The control for the Hijend hotel was originally designed as a full DDC system. But it, along with the central plant was heavily value engineered during the bidding cycle due to budget issues. During the control system value engineering process:

a. Zone controls were reverted from DDC to pneumatic, including the control of the guest room fan coil units.

b. Proof of operation points were eliminated unless they were required for some portion of the control logic and the function could not be provided in any other way.

c. Sensor were procured on a best first cost basis and specified as the manufacture's standard product, meaning generally less accuracy than originally designed

d. Trending requirements were reduced to the manufacture's standard. As a result, trend samples are universally set at 30 minutes currently. It is possible to increase the sampling rate to a maximum of once every 5 minutes on a point by point basis. But the network architecture will not support the traffic rates associated with sampling all points at this frequency. It is possible to use this frequency on a system by system basis.

e. Flow meters and flow measuring stations were eliminated.

f. BACnet or other network type integrations to packaged control systems like the chillers were eliminated.

g. Poly tubing with barbed fittings was used for the pneumatic system other than where exposed, where copper was provided.

h. Only points deemed necessary for control were provided. For instance if an AHU could be controlled based solely on discharge temperature, then no sensors were provided at intermediate points in the system, like in the mixed air plenum or after a preheat/heating coil.

Since construction a number of changes and improvements have been undertaken during renovation cycles or at the initiative of the operating team as they attempted to solve operational problems like nuisance freezestat trips on start up (no mixed air low limit cycle) and learned about the value of having accurate data in terms of operating their facility efficiently. Some of the improvements are being accomplished in-house using a upgrade by repair strategy

- In a recent guest room renovation, the original pneumatic thermostats were replaced with the hotel chain's new standard wireless networked thermostat. However, the pneumatic control valves on the fan coils were retained because it was cheaper to interface them with the electric thermostat using two EP switches than it was to replace the valves. There have been a number of issues that have come up as a result.

    a. Guest complaints due to the "click" that occurs when the EP switches are triggered.

    b. A poor insulation detail for the original fan coil unit chilled water valves results in significant corrosion of the valve bonnet. As a result, when the corrosion is severe enough, when full main air pressure is applied to close the valve, the bonnet fails and the guest room floods. The resulting water damage to the room as well as adjacent rooms (both next door and below) is expensive, especially when the funds paid to compensate the guests are taken into account.

c. The pneumatic distribution system is extensive and leaky. As a result, portions of the system at remote locations have significantly lower main air pressure available to them. In turn, it is not uncommon for there to be insufficient air pressure available to fully actuate the fan coil unit chilled and hot water valves. In other words, if a Normally Open hot water valve had a 3-10 psi spring in it and the air pressure available is 8 psig due to the pressure drop in the mains created by the flow caused by the leaks, then the hot water valve will never close even though the EP switch is apply main air pressure. As a result, cooling is impacted and an unintentional simultaneous heating and cooling load is created.

- After attending the hotel chain's AEP (Advanced Engineering Training) program and recognizing the power of trending and diagnostic points, the chief has started a project where they are upgrading the input sensors to the control system and, if the capacity exists in the controllers, adding sensors for diagnostics. So far, they have completed the upgrade effort in the central plant and for several of the air handling systems, including the Ball Room AHU and the Corridor Make Up Air systems. The new temperature sensors are indicating sensors but there are still issues with relative calibration and in some cases, single point sensors have been installed when averaging sensors would be a better or necessary solution.

  Some of this work is being accomplished in house as time and budget permits. But if a system is overhauled or renovated, the team endeavors to include the sensor upgrades in the project if possible. But they have yet to realize they need to specify all of the features they want, which is why they have ended up with the single point sensors in mixed air plenums; they asked for an indicating sensor with the accuracy they felt they needed but did not require averaging sensors. Hotel policy required them to take the low bid, so even though their favored vendor knew that averaging sensors would be desirable in some locations, because they included them in their bid, they came in high.

- A number of the systems in the facility were provided with Variable Speed Drives (VSDs) in the form of a VFD (Variable Frequency Drive) under the auspices of a utility incentive program targeting improving energy efficiency. Unfortunately, the program literally incented the Owner to add a VFD to their system but did not provide for controlling it. The program simply removed the existing across the line starter and replaced it with a VFD and connected it to the existing control system points that were serving the original starter. As a result. several constant volume air handling systems in the facility have a VFD that does nothing (but waste energy due to drive losses). The drives were set to manual, full speed and any points that existed prior the installation (start/stop and safeties for instance) were wired to the drive.