## Project Introduction

This thesis focuses on the Center for Health Research and Rural Advocacy project currently under construction on the Geisinger Medical Campus in Danville, Pennsylvania. The 67,200 square foot facility will house numerous conference spaces, research offices, and a three hundred seat auditorium. Funds for the design and construction of the facility are through the Geisinger Health System in the amount of approximately $18,400,000. This amount includes design and general building construction costs as well as utility and infrastructure redevelopment. The eventual client of the facility will be the Health Research and Rural Advocacy division of the Geisinger Health System. The facility will be a center for healthcare research regionally, nationally, and globally in the years to come.

The Center for Health Research and Rural Advocacy will connect directly to the Weis Research Center, a predominately beige brick and CMU constructed facility. The design of the CHRRA counteracts the beige brick of the Weis Center, through the use of a "high tech" appearance of an aluminum curtain wall system. The research center slices through the medical campus with its arching glazed façade and lack of harsh corners. The project features a link between the adjacent research facilities on the ground floor. Upon completion, the CHRRA will be the prized architectural achievement of the Geisinger Hospital Campus. The four level multi-use facility will house numerous clinical, epidemiological and health services researchers, as well as large conference spaces and a 300 person capacity, full functional auditorium. Bordering the auditorium is an open two-story café with an outdoor terrace. The roof of the auditorium will be a roof garden similar to those designed by Le Corbusier, overlooking the café terrace at the ground level. A large, two-story multi-purpose room is located adjacent to the connection point between the Weis Research Center and the new CHRRA. The fit-out of the Weis Research Center includes the demolition of the mechanical room on the lower floor, and replacing it with offices and restrooms.

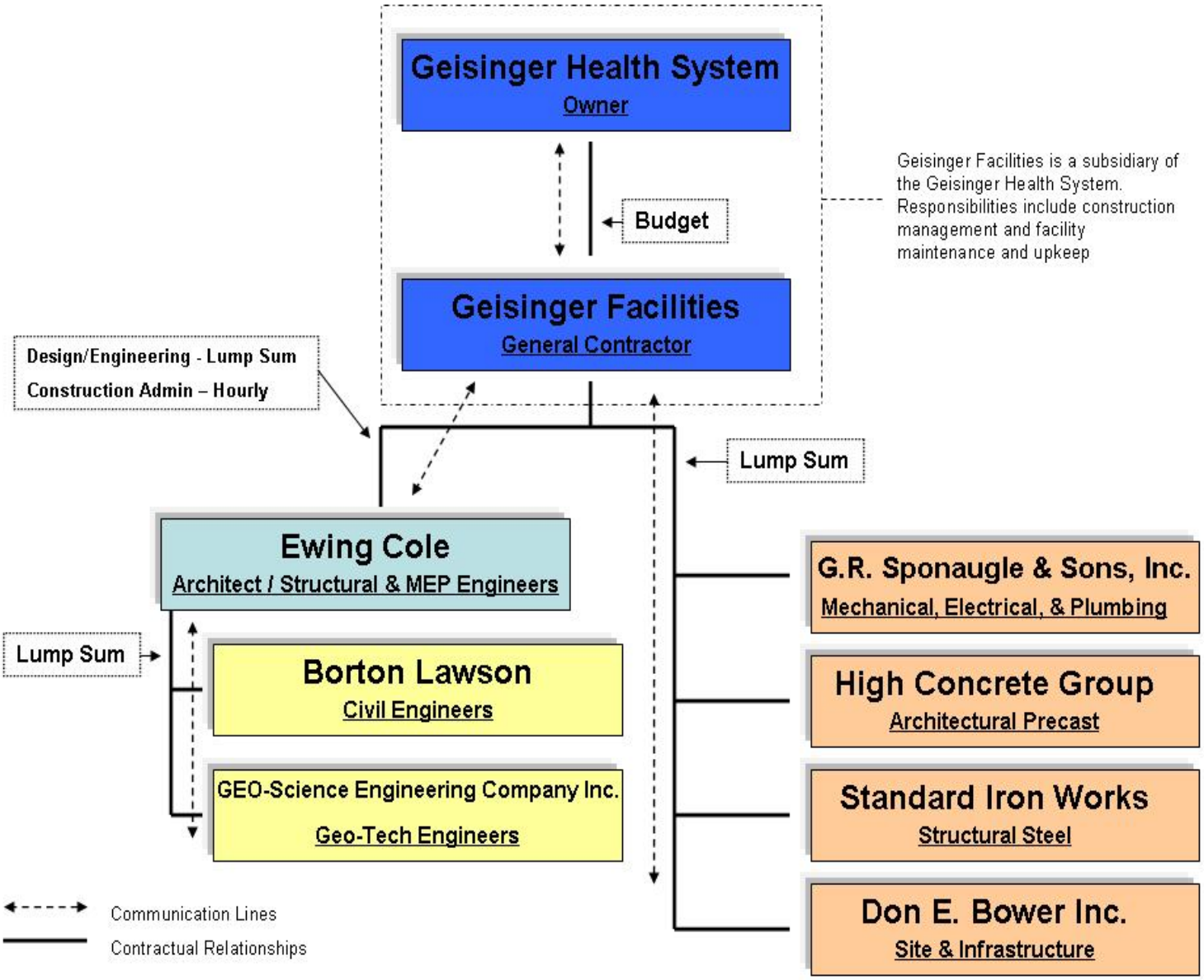
Constructing on a hospital campus has many challenges, and this project is no different. Parking and transit routes for the patients and doctors can not be disturbed, requiring the re-routing of Center Street and relocation of a parking lot. Existing utilities on site are abundant, with the CHRRA building footprint sitting on the water main loop, telecommunication lines, storm water, and sewage lines. All of these may not be shutdown at all during standard hospital operation hours and must be closely coordinated with the hospital facility. It is a phased construction, with the auditorium being constructed before excavation is complete, due to the need to relocate Center Street.

Geisinger Health Systems will budget the project out to their own construction division known as Geisinger Facilities which will act as a general contractor throughout the process. Geisinger Facilities will oversee the design process and manage construction through lump sum contracts with the subcontractors. The project will be delivered through a design-bid-build structure, which will allow for the infrastructure and utility relocations to occur while the remainder of the project is designed. Geisinger Facilities' experience greatly enhances their ability to effectively manage a design-bid-build project on the campus. Here is a brief listing of some of the key project team members as well as an organizational chart on the following page.

**Primary Project Team:**

***Owner:*** Geisinger Health System
*Website:* www.geisinger.org
***Architect:*** Ewing Cole
*Website:* www.ewingcole.com
***MEP & Structural Engineers:*** Ewing Cole
*Website:* www.ewingcole.com
***Geo-Technical Engineers:*** GEO-Science Engineering Company, Inc.
***Civil Engineers:*** Borton Lawson
*Website:* *www.borton-lawson.com*
***General Contractor:*** Geisinger Health Systems Facilities Administration
*Website:* www.geisinger.org

## Project Delivery System



## Client Information

Heal. Teach. Discover. Serve.

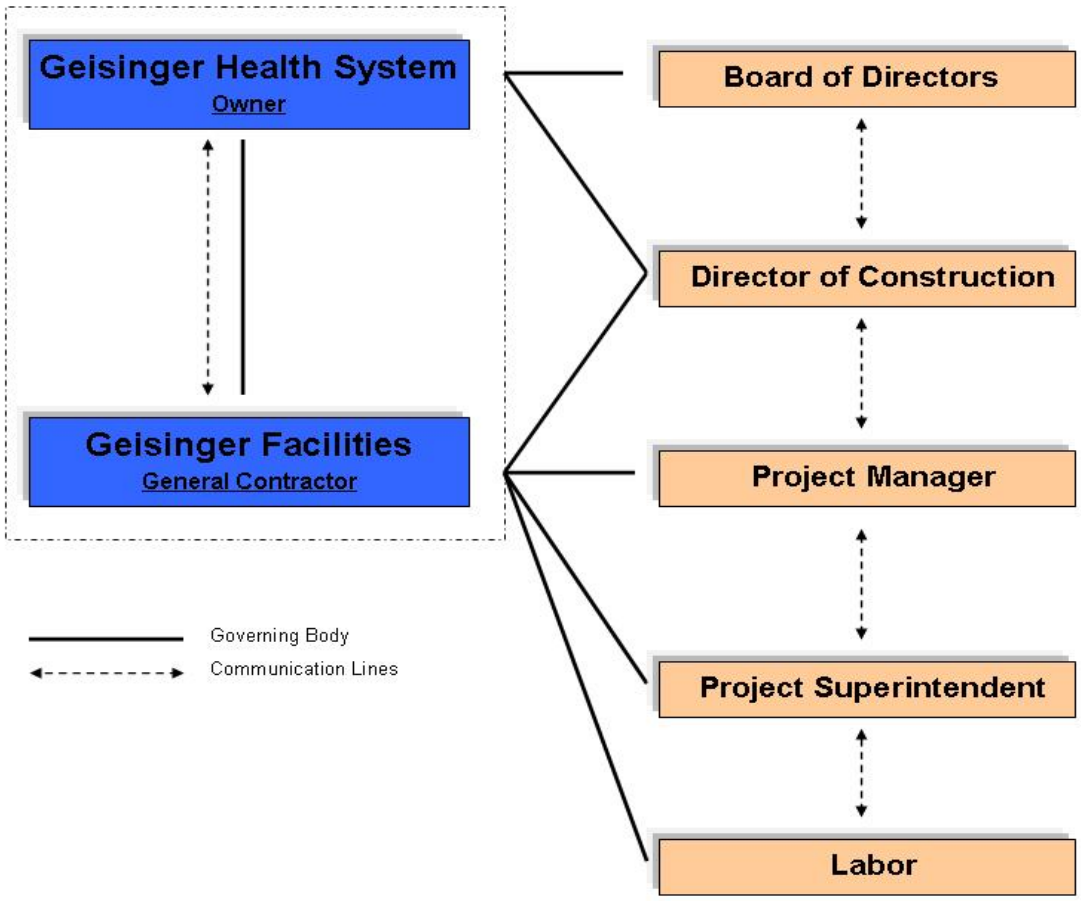
Geisinger Health System is a physician-led health care system, providing health care, education, research, and service to almost two million people across Pennsylvania. The 437-bed Geisinger Medical Center houses doctors, nurses, researchers, and other healthcare specialists dedicated to providing exceptional service through state-of-the-art facilities. The Geisinger Health System contains a division known as Geisinger Facilities which manages all aspects of the buildings and infrastructure on the Geisinger Health Campus located in Danville, Pennsylvania. The Geisinger Facilities division is essentially a General Contractor employed during the design phases their projects. Once the Geisinger Health System Foundation Board of Directors approves the construction of a project, the Geisinger Facilities managers act as the owners and general contractor for that specific project.

The Center for Health Research and Rural Advocacy (CHRRA) needed a new high tech facility to cope with ever changing demands in healthcare research. The relocation of one hundred and twenty staff members from the Weis Research Center to the CHRRA building will allow for improvements in the effectiveness of health services and medical treatments research. The three hundred seat auditorium and numerous other conference rooms will fulfill CHRRA's need for educational spaces where professionals from across the country may present research findings.

The Geisinger Facilities' goals for the project include a timely and cost efficient management of the relocation, construction, and infrastructure work required for the Center for Health Research and Rural Advocacy. Safety standards are extremely high, which includes the laborers on-site, as well as protection for the doctors, nurses, and other healthcare specialists who drive and walk by the construction site everyday. Waste management, emissions control, and other health risks are of high concern due to the close proximity to the existing Weis Research Center and the main patient care compound. The Geisinger Health System always employs a high quality of construction for all their healthcare projects which is evident in all the facilities on the Geisinger Medical Campus.

Sequencing issues for the Facilities' project management team are important, but not critical for the CHRRA building. It is more important that the project is completed when scheduled to allow a smooth transition for the researchers rather than monetary concerns as in most other construction projects. Some key sequencing issues the owner cares about include integrating the MEP systems for the two research facilities during normal operating hours, as well as the eventual connection of the two facilities.

At completion of the Center for Health Research and Rural Advocacy project, the Geisinger Facilities' team would like to see a state-of-the-art facility completed as scheduled and at a cost equal to or less than the allotted budget. The CHRRA will be a jewel on the Geisinger Medical Campus and will hopefully be a center for healthcare research regionally, nationally, and globally in the years to come. The following is an illustration of the project team employed for the Center for Health Research and Rural Advocacy project.



## Building Systems Summary

### Demolition

There are two phases or areas of the Center for Health Research and Rural Advocacy project which involve the demolition and relocation of existing facilities and structure. The CHRRA building will connect directly to the Weis Research Center through a walkway on the lower level. Materials to be removed include concrete structure and core, gypsum wallboards, masonry exterior walls, fireproofing, roof membrane where piping is removed, and partitions.

Additionally, two existing exhaust fans will be relocated from the Weis Research Center's mechanical area on the roof to the new mechanical suites in the CHRRA. One cooling tower and required piping will be completely removed from the Weis Research Center since the two buildings will eventually share a mechanical system.

Electrical demolition for the project includes the removal of two automatic switch controls, 6 sixty amp control panels, and 2 thirty amp control panels and wiring. These systems are located in one electrical room in the Weis Research Center where the connection to the CHRRA will occur.

### Structural Steel Frame

The structural steel frame for the Center for Health Research and Rural Advocacy employs a braced frame system with diagonal HSS steel. These are of typical sizes 7x7x1/2" or 10x6x5/8" and are connected to the structural columns and beams with ¾" gusset plates. At the ground level, these connections are encased in concrete for additional support.

The basement floor is a 5" concrete slab on grade with the intermediate floor systems being 6" concrete slab reinforced with 6x6-W2.9xW2.9 welded wire fabricate on top of 2" 20 gauge metal decking.

Since the largest and highest pick for the crane will involve a 43' W10x100 column, a 35 ton mobile crane with a 120 foot boom will be used for the structural steel erection. The mobility of the crane will allow it to travel around the arched building footprint to reach areas that would

require an oversized tower crane. Since the lifting heights do not exceed 43' above grade, a mobile crane can be used extensively.

**Cast in Place Concrete**

Cast in place concrete is used for the basement walls as well as the for the floor slabs. The horizontal and vertical formwork is to be made of wood of quality related to if the surface is exposed or not. Unexposed concrete surfaces may be formed with No. 2 Common lumber or plywood while exposed concrete surfaces must be formed with New Douglas Fir B-B not less than 5-ply and at least 5/8" thick.

The cast in place work is in accordance with ACI 301, ACI 318, and ACI 347 and is to be completed in phases. The slab on grade is to be made in two pours, one being the large mechanical room space. The other composite floor systems are to be poured in two sections as well, one being the open office spaces, while the other includes the multi-use areas and supporting facilities.

**Pre-cast Concrete**

The casting of the architectural pre-cast concrete will occur at High Concrete Structures, Inc. facilities in Denver, Pennsylvania and transported to site. The architectural panels range in rectangular shapes from 18' x 4' to 12' x 2' and are all 6" thick. The panels will match the existing Weis Research Center in terms of color, texture, and finish.

Panels will be connected through the use of shear bars, 1'x4'x6" embedded to the structural steel below the finished floor elevations. Pre-cast panels will be lifted with a mobile crane similar to the structural steel. The mobile crane will be able to move around the site and position the pre-cast panels as needed.

**Mechanical System**

The mechanical support system of the CHRRA will also serve the Weis Center. The new mechanical system will use 4 variable fan speed Air Handling Units, each with ½" coiling coils and 5/8" heating coils ranging in size from 27,000 CFM to 4,000 CFM. Three, 500 ton capacity,

variable frequency drive water chillers will service the two buildings. A complex refrigerant recovery system will have the ability to monitor, test, and purge all refrigerant. There are four designated mechanical spaces servicing the two buildings, three rooms in the CHRRA and the Weis roof. Extensive re-piping work is to be done in the Weis Center for hot and cold water, high pressure steam, and condensate return. The distribution piping is made of copper type L, hard temper and of typical sizes 1" to 4", riser piping made of black steel for sizes larger than 10".

A hydraulically designed sprinkler system is used for fire protection at the CHRRA. Sprinklers service no more than 225 square feet in the office and open areas, and no more than 130 square feet in mechanical spaces. Concealed quick response heads are used in finished ceiling areas and are designed for use in 155$^{oF}$ temperatures. Sprinkler piping is made of black steel typically 2" in distribution areas and 6" in riser piping.

Notification system includes addressable heat and smoke detectors, standard manual pull stations, and electro-magnetic door holders. There are also two LCD annunciators located at the main entrance and nurse's station.

**Electrical System**

Power supply comes into the new research facility at 480/277V standard from the Plant Engineering Building. A 1500/1750KVA transformer, located in the electrical substation room, is used to feed the substation 2500A, 480/277V supply power. The substation serves nine distribution panels utilizing the three phase service. An additional four dry 300KVA transformers are to be used to step down the voltage to 208/120V for the main distribution panels. All circuit breakers and switches for the project are three-pole.

Emergency power for the facility is provided by a 1250 KW, three phase, 60 Hz emergency generator located in the emergency generator room on the lower level. The generator includes electronic metering of supply needs as well as an adjacent emergency standby motor control center.

**Curtain Wall**

The finished aluminum curtain wall system with glazing at the main lobby entrance, and west stairwell will consist of structurally reinforced .125" thick extruded aluminum framing with glass infill panels of typical size 4' x 9'-6". The color will be an Architectural Class 1 clear anodic coating. The remaining aluminum wall system, which is the majority of the project, is made up of a two glass system. The insulating glass is spliced by 1" thick strengthened float glass with reflective coating. These reflective glass panels are also used above the windows on the west façade.

The remaining façade consists of a 2" metal panel system fastened to 16 gauge metal framing. These metal panels will be 2" thick and typically 1' x 13' fabricated from 22 gauge G90 galvanized steel. There are seven metal wall louvers at the mechanical room which are also finished to match the aluminum anodic coating of the curtain wall system.

The design and construction responsibilities rest directly on the selected subcontractor, who must submit shop drawings and product data with a letter of certification of a registered Professional Structural Engineer in the commonwealth of Pennsylvania that the shop drawings were completed under their direction. Field testing must also be conducted to verify performance criteria of the curtain wall system. The design basis was created by Ewing Cole.

The construction of the system occurs in two phases. First, the aluminum framing will be installed, followed by the installation of the glazing and required sealing.

**Support of Excavation**

Since most of the site was made up of stiff silty clay, the excavation for the auditorium could be sloped and comply with OSHA regulations. Dewatering was necessary for ground water during auditorium excavation. Once excavation begins on the remainder of the site, a soldier beam and lagging system will be used to retain the newly positioned Centre Street. The remainder of the site will utilize a slope since there is plenty of available area to the west and south.

## Local Conditions

The preferred method of construction for Geisinger Medical Campus projects includes a structural steel frame, with composite floor slabs, and typical tan brick and masonry facades. The Center for Health Research and Rural Advocacy is drastically different than the other projects in terms of the exterior envelope. The other Geisinger facilities do not employ large aluminum curtain wall systems or large pre-cast concrete panels. Since infrastructure work is not an aspect that Geisinger Facilities has a lot of experience in, an MEP contractor was brought on early in the construction process to raise issues and concerns with the movement of utilities and roadways.

Construction parking is a complex issue at the Center for Health Research and Rural Advocacy site, since a large doctor parking lot sits adjacent to the property. Contractors must park in the large patient parking lots located on the opposite side of the medical campus, and then ride the Geisinger bus system to the site. Geisinger Facilities denoted an area for the contractors to park as to not take parking away from normal hospital patients.

Since the Center for Health Research and Rural Advocacy will be a LEED certified building, recycling is huge issue. Danville, Pennsylvania offers free recycling for all residents; however, the commercial building industry is not as lucky. The lack of a local recycling plant makes tipping fees upward of $20 per ton.

Ground water locations for the project site were encountered at 25 feet below finished grade, however; only three of the eleven bore samples found any water when drilled to 30 feet. The vast majority of the boring logs found reddish brown silty clay which was moist and stiff. This clay material was found throughout the entire range of the boring logs, with the exception of some sporadic brown clay with rock fragments.