



RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Modern Vehicle Hazards in Parking Garages and Vehicle Carriers

Vehicles have changed significantly over the years. Modern Vehicles present new hazards due to the incorporation of larger quantities of combustible materials (e.g. fuels, plastics, synthetic materials, etc.) into their designs. As alternative fuel vehicles are popularized, concerns regarding their unique hazards, burn characteristics, and typical burn duration have been raised. Compared to older vehicles, modern vehicles burn differently.

Modern parking garages have optimized space requirements for vehicle parking and storage and often implement automated retrieval features and car stacking, which presents unique hazards as well. Thus, it raises the question if the safety infrastructure of these parking structures and vehicle carriers (i.e. maritime vessels) have kept pace.

Vehicle fires in parking structures developing into large, out of control incidents are fairly rare and the rate of civilian injuries is low. However, fires in parking structures can lead to significant economic losses, as evidenced by recent fires at Liverpool's Echo Arena in the UK and Stavanger Airport in Norway. These incidents involved hundreds of automobiles and resulted in severe structural damage.

Project Goal & Approach

This project aimed to quantify the fire hazard of modern vehicles in parking structures and vehicle carriers to provide guidance for the applicable technical committees (e.g. NFPA 13, NFPA 88A, and NFPA 301).

The final report is available [here](#). And a recording of "Modern Vehicle Hazards in Parking Garages and Vehicle Carriers" is available [here](#).

Research by:



Sponsored by:



Summary Observations

The fire hazard of vehicles has changed over time due to modifications in vehicle design and an increased use of plastics and other combustible materials in vehicle construction. These changes lead to faster flame spread within the vehicle, easier ignition and more rapid fire spread to neighboring vehicles. The spread of fire between cars in a garage is shown to be critical in determining the extent of the fire and the ability of the fire department to successfully control and extinguish it. While the testing is limited, some tests of multiple vehicles has shown rapid fire spread between vehicles in a parking garage configuration, on the order of 10-20 minutes. Based on the findings, test data from older vehicles (>15-20 years at the time of writing) should not be used as basis for development of codes and regulations.

The evaluation of modern vehicle fire hazards and current code requirements found that:

- The existing requirement for active protection systems for enclosed parking garages and maritime vessels appears adequate to control a vehicle fire until the fire department arrives, based on historical fires and laboratory testing.
- Open parking structures emerge as the main area of concern regarding fires in modern vehicles. The lack of active protection requirements in fire codes, and trends in both vehicle and garage design suggest that large, devastating fires in these structures could become more common.
- The risk of civilian injuries is expected to continue to remain low, however, fires could cause extremely large property losses, business disruption, and adverse environmental impacts.

The identified knowledge gaps primarily focus on the impact of earlier detection and notification, viable sprinkler protection, influence of wind, and fire spread between modern vehicles in varied configurations.