British Precast Drainage Association

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All CPSA and BCA web traffic will be redirected to the new BPDA web site at www.precastdrainage.co.uk

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BRIEFING PAPER: DISCREPENCIES WITH KIJLSTRA'S MANHOLE CARBON FOOTPRINT COMPARITIVE REPORT

A number of data sourcing and assumption discrepencies are found in the Kijlstra Carbon Footprint report comparing 2, 4, and 6 metre deep Kijlstra square manhole systems (sizes 800, 1000, 1250mm) with what was claimed to be equivalent sizes of tranditional circular manhole systems (DN 1050, DN1200 and DN1500). These are detailed below:

FUNCTIONAL UNITS & EN 752

To conduct any environmental impact assessment study there is a need for an appropriate **functional unit**. Functional Units are defined in ISO 14044 and PAS 2050 as the *quantified performance of a product system for use as a reference unit*. ISO 14044, section 4.3.2.7, states that "*in a comparative study... Systems shall be compared using the same functional unit and equivalent methodological considerations, such as performance, system boundary, data quality, allocation procedures, decision rules on evaluating inputs, and outputs and impact assessment.* PAS 2050 identifies the same principles. The Kijlstra study bases the comparison on the notion that Kijlstra's 800, 1000 and 1250 mm manhole units (as product systems) have the same quantified performance of DN1050, DN1200 and DN1500 circular manhole units respectively. This contradicts with the quantified functional equivalence as currently defined by Table NA.22, of **EN 752: 2008** *Drains and Sewer Systems Outside Buildings*, for circular manholes compared will rectangular ones with **> 1.5** metre depth (no square manhole are found at EN752).

Type of access	*Depth to pipe soffit from cover level*	*DN largest pipe in manhole/ mean of descent into shaft*	*Minimum internal dimensions*	
			Rectangular length and width (mm)	Circular diameter (mm)
Manhole	*≥1.5*	*≤225*	*1200 x 1000*	*1200*
		300	*1200 x 1075*	*1200*
		375 – 450	*1350 x 1225*	*1350*
		500 – 700	*1500 x 1475*	*1500*
		750 – 900	*1800 x 1675*	*1800*
		>900	*1800 x (DN + 775)*	*The larger of 1800 or (DN + 900)*

Table 1. Extract from Table NA.22 (EN 752) recommended dimensions for the construction of new manholes and manhole shafts.

Table 2 shows the equivalent products proposed in the Kijlstra Carbon Footprint report and the correct functional equivalents. The discrepency has a significant impact on the findings of the study as the functional units compared are not equivalent and the claim that Kijlstra manholes "*are 65% more carbon efficient*" is distorted.

Circular m/h	*Kijlstra proposed square m/h functional equivalent*	*Actual Kijlstra functional equivalent*
1050mm dia	800 x 800mm	n/a
1200mm dia	1000 x 1000mm	1250 x 1250mm
1500mm dia	1250 x 1250mm	1500 x 1500mm

Table 2. Functional equivalent comparison between Kijlstra square manholes and standard circular units

USE OF SECONDARY INFORMATION: UK PRECAST CONCRETE DATA

For the carbon footprint of UK traditional concrete manholes, the Kijlstra study uses generic carbon footprint data sourced from the Inventory of Carbon and Energy (ICE), developed by Bath University. The carbon footprint figure used is **215 kg CO_2e per tonne**. Comments made by Bath University

researchers in the ICE document suggest that this value was **suspected to be significantly high**. It was found that the use of this value:

- Is not in accordance with ISO 14044 Section 4.2.3.6 (Data Quality Requirements) due to the absence of appropriate geographical coverage/representativeness. It is believed that some elements of this figure were sourced by Bath University from studies from other countries (such as the United States), where sources of energy, nature of practices and attitude to energy consumption are different to the UK.
- Is not in accordance with ISO 14044 Section 4.2.3.6 (Data Quality Requirements) due to the absence of appropriate technology coverage/representativeness: The carbon footprint value used for traditional manholes concrete in the study is based on a **C50** concrete mix with no fly ash or GGBS replacement to Portland cement (CEM I) to provide the required sulphate resistance. According to BS 8500: 2008, manholes should be manufactured using a mix with a substantial proportion of fly ash or GGBS replacing CEM I in the concrete and a much lower Portland cement content. This can have a considerable impact on the carbon footprint.

As a result, the Kijlstra report uses a carbon footprint of traditional manhole units which is inflated by over 25%. CPSA has undertaken a comprehensive study of the carbon footprint of precast concrete pipes and manholes which includes a detailed analysis of UK manufacturer's production facilities and the greenhouse gas emissions associated with their operations. It is believed that the actual carbon footprint of traditional manholes should be around **150 kg CO_2e/t**.

USE OF SECONDARY INFORMATION: READY MIXED CONCRETE DATA

The carbon footprint of the ready mixed concrete used in and around an installed tradtional concrete manhole unit was taken in the Kijlstra study as **129 kg CO_2e/t**. This was based on a **C20** grade concrete assumed[1]. The use of this value:

- May not be in accordance with ISO 14044 Section 4.2.3.6 (Data Quality Requirements) due to the absence of appropriate technology coverage/representativeness. The main specification for the wastewater industry (Sewers for Adoption 6th Edition) require manufacturers to use a **GEN3** ready mixed concrete for concrete manholes – this concrete designation requires less cement in its mix (up to 20 kg per m^3) and could reduce the carbon footprint by over 5%.
- Is not in accordance with ISO 14044 Section 4.2.3.6 (Data Quality Requirements) due to absence of appropriate technology coverage/representativeness as all local authorities and water companies in the UK require the concrete surround to be sulphate resistant (in accordance with BRE Special Digest 1). This will require replacing CEM I in the mix with fly ash or GGBS which can also reduce the carbon footprint considerably.

It is believed that if these two factors were accounted for in the Kijlstra study, the carbon footprint for in-situ concrete would have been taken as **90 kg CO_2e/t** or even a lower value.

ESTIMATION OF TRANSPORT TO SITE IMPACTS

The Kijlstra study considered an address in East London as the suggested construction site for the comparison. The study takes CPSA member, CPM Group Ltd as a "typical competitor/ UK traditional manhole manufacturer and considers CPM's North Yorkshire plant for the estimation of a distance (around 299 km) and transport emissions. The use of such assumption:

- Is not in accordance with ISO 14044 Section 4.2.3.6 (Data Quality Requirements) according to the stated goal of that study due to lack of proper representativeness and precision. CPM Group

[1] It is thought that the carbon footprint values were quoted from Bath University ICE Database.

is only one of a number of UK traditional concrete manhole manufacturers – these manufacturers are based at a number of manufacturing sites in the South East, South West, Midlands, and Yorkshire. CPM Group have other manufacturing sites located closer to East London. One CPSA manhole manufacturer, Milton Precast Ltd is located in Sittingbourne, Kent 70 kilometres away from the construction site considered for the study. CPM's North Yorkshire factory has the longest distance from the construction site considered by Kijlstra's study. This distance choice also had an impact on the overall result of the study.