



ADVENTURES IN APGS

LEARNINGS FROM REAL-LIFE INSTALLATIONS

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AUTOMATED PARKING GUIDANCE SYSTEMS (APGS) – A PRIMER

- Systems used to count occupancy of parking facilities and indicate the results on digital signs, overhead indicator lights (with single space), and websites/apps.
- Available for both garages and surface lots.
- May be installed at time of new parking facility construction or as a “retrofit” into an existing facility.
- Three broad types of systems:
 1. Facility count
 2. Level/Zone Count
 3. Single Space Count (a/k/a “Individual Space” or colloquially “red light/green light”)
- Several types of sensor technology:
 - Loops
 - Infrared sensors
 - Ultrasonic sensors
 - Camera sensors incl. LPR
 - LIDAR sensors

APGS ARE SUPER-EASY TO INSTALL AND GET WORKING – RIGHT?

On the one hand...

- APGS is innovative and useful technology.
- Can greatly increase parking efficiency and enhance customer experience.
- APGS available for many years, now pervasive in both new construction and retrofit parking facilities.
- Many excellent choices of APGS products and integrators.

But the “devil’s in the details” ...

- From actual project experience, properly designed or installed systems work well – and vice versa!
- APGS issues often relate to APGS’s most fundamental feature – ACCURACY.
- Improperly selected or placed signs can reduce readability and usefulness.
- Construction coordination issues exist with APGS’s which can cause delays and increase cost if not managed.

Let’s explore some common APGS design and installation considerations and illustrate them with references to actual projects.

THERE'S A PLACE FOR US

- Location and height of APGS sensors and signs is a critical design factor.
- Generally ceiling-mounted inside garages:
 - AFF clearance considerations
- Design decision for garage APGS: pre-embedded vs. post-installed power/network wiring
 - Both have advantages and disadvantages
 - Pre-embedded has cleaner appearance and can lower cost but implies early vendor selection and close coordination.
 - Post-installed allows more flexibility in actual built environment but may increase wiring/conduit costs.
- Design decision for surface lot APGS: wired network vs. LTE vs. WiFi
 - Wired networks can be difficult and costly to deploy in surface lots.
 - LTE/5G is often the best choice, WiFi could be used but is more complex.

REAL-LIFE PROJECT EXAMPLES – GARAGE APGS



Airport Garage: Pre-embedded, camera-based sensors



Airport Garage: Pre-embedded, examples of junction box misplacement



University Garage: Post-installed Centerline camera-based sensors with over-stall indicator lights

ACCURACY – AGAINST ALL ODDS

- APGS Accuracy is Paramount and Fundamental!
- Poor APGS accuracy can render a system useless as drivers won't rely on it.
- System accuracy goals and test procedures should be described in detail in Performance Specifications.
- Accuracy testing witnessed by client or a third-party should occur upon initial system activation and during final acceptance testing period.
- Accuracy tests should include all relevant system aspects:
 - Sensor accuracy
 - Sign accuracy and latency
 - LPR accuracy
 - Overall system accuracy

REAL-LIFE PROJECT EXAMPLES



inaccurate space status caused by sensor displacement on pavement



**Video from Device Acceptance Test at Garage portal
(skip to 1:20 for vehicle detection)**

UP ON THE ROOF

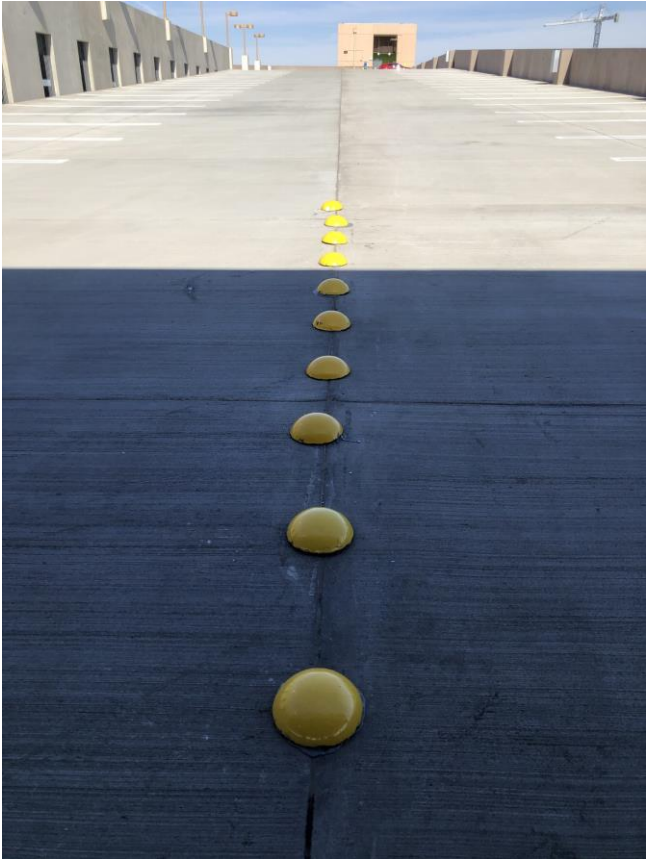
- Most above-ground parking structures have partially or fully sky-exposed top level, and surface lots are generally completely sky-exposed.
- Can result in need for different sensor types due to lack of overhead structure.
- Sensor options include:
 - Ultrasonic/LIDAR sensors at bottom of ramp to top deck*
 - In-motion cameras to count ramp traffic*
 - Embedded loops to count ramp traffic*
 - Elevated cameras on luminaries (can provide single space counting)
 - Sensors mounted on top of or embedded within pavement.
- These options all have differing trade-offs and design/installation considerations:
 - Ultrasonic: Potential need for lane/stall delineation or stall loss
 - Cameras: Proper sight lines, potential glare issues, blockage by trees or other objects
 - Loops: Proper size, placement, installation methods, and lane delineation/stall loss.
 - Pavement sensors: Battery maintenance, potential trip hazard, damage from snow plows

* These options count the top deck as one zone.

REAL-LIFE PROJECT EXAMPLES



Airport Garage
“WHERE ARE THE LOOPS?”



A study in contrasts on ramp lane delineation
Left: Hospital Garage Right: Airport Garage



SIGN, SIGN, EVERYWHERE A SIGN

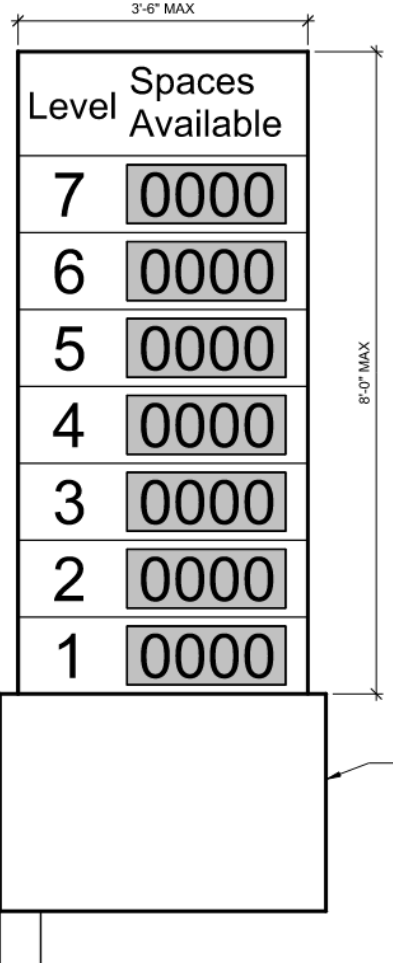
- Digital Messaging Signs (DMS), a/k/a Variable Messaging Signs (VMS) -- critical component of APGS, most obvious and sometimes only “customer facing” component.
- Must be clear, readable and non-confusing for drivers.
- Often require extensive discussion and coordination between Owner, GC, Designer, APGS Vendor, and Signage Vendor.
- Some typical issues that arise:
 - Whose design/graphics palette will be followed?
 - Requirements for signage encasement and mounting – who develops these?
 - Best locations for signs – not too many and not too few.
 - How flexible does signage content need to be?
 - Does the sign need to be designed to accommodate future parking facility changes/additions?
 - Brightness control based on ambient light level.

REAL-LIFE PROJECT EXAMPLES



Hospital Garage

Sign with no auto-brightness control



University Garage

WHAT HAPPENS TO THIS SIGN WHEN LEVELS 8 AND 9 ARE ADDED TO THE GARAGE?



City Garage

Example of a flexible format, full matrix, full color, LED sign

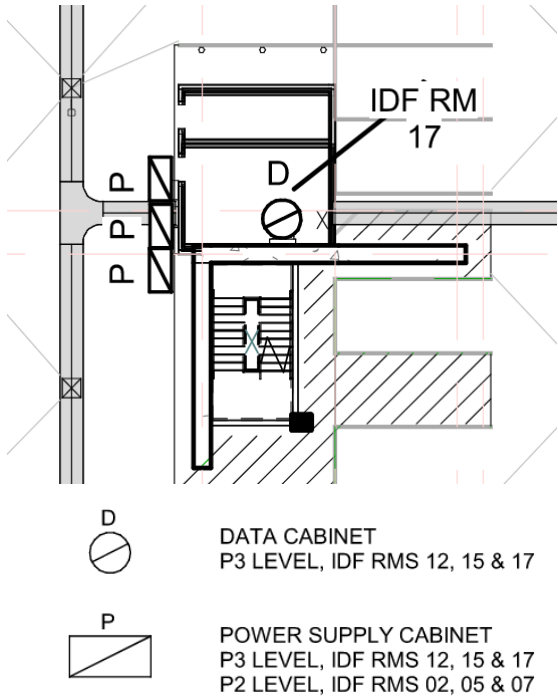
I'VE GOT THE POWER

- APGSs comprise standard electronic devices which require power and data connections.
- Garage APGS use standard power sources (120VAC or low voltage DC) and typical modern networking connections such as TCP/IP over CAT6 wiring.
- Surface lot APGS may use combination 120VAC + solar/battery, and usually require wireless networking.
- Electrical and network design for APGS needs to be done carefully and comprehensively.
- Typical details that shouldn't be overlooked:
 - Demarcation locations for power and network sources carefully designed
 - If intending to draw power from luminary poles – Do they actually have constant 24x7 power?
 - Clear specifications of who is to run power to and from demarcations
 - Low voltage wiring that is NEC compliant (e.g. NEC725 Class 2)
 - Appropriate UPS design and coverage
 - Adequate external internet connection available for calibration, monitoring, reporting and support
 - Potential of using more modern technologies such as POE++ to save cost
- Understand the role of the client's IT organization.
 - Failure to do this can result in significant surprises and delays.

REAL-LIFE PROJECT EXAMPLES



Airport Garage
Typical Floor Power/Data Cabinet Installation



Corporate Garage
Example of Design Drawing for Power and Network Demarcations



City Surface Lot
Camera Sensors powered from base of luminary

BUILD ME UP, BUTTERCUP

- Several approaches to APGS design, procurement, installation, and support
 - Design-Bid-Build
 - Design-Build
 - Vendor/Contractor Direct
- Each has its pluses and minuses – important to consider trade-offs, make a clear and informed decision, and ensure all project team members agree.
- Not all APGS vendors can deliver in all three approaches.
- Discuss and clarify who will provide the physical installation labor and what project-specific labor policies exist.
- APGS project doesn't end when installation is complete; ongoing preventive and corrective maintenance is needed.

REAL-LIFE PROJECT EXAMPLES



OUR STORY OUR COMPANY OUR SERVICES



Courtesy of Symmetry Builders
<https://tinyurl.com/3nmy53v3>

An excellent comparative description of these two project approaches.



Corporate Garage

Left: Properly cleaned and maintained sensor
Right: Sensor covered with dust/sand and can't emit IR

THE LEADER OF THE BAND

- It's critical to identify an effective and knowledgeable APGS project manager from the client and/or a consultant.
- Similar, the APGS contractor should clearly identify a lead person/project manager on their side.
- The “5 P’s” – **P**rior **P**lanning **P**revents **P**oor **P**erformance
- Early involvement and client education is key.



PIPTA

Q&A



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MUSIC TRIVIA QUIZ – NAME THE ARTISTS

- There's a Place for Us (Somewhere)
- *Leonard Bernstein/Stephen Sondheim from "West Side Story"*
- Against All Odds
- *Phil Collins*
- Up on the Roof
- *James Taylor*
- Signs (Sign, Sign, Everywhere a Sign)
- *Five Man Electrical Band*
- I've Got the Power
- *SNAP!*
- Build Me Up, Buttercup
- *The Foundations*
- Leader of the Band
- *Dan Fogelberg*