T.C. ULAŞTIRMA VE ALTYAPI BAKANLIĞI

EPC Contractor

REC ULUSLARARASI

PROJECT

NORTHERN MARMARA MOTORWAY SECTION 8 PPP PROJECT

REV	DATE	REMARKS	PREPARED BY	CHECKED BY	AUTHORIZED BY
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STATUS

FOR INFORMATION	☐
FOR REVİEW	☐
FOR APPROVAL	☒
APPLICABLE TO DESIGN	☐
APPLICABLE TO PURCHASING	☐
APPLICABLE FOR CONSTRUCTION	☐
FINAL	☐

PUBLICATION OWNER

REC ULUSLARARASI

SIGNATURE	DATE

DOCUMENT NO

REC-İSG-ÇYS-KMO-PL-18

DOCUMENT TITLE

Blasting Management Plan

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ABBREVIATIONS AND ACRONYMS

ANFO	Ammonium Nitrate-based Explosive
BAP	Biodiversity Action Plan
CESMP	Construction Environmental and Social Management Plan
CLO	Community Liaison Officer
EBRD	European Bank for Reconstruction and Development
EHS	Environmental, Health, and Safety
EHSS	Environmental, Health, Safety, and Security
ESHS	Environmental, Social, Health and Safety
EPA	Environmental Protection Agency
EPC	Engineering, Procurement, and Construction
EPRP	Emergency Preparedness and Response Plan
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
GBVH	Gender-Based Violence and Harassment
GIIP	Good International Industry Practice
HSE	Health, Safety and Environment
IFC	International Finance Corporation
ISO	International Organization for Standardization
KPIs	Key Performance Indicators
MIC	Maximum Instantaneous Charge
ms	Millisecond
NMM	Northern Marmara Motorway
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
PS	Performance Standards
REC	REC International
SDSs	Safety Data Sheets
SEP	Stakeholder Engagement Plan
SPV	Special Purpose Vehicle (Nakkaş Otoyol A.Ş.)
WHO	World Health Organization

1. PURPOSE

The Blasting Management Plan was prepared by the EPC Contractor “REC International” (hereafter called “REC”) which is applicable to the construction phase of the Project.

The ultimate responsibility for its implementation resides with REC, and REC’s sub-contractors and suppliers will be required to demonstrate compliance of their activities against this plan. This plan is intended to be ‘living document’ that can be refined and modified as situations change.

This Plan applies to the construction phase of the Northern Marmara Motorway Section 8 PPP Project (NMM -Nakkaş -Başakşehir Otoyolu) and risks and potential impacts associated with blasting activities. The objectives of this plan are to:

- Provide guidance for the preparation of location specific blasting activities;
- Minimizing environmental impacts such as vibration and air shock caused during blast excavations to be carried out within the scope of "Earthworks Between 35+300 - 49+399" in the Nakkaş Başakşehir Section of the Project (Km: 35+300 - 49+399).
- Outline mitigation measures to be implemented to ensure blasting activities and explosive management are conducted within the Project’s applicable standards and in accordance with the Environmental and Social Management and Monitoring Plan (ESMMP);
- Protect the workforce, community and biodiversity features from blasting impacts;
- Define roles and responsibilities for implementing mitigation measures defined in this plan;
- Outline monitoring and auditing requirements, and
- Describe additional measures required to implement Good International Industry Practice (GIIP)

2. SCOPE

This plan applies to the Northern Marmara Motorway Section 8 PPP Project (NMM -Nakkaş -Başakşehir Otoyolu) and the Contractors’ (including sub-contractors and third-party consultants) and to all blasting and explosive management activities connected with the Project’s construction phase.

Contractors that perform blasting activities are responsible for developing site-specific environmental and social management systems (ESMS) and all supporting procedures and method statements to satisfy REC’s Project standards. Each Contractor is responsible for

ensuring that all sub-contractors have site procedures and method statements to align with this plan or are committed to work under REC's ESMS.

2.1. DEFINITIONS

Detonator – a device used to detonate a charge of explosive and includes a blasting cap.

Magazine – a fixed unit used for the unattended storage of explosives which meets the national requirements

Explosives – Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion

ANFO – A type of ammonium nitrate-based explosive prepared in the form of a mixture, which is widely and frequently used in the mining and construction industries.

MIC – The Maximum Instantaneous Charge

3. REGULATORY AND INSTITUTIONAL FRAMEWORK

3.1. NATIONAL REQUIREMENTS

National requirements for the management of this topic are set out in:

- Regulation on Occupational Health and Safety Services (Resmi Gazete, 2012-06-30, No. 28339)
- Regulation on Occupational Health and Safety Risk Assessment (TUR-2012-R-94687, 2012-12)
- Regulation on Protection of Workers from the risk of Explosive Media (TUR-2013-R-94790, 2013-04)
- Regulation on Equipment and Protective Systems Used in Potentially Explosive Atmospheres (TUR-2016-R-29758).; and
- Ministry of Environment and Urbanization Regulation on Evaluation and Management of Environmental Noise (TUR-2013-R-94673, 2013-07).

REC and its subcontractors are responsible for reviewing relevant national and local legislation to capture all the necessary requirements.

3.2. INTERNATIONAL STANDARDS

International requirements and GIIP are set out in the following standards and guidelines:

- International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Construction Materials Extraction; (April, 2007)[1]
- IFC General EHS Guidelines[1]
- IFC Performance Standards (PSs) (2012)[2]
- EBRD Performance Requirements (PRs) (April 2019)[3]
- ISO 45001 Health and Safety Management Systems (March 2018)[4]
- Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres (15th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)

[1] https://www.ifc.org/ehsguidelines
[2]www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards
[3] https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html
[4] https://www.iso.org/standard/63787.html

4. LINKS TO OTHER PLANS/PROCEDURES

This plan is supported by the other plans/procedures of the Project-specific ESMS. Those of particular relevance to this plan are as follows:

- Istanbul University Cerrahpaşa Engineering Faculty Mining Engineering Department Nakkaş Başakşehir Highway Project KM 35+300-49+399 Blasting design based on risk analysis within the scope of earthworks
- Environmental and Social Impact Assessment (ESIA)
- Construction Environmental and Social Management Plan (CESMP)
- Emergency Preparedness and Response Plan (REC-İSG-KMO-PL-06)
- Health and Safety Plan (REC-İSG-ÇYS-KMO-PL-01)
- Community, Health Safety and Security Plan (REC-İSG-KMO-PL-13)
- Cultural Heritage Management Plan (REC-ÇYS-KMO-PL-08)
- Waste Management Plan (REC-ÇYS-KMO-PL-02)
- Stakeholder Engagement Plan (SEP)
- Air Quality and Emission Control Plan (REC-ÇYS-KMO-PL-05)
- Security Management Plan (REC-İSG-KMO-PL-22)

Blasting works will be carried out according to ‘‘Istanbul University Cerrahpaşa Engineering Faculty Mining Engineering Department Nakkaş Başakşehir Highway Project KM 35+300-49+399 Blasting design report based on risk analysis within the scope of earthworks’’.

5. ROLES AND RESPONSIBILITIES

REC PROJECT MANAGER

The REC Project Manager has the overall responsibility for the implementation of the Project activities stated in this plan. They will be suitably competent and have a strong understanding of construction best practice aligned with national law and applicable Lender requirements.

REC Project Manager is accountable for overall ESHS performance and making the human and financial resources available to ensure compliance with Project ESHS requirements.

REC CONSTRUCTION MANAGER

The Construction Manager is responsible for implementation of the ESHS mitigation measures of this plan through method statements and site working practices.

The Construction Manager will:

- Ensure that blasting schedules are distributed to the users of the grazing areas, residents and local governments including the name, address and telephone number of the operator; an identification of the specific areas in which blasting will take place; the dates and time periods when explosives are to be detonated; the methods to be used to control access to the blasting areas; and the type of patterns of audible warning and all-clear signals to be used before and after blasting.
- Ensure that specific warning devices (e.g., horn signals and flashing lights) are in place before each blasting activity to alert all workers and third parties in the surrounding areas (e.g., local communities).
- Ensure that clearly visible signs have been installed and maintained that identify a blast area at all approach routes to the area.
- Ensure that the access within the blasting area is controlled to prevent presence of livestock or unauthorized persons during blasting.
- Ensure that access will remain controlled until an authorized representative of the operator has reasonably determined that: no unusual hazards, such as imminent slides or undetonated charges, exist, and access to and travel within the blasting area can be safely resumed.
- Inform all departments about the timing and location of blasting activity.
- Ensure that all non-conformities on the transport, storage, and use of explosives are resolved in a timely manner.
- Ensure that the stock positions of explosives are maintained, regular audits are carried out on stocks and explosive handling and usage are monitored.
- Ensure that all blasting material including detonators are of approved type and in good physical condition.
- Report any identified nonconformities to all related departments
- Maintain records and explosives inventory.

REC E&S AND H&S MANAGERS

E&S and H&S Managers are responsible for the following:

- Monitoring and assurance of the EPC Contractor’s subcontractors ESHS system performance and requirements of the Project.
- Develop CESMP and other ESHS plans and procedures and assures that Project requirements are considered.

- Review subcontractors and suppliers ESHS documentation and ensure that they are aligned with Project ESHS requirements.
- Monitor performance through Key Performance Indicators (KPIs), reports, audits, and meetings.
- Report ESHS performance to REC Project management, Nakkaş Otoyol A.Ş ESHS Management, and other related parties.
- Establish Emergency Response Teams (ERT) and define roles and responsibilities of ERT members.
- Ensure that all ESHS training needs are identified, provided and recorded.
- Disclose relevant ESHS information to Project staff and public and coordinate activities for raising awareness.

REC SOCIAL EXPERT

Social Expert is responsible for the following:

- Ensure that the residents of the local communities receive a written notification at least 30 days in advance of a nearby blasting as well as two (2) more written reminders.
- Ensure that blasting schedules are distributed to the users of the grazing areas, residents and local governments including the name, address and telephone number of the operator; an identification of the specific areas in which blasting will take place; the dates and time periods when explosives are to be detonated.
- Ensure that the blasting related grievances are managed via Project Grievance Mechanism (GM) and the grievances are resolved in accordance with GM.
- Manage and supervise the CLOs including consultants for implementation of the Project social requirements.
- Report social performance to Nakkaş Otoyol A.Ş Social Manager and other related parties.
- Manage the Grievance Mechanism.
- Provide the EPC Contractor’s Project management team with advice, guidance and assurance on social topics.
- Liaise with the relevant NGOs and other stakeholders on a regular basis in line with the SEP:
- Responsible for ongoing stakeholder engagement at all levels and monitoring of the overall stakeholder activities.

- Managing labour and working conditions, gender equality, human rights, community safety and security, local procurement and recruitment in line with Lenders standards.
- Oversight of the EPC Contractors' and subcontractors' activities to ensure they align with Project and Lender requirements.

REC CLO

CLO is responsible for the following:

- Support Social Expert during planning and implementation of her/his tasks.
- Contact persons for statutory stakeholders and Non-Governmental Organisations (NGOs).
- Initiate institutional agreements with statutory stakeholders (e.g. training to be received by Project affected people).
- Set-up and perform meetings on the non-community level.
- Be accessible to liaise with affected population per requests, especially for vulnerable groups.
- Assist affected people in issues related to the Project (answer questions about the process, delivering and resolving the grievances, information about consultation activities etc.).
- Facilitate access of Project-Affected-Persons (PAPs) to third party legal support, if necessary.
- Advise on avenues for the resolution of conflicts amongst land owners in cases of multiple ownerships.
- Assist with grievance management.

REC ENVIRONMENTAL ENGINEER AND H&S INSPECTOR

- Conduct daily ESHS inspections.
- Ensure that all construction personnel (including subcontractors) working or visiting the site understand the ESHS requirements of the Project and comply fully with them.
- Make sure that the ESHS risk assessments are performed prior to the activities.
- Monitor subcontractors' ESHS performance, their compliance to the ESIA and ESHS plans.
- Report and record the ESHS accidents, incidents to H&S Supervisor.

- Monitor to ensure that all personnel (including contractors) have undergone all necessary training.
- Assist subcontractors and suppliers to develop and implement their site-specific plans and procedures.
- Monitor implementation of all relevant management plans and procedures.
- Track the impacts of the Project against the Project Objectives and Key Performance Indicators as defined in the Management and Monitoring Plans and work with the subcontractors where amendments to the mitigation measures are required.
- Identify breaches of management plans, and recommend corrective actions.
- Stop work activities in the event of serious breaches of relevant rules that may cause serious impacts on health and safety, environment and community or on the reputation of the Project. (All workers have the obligation to intervene in case of a dangerous situation and have to report to the supervisor).

CONTRACTORS/SUBCONTRACTORS/THIRD PARTIES

- Implements mitigation measures as defined in this plan.
- Prepares Method Statement and Risk Assessment for Permit to Work

6. GENERAL RULES AND IMPLEMENTATION

6.1. RISK ANALYSIS

For this Project, ground vibration and air blast levels have been predicted using the methodology outlined in the ICI Blasting Guide (ICI 1995) to provide an understanding of the potential of impacts from blasting. According to Nakkaş Otoyol A.Ş., blasting will be subcontracted to a specialized company and modern blasting technique (with micro-delay) will be used. Blasting will take place within the five areas along the suggested alignment, and details of blasting at each area are presented in Table below:

Table 1 Blasting Details

Blasting Location	Kilometric Point	Number of daily blastings	Blasting days in total	Number of holes per blasting event	MIC (kg)	Delay between holes (ms)
Blasting Area-01	54+340-54+900	1-2	100	30-100	5.8-41	17-25-42-67
Blasting Area-02	53+520-53+780	1-2	60	30-100	5.8-41	17-25-42-67

Blasting Area-03	52+440-53+060	1-2	140	30-100	5.8-41	17-25-42-67
Blasting Area-04	49+760-50+680	1	105	50-150	8-60.5	17-25-42-67
Blasting Area-05	48+200-49+400	1	40	50-150	8-60.5	17-25-42-67

Within the scope of the Project (Including Connection Roads and Bridge) due to the blast splitting excavations, the surrounding areas located within 200 m to the blasting locations[5] were investigated. A risk analysis has been made for the damages that may occur in the structures. By using the most appropriate parameters in the analysis, it was investigated whether the concussive effects that may occur in the most unfavorable situation are within legal requirements.

6.2. IMPACTS FROM BLASTING

Acceptable Maximum Instantaneous Charges (MIC), at which the criteria will be met, have been predicted based on the minimum distances between receptors and each blasting location. Results of these calculations are presented in Table 2 (for airblast) and Table 3 (for ground vibration). Precise locations of the blasting activities were provided in a range; therefore, the distances have been estimated using Google Earth, based on motorway's boundaries and the nearest receptor. It has to be noted that it is likely that the actual minimum distances between the blasting location and the receptors is greater than the ones presented on the table below.

Table 2 Airblast Calculation

Blasting Location	Minimum Distance from receptors (m)	Airblast dB(Z) (min)*	MIC (kg) (min)*	Airblast dB(Z) (max)*	MIC (kg) (max)*
Blasting Area-01	40	115	0.03	125	0.6
Blasting Area-02	50	115	0.06	125	1.1
Blasting Area-03	110	115	0.7	125	12.2
Blasting Area-04	180	115	3.01	125	53.5
Blasting Area-05	100	115	0.5	125	9.2

**minimum and maximum values are based on airblast design criteria MIC[6] where:*

- *for Blasting Area 01, 02, 03 - min. MIC 5.8 kg and max. MIC 41 kg*
- *for Blasting Area 04, 05 – min MIC 8 kg and max. MIC 60.5 kg*

[5] Locations where blasting-related solid waste (e.g, rocks) are to be disposed
[6] Please refer to Table 7-17 of the ESIA report

Results for Blasting Area 01 are used as reference, considering the shortest distance to the receptors and calculations indicate that the MIC value should be up to 0,6 kg to avoid any major impact.

Based on the information above, impacts are anticipated to be major for Blasting Area 01 and 02 but moderate for Blasting Area 03. In order to avoid major impacts, the following distances to the nearest receptors are recommended:

For MIC of 5.8 kg, a minimum distance of 85 meters; and

For MIC of 41 kg, a minimum distance of 165 meters.

For Blasting Area 04 and 05, the following distances to the nearest receptors are recommended:

For MIC of 8 kg, a minimum distance of 95 meters; and

For MIC of 60.5 kg, a minimum distance of 190 meters.

Table 3 Ground Vibration Calculation

Blasting Location	Minimum Distance from receptors (m)	Ground Vibration PPV (mm/s)	MIC (kg) (min)*	Ground Vibration PPV (mm/s)	MIC (kg) (max)*
Blasting Area-01	40	2	0.57	5	1.8
Blasting Area-02	50	2	0.9	5	2.8
Blasting Area-03	110	2	4.34	5	13.7
Blasting Area-04	180	2	11.63	5	36.3
Blasting Area-05	100	2	3.59	5	11.3

Results for Blasting Area 01 are used as reference, considering the shortest distance to the receptors and calculations indicate that the MIC value should be up to 1.8 kg to avoid any major impacts.

For Blasting Area 01, 02 and 03, the following distances to the nearest receptors are recommended:

For MIC of 5.8 kg, a minimum distance of 70 meters; and

For MIC of 41 kg, a minimum distance of 200 meters.

For Blasting Area 04 and 05, the following distances to the nearest receptors are recommended:

For MIC of 8 kg, a minimum distance of 85 meters; and

For MIC of 60.5 kg, a minimum distance of 230 meters.

6.3. PLANNING FOR BLASTING ACTIVITIES

- It is understood that the dominant rock formation around this road alignment is limestone and marl, according to the current studies submitted to the research team. The blast excavation in various cuts on the route is inevitable due to technical and economic reasons (i.e the geology of the soil requires blasting as the most cost-efficient method for excavation).
- The risk points are located around the border of the blast excavation to be carried out in Section-8 of the Northern Marmara Motorway. Accordingly, it has been determined that the closest risk distances in different blasting zones on the route are between 25 m and 768 m.
- In the cuts where blast excavation will be carried out, a risk analysis has been made for the damages that may occur in the surrounding structures located at close distances to the firing locations due to the blast excavation. By using the most appropriate parameters in the analysis, it was investigated whether the concussive effects that may occur in the most unfavorable situations are acceptable. The maximum amount of explosive material to be used should be determined considering the structures around the blasting area in order to avoid the effects of vibrations arising from blasting.
- Karadoğan (2008)[7] has similar characteristics with the prevailing geological formations at the points where open cuts are to be excavated on the route. The study of Karadoğan (2008) focused on whether the vibrations arising from the blasts to be made in the cuts can be at levels that may cause damage to the surrounding structures. Risk analysis was carried out by using the estimation equation that was developed as a result of the studies in the fields.
- In risk analysis, the vibration damage limits of the Ministry of Environment and Urbanization "Regulation on Evaluation and Management of Environmental Noise" are taken as the basis of the analysis. Based on the blast excavation experiences of the research team, it is known that vibration frequencies are generally medium and high in areas containing similar rock formations. Therefore, Evaluation and Management of Environmental Noise, the particle velocity value of 19 mm/s, which is foreseen according to the Regulation, was taken as the threshold damage limit and the evaluations were made according to these principles.
- According to the result of the risk analysis, the maximum amount of charge per delay to be used in order to not exceed the threshold damage limit of 19 mm/sec at various

[7] Karadogan, A. (2008). *The investigation of establishing the national structure damage criteria for the ground vibration induced by blasting* (Doctoral dissertation, Istanbul University).

risk distances in the cuts to be excavated with blasting is given in the university report (Karadogan, 2008).

- In regions where the rock formation is limestone, the maximum amount of explosive material that can be used per delay for shots to be made at a distance of 25 m from structures that may pose a risk is 8 kg, while the maximum amount of explosives that can be used at a distance of 40 m from structures that may pose a risk will be 20 kg.
- In regions where the rock unit is marl, the maximum amount of explosive material that can be used per delay for shots to be made at a distance of 30 m from structures that may pose a risk is 9 kg, while the maximum amount of explosives that can be used at a distance of 60 m from structures that may pose a risk will be 37 kg.
- In this research, vibration-based risk analysis in open blast excavation activities to be carried out within the scope of "Nakkaş Başakşehir (Including Connection Roads) Section Project of the North Marmara Highway (including the 3rd Bosphorus Bridge) Project Earthworks Between Km 35+300-49+399" and blasting preliminary design models were proposed for the Project site.
- ANFO was chosen as the explosive material in the proposed design models for open excavations, taking into account the capacity of the activity, local supply and storage possibilities, and company capabilities. However, in case of water in the blast holes, EMULSION type explosive sensitive to feeding should be used.
- Depending on the request of the relevant company, a feeder suitable for the hole diameter and twice the length of the diameter (considering the commercial dimensions) should be used as the feeder.
- Delayed ignition is aimed with non-electric detonators.
- In the proposed blasting design, it is thought that each hole will be blasted separately. Therefore, care was taken to keep the charge per delay to a minimum. Therefore, it can be applied in single row pulses as well as multi-row pulses in the model.
- "Controlled Step Blasting" is envisaged in order to ensure that the energy is used in breaking without turning into a seismic wave and without causing environmental effects.
- Inclined hole application is considered in order to use the energy in breaking and translation. In order to stay within a safe area from the risk points (buildings), the throwing direction should be adjusted according to the risky points in order to prevent the stone from being thrown in the blasting to be carried out at distances closer than 100 m and the possible stone throwing must be controlled by covering the throwing group with a suitable covering material (mat).

- It is foreseen that necessary corrections and renewals will be made after the test shots, taking into account the rock behavior and environmental effects.
- Daily beats should be archived by preparing beat patterns and protocols duly, both in trial shots and in the general application process. Qualified personnel should work in accordance with safety rules.
- In terms of biodiversity, a key measure would be that pre-blasting checks of habitats are undertaken for any sensitive species; flushing out of habitats prior to blasting taking place; and blasting to avoid nesting period. Pre-checks would identify bird nests and bat roosts and rescue/removal/translocation to be done as per CESMP Section 7.9 'Wildlife Management'.
- First shepherd any domestic animals and wildlife outside of the blast site, then fence to prevent reentry.

6.4. AIRBLAST CONTROL MEASURES

The following control measures should be applied:

- The Maximum Instantaneous Charge (MIC) is the maximum mass of explosive detonated in any 8 ms period throughout the blast. A reduction in the MIC would correspondingly result in a reduction of the airblast level. The MIC may easily be reduced by reducing the number of holes fired at any one time, resulting in airblast levels lowered by 1 dB Linear to 3 dB Linear. In addition, a pre-blast assessment protocol plays an essential role in managing blast impacts. Therefore, it is very important to draw an appropriate and detailed protocol that minimises the impacts on the surrounding area.
- Fly rock control is essential, and the area around the blast site where flying debris may occur will be secured.

6.5. GROUND VIBRATION CONTROL MEASURES

The following control measures should be applied:

- An appropriate and detailed protocol that minimises the impacts on the surrounding area will be developed.
- The Maximum Instantaneous Charge (MIC) is the maximum mass of explosive detonated in any 8 ms period throughout the blast. A reduction in the MIC would correspondingly result in a reduction of the airblast level. The MIC may easily be reduced by reducing the number of holes fired at any one time, resulting in airblast levels lowered by 1 dB Linear to 3 dB Linear.

- A pre-blast assessment will be undertaken to manage blast risks and impacts, including a meteorological condition protocol to avoid blasting in unfavourable weather conditions;
- Use of an appropriate charge mass design and loading.
- Application of an appropriate initiation sequence for each blast to minimise the possibility of hole interaction, i.e. avoid reinforcing effect and aim for a single hole initiation.
- Undertake an alternative blast design around identified geological features to avoid face burst and excessive airblast emission;
- Use of an appropriate quality stemming material and stemming height to enable correct confinement of explosive charges and therefore minimise airblast emission; and
- Use of an appropriate pre-blast meteorological condition protocol to avoid blasting in unfavorable weather conditions.

6.6. OCCUPATIONAL AND COMMUNITY HEALTH AND SAFETY MEASURES

Blasting activities (including transportation and storage) may create unsafe working environment both for workers and for the community in case the necessary mitigations are not in place. Nakkaş Otoyol A.Ş., REC and subcontractors shall follow the requirements of Turkish Regulation on Health and Safety for Mining Workplaces with regard to blasting activities and obtain all necessary permits from relevant authorities before blasting activities. In addition to the national legal requirements, the following measures listed in IFC EHS Guidelines on Construction Material Extraction and international best practices will be taken before, during and after blasting activities:

- Community awareness/consultation and emergency preparedness and response planning should be undertaken, including control of third-party access to blasting areas (including animal grazing activities);
- Blasting should be conducted according to a consistent timetable agreed with the stakeholders who may be affected. If changes to the blasting timetable occur, nearby communities should be immediately informed of those changes;
- Residents of the local communities should receive a written notification at least 30 days in advance of a nearby blasting as well as two (2) more written reminders. This notification should include the blasting schedules, as well as the name, address and telephone number of the operator; an identification of the specific areas in which blasting should take place; the dates and time periods when explosives are to be detonated; the methods to be used to control access to the blasting areas; and the

type of patterns of audible warning and all-clear signals to be used before and after blasting.

- Access within the blasting area should be controlled to prevent presence of livestock or unauthorized persons during blasting. Access should remain controlled until an authorized representative of the operator has reasonably determined that: no unusual hazards, such as imminent slides or undetonated charges, exist, and access to and travel within the blasting area can be safely resumed.
- Blasting schedules should be distributed to the users of the grazing areas, residents and local governments including the name, address and telephone number of the operator; an identification of the specific areas in which blasting will take place; the dates and time periods when explosives are to be detonated; the methods to be used to control access to the blasting areas; and the type of patterns of audible warning and all-clear signals to be used before and after blasting;
- Specific warning devices (e.g. horn signals and flashing lights) and procedures should be implemented before each blasting activity to alert all workers and third parties in the surrounding areas (e.g local communities). Warning procedures shall include traffic limitation along local roadways and railways;
- Specific personnel training on explosives handling and safety management should be conducted;
- Blasting-permit procedures should be implemented for all personnel involved with explosives (e.g. handling, transport, storage, charging, blasting, and destruction of unused or surplus explosives);
- Blasting sites should be checked post-blast by qualified personnel for malfunctions and unexploded blasting agents, prior to resumption of work;
- Blasting blankets are also recommended to prevent rock and stone fly.
- Blasting signs are to be conspicuously place along the edge of the blast site and area where flying debris may occur.
- Identification of buildings located within 50 m of significant sources of vibration ahead of construction works. Evaluation of the sensitivity of the identified buildings and building occupants to vibration.
- A documentation should be prepared for each of the identified buildings which will include photographs of buildings sensitive to vibration and results of the sensitivity evaluation.
- Monitoring of vibration on commencement of relevant blasting activities should be undertaken to ensure that the Turkish regulatory requirements are met. If the standards

are exceeded additional measures will be taken such as altering the methods of working to use equipment that creates lower levels of vibration. It is assumed that the standards will not be exceeded considering that the bored piling method will be preferred instead of the driven piling method which would create disturbance and vibration on the ground. The produced piles will work as friction piles, and only drilling will be done on weak, loose ground without entering the solid rock which will avoid vibration.

- In line with international best practice, condition surveys of buildings located within 50 m of blasting will be completed ahead of construction works. Buildings and their occupants will be evaluated in terms of sensitivity to vibration.
- Results of all the building condition surveys should be documented including photographs to indicate the baseline condition of the building prior to blasting/construction activities. Buildings will be re-surveyed upon completion of construction to determine if any impacts have occurred.

7. TRAINING

REC should provide training on blasting activities to each relevant employee to ensure every person understands his or her responsibilities. Personnel involved in blasting activities will be given regular training on:

- Blasting and explosives management activities including, promotion of safety practices.

8. MONITORING, ASSURANCE AND VERIFICATIONS

Ongoing stakeholder engagement will include consultation with authorities, local communities and any other relevant stakeholders with regard to management of blasting activities. Any grievances received from stakeholders will be managed in accordance with the Grievance Mechanism as detailed in the Project Stakeholder Engagement Plan (SEP).

9. REPORTING REQUIREMENTS

The following reporting requirements apply for the EPC Contractor:

- Incident reporting (as necessary, addressed in terms of the Accident and Incident Management Procedure);
- Biannual reports on KPIs and performance trends;
- Monthly reports of relevant training activities completed and attendance registers to be maintained;
- Daily/Weekly/Monthly reports of site inspection activities;
- Audit reports;
- Inspection logs and status of non-compliances.

In addition, the following external reporting will be done:

- Monthly and biannual ESHS reports on KPIs and performance trends will be submitted to Nakkaş Otoyol A.Ş.;
- All environmental and social incidents will be appropriately documented, notified and reported in accordance with established procedures.
- Incident notification and reporting to relevant Turkish regulatory bodies will be performed in line with applicable legislation in force and as stipulated in permits and licenses.
- The Lenders will be notified of incidents pursuant to the terms and conditions agreed upon in the Finance Agreements.

10. KEY PERFORMANCE INDICATORS

Following Key Performance Indicators (KPIs) will be monitored, verified and evaluated by the relevant parties in accordance with their responsibilities set forth in the REC-İSG-ÇYS-KMO-PR-09 HSE Monitoring, Assurance and Verification Procedure and Labour Management Plan: (REC-HSE-EYS-KMO-PL-36)

Table 4. KPI's for Blasting

KPI	Measurement	Target	Frequency
Grievances received related with blasting	Number	100% closed or responded to within 30 days	Monthly
Blasting storage, transportation and usage permits are in place	Percentage	100%	Prior to procurement and bringing to the site
Community safety awareness trainings in place	Percentage	100%	Monthly
Residents of the local communities received a written notification at	Timeline	Written notification sent within 30 days	30 days prior to blasting

least 30 days in advance of a nearby blasting as well as two (2) more written reminders.	Percentage	100% nearby communities have been engaged	
Blasting schedules are distributed to the users of the grazing areas, residents and local governments	Timeline Percentage	Written notification sent within 30 days 100% nearby communities have been engaged	30 days prior to blasting
Specific warning devices (e.g., horn signals and flashing lights) are in place before each blasting activity to alert all workers and third parties in the surrounding areas (e.g., local communities).	Percentage	100%	Prior to blasting
Visible signs have been installed and maintained that identify a blast area at all approach routes to the area.	Percentage	100%	Prior to blasting