

Making the Old/New or Turning Castles into Condos

How the Southern Colonies of The U.S. Do It Better And Cheaper

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Abstract

Buildings today must be integrated to include all services and coordinated to provide an acceptable comfort and usability level to justify their continued existence. The engineer is responsible for function¹ **where looks and form are the prime requisites of the architect.**

The idea for providing such accommodations for an existing historical facility, built for an entirely alien purpose, extends beyond a challenge. While "historical", as defined for facilities in the States, is significantly different from Europe, nonetheless, the challenges are similar. This synopsis intends to expand on and present some new innovative solutions.

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Summary

Buildings today must be integrated to include all services and coordinated to provide an acceptable comfort and usability level to justify their continued existence. Architects tend to wish to be the master builder; however, looks and form are no longer prime requisites. We, today, want to be atmospherically comfortable, well lit, and assured of clean water and immediate expulsion of waste. The engineer is responsible for these

functions. Buildings provide significantly new challenges to be acceptable to our current lifestyles. This is, at best, a problem for new buildings.

The idea for providing such accommodations for an existing historical facility, built for an entirely alien purpose, provides a true challenge. While "historical", as defined for facilities in the States, is significantly different from Europe, nonetheless, the challenges are similar. Both the colonies and the Old Country now have computers, cell phones and asthma. Interior environment and availability of showers and toilets are ever increasing in popularity. This synopsis intends to expand on and present some innovative solutions.

Subjects include such concerns as localized conditioning (a fireplace that cools), maintaining appearances, and concealing services. Weaknesses in buildings are the HVAC/Electrical Engineer's strong points for utility routing just as the structural strong points are also the responsibility of the Civil or Structural Engineer. Fake plaster fill above arches, unused massive and frequent chimneys provide outside access of combustion and ventilation air. Codes become user or owner unfriendly in the frequent attempts to protect our health, safety and lives. The mission of the engineer is to work within the code and yet produce a safe, functional and owner/user acceptable environment.

The paper intends to offer experiences (success and failure) of installations in reconstituted derelict structures. Yes, we can, at least in the Southern Colonies, do it better and cheaper; we had to.

Obviously, Differences Exist

Differences exist. Keep in mind that the last time my area of the country was invaded by a foreign Army and occupied, occurred in the mid-1800s by Yanks under W. T. Sherman. Simply put, this means our historical challenges date from 1865, a mere Irish minute. On the other hand, European challenges may date to the B.C.s (that's before Columbus 1492±). In our worst case, the oldest structure would be circa 1700, more or less.

European structures appear to be massive, built to last centuries. In the States, only government buildings, hospitals and jails are massive and a tribute to public taxation. Otherwise, our structures are of lighter, less expensive construction. The climates are different. The ASHRAE Fundamentals indicate Atlanta ranges from -5 C/23 F to 32 C/90 F as opposed to Dublin at 0 C/32 F to 20 C/68 F. (Those are your 99% and 1% options). We would not have risen from the ashes of "Terminus", Atlanta, Georgia, USA as you know it, if it had not been for Rueben Trane and Willis Carrier. Heating and ventilation have, however, been around much longer. Electrification and "indoor" plumbing are still a developing issue. Air conditioning recreated the Southern States from agriculture to techno-business. We now proudly boast a well known TV Mogul and his company and an Internet international server, like we used to praise cotton.

So that's history lesson in a nutshell. Now, how to apply new (relatively speaking) technology to the requirements of a totally alien generation of uses for antique or historical structures. I show Figure I as an example of what I normally view when asked to give a lump sum fee for a "rehabilitation" of a historical structure.

Having spent some time in Ireland, I feel certain some of you can relate to this illustration. You may be thinking the Architect is going to tell you all you need to know to begin calculating a design load. After all, they are the master builders. Well, consider how many monuments have been left to be torn down or recycled.

What Factors Created the Need

What created the need. None of us are what we were when our forefathers were pioneering! In the States, we now live to eat, not eat to live. As proof of this, where I live in Tucker, Georgia, near Atlanta, there are 200 restaurants, 20 of which are the same franchise that specializes in waffles in an 8-kilometer radius of my home. Smoking in bars is under assault, while specialty "humidor" cigar stores are a current rage. We have "sick" buildings. This is still under investigation. I am sure Dr. Olie Fanger or Mr. Barney Burroughs, if you are familiar with them, can give you a more technical background on this issue. We are universally complaining about

air quality, the altitude of airline pressurization, how hot, how cold we are, and why our water has to be bottled. I'll bet Columbus would have said "I'm not going anywhere"; if he only knew what he was unleashing on society. All his Queen Isabella wanted was a broader tax base; sounds like a current subject, does it not.

Our computers must be kept dry and cool; our wine must be kept humid and comfortable. Our power must be smooth and protected from surges. Our sewage and trash must be tastefully discharged, and environmentally friendly. All of the above to be accomplished at the lowest possible cost or available tax base. Yes, we have evolved. Our life styles have changed; we are not our ancestors. I recently read an article concerning the effect of altering the interior environment on historical structures. The Article stated that extreme modifications to what the structure has "experienced" over the years may create premature deterioration. Which is truly more important: the facility, the occupants, or its significant purpose? A castle could repel an invading Army without being environmentally comfortable. It can most certainly meet the minimum power utilization of an energy code, but a computer will be toast if utilized in this environment.

In the States, and especially the South, we have adopted "throw-away" construction, for the most part. With the exception of numerous government enclaves, most of our permanent structures are less than 150 years old. Keep in mind that true air "conditioning" (cooling/humidity control/etc.) of air is less than 100 years old, barely giving at least the South time to switch from cotton to computers. As implied, old buildings had a purpose; without sounding architectural, our purpose is to make them fit a new use or function. We have "air conditioned" the outdoors in several southern states to create an acceptable atmosphere at amusement parks and, not to mention an Olympic event held in Atlanta, Georgia. Heat and humidity must be "controlled" for business, as we know it today, to continue. How is this actually accomplished within a reasonable cost? Also, what does this truly say about our energy concerns? How much control should we (the Engineer), exercise over the master builder (Architect), when the structure exists? Figures II and IIA indicate the result of turning a "Plow" manufacturing facility into an upscale Generation X complex (i.e. cotton to computers). The challenges exceeded the existing codes.



Figure II. A significant area of land near downtown Atlanta, the facility dates to pre-1900s and peaked production around the 1930s. It was abandoned in the mid-1980s.

Figure IIA. An interior loading dock served by a currently abandoned rail spur.



Here is the guidance received from the locally adopted building code as included as Figure III.

Code Section

101.6 Special Historic Buildings

The provisions of the technical codes relating to the construction, alteration, repair, enlargement, restoration, relocation or moving of buildings or structures shall not be mandatory for existing buildings or structures identified and classified by the State or local jurisdiction as Historic Buildings when such buildings or structures are judged by the Building Official to be safe and in the public interest of health, safety and welfare regarding any proposed construction, alteration, repair, enlargement, restoration, relocation or moving of buildings within fire districts.

**Figure III. A section from the Building Code
(reproduced).**

Now, tell me exactly what this means when applied to Figure II; hereinbefore as, this was the heating, ventilating and air conditioning guidance that was the starting point. The structure, when all tenant areas are addressed, contains residential units, business/residential suites, a restaurant or two, a performing arts theater, a dance studio, several art studios, as well as light manufacturing. Try to apply mixed occupancy rules to this. One space required fire rated mechanical areas while the adjacent residence did not. Portions required egress control; other portions did not. We are now subject to an International Code on this issue. So where do we go from here and how does the Engineer's role fit in or change? Well, obviously we no longer start by calculating the HVAC load.

How to Address A Derelict

So what do we start with? Obviously, a derelict is a building not suitable for a current use, but is either on valuable property and too costly to tear down and reconstruct from the ground up, or on some historical register with a Society or Agency, who wrote Figure III, looking over our shoulder. Referring back to Figure II-A, this occupant-friendly area was a rail spur loading dock. As stated, if the building serves a current need, it is not vacant. The demand for mule-drawn plows has dropped significantly, even in the deep Southern States. The need for rail spurs is greatly lacking. Look for weak points and/or "what was it?". Then, look for ways to use space available. The architect frequently has to be led to an "engineer" friendly solution. Notice the gas meters; a rail spur siding was an acceptable place for such things. Forts are massive outside, but are a myriad of "chases or shafts" inside. These are the areas that must be considered for "utility" paths. A slaughter house, or abutour, if you prefer, abandoned near my office, will, in fact, turn into an upscale steak restaurant. Refer to Figure IV again and note the loading dock with a trolley system for processed products. This original facility actually was pre-refrigeration, as we now recognize.



Figure IV. An existing structure in Atlanta currently under renovation.

This project is developing as of the writing of this paper. The structure was massive, contained blood and rendering pits and many openings and shutes to control the processing flow. So far, at least two up-scale restaurants, a major wine storage cellar and other normal businesses are vying for space or under construction. Again, local codes were challenged to the limit.

Even our antiques, the major jails, hospitals and government complexes, built over the years, had steam piping tunnels or routings for ventilation air. Have you seen a movie where the inmate did not escape through the ventilation shaft? Figure out how to use them or reuse them. Do not let your ego control the "best" design or energy solution. Sometimes central plants do not fit the new usage; sometimes they may. Use water source heat pumps at radiator locations. Removal of a coal-fired boiler leaves room for a gas boiler and reciprocating or centrifugal water chiller or cooling tower. Exterior cooling towers can be hidden, sometimes in the coal bunker. Somehow, our predecessor engineers could get space in building that today has to be bargained or fought for. Usable "rentable" space is the prime concern. Residential split systems are controllable with current low voltage technology and can be kept energy efficient in operation. Keep in mind that sometimes a "residential" solution serves your client better than a more complicated, but harder to maintain, "better" solution.

Expose services. Ducts will not sweat if air motion is adequate. This is a central issue, in my opinion, to a good historical retrofit design. Electrical conduits can be routed with taste and combined with air conditioning ducts. Sewer lines can offer a higher degree of opportunity. Use attractive cable tray techniques for telephone and other data or low voltage systems. If our work is parallel, neat, and perpendicular, who will complain. It may even serve as an architectural feature. Think the project through first before you begin to get technical. Refer to Figures V and V-A; this is actually a second generation of a first renovation of a historical structure.

Figure V. Occupied currently by an internet agency, taken over from a construction company and originally a buggy manufacturing company.



In my opinion, air motion is a frequently over-looked factor in many of our designs today. In massive or "historical structures", it is the single most critical issue. Referring to illustration, Figure V, I was told that the duct is going to sweat, if the duct was not lined. This Engineer has occupied this historical structure for seven years and a second generation of tenants with no "duct sweat". The building is unique. It houses part of a cartoon network and webb international staff of a media conglomerate. This was a success developed by a construction company owned by a developer, with the engineer as a team player and chances were taken. The duct did not sweat and a combination of parallel air-cooled chillers cooled the facility. Heating truly was a non-issue due to internal loads. This project worked when calculations may have led me down a different path. Cost was a prime issue as the developer, contractor and owner were all one and the same. We all agreed to not sue.

Failures can and will occur. Has anyone here ever had a building not respond to your exacting calculations? Did every project turn out perfect and the Owner was ecstatic? How many times was the Owner incapable of operating the most perfect energy efficient and operational building we painstakingly developed?

Heat pumps, closed central loop, the ideal solution. Forgiving equipment selection; they are provided to us in increments; all we have to do is pick the one slightly larger than our safety factor. What could possibly go wrong? The central equipment is sized, just like the manufacturer advised us. Nobody gave the Owner a lesson in water quality control! This design was for a City and housed the engineering staff and water department. Why didn't I go with a non-central residential system. The Owner operated a City! Keep in mind a previous comment about a "throw away" market. Many times, simple costs less and is "current maintenance level" friendly.

How to Maintain Cost, Appearance and Make It Work

Cost, appearance and serviceability are the goals. Cost to the owner, appearance to the Architect and serviceability to whoever ultimately maintains, pays the bill or sues; that is what our mission consists of. Holding down the cost, especially for an existing structure over which you seldom have control of the envelope, offers the first goal. What is the actual insulating value of a 46 centimeter to 1 meter brick wall? No interior insulation can be applied to "historical" brick

surfaces. My office, which I assure you is interior space, has an "exterior" sign painted on it, declaring it a Buggy Company. The office is arranged so as not to interfere with this edifice. In most cases, roofs can be insulated, assuming they exist. Windows become an issue so as not to alter the facade. We are at odds here with ASHRAE 90.1, the Fundamentals, the Codes and the historical societies, not to mention the Owner/Developer and cost of construction. Very likely, the ventilation, heating, cooling, plumbing, electrical and low voltage (security/ communication) system will exceed 50% of the renovation construction cost.

Consider the usage, time of operation and what really happens when the facility is not in use or those areas where the people are not located. Massive block structures have longer lag times, making them ideal candidates for anticipation-type control thermostats. In my vernacular, if you "lose" the building, i.e. it reaches ambient either too hot or too cold, it takes time to bring the facility back to desired interior conditions. Again, air flow in the occupied area is critical. I frequently back into the load for cooling from the cubic meters per second or cubic feet per minute that will produce "comfortable" air motion. I seldom use less than .59 cubic meters per second per square meter; 1.25 cfm/square foot of area as a guide for older structures. This reduces moisture build-up and provides a feeling of comfort in an otherwise larger space. Also, you treat the occupant. I have witnessed diffusers in cathedral-type ceilings. Although cool air does "fall", I doubt the conditioning serves much purpose thirty feet above the pews, at least in the South. Treating from the floor up to 3.6 meters or twelve feet of a vaulted space can be accomplished by floor or low side wall air distribution. Core area returns keep the conditioned air within the occupied area. Crawl spaces or basements were common in older structures. Ductwork can be buried in earth and below concrete, and it will "float" if not secured in or below the structure. Stratification may occur above the occupants. We frequently use void space or "partition" walls as a break between temperature gradients (not humidity). What is the effect of this to interior conditions? An efficient comfortable condition can be achieved. I have witnessed "cloud" formation interior to structures under unique conditions. Humidity does have to be addressed. Again, proper air motion and psychrometric analysis, as well as positive pressure of the area served, must never be overlooked.

Appearance, appearance and appearance are the architectural mantras. Thru-wall units do not bode well for 1/2 to 1 meter or two to three foot stone edifice-type structures; however, a water source heat pump console unit may be acceptable to replace steam radiation. The ductless split system is another option for this application. In-floor, perimeter supply systems can serve high

ceiling areas. Treat the first 3 to 4 meters or 10 to 12 feet as noted above. Think of the sheet metal wasted in trying to reach unproductive conditioning areas (i.e. where the people are not). Once upon a time, we sat near the fire to stay warm. So why not use some history and treat the occupant? The article I referenced earlier is a study being conducted to prove the building may or may not care. Treat the equipment, if that is the driving concern. Many of our true antiques do not like the rapid temperature and humidity alterations we, as humanity, have come to adore. This becomes another consideration. Museums, or other critical-use areas, are a special case all to themselves. Some buildings simply need up-grading to our lifestyles.

There was actually a dormitory to be recycled as a dormitory. A central kitchen serving two separate dining halls controlled the intermingling of male and female students. A coal-fired boiler plant served a single pipe, radiator, and heating system. The heating and electrical system did constitute a portion of the desired renovation, not to mention the elimination of separation of sexes. Cooling was the primary requirement just below the budget.



Figure VI. One of the oldest ethnic universities in the States, circa 1890s, Atlanta, Georgia.

Use the weak areas and available space. Use false columns that simulate existing structure. In the historical university, noted above, a two-pipe change-over chilled/hot water system served under window console units. I show Figure VI as a facade that could not under any circumstances be defiled. The cooling was added as a “necessary” additive alternate after the project was complete. Piping and electrical power for outlets (previously non-existent) and smoke detector/alarm services were routed in a corner false chase/column. This false column followed the same route as the steam radiator piping. Water piping, conduits and telephone wiring all share the same space of the original exposed piping.

All air systems were a possible option to fan coil (console units), as finally designed. High corridor ceilings, and in many cases, fake archways could be penetrated and a little sheet rock here and there actually could hide our obnoxious, but functional duct system. Simply distribute high side wall through previous ventilation windows or grilles. Variable volume can be effective for localized control even if exposed. This assuming the Owner/User has maintenance capability available. I do not intend to say maintenance is to blame for poor engineering, only to stress that a "man needs to know his clients' limitations".

I show Figure VII only as an indication of applying residential split systems to an award winning historical renovation of a convent turned low income residence. The prayer path inside the cloistered brick barrier became the condensing unit, meter bank area. The residents find it restful to stroll along with the humming of the units to block out city traffic noise.



Figure VII. A cloistered Convent in Savannah, Georgia, circa 1850s, winner of two national housing awards.

Take charge of the services to make the facility functional. We have all heard "the air conditioning never worked". It does, but many times not to our anticipated results. Expose as much as possible, but neatly and near the desired recipient. The old adage that air conditioning should not be seen, heard or felt is no longer an option for true historical renovations. Older buildings do not care and a few redheads (masonry inserts) will not destroy one meter of block. I cannot dwell on this subject too much, but keep in mind that in a renovation, HVAC, Plumbing and Electrical could actually exceed 65% of the construction cost. A functional end result may surprise both you and the Architect, not to mention the Owner/Developer. In the South, air conditioning is critical. We are dependant on it to be inexpensive and available.

I have not covered light weight "clap-board" construction much. Rough hewn timber and wood peg construction still abound in the States, mostly in the northern climates where urban renewal did not take place in the mid-1800s. Again, try to model the structure and then mate with the building performance the usage. Dust and utility routing become more critical to preserve the structural integrity and looks. An interesting analogy did occur when a group of the military decided to replace thousands of World War I wood barracks with block structures.

Unfortunately, unlike the light wood buildings, which cooled off rapidly when the sun set, the new block version peaked at 2200 hours, ten o'clock PM, just about the time of lights out, creating a cooling demand in the South, far greater than the wood structure with proper insulation and ventilation only. Of course, the opposite occurred in the Northern climates.



Conclusions

Design for occupancy, where the people are localized. Utilize time factors of the structure in calculations. Review weak areas of the facility for shafts and/or space for utility routings. Keep air flows high. Combine disciplines and finally, never give in to the Architect. I show Figure VIII and VIII-A as examples of the factors above. Utilities became the ceiling. The units on either side had lofts creating a high long corridor. Lighting and "spot" cooling and racked conduit became an architectural feature. One last point, maintenance capabilities must be addressed if your design is a success. With the number of buildings and system types present today, not all owners have the resources nor personnel for proper maintenance and continued operation. Finally cheaper can be better. Less expensive systems can be maintained less costly and/or thrown away.

The idea of converting historical facilities for new uses can be accomplished. Function of the space has replaced, to some degree, looks and "user friendly" appearance. While we now control a majority in some cases of the construction cost, control the functional results. In the South, cooling is crucial. Be a team player, especially for the person paying the fee; but never, never give in to the Architect.

SUMMARY POINTS

Design for the occupant.

Consider the Owner's maintenance capability.

Consider time factors of usage and the structure in calculations.

Review available structural weak areas and available shafts.

Combine disciplines.

Keep air flows high.

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