



Commercial Restrooms That Work Right

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By C.C. Sullivan and Barbara Horwitz-Bennett

When you've got to go, you've got to go. But where? "The reality is that public restrooms matter to the public. The way a business or building treats its facilities is a reflection of its operating standards," according to America's Best Restroom program, sponsored by Cintas Facility Services, Cincinnati. A recent Cintas survey found that more than 75% of respondents said they simply wouldn't return to a restaurant if the restrooms were not well kept.

It behooves public building owners to invest sufficient resources into the design, construction, and maintenance of their restrooms. As with all aspects of building design and construction, not only are durability, energy and resource efficiency, and ease of operation and maintenance of utmost importance, but washrooms have the added burden of upholding the owner's or tenant's image. Not only that, cleanliness and hygiene must be assured through good specifications, layout, and detailing.

In order to achieve this, a whole range of options should be considered, starting with low-flow and sensor-operated fixtures, which deliver energy sav-

Learning Objectives

- After reading this article, you should be able to:
 - ✓ List the main factors affecting the design and operation of public restrooms.
 - ✓ Understand how the user population drives restroom design and product decisions, including the selection of restroom finishes and fixtures.
 - ✓ Describe three public health, safety, and welfare (HSW) considerations affecting restrooms.
 - ✓ Explain how MEP systems and coordination affect restroom design and construction.

ings and improved hygiene while also appealing to a broad end-user base. In the same vein, the public now considers amenities such as family restrooms and baby-changing equipment to be standard fare. Finally, new washroom designs offer more than mere “accessibility”—their universal designs greet the aging American public and people of all abilities with open arms.

IMAGE VS. FUNCTIONALITY?

Although functionality seems to trump image when it comes to planning for public restrooms, that equation seems to be changing, say experts in design and construction. In fact, today the two are getting closer in definition, with simple, modern restroom designs being favored by both owners and Building Teams. “When planning for the design of public restrooms, functionality is the foundation which supports image,” says Sam Colucci, PE, director of engineering and design services for Integrated Project Services (IPS), Lafayette Hill, Pa. He adds, however, that a clean, attractive design is still important to achieving both goals.

“Functionality, meeting code, and accessibility will always be the key to a successfully designed public restroom,” says Kimberly Cicchella, ASID, associate and interior designer, Albert Kahn Family of Companies, Detroit. “However, it is the designer’s responsibility to incorporate durable and creative lighting, finishes, and fixtures to intrigue the restroom occupants.”

As a matter of fact, because trendy interiors are in greater demand, as evidenced by a rapidly growing market of products, the specification of plumbing fixtures is often driven not by the plumbing systems engineer but rather by the architect or interior designer (or both), according to Donald Posson, PE, CPD, LEED AP, a managing principal of R.G. Vanderweil Engineers, Alexandria, Va.

Kevin Rowan, senior project manager with Smith Seckman Reid (SSR), Nashville, says, “Higher-end spaces that we see in lobbies and premium seating levels of entertainment venues generally receive very sophisticated fixtures and trim. These are carefully coordinated with the architect’s interiors team to ensure expectations are met for quality and aesthetics.”

In other cases, however, owner procurement guidelines or even contractor or design-builder preferences drive the selection of restroom finishes and fixtures. When it comes to simply covering the basics, Rowan’s colleague Will Seimens, a senior plumbing designer based in SSR’s Houston office, lists the main design requirements of a public bathroom as being:

- handicap-friendly
- clean and dry
- well ventilated
- easy to maintain
- aesthetically pleasing, with a well-planned layout

In order to achieve this standard, products such as *wall-mounted sinks* are becoming more popular, offering both a clean look and ease of maintenance. And in high-trafficked areas, durability, in addition to maintenance, is given priority.



PHOTO: KOHLER

“Stage Fright” Considered in Restroom Solutions

An important side issue that designers of public restrooms should be aware of carries the medical term *paruresis*, also known as shy bladder syndrome or more simply a phobia of relieving oneself in a public setting. According to recent studies, about 7% of Americans are affected by this social anxiety disorder, says the Baltimore-based International Paruresis Association (IPA).

“Public toilets are places where one is obliged to ease oneself in unfamiliar surroundings among strangers of the same sex,” explains Will Seimens, senior plumbing designer with Smith Seckman Reid, Houston. “Therefore the fundamental principles of design of public toilets should include human psychological studies and not just physical clearances and space requirements.”

To assist designers, the IPA has delineated a few key areas that are often lacking in consideration and that exacerbate paruresis:

- Urinals – Watch for lack of privacy, and use dividers wherever possible.
- Stalls – Make sure there are enough stalls, and provide for the most floor-to-ceiling privacy possible.
- Odors – Restrooms should smell and appear clean.
- Noise levels – A restroom with piped-in music provides a more comfortable space for the public.



PHOTO: COURTESY BOBRICK

Stainless-steel women's restroom accessory collection. Accessories (left to right): combination towel dispenser and waste receptacle, mirror, lavatory-mounted universal bulk soap dispensers, sanitary napkin vendor, sanitary napkin receptacle (in toilet space at left), double-roll toilet tissue dispenser, and toilet seat cover dispenser. ADA-compliant grab bars in toilet unit at right. Toilet partition is fabricated of plastic laminate with stainless-steel hardware.

"In some general public spaces, such as arenas, consideration of *concealed valves* may be given," says Rowan. "Also, wall-hung fixtures, which are preferred for cleaning and sanitation, may be equipped with heavy-duty wall carriers that will absorb more shock and support more vertical force application."

Similarly, the choice of fixture materials may also be dictated by the nature of the application. "A venue that host concerts may be subject to sometimes hostile crowds, while a convention or conference center may not," says Rowan. "So when choosing between *cast iron*, which is very durable, yet costly, as opposed to fragile *vitreous china*, the choice often hinges both on the anticipated exposure and cost."

Products and materials also must be carefully selected with the reality of vandalism in mind. So even though an owner may be interested in newer, more sophisticated fixtures, they are often not as vandal resistant.

In general, says Tim Repetz, PE, senior electrical engineer with IPS, keep the following rule of thumb in mind: "Materials and products in public restrooms must be as vandal-resistant as the client can afford, and installed with *concealed or tamper-proof connections*."

At the same time, when it comes to preventing vandalism,

Seimens emphasizes the importance of supervision. "An unsupervised facility will eventually become sub-standard, even with the most vandal-resistant appliances. Scheduled maintenance and upgrades should be factored into the design, and piping, traps, and electrical supplies should, where applicable, be concealed."

CALCULATING AND ACCOMMODATING USAGE

Calculating restroom usage and needs and meeting code are additional aspects of public restroom planning. Essentially, these calculations are made based upon experience and historical usage data, though some rules of thumb are useful for Building Teams (see sidebar, "Potty Parity"). And now, with federal regulations and new municipal and state codes—as well as the advent of sustainable design guidelines, such as the U.S. Green Building Council's LEED program—the impact of restroom design on water usage has been put under the spotlight. As a result, designers have more information and product choices to incorporate when working out this equation, says Posson.

With regard to code mandates, IPS plumbing design supervisor Will Kraenbring and senior project architect Bill Furze, RA, explain that building and plumbing codes establish the minimum requirements for fixture count and water/waste requirements.

“But the experienced designer is equipped to evaluate the actual need based upon the occupancy, and is conversant with the planning, materials, and methods that will result in an aesthetically pleasing, as well as enduring, functional facility,” says Furze.

Family facilities. One unique area of usage planning—and an interesting service-oriented trend being embraced by the public—is the inclusion of “family restrooms” in public facilities. “Family restrooms appropriately afford users a comfortable environment where privacy does not compromise supervision,” says IPS associate and architectural manager Rich Conti, AIA.

These family-oriented environments support multiple functions, such as changing diapers and accommodating and providing assistance to disabled individuals. In addition, “family restrooms, unisex restrooms, or gender-neutral restrooms are widely used by fathers with young daughters and mothers with young sons in a safe, family-friendly atmosphere,” says SSR’s Seimens.

Changing stations. In order to accommodate this variety of uses, a family restroom should incorporate an adult toilet and a children’s toilet, as well as low sinks and, ideally, paper towels in addition to electric hand dryers. “Space to maneuver and assist an adult person in a wheel chair is a critical design factor,” says Colucci. “Also, height requirements for fixtures, grab bars, and electrically operated devices are important considerations.”

Another common feature of the family restroom is a changing station, which has become almost a standard spec in many public facilities. According to several building owners, a changing station may be used infrequently, but it sends a message to the building occupants that their needs are being met. Last year, when the owners of the St. Louis Rams of the National Football League asked operators of the Edward Jones Dome to install the changing stations in all the men’s rooms in the stadium, it caused a minor buzz among fans.

Convertible facilities. Yet another attractive feature for building owners, says SSR’s Rowan, is the fact that family rooms can be converted to male- or female-only facilities during events

PHOTO: COURTESY BOBRICK



Changing stations have become almost a standard spec in many public facilities. Even if they’re used infrequently, installing changing stations sends a message to the building occupants that their needs are being met.

Potty Parity: Calculating Restroom Fixture Counts

To calculate the number of plumbing fixtures needed for a public bathroom, start by reviewing all applicable codes. Then count the total number of expected users. For example, in a theater, lecture hall, or other facility for public assembly, the project team should use the seat count as a design basis. In an office building, the anticipated average number of workers per floor is the target number.

Occupancy profile is considered generically unless the facility has a highly specific, unchanging use. Total seat count for the base building design will generally be based on a 50/50 gender distribution: half for males, half for females. These numbers are then used by the Building Team, based on prescriptive codes and ratios for their jurisdiction, to determine the minimum number of toilets and urinals.

In general, a public restroom will provide two toilets in ladies’ rooms for each one in the men’s. In addition to this 2:1 ratio, urinals may be substituted for toilets in men’s rooms for up to as many as half of the total fixture counts. Some states have recently passed so-called “potty parity” laws, which provide for even higher ratios of female-to-male counts of water closets. The laws are designed to reduce lines outside women’s restrooms, primarily in public assembly venues.

when one gender is anticipated to be the majority. Whether or not that convertible restroom may be included in the fixture count to ensure the proper male–female ratio depends on state and municipal codes and health laws.

RESOURCE CONSERVATION: WATER, PAPER, AND ELECTRICITY

One of the biggest trends driving commercial bathroom design is water conservation. Although the vast majority of people take the availability of fresh water for granted, the quantities and costs associated with this “luxury” are astounding. According to the U.S. Geological Survey, 408 billion gallons of water were being withdrawn for daily use in 2000.

Moreover, the cleaning, filtering, pumping, and transportation of water is the largest single use of energy in the United States. Saving water results in greater energy efficiency for buildings. It’s no wonder, then, that new water efficiency standards are being established, accompanied by a quickly growing selection of low-flow fixtures and high-efficiency models.

Although it seemed revolutionary when toilets went from 3.5 gallons per flush (gpf) to 1.6 gpf several years ago, the newer *high-efficiency toilets*, which are now actually required in the state of California, use just 1.28 gpf.

In addition, *dual-flush technology*, made popular in Australia and Europe, has now come to the United States. Although these

units have been documented to save water, depending on the fixture mechanism design, it may not always be clear to users that one flush valve is for liquids and the other is for solids. “Dual-flow flush valves for water closets seem like a good idea but require some knowledge on the part of the user to be effective,” says Kahn’s Philip S. Leader, PE, senior associate and director of mechanical engineering.

User awareness may not adequately address the problem, according to John A. Clark, PE, senior quality assurance engineer with the M/E firm Karges-Faulconbridge, St. Paul, Minn. With the sensor-operated models, if the mechanism is too sensitive, it can be triggered too easily, whereas if it’s not sensitive enough, the flush may not adequately clean the bowl, he explains.

Another much talked about product group is the *waterless urinal*. Although it is taking time for the Building Teams to unflinchingly recommend these novel and highly sustainable fixtures, the technology continues to improve. As a result, more and more jurisdictions are becoming familiar with the option, and it is becoming a more serious consideration. It is even being called out in local codes, particularly in water-depressed regions. Manufacturers claim that one urinal replacement could save, on average, 40,000 gallons of fresh water per year.

However, in municipalities where the code still requires water in urinals, owners can choose fixtures with extremely low water levels, even as low as 0.13 gallons per flush, which is what Kahn’s Leader advises. “We are not in favor of waterless urinals due to the cost of the trap fluids and chemical build-up problems in the drains, and would recommend the pint urinals once more manufacturers bring them to the market,” he says.

The other big trend in water conservation is for “faucets, water closets, and urinals to be equipped with *automatic controls*,” observes Kahn’s Elliott Krieger, PE, LEED AP, senior associate and assistant director of electrical engineering.

A recent informal study conducted by Minneapolis-St. Paul International Airport found that after more than 500,000 cycles, the airport’s hands-free, automatic faucets saved an average of 0.45 gallons per use. Those water savings, in combination with energy use and maintenance, suggest that overall, *sensor-operated faucets* are operating 70% more efficiently than conventional faucets.

Another related newer product, *hydro-powered faucets*, “are extremely popular because they do not use electricity and they don’t require constant batteries maintenance,” according to R.G. Vanderweil’s Posson.

HEALTH, HYGIENE AND TOUCHLESS WASHROOMS

Besides water conservation, the other big gain achieved by touchless fixtures is improved hygiene, along with enhanced public image for the building owner or occupant.

The fact is that public restrooms carry a negative stigma. This is evidenced by a large library of surveys by manufacturers, facility operators, and public opinion groups. A recent poll by Los Angeles-based Impulse Research Corporation reported that 30% of Americans use public bathrooms only when they are “desper-

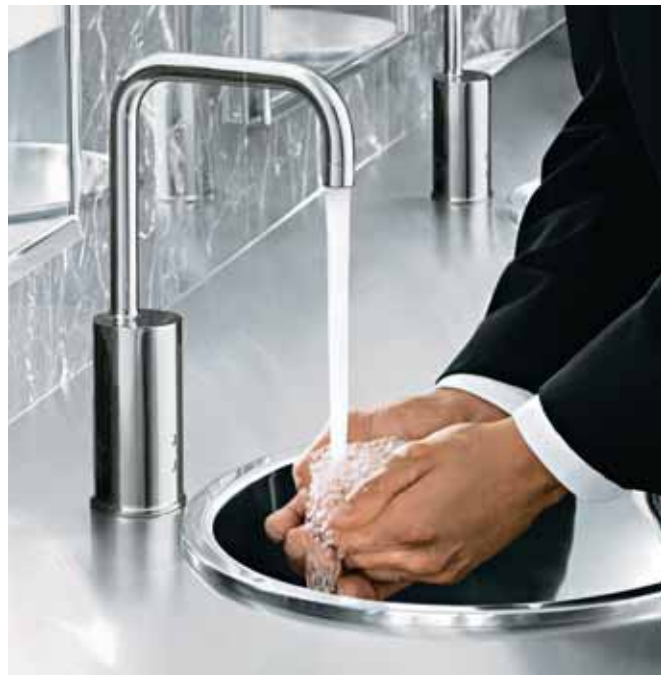


PHOTO: KOHLER

Touchless plumbing fixtures like sensor-operated faucets have proven to be effective in reducing water and energy use and improving hygiene.

ate.” Worse yet, nearly 66% employ a variety of maneuvers—the elbow push, the foot flush, and even skipping hand-washing altogether—to avoid touching any potentially germ-laden surfaces in public washrooms. Similarly, a National Sanitation Foundation survey revealed that more than 90% of restroom users perform some sort of “bathroom gymnastics,” as they call it, to avoid making any contact with surfaces in a public restroom.

Fortunately, touchless fixtures are beginning to change this, from sensor-operated toilets, urinals, and faucets, to automated soap and towel dispensers. The result is two-fold: not only are Americans showing more comfort with public facilities, but the No. 1 combatant to the spread of germs—washing one’s hands—is not being neglected as much as in the past. In fact, most malls, bigger retail stores, and highway rest areas have actually removed their restroom’s entrance doors in order to eliminate this final point of contact.

In terms of practicality, the American Restroom Association recommends doors that swing outward to allow the public to exit without gripping a surface. However, the doors “must be configured to avoid hitting passing hallway traffic.” *Labyrinth entrances*—doorless restroom access areas with sightlines blocked by corners or overlapping walls—“have no surfaces to contaminate and they avoid the problem of an outward swinging door hitting someone,” according to a report from the association.

In actual application, one important thing for Building Teams to consider is the sensor technology and mode of operation. When touchless products first started coming out, the first-generation *infrared (IR) sensors* were not very precise and were easily

activated by changes in background lighting and surface reflections. Now that the technology has improved—some manufacturers have adapted IR sensing devices similar to those used in auto-focus digital cameras—the products are performing better, making facility managers happy.

The newest automatic faucets use capacitive sensors that are more responsive than infrared sensors, says Thomas Westerkamp, a Naperville, Ill.-based consultant and author of *Maintenance Manager's Standard Manual*. “They surround the fixture with a force field. Water flows as soon as hands approach the top, the bottom, or any side of the faucet,” he explains.

In terms of supplying power to the unit, Kahn's Krieger explains that the source for an IR sensor-operated fixture “can be either batteries or low-voltage AC power. Battery-powered units are less costly to install, but require ongoing maintenance for battery replacement. AC-powered units will require a step-down transformer and a permanently wired installation.”

One other point is whether the product uses a solenoid valve or *cam gear*. Solenoid valves continuously draw electricity, whereas cam gears only draw power when the units are in use. As such, the cam gear, which is being incorporated into the newer products, uses less power overall and require less-frequent battery changes. Cam gears also “keep all electronics away from water, unlike solenoid valves that are sensitive to moisture and can corrode and fail,” according to Westerkamp.

Product and Material Selection

Beyond the plumbing fixtures themselves, Building Teams must consider many other components of restroom design and operations, such as the specifications for floors, walls, ceilings, and toilet partitions. SSR's Seimens advises that, while material choices and construction will vary depending upon the end use, the following common approaches are important to consider:

- Floors – Non-slip ceramic tile, natural stone, homogeneous tiles, or terrazzo.
- Walls – Ceramic tile, natural stone, homogeneous tiles, stainless steel, glass block, and mirrored glass.
- Partitions – Enameled steel panels, aluminum panels, phenolic cladding, solid reinforced composites, and marble slabs.
- Ceilings – Mineral fiber board for ceiling tile, fibrous plaster board, and aluminum panels or strips.

Selection and detailing of each material should take into consideration all aspects of facility operations, from the user population to anticipated maintenance practices. Focusing in on flooring specs, Kahn's Cicchella explains: “Porcelain tile holds up very nicely on the restroom floors with a medium-grey grout joints. The lighter grout joints show more dirt over time. If a light grout joint is desired, an epoxy- or urethane-based grout would be the preference.”

However, maintenance experts caution that tile and grout take more time and effort to clean. “Special grout-cleaning chemicals are needed periodically, their standing time is longer to penetrate the dirt embedded in the grout, and cleanup to remove excess liq-



PHOTO: BROKENSHERE

uid takes longer,” says Westerkamp. As an alternative, he suggests substituting this flooring choice with seamless, one-piece epoxy flooring or a similar membrane, which requires less maintenance labor while maintaining “a bright, pleasant appearance that is free from dingy, gray grout lines.”

Also keeping maintenance in mind with regards to toilet partitions, Westerkamp observes, “Plastic stalls are tougher than metal and anchored to walls instead of floors, so they reduce cleaning time and resist graffiti and vandalism.”

At the same time, Cicchella points out, “Stainless-steel toilet partitions with a surface texture are very durable, cleanable, and show fewer fingerprints with the surface texture.”

In the interest of efficiency of use, the ARA recommends partition doors that remain slightly ajar when not in use, as a means of signaling occupancy. Other means are available, such as partitions with mechanical vacancy signs integrated into the locking hardware, offer ways to help users quickly navigate to open stalls. “The doors of stalls often lose alignment over time,” the ARA points out. In the event the stall frame becomes misaligned, the ARA advises that doors should have sufficient clearance and the latch length of the locks should be long enough to still function properly.

Similarly, with other aspects of the design, the team needs to consider what's involved in maintaining a clean, sharp look. For example, water stains will be better camouflaged on light-colored countertops, whereas splashes of water will be much more visible on darker-colored countertops, thus requiring more cleaning. Likewise, high-polish surfaces will need to be wiped down more frequently.

THE LETTER AND THE SPIRIT OF ACCESSIBILITY

Any discussion of public restroom design needs to address the Americans with Disabilities Act (ADA) and pertinent acces-



sibility requirements, which during the 1980s and early 1990s revolutionized the design of public restrooms. Armed with the knowledge that about 54 million Americans live with a disability, coupled with the fact that, due to the aging national populace, proper accessibility is more and more in the public spotlight today, Building Teams must work together to give due attention to this aspect of the design.

At first glance, the unseasoned designer may be overwhelmed by a long list of requirements and recommendations for universal design. However, the Association of Science-Technology Centers (ASTC), a Washington, D.C.-based group that represents museums and science centers globally, points out that the *ADA Accessibility Guidelines (ADAAG) for Buildings and Facilities*, [<http://www.access-board.gov/adaag/html/adaag.htm>] address “bathroom basics” that make restrooms better for all users. Among the keys to good design, says ASTC, are “readable signage; easy-to-open doors; floor surfaces that are clear, level, and barrier-free; enough space to get to things and turn around; doors that are easy to lock and unlock; and faucets, sinks, coat hooks, trash receptacles, and soap, paper towel, and toilet paper dispensers within easy reach.”

While this overview is helpful, the devil is in the details. For example, in terms of providing ADA-compliant toilet stalls, the basic requirement is to provide at least one per toilet room, as required by the ADAAG section 4.17.3. However, if a public restroom has six or more stalls, then at least one stall must provide for all of the features and accessories laid out in section 4.23.4, including a 36-inch-wide “ambulatory” toilet stall with an outward swinging, self-closing door, and parallel grab bars.

Clearly, the ADAAG is an exhaustive document, and Building Teams must be familiar with its provisions. But as with any aspect of public restroom design, the key is in anticipating usage levels and the vagaries of the user population.

Because accessibility regulations do vary from jurisdiction to jurisdiction, “The designer must be knowledgeable not only with the requirements, but what amenities and planning techniques will best serve the need,” says the IPS’s Colucci. “A common mistake is to assume that a product, its placement, plan arrangement, etc., fulfills only a single, specific need. Designers need to participate and collaborate with a group of handicapped persons when planning a facility to better understand the realm of disabilities and how to overcome the barriers to everyday life that these individuals were previously asked to endure.”

Though awareness among design and construction professionals is improving, facilities are sometimes negligent in failing to provide the extra-wide stall or a sufficient number of accessible stalls. In some instances, for example, public restrooms simply lack the space and amenities required for the growing number of users on battery-powered wheelchairs. More commonly, soap dispensers are often placed above the sink, making it difficult for those in wheelchairs to reach.

As a starting point, Building Teams members should be conversant in basic ADAAG guidelines, including the following

recommendations and requirements:

- Specify door hardware and faucet controls operable with one hand.
- Locate one grab bar behind the toilet and one on the side wall nearest to the toilet.
- Specify toilet seats that stand between 17 inches and 19 inches above the floor.
- Mount the toilet paper dispenser below the side grab bar, at least 19 inches above the finished floor.
- Place and design sinks to take into account proper height, space for knees, and reach by all users.

A TEAM APPROACH: COORDINATING ENGINEERED SYSTEMS

As with most types of construction projects, the development of facilities with successful restrooms demands close coordination among the various consultants and trades. “The overall project budget can be reduced and the construction schedule shortened when all design trades are fully integrated and coordinated during the design phase of the project,” says the IPS’s Conti.

In fact, the restroom project is a microcosm of any building development, because essentially all engineered systems come into play in one concentrated space. Knowing one’s responsibilities helps keep the work on schedule and under budget. Winston Huff, CPD, LEED AP, project manager and plumbing designer with SSR’s Nashville office, offers this useful rundown of the role each building professional plays in the design and construction of a public restroom:

- **Architect and Interior Designer** – In most cases, the architect or interior designer will take the lead. Essentially, he or she will determine the basic number of fixtures, the layout of the room, the finishes, ADA clearances, and aesthetics of the room.
- **Building Operations and Maintenance Executive** – Most building managers have standard requirements for plumbing fixtures, accessories, and material finishes that they prefer for their buildings. The owner generally decides the quality of fixtures and such things as whether electrified components should be battery-operated or hard-wired.
- **Plumbing Engineer** – The lead plumbing designer usually specifies the fixtures and monitors their installation. This engineer also advises the client on the type of fixture that is appropriate for each installation and is responsible for the design of the water and waste system that serves the restroom fixtures.
- **Mechanical Engineer** – Working with the team and key regulatory agencies, the mechanical engineer ensures that proper supply air and exhaust air will be delivered to the toilet room.
- **Electrical Engineer** – With input on the type and specs of lighting fixtures, the electrical engineer works with the architect, owner, or interior designer on the location of those fixtures. In addition, this professional lays out the power system that feeds the lighting, plumbing fixtures, and accessories in the room.

Restroom product selection demands input from every team member. SSR’s Rowan points out that lead times for plumbing fixtures, special colors, and valve finishes are generally not a

major issue. However, some colors and premium metal coatings will cost more and may take longer to reach the jobsite, depending on type and availability. How to deal with this? “The key to any successful restroom is to closely coordinate fixture selection and finishes with the architect and owner to achieve the desired result,” Rowan says.

But beyond just coordinating fixtures, the IPS’s Kraenbring describes a successfully coordinated project as articulating the architectural design to incorporate the mechanical, electrical, and plumbing amenities in a manner that enhances the architecture of the space without unduly calling attention to its functional components.

To achieve this goal, consider the following notes on specific mechanical, electrical, and plumbing (MEP) systems:

Mechanical systems. One of the biggest issues for restrooms and their HVAC system designs is ensuring good indoor air quality (IAQ) with sufficient exhaust-air changes. In fact, designers routinely recommend exceeding code requirements to achieve this, especially for facilities with periods of heavy use, such as assembly occupancies.

For example, Rowan points out that the code minimum exhaust quantity for public restrooms is 2 cubic feet per minute (cfm) per square foot, but one good strategy for exceeding this in public areas, such as arenas, is by pulling conditioned air from the concourses to serve the restroom space. In other facilities with predictable and moderate use of the restrooms, the code-minimum ventilation rate of 75 cfm per water closet or urinal may adequately meet odor control needs, says Kahn’s Leader.

Other important mechanical design considerations, according to Leader, include:

- Whether toilet should be mounted on the wall or floor in bariatric water closets.
- Housekeeping concerns with floor outlet fixtures.
- Coordination of floor outlet water closets with structural beams below the floor.
- Radiant-floor heating and towel warmers, seen in some high-end applications.
- Minimizing floor drains to avoid costly trap primers.

Lighting systems. Building Teams should be aware of regular and emergency code requirements for lighting in restrooms, says Krieger. For example, energy codes are now requiring that restroom lighting be controlled automatically, most commonly via occupancy sensors.

As for emergency egress to comply with *NFPA 101, Life Safety Code*, “Normal lighting providing a minimum of 1 foot-candle to illuminate the means of egress must be provided when the building is occupied,” says Krieger. “During a power outage the path of egress must be illuminated using an emergency source of illumination providing an average of one foot-candle, with no point along the path of egress being less than 0.1 foot-candles.” In addition, the emergency lighting must remain on for at least 90 minutes.

In order to meet these requirements, Krieger offers one strat-

egy: placing some of the lighting fixtures in the toilet rooms on an emergency source. “Also, by providing an emergency bypass relay, all the lights in the toilet room can be shut off to comply with the energy codes, with only the emergency lighting coming on during the power outage. Emergency power can be from batteries or a standby generator,” he says.

Rowan notes one challenge unique to restroom lighting: the shadows cast by toilet partitions. “The wall-hung partitions tend to block light from lay-in fluorescent fixtures and cove lighting when spaced in a traditional grid,” he explains. “Many times it is necessary to place light fixtures directly above each stall to achieve desired lighting levels. This, of course, applies to emergency lighting too.” On the other hand, Rowan adds, cove lighting solutions are very effective for open areas, such as those around sinks and urinals,

Plumbing systems. R.G. Vanderweil’s Posson points out that the codes and standards have not kept up with the new, lower-water-consumption fixtures. Consequently, most water piping designs are slightly oversized. “A good plumbing engineer can save the owner money by studying the real water usage numbers and sizing the water mains in the building based on those,” he advises.

Also on the topic of piping, Leader points to the use of nonmetallic materials, such as chlorinated polyvinyl chloride (CPVC). “Some of the newer plastic piping manifold-type systems warrant consideration due to the cost of copper and better corrosion resistance [of CPVC] in appropriate markets, where the code issues with plastics in return-air plenums don’t create conflicts,” he says.

Posson offers the following advice on plumbing systems:

- **System noise:** Water hammer arrestors are still important with all the automatic flush valves and automatic faucets that are being used.
- **Interstitial space:** Building Team members should know what will be behind the walls in restrooms, to ensure access adequate to maintain carrier assemblies, operators, and remote transformers for automatic valves.
- **Generic specs:** Designers should be wary of proprietary systems that are difficult to integrate or maintain. They can drive costs up—and drive maintenance-and-operations teams up the wall.

When it comes to the design and construction of public restrooms, the full list of critical project factors and product specifications is long. Yet the outcome can make a big difference in terms of resource efficiency, occupant comfort, and public image.

Consequently, it takes a group of experienced, practical, and savvy building professionals to pull it together. Kahn’s Cicchella concludes, “Balancing the selection of products and finishes with the budget to create a design with a ‘wow factor’ is an enjoyable and welcoming challenge for us.” BD+C