

Battery Energy Storage System - Dig Gate Lane, Rochdale GG104 Risk Assessment

Prepared by



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1. INTRODUCTION

The Rochdale Battery Energy Storage project is located on the land at Dig Gate Lane, Rochdale adjacent to the M62, to the south-east of Rochdale near Kingsway Business Park. The project assists Rochdale Council in meeting its renewable energy targets, as well as providing secure and stable energy supply to the local network during times when renewable energy sources are inconsistent.

1.1 Context

The Risk Assessment Form provides supporting documentation, and impact on affected population groups, for the above-named project and assesses the comparative safety risk associated with the installation of a Battery Energy Storage System (BESS) adjacent to the M62 motorway.

The project seeks to install 12no. BESS modules along with associated inverters, transformers and control facilities on a parcel of land sandwiched between the northern boundary of the M62 motorway and Dig Gate Lane in Rochdale, Greater Manchester. The site is adjacent to the M62 motorway in cutting with a 4 to 5m high 1:3 embankment slope bordering the site. It is proposed to construct a split-level facility with a high-level access road at the top of the embankment serving the control room, stores, private sub-station, transformer and welfare facilities to the south west of the site. To the north east of the site it is proposed to construct a lower level area to situate the BESS modules along with associated inverters and transformers. This area will be separated from the high level perimeter access road by a retaining wall 3.7m in height.

Due to the presence of existing comms cabinets within the motorway embankment adjacent to the site and metal hand railing associated with the steps required to access the cabinets, there is an existing vehicle restraint system (VRS) in place to help prevent the incursion of an errant vehicle onto the embankment.

1.2 Scope

This assessment will:

- Follow the approach listed in DMRB document GG104 “Requirements for Safety Risk Assessment”
- Define hazards and populations affected by the project.
- Document risk control decisions to enable safe operation post-construction.

This assessment will not:

- Justify particular courses of action by direct reference to technical standards.

2. HAZARD IDENTIFICATION AND ANALYSIS OF SAFETY RISK, RISK VALUES AND SAFETY RISK MITIGATIONS (GG104 TABLE D.2)

Ref	Hazard	L	S	R	Response/Control Measure	L	S	R	Details/Assumptions/Monitoring	Risk Rank
01	<i>Road Users</i> Risk of an errant vehicle breaching the existing VRS, travelling up the embankment, breaching the site perimeter fence and colliding with one of the BESS modules with enough force to trigger a thermal runaway incident requiring a controlled burn down with associated risk of smoke drifting across both carriageways of the M62 causing a loss of visibility and subsequent collisions.	1	5	5	The presence of existing VRS adjacent to the BESS installation will prevent the majority of errant vehicles from ever reaching the site. In addition to this, the adjacent embankment is 5m in height which should an errant vehicle pass through/over the VRS, would prevent the vehicle from travelling to the site. Guidance states that it is unlikely for a vehicle to travel beyond an embankment >2.5m in height without a VRS in place. Refer to RRRAP.	1	5	5	Ensure frequency of inspection and maintenance regimes are monitored. Ensure control measures are maintained and reviewed as necessary.	Low
02	Road Users/Other Parties Risk of a fault within the BESS causing thermal runaway incident requiring a controlled burn down with associated risk of smoke drifting across both	3	5	15	The developer has provided the Sungrow PowerTitan 2.0 BESS white paper in support of the proposed installation. The paper demonstrates significant inherent safety systems within the BESS and the operator has provided a commitment	1	5	5	It is noted that research by The Faraday Institution explains that lithium-ion battery fires are very rare. It notes that “even with billions of lithium-ion cells in circulation, there are very few safety incidents involving them”. It estimates that only one in 40 million battery cells experience failure that results in fire.	Low

	carriageways of the M62 causing a loss of visibility and subsequent collisions.			to provide the optional safety systems including integrated sprinklers inside the BESS container and NFPA69 compliant explosion prevention systems. The provided example Battery Safety Management Plan makes reference to the use of dry agent fire suppression systems which are integrated into the BESS housing and are designed for total flood extinguishing. Provided the above mentioned fire extinguishing and explosion prevention systems are in place it is felt that the risk of sustained smoke intrusion onto the SRN has been reduced ALARP.			There has only been one documented incident of a BESS fire in the UK. In September 2020, one of the three battery system containers at a BESS site in Liverpool caught fire. An investigation by the Merseyside Fire and Rescue Service found the fire was the result of a failure of one of the batteries within the container which led to thermal runaway and a build-up of gas. This resulted in a fire and explosion that cause the container to warp and doors to blow off. A research paper on the incident by the Electric Power Research Institute (EPRI), an organisation based in the United States which conducts research on the generation, delivery, and use of electricity, notes that BESS design has improved since the Liverpool BESS was installed in 2018: Some newer system designs use smaller, modularized cabinets with fewer racks of batteries. The system layout limits damage because of thermal runaway and allows a more targeted first responder approach in the event of a fire. The developer has committed to providing a BESS installation that utilises the improved BESS designs as well as utilising optional safety systems.	
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2.1 Risk Classification (GG104, Table D.1)

Likelihood (L) x Severity (S) = Risk value (R)		Severity (S) *				
		Minor harm	Moderate harm	Serious harm	Major harm	Extreme harm
		Minor damage or loss no injury	Slight injury or illness, moderate damage, or loss	Serious injury or illness, substantial damage, or loss	Fatal injury, major damage, or loss	Multiple fatalities, extreme loss, or damage
Likelihood (L)	Very unlikely Highly improbable, not known to occur	1	2	3	4	5
	Unlikely Less than 1 per 10 years	2	4	6	8	10
	May happen Once every 5-10 years	3	6	9	12	15
	Likely Once every 1-4 years	4	8	12	16	20
	Almost certain Once a year or more	5	10	15	20	25

Risk rating/classification	Actions	Control Measures should be considered using these categories:	
1 – 9 = Low	Ensure control measures are maintained and reviewed as necessary	Infrastructure	Training/Education/induction briefing
10 – 19 = Medium	Control measures needed to reduce risk rating to a level which is as low as is “reasonably required”	Enforcement	Permits
20 – 25 = High	Activity not permitted – hazard to be avoided or risk to be considerably reduced so it is tolerable	Operating Procedures Specific monitoring (with owners and timescales)	Method Statements

2.2 Traffic Flows and Accident Data

2.2.1 TRAFFIC FLOWS

2023 AADT @ MIDAS site at M62/1669A priority 1 on link 200116672; GPS Ref: 391622;410930; Eastbound: 63,174 (combined) 19.4% HGV

In order to quantify the collective and individual risk, it is necessary to determine the existing collision history of the M62 eastbound prior to Junction 21. The latest 10-year Road Traffic Collision (RTC) record (between 2013 and 2022) shows:

2.2.2 ROAD TRAFFIC COLLISION DATA

4 Personal Injury Collisions (PIC) were recorded within the 10-year period 2013 to 2022 within a 500m radius of the proposed BESS site. No PIC's occurred within a 200m radius of the site. Of these PIC's, all 4 were slight in severity.

2.2.3 ANALYSIS OF COLLISION DATA

From analysis of the collision data it can be seen that there is no history of PICs adjacent to the site. There was only a single collision on the eastbound approach to the site which involved a 3-car shunt. The remaining collisions occurred in the vicinity of junction 21 to the east of the site. 2 of these collisions involved shunts and the remaining collision involved a single vehicle leaving the carriageway and colliding with either the near or offside barrier.

Upon examination of the data it can be seen that there is no historic risk of vehicles leaving the carriageway on the near side in the vicinity of the proposed BESS development. On that basis and coupled with the topography in the area, the risk of a vehicle leaving the carriageway and reaching the site is very low.

3. CHARACTERISATION

The Characterisation of this Project is determined from GG104 Table 2.6.

Within the GG104 Table 2.6: Categorisation of activity type table (see below), the appropriate decision maker for each aspect of the decision process has been considered and is highlighted. It is seen that the outcome of characterisation based on Table 2.7N for the Rochdale Battery Energy Storage Project, is Type A.

Categorisation of the activity, based on GG 104 Table 2.6		
Feature	Selection criteria	
	Type	Indicator
Extent of prior experience of activity The degree of knowledge available from undertaking the activity previously or the degree to which knowledge is available from the activity being undertaken by other industries or organisations.	A	Activities for which there is significant experience within National Highways. Previous safety studies and data are available, and some activity features are codified in a standard or formal procedure.
	B	Activities for which there is limited experience within National Highways but there is transferable experience elsewhere in the UK or internationally. Activities for which there is limited experience in National Highways but there is experience elsewhere in the UK or internationally, including in different industries, which is deemed sufficiently similar to the activity in question to be deemed relevant. Activities for which there is experience within National Highways but that experience is in a different application of the activity and some adaptation will be required. There might also be local and site specific issues to take into account that can affect the relevance of the available experience.
	C	Activities for which there is no previous applicable experience from either National Highways or other industries.
Statutory and formal processes and procedures (including standards and legislation) Consideration of the applicability of current	A	The activity is substantially or entirely within the scope of existing standards, guidance, formal processes or procedures and applicable legislation. The activity requires minimal or no safety related departures from standard or safety related changes to formal processes or procedures (including any legislation).
	B	The activity is largely within the scope of existing standards, guidance, formal processes or procedures. There can be some safety related departures from standards needed and/or safety related changes to formal processes or procedures. The activity can need minor changes to existing legislation.

standards, formal processes or procedures, guidance and legislation.	C	Activities that are not within the scope of existing standards, formal processes or procedures and require new ones to be developed. Activities for which significant departures from standards, formal processes or procedures are required. Activities which require significant changes to existing legislation or new legislation to be written. Whilst the number of safety departures from standards, formal processes or procedures can affect the categorisation, the most important element in determining this is the nature and type of the departures. For example, a large number of safety departures that can be addressed straightforwardly will have less impact on feature type than a single safety departure that cannot and requires a detailed risk assessment to support it.
Impact on the organisation The effect that the activity will have on current National Highways processes, procedures, structure, roles and responsibilities, competencies, policies and strategy, in addition to contractual and workforce arrangements.	A	The activity has no impact on National Highways. The activity has a minor impact on any of these for a finite period of time. Length of time National Highways is affected by decision to undertake the activity is short term.
	B	The activity can lead to permanent minor changes to any of these. These minor changes can introduce new roles and responsibilities, policies, contractual and workforce arrangements. The activity can require a change to organisational arrangements. Length of time National Highways is affected by decision to undertake the activity is medium term.
	C	The activity has significant impact on any of these. The activity can change core safety roles and responsibilities. Length of time National Highways is affected by decision to undertake the activity is long term.
Activity scale Consideration of the size and/or scale of the activity. Does or can the activity have an impact on the motorway and all-purpose trunk roads, either directly or indirectly	A	The impact of the activity is limited in nature or scale.
	B	The impact of the activity is significant in nature or scale.
	C	The impact of the activity is wide ranging across the network, and/or significantly impacts infrastructure, interventions or workforce.
Technical	A	An activity where any processes, techniques, methodologies and/or technologies involved are currently in widespread use and re-examination is unlikely to be needed.

Measure of technical and/or technological novelty and/or innovation the activity involves.	B	There can be some experience of the processes, techniques, methodologies and/or technologies. The experience can be from use in either another application, or by another road authority, supplier, industry or perhaps from overseas in which case some additional work can be required to adapt them and/or to demonstrate that safety can be assured for the intended application.
	C	Activities that use new processes, techniques, methodologies and/or technologies for which there is no previous experience in the UK or elsewhere.
Stakeholder impact and interest The quantity and/or impact of stakeholders, their interest in and resulting ability to influence or/impact on the activity. The degree to which the safety issues, as perceived, are capable of being understood and fully addressed.	A	Activities for which the quantity and/or impact of stakeholders, their interest in and resulting ability to influence or impact the activity is low.
	B	Activities that have only a single or a few stakeholders but their impact, in terms of their attitude towards, or ability to influence, and/or interest in the successful achievement of the activities aim can be significant. Alternatively it will represent an activity that has several stakeholders but the amount, or type, of safety issues involved are limited.
	C	Activities for which there are a large number of stakeholders and their impact in terms of their attitude towards, or ability to influence can be significant. Stakeholders with a strong interest in the potential safety impact of the activity on themselves. Activities where there are conflicting needs arising from different stakeholders or stakeholder groups.

Determining the activity category, based on GG 104 Table 2.7N		
Feature classification	Type	Comments
All type A.	A	Where all activity features are categorised as type A then the entire activity is type A.
All type B.	B	Where all activity features are categorised as type B then the entire activity is type B.
All type C.	C	Where all activity features are categorised as type C then the entire activity is type C.
Three or more features categorised as Type A.	A	Where three or more features are categorised as type A but the remaining features are categorised as a combination of type B or C, the activity is categorised as type A but the features categorised as B or C require a greater rigour of analysis, assessment and evaluation.
Three or more features categorised as Type B.	B	Where three or more features are categorised as type B but the remaining features are categorised as a combination of type A or C, the activity is

		categorised as type B but the features categorised as C require a greater rigour of analysis, assessment and evaluation.
Three or more features categorised as Type C.	C	Where three or more features are categorised as type C then the entire activity is of type C.
Equal distribution of categories across features (no majority).	C	Where the categorisation of activity features results in an equal distribution between two or more category types the decision on the overall activity categorisation is governed by the importance of each feature relative to the activity. If this results in a decision to select the overall activity categorisation as the lower category type, the features that were identified with the higher category type require a greater rigour of analysis, assessment and evaluation.

4. REQUIRED MITIGATIONS AND AFFECTED POPULATIONS

4.1 Required Mitigations

4.1.1 ROAD WORKERS

Maintenance regimes for existing VRS systems would remain as per existing, with workers being exposed to risk when carrying out barrier inspections or work within the existing comms cabinets. Any maintenance works/inspections would be carried out under temporary Traffic Management such as lane closures.

4.1.2 ROAD USERS

It has been demonstrated that the likelihood of an errant vehicle reaching the installation is extremely small through the RRRAP process and through empirical collision data. The RRRAP did highlight that the existing VRS provision starts short of where it should be to protect the existing hand railing that is in place on the embankment. If this issue was resolved, that would effectively prevent a vehicle reaching the embankment adjacent to the installation further reducing the risk of a vehicle ever reaching the BESS.

As discussed in the risk assessment, the developer has committed to the provision of optional BESS safety systems such as optional sprinkler systems, dry agent fire prevention systems and explosion prevention systems which are designed to contain a thermal runaway incident which could in turn cause the BESS to burn for a significant period with associated smoke production. In a worst case scenario, the smoke could drift onto the carriageway of the M62 causing a loss of visibility and subsequent collisions.

Notwithstanding the above, research by The Faraday Institution explains that lithium-ion battery fires are very rare. It notes that “even with billions of lithium-ion cells in circulation, there are very few safety incidents involving them”. It estimates that only one in 40 million battery cells experience failure that results in fire.

There has only been one documented incident of a BESS fire in the UK. In September 2020, one of the three battery system containers at a BESS site in Liverpool caught fire. An investigation by the Merseyside Fire and Rescue Service found the fire was the result of a failure of one of the batteries within the container which led to thermal runaway and a build-up of gas. This resulted in a fire and explosion that cause the container to warp and doors to blow off.

A research paper on the incident by the Electric Power Research Institute (EPRI), an organisation based in the United States which conducts research on the generation, delivery, and use of electricity, notes that BESS design has improved since the Liverpool BESS was installed in 2018: Some newer system designs use smaller, modularized

cabinets with fewer racks of batteries. The system layout limits damage because of thermal runaway and allows a more targeted first responder approach in the event of a fire.

With the above systems in place it is considered that the risk of a thermal runaway incident and of smoke intrusion onto the SRN has been reduced ALARP.

4.1.3 OTHER PARTIES

No other parties associated with the road network are affected.

4.2 Affected Populations

Based on the above Risk Assessment and Characterisation the following populations are deemed to be affected:

Population	Is population affected by options assessed?	Are the resultant risk levels after the scheme mitigations ALARP?
Road Workers	Affected	Yes
Road Users	Affected	Yes
Other Parties	Not Affected	N/A

4.3 Conclusion

In accordance with CD 377 and the RRRAP procedure, consideration has been given to the potential for an errant vehicle to leave the carriageway and reach the BESS installation and cause damage that could lead to a significant fire. Due to height of the existing embankment in the area and backed up by empirical data which shows there have been no collisions involving the near side VRS in the most recent 10 years, it is concluded that the risk of damage to the BESS from an errant vehicle is low. Additionally, with some minor improvement work to the existing VRS the risk would be reduced further.

The risk associated with a thermal runaway incident leading to sustained fire with associated smoke intrusion onto the M62 carriageway and the subsequent risk of collisions and serious injury/fatality has been reduced ALARP.