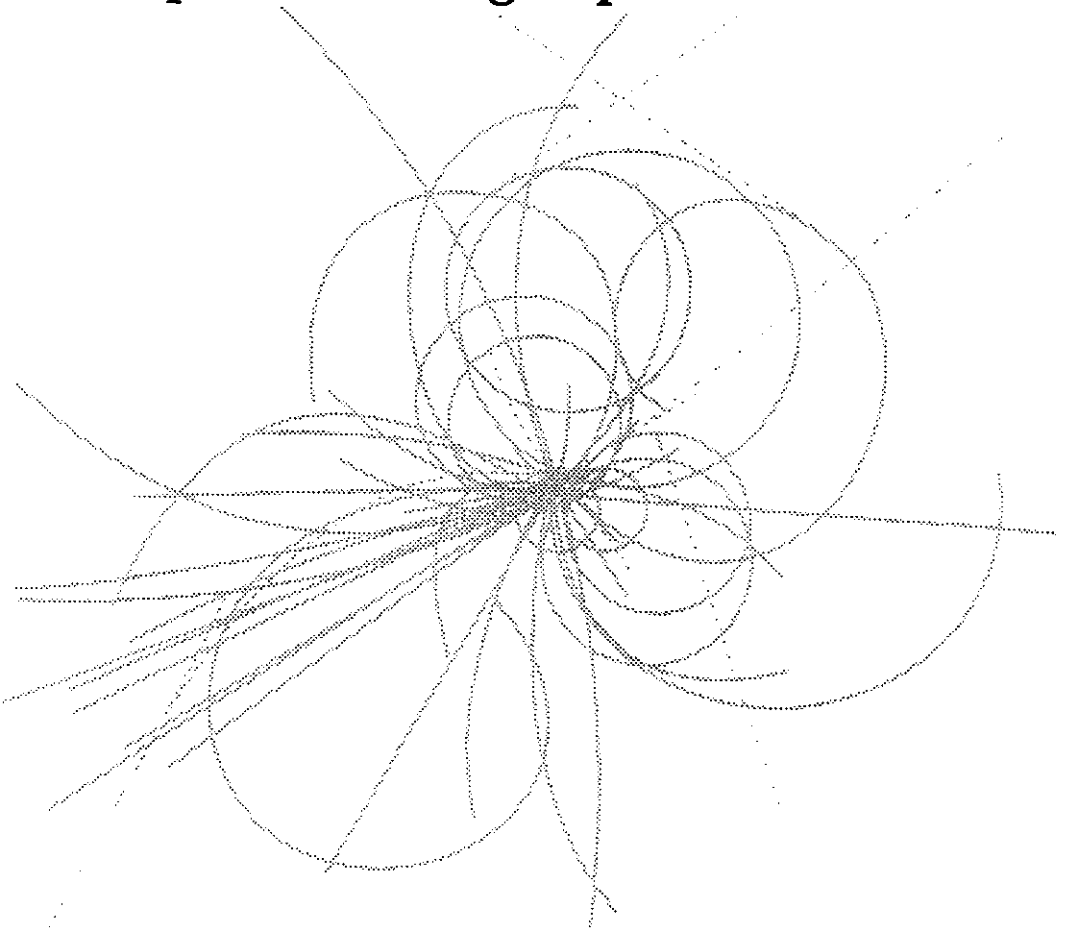
SSCL-N-736

Superconducting Super Collider Laboratory



Design Requirements Work Package Magnet Development Laboratory

Craig Trimble

September 1990

For Internal Use Only

SSCL-N-736

DESIGN REQUIREMENTS WORK PACKAGE MAGNET DEVELOPMENT LABORATORY

Craig Trimble

Superconducting Super Collider Laboratory†
2550 Beckleymeade Ave.
Dallas, TX 75237

September 1990

†Operated by the Universities Research Association, Inc., for the U.S. Department of Energy under Contract No. DE-AC02-89ER40486.

DESIGN REQUIREMENTS WORK PACKAGE
MAGNET DEVELOPMENT LABORATORY
Superconducting Super Collider

September 1990

Approvals:

Ted Kozman

~~Richard Briggs~~ TED KOZMAN
~~Deputy Director~~/Project Manager
SSC Laboratory

Thomas O. Bush
Associate Director, Magnet Systems Division
SSC Laboratory

Jim Sanford, Acting Director
Conventional Construction Division
SSC Laboratory

Document Production:

Craig Trimble
Conventional Construction Division

TABLE OF CONTENTS

1. Scope of Work 1
- 1.1 Introduction 1
- 1.2 Work Package Scope 1

2. Management Plan 3
- 2.1 Introduction 3
- 2.2 Facility Scope 3
- 2.3 Roles and Responsibilities 3
- 2.4 Key Individuals for Project Working Group 4
- 2.5 Meetings and Reviews 4

3. Design Requirements 5
- 3.1 Program Data 5
  - 3.1.1 Functional Use and Relationships to Other Facilities 5
  - 3.1.2 Personnel and Area Requirements 6
  - 3.1.3 Facility Data 10
  - 3.1.4 Construction Quality 10
- 3.2 System Descriptions 10
  - 3.2.1 Foundations 10
  - 3.2.2 Substructure 11
  - 3.2.3 Superstructure 11
  - 3.2.4 Exterior Closure 12
  - 3.2.5 Roofing 12
  - 3.2.6 Interior Construction 12
  - 3.2.7 Conveying Systems 12
  - 3.2.8 Mechanical 13
  - 3.2.9 Electrical 14
  - 3.2.10 SSC Furnished Equipment 15
  - 3.2.11 Site Work 15

4. MSF Complex Off-Site Infrastructure Requirements 17
- 4.1 Introduction 17
- 4.2 Roadways 17
- 4.3 Water Supply 17
- 4.4 Drainage and Sewage Systems 18
- 4.5 Natural Gas 18
- 4.6 Electric Power 18
- 4.7 Communications 19

APPENDIX: 20
Design Reference Standards 20
National Standards 20
State and Local Codes and Requirements 20
Highway Standards 20
Environmental Guidelines 21
Climatic Conditions 21
Interfaces with State and Private Infrastructure 21

TABLES

Table 3.1 7
MDL Space Requirements 7
Table 3.2 10
Water, Sewage, Natural Gas, and Electrical Requirements 10
Table 3.3 13
Inside Design Conditions 13
Table 3.4 14
Lighting Levels 14
Table 3.5 16
MSF Complex Paving Requirements 16
Table 4.1 18
Estimated MSF Complex Utility Requirements 18
Table A.1 22
Environmental and Regional Data 22
Table A.2 23
Special Slab Conditions 23

FIGURES

Figure 1.1. Schematic Site Plan—Magnet Support Facilities Complex. 2
Figure 3.1. Magnet Logistics Flow. 5
Figure 3.2. Functional Adjacencies. 8
Figure 3.3. MDL Equipment Layout—High Bay. 9

1. Scope of Work

1.1 Introduction

The magnet development laboratory (MDL) is a component of the Superconducting Super Collider (SSC). The SSC is in Ellis County, Texas about 30 miles south of Dallas. The MDL is one facility comprising the magnet support facilities (MSF) complex. The MSF complex will be located within Ellis County.

1.2 Work Package Scope

Property Acquisition. Approximately 25 acres of property (not including area associated with access roads and easements) may be needed should the magnet support facilities be sited in a complex. (A schematic site plan detailing with the exterior site flows between MSF is shown in Fig. 1.1.)

Site Surveys and Geotechnical Investigation. The SSC's contractor will obtain all necessary out-boundary and topographical surveys, and all geotechnical data and reports for the MDL.

Off-Site Infrastructure. TNRLC will be responsible for all design and construction of necessary roads, electric power, water, sewage, and gas services for the MDL. Requirements for off-site infrastructure are described in Section4 of this work package.

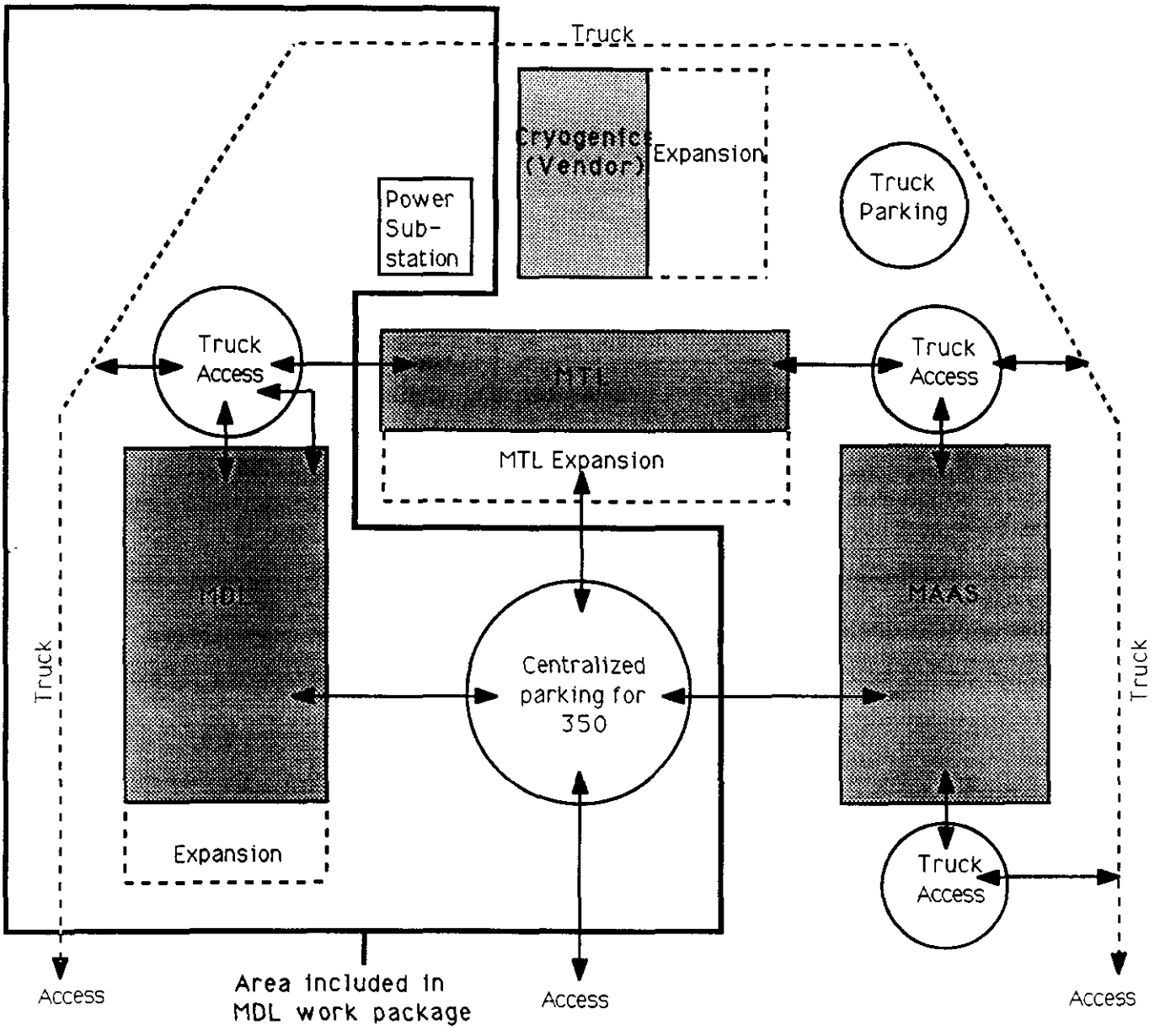


Figure 1.1. Schematic Site Plan—Magnet Support Facilities Complex.

2. Management Plan

2.1 Introduction

This management plan briefly outlines the responsibilities of the various participants and the principal actions required by all parties.

2.2 Facility Scope

The MDL will be a 109,000 square-foot building containing offices and assembly bays.

2.3 Roles and Responsibilities

Defined below are the roles and responsibilities of the various participants in the construction of the MDL.

Office of the Superconducting Super Collider (OSSC). OSSC is the DOE headquarters office in Washington, D.C. This office has the authority to approve any SSC construction. The OSSC is also responsible for the acceptance of the land titles for SSC building sites. DOE will also determine how the National Environmental Protection Act (NEPA) review process will be handled for this research and development facility.

On-Site Project Office (OPO). The OPO is responsible for DOE monitoring of SSC construction activities. OPO staff will attend design reviews and management meetings as appropriate.

SSC Laboratory.

Texas National Research Laboratory Commission (TNRLC). The TNRLC will be responsible for the design and construction of off-site infrastructure of the MSF complex on behalf of the SSC Laboratory and the DOE. The TNRLC will utilize a combination of its staff, SSC Laboratory staff, and contractors procured by TNRLC for design and construction. Specifically, the TNRLC is responsible for the following:

1. Assigning the MDL status and a project director within the TNRLC line organization.
2. Acquiring the necessary land by title transfer.
3. Funding construction of the MDL's off-site infrastructure.
4. Selecting and managing an engineering firm to design, estimate, schedule, and monitor construction of the MDL's off-site infrastructure.
5. Advertising and awarding the construction contract(s).
6. Maintaining a fund of 10 percent of building costs for purchasing infrastructure (power, water, sewer, rail, roads, and so forth) if not provided by Ellis County or the utility companies.
7. Managing the off-site construction process on behalf of the SSC Laboratory and DOE by using TNRLC management and technical staff to supervise and

coordinate functions, and TNRLC contractors and consultants to carry out scheduled activities.

8. Periodic reviews with the SSC Laboratory and DOE.

2.4 Key Individuals for Project Working Group

Day-to-day coordination of the project will be the responsibility of the following lead individuals for each organization. These individuals will keep their organizations informed of project status and progress:

- SSC Laboratory: magnet systems (MDL) project manager and conventional construction's liaison.
- A-E/CM (SSC): project manager
- DOE-OPO: conventional facilities manager.
- A-E: project manager.
- TNRLC: project director.
- E-A (TNRLC): project manager

2.5 Meetings and Reviews

Starting with notice to proceed, there will be management meetings at appropriate intervals of the joint project management group. The SSC's A-E/CM will publish a proposed meeting and milestone review calendar which will denote TNRLC participation in both the project coordination group and the joint project management group.

3. Design Requirements

3.1. Program Data

3.1.1 Functional Use and Relationships to Other Facilities

The MDL will be utilized for the assembly of prototype and production of collider magnets which will be tested and subsequently installed in the SSC ring and injector area. The MDL will then function as a research and development facility for magnets.

The MSF complex may consist of the MDL, the MTL, and the MAAS buildings. (See Fig. 1.1. Schematic Site Plan - Magnet Support Facilities Complex, in Sec. 1 of this document.) See Fig. 3.1 below for a depiction of the relationship of the MDL component facilities as they relate to the magnet logistic flow.

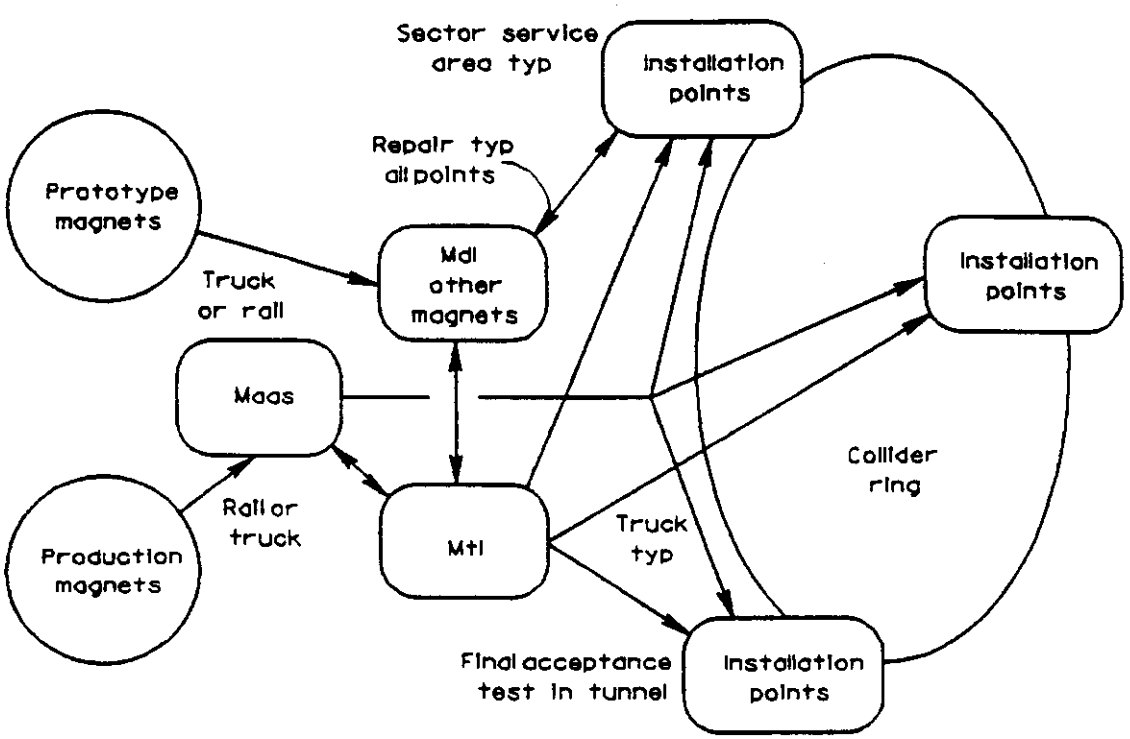


Figure 3.1. Magnet Logistics Flow

3.1.2 Personnel and Area Requirements

The MDL will operate with a staff of technicians working on two shifts. It will also provide office space for professional personnel and technical managers. and will also serve as the central office for the Magnet Division permanent professional staff. Additional technical and professional personnel will work at the facility during construction of the SSC.

The square footage requirements for the MDL are given in Table 3.1. The spatial adjacencies for the MDL are shown in Fig.3.2, and the equipment layout in the high bay area is shown in Fig. 3.3. Each area will require further programming by the A-E/CM to define layout and equipment fit-up, and to verify square footage.

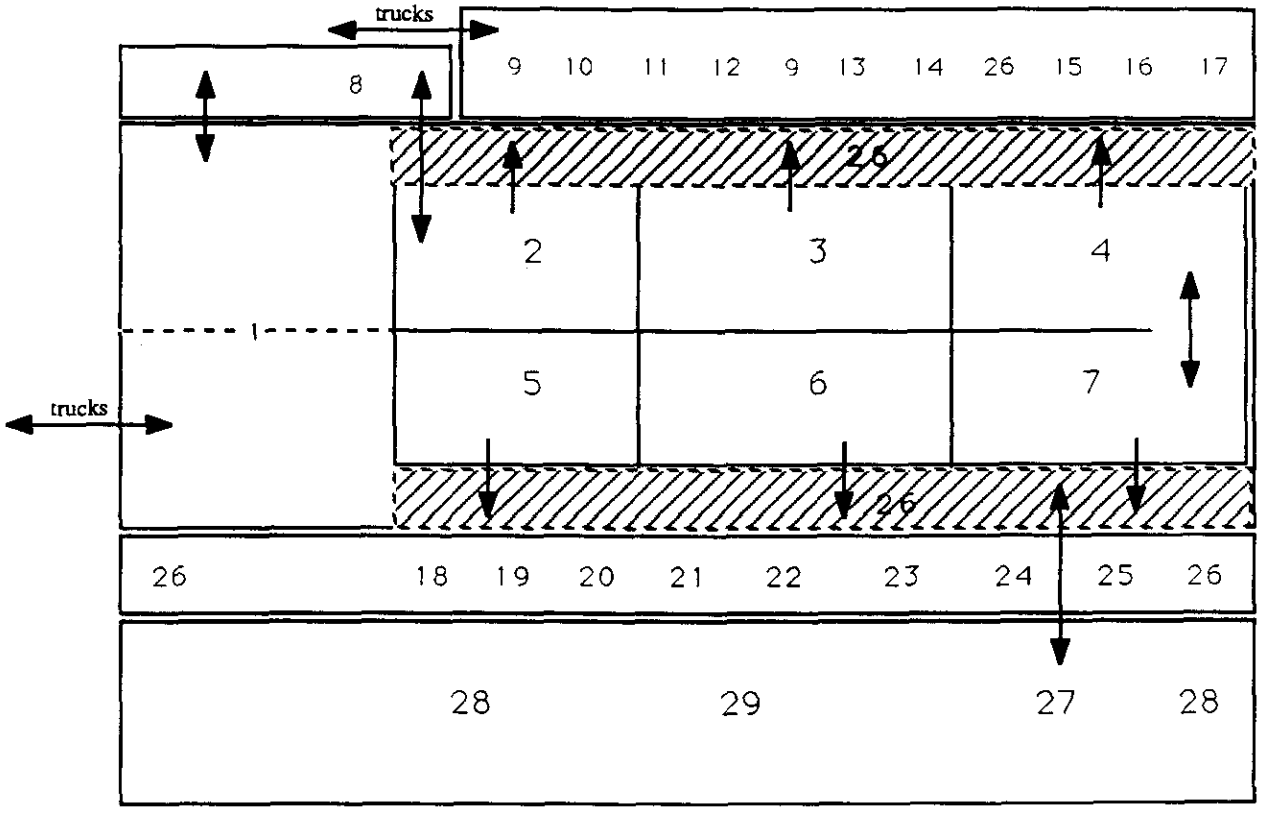
The A-E/CM will receive and should reference the following documents provided through the Magnet Division's project manager for establishing functional affinities, space and convention systems "fit up" requirements for technical systems in the MDL:

Preliminary - MDL Shop Area Layout (plans) (7/25/90)
Draft - MDL Production Floor (8/2/90)

Table 3.1
MDL Space Requirements

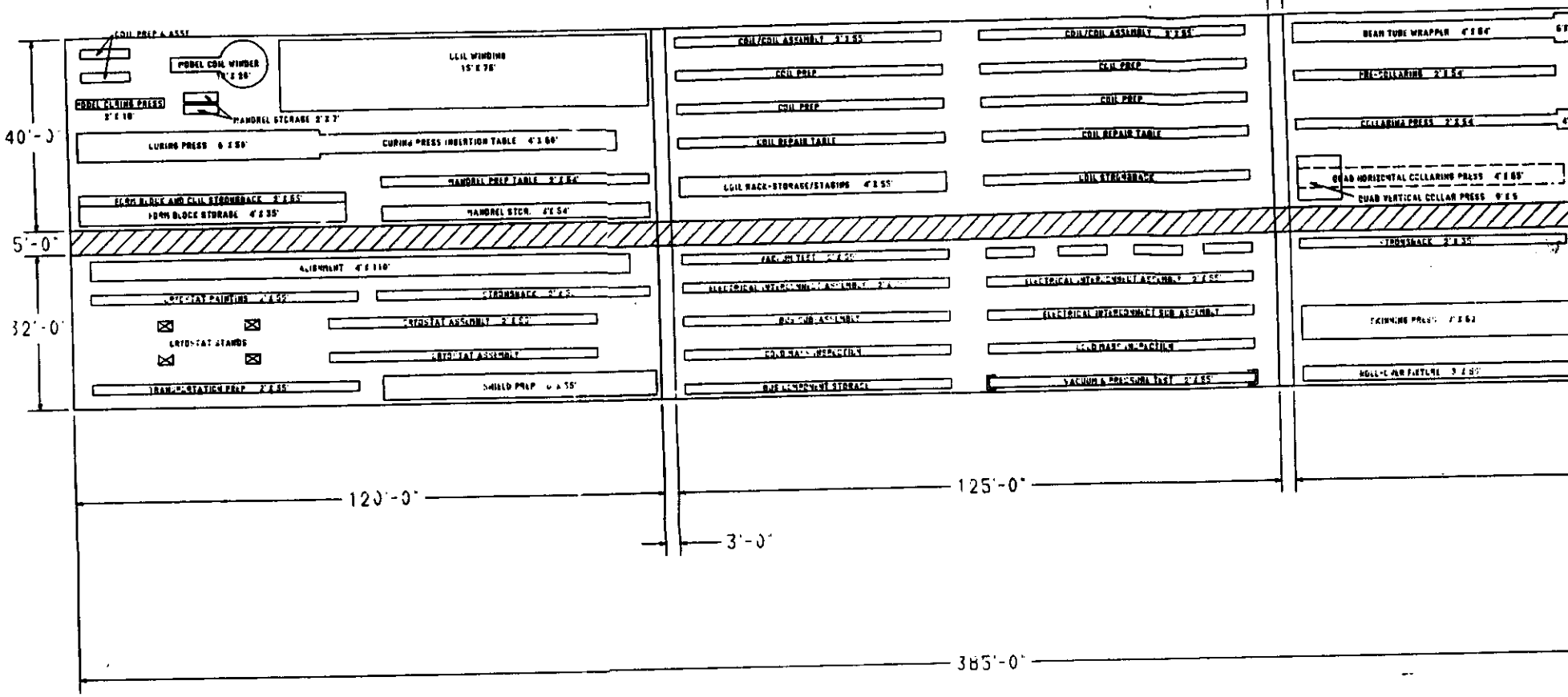
	Functional Description	Area (Sq. Ft.)	
I. Magnet Production Line: (Machine drawings to further define Fig. 3.3 will be available at pre-design conference.)	1. Shipping/Receiving and Storage	9350	
	2. Coil Winding Area	4800	
	3. Curing	5200	
	4. Coil Preparation Area	5200	
	5. Align./Transp. Prep/Cryo Assembly	4800	
	6. Bus Installation and Testing	5200	
	7. Collaring/Skinning	5600	
	8. Cable Wrapping	2380	
	Subtotal Production Areas		42530
II. Support Areas:	9. Quality Control	2950	
	10. Refrigerator and Freezer	950	
	11. Coil Preparation Area	1520	
	12. Vacuum Test Area	760	
	13. Electrical Preparation and Electronics	1900	
	14. Mech. Subassembly /Collar Lamination Area	1900	
	15. First Aid	570	
	16. Computer Room	1140	
	17. Mole	950	
	18. Survey Group	1140	
	19. Maintenance Area	1330	
	20. Weld Shop	760	
	21. Tool Crib	950	
	22. Machine Shop	4750	
	23. Yoke Lamination Area	1330	
	24. Vacuum Leak Test	950	
	25. Magnet Disassembly Area	1200	
	Subtotal Support Shop		25050
III. Miscellaneous Areas:	26. Factory Aisles	11600	
	27. Entry	510	
	Subtotal Miscellaneous Areas		12110
IV. Offices and Support Areas:	28. Staff Area - 150 @ 135 square feet*	19980	
	29. Building Systems**	9330	
	Subtotal Office and Support Areas		29310
	Total Square Footage (not to exceed)		109,000

*135 square feet per person includes circulation, conference rooms, and cafeteria.
** Mechanical, electrical, telephone, elevator, toilets, vending.



Note: (1) See Table 3.1 for legend of area function names and allotted square footage.
(2) For layout of areas 2-8 see Figure 3.3.

Figure 3.2. Functional Adjacencies.


COIL PREP & ASSY
MODEL COIL WINDER
COIL WINDING
15' X 75'
MODEL CURING PRESS
MANDREL STORAGE 2' X 7'
CURING PRESS
CURING PRESS INSERTION TABLE 4' X 60'
MANDREL PREP TABLE
FORM BLOCK AND COIL STORAGERACK
FORM BLOCK STORAGE 4' X 35'
MANDREL STOR. 4' X 54'
ALIGNMENT 4' X 110'
CRYOSTAT PAINTING
STORAGERACK
CRYOSTAT ASSEMBLY
CRYOSTAT STANDS
CRYOSTAT ASSEMBLY
TRANSPORTATION PREP
SHIELD PREP
COIL/COIL ASSEMBLY
COIL/COIL ASSEMBLY
COIL PREP
COIL PREP
COIL PREP
COIL PREP
COIL REPAIR TABLE
COIL REPAIR TABLE
COIL RACK-STORAGE/STAGING
COIL STORAGERACK
ELECTRICAL INTERCONNECT ASSEMBLY
ELECTRICAL INTERCONNECT ASSEMBLY
ELECTRICAL INTERCONNECT SUB ASSEMBLY
COLD MASS INSPECTION
COLD MASS INSPECTION
VACUUM & PRESSURE TEST
BEAM TUBE WRAPPER
PRE-COLLARING
COLLARING PRESS
QUAD HORIZONTAL COLLARING PRESS
QUAD VERTICAL COLLAR PRESS
STORAGERACK
SKINNING PRESS
ROLL-ON FIXTURE
40'-0"
5'-0"
32'-0"
120'-0"
125'-0"
3'-0"
385'-0"

3.1.3 Facility Data

Equipment Interfaces. Refer to Table A.2 in the appendix for structural interfaces.

Utility Requirements. Preliminary water, sewage, natural gas, and electrical requirements are listed in Table 3.2. All loads must be re-verified during schematic design.

Occupancy. The building occupancy will be primarily industrial in nature. The MDL will house technicians who will develop and manufacture magnets. Additionally, the MDL will provide office space for professionals and technical management.

Table 3.2
Water, Sewage, Natural Gas, and Electrical Requirements

Domestic Water	51,000	gpd
Sanitary Sewer	24,000	gpd
Fire Water	1,000	gpm
Storm Drainage	3,500	gpm
Irrigation Water	3,000	gpd
Natural Gas	3,700	cfh
Electrical	3,718	@480V

Hours of Operation. There will be a maximum of two shifts of 8 hours each per day in the production area, with a typical 8- to 12-hour-per-day occupancy in the offices.

3.1.4 Construction Quality

Design Life. The MDL should be designed for a 30-year life expectancy.

Public Access. The MDL main entry and access to the high bay assembly area should be designed to accommodate public tours.

3.2 System Descriptions

3.2.1 Foundations

Performance Requirements. Vertical movement of the total foundation system will be limited to the following:

- Superstructure Support : ±1/4 inch.
- Equipment Support: See Table A.2 in the appendix.

Interface with Technical Equipment. See Table A.2 in the appendix for equipment loading information.

Material/Equipment Restrictions. The 28-day compressive strength of concrete will be determined based on strength requirements and cost-effective design, but will not be less than the following minimum values:

- Drilled Piers: 3,000 psi.
- Grade Beams: 3,000 psi.

3.2.2 Substructure

Description of System Components. The substructure will consist of a concrete floor overall in the high bay area with trenches for utility distribution, as indicated on the floor plan. (Figures 3.2 and 3.3.) Additionally, any tie-ins to utilities, tunnels, or trenches are included and extend 5 feet outside the building line. Foundations or concrete pads will be provided for any exterior storage building, exterior exchanger enclosure, and exterior heating, ventilating, and air conditioning unit(s).

Special Requirements. Depressed floor slabs will be provided at freezer and refrigerator locations that permit the placement of insulation and finish wearing slab without requiring ramps or steps to the freezer/ refrigerator floor. The slab will be independent of other surrounding foundations and wall support systems. Freezer/refrigerator wearing slabs and insulation will be proportioned to meet strength and heat transmission requirements. (Refer to Table A.2 in the appendix for floor loadings in freezer/refrigerator areas. See Section 3.2.8 for subgrade warming system requirements to prevent subgrade freezing beneath freezers.)

Interfaces with Technical Equipment. See Table A.2 in the appendix for slab loading information.

Material/Equipment Restrictions. The 28-day compression strength of concrete will not be less than the following minimum values:

- Slabs on grade: 4,000 psi.
- Equipment pads: 3,000 psi.

3.2.3 Superstructure

Description of Superstructure Components. The building will include two adjacent high bay spaces that are attached to support spaces. The clear height to the bottom of the high bay will be sufficient to allow for required clearances above the bridge cranes and to provide for a hook height requirement of 25 feet. The height from the bottom of structure will be a minimum of 12 feet in the support (administrative) spaces and 18 feet in the shop areas. The structure will be designed to support one bridge crane in each high bay space (two high bay spaces—one on each side of center dividing wall), and will accommodate transfer rails linking the bridge cranes at two locations. Transfer rails will be located at the shipping and coil preparation areas. (Bridge crane number(s) and layout will be verified with the SSC liaison during final programming.) The minimum clear distance between columns will be 20 feet in each area. Lateral X-bracing for buildings (if used) will not interfere with possible building expansion on one end of the building. Truss-type bracing in a horizontal plane at the roof level will be used to distribute lateral loads in lieu of utilizing the diaphragm action of the roof deck.

Performance Requirements. Superstructure design loads include the live, dead, crane, and overhead door loads. The building shall be designed to resist lateral loads in accordance with DOE criteria. Lateral drift will be limited to a maximum of height/240.

Structure Support of Hoist. See the overhead bridge crane description (Section 3.2.7. Conveying Systems for loads. One monorail beam with a 2-ton hoist will be supported from the second-level framing and located in the lamination area.

3.2.4 Exterior Closure

Exterior Walls. The exterior walls should have a minimum R factor to meet or exceed DOE energy criteria.

Exterior Doors and Windows. Windows should accommodate insulating glass. Exterior doors will be insulated. Overhead doors in the shipping/receiving area should be insulated overhead doors 12 feet wide by 15 feet high. Doors in the storage shipping/receiving area will consist of a pair of 10-foot-wide-by-25-foot-high steel-bottom-rail-supported, automatic, hangar-type sliding doors for crane access between areas. Fifteen-foot-wide-by-25-foot-high, steel-bottom-rail-supported, automatic, hangar-type sliding doors will be used between the shipping/receiving areas and the cryostat and storage areas. An overhead door 54 feet wide by 10 feet high will separate the cold mass disassembly and skinning press areas. All other interior overhead doors will be 8 feet wide by 10 feet high. (Please reference Magnet Division's data cited in 3.1.2 for door sizes and locations.)

3.2.5 Roofing

The roof system should be insulated, equal to or exceeding single-ply membrane over rigid insulation in performance characteristics and warranties, with a minimum R factor to meet DOE energy criteria.

3.2.6 Interior Construction

Partitions. Concrete masonry units (reinforced as required by code) should be considered for usage in the production and support shop areas to protect from industrial usages. Steel stud and drywall partition systems with sound insulation batts should be installed in all administrative areas. Open office system partitions will be furnished and installed by the SSC Laboratory. Plastic strip air curtains will be provided over partial height walls surrounding the shipping/receiving area so that bridge crane movement is not impeded.

3.2.7 Conveying Systems

Elevators (if required). A minimum rate of travel will be 100 feet per minute, 2500 pound capacity. Elevators will be hydraulic.

Cranes. Two 25-ton overhead cranes will be provided to travel to any assembly bay and staging area. (Verify during final programming.) Bridges = 55-foot; hook height = 25-foot minimum. Speed: trolley = 50 feet per minute, bridge = 100 feet per minute, hoist = 15 feet per minute. Controls: hoist = 5 step variable speed, bridge and trolley = variable speed.

Hoists. One 2-ton hoist will be provided on a monorail beam in the lamination area. It will have a 15 foot per minute maximum speed and variable-speed controls. All cranes and hoists will be designed in accordance with the Crane Manufacturers' Association of America Standard 70 requirements.

3.2.8 Mechanical

Plumbing. Other than normal systems to support building functions, plumbing will include compressed air systems. The compressed air system will consist of a duplex air compressor unit, air receiver, air filter, and dryer and piping with 100 psi capacity. Plumbing utilities will be extended to SSC Laboratory furnished equipment locations (reference 3.1.2). Final connections will be made by the equipment vendor.

Heating, Ventilating and Air Conditioning (HVAC). HVAC design will be in accordance with DOE criteria and within the preliminary requirements listed in Table 3.3.

Table 3.3
Inside Design Conditions

Area	Winter	Summer
Offices, Laboratories, Workshops	72°F DB	78°F DB/50% RH
Storage	55°F DB	78° F DB/50% RH
Toilets, Lunch Rooms	70°F DB	78°F DB/50% RH
Shops	72°F DB	78°F DB/50% RH

Special HVAC Requirements. Air handling units will be provided with high efficiency filters (65 percent). In addition pre-filters will be provided on those air handling units serving the beam tube, curing and coil press areas. All air handling units will have the capability to operate on an economizer cycle. In the curing press, collaring press, skinning press and cryostat assembly areas, welding exhaust systems with fume hoods and flexible tubing with portable magnetic base fume receptors will be provided. An exhaust system for removing curing process fumes will be provided in the curing press area. A combined pneumatic-electronic (direct digital control) HVAC control system will be designed. Controls and instrumentation will be selected to allow interfacing with a future central energy management and control system (EMCS). An underfloor subgrade warming system will be required to prevent subgrade freezing beneath freezer areas.

Fire Protection. The fire suppression system will be hydraulically designed automatic fire sprinkler systems in accordance with DOE design criteria. Special consideration will be given to a dry pipe pre-action system in areas housing heavy electronics gear.

Mechanical Work by Others. SSC Laboratory furnished equipment and systems such as refrigerators and freezers, heat exchangers and pumps for process, steam generators, curing ovens, and machine shop equipment will be installed under separate contracts.

Special Mechanical Systems. A grease interceptor will be provided in the sanitary sewer line receiving drain water from kitchen plumbing fixtures. An oil separator will be

provided in the sanitary sewer line receiving drain water from the utility trench or any trenches over which vehicles park.

3.2.9 Electrical

Emergency Generator. An engine generator will be specified unless dual primary service is provided from separate grids. It should be sized to supply continuous power for the curing and skinning presses only.

Raceways. Rigid galvanized steel conduit will be utilized in any work beneath 8 feet above the finished floor and in concrete-embedded locations. EMT with compression fittings may be utilized in other locations within the building. Aluminum cabletray will be used for communication, data, and control cabling when several cables are involved in a common run.

Lighting. Incandescent and high intensity discharge (HID) high bay fixtures will be utilized in the machine shop, refrigerator/freezer area, and high bay central area. Maintained lighting levels will be shown in Table 3.4.

Table 3.4
Lighting Levels

Area	Lighting Level (footcandles)
Offices	70
High Bay Area	100 (at task area)
Catwalks	30
Lobby	30
Service Areas	20
Electrical and Mechanical Rooms	30
Other areas	IES standards

Special Electrical Systems. A telephone switchroom will be provided. Two underground conduits will be installed from the switchroom to a designated connection point established by the telephone company. Requirements for conduit and cabletray are based on one twisted pair of wire per each outlet and an estimated one outlet each for telephone and data base for each 200 square feet of floor area. Distribution trunk lines constructed of two concrete-encased conduits will be run underground between buildings. Telephone, video tele-conferencing, and data base transmission from other special facility systems will be transmitted from the MDL to the main control room in the future office/laboratory building on the west campus via the local common carrier network (e.g.. Southwestern Bell Telephone Company, MCI or others).

A zoned fire alarm detection system with a central control panel will be installed. The control and annunciator panel will be located at the security station. The system will monitor ionization smoke detectors in the supply air ducts and the computer room, manual pull stations at doors of egress, and the sprinkler system flow and tamper switches.

A facility ground grid will be required. A parallel instrumentation and computer grounding system will be established.

Dry type transformers providing step-down voltages of 480-120/208 V, 3-phase, 4 wire and 480/240 V, 3-phase, will be located at points of utilization throughout the building.

Final equipment and modular office electrical connections will be the responsibility of the MDL contractor through their equipment suppliers. Provision will be made in the high-bay process area for motor control centers with floor trenches to act as flexible locations for equipment cables.

3.2.10 SSC Furnished Equipment

Heat Exchanger. A heat exchanger will be furnished and installed by the SSC Laboratory.

Cooler/Freezer. The cooler/freezer will contain approximately 950 square feet. One-third of this unit will maintain 10°F, and two-thirds of the unit will maintain 40°F. The unit will have a door with a hydraulic hand lift that can withstand up to 800 pounds of force. The cooler panels will house a minimum "U" value of 0.030. The freezer panels will house a minimum "U" value of 0.024.

Food Service. Food service equipment will be designed and furnished by the Architect-Engineer (A-E) to provide a short order/salad bar serving unit and associated seating for approximately 100 persons.

Furnishings. All office, laboratory, shop, and kitchen furnishings will be provided by the SSC Laboratory.

3.2.11 Site Work

Site Preparation. Site preparation will include select clearing, removal, and salvage of topsoil; excavation of unsuitable material under the building, roads, and parking areas; and backfill with suitable materials. A minimum 4-inch thick layer of topsoil will be placed on all earth areas as finish grading. Excess and unsuitable soil will be removed from the property.

Parking, Roads and Walks. Paved parking areas will be needed to accommodate 350 automobiles and two AASHTO type WB-50 trucks. Pavement material will be concrete on suitable base material having properties required to support applied wheel loads. Traffic aisles in automobile parking areas will be designed to support fire truck wheel loads. Minimum requirements for paving concrete will be as shown in Table 3.5.

Site Development. There will be no requirement for fencing. Signs will be provided at entrance roads and will be consistent with the character of the overall SSC Laboratory sign scheme approved by CCD's liaison.

Landscaping. Disturbed areas will be seeded between building and parking areas, in areas on the site plan designated as landscaped, and 15 feet around the perimeter of all roads and buildings. Other areas disturbed by construction will be restored to be consistent with adjacent vegetation. All disturbed areas or areas to receive seed will have 4 inches of finely graded topsoil. Landscape design will be in accordance with the SSC Laboratory design guidelines and approved by CCD's liaison.

Table 3.5
MSF Complex Paving Requirements

Use	Min. Thickness	Min. 28-Day Compressive Strength
Truck Roads and Parking	8 inch	4000 psi
Auto Roads and Parking	6 inch	3000 psi
Walks	4 inch	3000 psi

Utilities. A water line will be installed from the MDL water meter to supply water to the MDL for domestic and irrigation purposes. A connection for a fire line to the building will be provided in the water line. A fire line of an appropriate size will be installed from the fire line connection on the water line to the building.

Storm water runoff from the MDL is preliminarily estimated at 3,500 gpm. Roof drains (if utilized) and necessary piping will be installed to direct the runoff to the on-site storm water collection system. The design of the storm water system will include measures for storing runoff for the complete site in excess of current experienced amounts so the post-development runoff will not exceed pre-development characteristics. Sanitary sewage will be piped from the building to a sanitary sewer main.

An on-site natural gas distribution system will be needed from the main line serving the site to the building. In sizing this distribution system, consideration should be given as to how future magnet support facilities will be serviced. The preliminary estimated natural gas requirement for the MDL will be about 3000 cfh.

Electric distribution to the building from the substation serving the site will be run underground. Primary service will be provided in underground duct to a pad-mounted, fused-disconnect switch and transformer. Three-phase 480 V Wye secondary service from the transformer secondary will be run underground to a fused main switchboard braced for anticipated fault currents.

Underground communication conduit will be provided to the MDL from a telephone-company-owned connection point provided at the edge of the property. The conduit will be sized considering that the telephone room and PBX in the MDL will be the central distribution point for all MDL communications and data terminals. Conduit stubouts from the telephone equipment room will be provided for future extension of service to possible adjacent facilities. Capabilities for the network will be provided as follows:

- MDL: One connection per 200 square feet of floor area.
- MDL: Video tele-conferencing capabilities at required SSC locations.

4. MSF Complex Off-Site Infrastructure Requirements

4.1 Introduction

The magnet support facilities (MSF) complex for the SSC will be in Ellis County, Texas. The MSF complex may consist of three major buildings sited adjacent to each other: the magnet development laboratory (MDL), the magnet test laboratory (MTL), and the magnet acceptance and storage (MAAS) building.

Design, estimating, scheduling, and construction of the infrastructure consisting of roads, water, sanitary and storm sewage, electric power, and communications is required by TNRLC. With the construction of the first building, the MDL, all off-site infrastructure required for the entire MSF complex or any site which has been planned for facilities adjacent to the MDL, will be provided. The requirements only for the MSF complex infrastructure are described in this document.

4.2 Roadways

Truck and automobile traffic will have direct access to the MDL site. Most of the 350 autos that will access the site daily are expected to arrive between 7 a.m. and 9 a.m., and leave between 5 p.m. and 7 p.m. Trucks transporting SSC magnets and other supplies will enter and exit the MDL area throughout the day. The heaviest truck loads will require roads and bridges rated for AASHTO-type WB-50 trucks, including a load limit of 58,420 pounds.

4.3 Water Supply

Water is required for domestic purposes, irrigation, makeup water for cooling and heating, and fire suppression. Preliminary fire flow requirements are 1,000 gpm at a residual pressure of not less than 10 psi at each hydrant within or adjacent to the MSF complex. Estimated requirements by building for domestic, fire suppression, and irrigation water are summarized in Table 4.1.

Table 4.1
Estimated MSF Complex Utility Requirements

	MDL	MTL **	MAAS	TOTAL
Domestic Water (gpd)	51,000	16,000	14,000	81000
Fire Suppr. Water (gpm)	500	500	500	1,000*
Irrigation Water (gpd)	3,000	3,000	3,000	9,000
Cooling Water (gpm)	30	12	19	61
Sanitary Sewer (gpd)	24,000	16,000	14,000	54,000
Natural Gas (cfh)	3,000	1,600	2,000	6,600
Electrical Loads (kW)	4,189	4,822	1,012	10,023

* 500 gpm sprinkler system requirement plus 500 gpm hose stream requirement.
** MTL includes cryogenics building (vendor supplied).

4.4 Drainage and Sewage Systems

The development of the MSF complex will increase the volume and peak rate of runoff from rainfall. The design of the site improvements will include measures for storing the excess volumes of runoff, and measures for attenuating peak flows so that post-development runoff from the site matches pre-development runoff characteristics.

Sanitary sewer services will be provided. A below-grade sewage pumping station may be required. The design of the pumping station will provide for the sanitary sewage flows from the total complex. Estimated sanitary sewer flows by building for the MSF complex are summarized in Table 4.1.

4.5 Natural Gas

Natural gas is required for heating water for domestic use and for building heating. Estimated requirements by building for natural gas are summarized in Table 4.1.

4.6 Electric Power

The main substation should be a low-profile unit that utilizes metal-enclosed switchgear. All circuits from the substation serving the complex will be in concrete-encased underground ductbanks. The electric utility company will supply the incoming feed and the substation. The primary voltage to serve the facility will be 12.5 kV, 3-phase Wye.

4.7 Communications

Communications services for the MSF will be part of the overall SSC information transport system (ITS). The ITS will connect to the local common carrier network providing a link for telephone, private branch exchange (PBX), data transfer, security, and fire alarm systems. Each workstation at the MSF will be served by a network connection capable of telephone, data, video, and fiber optic traffic. The requirements are as follows:

- MDL: one network connection for each 200 usable square feet of floor area.

APPENDIX:

Design Reference Standards
Environmental and Regional Data
Special Slab Conditions

DESIGN REFERENCE STANDARDS

National Standards

- Occupational Safety and Health Administration (OSHA) regulations.

State and Local Codes and Requirements

- *Uniform Building, Mechanical and Plumbing Code* (1988).
- Texas Revised Civil Statutes, *Elimination of Architectural Barriers*, Article 7, Article 6016.

Highway Standards

- *A Policy on Geometric Design of Highways and Streets* (AASHTO, 1984).
- *Texas State Department of Highways and Public Transportation Standards* (SDHPT).
- *Highway Design Division Operations and Procedures Manual* (SDHPT, as updated).
- *Bridge Design Manual* (SDHPT, as updated).
- *Standard Specifications for Construction of Highways, Streets and Bridges* (SDHPT, 1982).
- *Bridge Detailer's Manual* (SDHPT, as updated).
- *Hydraulic Manual* (SDHPT, as updated).

Environmental Guidelines

- *Final Environmental Impact Statement, (FEIS) Superconducting Super Collider* (DOE/EIS-0138, 1988). The design of the MDL will be required to follow the environmental control standards identified in the FEIS, as well as those of the State of Texas.

Climatic Conditions

The climatic conditions for rainfall, wind, temperature, relative humidity, and frost depth for the project are listed in Table A.1.

Interfaces with State and Private Infrastructure

Interfaces to utility infrastructure systems will be coordinated by the TNRLC and its E-A.

Table A.1
Environmental and Regional Data

Location

Ring Center

North Central Zone, Texas State Plane Coordinate System, based on the North American Datum (NAD) of 1927 (NAD'27)

N 252,561.3010
E 2,213,072.3336
Global Lat. N 32° 21' 31"
Global Long. W 96° 48' 35"

Elevation

Ring Center - 520 feet mean sea level *

Elevation Range Along Ring Perimeter - 760 to 410 feet mean sea level*

Temperature Conditions

Process (high bay areas), Laboratory, and other uses where close temperature and humidity control is required.

Winter:	18°F Dry Bulb
Summer:	102°F Dry Bulb
	78°F Wet Bulb

Personnel Comfort Systems:

Winter:	22°F Dry Bulb
Summer:	100°F Dry Bulb
	78° Wet Bulb

Cooling Towers and Research, Technical Systems 78°F Wet Bulb

Air-Cooled Condensers: 107°F Dry Bulb

Mean Daily Range: 20°F

Median of Annual Extremes:

Maximum:	107°F Dry Bulb
Minimum:	11.5°F

Annual Degree Days: Base = 65°F 266 Degree Days

Wind

Prevailing Wind (Mean Average):

Winter, North:	13 mph
Summer, South:	9 mph

Wind Speed for Determining Design Wind Pressure: 70 mph

Maximum Rainfall per Half Hour: 2.3 inches **

Extreme Frost Penetration in Soil: 10 inches

---

* Mean sea level is based on the National Geodetic Vertical Datum of 1929 (NGVD'20)

** 10 yr. - Rainfall Frequency Atlas, US Tech Paper 40, National Weather Bureau

Table A.2.
Special Slab Conditions

Additional Loading/Special Conditions

Slab Loadings

Office	100 psf	
Electrical Control Rooms	250 psf	
Slabs-On-Grade		
Uniform Load	500 psf	
Linear Load	750 psf	@ 2 ft O.C.
Fork Lift Truck Capacity	8000 lbs	
Point Loads - See Sketches 1 through 5		
Shipping/Receiving Area	AASHTO H20-44	Truck Load
15-ft wide side aisles	AASHTO H20-44	Truck Load

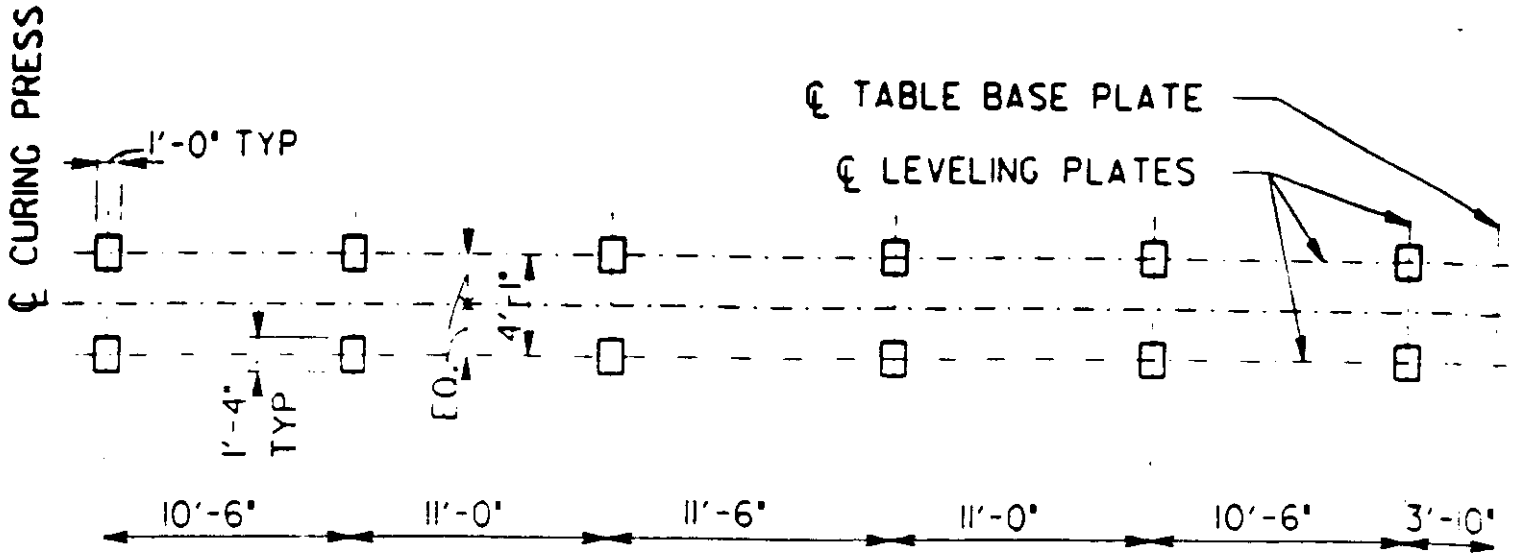
Freezer Area - Capable of stacking a maximum of three 28-in. diameter spools weighing 750 lbs each

Equipment Weights - (See Plan-Table B, Sketch 5 for Locations)

Curing Press and Curing Press Feed Table - See Sketch 1
Collaring Press and Collaring Press Staging Table - See Sketch 2
Skinning Press and Skinning Press Staging Table - See Sketch 3 & Note A
Cold Mass Disassembly Tables (in Cold Mass Area) - See Sketch 4
Work Tables - See Sketch 5

Note A: Vertical movement of the foundation will be limited to 1/1000 inches in a 60 ft length.

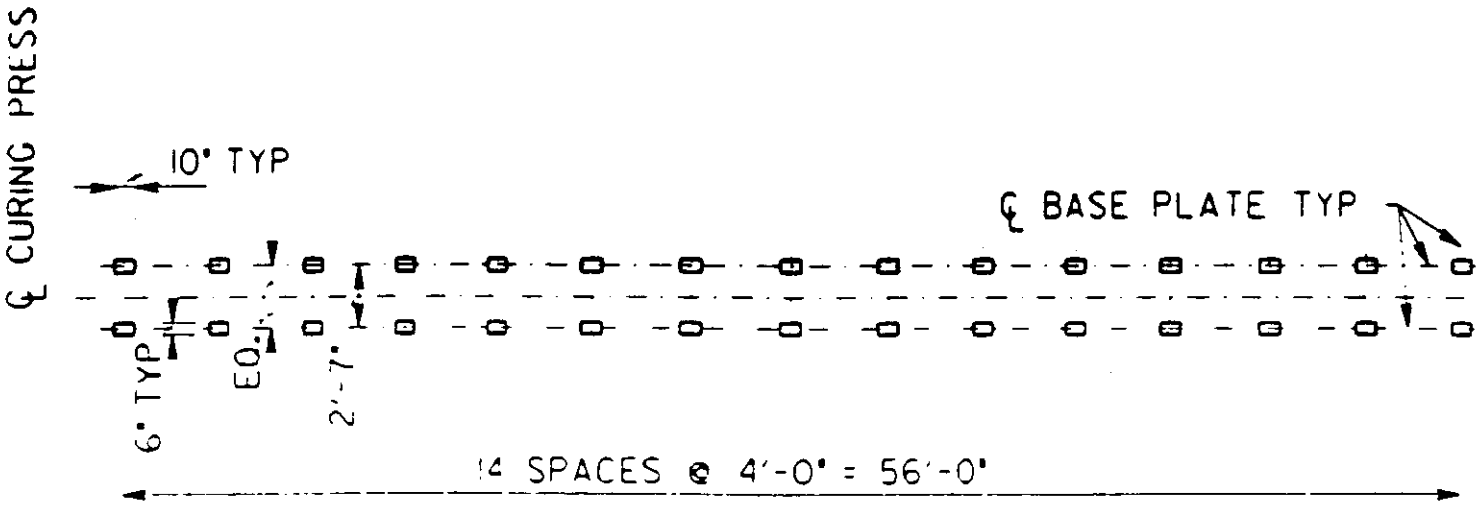
B: The final loads and dimensional information for the presses may vary from those given in the following sketches. The final loads and dimensions will be provided during the design process.



NOTE:
LEVELING/BEARING PLATES WILL BE PROVIDED AND INSTALLED BY THE EQUIPMENT SUPPLIER CAPABLE OF SUPPORTING POINT LOADS OF 21.0 KIPS EA. ACTUAL BEARING PLATE SIZE MAY VARY.

PLAN - CURING PRESS LEVELING PLATES

NTS

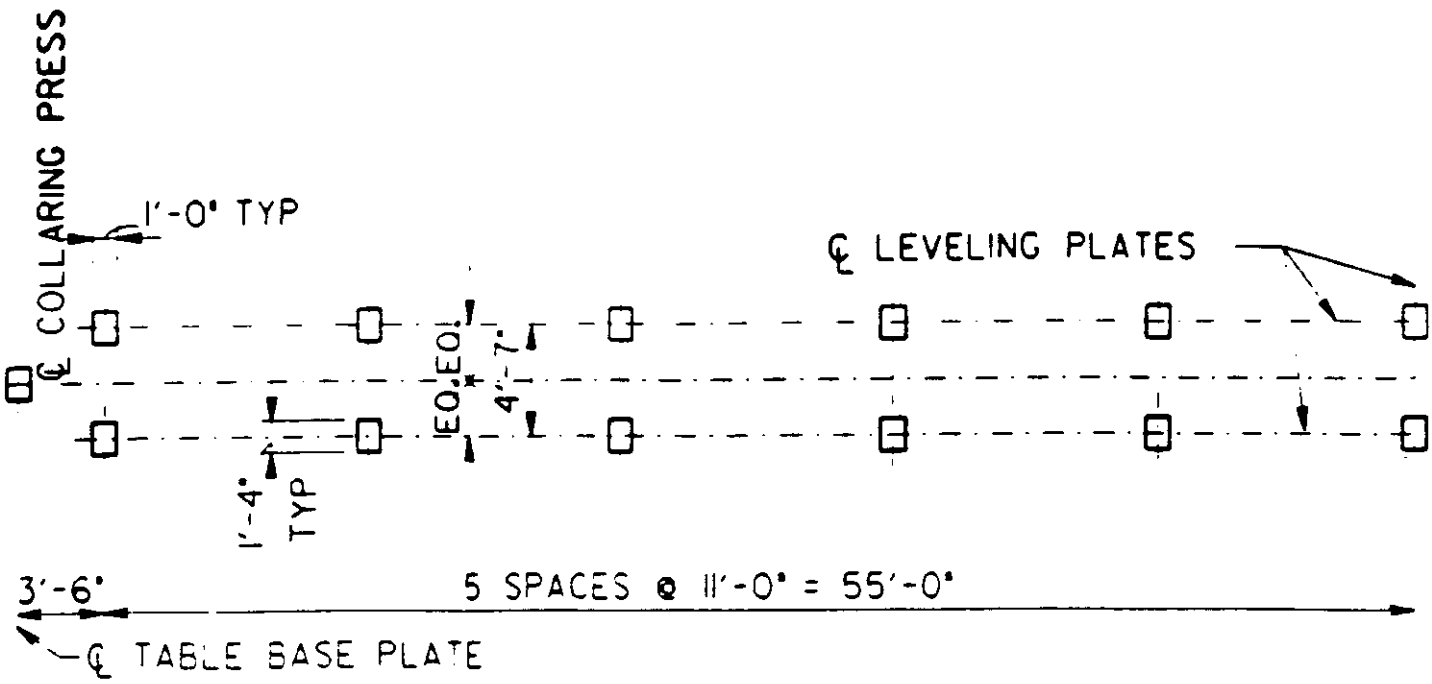


NOTE:
BASE PLATE LOAD = 2.4 KIPS

PLAN - CURING PRESS FEED TABLE BASE PLATE

NTS

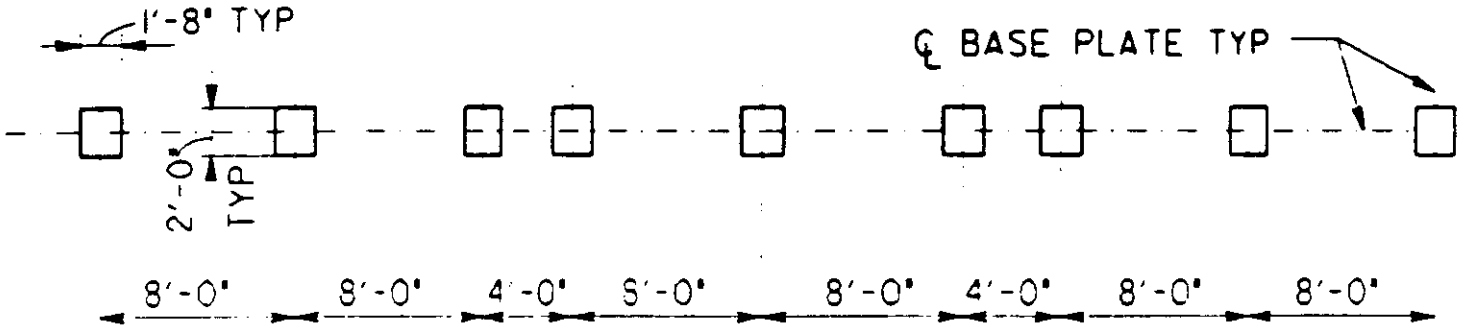
SKETCH 1



NOTE:
LEVELING/BEARING PLATES WILL BE PROVIDED AND INSTALLED BY THE EQUIPMENT SUPPLIER CAPABLE OF SUPPORTING POINT LOADS OF 22.0 KIPS EA. ACTUAL BEARING PLATE SIZE MAY VARY.

PLAN - COLLARING PRESS LEVELING PLATES

NTS

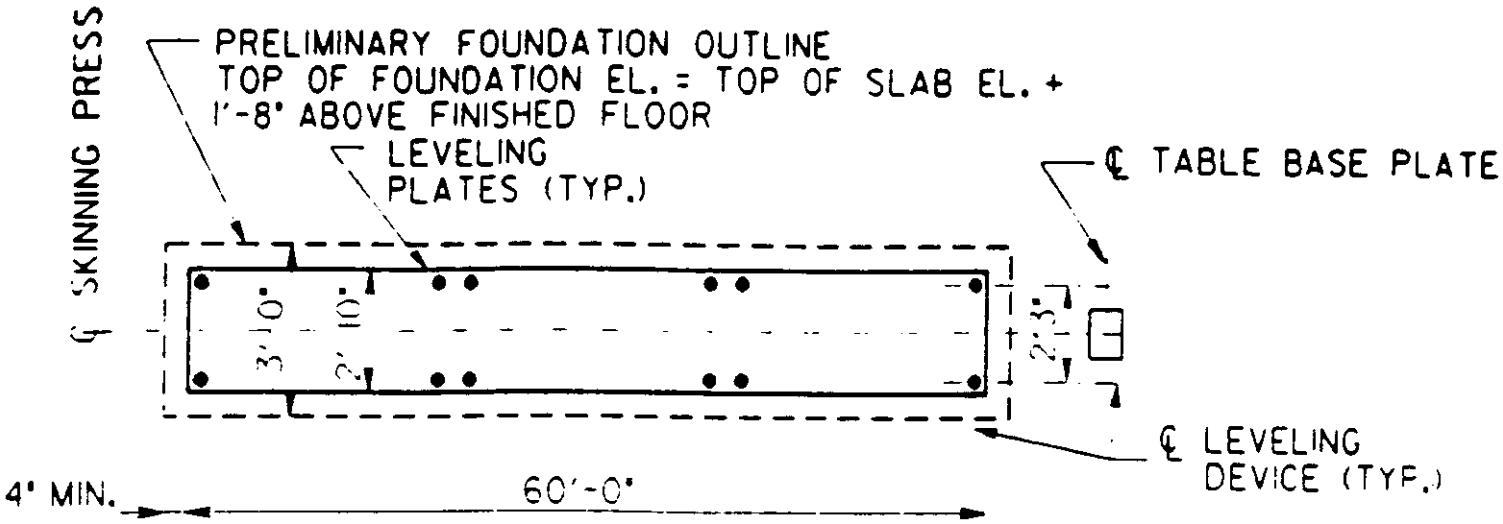


NOTE:
BASE PLATE LOAD = 2.5 KIPS

PLAN - COLLARING PRESS STAGING TABLE BASE PLATES

NTS

SKETCH 2



NOTE:
FOR DESIGN/ESTIMATING PURPOSES ASSUME
BEARING PLATES WILL BE PROVIDED AS SHOWN
CAPABLE OF SUPPORTING A LINEAR LOAD OF 6.2 KIP/FT
FINAL LOADS & DIMENSIONS WILL BE PROVIDED
WHEN THE ARE AVAILABLE.

PLAN - SKINNING PRESS LEVELING PLATES

NTS

NOTE:
BASE PLATE LOAD = 10.0 KIPS

PLAN - SKINNING PRESS STAGING TABLE BASE PLATES

NTS

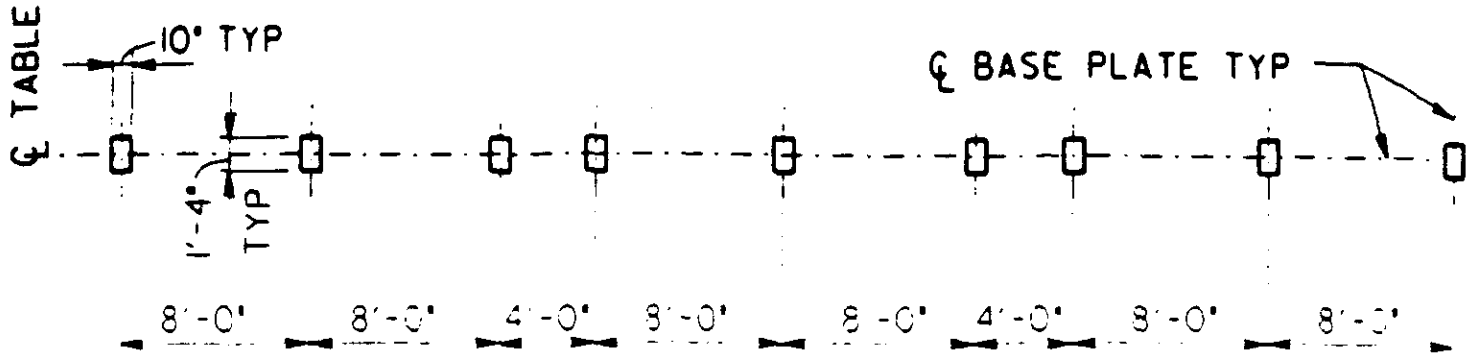
SKETCH 3

NOTE:
BASE PLATE LOAD = 5.0 KIPS

PLAN - COLD MASS DISASSEMBLY TABLE BASE PLATES

NTS

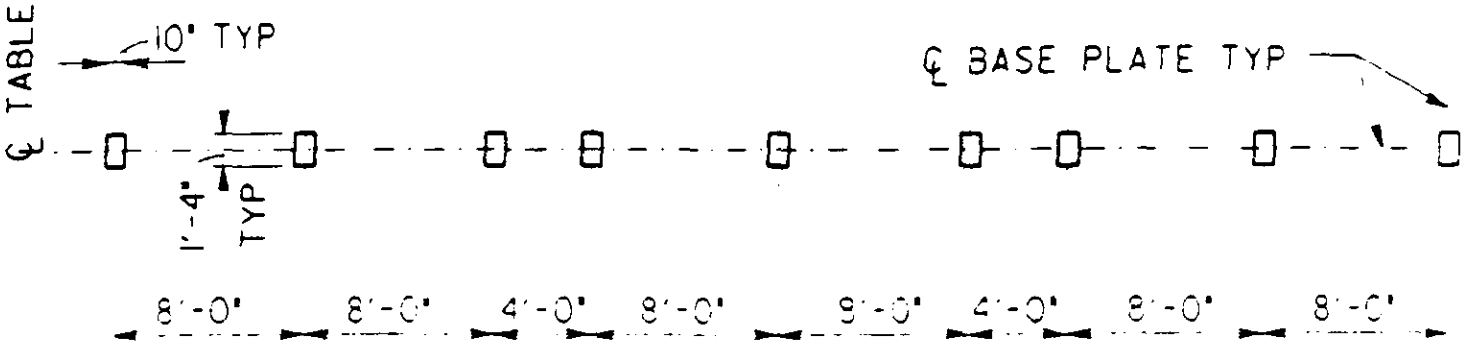
SKETCH 4



NOTE:
BASE PLATE LOAD = 2.0 KIPS

PLAN - TABLE A

NTS



NOTE:
BASE PLATE LOAD = 5.0 KIPS

PLAN - TABLE B

NTS

SKETCH 5