MARCH 2021

PROPERTY MATTERS

Vehicle Depots – Identifying Risks and Managing Exposure

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Depots, also referred to as transit operator's depots, wagon sheds or parking halls, are facilities where railroads, streetcars, trolley buses or omnibuses are parked during non-operating hours. A characteristic feature of depots is that they are almost completely empty during transport companies' operating hours, while in non-operating hours vehicles are parked close to each other. During this time, the parked vehicles accumulate high values, which can be well in excess of double-digit millions. Should damage such as a fire occur, significant losses can be expected on property insurance claims. Due to depots' high-density occupancy, fire departments have often described fighting fires there as very difficult, if not impossible.

The extent to which the risk exposure for bus depots has been exacerbated by the increasing introduction of electric/battery-powered buses cannot be proven, despite recent losses indicating a correlation. In some cases, for example, it was possible to prove that damage occurred during the charging of an e-vehicle; distinctive fire qualities and temperature allowed the fire to spread to neighboring vehicles faster than expected. In other cases, other causes were responsible for the fire.

This article takes a close look at depots, especially bus depots, and related emerging exposures. The article concludes with practical recommendations to consider when underwriting a portfolio from the perspective of property insurance.

Definition of a depot

A depot is the operating base for a transport system. Depending on the size of the fleet or the required geographical coverage, an operator can have a number of different depots in different locations. Depots may also include maintenance

Content

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and repair workshops, service stations, and car wash facilities as well as administrative and social facilities such as canteens, medical facilities for personnel, and, if necessary, accommodations for off-duty personnel and standby crews.

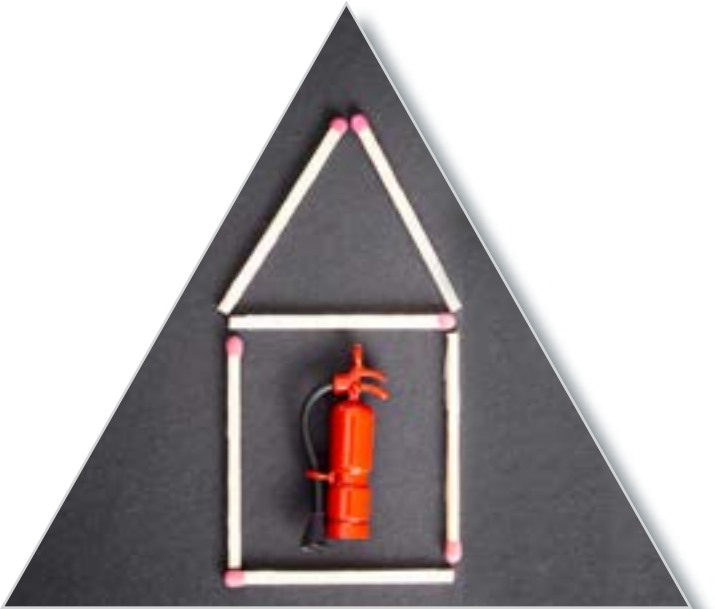
Vehicles are usually parked close to each other to maximize use of the available space. If, for example, buses are parked in a way that one bus can be moved without having to move another bus, about 12 buses of 12.5 meters in length can be accommodated per 1,000 m². If, however, they are parked in blocks, (i.e., not every bus can be reached without moving others), 18 buses can be accommodated in the same space.

Construction of a depot

The size of a depot is usually specified in terms of the maximum number of vehicles it can accommodate, which can range from less than 10 to several hundred, depending on the type of vehicles. The area required depends on the shape and layout of the site. The building structure often consists of steel columns with exterior walls of precast concrete or steel slabs, and a roof of steel trusses with trapezoidal sheet metal roofing and waterproofing.

As a rule, a depot includes one or more large storage halls housing a workshop, car wash, storage for operating materials, social rooms, etc. Sometimes the different areas or buildings are spatially separated from each other. Sometimes large storage halls are divided into fire compartments and ancillary areas are separated by fire-resistant partitions or by distance from the storage hall.

Due to the different building and construction regulations, existing fire protection structural and plant engineering measures in depots vary greatly. In some cases, automatic fire alarm systems (e.g., flame detectors and heat conduction cables in the storage hall, and smoke detectors in adjoining rooms, workshops and warehouses) or a sprinkler system are installed.



Insurance values

The cost of new vehicles has risen significantly in recent years. This is due, in part, to increasing investment in comfort as well as in engine and operating technology and automated driving and assistance systems. The investment required for a standard electric bus of about 12.5 meters in length, for example, ranges from EUR 560,000 to EUR 600,000; for an articulated bus, it can be up to EUR 720,000. Buses with fuel cell drive systems are significantly more expensive than conventional diesel-powered buses that are predominantly currently in use.[1] Additional costs include infrastructure investments (e.g., charging structure) as well as necessary modifications to existing halls or requirements for appropriately equipped new bus depots. For example, the cost for the construction of the new multi-storey BVB Rankhof bus depot in Basel for 144 articulated electric buses is estimated at around CHF 161 million.[2]

It is easy to anticipate how a potential fire loss can quickly exceed the one million mark and, depending on how the loss progresses, large bus depots may result in losses in the hundreds of millions. In addition, there also may be loss expenses from any Business Interruption insurance for unearned profits or additional expenses to minimize losses.

Causes and development of losses/ loss examples

Here in Germany, several major cities have witnessed bus depot fires in recent years: For example, fires occurred in bus depots in Heidelberg in 2007, Darmstadt in 2009 and Münster in 2013.[3] Further losses occurred in Bottrop in 2011[4], Springe in 2014[5], Spenge in 2015[6], Pforzheim in 2016[7] and Bielefeld in 2019[8]. The incident in Bottrop was one of the largest losses to have occurred so far, with around 60 of 224 buses stationed at the Vestische Straßenbahnen AG bus depot destroyed.[9]

Beyond Germany, fires in depots have also occurred in the United Kingdom (e.g., in the London district of Orpington in 2018,[10] in Yorkshire in 2020,[11] in Grantham in 2021[12]) and in Italy, such as the fire in Rome in October last year which destroyed 30 natural gas-powered buses.[13] Fires have also been reported in streetcar and train depots.[14] According to an internet search, however, these are not as frequent and usually less serious than those at bus depots.

The number of major bus depot fires in 2021 was particularly striking, many resulting in enormous insurance losses:

- April 2021 – 38 Rheinbahn public transport buses were destroyed in a fire in Düsseldorf; the damage amounted to almost EUR 50 million. A diesel bus is suspected to be the source of the fire.[15]

- May 2021 – five electric buses were destroyed in Baise, China.[16]
- June 2021 – nine buses were destroyed, five of them electric buses, in a fire at an electric bus depot in Hanover. The fire was not caused by one of the electric buses; it was triggered by a technical defect.[17]
- September 2021 – 25 vehicles were destroyed at a depot in Stuttgart. The trigger is said to have possibly been a technical defect in an electric bus.[18]
- October 2021 – a fire destroyed 30 mostly natural gas-fueled buses in Rome.[19]
- Several buses were damaged in Walshall, UK, in December 2021. [20]

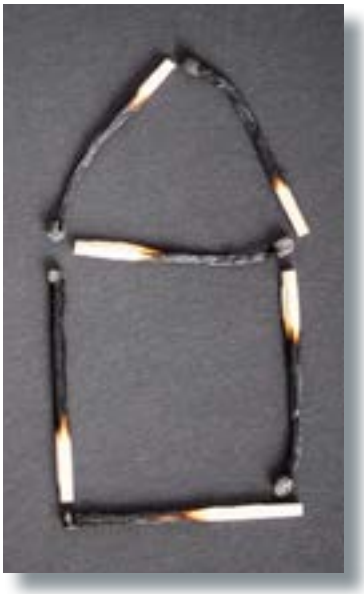
Fire risk situation

As the above examples illustrate, fires in depots, especially in bus depots, can quickly develop into major losses, especially if the fire breaks out when the depot is fully occupied during the transit system's non-operating period. Where electric buses were parked in the depot, the cause of the fire was quickly assumed to be related to these, but this could not always be confirmed.

Regardless of whether the fire originated from an electric bus or a conventionally powered one, fire departments describe the firefighting effort as significant due to:

- High fire load due to the interior materials used in the buses
- Reduced effectiveness of existing extinguishing systems or during firefighting operations since water cannot pass through the metal bodywork into the passenger compartment
- Narrow space between the parked vehicles, which causes rapid fire flashover to surrounding vehicles
- Rapid spread of fire (approximately two minutes until full fire)
- Development of strong smoke and heat. The increased release of toxic, flammable or explosive contents from electric vehicles with lithium-ion batteries is to be expected, which further complicates firefighting procedures.

These factors make it enormously difficult for a fire department to quickly locate and fight a fire. When electric vehicles with lithium-ion batteries (which have bound oxygen in the positive electrode (cathode)), combustion events are sometimes violent, even under oxygen-reduced environments such as when gas extinguishing systems are triggered. Additionally, due to the increasing use of combustible materials in the construction of vehicles, reduction of the fire load is rarely possible and an increased development of smoke gas and heat is to be expected.



Fire protection concepts are required as part of the approval process when new vehicle depots are built. However, these do not consider the enormous fire load in the vehicles, the burning velocity observed in fires or the inability of extinguishing water to penetrate a vehicle's exterior. This also applies to the fire extinguishing system (e.g., sprinkler system) installed in the respective building.

The planning of multi-story parking halls for buses, whether above or below ground, presents particular challenges. This is especially true as the electrification of transport continues and predominantly electrically powered vehicles are being charged and parked there. As mentioned, greater damage is to be expected when vehicles powered by lithium-ion batteries are involved. Multi-story parking halls also raise (or should raise) questions about how firefighters can reach the source of the fire, how the affected vehicles can be salvaged and what damage will be caused to the building.

As the high loss examples above suggest, previous classical fire protection considerations and concepts cannot prevent a major loss or even a total loss due to the special circumstances. Therefore, other fire protection concepts that consider the actual fire behavior, the burning velocity, the heat release and the smoke and gas development are required.

Concepts for potential protective measures

Internet research suggests that no special fire protection regulations for vehicle depots currently exist. In this respect, it is necessary to carry out a fire risk analysis and to develop a coordinated and effective fire protection concept according to the determined risks. In addition to the usual structural, technical, defensive and organizational fire protection measures, the following points should be addressed as part of the fire protection concept:

Structural fire protection

Fire and complex partitions have proven particularly effective since they divide a building into fire compartments, enabling the fire department to confine a fire to the affected fire compartment. To ensure their full effectiveness, fire/complex partitions should reach at least 50 cm beyond the roof (in the case of adjoining buildings, beyond the roof of the higher building).

Photovoltaic systems

If installed on the roofs of the buildings, like any electrical system, photovoltaic systems represent a potential source of fire and can be a challenge for firefighters. Care should be taken to ensure that, in addition to the usual protective measures (e.g., proper installation and regular maintenance, fire department switches), such systems are not installed across walls that provide fire protection.[22]

Fire/complex partition walls should always be made of non-combustible building materials and have a fire resistance duration of at least 90 mins or 180 mins (complex partition wall). Building components must not interfere with such walls. In order not to endanger their stability, no structural components or technical equipment such as columns, trusses or beams may be connected to the fire/complex partition walls. Any openings present in the walls should be sealed off in a fire-resistant manner by means of appropriate closures to prevent fire flashover through these openings (see also VdS 2234).[21] Ideally, a maximum of 20 vehicles should be parked in a fire compartment; this is a manageable number for insurance and organizational reasons.

Currently, it seems difficult to implement suitable and effective fire protection concepts for multi-story storage halls for battery-powered electric vehicles since their multi-story nature makes it difficult for the fire department to extinguish fires. In addition, considerable effects on the building structure are to be expected due to the higher temperature of the fire and the chemical combustion products. Small-cell parceling of the individual floors into fire-resistant compartments coupled with automatic fire alarm and fire-fighting systems appear to be necessary to prevent a possible total loss.

The separation of a depot into fire compartments is, and remains, a necessity to avoid a possible total loss of all vehicles. In an ideal world individual vehicles would be parked in separate fireproof boxes, but this is hardly realistic.

Fire alarm system

In order to detect an incipient fire as quickly as possible and to alert the fire department, the installation of an automatic fire alarm system is recommended. Conventional fire detectors, which are installed under the ceiling of the hall, do not immediately detect a developing fire and consequently delay an alarm. An early alarm system enables the personnel to drive as many vehicles as possible out of the depot and to park them at a safe distance from the source of the fire. This also applies to vehicles in the fire compartments not affected by the fire.

Extinguishing systems

For building protection and to support the fire department, the installation of an automatic fire fighting system, (such as a sprinkler or deluge system) is recommended. It should be designed, installed and operated in accordance with the acknowledged technology rules (e.g., VdS, FM, NFPA). Alternative fire detection and extinguishing concepts installed in the energy compartment of a bus should also be considered.

Electrically powered vehicles should be parked in a separate fire compartment. Extinguishing systems using water are usually suitable because they remove reaction heat from the combustion process as quickly as possible. However, since the water does not reach the source of the fire directly in electric vehicles, the necessary cooling effect does not occur. One proven possible solution for conventional engines would be to install stationary extinguishing systems in the engine compartment.[23] However, whether such extinguishing systems are effective for electric buses is doubtful since they generally use gas as the extinguishing agent, which only leads to short-term success, particularly

in the case of fires involving lithium-ion accumulators. In this respect, the extinguishing systems are merely a support, albeit a valuable one, for fire departments. Success ultimately depends on how quickly the fire department is alerted and reaches the fire area.

Underwriting considerations

Due to the enormous concentration of values, the high fire load, the diverse causes of damage, the difficulties presented to fire departments and the increasing risk of battery fires with significantly higher fire temperatures and losses with electric vehicles, the above-mentioned structural fire protection measures should take priority. When underwriting vehicle depots, the following should be considered:

Operational description

What kind of and how many vehicles are parked in the depot? The answer to this would include time-related information on the parking hall occupancy. Information gathered should include possible other uses and ancillary operations on the premises such as repair workshops, refueling and loading facilities.

Scope of coverage

Which perils are considered insured? Is it an all-risks coverage or are only named perils insured (All Risks vs. Named Perils)? What are the exclusions? It should be clarified whether only the stationary risk (i.e., when the vehicles are in the depot) is to be covered (so-called accumulation coverage) because individual vehicles are usually insured under third party or comprehensive coverage. The additional conditions and clauses agreed in the insurance contract should also be taken into account to rule out the possibility of surprising circumstances being covered that go beyond the expectations of a conventional property insurance contract.

Sums insured

Should the replacement value or the current value be covered? What is the basis for determining the sum insured and what applies in the event of a claim? What is the insured value of the buildings, the furnishings and equipment? Furthermore, any insured first risk positions and sub limits should be considered for the exposure analysis.

Type of buildings

Type of construction, dimensions, number of storeys and design of the buildings.

Fire protection measures

What preventive fire protection measures are in place at the depot and what is their protective status? Are the measures appropriate to the risk and are they operational and free of defects? It is advisable to have a current inspection report describing the use of the buildings, the potential risks and the preventive measures in place and listing recommendations for eliminating any identified deficiencies.

Business Interruption

Information should be available on the potential consequences in the event of a loss. One must consider whether the entire operation is impaired if the storage hall is destroyed or whether alternative options are given to maintain operations in an emergency. A Business Continuity Plan (BCP) can provide valuable insights in this regard. This includes information on how quickly and in what quantity replacement vehicles can be procured to restore the scope of operations back to the level prior to the damage.

Maximum Possible Loss

The accumulation exposure should be identified as part of the MFL/PML determination. For this purpose, all insured assets under the underlying insurance contract, including insured-first loss items, that may be damaged or destroyed in a possible risk scenario should be included.

Summary

Vehicle depots contain enormous accumulations of value and pose numerous challenges to fire departments in the event of a fire. Vehicles with alternative drive technology, in particular gas, electric, or even hydrogen-based propulsion systems, present additional complications. If a depot is not subdivided into fire-protection sections using partitions, a major – if not total – loss can be expected. Realistically, a fire in one fire compartment may lead to a total loss of that area's assets as well as damage to the neighboring compartments.

In addition to the risk of property damage, significant consequences can also be expected for any Business Interruption insurance that may be in place, particularly as replacement vehicles are not so easy to procure in the current economic environment. This means, of course, transport services will be significantly restricted.

There is an urgent and increasing need to include fire protection in the planning of new depot buildings. Fire protection and safety measures must also be included in the modernization of transport fleets to new drive types.

Further reading

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