

# ASFINAG IN CASE OF A BLACKOUT – OVERVIEW AND MEASURES

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## ABSTRACT

ASFINAG is part of critical infrastructure and must be prepared for a blackout. A detailed emergency plan and over 70 concepts ensure safe and quick emergency operations, maintain communication, and keep roads open to guarantee security and stability during the crisis.

*Keywords: Blackout, critical infrastructure, emergency plan, maintain communication*

## 1. INTRODUCTION

**ASFINAG** (Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft) is the Austrian company responsible for planning, construction, maintenance, operation, and financing of the motorway and expressway network. The company currently manages a network of **2,266 km** of motorways and expressways. In addition, it operates **171 tunnels**, 92 of which are longer than 500 meters and fall under the **Road Tunnel Safety Act (STSG)**. The entire network is monitored through **nine traffic management centers**. The infrastructure also includes **59 rest areas**, **43 highway maintenance depots**, and **six toll stations**. In total, ASFINAG employs around **2,967 people** across Austria.

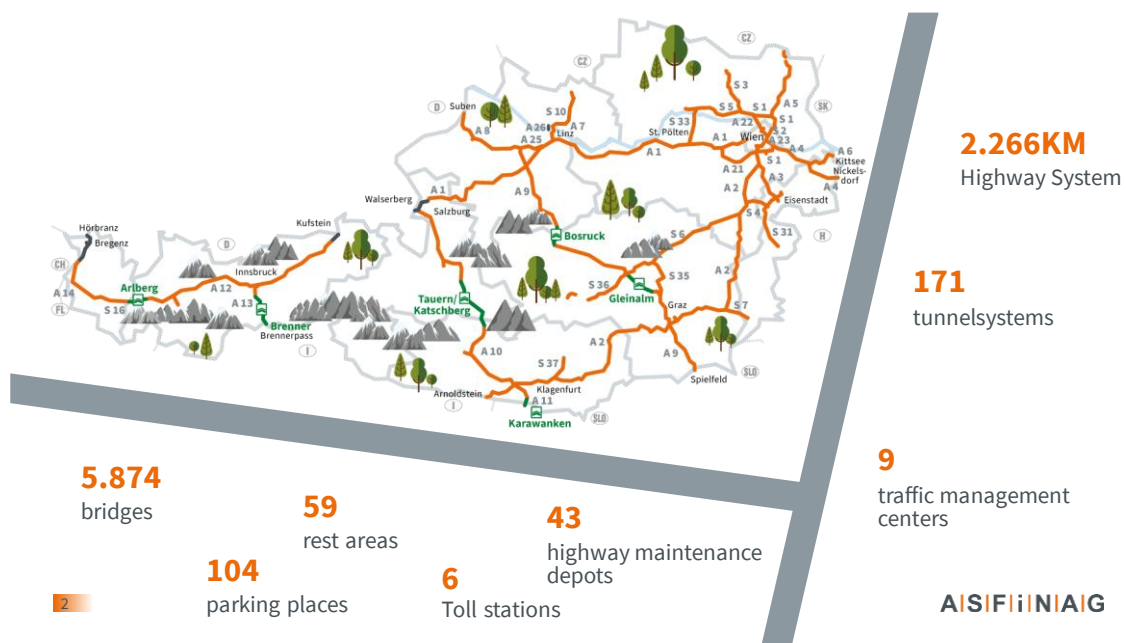


Figure 1: Overview of the ASFINAG Network

With **416 kilometers of tunnels**, which represents about 18.4% of the total network length of 2,266 kilometers, ASFINAG operates one of the most important tunnel networks in Europe.

## **2. PREPARATION FOR A BLACKOUT**

### **2.1. Critical infrastructure**

Critical infrastructure refers to organizations and facilities that are essential for the functioning of a state and society. They are responsible for basic services in areas such as energy, transport, communication, healthcare, and security. Important examples include hospitals.

A failure or serious disruption of these systems would have severe consequences: from long-lasting supply shortages and major disturbances of public order to extensive social and economic damage. The stability of these infrastructures is therefore crucial to ensure daily life, safety, and the economic performance of a country.

The **transport** sector provides **mobility** for people and goods and includes road, rail, air, and sea transport. This sector also includes ASFINAG, which is responsible for operating Austria's motorway and expressway network.

### **2.2. Ensuring Mobility During a Blackout**

In the first step, it is important to clearly distinguish between the scenarios of power outage, energy shortage, and blackout. All these scenarios have been precisely defined within the company to ensure clear differentiation.

There is no uniform definition of the term "blackout" in Austria. However, the European Network of Transmission System Operators (ENTSO-E) provides a definition in its "System Operation Guideline" (SOGL, Regulation (EU) 2017/1485, Article 18, Paragraph 4):

A transmission system is considered to be in a blackout state if at least one of the following conditions is met:

- Loss of more than 50% of the load in the control area of the respective transmission system operator (TSO)
- Complete loss of voltage in the control area of the respective TSO for at least three minutes, requiring activation of system restoration plans

ASFINAG defines a blackout as a prolonged power outage (more than 12 hours) affecting at least all of Austria and large parts of Europe. Internally, a blackout is declared when two regional traffic management centers report an outage in their respective regions.

In addition to electricity, other infrastructures such as public transport, telecommunications, and logistics chains also fail immediately or with some delay.

To fully understand the impact of a blackout, it is necessary to consider the overall scenario, including the associated infrastructure failures and the time factor. In principle, a blackout is divided into three phases:



**Figure 2:** Overview of the ASFINAG Network

### 2.2.1. Key Responsibilities of ASFINAG in Standard Operations

ASFINAG uses about 128 GWh of electricity every year to carry out its core tasks. This is almost equal to Austria's total energy consumption for one day, making ASFINAG a major consumer nationwide.

This internal consumption includes all activities that ASFINAG performs on a daily basis. The core tasks are:

- Maintaining the infrastructure
- Building new roads and tunnels
- Operating toll systems
- Managing the network
- Financing the measures

In the cases of a blackout, these core tasks are reduced to **emergency operations**. This means that all tasks except “**managing the network**” are suspended. However, the entire road network remains open for individual traffic.

### 2.3. Emergency Plan & Emergency Operation Concepts

A blackout poses a serious risk to business operations. To be prepared and remain capable of acting in such a situation, ASFINAG has developed a structured emergency plan. The focus is on taking all necessary steps together to ensure safety, stability, and an orderly resumption of operations.

The blackout emergency plan aims to maintain stable emergency operations during a large-scale power outage, keep communication within the crisis organization running, and enable a controlled shutdown and restart of operations.

For all operational units at locations, offices, and construction sites, predefined procedures for blackout scenarios have been developed. In addition, specific emergency operation concepts have been created for the orderly suspension of construction sites. These concepts ensure a standardized approach in case of emergency and form part of ASFINAG's blackout emergency plan. In total, more than 70 emergency operation concepts have been prepared for sites and operational units.

These documents serve as the basis for being prepared for a potential blackout. For all operational units, clear specifications have been defined—from the number of required employees to duty schedules and concrete measures that must be implemented during emergency operations.

The emergency operation concepts apply from the moment a blackout is declared until it is officially ended by the ASFINAG crisis team.

In addition, checklists, forms for analog documentation, blackout entry procedures, maps, and instructions have been developed for each location. These structured checklists provide essential support for staff during a blackout.

Both preventive and immediate action checklists have been created. The checklists are adapted to the priorities of each location. Furthermore, the procedures for restarting operations have been clearly defined.

Emergency operation concepts have been prepared for the following operational units, among others:

- **Highway Maintenance Depot (ABM)**  
The main goal of the highway maintenance depot during a blackout is to keep the route operational as much as possible—at least one lane should remain open for all road users to ensure emergency operations and safety along the route. The emergency operation concept regulates the emergency operation of the motorway and expressway network, the minimum operating conditions during a blackout, and communication between ASFINAG's operational units and the crisis team.
- **Traffic Management Center (VMZ)**  
In the event of a blackout, the primary task of the traffic management center is to monitor the motorway and expressway network as effectively as possible, control tunnel and open-road facilities, and immediately alert internal and external emergency services about traffic disruptions (e.g., accidents). This ensures traffic safety and flow for road users during emergency operations.
- **Maintenance (IH) / Operational Technology (BT)**  
During a blackout, the main task of maintenance and operational technology is to keep the technical systems of tunnels and open-road facilities running to maintain the minimum operating conditions (e.g. LED guidance systems, 25% of lighting, Emergency call systems, Escape route signage and orientation lights...) of the motorway and expressway network. This ensures traffic safety and flow for road users during emergency operations.
- **Main Toll Stations (HMS)**  
In the event of a blackout, the primary task of the main toll station is to shut down the toll system in an orderly manner to maintain traffic flow in the toll area during the blackout. Toll collection will be suspended for the duration of the blackout.
- **Construction Sites**  
During a blackout, the main task of construction site managers (internal/external) is to secure the construction sites on the route with appropriate measures so that traffic flow and safety can be guaranteed for the duration of the blackout.

#### **2.4. Communication During a Blackout**

To ensure the maintenance of essential communication and data connections between the eight regional traffic management centers (VMZ), the VMZ Vienna-Inzersdorf, and the data center locations in Bruck/Leitha and Vienna-Inzersdorf during a blackout, ASFINAG has established a fail-safe communication network known as the ASFINAG Blackout (BO) Network.

In addition, extensions have been implemented to increase the reliability of the BO Network, ensuring availability for approximately seven days. For example, the regional VMZs in Klagenfurt and Plabutsch, as well as Bruck/Mur and the data center in Bruck/Leitha, have been interconnected within the BO Network. This interconnection creates a ring structure, which allows communication to continue even if individual connection paths fail, thereby improving resilience.

If the BO Network experiences a regional outage, a fallback option is available via the satellite internet uplink (Starlink). This ensures that communication between the St. Jakob site in the west and the Vienna-Inzersdorf site in the east remains possible when needed.

### 2.4.1. Information platform: Crisis Team

In the event of a blackout, functioning communication is of great importance. During such a situation, all normal communication channels (telephone, mobile phone, fax, email, internet) will no longer be available or will only work in a very limited way within a short time. To maintain communication with operational units, a “Vehicle Reporting System system” has been developed.

All information is collected by the crisis team and distributed from there using the available technical means. If all communication options fail, the Vehicle Reporting System system should be used whenever possible and reasonable. In this case, a clear picture of the local security situation must be available to avoid exposing the messenger to unnecessary risks. The decision on this lies with the crisis team, the regional traffic management centers (VMZ), and the highway maintenance depots (ABM).

The situation report serves as an exchange between the operational units and the crisis team. This report must be submitted at predefined time intervals. After a short processing period by the crisis team, the report is sent back to the operational units. The Vehicle Reporting System system is used for transmission. Feedback must be returned to the VMZ and handed over to the messenger for delivery to the respective locations.

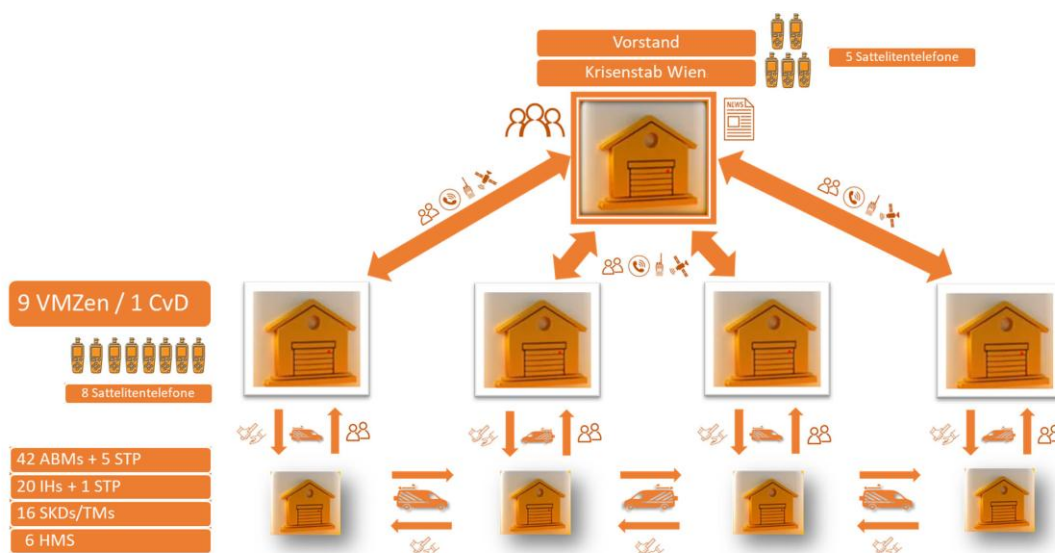


Figure 3: Communication Procedure between the

## 2.4.2. Vehicle Reporting System

Starting from the day after the blackout begins, the Vehicle Reporting System serves as the primary communication channel for operational units to deliver information about the current situation and to receive instructions.

Clear routes have been defined in advance for all units, determining the order of stations. At a specified time, a messenger collects the situation reports and delivers them directly to the next location, ensuring that the flow of information continues without delay.

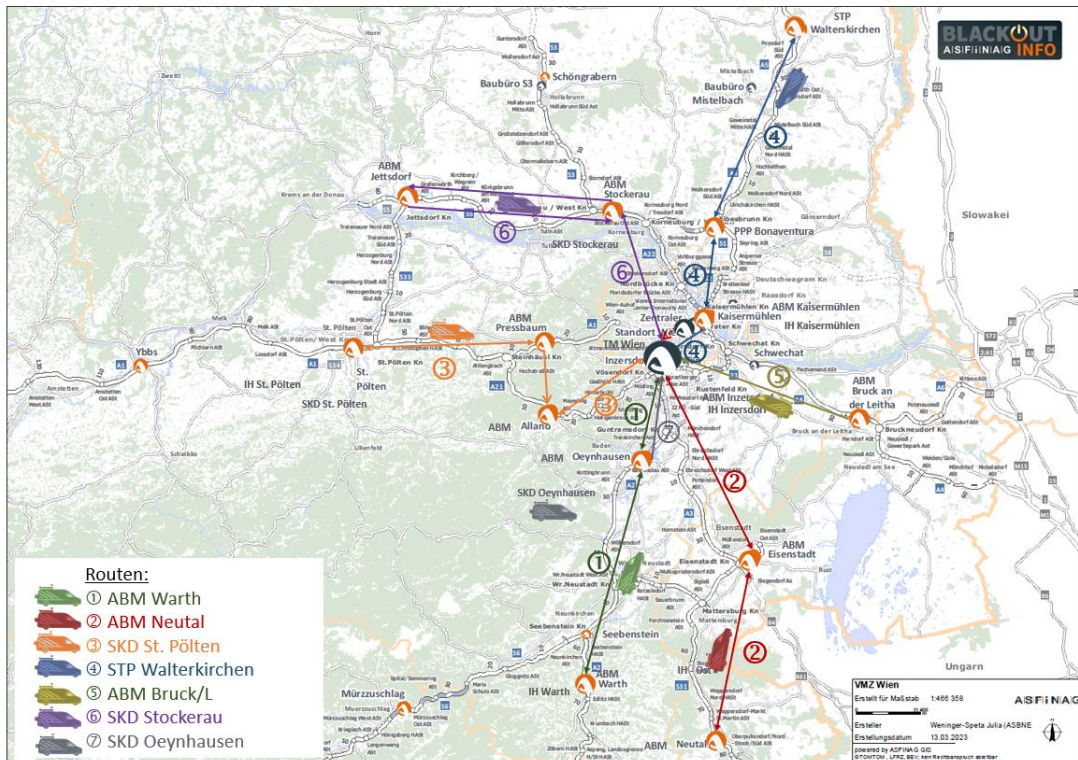
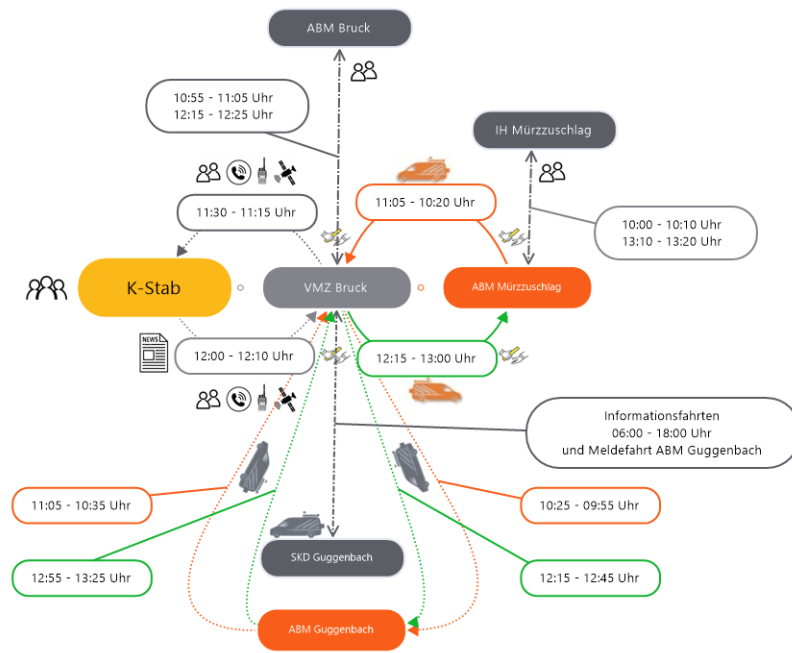


Figure 4: Example Region East of Austria

The transmission of daily reports follows a precisely coordinated schedule to ensure structured processing of possible measures. Without this clear timing, delays, bottlenecks, and coordination problems would occur within the crisis team.



**Figure 5:** For example the Region around Bruck/Mur

The exact routes, handover times (start/end), handover locations (departure/arrival), handover method (in person/Vehicle Reporting System), and responsibilities (assigned to) are defined in specially adapted schedules for outbound and return trips for each location. All employees have been clearly instructed to strictly adhere to these times.

The Vehicle Reporting System system remains active until, after the restart, the crisis team announces the transition back to normal operations and the discontinuation of the reporting system.

## 2.5. Restart Planning System

The ASFINAG crisis team is responsible for the overall restart planning across ASFINAG and for the final termination of the blackout response. Once a secure power supply including communication is available, the ASFINAG crisis team will issue the clearance for restart to the Traffic Management Center (VMZ).

The VMZ must then independently resume its previously suspended activities step by step, reverse the immediate measures previously implemented in close cooperation with the technical maintenance team, and restore normal operations.

Special attention must be paid—across all systems (tunnels, variable message signs, rest areas, pumping stations, etc.)—to a controlled recommissioning process to avoid additional technical failures and damage to the facilities.

During recommissioning, priority must be given to critical route sections and those with high traffic volumes, tunnel systems with elevated risk levels, facilities in metropolitan areas (Vienna, Linz, Salzburg, Graz), and routes without diversion options (e.g., truck driving bans) before recommissioning rest areas, traffic control points, etc.

A prerequisite for starting the general recommissioning of outdoor facilities in tunnels and open areas is a stable control system, the ability for video surveillance, and communication

via radio and/or telephone with internal and external organizational units/emergency services. The crisis team will provide information on when these prerequisites are met.

In tunnel areas, the “Operational Conditions for Emergency Operation” will be lifted, and the facilities will, if necessary (e.g., system malfunctions; during spare part procurement, etc.), be operated based on the minimum operating conditions according to RVS 09.04.11 (Working Paper #32).

The transition of shift handover between the phases “Blackout” and “No Blackout” must be initiated by the responsible manager after recommissioning.

### **3. SUMMARY AND CONCLUSION**

A blackout or large-scale power outage poses a major challenge for ASFINAG, as operations must be maintained in emergency mode for seven days. For this emergency operation, all necessary resources are provided to ensure operational capability. This includes the daily supply of food and drinks for key personnel and operational staff. Approximately 250 employees are required to maintain emergency operations.

The entire road network remains open for individual traffic. Tunnel facilities are operated in two groups: 24 high-priority tunnels are equipped with emergency generators to power safety-related systems. All other tunnels remain open, but only organizational measures apply. All tunnels operate with reduced speed limits.

A comprehensive communication system guarantees continuous information exchange between all relevant parties. This includes redundant channels and secure connections to ensure stable communication even during emergency operations.