

Loss of AC Main' Investigation Report

1. Objective

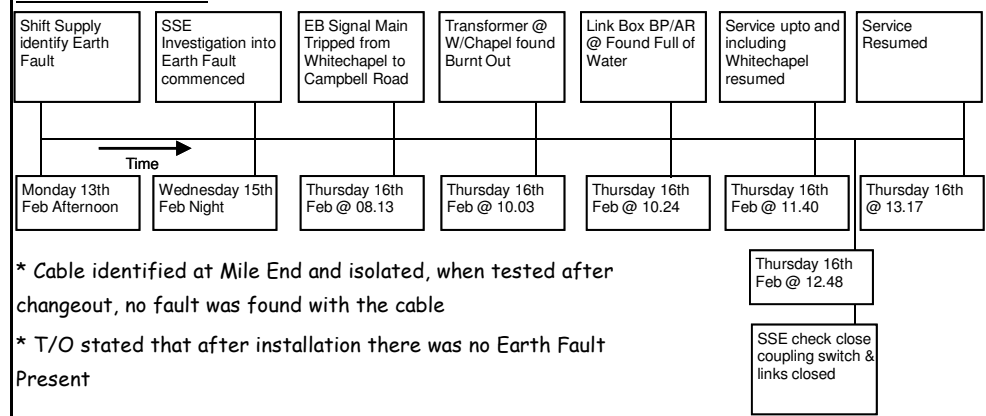
- * Investigate Cause of Major Failure to AC Signal Main on Thursday 16th February 2006.
- * Identify activities required to prevent future re-occurrence of similar failures.
- * Provide Learning Points to share with other business areas

2. Clarify the Problem

On Thursday 16th February 2006 , the East Bound Signal Main tripped out from Whitechapel to Campbell Road causing severe delays

The financial cost of the incident is estimated at £x

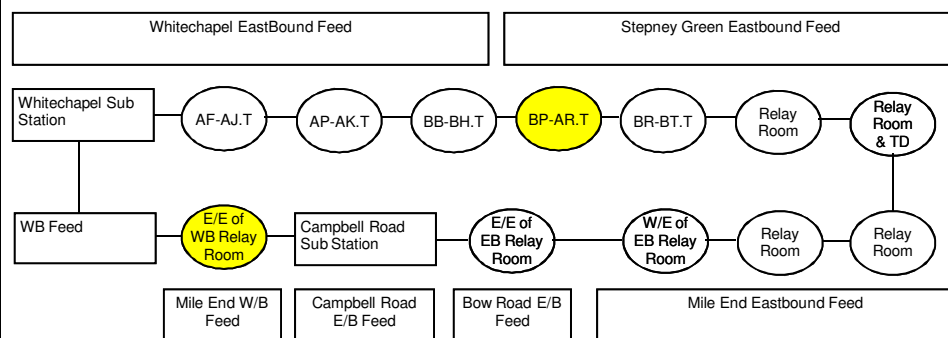
Time Line of events



Weather

Sunday 12th	Monday 13th	Tuesday 14th	Wednesday 15th	Thursday 16th	Friday 17th
Low Rain	Mod Rain	Mod Rain	Mod Rain	Heavy Rain	Fine

3. Point of Cause

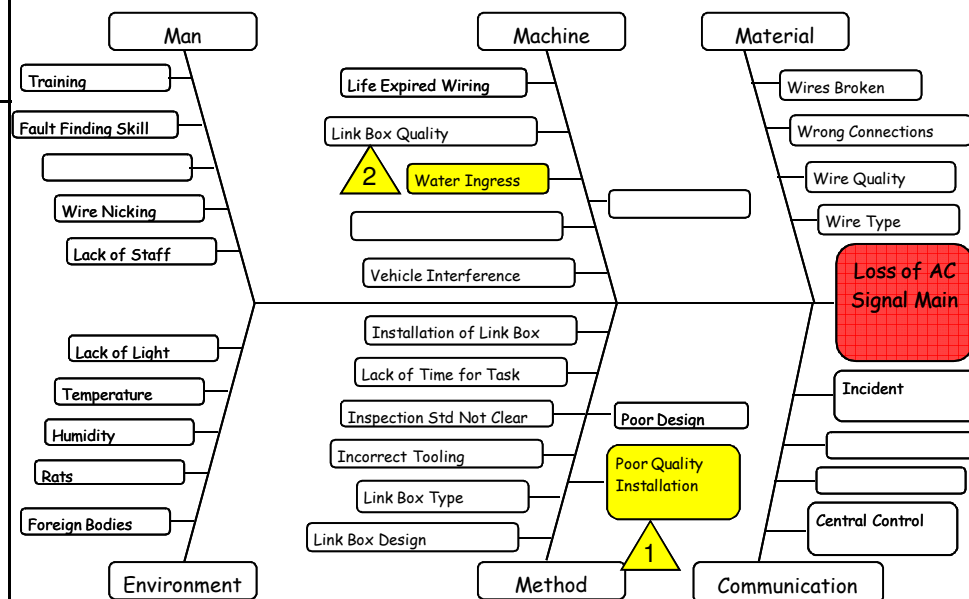


- * The first Earth Leak was found to be the connection of the signal main at the Relay Room on the East End of the West Bound Relay Room caused by Poor Termination
- * The second Earth Leak was suspected to be the Link Box BP-AR.T as this was found to be full of water during the isolation investigations

4. Initial Containment Activity

Item	Investigation	Resp	When	Status
1	Isolated Cable to be changed during Engineering Hours	IN SOMS	16-Feb	Comp
2	SSE Reported Earth Fault Still Present - Further Checks on-going to find Point of Cause of 1st Earth Leak	Maint SOMS	17-Feb	Comp
3	SEE Reported Earth Fault Still Present - Checks to continue in Engineering Hours	TH	17-Feb	Comp
4	Mitigation Plan put in Place to minimise disruption whilst Point of Cause was Identified	VD	17-Feb	Comp

5. Cause Analysis



6. Cause Investigation

Item	Investigation	Resp	When	Status
1	Mile End Room Insp E/E of WB - 30th Sep	MC	Comp	●
	Mile End Room Insp W/E of EB - 9th Dec	MC	Comp	●
	Mile End Room Insp Between EE - 9th Dec	MC	Comp	●
	Mile End Signal Power Room - 9th Dec	MC	Comp	●
	Mile End AC Main Link Box Installed - 11th Feb	RM	Comp	✘
	Inspection of Work Pre Power - 11th Feb	RM	Comp	✘
2	Confirm Condition of Wiring on Circuit	RM	Comp	●
	Photo of Link Box required Peter Sauro	TH	Comp	●
	Last Maintenance Date of Link Box - 9th Sep	MC	Comp	●
	Mk 1 Link Box does Not Have Drain Holes	TH	Comp	✘
	Confirm Condition of W/Chapel Link Box	JS	Comp	✘
	Replacement Link Box was Mk 3 Type	TH	Comp	●
Obtain List of Mk 1 Boxes	MC	Comp	●	

- Direct Cause #1 : Poor Quality Installation on E/E of WB Relay Room
- Direct Cause #2 : Water Present in BP-AR.T Link Box

7. Root Cause Investigation

Poor Quality Installation	Earth Fault on BP-AR.T Link Box
Why : Poor Quality Installation	Why : Water Present in Box
Because : The New Cable was Incompatible with the New Gland	Because : Water was able to get into the box and unable to drain away
Why : Incompatible Cable and Gland	Why : Water able to enter box
Because : Incorrect Materials were selected for the Installation	Because : The Mark 1 Link Box does not seal correctly
Why : Incorrect Materials selected	Why : Does not seal correctly
Because : No Specification or Method Statement for a Temporary Installation	Because : The box does not have a method for diverting the water away from the seal
Why : No Specification	Why : No Diversion Method
Because : It was not anticipated that a temporary connection would be needed	Because : The design of the Mark 1 Link Box is not adequate for the operating conditions
Root Cause : Specification for Temporary Repairs not included in Project Scope	Root Cause : Design of Mark 1 Box not suitable for operating conditons

8. Countermeasure Implementation

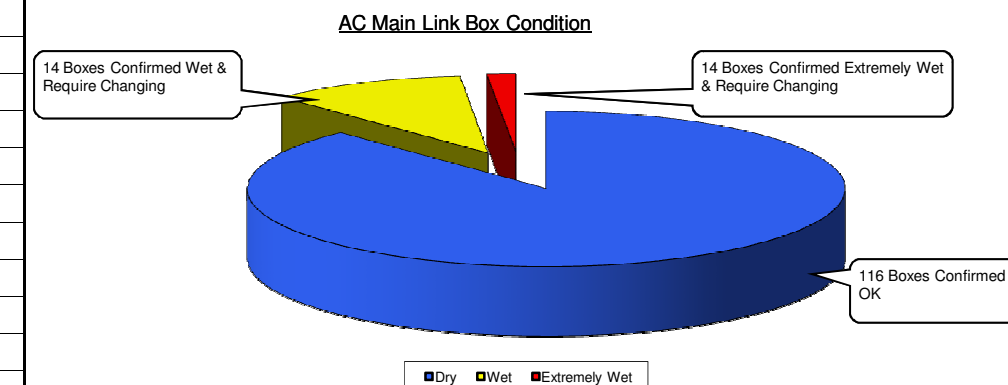
Item	Root Cause	Countermeasure	Date	Status
1	Correct Materials Not Available	40mm Dia Cable Gland & Plate to be specified in Method Statement	OH	Comp
		40mm Dia Cable Gland & Plate to be made available in stores	OH	Comp
2	AC Main Switch Box Installation	Modify Method Statement to include Temporary Repair Instructions	OH	Comp
3	Other Temporary Installations	Confirm if other similar Installations are currently on-going	OH	Comp
4	Water Ingress into Link Box	Check condition of all existing Mk1 Link Boxes	PW	Comp
5	Water Ingress into Link Box	Check Condition of Seals on Link Boxes and Adjust if possible	PW	Comp

9. Results

Modification of Method Statement

Document Number : DMS-MS-04023 modified and re-issued as Issue 1 to include the following statement in section 3.3 " In case a temporary connection is needed, the New AC Mains cable will be terminated into an old link box via an appropriate gland and blanking plate (with holes drilled into it), 40mm glands (Part # 24176/756 or 24176/923) and blanking plates with 40mm holes will be used for "

Link Box Inspection Results



10. Follow Up Activity

Item	Activity	Resp	Date
1	Earth Fault Follow Up - Incidents to flag up all faults through VMC meetings?	PB	Comp
2	AC Main Fault Finding Guide/Fault Finding Team	CW	Comp
3	Incident Management - Information Flow could be improved between shifts to support faster Fault finding	PB	Comp
4	Change Plan for 16 x Mk 1 Link Boxes with Poor Seals	S&E	Comp

11. Learning Points

- * Mansion House - Monument, signalling is very old and high risk of significant failure, add to renewal plan.
- * AC Main terminology idiots guide would help when fault finding
- * Importance of building contingency into project plans to cover events such as temporary repairs.