

## **4.2.10 Work Cell Design**

### **4.2.10.1 Work Cell function and specifications**

The purpose of the NuMI Target Hall Work Cell is to provide a well-shielded facility for repairing or replacing NuMI target and horn assemblies that have developed faults during operation. In normal NuMI beamline operation these components are mounted on steel framework structures called “modules” that provide mechanical support, utility connections and precise positioning. (A single module serves both the production target and the upstream baffle assembly.) The target and horn assemblies and their modules become intensely radioactive during beamline operation. The modules are designed to be reused (there are no spares) but a failed target or horn assembly will usually be replaced with a spare because it will be too radioactive for repairs to be practical.

The Work Cell provides facilities for performing the following operations with minimal radiation exposure to the personnel involved:

1. Place a failed target or horn assembly, mounted on its module, in the work cell using the overhead bridge crane. The upstream steel door of the Work Cell must be opened and closed by remote control during this operation.
2. Install top shield cover, except at end-wall and stripline penetrations, to allow personnel access to top of module.
3. Repair the failed component or detach it from its module if repairs are not possible.
4. In the case where repairs are not possible, remove the module and the failed component separately from the Work Cell. (The module is temporarily returned to the target chase and the horn or target assembly is placed in the morgue.)
5. Move a replacement target or horn into the Work Cell and place it on the lifting table.
6. Move the module into the Work Cell and use the lifting table to align the component accurately relative to the module.
7. Make the required mechanical connections between the module and component.
8. Test utility lines and connections (water, vacuum, instrumentation) of the module-component assembly.
9. Remove the module-component assembly from the Work Cell and reinstall it in the target chase.

#### 4.2.10.2 Work Cell design

The Work Cell consists of the following major components:

1. Three-foot thick concrete shield-block side walls (East and West).
2. One-foot thick steel end walls (North and South). The South wall is remotely movable. It opens by sliding to the East on upper and lower rails with Hillman rollers.
3. Rails for supporting target and horn modules in the same way they are supported in the target chase.
4. Electrical power for South door, lifting tables, etc.
5. A remotely controlled Lifting Table (also known as the Motion Table) that provides x-y-z positioning capability for aligning the horn or target relative to the module before the two are mechanically connected. The system provides position ranges of:  $x = \pm 6$  inches,  $y = 0$  to 25 inches,  $z = \pm 9$  inches.
6. Three apertures in the East concrete side wall that are filled with (manually) removable lead bricks and lead-glass blocks. The lead-glass blocks allow workers to view the connections between the component (target or horn assembly) that must be disconnected or connected by remote control.
7. A fourth aperture, located in the downstream (North) steel end wall is also filled with removable lead bricks and lead-glass blocks. This provides a view of the connection between the horn and the stripline flexible joint as well as access to that joint if a stripline needs to be disconnected from a horn.
8. Removable steel cover plates that provide radiation shielding and personnel access to the top of the Work Cell after a module assembly has been placed inside.
9. Note: the Work Cell structure is built on the same 3.5-degree slope as the target chase so that the module can be supported in the same manner in both locations.
10. Note: the mechanical, water and electrical connections between a module and its target or horn assembly are made from the top of the Work Cell by way of the same penetrations,

through the module end walls and stripline-penetration shielding block, that are used when the module is installed in the target chase.

11. Note: transportation and lifting fixtures for moving and installing the steel doors and the concrete shield blocks of the Work Cell are included in the Work Cell construction task.

Most of the figures that follow are derived from current engineering drawings of the Work Cell and its components. They are intended only to illustrate the major design features of the device and should not be used to obtain exact specifications or dimensions.

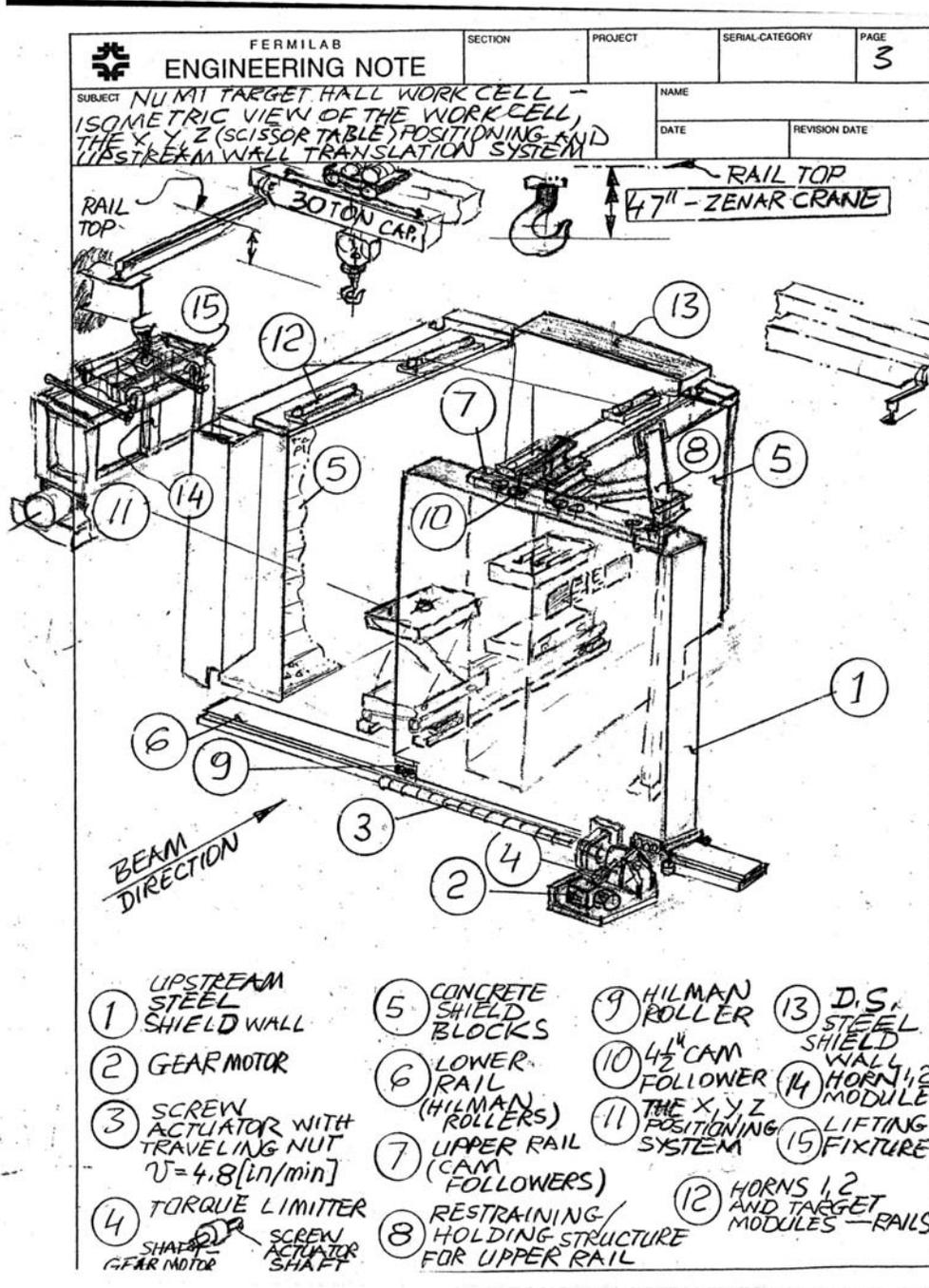


Figure 4.2-30 Sketch of the main Work Cell components.

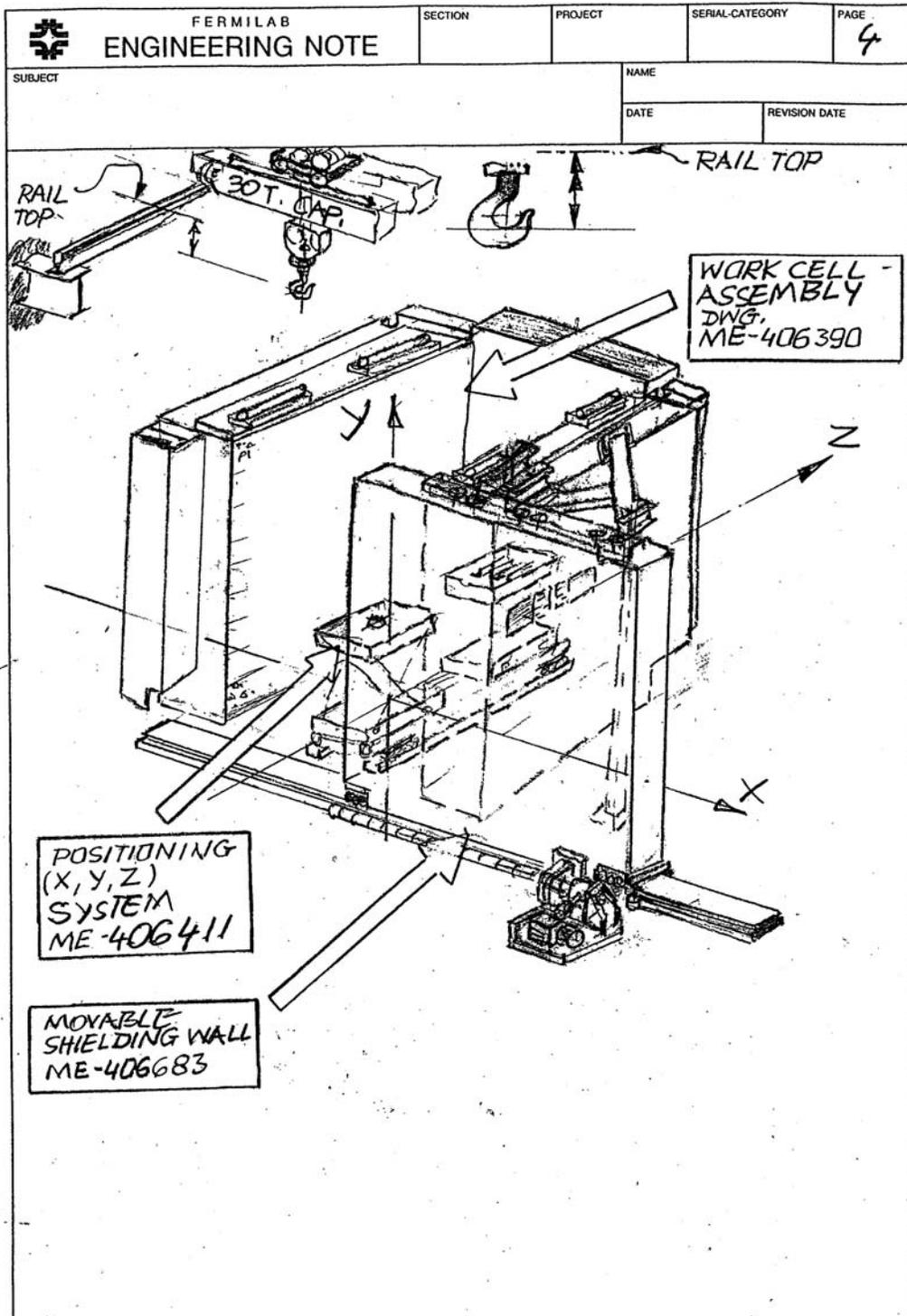
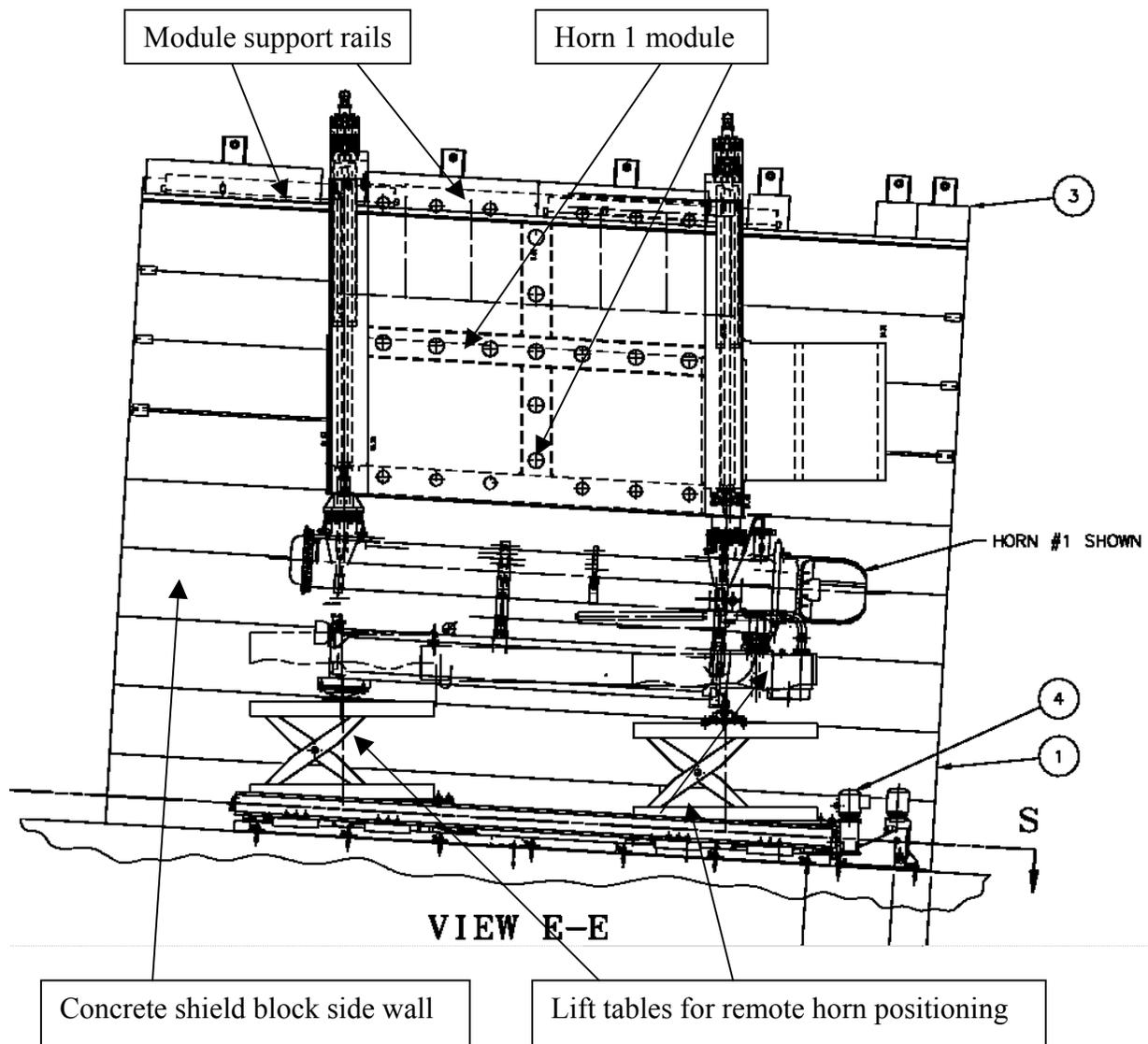


Figure 4.2-31 Work Cell sketch showing coordinate systems and drawing numbers.



**Figure 4.2-32** Side elevation view of the Work Cell assembly with Horn 1 module installed.

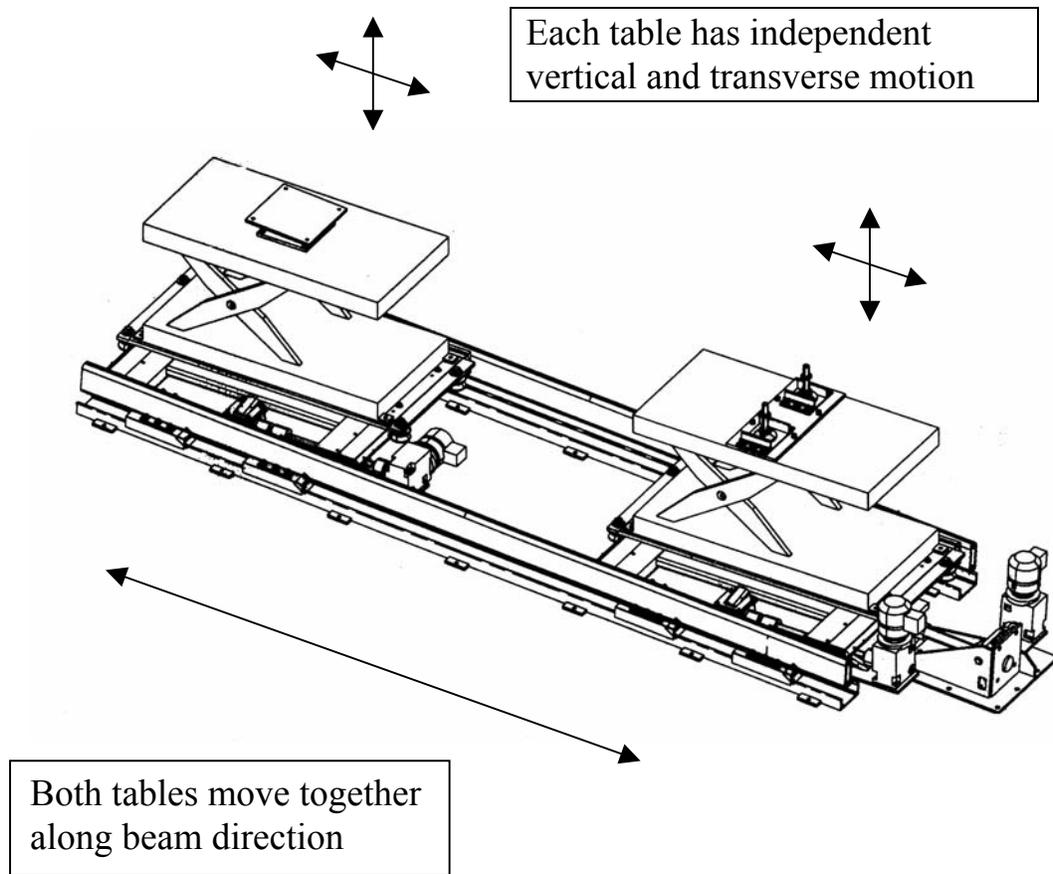


Figure 4.2-33 Sketch of Lifting Table.

29	MD-406576	TRACK - BASE PLATE 1	2
28	MD-406589	WALKWAY-RAILING BRACKET ASSEMBLY A	8
27	MD-406593	WALKWAY ASSEMBLY	1
26	MC-406585	WALKWAY - KICKER SUPPORT ASSEMBLY #2	3
25	MC-406579	WALKWAY - KICKER SUPPORT ASSEMBLY #1	2
△	24	FURNISHED GLASS BRICK (6 x 6 x 18)	6
	23	COML. FERRY HD SCREW, 3/8-16UNC-2A x 1 LG. S.S. 304, CAP SCREW HEX.HD.	36
	22	COML. HILTI HDI 3/8 DROP-IN ANCHOR ITEM NUMBER 0045731	36
	21	COML. PIPE, 1 1/2 SCH. 40 x 37.00 LG., ALUMINUM E8061-T6	4

Table 4.2-16a Key to numbered components in drawings that follow.

3. ITEM 9 TO BE FIELD INSTALLED. STEPS MUST BE LEVEL. DRILL (2) 9/16 THRU HOLES INTO ITEM 37 PER DIMENSIONS IN DETAIL N. USE FOOTING OF ITEM 9 TO LOCATE ANCHOR POSITIONS. SHIM IF REQUIRED AT BOTH FOOTING AND LANDING.
2. FIELD WELD ITEMS 3, 4 AND 6 PRIOR TO ANCHORING TO CONCRETE BLOCKS (ITEMS 1 & 2) ON SOUTH AND NORTH ELEVATIONS.
1. ALL STEEL (ALLOY & CARBON) SHALL BE PAINTED WITH 2 COATS PRIMER (ITEM #47) & 1 COAT HIGH GLOSS WHITE (ITEM #48). ALL WELDS, BURNS ETC. SHALL BE TOUCHED-UP WITH SAME PAINT.

NOTES:

ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.
70	COML	HILTI DROP-IN ANCHOR, HDI(SS303)1/2, HILTI P/N 45739	2
69	1210-0740	NUT, HEX, FULL, TYPE 18-8 S.S., 1/2-12UNC-2B THD	2
68	1218-0635	SCREW, CAP HEX HD, TYPE 18-8 S.S., 1/2-13UNC-2A x 1.50 LG	2
67	COML	BAR GRATING FASTENER - FLAT-HEAD J-BOLT, McMASTER-CARR P/N 6268T2B	12
66	COML	C 6 x 13 x 183.00 LG STEEL CHANNEL	1
65	MC-427002	EAST CHANNEL MTG PLATE	2
64	1218-1140	WASHER, LOCK, TYPE 18-8 S.S., SCREW SIZE 1/2	32
63	1226-0630	SCREW, CAP HEX HD, TYPE 18-8 S.S., 1/2-13UNC-2A x 1.00 LG	30
62	FURNISHED	LEAD BRICK - 2 x 4 x 8	194
61	MC-406998	WINDOW CORNER SPLICE PLATE	4
ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.
20	COML.	PIPE, 1 1/2 SCH, 40 x 32.50 LG., ALUMINUM E6061-T6	4
19	COML.	PIPE, 1 1/2 SCH, 40 x 22.00 LG., ALUMINUM E6061-T6	3
18	COML.	PIPE, 1 1/2 SCH, 40 x 58.00 LG., ALUMINUM E6061-T6	12
17	COML.	PIPE, 1 1/2 SCH, 40 x 48.00 LG., ALUMINUM E6061-T6	8
16	COML.	PIPE, 1 1/2 SCH, 40 x 43.00 LG., ALUMINUM E6061-T6	4
15	COML.	PIPE, 1 1/2 SCH, 40 x 68.00 LG., ALUMINUM E6061-T6	2
14	COML.	PIPE, 1 1/2 SCH, 40 x 8.50 LG., ALUMINUM E6061-T6	6
13	COML.	FLANGE, HOLLAENDER FITTING NO. 48	2
12	COML.	SIDE OUTLET ELL, HOLLAENDER FITTING NO. 9	9
11	COML.	CROSS, HOLLAENDER FITTING NO. 7	13
10	COML.	TEE, HOLLAENDER FITTING NO. 5	14
9	COML.	SPACE SAVER STRIP, McMASTER-CARR #7948T999, 167.50" TOP STEP HGT, 88 DEG, CARBON STEEL, GRAY	1
8	MD-406681	DOWNSTREAM SHIELD WALL BLOCK #1	1
7	MC-406685	DOWNSTREAM SHIELD WALL BLOCK #2	3
6	MC-406686	SHIELD WALL BLOCK 4	3
5	MC-406696	WALL BRACKET 3	1
4	MD-406627	WALL BRACKET 2	2
3	MD-406624	WALL BRACKET 1	7
2	FURNISHED	*D* BLOCK (3 x 6 x 1.5) WEST WALL ONLY	9
1	FURNISHED	*J* BLOCK (3 x 12 x 1.5) WEST WALL ONLY	9
ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST			
UNLESS OTHERWISE SPECIFIED	ORIGINATOR	A. SZYMULANSKI	07-JUN-2001
FRACTIONS	DECIMALS	ANGLES	DRAWN
± .06	± .005	± —	L. SZCZEPANIK
			CHECKED
			D. FRIEND
			08-MAY-2002
			APPROVED
			A. SZYMULANSKI
			08-MAY-2002
1. BREAK ALL SHARP EDGES .015 MAX.			
2. DO NOT SCALE DRAWING.			
3. DIMENSIONS BASED UPON 4051 Y14-34-1589			
4. MAX. ALL MACH. SURFACES			
250 ✓			
USED ON			
ME-406747			
MATERIAL			
SEE PARTS LIST			
 <b>FERMI NATIONAL ACCELERATOR LABORATORY</b> UNITED STATES DEPARTMENT OF ENERGY			
PPD/MECHANICAL DEPARTMENT NUMI TARGET HALL-WORK CELL WORK CELL ASSEMBLY			
SCALE	DRAWING NUMBER	SHEET	REV
FULL	8875.126-ME-406570	1 OF 2	A
CREATED WITH :	Idaesoft	GROUP :	PPD/MECHANICAL DEPARTMENT

Table 4.2-16b Key to numbered components in drawings that follow (continued)



60	MC-406997	WINDOW FRAME SPLICE PLATE	4
59	MC-406996	VERTICAL WINDOW FRAME SECTION	2
58	MC-406995	HORIZONTAL WINDOW FRAME SECTION	2
57	MC-406993	STOP BRKT SPLICE PLATE	2
56	COML.	HOT ROLLED FLAT, 1/2 x 4 x 3.00 LG. CARBON STEEL ASTM A-36	2
55	COML.	HOT ROLLED FLAT, 1/2 x 4 x 2.00 LG. CARBON STEEL ASTM A-36	9
54	COML.	HOT ROLLED FLAT, 1/4 x 4 x 3.00 LG. CARBON STEEL ASTM A-36	2
53	COML.	HOT ROLLED FLAT, 1/4 x 4 x 2.00 LG. CARBON STEEL ASTM A-36	9
52	COML.	SHIMS - LEAD	AS REQ'D
51	_____	_____	—
50	MC-406992	LEAD GLASS STOP BRKT WELDMENT	4
49	COML.	1 x 3 x 4.00 LG. ASTM A 36 STEEL FLAT	2
48	1825-3750	PAINT, HIGH GLOSS WHITE RUSTOLEUM #27881	AS REQ'D
47	1825-4000	PAINT, RED PRIMER RUSTOLEUM #768	AS REQ'D
46	COML.	WASHER, FLAT, ALLOY STEEL FOR 5/8" BOLT	32
45	COML.	CAP SCREW, HEX. HD, ALLOY STEEL 5/8-11UNC-2A x 2.00 LG.	32
44	COML.	HILTI KWIK BOLT, 5/8 x 4 3/4 LG. HILTI #000453712	48
43	COML.	C 6 x 13 x 225.00 LG STEEL CHANNEL	1
42	MC-406651	WALL BRACKET	4
41	COML.	1/2 x 3 x 182.00 LG STEEL ANGLE	2
40	COML.	3/8 FLAT WASHER	40
39	COML.	CONCRETE GROUT, HIGH STRENGTH MASTERFLOW 925, ASTM C-1107	AS REQ'D
38	ME-406748	EAST WALL ASSEMBLY	1
37	MD-406750	KICKER SUPPORT ASSY 3	1
36	COML.	HILTI KWIK BOLT 3/4 x 8" ITEM # 000453738	10
35	COML.	1/2-13 UNC x 5.50 LG. HILTI S.S. KWIK BOLT ITEM NO. 000453936	32
34	COML.	5/8-11 UNC x 7.00 LG. HILTI KWIK BOLT ITEM NO. 000453738	83
33	COML.	FLAT WASHER FOR 7/8 BOLT ALLOY STEEL	24
32	COML.	7/8-9 UNC-2A x 8.75 LG. HEX. BOLT ALLOY STEEL	24
31	MC-406562	TRACK - WELDMENT	4
30	MD-406578	TRACK - BASE PLATE 2	2
29	MD-406576	TRACK - BASE PLATE 1	2
28	MD-406589	WALKWAY-RAILING BRACKET ASSEMBLY A	8
27	MD-406593	WALKWAY ASSEMBLY	1
26	MC-406585	WALKWAY - KICKER SUPPORT ASSEMBLY #2	3

Table 4.2-16c Key to numbered components in drawings that follow (continued)

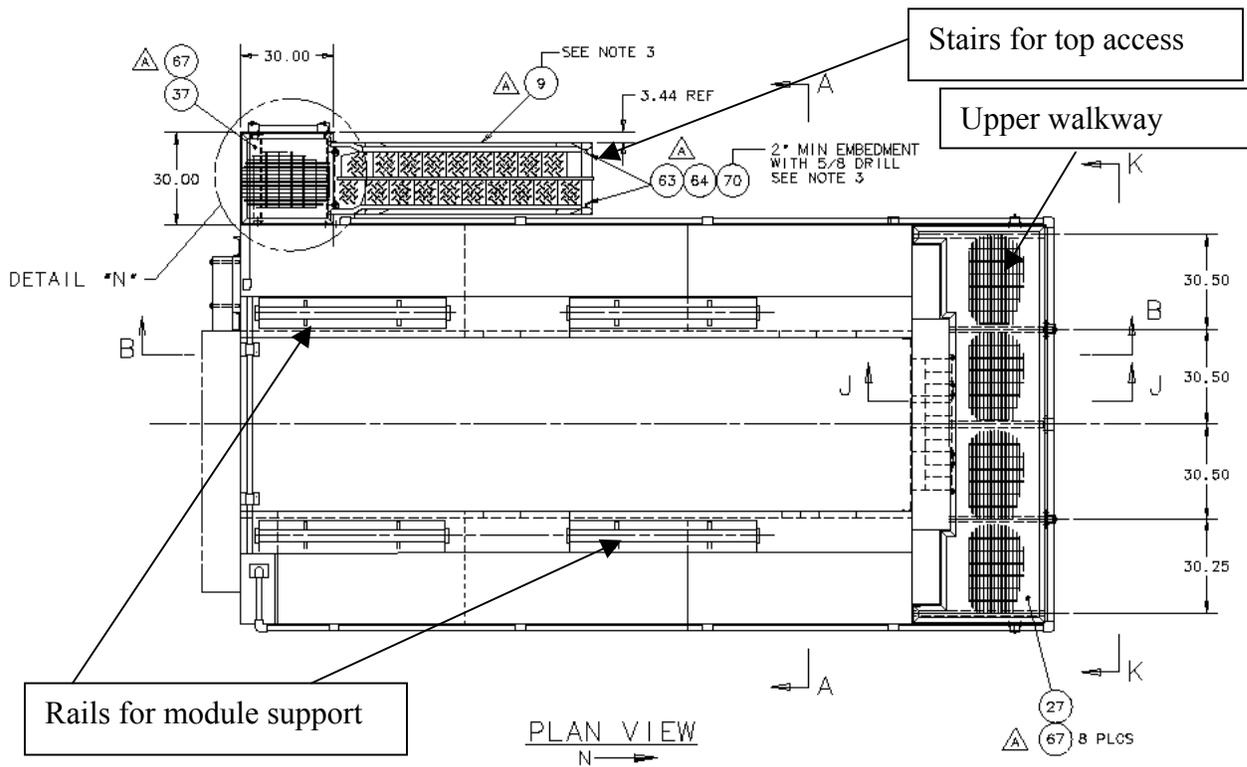


Figure 4.2-34a Plan view of the Work Cell assembly.

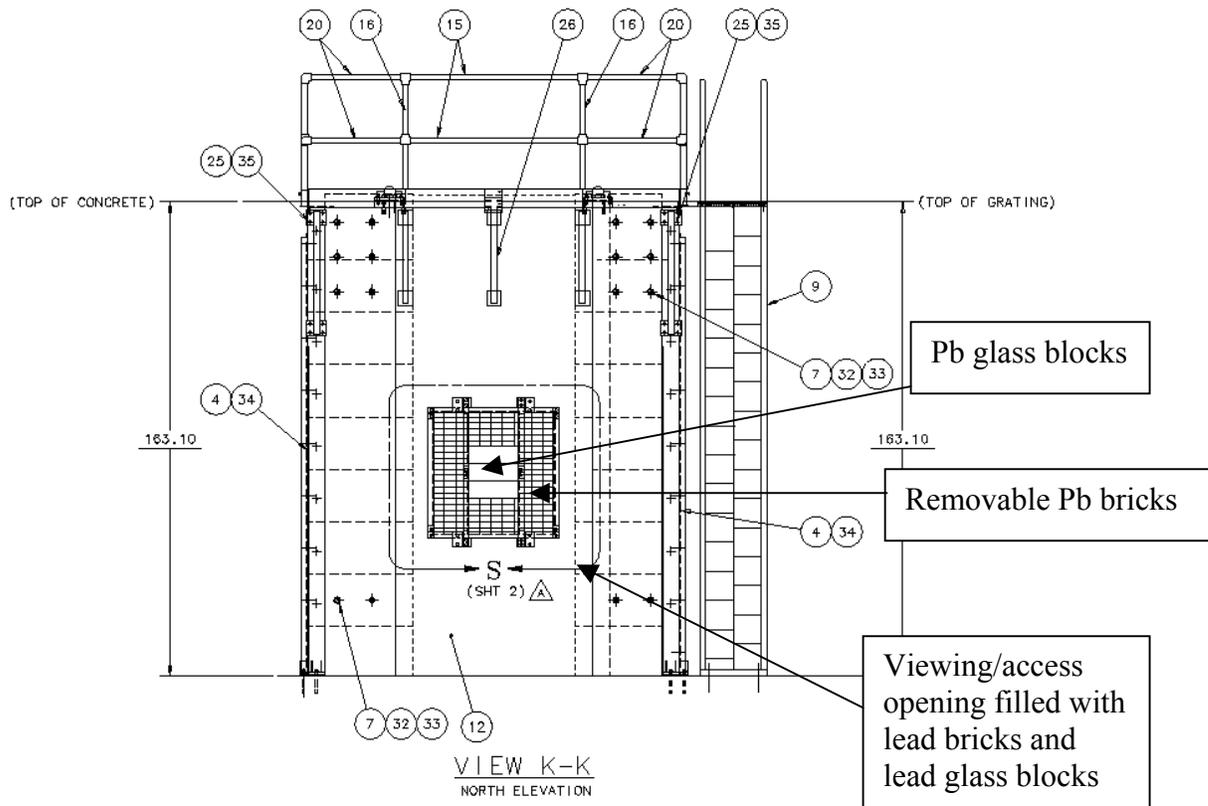
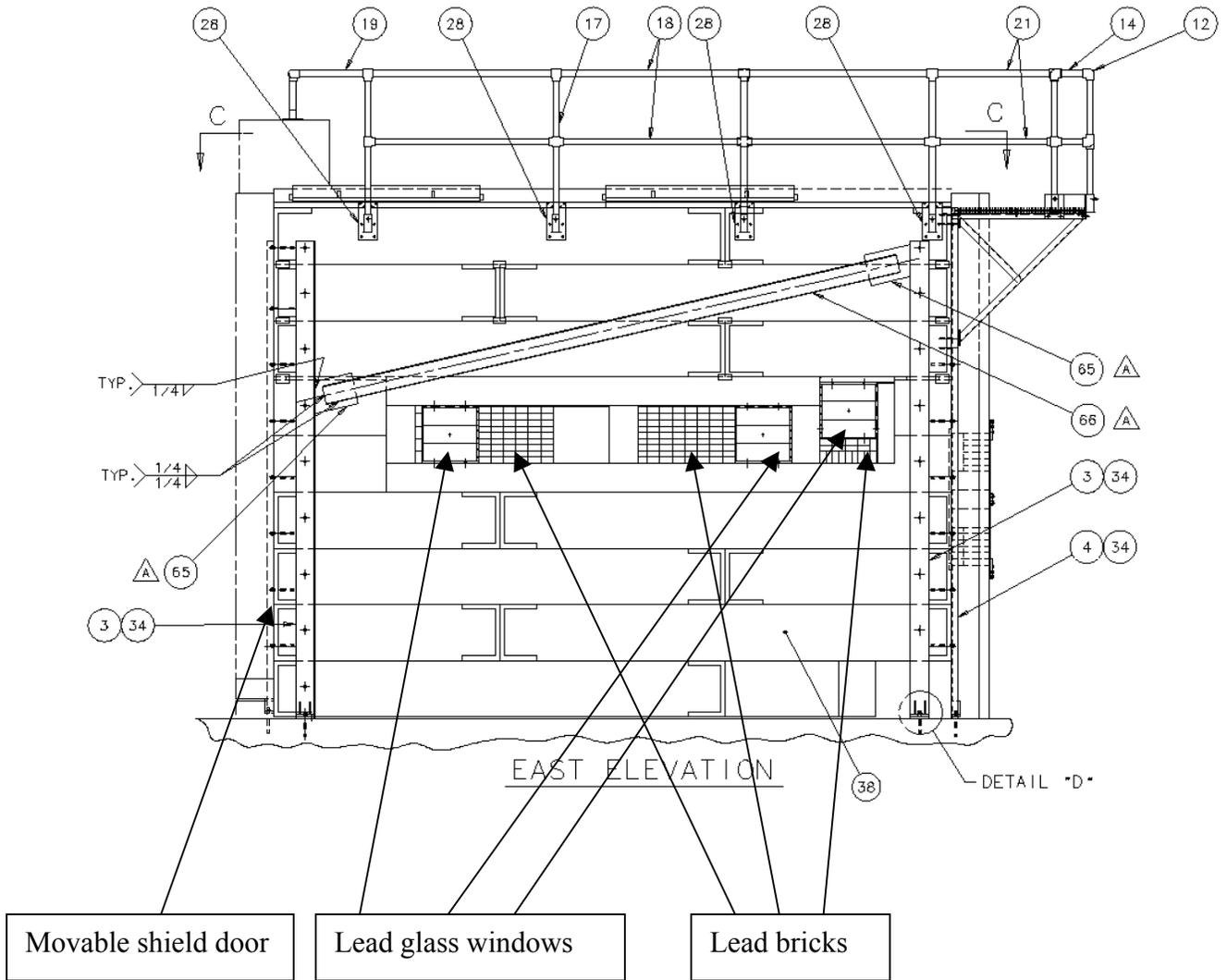


Figure 4.2-34b North end elevation of the Work Cell assembly.



**Figure 4.2-34c-Side elevation view of East wall of Work Cell.**