Total Steel

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TUNRA BULK SOLIDS

# Linear Abrasion Wear Tests on 360 Brinell and EHSP Steel Plate with Black Coal

Report No 5785 January 1999

**Client: Total Steel of Australia Pty Ltd**

total quality total service **Total Steel**

**TUNRA BULK SOLIDS HANDLING RESEARCH ASSOCIATES**
(a division of The University of Newcastle Research Associates Ltd - inc. in NSW)
A.C.N. 000 710 074

# LINEAR ABRASION WEAR TESTS ON 360 BRINELL AND EHSP STEEL PLATE WITH BLACK COAL

Project No. 5785 January, 1999

**S. J. Wiche B.E.**

**Client: Total Steel of Australia Pty Ltd**

Address: 46 Anzac Avenue
Smeaton Grange
NSW 2567

Telephone: 02 4648 8111

Facsimile: 02 4647 8011

Attention: Lyell Morris

This report has been checked and authorised by the undersigned

Signed.....

**Users of this report are invited to contact the author if clarification of any aspect is required.**

**Any extrapolation of the data and/or recommendations to situations other than those for which they were specifically intended without confirmation by the author may lead to conclusions which are either erroneous or far from optimal.**



**This investigation was performed using the facilities of the Bulk Solids Handling Laboratories of Tunra Bulk Solids Handling Research Associates and Centre for Bulk Solids and Particulate Technologies at The University of Newcastle**

**POSTAL ADDRESS:**

Tunra Bulk Solids
Engineering Faculty, University of Newcastle
University Drive, Callaghan N.S.W. 2308
AUSTRALIA

Telephone: 21 7127 Area Prefix: 049
Facsimile: 21 6094 Intl. Prefix: 61 49
Email: tbshra@mail.newcastle.edu.au

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Client (2)
S.J. Wiche
A.W. Roberts
Office File

Note: JFE is the merged identity of NKK and Kawasaki Steel. EHSP was manufactured under the NKK name at the time of this report.

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## 1. INTRODUCTION

This report is concerned with the relative abrasion resistance properties of two different types of steel plate samples when abraded with black coal. The two samples were a 360 Brinell plate and EHSP plate manufactured by JFE. The coal used was from a local Hunter Valley Mine, Newstan Colliery, and the sample was of a steaming coal for a local power station.

## 2. TEST EQUIPMENT

The test rig is shown schematically in Figure 1. As illustrated, the rig incorporates a surge bin containing the coal that feeds onto a belt conveyor. The belt delivers a continuous supply of coal to the sample that is held in position by a retaining bracket secured to load cells that monitor the shear load. The coal is drawn under the sample to a depth of several millimetres by the wedge action of the inclined belt. The normal load is applied by weights on top of the sample holding bracket. The coal is cycled back to the surge bin via a bucket elevator and chute.

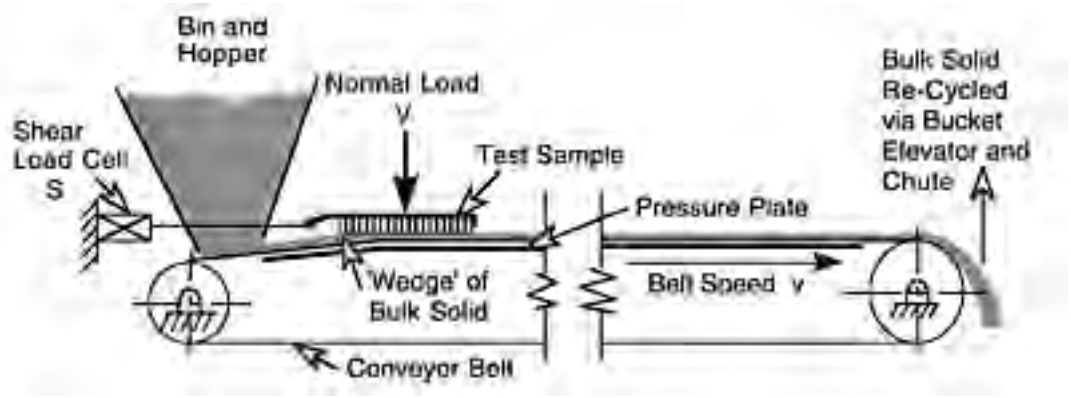


**Figure 1 Wear Test Apparatus**

## 3. TEST PROCEDURE

Test samples were approximately 12 mm in thickness and 75 mm x 150 mm in size, suitable for placement side by side under the test equipment holding bracket.

A weight was placed on the samples during testing to provide a normal pressure of 8.6 kPa and the belt speed was set to 0.5 m/sec. The coal sample used for the test was crushed and sieved to -6 mm before loading into the system. Testing took place for 100 hours, during which time the following measurements were made.

1. The weight of the samples before and at intervals during the test.

2. A sieve analysis of the bulk material before and after the 100 hour test.

3. The moisture content of the coal before and at intervals during the test.

## 4. TEST RESULTS

### 4.1 Wear

Although wear of the belt samples is measured in terms of weight loss in grams this is not a convenient parameter with which to compare wear rates if the density of the samples differ. It is more useful to compare wear in terms of loss in thickness. For the results presented here weight loss has been converted to loss in thickness, in microns, using the following relationship:

$$\text{Thickness Loss} = \frac{M.10^3}{A.\rho}$$

where M = Mass Loss (gms)
A = Surface Area ($m^2$)
$\rho$ = Density ($kg/m^3$)

The density used for the two steel samples was determined to be approximately 7800 $kg/m^3$.

Figure 2 shows graphically the loss in thickness obtained for both tested samples at a lineal velocity of 0.5 m/s and a normal pressure of 8.6 kPa.

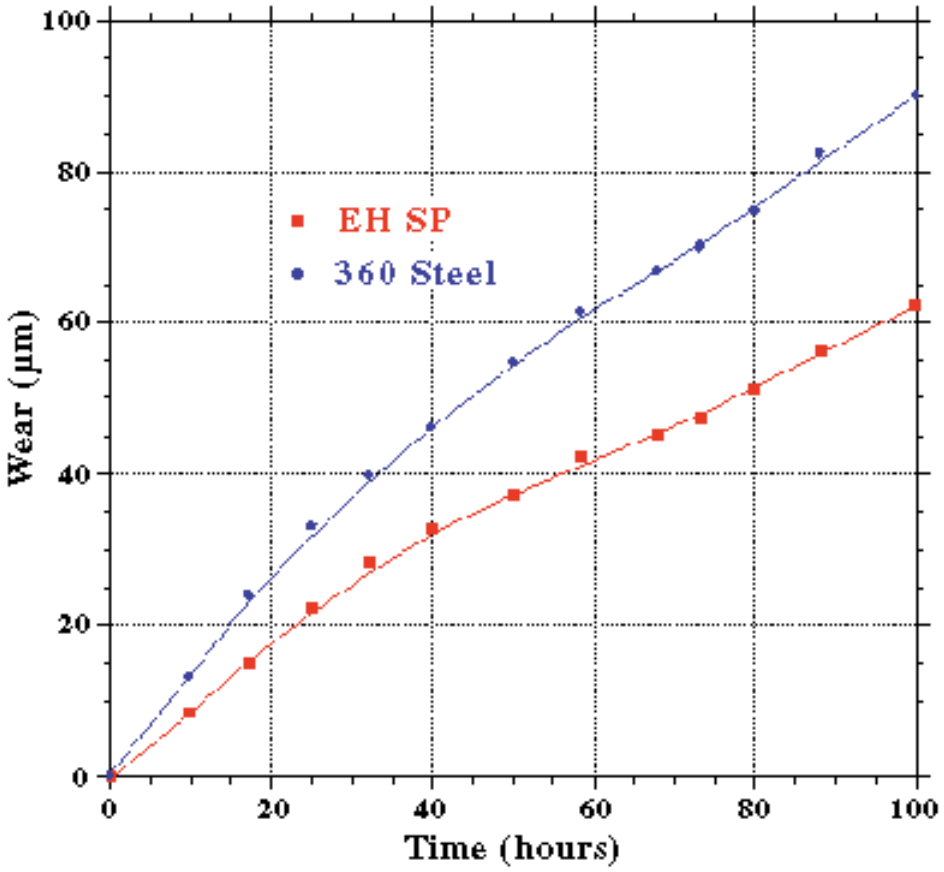


**Figure 2 Wear Test Results**

### 4.2 Moisture Content

The moisture content of the coal was monitored throughout the test, the results of which are given in Figure 3. Initially the moisture content was allowed to drop from 7 % to 3%. However dust became a problem and water was added on a continuous basis to keep the moisture level at around 5 to 6%. The moisture content of the coal clearly had an influence on the wear rate. Figure 2 indicates a reduction in wear rate for both steel samples after the moisture content was increased from 3% to around 5 to 6%.

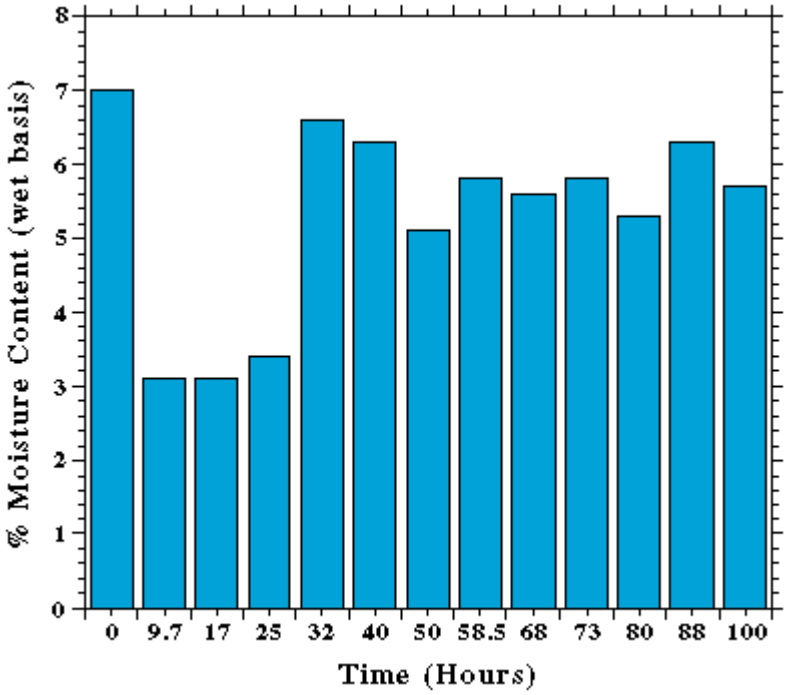


**Figure 3 Moisture Content**

### 4.3 Sieve Analysis

Graphical results of sieve analyses before and after completion of the test are given in Figure 4. The graph shows a reduction in the maximum particle size which is to be expected due to particle attrition.

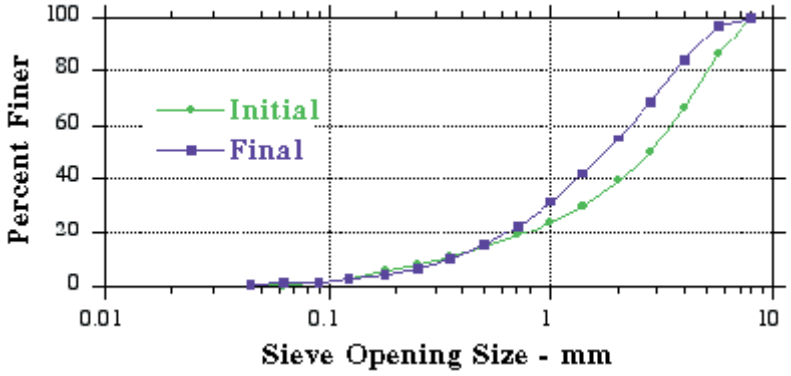


**Figure 4 Sieve Analysis Results**

## 5. COMMENTS

The results obtained for loss in thickness as a function of wear hours given in Figure 2 show that the 360 Brinell sample had a faster wear rate than that for the EHSP sample. With the moisture content of the coal at around 5 to 6% the wear rate of the 360 Brinell sample was 0.7 µm /hour and that for the EHSP sample was 0.5 µm/hour.



# Total Steel

**Total Steel of Australia Pty Ltd**
ABN 34 001 201 850

**Administration**
Suite 10, 35–37 Railway Parade
Engadine, New South Wales 2233
PO Box 70 Engadine NSW 2233
Telephone: (02) 8508 4800
Fax: (02) 9520 8628
Email: admin@totalsteel.com.au

**Sydney**
46 Anzac Avenue
Smeaton Grange, New South Wales 2567
Box 3205 Narellan DC NSW 2567
Telephone: (02) 4648 8111
Fax: (02) 4647 8011
Email: sydney@totalsteel.com.au

**Melbourne**
207-211 Fitzgerald Road
Laverton North, Victoria 3026
PO Box 477 Laverton VIC 3028
Telephone: (03) 9369 8855
Fax: (03) 9369 8866
Email: melbourne@totalsteel.com.au

**Brisbane**
106 Mica Street
Carole Park, Queensland 4300
PO Box 265 Carole Park QLD 4300
Telephone: (07) 3723 9200
Fax: (07) 3271 1699
Email: brisbane@totalsteel.com.au

**Perth**
53–75 McDowell Street
Welshpool, Western Australia 6106
PO Box 626 Welshpool DC WA 6986
Telephone: (08) 9351 6800
Fax: (08) 9351 6868
Email: perth@totalsteel.com.au

**Darwin**
48 Dawson Street
East Arm
NT 0822
Tel: (08) 8984 4324
Fax: (08) 8947 4615
Email: darwin@totalsteel.com.au

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