

LIFETIME WATERPROOFING AND PROTECTION FOR STRUCTURAL CONCRETE

RADCON[®] FORMULA#7



Raised Highway SS115 - Italy

BRIDGE SITE REFERENCES

SITES OF INTEREST 2008

Radcrete Pacific presents: **Trafficable Areas**

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SITE DETAILS:

COUNTRY	- Johannesburg, South Africa
SITE	- Nelson Mandela Bridge
TREATED AREA	- Bridge deck
APPLICATOR	- Verni Construction

FIGURE 1.

A view of the Nelson Mandela Bridge in Johannesburg, South Africa.

RADCON Formula #7 protects the Nelson Mandela bridge in Johannesburg

The **Nelson Mandela Bridge**, a centre piece of the Blue IQ rejuvenation project in South Africa, quickly became the newest landmark of the Gauteng province.

Verni Construction, the long-term and experienced Radcon Formula #7 distributor for the region, treated the bridge deck ensuring lifetime waterproofing and increased serviceability to this spectacular structure.

Pollution is a serious concern in the city, resulting in rapid carbonation and deterioration of structural concrete. With Radcon #7 protection, the bridge will be in use for many years with no further maintenance required.

Being the largest cable-stayed bridge in southern Africa, it is 284 metres long, spanning over 42 operational railway lines in the heart of the Johannesburg's central business district.

The asymmetrical dual-pylon design, with a 42 meter tall north pylon and 27 meter tall south pylon, received an outstanding engineering achievement award from the South African Institute of Civil Engineers (SAICE) on 27 October 2004.



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"Bridge of Highway SS 115 TRAPANI-SCIACCA, Km 82,5" - 28.000 smq

Waterproofing with RADCON #7 of the bridge deck.



Bridge over Livenza river, (TREVISO) - 1.600 Sqm
Waterproofing with RADCON #7 of the bridge deck.



"Bridge of the Highway A/13, Bologna-Padova" , Località Villamarzana (ROVIGO)

Waterproofing with RADCON #7 of the bridge deck.



Bridge of MONGUELFO highway, (BOLZANO) - 2.500 Sqm
Waterproofing with RADCON #7 of the bridge deck.

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Trafficable Areas 6

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FIGURE 10.
Works on Gaia Bridge

Gaia Bridge Portugal

When Radcon # 7 waterproofing is applied the structural concrete for rail bridge decks, massive engineering cost savings are derived.

As the actual concrete is waterproofed internally and becomes as hard as granite, "no structural topping slab" is required.

The stone ballast for the rail lines may be placed directly onto Radcon # 7 lifetime waterproofing.

SITE DETAILS:

COUNTRY	- Portugal
PROJECT NAME	- Gaia Bridge
OWNER	- C.P.
CONTRACTOR	- Bento Pedroso
SIZE	- 600 sq mtr



FIGURE 11.
Inspecting the structure before waterproofing



FIGURE 12.
The reinforcement works



FIGURE 13.
Radcon application



FIGURE 14.
Works on Gaia Bridge

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SITE DETAILS:

COUNTRY - Japan
SITE - Tomei Highway
CLIENT - Shimizu Corporation
TREATED AREA - bridge deck
APPLICATOR - Kankyo Biken

FIGURE 1.

RADCON #7 application on a bridge deck of the new beam of Tomei Highway in Shimizu City.

RADCON #7 called to the rescue of a new raised highway segment in Japan.

The Number 2 Tomei Highway is a part of the busiest expressway in Japan, located west of Tokyo.

The first sections were opened as early as 1968 and today it covers more than 320 kilometers connecting Tokyo and Nagoya.

The newly erected raised segment, constructed by Shimizu Corporation, exhibited water leakage issues.

The contractor, Japan Highway Public Corporation, have used RADCON #7's before and were aware of its faultless performance on structures subjected to thermal stress, carbonation and weight loading.

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SITE DETAILS:	
COUNTRY	- Vietnam
SITE	- Calmette Bridge
CONTRACTOR	- OBAYASHI/MITSUBISHI JV
CONSULTANT	- Pacific Consultants International
APPLICATOR	- Indochina Centrepro
TREATED AREA	- Bridge deck
SIZE	- 10,549 sq metres

FIGURE 1.

Radcon #7 treated bridge deck of the East West Freeway of the Calmette bridge.

OBAYASHI and MITSUBISHI utilise RADCON #7 for East West freeway in Vietnam.

Radcon #7 has been the preferred bridge deck waterproofing solution in Vietnam for some 20 years now.

The contractor, OBAYASHI, knew from previous applications that only RADCON #7 can deliver unique lifetime waterproofing performance even though it will be subjected to high thermal stress and load conditions.

The 300 metres long and 24 metres wide bridge deck will facilitate 6 traffic lanes as a relief to heavy traffic between Calmette Street in District 1 and Doan Van Bo Street in District 4. The Calmette Bridge is just one of a series of bridges in the East West freeway through the heart of Ho Chi Minh City.

Radcon #7 re-seals any future hairline cracks on contact with water and protects the concrete surface from carbonation.

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FIGURE 2.
Tuyen Son Bridge construction.
Waterproofing work
commencing MM/YY

**Radcrete Pacific's product system specified in TUYEN SON BRIDGE ,
a Japanese funded construction site.**

SITE DETAILS:

COUNTRY	- Vietnam
PROJECT NAME	- Tuyen Son Bridge
DEVELOPER	- PMU 85 from MOT of Vietnam
DESIGNER	- Japan Port Consultant Co. + Maunsell Group + Tedi
CONTRACTOR	- Cienco 1 Corp. & Cienco 5 Corp. (525 Joint Stock Co.)
APPLICATOR	- Radcon Vietnam
SIZE	- 13,000 sq mtr bridge deck

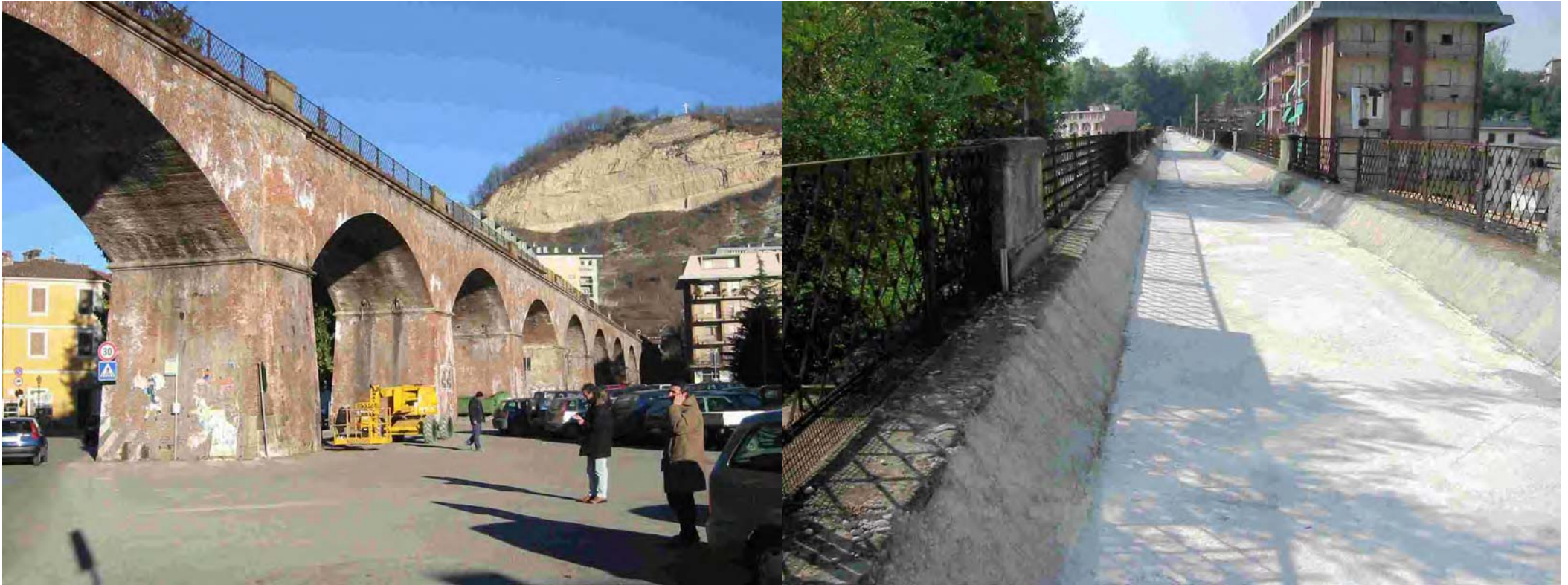
As a result of Radcrete Pacific being well known internationally, most of the product from Radcrete were specified into this sea port & bridge project by a group of international bridge designer including Japan Port Consultants, Maunsell group and TEDI Vietnam.

Ministry of Transportation of Vietnam approved for this typical specification due to an in fact qualification for Radcon #7 used in previous hundred bridge and tunnel projects in Vietnam before. In this sea bridge, Radcon #7 was applied for waterproofing the whole bridge deck prior asphalt topping and

to protect all bridge columns immersed in seawater at 14 meters depth. Tuyen Son Bridge is the second bridge in Vietnam approved by MOT in choosing Radcon #7 to protect the bridge structure immersed in seawater. The first bridge is To Chau sea Bridge in Kien Giang province, constructed for linking to Cambodia territory, also was applied Radcon #7 to protect all main column from sea water attack. Radcote mineral silicate paint, a famous paint produced in Australia was applied in all exposed area of bridge structure, about 25,000 sq mtrs, after Radguard

applying for a structure protection. The reason to use this kind of effective paint is a requirement from the local government for a long-term performance out door paint against the attack from the moist climate of the Central of Vietnam. Located in Danang City coastal area, this bridge is an important construction unit in the transportation system of Asia Link between Thailand-Laos-Vietnam.

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Railway bridge of CEVA (CUNEO) - 1.200 Sqm
Waterproofing with RADCON #7 of the bridge deck.

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SITE DETAILS:

COUNTRY	- USA
PROJECT NAME	- Interstate 295
TREATED AREA	- 4 Bridge Decks
APPLICATOR	- Express Polymers, Inc.
SIZE	- 3, 100 sq mtrs (33,500 sq ft)

RADCON Formula #7 features in New Jersey DOT Surface-Applied Corrosion Inhibitor Study

As part of an ongoing evaluation of new technologies and products, RADCON Formula #7 was selected as one of three products in a demonstration program by the New Jersey Department of Transportation to evaluate the performance of surface-applied corrosion inhibitors.

The objective of the program is to determine and compare the effectiveness of the three treatments - each of a different technology - in mitigating corrosion under New Jersey conditions; premature deterioration of the concrete caused by chloride-induced corrosion of deck reinforcement and freeze-thaw damage.

RADCON Formula #7 was applied to 4 bridge decks on a very busy Interstate 295, Mercer County, New Jersey in November 2005. The process was completed in eight nights followed by three night watering procedures.

Nelson Tonet, P.E., principal of Express Polymers, Inc. (Smartech Structure Protection's regional representative in the US northeast), worked closely with the New Jersey DOT in evolving the test application program for RADCON Formula #7 and then supervising the contractors in all aspects of the application program and post treatment waterings.

First results from this surface-applied corrosion inhibitor study should become available from the New Jersey DOT's New Technologies and Products section in mid-2007.



Pictured above: RADCON Formula #7 application - electrical pump/tank with a hose spray wand or a boom with a number of sprayers.

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Traffic Areas

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TRAFFIC AREAS
Motorway overpass in Plzeň,
Czech Republic

Project description: The project involved the application of Radcon Formula #7 waterproofing concrete to the drainage areas of a motorway overpass in Plzeň, Czech Republic. The work was completed in October 2004.

Motorway overpass Tyrs Sad is represents a great start-up site reference for Radcon in the Czech Republic. A Plzeň entrance of the interconnection into the city.

Application took place in October 2004, a treatment some 100 sq mtrs for the drainage areas.

Prior to the site opening developers received a quality standards complaint from the investors.

The concern was about the poor drainage system construction and the affect of de-icing salt scattering.

Developers were facing either a drop of the initial price or to provide a drainage protection against de-icing salts effects.

There is where Radcon Formula #7 was proven to be the most efficient and time effective alternative.

Application was carried out 30 days before the official opening of the bridge using a diesel sprayer as shown in figure 1.

SITE DETAILS:

COUNTRY	- Czech Republic
PROJECT NAME	- Overpass Tyrs Sad
DEVELOPER	- Státní Most Praha a.s.
ARCHITECT	- Pontex s.r.o.
CONTRACTOR	- Roads Traffic Authority CZ
APPLICATOR	- Metalspec Plzeň s.r.o.
SIZE	- 100 sq mtr

TRAFFIC AREAS
Radcon application using a diesel sprayer



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SITE DETAILS:	
COUNTRY	- UAE
SITE	- Madinat Zayed
ENGINEERS	- Ove Arup
CLIENT	- Public Works Department Abu Dhabi
CONTRACTOR	- RAPCO
APPLICATOR	- Isam Kabbani
TREATED AREA	- Bridge Deck
YEAR COMPLETED	- 2002

FIGURE 1 & 2.
RADCON #7 protected bridge deck near Abu Dhabi

RADCON #7 lifetime waterproofing proven performance in the UAE.

Madinat Zayed overpass is another 'living proof' of RADCON Formula #7's faultless track record in the Middle Eastern region.

Ove Arup & Partners have used the product on projects in Asia and Australia and were aware of its *ability to reseal future hairline cracks.*

This makes RADCON #7 ideal for protection of structures exposed to thermal stress and weight loading, which may cause flexural deflection.

RADCON #7 also maintains watertight seal and protection without any future need for repair.



RADCON #7 - RAMA VIII - BANGKOK - THAILAND.

Owner: Bangkok Metropolitan Authority
Designer: Buckland & Taylor Ltd
Site Engineers: Mott MacDonald - Epsilon Co. Ltd
Design Site
Representatives: Scott Wilson Kirkpatrick
Area: Bridge Deck
12,000 sq. metres
Applicator: Radcon Thailand.

The Radcon Thailand team was most honoured recently when the King of Thailand together with the evening Television News crew came to inspect progress on the Rama VIII Bridge site.

During the King's visit Radcon #7 was being applied to the joints of the pre-cast panel infill strips; the bridge still had some 30 metres of construction work to meet the shoreline.

Eventually an asphalt topping will be emplaced over the panels after Radcon #7 has been applied to the entire deck, without the need of a protective topping to the Radcon #7.

And unlike many recent horror stories coming from bridge decks in Hong Kong where membrane coatings were used, the Rama VIII will have no problems of asphalt delamination or pot holing due to delamination. *Hong Kong Highway decks treated with Radcon #7 are still performing faultlessly.*

Washington Highway testing in 1984 confirmed no loss of asphaltic adhesion when applied to Radcon #7 treated concrete.

The actual bridge deck is made up of pairs of cast between precast units, after a super saturation of the Radcon #7.

Heavily reinforced concrete infills are cast between the pre-cast units.

Each successive group of pre-cast units are held in compression along the deck length by both the deck supporting tendons and also by post-tensioning which ties the total deck together.



RAMA VIII - BRIDGE BANGKOK

With all pre-cast units in compression and with the quality of consolidation of the infill strip concrete of the highest quality the designer chose to exclude installation of expanding waterstops which were originally proposed.

We are confident with this decision and believe Radcon #7 alone will maintain a waterproof integrity in these joints based on many years'

experience in repairing post-tension highway joints where eventually the original epoxy waterproofing must fail with age.

As the demand for Radcon #7 waterproofing on bridge decks globally increases we congratulate the Radcon Thailand team for gaining this most prestigious bridge site ever to be constructed in Thailand to date.



RAMA VIII - PRE-CAST PANEL JOINTS

RADCON #7 - THE RAIL BRIDGE - BELGIUM

Client: Belgium State Rail
Builder: T.V. van Laere
N.V. / Bouygues N.V.
Site: H.S.L. Kortenberg –
Proj 3383
Size: Bridge Deck treatment
1,800 sq. metres
Applicator: Orbi Construct N.V.

Our top photo depicts Radcon #7 waterproofing being applied to the structural concrete of the Tuc-Rail Bridge in Kortenberg in the neighbourhood of Brussels.

Huge cost savings are achieved using Radcon #7 as no structural topping slabs are required to protect Radcon #7 from rail ballast stone.

A slag blend was utilised as the mix design and as you can see from the photo, severe cracking occurred.

However, the cracks are stable and cause no problems in Radcon #7 achieving a total watertight result.

Whilst it may not look so good, environmentally responsible specifiers may increase the cracking tendencies



RADCON #7 - APPLIED TO STRUCTURAL CONCRETE



SEVERE CRACKING IN SLAG BEND - EVIDENT

of concretes by utilising blended cements knowing that Radcon #7 will produce a 100% watertight result.

This site in fact contained a 60% slag

replacement to cement. The concrete was a CEM / 111A mix design.

RADCON #7 - DAN XAY BRIDGE - VIETNAM

Client: Tedi – M.O.T.
Architect: Bridge & Tunnel
Engineering Consultants
Developer: Peoples Committee
of Ho Chi Minh City
Location: Can Ctio Town
Area: 1,574 sq. metres,
Bridge Deck
Applicator: IDC Centrepro.

Unfortunately this suspension bridge ran into piling problems and a one-year completion took some three years.

A sheet membrane and primer had been purchased for the job and waterproofing was begun. Unfortunately the primer was way out of use-by-date so a quick decision to apply Radcon #7 was agreed to. No problem with Radcon #7, as the material maintains an unlimited shelf life providing any opened drums are

properly resealed against any air intrusion.

Given Vietnam's tropical climate combined with many rivers and rivulets running east to west, the construction of bridges remains one of the most important infrastructure challenges in order to see the economy move forward in the global arena.

As Radcon #7 continues to deliver faultless performance to the people of Vietnam, our representative, IDC Centrepro not only gains market share in high risk, high profile sites for Government projects such as hospitals, public buildings and commercial centres, but reduces long term maintenance costs in future Government budgets.



DAN XAY BRIDGE - RADCON #7 APPLICATION

SITES OF INTEREST 2009

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SITE DETAILS:

COUNTRY	- UAE
SITE	- Tarif Interchange
CONSULTANT	- Ove Arup & Partners
CLIENT	- Emirates of Abu Dhabi Works Department
CONTRACTOR	- Saif Bin Darwish
APPLICATOR	- Isam Kabbani
TREATED AREA	- Bridge Deck
YEAR COMPLETED	- 2001

FIGURE 1-3.

RADCON Formula #7 faultless performance on the Tarif Interchange.

Tarif Interchange proves RADCON #7's proven performance on a raised interchange near Abu Dhabi.

The pictured raised section of the Tarif Interchange located near Abu Dhabi was waterproofed with RADCON Formula #7's unique technology in 2001.

The project was one of the first to utilise this sub-surface membrane which remains active inside the concrete in the UAE, although the technology has been available on the market for over 20 years.

After 8 years of operation, the RADCON #7 sealed *deck remains completely watertight and continues to protect concrete* from carbonation and steel reinforcement corrosion.



RADCON #7 PROTECTS HONG KONG OVERPASS

Contact No. 21/HY/95 W/O D029793-2
Location: K11A - Prince Edward Road West
Client: Hong Kong Government
Engineer: Hong Kong Highways Department - Structures Division
Main contractor: Chiu Hing Construction & Transportation
Area treated: existing raised freeway
Size: 15,150 square metres
Application Date: April 1997

Radcon Formula #7 has been utilised by the Hong Kong Highway Department to protect its' civil structures numerous times over the past decade. This project shown here is a typical example of the scope of work that Radcon #7 is specified for.

All engineers are faced with the challenge of addressing the durability of a structure when it is located near to marine environments. Inevitably chloride ions penetrate the matrix of the concrete eventually corroding the reinforcement which reduces the serviceable life of the structure.

This particular section of raised freeway shown in Figure 12 is located in the Kowloon area of Hong Kong near the famous Kai Tak Airport. After many years of service and with proximity of less than 1 kilometre to the ocean there were signs of durability concerns in the form of cracks and small amounts of spalling.

In this situation, Radcon #7 was applied to the concrete road surface. The end benefit is that Radcon #7 reacts with Calcium Hydroxide in the concrete to create a gel which sets up a sub-surface barrier. The gel fills pores and capillaries

significantly reducing the concretes' permeability. Equally as important the gel will seal cracks up to 2.00mm, and it is the cracks which provide a direct path for pollutants and chlorides to the reinforcement.

When the application is complete it is important



FIGURE 11 - CLOSE UP OF OVERPASS

to understand that there is no film or coating layer on the surface which can be damaged. The product functions by penetrating into the concrete.

To treat such an old and busy freeway section caused a few logistic issues. Firstly, this section of freeway can only be shut down for very short periods of time during the evening. Secondly, after many years of service the road surface was contaminated with airborne pollutants, tyre rubber deposits, oil and fuel.

Therefore, part of the Method Statement included light acid etch and high pressure wash prior to the Radcon #7 treatment. After this preparation was complete and the road surface was dry, Radcon #7 was applied utilising motorised spray units. Each unit has the capacity to spray 800 square metres per hour enabling very fast application rates.

Radcon #7 requires three waterings to facilitate penetration and the products' reaction with the concrete. The specification states that the waterings should be spaced at approximately 24 hour intervals: Day 1, Day 2 and Day 3. The



FIGURE 12 - K11A - PRINCE EDWARD ROAD WEST, KOWLOON

first watering must commence as soon as the product becomes touch dry, in this situation it was as little as 1-2 hours.

On this project, the waterings were simply a matter of having the water truck drive along the freeway at a controlled speed flood spraying water. The freeway was closed until the completion of the first watering at which time it is safe for vehicular traffic without affecting the integrity of the treatment.

The second and third waterings were undertaken without closing the freeway at all. The trucks were again driven along the freeway at controlled speed, watering the road surface whilst it was open to traffic.

As part of Quality Assurance for this project, the Hong Kong Highways Department specified that post-application tests be undertaken to confirm the product had been applied correctly and penetrated sufficiently into the concrete.

Specific areas were nominated on the structure and cores were taken for analysis. The Australian government owned C.S.I.R.O. (Commonwealth Scientific & Industrial Research Organisation) was commissioned to determine the penetration of Radcon #7 into these cores. The reaction products of Radcon #7 are a close cousin to the naturally occurring C-S-H in concrete, so determining depth of penetration is difficult.

The investigation techniques selected for this work were Scanning Electron Microscopy (SEM) and X-ray Microanalysis (EDS).

The recorded depth of penetrations of Radcon #7 were:

Core 1	2.5mm	road surface
Core 2	4mm	road surface
Core 3	10mm	road surface
Core 4	12mm	road surface
Core 5	8mm	road surface
Core C121	8mm	column
Core C122	14mm	column

Overall the penetration results were acceptable. It should be noted that road surfaces (particularly old ones such as these) can be contaminated with many forms of pollutants from those that are airborne to vehicular oil, grease and petrol. These contaminants are impossible to completely remove from the concrete thus reduce the ability of Radcon #7 to penetrate concrete as shown in Core 1 & 2. Fortunately this is normally isolated to areas of heavy contamination only.

BREMSA BRIDGE, NORWAY

Client:	Jernbaneverket Utbygging (Norwegian State Railway)
Civil Engineering:	Arild Berg AS
Main Contractor:	PEAB
Approved Applicator:	Betongforsegling AS (Radcon Scandinavia AS)
Areas Treated:	Bridge Deck, edge beams
Size:	5,300 square metres
Length of Bridge:	381m
Width:	13.6m
Concrete:	C45

Radcon #7 is now included in the standard specification on railway bridges built for the Norwegian State Railway. The principle advantage of using the product is that no protection toppings, screeds or mats are required to protect the waterproofing treatment. This not only saves time and money, but also lowers risk.

In these applications, ballast is placed over the concrete prior to installation of the railway tracks. During the life of the structure many trains rumble over the track vibrating the ballast that is in contact with the concrete.



FIGURE 24 - RADCON #7 APPLICATION



FIGURE 25 - BREMSA BRIDGE, NORWAY

This vibration causes severe abrasion between the ballast and the structural concrete such that it will damage any unprotected membrane system.

This is yet another bridge where Radcon #7 has been used to waterproof and protect the concrete without the need for any topping slab. The reason for this is that the product functions by penetrating and hardening the concrete, not just forming a surface film.

The Bremsa bridge is the first steel/concrete composite bridge built for the Norwegian State Railway and forms part of a new high speed rail link that connects the new Airport at Gardemoen to Oslo.

The structure is composed of a large steel box section on top of which is a flat concrete slab. The thickness of which is only around 200mm.

Radcon #7 was treated to some 5,300 square metres of this bridge deck seen here in Figure 24. This is one of many bridges that are now being protected by Radcon #7 against deterioration.

FASHION CENTRE, JAPAN

Client:	Shimamura Co. Ltd.
Architect:	The Sigmasystem Architect
Area treated:	Rooftop car park
Main Contractor:	Fukuda Corporation
Size:	1,500 square metres
Approved Applicator:	Rad Japan

Fashion Centre is a delivery and logistic centre for the Shimamura company located in Okegama-shi Saitama prefecture. Radcon #7 was used to waterproof the suspended loading dock seen here in Figure 27. This is a typical critical Radcon #7 application because of the office facilities located below.



FIGURE 26 - INSPECTION OF APPLICATION

Normally a membrane and a topping slab or wearing course would be needed to isolate the waterproofing membrane from traffic and potential damage. This usually has structural implications because of the extra weight of the topping slab.



FIGURE 27 - FASHION CENTRE, JAPAN

Radcrete Pacific's Managing Director, Mr Edward L Byrne can be seen in Figure 26 with Mr Hideoshi Itoh of Rad Japan. Mr Byrne was present during the application and was impressed with the Rad Japan's attention to detail and efficiency. The circular stamp seen in both photos provides additional grip to the trucks in slippery conditions.

GRANDE ESPLANADE, MANLY COVE

Architect: Michael Dysart & Partners
Engineer: Ashby Doble
Main Contractor: Concrete Constructions
Area treated: Level 9 & Level 4 rooftops, swimming pool & plant rooms
Size: 2,100 square metres
Applicator: Multitech Sealants & Waterproofing

After extensive research and visits to past Radcon Formula #7 treated projects in Sydney, the consultants for Grande Esplanade chose our system approach to waterproof the key areas of this project.

As the decision was made before the concrete slab was poured, Concrete Constructions were able to take full advantage of the benefits of the Radcon #7 sealing system.



FIGURE 9 - APPLICATION

These revolve around casting hobbbs/ upturns into the pour at all parapet walls, major penetrations and plant rooms as seen in Figure 10. By planning these upturns the Radcon #7 system is greatly simplified as a liquid membrane strip seal is no longer required.

The rooftop on this site was broken into 2 major post-tensioned areas with a final interconnecting normally reinforced pour strip. Being a large area with no expansion joints additional steps were made to ensure a water tight result was achieved.

Firstly, the face of the construction joints in the pour strip were scabbled to allow the new concrete to get an adequate 'key'. Full detailing is photographed in Figure 11. Secondly, **RX Waterstop**® was installed below the first row of steel and just prior to the concrete pour Radcon #7 was sprayed onto the construction joint faces.

The application of Radcon #7 in this situation acts as a bonding and wetting agent, also ensures that Radcon #7 has a good presence down the construction joint. After supervising the placing of the concrete we were confident that



FIGURE 10 - CAST IN-SITU PARAPETS



FIGURE 11 - EXPOSED CONSTRUCTION JOINT



FIGURE 12 - GRANDE ESPLANDE, MANLY COVE, SYDNEY

the joint would act monolithically. But due to the size of the rooftop the potential for movement at one of the construction joints was a reality and thus a liquid membrane bandage with bond breaking tape was also emplaced.

On this project the client engaged Ove Arup Engineers to inspect all products applied to horizontal surfaces.

Finally, the original Development Application called for the finished rooftop to be green in colour. After the Radcon #7 application and waterings were complete an alkyd-free green chloro-rubber paint was applied which can be seen here in Figure 13.

What could be more simple: stressed concrete, good design and detailing, working together closely to achieve a common goal. Waterproof structural concrete, no complicated multi-layered membranes and protective toppings.



FIGURE 13 - RADCON #7 TREATED FIRST, THEN PAINTED

ROADS & TRAFFIC AUTHORITY BRIDGE DECK, SYDNEY

The Roads and Traffic Authority of New South Wales recently specified Radcon Formula #7 for application to the F4 Highway Entrance ramp on James Ruse Drive after there was an accident which resulted in an acid spill.

The damaged asphalt was removed exposing the old structural concrete. Due to the time constraints and heavy traffic on this major artery the application was undertaken at night. Kratrim, our approved applicators completed the work.

After the application was complete, a new asphalt topping was installed over the Radcon #7 treatment. There are two critical performance features of Radcon #7 in this type of application.

Firstly, the asphalt topping will still be able to gain full bond to the treated structural concrete.

And secondly the temperature of up to 160°C during installation of the asphalt does not affect in the performance of Radcon #7.



FIGURE 14 - SCABBLED BRIDGE DECK

KVERNDALEN BRIDGE DECK, NORWAY

Name of section: Arteid Bridge - Kverndalen
Bridge: Kverndalen
Owner: NSB Gardermobanen
(Norwegian State Railways)
Main contractor: AP Spesialprosjekt/Skanska
Applicator: Minihaller AS
Area: Bridge deck
Size: 1,500 square metres

The Arteid Bridge located forms part of the New Fast Train to Norway's new airport just outside Oslo. The railway project



FIGURE 28 - BRIDGE DECK

includes several major bridges, of which Radcon Formula #7 has been applied to three - to the deck and culvert. One of the bridges, Kverndalen, can be seen in Figure 29.

A strong reason for choosing Radcon #7 on

these bridges is due to the crack sealing performance of the product. Any concrete protection product will provide some protection to the structure by protecting the general matrix of the concrete, but Radcon #7 can address cracks which may be present or develop in the structure. Local testing has been undertaken through SINTEF for chloride ingress and permeability.



FIGURE 29 - KVERNDALEN BRIDGE, NOOSDLO

By sealing cracks in the concrete as well as the matrix, Radcon #7's performance is greatly enhanced offering superior protection for concrete exposed to freeze-thaw attack, chloride ingress and other air borne pollutants.

Also a major consideration on this civil project was the extensive use of heavy balustrade (stones) along the rail tracks. Although Radcon #7 is a spray applied liquid it penetrates the concrete without leaving a surface film. The product works by reacting with the free Calcium Ions within the concrete to form a sub-surface waterproofing barrier. Therefore the placing of heavy balustrade onto the treated concrete does not damage the Radcon #7 treatment.

ITALIAN SWIMMING POOL

Main Contractor: Genio Militare - Ing. Tornabene
Application: Maffei Company - Mirandola, Modena
Pool Dimensions: 25m x 12m (up to 4m deep)

The Military Academy in Modena, Italy is the Training Base and home for the Italian equivalent of the Marines. Their swimming pool was built in 1950 and is suspended on beams and piers. The pool was leaking profusely producing 300mm calcium stalactites as seen in Figure 31. Traditional repair methods were more expensive than completely re-building the pool. Radcon Italia provided an alternative method to try to resolve a difficult problem.

The empty pool was washed and mortar joints in poor condition were re-grouted. Then the whole tiled internal area of the pool was treated with Radcon #7 with the first watering using a 3% calcium solution to help trigger the reaction in the older mortar joints. The pool was filled. During the first week



FIGURE 30 - SWIMMING POOL RE-FILLED AFTER SUCCESSFUL REPAIRS

there was no significant improvements. After 10 days large saturated areas started to dry. After 2 weeks, 70-80% of the problem was resolved.

The remaining problem was a construction joint running horizontally around the pool. A unique and untried method was put forward to seal this joint from the outside. Firstly the leaking joint was ground out 40mm deep and 20-30mm wide. A PVC tube of 15mm diameter with regular holes was placed in the cut-out. The tube was covered in a quick setting mortar. After 8 hours the tube was sealed at one end and injected with Radcon #7 at 2 atmospheres pressure. The Radcon #7 displaced the water and reacted with the calcium in the joint creating a watertight seal.

This methodology proved successful and was thought to be miraculous by the Military Engineers. The pool has been given a new lease of life at an exceedingly low repair cost.



FIGURE 31 - SOFFIT WITH 300MM CALCIUM STALACTITES

RADCRETE



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EDITORIAL

When faced with building a structure there are many factors to consider. One small component which causes most headaches is waterproofing.



With waterproofing, some products may be suited to one type of application but not every application. In these situations consultants often acknowledge that when deciding on the best suited waterproofing product, it's 'horses for courses'.

This phrase comes from the fact that on the race track it is well established that some animals run better on wet turf, while others are more suited to dry. For years consultants have also used this phrase to infer that a particular product may be better suited for a certain job - or certain job conditions - than other products.

For all readers who use this phrase or have heard it, we would like to highlight which applications we feel Radcon Formula #7 has an edge on the competition: (1) suspended car parks, particularly over habitable areas, (2) trafficable rooftops, (3) podium decks & (4) suspended water holding vessels.

In this Newsletter you will find most of our sites from around the world fit into one of these four categories. Please read on.

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FIGURE 1 - NEW BURNETT RIVER BRIDGE WITH CRACK INSERT

NEW BURNETT RIVER BRIDGE

Client: Queensland Transport
Builder: McConnell Dowell Contractors
Applicator: Concrete Cutting & Sealing
Application: Bridge deck with shrinkage cracks

During construction, this bridge located in Queensland over the Burnett River developed a number of shrinkage cracks which were treated with Radcon Formula #7. The bridge deck was made up of precast panel sections spanning the cast in-situ columns seen here in Figure 1.

After Queensland Transport noticed some damp patches and calcium staining on the underside of the deck, it was decided that a suitable treatment was necessary prior to the laying of the asphalt topping. To cure the concrete, a wax emulsion curing compound was used which retards >90% of moisture loss, meeting AS3799's requirements.

Unfortunately, this compound retards general surface adhesion and importantly prevents absorption of Radcon Formula #7 so the bridge deck was grit blasted prior to treatment. Any surface material such as excess curing compounds, paints, mortar etc., that retards the absorption of the concrete must be removed prior to an application of Radcon #7. After the final watering, the surface was flood tested with water trucks.

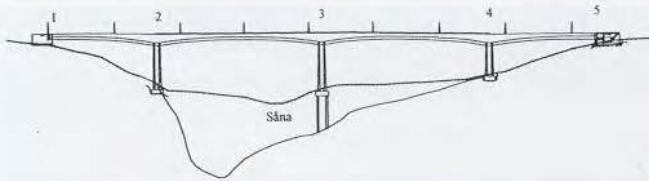
For a 'belts and braces' approach a bitumen emulsion was applied over the Radcon #7 treatment prior to the installation of the asphalt topping.

Concrete Cutting & Sealing, a long time applicator of Radcon #7, performed the application to 2,000 square metres of the deck for Queensland Transport.

INSIDE: LIPPO KARAWACI - 46,000 SQM, NORWAY BRIDGE, TECHNICAL UPDATE, RHKJC CAR PARK

EXCLUSIVE GLOBAL DISTRIBUTOR FOR **RADCON**® WATERPROOFING CONCRETE FOR LIFE
FORMULA #7

HOLENDALEN RAILWAY BRIDGE, NORWAY



MAIN DATA

Length	416m, Span width 80-128-128-80
Width	11.5m
Height	50m
Client	NSB (Norwegian State Railway)
Main Contractor	Skanska (Sweden) & Ragnar Evensen AS (Norway)
Consulting Engineer	John Holt AS
Applicator	Radcon Scandinavia AS / Minihaller AS
Concrete	9,000m ³ c70/C55 MA
Area	6,000 square metres Bridge Deck and Edge Beam

CONCRETE MIX DESIGN

Cement HS-65	410kg
Silica Fume	15kg
Water (total)	164kg
Natural Gravel 0-8mm	890kg
Gravel 8-16mm	221kg
Gravel 16-27mm	708kg
Additives, Water and Air	0.6%
Water/Binder	0.38



FIGURE 15 - BRIDGE DURING CONSTRUCTION



FIGURE 16 - CRACKING IN CONCRETE

Radcon #7 is approved and recommended by NSB (Norwegian State Railway Authority) and was applied to the deck and edge beams seen in Figure 15. The total area was approximately 6,000 square metres. The applicators were Radcon Scandinavia AS in association with Minihaller AS. The NSB recognises Radcon Formula #7's unique ability to reduce the ingress of chloride ions in both the matrix and more importantly maintaining a seal and highly alkaline environment in cracks to protect the steel.


The mix design of the bridge is now the standard for such structures in Norway. Silica Fume content is 3.5%.

The Holendalen bridge forms part of the main railway between Oslo and Sweden. Norway is often regarded as the home of concrete technology and high performance concrete. This bridge is no exception and the bridge deck and pillars were design strength of C70, the actual strength is >90MPa. The Cement is HS65 and had a water/cement ratio of 0.38. To keep the temperature below 60°C the builders SKANSKA (Sweden) and Ragnar Evensen AS (Norway) used cooling pipes in the formwork with liquid nitrogen tails.



FIGURE 14 - HOLENDALEN RAILWAY BRIDGE, NORWAY

RADCON #7: THE ULTIMATE ANSWER FOR TAIWAN'S FREEWAYS

Site: Dual raised freeway
Location: Wuku to Sitchu, Taipei
Client: Ministry of Transportation & Communication,
Taiwan Area National Freeway Bureau

Consultant: TY Lin Engineers
Concrete: 4000psi
Application: Kingal Trading Co., March 1995
Size: 65,000 square metres
(2km parallel - total 4 km)

Some 4 years of on-site product tests and evaluation led to our Radcon #7 waterproofing treatment to the New Taipei Raised Freeway as photographed.

The first Radcon #7 trial areas for Ministry of Transportation & Communication ~ Taiwan Area National Freeway Bureau were applied in 1992. Approximately 500 square metres was treated to Sanchung Bridge in Taipei. The success of this treatment & numerous other waterproofing works around Taipei led to the product's acceptance.

Taking into account the sheer cost and maintenance of such infrastructure, the engineers considered waterproofing important to increase the structure's serviceable life. Also when considering the amount of structural steel present in these raised freeway sections waterproofing protection is all important.

Prior to utilising Radcon #7, the freeway bureaus of Taiwan were specifying both Japanese and US manufactured membranes which were suitable for accepting a bituminous topping after application.

In striving for the very best construction and structural protection methods available, these membrane approaches proved to be extremely problematic. Even though the membranes themselves and the application of same were of the highest quality, the very high and consistent rainfalls experienced in Taiwan meant that latent moisture trapped in the slabs caused the membrane to delaminate. This led to pot holes forming as chunks of bitumen were gorged out of the road surface in the delaminating areas.

Radcon #7 offered the ideal solution to these inherent problems. The product could be quickly applied during short dry spells, with the knowledge that Radcon #7, as a breathing material will allow for out-gassing of entrapped moisture vapour, thus eliminating any potential delamination problems.

Kingal can be seen in Photo 10 applying Radcon #7 with 4 motorised spray units enabling an application



PHOTO 8 - FINISHED FREEWAY COVERED IN ASPHALT TOPPING



PHOTO 9 - UNDERSIDE OF RAISED FREEWAY



PHOTO 10 - RADCON #7 APPLICATION

rate of approximately rate of approximately 4,000 square metre per hour.

Furthermore, our 'Effect of Out-gassing on Concrete Slabs', 'Effect of Placing Hot (160°C) Asphaltic Concrete' & 'Asphaltic Bond Tests' performed by the US Department of Transport¹, demonstrated that there would be no significant loss of adhesion by the bituminous topping.

Both Radcrete Pacific and Kingal Trading Co., were pleased to have completed the project after the four years involved to demonstrate to the Taiwan Freeway Bureau and T.Y.Lin, the very best technology available to meet their freeway waterproofing and protection needs.

1. "Low Cost Bridge Deck Surface Treatment", US Department of Transport - Federal Highway Administration, Report PB84-238740, April 1984, pp. 15-16

MEKONG RIVER BRIDGE

John Holland Constructions recently completed the construction of the Meekong River Bridge, officially known as the 'Friendship Bridge'. The 1.23km bridge spans the 700 metre wide river between Nung Khai in the north east of Thailand and Tha Naleng in Laos.

The bridge superstructure was built by the balanced cantilever method, due to the difficulty of constructing temporary supports when the river level is high. Each span starts at the pier and progresses in both directions until the cantilevers are joined at the mid-span section. Radcon #7 was treated to the surface and construction joints of this mid-span section which was poured in-situ. There was some 21 mid-span sections in total.

Radcon #7 provided a cost effective alternative to the original membrane specification and was accepted by Maunsell Engineers. John Hollands were happy with the performance of the product particularly taking into consideration the ease of application and unlimited shelf-life of the product in such a remote area.

The bridge will carry two lanes of traf-

fic on a single carriageway and has provision for a future railway down the centre. Because the Lao and Thais drive on different sides of the road there is a traffic change-over on the Lao side.

This is now the second time John Hollands have utilised Radcon #7 in offshore work. The former application being in the construction of an airport hanger in Bangladesh.

Radcrete Pacific, now active in some 25 countries around the world are happy supporting Australian companies remain competitive in the international marketplace.



RADCON #7 IN NAURU

Radcon #7 was chosen to protect the new concrete tank walls formed against the existing walls. The existing tank walls were suffering as a result of chloride ion related corrosion.

The tanks themselves hold sea water for the sanitation needs of the islands inhabitants. In the fore-

ground some of the locals have found another more enjoyable use for an already completed tank.

Given the ease of application and non-toxic nature of Radcon #7 the product is ideal for shipping to remote areas for application by relatively unskilled labour.



SITES OF INTEREST 2009

Radcrete Pacific presents: **Trafficable Areas**

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SITE DETAILS:

COUNTRY	- Cambodia
SITE	- Cau Monivong
CLIENT	- Orbit Engineering Vietnam
TREATED AREA	- bridge deck
APPLICATOR	- Indochina Centrepro
AREA	- 3,100 sq mtrs

FIGURE 1-2.

Construction of the Cau Monivong bridge in Phnom Penh.

RADCON #7 protection for a structure built to last in the Cambodian capital.

The Cau Monivong bridge, named after the King of Cambodia, was designed to improve the traffic flow from an international highway connecting Ho Chi Minh City with Phnom Penh.

It is 270 meters long in total and spans across the Bassac river, a tributary of the Mekong River and Tonle Sap.

The head of the design team and the Chairman of Orbit Engineering Vietnam, Eng. Tran Dai Minh, insists the standard of construction and materials used is only of the highest standard.



SITES OF INTEREST 2009

Radcrete Pacific presents: **Trafficable Areas**

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SITE DETAILS:

COUNTRY	- Trinidad & Tobago
SITE	- CRH/UBH Interchange
CLIENT	- Ministry of Works and Infrastructure
CONTRACTOR	- VINCI Construction
CONSULTANT	- Cansult Ltd
EXECUTING CO.	- National Infrastructure Development Company
TREATED AREA	- Bridge deck
APPLICATOR	- Dover Waterproofing Technologies Ltd
SIZE	- 9,014 sq mtrs

FIGURE 1.

RADCON #7 treated highway interchange in Trinidad and Tobago.

RADCON #7 lifetime protection for the new highway hub in Trinidad and Tobago.

The Churchill Roosevelt/Uriah Butler Highway Interchange is one of the NIDCO's (National Infrastructure Development Company Limited) mass transit solutions to the ever increasing traffic congestion problem in Trinidad and Tobago.

The contractor, VINCI Construction France, used innovative construction technology to assemble the individual steel frames without disturbing the normal traffic flow below.

Each frame of 2500 tons and 600 meters long, were "pushed" into place by hydraulic jacks anchored to concrete beams.

The interchange is currently the country's highest bridge structure towering some 18 meters high.

In the final stages of the development, the project was rushed to completion for the "Summit of the Americas" conference and President Barack Obama's visit in April 2009.

RADCON #7's ease of application alone proved to be quite beneficial for this particular project, not to mention the cost savings with no protective slab or asphalt topping requirement.

Furthermore, no future maintenance costs are guaranteed by RADCON #7's unique ability to reseal future hairline cracks up to 0.30 mm.

RADCON Formula #7 technology, has proven over the years, to be a superior structural concrete waterproofing solution for its versatile and reliable characteristics.

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SITES OF INTEREST 2008

Radcrete Pacific presents: **Trafficable Areas**

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SITE DETAILS:

COUNTRY	- Vietnam
SITE	- Super Highway
TREATED AREA	- Raised highway
APPLICATOR	- Indochina Centepro
SIZE	- 450,000 sq meters

FIGURE 1.
Part of the raised Super Highway in Vietnam

Vietnam raised super highway protected with RADCON #7.

RADCON Formula # 7 is a well known product to the Vietnamese road authorities.

It is actually their preferred waterproofing solution for bridge deck protection and so far has been used on 200+ bridges through out the region.

The latest project currently under way is a 58 km long Super Highway connecting Ho Chi Minh City with the Long An and Tien Giang provinces.

In order to preserve rice plantations in the surrounding areas, 25 km is raised above the ground level.

It is the first project of this kind in Vietnam - addressing the ever growing transportation problems in the country.

Indochina Centepro have commenced waterproofing works of 720 meters long raised section in June 2008.

We will keep you updated on the progress of this project.



FIGURE 2.
Part of the Super Highway currently under construction

HONG KONG HIGHWAY TREATMENT COMPLETED



Wong Fu & Co Ltd, our Hong Kong distributors for Radcon #7, concluded in February 1990 an extensive sealing treatment for the K37 Highway Overpass and Underpass situated on the Kowloon side of Hong Kong.

What makes this job of even greater significance is that the Hong Kong government department responsible for public roads insists on a minimum test period of two years for any product prior to being accepted for use. Radcon #7 was accepted within 6 months from its introduction.

We have no doubt that Wong Fu's client will be pleased with the budget savings and superior performance characteristics achieved by the Radcon #7 sealing technology.



RADCON #7 TOPS OFF THIS SITE IN TAIPEI, TAIWAN



We are pleased to be working with Kingal Trading in Taiwan who are well advanced in promoting and effecting applications for the Radcon #7 sealing technology.

This new retail/residential complex in Taipei has Radcon #7 applied to the roof areas.

Simon Chou, from Kingal Trading, and Mark Sneddon, from Radcrete Pacific (Sydney), discuss Radcon #7 application detailing on site.

JAPAN & KOREA DISTRIBUTOR APPOINTED

It is a pleasure to announce that C&L Co Ltd, Tokyo, is the sole Radcon #7 distributor for Japan and Korea.

We look forward to bringing you news from Japan in our next Newsletter.

BRIDGE DECK PROTECTED AGAINST FURTHER DEGRADATION

The Perth Bridge in Tasmania recently had its deck, of some 2,600 square metres, Radcon #7 waterproofed.

The bridge is constructed of pre-cast panels with a topping slab emplaced.

The bridge is exhibiting severe wear from freeze/thaw conditions experienced in this area which is compounded by the heavy use of logging trucks.

At the time of treatment, the degradation to the deck had reached the stage where the aggregate, a coarse river gravel, was becoming dislodged from the concrete.

The Radcon #7 waterproofing treatment will stop any further freeze/thaw degradation without any loss in slip resistance.

In addition, the 20mm of concrete penetrated by Radcon #7 will exhibit a hardness equivalent to granite.

The Radcon #7 treatment was specified by the Department of Main Roads and undertaken through the Department of Construction.

