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for information

Highways Department
Presentation to the Advisory Council on the Environment
15 May 1995

Progress Report on Environmental Protection Measures of ACP Projects - WESTERN HARBOUR CROSSING

1. EIA Studies

The WHC Study EIA was completed in April 1991. The study recommended site management measures to mitigate construction impacts.

The Shek O Casting Basin EIA was completed in March 1994. The results of the EIA indicated that only minor environmental impacts would arise in relation to the casting basin. Control and mitigation measures for air, noise, marine water quality, marine ecology, terrestrial ecology and waste arisings were recommended in the EIA.

The Noise Insulation Work Study for indirect technical remedies for residential dwellings at Sai Ying Pun was completed in May 1994.

2. Scope and Progress of the Works

At Sai Ying Pun, construction of the substructure and the superstructure for a number of bridges is in various stages of progress. Bulk excavation is almost complete in the cut and cover tunnel. Construction of the ventilation building basement and superstructure is complete.

At the West Kowloon Reclamation, excavation for the tunnel and open cut approaches has been completed, and concreting of the tunnel box and base and wall sections are underway. Piling for the toll plaza ventilation building, toll booth canopy, toll plaza footbridge and future highway structure has been completed.

In the harbour, bulk dredging has been completed, and final trimming of the trench is taking place in front of immersed tube laying.

At the Shek O casting basin site, the first batch of four immersed tube units has been completed and transferred to the mooring position at Tseung Kwan O. Construction of the second batch of units is well underway. Three of the units have been towed to Sai Ying Pun, and lowered and jointed to the ventilation building.

3. Environmental Monitoring and Audit

Monitoring is carried out by a consultancy (CES), that issue Action Plans if exceedances of target levels occur. An independent audit of the monitoring procedures is carried out by another consultancy (ERM).

Sai Ying Pun and Victoria Harbour:
Air and noise monitoring is carried out at sensitive receivers located close to the construction site. There are two dust sampling stations and four noise monitoring stations. Water quality monitoring is carried out at ten stations along the length of the WHC alignment.

Shek O Casting Basin:
There is one monitoring station for air quality and three monitoring stations for noise. Water quality monitoring is carried out at six stations in Tai Tam Bay.

West Kowloon:
The site is within ENPO's project area, and EM&A operations are carried out by them. Air and noise monitoring is carried out at stations installed at the nearest sensitive receivers at Man Cheong Street and Canton Road.

4. Problem Areas

Air Quality:
At both Sai Ying Pun and Shek O, dust has presented intermittent problems in dry weather conditions. In these circumstances, additional attention has been paid to ensure regular watering of site access roads and cleansing of carriageways.

Noise Control:
Construction noise has not generally been a major issue in the most sensitive residential area of Sai Ying Pun. As predicted, traffic along Connaught Road West is the major contributor to the noise in this area. Residential units along Connaught Road West which will be affected by future tunnel traffic noise have been identified. Mitigation measures in the form of improved window glazing and air-conditioning have been recommended, and implementation is now in hand.

Water Quality:
Although all liquid arisings from the Shek O casting basin are pumped to sedimentation tanks, there have been exceedances of the suspended solid target level. In order to eliminate this problem, the channel leading to the tanks has been modified to forma series of primary settlement ponds. This measure is being monitored to check it's effectiveness.

5. Additional Information

Enclosed with this Progress Report is an Implementation Status Report, comparing the measures recommended in the EIA studies with those implemented on site.

Also enclosed are the latest four Quarterly Reports on Environmental Monitoring and Audit for WHC, prepared by EPD, giving a detailed analysis of TAT exceedances, complaints received and mitigation measures proposed.

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Presentation to the Advisory Council on the Environment
15 May 1995

Implementation Status Report
Western Harbour Crossing

Mitigation Measures Proposed	Mitigation Measures Implemented
Sai Ying Pun	
a) Air Quality	
Use of regular watering, with complete coverage, in dry periods to reduce dust emissions from unpaved roads.	Partially implemented - bowsers are used to water most site roads. A spray system is employed alongside the access road to the Indoor Games Hall.
Imposition of speed controls for vehicles on unpaved site roads, 8 km/h being the limit recommended by EPD.	Fully implemented - an 8km/h speed limit is imposed.
Paving of frequently used site roads.	Partially implemented - some frequently used site roads are concreted, but the nature of the site and the works means that these site roads are continuously relocated.
Use of frequent watering for particularly dusty static construction areas.	Partially implemented - continuous spraying is used for dusty operations, such as concrete breaking of demolished footbridge piers.
Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. When this is not practiced owing to frequent usage, watering should be employed to aggregate fines.	Partially implemented - large surcharge mounds have not been covered as they are static and not particularly dusty. No batching plant and therefore no mounds of loose aggregate or fine material on site.
Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations.	Partially implemented - these are used for off-site movement of materials. On-site vehicle movements are short and generally consist of transporting damp excavated material to the barge loading ramp.
Establishment and use of vehicle wheel and body washing stations at exit point of site and public roads.	Partially implemented - wheel wash facilities are installed at semi-permanent exits to public roads. In other situations, labour is employed to maintain the carriageway in a clean condition.

Where feasible, routing of vehicles and positioning of construction plant at maximum possible separation distance from sensitive receptors.	Access roads are generally located to the north of the site, away from the residential premises along Connaught Road West.
Instigation of a control programme to monitor the construction progress in order to enforce controls and modify methods of work if dusty conditions arise.	Fully implemented - two dust sampling stations are located close to the works. Monitoring and reporting arrangements have been agreed with EPD, and exceedances of TAT levels initiate recommendations for and implementation of action plans to mitigate the adverse effect.
The use of high level alarms on cement storage silos to prevent overfilling.	Not applicable - no concrete batching plant on site.
The use of filters on vents for cement silos, weigh hoppers and dry mixers.	Not applicable - no concrete batching plant on site.
Mitigation measures for the operational stage should ideally be introduced at the planning stage by means of provision of buffer zones of non-sensitive land use between the proposed road network and sensitive receivers.	Not practically feasible due to the constraints of the site, the design of the interchange with the tunnel and the existing Connaught Road West transport corridor.
b) <u>Noise</u>	
Acoustic screening of receivers from direct line of sight of construction activities.	The construction works cannot be screened due to the proximity of the site to high-rise receivers along Connaught Road West. However, it should be noted that a significant element of the works is now taking place below ground in tunnel.
Acoustic shielding of individual plant items to reduce noise at source.	Partially implemented - some plant has acoustic shielding.
Employment of silenced and super silenced plant.	Partially implemented - some plant employed is silenced.

Structural alterations to receivers to reduce noise levels, (e.g. provision of double glazing).	Residential units along Connaught Road West which will be affected by tunnel traffic noise have been identified. Mitigation measures in the form of improved window glazing and air-conditioning have been recommended, and implementation is now in hand.
Operational limitations imposed on the contractor in the form of contract clauses.	The Project Agreement with the Franchisee for the WHC stipulates the requirements of the EPD to abide by the Noise Control Ordinance and compliance with Acceptable Noise Levels.
The adoption of absorbent surfacing for permanent traffic roads.	Low-noise friction course material is to be provided on all elevated road structures.
c) Water Quality	
Prevent overflow during hydraulic dredging or using sealed grabs for mechanical dredging.	Fully implemented - mechanical dredging using sealed grabs has been used.
Ensure that the release of fines to the water body during backfilling operations is limited through careful placing of fill close to the point rather than dumping the material from a holding barge positioned on the surface.	Backfilling is being carried out by pumping sand beneath the units and by careful placement, using a crane and grab, of selected fill up the sides of the units.
Drainage from the site should be channelled to a series of sediment traps.	Partially implemented - there is one sediment trap.
Large volumes of fuel, oil and paint should be stored in properly secured containers and kept within bunded areas.	Partially implemented - some containers are stored in bunded areas.
All areas surrounding the batching plant should be concrete paved, with all hard standing areas being laid to fall to specially constructed settlement tanks.	Not applicable - no concrete batching plant on site.

Shek O Casting Basin

a) Air Quality

Concrete batching: Use of filters on vents, regular watering, water sprays at vehicle loading points. Partial enclosure of truck loading area.	Fully implemented - a new batching plant has been installed.
Site roads: Watering on a regular basis.	Fully implemented - regular watering of all site roads is carried out in dry weather conditions.
Conveyors: Enclose or protect with wind boards. Minimise drop heights where practical and shield conveyor drops.	Fully implemented - a new enclosed rock crushing plant for quarrying operations was commissioned in April 1995, thus minimising dust arisings.
Stockpiles: Use of silos and storage bins, where possible.	Fully implemented.
Cement : Deliveries from tankers to silos through an enclosed system. Silos to be fitted with a high level alarm and vents to be fitted with fabric filters.	Fully implemented.

b) Water Quality

Sediment dispersion during dredging : Cofferdam is used. Small area to be dredged will use mechanical grab dredger fitted with a closed seabed grab. Dredged material will be loaded onto a split barge with water tight seal.	All measures fully implemented. All dredging has been completed, and the temporary cofferdam has been removed.
Sewage disposal : Sewage will be transported and treated off-site.	Fully implemented.

Formwork requiring the use of form oil and concrete curing material : Preparation of formwork to be carried out where possible outside of the Basin in an area provided with a solid concrete base and sides. Concrete curing water to be pumped to treatment tanks prior to discharge.	Partially implemented - it is not possible to prepare large forms outside the basin itself. All liquid arisings from the basin are pumped to sedimentation tanks and tested for contaminants. Some problems have been experienced and modifications to these tanks have recently been made.
Flooding and draining of the basin upon completion of the tube tunnel units : Removal and skimming of floating debris and oil prior to opening. Draining of the Basin after the caisson gate has been put in position.	Fully implemented during the flooding, floating, towing and draining operation carried out in December 1994.

c) Noise

No specific mitigation measures were recommended in the EIA, due to the topography of the site and the considerable distance to any sensitive receivers.

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Summary on Quarterly Reports on Environmental Monitoring and Audit - Western Harbour Crossing

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The Quarterly Reports set out the results of the environmental monitoring and audit carried out by an independent consultant - Consultants in Environmental Sciences Asia Ltd (CES) - employed by the Western Harbour Crossing contractor, Nishimatsu Kumagai Joint Venture. The construction areas that are being monitored by CES are the works sites at Sai Ying Pun and Victoria Harbour and the casting basin at Shek O. Monitoring locations and parameters have been agreed by Environmental Protection Department.

The Reports show the total number of breaches of the Action and Target Levels and complaints received, with action taken or explanation given by the contractor and/or the project management team.

At Sai Ying Pun and Victoria Harbour, exceedances are mostly considered insignificant. Further mitigation measures were taken after the exceedances in air quality measurements and improvements have been made.

Works at Shek O commenced in March 1994 and monitoring results were first reported in the third quarter of 1994. Only measurements in water quality were in breach of the Action/Target levels. The contractor has taken appropriate remedial or further mitigation measures to improve the situation.

Highways Department
Presentation to the Advisory Council on the Environment
15 May 1995

Progress Report on Environmental Protection Measures of ACP Projects
WEST KOWLOON EXPRESSWAY

1. EIA Study

The EIA study was completed in June 1991 and recommended mitigation measures during the construction phase.

2. Scope of Works

The scope of works for both the WKE contractors has been expanded to include entrusted LAR civil works which include sheetpiling, excavation and stockpiling of material, tunnel concrete works then backfilling and removal of sheetpiles. These activities are similar types of work to that envisaged for WKE works and as such mitigation measures proposed for WKE works are equally applicable for LAR works. The main factor resulting from this additional work is the requirement for extra resources which mainly include excavators, trucks, cranes and dewatering facilities.

3. Environmental Monitoring and Audit

Monitoring is carried out by ENPO on behalf of EPD. Cumulative air, noise and water quality monitoring is carried out and, for any exceedances or potential problem areas, the responsible party is identified. ENPO staff then liaise with the site staff to recommend mitigation measures to be implemented.

4. Problematic Areas

Noise:
There have been minor isolated incidents of the contractor working in breach of the conditions of Construction Noise Permits. After identification and warning, these incidents have ceased.

Air quality:
Dust from the WKR site has given rise to exceedances of Target levels and complaints. The contractors have been reminded to utilise the dust suppression methods available, and have increased watering of site haul roads by bowser. Additional wheel washing facilities are being installed. However, generally at site exits, hand watering by hose and sweeping of the public carriageways is employed.

Water quality:
There are no construction activities on the WKE sites which affect water quality in the harbour area.

5. Additional Information

Enclosed with this Progress Report is an Implementation Status Report, comparing the measures recommended in the EIA study with those implemented on site.

Also enclosed are the latest four Quarterly Reports on Environmental Monitoring and Audit for the WKR area, prepared by EPD, giving a detailed analysis of TAT exceedances, complaints received and mitigation measures proposed.

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15 May 1995
Project Implementation Status Report
West Kowloon Expressway

Mitigation measures proposed	Mitigation measures implemented
a) Noise (Sections 4.2.37 to 4.2.40 of EIA)	
Noise control requirements specifying standards and monitoring to be included in tender documents.	The contractor's obligations regarding noise and nuisance control are set out in the tender documents, (Particular Specification).
Use of silenced equipment.	Silencers are fitted to all items of plant which could otherwise cause excessive noise.
Schedule activities to avoid parallel operations of several sets of equipment and reduce the number of operating items of powered mechanical equipment.	Contractors have generally kept plant to the minimum to meet programme requirements.
Siting equipment as far as practical from sensitive noise receivers.	Contractors have generally been able to site equipment well clear of sensitive receivers.
Use of temporary noise barriers or earth bunds to screen specific receivers.	Much of the work is shielded from sensitive receivers by temporary sand stockpiles and in addition the work site is generally a significant distance from those receivers.
Scheduling noisy operations to coincide with periods of high background noise.	Allowable noise levels are fixed at 75 dB(A) during the day time and between 45 and 65 dB(A) at night. Night work is limited and since March 1995 night time segment erection works have ceased. Noise permits are obtained for all operations as required under the Noise Control Ordinance.

Ban certain activities.	Percussive piling is not used.
Proper maintenance of plant.	Routine maintenance is carried out on items of plant to ensure it is in good operating condition.
Compliance monitoring.	ENPO monitor noise at 7 sites - no exceedences relating to WKE works detected.

b) Air quality (Sections 5.2.21 to 5.2.26 of EIA)

Incorporate dust control measures into the tender documents.	The contractor's obligations regarding air quality and nuisance control such as avoiding trafficking mud onto public roads are set out in the tender documents, (Particular Specification).
Batch plants. Store materials in closed silos fitted with fabric filter, conveyor belts and transfer points to be covered, hard standing within the works area and to be frequently watered, vehicles leaving the area to be wheel washed.	The concrete batch plant located at Mei Foo meets the specified requirements and in addition is situated well clear of sensitive receivers. There is no batch plant located on the south contract site.
Haul road emissions can be controlled by hard surfacing and frequent watering, limit vehicle speeds to 15 km/hr., wheel washing for vehicles leaving the site area, avoid filling vehicles to above side boards.	Bowsers regularly water haul roads and a speed limit of 15 km/hr is in place on these roads. Hard surfacing of site access roads has been provided where appropriate. Wheel washes have been constructed and although full use is not being made of these facilities this is not resulting in significant trafficking of site material onto public roads. The contractors prefer to keep a crew engaged full time in keeping the road clear of site material.

Stockpiles to be covered or watered wherever practical.	Covering sand stockpiles is not practical due to their extent. Some watering of access roads onto the stockpiles is provided where necessary.
Compliance monitoring.	ENPO monitor air quality at 10 sites - no exceedences relating to WKE works detected.

c) Water quality (Sections 6.2.13 to 6.2.19 of EIA)

Incorporate water quality control measures into the tender documents.	The contractor's obligations regarding discharge of site run-off and water quality in Victoria Harbour adjacent the WKE sites are set out in the tender documents, (Particular Specification).
Site compounds to be designed to take account of contaminated surface water.	Site compounds at which contaminated water is able to collect are designed with sumps to prevent discharge into the site outfall.
Sewerage outfalls to be connected to foul sewers.	Site office sewerage is connected to appropriate septic systems as foul sewers have not yet been provided in the reclamation.
Discharge from concrete batch plants to be settled.	The batch plant at Mei Foo is depressed thus avoiding contaminated water from leaving the area. Solids are loaded into bins which are then removed from the site.
Oil interceptors to be provided and fuel to be stored within bunds.	Fuel tanks are located within bunds to prevent discharge into the site.
Bentonite to be prevented from entering site drainage.	Bentonite is recycled and stored in tanks or concrete lined bunds to ensure it is not discharged into the site outfall drainage.

Careful location of discharge points.	Site drainage is discharged at selected sites.
Compliance monitoring.	ENPO monitor water quality at 5 sites - no exceedences relating to WKE works detected.

d) Land use impacts (Section 7.4.8 of EIA)

Avoid siting construction activities close to sensitive receivers.	On the north site the batch plant and casting yard have been located well clear of sensitive receivers and on the south site the works are generally clear of sensitive receivers.

e) Visual impacts (Sections 8.3.16 to 8.3.22 of EIA)

Attention to site layout by minimizing the working area, use of hoardings, avoid visually obtrusive elements such as tall cranes close to sensitive receivers, minimize erection time of equipment, restrict heights of stored materials and stockpiles, avoid unnecessary movements on haul roads, minimize night activities requiring lights, choice of haul road locations.	Contractors have been made aware of the impact of construction works on sensitive receivers and have responded favourably by taking appropriate action to comply with the requirements. Night time activities are limited and have not generated complaints.
Advance planting particularly at Yau Ma Tei interchange, include also in buffer zones at Mei Foo Sun Chuen and Nam Cheong.	Whilst planting has occurred at Mei Foo it is not possible at the current stage of construction to carry out advance planting at Nam Cheong or Yau Ma Tei interchange as these areas would be disturbed during later stages of construction. The works are generally shielded by sand stockpiles which reduce the visual impact of the works at receivers.

Ground modelling.	Not possible at the current stage of construction however sand stockpiles provide some relief from the works areas.
Temporary screen planting may be beneficial at sensitive receivers such as Man Cheong along Ferry Street and Tai Kok Tsui using fencing.	A number of interfacing contracts have been awarded in the vicinity of the WKE site which may not have been anticipated at the time of preparing the EIA and these interfacing contracts are carrying out works in the buffer zones where temporary plantings could have been provided. As such the space for providing such plantings has been allocated as works areas for the interfacing contractors.

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Summary on Quarterly Reports on Environmental Monitoring and Audit - West Kowloon Expressway

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The quarterly reports summarize the results of the environmental monitoring and audit carried out by the Environmental Project Office (ENPO) in the West Kowloon Project Area (WKPA). ENPO is managed by consultants reporting to the Environmental Protection Department and is responsible for overseeing and assessing the cumulative environmental impacts of the various ACP projects being undertaken in the area.

The reports indicate the status of monitoring for air, noise and water quality together with a a ·ecord of exceedances of Target and Action levels and complaints received which occurred during the period together with actions taken by ENPO or given to RSS staff, contractors or others.

In regard to the West Kowloon Expressway which forms part of the WKPA, during the last year there have been no incidences recorded of exceedences of either Target or Action levels for any of the measured items.

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Progress Report on Environmental Mitigation Measures of ACP Projects - Route 3 - Tsing Yi and Kwai Chung Sections

1. The Environmental Impact Assessment (EIA) Report identified possible major impacts on water quality, vibration, noise and air pollution arising from construction activities, with recommendations of or suggested options for mitigation measures. Highways Department is committed to ensuring that the requirements for environmental mitigation measures defined in the EIA are implemented. This is done by:

- Relevant specifications incorporated in the construction contracts;
- Environmental monitoring and audit performed by the Engineer;
- Full-time site staff to supervise environmental aspects;
- Established procedure to deal with public complaints.

2. Up to now, we have been able to accomplish the following:

2.1 Water Quality - To monitor the effect of marine piling works to the water quality of the Rambler Channel, water samples were taken for suspended solid tests. The monitoring results have been within target limits and all marine works have now been completed.

2.2 Vibration - Blasting was adopted for excavating the Cheung Ching Tunnel. The vibration due to blasting were monitored by measuring the peak particle velocity. The following have been adopted to minimize blasting vibration:

- Suitably controlling the amount of explosive used;
- Suitably designing the blasting pattern;
- Only pilot tunnels have been excavated from the east portal thereby reducing the amount of equipment required and the associated environmental impacts to nearly residents. Excavation of the total length of the tunnels to the final cross section were via the west portal.

All blasting have now been completed; vibration levels were mostly within the allowable limits.

2.3 Air pollution - Air pollution during construction phase is primarily due to the generation of dust. This is being controlled by the following:

- Concrete batching plant was established in accordance with EPD requirements;
- Limiting vehicle speed on site;
- Watering the sites;
- Provision of wheel washing facilities.

2.4 Noise - The EIA recommended that no percussive piling should be used. As a result, all piling works to the foundations for the bridges are of non-percussive type. Other noise mitigation measures implemented includes exhaust silencers for equipment, use of portable noise screen for caisson excavation works, and provision of noise insulation at the ventilation fan at the east portal of Cheung Ching Tunnel etc.

3. Conclusion - Mitigation measures for construction activities for Route 3 projects have been implemented and environmental monitoring and audit have shown satisfactory results.

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15 May 1995

Summary on the Project Mitigation Implementation Schedule - Route 3 - Tsing Yi and Kwai Chung Sections

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Impacts on environment caused by construction works have been identified in the Environmental Impact Assessment (EIA) Report. Various action have been taken to implement the mitigation measures and recommendations of the EIA and the following are the more notable ones:

1. The EIA recommends that no percussive piling should be used. As a result, the piling foundation adopted are either bore piles or caissons, ie, non-percussive type.

2. Although the EIA identified that vibration due to blasting is not a major problem during the course of excavation for the Cheung Ching Tunnel, careful control on the explosives and blasting pattern were still exercised to make sure the vibration and noise from the blasting would be kept to a minimum.

3. A comprehensive environmental monitoring and audit system has been implemented to alert all relevant parties to take appropriate action on any deterioration of environmental conditions detected.

4. The Engineer has been empowered under the relevant contracts to direct the contractors to modify the construction methods or even cease part of the works in the event that serious environmental problem persist.

5. The contract specification may not be written in such a way that all specific mitigation measures suggested in the EIA are incorporated as it is a performance specification and flexibility should be allowed for the contractors to use their own way to plan the works. Nevertheless, the intentions of the EIA have all been included into the contract specification and the contractors' works are subject to close supervision and direction of the Engineer.

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15 May 1995

Project Mitigation Implementation Schedule - Route 3 - Tsing Yi and Kwai Chung Sections

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
	Planning	
9.14.27	It is not appropriate at this stage to limit contractors to specific construction methods. Specification requirements and noise legislation, such as the NCO should be used to limit the noise from construction.	The Contracts have been written to limit construction noise during unrestricted hours to 75dB(A). Percussive piling during unrestricted hours and construction during restricted hours is subject to the NCO.
9.14.28	The first step in noise mitigation for construction noise involves detailed planning of both the contract documentation and the construction.	The contract documentation incorporates noise mitigation requirements. The contractors planning the construction are required to comply with the noise mitigation requirements specified in the contracts.
9.14.29	The Tender Documents should include details of the noise restrictions which will apply to the projects. Where appropriate noise and vibration monitoring by the Contractor should be specified. This will enable the Tenderers to take the associated costs into account when estimating plant requirements and programme. During the tender stage Tenderers should assess where special noise control measures will be required.	As recommended. Noise monitoring is being undertaken by the Engineer.
9.14.30	It is recommended that the successful Contractor be required to submit a proposal detailing the location of equipment and the operating periods of plant. Typical noise levels for plant should be submitted with an estimate of the impact on the NSRs. Where necessary details of noise mitigation methods should be provided.	The Engineer have defined Trigger, Action and Target Limits to guide them to take action on the monitoring results. The contracts empower the Engineer to direct the contractors to modify the construction methods and, if necessary, even cease work. For night-time work, operation of plant is subject to the issue of a Construction Noise Permit.
9.14.32	During the construction stage scheduling of plant operation and the periods of blasting may be required to be adjusted to allow for:	The scheduling of plant operation and periods of blasting are the contractors' responsibility but they are subject to the Engineer's supervision and direction.
	- favourable wind conditions - periods of peak background noise - appropriate working hours	These are part of the factors considered by the contractors and the Engineer.
9.14.34	Traffic for haulage may be restricted at night.	Use of haulage on site is restricted under the NCO.

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
	Construction Equipment Noise Attenuation	
9.14.35	The extent of noise control measures for various construction equipment should be fully assessed during the planning stages. Particular attention will have to be paid to the actual likely noise levels of the equipment to be used. Typical noise control measures for equipment could include the following:	Implemented.
	a. **Diesel Engine Machines**	
9.14.36	- use equipment with optimized cooling systems, for reduced fan noise.	As recommended.
	- use equipment with adequately sized exhaust silencers. Typically 4 to 5 times the swept volume of the engine is required.	
	- air inlet pipes should be located to reduce noise levels at the operator's location.	
	- engine enclosures should be provided for some equipment, e.g. hydraulic crawler with rear mounted transverse engine.	
	- acoustic treatment to the cab should be provided for noise control at operators location.	
	b. **Pile Drivers**	
9.14.37	- where applicable use quieter types of pile drivers, such as hydraulic jacking type, vibratory pile driver and based pile systems.	As recommended.
	- no percussive piling should be used.	As a result, the Engineer designed all piling foundation to the bridge works to be non-percussive.
	- drop hammers and piles can be enclosed in steel plastic laminated boxes.	This will not be applicable if drop hammers are used just to drive sheetpile wall because of its contiguous construction.

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
	- provide cushions between the drop hammer and the anvil.	Diesel hammers are not being used because of their high noise level.
	- it is noted that due to noise impact considerations the current practice in Hong Kong is for the use of drill piling and the use of caissons. This will reduce the associated noise levels. Full construction requirements, however, cannot be identified at this stage.	A large quantity of drill piling and occasionally some caissons are being used.
	- diaphragm walling should be used as an alternative to sheet piling.	Sheetpiling is being used for temporary works due to limited working space.
	c. Compressors	
9.14.38	- provide improved acoustic canopies and silenced exhausts. This may require an improvement in cooling facilities, oils etc.	The compressors are controlled by the Noise Control Ordinance which requires the fixture of Noise Emission Labels to all equipment which complies. On several occasions the contractors have not complied with this but have rectified the situation under the supervision of the Engineer.
	- ensure doors of enclosures are sealed, vibrations are not transmitted to enclosing sheds and lifting chains etc cannot rattle.	On several occasions the contractors have not complied with this but have rectified the situation under the supervision of the Engineer.
	d. Jack Picks	
9.14.39	- provide rubber sheaths	Jack picks are controlled by the Noise Control Ordinance which requires the fixture of Noise Emission Labels to all equipment which complies. On several occasions the contractors have not complied with this but have rectified the situation under the supervision of the Engineer.
	- provide exhaust mufflers	
	- use equipment designed to reduce pick steel noise, e.g. damping rings.	
	e. Circular Saws	
9.14.40	- use screening barriers	To date no impacts from circular saws have been observed.

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
	f. Equipment Screening/ maintenance	
9.14.41	- localized equipment screening to protect NSR may be appropriate.	The KCV Contractor has been reminded to implement these types of measures at Fung King House, Lai King Catholic Secondary School and Lingnam Dr C W K M Middle School where noisy construction will be undertaken close-by. He has provided noise screens to the caisson wall excavation works outside Fung King House.
	g. Rock Drills	
9.14.42	- rock drill use should be minimized.	Generally noise levels from rock drills have not been sufficient to warrant this requirement. The exception to this is at Fung King House where a caisson retaining wall is being constructed near-by. In this case screens have been installed.
	- drills should be screened.	See above.
	h. Site barriers	
9.14.43	- site barriers may provide up to about 10 dB noise reduction for 'line of sight' receivers.	See 9.14.41.
	- noisy equipment should be enclosed.	Generally equipment is silenced and in good mechanical condition.
	- equipment should be kept in good working order and manufactured enclosures should be properly fitted with doors closed.	Generally this has been complied with. Any exception have been quickly rectified.

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
	Blasting Noise and Vibration Control	
9.14.44	This area is discussed in detail in Section 9.11. Blasting technique is a specialist area and appropriately qualified people should be used. Their expertise should be used to reduce noise and vibration levels. Some considerations applicable to noise and vibration control are as follows: - shooting large scientifically designed blast infrequently - shooting during periods of high background noise - orientating the blast to minimize the effect on structures and residences - keeping detailed blasting records - using appropriate explosives - using minimum sub-drilling, compatible with good blasting results - shooting with the face parallel to predominant joint planes.	As recommended.
	Bored Tunnel - Rambler Bridge	
9.14.46	As the nearest NSR is Ching Pak House which sits on a platform high above the east portal, an effective way to reduce the noise impact on this receiver during the initial stage of the tunnelling is to enclose the tunnel portal by an acoustic shroud. A noise screen suitably located above the tunnel portal could serve a similar purpose. Also, all tunnelling equipment should be positioned close to the portal in order to capitalize on the local terrain to screen the noise. As the works proceed into the tunnel, the noise impact should be much reduced.	A noise shroud has not been constructed but noise insulation has been installed around the ventilation fan at the east portal.
9.14.47	It is common practice for tunnelling to proceed 24 hours a day. In the case of night operations, spoil mucked out from the tunnel should be stockpiled in front of the portal for disposal in the daytime in order to minimize truck movements on and off-site at night. Also, all noisy operations should be scheduled to the daytime to reduce noise nuisance.	This work was subject to a Construction Noise Permit. Spoil was not stockpiled at the tunnel entrance but silenced equipment was used to ensure minimal disturbance.

EIA Ref.	Noise Mitigation Recommended in EIA	Noise Mitigation Measures Implemented
9.14.48	Bored piling for the Rambler Channel Bridge construction should be a quiet operation, but noise from the operation could be further reduced by careful handling of hammer grabs and chisels. Clanking of hammer grabs and chisels is a common source of noise nuisance in such operations. Jackhammers for the removal of excess concrete from pile caps and all diesel engines should be muffled.	The techniques stated have been adopted.
	Conclusions and Recommendations	
9.14.50	Tunnelling at the east portal could produce a short-term noise impact on Ching Pak House in Tsing Yi because of the noisy drills and breakers to be used. Effective mitigation measures have been recommended to reduce the noise.	Minor short term noise impacts were experienced at Ching Pak House.
9.14.51	For the control of construction noise in the daytime, it is recommended that a set of noise limit criteria should be built in the contract documentation for contractors to comply with. Noise criteria should be realistic and reasonably achievable by potential contractors. Based on a survey of the prevailing background noise levels in the Study Area, a set of noise limit criteria has been proposed. It is considered that this is both realistic and achievable within the technological capability of the potential contractors. Noise control in the restricted hours will, of course, be enforced through the existing Construction Noise Permit system.	As recommended.
9.14.52	Also, a noise monitoring programme should be exercised to ensure that the prescribed noise limits are strictly observed by all concerned parties. It is recommended that construction noise should be monitored by measuring the equivalent continuous A-weighted noise level over a period of 30 minutes at the facade of the nearest noise sensitive receivers at a frequency of no less than once a week. Immediate action should be taken to reduce noise if the measured level exceeds the recommended noise criteria.	As recommended.

EIA Ref.	Predicted Air Pollution Impacts and Recommended Mitigation	Actual Impacts and Mitigation
9.13	Air Pollution	
	Mitigation of Dust Impacts	
9.13.14	General site management is important in dust control. Typically a 50% reduction in dry dust levels can be achieved by twice daily watering of the site. Storage facilities on site must also be well maintained. Where appropriate the following should apply: a. high level alarms for cement silos b. use of filters and vents for silos, hoppers and mixer c. local enclosures or covers	This has been provided for in the contracts. The concrete batch plants on Kwai Chung Viaduct were also installed in accordance with licences issued by EPD. Watering has been undertaken on the sites. The Engineer has been pressing the contractors for further improvements.
9.13.15	In practice wetting of storage areas for aggregate is not as effective as chemical treatment where emissions are reduced 40% and 90% respectively. In both cases the water run off should be considered.	Wetting has generally been undertaken. The Engineer has been pressing the contractors for further improvements.
9.13.16	The control of dust from mobile sources can most effectively be achieved by controlling vehicle speed, with 8 km/h being recommended by the EPD. Dusty loads should be protected by tarpaulin. Surface treatment of unpaved roads by penetrating chemicals, oils, water etc may also be effectively used. The routing of vehicles should also be considered and planned so as to minimize the impact on sensitive receivers.	A vehicle speed restriction of 15 km/hr is enforced on all sites. Dusty loads are protected by tarpaulin and unpaved roads are watered.
9.13.17	To support the mitigation measures a dust monitoring programme is recommended.	Dust monitoring is the responsibility of the Engineer's Representative. Data have been collected at the designated monitoring stations.
9.13.18	To effectively implement the mitigation measures the contract requirements must be fully specified.	The contract empowered the Engineer to take any appropriate action with the contractors should serious dust problem occur.

Highways Department
Presentation to the Advisory Council on the Environment
15 May 1995

Summary on Quarterly Reports on Environmental Monitoring and Audit - Route 3 - Tsing Yi and Kwai Chung Sections

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The Quarterly Reports set out the results of the environmental monitoring and audit carried out by the Environmental Project Office - Kwai Chung Tsing Yi (ENPO KC/TY) and also the resident site staff of the concerned construction contracts. ENPO KC/TY is run by consultants managed by the Environmental Protection Department, and is charged with overseeing and assessing the cumulative environmental impacts of various major construction works being or to be undertaken in the area. Currently, the works within its scope include the Route 3 (commenced in March 1993) and the Airport Railway (commenced in January 1995), and in future these will include the Container Terminal No. 9 and the Duplicate Tsing Yi South Bridge.

The Reports show total number of breaches of the Action and Target Levels and complaints received, with action taken or explanation given by the contractors, resident site staff and/or other relevant parties involved in the construction works.

As far as the Route 3 works are concerned, out of a large quantity of monitoring data taken and processed, there have been only a few isolated breaches of the Action and Target Levels in the past year, which indicates that we have been able to keep the environmental impacts under control. When breaches of the Action and Target Levels were found, the resident site staff and the contractors were alerted to take appropriate remedial or further mitigation measures to improve the environmental situation.