Written Submission to the OCOT Panel for Apprentice Ratio Reviews

Group 18:

Electrician: Construction and Maintenance, Electrician: Domestic and Rural

Why Apprentice Ratios Matter

“For every 10% increase in the percentage of apprentices at the worksite (in one hazardous trade), there was a 27% increase in ladder falls” (Kaskutas, Dale, Lipscomb, Gaal, & Fuchs, 2010, p. 262).

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Abstract

This electrical safety researcher believes, and the incident data and literature confirm, the single most important criteria for judging whether or not to increase the ratio of apprentice electricians to journeymen electricians ought to be the safety of the workers themselves.

All other criteria pale in the face of the evidence confirming that human lives and livelihood must be placed ahead of commercial or economic interests. Whether in a unionized environment or not, risk is blind when it comes to workers, especially young workers in hazardous trades. The U.S. Bureau of Labor research has shown that “fatal work injuries amongst young workers 20-24 were up by 18% YTD” (Kaskutas et al., 2010, p. 258). Further, “in 2007 the US construction industry experienced more fatalities than any other industry” (p. 258).

What defines a hazardous trade? The incidence of occupational death and injury and their prevalence in a specific construction trade, relative to other construction trades, are, I believe, a good arbiter as to what is hazardous work and what is not. I would add the morbidity rate of an occupational injury (i.e., how likely is an injury to result in the death of that worker) is also a key indicator of what constitutes a hazardous trade.

What ratio is an appropriate one for apprentices to journeymen in hazardous trades? It would be difficult to state what is a good ratio of new, young, unskilled, untrained, apprentice electricians to journeymen electricians and master electricians. However, the research data confirm that to increase the ratio of apprentices to journeymen in hazardous trades is to put more young lives and livelihood at risk while on the job site.
Why Apprentice Ratios Matter

Kelloway, Yue, and Hessian (2008) stated, “Young workers experience more injuries, but fewer fatalities than do older workers” (p. 3). They further added that “within a population of young workers, adolescent males are consistently identified as the high risk group” (p. 4).

I argue that until more is known about the human factors involved in occupational death and injury in hazardous construction trades, the Ontario College of Trades should not increase the ratio of electrical apprentices to journeymen electricians. “Electrocution ranked as the 5th leading cause of occupational death from 1992 to 1999” (Electrical Safety Authority [ESA], n.d., pp. 1-2), and it was serious trade injuries and power line contact that caused 49% of all workplace electrical fatalities (p. 1).

The average age of an electrical apprentice in Ontario is 28 years old, while over 80% of electricians who were injured on the job are 30 years and older (ESA, n.d., p. 10). Therefore, it appears that older workers are the ones getting electrocuted, and the prevalence of electricians getting electrocuted has more than doubled from the 2000-2004 time period to 2005-2009 time period (pp. 6 & 10). Further, serious electrical injuries to all occupations had been reduced by more than 50% between the 2000-2004 time period to the 2005-2009 time period; however, in comparison, the number of serious injuries to electricians has increased six-fold in this span of nine years from 2000 to 2009 (p. 8), and the average age of a person involved in a fatal accident is 40.1 (p. 10).

Why is that?

To start with, non-serious occupational electrical injuries doubled from 1998 to 2006 and have stayed near this elevated level until 2009 (the most recent data available,
see Table 1), and non-critical accidents are a precursor of serious accidents and death. These data, though, only represent those reported electrical injuries, and scholars have agreed that upwards of 40% to 90% of workplace injuries go unreported (Kelloway & Francis, 2011, p. 52).

More worrisome, in spite of a drop in other construction injuries, non-critical occupational electrical injuries, and power line contact have doubled (see Table 1). and to help define the notion of hazardous trade more explicitly, the ratio of electrical fatalities to non-serious injuries is 1:15, compared to 1:755 for other occupational injuries (ESA, n.d., p. 4). Further, if a worker contacts an energized piece of machinery, system, or power line which results in a lost-time injury, he or she is almost 100 x more likely to die from that contact as compared to all other types of LTI’s combined (Ontario Ministry of Labour [MOL], 2009, p. 2). One other contributing factor is that 71% of electricians have worked on “live” 347-volt circuits or lighting (Olechna, n.d., p. 1).

In his research, Howe (2008) showed that young, single, extroverted males are the greatest risk takers on a construction site (p. ii), and ESA (n.d.) noted that all fatalities due to occupational electrical contact over the past 15 years were to male workers, and there were no incidents of female electrical workers being electrocuted (p. 4). ESA (n.d.) has noted:

Death and serious injuries to the electrical trade increase both in numbers and prevalence. Death to electricians between 2000-2004, accounted for 8% of all electrocution in the workplace. Between 2005-2009, the prevalence jumped to 20%, an increase of almost two-fold. . . . Totaling all serious injuries (fatalities and critical injuries), the number jumped from five to 30 for the same period, a six-fold increase. (p. 1)
Williamson and Feyer (1998) confirmed that human factors are the prime reason for fatalities to electrical workers, and “these human factors are most likely to be knowledge-based errors of omission, not commission” (p. 192). “Most (electrical) deaths (85%) occurred when the workers were performing repair, maintenance, or new construction” (ESA, n.d., p. 1).

So the question is: Does the ratio of apprentices to C of Q journeymen have any impact on the health and safety of these workers? The answer is a resounding yes for another hazardous trade: residential carpenters, as falls from height are one of the most prevalent occupational injuries, and such injuries relate closely to work place fatalities. Kaskutas, Dale, Lipscomb, Gaal, and Fuchs (2010) stated that in a study of 1,025 unionized residential carpenters, apprentices confirmed that “journeymen teach them how to do the job safely” (p. 261) and that “the strongest single risk factor predicting falls was having less than one year of work experience” (p. 262). Most concerning though was the finding that “for every 10% increase in the percentage of apprentices at the worksite, there was a 27% increase in ladder falls” (p. 262).

If this significant increase in workplace injury is taking place with only a 10% increase in the percentage of apprentices to journeymen in one hazardous trade (i.e., residential carpentry), why would it not be mirrored in an other hazardous craft such as the electrical trade? The vast majority of learning the safe work practices in hazardous construction trades takes place on the job site, not in the classroom. New, young, and inexperienced workers learn safe work practices under the tutelage of seasoned masters in their trade, and if there is a lack of these journeymen/mentors, accidents will increase.
Members of the Panel

Thank you for taking time to hear my recommendation calling for the retention of the current apprentice-to-journeyman ratios for workers employed in the electrical trade, specifically construction, maintenance, rural, and domestic electricians.

Electricity is an invisible, odourless, and highly toxic material, and as such, workers each year are killed and injured due to planned and unplanned contact with energized machinery, power lines, and equipment. Being an electrician in Ontario is to be employed in a dangerous craft because of the high morbidity rate due to contact with energized machinery, equipment, or power lines, based on the increasing prevalence of electricians being killed by electrical contact ESA (n.d.). This situation is compounded by the poorly understood practice of “working live” on energized machinery or equipment (p. 1).

This presentation, similar to my Submission to the Dean Panel, states that although I recognize that apprentice-to-journeyman ratio’s can have an economic impact, I believe, and the data have confirmed, that Occupational Health and Safety should be the number one criteria utilized by the Review Panel to judge whether or not to increase the ratio of apprentices to C of Q electricians in Ontario.

This presentation will demonstrate that in hazardous trades, such as electrical, residential roofing, and others, it is the youngest, newest workers on a job site who are the most vulnerable. It is these workers who need the protection afforded them under Ontario’s Occupational Health and Safety Act (1990) and through the consistent, watchful training of C of Q journeymen and journeywomen.

Make no mistake; this presentation is not about the unionized sector or the non-unionized sector. This submission is about young, vulnerable construction workers
because, quite frankly, they get injured and killed while working in all types of construction organizations.

In my arguments in favour of maintaining the existing apprentice-to-journeyman ratio for Ontario electricians, I will address each of the 11 Review Criteria: Group 18: Electrician - Construction and Maintenance, Electrician: Domestic and Rural established by the Ontario College of Trades (2012) from the perspective of worker safety.

**Panel Criteria I: The scope of practice of the trade**

Currently the effective ratio of apprentices to journeyman domestic and rural electricians is one apprentice for every two journeyperson electricians, or greater (1:1) for these classes of electricians, given that ESA data show that over 86% of all Ontario electrical contractors have five employees or less (ESA, 2012, p.12).

C of Q electricians, journeypersons, and master electricians are highly trained in the safe practices of their craft, the scope of which is wide and varied, insofar as it includes diagnostics and repair of faulty and working machinery, equipment, control panels and wiring installation. One notable practice of the trade that is deadly, unsafe, and widely practiced is the notion of “live work”.

In the Electrical Engineering Technician Program at one Ontario College, apprentices receive less than 60 hours of safety training over four years. Given the technical and “hands on” nature of electrical work, the vast majority of safety training for new, young apprentice electricians takes place on the job site. These safe work practices and safety training are delivered by qualified (C of Q) electricians while on the job site and represent learnings and skills that are vital to understanding safe work practices, and habits when around electrical equipment.
Panel Criteria II: The apprenticeship program established by the College.

The ratio of apprentice to journeyperson in the apprenticeship programs is established by the College. In the case of non-hazardous trades where the rate of job-site injury is low compared to other construction trades; I would argue that commercial interests (i.e., demand for these types and classes of workers) should drive the ratios that apply to apprentices in safe trades. Kleiner and Won Park (2011) stated that “10% of class study is spent on safety” (p. 3).

Panel Criteria III. How the journeyperson-to-apprentice ratio for the trade may affect the health and safety of apprentices and journeypersons working in the trade and the public who may be affected by the work.

There is little data on the public who may be affected by electrical work, other than the obvious hardship, ongoing sorrow, pain, and loss that some publics suffer when a worker gets injured or electrocuted at work. Electricians today continue to work in a hazardous trade with an invisible, odourless, colorless, and highly toxic harm, as the following data will confirm.

Electrocutions ranked as the fifth leading cause of occupational deaths between 1992 to 1999 (ESA, n.d., p. 1). Serious trade injuries and power line contact were “the two most prevalent problems in the last 10 years for Ontario, accounting for 49% of all electrical related fatalities in the work place” (p. 2). Further, “electrical related serious injuries (death and critical injuries) decreased dramatically in the last ten years, while the number of electrocutions to the electrical trade have remained the same” (p. 6).

Trend-wise, “the prevalence of electricians electrocuted has more than doubled, when comparing the two five-year periods: from 8% between 2000-2004, to 20% between 2005-2009” (ESA, n.d., p. 6). However, “the number of serious injuries to
electricians has increased six fold’ from the 2000-2004 time period to the 2005-2009 time period” (ESA, n.d., p. 8). That being said, both ESA and MOL have executed highly effective communications and enforcement initiatives, yet live work continues today. Based on their research of a 2009 census of fatal occupational injuries, Kleiner and Won Park (2011) agreed that “deaths and injuries of electricians rank amongst the highest in the construction industry” (p. 4).

How are electricians and other expert trade workers getting injured and killed at work? ESA (n.d.) has noted that 58% of electricians were doing non-residential repair, and maintenance work (35 out of 45 serious injuries) and for electricians: working live on energized equipment and machinery was the primary cause. For non-electrical trades it was the inadvertent contact with an energized source: not knowing the equipment was energized (lack of training in risk hazard identification?). (p. 8)

Who is getting injured by occupational electrical contact? As reported by ESA (n.d., p. 10):

- 100% are males;
- 80% of them are 30 years of age and older;
- Most had performed these tasks before; [and]
- With regards to electrical fatalities, the average age of the victim was 40.1 years old.

Some would argue that ratios of apprentices to journeypersons in hazardous trades has no impact on workplace safety; however, they would be mistaken. In 2007, researchers from Washington University School of Medicine (as cited in Kaskutas et al., 2010), reported clear evidence linking increased apprentice ratios to increased injuries in
a peer reviewed study on another high-risk trade: residential carpentry. Falls from ladders for carpenters along with electrical contact for electricians and other trades are some of the occupational hazards causing an inordinate number of occupational deaths, and injuries.

Deaths due to falls in construction have risen in the past decade contrary to national trends of declining mortality from other occupational fatalities. Kaskutas et al. (2010) found that “apprentices on work crews characterized by a high number of apprentices, are also more likely to fall from heights, suggesting that adequate, on the job mentorship is essential” (p. 261). Limiting the number of apprentices working at residential construction sites will increase the opportunities for mentorship because research by these authors showed that “inexperienced carpenters do not receive the type, or amount of mentorship they would like from journeymen on their work crews” (p. 263).

Kaskutas et al. (2010) also found that an increase in ratio of apprentices to journeymen had a direct and negative impact on apprentice and worker safety:

For every 10% increase in the percentage of apprentices at the worksite, there was a 27% increase in ladder falls. . . Apprentices working on crews with safe work behaviors and climates were less likely to experience falls, as were those on crews with fewer apprentices. (p. 262)

Additionally, Kaskutas et al. also found “the strongest independent risk factor predicting falls was having less than one year of work experience” (p. 262). Other findings from Kaskutas et al. (pp. 261-262) include:

- Over half of all apprentices reported knowing a colleague who experienced a serious work related fall;
• 16% had personally fallen from a height;
• apprentices reported they always, or often, observed crew members performing unsafe acts;
• 16% had been asked to sign off on safety training they never received;
• the average apprentice-to-journeyman ratio in this study was 1:1 (for all crews);
• this study included all four years of apprentices, all were unionized; and
• 1,025 apprentices participated in this two-year study.

McVittie and Vi’s (2009) research findings agreed with the later findings of Kaskutas et al. (2010) in regards to the vital role that apprentice-to-journeyperson ratios play in keeping young, vulnerable workers free from harm while on the construction site. McVittie and Vi discovered that “as the density of trained supervisors increases, there is a statistically significant reduction in the rate of lost-time injuries” (p. 1).

In their report, McVittie and Vi (2009) noted the Lambton/Sarnia area had a much lower rate of occupational injury, in part due to its very high ratio of supervisors to apprentices (p. 6). They noted that in Sarnia during 2007, there was on average 17.41 supervisors for every 100 workers, versus a provincial ratio of 6.04 supervisors for every 100 workers (p. 6). Lastly, McVittie and Vi stated, “WSIB injury data show a relationship between, on one hand, the density of supervisors who have received training in both basic supervisory skills and in health and safety, and on the other hand, the rate of lost time injuries” (p. 12). They also noted that the employers in Sarnia were vigilant in safety and safety reporting from all trades working on/in their sites.

Other scholars’ research agreed with McVittie and Vi’s (2009) findings. West, De Castor, and Fitzgerald (as cited in Janicak, 2008) found that ‘in terms of fatality rates,
young workers have been found to suffer from a significant number of occupational injuries and illnesses compared to other at risk groups” (p. 618).

**Under Reporting of Electrical Injuries**

So far we have only discussed reported electrical injuries, but Kelloway and Francis (2011) stated,

Workers Compensation Boards are the main purveyors of incident statistics and provincial/territorial health and safety policies often driven by trends in workers compensation data’ and ‘that being said there are also good reasons why we should not rely solely on Workers Compensation data as a source of policy, or information’. (p. 52)

This phenomenon is due, in part, to the following filters:

1. Under reporting of workplace injuries: “Studies have suggested reported injuries may represent only one-tenth of the actual injuries” (Kelloway & Francis, 2011, p. 9).
2. "Since Workers Compensation rates are based on the number of claims filed, there are strong incentives for employers not to file claims. Some data indicate that up to 40% of all injuries remain unreported due to the experience rating provisions and other factors” (Kelloway & Francis, 2011, p. 9).
3. There is substantial disincentive, legal and otherwise for unlicensed contractors to report accidents: Non-reporting of accidents and injuries in the underground economy is a common practice (Fairey, Calvert, & Peppard, 2009, p. 6).

With respect to underreporting due to the Experience Rating (ER) system, this is what the Ontario Nurses Association noted in a Submission to the Ontario Standing
Committee on Government Agencies Regarding Workplace Safety and Insurance Board (Haslam-Stroud, 2012): one large health care provider received $352,000 in rebates from the WSIB in 2007 “while engaging in this questionable health and safety practices” (p. 1). After a WSIB investigation, this rebate was turned into a $770,000 surcharge in 2008, a $997,000 surcharge in 2009, a $2.1 million surcharge in 2010, and $1.8 million surcharge in 2011 (p. 2).

Underreporting due to ER and other systemic issues represent psychosocial risk and harm to apprentices, young journeymen, and veteran electricians, and to all those in construction trade, Azaroff, Levenstein, and Wegeman (2002) stated, “Empirical findings indicate that workers repeatedly risk adverse consequences if they complete these steps, (reporting a workplace injury) while systems for insuring their completion are weak or absent” (p. 1241). Azaroff et al. reported on the many layers or “filters” an injured worker must negotiate through, in order to successfully file an injured worker report: “Workers who report health problems to supervisors may risk disciplinary action, denial of overtime or promotional opportunities, stigmatization, drug testing, harassment, or job loss. Others may fear these outcomes even in the absence of demonstrable risk” (p. 1242). Another factor involved in the promotion of non-reporting of occupational injury is a purely business issue:

In the construction industry, contractors’ records of compensation claims also affect their competitiveness in contract bids. . . . Employers may record occupational injuries and illnesses in ways that protect the business from liability, particularly in the identification of the source, causal event, and exposure leading to the injuries. For example, providing on-site medical treatment and classifying it as first aid circumvents reporting requirements. (p. 1245).
What does the data on electrical death and injuries tell us?

Contact is often deadly. ESA (n.d.) has stated, “The ratio of electrical fatality to critical electrical injury is 1:4, compared to 1:755 for other occupational injuries. This means that in one out four times, an occupational electrical contact causing a critical injury will end up killing a worker (p. 4).

Additionally, non-critical injuries were higher in each year after 1998 increasing 1998 to 2006, then dropping back to 2004 levels, MOL WESC, and ESA Abstract), see Table 1, and as noted between the two five-year periods (2000 to 2004 and 2005 to 2009), “the number of serious injuries to electricians has increased six-fold” (p. 8). Though recent trends suggest this is improving, young apprentices and veteran electrical workers are at risk when working on or near energized electrical equipment, machinery, powerlines and panels. Until more is understood about the human factors involved in occupational electrical injuries and death, the ratio of electrical apprentices to journeymen in Ontario should not be increased.

Panel Criteria IV: The effect, if any, of the journeyperson-to-apprentice ratio of the trade on the environment.

There is little in the literature to indicate that ratio of apprentice to journeyperson has a meaningful impact on the environment.

Panel Criteria V: The economic impact of the journeyperson-to-apprentice ratio of the trade on apprentices, journeypersons, employers and employer associations and, where applicable, on trade unions, employee associations, apprentice training providers, and the public.

One message is clear occupational electrical fatalities are expensive: Albert and Hallowell (2013) stated that the average cost of each electrical fatality was $4 million,
and the cost of each lost-time injury was $42,207 (p. 119). However, in what currency is electrical risk paid for? Would the action of increasing the percentage of apprentices on hazardous job sites not be like simply trading off worker safety for lower wages paid?

Noted economist Adam Smith, in 1937, suggested that workers will demand higher wages for risky work, and I argue that given electricity is an environmental hazard, as it is invisible, ordourless, and highly toxic to humans on contact, then expert workers in this dangerous craft deserve a higher wage, or danger pay, due to the dangerous nature of working on or near electrical equipment.

**Panel Criteria VI: The number of apprentices and journeypersons working in the trade.**

The MTCU, in its External Data Report October 2012, stated that in 2012, there were 10,204 apprentices in the Electrical Construction and Maintenance program, with 39,668 C of Q electricians in the is sub-trade. There were 141 apprentices and 852 C o Q electricians in the domestic and rural electrical trade.

**Panel Criteria VII. The rates of completion for apprentices in an apprentice training program for the trade.**

Statistics Canada (2010) has told us four out of 10 apprentices never complete their program, while one out of 10 is still in the program 11 years later, resulting in approximately 52% completion for apprentices employed in Electrical Electronics and Related Trades, a sub class created by Stats Canada (p. 1).
Panel Criteria VIII. The journeyperson-to-apprentice ratio, if any, for a similar trade in other jurisdictions.

Other provinces have higher apprentice-to-journeymen ratios, while BC eliminated the concept of compulsory trades in 2002 and has since seen its completion rate for apprentices fall, resulting in a startling increases in serious injuries in subsequent years (Penner, 2007). Most provinces have gone in the opposite direction from BC and strengthened their compulsory trade regulations.

Panel Criteria IX. The supply of, and demand for, journeypersons in the trade and in the labour market generally.

Service Canada (2012) supports the notion that there is little in the way of marketplace demand for additional electricians, "considering the projected slight growth in this industry, the number of electricians should increase slightly over the next few years: (Important Considerations section, para. 1).

Panel Criteria X. The attraction and retention of apprentices and journeypersons in the trade.

In 2012, MTCU data tell us that 2,037 new apprentices were attracted to the trade of construction and maintenance electrician, while 29 new apprentices were attracted to the trade of domestic and rural electrician. As noted, with a retention rate of approximately 52%, one could extrapolate the data to show that over the next four-year period, 4,236 newly qualified C of Q Construction and Maintenance and Domestic electricians will enter the labour market in Ontario (Ministry of College and Trades, 2012).
Panel Criteria X1. The average age of apprentices and journeypersons in the trade and the projected attrition of journeypersons working in the trade.

The average age of electrical construction and maintenance workers: 49 years old, with apprentices aged an average 28 years old. For domestic and rural C of Q electricians, the average age was 51, with apprentices being 28 years old (MTCU, 2012). What is the projected attrition rate of electricians? Some have stated the attrition rate is as high as 20%, while others have suggested that attrition will be matched by the intake of new apprentices into the program.

One factor that may cause an increase in demand for C of Q electricians in North America is our increasingly “smart” electrical grid. This is so because of the many new electrical devices and systems now being connected to the electrical grid, such as electric vehicles, solar panels, and wind turbines.
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Table 1
Occupational Death and Injury Due to Electrical Contact in Ontario, 1998 to 2012

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- Rieser, M. WESC Report, Lessons Learned From Nine Years of Reports, MOL, 2007, 2006

- Electrical Safety Authority (date unknown): ESA Report Abstract. Electrical Safety in the Workplace and Arc Flash

Table 2
Occupational Death and Injury Due to Electrical Contact in Ontario, 1998 to 2006

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