



CPD session for Midlands Highway Alliance members

Dual Distribution Network

Power and fibre to the column in one cable

By the end of the hour you will be able to

- 1 explain what a DDN is and how power and fibre reach a column
- 2 describe what it changes on a lighting scheme: civils, grid connection, column equipment, maintenance, standards
- 3 say what a designer needs from you to specify one

Follow Up Contact: mark.Kellett@keltechioe.com

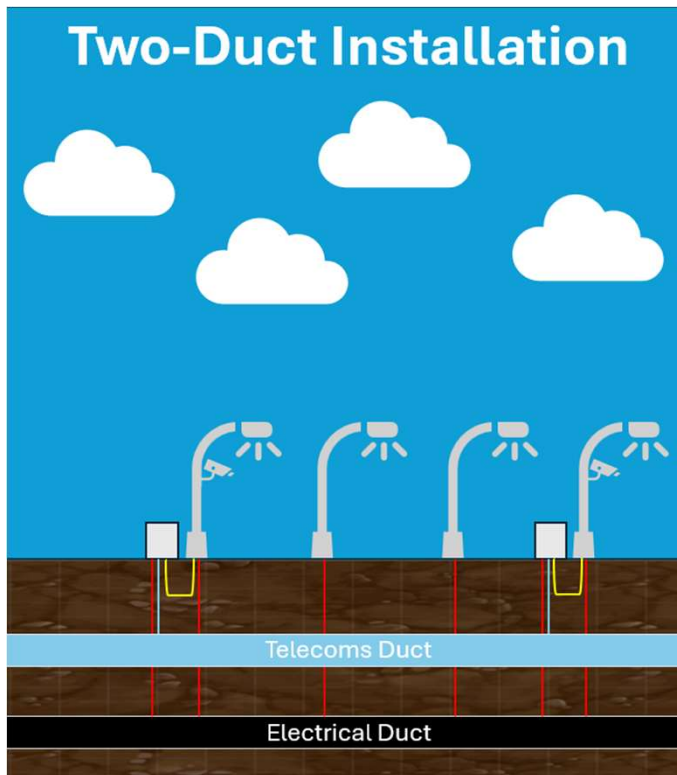
KelTech IoE | 13 October 2026, 1 pm | One hour including questions



Photo: East Riding of Yorkshire, Live Labs 2 DDN-powered lighting

Why we are here: getting power to the column today

Every new service on a column means another cable, another connection and another dig



Deep, separate civils

Armoured LV cable at electrical burial depth in its own trench, with a second duct if you ever want data.



A grid connection per feeder pillar

DNO works on the critical path; pillars to find space for, protect and maintain.



Mains at every column top

An AC driver in each luminaire, exposed to surges and heat; replaced from a MEWP.



Little visibility

A dark lamp is found by patrol or public report; the fault is traced by hand.

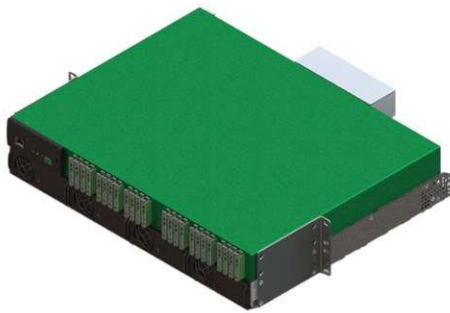


Dig again for each new service

CCTV, sensors, speed cameras and Wi-Fi each arrive with their own power and comms problem.

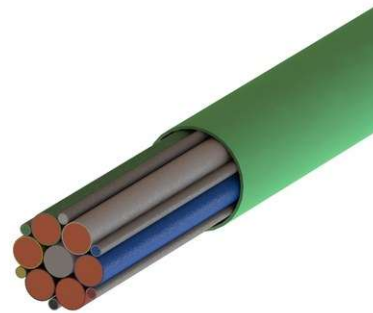
What a DDN is: three parts

One headend, one hybrid cable, street-level nodes. Everything else is a device plugged into a node.



DDN headend

A rack-mounted unit about the size of a hi-fi amplifier, fitted in an ordinary street cabinet. It takes a normal mains supply (or battery and solar) and feeds up to 24 cable routes, 12 kW in total. It watches every route and reports faults.



Hybrid cable

Three copper pairs for power and 12 fibres for data in one sheath under 8 mm across, about 100 kg per km. More fibres to order, and one fibre can be split passively to serve 32 or 64 devices. Blown or pulled through standard telecoms microduct.



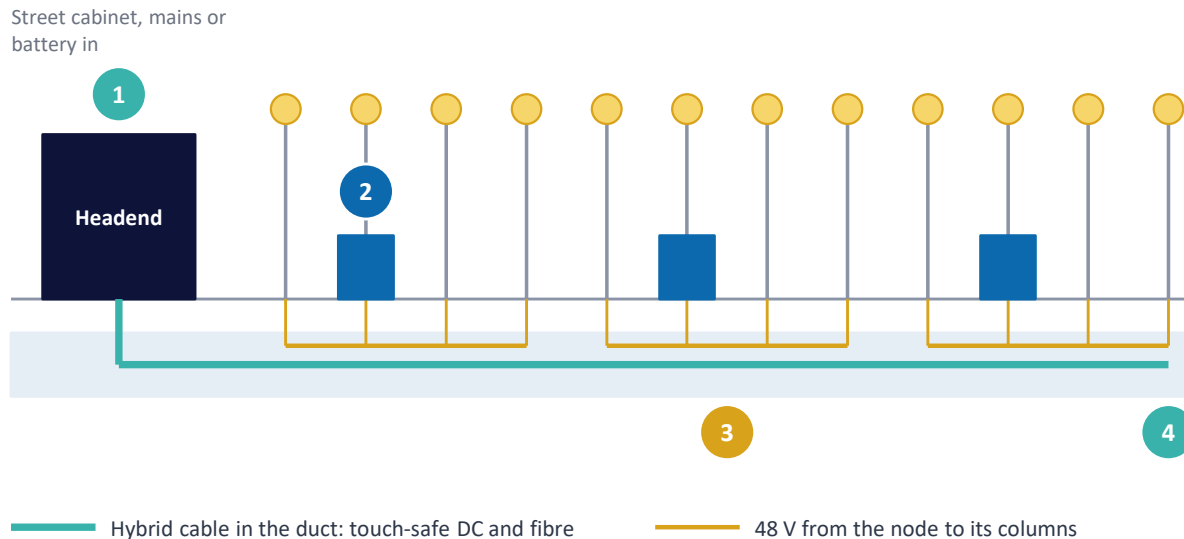
Street-level node

A sealed, weatherproof enclosure in a column base, chamber or small cabinet. It turns the touch-safe DC into 48 V for a group of columns and passes fibre to any device that needs it. Up to 300 W as standard, 900 W in the larger unit.

Up to 2 km from headend to node and up to 2 kW per cable route. Product images; installed examples follow on the East Riding and Durham slides.

How power reaches the column

Touch-safe DC along the route, 48 V to the columns



Schematic, not to scale. Twelve columns and three nodes shown; a real route can carry more of both within the limits in step 4.



The headend sends touch-safe DC

From a street cabinet on an ordinary mains supply. It checks the line hundreds of times a second and only keeps sending power while the far end answers. Cut or touch the cable and that pair is off in milliseconds.



A node at a column base makes 48 V

Each node takes one copper pair from the cable and turns it into 48 V for a group of columns, in both directions along the route.



Spare pairs in the cable carry the 48 V

A pair that has reached its node is free beyond it, so the same three-pair cable feeds the nodes and carries 48 V to every column. No second cable.

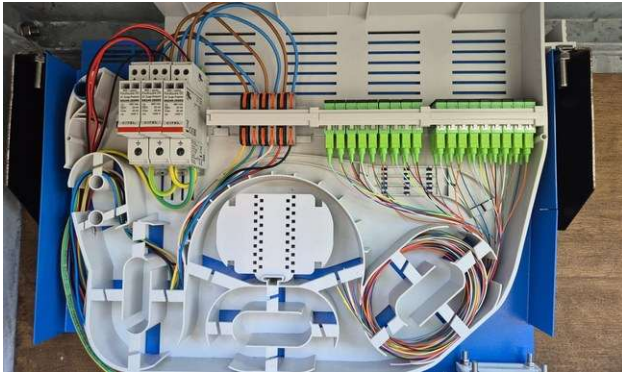


Distance is a design rule

Up to 2 km from cabinet to node. Columns per node are set by the 5 % voltage-drop rule: for 20 to 40 W lighting at 15 m spacing, about three to five columns each way.

How fibre reaches the column

The same cable, the same node, the same civils event



Hybrid distribution panel in the headend cabinet, East Riding



DC luminaire fed from a breakout box



Fibre rides in the cable

Twelve fibres as standard, more to order. Spliced through at each node, so a fibre can run the whole route or drop out anywhere. A passive 1:32 or 1:64 split lets one fibre serve dozens of devices.



Devices plug into the node

CCTV, speed and ANPR cameras, environmental sensors, Wi-Fi and small cells take 48 V and fibre from the nearest node through a breakout box.



Backhaul to suit the site

Fibre to the headend where it exists, or a 4G/5G router at the headend cabinet where it does not.



Recorded as it is built

Every route, splice and node is logged at install, so the next device is added from the record rather than a site survey.



KelTech IoE
SMART NETWORKS

DDN

DUAL DISTRIBUTION NETWORK
Power + Fibre. One Infrastructure.

POWERING LA'S SMART CITY FUTURE

One cable. More power. More possibilities.



DC POWER

Human Safe
IEC 62368-1
NEC Article 726



FIBRE

High capacity
connectivity



SUSTAINABLE

>40% energy
savings



SECURE

Less copper
Lower theft risk



SCALABLE

Future-ready
infrastructure



SMART LIGHTING



CCTV SURVEILLANCE



5G / WI-FI SMALL CELLS



ENVIRONMENTAL SENSORS



E-BIKE CHARGING



IOT GATEWAY / OTHER DEVICES

LA
SMARTER
GREENER
SAFER

ONE INFRASTRUCTURE

Power everything.
Connect everything.
Sustain everything.

DDN ARCHITECTURE

ONE CABLE. POWER + FIBRE. EVERYWHERE.

DDN is a Dual Distribution Network that delivers DC power and fibre data over a single hybrid cable in a daisy-chain architecture – up to 2km from the Headend in any direction.

DDN HEADEND
4U RACK MOUNTED UNIT
12 kW PER HEADEND
STACKABLE ARCHITECTURE

12 kW
PER HEADEND

10 HEADENDS =
120 kW CAPACITY

ONE HYBRID CABLE
POWER + FIBRE

DC POWER
(up to 450V DC
typ to 2 kW per node)

FIBRE DATA
Singlemode /
Multimode

**UP TO 2KM IN
ANY DIRECTION**

POWER INPUTS TO HEADEND

AC INPUT (GRID)
100–277V AC
50 / 60 Hz

DC RENEWABLE INPUTS

SOLAR PV
BATTERY STORAGE
WIND
GENERATOR / OTHER DC

GEMINI ENCLOSURE (ACTUAL)
IP68 BREAKOUT NODE
250 (H) x 140 (W) x 140 (D) mm

IP68 RATED
(Submersible)

UV & CORROSION
RESISTANT

–40°C TO +70°C
OPERATING

LID ON (IP68)

LID OFF (INTERNAL VIEW)

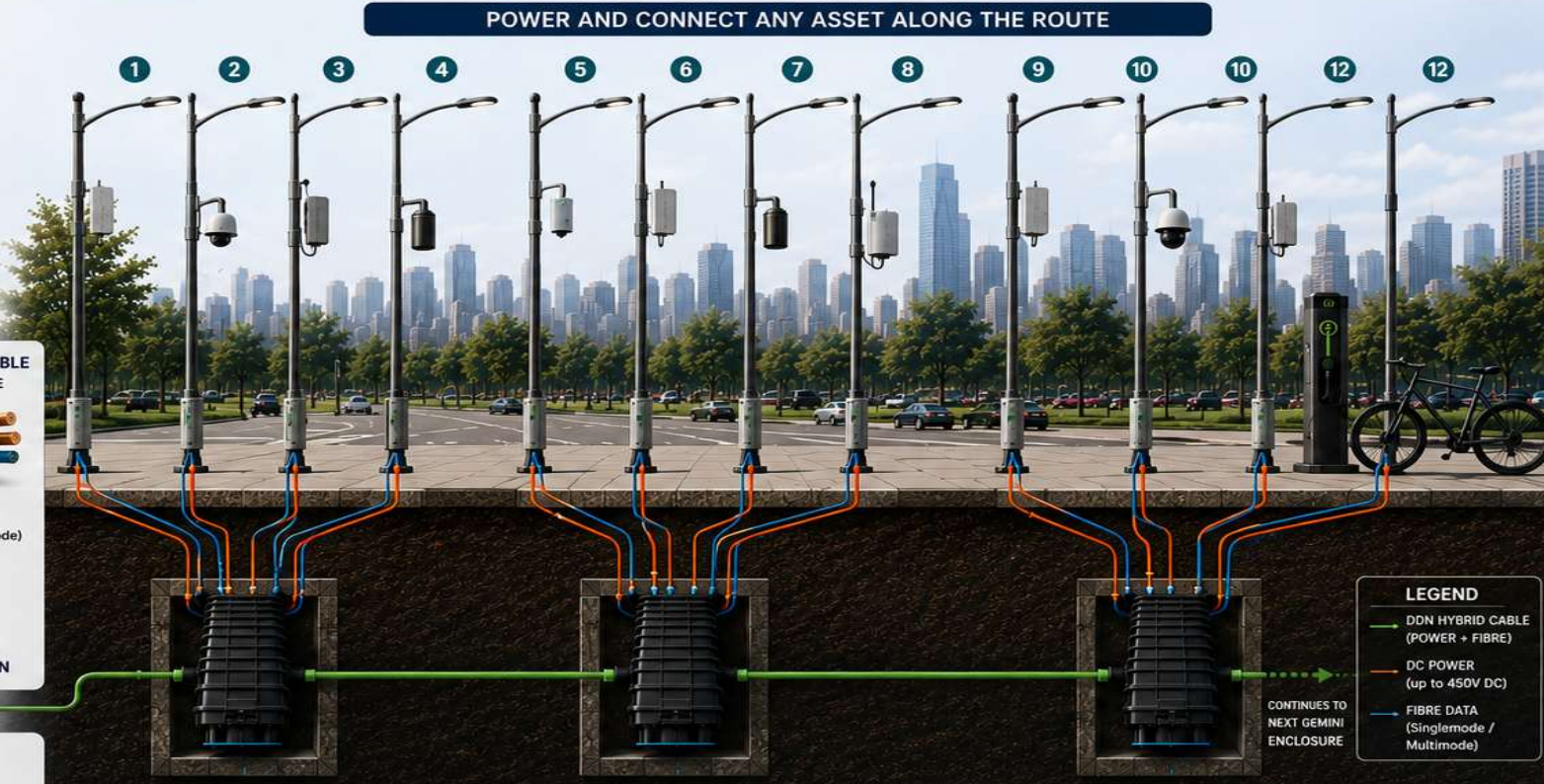
**ONE CABLE
INFRASTRUCTURE**

**LOWER CIVIL
COST**

**LESS COPPER
LOWER THEFT RISK**

**SCALABLE &
FUTURE-READY**

**POWER + DATA
WHERE YOU NEED IT**



HUMAN SAFE DC POWER
IEC 62368-1 & NEC
ARTICLE 726 COMPLIANT

> 40% ENERGY SAVINGS
LOWER LEAKAGE LOSSES
~65% VS AC

LOWER CIVIL COST
ONE TRENCH. ONE DUCT.
ONE INSTALLATION

SCALABLE & FUTURE READY
EASY TO ADD DEVICES
ANYWHERE ALONG THE ROUTE

**Up to 2km from the Headend
in any direction. Daisy chain
or point-to-multipoint
topologies.**

Standards and safety

What the system is designed and certified to, and who can work on it



Limited power source

Certified under IEC 62368-1 as a limited power source. In North America the same class of system is NEC Article 726 Class 4 (UL 1400-1). That classification is what allows the cable to run in telecoms duct without electrical burial depth or conduit.



BS 7671 on the column side

The 48 V lighting side is an extra-low voltage lighting installation under Section 715. Regulation 715.525 limits voltage drop to 5 % from the converter to the furthest luminaire, which sets how many columns a node can feed. Parallel pairs follow Regulation 523.7.



What happens on a fault

A fault on a column drop isolates that drop only; the headend de-energises the pair in milliseconds and reports it. A strike through the cable itself is detected, made safe and located from the headend. Other routes stay lit.



Who installs and maintains it

Telecoms-trained technicians install, terminate and commission. Surge protection is concentrated at the headend. Column-top equipment sees 48 V only, and the conversion equipment is serviced at ground level.

Build: one network instead of two

Where the difference comes from on a lighting scheme

Conventional LV AC plus separate data

DDN

 Cable	Armoured AC power cable plus a separate fibre: two products, two pulls	One lightweight hybrid cable with DC power and fibre in one pull; 60 % less copper and 82 % less plastic than SWA plus fibre
 Civils	Power at electrical burial depth in its own duct; data in a separate telecoms duct	Limited power source, 48 V side ELV to BS 7671, so one telecoms duct on one shared trench
 Electrical assets	Feeder pillars, distribution boards, per-circuit protection; an AC driver in every luminaire	One headend in a cabinet; compact street-level nodes; no feeder pillars, no per-column AC switchgear
 Data network	A second build to every camera and access point, with its own cabinets and power	Included: fibre arrives at every node in the same cable
 Labour and programme	Electrical contractor plus telecoms contractor; DNO LV works on the critical path	One telecoms-grade install and commission; one small grid connection at the headend

Material figures from the KelTech cable sustainability analysis. The largest single saving on most schemes is the shared shallow civils; the size of it depends on your trench specification.

In life: what changes at the column

Dimming, drivers and the grid connection



Dimming behaviour

Comparable to a good AC driver at full output. Under a dimmed night-time profile, a DC-DC driver keeps its efficiency where AC drivers lose theirs.

Every driver has built-in dimming control, so profiles are set centrally.

Basis: driver efficiency curves; confirm against your luminaire's driver



Fewer things to fail at the column top

The column sees 48 V and nothing else: no mains surges, which are the leading cause of street-lighting driver failure, no mains-side electrolytic capacitor, and far less heat in the housing.

Surge protection sits at the headend. Conversion equipment is serviced at ground level, not from a MEWP.

Touch-safe DC on the route; 48 V at the column



One clean grid connection

One power-factor-corrected headend replaces dozens of small drivers whose power factor collapses when dimmed, so the connection is sized in kW, not kVA.

Solar and battery connect directly at the headend. Per-circuit energy data comes from the headend with no extra metering.

Headend input; per-circuit telemetry

On a lighting scheme the energy case is in the dimmed hours, the driver population and the grid connection, not in a headline efficiency figure.

East Riding of Yorkshire Council: Live Labs 2

Department for Transport and ADEPT programme, decarbonising street lighting



Node in a column base



The test-bed route

500 m

one hybrid cable

3

street-level
nodes

34

7 W luminaires

What was built. One side of the carriageway on the test-bed route, delivered with Urbis Schröder as the luminaire partner: one headend in a street cabinet with battery back-up, one hybrid cable in standard duct, three nodes each feeding a group of timber columns at 48 V, DC luminaires dimmed to a fixed level, fibre in the same cable. The other side of the road is another manufacturer's trial, so the two approaches can be compared side by side.

2025 awards

Highways Awards: Environmental Sustainability
LCRIG / DfT Special Recognition: Net Zero Project of the Year
HEA and HEMSA: Project of the Year

"We are now at a stage where we can turn off the now not-needed streetlights along two routes, knowing that we can do it safely."

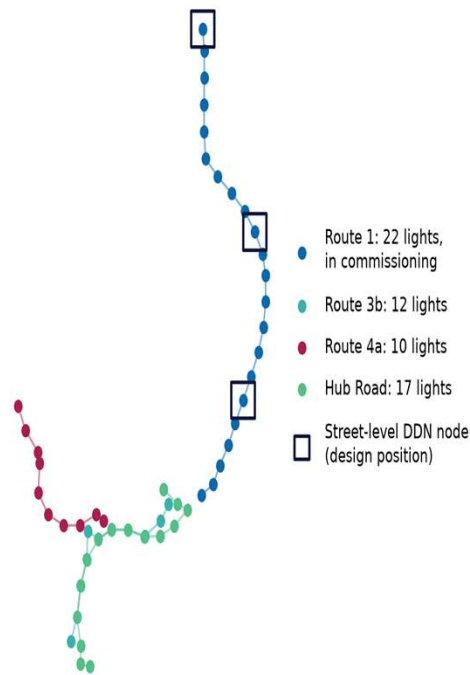
Karl Rourke, Service Manager for Street Lighting and Live Labs project lead, East Riding of Yorkshire Council

Durham County Council: Aykley Heads

Lighting a regeneration estate and leaving a data backbone in the ground



Route 1 lit, autumn 2026



Lighting design: 61 luminaires on four routes; squares are node positions on Route 1.

61

luminaires

4

routes

660 W

lighting load

The site. Parkland and public realm on the future Durham Innovation District, delivered in phases. The council wanted lighting now and a route to CCTV, sensors and connectivity later without digging twice.

What is being built. One headend in a cabinet on a mains supply. One hybrid cable per route in telecoms duct. Route 1 first: 22 luminaires of 5.8 to 20.4 W fed from three nodes, each serving columns in both directions at 48 V, with terminated pairs re-used for the 48 V run. Fibre to every node.

Status. Route 1 lit and in commissioning, autumn 2026. Routes 3b, 4a and Hub Road follow, then phase 2 devices on the same cable.

Derbyshire: what is coming

The next highways deployment, and the first non-lighting use case



Lighting scheme

Scope, route length and column count: to be confirmed with Derbyshire County Council before the session.

Same architecture as Durham: one headend, one hybrid cable per route in telecoms duct, nodes at the columns, 48 V to the luminaires.

Programme: to be confirmed.



Speed cameras, High Peak

The problem: camera sites on rural roads with no convenient mains and no comms, where a new DNO connection and a trench are most of the cost.

The DDN answer: a headend at the nearest supply, one hybrid cable along the verge or footway, a node at each camera with 48 V and fibre, and battery at the headend to ride through outages.

Status: under consideration with the client; detail to be confirmed before the session.

Placeholder content. Replace with agreed scope once Derbyshire County Council confirms what can be shown.

Beyond lighting: what else hangs off the node

Power and fibre are already at the column, so the next device is a plug-in



Speed and ANPR cameras

Power and fibre at rural sites with no mains; battery at the headend keeps them running through outages.



CCTV

Cameras at the column with fibre backhaul, no separate power cabinet.



Sensors

Flood, air quality, weather, structural and traffic sensors on the same 48 V and fibre.



Wi-Fi and small cells

Access points and small cells powered from the node; PoE switch in the node where needed.



Micro-mobility and signage

E-bike docks, information displays and variable message signs within the node's power budget.



Resilience and renewables

Headend takes 48 V DC in, so solar and battery hold lighting and cameras up through a grid outage.

Scope boundary: a standard node delivers up to 150 W continuous and a hub node up to 600 W. Ample for cameras, sensors and access points; not for Type 2 EV charging, which can share the civils but not the DDN power.

How to specify a DDN scheme

What a designer needs from you, and how the design is validated

What we need from you

- 1 Load locations, ideally as GIS data (shapefile, GeoPackage or CSV with coordinates)
- 2 Load characteristics: wattage, voltage and type for each device (luminaire, camera, sensor)
- 3 Duct or containment routes available for the hybrid cable, if any
- 4 Preferred headend locations, if any; otherwise we start near the centre of the loads



Map the loads

Import locations and load data; place the headend near the centre of the loads if no location is given.



Group and place nodes

Group columns within roughly 100 m of each other (further for very small loads) and put a node near the middle of each group.



Validate

Voltage drop under 5 % to the furthest luminaire (BS 7671 Section 715) and headend-to-node distance inside the cable's limit. Iterate; this is normal.



Bill of materials

Cable length plus 10 % slack, nodes, headend and power modules, connector kits. Add power modules for N+1 or loads above 3 kW.

Summary

Back to the three outcomes

1 What a DDN is

One headend in a cabinet, one hybrid cable in telecoms duct, street-level nodes giving 48 V and fibre to groups of columns. Touch-safe DC on the route; up to 2 km and 2 kW per cable.

2 What it changes

One shallow shared civils event instead of two networks; one grid connection instead of feeder pillars; no mains at the column top; faults isolated per drop and reported at the headend; lighting that rides through outages where storage is fitted; the next device is a plug-in.

3 How to specify it

Give the designer load locations, load characteristics, duct routes and headend preferences. The design is validated against the 5 % drop rule and the cable distance limit, and returned with a bill of materials.

After the session: case studies for East Riding of Yorkshire and Durham County Council will be circulated through the Alliance. Presented by Mark Kellett, CEO, KelTech IoE | www.keltechioe.com

Questions

Fifteen minutes. Anything on design, standards, installation or the live schemes.

Mark Kellett
Chief Executive Officer, KelTech IoE
www.keltechioe.com

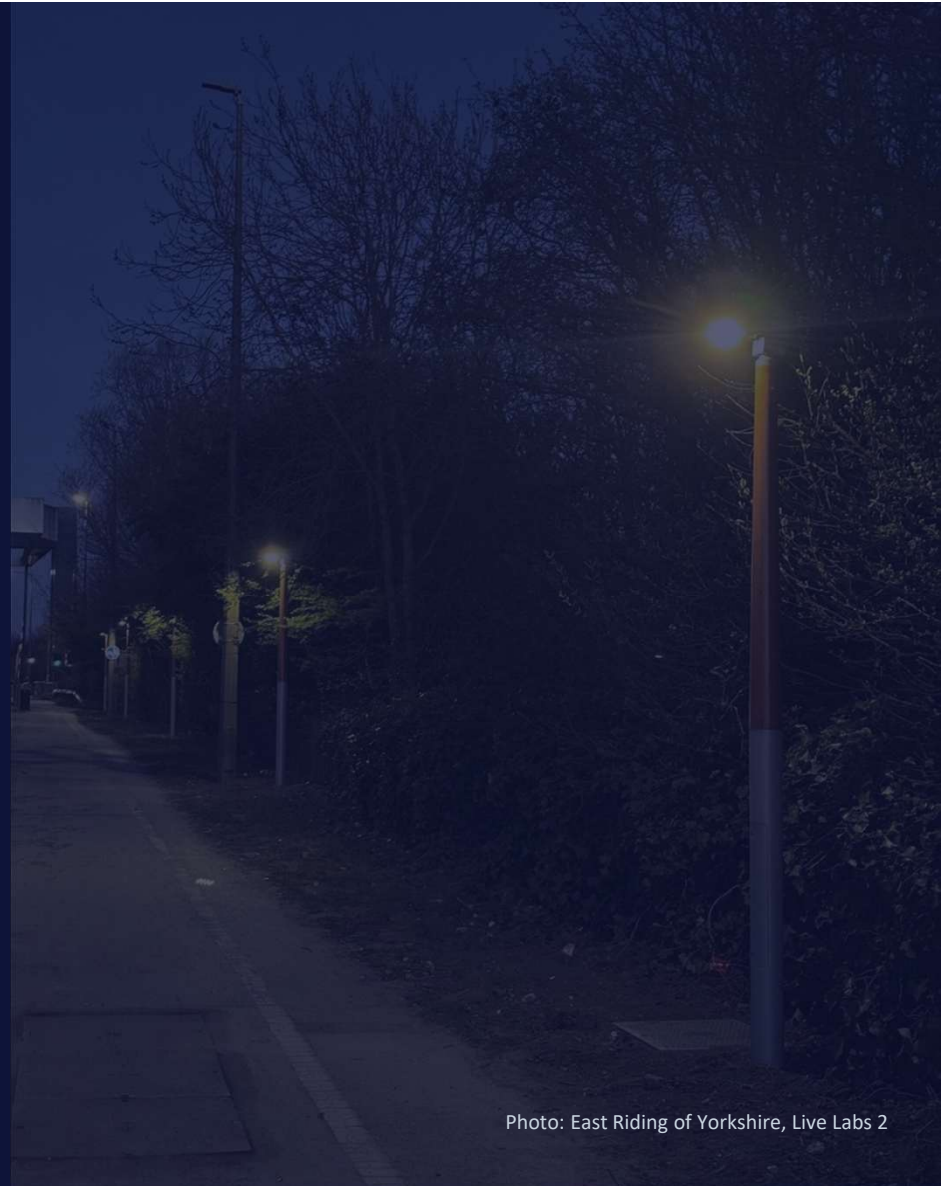


Photo: East Riding of Yorkshire, Live Labs 2