



ELEMENT
SUSTAINABILITY

ROYLE ROAD, ROCHDALE LIFE CYCLE ASSESSMENT

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ELEMENT SUSTAINABILITY

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1. INTRODUCTION

Element Sustainability has been commissioned by BMC Rochdale Limited to undertake a Life Cycle Assessment (LCA) of the proposed construction of 75 self-contained apartments (Use Class C3), comprising 38 No.1-bedroom apartments and 37 No.2-bedroom apartments, with extra care light facilities, residents' facilities, associated landscaping, parking, a new access and internal access road Royle Road residential apartment building located in Rochdale. In order to understand what impact, the scheme will have on the environment, regarding both embodied and whole life carbon. This also enables comparisons to be made against industry benchmarks.

An LCA has been prepared to show compliance with Greater Manchester Combined Authority's 'Places for Everyone' (PfE) Design Guidance for Net Zero requirements. This assessment aims to show compliance with the net zero design and carbon reporting requirements set out in the 2025 guidance.

The purpose of this assessment is to assess the whole life carbon impact of the proposed scheme, in line with the Royal Institute of Chartered Surveyors (RICS) Professional Statement 2nd edition (incorporating all life cycle modules), and to separately report on the upfront embodied carbon (lifecycle modules A1–A5), whole life cycle carbon (lifecycle modules A-C, excluding B6, B7 and D), and life cycle module D.

The primary metric used to analyse the Global Warming Potential (GWP) of the scheme is expressed in terms of carbon dioxide equivalent (CO₂e), often referred to as carbon emissions. Whole Life-Cycle Carbon (WLC) emissions are the carbon emissions resulting from the materials, construction, and use of a building over its entire life, including its demolition and disposal.



2. PROJECT DETAILS

2.1 Project Details

The mandatory asset-related technical characteristics for the project are set out within Table 2.1 as per the requirements of the RICS Professional Statement.

Table 2.1 - Key Project Details

Category	Project Details
Project Name	Royle Road, Rochdale
Asset type	New construction – Residential Apartments
Development Proposal	Construction of 75 self-contained apartments (Use Class C3), comprising 38 No.1-bedroom apartments and 37 No.2-bedroom apartments
Gross Internal Area	5,679m ²
Number of Storeys	5 floors (including ground)
Location	Royle Road, Castleton North, Trub, Rochdale, OL11 3
Anticipated start-on-site and completion dates.	TBC

The mandatory assessment details for the project are set out within Table 2.2 as per the requirements of the RICS Professional Statement.

Table 2.1 - Key Assessment Details

Category	Assessment Details
Assessed by	Element Sustainability Limited
Date of Assessment	March 2026
Project Phase	Concept Design – Planning Stage
Assessment Scope	Fully fitted



Figures 2.1-2.3 below demonstrate the proposed elevations and Ground Floor Plan for the scheme:

Figure 2.1 – Proposed West Elevation



Figure 2.2 – Proposed Front and Rear Elevation



Figure 2.3 – Proposed Ground Floor Plan



3. LIFE CYCLE ASSESSMENT

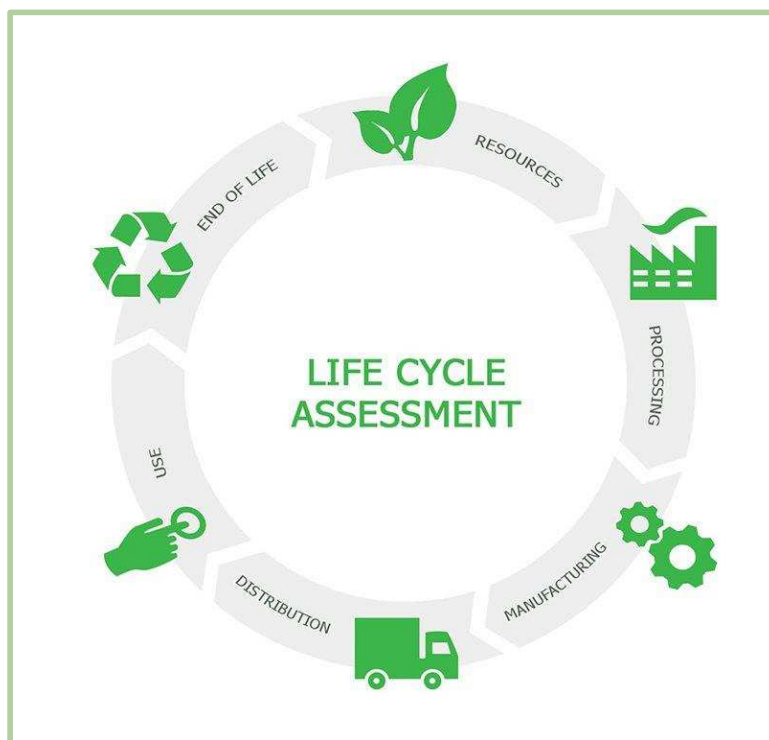
3.1 Definition

Building Life Cycle Assessment (LCA) is a science-based methodology for quantifying the lifetime environmental impacts of a building. It is used to measure and reduce the embodied, and whole-life carbon of a building. The embodied carbon refers to the emissions arising from the extraction, manufacture, transportation, installation, maintenance and disposal of all building materials.

Typically, the assessment is used to calculate the overall environmental footprint of a product and then identify design measures to reduce the carbon emissions associated with each stage of the project's lifecycle.

The following image shows a LCA model that would apply to a scheme within the built environment.

Figure 3.1 – Lifecycle Stages of a Building



Source: OneClickLCA



3.2 Methodology

The RICS Professional Statement mandates a whole life approach to reducing carbon emissions within the built environment. It is intended to standardise whole life carbon assessments and enhance consistency in outputs by providing specific practical guidance for the interpretation and implementation of the methodology stipulated by EN 15978. This assessment has been conducted in line with the RICS Professional Statement.

One Click LCA Carbon Designer 3D software was used to undertake this life cycle assessment, as it is a compliant and recognised tool to conduct life cycle assessments, in accordance with the following standards:

- BS EN 15978: 2011 – Sustainability of Construction Works – Assessment of Environmental Performance of Buildings - Calculation Method;
- ISO 14040 2006: Environmental Management – Lifecycle Assessment – Principles and Framework; and,
- ISO 14044 2006: Environmental Management – Lifecycle Assessment – Requirements and Guidelines.

Carbon Designer 3D has been used for this project due to the project being in the early stages of the design process, detailed information on the construction materials and quantities for this project were not readily available. The data used within the model were provided by the design team or extracted from the necessary plans and Concept Design (Stage 2) specification documents, as listed below:

- 4523_Royle Road.

The LCA templates selected for this assessment match the details of the materials provided and, where certain material templates were not available, a similar product was then selected from those available within the extensive One Click database.

One Click LCA default scenarios were used to facilitate the carbon calculations for this scheme, as set out below:

- Service life values were set to the 'RICS 2nd Edition Default Service Life';
- Transportation distances for materials were set to reflect UK construction best practice;
- The 'End of Life' calculation method used reflects market scenarios, which utilises the most typical method for that material in the market;
- Country specific end of life scenarios were set to 'United Kingdom – RICS V2'; and,
- The study period was set at sixty years in line with the methodology outlined in the RICS Professional Statement.

The LCA undertaken for this report will demonstrate the environmental impact of the proposed scheme in terms of its Global Warming Potential (GWP), which represents the impact of all greenhouse gases on a carbon dioxide basis emitted as a direct result of the building.



3.3 Scope

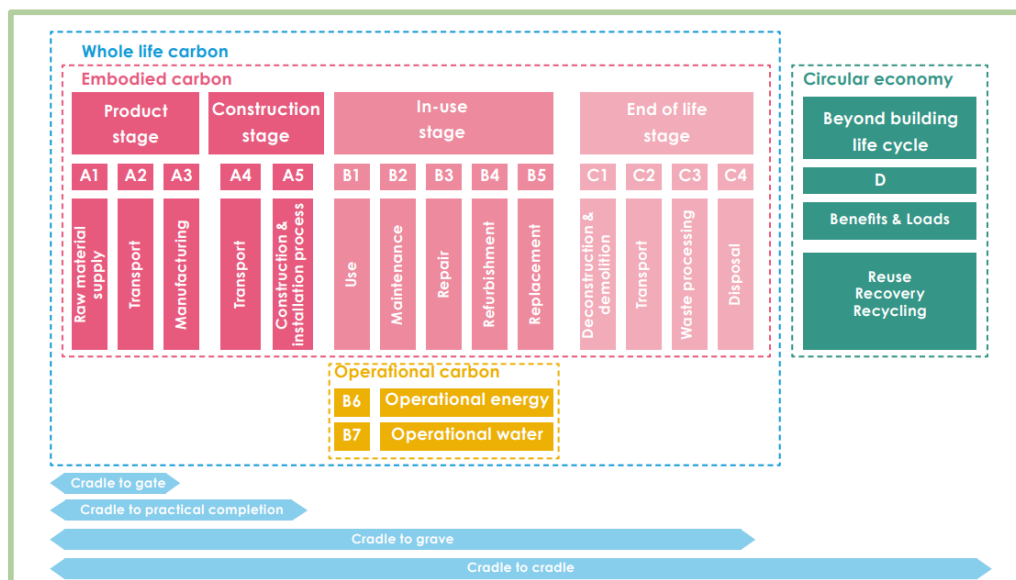
The LCA undertaken for this report will cover the (Concept) RIBA Stage 2 design and be assessed in accordance with the RICS Professional Statement 2nd Edition (2023). Consequently, all lifecycle modules have been included.

The assessment scope has therefore considered the following elements:

- Demolition;
- Facilitating Works;
- Substructure;
- Superstructure;
- Finishes;
- Fittings, Furnishings and Equipment;
- Public Health;
- Heating, Ventilation and Air Conditioning (HVAC);
- Electrical Installations;
- On Site Renewable Energy; and,
- External Works.

The 'study boundary' has been defined, as per the life cycle modules set out in Figure 3.2 below:

Figure 3.2 – EN 15978 Assessment Scope



Source: LETI Embodied Carbon Primer.

The focus of this assessment is on the environmental impacts of the project, in particular the embodied carbon of the materials sourced, and energy consumed in the manufacturing, transportation, assembly, in use and the end-of-life stages of the scheme.

3.4 Assumptions

This assessment is being conducted during RIBA Stage 2 (Concept Design); therefore, design detail is limited and will be considered further as the scheme progresses through to the Technical Design Stage. A number of assumptions were consequently used in order to complete the baseline assessment. The RICS Professional Statement has provided reasonable assumptions, based on UK average industry standard practice, which must be used during the early design phase whole life carbon assessments (WLCA's) that are to act as baselines for progressive reporting. This data should be refined during later project phases and replaced by more comprehensive and product specific information as it becomes available.



3.5 The Contingency Factor

When costing projects, it is common for contingencies to be used to reflect uncertainties. For WLCA's, there are similar uncertainties, particularly during the early design phase when far less is known about the final design and materials.

This uncertainty is managed by developing a WLCA uncertainty factor, which is made up of three component parts.

1. A contingency factor;
2. A carbon data uncertainty factor; and,
3. A quantities uncertainty factor.

3.5.1 The Contingency Factor

The contingency factor used for this assessment is aligned with the early design information listed in Table 3.2 below, which was extracted from the RICS Professional Statement.

Table 3.2 – RICS Professional Statement Default Contingency Factors

RICS project phase	RIBA stage	Default contingency factor to apply to all life cycle stages and modules	Additional uncertainty factors
Early design	0-2	15%	-
Technical design and construction	3-5	6%	Carbon data uncertainty factor and quantities uncertainty factor
Post-completion	6	0%	Carbon data uncertainty factor and quantities uncertainty factor

In order to account for uncertainty and lack of detailed or complete information, particularly during the early design phases, the contingency factor has been applied to the results for each life cycle information module and element category and reported separately in Section 4 of this report.

3.5.2 The Carbon Data Uncertainty Factor

During early design stages, it is best to use generic data to represent products and materials, as it is generally not clear which exact products will be used, and from where and which manufacturers they will be sourced. There is, therefore, considerable uncertainty as to whether the dataset chosen will accurately represent the product that is finally selected, and **it is therefore, inappropriate to use the carbon data uncertainty factor during the early design phase.**



3.5.3 The Carbon Data Confidence Score Approach

Carbon data confidence scores are calculated for each of the key products used in the asset. Key products are identified as the ten most impactful products or materials in terms of the percentage of the asset's embodied carbon impact (modules A1–A5, B1–B5, C1–C4).

However, this is only required during the technical design, construction and post-completion phases; the asset carbon confidence score produced using this method must be reported in the WLCA report, together with the percentage of the asset's overall upfront and embodied carbon for which the key products are responsible.

3.5.4 The Quantities Uncertainty Factor

A quantities uncertainty factor for key products (the most impactful products and materials used) provides an indication of the uncertainty associated with the quantities used for the WLCA.

However, this is only required during the technical design, construction and post-completion phases, when the quality of the quantities data must be assessed for each of the key products: the ten products or materials that cause the greatest impact for the asset.

3.5.5 The Whole Life Cycle Uncertainty Factor

The total percentage figure to be added to the WLCA is therefore a combination of the contingency factor, the carbon data uncertainty factor and the quantities uncertainty factor. For the purpose of this assessment, only the contingency factor will be used to determine the level of uncertainty in line with the minimum requirements of the RICS Professional Statement. It is, however, advised that the entire whole life cycle uncertainty factor is calculated at the Technical Design Stage to entirely align with the RICS Professional Statement methodology.

3.6 Limitations

The One Click LCA predictions of embodied impacts conducted in One Click LCA software, by their very nature, cannot be exact. It is not possible to track all the impacts associated with a product or service back through history. One Click LCA software has been built and tested to enable informed decisions when comparing design options. Generic environmental impact coefficients do not necessarily correspond to those of individual brands of the same product or service due to differences within industries and in the way these products and services are delivered.

Due to the nature of Whole Life Carbon Assessments, certain assumptions and default values can be used, to fill any gaps throughout the early design stages. Therefore, the service life of the materials inputted have been based on the latest guidance from the RICS Professional Statement, which in practise may vary from these values and could well be extended. Thereby reducing the overall environmental impact associated with Life Cycle Module B4 – Replacement.



4. LCA RESULTS

4.1 Embodied Carbon

Embodied carbon impacts arise from sourcing, manufacturing and installing the materials and components that make up a built asset (life cycle modules A1-A5).

To obtain a more accurate representation of the operational energy (module B6), it is recommended that a TM54: Operational Energy Performance analysis be conducted in accordance with the Chartered Institution of Building Services Engineers (CIBSE) criteria on the entire building, as for this assessment, the operational energy figure was calculated using an average figure for the various apartment types.

4.1.1 Upfront Embodied Carbon Assessment

The results of the upfront embodied carbon assessment are based on the information provided by the design team and are presented in Table 4.1 below.

Table 4.1 - GWP Impact of 'Upfront' Modules A1 to A5 (Excluding Biogenic Carbon)¹

	Total upfront embodied carbon (kgCO ₂ e)	Total kgCO ₂ e/m ²
Royle Road	2,644,468.28	389.82

4.2 Whole Life Carbon

Whole life carbon emissions are the sum total of all assets relating to GHG emissions and removals, and both operational and embodied carbon, over the life cycle of an asset, including its disposal (modules A0-A5, B1-B7, B8 optional, C1-C4, all including biogenic carbon, with A0 assumed to be zero for buildings). Overall, whole life carbon asset performance includes separately reporting the potential benefits or loads from future energy or material recovery, reuse, and recycling and from exported utilities (modules D1, D2).

4.2.1 Whole Life Carbon Assessment

The results of the whole life carbon assessment are based on the information provided by the design team and are presented in table 4.2 below.

Table 4.2 – Whole Life Cycle GWP Impact

	Total whole life carbon (kgCO ₂ e)	Module D ²
Royle Road	5,934,237.33	-752,039.89

¹ Omits carbon sequestration (biogenic carbon), in accordance with the LETI Embodied Carbon Target Alignment publication and the RICS Whole Life Carbon Assessment/ RIBA 2030 targets. Therefore, allowing for accurate comparisons to be made.

² Module [D] is communicated separately as it occurs beyond the life cycle of the project under study and also bears high inherent uncertainty regarding the future treatment of building components. It is, however, important to assess module [D] figures along with cradle to grave [A-C] figures to acquire a holistic understanding of the environmental impacts of a built project.



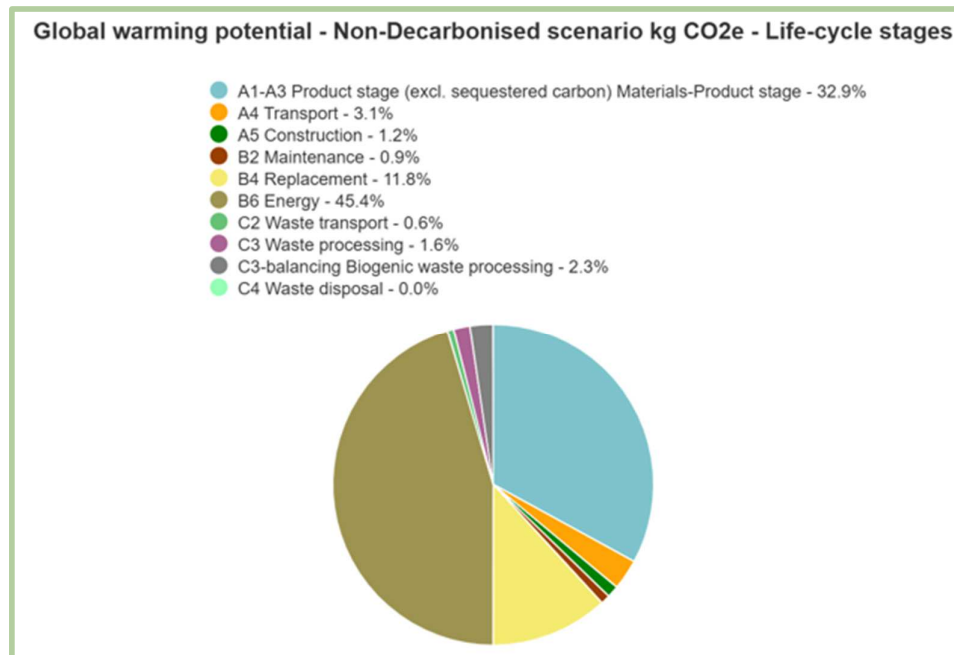
The total GWP impact per life cycle module is presented in Table 4.3.

The contingency factor used for this assessment is aligned with the early design information listed in Section 3 of this report, which was extracted from the RICS Professional Statement. For ease of reference, a 15% contingency has been applied to the non-decarbonised data as presented.

Table 4.3 - GWP Impact Per Life Cycle Modules

Module	Total KgCO ₂ e
A1-A3	2,002,791.22
A4	187,130.35
A5	72,957.3
B1-B4	909,096.22
B6	2,758,555.08
B7	-
C1	-
C2	39,068.52
C3	240,600.58
C4	201.62
Biogenic Carbon (Carbon Sequestration) ³	-642,769.13
Total	5,934,237.33
D	-752,039.89

Figure 4.1 - GWP Impact Per Life Cycle Module



³ Carbon sequestration can be included as it meets the following criteria:

1. The whole life carbon assessment of the project includes the impacts of the End-of-Life stage [C]; and,
2. The timber originates from sustainable sources - Timber sourced and processed by Grosvenor Estate own woodland and mill



It is evident from the results displayed in Figure 4.1 above that the life cycle modules B6 (regulated energy), A1-A3 (materials) and B4 (replacement) will have the most significant impact throughout the lifecycle of the project.

Life cycle modules A1 to A3 are likely to have high carbon emissions due to the high energy production processes associated with materials such as concrete and steel.

The environmental impact associated with the replacement emissions (module B4) considers the anticipated replacement of building components, including any emissions from the replacement process. The building components which are expected to be replaced the most relate to the building services and the finishes and coverings. To obtain a more accurate representation of the operational energy (module B6), it is recommended that a TM54: Operational Energy Performance analysis is conducted in accordance with the Chartered Institution of Building Services Engineers (CIBSE) criteria on the entire building, as for this assessment, the operational energy figure was calculated using the average TM54 figure for the various apartment types.



5. BENCHMARKING

Embodied carbon benchmarks and targets are a developing knowledge area; it is anticipated that, as the quantity of more accurate and detailed information becomes available, target figures may be updated.

Following the release of the (PfE), Design Guidance for Net Zero in March 2025, the Greater Manchester Combined Authority released Embodied Carbon targets for major developments as part of the Whole Life Carbon assessment required.

Targets have been created for upfront embodied carbon for both Major and Large Major Developments, which is expressed in terms of kgCO₂/m². The following lifecycle modules are required to compare accurately with these targets:

- Upfront embodied carbon: A1-A5 excluding carbon sequestration (biogenic carbon).

Table 5.1 presents the upfront embodied carbon and life cycle embodied carbon performance of the Royle Road scheme

Table 5.1 – Royle Road Results

	Upfront Embodied Carbon	Life Cycle Embodied Carbon
Royle Road	389.82 kgCO ₂ /m ²	477.37 kgCO ₂ /m ²

5.1.1 Embodied Carbon Key Performance Indicators

Places for Everyone, Design Guidance for Net Zero (March 2025) states the following broad key performance indicators for residential buildings:

Table 5.2 – Places for Everyone Upfront Embodied Carbon Comparison (Residential Buildings)

	Upfront Embodied Carbon A1-A5 (kgCO ₂ e/m ²)
Major Development: Flats	<600 kgCO ₂ /m ²
Royle Road	389.82 kgCO ₂ /m ²

Compared to the residential upfront embodied targets stipulated within Places for Everyone Design Guidance for Net Zero (March 2025), it is evident that **the proposed scheme improves upon the Places for Everyone Residential Major Development: Flats target for upfront embodied carbon.**

5.1.2 Embodied Carbon Targets

The Places for Everyone guidance outlines various metrics and key performance indicators (KPIs). These are used to measure success of Net Zero Carbon design and construction to provide an indication of how design decisions have influenced the carbon performance of the building.

Below are the upfront embodied carbon (kgCO₂e/m²) targets outlined for residential developments in section 2: Energy and Carbon requirements of the Design Guidance for Net Zero, Places for Everyone policies.

Table 5.3 – Places for Everyone Upfront Embodied Carbon Targets

	Minor development		Major development	
	Small minor Single home and XL extensions	Minor 2-9 homes	Major 10-149 homes	Large major +150 homes
Upfront embodied carbon (kgCO ₂ e/m ² _{GIA}) Minimise embodied carbon				

As the proposed Royle Road Scheme has seventy-five apartments, it is classified as a ‘Major’ development under PfE and therefore has the upfront embodied carbon target of ≤600 kgCO₂e/m². As shown in Table 5.2 the Royle Road development improves upon with a total of 389.82 kgCO₂/m².

Table 5.4 – Top Three Materials with the Highest Upfront Embodied Carbon

	Upfront embodied carbon	kg CO2e/m2
Minimise embodied carbon	Material 1: Ready-mix concrete, generic, C32/40	93.1
	Material 2: Precast hollow core concrete slabs, C40/50	88.9
	Material 3: Brick-faced precast cladding panel	22.5

Table 5.4 shows the top three materials with the highest upfront embodied carbon emissions (kgCO₂e/m²GIA) being: Ready-mix concrete, generic, C32/40, Precast hollow core concrete slabs, C40/50, Brick-faced precast cladding panel, which together contribute to around 58% of the cradle to gate (A1-A3) CO₂e.

6. CONCLUSION

The purpose of this Life Cycle Assessment is to quantify the environmental impacts of the proposed Royle Road scheme in accordance with the methodology expressed within the RICS Professional Statement – 2nd Edition (2021), and to benchmark the results against the PfE Design Guidance for Net Zero targets.

The total global warming potential for the scheme has been calculated as follows:

Table 6.1 – Results Summary

	Total – kgCO ₂ e	kgCO ₂ e/m ²
Upfront Carbon	2,644,468.28	389.82
Whole Life Carbon Assessment	5,934,237.33	477.37

	Targets	
	PfE Benchmark - kgCO ₂ e/m ²	Royle Road - kgCO ₂ e/m ²
Upfront	<600 (Residential Major Developments Targets)	389.82
Whole life	n/a	477.37

When compared to the targets stipulated within Places for Everyone Design Guidance for Net Zero (March 2025), it is evident that **the Royle Road scheme improves upon the Places for Everyone Residential Major Development: Flats target for upfront embodied carbon.**

It is recommended that further life cycle assessments are conducted at the Technical Design stage when increasing levels of detail in the design and specification of the built asset will become available. It is during this stage that uncertainties around the data used are managed using carbon data confidence scores.

