

Multiple Level Parking Garage Design Considerations and Maintenance

Introduction

Designing and maintaining a multiple level parking garage involves many considerations to ensure its functionality, safety, aesthetics, and longevity. These considerations include structural integrity, vehicular circulation, environmental impact, user experience, and ongoing maintenance.

Design Considerations

Structural Integrity:

The garage must support vehicle weight, impact loads from vehicle movement, and additional loads such as snow, wind, and seismic. Most parking garages on the NIH Bethesda campus have a design live load of 50 psf, which is 25% greater than the minimum design live load required by the International Building Code (IBC). Engineers evaluate these loads to ensure safety and durability. Common materials used in parking garage construction include reinforced concrete, pre-stressed concrete, and structural steel. Material choice depends on site conditions, time, and budget constraints. Proper traffic coating is essential to prevent salt and other chemicals from penetrating the surface of the concrete, which can cause significant structural damage to the reinforcing and concrete surface over time.

Vehicular Circulation:

An efficient ramp design is critical for smooth traffic flow. Options include straight, helical, or sloped floors, each of which affects the speed and ease of navigation. Strategic placement of entrances and exits minimizes congestion on surrounding streets. The layout of a multiple level parking garage must maximize space utilization while ensuring easy access. Angled parking spaces facilitate easier parking and retrieval but are less space-efficient than straight-in parking stall designs. Adequate overhead clearance height for different types of vehicles, including emergency vehicles and ADA vans, is essential. The design should consider potential future expansion or conversion to different uses.

Safety and Security:

Adequate illumination is essential for safety and security, including accident reduction and deterrence of criminal activity. LED fixtures are energy efficient, especially when combined with vacancy sensors (see table 10.7.3 of the NIH *Design Requirements Manual* for parking garage lamp types). Conveniently located and easily accessible distress call stations placed at every level of the parking garage greatly enhance security. CCTV cameras may be provided to enhance safety in areas with inadequate sightlines. Strategically placed mirrors and signs can help to mitigate blind spots and improve safety in high traffic areas. Sprinkler systems, fire alarms, smoke ventilation, mass notification systems, and emergency egress routes are mandatory. Sprinkler systems must be designed and constructed to protect from freezing.

User Experience:

It is crucial to ensure compliance with ADA standards by providing accessible parking spaces, ramps, and elevators. Beyond ADA requirements, clear wayfinding helps drivers navigate efficiently. Color-coded floors and various technology, such as integrating real-time occupancy tracking with digital displays, enhance efficiency and user experience, as does a well-lit, clean, and aesthetically pleasing garage. Landscaping around the garage and attractive facades help it blend into the urban environment and can provide easily identifiable and safe entry and exit points to the garage for vehicles and pedestrians.

Environmental Considerations:

Incorporating sustainable building practices such as using recycled content materials, installing solar panels, and implementing adequate stormwater management reduces environmental impact (see section 8.4.20.7 of the NIH *Design Requirements Manual* for parking garage drainage). It is increasingly important to provide electric vehicle charging stations as the number of electric vehicles grows. Proper ventilation for garages reduces exhaust fume buildup for personnel safety.

Maintenance Considerations

Regular structural inspections to identify cracks, spalling, and other structural issues are a must. Early detection can prevent minor issues from becoming major problems. Lighting, ventilation, fire safety systems, and elevators require regular checks to ensure they are functioning correctly. Regular cleaning of surfaces, especially in high-traffic areas, prevents the buildup of dirt, oil, deicing salts, and debris that can cause surface degradation. A well-maintained drainage system will prevent water accumulation or flooding that can lead to structural damage, premature corrosion of structural steel, and safety hazards.

Conclusion

Designing and maintaining a multi-level parking garage requires a holistic approach that balances numerous factors. From structural integrity and vehicular circulation to safety, user experience, environmental impact, and maintenance, each aspect plays a critical role in creating a functional, safe, and efficient parking design. By carefully addressing these design considerations, engineers and operators can ensure the parking garages meet current needs and adapt to future changes while remaining safe and cost-effective.

References

1. NIH *Design Requirements Manual*
2. International Building Code

