JCT 2013

Passive Poles – Active Thinking

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Presentation content

- Detailed look at the new Siemens design and risk assessment process for passively safe systems
- Detailed look at the new Siemens structural analysis process for passive poles
- Other equipment considerations
- The Siemens Passively Safe Systems project
- Questions

Some provocative statements!

Passive safety at traffic signals is expensive and a waste of taxpayers money!

The use of passively safe poles create more risks than they solve!

Passively safe solutions are rarely installed properly and consequently don't really perform!

Passive poles are weak and will fall over in strong winds!

Like all such statements these contain an element of truth, but the **correct and appropriate use** of passively safe solutions at traffic signals can improve overall safety

Some issues

Extensive published material on this topic exists

But often the full implications of using passive poles are still not well understood by many

Some perceived problem areas:-

- Lack of knowledge of the subject and real understanding of all the practical product limitations, particularly basic pole strength
- Blinkered implementation, where full account of all risks are not fully understood or considered when selecting pole types

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Risk Assessment

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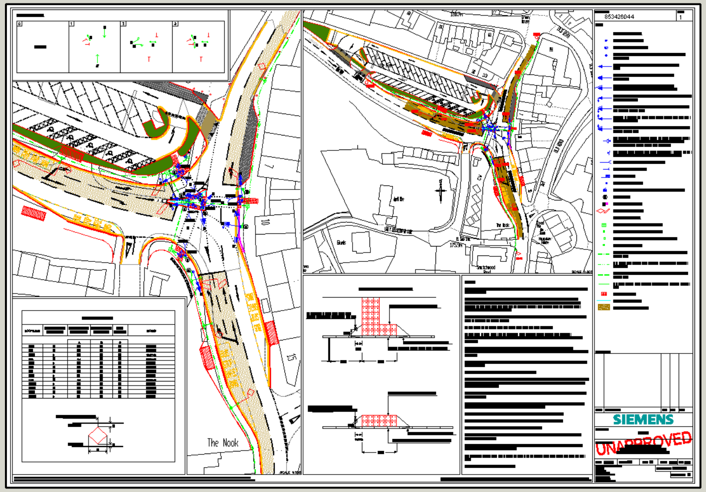
Traffic signal design

The designer of a traffic signal control scheme is required to consider all potential proven alternatives for a particular component and select an option with the aim of ensuring that risks are kept as low as reasonably practicable

The designer should prepare risk assessments for all aspects of the system and its physical and human context throughout the complete life cycle

- Construction, installation and testing to operation, maintenance and eventual decommissioning.



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Traffic signal design

Project scope

Design considerations

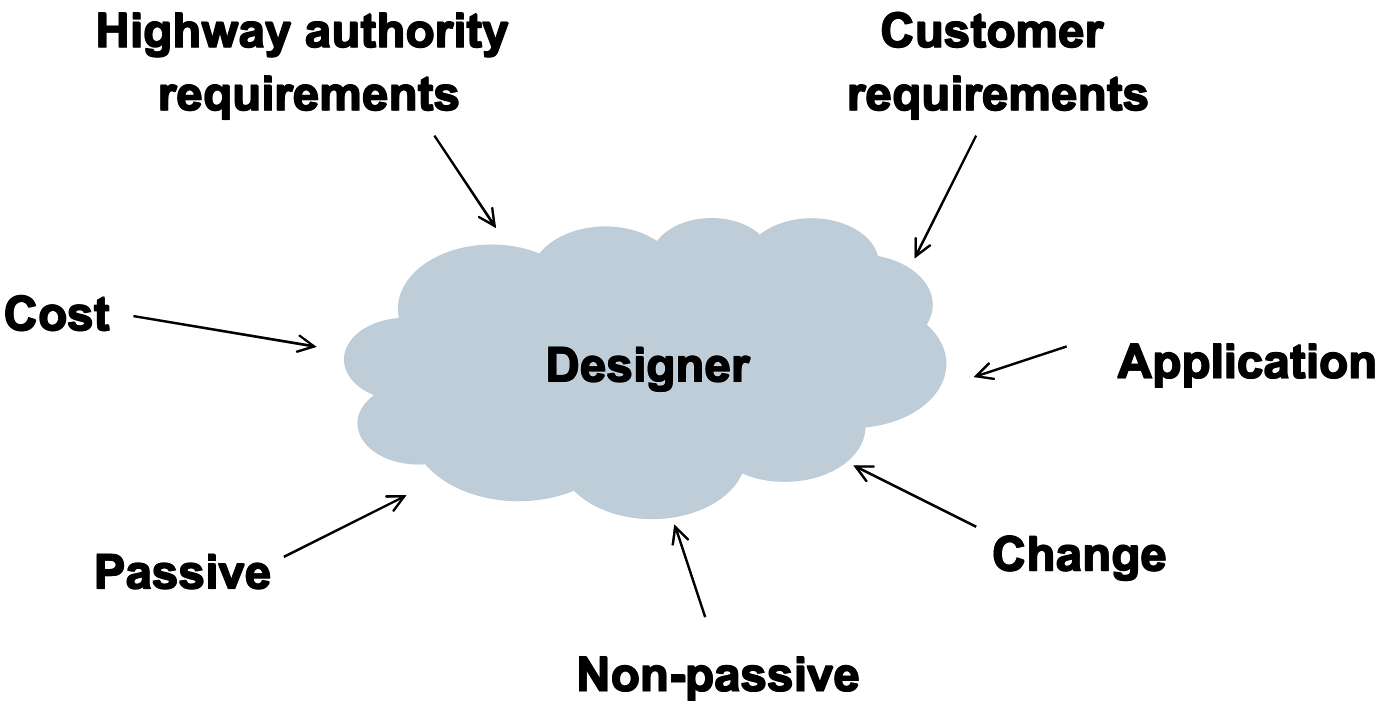
Equipment specification

Design Risk assessment

Traffic signal design

Pole choice

Pole choice



How should a designer decide on a pole type?

Pole choice

Considerations

- Location of the pole
- Speed of the road
- Volume of road users; vehicles, cyclists, pedestrians
- Required equipment on the pole
- Mounting of equipment
- Structural integrity of the pole
- Pole installation
- Electrical connection
- Associated equipment
- Cost
- Future maintenance

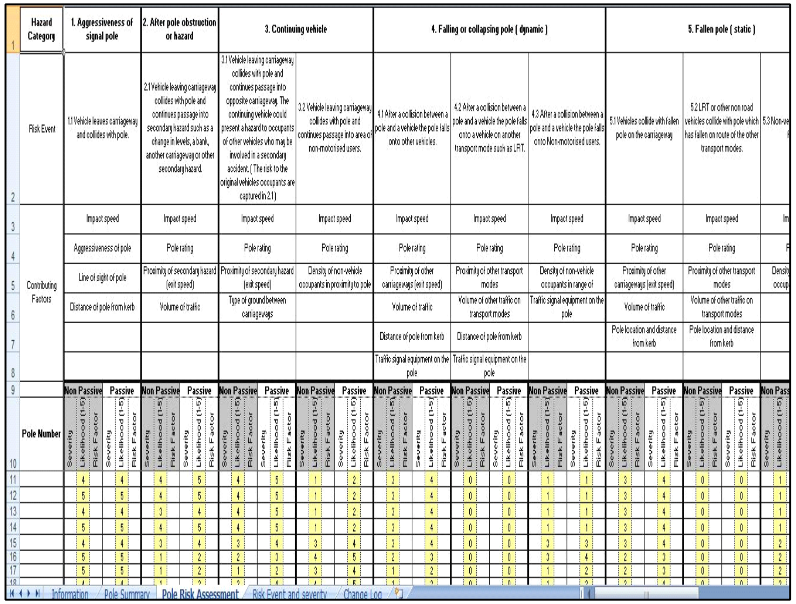
Pole choice

Risk assessment

Assessment of pole type against different risk events to determine a Risk Factor

Risk Factor = Severity x Likelihood

- Severity Factor calibrated over number of schemes to provide un-biased approach
- Likelihood assessed by the designer



Further considerations

Determine the size of each traffic signal pole based on:
•Wind pressure at a particular site
•The configuration of signal equipment mounted on the pole

Design summary

Pole choice is an important part of the overall traffic signal design process

Scheme designers should be satisfied that they have used a robust method to determine and record pole type choice

Full documentation of the desired pole type within the design will help to ensure that the design is correctly implemented by the installation company

Siemens designers are using a risk assessment based process to determine pole type and further design tools to assess structural suitability of passive poles

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Structural strength assessment

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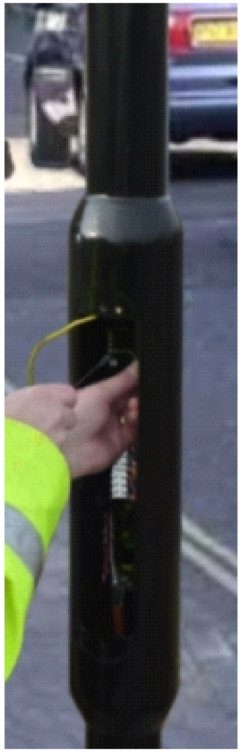
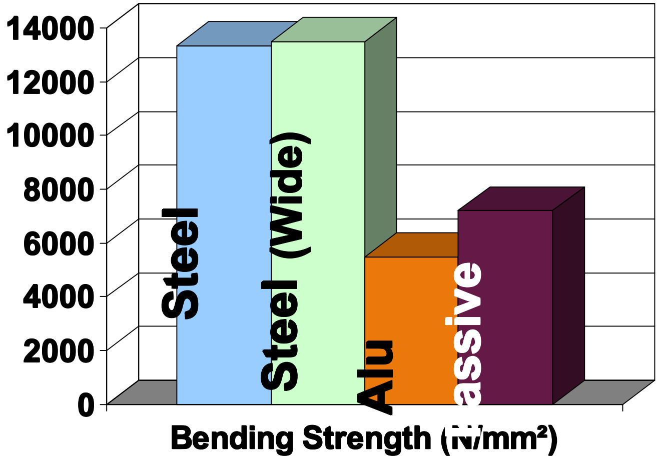
Relative pole strengths

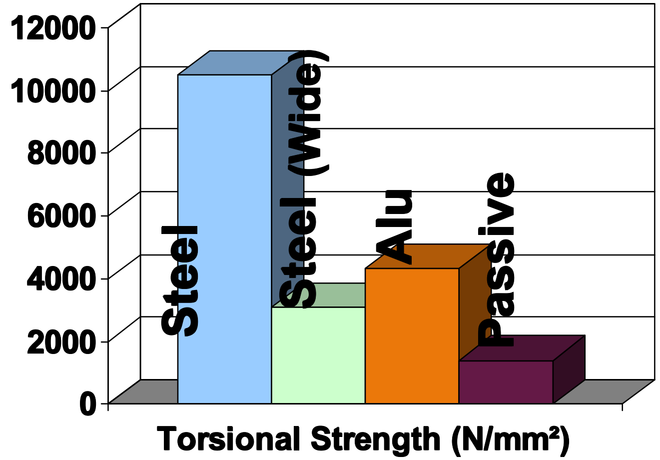
The Industry is used to steel poles, without access doors

'These are strong in bending and torsion so have few limitations in the UK at 4m height'



- Low level access door cut-outs significantly reduce the pole strength, especially in Torsion
- Materials used for Passive Poles are generally weaker
- EN40, which is widely used to calculate door aperture strength, over estimates Torsional strength

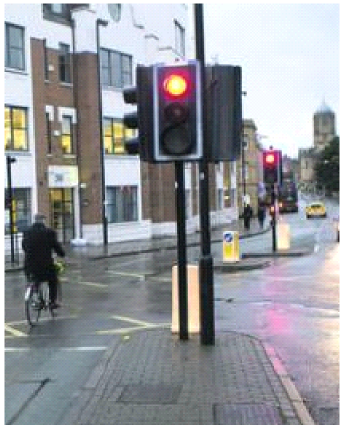


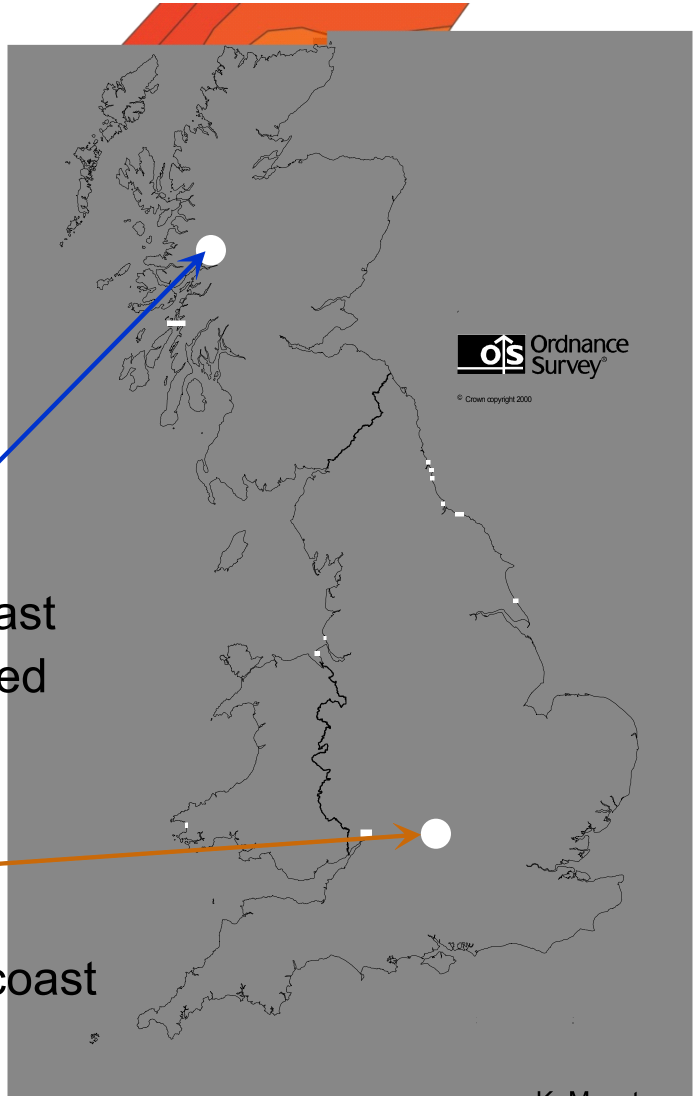


Wind Loads vary significantly throughout the UK

Wind Pressures affected by:

- Basic wind speed
- Altitude
- Distance to coast
- Height above ground
- Orography
- Terrain category





Fort William
Close to exposed coast
High basic Wind speed

Oxford
Built up location
Low basic Wind speed
Long distance from exposed coast

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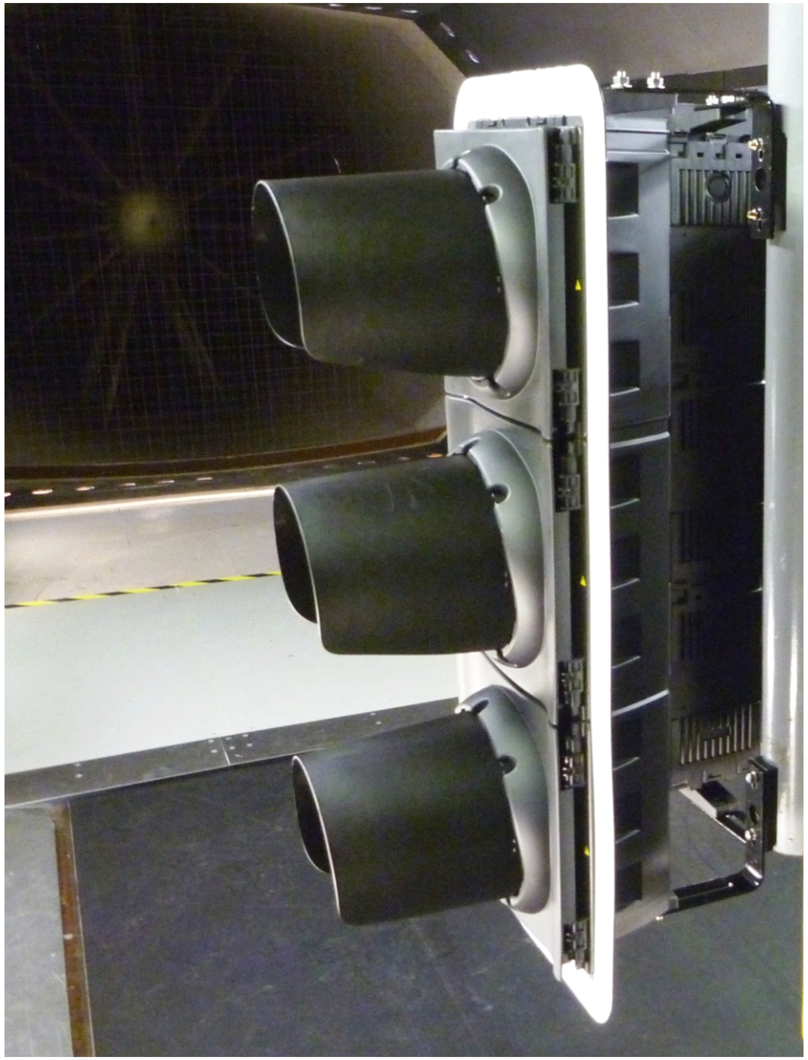
Forces exerted by traffic signals

- A lot of published data is available for the shape factors (drag) to use for various sized signs and poles
- Very little data available for the wind loads generated by traffic signals
- Engineers used Shape factors (Cd) ranging from 1 to 1.8 to calculate loads
- Inconsistency gave very different answers when it came to specifying suitable poles
- Decided to carry out detailed wind tunnel testing out at the University of Southampton’s RJ Mitchell tunnel
- Numerous configurations of signal head were tested at varying wind speeds and incident angles



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Making sense of the Wind Tunnel data

From the data obtained at the wind tunnel, we have extrapolated the loads, for the most common configurations, in terms of:

Specific Force (SF)

Specific Torque (ST)

These figures are forces per unit of wind pressure so they can be easily applied to any application in the UK.

Case	Table	Configuration	SF (m^2)	ST (m^3)
1	17	No Equipment Fitted	0	0
2	18	1x3	0.64	0.14
3	19	2x3	0.94	0.21
4	20	3x3	1.77	0.31
5	21	4x3	1.77	0.31
6	22	1x4	0.87	0.16
7	23	2x4	1.28	0.24
8	24	3x4	2.41	0.35
9	25	4x4	2.41	0.35
10	26	1x(3+1)	0.86	0.22
11	27	2x(3+1)	1.26	0.33
12	28	3x(3+1)	2.37	0.49
13	29	1x3 + (3+1)	1.16	0.29
14	30	2x3 + (3+1)	1.99	0.39
15	31	3x3 + (3+1)	1.99	0.39
16	32	1x4 + (3+1)	1.27	0.33
17	33	2x4 + (3+1)	2.41	0.41
18	34	3x4 + (3+1)	2.41	0.41
19	35	1x3 + 1x4	1.28	0.24
20	36	1x3 + 2x4	2.41	0.35
21	37	1x3 + 3x4	2.41	0.35
22	38	1x4 + 2x3	2.00	0.33
23	39	1x4 + 3x3	2.00	0.33
24	40	1x(4+1)	1.08	0.26
25	41	1x(3+2)	1.21	0.33

Calculation for 1x3 & 3+1 signal

(Assumed wind pressure for location = 900Pa)

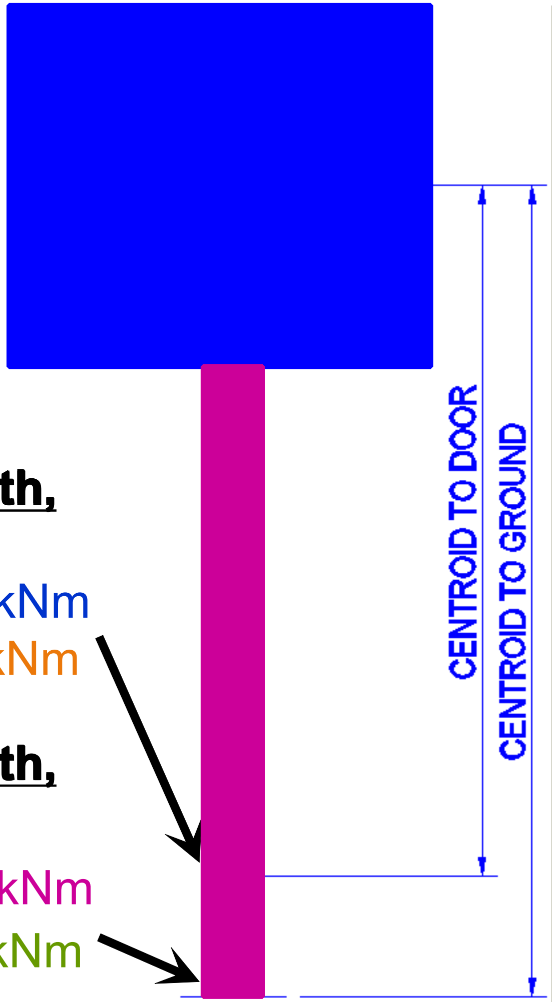
Specific Force $_{(1x3)+(3+1)}$ (SF) = 1.16m^2

Specific Torque $_{(1x3)+(3+1)}$ (ST) = 0.29m^3

Force due to Signal Heads = 1.16 x 900Pa = **1044N**

Torque due to Signal Heads = 0.29 x 900Pa = **261Nm**

Calculating pole suitability



Pole strength, door

Mu_{Door} = 7.2kNm

Tu_{Door} = 1.4kNm

Pole strength, ground

Mu_{Base} = 6.5kNm

Tu_{Base} = 7.6kNm

This may appear complicated, but can be very simply translated in a simple Excel Spreadsheet.

140	**Combined about Ground**		
141	Total Bending Moment	3894.12	Nm
142	Total Torsional Moment	261.00	Nm
143			
144	**Total Bending Factor about Ground**	**0.85**	
145	**Overall Torsional Factor about Ground**	**0.05**	
146	**TOTAL FACTOR ABOUT GROUND**	**0.89**	**ADEQUATE**
147			
148	Combined about Door		
149	Total Bending Moment about Door	3379.43	Nm
150	Total Torsional Moment about Door	261.00	Nm
151			
152	**Total Bending Factor about Door**	**0.51**	
153	**Overall Torsional Factor about Door**	**0.22**	
154	**TOTAL FACTOR ABOUT DOOR**	**0.73**	**ADEQUATE**

Our aim is to simplify this process as much as possible without compromising on safety.

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Next steps

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Other “thorny” issues to be resolved

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Electrical disconnection systems

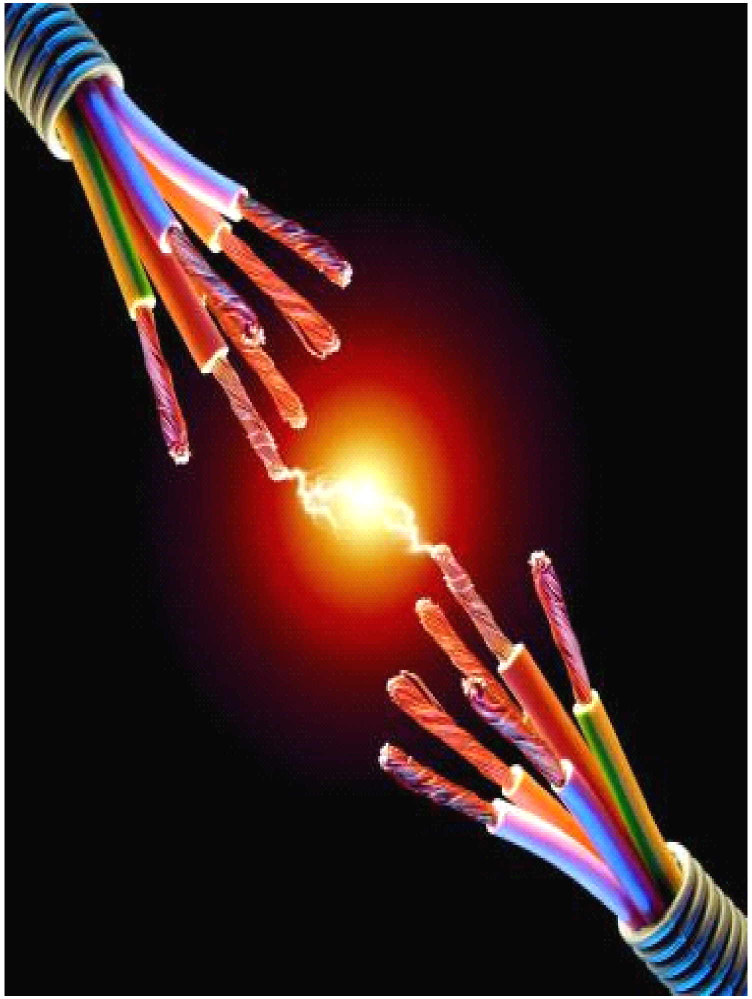
- Are these really necessary, what are they trying to protect against?

Physical break-away systems

- Is it reasonable to install passive poles without physical breakaway systems or should these always be used?

Opinion is widely divided on these topics but a degree of rationality needs to be brought to the discussion

Do you have evidenced views to help clarify thoughts in this area?



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Bringing it all together
The Siemens Passively Safe Systems Project

Aims of the project

Research and work with suppliers to agree set of acceptable poles to be used (from a structural viewpoint)

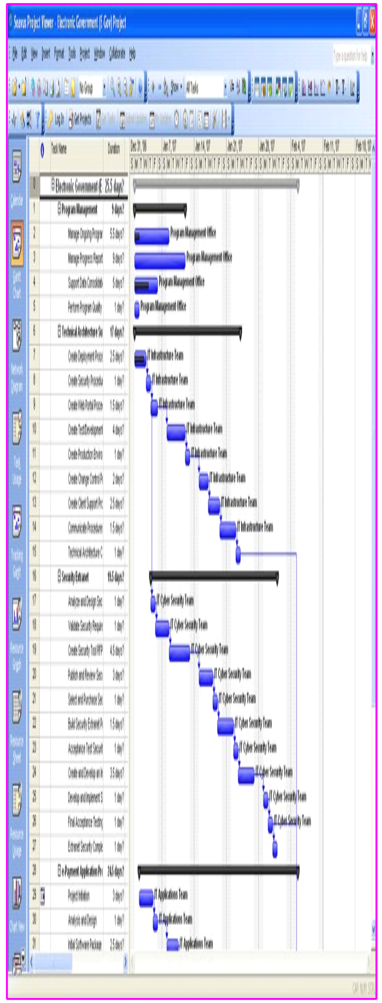
- Ensure that passively safe sites are not only safer for drivers, but also meet the structural requirements of BS EN 12899
- Help designers understand how to use our Wind Tunnel data (available from http://www.siemens.co.uk/traffic)
- Streamline the design processes to make it is easier to select the correct traffic signal poles without requiring a deep technical knowledge

Research and agree full set of associated equipment

- Seek guidance and advice from current users, suppliers and the HA

Finalise the Siemens design and specification process for passively safe systems

- Publish as ‘best practice’ to be used by Industry if desired



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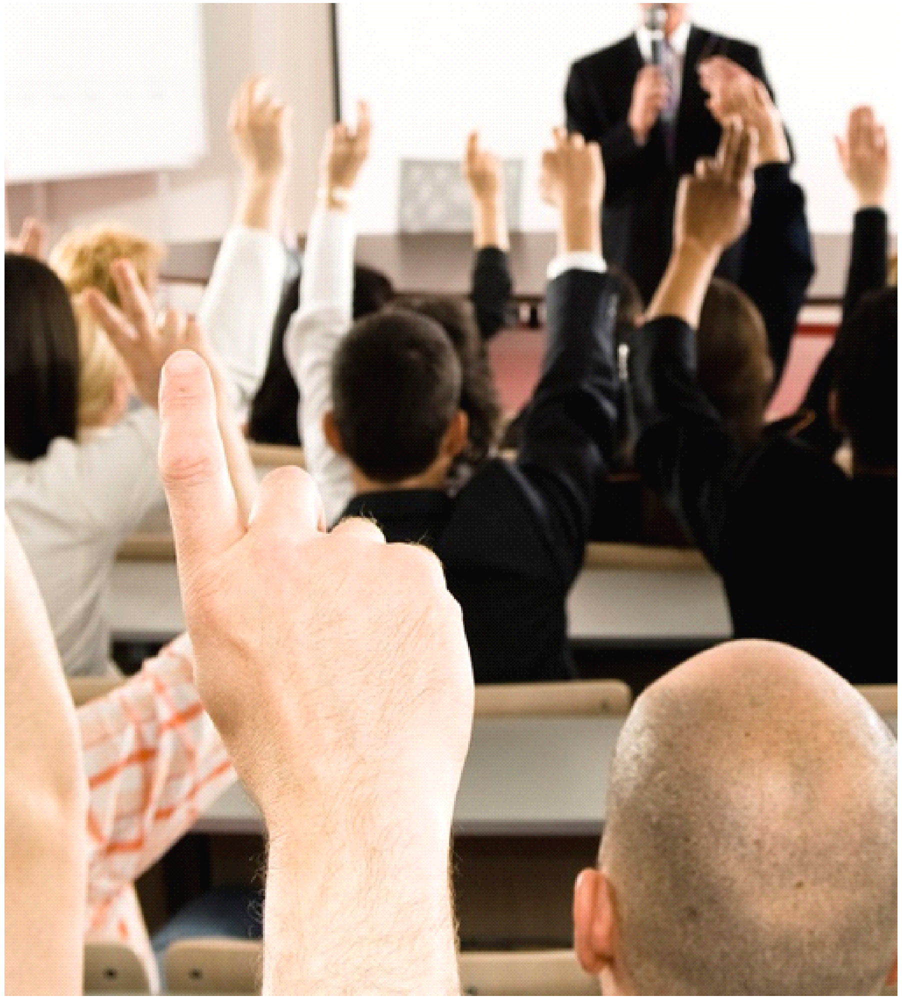
Questions?



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