PROJECT SUMMARY

Modern Vehicle Hazards in Parking Garages and Vehicle Carriers
27 September 2019

Background: Vehicles have changed significantly over the years. Modern vehicles present new hazards, such as 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.

Research Goal: The goal of this project is 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).

Project Tasks: This project consists of the following tasks:

Task 1: Literature Review. The literature review should include the following:
1) Problem identification: Assess fire incidents in vehicle parking and transportation infrastructures (parking structures (open, closed, automated vehicle parking and retrieval facilities, vehicle stacker facilities), ferries, maritime vehicle transportation vessels, etc.) Provide summary information on present and future trends of the number and size of applications.
2) Review the current protection requirements for vehicle parking structures and vehicle carriers and the associated fire protection requirements and technical substantiation in the applicable codes and standards.
3) An overview of the fire hazard of modern vehicle and how the hazard has changed over time (addressing internal combustion engines (ICE vehicles) vs alternative fuel vehicles (i.e. electric, hybrid, etc.)) increased use of plastics/synthetic materials, modifications to increase fuel efficiency, etc.
4) Identify the other factors of modern vehicles and parking structures that may contribute to burn behavior, such as construction type, vehicle arrangement, presence of charging equipment, and any other factors.

Task 2: Hazard Assessment. Using the information collected in task 1, conduct a hazard assessment of internal-combustion-engine vehicles and alternative-fuel vehicles. Compare and quantify the hazards of modern vehicles to the fire hazard of older vehicles in terms of severity (e.g. heat release rate, temperature, products of combustion) and burn duration. The hazard assessment should also include the impact of automated parking structures, presence of electric vehicle charging equipment, building type and configuration, among other factors.
Task 3: Assess existing design criteria. Based on the hazard assessment of modern vehicles performed in task 2, evaluate the appropriateness of the existing fire protection requirements and the associated design criteria. Some key questions to be addressed include, but should not be limited to:

1) When and where should automatic sprinkler systems be provided (are the current requirements still adequate?)
2) How does/should the requirements change for a more open parking structure versus one that is more confined?
3) Are modern vehicles presenting hotter and more challenging fires that require greater sprinkler design densities?
4) Do modern vehicles burn longer and require longer water supplies than what is currently required in the codes and standards?

Task 4: Develop guidance and identify knowledge gaps. Based on the literature review and hazard assessments conducted in the previous tasks, make a recommendation for design criteria for the present and anticipated hazards in vehicle parking and transportation infrastructures (single level or multi-level parking garages (open, closed, underground, automated parking systems, semi-automated parking systems, vehicle stackers, etc.), ferries, maritime vehicle transportation vessels, etc.) Identify any knowledge gaps that need to be filled to provide technical guidance to inform appropriate design criteria.

Deliverables:
- An interim report documenting task 1 and 2 findings.
- A draft final report and final report that includes recommendations and any knowledge gaps.
- The results of this project should be presented to at least two relevant meetings/conferences.

Implementation: This research project will be conducted under the auspices of the Fire Protection Research Foundation and will be conducted in accordance with the “Research Foundation Policies for the Conduct of Research Projects”. The project will be guided by a Project Technical Panel who will provide input to the project, recommend contractor selection, review periodic reports of progress and research results, and review the final project report.