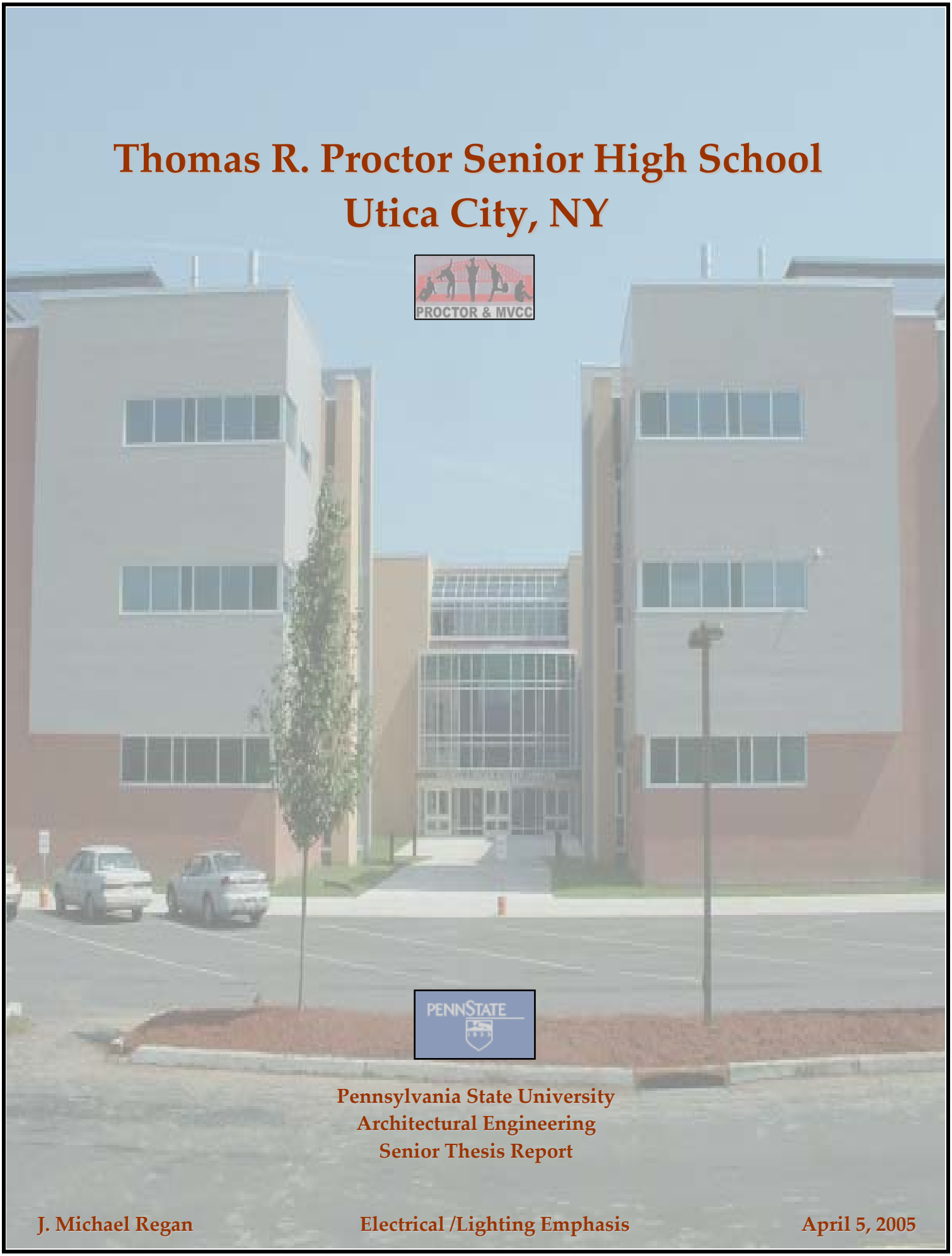
# Thomas R. Proctor Senior High School
# Utica City, NY




Pennsylvania State University
Architectural Engineering
Senior Thesis Report

J. Michael Regan

Electrical /Lighting Emphasis

April 5, 2005

# Thomas R. Proctor High School
# Utica City, NY

**Michael Regan**
**Lighting/Electrical**

http://www.arche.psu.edu/thesis/2005/jmr370

## Construction

**Owner:** Utica City School District
**Architect**: The Hillier Group
**Civil:** Hillier Engineering and Technologies
**Structural:** Greenman-Pedersen, Inc.
**MEP:** Greenman-Pedersen, Inc.
**CM:** Turner Construction Company
**Project Delivery Method:** Design-Bid-Build
**Project Cost:** $35,810,000

## Architecture

**Size:**
- 190,000 sq. ft, 3-story of addition to an existing 250,000 sq. ft, 4-story building
- Combination exterior of red brick and gray/sand architectural concrete finish

## Structural System

- CMU base wall construction
- Concrete slab floor
- High strength, low alloy structural steel beams and columns
- Galvanized, zinc-coated floor decking

## Mechanical System

- 2-350 ton lead/lag chiller units
- 3-500 hp gas-fired full-modulating boiler units
- VAV air-handler units with terminal hot water reheat
- Unit ventilators in classrooms

## Electrical System

- Main unit substation with 600 amp, fused disconnect switch
- 1500 KVA, 13.2kV-480Y/277V main transformer
- 3000 A, 480Y-277V, 3ø-4W main switchboard
- 500 KW/ 625 KVA diesel fuel emergency generator

## Lighting System

- Indirect recessed 2x2 luminaires in hallways
- Indirect pendant strips and 2x2 recessed luminaires in library
- Bollards for exterior garden lighting
- 2x4 parabolic fluorescent luminaries in classroom/offices



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# Executive Summary

The following report is a culmination of research, analysis and redesign of several systems at Thomas R. Proctor Senior High School. The report examines a redesign of three different lighting spaces, an implementation of an emergency data recovery system, a structural system adjustment, and an addition to the present telecommunications system.

The lighting spaces analyzed in the report are the school's lobby, library and auditorium. All three of these spaces have unique features that allow for interesting design approaches.

The lobby redesign involves illuminating the center metal panel ceiling and washing the artwork while providing complete dimmable control. This allows for the space to best serve whichever of the many functions it is to serve.

The redesign in the library of the school involves the implementation of various different fixtures for specific reasons. Compact fluorescent downlights are used to light the pathways through the library while the wallwash/downlights illuminate the wall book stacks. Recessed parabolic fixtures are used over the reading/computer tables while indirect pendant fixtures illuminate the floor stacks. A daylight analysis was conducted to verify that a photosensor dimming system would be a practical approach to the space as well.

The auditorium heavily draws from the abundant daylight while providing the necessary illumination for evening activities. High wattage and standard compact fluorescents illuminate the seating areas while gold/crystal decorative fixtures add value to the historic architecture. The lighting systems in all three spaces successfully achieved the desired design objectives while meeting the necessary design criteria.

The electrical system design involves an adaptation for the building to serve as an emergency data recovery center. This process involves a conversion of the two (usually vacant) auxiliary gymnasiums into localized emergency power/data epicenters for the surrounding business community and schools in times of crisis. The plan also entails backing up all of the clean power panels in the school for times of incoming spillover of personnel. A design has been laid out for the gymnasiums with new panelboards to serve them. The entire system is to be served from a new 600kW/750kVA generator. All of the new and existing panels in the scheme will be fed by the newer switchboard 2 and will all be backed by emergency power. A UPS system has been added to the design to



provide redundancy to the system. A price estimate has been compiled show what the new recovery system would cost.

A study has also been performed to compare the use of bus duct vs. the existing conduit/cable system feeding the stacked electrical closets at several locations in the school. It was determined that the existing system was a more efficient system due to first cost.

Two additional breadth studies that corresponded to the depth areas of study were completed. The first involves a structural redesign due to the relocation of a span of four columns from the lobby lighting redesign. The new column and girder members have been sized according to the loads that are expected. The second breadth study is a telecommunications system addition to accompany the new emergency power system. This design adds two additional closets to the present system which are each designed to serve the gymnasiums with telephone and data service.



# Background Information Summary

This statistics summary provides information of the physical existing conditions of Thomas R. Proctor High School. It includes summary information relative to the individual systems and design concepts and contains a broad overview of the scope, cost, and delivery of the project.

## General Project Data

**Building Name:** Thomas R. Proctor High School

**Location and Site**

The school is located in Utica City, NY. It is located in a residential area of single-family homes near the center of the city. The suburban neighborhood lies on a large, relatively flat plot of land that includes exterior tennis courts, baseball/softball fields, and a football field, among other features.

**Building Occupant Name**

The school is part of the Utica City school district and is under the city's jurisdiction:
Utica City School District
1115 Mohawk Street
Utica, NY 13501-3709

**Occupancy/ Function Types**

The functionality of the school is directly geared towards student activities: The school contains a full-size gymnasium for basketball/volleyball, swimming pool, an approximately 1,500-seat auditorium, giant cafeteria, library, and NCAA regulated football field, among the typical student-related facilities.

**Size**

Overall Size: 441,200 sq. ft.
Existing Building: 272,969 sq. ft.
New Addition: 168,231 sq. ft.

**Number of Stories Above Grade/ Total Levels**

The existing school has four floors, three of which are above grade. The addition to the school has three total floors, all of which are above grade.



**Primary Project Team**

The project team consists completely of multiple prime contractors with a CM. There is no GC for Proctor High School. The following is a list of the design and engineering team:

**Architect**
The Hillier Group
Architects/Planners
744 Broad Suite 3000
Newark, NJ 07102
Phone: (973) 242-8899

**Civil, Structural, MEP**
Hillier Engineering & Technologies
(currently Greenman-Pedersen Inc.)
Suite 301, 50 Glenmaura National Blvd.
Scranton, PA 18505-5777
Phone: (570) 342-4080

**Construction Manager**
Turner Construction Company
8195 Cazenovia Road
P.O. Box 450
Manilius, NY 13104-00450
Phone (315) 682-2310

**Dates of Construction**

February, 2002 to August 2004

**Cost Information**

The following list is a bid-cost breakdown according to system:

| | |
|---|---|
| Site work: | $4,227,755.00 |
| General Work: | $15,669,637.00 |
| HVAC: | $5,940,000.00 |
| Plumbing: | $1,565,000.00 |
| Electrical: | $4,116,866.00 |
| Structural: | $2,059,900.00 |



Roofing: $632,370.00
Casework: $1,598,000.00

**Total: $35,809,528.00**

**Project Delivery Method**

Design-Bid-Build

**Architecture**

The exterior architecture of the existing school is very different from the design of the new addition to the school. The existing school is over 65 years old and is comprised completely of standard red brick design with long vertical windows and arches. The new design of the addition is a very modern look, using many colors and materials in its design. The new design wings of the school are made up of gray and tan concrete block, with red brick and green fascia. The windows of the addition are square, giving the building a more commercial feel than the existing school. The gym entrance, serving as a main entrance to the building, is comprised of structural steel with complete curtain windows spanning the entire height of the building entrance.

**Major National Model Code/s**

The school follows the standard BOCA codes as per the Utica City School District as well as NY SE

**Zoning and Historical**

Since the schools inception in 1938, the zoning requirements have always been residential, with no known concerns.

**Building Envelope**

The building envelope is a combination of concrete and brick with a steel frame. Almost the entire exterior is made of a concrete block base with a brick or architectural block exterior. The old sector of the school contains long vertical windows and traditional arched doorways while the new addition of the building has more squared edges to its casework, including doors and windows. The areas of the exterior that are not concrete block or brick consist of structural steel with floor-roof curtain walls. Overall, the addition to the school was meant to be a complete readjustment to the existing building, rather than a continuation of the design.



## Electrical

Thomas R. Proctor High School has been upgraded from an existing radial electrical system to an expanded radial system. The new system incorporates two separate substations, one located in the main electrical room of the existing building and one located in the main electrical room of a new wing of the addition. Both main electrical rooms are located in the basement of their respective areas. Before the incoming electrical service reaches the school, the 13.2 kV underground it enters new metal enclosed outdoor switchgear, containing a 600A fused disconnect switch. The utility metering equipment is located on the primary side of this switchgear. The service is stepped down in each main substation from 13.2 kV to 480Y/277V via a Δ-Y transformer. Each transformer is protected on the primary side by a 600A fused disconnect switch. All the loads in the school that operate at 208Y/120V are stepped down by 480Y/277 - 208Y/120 V transformers. The electrical system is backed by a 500W/625kVA diesel emergency generator.

## Lighting

The lighting is comprised mostly of 2'x2' indirect recessed troffers and recessed compact fluorescent downlights in the hallways. 2'x4' parabolic recessed troffers are found throughout the classrooms and offices. Specialty luminaires exist where they are appropriate. Examples include indirect suspended luminaires in the lobby and direct/indirect strip pendant luminaires in the library. The sidewalks and walking areas around the exterior of the building are mostly provided by free-standing bollards and metal halide downlights.

## Mechanical

The school relies on two large air cooled chiller units that feed AHU cooling coils, unit ventilators, fan coils, and sensible cooler units. Three fire tube hot water boiler units and two cast iron hot water boiler units are used for heating. These units feed the AHU main heating coils, unit ventilators, fan coils, radiant/convection units, and terminal reheat coils. In addition, the gymnasium has two indirect fired roof top units for auxiliary heating.



## Structural

The construction of the school utilizes high strength, low alloy structural steel beams and columns. The floor is comprised of galvanized, zinc-coated floor decking below a concrete slab floor. The exterior walls of the school are made up of concrete masonry units, while brick and aesthetic concrete finish exists over the new addition.

## Fire Alarm System

The addressable fire alarm system provides the new and renovated spaces consists of manual pull stations, smoke detectors, heat detectors, duct detectors, flow switches, supervisory valves, PIV's and audible/visual devices as required by NFPA 72A. In addition, the school is provided with an automatic sprinkler system. A class I standpipe system (2-1/2" connections) for use by the local fire department. A new fire pump was installed to account for this new system.

## Transportation System

The elevator system in the new addition to the school consists of an elevator in each new wing. These elevators are backed by the emergency generator and are integrated with the smoke detectors and heat detectors. These elevators have shunt trip in case of a fire emergency.

## Telecommunications System

Each office workstation in the school is provided with 2 data and 1 telephone outlet. Each computer workstation is also provided with one data outlet. Each classroom is provided with 7 data outlets near clean power outlets. All of the cable used is Category 6, four pair, 24 UTP in a plenum rated jacket. All of the cables terminate into RJ-45 jacks at both ends.

## Special Systems

New MATV coaxial television cable was run to classrooms and a new clock/paging system was provided to cover both the new addition and renovated spaces. New CCTV monitoring equipment was installed in the corridors and new monitors were installed in the security office. In addition, new access control equipment for all entry doors was installed.