Robotic Parking Systems, Inc

RPS Steel Data

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Robotic Parking Structural Steel Overview

Robotic Parking Systems are designed as standalone steel structures, where all vertical loads are efficiently transferred to the foundation through anchor bolts. This design allows for flexibility in integrating various architectural features, such as facades, which can be attached to the steel framework using existing substructures. The roof decking is directly connected to roof rafters.

The structural system of the robotic steel framework is composed of several key functional elements bolted together on site to ensure stability, durability, and precision in operation, the design is such that there is minimal or no welding on site.

01 Steel Columns & Beams

The structure employs standard steel columns spaced at regular grid intervals of approximately 8 ft 2 in in width and 20 ft in length. These columns provide the primary vertical support for the entire structure and ensure uniform distribution of structural loads. Each column is supported by a base plate with thickness designed to accommodate the applied loads. The number, size, and embedment of the anchor bolts will be determined based on the governing structural loads, seismic and wind requirements, and the geotechnical properties of the supporting soil.

Standard steel columns include W8x31, HEB 200 or 203x203x46.

Transfer beams are utilized at the second level (above grade) to transfer structural loads where column locations or load paths change. These members may consist of standard rolled wide-flange (W) sections or European HEB sections, depending on the design requirements and project location. Roof framing may also utilize steel trusses or standard W or HEB sections, as required by the structural design, span lengths, and loading conditions.

Strut pipes are also incorporated between the columns in the aisle area between Line C and Line D to maintain the vertical alignment and overall stability of the steel structure. These members provide additional lateral restraint, helping to control column deflection and maintain the required geometry and alignment of the automated parking framework. The strut pipes contribute to the overall rigidity of the structure and ensure consistent performance under operational, wind, and other applicable loading conditions.

02 Custom Beams for Parking Slots

Each parking space is supported by two cold-formed Grade 50 steel C-channels, each with a nominal depth of 12 inches. These structural members function as primary support beams, forming a robust platform capable of safely supporting the weight of a parked vehicle. Each channel has an approximate unit weight of 44 kg/m (29.6 lb/ft), providing the required strength and stiffness for long-term service. The C-channels were sourced from qualified suppliers in China and Canada in the past, both of which have successfully supplied materials for our previous projects.

03 Robotic Custom Rails for Machine Movement

The robotic machines travel on custom-designed steel rails that provide a precise and durable guideway for automated vehicle transport throughout the structure. The rails are mounted on 8 × 4 × 1 in. structural steel angles, which serve as the supporting members and provide a stable, accurately aligned running surface. The rails are supplied by Robotic Parking Systems and are shop-fabricated, including pre-drilled bolt holes, to facilitate efficient field installation onto the supporting angles. The rails have an approximate unit weight of 10 lb/ft (14.9 kg/m), ensuring a strong and reliable support system for long-term operation.

04 Bracing Systems

Standard vertical and horizontal bracing members are incorporated throughout the structure to provide lateral stability in both the X and Y directions. The bracing system enhances the overall rigidity of the steel framework, effectively resisting wind, seismic, and other lateral loads while maintaining structural integrity. Vertical bracing typically utilizes 125 × 125 mm and 125 × 75 mm structural steel angles, while horizontal bracing is generally formed using 70 × 70 mm steel angles. These are standard structural sections that are readily available from regional steel suppliers and are selected based on the project's structural design requirements.

05 Anchor Bolts and Load Transfer

The structural columns are anchored to the reinforced concrete foundation using steel base plates and high-strength anchor bolts. This connection is designed to effectively transfer axial, shear, and overturning loads from the steel structure into the foundation, ensuring the overall stability and structural integrity of the system. Anchor bolt diameters typically range from M24 to M36, depending on the design loads, column reactions, and project-specific structural requirements. All anchor bolts are designed in accordance with the governing structural design codes and are installed with the required embedment depth and leveling tolerances to ensure proper load transfer and alignment.

06 Hoist Rail Beam for Maintenance Crane

A central hoist rail beam is provided along the longitudinal centerline of the garage to support a 10-ton maintenance bridge crane, facilitating the installation, inspection, and maintenance of the robotic equipment and other critical system components. The crane runway is typically constructed using an IPN 450 structural steel beam, selected to safely support the crane loads while maintaining the required stiffness and alignment. The beam is integrated into the structural framework and designed in accordance with the applicable crane loading and structural design standards to ensure safe and reliable operation throughout the facility's service life.

07 Tie Members for Load Transfer

Tie members are incorporated wherever a single support channel is utilized to improve load distribution, enhance structural continuity, and increase the overall stability of the parking platform. These members help transfer localized loads between adjacent structural elements, reducing deflection and improving the load-bearing performance of the system. Tie members are typically fabricated from 75 × 75 mm structural steel angles, which are standard rolled sections readily available from commercial steel suppliers and are selected to meet the project's structural design requirements.

08 Stopper Angles for Machine Safety

Stopper angles are installed at the ends of the rail paths to serve as positive mechanical stops, preventing unintended travel of the robotic equipment beyond its designated operating limits. These components provide an additional level of operational safety by protecting both the rail system and the automated machinery from overtravel. The stopper members are typically fabricated from 125 × 75 × 12 mm structural steel angles, providing the strength and durability required to withstand potential impact loads during maintenance or abnormal operating conditions. They are securely fastened to the supporting steel structure and positioned in accordance with the system's design and safety requirements.

09 Connection Details

All structural connections are assembled using high-strength property class 10.9 bolts, providing reliable load transfer and ensuring the integrity of the steel framework. The structure is designed as a fully bolted system, with no field welding required during installation. All steel members are shop-fabricated and pre-drilled to facilitate accurate and efficient assembly on site. This bolted construction approach minimizes installation time, improves dimensional accuracy and alignment, enhances quality control, and allows for easier maintenance or future disassembly if required. All bolts are tightened to the specified design torque using calibrated torque-controlled installation procedures to ensure the required preload and connection performance. Bolted connections are designed in accordance with the applicable structural steel design standards and project-specific loading requirements.

10 Corrosion & Fire protection

Typically, all fabricated steel components undergo surface preparation by sandblasting prior to the application of protective coatings. After fabrication, the steel members receive a primer/fabrication coat of approximately 80 microns, followed by a 170-micron enamel finish coat to provide corrosion protection and a durable surface finish. The final coating system is selected based on the project environmental conditions and applicable specifications.

In certain jurisdictions or specific installations, intumescent fire-resistant coating (fire paint) may be required. The requirement for fire protection coatings is dependent on the applicable building codes and the approval of the Authority Having Jurisdiction (AHJ). If required, the fire protection system will be applied in accordance with the manufacturer's specifications and the project fire-rating requirements.

11 Stairwell

Stairwells are provided in accordance with applicable fire and life safety codes and are also incorporated where required to facilitate safe maintenance access within the structure. The stairwell assembly includes stair flights, handrails, guardrails, and intermediate landings, and is integrated directly into the main steel framework. No independent support structure is required, as the stair system is supported by the primary structural columns and framing members. Additionally, steel grating platforms and access walkways are provided at required locations to allow safe and convenient access for inspection, servicing, and maintenance of critical robotic system components as needed. The stair and access systems are designed to comply with the applicable safety, access, and structural requirements.

12 Material Selection

Robotic Parking Systems utilizes ASTM A36 and ASTM A572 Grade 50 structural steel for the primary steel framework. These components are selected based on their strength, durability, availability, and suitability for the various loading conditions associated with automated parking operations. A36 steel is widely used for general structural applications due to its proven performance and versatility, while A572 Grade 50 steel provides higher yield strength and enhanced structural capacity for members subjected to increased loading demands.

For projects following British or European steel standards, equivalent structural materials such as S275 and S355 grade steels may be utilized for applicable structural elements, depending on regional requirements and design specifications.

Apart from the custom robotic rails supplied by Robotic Parking Systems, all structural materials are selected from standard, commercially available steel sections that can be readily sourced from qualified suppliers. No proprietary or specialty steel materials are required, ensuring cost efficiency, supply availability, and ease of procurement for projects worldwide.

This comprehensive approach to structural design, material selection, and fabrication ensures that Robotic Parking Systems deliver a durable, safe, and efficient automated parking solution capable of meeting the operational, structural, and long-term performance requirements of each installation.

Rough quantities and percentage distribution of the major structural elements are provided in this section for preliminary estimation and budgeting purposes only. These values serve as a general guideline based on typical Robotic Parking Systems projects and may vary depending on the specific project configuration, structural design requirements, site conditions, applicable codes, and final engineering calculations.

Final quantities and material breakdown will be confirmed during the detailed design and fabrication drawing stage.

Estimated Structural Element Quantities and Material Distribution

Steel BOQ Reference				
S.No	**Section Size**	**Description**	**Weight Kg/m**	**Percentage of Steel**
1	Cold Rolled C Channel	C 305x92x12.7 mm	44.0	38%
2	Rail Angle	8"x4"x1"	55.0	10%
3	Custom Rail	3"x1.85"	15.0	2%
4	Tie Member Angle	125x75x10	15.0	3%
5	Horizontal Bracing Angle	100x100x10	15.0	8%
6	Steel Column & Beams	HEB 200/203x203x46	46.0	15%
7	Strut Pipe	139.7x10 CHS	32.0	2%
8	Hoist runway Beam	IPN 450	115.0	2%
9	Staircases	Several profiles		10%
10	Connection Plates Etc.	Several profiles		10%
			Total	**100%**

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