SSC-N-9

THE IMPACT OF MAGNET SIZE ON CONVENTIONAL FACILITIES

SSC Central Design Group*

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The design of conventional facilities for the SSC must take into account besides personnel considerations, the installation, operation and maintenance of all of the equipment for the facility. Magnets are a primary component of the facility both in terms of the accelerator structure and of the number of units to be handled. They are to be installed in a tunnel which is a restricted space with very limited access. The conventional facilities must be designed with this in mind.

The weight of the magnets must be accommodated by any cranes or handling equipment in the assembly buildings or access areas. Since the magnets are low density, small cross-section objects this is not a problem. Any crane of reasonable capacity of the order of 10T will handle them. The fragility of the low heat leak supports of the cryostats, however, requires that cranes to handle the magnets have soft start and stop features.

The installed width of the magnet impacts the width of the tunnel invert, but this is small ($\approx$ 30") compared with the width imposed by the requirement for standard personnel/equipment transporters ("golf carts") to pass in the tunnel ($\approx$ 70"). (cf Figs. 1 & 2)

The impact of the length of the magnets is a variable function of the particular magnet design chosen. It can impact the size and possibility of access shafts, the required handling equipment for the magnets, the depth of the tunnel and the road and railroad systems serving the campus and the collider ring.

Reference Design C

The most severe impact is that due to the 140 meter long magnet, Design C, composed of 35 meter modules. The modules can be transported from some fabrication plant to the campus by rail. Neither the modules, nor the assembled magnets can be transported over the roads[1] unless a restricted ring road is built around the whole site[2] (cf Fig. 3). This implies that the magnets must be assembled at the tangent to the ring and inserted down a ramp. This in turn implies a near-surface ring, since it is not practical to ramp down to a deep tunnel. Use of clustered IR's is attractive with this design since it gives two major areas for assembling and inserting the magnets and makes two rail access points feasible.

Within the tunnel it is necessary to be able to transport the magnets through the bypasses around the collision halls. The length of the magnet requires that the take off angle for the bypass be very shallow. This makes the bypass tunnel very long, and in fact probably makes it conceivable only in the case of clustered IR's. Even here it is difficult to see how the magnets between IR's can be handled without multiple ramps in this region.

Reference Design A (D)

The conventional facilities of the RDS were designed around Reference Design A. In that document a shallow site was assumed. Consistent with this, it was assumed that magnets would be lowered into the Ring through hatches incorporated into the bypasses at the six IR locations. This assumption is flawed for a deeper site because the rectangular coffin-shaped shaft would be difficult (and expensive) to build to depth. In addition, for initial installation this would couple the magnet installation to the construction schedule for the interaction regions, rather than that for the sectors. For both reasons, of shaft economy and installation schedule, it is preferable to insert the magnets through the equipment shafts at the refrigerator locations. These shafts would then have to be sized with a view to the length of the magnet elements. A shaft diameter to accommodate the 57 feet of the Design A magnet in a horizontal position would be prohibitively expensive. The magnets must, therefore, be braced for non-horizontal handling (probably vertical). The base of the shaft must be designed to allow space to turn the magnets from vertical to horizontal for transport in the tunnel.

The Type A(D) magnets would require special vehicles for road transport and would be restricted in traveling from the campus to the access points around the Ring, unless roads were wholly incorporated into the site[1].

Type B

The Type B magnet length is wholly consistent with Type A(D) as far as access and movement in the tunnel. However, the 3.5 meter difference in length is sufficient to remove the specialized restriction in road access. This 14-meter length is consistent with a normal semi-trailer truck. It is consistent, then, with the road criteria incorporated into the Site Parameters Document, HS-20-44, noted above.

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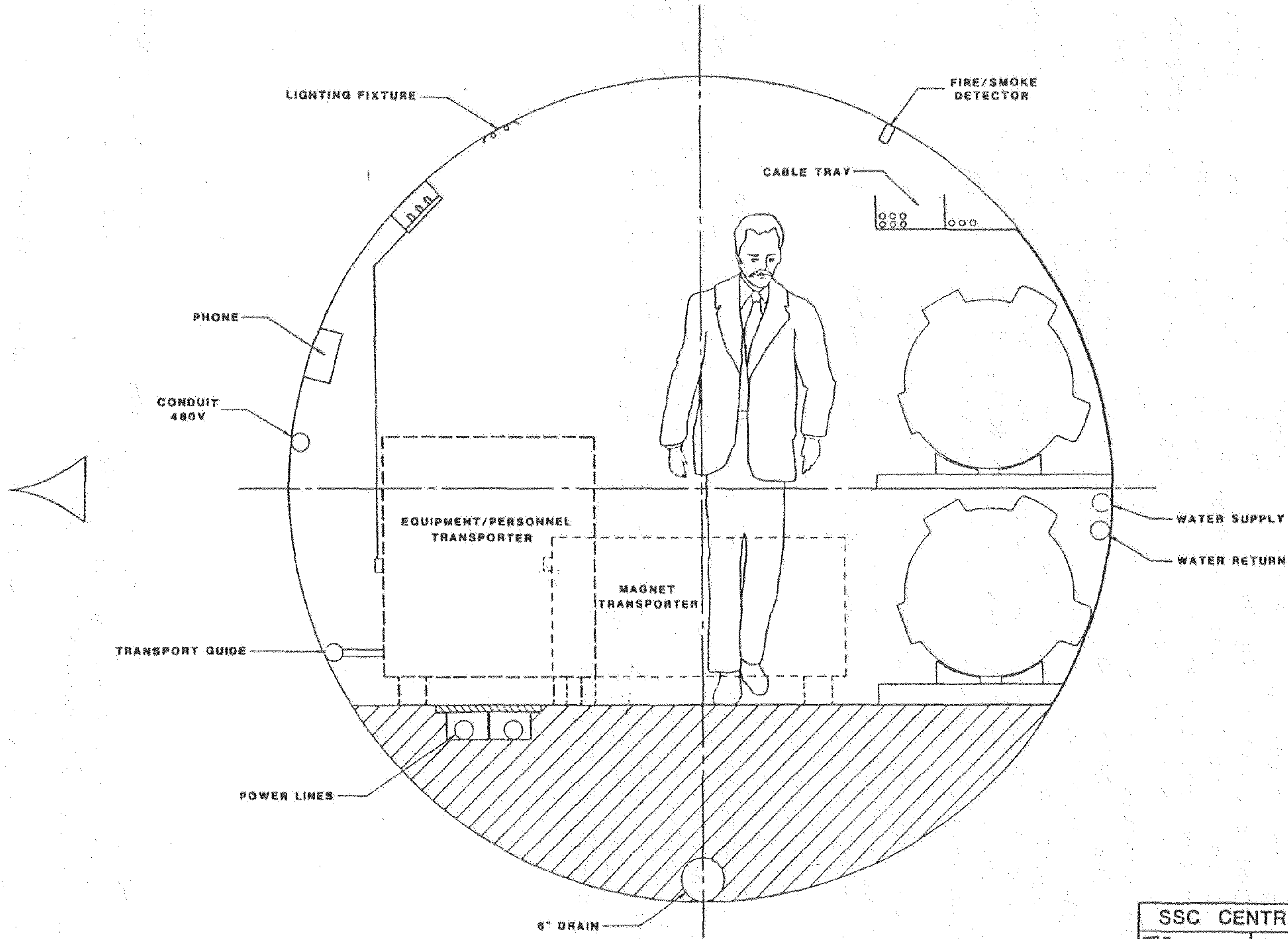
[1]Summary of Size and Weight Limits, May 1985, prepared by Department of State Laws, American Trucking Association, Inc. See also HS-20-44, which is specified in the Site Parameters Report.

[2]But this would imply in turn many long ramps to make it worth while.



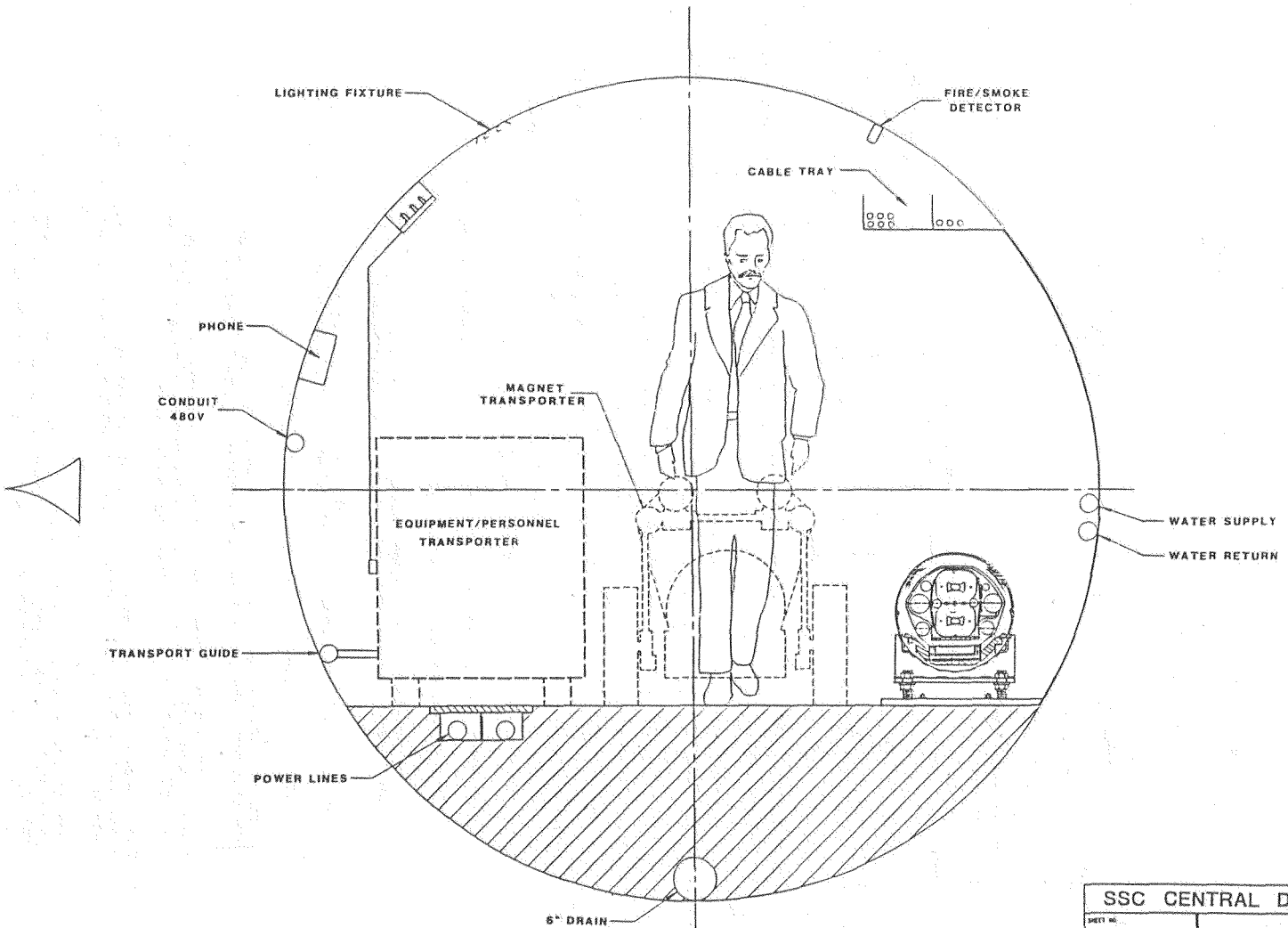
TUNNEL CROSS SECTION

SSC CENTRAL DESIGN GROUP

DESIGN 'D' MAGNET

SCALE 1½" = 1'-0" DATE 6-24-85 APPR. BY VM/TT DATE 6-24-85

Figure 1



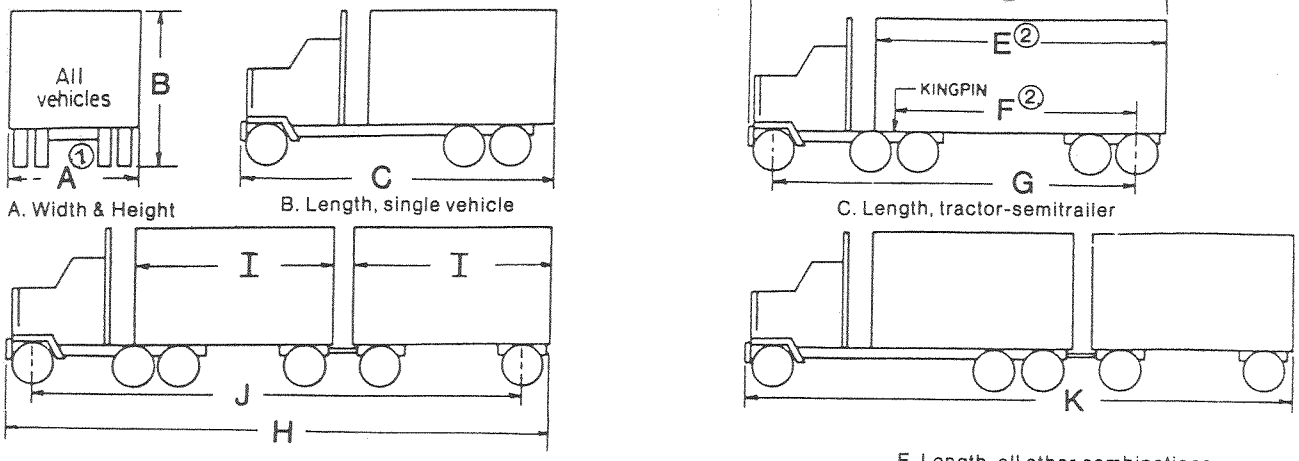
TUNNEL CROSS SECTION

SSC CENTRAL DESIGN GROUP			
SHEET NO.	DESIGN 'C' MAGNET		
SCALE 1½" = 1'-0"	DRAWN BY	DATE 6-24-85	CKD BY / DATE
ACCT NO.		APPR. BY VM/TT	DATE 6-24-85

Figure 2

FIGURE A

MAXIMUM LEGAL DIMENSIONS OF MOTOR VEHICLES.



A. Width & Height

B. Length, single vehicle

C. Length, tractor-semitrailer

D. Length, tractor-semitrailer-trailer(Double-Bottom)

E. Length, all other combinations

TYPE OF HIGHWAY OR STREET	MAXIMUM LEGAL DIMENSIONS											MAXIMUM WEIGHTS		
	A (1)	B	C	D	E (2)	F (2)	G	H	I	J	K	SINGLE AXLE	TANDEM AXLE	GROSS (table ✱)
CLASS I (7)	8'-6"	13'-6"	42'	N.S. (3)	53'	40'	N.S.	N.S.	28'-6"	N.S.	60'	20,000	34,000 (4)	I
CLASS II (7)	8'-6"	13'-6"	42'	N.S.	53'	40'	55'	N.S.	28'-6"	65'	60'	20,000	34,000 (4)	I
CLASS III (7)	8'	13'-6"	42'	N.S.	53'	40'	55'	60'	N.S.	N.S.	60'	20,000	34,000 (4)	I
OTHER STATE HIGHWAY	8'	13'-6"	42'	N.S.	53'	40'	55'	60'	N.S.	N.S.	60'	18,000	32,000 (5)	II
LOCAL ROADS AND STREETS	8'	13'-6"	42'	55'	N.S.	N.S.	N.S.	60'	N.S.	N.S.	60'	18,000	32,000 (5)	II

NOTES

✱ ON REVERSE SIDE

1. Does not include certain safety devices approved by the Department.
2. On semitrailers longer than 48', the maximum kingpin to rear axle distance allowed is 40'.
3. N.S. indicates a legal dimension is not specified.
4. Tandem defined as any 2 or more single axles whose centers are more than 40" and not more than 96" apart, measured to the nearest inch between extreme axles in the series.
5. Tandem defined as any 2 or more consecutive axles whose centers are more than 40" and not more than 72" apart, measured to the nearest inch between any 2 adjacent axles in the series.
6. Maximum sizes and weights apply whether unladen or with load.
7. Streets or highways designated by Department of Transportation or local officials having jurisdiction. Map of designated State system available by calling 217/782-6271.
8. Vehicles specifically designed to transport motor vehicles may have an overall length of 65 feet plus an overhang of three feet in front and four feet in the rear on Class I & II highways. The maximum overall length on all other streets and highways is 60 feet.
9. Permits may be issued for overdimension objects and vehicles if they have been reasonably disassembled. Multiple objects loaded side-by-side, end-to-end, or on top of each other may not cause the overdimension.
10. Length limits do not apply to vehicles operating in the daytime, except on Saturdays, Sundays, or legal holidays, when transporting poles, pipe, machinery or other objects of a structural nature which cannot be readily dismembered, provided the length of the object being transported does not exceed 80'.
11. Large vehicles operating on designated State highways shall have access for a distance of 5 highway miles on a street or highway in the system of State highways, and upon any street or highway designated by local authorities, to points of loading and unloading and facilities for food, fuel, repairs and rest. These vehicles are prohibited on all streets and highways under local jurisdiction unless specifically designated by local officials.
12. Length limits shall not apply to household goods carriers enroute to points of loading and unloading.

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Figure 3