

CATEGORY 2: PRACTICAL ELECTRICAL UPGRADES & TECHNICAL EXECUTION

Case Study 4: Specialized EV Charging or Outbuilding Sub-Main Installation

AUTHOR & CONSULTANCY OVERVIEW

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Practice: St George Consultancy Services | **Web:** <https://stgeorgeconsultancy.co.uk>

1. The Client & Challenge

A commercial client required a high-capacity, dedicated sub-main electrical supply extended from the primary distribution board across an external yard to power an outbuilding workshop and a fast 7.4kW EV charging point.

- **Sector:** Commercial Outbuilding & EV Fleet Infrastructure.
- **Challenge:** Long cable run across outdoor environment involving high ambient thermal fluctuations and mechanical damage exposure.
- **Requirement:** Sub-main distribution design ensuring negligible voltage drop and dedicated isolation.

2. The Risk & Problem

Improper cable sizing or inadequate mechanical protection across outdoor spaces leads to excessive voltage drop, cable overheating, and structural insulation breakdown. In addition, EV charger installations require strict compliance with PME earthing restrictions (PEN conductor fault risks) to prevent fatal touch voltages on vehicle bodies.

- **Thermal Overload & Voltage Drop:** Insufficient conductor cross-sectional area causing equipment malfunction and heat dissipation risks.
- **Mechanical Hazards:** Standard PVC cables damaged by vehicular traffic, weather, or UV degradation.
- **Open PEN Conductor Faults:** Deadly shock risk associated with protective multiple earthing (PME) outdoors.

3. The Technical Solution

Applying precise electrical engineering calculations, St George Consultancy designed and executed a robust sub-main supply infrastructure.

- **Cable Sizing Calculations:** Applied derating factors for grouping (Cg), ambient temperature (Ca), thermal insulation (Ci), and installation method (Ci) to select 3-core 10mm² Steel Wire Armoured (SWA) copper cable.
- **Structural Containment:** Cleated SWA cable to exterior masonry at engineered centers and buried under-yard sections in heavy-duty ducting at a depth of 600mm with warning tape.
- **Earthing & Protection:** Integrated a dedicated sub-board with Type B RCD / open PEN detection technology specifically designed for EV charging equipment.
- **Testing & Commissioning:** Executed complete dead/live testing regime, verifying R1+R2 continuity, Zs loop impedance, and RCD trip response times.

4. The Results & Business Value

Delivered a clean, durable, high-capacity power distribution link capable of handling continuous maximum load demands safely.

- **100% Statutory Compliance:** Fully certified under BS 7671 Section 722 (Electric Vehicle Supply Equipment) and Part P requirements.

- **Zero Voltage Drop Issues:** Calculated voltage drop kept well within the 3% limit for lighting and 5% for power.
- **Future-Proofed Infrastructure:** Heavy-duty sub-main allows for future expansion of additional outbuilding machinery or fleet charging points.
- **Complete Mechanical Protection:** SWA containment guarantees decades of resilience against mechanical and environmental wear.