Façade Redesign

Original Façade
The original façade that is supported by the cast-in-place structure consists of a one-wythe brick face with concrete backup that is supported by angles on each floor. This is a very simple system that ties in quite well with concrete structures. There is no need for an extra steel support system because the concrete frames are continuous and can be tied into the façade anywhere along their length.

Design Changes
Changing the structural system in Bradley Tech not only impacts the design of the framing system itself but other components that are supported by or tie into the structural system. The most obvious item that will change with a new structure is the façade. The simple brick face and concrete backup cannot be randomly supported by the steel spans. The façade must be changed to a one-wythe brick with steel stud backup system. This type of façade is much more common with steel buildings and ties in very well with the edge beams. The system can still be supported by steel angles and will be hung from each story level. A section of the new system can be seen below in Figure 23.

Figure 23: Typical Brick Veneer on Metal Stud Backup Facade
Façade Investigation

Since a new façade will be needed a small investigation was preformed to analyze the types of problems encountered with the particular façade system as well as any design and construction considerations that would help avoid such failure scenarios.

Façade Problems

- Poor flashing/waterproofing design, resulting in water penetration into the building interior, corrosion damage to anchors or even steel stud components, and gradual deterioration of the water soluble gypsum sheathing on both sides of the stud walls.
- Poor or missing flashing at windows and other penetrations of the wall, resulting in water penetration into the interior of the building.
- Miscellaneous damage
  - Physical damage to the brick walls by freezing water
  - Loss of insulation value because of wet blanket insulation
  - Efflorescence stains on the exterior of the bricks
  - Damage to interior finishes by mildew
  - Gradual deterioration of improperly designed or constructed mortar joints.

Structural Analysis Recommendations

- Determine the distribution of forces in the system. Design backup to limit veneer cracking and areas of stiffness incompatibilities
- Disregard potential contribution of gypsum board in determining the strength and stiffness of the backup.
- Use adjustable wire brick ties of adequate strength and stiffness.
- Veneer is much stiffer in bending than the backup and the behavior of the system is not specifically known, design brick ties or anchors at each floor level to support veneer spans assuming that the veneer carries full design wind loads.
- Design brick ties and backup framing assuming the system carries full design wind loads.
- Design brick tie fasteners to steel studs to prevent moisture transfer through the screw holes around the anchor fasteners.
Design and Construction Considerations

- Do not rely on a single wythe brick veneer to waterproof the wall.
- Provide durable ties between masonry and steel stud walls.
- Match the durability of waterproofing and flashing to that of the other wall components.
- Protect the water sensitive gypsum sheathing by use of waterproofing.
- Provide through-wall flashing and weep details at each floor level.
- Use ‘soft’ horizontal joints in the masonry under shelf angles.
- Provide vertical relief joints in the brick wall at close intervals.
- Maintain a wall cavity.
- Keep the cavity and the weep slots free of mortar and debris.
- Prevent condensation and air flow inside the stud wall.
- Coordinate the various trades needed to install the wall and its flashing.
- Provide exterior sheathing and weather barrier
  - Exterior grade gypsum board and building paper or self-adhered sheet membrane
- Windows and doors must be tied into weather barrier and the exterior face of the wall.
- Develop adequate head and sill flashing for windows.
- Maintain fire rating, acoustical rating (especially in gym area), and thermal rating.

Results and Conclusions

From the analysis done on the redesigned façade it can be seen that although the brick veneer on metal stud backup is an acceptable design it does present some problems if not designed or constructed properly. The majority of the problems occur when looking at waterproofing the system. Preventing moisture from entering the system or building up in the cavity is the main goal of designing a successful façade. More important, but less common is the failure of the façade structure. If design loads are not accurately applied to the system and then properly analyzed, key elements of the support system may fail. Incorrect usage of fasteners or inaccurate connection details may be a result of such a design error.

In general the brick with metal stud backup system is an excellent design choice. Like all façade systems, problems with design and construction exist, however with the ability to foresee such problems they can be avoided and a quality design that lasts through time can be obtained.