Shippensburg University

1871 Old Main Drive
Shippensburg, PA 17257

Telecommunications Renovation Feasibility Study

Project: SU-2004/14

Professional:
Entech Engineering, Inc.
4 South Fourth Street
P.O. Box 32
Reading, PA 19603
Telephone: 610-373-6667
Fax: 610-373-7537
www.entecheng.com
Entech Project #: 2184.25

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TELECOMMUNICATIONS RENOVATION FEASIBILITY STUDY
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Attachments

Attachment A: University Existing Manholes (Including Conduit Entry & Associated Photos)

Attachment B: University Existing Buildings (Including Conduit Entry & Associated Photos)

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Drawing E-1 – Site Plan - Existing

Drawing E-2 – Site Plan - Proposed
EXECUTIVE SUMMARY

In order to maintain and improve the university telecommunications distribution system at Shippensburg University, Entech Engineering, Inc. was asked to study and review the telecommunications underground distribution system. As part of the study, Entech updated the university telecommunications site plan identifying the general location of manholes, building entrance areas, and ductbank routing between buildings and manholes. As part of the survey, existing manholes and individual building telecommunications equipment rooms were observed and documented.

As part of the study, the University master plan was reviewed. Development of new buildings and improvements to existing facilities were identified in order for the university to make proper decisions for routing future telecommunications systems.

In general, the telecommunications underground distribution system is in relatively good condition. Some manholes have drainage problems, while others have relatively no conduit spare capacity for future requirements. The overall distribution system appears to be maintained and upgraded as needed to provide adequate telecommunications support throughout the university.

However, there are some areas where upgrades to the underground distribution system can be made to enable the system to continue to meet the requirements of the University as the telecommunication system develops and grows.

The following table lists the underground distribution upgrade/improvement recommendations and the associated cost. These cost projections are in current dollars for the year 2005. Budgets developed utilizing this information should be increased to reflect the year in which the work will actually be completed.
<table>
<thead>
<tr>
<th>UPGRADES/IMPROVEMENTS</th>
<th>ESTIMATED COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Manhole Upgrades</td>
<td>$204,490</td>
</tr>
<tr>
<td>Total (Including O&amp;P, Professional Services, Contingency)</td>
<td></td>
</tr>
<tr>
<td>2) Administration System Identification Upgrades</td>
<td>$303,600</td>
</tr>
<tr>
<td>Total (Including O&amp;P, Professional Services, Contingency)</td>
<td></td>
</tr>
<tr>
<td>3) New Telecommunication Manhole and Ductbank System</td>
<td>$1,159,630</td>
</tr>
<tr>
<td>Total (Including O&amp;P, Professional Services, Contingency)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$1,667,720</td>
</tr>
</tbody>
</table>

**INTRODUCTION**

On September 23, 2004 Entech Engineering Inc. began work documenting the existing underground telecommunications distribution system at Shippensburg University. The purpose of this work was to develop an accurate telecommunications distribution site plan, along with a proposed telecommunications distribution site plan incorporating known future university additions provided from the University Master Plan. The following is a brief description of the existing distribution system along with recommendations for distribution system renovations and additions to better serve the university into the future.

**SYSTEM DESCRIPTION**

The telecommunications distribution system at Shippensburg University currently initiates from two separate buildings within the University. The distribution of the telephone system initiates from the Centrex Building, while the distribution of the data system initiates from the Mathematics Computer Technologies Center. Both systems are routed throughout the university via a manhole/ductbank system. Manholes have been strategically placed to accommodate conduit ductbanks routed from one building to another. Drawing E-1 represents the existing telecommunications distribution system layout including individual manholes & ductbanks routed between manholes and buildings throughout the University. Existing manholes are identified by a numerical value (Example: MH - #) as designated on the drawing. Cabling type & quantity as designated on the drawing (Example: C###, F##, & CO/C/F) was provided by the University, but was not verified as part of the telecommunications system renovation planning study.
Attachment “A” included with this report represents documentation of all the existing manholes located throughout the University that were surveyed as part of the telecommunications system renovation planning study. The manholes are sorted by a numerical value. Photographs, conduit entry & capacity within each manhole, and building proximity are identified for each manhole surveyed.

Attachment B included with this report is a listing of all existing University buildings that were surveyed as part of the telecommunications system renovation planning study. The buildings are sorted alphabetically by building name. Photographs, conduit entrance within each building, and telecommunications equipment rooms are identified for each building.

SYSTEM ASSESSMENT

Existing University Buildings & Manhole System & Administration System Identification

Based on the visual inspections conducted during Entech’s site survey, the underground ductbank & manhole system and building telecommunication entrance equipment rooms appear to be in good condition. However, the following observations were made:

1. Manholes with water infiltration or flooding.
2. Manholes and ductbank systems with insufficient capacity to add or route future cabling.
3. Debris and/or Abandoned cabling within existing manholes and/or duct system.
4. Blocks added to throat of manhole to raise the manhole even with new paved road.
5. Inaccessibility of manholes or buildings during site survey.
6. Manholes that require concrete patching.
7. Inconsistent telecommunication administration system for the underground ductbank system and telecommunication equipment rooms located within each building.

In general most of the observations listed above are obvious; however, a consistent telecommunication administration system is essential. The administrative system although not obvious, it provides both operational and maintenance benefits as follows:

Operational: An effective administration system simplifies moves, additions, and modifications by allowing the work details to be determined in advance and then carried out with minimal guesswork. Labeling conduits and keeping updated records of conduit use greatly simplifies determining whether unused conduit capacity is available and, therefore, the best routing for new cables.
Maintenance: Maintenance is simplified because the components involved in the failed telecommunications channel can be easily and quickly identified during troubleshooting and repair activities.

Infrastructure administration requirements generally follow the recommendations of the administration standard ANSI/TIA/EIA-606. However, since the scope of ANSI/TIA/EIA-606 does not include equipment administration, the University should determine the best method of recordkeeping to identify the overall University telecommunications system.

The administrative system usually consists of three basic elements as listed below:

1. Labeling or other means of identifying the infrastructure components and equipment.
2. Computer or paper-based recordkeeping system, which tracks the location, use, and status of the infrastructure components and equipment.
3. An alphanumeric scheme (called linkages) used both in labeling and in the record system that defines the relationship and allows cross-referencing of the equipment and components.

In addition to the administration system issues listed above, Table 1 below lists these specific observations made at buildings and manholes during the site survey.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Observations</td>
<td></td>
</tr>
<tr>
<td>Manholes: #2,4,8,9,13,15,16,18,21,24,29,30,32,37A,46,49,50,51,54,55,56,60,61</td>
<td>Water Infiltration or Flooding</td>
<td></td>
</tr>
<tr>
<td>Manholes: #22,23,35,37A,42</td>
<td>Manholes with Insufficient capacity to add or route future cabling</td>
<td></td>
</tr>
<tr>
<td>Manholes: #2,3,5,6,8,9,10,11,14,15,16,17,22,23,24,28,29,31,33,34,35,37,38,43,44,45,46,50,51,52,53,54,55,56,58,59,60,61</td>
<td>Debris and/or Abandoned Cabling</td>
<td></td>
</tr>
<tr>
<td>Manholes: #1,2,3</td>
<td>Blocks added to throat to raise manhole even with road</td>
<td></td>
</tr>
<tr>
<td>Manholes: #2,25,50A,37 (#57-not utilized) Buildings: Seth Grove Stadium, Bookstore, Instructional Arts Facility</td>
<td>Inaccessibility of manhole or buildings during site survey</td>
<td></td>
</tr>
<tr>
<td>Manholes: #3,4,6,15,17,22,23,29,32,37A,41,46,47,52,53,54,55,56,59,62</td>
<td>Manholes that require concrete patching and/or sealing around exterior of conduits.</td>
<td></td>
</tr>
</tbody>
</table>
New Manhole & Ductbank System - Future Expansion

The University has plans for the following future additions to the Campus:

1. A new 82,200ft² Instructional Arts Facility.
2. A 34,000ft² addition to the Heiges Field House.
3. A 10,500ft² addition to the Ezra Memorial Library.
4. A 30,000 ft² addition to the Cumberland Student Union.
5. A new 63,500 ft² Recreation Center.

Based on the visual inspections conducted during Entech’s survey of the existing underground distribution system, provisions for additional manholes and conduit ductbank systems are needed to accommodate the future building additions & expansions proposed by the University. Attached drawing E-2 (Site Plan – Proposed) indicates known future University building additions & expansions, and also indicates proposed new manholes & routing for new underground conduit ductbanks.

The University also has projects that are currently in the feasibility phase that could impact the current telecommunication distribution system. These items are listed below:

The University has a project currently under design which will add two four inch conduits to provide additional services to Rowland Hall and Shearer Hall. The conduit pathway will be routed from the Centrex Building through manholes #12, #13, #14, & #16, ending at manhole #17 located adjacent to Shearer Hall. The project construction will start in the fall of 2005.

The University is currently reviewing a feasibility study to renovate and possibly expand Reisner Dining Hall. The expansion size and exact location of the expansion have not been determined. The expansion in all probability will be directed southeast toward Naugle Hall. Attached drawing E-2 (Site Plan – Proposed) indicates proposed new manholes & routing for new underground conduit ductbanks to Reisner Dining Hall, but does not show the size of the building expansion, since it is still not determined. The new conduit ductbank to Reisner Dining Hall shall be connected to the new manhole adjacent to Ezra Lehman Library, and then routed via existing manhole #33 to a new manhole #32 located outside of the building expansion. Existing manhole #32 would have to be removed as part of the building expansion. New manhole #32 would have to be provided and the actual location of the manhole would have to be coordinated with the building expansion layout.
RECOMMENDATIONS

The following recommendations are based on Entech’s survey and assessment of the existing telecommunications distribution system. Included with each recommendation is an estimate of probable construction cost. Detailed cost estimates are included in Attachment C of this report.

Existing University Buildings & Manhole System

The following should be completed to improve performance of the manhole and ductbank distribution system:

1. Eliminate water infiltration and flooding in existing manholes.
2. Remove Debris and Abandoned cabling from existing manholes and/or duct system.
3. Patch concrete and/or seal around conduits in existing manholes where indicated.

The approximate cost to implement these corrections is $204,490.

Administration System Identification

As part of the site survey work, a visual administrative system assessment of the existing telecommunications cabling routed within the underground ductbank distribution system and each building telecommunication equipment room was performed. There appears to be an inconsistent administrative documentation system utilized throughout the University. A new more effective and operational administrative system would benefit the University for present and future requirements. Cabling type, quantity, and routing was not verified as part of this study, but is a critical part of the documentation system.

The approximate cost for the telecommunications Administrative System documentation would be $303,600.

New Manhole & Ductbank System – Future Expansion

Based on the University’s future plans for additions to the Campus, drawing E-2 (Site Plan – Proposed) was developed to show proposed telecommunications distribution system pathways to accommodate the future buildings and renovations to existing buildings. New manholes & ductbanks are shown along with utilization of existing manholes to supply adequate underground pathways for proposed and future desires.

The approximate cost for the new telecommunications distribution system would be $1,159,630.
Cost associated with Rowland Hall & Shearer Hall additional services conduit pathway routing is part of another project and has not been included in the new telecommunications distribution system cost estimate.

Cost associated with the possible expansion of Reisner Dining Hall has been included in the new telecommunications distribution system cost listed above.

Construction Phasing Plan

To facilitate implementation the recommendations within the Telecommunications Renovation Feasibility Study, the University should complete the proposed installations and upgrades in phases. The allocation of money for upgrading the existing distribution system & implementation of the proposed new ductbank system may be extended over time. The proposed phasing of work is based upon immediate and future requirements as follows:

Phase 1

Route new manholes & underground ductbanks between the Centrex Building and existing manhole #39. The work consists of five new manholes and various new underground ductbanks between these manholes. Refer to Phase 1 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 2

Install an underground ductbank routed between existing manhole #39 and the new manhole located adjacent to Recreation Center. The work consists of a new underground ductbank routed between the existing and new manhole containing six 4” conduits. Refer to Phase 2 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 3

Installation of new manholes & underground ductbanks routed between the new manhole located adjacent to the Cumberland Union Building and new manhole #32. The work consists of various new underground ductbanks between the new & existing manholes. Refer to Phase 3 New Manholes/Ducts cost estimate in attachment “C” for additional information.
Phase 4

Provide new manholes & underground ductbanks routed between the new manhole located adjacent to Mathematics/Computing Technologies Center and existing manhole #50 and Mathematics/Computing Technologies Center. The work consists of various new underground ductbanks between the existing manholes. Refer to Phase 4 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 5

Route new underground ductbank from the new manhole located adjacent to Ezra Lehman Library to the future building addition of the Ezra Lehman Library. The work consists of a new underground ductbank routed between the new manhole and the building addition containing four 4” conduits. Refer to Phase 5 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 6

Install a new underground ductbank from the new manhole located adjacent to Cumberland Union Building to the future building addition of the Cumberland Union Building. The work consists of a new underground ductbank routed between the new manhole and the building addition containing four 4” conduits. Refer to Phase 6 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 7

Provide a new underground ductbank from the new manhole located adjacent to Recreation Center to the future building addition of the Heiges Field House. The work consists of a new underground ductbank routed between the new manhole and the building addition containing four 4” conduits. Refer to Phase 7 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 8

Route a new underground ductbank from the new manhole located adjacent to Recreation Center to the future Recreation Center. The work consists of a new underground ductbank routed between the new manhole and the Recreation Center containing four 4” conduits. Refer to Phase 8 New Manholes/Ducts cost estimate in attachment “C” for additional information.
Phase 9

Install a new underground ductbank from the new manhole located adjacent to Reisner Dining Facility to the future building addition of the Reisner Dining Facility. The work consists of a new underground ductbank routed between the new manhole #32 and the Reisner Dining Facility containing four 4” conduits. Refer to Phase 9 New Manholes/Ducts cost estimate in attachment “C” for additional information.

Phase 10

This work consists of the administration system identification and manhole upgrades for the existing telecommunication distribution system. The actual work involved within individual manholes or buildings may be included within any other phase of construction, or may be provided as its own phase of construction. The work consists of the following: 1) Administration identification for individual building equipment room distribution and telecommunication cabling routed within the underground ductbank distribution system 2) Removal of debris and/or abandoned cabling within the existing manholes 3) Installation of sump pumps within manholes with Water infiltration/flooding 4) Concrete patching for existing manholes that require maintenance. Refer to Administration System Identification & Manhole Upgrades cost estimates in attachment “C” for additional information.
Conclusion

The total cost for system upgrades and additions mentioned above is roughly $1,667,720. With these improvements, the system should be capable of meeting the need of the growing University well into the future. In addition the telecommunication system routed throughout the University should be completely documented to facilitate future system additions. However, as the University is expanded, care should be taken to provide distribution systems with adequate capacity to handle most any change that may be required.

References

Along with review of existing site drawings, the 1997 Manhole & Conduit survey, and the telecommunications building floor plans manual, the following University Personnel assisted with gathering information for this study:

Terry L. Starr, Assoc. Dir./Planning, Design & Construction

Michael F. Bonafair, Director of Telecommunications

Kevin L. Oakes, Electrical/Electronics Supervisor

The information provided by the University Personnel was critical for completing this study.
MANHOLE #3

LEGEND:
- SPARE
- SPACE AVAILABLE
- FULL

NORTH WALL

EAST WALL

SOUTH WALL

WEST WALL
MANHOLE #4

LEGEND:

- ○ SPARE
- ● SPACE AVAILABLE
- ● FULL

ELECTRIC SUBSTATION

NORTH WALL

KIEFFER HALL

WEST WALL

MCCUNE HALL

SOUTH WALL

HARLEY HALL

EAST WALL

NORTH WALL

SOUTH WALL

WEST WALL

PROJECT: SU-2004/14
MANHOLE #8

LEGEND:

- O SPARE
- O SPACE AVAILABLE
- O FULL

NORTH WALL

EAST WALL

SOUTH WALL

WEST WALL

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TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #13

LEGEND:

- SPARE
- SPACE AVAILABLE
- FULL

NORTH WALL

EAST WALL

SOUTH WALL

WEST WALL

PROJECT: SU-2004/14
MANHOLE #14

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL

NORTH WALL

WEST WALL

SOUTH WALL

EAST WALL

KIRNER DINING HALL

HUBER ARTS CENTER

SHEARER HALL

STEWART HALL
MANHOLE #15

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

PROJECT: SU-2004/14
MANHOLE #16

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL

NORTH WALL

EAST WALL

SOUTH WALL

WEST WALL
MANHOLE #18

LEGEND:

○ SPARE
● SPACE AVAILABLE
● FULL

NORTH WALL

WEST WALL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #20

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

EAST WALL

WEST WALL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #21

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

EAST WALL

SOUTH WALL

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #24

LEGEND:

○ SPARE
● SPACE AVAILABLE
● FULL

WEST WALL

NORTH WALL

EAST WALL

SOUTH WALL

DAUPHIN HUMANITY CENTER

SHIPPEN HALL

FRANKLIN SCIENCE CENTER

EZRA LEHMAN LIBRARY

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PROJECT: SU-2004/14
MANHOLE #28

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

NORTH WALL

WEST WALL

WEST WALL

PROJECT: SU-2004/14
MANHOLE #29

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL
TELECOMMUNICATIONS SYSTEM
DOCUMENTATION STUDY

MANHOLE #31

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL

NORTH WALL

SOUTH WALL

WEST WALL

EAST WALL

FRANKLIN
SCIENCE
CENTER

REISNER
DINING FACILITY
NORTH WALL

NAUGLE HALL

SOUTH WALL
MANHOLE #32

LEGEND:
- ○ SPARE
- ○ SPACE AVAILABLE
- ● FULL

NORTH WALL
EAST WALL
WEST WALL
MANHOLE #33

LEGEND:

○ SPARE
● SPACE AVAILABLE
○ FULL

PROJECT: SU-2004/14
MANHOLE #34

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

EAST WALL

WEST WALL
MANHOLE #35

LEGEND:

- O SPARE
- O SPACE AVAILABLE
- O FULL
MANHOLE #36

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL
MANHOLE #37

LEGEND:

• SPARE
○ SPACE AVAILABLE
○ FULL
MANHOLE #37A

LEGEND:

〇 SPARE
〇 SPACE AVAILABLE
● FULL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #40

LEGEND:

○ SPARE
● SPACE AVAILABLE
● FULL

EAST WALL

WEST WALL

PROJECT: SU-2004/14
MANHOLE #43

LEGEND:

〇 SPARE
〇 SPACE AVAILABLE
〇 FULL

EAST WALL

WEST WALL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #45

LEGEND:
- ○ SPARE
- ● SPACE AVAILABLE
- ●● FULL

ETTER HEALTH CENTER
SEAVERS APARTMENTS
NORTH WALL
D.G.S. BLDG.

BOOKSTORE STORAGE
SOUTH WALL

WEST WALL
EAST WALL

SOUTH WALL
WEST WALL

EAST WALL
MANHOLE #47

LEGEND:

〇 SPARE
〇 SPACE AVAILABLE
〇 FULL

NORTH WALL

SOUTH WALL

PROJECT: SU-2004/14
MANHOLE #48

LEGEND:
- ○ SPARE
- □ SPACE AVAILABLE
- ● FULL
MANHOLE #49

LEGEND:
○ SPARE
○ SPACE AVAILABLE
● FULL

NORTH WALL

SOUTH WALL

PROJECT: SU-2004/14
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MANHOLE #53

LEGEND:
- ○ SPARE
- ○ SPACE AVAILABLE
- ● FULL

Project: SU-2004/14
MANHOLE #54

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL
MANHOLE #56

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL

NORTH WALL

SOUTH WALL

SOUTH WALL

SOUTH WALL
MANHOLE #58

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MANHOLE #59

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL

NORTH WALL
SOUTH WALL

PROJECT: SU-2004/14
MANHOLE #60

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL
MANHOLE #61

LEGEND:

○ SPARE
○ SPACE AVAILABLE
● FULL
PULLBOX #1

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

PULLBOX #2

LEGEND:

○ SPARE
○ SPACE AVAILABLE
○ FULL

WRIGHT HALL
HARLEY HALL
MCGUNE HALL

NORTH WALL
UTILITY POLE (SOUTHWEST END OF UNIVERSITY)
UTILITY POLE (NORTH EAST END OF UNIVERSITY)
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

ALUMNI HOUSE - FIRST FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"

(Photographs taken on the first floor of the Alumni House.)
BOOKSTORE STORAGE - FIRST FLOOR

PHOTO "A"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

CENTREX BUILDING - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

DATA ROOM 126
PHOTO "A, B, C, D, & E"

CHAPEL - FIRST FLOOR

PHOTO "A"
PHOTO "B"
PHOTO "C"

"PHOTO "D"

PHOTO "E"

PROJECT: SU-2004/14
CUMBERLAND UNION BUILDING - GROUND FLOOR

PHOTO "A"

"PHOTO "C"

PHOTO "D"

PHOTO "A, B, & D"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

CUMBERLAND UNION BUILDING - GROUND FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
DAUPHIN HUMANITY CENTER - GROUND FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"
D.G.S. BUILDING - FIRST FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"
ETTER HEALTH CENTER - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

FAC. OFFICE BUILDING - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

FRANKLIN SCIENCE CENTER - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"

PHOTO "E"

PHOTO "F"

PROJECT: SU-2004/14
FRANKLIN SCIENCE CENTER - BASEMENT FLOOR
GILBERT HALL - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"
HEIGES FIELD HOUSE - GROUND FLOOR PLAN
HENDERSON GYMNASIUM - SUB-BASEMENT FLOOR

PHOTO "A"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

HORTON HALL - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

"PHOTO "D"

"PHOTO "E"

PHOTO "F"
JOHN L. GROVE HALL - BASEMENT FLOOR PLAN

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

KENNETH O. REED OPERATIONS CENTER - FIRST FLOOR

PHOTO "A"

PHOTO "B"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

PHOTO "A, B, C & D"

KIEFFER HALL - GROUND FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

KRINER DINING HALL - GROUND FLOOR

PHOTO "A"

PHOTO "B"

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

LACKHOVE HALL - GROUND FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

LITTLE RED SCHOOL HOUSE - FIRST FLOOR

PHOTO "A"
MARTIN HOUSE - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

MATHEMATICS COMPUTING TECHNOLOGIES CENTER - GROUND FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
PHOTO "A, B, C, & D"  
(LOCATED ON FIRST FLOOR ABOVE THIS AREA)

MCLEAN HALL - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"
MEMORIAL AUDITORIUM - BASEMENT FLOOR

PHOTO "A & B"
PHOTO "C & D"

PHOTO "A"

PHOTO "B"

"PHOTO 'C"
PHOTO "D"

PROJECT: SU-2004/14
MOWERY HALL - GROUND FLOOR
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

PHOTO "A"

PHOTO "B & D"

PHOTO "C"

NAUGLE HALL - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
OLD MAIN - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

PHOTO "E"
REISINGER HOUSE - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C""
REISNER DINING FACILITY - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"

PHOTO "D"

TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

PROJECT: SU-2004/14
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

ROWLAND HALL - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

SEAYER APARTMENTS - GROUND FLOOR

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"

PROJECT: SU-2004/14
SETH GROVE STADIUM - GROUND FLOOR

SETH GROVE STADIUM WAS NOT REVIEWED DURING SITE SURVEY. (BUILDING WAS INACCESSIBLE WITHOUT AUTHORIZED PERSONNEL)
SHEARER HALL TELECOM, FEEDS ROWLAND HALL TELECOM.

SHEARER HALL - BASEMENT FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"
SHIPPEN HALL - FIRST FLOOR RM #1

PHOTO "A"

PHOTO "B"

PHOTO "C"

PHOTO "D"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

SHIPPEN HALL - FIRST FLOOR RM #2

PHOTO "A"

PHOTO "B"

"PHOTO "C"
TELECOMMUNICATIONS SYSTEM DOCUMENTATION STUDY

STEAM PLANT - BASEMENT FLOOR

PHOTO "A"

PHOTO "C"

PHOTO "B"

"PHOTO "C"
STEWARD HALL - BASEMENT FLOOR
STUDENT RECREATION FACILITIES - FIRST FLOOR

PHOTO "A"

PHOTO "B"

"PHOTO "C"
WRIGHT HALL - BASEMENT FLOOR

Photo "A"

Photo "B"
Opinion of Probable Construction Cost

Entech Engineering, Inc.  
Project Number: 2184.25  
Project Name: Telecom. System Renovation Planning  
Project Location: Shippensburg University  
Estimator: SCH  
Checked by: PLK  
Date: 28-Apr-05  
Estimate Type: Telecom. System  
Estimate Phase: Final Construction Phases  
Drawing Numbers: E-1 & E-2  
Filename: G:\Projects\2184.25wp\telecom report\New Manholes & Ductbanks.xls

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<tr>
<th>Description</th>
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<th>Labor Cost</th>
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TOTAL ELECTRICAL  
$853,500  
$814,220  
$1,667,720
# Opinion of Probable Construction Cost

**Entech Engineering, Inc.**

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<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost $/Unit</th>
<th>Material Cost $</th>
<th>Labor Cost $/Unit</th>
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## Opinion of Probable Construction Cost

**Entech Engineering, Inc.**

<table>
<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost</th>
<th>Labor Cost</th>
<th>Total Cost</th>
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<tbody>
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<td>$/Unit</td>
<td>Cost</td>
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<td>Labor Cost $/Unit</td>
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**Overhead & Profit**

\[
\begin{align*}
\text{20%:} & \quad \text{1 LS} \quad \$24,696.00 \quad \$24,696 \quad \$0 \quad \$24,696 \\
\text{Professional Services} & \quad \text{Engineering (10%)} \quad \text{1 LS} \quad \$14,817.60 \quad \$14,818 \quad \$0 \quad \$14,818 \\
\text{Subtotal} & \quad \$98,314 \quad \$64,680 \quad \$162,994 \\
\text{15% Contingency} & \quad \$14,747 \quad \$9,702 \quad \$24,449 \\
\text{TOTAL ELECTRICAL} & \quad \$113,060 \quad \$74,380 \quad \$187,440
\end{align*}
\]
## Opinion of Probable Construction Cost

**Entech Engineering, Inc.**

<table>
<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost</th>
<th>Labor Cost</th>
<th>Total Cost</th>
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<tr>
<td>Math Bldg. to Math MH</td>
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<td></td>
<td></td>
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<tr>
<td>Ductbank (Six 5&quot; conduits)</td>
<td>210</td>
<td>LF</td>
<td>$70.00</td>
<td>$70.00</td>
<td>$29,400</td>
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<tr>
<td>MH #49 to MH #50</td>
<td></td>
<td></td>
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<tr>
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<td>365</td>
<td>LF</td>
<td>$70.00</td>
<td>$70.00</td>
<td>$51,100</td>
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<tr>
<td><strong>COSHA Compliant Entry</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
<td>$10,196</td>
</tr>
</tbody>
</table>

**Overhead & Profit**

20%  

1 LS | $42,823.20 | $42,823 | $0 | $42,823

**Professional Services**

Engineering (10%)

1 LS | $25,693.92 | $25,694 | $0 | $25,694

Subtotal

$170,477 | $112,156 | $282,633

15% Contingency

$25,572 | $16,823 | $42,395

**TOTAL ELECTRICAL**

$196,050 | $128,980 | $325,030
# Opinion of Probable Construction Cost

## Entech Engineering, Inc.

### Project Information
- **Project Number:** 2184.25
- **Project Name:** Telecom. System Renovation Planning
- **Project Location:** Shippensburg University
- **Estimate Type:** New Manholes/Ducts
- **Estimate Phase:** Final Phase 5
- **Drawing Numbers:** E-2
- **Estimator:** SCH
- **Checked by:** PLK
- **Filename:** New Manholes & Ductbanks.xls

## PHASE 5

<table>
<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost</th>
<th>Labor Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ezra Lib. MH to Ezra Lib.</td>
<td>50</td>
<td>LF</td>
<td>$50.00</td>
<td>$2,500</td>
<td>$5,000</td>
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<td>Ductbank (Four 5&quot; conduits)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSHA Compliant Entry</td>
<td>1</td>
<td>LS</td>
<td></td>
<td>$250</td>
<td>$250</td>
</tr>
</tbody>
</table>

## Overhead & Profit
- **20%**
  - **Engineering (10%)**
    - **# of Units:** 1
    - **Unit Measure:** LS
    - **Material Cost:** $1,050.00
    - **Labor Cost:** $1,050
    - **Total Cost:** $1,050
- **Professional Services**
  - **Engineering (10%)**
    - **# of Units:** 1
    - **Unit Measure:** LS
    - **Material Cost:** $630.00
    - **Labor Cost:** $630
    - **Total Cost:** $630

## Subtotal
- **Total:** $4,180
- **Total Labor:** $2,750
- **Total Cost:** $6,930

## 15% Contingency
- **Total:** $627
- **Total Labor:** $413
- **Total Cost:** $1,040

## TOTAL ELECTRICAL
- **Total:** $4,810
- **Total Labor:** $3,160
- **Total Cost:** $7,970
### Opinion of Probable Construction Cost

**Entech Engineering, Inc.**

**Project Number:** 2184.25

**Project Name:** Telecom. System Renovation Planning

**Project Location:** Shippensburg University

**Date:** 28-Apr-05

**Estimate Type:** New Manholes/Ducts

**Estimate Phase:** Final Phase 6

**Drawing Numbers:** E-2

**Filename:** G:\Projects\2184.25\wp\telecom report

<table>
<thead>
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<th>Description</th>
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<td>PHASE 6</td>
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<tr>
<td>CUB MH to CUB</td>
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<td></td>
<td>$675</td>
<td>$675</td>
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</table>

**Overhead & Profit**

| 20%                          | 1          | LS           | $2,835.00     | $2,835     | $2,835     |

**Professional Services**

| Engineering (10%)            | 1          | LS           | $1,701.00     | $1,701     | $1,701     |

**Subtotal**

- $11,286
- $7,425
- $18,711

**15% Contingency**

- $1,693
- $1,114
- $2,807

**TOTAL ELECTRICAL**

- $12,980
- $8,540
- $21,520
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<th>Unit Measure</th>
<th>Material Cost $/Unit</th>
<th>Material Cost</th>
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<td>Rec. Cen. MH to Heiges</td>
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<td></td>
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<td>Labor Cost $/Unit</td>
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<td>$2,500</td>
<td>$5,000</td>
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<td>$250</td>
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<td>$6,930</td>
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<td>15% Contingency</td>
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<td></td>
<td>$627</td>
<td>$413</td>
<td></td>
<td>$1,040</td>
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<td>$7,970</td>
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## Opinion of Probable Construction Cost

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<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost</th>
<th>Labor Cost</th>
<th>Total Cost</th>
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<td><strong>PHASE 9</strong></td>
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<td>MH #32 to Reisner Dining</td>
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<td>LF</td>
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<td>LS</td>
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<td>$125</td>
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**Overhead & Profit**

20% Engineering (10%)

### Overhead & Profit

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Material Cost</th>
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<th>Total Cost</th>
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<td>20%</td>
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<td>$525.00</td>
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<td><strong>TOTAL ELECTRICAL</strong></td>
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<td>$1,580</td>
<td>$3,980</td>
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<tr>
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<td>Unit</td>
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<td>Labor Cost</td>
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<td>----------------------------------------------------------------------------</td>
<td>------------</td>
<td>------</td>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td>Identify and Label Cables Between Manholes and in each Individual Building Telecom. Equipment Room.</td>
<td>1</td>
<td>LS</td>
<td>$200,000.00</td>
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<tr>
<td>OSHA Compliant Entry</td>
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<td>LOT</td>
<td></td>
<td>$20,000</td>
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<td>Overhead &amp; Profit</td>
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<td>LS</td>
<td>$44,000.00</td>
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</tbody>
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Subtotal: $0 + $264,000 + $264,000 = $528,000

15% Contingency: $39,600

Total Electrical: $0 + $39,600 = $39,600
### Opinion of Probable Construction Cost

<table>
<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Unit Measure</th>
<th>Material Cost</th>
<th>Labor Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demolition</strong></td>
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<td></td>
</tr>
<tr>
<td>Remove Debris and/or Abandoned Cabling within</td>
<td>1</td>
<td>LS</td>
<td>$6,100.00</td>
<td>$6,100</td>
<td>$6,100</td>
</tr>
<tr>
<td>Manholes: # 2,3,5,6,8,9,10,11, 14,15,16,17,22,23,24,28,29,31, 33,34,35,37,38,43,44,45,46,50, 51,52, 53,54,55,56,58,59,60,61</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>New Work</strong></td>
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</tr>
<tr>
<td>Manholes with water Infiltration or Flooding</td>
<td>1</td>
<td>LS</td>
<td>$92,000.00</td>
<td>$23,000</td>
<td>$115,000</td>
</tr>
<tr>
<td>Install sump pump &amp; connect to adjacent Bldg. power Manholes: # 2,4,8,9,13,15,16, 18,21,24,29,30,32,37A,46,49, 50,51,54,55,56,60,61</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Manholes that require concrete patching Manholes: #3,4,6,15,17,22,23, 29,32,37A,41,46,47,52,53,54, 55,56,59,62</td>
<td>1</td>
<td>LS</td>
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<tr>
<td>OSHA Compliant Entry</td>
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<td>$3,610</td>
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<tr>
<td><strong>Overhead &amp; Profit</strong></td>
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</tr>
<tr>
<td>20%</td>
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<td>LS</td>
<td>$26,942.00</td>
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<td>Engineering (10%)</td>
<td>1</td>
<td>LS</td>
<td>$16,165.20</td>
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<td>$16,165</td>
</tr>
</tbody>
</table>

**Subtotal**                                     |            |              |               |            |            |
| $138,107                                         | $39,710    | $177,817     |

**15% Contingency**                              |            |              | $20,716      |            | $26,673    |

**TOTAL ELECTRICAL**                             |            |              | $158,820     | $45,670    | $204,490   |