

## **APPENDIX K**

### **NOISE MODEL METHODOLOGY AND CONSTRUCTION NOISE MODEL RESULTS**



## 1. NOISE STANDARDS

1. Admissible noise standards of the IFC and Georgian national standards for residential areas are similar. The national standards for noise are set according to the Technical Regulation—"Acoustic Noise Limits for Rooms/Premises in Residential Houses and Public Establishments" (Document #300160070.10.003.020107) issued on August 15, 2017. Georgian standard requirements for noise levels are given in the Table 1 below.

2. For IFC, noise impacts should not exceed the levels presented in Table 3 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site. This project will comply with both IFC Guidelines and Georgian Standards. Note that Georgian standards refer to the allowable limits indoors, not at the building façade.

**Table 1: Georgian Standards for Noise Levels**

| Purpose/use of area and premises                                                                                                | Allowable limits (dBA)                |                        |                                 |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------|---------------------------------|
|                                                                                                                                 | Lday                                  |                        | Night,<br>Night23:00<br>– 08:00 |
|                                                                                                                                 | 08:00 - 19:00,<br>Night, Night<br>Day | Evening<br>19:00-23:00 |                                 |
| Educational facilities and library halls                                                                                        | 35                                    | 35                     | 35                              |
| Medical facilities/chambers of medical institutions                                                                             | 40                                    | 40                     | 40                              |
| Living quarters and dormitories                                                                                                 | 35                                    | 30                     | 30                              |
| Hospital chambers                                                                                                               | 35                                    | 30                     | 30                              |
| Hotel/motel rooms                                                                                                               | 40                                    | 35                     | 35                              |
| Trading halls and reception facilities                                                                                          | 55                                    | 55                     | 55                              |
| Restaurant, bar, cafe halls                                                                                                     | 50                                    | 50                     | 50                              |
| Theatre/concert halls and sacred premises                                                                                       | 30                                    | 30                     | 30                              |
| Sport halls and pools                                                                                                           | 55                                    | 55                     | 55                              |
| Small offices (≤100m <sup>3</sup> ) – working rooms and premises without office equipment                                       | 40                                    | 40                     | 40                              |
| Small offices (≤100m <sup>3</sup> ) – working rooms and premises without office equipment                                       | 40                                    | 40                     | 40                              |
| Conference halls /meeting rooms                                                                                                 | 35                                    | 35                     | 35                              |
| 35A35reas bordering with houses residential, medicalestablishments, social service and children facilities(<6 storey buildings) | 50                                    | 45                     | 40                              |
| Areas bordering with houses residential, medicalestablishments, social service and children facilities(>6 storey buildings)     | 55                                    | 50                     | 45                              |
| The areas bordering with hotels, trade, service, sportand public organizations                                                  | 60                                    | 55                     | 50                              |

Note:

1. in case noise generated by indoor or outdoor sources is impulse or tonal, the limit must be 5dBA les than indicatedin the table.

2. Acoustic noise limits given above are set for routine operation conditions of the 'space', i.e. windows and door areclosed (exception – built-in ventilation canals), ventilation, air conditioning, lighting (in case available) are on; functional (baseline) noise (such as music, speech) not considered.

**Table 2: IFC Noise Level Guidelines**

| <b>Receptor</b>                            | <b>One hour Laeq (dBA)</b>     |                                     |
|--------------------------------------------|--------------------------------|-------------------------------------|
|                                            | <b>Daytime<br/>07.00-22.00</b> | <b>Night-time<br/>22.00 – 07.00</b> |
| Residential; institutional;<br>educational | 55                             | 45                                  |
| Industrial; commercial                     | 70                             | 70                                  |

3. For workplace noise the following IFC standards are applicable.

**Table 3: IFC Work Environment Noise limits**

| <b>Type of Work, workplace</b>                                     | <b>IFC General EHS Guidelines</b> |
|--------------------------------------------------------------------|-----------------------------------|
| Heavy Industry (no<br>demand for oral<br>communication)            | 85 Equivalent level Laeq,8h       |
| Light industry<br>(decreasing<br>demand for oral<br>communication) | 50-65 Equivalent level Laeq,8h    |

## **2. EXISTING SITUATION**

### **2.1 Environmental Conditions**

4. Dusheti municipality comprises medium and high mountain areas. Elevation ranges from 870m to 4,000m above sea level, therefore the climate conditions are rather diverse. In the lower areas the climate is moderately humid with mild winter and warm lengthy summer. Average annual temperature in the low-sited areas (870-899 masl) is 9.7 °C. Precipitation level is around 750mm. In the higher-sited areas the climate is more humid, precipitation level increases and ranges from 1,200 till 1,600mm. The climate in Kazbegi municipality is moderately humid. At comparatively low elevation (around 1,700m, up to 2,000m) winter is cold and dry, summer – cool. Steady snow cover persists for 3-4 months. In the 2,000-2,600m zone winter is comparatively dry, summer – cool and short. Average temperature of around 10 °C lasts 1-3 months. For 4-5 months temperature is below 5 °C. Temperature of the warmest month is 10-14 °C. In the upper zone west winds dominate. Precipitation level is 1,000-1,200mm.

### **2.2 Noise Sources**

5. The only significant source of noise in the project zone is traffic. There are no large plants or industrial centers in the project zone. Small and medium businesses located along the road are mostly small markets and catering objects.

6. The traffic in the project zone is not intense. Presently, during the most intense traffic, approximately 4 vehicles a minute drive in both directions. The situation is aggravated by the hard situation with the vehicle fleet of Georgia evidenced by alarming statistics, under which:

1. 57% - produced before 1998;
2. 23% - produced before 2003;
3. 18% - produced Before 2008;
4. 3% - produced before 2013

7. Even with the same traffic intensity:

1. Old, 20-25-year-old car models are safer than new vehicle models, including the less noisy ones.
2. Surely, the old and often faulty vehicles make higher noise than the new vehicles, even if they are of the same class.

### **2.3 Main Receptors**

8. The main receptors, the noise will have an impact during the project implementation and operation phases are settled areas and existing fauna. The largest portion of the project road will run through the new alignment, where, despite the fact that there is a local ground road, the traffic almost takes no place.

9. The main villages found adjacent to the project zone are: Kvesheti, Arakhveti, Zaqatkari, Sviana-Rostiani, Benian-Begoni, Tskere and Kobi.

10. Description of main receptors within the Project zone are given in the Table 4 below.

**Table 4.** Main receptors within the project zone

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Kvesheti:</b></p> <p>A village in east Georgia, in the gorge of the river Mtiuletis Aragvi, Dusheti Municipality, Mtskheta-Mtianeri region. The center of the community Sakrebulo includes 32 villages. The village population, as per the census of 2014, is 257, with 122 men and 135 women. Both, the existing and the design highway cross the village.</p>                         |
|   | <p><b>Arakhveti:</b></p> <p>A village in Dusheti Municipality, on the right bank of the River Aragvi, on the Military Road of Georgia, at 1520 m asl, distanced from Dusheti by 61 km. The village population, as per the census of 2014, is 205 people, with 110 men and 95 women. Both, the existing and the design highway cross the village.</p>                                          |
|  | <p><b>Zaqtakari:</b></p> <p>A village in Dusheti Municipality; one of the villages of Kvesheti community located in the gorge of the river Mtiuletis Aragvi, on Didveli or Kaishauri Plateau, at 1640 m asl, distanced from the city of Dusheti by 70 km. The village population, as per the census of 2014, is 57 people.</p>                                                                |
|  | <p><b>Village Sviana-Rostiani:</b></p> <p>A village in Georgia, in Dusheti Municipality, Mtskheta-Mtianeri region, Kvesheti community. The village is located on the south-western slope of Mtiuleti ridge, at 1 500 m asl. It is distanced from Dusheti by 72 km. The village population is 2 people (2014). National background: the Georgians. Center found at the altitude of 1580 m.</p> |

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p><b>Village Benian-Begoni:</b></p> <p>A village in Georgia, in Dusheti Municipality (Kvesheti community). It is located adjacent to the river Khidistskali (the left tributary of the river Mtiuleti Aragvi), on the southern slope of the main watershed ridge of Caucasioni, at 1680 m above sea level. It is distanced from Dusheti by 64 km. Its population is 12 people. (2014). National background: the Georgians. Center found at altitude: 1680 m.</p> |
|   | <p><b>Tskere:</b></p> <p>A village in east Georgia, in Dusheti Municipality, Mtskheta-Mtianeri region, Kvesheti community. It is located on the southern slope of Mtiuleti Ridge, at 1880 m asl. It is distanced from Dusheti by 70 km. Its population is 3 people. National background: the Georgians. Center found at altitude: 1880 m.</p>                                                                                                                     |
|  | <p><b>Kobi</b></p> <p>village in the historical region of khevi, Georgia,. Administratively, it is part of the Kazbegi Municipality in Mtskheta-Mtianeti. It is a community center of Truso Valley villages. Distance to the municipality center Stepantsminda is 20 km. Its population is 3 people. (as per the census of 2014).</p>                                                                                                                             |

### 3. TRAFFIC

#### 3.1 Traffic Data

11. The following data set provided by the ADB was used as part of the noise model.

**Table 5: Traffic Forecast**

|              | Year | Car   | Minibus | Van/pickup | Bus | 2ax<br>MGV | 3ax<br>HGV | T-T   | Sum    |
|--------------|------|-------|---------|------------|-----|------------|------------|-------|--------|
| Construction | 2017 | 2,396 | 191     | 191        | 112 | 144        | 81         | 316   | 3,432  |
|              | 2018 | 2,546 | 203     | 203        | 119 | 154        | 86         | 337   | 3,649  |
|              | 2019 | 2,705 | 216     | 216        | 127 | 164        | 92         | 359   | 3,879  |
|              | 2020 | 2,873 | 230     | 230        | 135 | 175        | 98         | 384   | 4,124  |
|              | 2021 | 3,023 | 242     | 242        | 142 | 185        | 104        | 405   | 4,341  |
|              | 2022 | 3,180 | 254     | 254        | 149 | 195        | 109        | 428   | 4,570  |
|              | 2023 | 3,345 | 267     | 267        | 157 | 206        | 115        | 452   | 4,811  |
| Year 1       | 2024 | 3,518 | 281     | 281        | 165 | 218        | 122        | 477   | 5,061  |
|              | 2025 | 4,052 | 324     | 316        | 190 | 248        | 139        | 544   | 5,813  |
|              | 2026 | 4,580 | 366     | 351        | 215 | 279        | 156        | 612   | 6,559  |
|              | 2027 | 5,143 | 411     | 387        | 241 | 313        | 175        | 684   | 7,354  |
|              | 2028 | 5,744 | 459     | 426        | 269 | 348        | 195        | 762   | 8,204  |
|              | 2029 | 5,974 | 477     | 443        | 280 | 364        | 204        | 798   | 8,541  |
|              | 2030 | 6,213 | 497     | 461        | 291 | 379        | 212        | 829   | 8,881  |
|              | 2031 | 6,437 | 514     | 477        | 302 | 392        | 219        | 858   | 9,199  |
|              | 2032 | 6,669 | 533     | 494        | 313 | 406        | 227        | 888   | 9,529  |
| Year 10      | 2033 | 6,909 | 552     | 512        | 324 | 420        | 235        | 919   | 9,871  |
|              | 2034 | 7,157 | 572     | 531        | 336 | 435        | 243        | 952   | 10,225 |
|              | 2035 | 7,415 | 593     | 550        | 348 | 450        | 252        | 985   | 10,592 |
|              | 2036 | 7,682 | 614     | 569        | 360 | 466        | 261        | 1,020 | 10,972 |
|              | 2037 | 7,959 | 636     | 590        | 373 | 482        | 270        | 1,056 | 11,366 |
|              | 2038 | 8,245 | 659     | 611        | 387 | 499        | 279        | 1,093 | 11,774 |
|              | 2039 | 8,542 | 683     | 633        | 401 | 517        | 289        | 1,132 | 12,196 |
|              | 2040 | 8,849 | 707     | 656        | 415 | 535        | 299        | 1,172 | 12,634 |
|              | 2041 | 9,168 | 733     | 680        | 430 | 554        | 310        | 1,213 | 13,088 |
|              | 2042 | 9,360 | 748     | 699        | 439 | 569        | 318        | 1,246 | 13,380 |
| Year 20      | 2043 | 9,555 | 764     | 718        | 448 | 585        | 327        | 1,280 | 13,677 |
|              | 2044 | 9,603 | 767     | 732        | 450 | 596        | 334        | 1,305 | 13,788 |
|              | 2045 | 9,643 | 771     | 746        | 452 | 608        | 340        | 1,330 | 13,889 |
|              | 2046 | 9,673 | 773     | 760        | 454 | 619        | 346        | 1,355 | 13,980 |
|              | 2047 | 9,693 | 775     | 768        | 455 | 625        | 350        | 1,368 | 14,033 |
|              | 2048 | 9,701 | 775     | 775        | 455 | 631        | 353        | 1,381 | 14,071 |

Source: ADB

#### **4. RESULTS OF THE BASELINE NOISE MEASUREMENTS**

12. From June 28 through July 3, 2018, the specialists measured the baseline noise level in 4 points of the project zone. The noise was measured continuously, for 24 hours and the data were taken in every second. Total 43000-44000 data were obtained from every point. Noise level measurements were done in village Kvesheti and Arakveti. Additional 24-hour noise measurements were done on the territory of village Kobi. The measurement was done on September 1-2.

13. The existing noise level measurements were done only in the villages located along the existing road. As the only anthropogenic source of noise in the project zone is the noise originated from the traffic, measuring the baseline noise in other villages would not give any practical outcome.

14. Sampling was done with American noise meter „REED 8080“. The noise meter was calibrated by the Georgian National Agency for Standards and Metrology on April 23, 2018. Calibration Certificate: GE/MI 07-00474-18.

15. The points of measurement were selected in line with the requirements of Resolution no. 398 of the Government of Georgia on August 15, 2017 “On the levels of acoustic noise in the rooms of the residential houses and public establishments and their accommodation areas”<sup>1</sup>.

16. In the area, which immediately adjoins the residential houses and buildings of public establishments, a noise measuring device was installed at least 2 m from the structures of the buildings and at 1,5-2,0 m high from the ground level.

**Figure 1: Kvesheti village**



**Figure 2: Kvesheti village**



17. During the measurements, the microphone was directed towards the main source of noise and was distanced from the entity making the measurements by at least 0,5 m. If it was impossible to identify the main source of noise in the area, the direction of the microphone was vertical and upwards.

18. Table 6 shows the averaged index of the data taken at 5 points of the project zone in a 24-hour continuous mode in every 3 hours.

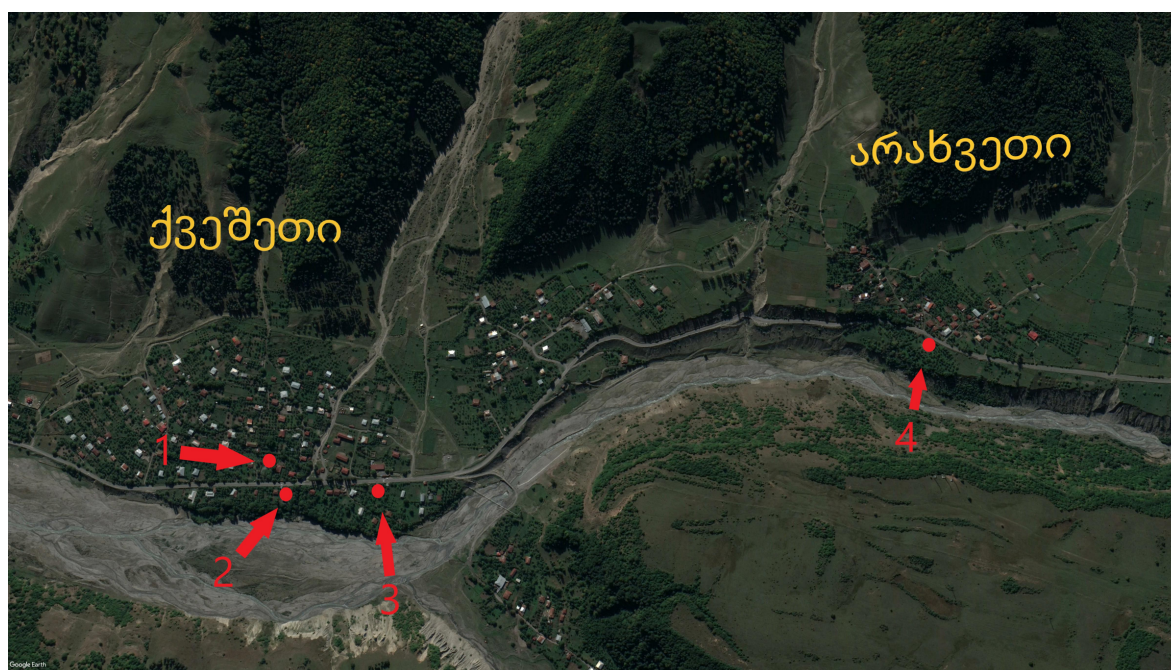
<sup>1</sup> Technical Regulation sets the admissible level of acoustic noise in the rooms of the residential houses and public establishments and their accommodation areas.

**Table 6:** Average noise indicator with 3-hour intervals

| N              | Date                          | Coordinates                    | Average indicator of noise (dBA) |                     |                     |                     |                     |                     |                     |                     |
|----------------|-------------------------------|--------------------------------|----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                |                               |                                | 21:00<br>-<br>24:00              | 00:00<br>-<br>03:00 | 03:00<br>-<br>06:00 | 06:00<br>-<br>09:00 | 09:00<br>-<br>12:00 | 12:00<br>-<br>15:00 | 15:00<br>-<br>18:00 | 18:00<br>-<br>21:00 |
| 1              | 28.06.2018<br>-<br>29.06.2018 | 42°25'35.57"N<br>4°33'26.37"E  | 53.6                             | 51.1                | 52.0                | 52.3                | 53.8                | 54.4                | 53.8                | 53.2                |
| 2              | 29.06.2018<br>-<br>30.06.2018 | 42°25'38.32"N<br>4°33'24.29"E  | 54.5                             | 53.9                | 52.3                | 53.9                | 55.2                | 58.6                | 55.9                | 55.9                |
| 3 <sup>2</sup> | 30.06.2018<br>-<br>01.07.2018 | 42°25'38.57"N<br>44°33'13.58"E | 46.0                             | 43.4                | 46.1                | 45.6                | 49.0                | 50.9                | 49.7                | 50.1                |
| 4              | 02.07.2018<br>-<br>03.07.2018 | 42°25'30.07"N<br>44°32'7.42"E  | 53.1                             | 52.6                | 53.9                | 51.6                | 54.8                | 57.7                | 50.3                | 53.7                |
| 5              | 01.10.2018<br>02.10.2018      | 42°33'22.23"N<br>44°29'59.21"E | 52.4                             | 52.1                | 53.1                | 50.4                | 52.9                | 54.1                | 52.1                | 52.8                |

19. Although, the noise level at night exceeds the admissible level, as Table 6 shows, the difference between the day and night noise levels is quite little, making maximum 4-5 db. Such a minor difference is caused by the fact that the major noise sources, the heavy trailers, move along the given road section both, during the day and at night (many of them prefer traveling at night along the less loaded road).

<sup>2</sup> This point was located 2 m under noise source level.



**Figure 3:** Noise measuring points

## 5. MODELING THE EXISTING SITUATION

### 5.1 Introduction

20. As already mentioned, the project zone belongs to mountain areas. There are small villages in the project zone and in the adjacent areas. There are 6 villages adjacent to the project zone. Of the six villages, the road will cross only two, while at present, other 4 villages are distanced from the design highway by various distances.

21. The villages are not big and if considering the statistics of general censuses of 2002 and 2014, we will see that the population in villages reduces at a catastrophic rate (See Table 7). As the table shows, the population in the villages adjacent to the project zone has reduced by virtually 60% in the last 12 years.

**Table 7:** Population in the villages adjacent to the project corridor

| No | VillageName     | 2002 census data | 2014 census data | Populationreductionrate % |
|----|-----------------|------------------|------------------|---------------------------|
| 1  | Kvesheti        | 355              | 257              | 27.4                      |
| 2  | Arakhveti       | 326              | 205              | 37.1                      |
| 3  | Zaqatkari       | 81               | 57               | 29.8                      |
| 4  | Sviana-Rostiani | 15               | 2                | 86.7                      |
| 5  | Benian-Begoni   | 65               | 12               | 81.5                      |
| 6  | Tskere          | 40               | 3                | 93.5                      |
| 7  | Kobi            | 25               | 3                | 92.0                      |

### 5.2 Methods of noise modeling

22. CadnaA (Computer Aided Noise Abatement) is the leading software for calculation, presentation, assessment and prediction of environmental noise. Whether your objective is to study the noise emission of an industrial plant, of a mart including a parking lot, of a new road or railway scheme or even of entire towns and urbanized areas: CadnaA is designed to handle all these tasks.

23. With more than 30 implemented standards and guidelines, powerful calculation algorithms, extensive tools for object handling, outstanding 3D visualization and the very user-friendly interface CadnaA is the perfect software to handle national and international noise calculation and noise mapping projects of any size.

24. With its technical capabilities and its ease of use CadnaA represents state-of-the-art technology. CadnaA is developed in C/C++ and communicates perfectly with other Windows applications like word processors, spreadsheet calculators, CAD software and GIS-databases. CadnaA includes a multi-lingual user interface and is successfully applied in more than 60 countries all over the world.

25. In order to use the software, it was necessary to accomplish a number of studies to collect all the information needed for modeling.

26. The Environmental noise model is based on a specific set of conditions for which the noise is being estimated, it will be a fixed representation or 'snapshot' of a physical environment of interest; in practice the physical environment of the area of interest is constantly and randomly changing; the model intend to represent the most typical or frequently occurring conditions as reconstructed by the input data.

27. Modeling takes into consideration both worse scenario and the average conditions, the latter being a good representation in case of pretty constant traffic conditions. The key conditions for the development of a good noise model are:

- Knowledge of the noise source, or sources, for which associated environmental noise levels are of interest.
- The physical environment through which noise will transmit from the noise source(s) to the location or targets/region of interest. This includes the ground terrain, the built environment, and atmospheric conditions (e.g. wind, temperature, humidity).
- An approximation of the way in which sound will travel from the noise source(s) via the physical environment, to the receiver location or region of interest (building surface).

28. The road will be considered as a linear source of noise, composed by a number of vehicles considered as single sources moving along a line. Application of calculations to each point on a uniformly distributed grid enables a noise contour map to be developed to depict regions of equal estimated noise level and depict trends in the spatial pattern of the sound field.

29. To calculate the propagation the model takes into account:

- The absorption associated with the propagation of noise through the atmosphere.
- The change in noise level that occurs as a result of interactions between the sound wave travelling directly to the receiver and those reflected from the ground, buildings and accounting for influence of the ground cover type.
- The attenuation offered by obstacles that fully or partly obstruct line of sight between a source and a receiver location.
- The influence of atmospheric conditions that can change the direction of an advancing sound wave front by refracting the wave at points where there are significant changes in wind speed and/or temperature.
- The influence of reflecting surfaces which re-direct an advancing sound wave front.

### **Simulation parameters**

30. The modeling of the noise emissions and noise propagation from the new road takes into account that there are many houses very close to road side in certain sectors and others where urbanization is almost absent. The morphology, characterized by hills, and the presence of the river valley and riverbed plays a very important role mostly because this determine the distribution and type of vegetation which is acting as noise barrier and the absence of obstacles for the propagation across the valley.

31. The following parameters were used in the model:

- DTM Ground Elevation Model was used provided by the Detailed Design Consultant;
- Projected Traffic horizons were modeled at 2024, 2028 and to 2033;
- Uniform traffic speed of 80 kph was used;
- Trees and grassland was assumed as volume attenuation areas;
- Each receptor was separately identified, with location, building height and number of floors;
- No noise emission from the tunnels was assumed;
- Road Surface: Asphalt concrete, without gritting; and
- Split of day and night noise following IFC guidance 07:00 – 22:00 day; 22:00 – 07:00 night

## 6. CONSTRUCTION STAGE

32. The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling. Only in a few cases noise generated by the process dominates (for example, impact pile driving, pavement breaking).

33. Noise levels during construction will vary depending on the activity, type and number of equipment, work schedule, duration of use and the distance from receptor. Construction in this analysis, first the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated. Noise levels induced by the main road construction equipment considered in assessment are presented in Table 8. (Note: the values indicated in the table may differ depending on the brand of machinery provided/used by contractor). The list includes all equipment except vehicles and some minor pieces of equipment.

**Table 8: Typical Noise Levels from Construction Equipment**

| Equipment              | Typical noise level (dBA) <sup>3</sup> |
|------------------------|----------------------------------------|
| Pavement               |                                        |
| Dozer                  | 81.7                                   |
| Excavator              | 80.7                                   |
| Grader                 | 85                                     |
| Roller                 | 80.0                                   |
| Rock Drill             | 81.0                                   |
| Dump Truck             | 76.5                                   |
| Paver                  | 77.2                                   |
| Concrete Mixer Truck   | 78.8                                   |
| Tunnel Mouth           |                                        |
| Jackhammer             | 88.9                                   |
| Dozer                  | 81.7                                   |
| Dump Truck             | 76.5                                   |
| Tunnel                 |                                        |
| Blasting               | 94.0                                   |
| Bridge                 |                                        |
| Piling                 | 90.0                                   |
| Dozer                  | 81.7                                   |
| Dump Truck             | 76.5                                   |
| Paver                  | 77.2                                   |
| Boring Jack Power Unit | 83.0                                   |

34. During the noise modeling in the construction phase, we assumed that 4 heavy techniques would operate at the same time.

35. The following tables indicate the predicted construction noise values within the populated areas of the Project area.

<sup>3</sup> The given noise level is given near the source of noise.

**Table 9:** Construction Noise: Village Kvesheti



| House No | Baseline |       | Construction |
|----------|----------|-------|--------------|
|          | Day      | Night | Day          |
| 1        | 51       | 48    | 63           |
| 2        | 55       | 51    | 71           |
| 3        | 53       | 49    | 70           |
| 4        | 64       | 59    | 77           |
| 5        | 57       | 52    | 72           |
| 6        | 58       | 54    | 73           |
| 7        | 47       | 43    | 65           |
| 8        | 44       | 41    | 63           |
| 9        | 52       | 48    | 69           |
| 10       | 56       | 53    | 73           |

|    |    |    |    |
|----|----|----|----|
| 11 | 63 | 58 | 77 |
| 12 | 50 | 47 | 65 |
| 13 | 48 | 45 | 64 |
| 14 | 47 | 44 | 63 |
| 15 | 44 | 40 | 62 |
| 16 | 40 | 36 | 59 |
| 17 | 42 | 39 | 59 |
| 18 | 42 | 39 | 59 |
| 19 | 41 | 39 | 58 |
| 20 | 42 | 38 | 57 |
| 21 | 44 | 41 | 60 |
| 22 | 64 | 60 | 75 |
| 23 | 54 | 50 | 68 |
| 24 | 51 | 48 | 64 |
| 25 | 46 | 43 | 61 |
| 26 | 41 | 38 | 60 |
| 27 | 40 | 37 | 58 |
| 28 | 41 | 38 | 57 |
| 29 | 41 | 38 | 58 |
| 30 | 65 | 60 | 72 |
| 31 | 65 | 60 | 70 |
| 32 | 52 | 48 | 64 |
| 33 | 49 | 46 | 62 |
| 34 | 47 | 44 | 61 |
| 35 | 49 | 45 | 62 |
| 36 | 44 | 41 | 59 |
| 37 | 45 | 43 | 58 |
| 38 | 42 | 40 | 58 |
| 39 | 44 | 41 | 57 |
| 40 | 43 | 41 | 58 |
| 41 | 46 | 43 | 58 |
| 42 | 45 | 43 | 59 |
| 43 | 44 | 41 | 58 |
| 44 | 45 | 42 | 58 |
| 45 | 45 | 43 | 59 |
| 46 | 45 | 43 | 59 |
| 47 | 46 | 43 | 60 |
| 48 | 45 | 42 | 62 |
| 49 | 45 | 42 | 60 |
| 50 | 45 | 42 | 60 |
| 51 | 44 | 42 | 58 |
| 52 | 41 | 39 | 58 |
| 54 | 42 | 40 | 56 |
| 55 | 41 | 38 | 58 |
| 56 | 41 | 38 | 58 |
| 57 | 41 | 38 | 59 |
| 58 | 45 | 42 | 60 |
| 59 | 45 | 42 | 61 |
| 60 | 44 | 41 | 60 |
| 61 | 46 | 43 | 63 |
| 62 | 51 | 48 | 63 |
| 63 | 50 | 46 | 63 |
| 64 | 47 | 43 | 61 |
| 65 | 50 | 47 | 64 |
| 66 | 57 | 53 | 67 |
| 67 | 66 | 62 | 70 |
| 68 | 64 | 59 | 69 |
| 69 | 64 | 56 | 67 |

|                  |    |    |    |
|------------------|----|----|----|
| 70               | 61 | 57 | 68 |
| 71               | 62 | 58 | 68 |
| 72               | 62 | 58 | 68 |
| 73               | 53 | 50 | 64 |
| 74               | 54 | 50 | 64 |
| 75               | 51 | 47 | 64 |
| 76               | 51 | 47 | 63 |
| 77               | 48 | 44 | 62 |
| 78               | 47 | 44 | 62 |
| 79               | 66 | 61 | 75 |
| 80               | 65 | 61 | 72 |
| 81               | 67 | 62 | 71 |
| 82               | 66 | 62 | 71 |
| 83               | 66 | 61 | 71 |
| 84               | 65 | 61 | 72 |
| 85               | 66 | 61 | 71 |
| 86               | 66 | 61 | 71 |
| 87               | 64 | 59 | 70 |
| 88               | 64 | 59 | 69 |
| 89               | 52 | 48 | 73 |
| 90               | 66 | 62 | 69 |
| 91               | 49 | 46 | 74 |
| 92               | 52 | 48 | 72 |
| 93               | 61 | 57 | 68 |
| 94               | 58 | 54 | 71 |
| 95               | 50 | 47 | 74 |
| 96               | 57 | 53 | 71 |
| 97               | 65 | 60 | 69 |
| 98               | 65 | 61 | 68 |
| 99               | 64 | 59 | 67 |
| 100              | 58 | 54 | 65 |
| 102              | 51 | 48 | 62 |
| 103              | 52 | 48 | 64 |
| 104              | 47 | 45 | 60 |
| 105              | 46 | 43 | 60 |
| 106              | 48 | 44 | 61 |
| 107              | 46 | 43 | 60 |
| 108              | 50 | 47 | 62 |
| 110              | 52 | 49 | 64 |
| 111              | 56 | 52 | 65 |
| 112              | 55 | 51 | 69 |
| 113              | 51 | 48 | 66 |
| 114              | 49 | 46 | 64 |
| 115              | 44 | 41 | 62 |
| 116              | 47 | 44 | 64 |
| 117              | 45 | 43 | 62 |
| 118              | 45 | 42 | 62 |
| 119              | 43 | 41 | 59 |
| 120              | 42 | 40 | 59 |
| 120 <sup>1</sup> | 39 | 36 | 58 |
| 121              | 43 | 40 | 60 |
| 122              | 42 | 39 | 60 |
| 123              | 44 | 41 | 62 |
| 124              | 42 | 39 | 62 |
| 125              | 43 | 40 | 60 |
| 126              | 45 | 42 | 61 |
| 127              | 40 | 37 | 59 |
| 128              | 36 | 33 | 57 |

|     |    |    |    |
|-----|----|----|----|
| 129 | 55 | 51 | 70 |
| 130 | 49 | 46 | 65 |
| 131 | 62 | 57 | 75 |
| 132 | 59 | 55 | 73 |
| 134 | 43 | 41 | 62 |
| 135 | 40 | 37 | 59 |
| 136 | 42 | 40 | 60 |
| 137 | 61 | 56 | 60 |
| 138 | 61 | 56 | 60 |
| 139 | 62 | 57 | 73 |
| 140 | 58 | 53 | 73 |
| 141 | 62 | 57 | 77 |

**Table 10:** Construction Noise: Village Arakveti

|  |         |       |              |
|-------------------------------------------------------------------------------------|---------|-------|--------------|
| House No                                                                            | Current |       | Construction |
|                                                                                     | Day     | Night | Day          |
| 142                                                                                 | 54      | 51    | 72           |
| 143                                                                                 | 47      | 44    | 64           |
| 144                                                                                 | 46      | 44    | 63           |
| 145                                                                                 | 46      | 44    | 65           |
| 146                                                                                 | 49      | 46    | 67           |
| 146 <sup>1</sup>                                                                    | 49      | 46    | 67           |
| 147                                                                                 | 49      | 46    | 68           |
| 148                                                                                 | 58      | 52    | 74           |
| 149                                                                                 | 49      | 46    | 67           |
| 150                                                                                 | 50      | 47    | 69           |
| 151                                                                                 | 54      | 50    | 71           |
| 152                                                                                 | 58      | 55    | 74           |

|     |    |    |    |
|-----|----|----|----|
| 153 | 63 | 59 | 77 |
| 154 | 64 | 60 | 78 |
| 155 | 54 | 50 | 72 |
| 156 | 64 | 60 | 79 |
| 157 | 54 | 50 | 72 |
| 158 | 65 | 61 | 82 |
| 159 | 67 | 62 | 83 |
| 160 | 63 | 59 | 77 |
| 161 | 70 | 65 | 82 |
| 162 | 54 | 50 | 72 |
| 163 | 54 | 50 | 72 |
| 164 | 62 | 57 | 77 |
| 165 | 61 | 57 | 77 |
| 166 | 54 | 51 | 72 |
| 167 | 50 | 47 | 70 |
| 168 | 49 | 46 | 69 |
| 169 | 51 | 47 | 70 |
| 170 | 48 | 45 | 68 |
| 171 | 49 | 46 | 68 |
| 172 | 53 | 50 | 71 |
| 173 | 61 | 57 | 76 |
| 174 | 60 | 56 | 75 |
| 175 | 51 | 48 | 70 |
| 176 | 45 | 43 | 64 |
| 177 | 44 | 42 | 62 |
| 178 | 44 | 42 | 62 |
| 179 | 46 | 44 | 63 |
| 180 | 55 | 52 | 73 |
| 181 | 52 | 50 | 72 |
| 182 | 52 | 49 | 70 |
| 183 | 58 | 54 | 74 |
| 184 | 62 | 58 | 73 |
| 185 | 59 | 55 | 70 |
| 186 | 57 | 54 | 67 |
| 187 | 51 | 48 | 63 |
| 188 | 52 | 49 | 66 |
| 189 | 53 | 50 | 69 |
| 190 | 50 | 47 | 65 |
| 191 | 48 | 46 | 63 |
| 192 | 49 | 47 | 64 |
| 193 | 49 | 46 | 65 |
| 194 | 48 | 46 | 65 |

**Table 11: Construction Noise: Village Zakatkari**



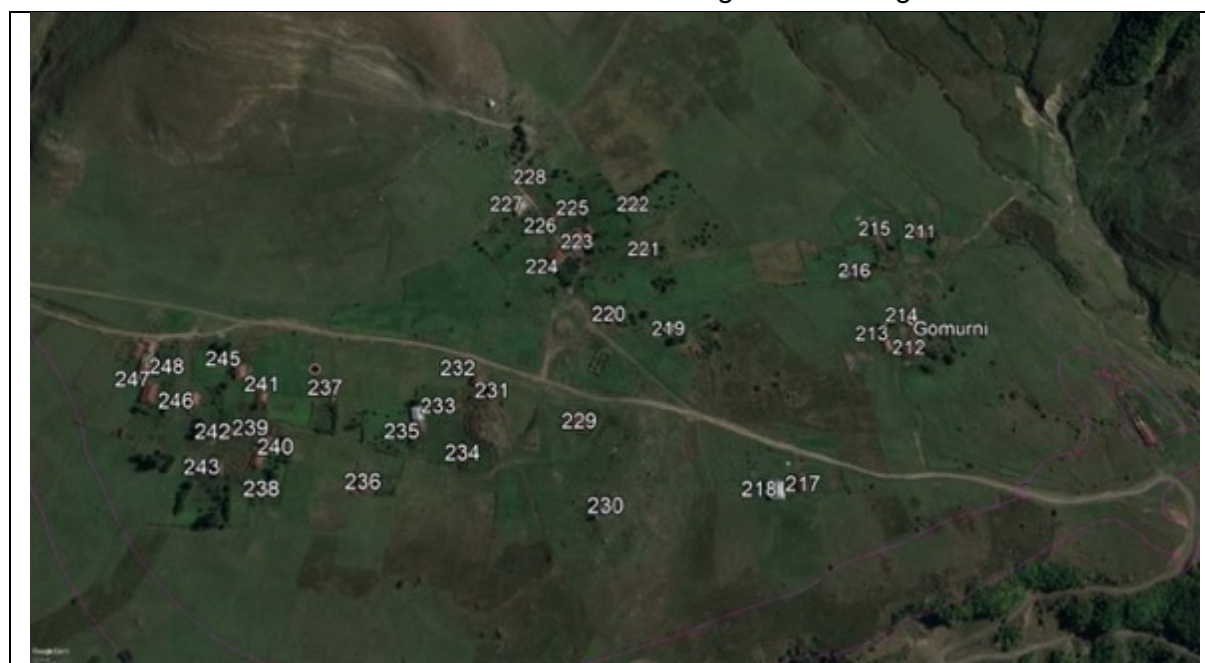
| House No | Current |       | Construction |
|----------|---------|-------|--------------|
|          | Day     | Night | Day          |
| 195      | -       | -     | 67           |
| 196      | -       | -     | 65           |
| 197      | -       | -     | 66           |
| 198      | -       | -     | 66           |
| 199      | -       | -     | 68           |
| 200      | -       | -     | 63           |
| 201      | -       | -     | 67           |
| 202      | -       | -     | 71           |
| 203      | -       | -     | 70           |
| 204      | -       | -     | 73           |
| 205      | -       | -     | 69           |
| 206      | -       | -     | 69           |
| 207      | -       | -     | 74           |
| 208      | -       | -     | 68           |
| 209      | -       | -     | 70           |
| 210      | -       | -     | 75           |
| 211      | -       | -     | 72           |

**Table 12:** Construction Noise: Village Sviana-Rostiana



| House No | Current |       | Construction |
|----------|---------|-------|--------------|
|          | Day     | Night | Day          |
| 271      | -       | -     | 63           |
| 272      | -       | -     | 62           |
| 273      | -       | -     | 61           |
| 274      | -       | -     | 63           |
| 275      | -       | -     | 64           |
| 276      | -       | -     | 67           |
| 277      | -       | -     | 66           |

**Table 13:** Construction Noise Village Benian-Begoni



| House No | Current |       | Construction |
|----------|---------|-------|--------------|
|          | Day     | Night | Day          |
| 211      | -       | -     | 52           |
| 212      | -       | -     | 55           |
| 213      | -       | -     | 55           |
| 214      | -       | -     | 55           |
| 215      | -       | -     | 52           |
| 216      | -       | -     | 54           |
| 217      | -       | -     | 67           |
| 218      | -       | -     | 68           |
| 219      | -       | -     | 55           |
| 220      | -       | -     | 56           |
| 221      | -       | -     | 54           |
| 222      | -       | -     | 54           |
| 223      | -       | -     | 54           |
| 224      | -       | -     | 56           |
| 225      | -       | -     | 54           |
| 226      | -       | -     | 55           |
| 227      | -       | -     | 55           |
| 228      | -       | -     | 55           |
| 229      | -       | -     | 64           |
| 230      | -       | -     | 70           |
| 231      | -       | -     | 61           |
| 232      | -       | -     | 60           |
| 233      | -       | -     | 61           |
| 234      | -       | -     | 64           |
| 235      | -       | -     | 61           |
| 236      | -       | -     | 68           |
| 237      | -       | -     | 64           |
| 238      | -       | -     | 68           |
| 239      | -       | -     | 64           |
| 240      | -       | -     | 68           |
| 241      | -       | -     | 65           |
| 242      | -       | -     | 67           |
| 243      | -       | -     | 69           |
| 245      | -       | -     | 67           |

|     |   |   |    |
|-----|---|---|----|
| 246 | - | - | 70 |
| 247 | - | - | 70 |
| 248 | - | - | 70 |

**Table 14:** Construction Noise: Village Tskere



| House No | Current |       | Construction |
|----------|---------|-------|--------------|
|          | Day     | Night | Day          |
| 249      | -       | -     | 45           |
| 250      | -       | -     | 45           |
| 251      | -       | -     | 44           |
| 252      | -       | -     | 43           |
| 253      | -       | -     | 44           |
| 254      | -       | -     | 43           |
| 255      | -       | -     | 37           |
| 256      | -       | -     | 43           |
| 257      | -       | -     | 43           |
| 258      | -       | -     | 43           |
| 259      | -       | -     | 42           |
| 260      | -       | -     | 42           |
| 261      | -       | -     | 39           |
| 262      | -       | -     | 38           |
| 263      | -       | -     | 36           |
| 264      | -       | -     | 36           |
| 265      | -       | -     | 42           |
| 266      | -       | -     | 42           |
| 267      | -       | -     | 42           |
| 268      | -       | -     | 37           |
| 269      | -       | -     | 38           |
| 270      | -       | -     | 48           |

**Table 15: Village Kobi**



| House No | Current |       | Construction |
|----------|---------|-------|--------------|
|          | Day     | Night | Day          |
| 271      | 54      | 49    | 71           |
| 272      | 70      | 65    | 76           |
| 273      | 66      | 62    | 69           |
| 274      | 66      | 61    | 67           |
| 275      | 60      | 55    | 61           |
| 276      | 63      | 58    | 63           |
| 277      | 67      | 62    | 68           |
| 278      | 55      | 51    | 68           |
| 279      | 65      | 60    | 71           |
| 280      | 57      | 52    | 69           |
| 281      | 53      | 49    | 74           |
| 282      | 53      | 49    | 68           |
| 283      | 61      | 56    | 74           |
| 284      | 61      | 56    | 74           |

|     |    |    |    |
|-----|----|----|----|
| 285 | 55 | 51 | 72 |
| 286 | 55 | 51 | 72 |
| 287 | 52 | 49 | 68 |
| 288 | 49 | 46 | 68 |
| 289 | 47 | 44 | 64 |
| 290 | 49 | 46 | 66 |
| 291 | 48 | 45 | 65 |
| 292 | 46 | 43 | 63 |
| 293 | 50 | 47 | 67 |
| 296 | 50 | 47 | 68 |
| 297 | 48 | 45 | 66 |
| 298 | 48 | 45 | 64 |
| 299 | 48 | 45 | 65 |
| 300 | 49 | 46 | 61 |
| 302 | 47 | 43 | 63 |
| 303 | 47 | 43 | 63 |
| 304 | 41 | 37 | 64 |
| 305 | 44 | 41 | 61 |
| 306 | 43 | 40 | 61 |
| 307 | 43 | 40 | 60 |
| 315 | 47 | 44 | 64 |
| 316 | 52 | 49 | 65 |
| 317 | 44 | 40 | 62 |
| 318 | 46 | 43 | 63 |
| 319 | 46 | 43 | 60 |
| 320 | 57 | 52 | 64 |
| 321 | 49 | 45 | 64 |
| 322 | 61 | 57 | 66 |
| 324 | 67 | 62 | 69 |
| 325 | 54 | 51 | 63 |
| 326 | 57 | 53 | 62 |
| 327 | 67 | 63 | 69 |
| 328 | 70 | 65 | 70 |
| 329 | 60 | 56 | 65 |
| 330 | 48 | 44 | 58 |
| 331 | 60 | 56 | 64 |
| 332 | 52 | 48 | 59 |
| 333 | 74 | 69 | 74 |
| 334 | 52 | 48 | 59 |
| 335 | 57 | 53 | 62 |
| 336 | 70 | 65 | 70 |
| 337 | 65 | 61 | 66 |
| 338 | 63 | 58 | 65 |
| 339 | 66 | 62 | 68 |
| 340 | 46 | 43 | 58 |
| 341 | 43 | 41 | 59 |
| 342 | 41 | 38 | 58 |
| 343 | 45 | 42 | 59 |
| 344 | 41 | 38 | 58 |

