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FESS/Engineering Project No. 6-7-82a

Mini-BooNE Removals

PDR

Project Definition Report for the preparation of the existing detector hall for the installation of the new Micro-BooNE detector.

PREPARED BY:

CRAWFORD, MURPHY, & TILLY, INC.
CONSULTING ENGINEERS
AURORA, ILLINOIS

CMT

This Project Design Report (PDR) is intended to be a self-consistent basis for the development of a planning level cost estimate for the conventional facilities to support the programmatic requirements. This report has not answered every technical design question and as such, the current level of contingency is believed to be consistent with the degree of technical confidence in the design at this stage. It is recognized that some basic construction concerns will be reviewed and optimized during the remaining stages of the project.

Authors of this document:

Bernie Held - Crawford, Murphy & Tilly, Inc.
Ahmad Idriss – Crawford, Murphy & Tilly, Inc.
Asad Bajwa – Crawford, Murphy & Tilly, Inc.
Joel Koenig – Crawford, Murphy & Tilly, Inc.

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C. Federowicz
R. Alber
C. James
D. Bogert

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EXECUTIVE SUMMARY

The objective of the MiniBooNE removal project is to present the various structure and site components, the schedule, and the associated probable costs that are necessary to decommission the existing MiniBooNE facility and prepare the facility for a future re-use in the MicroBooNE project. The Project Definition Report (PDR) addresses the removal of the existing structural steel sphere from the existing structure and the installation of a removable roof system to ready the location for the new MicroBooNE experiment. The PDR report also includes the anticipated conditions of the MiniBooNE facility upon completion of the decommissioning stage. The decommissioning of the MiniBooNE facility shall include the removal of existing roof and floor systems, relocation of spherical steel tank, and removal of all electrical and mechanical components associated with the MiniBooNE experiment.

Project Cost

The Total Estimated Cost (TEC) for the MiniBooNE removal project is estimated at $1,401,000. The project cost includes $73,000 for civil, $1,044,000 for structural, and $35,000 for electrical disciplines with an additional $214,000 allotted for overhead and profit and $35,000 for economic conditions and training.

See Appendix C for a detailed breakdown of the anticipated costs and quantities.

Project Schedule

The preliminary project schedule is anticipated to take 8 months from the start of engineering design to the project completion and close out. The schedule is based upon technical requirements of the project and anticipated timeframes for design approval, contract approval, and construction timelines. At this time, funding support and other approvals have not been incorporated into the schedule. Refer to pages 10 and 11 of this report for a more detailed breakdown of the project milestones and construction schedule.

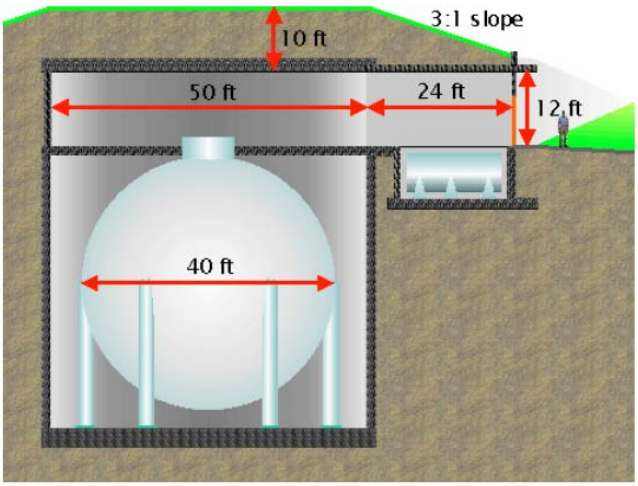
REQUIREMENTS

Existing Conditions

The existing structure consists of a cast-in-place concrete cylindrical vault with an interior diameter of 48'-8" and a total height of 62'-0". The vault's wall is 1'-6" thick up to elevation 749'-0" and 10" thick between elevations 749'-0" and 760'-0". The wall is supported by a 3'-3" thick circular foundation at elevation 706'-0" and covered by a precast prestressed roof system at elevation 760'-0". The roof system consists of 27"x36" precast prestressed box beams supported by 2'x2' collar beam and topped by a 6" cast-in-place concrete slab. The structure has a 10"x48" precast prestressed concrete intermediate floor at elevation 749'0" supported by the vault's wall and two precast concrete inverted-T beams. The structure has one 26'-8" long and 12'-10" wide covered eastern entrance at elevation 750'-0" with two 22'-9" long wing walls. The structure is covered by soil up to elevation 771'-6" with 2:1 (H:V) side slopes to meet existing ground at elevation 746'-0".

The vault contains a 40'-0" diameter steel spherical tank centered horizontally and vertically at elevation 729'-2". The steel sphere weighs 115.2 kips according to its manufacturer, Chicago Bridge and Iron, Inc. (CBI). (See attached Report 1, Page 4 of 8.) The tank rests on steel legs upon the floor of the lower level at elevation 706'-0". Above the tank is a service level where personnel enter the structure. This floor also presently houses the operations facility for the MiniBooNE experiment consisting of various computing and work stations. Laboratory equipment and workstations are anticipated to be removed prior to the decommissioning stage.

The building is serviced with several utilities including domestic water, industrial cooling water, electrical power supply lines and communication lines. The existing electrical power distribution system consists of two 150KVA utility transformers and two feeds to the building. One transformer is connected to a 225A, 480/277V PHP-MBDA1 panelboard, which feeds the building power distribution system, interior and exterior lighting, sump pump and HVAC equipment. The other transformer is connected to a 225A, 480/277V PHP-MBDB panelboard, which feeds circuit for all experiment loads.

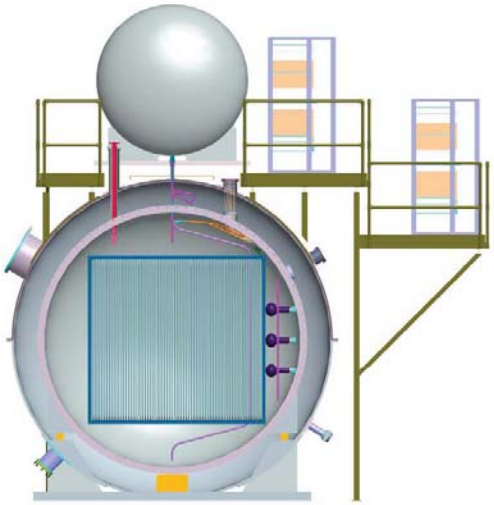


(*Graphic above right - showing cross section of existing MiniBoone detector and round spheroid, source of graphic above from http://www-boone.fnal.gov/public/const/detector.html*)

Proposed Modifications

This study will address the engineering aspect of decommissioning the MiniBooNE experiment and the removal of all the equipment and interior structural, mechanical, and electrical appurtenances within the MiniBooNE structure. The groundwater duplex sump pump and pipes will remain in place as well as the circular stairs if they do not hinder the sphere removal process. The steel spherical tank will be removed in one piece and staged near the site prior to transporting it to its final destination.

To access the sphere, the existing roof and shielding soil (approximately 7' in height) will be removed. An additional 5' ± of soil will be removed to elevation 755'-0" to lower and level the surrounding grade. With the lower grade, the exterior walls of the structure will protrude above the surface, providing the benefit of a perimeter barrier to humans and animals that might wander towards the site. As a secondary benefit, the lower, level grade will provide a working platform for the next phase of operations where a new sphere is lowered into the structure and a new roof structure is constructed.



The removed sphere will be located at two possible sites. Both sites are near the intersection of Minos Service Road and MiniBooNE Road. The approximate distances of those sites are 250 ft and 500 ft from MiniBooNE enclosure entrance. The final site location is to be determined at a later date.

A new roof system will be proposed to carry a load equivalent to 10 feet of soil or 1200 psf. The new roof will have a removable portion to allow a new tank placement inside the vault for the MicroBooNE experiment. (*Graphic showing above left of the proposed MicroBoone detector and the liquid argon time projection chamber, source of graphic from http://www-microboone.final.gov/document/microbooNE_101520078.pdf*)

As the configuration of the existing MiniBooNE facility will change with the outfitting of the structure under the MicroBooNE experiment, all existing utilities will be shut-off and de-energized. Service connections will be capped and the location of these caps marked with posts for reconnection when the building is re-commissioned.

One 150KVA utility transformer, HVAC equipment and all of the power distribution equipment will be removed from the building, salvaged and transported to the location designated by Fermilab. All interior lighting fixtures, wiring devices, surface mounted conduits and conductors will be removed.

The electrical service to the existing sump pumps will be relocated to a new service panel that is rated for outdoor use. The existing sump pumps and the discharge lines will need to remain in service while the building is awaiting re-commissioning. The existing sump pump controller, manual transfer switch, and generator receptacle will be relocated to the location as shown on the Electrical Plan Exhibit, sheet PDR-12, Appendix A. A new weatherproof enclosure with a small 480-120/208V, 3-phase transformer will be installed to feed relocated sump pump controller. Existing 150KVA utility transformer will be utilized to feed sump pumps, the trip plug/settings for the transformer secondary circuit breaker will be changed to 20A. Existing 3" conduit which feeds PHP-MBDA1 will be intercepted and utilized for new conductors to feed sump pumps.

Final Structure Description

The final structure shall have the following configurations:

- The concrete vault will be an open top structure with finish concrete elevation at 760’-0”.
- The berm soil will be graded to elevation 755’-0” around the vault and elevation 749’-0” at the future loading dock area for the MicroBooNE experiment.
- The circular stairs will remain, if possible, to allow accessibility to the vault’s base during the transition period. The stairs will be extended from elevation 741’-5¼” to elevation 760’-0”.
- Duplex sump pump controller with manual transfer switch and generator receptacle will be operational.
- The vault shall be free of all electrical and mechanical components unless mentioned otherwise.

DETAILED DESCRIPTION

The detailed descriptions of the MicroBooNE Site Preparation Project aspects are listed below:

I. Civil:

The civil aspect of this project consists of the work required to remove the overburden berm soil down to elevation 755'-0" around the enclosure wall. The soil below the 755'-0" elevation will be maintained except at the southern elevation where the soil will be removed to the 749'-0" elevation to provide an alternative approach area for crawler crane. The total anticipated quantity of earth removal is approximately 3,240 Cu Yd. The civil work will also include the construction of a foundation system to support the relocated spherical tank. It is highly recommended to designate an area within the reach of the heavy crawler crane for tank storage to avoid using a transporter and reduce cost. There are two possible sites for sphere relocation. Both sites are near the intersection of Minos Service Road and MicroBooNE Road. Site 1 is at the northeast corner of the intersection, and Site 2 is roughly 250 ft south of Site 1 on the west side of Minos Service Road. See Item 5, Page 7 for proposed site sketch. It is our understanding that Site 1 may be challenging to construct a foundation system to carry the spherical tank due to the existence of a utility corridor under Site 1 proposed location. The foundation system type will be addressed in the structural task.

Following are the tasks required for the site preparation:

1. Removal of shielding soil roof overburden and temporary storage of these soils.
2. De-grading of the soils surround the existing building to elevation 755 and the storage of these soils.
3. Installation of a security fence around the perimeter of the excavation site.
4. Installation of temporary seeding and soil erosion control measures.
5. Grading and placing of aggregate and ditch culverts for temporary driveways to the existing structure and temporary tank lay-down parking area
6. De-energizing and shut-down of existing utilities including the domestic water service (DWS), Industrial Cooling Water (ICW), Fire Department Connection (FDC), power supplies, communication lines, and HVAC service conduit. All connection locations will be capped and marker post placed at the termination points of these utility lines.
7. Protection of the existing sump discharge lines.

II. Structural:

The structural aspect of this project consists of the following tasks:

1. Removal of monorail and other crane beams attached to the roof system in the computer room.

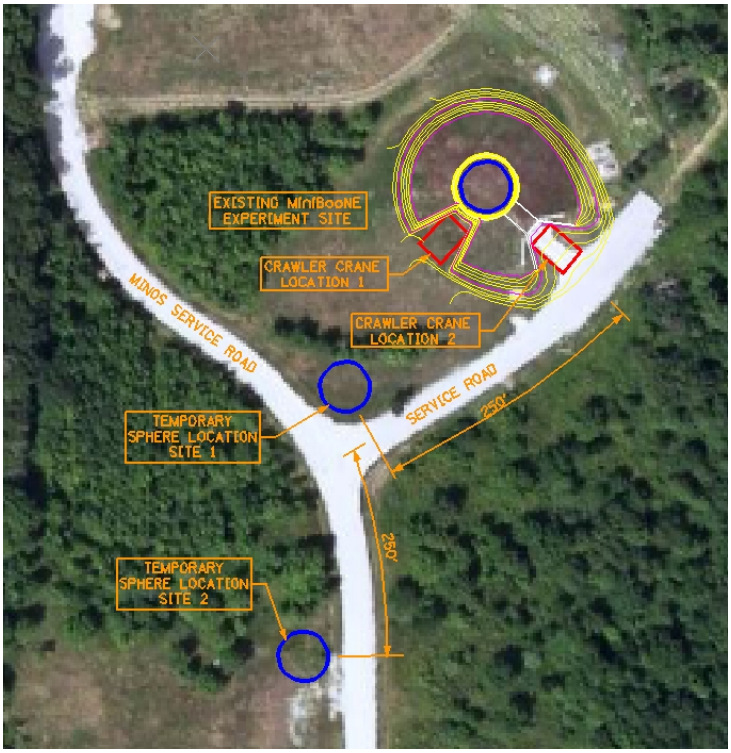
2. Removal of the existing MiniBooNE enclosure precast prestressed roof system at elevation 760'-0". The roof system consists of 27"x36" precast prestressed concrete box beams supported by 2'x2' collar beam and topped by a 6" cast-in-place concrete slab.
   (a) This task will start with the jack-hammering and removal of the 1'-6"x2'-9" cast-in-place concrete collar at the perimeter of the precast prestressed beams. The total quantity of concrete removal for this item is 25.2 Cu Yd.
   (b) The second step will be the removal of the 27"x36" precast prestressed concrete box beams and the 6" cast-in-place concrete topping. This step will start by locating and marking up the box beam joints on the top of the concrete surface, then saw-cutting through the box joints and removing the separated boxes using a moderate size crane. The heaviest box beam weighs about 20 Tons. The box beams are expected to be lifted using roundslings and a spreader beam. No mechanical attachments are anticipated. The total box beam removal quantity of this step is 2206 Sq Ft. Beam joint saw-cuts shall be incidental to the box beam removal.
   (c) The last step in this task is the removal of the 2'x2' cast-in-place concrete collar beam by jack-hammering or saw-cutting into pieces and lifting using same moderate size crane. Total quantity for this step is 24.2 Cu Yd of concrete removal.

3. Removal of the existing MiniBooNE enclosure precast prestressed floor system at elevation 750'-0". The floor system consists of 10"x48" precast prestressed concrete floor panels supported by the perimeter wall and two precast concrete inverted-T beams spaced at 23'-0" on center. The floor panels are topped by a 2" cast-in-place concrete overlay.

   a) This task will start by furnishing a protective shield/net over the spherical steel tank to protect it from falling debris during precast floor removal.
   b) The second step will be saw-cutting through the joints and removing the separated boxes using a moderate size crane. The box beams are expected to be lifted using roundslings and a spreader beam. No mechanical attachments are anticipated. The total floor beam removal quantity of this step is 1964 Sq Ft. Panel joint saw-cuts shall be incidental to the floor beam removal.
   c) The last step in this task is the removal of the two 4'x2'-4" inverted-T precast concrete beams using the moderate size crane where the weight of each beam is 30 Tons. The quantity of this item is incidental to the floor beam removal.

4. Construction of a foundation system to support the removed spherical tank. The foundation system consists of six 3'-6" diameter and 18'-0" long concrete caissons with 14'-0" embedment length. The top 4'-0" of the embedded length of the soil is ignored due to presence of fill material at the targeted area.

5. Removal of MiniBooNE spherical steel tank using a 275 ton minimum capacity crawler crane positioned within 50 ft distance of the sphere's centerline. The sphere will located at two possible sites. Both sites are near the intersection of Minos Service Road and MiniBooNE Road. The approximate distances of those sites are 250 ft and 500 ft from MiniBooNE enclosure entrance. The final site location and condition that tank will be left in will be determined at a later date. See the following sketch for the proposed relocation areas.



6. Conducting structural analysis to verify stresses in the vault's wall due to crane load during the steel spherical tank removal. Finite Element Analysis was used to accomplish this task. A hollow cylinder without a top was modeled to carry earth load and a live load from fully loaded crane positioned near the vault's wall at elevation 749'-0". The analysis showed that the induced stresses due to the extra live load were within the cylinder capacity range. Refer to Appendix B for details.

7. Conducting structural analysis to verify stresses in the vault's wall due to the concrete wall removal at the proposed loading dock near the western quadrant of

the cylindrical vault. Finite Element Analysis was used to accomplish this task. A hollow cylinder without a top was modeled to carry earth load up to elevation 760'-0". The analysis showed no stresses were induced stresses that exceeded the cylinder capacity. Refer to Appendix B for details.

8. Designing a new concept removable roof system for the cylindrical vault at elevation 769'-0" to carry a load equivalent to 10 Ft of soil overburden or 1200 PSF. The removable element was selected to be 21"x48" precast prestressed box beams 24'-10" long supported by two precast concrete beams positions at 14'-0" from the vaults centerline. The remaining portion of the roof will be 11"x48" precast prestressed concrete deck beams topped with 2" of concrete overlay. The deck beam shall be supported by the two precast concrete beams that positioned at 14'-0" from the vault's centerline. See sheets PDR-8 and PDR-9 in Appendix A for details.

9. Designing a concept roof over the new entrance at elevation 766'-0". No unusual loads are anticipated for this roof. This roof will be 12"x48" hollow-core slabs spanning in the transverse direction as shown in sheet PDR-8, Appendix B.

III. Electrical/HVAC:

Existing electric service to the MiniBooNE Detector building will be disconnected and electrical and HVAC equipment will be removed from the building. The existing sump pump controller will be relocated adjacent to the transformer pad and sump pumps will remain operational.

Following are the tasks required for a complete removal of existing electrical and HVAC systems:

1. Disconnection of existing (1) 150KVA 13,800 – 480/277V liquid filled transformer, TR-MBDA. The existing conduits feeding the switchboard PHP-MBDA1 for building loads will be cut and capped approximately 20 feet from the building. Existing feeder conductors for PHP-MBDA1 and ACCU will be removed from the conduits. Refer to Appendix A, sheet PDR-3.

2. Disconnection and removal of existing (1) 150KVA 13,800 – 480/277V liquid filled transformer, TR-MBDB. Existing transformer will be disconnected and removed from the concrete pad, salvaged and disposed of at a location directed by Fermilab. The existing conduits feeding the switchboard PHP-MBDB1 for experiment loads will be cut and capped approximately 20 feet from the building. Existing feeder conductors for PHP-MBDB1 will be removed from the conduits. Refer to Appendix A, sheet PDR-3.

3. Disconnection, removal and relocation of existing sump duplex sump pump controller, manual transfer switch and stand-by generator receptacle. Existing

sump pump controller will be located adjacent to the existing transformer concrete pad. New uni-strut frame will be installed to mount new 60 Amp, 3-pole disconnect switch and relocated sump pump controller, manual transfer switch and stand-by generator receptacle. Existing conduits 2-3/4" conduits for sump pumps will be extended to the relocated location of the sump pump controller and new conductors will be installed between the sump pump controller and sump pumps. Refer to Appendix A, sheet PDR-3.

4. Disconnection and removal of existing air-conditioner condensing unit (ACCU). Existing ACCU will be disconnected and removed from the concrete pad, salvaged and disposed off at a location directed by Fermilab. The existing concrete pad will be removed. Existing conductors will be removed from the conduits and conduits will be cut and capped. Refer to Appendix A, sheet PDR-3.

5. Disconnection and removal of existing power distribution equipment. Existing distribution panelboards, power panelboards, low voltage transformers and disconnect switches will be removed, salvaged and disposed off at a location as directed by Fermilab. All conduits and conductors associated with the removal of the power distribution equipment will be removed. Refer to Appendix A, Electrical Demolition, sheet PDR-12 for equipment to be removed and salvaged.

6. Disconnection and removal of existing building wiring equipment. Existing general purpose receptacles, welding receptacles and light switches will be removed and disposed of. All conduits and conductors associated with the removal of the building wiring equipment will be removed. Refer to Appendix A, Electrical Demolition, sheet PDR-12 for equipment to be removed.

7. Disconnection and removal of existing interior lighting Fixtures. Existing ceiling mounted fluorescent light fixtures, wall mounted light fixtures, emergency light fixtures and exit signs will be removed and disposed of. All conduits and conductors associated with the removal of the interior lighting fixtures will be removed. Refer to Electrical Demolition Exhibit for interior lighting fixtures to be removed.

8. Disconnection and removal of existing HVAC equipment. Existing rooftop unit CRU-1 and supply fan SF-1 will be removed and disposed off. All conduits, conductors and piping associated with the removal of HVAC equipment will be removed. Refer to Appendix A, Electrical Demolition, sheet PDR-12 for HVAC equipment to be removed.

COST AND SCHEDULE

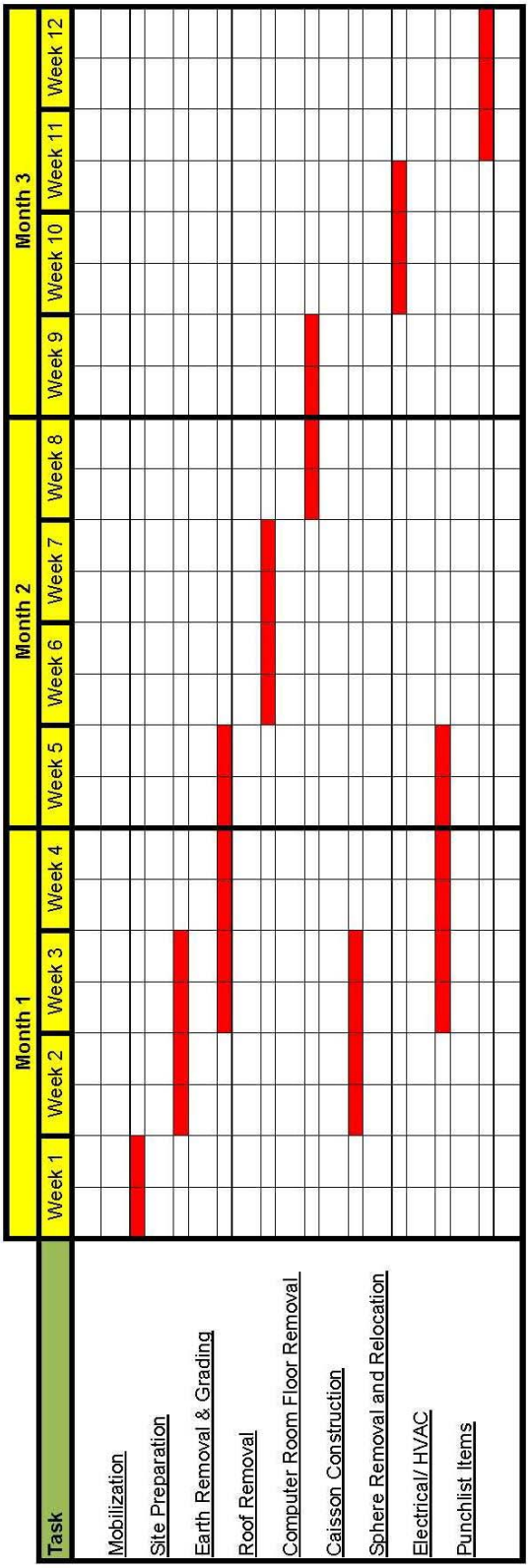
Cost Summary

Listed below is the summary table of the costs associated with the scope of work contained in this project definition report.

DESCRIPTION OF WORK	COST	TOTAL
Civil	$73,000	
Structural	$1,044,000	
Electrical//HVAC	$35,000	
Overhead & Profit	$214,000	
Economic Conditions & Training	$35,000	
		$1,401,000

Preliminary Project Schedule

Listed below is the preliminary project schedule of the major activities and milestones associated with the scope of work contained in this project definition report. This schedule will be updated upon concurrence of the PDR with the Fermilab staff.

MILESTONE	DEFINITION	BASELINE
Start Engineering	Prepare Project Plans and Construction Documents	Month 0
Awarding Process	Contractor Selection & Agreement	Month 3
Begin Construction	Notice to Proceed & Purchase Order Issued	Month 4
Construction Complete	Final Acceptance of Work	Month 6
Engineering Complete	Completion of Close-out Documents	Month 7
Project Complete	Project Closed	Month 8

Construction Schedule
MiniBooNE Removal Project
Fermi National Accelerator Laboratory
Project No. 6-7-82a