the unit of analysis may yield stronger inference and value to practitioners than the more traditional approaches.

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