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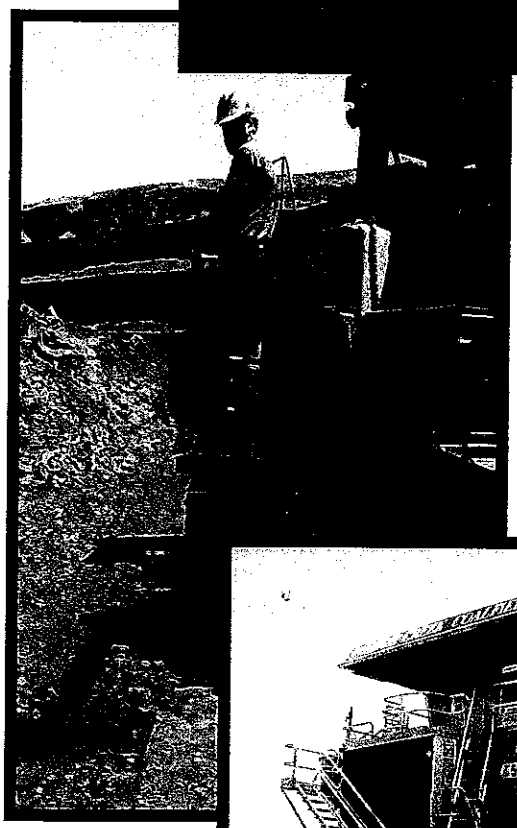

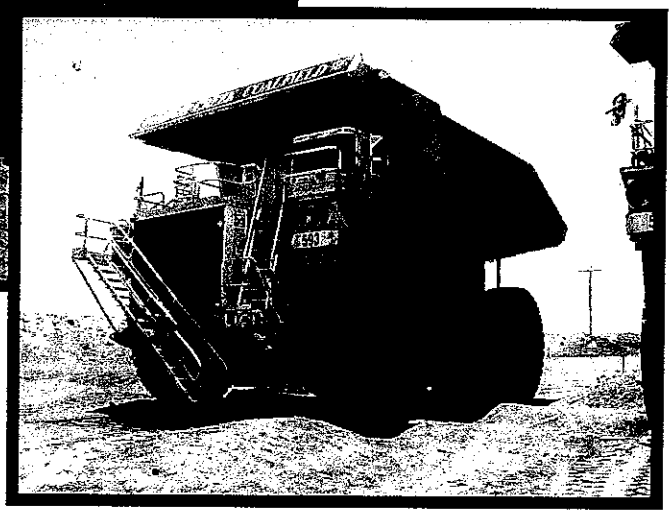

Final Report Pilot Project

Ergonomic Assessment

of

Access & Egress Hazards

for

Off Road Mobile Plant

at

NRG Flinders Coal Field

Leigh Creek, SA, 5731

13th January 2003

Project Completed By:
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Acknowledgements

I would like to thank all personnel at the NRG Flinders Leigh Creek Coal Field who provided significant input for this Pilot Program particularly in terms of participation in audits and constructive ideas to develop solutions for controlling identified hazards.

Particular thanks to Shaune Finn (Corporate OH&S Advisor, NRG Flinders) and Peter Haynes (Site Health & Safety Manager, NRG Finders Leigh Creek) for their tremendous support throughout the project.

Finally, I would like to thank Ken Cram and Sharon Buckley who assisted in the development and delivery of this Ergonomic Hazard Management Program.

Executive Summary

This is the Final Project Report for the Pilot Ergonomic Program on access and egress for mobile plant at the NRG Flinders Leigh Creek Coal Field in South Australia.

The aims of this project are as follows:

- Identify and assess hazards associated with the design and use of 17 different types of mobile plant.
- Prepare a Hazard Management Report for each piece of mobile plant.
- Undertake debrief reviews at the site to facilitate the implementation of the report's recommendations.
- Prepare and deliver access and egress safe work methods training program.

The methodology for this project was structured to cover the following 7 stages:

1. ***Stage 1*** - Identification, assessment and control of hazards associated with the design and use of mobile plant;
2. ***Stage 2*** - Prepare Mobile Plant Hazard Management Report;
3. ***Stage 3*** - Undertake debrief of audit and facilitate implementation of recommendations contained in the report;
4. ***Stage 4*** - Prepare audit report to the Joint Coal Board;
5. ***Stage 5*** - Provide on-site training;
6. ***Stage 6*** - Broader industry communication;
7. ***Stage 7*** - Final report.

The hazard based results and recommendations were structured to cover the following aspects of each piece of mobile plant:

1. ***Access & Egress Design***
2. ***Maintenance***
3. ***Safe Work Procedure***
4. ***Task Factors***
5. ***Individual Factors***
6. ***Environmental Factors***

The results of the audit program were structured to provide 9 Case Studies for hazards and risk control solutions for the mobile plant[1]. The following Case Studies were developed as a result of the audit conducted on mobile plant.

- ***CASE STUDY 1:*** *Design of the bottom step of the plant.*
- ***CASE STUDY 2:*** *Design of step for access into the rear of a truck.*
- ***CASE STUDY 3:*** *Design of the step access into a CAT 16H Grader.*
- ***CASE STUDY 4:*** *Design of the step access into a P & H 2800 Shovel.*
- ***CASE STUDY 5:*** *Safe work procedures - Access from a CAT D10 Track Dozer.*
- ***CASE STUDY 6:*** *Safe work procedures - Access & Egress Techniques.*
- ***CASE STUDY 7:*** *Using external steps and rails as required.*
- ***CASE STUDY 8:*** *Individual reach capabilities for handles and steps.*
- ***CASE STUDY 9:*** *Individual reach capabilities for handles and steps.*

We have provided some initial training at the site. The participation in the training has not been as broad-based as originally anticipated (a number of logistical and production-based reasons why personnel have not been able to be released for training). However, NRG Flinders has committed to release personnel for training purposes during 2003 and this commitment will be followed up as an item outside of the scope of this original Pilot Program.

There has been significant dissemination of the results of this Pilot Program through presentation of our findings at the Coal Services seminars in Queensland and New South Wales in 2002 as well as presenting the findings of the project during a Queensland Mining Industry workshop in Townsville in 2002.

In terms of ongoing dissemination of information derived from this Pilot Program, results will be summarised and presented as a "Fact Sheet" which will be made available on the Coal Services website.

Given the commonality of many pieces of mobile plant used within the coal mining industry, it is anticipated that the outcomes of this Pilot Program will have a reasonable applicability across a range of coal mining sites within Australia. As a result, a more extensive Ergonomic Program has been commenced for 2003 at coal sites in the Hunter Valley region. Results of this broader based project will be made available as the study progresses through 2003.

I would like to take this opportunity to thank Coal Services for supporting this project and all those at Coal Services and NRG Flinders who contributed constructive and generous support throughout this Pilot Program.

[1] *Refer to Appendix A for full report on each of the Case Studies.*

Introduction

This is the Final Project Report for the Pilot Ergonomic Program on Access & Egress from Mobile Plant at the Leigh Creek Coal Field in South Australia.

This report summarises the following aspects of this project:

- Background Information
- Aims on the Project
- Methodology
- Project Outcomes
- Broader Industry Communication

Background Information

This project is a Pilot Program which is focused on the mobile plant being used at the NRG Flinders Coal Field at Leigh Creek in South Australia.

There are 17 different types of Mobile Plant being used at the NRG Flinders Coal Field at Leigh Creek. Access and egress to these mobile plant is required on a frequent basis for operators and other personnel who may be involved with the operation, maintenance, cleaning or other tasks associated with the general operation of the mobile plant.

The South Australian Occupational Health, Safety and Welfare Regulations (1995) state the following in relation to the duties of employers with respect to mobile plant:

> *"An employer must ensure the hazards are identified .....*
> *.....before and during the introduction of plant to the workplace. "*
> *(Section 3.2.15)*

Furthermore, there is a legal requirement to continue to undertake risk assessments of mobile plant access and egress throughout the use of the plant at a site. The South Australian Occupational Health, Safety and Welfare Regulations (1995) state the following in relation to the provision for ongoing risk assessments of mobile plant:

> *"This regulation requires the identification of all reasonably foreseeable hazards to health or safety arising from plant, or systems of work associated with plant"*
> *(Section 3.3.1)*

In summary, there is frequent and varied access and egress to mobile plant by a variety of personnel on site. Furthermore, there are significant regulatory requirements to identify and manage plant related hazards on an ongoing basis.

This project involved a comprehensive review of hazards, provision of training for hazard management and a detailed report covering these aspects of the project.

Given the commonality of many types of mobile plant used in the coal industry, it is quite foreseeable that the outcomes of this project will have significant transferability to other sites who are involved with using similar types of mobile plant.

Aims of this Project

The aims of this project are as follows:

1. Identify and assess hazards associated with the design and use of 17 types of mobile plant used at NRG Flinders Coal Field at Leigh Creek, South Australia;
2. Prepare report of the hazards identified and risk control options for the previously mentioned mobile plant;
3. Undertake debrief reviews at the site to facilitate the implementation of risk control measures contained in the original audit report;
4. Prepare and deliver a training program for safe work methods in relation to access and egress for mobile plant on site.

Methodology

This Pilot Program was undertaken between January to December 2002.

The project involved undertaking site visits during the audit, debrief and training phases of the program.

In summary, the project consisted of the following 7 stages:

1. ***Stage 1***

   Identification, assessment and control of hazards associated with the design and use of mobile plant;
2. ***Stage 2***

   Prepare Mobile Plant Hazard Management Report;
3. ***Stage 3***

   Undertake debrief of audit and facilitate implementation of recommendations contained in the report;
4. ***Stage 4***

   Prepare audit report to the Joint Coal Board;
5. ***Stage 5***

   Provide on-site training;
6. ***Stage 6***

   Broader industry communication;
7. ***Stage 7***

   Final Report.

This section of the Final Report provides a summary of the previously mentioned 7 stages of the project.

Stage 1 – Audit of Access & Egress Provisions for Mobile Plant

The following 17 different types of mobile plant were assessed in this program:

1. CAT 623E Scraper
2. CAT 773 D Water Cart
3. CAT 854G Rubber Tyred Dozer
4. CAT D10N Track Dozer
5. CAT D10R Track Dozer
6. DeMag H241 Executive Shovel
7. Euclid – Back Up Water Truck
8. Euclid – Converted Tow Truck
9. Hino Truck – Back Up Fuel Truck
10. Hino Truck – Crane Truck
11. Hino Truck – Explosives Truck
12. Komatsu 375A Dozer
13. Letourneu L800 Loader
14. OKA Drill & Blast Vehicle
15. P & H 2800 Shovel
16. Unit Rig 240 Truck
17. Volvo Tipper Truck

Stage 2 – Prepare Audit Report

Appendix A contains the Audit Report of the mobile plant.

Stage 3 – Audit Debrief

The are a number of levels of the audit debrief that were undertaken at the NRG Flinders Coal Field.

At a corporate level, a debrief meeting was undertaken with the Corporate Health & Safety Manager and the Site Health & Safety Manager. A debrief was also undertaken for Departmental Managers at the Leigh Creek site and this included consultative input of Operators and Safety Representatives.

The purpose of the debrief was to articulate the findings of the report and develop a plan for the implementation of the recommendations submitted in the report. The recommendations contained in the report were accepted and have been planned or implemented as part of this ergonomic program.

Stage 4 – Report to the Joint Coal Board

Appendix A of this report is a copy of the audit report prepared on 6th February 2002. This report was submitted to the Joint Coal Board.

Stage 5 – On-site Training

This stage of the program involved training operators and maintenance personnel on safe access and egress methods for mobile plant at the site.

The audit report (Appendix A) indicated that the overall design of the access and egress provisions of the mobile plant was generally quite good. Therefore, the originally intended training was modified to include a range of ergonomic issues such as manual handling training and training in stretching exercises (to avoid static muscle fatigue associated with the prolonged operation of mobile plant) along with general health, fitness and body well-being.

A recent health survey at the site (which was not performed by Nery Ergonomic Services) identified a number health issues such as; over half the personnel being identified as a high risk in weakness of abdominal muscle strength, 47% of staff not participating in any aerobic exercise and 79% of staff having unacceptable nutritional habits. This is merely a 'snapshot' of a comprehensive health screening program which was undertaken in an unrelated project at the site.

Based on the results of the health screening program, our access and egress training was broadened to integrate a range of musculo skeletal injury prevention strategies in relation to posture, stretching and strengthening exercises and manual handling techniques which can be used by operators to improve their safety at work.

Appendix B is a copy of the training handout which was prepared for inclusion in Stage 5 of the project.

Stage 6 – Broader Industry Communication

As part of the dissemination of the outcomes of this program, we have participated, and plan to participate in the following activities in 2002:

- Presented project findings at the Joint Coal Board industry seminars in New South Wales and Queensland.
- Presented the findings of the project to a Queensland Mining Industry Council conference (Townsville, Queensland).
- It is proposed that the final project results will be presented at the Coal Services Industry Seminars in New South Wales and Queensland during 2003 and a project summary will be prepared for posting on the Coal Services website for broader industry review.

Stage 7 – Prepare Final Project Report

This report represents stage 7 of the project being the Final Project Report summarising the aims, process and outcomes of the project.

Results & Recommendations Derived from Mobile Plant Audit

The results of the audit are discussed in detail in the Ergonomic Assessment Report contained in Appendix A of this report.

This section of the Final Project Report summarises the key aspects of the Ergonomic Assessment Report.

The hazards associated with mobile plant access and egress are categorized into one of 6 major types as follows:

1. ***Access & Egress Design***

   Example: Steps not placed for easy access, rails placed outside of a safe reach or a complete absence of appropriate steps / rails for safe access etc.

2. ***Maintenance***

   Example: Broken handrails not replaced, grips on steps worn etc.

3. ***Safe Work Procedure***

   Example: Jumping down from the plant, personnel not having three points of contact when climbing on the plant etc.

4. ***Task Factors***

   Example: Specific provisions for access and egress may need to be made for specific requirements such as operator access, access during maintenance and cleaning the plant etc.

5. ***Individual Factors***

   Example: Physical differences in people, such as height, strength, and reach can affect the risk to them during access or egress from mobile plant.

6. ***Environmental Factors***

   Example: Factors such as mud, rain or grease on steps would make them more slippery or if the plant was parked on an incline the bottom step height relative to the ground would be effected etc.

To follow is a summary of the results for each of the previously mentioned 6 types of hazards as discussed in the Ergonomic Assessment Report of Appendix A.

1. Access & Egress Design

This section of the report summarises all of the hazards and risk control options associated with the design of the following examples of plant access and egress:

- *Case Study 1: Design of the bottom step of the plant*
- *Case Study 2: Step Design into the rear of a truck*
- *Case Study 3: Design of the step and rail system for access into a Grader*

CASE STUDY 1: Design of the Bottom Step of the Plant- (Injury Risk Rating 3 = Medium Priority)

The design of the bottom step for access and egress on mobile plant is crucial. The design has to be flexible in many ways because the step has to be high enough from the ground so that it does not become "knocked off" when the plant is being driven, but it also has to be low enough to the ground so it can be used for safe access. These conflicting requirements have given rise to a variety of different step designs.

Hazards Identified & Assessed

(i) Rubber Supports on the Step Becoming Worn

Figures 1 and 2 illustrate the rubber straps on the bottom step of the main access point on the drill rig. The rubber strap has become damaged causing the bottom step to move too far inwards (i.e. forwards – towards the plant) when a person stands on the step. This causes more strain on the person's shoulders and spine (as their body weight moves backwards when they stand on the step).

Figure 1 (left): The Main Step Access into the Drill Rig.

Figure 2 (right): The rubber strap has become fatigued through use and does not have much forward movement when the person stands on the step.

(ii) Metal Wire Supports on the Step Becoming Worn

Metal wire is another common form of support for the bottom step on mobile plant access and egress. The metal wires are flexible (so the step does not get knocked off) but the bottom step can be highly displaced when the person stands on it (refer to Figure 3). This causes more strain on the person's shoulders and spine (as their body weight moves backwards when they stand on the step).

If the wire is too long there is a risk the person may hit their leg on the plant as they climb on the step. This is because the step has moved closer to the plant when the person stands on the step.

Figure 3 (above): The metal wire supporting the bottom step is moving too far forwards when the person stands on the step.

Risk Control Recommendations for the Design of the Bottom Step

(i) Rubber Supports on the Step

The step in figure 4 has good grip, and it is easy to clean. The rubber supports give the step some movement (so the step does not get knocked off) but it is more stable than the metal wire supports that are often used on some forms of mobile plant.

The rubber straps are effective in stabilising the step but they need to be checked regularly during maintenance to ensure they have not become ripped or dislodged from the step.

A second example of the rubber supports on the bottom step is on relatively smaller CAT trucks where access to the front of the plant is required.

Originally, the truck had chains or metal wires supporting the front step. These had a high level of movement that results in operators slipping from the step and on occasions hitting their leg on the mobile plant. The metal wires were replaced with a rubber step support that is illustrated in Figure 6.

Figure 4 (above): A rubber support for the bottom step (Photo courtesy of Cavpower, SA).

In both examples, it is a question of choosing the best type of step design and then keeping the steps maintained.

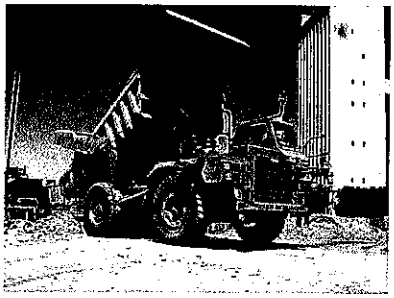


Figure 5 (above): The CAT truck that had the steps modified (One Steel Quarry, Ardrossan, SA).

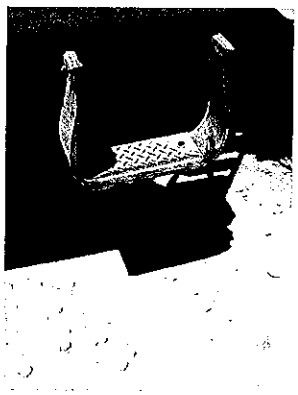


Figure 6 (above): A rubber support for the bottom step (One Steel Quarry, Ardrossan, SA).

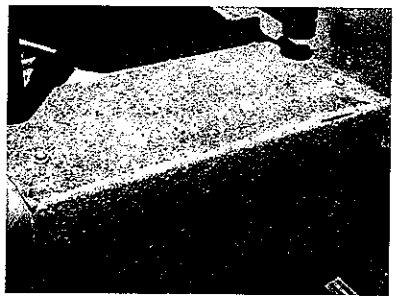


Figure 7 (above): Grips placed on all of the horizontal step areas of the CAT truck to reduce the risk of slipping (One Steel Quarry, Ardrossan, SA).

CASE STUDY 2: *Design of the Step for Access into the Rear of a Truck (Injury Risk Rating 4 = Low Priority)*

The design of the step access into the rear of the truck is important in terms of not protruding out past the edge of the vehicle itself and being able to support the weight and size of a person climbing into the rear of the truck.

Hazards Identified & Assessed

Climbing into the rear of the truck in hazardous in terms of having to climb onto a platform that is approximately 1.5 metres above the ground with steps that are often quite small and unstable. This may occur with people carrying a tool bag or other piece of equipment over their shoulder.

Risk Control Recommendations for the Design of the Step Access to the Rear of a Hino Back Up Fuel Truck

Using this step will reduce the risk of injury when climbing onto the rear of the truck because the step has the following safety benefits:

- It folds up under the platform of the truck so it does not protrude out from the side of the vehicle during travel.
- The steps are wide (550mm) which is a relatively stable width to stand on whilst climbing into and out of the rear of the plant.
- The steps are quite rigid so they provide significant stability for the person standing on the step.
- There are three rungs on the step so the bottom step is close to the ground (approximately 330mm above ground height) so it is reasonably easy to step up onto the first step.

Figure 8 (above): An extendable step on the side of the truck (Leigh Creek Coal Field, SA).

Figure 9 (above): An extendable step that can be pushed under the rear platform of the truck after it has been used. (Leigh Creek Coal Field)

Figure 10 (above): Climbing into the cabin of the grader

Case Study 3: Design of the Step Access into a CAT 16H Grader (Injury Risk Rating 3 = Medium Priority)

Operators may climb into and out of the grader 5-6 times per day. The maintenance and cleaning personnel also climb into the cabin of the grader. There are a variety of ways people climb into and out of the cabin. Some people use the steps only and others may use a combination of standing on the steps and the blade of the grader.

Hazards Identified and Assessed

The bottom step on the existing grader (CAT 16H grader) is quite high (550mm in height). Some people use the blade of the grader to stand on before climbing on the steps that lead into the cabin. The top of the blade is a thin strip of metal that does not provide adequate foot stability when the operator stands on the blade. This situation can be made more hazardous if the blade is rotated further away from the cabin causing the operator to have to reach further to move from the blade to the cabin (refer to Figure 10).

Risk Control Recommendations for Access & Egress to the Cabin of the CAT 16H Grader

In contrast, Figure 11 illustrates how the operator's foot on the blade is in line with their body that gives them more stability.

Figure 11 (left): Climbing into a grader with the modified steps and the blade rotated back towards the cabin (One Steel, Ardrossan, SA)

Figure 12 (right): Climbing onto a grader with the modified steps and the blade rotated away from the cabin. (One Steel, Ardrossan, SA)

Figure 13 (below right): The modified step and footplate that have been fixed on the grader (One Steel, Ardrossan, SA).

Figure 12 illustrates how the operators foot on the blade is behind his body (because the blade is rotated away from the cabin which increases the distance the operator has to reach the cabin).

Figure 13 illustrates how a non-slip board has been added to the blade to improve the access to the cabin (The operator must have the blade fully rotated towards the cabin).

This modification represents one option for improving the design for the access and egress from the cabin of the grader. As illustrated, this method will only be successful if the blade is rotated back towards the cabin (therefore reducing the distance the operator has to reach between the blade of the grader and the cabin door).

2. Maintenance

This section of the report summarises all of the hazards and risk control options associated with maintenance hazards associated with the access and egress to the mobile plant.

Some general issues about the maintenance of steps on the mobile plant have been discussed in example 1 (page 10). The example in this section of the report highlights how the maintenance of a set of steps on a crane can impact on the manual handling tasks when working on the plant.

CASE STUDY 4: *Design of the Step Access into a P & H 2800 Shovel (Injury Risk Rating of 3 = Medium Priority)*

Operators are required to grasp a rope and pull down the stair for access into the crane unit. On average task is performed approximately 4-6 times per shift, although this may increase depending on the access requirements to the plant.

Figure 14 & 15 (left & right): Reaching up to pull down the stairs.

Hazards Identified and Assessed

The operator pulls down the rope.
The operator has to reach above shoulder height that can increase the risk of injury for the operator. This is because the operator has reduced overall strength in this extended range of movement. Furthermore, the stairs did not slide down freely and so the operator had to exert more pulling force to pull the stairs down into position (refer to figures 14 & 15).

Risk Control Recommendations for Manual Handling on the P & H 2800 Crane

- Fix the steps so they slide more easily (i.e. with reduced pulling force by the operator).

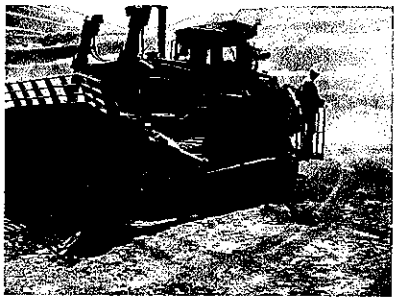
- Provide manual handling training for operators so they use the correct body mechanics when doing this task (This is included in this program).

3. Safe Work Procedures

A range of standard safe work procedures governs working on mobile plant. These procedures cover all aspects of the plant design and use. For example, safe operational use, maintenance, and emergency procedures etc... The safe access and egress from the plant is no different in terms of safe work instructions. That is, there are some safe work procedures for the safe access to and egress from the mobile plant.

The two case studies in this section of the report highlight the hazards associated with not following the safe access and egress procedures.

CASE STUDY 5: Safe Work Procedures: Access & Egress from a CAT D10 Track Dozer (Injury Risk Rating 2-3 = High-Medium Priority)



Both the CAT and Komatsu Track Dozers on the site are fitted with the mechanized platforms that are illustrated in Figure 16. These platforms allow the operator to be mechanically lifted from the ground to the cabin.

Figure 16 (left): An operator being lifted to the cabin of a CAT D 10 R Track Dozer.

Hazards Identified and Assessed

The hazards associated with operator's access and egress to the cabin is mainly due to circumstances where this mechanical platform is not used. For example, an operator leaves the cabin and makes a decision not to use the mechanical platform and the climb down the tracks to the ground. This means that when that same operator, or a different operator, come back to the dozer the platform is in the "up" position it cannot be reached from the ground. Consequently, the operator who returns to the plant is forced to climb up the tracks to the cabin.

There is step access to the tracks but it does involve an extended reach by the operator whilst standing on a relatively small step (refer to Figure 17). The risks associated with this task can be increased if the operator has to carry items up onto the plant (e.g. tools, box of materials etc.). This is because the operator may loose their "3 points of contact" if they have something in their hands and therefore increase their risk of falling from the plant.

Risk Control Recommendations for Safe Work Procedures a CAT D10 Track Dozer

The risk control recommendations for this particular hazard are quite reasonable and relatively simple to implement. These changes include adhering to safe work procedures and modifying the control on the platform lifter.

Figure 17 (left): An operator climbing up onto the tracks of the dozer so they can climb up to the cabin of the mobile plant.

(i) Follow The Safe Work Procedure

Operators should follow safe work procedures that require operators to use the lift that is illustrated in Figures 16 and 18. This would eliminate much of the risk associated with access to the cabin (particularly if materials have to be carried by the operator as they are climbing onto the mobile plant).

(ii) Modify Platform Controls

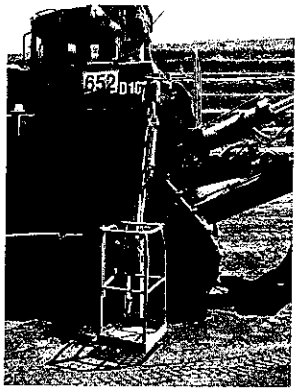


Figure 18 (above): The platform lifting unit on a CAT D 10 R Track Dozer.

The controls of the platform could be modified so that the lift could be operated from the ground as well as from the existing controls on the platform itself. This would mean that the operator could lower the platform to the ground if the previous user had left it in the "up" position. The ground operated controls would have to be positioned so the operator had full view of the moving platform at all times.

This recommendation requires further analysis in terms of the practicality of introducing additional controls on the plant. Issues such as ensuring the controls can be reached from the ground and ensuring the controls are placed in a position where they would not become damaged are considerations to be reviewed before implementing this recommendation.

CASE STUDY 6: Safe Work Procedures: Access & Egress Techniques (Injury Risk Rating 2-3 = High-Medium Priority)

There are a variety of techniques used by operators for climbing on the mobile plant. The general rule for access and egress on mobile plant is to have "3 points of contact" and climb up and down facing the plant. Occasionally there are exceptions to the direction the person may face when they are climbing on the plant. These exceptions should be based on a sound risk assessment of the process.

Hazards Identified and Assessed

When a person climbs down a set of vertical steps and that person is facing away from the mobile plant the following hazards can generally be identified:

(i) Shoulder Joint Strain

There is a strain on the shoulders of the person as their body weight is moving away from the mobile plant (refer to Figure 19).

(ii) Reduced Balance & Risk of Tripping

The person's centre of gravity is moving away from the plant as they walk down the steps. They are looking away from the handrails and steps and so their risk of tripping and falling increases.

(iii) Control of Descent From the Plant

There is less opportunity to control the speed and movement when stepping down onto the ground when the operator uses the egress method illustrated in Figure 19. This is a significant problem for all forms of mobile plant that have vertical steps. This problem is further exaggerated if the person jumps from the bottom step. Their lack of control of movement may increase the risk of twisting an ankle on a rock on the ground or sustain an injury through a high force impact on unstable ground.

Figure 20 (below) operator climbing up onto a drill rig

Figure 19 (above): A mechanic climbing down from a drill rig[2].

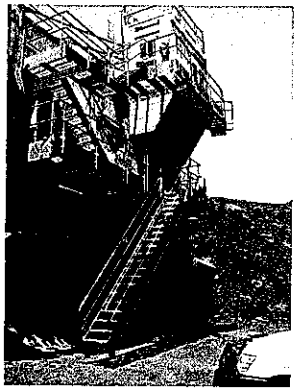


Figure 21 (above): The step access to a P & H 4100 shovel.

Risk Control Recommendations for Safe Work Procedures: Access & Egress Techniques

The risk control recommendations for improving the safety of the access and egress techniques for operators would include the following:

[2] *This is a simulated action, this operator indicated that this is not his "normal" method of climbing down from the plant – He said that he usually climbs down facing the plant, although he indicated several of his colleagues used the method illustrated in Figure 19.*

(i) Climb Up & Down Facing the Plant

With all plant the operators should climb up and go down facing the mobile plant.

Any exception to this rule should be made only after a risk assessment has been completed. For example, a long angled (not vertical) set of stairs that has handrails on both sides would be one possible scenario where a person would walk down the stairs facing forwards[3] (refer to Figure 22).

(ii) Keeping Three Points of Contact

Developing Safe Work Methods

Maintaining three points of contact is vital to ensure safe access and egress to the plant. When carrying items on the plant peoples three points of contact is often compromised.

Figure 20 illustrates an example where a mechanic has lifted some tools onto the drill rig platform. After this the operator climbs onto the platform unencumbered rather than trying to climb up the rig whilst carrying the tools and climbing at the same time.

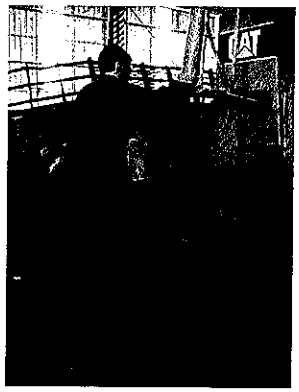


Figure 22 (above): Climbing onto the mobile plant to do some mechanical work whilst carrying the tools in a bag.

(iii) Using a Tool Bag

During maintenance work on the mobile plant, operators are required to carrying equipment and tools to all parts of the plant. Mechanics personnel have been provided with a tool bag that can be hung over the shoulder. This allows the operator to keep both hands free to retain three points of contact whilst climbing on the plant. This is illustrated in Figure 22 where the mechanic is able to retain three points of contact whilst climbing on the plant and the tools are kept in a bag on the mechanic's back.

4. Job Task Risk Factors

CASE STUDY 7: Using External Steps and Rails as Required (Injury Risk Rating 2-3 = High-Medium Priority)

Figure 23 (above-left): Access to walkway on the CAT 854G rubber tyre dozer.

Many pieces of plant have very good access and egress requirements for operators to reach the cabin of the plant. The CAT 854G rubber tyre Dozer illustrates a reasonable set of steps and rails on one side of the plant.

However, many maintenance and cleaning tasks require people to climb on the plant outside of the normal walkways.

[3] *A full risk assessment of this task will be completed in this project to determine the most appropriate access and egress methodology.*

This case study highlights some of the options for improving the safety of access and egress when people need to work outside of the "normal" walkways on the plant.

Hazards Identified and Assessed

Walking outside of established walkways on the mobile plant is an everyday activity in many maintenance activities. The NRG Flinders has many additional steps and rails that can be used to facilitate access to parts of the large mobile plant that cannot be reached by the existing steps and rails that are built onto the plant.

Risk Control Recommendations for Access & Egress: Task Factors

(i) Large External Steps

The large external steps illustrated in Figure 24 allows the maintenance personnel to work at elevated heights. The advantage of this step system is not only the safe access to the elevated height, but the platform at the top has the provision to store a tool box so the operator is able to keep their hands free for balance and to perform the maintenance task.

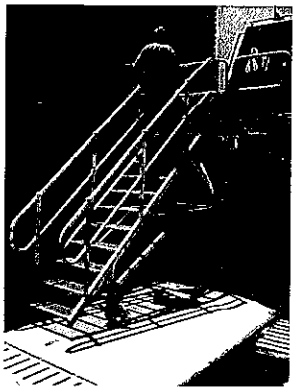


Figure 24 (left): An operator climbing up onto the side of the CAT 773 Water Cart.

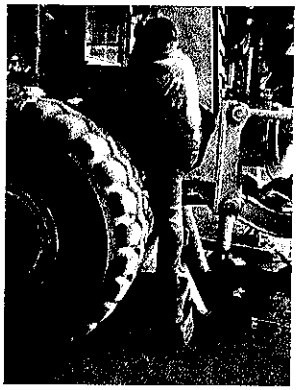


Figure 25 (right): An operator climbing up onto the rear of a CAT 16H Grader.

(ii) Small External Steps

Small steps are readily available within the workshop to assist with improving access to other parts of the mobile plant. For example, the small steps illustrated in Figure 25 are being used to improve access to the rear of a CAT 16H Grader.

(iii) Mechanised Steps

Figure 26 illustrates two "scissor lift" units that are used to improve access when working at elevated heights. They are pictured next to the drill rig where they are regularly used during maintenance.

In most mining workshops these pieces of equipment are not new, it is just ensuring that there is reasonable access to these devices and people are trained and the correct systems of work are implemented to ensure that they are used safely.

Figure 26 (above): An operator using a scissor lift unit to gain access to an elevated area of a drill rig.

5. Individual Risk Factors

CASE STUDY 8: Individual Reach Capabilities for Handles and Steps (Injury Risk Rating 3-4 = Medium – Low Priority)

The employer must as part of their duty of care accommodate a physically diverse range of employees. In terms of access and egress to mobile plant this means that people can safely use the steps, rails and other systems of work.

People vary considerably in terms of their strength, fitness, experience, physical size etc. Therefore, the assessment of the mobile plant needs to consider the implications for a variety of people using the equipment.

This case study reviews some examples of where the access and egress has been modified to accommodate a physically diverse range of people.

Hazards Identified and Assessed

The bottom step and handles are quite high. The bottom step is approximately 500mm above ground height and the top handrail is approximately 1,900mm above ground height. Taller operators maybe able to reach this but shorter people will put additional strain on their shoulders and knees, as they have to climb up into the cabin.

The recommendations section illustrates how the access and egress for this truck and other pieces of mobile plant can be modified to improve the safety for a variety of users.

Figure 27 (above): Climbing into the cabin of a truck

Risk Control Recommendations for Individual Reach Capabilities for Handles and Steps

(i) Extend Handles

The right hand vertical handrail (illustrated in Figure 27) could be extended down approximately 30cm. This will reduce the extended range of movement with the right shoulder and make it safer for people (especially shorter people) to climb into the cabin. If this change alone is not satisfactory, a lower handle on the left hand side of the cabin entry can be introduced.

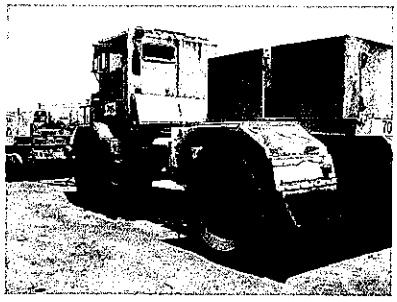


Figure 28 (left): The truck that requires the handle modifications to the cabin entry.

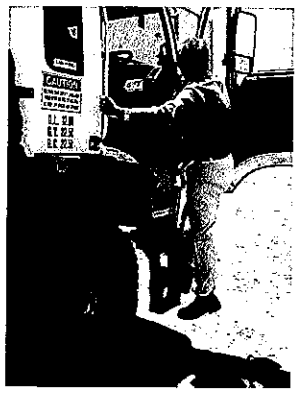


Figure 29 (right):Handles a significant distance apart for the operator climbing into the cabin.

(ii) Modified Step for Entry Into A Truck Cabin

Taller operators do not need to use the bottom step for climbing into the cabin. However, shorter operators are able to stand on the reduced height bottom step much more easily. Whilst the step access on the truck is quite good (refer to Figure 29) the handles are wide apart. That is the left handle is on the left of the cabin door and the right handle is inside the right hand side of the door. The two handles are approximately 750 mm apart. When the operator climbs into the plant this can place some strain on the shoulder because the arms are fully extended out to the side as the person climbs into the cabin.

(iii) Modified Hand Rails For Entry Into A Hino Truck Cabin

The left hand handles for climbing into the cabin are inside of the doorway, and not outside the cabin (like the cabin in Figure 24). This means the operators arms are not so extended out to the side as much when they climb into the cabin. This significantly reduces the strain placed on the shoulders during this task. The left hand handle has a curved shape so different operators (who have different arm lengths) can choose the most comfortable hand position for climbing into the cabin.

Figure 30 (above): Different handles for the Hino truck

6. *Environmental Risk Factors*

CASE STUDY 9: Individual Reach Capabilities for Handles and Steps (Injury Risk Rating 3-5 = Very Low Priority)

Hazards Identified and Assessed

The mine environment can cause many hazards for the safe access and egress from the mobile plant. Wet environments or grease in the workshop increase the risk of slipping when climbing on the plant. Mud and other materials on operators shoes and the steps increase the risk of slipping and grease or mud on the hands can make it more difficult to grasp handles on the plant.

Figure 31 (above): The steps on a P & H crane

If the steps are broken or the grips are worn or missing from the plant these environmental factors can further increase the risk of injury for people climbing on the plant.

The angle of the ground to the plant can affect the height of the bottom step from the ground

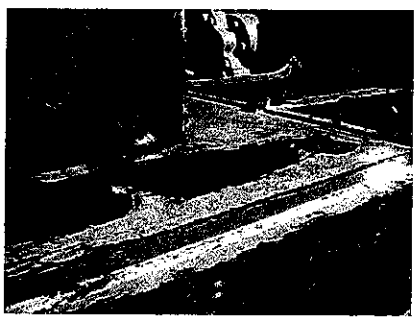


Figure 32 (above-right): The corroded steps on a piece of mobile plant[4] (photo courtesy of South Australian Mining and Quarrying OHS Committee).

[4] *This piece of mobile plant is not at the NRG Flinders Coal mine.*

Risk Control Recommendations for Environmental Factors

Constant review of the standard of the steps, rails and other access and egress requirements is essential to ensure that the risks of injury through using the plant are controlled. At NRG Flinders these issues are examined as part of the routine maintenance of the plant. Any hazards are fixed whilst the plant is being maintained. Furthermore, assessments of this type are undertaken regularly whilst the plant is being used in the field.

Project outcomes

This section of the report summarises the outcomes that were derived from this Pilot Program at the NRG Coal Field site at Leigh Creek, South Australia.

1. Identify, assess and control hazards associated with the design and use of 17 different types of mobile plant.

2. Ergonomic Hazard Management Report detailing the identification, assessment and control of hazards associated with the abovementioned 17 different types of mobile plant.

3. Undertake debrief meetings to articulate risk control methods and plan for implementation of risk control strategies.

4. Develop safe work training which includes stretching exercises, strengthening exercises, safe work methods for access and egress to mobile plant, adjustment of seating and other equipment to improve work posture, safe manual handling methods, general health and fitness.

5. Deliver training to personnel on site. (Some initial training has been provided on site and it is expected that this be extended to additional personnel outside the scope of this Pilot Program and to include training in ongoing safety training on site – this is yet to be confirmed by NRG Flinders but we anticipate that this additional training will be conducted in the first quarter of 2003).

6. Prepare final Pilot Project Report.

Where To From Here?

This Pilot Ergonomic Program has focused on access and egress hazards associated with the design and use of mobile plant at the NRG Flinders Coal Field site at Leigh Creek, South Australia.

Coal Services have approved an extension of this Pilot Program to include a number of sites in the Hunter Valley, New South Wales. The objective of this is to provide a booklet summarising the hazards and risk control options for mobile plant used in coal field operations. Given the commonality of mobile plant being used at various sites, the transferability of information contained in the planned booklet would be significant and easily adapted to a variety of operations in the Hunter Valley and, more broadly, throughout Australia.

This Pilot Program has developed the basis for the methodology planned for the broader project. Development of this program across various sites will provide increased diversity of hazard risk control options which can be communicated between sites, therefore providing greater innovation with regard to risk control options.

As discussed in this report, the outcomes of a broader industry program will not be confined to access and egress of mobile plant but will also provide training materials for operators and others with regard to stretching exercises, back strengthening exercises, tips on general health and well-being all with a view to reducing the risk of musculo-skeletal injury in the workplace. All of these previously mentioned issues have shown in the Pilot Program to contribute to the risk of injury for access and egress to mobile plant.

We will continue to disseminate the results of the broader industry program in the Hunter Valley through similar means as the Pilot Program such as Coal Services Seminars and state industry conferences in Queensland and New South Wales. The results of the study will also be made available on the Coal Services website and participating in industry meetings where possible.

Finally, I would like to reiterate my thanks to all those involved in this project both at Coal Services and NRG Flinders who provided enormous support throughout this Pilot Program.

Please do not hesitate to contact me if you have any queries in relation to any aspect of this report.

Kind regards

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Appendix A

Ergonomic Assessment Report of Access & Egress Hazards for Off Road Mobile Plant at NRG Flinders Coal Field at Leigh Creek, South Australia.

Appendix B

Training Handout