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PSMC 003: Auckland Harbour Bridge



Auckland Harbour Bridge

Resource Consents for Discharge of
Abrasive Blast Products

Annual Report

July 1999



*Opus: an accomplished work,
a creation, an achievement*



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Abrasive Blast Products**

Annual Report

July 1999

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1 Introduction

The following report has been prepared for the Auckland Regional Council in accordance with the special conditions of consent as set out in the Resource Consents for the Auckland Harbour Bridge (AHB). This is the fifth Annual Report and covers the period 29 June 1998 to 27 June 1999.

The Resource Consents have been granted to Transit New Zealand for the discharge of abrasive blasting products from abrasive blasting of the Auckland Harbour Bridge under the following Discharge Permits:

- Discharge Permit No. 938557 for discharge to air
- Discharge Permit No. 938508 for discharge to water
- Discharge Permit No. 938862 for discharge to ground

All conditions of these discharge permits are being complied with. In accordance with the special conditions of consent the following details are discussed:

- The location and extent of blasting
- The estimated quantity of abrasive blasting products generated and likely contaminants contained within the removed paint and abrasive.
- Confirmation of the quantity of abrasive blasting products recovered and disposed of.
- The quantity and type of corrosion inhibitors used during wet blasting.
- Details of the measures undertaken to avoid, remedy or mitigate any adverse environmental effects.
- Investigations into new paint technologies and other developments which will reduce the need for dry abrasive blasting.
- Investigations into alternative paint removal techniques.
- Results of a public survey taken to assess the effectiveness of the permit conditions.

The physical works contractor responsible for the painting of the Auckland Harbour Bridge changed on 1 December 1998 from Serco to Total Bridge Services. The Total Bridge Services contract has a contract period of ten years expiring 30 November 2008. Total Bridge Services is a Joint Venture Company comprising of TBS Farnsworth Limited and Roadtech Resources. Roadtech Resources is a joint venture comprising of Fulton Hogan Limited and Opus International Consultants Limited.

2 Discharge to Land and Water

2.1 Location and Extent of Blasting

Over the past twelve months to majority of the abrasive blasting, high pressure water blasting and maintenance painting was carried out on the West Extension.

The areas painted by Serco from 29 July 1998 to 30 November 1998 include:

- West Extension Exterior boxes 1 to 35 (outboard side only).
- East Extension Internal painting boxes 52-71
- Remedial painting on the interior of the Pier Brackets
- Gantry Refurbishment
- Above walkways Span 3, panel points 10/11, 12/13 and some minor remedial work in Span 3, panel point 9/10 and Span 2.

No blasting or painting operations were carried out between November 1998 and February 1999, with the exception of the deck resurfacing work during the period 25 December 1998 to 5 January 1999.

The blasting operation for the deck resurfacing was completed using steel shot and captivated blasters. This methodology eliminated the dust problems and resulted in virtually full recovery of the blast media.

The areas painted by Total Bridge Services include:

- West Extension Exterior Boxes 1 – 43.
- Span 7 panel 6 Transverse Walkway.

The total quantity of blasting media used over the past twelve months was 44,770kg.

The west extension maintenance works includes the re-coating of the seaward web and cantilever. The total area of painting was 5,300 sqm. It comprised of the outer web plate, outer cantilever, deck plate and longitudinal trough stiffeners. The total volume of blasting media used in this work package was 15,350kg, which made up 34% of all blasting work on the bridge.

The above walkways maintenance work includes all steelwork on the original truss bridge structure above the level of the maintenance walkways that runs the length of the structure. This includes all chords, posts, diagonals, laterals, road stringers, cross girders and services pipework. The total area of painting carried out in the panels mentioned above was 900 sqm. The total volume of blasting media used in this work package was 2,350kg, which made up 5% of all blasting work on the bridge.

The east extension interior maintenance work included the coating of all interior box components. These include the bottom flange, both webs, the deck plate and all stiffeners. This work was carried out from July 1998 to October 1998. No abrasive blasting media was used for this work and the existing lead based coating was encapsulated with a zinc phosphate alkyd system. The total area coated was 11,600 sqm. The coating system applied was that specified in standard AHB520:1994.

The north east outer and south west inner maintenance gantries for the west extension have been upgraded as part of the extension of the maintenance contract. This work was carried out intermittently between July 1998 and November 1998. The work involved the painting of all steelwork on the gantries. The approximate steel area of each gantry is 50 sqm. The total quantity of blast media used was 2,670kg, which made up 6% of all blasting work on the bridge.

After the completion of the initial pier bracket strengthening work some remedial painting was required. For this work all surface preparation was carried out by hand and power tool cleaning and no abrasive blasting was carried out in these areas.

Total Bridge Services commenced the 10 year contract on 1 December 1998. No blasting or painting work was carried out during the first ten weeks of this contract.

Coatings application commenced on 15 February 1999. The programmed work has focussed on the west extension, commencing at the north anchorage and progressing through southwards through spans 1,2 and 3. The treatment to the outboard sides of spans 1 and 2 consisted of water washing and application of the Moisture Cured Urethane (MCU) cover coat over the recently completed Serco work in that area. No abrasive blasting was required to this area.

The inboard faces of span 1 and 2 required blasting prior to application of the full protective coating system. The abrasives used for blasting in these areas was garnet. This material was selected due to its superior paint removal capabilities and low dust content. South of span two basalt continues to be used for blasting. The total volume of blasting media used in this work package was 21,175kg, which made up 47% of all blasting work on the bridge.

Remedial works were carried out in Span 7 Panel 6 on the area of steel work supporting the transverse walkway. This area was scaffolded and completely screened prior to blasting to minimise wind drift. The total volume of blasting media used in this work package was 1,575kg, which made up 4% of all blasting work on the bridge.

A small amount of blasting has recently been carried out at the North Anchorage to clean up access platforms. The abrasive used was Garnet. Clean up in this area includes recovery and disposal of approximately 1 tonne of blast media. The total volume of blasting media used in this work package was 1,550kg, which made up 4% of all blasting work on the bridge.

During the 1998/99 Christmas period the resurfacing of the extensions continued. The area resurfaced over this period was the west extension from box 31 to 0 (north anchorage), the approximate area was 3,600sqm. The RFT specified that all blasting activities shall comply with current resource consent conditions, be fully captive, where full captive blasting is not practicable open blasting shall be no more than 5% of the total area, open blasting areas must be screened and spent media to be removed on completion of blasting, captive shot blasting must have a 90%

minimum recovery rate. Media specifications included that the media must be free of soluble matter and chlorides. The minimum free silica content must not exceed 1%. The accepted tender advised that 3 Nelco CPX-16-65DC units would be used for the captive shot deck blasting. These units were fitted with shot blasting media cleaning machinery and free dust collectors. Any dropped shot was cleaned up immediately. The construction report showed the blasting operations were completed at 1100 hours on 28 December 1998. A magnetic truck swept up all left over shot and a minimum of 95% was recovered. Open blasting using Garnet abrasive was used over a total area of 5sqm, this was for blasting around manhole covers. All spent media was cleaned up upon completion of the blasting. Exact quantities of shot and garnet used are not available.

2.2 Abrasive Blasting Products and Likely Contaminants

Quantity of Abrasive Blasting Products Generated

Details of abrasive blasting carried out on the Auckland Harbour Bridge between 28 June 1998 and 27 June 1999 have been tabulated and included in Appendix A. For each day the location of the blasting, the work hours, wind speed, amount and type of abrasive, and controls used have been recorded. On some days the Contractors quality assurance records did not give work hours or wind direction during blasting. Total Bridge Services have been instructed to insure that all abrasive blasting data is fully recorded in the future.

Table 1 below gives the approximate amount of blasting abrasive used in each part of the Bridges by each Contractor over the past year. The period of blasting and prevailing wind direction is also given.

Table 1: Summary of Abrasive Blasting

Location of Blasting	Period	Approximate Amount of Abrasive Used (kg)	Prevailing Wind Direction
Serco			
West Extension Exterior boxes 1 to 35	29 June 1998-19 November 1998	15,350	SW
Gantry Refurbishment NE outer and SW inner	16 July 1998 – 20 November 1998 intermittently	2,670	NE
Above walkways remedial painting Span 3 panels 10/11, 12/13, 13/14	9 October 1998 – 29 October 1998	2,350	SW

Location of Blasting	Period	Approximate Amount of Abrasive Used (kg)	Prevailing Wind Direction
Total Bridge Services			
West Extension, Boxes 1-43	15 February 1999 – 27 June 1999	21,175	NE/SW
Span 7 Panel 6, Transverse Walkway	3 May 1999 – 18 May 1999	1,575	S
North Anchorage Access Equipment	8 – 14 June 1999	1,550	NE/SW

Likely Contaminants in Removed Paints and Abrasives

Basalt, garnet and glass abrasive blasting media have been used on the Auckland Harbour Bridge over the past twelve months. The basalt abrasive has been two grades Fine Blast and Min Blast. Both these products are supplied by Mintech NZ Ltd and are manufactured at their Waitakere plant. The garnet and crushed glass abrasive were supplied by Industrial Minerals Ltd. Note the crushed glass is not used by the current contractor TBS as the surface profile achieved by this abrasive is only just acceptable.

As mentioned in previous reports the basalt and garnet abrasive media do not contain any known toxic contaminants or free silica in excess of 1% and the concentrations of soluble materials are so low that they can be considered inert. The chemical and mineralogical composition of both the basalt and garnet abrasive have been given in previous reports. The crushed glass media is considered a more environmentally friendly product as the product is environmentally stable and non toxic as well as producing less dust than the other media used. However the profile achieved with crushed glass is only just acceptable.

The paint removed from the AHB structure over the past twelve months has been the original five coat system. The original system consisted of three coats of zinc chromate primer and two top coats of micaceous iron oxide. Particles of the original zinc spray coating system have also been removed by abrasive blasting and may be present in the discharge.

The blasting technique and type of coatings removed from the AHB structure over the past twelve months are the same as those used when the resource consent was issued in 1994. The composition of the abrasive blasting products and concentration of contaminants will therefore be essentially the same as at that time. See Works Consultancy Services Central Laboratories Report No 93/24730 for the results of the analysis of the abrasive blasting products.

2.3 Recovery and Disposal of Abrasive Blast Debris

Although quantities of shot and garnet used are not known from the resurfacing of the extensions, it is known that some 99% of the shot was recovered, recycled and ultimately disposed of off site in accordance with the disposal plan.

The gantry refurbishment carried out over the past twelve months deposited media on surrounding sealed areas. The Contractor (Serco) was requested to collect and dispose of all blasting deposits in these areas at the completion of the works. The collected abrasive blasting products were disposed of off site in accordance with our Disposal Plan, i.e. in the Northern Disposal Systems Waste Landfill at Greenmount.

2.4 Corrosion Inhibitors

Neither of the Maintenance Contractors working on the AHB over the past twelve months used corrosion inhibitors.

2.5 Measure Undertaken to Avoid, Remedy or Mitigate any Adverse Environmental Effects

Both Contractors over the past twelve months have continued to as far as practicable avoid, remedy and mitigate adverse effects on the environment from the abrasive blasting on the Auckland Harbour Bridge. Methods used include:

- Using the more expensive garnet abrasive for blasting where possible. Using the garnet reduces the amount of abrasive dust generated when blasting. Garnet is more efficient due to its hardness and angular profile and therefore a lesser quantity is used to prepare the steel surfaces compared to basalt and glass abrasive.
- Trials of the crushed glass abrasive continued on a larger scale. As stated in last years report the crushed glass is more environmentally friendly and non toxic as well as producing less dust than envirogrit. However the current Contractor believes the profile achieved is not satisfactory for the application of the MCU system.
- High pressure water blasting has continued to be used over the past twelve months to remove as much loose paint, scale and corrosion products from the surfaces as possible before abrasive blasting. Water blasting generates paint flakes rather than generating the dust associated with abrasive blasting. Following the water blasting, sweep blasting is required to obtain a surface profile for anchorage of the paint film.
- Ultra High Pressure (40,000psi) water blasting has continued to be used for crevice corrosion preparation works. This system removes all scale, corrosion products and leaves a suitable profile for filling of the crevice. The system has been used to remove paint from the west overarch top chord prior to hot metal spraying. A sweep blast was also required to obtain a suitable profile for the coating to adhere to. The overarch treatment with hot metal spray and a sealing coat is expected to give a coating live of 25 years.
- Signage was displayed advising motorists and the public of abrasive blasting and coating operations on the Auckland Harbour Bridge.

- Surrounding businesses and residents were forwarded blasting and painting programmes at regular intervals over the past twelve months. A survey was carried out of local residents by Total Bridge Services to ensure that over the past twelve months that they were happy with the controls provided. The results are contained An appendix B.
- Screens were used where practicable to reduce the spread of debris.
- Investigations and trialing of alternative paint systems continued to identify those that comply with health and safety legislation in terms of VOC and toxicity levels.
- The trial of long life paint systems continued. One of the trial systems is now the main coating system applied by the contractor. The next evaluation of the trial is due in June 2000.
- The current blasting philosophy is based on spot blasting followed by a light sweep blast. This philosophy together with the high pressure waterblasting and ultra high pressure water blasting where possible, minimises the volume of material that is generated.
- Regular wash down of the steel work maximises the coating life by removing salt deposits which are detrimental to coating life. By maximising the coating life we reduce the frequency of repainting and therefore the quantities of materials discharged to the environment. This practice will continue no matter what coatings are employed in the future.

3 Discharge to Air

3.1 Paint System Prior to 1 December 1998

As described in previous reports the paint system used up to 1 December 1998 was an alkyd system consisting of four coats; two primers of high build zinc phosphate over coated by two micaceous iron oxide top coats. This system is applied over the original paint system.

The original AHB paint system consisted of three coats of zinc chromate primer and two coats of micaceous iron oxide. A large proportion of this paint system has been removed and replaced or repainted over by the zinc chromate free system. The general philosophy that has been adopted for bridge maintenance painting system minimises paint removal by leaving sound paint intact and spot blasting where breakdown occurs. These areas are spot primed and covered by a single coat top coat. This minimises the quantity of paint being reapplied and will minimise future discharge quantities.

The current three year maintenance painting contract (MA 1357) was scheduled to finish on 31 August 1997 but was extended to 30 November 1998. By this time approximately 60,000m² of maintenance painting was completed.

3.2 Paint System Used From 1 December 1998

The current maintenance contractor Total Bridge Services (TBS) nominated an alternative to the current system in the tender for the ten year contract. The system now been applied is a Moisture Cured Urethane system.

The MCU system was selected by TBS due to its potential long life (expected to be a minimum of 15 years) and that it is an encapsulating system. The film thickness required for this system, are also greatly reduced compared to the system in use prior to 1 December 1998.

Similar systems are been trialed as part of the part trial. The Moisture Cured Urethanes have been rated highly against the other system on the Original Truss bridge due to there environmental characteristics (low VOC's) and ease of application. The overall rating given to this system in the latest inspection of the paint trial rates it above the system used prior to 1 December 1998.

The specification for the application of this system to the original truss bridge is given below. The specifications for other parts of the structure only differ slightly from this specification. The products names shown in brackets are those supplied by Wasser.

Moisture Cured Urethane Specification

- Thoroughly clean all surfaces in a work area by water blasting at 5,000psi nozzle pressure to remove all loose paint, rust flakes, bird droppings, salt deposits, and other surface contaminants.
- Prepare areas of corrosion by slurry blasting, to achieve an AS 1627.4 Class 22 standard with a surface profile of 35 - 75 microns and residual chlorides less than 100 milligrams/sqm.

- Spot prime areas of exposed steel with a 65 - 90 microns dry film thickness (DFT) of an aromatic MCU zinc-rich primer (MC-Zinc) after checking to ensure residual chloride levels are less than 100 milligrams/sqm. Where necessary surfaces shall be rinsed with potable water with a 1% solution of Chlor*Rid salt solubilising solution to assist in the removal of residual salts. In spans 5 to 7. Replace 'MC-Zinc' with a surface tolerant MCU zinc-rich primer (MC-Miozinc).
- Stripe coat by brush, all fasteners, welds, edges, crevices and zinc primed areas with 50 microns of a MIO pigmented aromatic MCU intermediate coat (Miomastic) and then spray apply a full tie coat of the same material to all surfaces. Where necessary, an accelerator (PURQuik) may be used in the zinc rich and MIO stripe, patch or tie coat to allow the intermediate coat to be applied before the cleaned surface is recontaminated and/or before the arrival of unsuitable weather conditions. Tie coat DFT to be 40 - 70 microns.
- When all patch and tie coats have been applied to the work area the surface shall be rechecked for salt contamination and where necessary rinsed with a potable water and 1% Chlor*Rid to ensure residual chloride levels are less than 75 milligrams/sqm. A full finish coat of a MIO pigmented aliphatic MCU (MC-Ferrox A) shall then be applied by spray to give a DFT of between 65 - 90 microns. Colour of the finish coat to be factory tinted using milled pigments to closely match the existing colour. Minimum TDFT 200 microns with 250 microns in the areas sheltered from rain washing.

It should be noted that the low salt concentrations encountered to date have allowed us to omit the use of Chlor*Rid in our preparatory work.

3.3 Alternative Paint Systems

Paint Trials

Some 30 different paint systems are currently included in the paint trials. Of these 24 systems are the original trial systems and in June 1997 six additional system were added and include Polysiloxanes developed by Resene Ameron and Moisture Cured Urethanes developed by Wasser. Both these systems were discussed in previous reports. All paint systems in the trials were assessed in June 1998 and the performance of each system rated against it performance, application characteristics and VOC content. At this stage it appears that for large flat areas such as the extension boxes that the inorganic zinc silicates are the best performing and on the original truss bridge the zinc phosphates are the best performing.

Zinc Metal Spray

The bridge structure was coated with zinc metal spray at the time of construction (with the exception of Span 7 and the interior surfaces of the extensions, pier brackets and diagonals which were painted with a lead based primer). The Zinc coating provides a high level of protection to the steel substrates due to its sacrificial action.

Over the last few years we have been trialing zinc spray on the AHB. Several types of metal spray systems exist to choose from. The most common sprays used world wide are zinc, zinc/aluminium and aluminium/magnesium with the aluminium alloy sprays offering superior protection. Although

zinc spray is more expensive to apply than conventional wet coatings the expected life to first maintenance is in the order of 20 – 25 years. The overall amount of abrasive blasting required over time for zinc metal spray may therefore be less than for conventional coatings.

In December 1994, a zinc metal spray trial was carried out on the top chord in span 3. Application of the zinc spray was relatively simple although costs were high. Over February and March 1997 three West Overarch Apexes were successfully treated with 85/15 zinc /aluminium metal spray and sealed. The underside of the Pier 1 East Extension Bracket were also treated with zinc/aluminium spray in May 1997. In May/June 1998 the West Overarch Top Face was treated with a zinc spray, sealed and top coated with a single coat of AHB 4. Performance of these trial areas is continuing.

3.4 Alternative Paint Removal Techniques

High Pressure Water Blasting

As mentioned above high pressure water blasting is now used to remove all loose paint, rust flakes, bird droppings, salt deposits, and other surface contaminants. Some abrasive blasting is still required however to provide the required steel profile for the application of the coatings. This quantity is however much reduced compared with removal of coatings by abrasive blasting alone.

High pressure water blasting has proved to be an efficient and cost effective method of paint removal. With high enough pressures this method can remove large quantities of coating in a relatively short period of time. Other advantages include:

- There is no airborne debris from discharge to air. Coating are removed in flakes rather than as a fine dust and therefore do not effect the respiratory system of the persons in the vicinity of the blasting operation.
- No abrasive blast media is deposited in areas where these may present a hazard.

Ultra High Pressure Water Blasting

Ultra high pressure water blasting is carried out at 40,000psi. This system has continued to be used over the past twelve months for both crevice corrosion repair and the removal of the existing coating system. The coating removal results are similar to those mentioned above for high pressure water blasting. The main advantage of this system is in crevice corrosion repair where the need for abrasive blasting is all but eliminated. The pressure used is sufficient, that all corrosion products are removed from the crevice and little hand preparation is necessary. A sweep blast may still be required on the surfaces surrounding the crevice prior to coating.

Alternative Blasting Abrasive

Crushed basalt continued to be used over the past year for the majority of blasting activities. However, alternative blasting abrasives have been investigated and trialed over the past three years.

Garnet abrasive was successfully used for the West Extension resurfacing project (1996/97) and for abrasive blasting of the AHB superstructure. The garnet abrasive is considerably harder than the basalt abrasive and does not breakdown upon impact to the same extent (leading to less dust). The

hardness of the garnet also meant that the used garnet from the resurfacing project was able to be recycled and reused on the AHB superstructure. In addition, the hardness and angularity of the garnet abrasive gives it an increased rate of coating removal in comparison to the softer less angular basalt. The initial cost of the garnet is still greater than for basalt, but this cost has been offset to a point by recycling.

An alternative basalt blasting abrasive has also been trialed. The abrasive was sourced from Whangerei and it was hoped that it could be used as a low dust blasting abrasive without the costs associated with the garnet. Trials proved the abrasive to be unsuitable for general use on the bridge as it breaks up on impact with the target surface creating excess dust.

Captive steel shot blasting was used on the West Extension Resurfacing project (1997/98 and 98/99). This was used for the majority of the surface preparation work. Only very small quantities of the shot were not captured and these were cleaned up easily with a magnetic sweeper. Garnet was used in the areas where it was not possible to use the shot system. The resurfacing contractor is intending to use this methodology for the remaining resurfacing work in 2000/01.

crushed glass has continued to be trialed as an alternative blasting abrasive. It was found from these trials that the glass like the garnet produced less dust than the basalt. However the profile achieved was not as good as that from the basalt. This was not seen as a problem by the previous Contractor as the profile achieved meet the specified standards. However the system been used by the current Contractor requires a higher standard of surface preparation than the crushed glass gives.

3.5 Public Survey Results

As required in special condition 9 of the Air Discharge Permit, survey questionnaires have been sent to the residents and businesses adjacent to the AHB. The questionnaire asked for comments on:

- Adequacy of screening provided
- Availability of the Contractors work programme
- Adequacy of street cleaning after blasting operations
- Adequacy of signage provided
- Comments were requested on any other issues.

No written response has been received to the circulated survey form by Total Bridge Services. A copy of the survey form circulated to local resident by Total Bridge Services in attached in Appendix B. However, we have received one verbal response from s9(2)(a), Northcote, one of the local residents. She has advised us that they do not have any concerns over the painting and blasting operations. They have not been adversely affected by dust drift and have been satisfied with the level of contact regarding the maintenance operations.

A copy of the letter received from s9(2)(a) is attached in Appendix B. This letter was written in response to Total Bridge Services letter advising local residents of works programmed for the areas adjacent to their properties.

The Contractor says that screening has been used on the AHB but that wind has sometimes made the use of screens in some locations difficult or not fully effective. The Contractor has attempted to place signage in locations that will expose the signs to the greatest number of the public as possible. On some occasions they may not be directly visible to every local resident and business surrounding the AHB. As has been done in the past, the Contractor will arrange for cleaning of any vehicle or building, soiled by abrasive blasting products or paint from the AHB when requested by the owner.



Appendix A
Abrasive Blasting Data

TRANSIT NEW ZEALAND
 AUCKLAND HARBOUR BRIDGE MAINTENANCE - MA 1357
 RESOURCE CONSENTS FOR ABRASIVE BLAST PRODUCTS
 ANNUAL REPORT - JULY 1998

ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Controls		
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)				Tot.	Recov.
			Garnet	Glass	Bassalt								
30-Jul-98	No Abrasive Blasting, Painting Only												
31-Jul-98	No Abrasive Blasting, Painting Only												
01-Aug-98	Weekend												
02-Aug-98	Weekend												
03-Aug-98	No Abrasive Blasting, Painting Only												
04-Aug-98	West Ext	500-1000'	08:20	16:00	0.5	0.5	SW		175		175	Screens	
05-Aug-98	No Abrasive Blasting, Painting Only												
06-Aug-98	West Ext	500-1000'	08:20	16:00	0.0	0.0	NE		475		475		
07-Aug-98	West Ext	500-1000'	08:30	15:00	1.5	3.5	SW		450		450		
08-Aug-98	Weekend												
09-Aug-98	Weekend												
10-Aug-98	No Abrasive Blasting												
11-Aug-98	West Ext	500-1000'	10:35	15:00	1.5	1.5	SW		550		550		
12-Aug-98	West Ext	500-1000'	11:15	14:40	3.5	3.5	NE		400		400		
13-Aug-98	West Ext	500-1000'	08:30	14:00	3.5	4.5	SW		325		325		
14-Aug-98	West Ext	500-1000'	08:30	14:00	1.5	3.5	SW		550		550		
15-Aug-98	Weekend												
16-Aug-98	Weekend												
17-Aug-98	West Ext	500-1000'	08:30	15:30	2.0	2.5	SW		275		275		
18-Aug-98	West Ext	500-1000'	08:30	14:20	4.5	5.5	SW		325		325		
19-Aug-98	West Ext	500-1000'	08:00	15:05	4.5	3.0	SE		275		275		
20-Aug-98	West Ext	500-1000'	08:00	15:15	4.5	5.0	SW		450		450		
21-Aug-98	West Ext	500-1000'	08:30	15:15	3.5	4.0	SW		425		425		
22-Aug-98	Weekend												
23-Aug-98	Weekend												
24-Aug-98	West Ext	500-1000'	11:30	15:00	0.0	1.5	SW		300		300		
25-Aug-98	No Abrasive Blasting												
26-Aug-98	Span 2	Remdial Wk	08:30	14:15	2.5	3.5	NE		100		100		
27-Aug-98	West Ext	500-1000'	11:30	15:00	2.5	3.5	NE		250		250		
28-Aug-98	No Abrasive Blasting												
29-Aug-98	Weekend												

TRANSIT NEW ZEALAND
 AUCKLAND HARBOUR BRIDGE MAINTENANCE - MA 1357
 RESOURCE CONSENTS FOR ABRASIVE BLAST PRODUCTS
 ANNUAL REPORT - JULY 1998

ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
								Garnet	Glass	Bassalt			
30-Aug-98	Weekend												
31-Aug-98	West Ext	500-1000'	08:00	16:00	0.0	0.0			400		400		
01-Sep-98	No Abrasive Blasting, Painting Only												
02-Sep-98	West Ext	500-1000'	11:00	15:05	1.5	2.5	NE		275		275		
03-Sep-98	West Ext	500-1000'	10:25	14:50	1.5	2.0	SW		325		325		
04-Sep-98	West Ext	500-1000'	08:00	14:15	1.5	1.5	NW		375		375		
05-Sep-98	Weekend												
06-Sep-98	Weekend												
07-Sep-98	West Ext	500-1000'	08:00	14:50	3.5	4.0	SW		325		325		
08-Sep-98	West Ext	500-1000'	10:45	15:00	3.5	4.5	SW		225		225		
09-Sep-98	West Ext	500-1000'	08:50	15:00	4.5	3.5	SW		350		350		
10-Sep-98	West Ext	500-1000'	08:00	15:15	3.5	4.5	SW		275		275		
11-Sep-98	West Ext	500-1000'	08:00	14:50	2.5	4.0	SW		450		450		
12-Sep-98	Weekend												
13-Sep-98	Weekend												
14-Sep-98	No Abrasive Blasting, Painting Only												
15-Sep-98	No Abrasive Blasting, Washdown												
16-Sep-98	No Abrasive Blasting, Washdown												
17-Sep-98	No Abrasive Blasting, Washdown												
18-Sep-98	No Abrasive Blasting												
19-Sep-98	Weekend												
20-Sep-98	Weekend												
21-Sep-98	No Abrasive Blasting, Painting Only												
22-Sep-98	No Abrasive Blasting, Painting Only												
23-Sep-98	No Abrasive Blasting, Painting Only												
24-Sep-98	No Abrasive Blasting, Painting Only												
25-Sep-98	No Abrasive Blasting, Painting Only												
26-Sep-98	Weekend												
27-Sep-98	Weekend												
28-Sep-98	West Ext	500-1000'	10:25	15:00	1.5	3.5	NE		275		275		
29-Sep-98	No Abrasive Blasting, Painting Only												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Controls		
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)				Tot.	Recov.
								Garnet	Glass	Bassalt			
30-Sep-98	No Abrasive Blasting, Washdown												
01-Oct-98	No Abrasive Blasting												
02-Oct-98	West Ext	500-1000'	08:00	15:00	4.5		SW		300		300		
03-Oct-98	Weekend												
04-Oct-98	Weekend												
05-Oct-98	West Ext	500-1000'	09:00	15:05	2.5	4.0	SW		350		350		
06-Oct-98	West Ext	500-1000'	08:00	14:45	3.5	4.0	SW		275		275		
07-Oct-98	No Abrasive Blasting, Painting Only												
08-Oct-98	West Ext	500-1000'	08:00	15:40	3.5	5.0	NE		225		225		
09-Oct-98	Span 3	12	08:00	15:00	4.0		NE		250		250		
10-Oct-98	Weekend												
11-Oct-98	Weekend												
12-Oct-98	No Abrasive Blasting, Washdown												
13-Oct-98	West Ext	500-1000'	08:00	15:15	4.5	5.5	SW		175		175		
13-Oct-98	Span 3	9	08:00	15:15	4.5	5.5	SW			375	375		
14-Oct-98	West Ext	500-1000'	11:30	15:00	3.5	3.0	NE		350		350		
14-Oct-98	Span 3	10	11:30	15:00	3.5	3.0	NE			175	175		
15-Oct-98	West Ext	500-1000'	08:00	14:15	3.5	5.0	SW		125		125		
15-Oct-98	Span 3	12	08:00	14:15	3.0	5.0	SW			325	325		
16-Oct-98	Span 3	12	08:00	14:50						75	75		
17-Oct-98	Weekend												
18-Oct-98	Weekend												
19-Oct-98	West Ext	500-1000'	09:10	15:15	3.0	4.0	NE		325		325		
19-Oct-98	Span 3	12	09:10	15:15	3.0	4.0	NE			150	150		
20-Oct-98	West Ext	500-1000'	09:50	15:30	3.5	5.0	NE		275		275		
20-Oct-98	Span 3	12	09:50	15:30	3.5	5.0	NE			200	200		
21-Oct-98	Span 3	12	08:30	14:25	5.0		SW			175	175		
22-Oct-98	Span 3	12	08:00	15:15	5.0	5.0	SW			175	175		
23-Oct-98	No Abrasive Blasting, Painting Only												
24-Oct-98	Weekend												
25-Oct-98	Weekend												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Controls		
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)				Tot.	Recov.
								Garnet	Glass	Bassalt			
26-Oct-98	Public Holiday												
27-Oct-98	Span 3	12	08:00	15:15	4.5	5.0	SW			175	175		
28-Oct-98	West Ext	500-1000'			1.5	2.5			275		275		
28-Oct-98	Span 3	12			1.5	2.5				125	125		
29-Oct-98	West Ext	500-1000'	09:15	15:10	3.5	4.0	SW		75	125	200		
29-Oct-98	Span 3	12	09:15	15:10	3.5	4.0	SW			50	50		
30-Oct-98	No Abrasive Blasting, Painting Only												
31-Oct-98	Weekend												
01-Nov-98	Weekend												
02-Nov-98	No Abrasive Blasting, Painting Only												
03-Nov-98	No Abrasive Blasting, Washdown												
04-Nov-98	No Abrasive Blasting, Painting Only												
05-Nov-98	No Abrasive Blasting, Painting Only												
06-Nov-98	West Ext	500-1000'	08:00		1.5	2.5	NE		275		275		
07-Nov-98	Weekend												
08-Nov-98	Weekend												
09-Nov-98	NE Gantry		08:30	14:40	2.5	4.0	SW			325	325		
09-Nov-98	Pier 1		08:30	14:40	2.5	4.0	SW			275	275		
10-Nov-98	NE Gantry				1.5	2.5	SW			325	325		
10-Nov-98	West Ext	1000-1300'			1.5	2.5	SW			425	425		
11-Nov-98	NE Gantry		08:00	14:15	1.5	1.5	NE			275	275		
11-Nov-98	West Ext	1000-1300'	08:00	14:15	1.5	1.5	NE			550	550		
12-Nov-98	NE Gantry		08:00	16:00	1.5	2.5	NE			225	225		
12-Nov-98	West Ext	1000-1300'	08:00	16:00	1.5	2.5	NE			425	425		
13-Nov-98	NE Gantry		09:30	14:15	0.5	0.5	SW			150	150		
14-Nov-98	Weekend												
15-Nov-98	Weekend												
16-Nov-98	No Abrasive Blasting, Painting Only												
17-Nov-98	No Abrasive Blasting, Painting Only												
18-Nov-98	NE Gantry		08:00	15:35	2.5	3.5	NE		325		325		
19-Nov-98	West Ext	1000-1300'	08:20	15:15	1.5	2.0	NE		375		375		

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Controls		
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)				Tot.	Recov.
								Garnet	Glass	Bassalt			
20-Nov-98	NE Gantry		08:10	15:00	1.5	3.0	NE		400		400		
21-Nov-98	Weekend												
22-Nov-98	Weekend												
23-Nov-98	No Abrasive Blasting, Painting Only												
24-Nov-98	No Abrasive Blasting												
25-Nov-98	No Abrasive Blasting												
26-Nov-98	No Abrasive Blasting												
27-Nov-98	No Abrasive Blasting												
28-Nov-98	Weekend												
29-Nov-98	Weekend												
30-Nov-98	No Abrasive Blasting												
01-Dec-98	No Abrasive Blasting												
02-Dec-98	No Abrasive Blasting												
03-Dec-98	No Abrasive Blasting												
04-Dec-98	No Abrasive Blasting												
05-Dec-98	Weekend												
06-Dec-98	Weekend												
07-Dec-98	No Abrasive Blasting												
08-Dec-98	No Abrasive Blasting												
09-Dec-98	No Abrasive Blasting												
10-Dec-98	No Abrasive Blasting												
11-Dec-98	No Abrasive Blasting												
12-Dec-98	Weekend												
13-Dec-98	Weekend												
14-Dec-98	No Abrasive Blasting												
15-Dec-98	No Abrasive Blasting												
16-Dec-98	No Abrasive Blasting												
17-Dec-98	No Abrasive Blasting												
18-Dec-98	No Abrasive Blasting												
19-Dec-98	Weekend												
20-Dec-98	Weekend												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
								Garnet	Glass	Bassalt			
21-Jan-99	No Abrasive Blasting												
22-Jan-99	No Abrasive Blasting												
23-Jan-99	Weekend												
24-Jan-99	Weekend												
25-Jan-99	No Abrasive Blasting												
26-Jan-99	No Abrasive Blasting												
27-Jan-99	No Abrasive Blasting												
28-Jan-99	No Abrasive Blasting												
29-Jan-99	No Abrasive Blasting												
30-Jan-99	Weekend												
31-Jan-99	Weekend												
01-Feb-99	Public Holiday												
02-Feb-99	No Abrasive Blasting												
03-Feb-99	No Abrasive Blasting												
04-Feb-99	No Abrasive Blasting												
05-Feb-99	No Abrasive Blasting												
06-Feb-99	Weekend/Public Holiday												
07-Feb-99	Weekend												
08-Feb-99	No Abrasive Blasting												
09-Feb-99	No Abrasive Blasting												
10-Feb-99	No Abrasive Blasting												
11-Feb-99	No Abrasive Blasting												
12-Feb-99	No Abrasive Blasting												
13-Feb-99	Weekend												
14-Feb-99	Weekend												
15-Feb-99	West Ext	Boxes 1-6	10:00	15:30					570			570	Screens
16-Feb-99	No Abrasive Blasting, Painting Only												
17-Feb-99	West Ext	Boxes 1-6	08:30	16:00					570			570	Screens
18-Feb-99	West Ext	Boxes 1-6	08:30	16:00					570			570	Screens
19-Feb-99	No Abrasive Blasting, Painting Only												
20-Feb-99	Weekend												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
								Garnet	Glass	Bassalt			
21-Feb-99	Weekend												
22-Feb-99	West Ext	Boxes 1-6	08:30	16:00					290			290	Screens
23-Feb-99	West Ext	Boxes 1-6	08:30	16:00					700			700	Screens
24-Feb-99	West Ext	Boxes 1-6	08:30	16:00					700			700	Screens
25-Feb-99	No Abrasive Blasting, Painting Only												
26-Feb-99	No Abrasive Blasting, Inspections												
27-Feb-99	Weekend												
28-Feb-99	Weekend												
01-Mar-99	West Ext	Box 13-18	09:00	15:00					575			575	Screens
02-Mar-99	West Ext	Box 7-12	09:00	15:00	5.0	5.0	SW		500			500	Screens
03-Mar-99	West Ext	Box 7-12	09:00	15:00	2.5	5.0	SW		325			325	Screens
04-Mar-99	West Ext	Box 7-12	09:00	15:00	0.0	10.0	NE		450			450	
05-Mar-99	West Ext	Box 7-12	09:00	15:00	10.0	10.0	NE		150			150	
06-Mar-99	Weekend												
07-Mar-99	Weekend												
08-Mar-99	West Ext	Box 7-12	11:00	16:00	6.0	2.5	NE		325			325	
09-Mar-99	West Ext	Box 7-12	09:00	15:00	2.5	2.5	NE		450			450	
10-Mar-99	No Abrasive Blasting												
11-Mar-99	West Ext	Box 13-18	09:00	15:00	2.5	5.0	NE		325			325	
12-Mar-99	West Ext	Box 7-12	10:00	14:30	2.5	2.5	NE		475			475	
13-Mar-99	Weekend												
14-Mar-99	Weekend												
15-Mar-99	West Ext	Box 19-24	09:00	16:00	0.0	2.5	NE		200			200	
16-Mar-99	West Ext	Box 19-30	09:00	14:00	2.5	3.0	NE		600			600	
17-Mar-99	West Ext	Box 35-30	09:00	15:00	2.5	2.5	NE		450			450	
18-Mar-99	West Ext	Box 19-30	10:00	15:30	0.0	2.5	SW		225			225	
19-Mar-99	No Abrasive Blasting, Painting Only												
20-Mar-99	Weekend												
21-Mar-99	Weekend												
22-Mar-99	West Ext	Box 19-30	08:30	14:00	0.0	2.5	SW		700			700	
23-Mar-99	West Ext	Box 19-24	09:00	15:00	2.5	6.0	NE		225			225	

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
								Garnet	Glass	Bassalt			
24-Mar-99	West Ext	Box 25-30	10:00	16:00	6.0	1.0	NE	400			400		
25-Mar-99	West Ext	Box 25-30	09:15	15:00	2.5	5.0	E	400			400		
26-Mar-99	West Ext	Box 25-30	10:00	14:00	6.0	7.5	NE	525			525		
27-Mar-99	Weekend												
28-Mar-99	Weekend												
29-Mar-99	West Ext	Box 31-36	08:30	16:00	8.0	10.0	NE	300			300		
30-Mar-99	West Ext	Box 31-36	08:00	15:00	6.0	6.0	NE	300			300		
31-Mar-99	West Ext	Box 1-6	08:00	15:00	0.0	0.0	-	225			225		Screens
01-Apr-99	West Ext	Box 1-6	09:00	16:00	2.0	2.5	S	150		100	250		Screens
02-Apr-99	Public Holiday												
03-Apr-99	Weekend												
04-Apr-99	Weekend												
05-Apr-99	Public Holiday												
06-Apr-99	West Ext	Box 31-36	09:00	15:00	10.0	10.0	NE			425	425		
07-Apr-99	West Ext	Box 31-36	09:00	15:00	0.0	5.0	NE			350	350		
08-Apr-99	No Abrasive Blasting												
09-Apr-99	No Abrasive Blasting												
10-Apr-99	Weekend												
11-Apr-99	Weekend												
12-Apr-99	West Ext	Box 31-36	08:30	15:30	0.0	0.0	-			500	500		
13-Apr-99	West Ext	Box 31-36	08:15	15:00	0.0	0.0	-			250	250		
14-Apr-99	West Ext	Box 31-36	08:30	14:00	0.0	4.0	NE			250	250		
15-Apr-99	No Abrasive Blasting, Painting Only												
16-Apr-99	No Abrasive Blasting, Painting Only												
17-Apr-99	Weekend												
18-Apr-99	Weekend												
19-Apr-99	West Ext	Box 31-36	09:15	14:00	0.0	5.0	SW			200	200		
20-Apr-99	West Ext	Box 31-36	10:00	16:00	0.0	1.0	SW			400	400		
21-Apr-99	West Ext	Box 25-30	08:00	16:00	0.0	5.0	SW			250	250		
22-Apr-99	West Ext	Box 25-30	09:00	15:00	0.0	0.0	-			375	375		
23-Apr-99	No Abrasive Blasting, Painting Only												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
						Garnet	Glass	Bassalt					
24-Apr-99	Weekend												
25-Apr-99	Weekend/Public Holiday												
26-Apr-99	West Ext	Box 31-36	09:00	14:00	10.0	13.0	E/NE			250	250		
27-Apr-99	No Abrasive Blasting, Painting Only												
28-Apr-99	West Ext	Box 31-36	10:00	14:30	3.0	8.0	SE/E			375	375		
29-Apr-99	West Ext	Box 31-36	10:00	14:30	3.0	5.0	NE			375	375		
30-Apr-99	West Ext	Box 31-36	08:00	15:00	2.0	5.0	S			150	150		
01-May-99	Weekend												
02-May-99	Weekend												
03-May-99	No Abrasive Blasting												
04-May-99	Span 7	Panel 6	08:00	15:30	2.0	5.0	S			375	375	Screens	
05-May-99	No Abrasive Blasting, Painting Only												
06-May-99	Span 7	Panel 6	08:00	16:00	2.0	10.0	S			300	300	Screens	
07-May-99	Span 7	Panel 6	10:00	15:00	10.0	7.0	S			500	500	Screens	
08-May-99	Weekend												
09-May-99	Weekend												
10-May-99	West Ext	Box 31-36	09:00	15:00	3.0	3.0	SW	500			500		
11-May-99	West Ext	Box 31-36	10:00	15:00	2.0	2.0	W			500	500		
12-May-99	No Abrasive Blasting, Painting Only												
13-May-99	No Abrasive Blasting, Painting Only												
14-May-99	No Abrasive Blasting, Painting Only												
15-May-99	Weekend												
16-May-99	Weekend												
17-May-99	West Ext	Box 25-30	09:00	15:00	2.5	5.0	SW			125	125		
18-May-99	Span 7	Panel 6	10:00	15:30	0.0	3.0	SW			400	400	Screens	
19-May-99	West Ext	Box 25-30	08:15	16:00	2.0	3.0	SW			750	750		
20-May-99	West Ext	Box 25-30	08:15	16:00	6.0	0.0	SE			525	525		
21-May-99	No Abrasive Blasting, Painting Only												
22-May-99	Weekend, No Abrasive Blasting, Painting Only												
23-May-99	Weekend												
24-May-99	No Abrasive Blasting, Painting Only												

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Tot.	Recov.	Controls
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)					
								Garnet	Glass	Bassalt			
25-May-99	West Ext	Box 19-30	08:00	16:00	2.0	2.0	NE			200	200		
26-May-99	West Ext	Box 19-30	08:00	16:00	4.0	4.0	NE			150	150		
27-May-99	West Ext	Box 19-30	08:30	14:00	5.0	0.0	N			200	200		
28-May-99	No Abrasive Blasting, Painting Only												
29-May-99	Weekend, No Abrasive Blasting, Painting Only												
30-May-99	Weekend												
31-May-99	No Abrasive Blasting, Painting Only												
01-Jun-99	No Abrasive Blasting, Painting Only												
02-Jun-99	No Abrasive Blasting												
03-Jun-99	No Abrasive Blasting, Painting Only												
04-Jun-99	No Abrasive Blasting, Painting Only												
05-Jun-99	Weekend												
06-Jun-99	Weekend												
07-Jun-99	Public Holiday												
08-Jun-99	North Anc.	0-1	09:00	15:30	0.0	2.0	SW			500	500	400	Screens
09-Jun-99	West Ext	Box 37-42	09:00	15:30	0.0	2.0	SW			850	850		
10-Jun-99	No Abrasive Blasting, Painting Only												
11-Jun-99	No Abrasive Blasting, Painting Only												
12-Jun-99	Weekend, No Abrasive Blasting, Painting Only												
13-Jun-99	Weekend												
14-Jun-99	North Anc.	0-1	08:00	15:00	0.0	2.0	NE			1050	1050		
15-Jun-99	No Abrasive Blasting												
16-Jun-99	No Abrasive Blasting												
17-Jun-99	No Abrasive Blasting												
18-Jun-99	West Ext	Box 25-31	08:30	14:30	2.5	3.5	W			250	250		
19-Jun-99	Weekend, No Abrasive Blasting, Painting Only												
20-Jun-99	Weekend												
21-Jun-99	West Ext	Box 25-31	09:00	14:00	2.5	3.5	W			250	250		
22-Jun-99	West Ext	Box 25-31	09:00	15:30	2.5	3.5	W			250	250		
23-Jun-99	West Ext	Box 25-31	09:00	14:00	2.5	3.5	W			250	250		
24-Jun-99	West Ext	Box 25-31	09:00	15:00	2.5	3.5	W			250	250		

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ABRASIVE BLASTING DATA

DATE	Span	Panel P.	Work Hours		Wind Speed (m/s)			Abrasive			Controls		
			From	To	0830 hrs	1400 hrs	Dir	Used (kg)				Tot.	Recov.
						Garnet	Glass	Bassalt					
25-Jun-99	West Ext	Box 25-31	09:00	15:00	2.5	3.5	W			250	250		
26-Jun-99	Weekend, Washdown												
27-Jun-99	Span 3	Panel 9	22:00	00:00						50	50		
28-Jun-99	No Abrasive Blasting, Painting Only												
29-Jun-99	No Abrasive Blasting, Painting Only												
30-Jun-99	No Abrasive Blasting, Painting Only												
01-Jul-99	No Abrasive Blasting, Painting Only												
02-Jul-99	No Abrasive Blasting, Painting Only												
03-Jul-99	Weekend												
Av. Wind Speed					2.59	3.54		Total Quantity Used			44770	400	



Appendix B
Survey Results



INTERNATIONAL
CONSULTANTS

