

PLANT, ROAD CONSTRUCTION, TRAFFIC, AND GENERAL HEALTH AND SAFETY: PERSPECTIVES OF GENERAL CONTRACTORS

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Statistics and various studies indicate that plant, road construction, and traffic safety are major issues in terms of construction H&S. Furthermore, motor vehicle accidents (MVAs) during employment are the dominating cause of fatalities in South African construction. A study was conducted among general contractor (GC) members of a civil engineering sector employer association using a self-administered questionnaire. The salient findings include: plant, road construction, and traffic safety are important aspects in respondents' organizations; plant is the more important of the three aspects; traffic accidents account for a fair percentage of total accidents, and respondents' organizations use a range of such devices and equipment to realize plant, road construction, and traffic safety. Conclusions include: respondents' organizations are managing the three aspects, and H&S programs must focus thereon. Recommendations include that respondents' organizations need to focus on drug and other substance abuse testing and medicals, and that plant, road construction, and traffic safety must feature prominently in H&S programs.

Keywords: Motor vehicle accidents, Construction Industry Development Board, Market and social influences, Injury prevention, Construction road signs.

1 INTRODUCTION

Motor vehicle accidents (MVAs) during employment are the dominating cause of fatalities in South African construction, contributing 47% of fatalities (Construction Industry Development Board (CIDB) 2009). In 2017, 43 / 69 (62.3%) of fatalities were attributable to MVAs during employment in construction (Federated Employers Assurance (FEM) 2018). "Struck by" accidents, which would include struck by plant, contributed 8.7% of fatalities. Furthermore, Sinclair (2010) states that although South Africa boasts a well-deserved reputation for having some of the finest roads on the continent, road construction and traffic safety remains a dominant problem within the South African and worldwide construction industry.

According to the Center for Construction Research and Training (2018), road construction site fatalities accounted for approximately 9% of all construction fatalities between 2003 and 2016 in the United States of America (USA), of which approximately 50% were due to being struck by a vehicle or mobile equipment.

However, the Health and Safety Executive (HSE) emphatically states that, "Construction vehicle accidents can be prevented by the effective management of transport operations throughout the construction process."

Given the aforementioned, a study named *Plant, Road Construction and Traffic Safety* was conducted among GCs to determine perceptions, problems, practices, and injury experience.

2 REVIEW OF THE LITERATURE

2.1 Road construction and traffic safety

Sinclair (2010) postulates that road construction by its very nature represents some of the highest risk work environments of all. These are roads which demand a great deal from the driver - attention, consideration and compliance with traffic regulations in an unforgiving road context. The efforts to improve safety on roads ironically create road construction and traffic safety challenges in the short-term; this is the paradox that countries around the world are dealing with daily (Sinclair 2010). According to Arrive Alive (2012), road construction zones present a deadly hazard for workers, motorists, and pedestrians. This hazard is brought about by high speed limits, impatient drivers, and widespread traffic congestion. Furthermore, heat, driving stress, and long stretches of highway under construction – create a recipe for extreme driving hazards for motorists and road workers alike.

Construction zones are also called “cone zones” - those portions of the highways marked by cones, barrels, and signs where road construction is taking place (Arrive Alive 2012). Some work zones might have a speed-monitoring device to alert motorists of their speed prior to entering the work zone. Even though they are marked and signposted as areas where motorists must slow down and drive with extra caution, many drivers speed up to get through the construction area as quickly as possible, which in its totality produces poor road construction traffic safety (Arrive Alive 2012).

2.2 Factors that influence plant, road construction, and traffic safety

According to BOMEL Limited (2004), there are four major influences in terms of the causes of plant, road construction and traffic accidents within the construction industry. These are: direct influences, which directly influence the likelihood of an accident being caused; organizational influences, which influence and reflect the culture, procedures, and behavior promulgated by the organization; policy level influences, which reflect the expectations of the decision makers in the employers of those at risk and the organizations they interface with e.g. clients, suppliers, and subcontractors, and environmental influences, which cover the wider political, regulatory, market, and social influences which impact the policy influences.

The HSE (2009) contend that most construction transport accidents result from the inadequate segregation of pedestrians and vehicles. This can be mitigated by careful planning, particularly at the design stage, and by controlling vehicle operations during construction work. Inadequate planning and control are the root cause of many construction vehicle accidents, which often involve: vehicles or people being struck by their loads, particularly when reversing; vehicles striking services and obstructions; disregard of manufacturers’ instructions for safe use; inadequate training of drivers and signalers, and unsafe loading and transportation of materials on vehicles.

2.3 Preventing Plant Related Accidents

The HSE (2009) advocate the following to prevent plant related incidents: detailed planning; hazard identification and risk assessment; public protection; establishment of separate pedestrian and vehicle routes; the deployment of signalers; dedicated loading and storage areas; information and warning; appropriate vehicle selection; vehicle inspection and maintenance; safe driving and work practices; circumspect loading of vehicles, and competent experienced drivers / operators, which are not under the influence of alcohol or drugs.

2.4 Preventing injuries at road construction sites

The CPWR (2018) advocate the following categories of solutions to prevent injuries at road construction sites: increased visibility; positive barriers between workers and traffic; warning systems for drivers; warning systems for workers; speed reduction systems; impact attenuators; engineering controls; separate workers on foot from plant and equipment; raise awareness, and equipment safety and rollover prevention.

3 RESEARCH

3.1 Research method and sample stratum

A study named *Plant, Road Construction, and Traffic Safety* was conducted among general contractor (GC) members of a civil engineering sector employer association using a self-administered questionnaire. 55 Responses were included in the analysis of the data, which entailed the computation of frequencies, and a measure of central tendency in the form of a mean score (MS) to enable the comparison of responses to Likert type scale questions, and the ranking of variables related thereto.

3.2 Research findings

Table 1 indicates the importance of plant, road construction, traffic, and general safety in respondents’ organizations in terms of percentage responses to a scale of 1 (not important) to 5 (very important), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the MSs are above the midpoint of 3.00, which indicates that in general, the respondents perceive plant, road construction, traffic, and general safety in to be more than important as opposed to less than important. It is notable that 3 / 4 (75%) MSs are $> 4.20 \leq 5.00$, which indicates that plant, general, and traffic safety are between more than important to very important / very important. Road construction safety’s MS is marginally below the cut-point of the former range.

Table 1. The importance of plant, road construction, traffic, and general safety in respondents’ organizations.

Type	Response (%)					MS	Rank	
	Un- sure	NotVery	1	2	3			4
Plant	0.0	3.6	3.6	0.0	16.1	76.8	4.59	1
General	1.8	3.6	0.0	12.7	23.6	58.2	4.35	2
Traffic	1.8	7.1	0.0	12.5	14.3	64.3	4.31	3
Road construction	3.6	10.7	3.6	7.1	10.7	64.3	4.19	4

Table 2 indicates the extent to which plant, road construction, traffic, and general safety constitute a problem in respondents’ organizations in terms of percentage responses to a scale of 1 (does not) to 5 (major), and a MS ranging between 1.00 and 5.00. It is notable that all the MSs are below the midpoint of 3.00, which indicates that in general, the respondents perceive plant, road construction, traffic, and general safety to constitute a minor as opposed to a major problem. However, in terms of ranges, all the MSs are $> 1.80 \leq 2.60$, which indicates that they constitute between does not to less than a problem / less than a problem.

Table 2. The extent to which plant, road construction, traffic, and general safety constitute a problem in respondents' organizations.

Type	Response (%)					MS	Rank	
	Don't know	Does not.....	1	2	3			4
Traffic	0.0	27.3	23.6	25.5	16.4	7.3	2.53	1
General	5.4	23.2	35.7	30.4	3.6	1.8	2.21	2
Road construction	3.6	33.9	30.4	17.9	7.1	7.1	2.20	3
Plant	0.0	25.0	44.6	25.0	0.0	5.4	2.16	4

Table 3 indicates the extent to which respondents agree with plant, road construction, and traffic safety related statements in terms of percentage responses to a scale of 1 (does not) to 5 (major), and a MS ranging between 1.00 and 5.00. It is notable that 4 / 6 (66.7%) MSs are > 3.00, which in general indicates agreement, and that 2 / 6 (33.3%) MSs are < 3.00, which in general indicates disagreement. However, in terms of ranges, 3 / 6 (50%) MSs are > 4.20 ≤ 5.00, which indicates that respondents agree to strongly agree / strongly agree that plant, road construction, and traffic safety are important components of H&S. In terms of accidents relative to the respective categories accounting for a fair percentage of total accidents, the agreement with respect to traffic is between neutral to agree / agree as the MS of 3.55 is > 3.40 ≤ 4.20. In the case of road construction, and plant operating, the agreement is between disagree to neutral / neutral as the MSs of 2.64, and 2.70 respectively are > 2.60 ≤ 3.40.

Table 3. Extent to which respondents agree with plant, road construction, and traffic safety related statements.

Statement	Response (%)						MS
	Don't know	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Plant safety is an important component of H&S	0.0	0.0	1.8	0.0	36.4	61.8	4.58
Traffic safety is an important component of H&S	1.8	0.0	0.0	3.6	29.1	65.5	4.56
Road construction safety is an important component of H&S	1.8	0.0	0.0	9.1	29.1	60.0	4.45
Traffic accidents account for a fair percentage of total accidents	1.8	3.6	14.3	21.4	37.5	21.4	3.55
Plant operating accidents account for a fair percentage of total accidents	7.1	10.7	26.8	28.6	21.4	5.4	2.70
Road construction accidents account for a fair percentage of total accidents	10.7	8.9	28.6	25.0	21.4	5.4	2.64

In terms of the extent to which respondents' organizations conduct medicals, training, and drug and other substance abuse testing, it is notable that operator training (89.1%) is ranked first, followed by drug and other substance abuse testing (41.8%), operator in-employment medicals (31.5%), and operator pre-employment medicals (22.2%).

Table 4 indicates the extent to which various issues constitute a problem in respondents' organizations and on projects, in terms of percentage responses to a scale of 1 (not) to 5 (major), and a MS ranging from 1.00 to 5.00. It is notable that only 3 / 11 MSs are > 3.00, which indicates the extent is major as opposed to minor. It is notable that no MSs are > 4.20 ≤ 5.00 – a near

major to a major / major extent. Only 1 / 11 (9.9%) MSs is $> 3.40 \leq 4.20$, namely speeding by public during work on or adjacent to existing roads, which indicates the frequency is between some extent to a near major extent / near major extent. Only 3 / 11 (%) of the MSs are $> 2.60 \leq 3.40$, which indicates that the extent is between near minor to some extent / some extent - poor road (public) surface conditions, poor road marking, and poor lighting. The remaining 7 / 11 MSs are $1.80 \leq 2.60$, which indicates the extent is between not to near minor / near minor.

Table 4. The extent to which issues constitute a problem in respondents' organizations and on projects.

Issue	Response (%)					MS	Rank	
	Don't know	Not	Major					
		1	2	3	4	5		
Speeding by public during work on or adjacent to existing roads	0.0	3.6	3.6	14.3	35.7	42.9	4.11	1
Poor road (public) surface conditions	1.8	10.7	12.5	35.7	21.4	17.9	3.24	2
Poor road marking	1.8	14.3	19.6	21.4	28.6	14.3	3.09	3
Poor lighting	5.4	14.3	25.0	21.4	21.4	12.5	2.92	4
Inadequate operator / driver education	1.8	21.4	32.1	30.4	10.7	3.6	2.42	5
Operating / Driving while under the influence	3.6	33.9	30.4	25.0	3.6	3.6	2.10	6
Overloaded vehicles – Materials / Plant	1.8	37.5	30.4	26.8	1.8	1.8	1.98	7
Overloaded vehicles - Personnel	7.3	32.7	41.8	12.7	3.6	1.8	1.92	8
Operator / Driver fatigue	0.0	33.9	39.3	19.6	1.8	1.8	1.88	9
Unlicensed operators / drivers	0.0	50.0	19.6	23.2	7.1	0.0	1.87	10
Unroadworthy plant / vehicles	1.8	46.4	32.1	14.3	5.4	1.8	1.84	11

In terms of the extent of use of devices and equipment when respondents' organizations undertake any type of road construction, 7 / 8 devices / equipment were identified by more than 60% of respondents, 5 / 8 by more than 80% of respondents, and 2 / 8 (25%) by more than 90% of respondents. Construction road signs were identified by 100% of respondents, followed by chevron hazard plates (95.7%).

It is notable that in terms of accidents, MVAs recorded the highest mean (4.50) followed by general (3.12), plant operating (2.23), and road construction (1.48). However, in terms of injuries, general recorded the highest (1.51), followed by road construction (1.30), and jointly by MVAs and plant operating (0.98).

In terms of the extent to which respondents' organizations calculate various types of accident rates, disabling injuries (100%) predominates, followed by plant accidents per hours operated (88.2%), fatalities (65.3%), and traffic accidents per km travelled (62.7%).

4 CONCLUSIONS

The degree of importance of plant, traffic, and road construction safety relative to general H&S leads to the conclusion that they are important aspects in respondents' organizations, and in civil engineering construction H&S. This is underscored by the extent to which respondents agree that plant, road construction, and traffic safety are an important component of H&S. The relative importance of plant safety leads to the conclusion that plant is the more important of the three aspects.

The extent to which plant, road construction, traffic, and general safety constitute a problem in respondents' organizations leads to the conclusion that the respondents' organizations are managing such aspects.

The extent to which respondents agree that traffic accidents account for a fair percentage of total accidents underscores the findings of literature, and industry statistics. This leads to the conclusion that H&S programs must focus thereon.

The extent to which respondents' organizations conduct medicals, training, and drug and other substance abuse testing leads to the conclusion that they appreciate the importance of operator training, but need to focus on drug and other substance abuse testing and medicals.

The extent to which certain issues constitute a problem in respondents' organizations and on projects, namely speeding by the public during work on or adjacent to existing roads, poor road (public) surface conditions, poor road marking, and poor lighting, lead to the conclusion that traffic safety is an important issue. This is underscored by the literature.

The extent of use of devices and equipment when respondents' organizations undertake any type of road construction leads to the conclusion that they use a range of such devices and equipment to realize plant, road construction, and traffic safety, and general H&S.

The mean number of accidents and injuries that occurred in respondents' organizations highlights the importance of MVAs during employment as reflected in the literature, and the conclusion that traffic safety must feature prominently in H&S programs. The extent to which respondents' organizations calculate various types of accident rates, namely plant accidents per hours operated, and traffic accidents per km travelled, leads to the conclusion that they are measured because they are issues, which further motivates the importance of plant and traffic safety.

Future research should review the status quo relative to the issues reported on, and given a key finding, namely that traffic accidents account for a fair percentage of total accidents, traffic safety issues should be addressed in more detail.

References

- Arrive Alive, *Road Safety Information, Education and Tips: Arrive Alive South Africa*, 2012. Retrieved from www.arrivealive.co.za on 25 February 2013.
- BOMEL Limited, *Improving health and safety in construction, Phase 2- Depth and breadth: Volume 3 Construction transport accidents, Underlying causes and risk control*, Norwich, United Kingdom, Health and Safety Executive, 2004.
- Center for Construction Research and Training (CPWR), *Quarterly Data Report, Fatal Injuries at Road Construction Sites among Construction Workers*, Washington, Second Quarter, 2018.
- Construction Industry Development Board (CIDB), *Construction Health & Safety in South Africa Status & Recommendations*, CIDB, Pretoria, 2009.
- Federated Employers Assurance (FEM), *Injuries per Injury Type for all MBA Regions from 2017 to 2018*. Retrieved from www.fem.co.za/Layer_SL/FEM_Home/FEM_Accident_Stats/FEM_Accident_Stats.htm on 11 March 2018]
- Health and Safety Executive (HSE), *The Safe Use of Vehicles on Construction Sites*, HSE, Richmond, United Kingdom, 2009.
- Sinclair, M., Vulnerability at Road Construction Sites, South Africa, in *Proceedings of the 29th Southern African Transport Conference*, Pretoria, South Africa, 610-620, 16-19 August, 2010.