Sustainability and Functionality of Railway Network and its Connecting Facilities in Kosovo

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Abstract
The railway network presents a special communication function, which keeps humanity closer. The first developments of the railway network in Kosovo date back to 1874 when the first train entered this area from Thessaloniki through Skopje. This paper aims to provide some data generated during the year 2020 regarding the railway network in Kosovo and its connecting facilities. Construction of railway lines, stations, tunnels, bridges, watersheds, protective walls, canals for surface water drainage has an average lifespan of 92 years. The total length of the railway network is 336.68 km, in which are built 23 tunnels with a total length of 9789.5 m. 26.1% of them are of medium depth, while 73.9% are of shallow depth from the ground surface. 66.07% of the railway lines are active, while 33.42% are non-functional.

Keywords: Railway Network; Kosovo; Stations; Sustainable Railway Infrastructure; Tunnels.

1. Introduction
To recognize and understand the development and importance of the railway network in Kosovo, it is necessary to consider its historical circumstances. It has over 147 years since the first construction of the railway, which connected the southern part with the northern part of Kosovo, and those creating connections with two important capitals, Skopje (North Macedonia) and Thessaloniki (Greece). The greatest development of the railway network and the associated facilities in Kosovo occurred from 1926 to 1960/1963. In this railway network, there are several facilities like stations, bridges, tunnels, canals, protective walls, watersheds, etc. Stations are places where the vehicles stop and depart, making a round trip to transport passengers and goods. There are main and secondary stations in the railway network. Figure 1 shows the types of stations according to the architecture of their construction. They represent a very characteristic feature in the country’s architectural and cultural identity [1, 2]. Although most of them severely damaged, the historical value of the station buildings cannot be ignored. They imprint the historical and cultural memory of a place, and people repay that prosperous era with new vitality [3, 4].

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Bridges are engineering facilities for crossing roads into rivers, valleys, or large slippery areas. Each bridge consists of supports and the aerial part, which is placed between the supports where is transmitted the load of the bridge itself and the moving vehicles [5, 6]. Its purpose is to connect two points at the shortest possible distance. Four types of bridges are identified on the railway lines (Figure 2). There are a total of 115 bridges with a length of 2.988m [7].

Tunnels are underground engineering facilities that are located inside a rock massif [5]. The tunnel is a road that opens underground by piercing a mountain, a hill, to pass by train or vehicle. Tunnels belong to the group of underground engineering facilities with a length much greater than their height and width. Tunnels depending on the geological conditions of the region may have different positions towards the geological structure. The tunnels in the railway tracks are built at an altitude of 331 m to 654 m with an average height of 501 m. The shape of tunnels that is identified in Kosovo is a horseshoe shape (Figure 3), with a height of 6 m and a width of 2.60 m.

Watersheds are the places where water passes under the railway. The shape, dimensions, and building materials depend on the size of the catchment that carries water to the railway. During the research are identified different types of watersheds in the railway network of Kosovo (Figure 4).

Protective walls are construction engineering works that are built to prevent landslides. There are several of those engineering works on Kosovo railways, which are built of rock material, but there are also concrete protective walls (Figure 5).
Canals are engineering facilities that aim to remove surface water that comes in the direction of the railway. They are made of concrete, with different shapes and dimensions (e.g. $L_1 = 50$ cm x $L_2 = 40$ cm, $h = 30$ cm; $L_1 = 50$ cm x $L_2 = 30$ cm, $h = 30$ cm) depending on the amount of water, respectively of the hydrological parameters of the area through, which pass the railway trail. This research identified only one form of canals, with different dimensions (Figure 6).

2. Geological Construction

The Çikatovo-Drenas tunnel is built on the Lower-Middle Triassic limestone "cT$_{1z}$" represented by meta-carbonate rocks-marbles, calcareous schists. The Baica-Terdevc-Drenas tunnel is built on the rock formations of the Drin-Ivanica element, Maastrichtian floor "sKmD" represented by sandstone, siltstone, marlstone (flysch). Gexhë tunnel in the formations of the Pashtrik Cretaceous, Coniacian-Maastrichtian floor is represented by limestone, marlstone, and calcarenite with chert "Kcn-mP". Tunnels Dresnik i Ulët-Kлина and Pogragja-Toplan-Kлина are built in formations K$_{mG}$, Pagarusha Cretaceous Maastrichtian floor, Santonian-Maastrichtian floor, thin-bedded limestone with chert (K$_{mG}$). Tunnels Ujëmirë-Kлина and Ujëmirë I-Kлина are built in the rock formations of the Drin-Ivanica element Maastrichtian floor represented by flysch (sandstone, siltstone, marlstone-flysch "sKmD" [8, 9].

The tunnel of Prishtina is built in the rock formations of the central area of Vardar Coniacian-Maastrichtian floor represented by limestone, marlstone, chert, calcarenite, partly conglomerate (calcareous flysch) "Ikcn-mC". Podujevë tunnel is built in the rock formations of the central area of Vardar Barremian-Aptian floor represented by sandstone, siltstone, conglomerate, partly marlstone (flysch) “Kb-ac” [10]. The Vllaq Tunnel is built in the rock formations Jurassic Magmatic Event Middle-Upper Jurassic floor represented by serpentinite. The Jellova tunnel is built on the rock formations of the Jurassic Magmatic Event Middle-Upper Jurassic floor represented by serpentinite "SJ$_{2,3}$". Tunnels Ballaban and Kulla (Banjska) are built on the rock formations of the Jurassic Magmatic Event Middle-Upper Jurassic floor represented by peridotite, dunite, and partlyserpentinitized “αJ$_{2,3}$".
The Pridvorci-Zveçan tunnel is built in rock formations of the Jurassic Magmatic Event Middle-Upper Jurassic floor represented by basalt "$\beta_{Jz2}$". The Tvergjane-Leposavic tunnel is built in rock formations of the External Vardar Zone of the Coniacian-Maastrichtian floor represented by sandstone, siltstone, conglomerate, marlstone, limestone "SKcn-mE". The Jerinje e Poshtme-Plavkovë tunnel is built in rock formations of the Cenozoic Magmatic Event Oligocene-Pliocene floor represented by "αEo-Nm" [11]. The Kaçanik i Vjetër-Stagovë tunnel is built in rock formations of the External Vardar Zone, the Coniacian-Maastrichtian floor represented by limestone, marlstone, siltstone (calcareous flysch) "fyKcn-mE". The Runjevo-Kaçanik tunnel is built in Lower Palaeozoic rock formations "cPz1" represented by marble, then in slabs represented by biotite gneiss, leptyntic gneiss "gPz1". Tunnel Gajre I is built in Paleozoic "mPz1" formations biotite muscovite schist. Tunnels Gajre II, III, IV, V are built in Paleozoic formations represented by biotite gneiss, leptyntic gneiss "gPz1" [9].

2.1. Study Area

The Republic of Kosovo is located in Southeastern part of Europe; it belongs to the countries of the Western Balkans. It extends in latitude from $41^\circ50'58''$ to $43^\circ15'42''$ and east longitude from $20^\circ01'02''$ to $21^\circ48'02''$ (Figure 7).

![Figure 7. Map of study area](image)

3. Research Methodology

The research methodology is based on two phases: the first phase of field research work and the second phase of office work (in figure 8 is shown in more extended form). Field research was carried out in different monthly stages during the year 2020. The following tools were used for field research: meter tape, GPS-Garmin, camera, notes from the field. The following working materials were used to achieve the goals of this paper: topographic maps of the territory of the Republic of Kosovo at a scale of 1:25000 [12], geological maps (1:100000 and 1:200000), satellite images from Google Earth, Arc Map v.10.1, Excel and field research visits. Topographic maps are georeferenced, and then the digitization of the railway network presented with line geometry is performed. Point and line geometry is used for the digitization of tunnels; polygon geometry is used for cities, while point and polygon geometry is used for stations, all in vector format.
4. Results and Discussions

The greatest development of the railway network and the associated engineering facilities in this area occurred from 1926 to 1960/1963. The data highlighted in this study (Table 1) shows that the total length of the network railway for general transport is 336.68 km, of which, functional length is 237.34 km, while 99.34 km is not functional. The longest railway line is Hani i Elezit-Fushë Kosovë-Mitrovica 98.25 km, then Klina-Prizren 58.74 km.

Table 1. Railway lines for general transport

| No. | Railway line                                | Length (km) | Construction date | Lifespan (years) | Current status         |
|-----|---------------------------------------------|-------------|-------------------|------------------|------------------------|
| 1   | Hani i Elezit-Fushë Kosovë-Mitrovica       | 98.25       | xx.xx.1874        | 147              | Good (functional)      |
| 2   | Mitrovicë-Leshak                           | 41.94       | 12.02.1931        | 90               | Good (functional)      |
| 3   | Leshak-Jarinje (Pllavkovicë)               | 9.32        | 12.02.1931        | 90               | Good (functional)      |
| 4   | Fushë Kosovë-Prishtinë                     | 6.65        | 09.07.1934        | 87               | Good (functional)      |
| 5   | Prishtinë-Podujeve (Merdar)                | 40.60       | 07.07.1948        | 73               | Not good (non-functional) |
| 6   | Fushë Kosovë-Klinë-Pejë                    | 81.18       | 12.07.1926        | 95               | Good (functional)      |
| 7   | Klinë-Prizren                              | 58.74       | xx.05.‘60-‘63     | 61               | Not good (non-functional) |

Overall Length: 336.68 km
Average: 91.86 km

Table 2. Lifespan of construction engineering facilities

| Category | Engineering Facility                                                                 | Lifespan (years) | Kosovovo Railway Network |
|----------|--------------------------------------------------------------------------------------|------------------|--------------------------|
| Out of category | Monuments, Museums, Power Stations, etc.                                            | Over 100         |                          |
| I        | Hydroelectric facilities, railways, central state capital buildings, large industrial buildings | Over 60         | Kosovo railways and tunnels |
| II       | Factories and plants, communal facilities, simple buildings                         | Over 40          |                          |
| III      | Light facilities, massive residential constructions, etc.                           | Under 40         |                          |
| IV       | Temporary facilities                                                                | Less than 10     |                          |

Based on the categories, lifespan, and construction engineering facility (Table 2), it results that the railway network and its accompanying facilities enter into the first category. Referring to this categorization, it is noticed that all railway segments have survived the time in terms of their sustainability and functionality. Assessed from their lifespan, respectively years of construction, it results that the railway line Hani i Elezit-Fushë Kosovë-Mitrovicë has 147 years (Table 1) since the time it was built and is still functional, although, in recent years several projects have been developed for its repair (reconstruction) (funding from European Union).

Railway lines for industrial transport - the research showed that 49.56 km of railway networks are built for industrial transport purposes in Kosovo (Table 3). The longest line (13.89 km) of the industrial railway is the one that connects the Mining and Magnesite Industry "Golesh" with the railway station Bardh i Madh. This railway line is used today by the NewCo Enterprise "Ferronikeli" for the transport of nickel-iron from the mine "Gllavica" in Medveca-Lipjan, while the line from the mine "Gllavica" to the mine "Golesh" is not functional.

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| 5   | Prishtinë-Podujeve (Merdar)                | 40.60       | 07.07.1948        | 73               | Not good (non-functional) |
| 6   | Fushë Kosovë-Klinë-Pejë                    | 81.18       | 12.07.1926        | 95               | Good (functional)      |
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Table 3. Industrial railway lines

| No. | Name of Railway Line | Length (m) | Percentage (%) |
|-----|----------------------|------------|---------------|
| 1   | Fabrika e këpucëve   | 588.76     | 1.19          |
| 2   | Fabrikapërperpunimin e metaleve | 597.40 | 1.20          |
| 3   | Remontitrenave        | 1943.80    | 3.92          |
| 4   | Fabrika e sheqerit    | 810.02     | 1.63          |
| 5   | Miniera e Goleshitdeminiera e Hekur Nikelit | 13688.36 | 27.60        |
| 6   | Fabrika e tekstilKosova | 1382.49 | 2.79          |
| 7   | TrafoZhitkove         | 435.91     | 0.88          |
| 8   | FabrikaTrepça         | 677.66     | 1.37          |
| 9   | FabrikaTrepça (Metalurgjia) | 4518.86 | 9.11          |
| 10  | Fabrika e PaimeveVodicë | 3537.81 | 7.13          |
| 11  | TermocentraliKosova "A" | 3499.99 | 7.06          |
| 12  | MinieraKizhnicë       | 12481.31   | 25.16         |
| 13  | Fabrika e vajit (M.Z) | 4518.86    | 9.11          |
| 14  | Fabrika e vajit (M.Z) | 424.22     | 0.86          |
| 15  | St. Drenas-Shkritorja e Feronikët | 4491.18 | 9.05          |
|     | **Total**             | **49599.99** | **100.00**   |

The research reveals that in the entire railway network of Kosovo, there are 23 tunnels with a total length of 9789.5 m (Table 4).

Table 4. Characteristic data of tunnels

| No. | Name of the tunnel /Location/ | Direction | Coordinates | Length |
|-----|-------------------------------|-----------|-------------|--------|
|     |                               |           | N          | E      | Z (m) | Length |
| 1   | Ujë Mirë-Klinë               | Entrance (direction from Fushë Kosovë) | 42° 37ʹ 25ʺ | 20° 42ʹ 47ʺ | 490   | 200   |
|     |                               | Exit (direction Peja)                 | 42° 37ʹ 20ʺ | 20° 42ʹ 47ʺ | 487   |       |
| 2   | Ujë Mirë I-Klinë             | Entrance (direction from Fushë Kosovë) | 42° 37ʹ 46ʺ | 20° 43ʹ 39ʺ | 508   | 134   |
|     |                               | Exit (direction Peja)                 | 42° 37ʹ 48ʺ | 20° 43ʹ 24ʺ | 504   |       |
| 3   | Baicë-Terdevë-Drenas         | Entrance (direction from Fushë Kosovë) | 42° 37ʹ 47ʺ | 20° 48ʹ 56ʺ | 654   | 1065  |
|     |                               | Exit (direction Peja)                 | 42° 37ʹ 30ʺ | 20° 48ʹ 16ʺ | 649   |       |
| 4   | Çikatovë-Drenas              | Entrance (direction from Fushë Kosovë) | 42° 38ʹ 21ʺ | 20° 55ʹ 12ʺ | 586   | 316   |
|     |                               | Exit (direction Peja)                 | 42° 38ʹ 12ʺ | 20° 55ʹ 06ʺ | 585   |       |
| 5   | Prishtinë                    | Entrance (direction from Fushë Kosovë) | 42° 41ʹ 31ʺ | 21° 10ʹ 25ʺ | 642   | 1593  |
|     |                               | Exit (direction Podujevë)             | 42° 42ʹ 09ʺ | 21° 09ʹ 36ʺ | 626   |       |
| 6   | Merdar-Podujevë              | Entrance (direction from Fushë Kosovë) | 42° 55ʹ 51ʺ | 21° 13ʹ 50ʺ | 624   | 1690  |
|     |                               | Exit (direction Serbia)               | 42° 56ʹ 09ʺ | 21° 14ʹ 59ʺ | 621   |       |
| 7   | Pogragjë-Toplan-Klinë        | Entrance (direction from Fushë Kosovë) | 42° 37ʹ 38ʺ | 20° 38ʹ 03ʺ | 510   | 412   |
|     |                               | Exit (direction Serbia)               | 42° 37ʹ 33ʺ | 20° 37ʹ 34ʺ | 438   |       |
| 8   | Dresnik i Ulet-Klinë         | Entrance (direction from Fushë Kosovë) | 42° 37ʹ 10ʺ | 20° 36ʹ 50ʺ | 435   | 402   |
|     |                               | Exit (direction Serbia)               | 42° 37ʹ 13ʺ | 20° 36ʹ 34ʺ | 434   |       |
| 9   | Gexhë-Rahovec                | Entrance (direction from Fushë Kosovë) | 42° 21ʹ 38ʺ | 20° 32ʹ 38ʹ | 336   | 715   |
|     |                               | Exit (direction Prizren)              | 42° 21ʹ 26ʺ | 20° 33ʹ 03ʺ | 331   |       |
| 10  | Stugovë-Kaçanik              | Entrance (direction from Fushë Kosovë) | 42° 16ʹ 50ʺ | 21° 14ʹ 35ʺ | 529   | 178   |
|     |                               | Exit (direction North Macedonia)      | 42° 16ʹ 47ʺ | 21° 14ʹ 33ʺ | 525   |       |
| 11  | Runjevë-Kaçanik              | Entrance (direction from Fushë Kosovë) | 42° 15ʹ 23ʺ | 21° 15ʹ 12ʹ | 526   | 205   |
|     |                               | Exit (direction North Macedonia)      | 42° 15ʹ 20ʹ | 21° 15ʹ 14ʹ | 515   |       |
| 12  | Kaçanik I (Gajre I)          | Entrance (direction from Fushë Kosovë) | 42° 11ʹ 14ʹ | 21° 15ʹ 58ʹ | 448   | 88.27 |
|     |                               | Exit (direction North Macedonia)      | 42° 11ʹ 12ʹ | 21° 15ʹ 57ʹ | 444   |       |
| 13  | Kaçanik II (Gajre II)        | Entrance (direction from Fushë Kosovë) | 42° 13ʹ 04ʹ | 21° 15ʹ 24ʹ | 484   | 100   |
|     |                               | Exit (direction North Macedonia)      | 42° 13ʹ 02ʹ | 21° 15ʹ 22ʹ | 484   |       |
The largest number of tunnels is in the railway line Fushë Kosovë-Hani i Elezit, a total of 7 tunnels with a length of 1216.5 m, and Mitrovicë-Jarinja, a total of 7 tunnels with a length of 2046 m. The third line in a row is Fushë Kosovë-Klinë in which are 6 tunnels with a total length of 2529 m (Table 5). From table 5 it can be seen that although in the line Prishtina-Podujeva there are only 2 tunnels, this line dominates in terms of the length, with a total length of 3283 m or with 33.54% of the length of all tunnels in the railway network of Kosovo. The highest percentage in terms of the number of tunnels is the lines Fushë Kosovë-Hani i Elezit and Mitrovicë-Jarinja (Plavković) with 20.90% (Table 5). The tunnels on the railway track are built at an altitude of 331 m (exit of the Gexhë tunnel) to 654 m (entrance to the Baica-Terdevc tunnel) with an average height of 501 m. The shortest tunnel 76m is in the locality Pridvorci, while the longest tunnel is 290 m or with 33.53% of the total length of tunnels in the railway network of Kosovo. The highest percentage in terms of the number of tunnels is the line Fushë Kosovë-Hani i Elezit and Mitrovicë-Jarinja (Plavković) with 20.90% (Table 5).

Table 5. Number of tunnels in the Kosovo railway network

| No. | Railway line              | Number of tunnels | Percentage (%) | Length (m)  | Percentage (%) |
|-----|--------------------------|-------------------|----------------|-------------|----------------|
| 1   | Fushë Kosovë-Hani i Elezit (Bilacë) | 7                 | 30.43          | 1216.7      | 12.43          |
| 2   | Mitrovicë-Jarinja (Plavković) | 7                 | 30.43          | 2046        | 20.90          |
| 3   | Fushë Kosovë-Klinë       | 6                 | 26.09          | 2529        | 25.83          |
| 4   | Prishtina-Podujeva (Merdar) | 2                 | 8.70           | 3283        | 33.54          |
| 5   | Klinë-Prizren            | 1                 | 4.35           | 715         | 7.30           |
|     | Total                    | 23                | 100.00         | 9789.7      | 100.00         |

According to the standard GN206 [13] (Table 6), it results that the tunnels in the railway network of Kosovo are divided into two groups. In the first group belongs the tunnels with short length and in the second one those with medium length. 90.5% of tunnels in the railway network of Kosovo are of medium length.

Table 6. Division of tunnels by length

| Rank according to GN206 | Length       | Number of tunnels by length in the Kosovo railway network | Percentage (%) |
|-------------------------|--------------|-----------------------------------------------------------|----------------|
| Very short              | up to 50 m   | 0                                                         | 0              |
| Short                   | 50-100 m     | 2                                                         | 9.52           |
| Medium                  | 500-2200 m   | 19                                                        | 90.5           |
| Long                    | 2200-4000 m  | 0                                                         | 0              |
| Very long               | above 4000 m | 0                                                         | 0              |
Referring to the division of tunnels according to depth from the ground surface [5], the research shows that 6 tunnels are 26.1% of them have average depth and 17 tunnels or 73.9% of them have shallow below (Table 7).

Table 7. Division of tunnels by depth

| No. | Rank       | Depth of railway tunnels in Kosovo from the ground surface (from the highest quota) | Percentage (%) |
|-----|------------|-------------------------------------------------------------------------------------|----------------|
| 1   | Very deep over 300 m | 0                                                                                     | 0              |
| 2   | Depth 100-300 m      | 0                                                                                     | 0              |
| 3   | Average 50-100 m    | 6                                                                                     | 26.1           |
| 4   | Shallow below 50 m  | 17                                                                                    | 73.9           |
|     | Total            | 23                                                                                    | 100            |

Other engineering facilities like bridges, watersheds, protective walls, water drainage canals are also constructed of environmental material combined with sand and river gravel for the preparation of mortar as the connecting elements of masonry. Seven shapes of tunnel opening are known (Table 8) [14, 15]. The selection of the shape of the tunnel, its position, lifespan, etc., depend on the geological conditions of the region, the position of the geological structure, the purpose of its use (transport, hydrotechnical, municipal, mining). This research shows that the shape of the tunnel in Kosovo railways is Horseshoe shape and partly segmental.

Table 8. Geometric shapes of tunnels

| No. | Shape    | Description                                                                 | Tunnel shape on Kosovo Railways | Scheme                                      |
|-----|----------|-----------------------------------------------------------------------------|---------------------------------|---------------------------------------------|
| 1   | Polycentric | This tunnel shape has a number of centers and provides a sufficient flat base for traffic movement. | There is no                     | ![Scheme](image1.png)                      |
| 2   | Circular | Circular tunnels are used to carry water under pressure. These are not appropriate for traffic tunnels because more filling is needed to make the base flat. | There is no                     | ![Scheme](image2.png)                      |
| 3   | Rectangular | For pedestrian traffic, rectangular shapes of tunnels are appropriate. These types of tunnels are not suitable to resist external pressure due to their rectangular shape and these are not in use these days. | There is no                     | ![Scheme](image3.png)                      |
| 4   | Egg-shaped | This tunnel shape has a number of centers and radius length. These are suitable as sewer tunnels to carry sewage water. | There is no                     | ![Scheme](image4.png)                      |
| 5   | Horseshoe | Horseshoe tunnel shape is a combined shape of arches and circular tunnel. These types of tunnels shape are quite popular. | Form of the tunnel in Kosovo   | ![Scheme](image5.png)                      |
| 6   | Elliptical | For carrying water, elliptical-shaped tunnels are appropriate. These are suitable in softer material. For better resistance to external pressure, the major axis of this tunnel is maintained vertically. | There is no                     | ![Scheme](image6.png)                      |
| 7   | Segmental | Segmental tunnels are suitable for traffic tunnels. It is a section with an arched roof and straight sides. These are generally used for subways or navigation tunnels. | Form of the tunnel in Kosovo   | ![Scheme](image7.png)                      |
5. Conclusion

The railway network presents a special communication function. In Kosovo, it has a history of over 147 years. In this railway network, there are several engineering facilities like stations, bridges, tunnels, watersheds, canals, etc. Their size and construction depend on the circumstances of the time of their construction, as well as the material used for their construction. The geological construction through which the tunnels are built is diverse and includes geological formations of different ages and floors. The total length of the railway network for general transport is 336.68 km, of which, functional lengths are 237.34 km, while 99.34 km are not functional. The railway network for industrial transport has a length of 49.56 km. The lifespan of the railway network and the engineering facilities in it are over 90 years. The research revealed that in the entire railway network of Kosovo there are 23 tunnels with a total length of 9789.5 m. 90.5% of the tunnels are tunnels of medium length. According to the depth from the surface of the ground, it results that 73.9% of them have average depth. The tunnels in the railways of Kosovo have a horseshoe shape. Ancillary facilities like stations, bridges, canals, protective walls, watersheds, etc., are of different shapes and dimensions. From 1963 until nowadays no new constructions have been made in this network, except some projects for the repair (funding of the European Union) of a segment in the railway line Hani i Elezit–Fushë Kosovë-Mitrovica. Based on the research, it results that in this railway network, intervention is required through a deeper analysis supported by technical analyzes, laboratory, etc., to bring to the standard state of operation the entire network and the engineering facilities attached to it.

6. Declarations

6.1. Author Contributions

Conceptualization, H.Ç. and B.J.; writing—original draft preparation, H.Ç. and B.J.; writing—review and editing, H.Ç. and B.J. All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available in article.

6.3. Funding

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6.5. Declaration of Competing Interest

The authors declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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