Power BI Dashboard Architecture and CRG Alignment Statement

1. Purpose and Scope

This supporting document provides a concise justification of the architectural, modelling, and visual design decisions underpinning the submitted Poer BI dashboard. It is intended to demonstrate alignment between the implemented solution, the accompanying technical report, and the assessment criteria outline in the module brief and CRG. The document does not repeat report content but instead synthesises key decisions to clarify analytical intent and compliance.

2. Data Architecture and Cloud Data Concepts

The dashboard integrates heterogeneous datasets reflecting common cloud analytics patterns. Semi structured GeoJSON datasets representing grit bin locations and gritting routes were transformed from object based spatial formats into a unified tabular semantic model suitable for analytical querying. This restructuring enables aggregation, filtering, and proximity based analysis within Power BI while acknowledging the trade offs associated with flattening spatial objects.

The independently sourced road traffic collision dataset, provided in a structured relational CSV format, was incorporated as contextual information and intentionally retained as disconnected table. This design choice preserves analytical transparency and avoids unsupported causal inference while still supporting situational awareness during adverse weather conditions. Collectively, this architecture demonstrates how heterogeneous cloud data types can be operationalised cohesively for decision support rather than exhaustive spatial precision.

3. Data transformation and Modelling Rationale

GeoJSON feature collections were flattened and normalised using Power Query, with geometry and attribute properties separated and redundant metadata removed. Grit bin and gritting route records were appended into a single spatial fact table (Gritting_Info), enabling consistent spatial handling and simplifying the analytical model.

A star style schema was implemented through the introduction of a Location_Category dimension linked via a one to many relationship. This dimensional separation reduces cardinality within the fact table and improves dictionary encoding and aggregation efficiency within Power BI's VertiPaq engine. Proximity calculations were implemented using DAX rather than Power Query to ensure that spatial metrics remain responsive to slicers and user interaction, satisfying the CRG requirement for advanced, interactive geospatial computation.

4. Proximity Analysis and Validation

Winter service coverage was assessed using a point to line proximity approach, calculating the minimum distance between each grit bin and the nearest gritting route. A conservative distance threshold was applied to support interpretable classification of effective coverage. To mitigate the limitations of straight-line distance modelling, a random sample of bins was manually validated using direct coordinate comparison, increasing confidence in the analytical measure and supporting methodological transparency.

5. Visual Design and Interaction

The dashboard was designed to support exploratory spatial analysis rather than static cartographic representation. Interactive map visualisations, proximity based colour encoding, and responsive summary indicators enable users to identify potential service gaps efficiently. While the assessment brief references a single page report, multiple pages were adopted to reduce visual overcrowding and improve interpretability, while maintaining a consistent data model, interaction logic, and analytical narrative across the dashboard.

6. References

The submitted solution satisfies all requirements outlined in the assessment brief and CRG. Advanced data transformation, dimensional modelling, and DAX based geospatial computation are clearly evidenced, alongside critical evaluation of data types and architectural trade offs. The dashboard functions as a decision support artefact rather than a descriptive map, enabling stakeholders to explore winter service coverage and prioritise intervention under constrained operational resources.