What Is in the Contract?

A successful automatic parking system (APS)—and the document that made it happen

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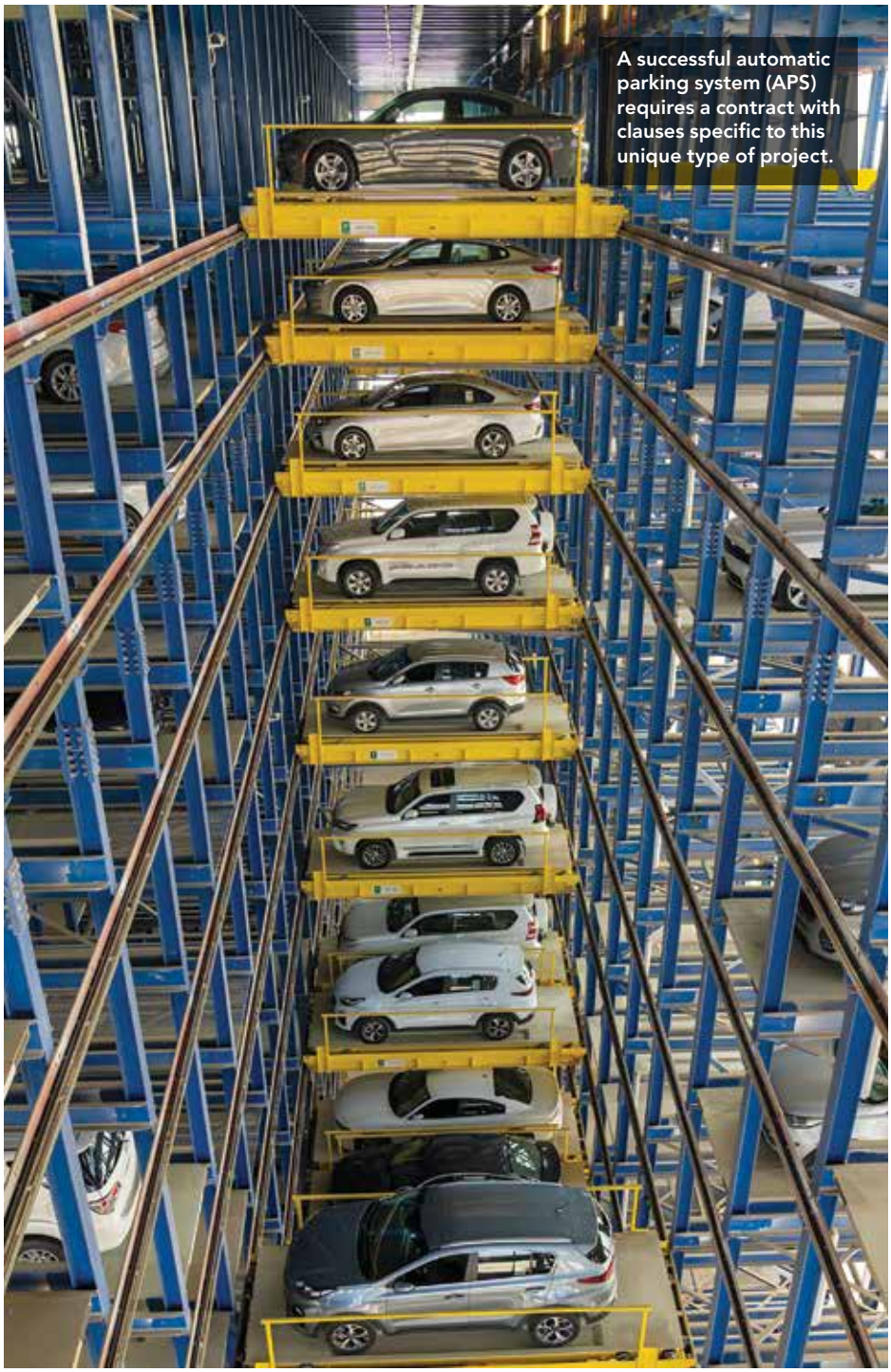

A successful automatic parking system (APS) requires a contract with clauses specific to this unique type of project.

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What is in the contract? This important document contains the guiding principles in any project, before, during, and after design and construction. When it comes to an automatic parking system (APS), however, there is no widely accepted standard contract to guide a project from inception to completion.

This course provides elements from such a contract. The model contract demonstrates the importance of providing neutral, comprehensive, and industry contract specifics and specs that—in the interest of all involved from users, owners, planners, and providers—are vital for the success of automatic parking in general. In addition, the course presents a comprehensive case study of the largest APS in the world that was successfully executed—manufactured in the United States, delivered overseas, and installed—using the model contract expanded upon here.

What Is an Automatic Parking System (APS)?

In the 1990s, automatic parking was still largely just a discussion about possibilities. While there were some old mechanical garages and systems in New York and New Jersey, to most people in the parking industry, a robotic garage was one where the entry and

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Learning Objectives

After reading this article, you should be able to:

1. Identify important points when contracting an automatic parking system (APS).
2. Explain the principle of standard of care: design responsibilities and fit for purpose.
3. Provide reasonable ways to secure performance.
4. Demonstrate performance measurements for APSs.
5. Share as an example the case study of a 2,314-space APS, certified by Guinness World Records as the largest in the world, that was successfully manufactured, delivered, and installed using this model contract.

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AIA COURSE #K2107H

exit gates went up and down automatically. The concept of a software system running a garage was still futuristic.

This was the environment in 1994, when one company coined the term 'robotic parking' and established the Florida-based company that designed, built, transported, and installed what would be certified as the largest robotic parking garage in the world. This company developed the lift-and-run system, a software-controlled system that ran three separate sets of machines for the X, Y, and Z axis motions to take a car from an entry bay terminal to an upper level, park it, and bring it back to the terminal on demand.

The lift-and-run system, integrating mechanical capability with software control, was a monumental breakthrough in the parking industry because it can handle 20, 30, or more simultaneous car transactions inside the system and thus drastically increase peak traffic performance. As the *New York Times* mentioned in a 2000 article, this company's working garage in Hoboken, New Jersey, was the country's first fully automatic garage.

Standard of Care

In the standard of care directive, a design professional has the responsibility or duty that anything that is designed needs to "fit for the intended purpose of use." This is a very general and broad definition. However, it becomes more and more important as it has been implemented by the courts during the past 10 to 15 years. In the automatic parking industry, it means that if an architect, engineer, or an automatic parking engineer knows that 400 parking spaces, for example, are needed for a residential development, s/he then has the obligation to make sure the associated required peak traffic capacity for a specified APS is designed in accordance with industry standards. It has to move the vehicles in and out of the system in a timely manner consistent with standards.

Here is an example where the standard of care (sometimes referred to as "fit for purpose") was not applied. A company installed an APS in south Florida for 230 parking spaces designed for a high-end apartment building at the beach. As per a table designed by the National Parking Association (NPA), a throughput requirement of 50 percent of parking capacity was needed, which would be 115 cars per hour, which means about two cars per minute. However, the actual installed system took 15 minutes to retrieve only one car, so it was not designed nor installed to fit the purpose of serving the residents. Legal action ensued, and at the end, the APS company had to pay for not achieving the design standard.

According to the NPA, "The most important factor for designing the access requirements for any parking facility is to determine the peak-hour arrival and departure traffic volume." This in turn determines the layout and design of the APS. If a design professional does not adhere to

STEP BY STEP: MANUFACTURING AND INSTALLING AN AUTOMATIC PARKING SYSTEM (APS)

While the three buildings shown here look strikingly different from each other, they all have something in common behind their facades: an automatic parking system (APS) that robotically parks the same number of cars in one-half to one-third the volume of space needed for conventional parking garages. This proves parking, while a necessity, is not the highest and best use of land on any project. The space saved by APSs allows developers and architects to use the space for additional revenue, green space, common areas for the community, or other uses that benefit the project as a whole. These parking facilities also offer more security, fewer emissions, and greater convenience for users.

This course illustrates, from start to finish, the building of a 2,314-space garage at the Al Jahra Court in Kuwait. This automatic garage was manufactured in the United States by a company with 25 years in APSs and then shipped to the site in Kuwait, where it was assembled and commissioned. It is the Guinness World Record holder for the largest automated parking facility.

The elements of the model contract illustrate the often unique aspects of automatic parking garages that must be spelled out to all parties to achieve success with such a massive, sophisticated project, involving more than 1,293 tons of machinery, electronics, and automation equipment.

Shown are three different APSs, including the one featured here.

APSs do not need to accommodate people driving cars with ramps and elevators and lighting. The robotic machinery and sophisticated software do the job. This model shows a conventional garage on the bottom with automatic parking above.

Every Project Is Custom

Every APS starts with a custom design. The manufacturer works closely with architects and developers around the world to design automatic parking garages that maximize site development.

The design of the parking facility considers:

- The dimensions of the buildable area, including height above and/or below grade.
- Any building or property restrictions.
- The number of parking spaces needed.
- The expected peak traffic per hour.
- Numerous other factors.

The result is creative parking solutions that fit within the available space in any project.

this industry standard, s/he can be held liable by the developer or owner.

In addition, it is extremely important at the very beginning of the planning process to determine the support-system grid layout of an automatic parking facility. This affects the efficiency of any layout of the facility and will optimize the footprint. This is exactly how planners start the layout of any building with a conventional concrete-ramp parking structure. First, the column layout is determined for the parking facility. Then, the upper floors of the building are based on this column layout. This process also should be followed with an automatic parking facility in the very early planning stage.

Contract Elements Specific to Automatic Parking

The elements of the model contract presented here are based on 25 years of international contract experience in APSs. It is based on appropriate forms of International Federation of Consulting Engineers (FIDIC) contracts.

Note that only the contract clauses specific to APSs are shown here. General contract clauses as covered in other AIA contract formats, such as General Notes, Languages and Law, General Obligations of Parties, Risk and Responsibility, Commencement and Delays, Variations/Changes, Suspension and Termination, Claims, Disputes, and Arbitration, Changes in Legislation, as well as Miscellaneous, are not covered here, as they are elsewhere described in detail in standard contracts.

PLANNING AND UNDERSTANDINGS

Scope of Work: Partial Supply versus Turnkey

In the case study presented here, which represents the largest APS in the world, the contract called for a turnkey scope of work. This means that the supplier, based in Florida, took on the complete design and organized the local building permits, manufacturing, shipping, installation, and testing of the parking system, including 15 years of maintenance and operations. While there might be some temptation to shop around for a number of suppliers to provide various elements, such as the manufacturing, support structure, installation and software—presumably to save money or channel work toward regular suppliers—the potential for error and failure increases to an unacceptable level. In such a large and sophisticated project, choosing a turnkey scope of work from a trusted, experienced, and proven supplier is by far the best path forward.

TABLE 1: PEAK HOUR ARRIVAL/DEPARTURE TRAFFIC VOLUME (Percent of Parking Capacity)

Land Use	Peak AM Inbound	Peak AM Outbound	Peak PM Inbound	Peak PM Outbound
Residential	5–10	30–50	30–50	10–30
Hotel/Motel	30–50	50–80	30–60	10–30
Office	40–70	5–15	5–20	40–70
General Retail	20–50	30–60	30–60	30–60
Convenience Retail	80–150	80–150	80-150	80-150
Medical Office	40–60	50–80	60–80	60–90
Hospital Visitors	30–40	40–50	40–60	50–75
Hospital Employees	60–75	5–10	10–15	60–75
Airport: Hourly Lot	50–75	80–100	90–100	90–100
Airport: Daily Lot	5–10	5–10	5–10	5–10
Special Event	80–100			80–200

Source: *Parking Structures: Planning, Design, Construction, Maintenance and Repair, Third Edition*

This table from the National Parking Association shows the peak traffic volume for each type of facility.

Sequence of Documents Pertaining to Contract

The several documents forming the contract are to be taken together, with each explaining the others. But in the case of discrepancies and ambiguities, the priority of the documents should be spelled out. Here is an example of priorities of documents:

1. Agreement
2. Owner letter of acceptance, if any
3. Conditions of contract
4. Supplier proposal signed and accepted by owner (including cover letter, if any)
5. Attachments and all related correspondences
6. Any other document forming part of the contract

Contractual Relations Between Parties

The APS contract should be prepared in accordance with sound international practice for the design and execution of

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First Manufacturing Step: Machine Fabrication

The APS consists of machines that are built to support independent motions on all three axes—vertically between floors, horizontally in a row, and in/out—to move cars into and out of racks in the steel shelving system. Multiple independent machines performing the same tasks are key to the system's reliability.

Raw steel is fabricated into frames for the different machines that move the cars inside the system. Once the frames are painted, mechanical components such as motors, gears, etc. can be installed.

Lower carrier modules with turntables rotate cars 180 degrees so that the car is returned to the owner facing forward for easy exit. These machines also move cars horizontally along a row in the APS. The machines are manufactured using off-the-shelf components from U.S., Japanese, and German producers.

Upper carrier modules move cars horizontally along an upper level. Rack entry modules move the car from a carrier into a parking slot. Carriers and rack entry modules fit together as a unit. Components for the entry/exit terminals are then fabricated.

Machines and Reliability

At least two of each type of machine are installed per area in the automatic parking facility for redundancy. Both of the machines can perform the same tasks at the same time. Therefore, if one machine needs maintenance or repair, there is always a backup machine to keep the cars moving into and out of the garage. No single failure will ever result in the system being inoperable. Performance for the manufacturer's parking systems, based on operations and maintenance data over the past 25 years, is 99.9 percent uptime.

In the Al Jahra Court garage, 210 machines are used for the 2,314 spaces, for example. If one machine fails or needs maintenance, this is only 0.48 percent of the total robots in the garage. The only consequence of a robot failure is that a few cars take a little longer for retrieval. The certified average retrieval time for cars at this garage is 177 seconds, or less than 3 minutes. This is much quicker than the time it takes a user of a conventional garage to walk into a facility, use the stairs or elevator, find where s/he parked the car, back out of the space, navigate around other cars and people, drive down the winding ramps, and finally reach the street level. In the automatic system, the user indicates while in the lobby or via smartphone application that s/he is ready to retrieve the car, and the system does the rest, delivering the car into a terminal in just a few minutes. It is widely considered to be a satisfying user experience.

Electronics

While the frames and electro-mechanical components are being assembled for the automatic parking machinery, the major electrical panels as well as the electrical boxes for individual machines are prepared. The APS uses only off-the-shelf, high-quality electrical and mechanical components with L10 lifetimes of 40,000 hours or above.

All major components have at least one backup. True redundancy translates into a greater level of reliability and ensures uninterrupted operations. No single failure will ever result in the system being inoperable. Uptime of the system is unprecedented.

Electrical panels are assembled, tested, and prepared for shipment to the job site. Electrical boxes for individual machines are assembled for installation on the machinery. Additional electrical components such as sensors, wireless radios, and other items are assembled for shipment to the job site.

Testing and Certification Before Shipping

To ensure quality control, every machine is tested and certified before it is shipped.

Packing and Shipping

After the APS machines are tested and certified, they are packaged along with other components for shipment to the job site. Machinery, electronics, and equipment are loaded onto trucks or into containers for shipment to the job site. Clauses in the model contract help ensure a smooth transition to the site.

Raw steel is fabricated.

Mechanical components are added to the frames.

Electronics are added to the machinery.

A newly built system is tested at the factory.

System elements are packed for shipping.

Systems elements are packed into a shipping container.

special installation and automation work. It should consider the general practices and customs prevailing in the market. Of course, care should be taken to maintain a balanced contract, giving due consideration to both owner's and supplier's rights and obligations.

A clear chain of command is necessary. In addition to the owner, the supplier should be responsible to report and take orders only from one entity, namely the consultant or owner's representative, project manager, or engineer, as spelled out in writing.

Plans and Boundaries Clearly Defined

The contract needs to specify who does what. The supplier should be responsible only for the assembly and installation of the APS, including associated trades inside the confines of the actual parking building.

Specific Quality Standards Need to be Spelled Out

However, the supplier should be responsible for preparing all of the submittals in compliance with the standards that apply to APSs. The include NFPA 13/ NFPA 88A-2019, ASME B30.13, as well as the "Guide to the Design and Operation of Automatic Parking Facilities," as published by NPA and the Automated and Mechanical Parking Association (AMPA).

Insurance

The APS supplier, using the example of the case study presented here, should offer these insurance protections:

- Factory general liability insurance for a period of one year covering bodily injury and property damage (could include a combined single limit of $1 million and an aggregate of $2 million)
- Workers' compensation insurance according to the laws of the state that the supplier is in.
- Professional indemnity insurance covering the design responsibilities for an amount of $1 million each occurrence and $2 million aggregate

However, the supplier and the project should be covered on-site under the owner's general liability or umbrella insurance covering bodily injury and property damage.

Software License and Escrow

All APSs require software to operate. Many contract agreements do not include a clause by which the owner has a recourse in case the system supplier defaults on its obligations, effectively rendering the system compromised or, even worse, useless. The solution for this is to enter into a software licensing agreement combined with an escrow agreement in which the source code is put into safekeeping of a third-party escrow agent. The code would then be released to the owner upon manufacturer's default. This then provides a remedy for the owner in case of supplier default. The same applies principally also to all other components of the APS.

Patent Coverage

It is desirable for the owner to ensure that the supplier has the rights for the technology applied for the project. This prevents possible stops through patent-infringement processes.

Performance Bonds

In the construction industry, it is common to request performance bonds to secure the contracted work being performed per contract. However, bonding companies do not generally cover, for example, elevators or HVAC systems. These mechanisms are typically built in a factory and merely installed on-site. This applies also to APSs if the building portion is excluded (which in itself can fall into the typical construction industry performance bond requirements).

Therefore, another method of securing the owner's down payment and progress payments needs to be established. In the case study project and other projects by the same supplier, a method was found that satisfied the owner's requirements by introducing the following procedures.

First and foremost, the owner investigated the past performance of the supplier and was satisfied with it.

Next, because substantial majority work was to be performed in the factory, the contract was split into a delivery portion and an installation portion. For the delivery contract, a substantial down payment was agreed upon because about 80 percent of the elements needed for fabrication must be ordered at issuance of the delivery contract in order to comply with scheduled product delivery. This down payment was secured by a company guarantee in the same amount.

Then, when the machines were completed for a factory acceptance test (FAT), the owner was invited to witness the production completion. Upon a successful FAT, the remaining portion of the delivery contract was paid, and goods were shipped to the site.

The installation contract was oriented to on-site progress with a retainer of 5 percent—half of it to be released upon issuance of substantial completion certificate and the other half after completion of the defects liability period. The completion of installation and startup operation was concluded with the site acceptance test (SAT), with its main part being the performance certification of the system's peak traffic capacity through an accredited third party.

Following the successful SAT, the "substantial completion certificate" was issued, which then entered the one-year defects liability period.

TIMING, APPROVALS, AND GETTING STARTED

The supplier should start the design and execution of the project on the date specified in the letter of acceptance or on the date mutually agreed. The maximum duration for commencement of the system should be within 30 days of the date of the letter of acceptance, unless otherwise mutually agreed later.

Approvals

The APS supplier, in cooperation with the owner/consultant, should provide all of the required drawings and system specifications under the scope of work. However, the owner/consultant should incorporate supplier drawings and system specifications into the owner's design documents at no cost to the supplier.

Timetable

Provisions need to be in place in case the approvals for the project are delayed. Any delays in getting the approval due to delays from the statutory authorities should entitle the supplier to an extension of time for completion, as well as reimbursement of any additional cost actually expended by the supplier.

Visas for International Travel

Because the equipment for an APS may be shipped across international borders, it makes sense for the building owner or contractor to obtain the necessary permissions. The owner or consultant should obtain site work permits, visas, or

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Meanwhile, the Site Is Prepared
While the APS machinery and equipment is being built, the job site is prepared. The slab is poured, and steel begins to arrive. The parking system can be installed using either a steel or concrete supporting structure.

Erecting the Steel Frame
The next step in manufacturing and installing the APS is erecting the steel frame. The compactness of the steel shelving system is the key to minimizing the impact of parking in a project, allowing architects and developers to allocate less of the land area for parking.

As the steel continues to be erected, electromechanical vertical lifting machine components are installed at the top of the steel shelving system. These robust, durable, and safety-compliant industrial modules are used to raise and lower cars between floors. Vertical lifts are equipped with long-lasting chain gearbox transmissions, variable frequency drives that allow speed adjustments, safety locks, and electronics that allow an automatic operation.

A hoist system is then installed at the top of the central area of the shelving support system. This is used for installing additional machinery inside the system and future maintenance in the garage.

Once the steel structure is in place, additional machinery can be installed within the automatic garage. Using independent machines moving the cars vertically, horizontally, and into and out of the racks in the shelving system, this 2,314-space garage can handle up to 425 cars per hour. This is a capacity to deliver more than seven cars each minute.

The independent carrier modules that move the vehicles horizontally along a row are installed in each level of the APS. The lower carrier modules are installed on the bottom level, and they include turntables to rotate a car 180 degrees for easy exit from the facility driving forward.

Building the Facade
The industrial lifts, machines, pallets, and computer-control systems are installed inside the supporting structure and never interfere with the facade. This gives architects a free hand in designing the exterior of the building.

Whether choosing a half-timbered, brick, aluminum, concrete, or glass facade, the decision is up to the designer. The garage can be designed to fit harmoniously into its environment. Terminals can also be integrated into the facade environment, while observing both visual as well as functional criteria. The APS can be constructed in every form: above ground, underground, on roofs, or inside a building complex.

The facade and roof are attached to the structural support system of the APS, designed to blend seamlessly with the complex.

Electrical and Electronics
As the APS machines are being installed and the facade completed, the main power feed for the automatic parking facility is connected as well as primary electrical panels for the automation components and other equipment.

The APS requires about 3.5 kWh to park and retrieve one car. This may vary based on auxiliary electrical needs, such as lighting, air-conditioning, etc.

The main electrical substation feeds into the electrical room inside the APS facility. From the electrical room, power is distributed for general lighting, air-conditioning, terminal stations, the control room and hoists, machinery, and other automation components. Many of the machines, such as carriers that move the cars horizontally, are connected to the electrical system through power rails so that the machines can move freely.

The site is prepared.

The steel framing is erected. In this development, conventional parking is on the bottom, with the APS above it.

The building facade is independent of the parking garage. In this case, the APS is installed above a conventional parking garage.

Other stationary machinery and equipment have their own electrical panels that connect directly into the electrical room.

This APS includes a backup emergency power diesel generator with an automatic transfer switch in the electrical room so that service can continue in the case of a power outage at the substation. The automatic transfer switch ensures a seamless transition to stand-by power within 6 seconds.

Firefighting and Sprinklers

This project includes firefighting systems based on the National Fire Protection Association's NFPA 88A: Standard for Parking Structures, which includes a special chapter for APSs.

The president of the company that manufactured and installed this parking system is a member of the NFPA Garage and Parking Structures Committee and was instrumental in automatic parking garages being defined in this key international code. Also, based on the company's experience and work with UAE Civil Defense, a new Civil Defense Code for automatic parking was developed to serve as a guideline for future projects in this region. This new Civil Defense Code takes into consideration the new NFPA 88A codes.

If needed, based on local water supplies, a water tank is added to the design to ensure immediate access to a large volume of water necessary to address any fires, which is typically 120 square meters. Three highly sensitive and quick-response sprinkler heads are used to cover every two parking slots in the steel racking system, providing protection for vehicles and the automatic parking garage.

This is the electrical room for the system.

This is a portion of the fire-prevention system.

other documents required by authorities, if needed, for the supplier and its staff to install the APS.

Setting Plan and Site Conditions

Before the supplier takes over the site and begins the installation, the owner or consultant should mark site boundaries, gridlines, and levels in accordance with the plans.

Storage of Supplier Equipment

An APS involves a tremendous amount of equipment to be delivered and stored on-site. This is unlike a conventional parking system that involves mainly poured concrete for various floors and ramps. In case the owner/contractor is not ready to accept delivery of the equipment on the date indicated in the contract for any reason, another delivery spot needs to be specified. Otherwise, the supplier may store the materials at an arranged warehouse at the owner's risk and cost. The owner should reimburse the supplier for additional costs due to extra handling, transfer and warehousing, and extra insurance costs.

Adverse Physical Conditions and Artificial Obstructions

The owner or consultant needs to alert the supplier in writing of any physical obstructions or physical conditions on the site, other than climatic conditions, that will impede the delivery and installation of the equipment. Otherwise, the supplier will be entitled to an extension of time and compensation.

Safety Precautions

The contract should spell out who is responsible for safety precautions. Here is the recommended breakdown.

The supplier should:

- Comply with all applicable safety regulations.
- Take care for the safety of their persons entitled to be on the site.

The owner's appointed general contractor or others should:

- Keep the site and APS equipment and installation area clear of unnecessary obstruction.
- Provide fencing, lighting, guarding, and watching of the APS until completion and taking over.
- Provide any temporary elements

(including roadways, footways, guards, and fences) that may be necessary because of the execution of the system for the use and protection of the public as well as the owners and occupiers of adjacent land.

Force Majeure

Provisions need to be spelled out for force majeure. According to Merriam-Webster, force majeure means "an event that could not be reasonably anticipated or controlled." It translates literally from French as "superior force."

Force majeure should be spelled out explicitly and may include:

- War, hostilities (whether war be declared or not), invasion, act of foreign enemies
- Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war
- Riot, commotion, disorder, strike, or lockout by persons other than the contractor's personnel and other employees of the contractor and subcontractors
- Munitions of war, explosive materials, ionizing radiation, or contamination by radioactivity, except as may be attributable to the contractor's use of such munitions, explosives, radiation, or radioactivity
- Natural catastrophes such as earthquake, hurricane, typhoon, volcanic activity, or flooding
- Such events with consequential delays, like delays in shipment on sea, delays in custom houses/clearances, delays in permitting or approval procedures, etc.
- Acts of government

If the supplier is prevented from performing any of its obligations under the contract by force majeure, the supplier should be entitled to an extension of time for any such delay, if completion is or will be delayed, and if the event or circumstance is of the kind described above, payment of any such additional cost incurred to supplier.

Optional Termination, Payment, and Release

Every project needs an optional "out." If the execution of substantially all of the APS in progress is prevented for a continuous period of a certain number of days (84 days in the case study presented here) by reason of force majeure of which notice has been given, then either party could give to the other party a notice of termination of the contract.

Quality Assurance

The supplier should demonstrate compliance with the requirements of the contract and in accordance with the procedures required by the statutory authorities. The owner or consultant should be entitled to audit any aspect of the quality assurance system. Details of all procedures and compliance documents should be submitted to the owner or consultant for information before each execution stage is started by the supplier.

Contract Sum and Payments

The owner should pay the supplier, in consideration of the construction, commissioning, completion of the system, and the remedying of any defects, the contract sum as set forth in the contract documents.

WHEN THE OWNER TAKES OVER

Tests on Completion

Following installation, the supplier will conduct testing of the APS. The mechanical peak-traffic capacity should be demonstrated by testing 10 percent of the peak traffic successfully. If the testing cannot be completed due to delays in other parts of the building project that are not completed, the supplier will need extra time to do the testing. This testing is typically a prerequisite of the owner taking possession and should be verified by a trusted and technically accredited third party.

However, if the testing of car parking is delayed more than 30 days due to no fault of supplier, the "taking-over certificate" may be issued, and the supplier may demobilize form the site. When the conditions are right, the owner may request and compensate the supplier to remobilize to conduct the testing.

Owner or Consultant Taking-Over Certificate

When installation has been substantially completed and has satisfactorily passed the required tests on completion, the supplier may give a notice to that effect to the owner or consultant, accompanied by a written undertaking to finish with due expedition any outstanding work during the defects liability period. The owner then issues the supplier a "taking-over certificate" stating the date on which, in his/her opinion, the work was substantially completed in accordance with the contract, or provide a punch list of items based on contract requirements that must be completed during defects liability period. Or, if the owner uses the system for parking, the owner is deemed to have issued a taking over.

Completion of Outstanding Work and Remedying Defects

For an APS, the defects liability period is typically one year from the date of the taking-over certificate, excepting normal wear and tear. If a defect appears or damage occurs, the supplier should be notified accordingly, by (or on behalf of) the owner.

The supplier should be responsible to remedy defects or damage only if defects are attributable to items for which the supplier is directly responsible for under the contract. Of course, the supplier should not be responsible for any defects as a result of improper operation and maintenance of the parking system.

The owner or consultant should issue a performance certificate or defects liability certificate within 28 days after the expiration date of the defects liability period, or as soon thereafter as supplier has completed the system, including remedying any defects.

Guarantees and Warrantees

Guarantees and warranties need to be spelled out clearly. For the case study presented here, the supplier warranted to the owner that materials and equipment furnished under the contract were of good quality and new, that the system and installation was in accordance with the norms of industry standard, and that the APS conformed to the contract and was fit for the intended purpose. The latter included that the system is fit for the intended purpose of parking 425 cars per hour.

However, this warranty excluded remedy for damage or defect caused by abuse, fire, or water originating outside of the APS, modifications not executed by the supplier, improper operation, force majeure, and wear and tear under normal use. Also, the supplier assigned to the owner all warranties and guaranties received from the original manufacturers

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Finishing Touches on Entry/Exit Terminals

As the facade is completed, it is time to put the finishing touches on the entry/exit terminals. The entry/exit terminals for the APS, as well as the lobby used by customers retrieving their cars, can be custom designed by the architect or interior designer to blend with any project's specific design theme. Functionally, the well-lit terminals and close-by lobby increase security and reduce the risk of personal injury for the users.

The interior walls of the terminals are finished, and roll-up safety doors are installed. These safety doors block the entrance to the interior of the garage, both prohibiting and protecting users from entering the inside of the APS.

Customers enter the secure ground-floor lobby and touchless swipe their access cards at one of multiple kiosks to retrieve their cars. A touchless system is available using a smartphone application. Screens display the nearby exit terminal where the car can be retrieved. It is not necessary to wander around inside a parking garage.

Numerous electronic and automation components such as wireless radios, a variety of sensors, cameras, display screens, card readers, card dispensers, and much more are installed throughout the parking system to facilitate the automatic functions and ensure the safe and smooth operation of the APS garage.

Electronics, Sensors, and Cameras

Multiple high-end laser curtains are used throughout the terminal in order to ensure that the vehicle is parked correctly inside the predetermined boundaries. Additional motion and positioning sensors round out the checks within the terminal area before the display screen provides further instructions to the user.

Hundreds of sensors are utilized, from safety sensors that monitor the opening and closing of roll-up doors in the entry/exit terminals to highly accurate proximity, distance, and positioning sensors that ensure cars and machinery are properly positioned, as well as precision scanners that tell a machine its current location.

Outside the terminal, a green signal light indicates when it is safe to enter the parking bay. A red signal light indicates that a car is entering or exiting a terminal. Information received from the sensors is forwarded to the automation software. Resulting instructions in local languages are then displayed on the screens in the terminals to provide guidance to users of the APS. Multiple cameras take high-resolution images of a vehicle upon entry and exit for the protection of both the owner of the garage as well as the vehicle owner.

Computer Hardware and Software

Duplicate electronics and mechanical components and systems ensure that if one machine requires maintenance or repair, a backup is already operating to keep cars moving into and out of the garage. The same philosophy applies to computer hardware and software systems.

This system uses redundant, ultra-high-end, fault-tolerant servers for guaranteeing continuous availability. This ensures that a worst-case scenario—cars cannot be retrieved for users because of a system failure—does not happen.

Automation software powers this system. This software controls the machinery, lifts, motors, sensors, and other automation components used to transport the vehicles in the parking garage. The software is used worldwide in processes where thousands of movements are performed on a 24/7 basis, such as in automobile assembly lines as well as in seaports around the world for container handling.

Sophisticated Diagnostics and Remote Access

This parking system includes a patented full-diagnostic suite and high-level warning system. The software records every rotation of any wheel, bearing, gearbox, and motor. All moving parts are monitored, and operators can see every machine movement and car location on display screens in real time. Supervisors can be alerted for system tasks, and any needed maintenance is immediately reported online to the service department.

The diagnostic system provides up to five different alarm messaging classifications. These early warning indicators and alarms recognize and report conditions before a problem occurs. Messages are sent to the computer system on-site and can also be automatically forwarded to technicians' cell phones. Up to three locations can be notified simultaneously. These early warnings ensure proactive maintenance and a high level of uptime. Real-time remote access allows off-site troubleshooting by operators or the manufacturer, if needed.

Start Up and Testing the Completed Garage

The machines are now installed, and the facade is completed. Electrical, firefighting, automation components, and software are all in place. The next step is a comprehensive battery of synchronization, tests, and adjustments to ensure that all of the elements of the APS are functioning at peak performance and all components are communicating properly with each other. Each design specification is tested and verified, including the throughput of cars and speed of retrieval, etc.

Pre-opening performance tests for this particular facility demonstrated that the garage handles 425 cars per hour. This peak traffic is faster than typical conventional ramp style garages. Additional tests showed that parking or retrieval of a vehicle can be completed within an average of 177 seconds. During various stages of the installation and start-up operation of the automatic parking garage, maintenance and operations staff have been fully trained on the APS.

The 2,314-space APS for Al Jahra Court in Kuwait is completed, turned over to the owner, and officially opened.

Flexible Operations Programs

For owners who want to use their own staff for operations and weekly maintenance functions, this manufacturer provides two sets of complete operation and maintenance manuals and will provide on-site training for these personnel.

The owner may elect to have the manufacturer provide operation services and will be presented a proposal for a full management contract for the automatic parking facility that includes a full system warranty for the life of the contract—a feature that was considered vital to the owner.

The Result

With guidance and clear communications from the model contract illustrated in this course, an innovative parking solution has been created with these advantages:

- Better parking experience; premium valet without the tip
- Better safety and security for individuals and their cars
- Better environment with more green space and less pollution
- Less congestion
- Better use of land and development space
- Better revenues and profits

The entry/exit terminals are the only part of the system that the user encounters. A luxurious setting provides for an upscale user experience.

This is a touchless kiosk.

Start up and testing is done before the garage is turned over to the owner.

and distributors of equipment components and programs incorporated into the APS.

The main electrical supplier provided an extended warranty of two years from the delivery date of parts. A 10-year warranty applied to all steel structural elements as well as all machine frames with welded elements. For any project, if a maintenance and service contract is executed, complete system warranty is covered for the life of the agreement. This is a very vital point for the owner.

CONCLUSION

APSs are the future. They offer up to three-and-a-half times as many parking spots as conventional parking garages in the same volume. This saved space can be used for more profitable uses or even green space. Automatic parking is safer for users and is a more pleasant experience. These systems offer a "wow factor" for buildings to attract tenants. While these innovative and proven systems bring multitudes of benefits and are increasingly specified, there is not yet a standard contract to guide a successful project from inception to completion, and which protects both the owner and the supplier. This course demonstrates how the largest automatic parking garage in the world came into being, plus elements of the contract that made it happen.

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