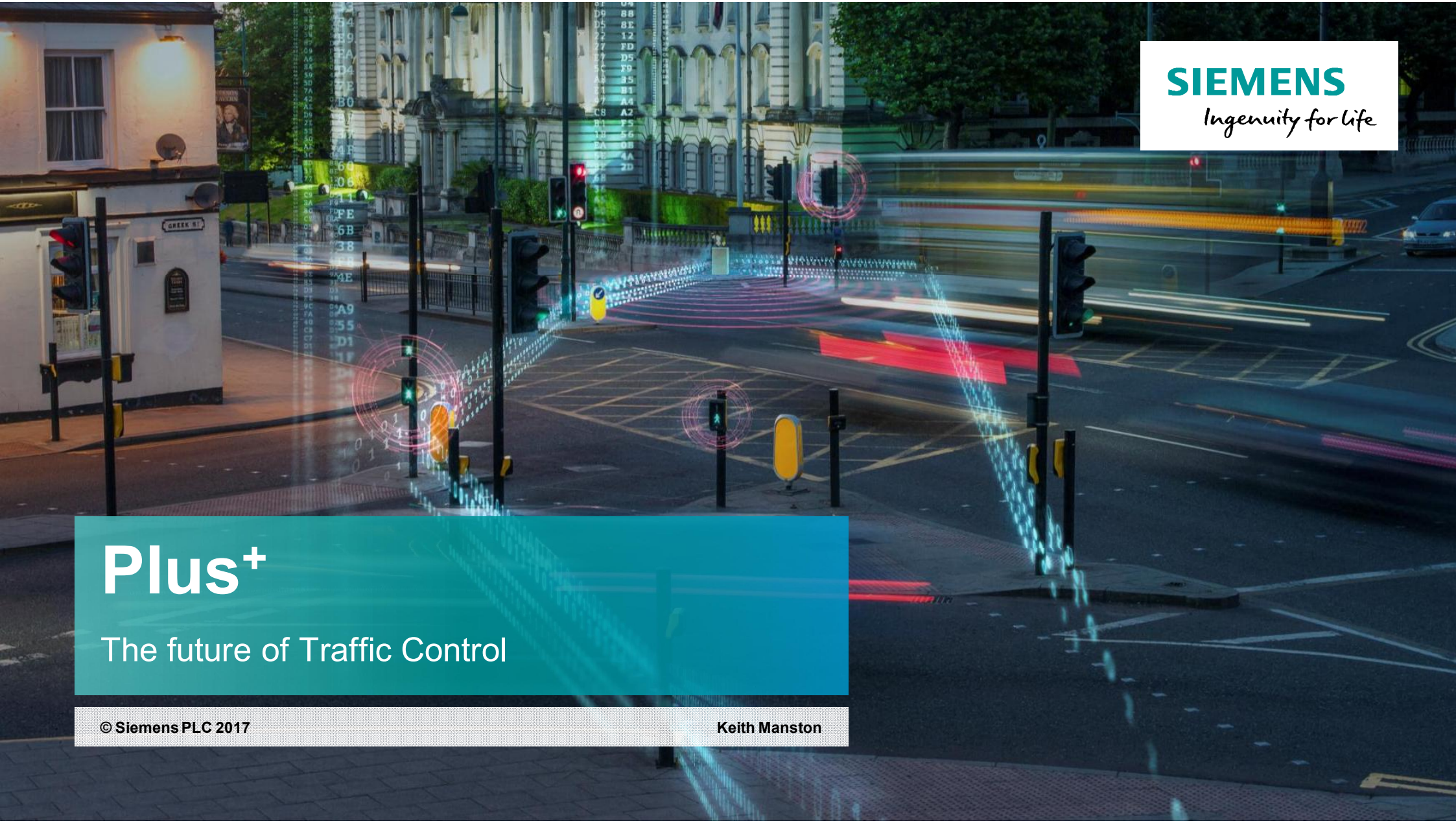

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Plus+

The future of Traffic Control

Keith Manston

Why “Plus+” ?

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“Plus” was a first generation serial data solution for the connection of signal heads to controllers

- Used serial communication to reduce cables and place more intelligence in the signal heads
- Implemented in Germany in the late 1990’s and was popular in some cities - still used occasionally by original customers
- Uses German specification controllers, with very special cables and 230V, 200cd signals, so take-up outside of Germany has been very limited

Current second generation solutions have advanced the concept a little

- Less reliance on special cables and allow ELV in some cases
- Usually simply achieved by moving the Lamp Switch elements to the signal head

An introduction to Plus+

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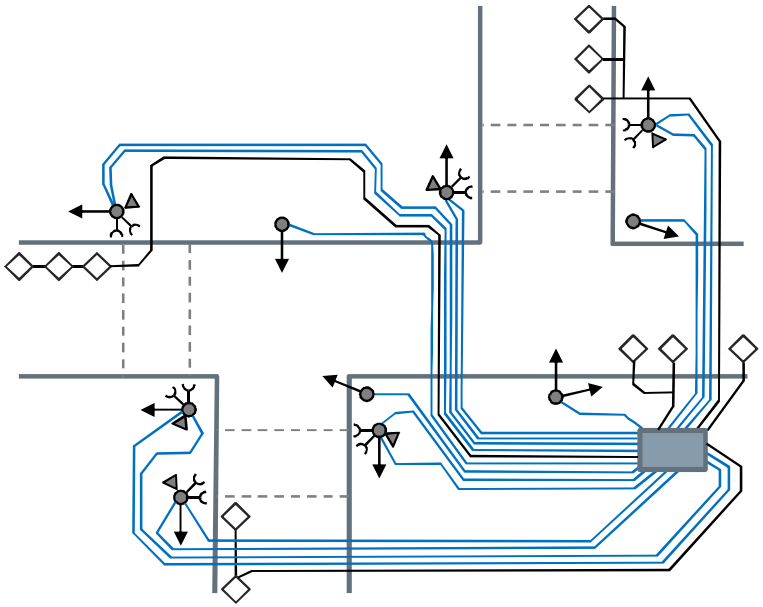
Plus+ is a new 3rd generation traffic control system, delivering:

- Increased safety and availability
- Reduced overall deployment costs
- Improved maintenance processes
- Inbuilt passive pole disconnection
- Reduced use of raw materials
  - Particularly copper cables

Traditional traffic control systems use many cables to connect street furniture to the traffic controller

Cabling has many cores

- Large numbers of individual connections
- Significant cable indenting and testing required during commissioning

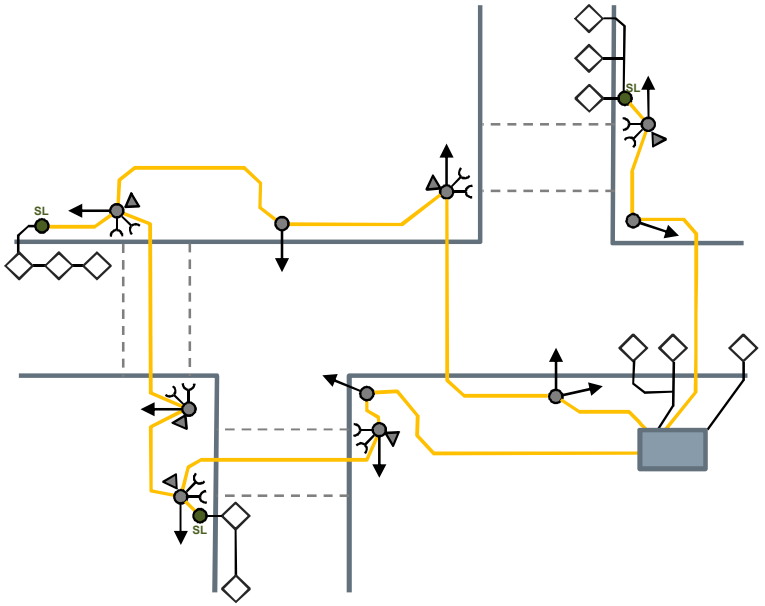


Typical traditional cabling

Plus+ uses advanced technology to distribute intelligence around the intersection, minimising cables

Cabling may be arranged as:

- Arms
- Rings



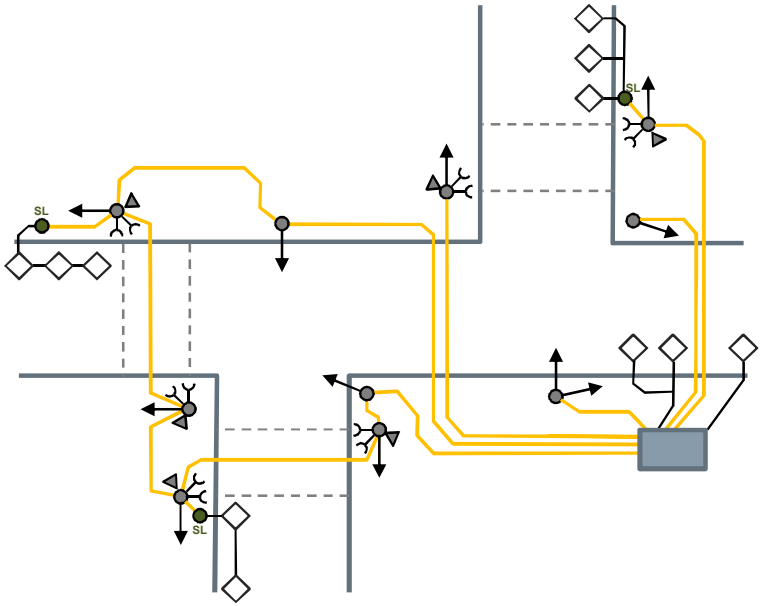
Typical Plus+ cabling

Plus+ uses advanced technology to distribute intelligence around the intersection, minimising cables

Cabling may be arranged as:

- Arms
- Rings
- Stars

Uses simple 4 core twisted pair feeder cable and ELV throughout



Typical Plus+ cabling

An introduction to Plus+

Plus+ uses dedicated new components to deliver a highly resilient system

- ST950 Plus+ controller
- Helios Plus+ Traffic and Pedestrian signals
- Helios Plus+ Nearside indicators
- Helios Plus+ Wait indicators
- Helios Plus+ PCaTS interface
- Plus+ Smartloop
- Plus+ Intersection design tool
  - Add-on to Key Signals

Plus+ Components

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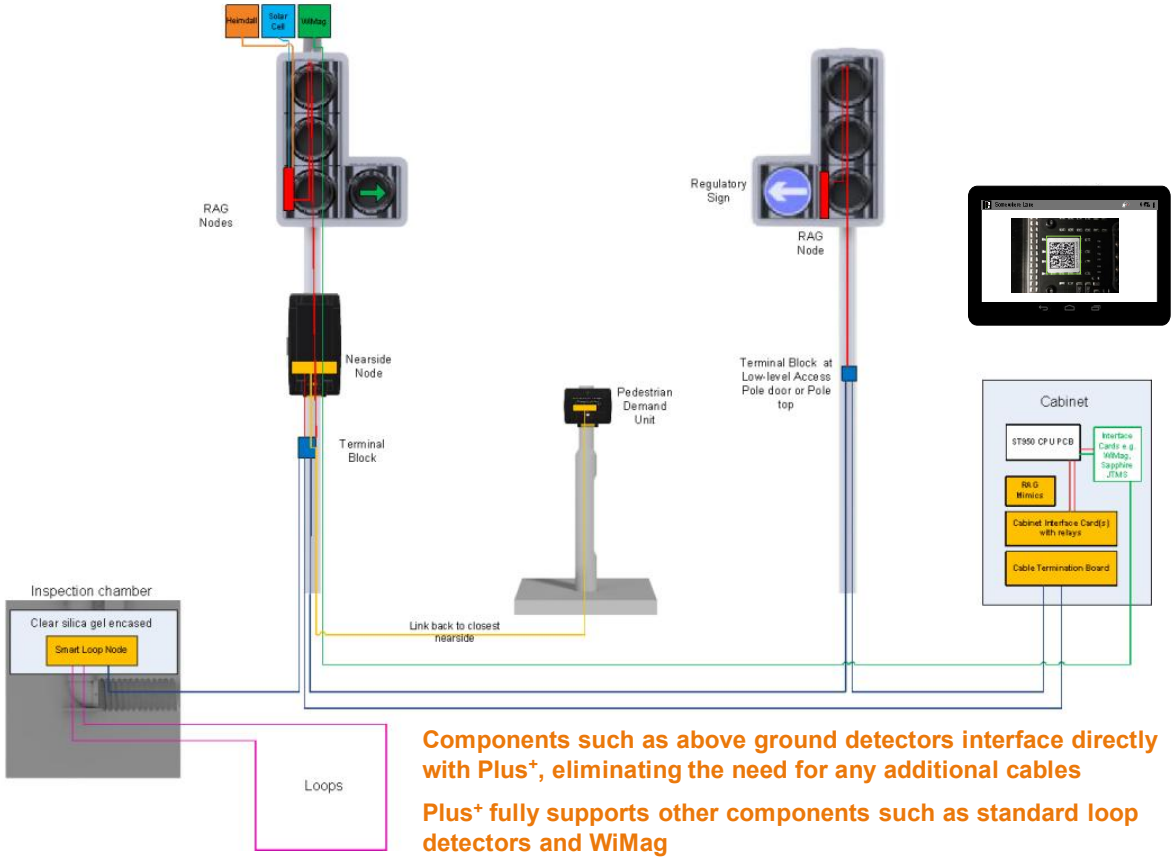
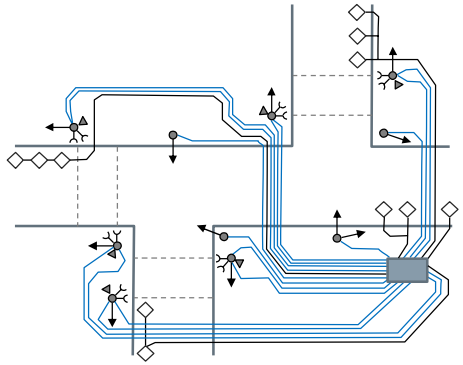
Plus+ Resilience by Design

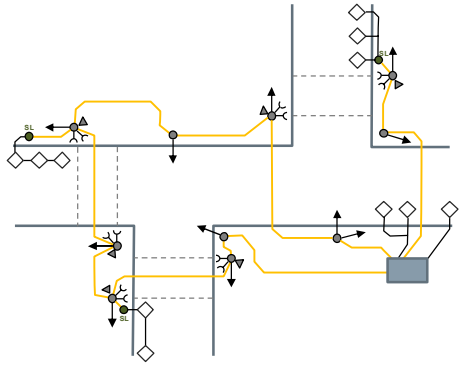


Components such as above ground detectors interface directly with Plus+, eliminating the need for any additional cables

Plus+ fully supports other components such as standard loop detectors and WiMag



Typical traditional cabling



Typical Plus+ cabling

Plus+ Resilience by Design

The Plus+ system has been designed from the 'ground up' and ensures high resilience to external damage or internal failure

Multiple data and power rings

Fully 'fail-safe' signal nodes

Redundant power supply options

High tolerance to cable damage

- System remains operational even if a ring is cut
- Able to withstand short circuits which may occur during cable damage events

Nodes are individually fail safe

- Failure of individual nodes does not result in loss of intersection control
- Nodes can be hot-swapped whilst signals remain on

Redundant power supplies

- Failure of a system PSU does not impact signal control.
- PSUs can be hot-swapped whilst signals remain on

Plus+ Integral Passive Safety

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Plus+ offers inbuilt passively safe pole disconnection

- Impact sensors are built into signal nodes
- Configurable to disconnect individual poles, arms or rings

Fully compatible with Siemens new range of passively safe poles

Plus+ Tools

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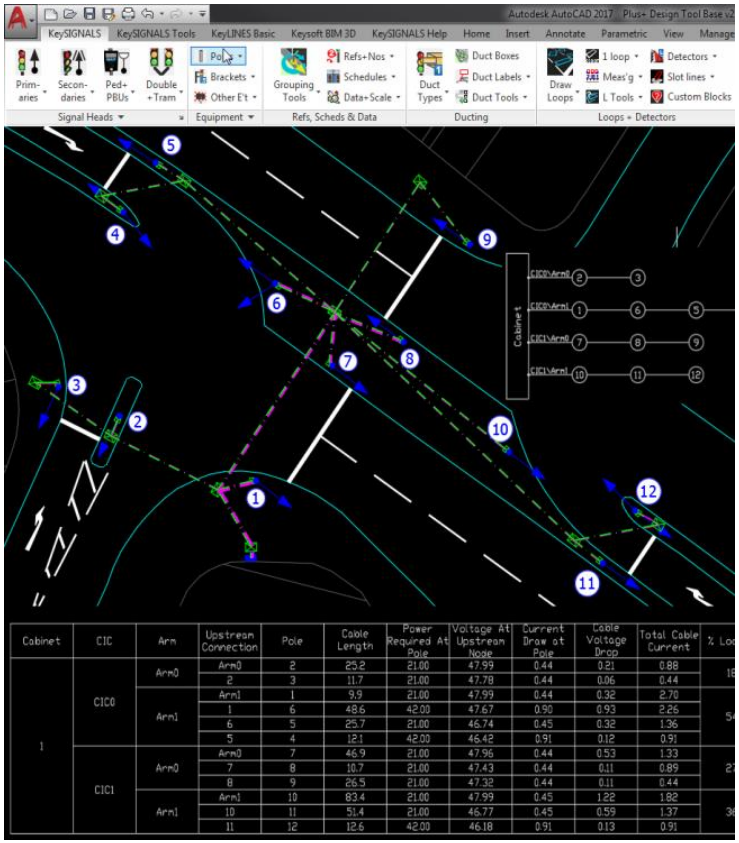
Plus+ Resilience by Design



Cabinet	CIC	Arm	Upstream Connection	Pole	Cable Length	Power Required At Pole	Voltage At Upstream Node	Current Draw at Pole	Cable Voltage Drop	Total Cable Current	% Lo
1	CIC0	Arm0	Arm0	2	25.2	21.00	47.99	0.44	0.21	0.88	
			2	3	11.7	21.00	47.78	0.44	0.06	0.44	
		Arm1	Arm1	1	9.9	21.00	47.99	0.44	0.32	2.70	
			1	6	48.6	42.00	47.67	0.90	0.93	2.26	
			6	5	25.7	21.00	46.74	0.45	0.32	1.36	
			5	4	12.1	42.00	46.42	0.91	0.12	0.91	
	CIC1	Arm0	Arm0	7	46.9	21.00	47.96	0.44	0.53	1.33	
			7	8	10.7	21.00	47.43	0.44	0.11	0.89	
			8	9	26.5	21.00	47.32	0.44	0.11	0.44	
		Arm1	Arm1	10	83.4	21.00	47.99	0.45	1.22	1.82	
			10	11	51.4	21.00	46.77	0.45	0.59	1.37	
			11	12	12.6	42.00	46.18	0.91	0.13	0.91	

Plus+ offers advanced tools to ensure optimum intersection design

- Closely linked with KeySignals
- Automatically captures data such as pole / signal head / phase relationships
- Optimises cable and civil infrastructure requirements
- Ensures all Plus+ design guidelines are met for maximum system reliability

The components, tools and Resilience By Design of the Plus+ technology ensures that a Plus+ intersection is as efficient as possible to install and offers the highest level of availability throughout its design life

But its not all about the technology!

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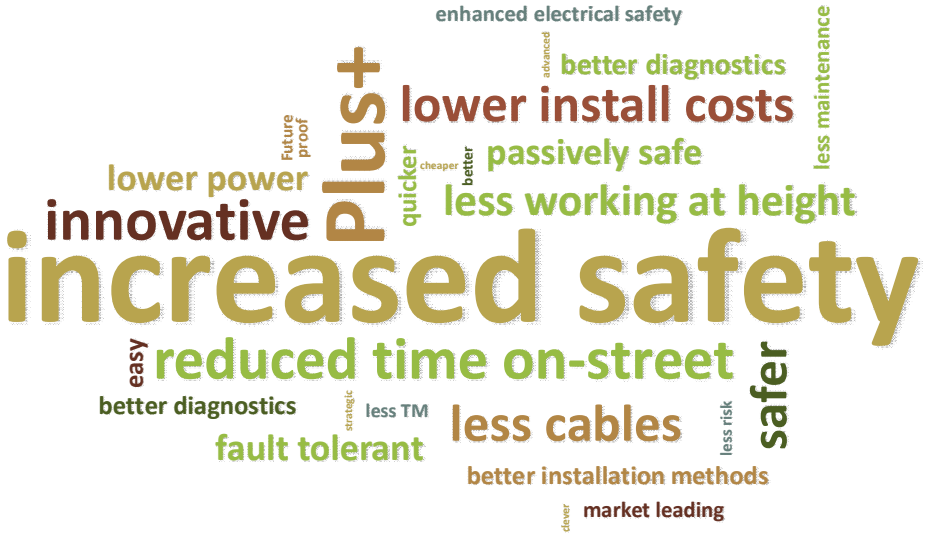
Plus+ will deliver significant reductions in on-street installation and maintenance time, improved safety and reductions in total deployment costs



But its not all about the technology!

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Plus+ will be safer to install than conventional deployment methods

Safer to install

- Operatives need be on-street for less time so less exposed to risk and also reducing public disruption
- Fewer, lighter cables
  - Less chance of injury when handling, pulling and terminating cables
- Cabling approach makes use of low-level access poles much easier
  - Further potential to reduce working at height
- Cabling approach makes pre-assembly of poles and heads in depot much easier
  - Potential to further reduce on-street working time

System methodology reduces other risks

- Plus+ only supports ELV
  - Ensures no electric shock risk on-street for either operative or the public
- Inbuilt system self checking makes misconnection of signals much less likely
  - Significant protection against false signals being presented on-street due to error or deliberate acts
- Reduced need for multiple cabinets on larger sites, minimising handling risks
  - Full cabinet distribution catered for in later development phase

But its not all about the technology!

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Plus+ will be easier (and safer) to maintain than conventional deployment methods

Quicker and easier to maintain

- Fewer cables so reduced need for expensive cable core testing and validation
  - Less cables and completely ELV solution will also mean less cable faults
- Better diagnostics and more specific fault identification
  - On-street faults identified to individual poles / locations so less time wasted 'finding' the fault before fixing it
- Easy module replacement
  - If faulty, most on-street modules can usually be exchanged with signals on, maintaining junction safety during maintenance activity

System methodology offers other benefits

- Plus+ will be more robust and offer higher availability than current solutions
  - Even complete failure of an on-street module can be tolerated, ensuring signals remain on, reducing the number and hence cost of short notice "all-out" callouts
- Greater tolerance to cable faults
  - Design concept supports 'ring' architecture so that a single cable fault or severed cable typically will not result in controller shutdown
- Detailed equipment inventory
  - Full on-site inventory available remotely allowing better planning of on-site maintenance

But its not all about the technology!

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Plus+ will be will be cheaper to install than conventional deployment methods

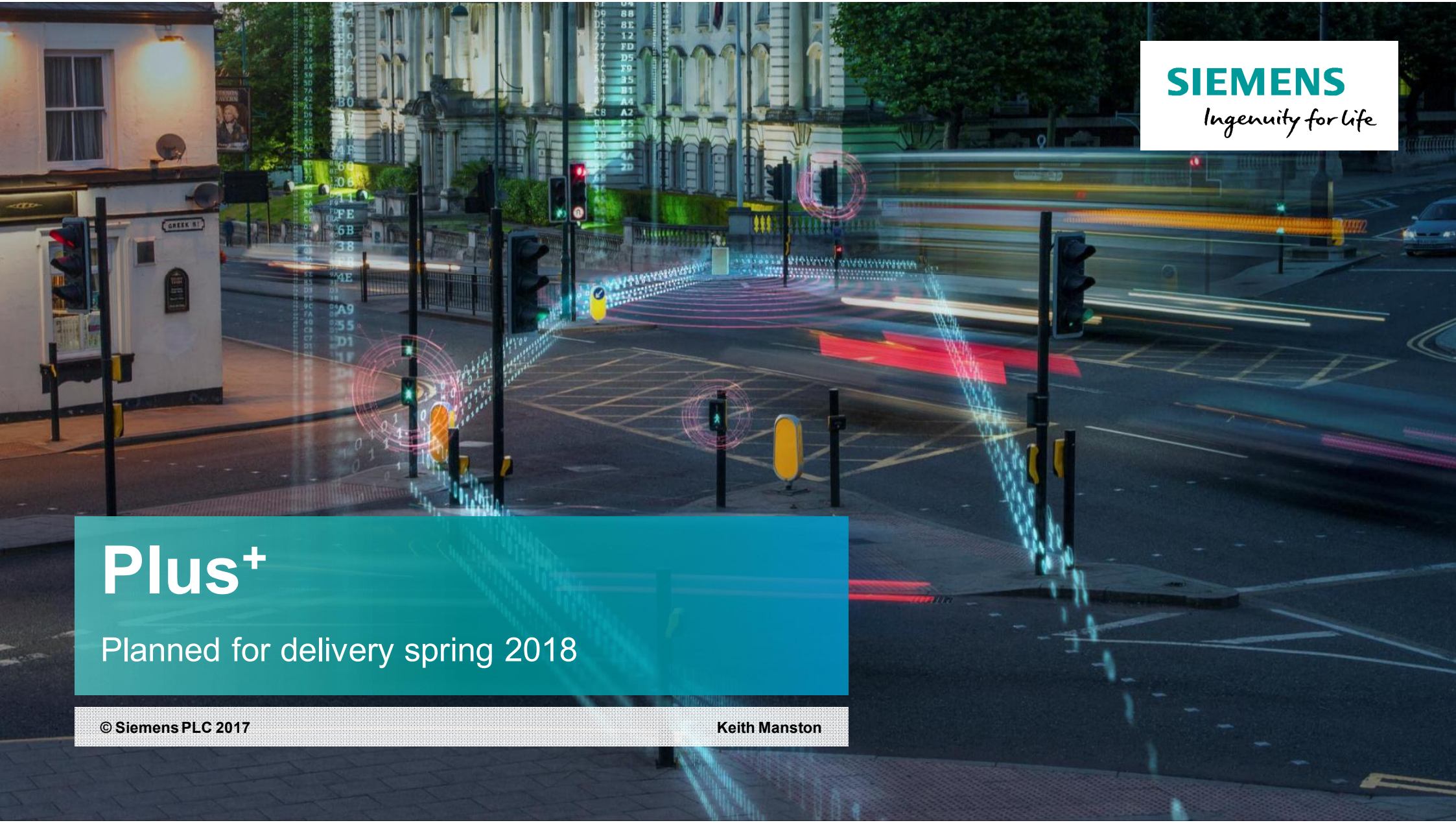
Quicker and cheaper to install

- Significantly fewer cables on-site
  - Reduced cost of cable
  - Reduced cost of terminating cables
  - Reduced cost of indenting cables – not required!
  - Reduced reduced cost of testing cables
- Reduced civil costs including TM
  - Significantly reduced ducting requirements
- Potential to significantly reduce on-street working time, particularly with ‘build in depot’ approach

System methodology offers other benefits

- Reduced cabinet count in larger sites
  - Less need for expansion cabinets often required to accommodate many cables
  - No need for separate ‘passively safe’ equipment cabinets
- Opportunity for smaller cabinets and potential ‘in-ground’ installation
  - Outline designs already considered – will be implemented if sufficient demand is apparent
- Offers future-proof solution
  - Designed to accommodate Ultra Low Power LED solutions in the future

But its not all about the technology!



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Plus+

Planned for delivery spring 2018

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