



Barnham Signal Box Relocation: Feasibility Study

ARUN DISTRICT COUNCIL				
No.	AL	54	09	
SUPPLEMENTARY				
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Date: 27th January 2009

Ref number: C626-1000

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1. Purpose

The purpose of this document is to supply all parties involved in the project with information relating to the Operations Methodology to be employed for the relocation of the Barnham signal box. The document contains information relating to site location, details of crane configuration, possession requirements, etc.

2. General

2.1. Background

Network rail have commissioned a new signal box for Barnham Station as a component of a major resignalling scheme. The existing signal box located on Barnham Station platform is now redundant.

The following options are available to Network Rail regarding the existing signal box:

- **Option 1:** Do nothing to the signal box and leave it in-situ. This option has been discounted by NR and need not be considered further.
- **Option 2:** Demolish the signal box.
- **Option 3:** Remove the signal box and relocate.

Network Rail have agreed to consider the economic viability of relocating the Signal box to site approximately 1.4 miles away via road. The intention being that the Bognor Regis Model Railway Club will utilise the building as their HQ. This option is dependent upon economic viability in comparison with option 2.

In choosing **Option 3**, to relocate the signal box there are three practical possibilities:

- **Option A:** Disassemble the building into its component parts and reassemble in new location. This option is not deemed structurally or economically viable.
- **Option B:** Take the building apart into 4-5 bay sections. By splitting the building into bays it will lose its inherent stability. This operation would also be time consuming and costly but is however feasible.
- **Option C:** Lift the building as one entity. With this option an exo-skeletal frame keeps the structure inherent stable. This option is more cost and time efficient and is considered the most viable solution.

2.2. Scope of Works

The scope of the works will conform with Option C, to move the building as one entity to the new location requested by Bognor Regis Model Railway Club.

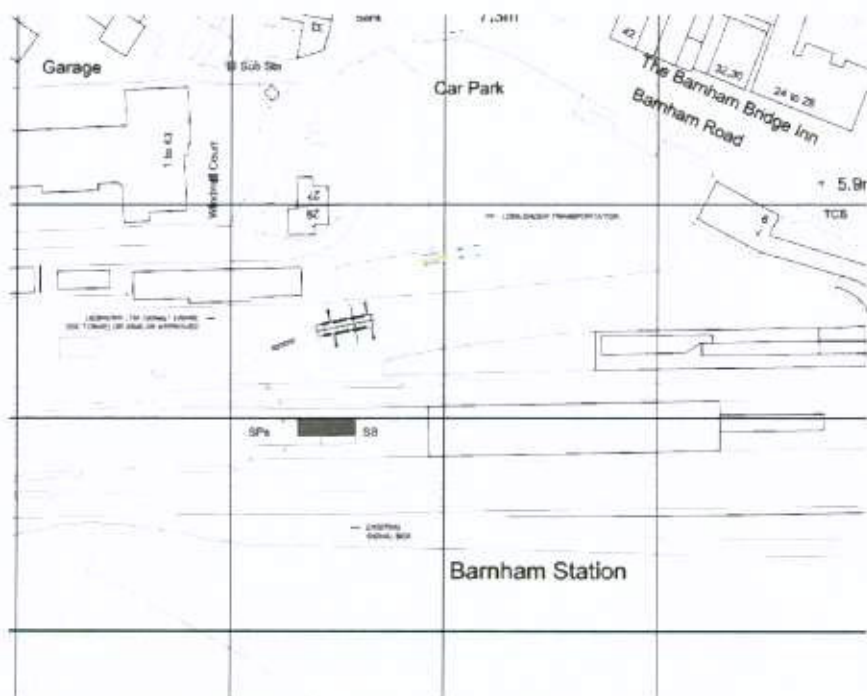
2.3. Proposed

Network Rail has instructed BCM Rail Ltd (BCM) to investigate removing the signal box from Barnham Station and relocate to Alingbourne Community Sports Centre, Oliver's Meadow, Westergate, Chichester, West Sussex, PO20 3YA. The following will define the scope:

- The safe stripping of the remaining contents of the Signal Box in preparation for relocation
- Signal box temporary works installation
- Lifting of signal box
- Transport of signal box
- Set down of signal box on pre determined location upon foundation prepared by others

2.4. Location and Relocation site

The Barnham Signal box is located in the 10ft of Barnham Station. (See drawing C626-0107-site plan).



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SITE PLAN

The proposed relocation site is a 1.4 mile journey via road from Barnham Station to the Alingbourne Community Sports Centre at Oliver's Meadow, Westergate, Chichester, West Sussex (See Appendix 1 for Route Map).



2.5. Access

The signal box is located in the 10ft at Barnham Station. Access to the signal box is via authorised walking routes or via the Station footbridge.

The Barnham Station car park provides an appropriate area for the Crane set up. Further investigation will be needed to confirm exact crane set up location within the station car park.

The exact set down location at Alingbourne Community Sports Centre is to be confirmed by others. Access will be assessed following receipt of details of exact location.

3. Operation requirements

The signal box will need to be completely stripped, and removal of all signalling equipment including all electrical equipment, furnishings and loose objects. The list below outlines items to be removed:

- Signal equipment – by others
- Electrical fittings and cabling – by others
- Windows,
- Doors
- Plumbing fixtures
- Furnishings
- Floor coverings
- Timber access stairs, timber landing and timber handrails
- Existing floor joists and support brackets
- Eaves and down pipes
- External metal Handrails

Note: The Network Rail Asbestos Register for the building will need to be obtained and reviewed prior to commencement of any works. Further investigation of the building is also required for a more detailed and extensive list of items to be removed prior to relocation. Full access to the structure was not available at this time as the signal box had not yet been fully stripped out.

3.1. Bracing

The floor of the building is to be sheeted out with 18mm plywood screw fixed at 400mm c/c to new floor joists. All plywood will be laid to a staggered format so that plywood joints are not aligned. This will form a horizontal structural diaphragm.

Drawings C626-0104 to C626-0106 (Appendix 5) show temporary bracing details. RMD Kwikform Super Slim soldiers, or similar, to be used to brace the building in 5 locations along its length. These braced soldiers will be connected to vertical support posts on the outside. Exact layout and make up of support posts to be confirmed based upon further investigation at detailed design stage.

3.2. Lifting

Lifting arrangements discussed with Ainscough Crane Hire Ltd. (Bill Hillier 13/11/08). Total approximate weight of lift 15.4t (see 3.6 for breakdown of weight).

The proposed lifting arrangements are outlined below:

- 3.2.1. Crane will be set up in the station car park as per drawing C626-0107 (See appendix 5. More detailed drawings will follow on further investigation of Crane location). Crane size will be approximately 160-200tonne. BCS Design Ltd (BCS) will formulate a crane location plan with the input of crane contractor at detailed design stage.
- 3.2.2. The lifting frame arrangement will also be designed by BCS and a temporary exo-skeletal frame will be designed to uniformly lift the building. The lifting arrangement will be in such a way that the lifting chains will be vertical until they are past the building outline to the temporary lifting frame. This way the lifting process will cause minimal damage to the building (see appendix 5, drawings C626-0105 and C626-0106) and provide an even distribution of forces upon the structure.
- 3.2.3. Lifting eyes will be located on the RMD Kwikform super slim braces to the outside of the building at structured frame locations.

- 3.2.4. Initial lifting of Signal box will be carried out by a series of linked jacks in the basement to overcome the initial inertia from any anchorage to the platform. BCS will formulate a procedure with contractors.
- 3.2.5. Possession will be needed of the up main, down main and up sidings (ELR TBH2) for lifting arrangements. Possession type and arrangements to be confirmed.
- 3.2.6. The lifting of the signal box into relocation position will use same lifting frame arrangement. Crane set up will be designed on confirmation of exact location of signal box drop off.

3.3. Transport

The proposed transport arrangements are outlined below:

- 3.3.1. Signal box will be lifted onto a stepped low loader which will position itself next to crane in the car park, exact location confirmed on further investigation at detailed design stage.
- 3.3.2. BCS will formulate a plan for the securing of the signal box to the stepped low loader with the transport contractor.
- 3.3.3. Traffic management plan will need to accompany a method statement by BCM or transport contractor. Local authorities will need to be notified and special licensing for the transport of the 'oversized' Signal Box will need to be obtained.
- 3.3.4. The transport will head north on the B2233 as far as junction A29, then head south on A29 toward Oliver meadows. Obstructions to be removed as detailed within obstruction schedule (Appendix 1). See also map in appendix 1 showing both locations relative to each other.
- 3.3.5. Exact location of drop off point at Alingbourne Community Sports Centre to be confirmed by others.
- 3.3.6. Lifting frame arrangement will need to be appropriately secured and transported to the relocation point. BCS will formulate this procedure with the transport contractor.

3.4. Risk assessment

See Appendix 2 for risk assessment/schedule.

4. Schedule of Activities

See Appendix 3 for schedule of activities

5. Signal Box dimensions and weights

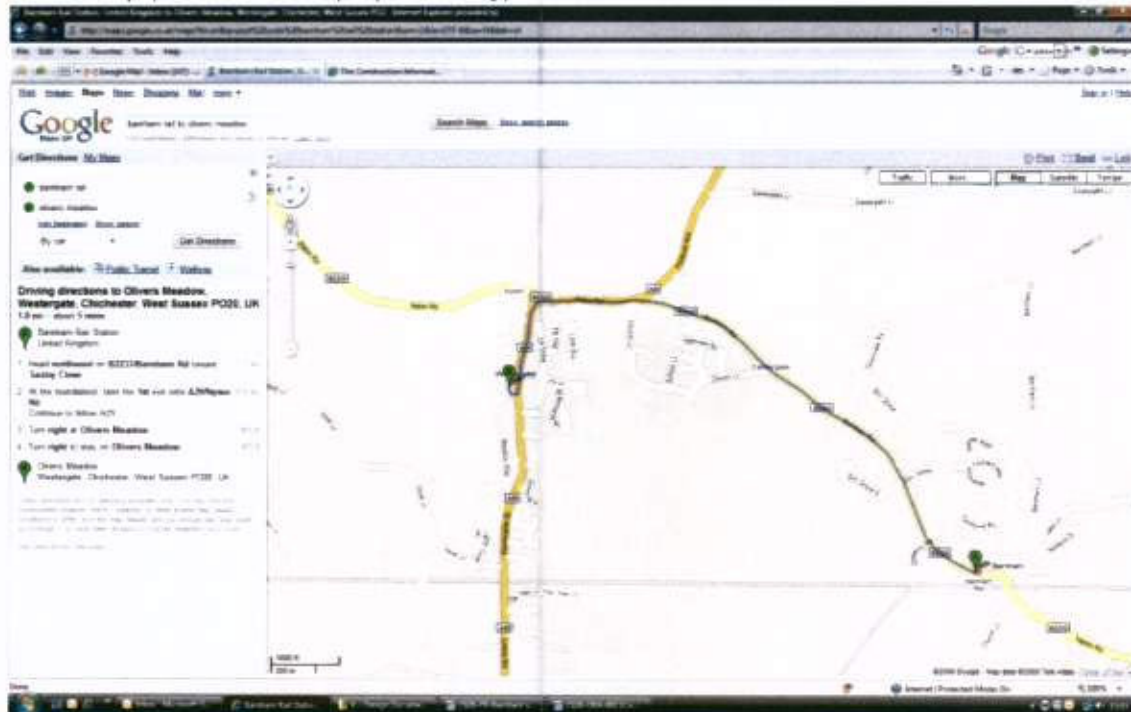
Description	Dimensions (mm)	Weight (tonne)
Signal Box	12830 x 3660 x 5145	5.7t
Temporary bracing	-	3.5t
Temporary lifting arrangement	-	6.2t

6. Photographs

Some general Photos have been taken of Barnham signal box and the surrounding area. Please see Appendix 4 for general photos.

Appendix 1: Route Map & Obstruction Survey

Route map (for information purposes only)



Directions are (from A to B): North on the B2233 to the junction of the A29, then south on the A29 for approximately 0.5 miles to Oliver's meadows on the west side of the A29. Exact location on this site is to be confirmed. Location at point B, Alingbourne Community Sports Centre at Oliver's Meadow, Westergate, Chichester, West Sussex.

Obstruction survey carried out on the 12/01/09:

Date:	12/01/2009
By	Martin Cure

Obstruction Survey

Location reference	Chainage (m)	Obstruction		Comment
		Type	Number	
1	Gate to rail car park, 0m	Telephone wire	3	
2	64	Telephone wire	4	
3	188	Telephone wire	3	
4	246	Telephone wire	2	
5	316	Telephone wire	2	
6	343	Bough to be trimmed	1	Adjacent to 75 Holmwood
7	444	Telephone wire	6	
8	579	Telephone wire	3	
9	666	Telephone wire	3	
10	710	Telephone wire	12	
11	780	Telephone wire	4	
12	887	Telephone wire	6	
13	1063	Telephone wire	1	
14	1130	Bough to be trimmed	3	Next to white cottage
15	1170	Telephone wire	7	
16	1262	Telephone wire	9	
17	1315	Telephone wire	1	
18	1381	Telephone wire	8	
19	1448	Telephone wire	3	
20	1460	Telephone wire	2	
21	1828	Telephone wire	2	
22	1891	Keep left bollard to be temporarily removed	2	
23	1920	Telephone wire	2	
24	2182	Telephone wire	3	
25	2664	Telephone wire	7	
26	2737	Telephone wire	3	
		Sum	102	

Note: The walk out survey was carried out from station car park to proposed relocation Community Centre. Survey was a visual Survey with approximate measurements.

Appendix 2: Risk Assessment

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NO	ACTIVITY/TASK	IDENTIFIABLE HAZARD	DEGREE OF RISK			CORRECTIVE ACTION REQUIRED	DEGREE OF RESIDUAL RISK			
			L	C	R		L	C	R	R
1.	Site Working - Crossing track.	Staff being struck by passing rail vehicle.	2	5	10	Ensure safe route to site is identified, use recognised walkways if possible. Safe system of work to be implemented. Due Care & Attention. COSS briefing.	1	5	5	5
2.	Site Working - Tripping.	Injury to staff.	2	2	4	Due care & attention. Highlight trip areas before accessing site. COSS briefing.	1	2	2	2
3.	Site Working - Slipping.	Injury to staff.	4	2	8	Due care and attention. COSS briefing.	2	2	2	4
4.	Working in possession	Incorrect application of Tii/Tiii arrangements causing staff to be struck by passing rail vehicle.	3	5	15	Ensure protection staff are competent. Work to existing procedures and Rule Book. Monitor green zone arrangements. Ensure staff are adequately briefed on the safe limits of the possession.	1	5	5	5
5.	Work adjacent to signal equipment	Signal sighting obstruction.	4	5	20	Assessment of operations prior to commencement of work. Method Statement to address signal sighting issues.	1	5	5	5
6.	Site access	Slip, trip, fall. Staff being struck by passing rail vehicle.	3	5	15	Site specific briefing on authorised access routes for operatives.	1	5	5	5
7.	Existing site hazards- buried or unrevealed services.	Damage to existing services or injury from unexpected contact with existing services.	3	5	15	All possible information to be retrieved from Network Rail. Services identification and marking. Site specific briefing.	1	5	5	5
8.	Working/ driving excessive hours	Injuries/ damage caused by lapses of concentration caused by tiredness.	4	3	12	Staff to comply with NR/SP/CPPR/008. Hours to be monitored. Excess of 12 hours requires specific risk assessment and agreement from Manager. Maximum of 14 hours total to be spent working and driving in any 24 hour period.	2	3	3	6
9.	Site Working - Working in poor visibility.	Unsafe working conditions/ Staff being struck by passing rail vehicle.	2	4	8	If in any doubt as to visibility particularly at track level don't start work, or stop work if visibility reduces during the course of the work.	1	4	4	4

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NO	ACTIVITY/TASK	IDENTIFIABLE HAZARD	DEGREE OF RISK			CORRECTIVE ACTION REQUIRED	DEGREE OF RESIDUAL RISK		
			L	C	R		L	C	R
10.	Site Working – Working during hours of darkness.	Unobserved hazards.	2	5	10	Site to be well illuminated. Briefing of staff.	1	5	5
11.	Incompetent/ inexperienced operatives	Injuries caused by lack of skill or experience	2	3	6	Confirm competence of staff for the task. Mentor/supervise as necessary.	1	3	3
12.	Site Working – Use of tools.	Manhandling equipment and tools.	3	2	6	All equipment and tools to be handled in accordance with safety procedures. Correct lifting methods to be used to prevent accidental injury.	2	2	4
13.	Site Working – Use of power tools.	Electrocution/ burns. Entanglement in rotating parts. Flying particles	4	2	8	Battery powered tools. Low voltage equipment. RCD protected supply. Regular electrical test. Regular maintenance of tools. Guards in place. Use of appropriate PPE.	2	2	4
14.	Site Working – Manual Handling.	Back strain/injury.	5	2	10	Use of correct lifting methods. Training/briefing of staff. Lifting aids/ team lifting.	2	2	4
15.	Noise	Damage to hearing.	4	2	8	Plant to conform to noise emission standards. Ear defenders to be used as required.	2	2	4
16.	Work at Height	Falls	4	5	20	Apply the hierarchy prescribed by the Work at Height Regulations. Ensure staff have received adequate training and instruction.	1	5	5
17.	Use of hazardous substances	Injuries. Acute and chronic effects to health. Environmental effects	4	3	12	COSHH assessments and control measures. Emergency procedures.	2	3	6

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NO	ACTIVITY/TASK	IDENTIFIABLE HAZARD	DEGREE OF RISK			CORRECTIVE ACTION REQUIRED	DEGREE OF RESIDUAL RISK		
			L	C	R		L	C	R
18.	Work likely to cause obstruction of the line	Temporary structures, structures under demolition/ repair or plant falling onto the track.	4	5	20	Temporary structure design to be verified. Appropriate possession and isolation arrangements to be in place. No unauthorised plant within 3m of line unless appropriate possession/ isolation has been taken. Assessment of load bearing capacity of ground or structure. Use of banksman. Emergency telephone link to controlling signal box.	2	5	10
19.	Delivery of equipment and materials	Damage to property by delivery vehicles. Vehicles contacting OLE or obstructing tracks. Unauthorised access	3	5	15	Ensure controlled times for deliveries. Supervise deliveries. Ensure vehicles can gain safe access to site. Ensure structure is capable of supporting equipment/ materials, including vehicles/ heavy plant.	2	5	10
20.	Work outside designated work area	Injury to public or damage to property	4	4	16	Method Statement to detail arrangements and limits of site. Site specific briefing.	2	4	8
21.	Work in or adjacent to public roadways	Plant, equipment materials striking traffic/ members of public. Traffic colliding with staff.	2	5	10	Authorised road closures and traffic management. Implement pedestrian walkways. Plant to be suitable for access to public roads. Comply with New Roads and Street Woks Act and Traffic Signs Regulations.	1	5	5
22.	Work in areas potentially infested by rats or birds.	Leptospirosis, respiratory disease.	3	4	12	Assessment of area prior to work. PPE/ RPE, good hygiene arrangements. Information for staff.	2	4	8
23.	Existing site hazards- fragile roofs, exposed openings, unstable structures etc.	Unexpected fall, trip, slip or collapse hazard.	4	5	20	All possible information to be retrieved from Network Rail. Full hazard survey. Site specific briefing.	1	5	5

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NO	ACTIVITY/TASK	IDENTIFIABLE HAZARD	DEGREE OF RISK			CORRECTIVE ACTION REQUIRED	DEGREE OF RESIDUAL RISK		
			L	C	R		L	C	R
24.	Entry into premises with potentially weak floors.	Floor failure- falls and injury	2	5	10	Building survey. Fragility tests.	1	5	5
25.	Emergency evacuation	Failure to evacuate or failure to warn others of the need to evacuate.	2	5	10	Site specific briefing of emergency arrangements. Communication with station/ depot operator. Interface with alarm systems where necessary. Emergency evacuation plan to be implemented. Appoint Fire Wardens.	1	5	5
26.	Cutting and abrading operations	Dust, fume and noise. Lacerations Inhalation of particles	5	3	15	Trained operatives. Use of PPE as required. Segregation of operations. Dust suppression techniques.	2	3	6
27.	Use of Hoists and lifts	Failure and collapse.	2	5	10	Ensure equipment is certified. Ensure operators are competent. Compliance LOLER 98.	1	5	5
28.	Design and use of access scaffold	Injuries and damage due to inadequate design, unsuitable material and/or incorrect assembly and use.	2	5	10	Approved scaffold designers. Competent contractors. Design acceptance. Statutory inspections.	1	5	5
29.	Working above the operational railway	Falls and falling objects	4	5	20	Correctly erected access equipment. Use of walkways with edge protection. Use of fall arrest system. Use of nets. Hard hats to be worn on site	1	5	5
30.	Work with electrical equipment	Fire and damage due to poor condition of wiring or insufficient capacity of existing cabling	3	5	15	Survey to be carried out to establish condition and capability of existing wiring.	1	5	5

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NO	ACTIVITY/TASK	IDENTIFIABLE HAZARD	DEGREE OF RISK			CORRECTIVE ACTION REQUIRED	DEGREE OF RESIDUAL RISK			
			L	C	R		L	C	R	
31.	Use of plant/Craneage	Collapse/ overturning of major items of plant. Damage to structures and plant. Injury to personnel.	3	5	15	Method Statement to document safe system of work. Assessment of load bearing capacity of ground and structures. Pre work inspection of plant. Trained and certified operatives. Work in possession if necessary. Use of banksman. Protect Railway infrastructure (e.g. temporary crossing).	1	5	5	
32.	Dust	Eye injury Dust inhalation Respiratory disease	4	2	8	Use of PPE as required. Dust suppression techniques	2	2	4	
33.	Extreme weather conditions (Wind)	Collapse of temporary structure	2	5	10	Design and erection by competent persons. Initial approval of temporary works using Form C. Ongoing inspection and maintenance regime.	1	5	5	
34.	Extreme weather conditions (Rain/ Snow)	Railway cutting/ embankment/ formation slip problems	2	5	10	Review of design and temporary works. Post event monitoring.	1	5	5	

Key

Risk Rating

L = Likelihood

Remote = 1

Occasional = 2

Average = 3

Frequent = 4

Probable = 5

(Likelihood is a function of frequency of exposure and number of people)

S = Severity

Ver Low = 1

Low = 2

Moderate = 3

High = 4

Very High = 5

(In relation to personal injury, very low = first aid on site, low = treatment off site, moderate = up to 3 days off work, high = major injury, very high = death)

R = Risk

Likelihood x Severity

Appendix 3: Schedule of Activities

Barnham Relocation Schedule of Activities		
Ref No.	Description	Detail
1	Initial Setup	
1.1	Briefing to Work force	
1.2	Fence off Platform from train users prior to works	
1.3	Signage at platform access, car park 'men at work'	
1.4	Fence off Car park area for access for crane and transport vehicles	As per crane access plan
1.5	Hire of scaffold for stripping of building	
1.6	2 No Generators on site (one platform, one car park)	
1.7	Battery, electrical drills, Electric Saw available	
1.8	Available PPE: Gloves, Earplugs, Safety goggles	
1.9	3Tonne/5Tonne slings on site (with certification)	
1.11	Rope	
1.12	Timber skip	
1.13	General skip	
1.14	Aggregate for platform	
1.15	Bomag Roller for compaction of lifting platform	
1.16	Possession arrangements	
1.17	Safety equipment for possession	Barriers
		Warning lights
		Rail crossing setup
		Vehicle Barriers
1.18	Platform protection	Timber sheeting
		Walking mats
1.19	Transport vehicle access fenced to insure clear area	
2	Stripping of Building	
2.1	Stripping of building	Plumbing internally and externally
		Windows
		Doors
		Access stair and landing
		Metal surround hand rail
		Remove existing floor joists and central support brackets
		Carpet
		Loose objects
		Non structural fittings

Ref No.	Description	Detail
2.2	Scaffold (movable/permanent) set up for removal of metal surround hand rail	
3	Bracing of Building	
3.1	Bracing of building	18mm Plywood sheeting for bracing of floor
		Timber bracing of Opening in Floor
		Installation of new floor joists supported upon joist hangers
		Installation of plywood sheeting (screwed fixed at 400c/c)
		Bracing detailed design
		Bracing equipment Hire
		Bracing Equipment setup
		Scaffold Hire (for Bracing)
		Scaffold setup (for bracing)
		Sheet roof to protect during transport
		Drilling of holes for bracing through building - 50 holes, 22mm Dia
4	Fabricated Frames	
4.1	Lifting frame	Lifting Frame Detailed design
		Lifting frame fabrication, transport and setup
		Welders and welding gear on site
		Lifting chains to design
4.2	Base frame on Low Loader	Detailed design of base frame to fit low loader transport
		Fabrication, transport and setup of Base frame on low loader
		Welders and welding gear on site
5	Lifting Setup/Equipment	
5.1	Guide slings ropes	
5.2	Crane lifting platform design for station car park and Community centre	
5.3	Crane Lifting Platforms setup	Aggregate for lifting platforms
		Compaction of lifting platforms
5.4	Crane setup	
5.5	Transport vehicle setup (clear area base frame in place)	
5.6	Securing chains/slugs on site	
5.7	Portable Access Scaffold/ladder for securing of building to low loader	

Ref No.	Description	Detail
5.8	Good grounding for access scaffold/ladder above	
5.9	Design of securing of building to low loader for minimal damage	
5.11	Lifting arrangements briefed to all workers	
5.12	Attachment to lifting frame	
5.13	Gradual Propping System from undercarriage of building	Propping system design
		Propping system hire
		Propping system setup
5.14	Removal of anchorage to platform	Wedges
		Hand saw
		Crow Bar
5.15	Lifting frame attachment to building	
		Chains to lifting eyes
5.16	Lifting with simultaneous propping for anchorage removal	
5.17	Lifting of building after anchorage removal	
5.18	Guide ropes/slugs attached to building	
5.19	Building lifted and guided over track	
5.21	Building secured as per design to cause minimal damage	
5.22	lifting frame unhooked	
5.23	Briefing of traffic management plan	
5.24	Lifting frame lifted onto second transport vehicle with all chains ropes and slugs	
6	Relocation of building	
6.1	Police presence?	
6.2	Traffic management plan put into place	Appropriate licences in place
6.3	Safety vehicles, flashing lights and signage ahead of transport	
6.4	Crane relocation and setup at community centre	
6.5	Lifting frame relocated and setup on crane	Welders and welding gear on site
6.6	Lifting frame lifted over building on transport and attached	
6.7	Access platform/ladder setup for removal of securing chains/slugs	
6.8	Securing chains/slugs removed from building	
6.9	Lifting of building into position allocated by others	
6.11	Area fenced off and signage 'Keep out' Put up in area	
6.12	Remove/relocate 102 obstructions at 26 locations (see obstruction schedule)	

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6.13	Lifting frame and base frame taken apart and loaded onto low loader	
6.14	Crane and transport vehicles leave	
7	Possession finish	
7.1	All safety equipment on rail for possession removed and rail reinstated	
8	Platform reinstating	
8.1	Detailed Design of platform reinstatement	
8.2	Compressor onsite and pneumatic hammer	
8.3	Top of concrete removed up to 75mm	
8.4	Old basement of signal box filled with appropriate aggregate	Aggregate brought over Rail crossing
8.5	Area compacted at 300mm intervals	
8.6	Area resurfaced as per design	
8.7	Fencing and signage removed from platform and car park	

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Appendix 4: Photographs

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3.



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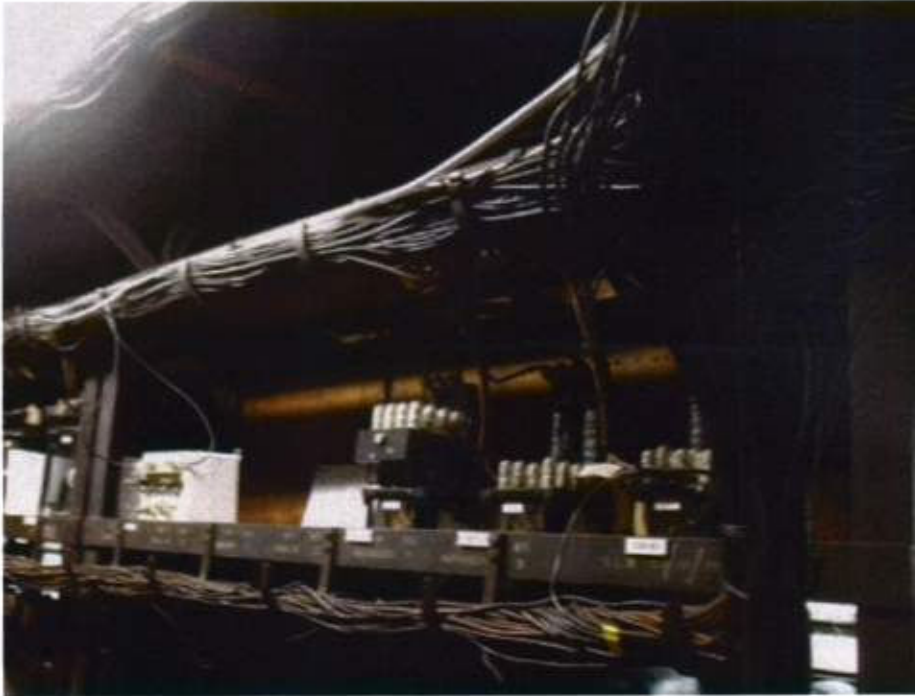
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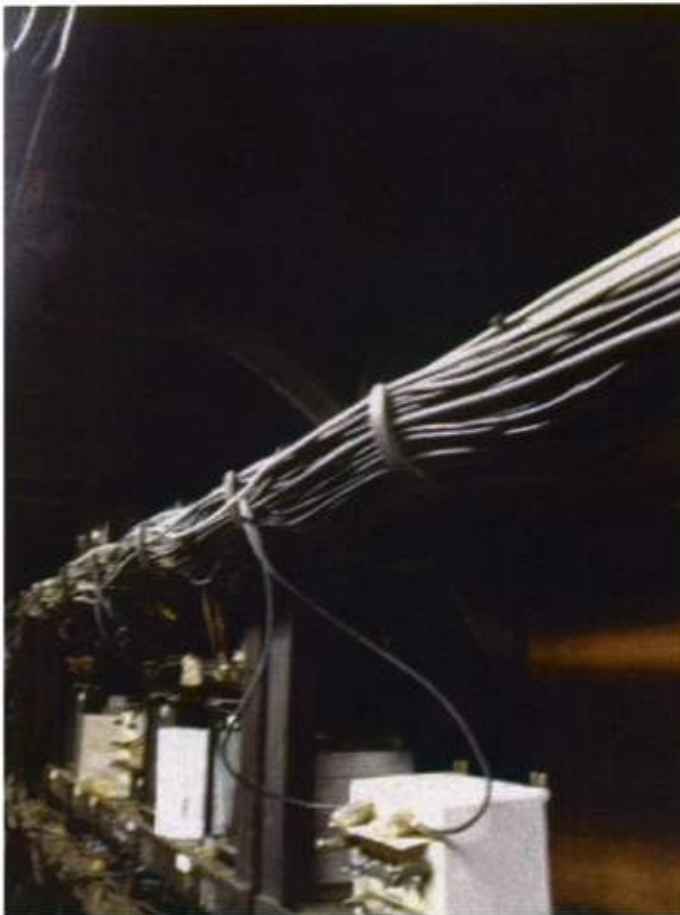
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7.



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20.



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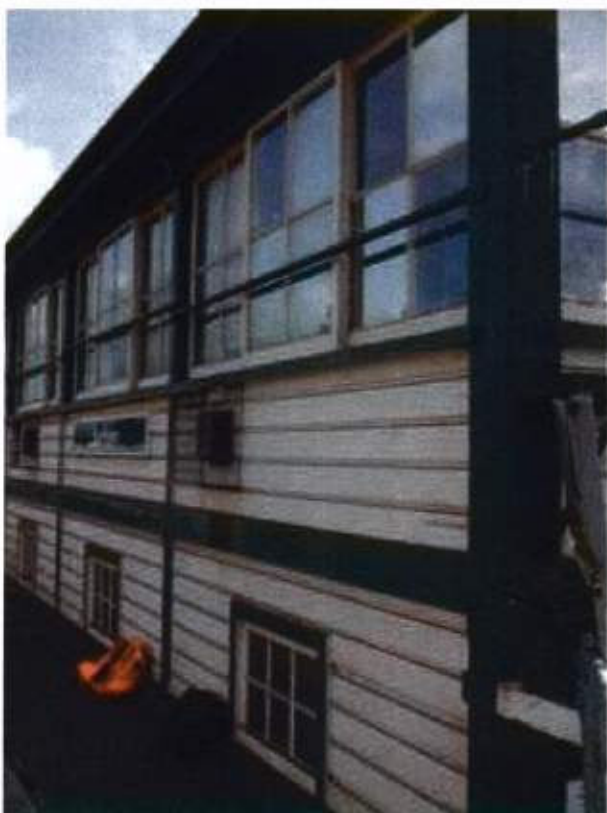
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26.



27.



28.



29.



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31.



32.



33.



34.



35.



36.



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Appendix 5: Drawings

Drawings Attached:

C626-0101-P02
 C626-0102-P02
 C626-0103-P01
 C626-0104-P02
 C626-0105-P02
 C626-0106-P02
 C626-0107-P01
 C626-0108-P01