TECHNICAL PAPER

DEVELOPMENT OF FRONTLINE STAFF TO IMPROVE SERVICE DELIVERY OBJECTIVES.

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ABSTRACT

Frontline worker training in the construction industry has traditionally centred around on-the-job training developed to complete clearly defined work tasks. In parallel the construction industry has developed into a highly regulated workplace requiring additional skill sets to be developed for frontline workers to facilitate their proactive contribution to meeting industry needs and practices. This initiative included over 1,700 construction industry participants at Downer EDI Works in New Zealand. Frontline workers were found through surveys to have low academic attainment levels resulting in a skill level gap which inhibits their inclusion in a knowledge-based society and workplace. The authors show how Downer EDI Works have recognised the skills potential of this group of people and have addressed the skills gap through a series of learning initiatives. This has resulted in an improvement of academic skill levels and development of critical thinking and communication skills resulting in over 1,400 nationally recognised qualifications being attained. A clearly defined career path linked to qualifications has been developed for frontline workers. Additionally, the newly acquired skills are applied through improved confidence and capability demonstrated here through a case study application.

INTRODUCTION

Work on the state highway network takes place daily with planned projects tending to be most noticeable during the summer months. All worksites are visible to the public mostly through the traffic management measures employed, from speed signs and cones on state highways to temporary traffic lights and Stop / Go boards at intersections. Roading projects are constructed, maintained and renovated with the aim of providing an acceptable trade-off during works between (a) road safety and (b) minimisation of disruption to the travelling public. When road works take place, measures are put into place to ensure that the above points (a) and (b) are met through planning of the work programme, temporary traffic management and procedures to provide (c) a safe working environment during works.

All aspects of a contractor's works are governed on the macro-scale by a regulatory environment. In order of seniority Acts, Regulations and Standards whilst at the micro-scale Codes of Practice and Company Policy are guides for standard practices to be followed. One might expect senior technical staff to have a good understanding of Standards, Codes of Practice and Company Policy with a working knowledge of salient detail from Acts and Regulations, but infrequently are details passed onto frontline workers actually carrying out physical work. In short, whilst frontline workers understand that they have a physical task to accomplish, they do not necessarily understand the importance that their personal role has on the completion of the entire task. This is not necessarily due to an unwillingness to transfer such data, but has been shown to be partially caused by an inherently low academic skill level at the frontline levels of employment.

Downer EDI Works (Works) employs over 4,000 people in New Zealand, with over 2,800 being at the operational level engaged in construction projects around the country. This paper concentrates on the effect of providing basic skills training in literacy and numeracy to around 1,700 frontline workers to improve their personal understanding and well-being together with providing the skills to allow such workers to access further training and knowledge to enhance their career and life prospects. The application of training received is put into practice as a case study on the Brynderwyn State Highway 1.

Traditional Training of Frontline Workers

Historically training has been task oriented, with the decision making process being performed by the manager with limited or no questions; Tannebaum and Schmitts (1973) "Boss-centred leadership". Academic research has shown, for example in the mining industry, by Paul and Matti (2007), that production pressure, lack of skills, saving time and effort, lack of awareness of the consequences of risk taking behaviour and illiteracy contribute to greater risk taking. This can be extrapolated on the construction site to reduced quality of work and increased probability of accidents occurring. Concerning the authors aims to promote points (a), (b) and (c), this situation was not sustainable and was not properly understood.

Works recognised that there was a need to link frontline workers' understanding of the required work with additional training to improve their performance and a projects successful completion. Paul and Matti, (2007) note similarly in the mining industry that training was mainly geared to the task rather than the individuals capability to contribute to the wider work experience.

UNDERSTANDING THE START POINT

Downer EDI Works and The Department of Labour undertook competence surveys with 123 of Works frontline employees in 2006 across 13 branches; this represented 7.4% of the eligible employees. The employee groups chosen for the survey were the frontline workers, mainly at the supervisory level. Figure No. 1 shows the percentage split of the sample group.

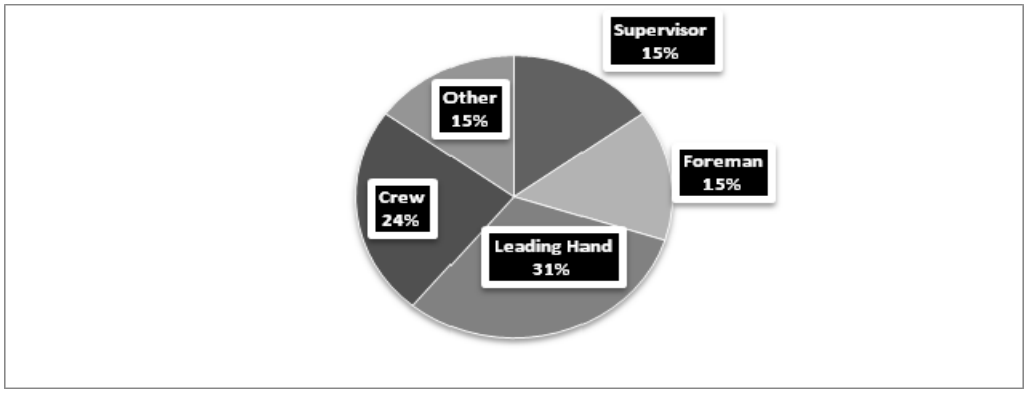

Figure No.1. Primary job roles of participants.

The survey evaluated reading, writing, mathematics, oral communication and critical thinking. (Benseman et al, 2007). The study found that there was an average 1.03 literacy and numeracy level gap between the skills available and those that were required to effectively complete significant tasks within the roading work environment, the academic attainment levels being compared with those required for work shown in Table 1.

Training in areas not directly required to complete the physical nature of their employment was seen as un-necessary and training even caused dissatisfaction according to some respondents. This was also noted by Smith and Gardner (2007), concerning work-life balance initiatives finding that dissatisfied employees were often less committed to the organisation. Anything other than the physical work was seen as an un-necessary hygiene function, as defined by Herzberg, Mausner and Snyderman (1959) rather than something that is an integral part of the work and life process. However, the majority of respondents indicated a willingness to participate in basic skills training to improve their skills.

The authors considered specific areas where this skill gap was expected to have an operational impact finding that compliance issues with Health, Safety and Environment changes requiring significant increases in critical thinking, paperwork and the communications skills of foremen and supervisors. Additional operational reporting activities have changed the ways that data are captured and there is an increasing reliance on mathematical skills across the business. The industry itself has changed from a price-based contract award system to a value-price system where a contractor's attributes are also considered in evaluating tender submissions e.g. New Zealand Transport Agency (NZTA), (2009). This has required frontline workers, mainly at the supervisory level, to be able to accurately write working methodologies and describe value adding activities whilst curriculum vitae are also evaluated in submissions for the skill level of key operational staff. Finally it was noted that skills required on modern construction sites were more diverse in a competitive environment and multi-skilling was essential to mitigate skilled-worker shortages.

The skill-gap shortage identified that foundation skills were limited for frontline workers and this in turn undermined their abilities to develop leadership abilities and success in their roles.

The survey was extrapolated across the 2,800 frontline operational workers to determine that benefits to the individual and the company could be realised through increasing the foundation skills of the participants. The initial surveys were also used to develop a Best Practice approach to meeting the business needs. The outcome from this initial extrapolation gave rise to the TeamWorks training programme aimed at addressing the skill level shortage identified amongst frontline supervisors.

Additionally (NZTA) and other government bodies have requirements as the Road Controlling Authorities (RCA's) for competence to be demonstrated by contractors e.g. NZTA (2005), Marlborough City Council, (2004). Requirements for competence are often written into tender documentation which places an obligation on the contractor to provide staff with appropriate literacy and numeracy skills. However, it is in the organisations own interest to develop training plans for employees, of which in an organisation such as Works, a high level of frontline employees have very little or no formal qualifications Figure 2, Benseman et al (2007). This initial research identified the need to develop learning within the company from a regulatory requirement and a participatory wish, with support from the top of the company to develop a "learning environment" Serge (2001).

In order to make the training specific, the training was linked to specific job-related functions to demonstrate the effect of upskilling frontline workers, Table 1. This information was disseminated to the frontline workers to increase relevance and application using an embedded approach. This is further developed later in this paper.

Table 1. The nationally accepted levels of attainment (left column) and what these mean to Works (Right column).

Level 1	**Example within Works**
Person with very poor skills. Can recognise very familiar signs and symbols including own name. Needs assistance to complete tasks requiring literacy.	Can't complete the JobStart Hazard Identification (ID) form or Accident/Incident Report. May be able to complete basics such as name, age or extremely consistent information that does not change regularly.
Level 2 Reads simple, clear text to perform tasks that are not complex. Recognises repeated language patterns on familiar topics, obtains information from familiar signs and symbols. Any variances in information given would result in tasks being completed inaccurately or not at all.	**Example within Works** Would be able to fill out the regular information required on the JobStart Hazard ID. If a job required the capture of new or varied information, person would be unable to complete this accurately or independently.
Level 3 Functional literacy level necessary to cope with everyday demands of life. Able to obtain information from everyday sources and understands short, straight-forward text accurately and independently.	**Example within Works** Can Complete forms such as JobStart Hazard ID, and Accident/Incident Report adequately with accurate information.
Level 4 High level of functional literacy. Can obtain information from different sources, of varying lengths, and on numerous topics accurately and independently.	**Example within Works** Can complete forms such as JobStart Hazard ID, Accident/Incident Report competently to a high level. Are able to give feedback and predict consequences relating to the information they have provided.

Level 5 High level of functional literacy. Able to demonstrate complex information processing skills.	**Example within Works** Can complete all forms to a high level of competency and makes relationships with information shared between reports. Is able to proactively communicate complex information.

TEAMWORKS PROGRAMME

Figure 2 is representative of frontline workers on roading projects and is the result from an initial assessment of the academic attainment level of the 849 participants in the 2007 TeamWorks training programme.

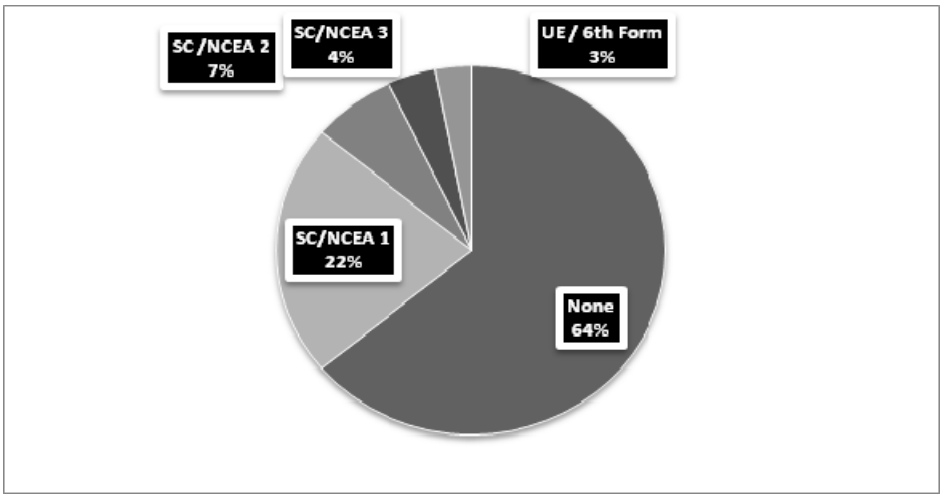

Figure No.2 Formal qualifications of TeamWorks participants.

Training is understood to have the following positive benefits for staff (Mullins, 1996, p635):

- Increase in confidence, motivation and commitment
- Provide recognition, enhanced responsibilities, pay and promotional prospects
- Personal satisfaction and achievements
- Improve the quality and availability of staff

These factors were taken into account in defining the course content and creating clear links to the business needs together with consideration of the literacy skills required to do the job. The result was a course based on eight modules of learning around i) the company's requirements for leaders at an operational level, ii) the main tasks carried out on a day to day basis and iii) how improvements can be developed. The modules were:

1. What a Downer EDI Works Leader looks like
2. What you do everyday
3. Keeping people safe
4. Communication skills
5. Leadership skills
6. How can I improve as a leader?
7. How can I improve my team?
8. Task planning

Foundation skills were embedded within each module and are stated in terms of the desired learning outcomes, such as:

- Identify individual strengths and challenges
- Give performance building feedback to group member
- Plan a piece of work in a way that meets the expectations of Downer EDI Works
- Accurately complete all paperwork required
- Complete a site Hazard Identification Form

At the beginning of the course, participants undertook a foundation skills assessment. The assessment consisted of six parts:

1. *Working with Numbers 1* – this is a set of addition and subtraction sums, vertically set out. Two word problems are also provided with their vertical sums. The sums increase in difficulty throughout the task.
2. *Working with Numbers 2* – this follows an identical format to Working with Numbers 1, but uses multiplication and division questions
3. *Doing the Paperwork 1* – this uses a Downer EDI Works text on floods that participants read then answer six comprehension questions
4. *Doing the Paperwork 2* – this requires participants to fill in a form-type text, answering questions on their expectations of the course, where they require support, their aspirations for the next five years, a description of their role and giving a personal view in response to a statement
5. Critical thinking/verbal response –uses a photograph of a Downer EDI Works site and requires participants to verbally respond to a series of questions.
6. Oral communication – requires participants to engage in a group discussion on a topic.

The topics included in the assessment and the course are intended to build the skills needed for frontline workers to operate confidently, contributing to the knowledge-based society through critical thinking and adaptive expertise as described by Hyo-Jeong So et al (2010). The initial foundation skills assessment is intended to highlight areas of need, which are recorded in an Individual Learning Plan. Hamilton (2009) proposes that the ILP is at the heart of the learning and teaching process. The participant is then provided with a program of individual study (such as worksheets and communication tasks) to address these needs, to be undertaken in the intervening six to eight weeks between workshops. On-going support is available from managers, other designated employees and the facilitator during this time. During days three and four of the second part of the course, participants are re-assessed. This assessment uses the identical *Working with Numbers 1* and *2* from the initial assessment. The sections on *Doing the Paperwork 1* and *2* and the critical thinking/verbal response questions use different content.

It was agreed that the potential outcome from the course for the participants, who had in many cases not finished school or attained any form of qualifications, was the ability to gain the National Certificate in Civil Infrastructure (General Introductory Skills) Level 2. This was coupled with an Operate Safe Bronze Card, an industry standard safety qualification. Linking the training to an external qualification was to benchmark the training to nationally recognised qualifications giving an effective system of review and evaluation (Mullins, 1996).

In addition to the initial assessment for all participants, the Department of Labour researchers interviewed the 132 participants at the Far North and Nelson branches on what they thought they might gain from the training. The researchers noted that the participants identified personal motivational factors as their required outcomes, the highest ranked factors related to the ability to perform better at work, whether that was in their current role or a future position, Table 2. This is supported by the work of Herzberg, Mausner and Snyderman, 1959

who noted that to reach full potential motivators or growth factors concerning job content need to be addressed.

Table 2. 132 participants principal expected outcomes from the TeamWorks training programme.

Outcome	Number agreeing
Improved skills for present job	22
Skills for a future job	17
Get new skills	13
Earn more money	12
Understand the bigger picture	10
Get more out of my team	9
Understand my team better	9
Develop leadership strategies	8
Improve chances of promotion	8
Give feedback to the company on things it could do better	7
Increase my confidence at work	6
Increase my confidence at home	3
Let the company know where I want to go	3
Get a better job	3
Know where I fit into the company	2

The training programme gave Works a greater understanding of the people that were employed, their relative confidence levels with literacy and their general interest to improve. The TeamWorks programme delivered 638 employees with 14 Unit Standards towards the National Certificate in Civil Infrastructure and the Site Safe Bronze Card, a 75% success rate.

Further analysis of the TeamWorks programme showed that workers below supervisory roles had Language, Literacy and Numeracy (LLN) levels generally between Level 1 and Level 2. The 1996 International Adult Literacy Survey (IALS), Ministry of Education (1997), found the one in five adult New Zealanders had very low literacy and numeracy levels and a further quarter have inadequate foundation skills to function in a knowledge society. Where these people are in work, they tend to be in semi-skilled employment, such as for example roading crews. This report recognised that acquiring foundation skills would have productivity gains and health and safety improvements for employees and employers.

Works decided to continue with the TeamWorks theme and develop further training modules for the low-skilled, poorly LLN equipped employees, principally below the supervisory level. The Way2Work programme was borne, developed for employees who would have ordinarily struggled to attain their Site Safe Bronze Card or gain a Level 2 qualification.

WAY2WORKS INITIATIVE

The Way2Works programme was aimed at improving LLN levels and, as a consequence, improving safety and productivity. 945 learners were engaged on 159 programmes in 37 locations throughout New Zealand, taking the training to the branches and local offices. This was all carried out over 2008 and 2009. 71% of the learners had no school qualifications and low LLN levels.

This programme sought to recreate practical situations seen by the workers in their daily employment but in a classroom environment. This technique was applied to reduce the perception of an academic situation and engage the learners in areas where their experience would provide opportunities to contribute to the learning framework, perfectly summed up by "Training experiences must include learning experiences which dramatize a new meaningfulness of education" Gordon (1976).

Three themes were progressed aimed at improving the individuals LLN capabilities, focussing on:

(1) Literacy and numeracy
Reading with understanding – comprehension
Writing to communicate – planning and composing
Making sense of numbers – number facts
The course information was provided in an easily understood format related to work activities to facilitate a sense of belonging to the material and to allow learners to contribute from their own experience. An example is shown as Figure 3.

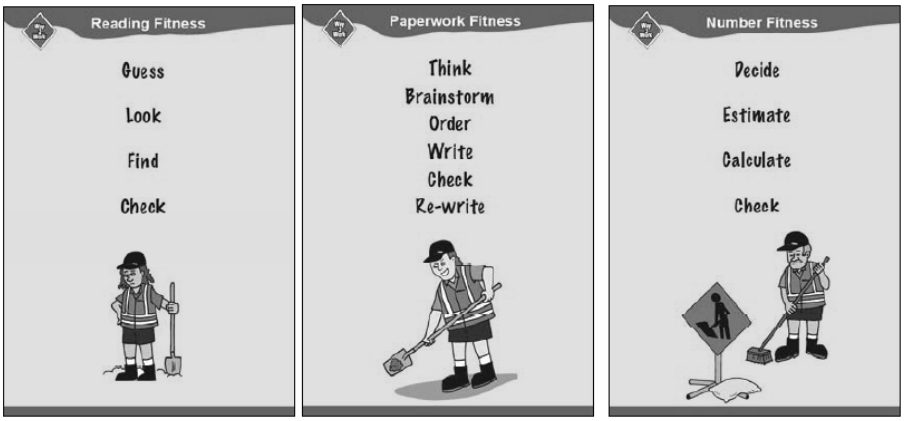

Figure 3. Course materials are based around day to day work situations.

(2) Bronze Card Health and Safety Qualifications
The units covered in the course gave the participants a nationally recognised qualification and included:
Health and fitness; communication; hazard identification; emergency response; and health, safety and environmental legislation.

(3) Culture Change
Works recognised that to compete in the 21st century, a change in the way that the company supports its employees was required to promote learning in a knowledge based society. In addition the social inclusion aspect of education was considered with the skills developed designed to allow people to function better in their own personal and social environment. This is recognised by Billett (2008) who states that workers need to engage in socio-culturally derived and supported practices that make up the workplace in order to gain knowledge required to work effectively. The firm needs to create that culture respecting that the individual (worker) and cultural (workplace) development are interlinked. Billett also makes inferences that a worker with a trade occupation is not necessarily of the same culture as the employer and this culture-match needs to be nurtured.

WAY2WORKS PROGRAMME

The Way2Works programme was delivered over five week periods including four day workshops and on-the-job learning activities. Coll, Taylor and Nathan (2003), state that there is support for the theory that work-based learning is most effective when combined with work-integrated learning. In effect the Way2Works programme is a short "sandwich-course". Further support to this theory is provided by Fuller et al (2007), expressing that apprentices who had the opportunities to participate in a wide range of learning activities, both on and off the job, were in a stronger position to progress within firms and externally. As Works has a large roading project presence in New Zealand and this was the primary sector in which participants worked, the tasks taught were based around day to day roadwork projects.

A self-assessment was carried out by participants before and after the course to measure any changes across six key areas. The pre and post surveys showed nationally, Figure 4a, that skills were improved by 13% to 15% in the case of LLN levels whilst cultural changes involving communication and health and safety showed 29% to 45% improvements. Northland results were more significant with a greater improvement in skills and attitude, in particular with LLN skills, Figure 4b. The authors propose that the increases in knowledge of health and safety, commitment to safety and communication skills are partly the result from the methods of course delivery and partly from the improvement in LLN skills, addressing the 1.03 level gap identified in the TeamWorks programme discussed earlier. These results are presented as Figure 4.

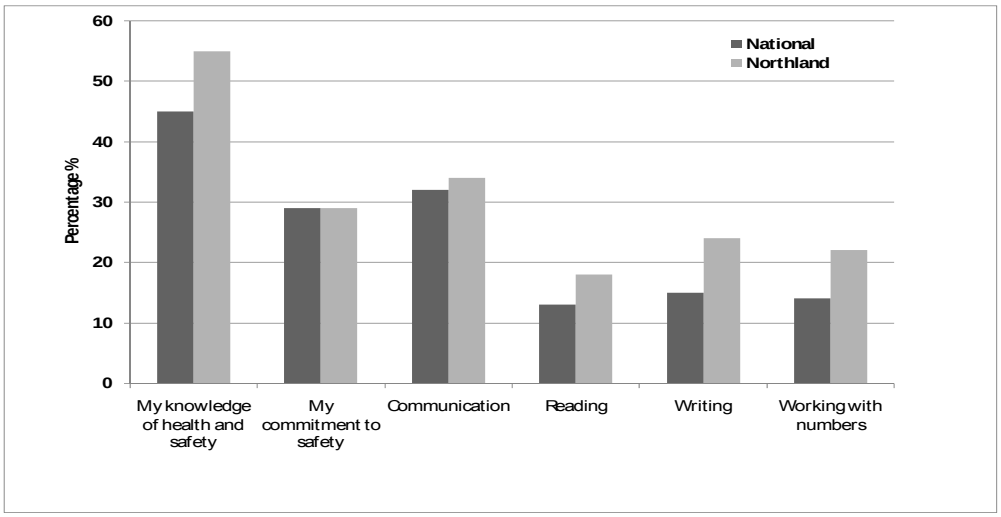

Figure 4. Percentage shift for each Skill and Attitude area nationally and in the Northland Region.

The increases in the Northland statistics could be interpreted as a low personal estimation of skill levels improved through the course delivery. However, a facilitator-assessment of the participants initial and final levels of understanding of literacy and numeracy show that the Northland start levels were up to 5% below those of other regions prior to the start of the course.

The course content were often delivered in a classroom mock-up of everyday workplace situations such as Figure 5 which was used to understand the health and safety requirements of managing live projects and worksites. On-the-job assignments were supported by colleagues, mentors and course facilitators ensuring that the classroom activities were not held in isolation.

Figure 5. Providing day to day relevance through the course material.

The success of the course was measured in terms of the reading, writing and numeracy levels of participants before and after completing the programme. It was found initially that 61% of participants attained Level 1 & 2, whilst post-completion 75% attained Level 3, only 20% remained at Levels 1 & 2. The writing skills initially peaked at 42% for Level 2, increasing to a peak of 43% at level 3. Of most significance, the numeracy skills improved with 69% gaining Level 4 skills. These were assessed using statistical techniques to determine whether the measured changes could be insignificant or potentially a null hypothesis (no change). A Standard t test showed that the results were statistically significant with confidence that the null hypothesis can be rejected at better than the 1% level. The average change in reading ability was found to be 7.24% with an σ (standard deviation) value of 1.7%. The Learning Wave, Downer EDI Works (2009).

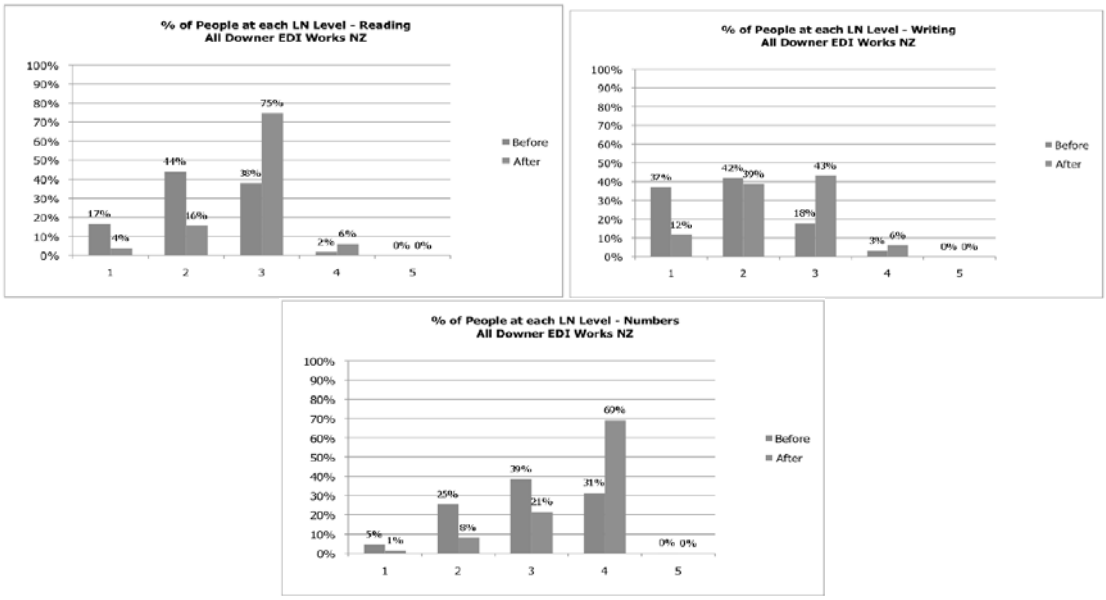

Figure 6. Before and after LLN skill levels for Way2Works programme participants.

A qualitative feedback session was conducted with participants to understand what they gained from the programme, these sessions showed many heightened awareness, examples of which are:

Worksite hazard identification, communication styles, planning and reporting, eating and drinking more healthily. Why paperwork is necessary and what happens to it once site workers complete it. Learning about Laws and Acts, what to do in an emergency and learning from one another.

In terms of the success rate of the programme, 84% of participants now hold the Bronze Card for work on civil engineering sites.

ONGOING TRAINING

It is understood that with an ongoing training plan, there is a need to maintain a "talent pipeline" which includes the frontline workers. A programme was developed to address this: Crew Essentials. This latest initiative was developed to assist with a yearly requirement for performance reviews; improve quality whilst reducing rework and provide motivational career pathways and multi-skilling opportunities. Onnismaa (2008) states that learning no longer precedes work but is interwoven with work on a lifelong basis… crossing the boundaries between vocational training and working life. At the frontline level the skills required were identified as developing:

Confidence
Job-specific technical skills
Ownership – more than just a job

These have now been developed for all major frontline activities, based upon three initial levels: trainee; crew member and qualified crew member. The latter level is facilitated by the Way2Works training programme or any subsequent developments. A series of advanced levels have also been developed to allow a complete career pathway to provide the succession plan to take an employee to senior positions and springboard onto the management scale, the general career progression chart based upon a competence-based framework is shown in Figure 7, this approach is supported by Onnismaa (2008).

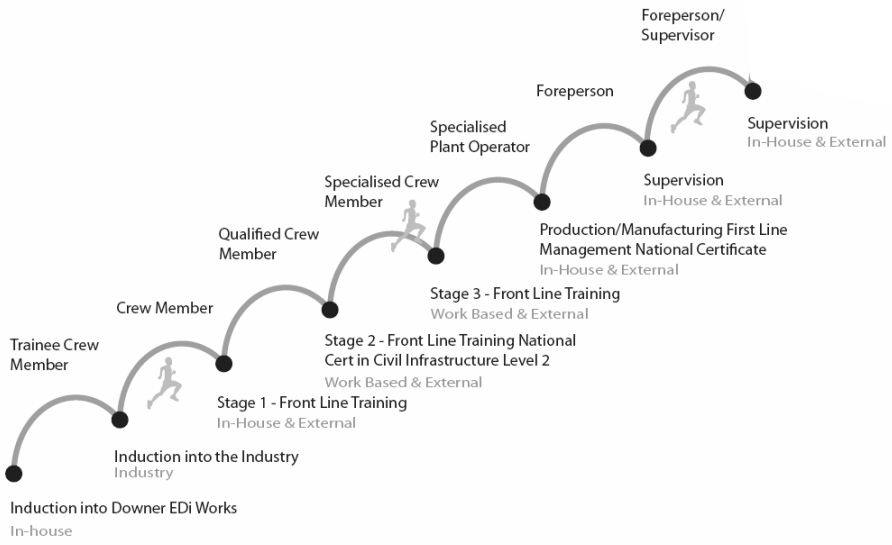

Figure 7. The outline career pathway for frontline workers, allowing access to a management position.

Case Study – Brynderwyn Hills Resurfacing

WORK NEEDED

The project entailed pre-surface repairs to 1,500m^2 of state highway, by way of mill and pave techniques. Localised patches required structural work to remediate areas of cracks and life expended seal edge deterioration. Once this was completed a surface treatment of polymer modified asphaltic concrete was overlaid to an area in excess of 27,000 square metres.

LOCATION

2,500m of State Highway One, Pilbrow Hill, Brynderwyn, November 2009. The road contains sharp bends, steep drop-offs and narrow carriageways with limited passing places.

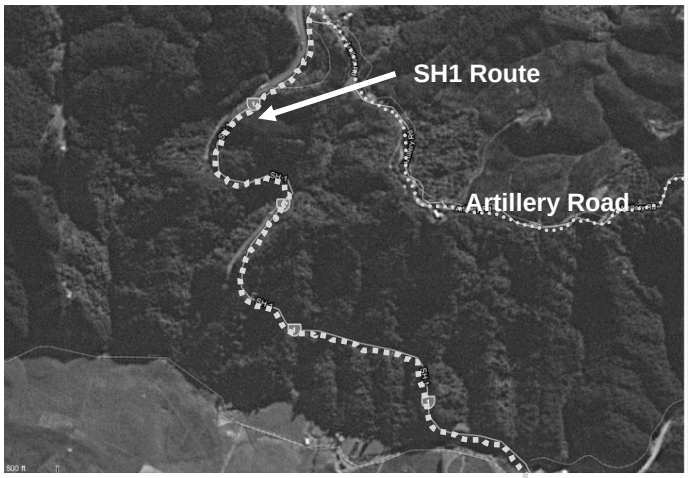

Figure 7. Pilbrow Hill, State Highway 1: the worksite.

TRADITIONAL METHOD OF WORKING.

The road would be partially closed during daytimes on one side over a distance of 50 - 100m with stop / go boards at either end with the probability that for peak flow time periods, work would have to be suspended. Surfacing would be laborious and disruption to the public and businesses would be felt over a period of around 20 weeks. Site crews and supervisors would have been briefed on the work by an engineer and there would be few comments as people "knew their places" were "to do" and not question. In practice, this type of job would have been almost impossible with partial closures due to the tight bends and narrow road widths. The pressure to get the job done would have been focussed upon the specific work tasks with little emphasis from the frontline workers on critically thinking about the process, improvements that could be made and planning and communicating progress.

ACTUAL WORK METHOD

13 night complete closures were undertaken (20:00 to 06:00 hours) on the highway with a diversionary route marked. These closures were agreed with NZTA, emergency services and local councils.

The worksites were particularly busy zones with simultaneous operation of milling and surfacing vehicles and heavy trucks alongside frontline workers and ground-staff.

REQUIREMENT OF WORKFORCE

The workforce needed to be educated in not only their job function but more importantly with the skills needed to think clearly and critically about their activities and how they affected those around them. In addition, the ability to communicate clearly and safely at all times was tested through empowering the workforce to take control of their worksite. In effect no more were the remote "Generals" in charge of the worksite, decisions were made on the ground in the live situations as they presented themselves.

IMPROVED SKILL SETS

The frontline workers and supervisors on this project had undertaken the Way2Work or TeamWorks (or both) training courses and this bridged the previously identified skills gap allowing the work to proceed as planned with the responsibilities resting on the frontline workers. Workers were briefed on the nights' activities prior to commencement and asked for their views on the work resulting in detailed questioning of the work plan and providing suggestions as to how to improve aspects of the work. At each pre-start meeting following the construction engineer's briefing, frontline workers participated in discussions, highlighting and effectively communicating safety concerns and areas where improvements were possible.

Near miss reporting was encouraged from the start and these were reported in a written format by frontline workers that previously would not have had the confidence in their skills to communicate in this way. Quantifying and reacting to near misses is also seen as nipping potential problems in the bud – the ability to report resolve issues before they become more serious is a key area where frontline workers are the eyes and ears of the construction company.

Whilst written emergency procedures have always been available, backed up by toolbox talks and briefings, the written content is now accessible to a wider number of the frontline workers who are encouraged to read and confirm understanding. The procedures were used on a live situation where an ambulance needed to pass through the site, good communication and co-ordination coupled an on-the-ground knowledge of the procedures ensured that the ambulance was swiftly escorted through the site without any delay.

It was also noted that frontline workers had a greater confidence in communicating with the emergency services, particularly with the police through reporting incidents where, for example, the public had ignored instructions and warnings.

The work was carried out with no lost time injuries or safety incidents. In addition the frontline crews have been taking ownership of their work, this being evidenced through crews reporting where their own work was below the acceptable standard on two occasions and allowing remediation to take place in a timely manner. Prior to the training initiatives the crews may not have felt able to communicate such detail.

CONCLUSIONS

The skills gap identified through initial surveys prior to training courses have been addressed, with the need to maintain learning opportunities. The implementation of the training programmes; TeamWorks and Way2Work, have improved the skill set of the individual front-line worker. This has a personal benefit in that they have a greater self-confidence in their ability and understanding of the modern methods of working and accountability.

The authors can report that Works have up-skilled our people from an average foundation skill level 2 to level 3, which gives greater opportunity for self-empowering the workforce at the frontline.

The creation of a career path allows frontline workers access to further training and empowers them with the ability to progress in stages to senior levels of employment, skills and learning.

The initial points raised of (a) road safety, (b) minimising disruption and (c) safe working have been addressed through job-related training activities which have been demonstrated in the case study.

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