Table I Typical boundary-layer wind tunnel characteritistics

Wind Tunnel Property		Range		
Tunnel height H_T	(m)	0.5	⇔	2.5
Tunnel width W_T	(m)	0.5	⇔	4.0
Tunnel length L_T	(m)	1.0	⇔	30.0
Boundary depth δ	(m)	0.10	⇔	2.0
Roughness z_o	(mm)	0.01	⇔	15.0
Velocity U_o	(m/s)	0.0	⇔	36.0
Integral scale L_{ux}	(m)	0.06	⇔	0.6
Temperature gradient $d\theta/dz$	(°C/m)	0.0	⇔	200.0
Hill height h	(m)	0.02	⇔	0.5
Hill half width L	(m)	0.0	⇔	2.0
Resolution Δz	(mm)	0.1		
Surface friction $C_f/2$	(dimensionless)	0.0005	⇔	0.0040
Richardson number Ri_B	(dimensionless)	0.0	⇔	1.0
Monin-Obukhov length L_{mo}	(m)	0.065	⇔	∞
Turbulence intensity $[\overline{u'^2}]^{1/2}/U_o$		0.01	⇔	0.30
Power⇔law coefficient				

Table II Typical wind tunnel and field parameter ranges

Dimensionless Parameter	Wind-tunnel Range	Field Range
Reynolds number $Re_h = U_o h/\nu$	0 ⇔ 7.0×10^5	0 ⇔ 6.0×10^6
Richardson number $Ri_B = \frac{g(dT/dz)h}{T\,U_o^2}$	-1.0 ⇔ 1.0	-1.0 ⇔ 1.0
Prandtl number $Pr = \mu Cp/k$	0.72	0.72
Skin frictioncoefficient or Stanton number $C_f/2 = (u_*/U_o)^2$ $St = q/(\rho Cp\Delta T)_o$	0.006 ⇔ 0.004	0.001 ⇔ 0.004
Insolation parameter $Fr_I = \frac{(U_o^2 T_w)}{(g[T_w - T_n]L)}$	0.002 ⇔ ∞	2.5×10^{-5} ⇔ ∞
Scaling lengths		
z_o/h	2×10^{-5} ⇔ 0.25	3.0×10^{-7} ⇔ 0.15
δ/h	0.20 ⇔ 50.0	0.10 ⇔ 100
h/L	0.05 ⇔ ∞	2×10^{-4} ⇔ ∞
Λ_x/L	0.06 ⇔ ∞	0.001 ⇔ ∞
h/H_T	0.01 ⇔ 0.15	--
L_T/L	0.0 ⇔ 30.0	--
h/L_{mo}	0.0 ⇔ 5.0	-360 ⇔ 240
Power-law coefficient α	0.05 ⇔ 0.8	0.05 ⇔ 0.7

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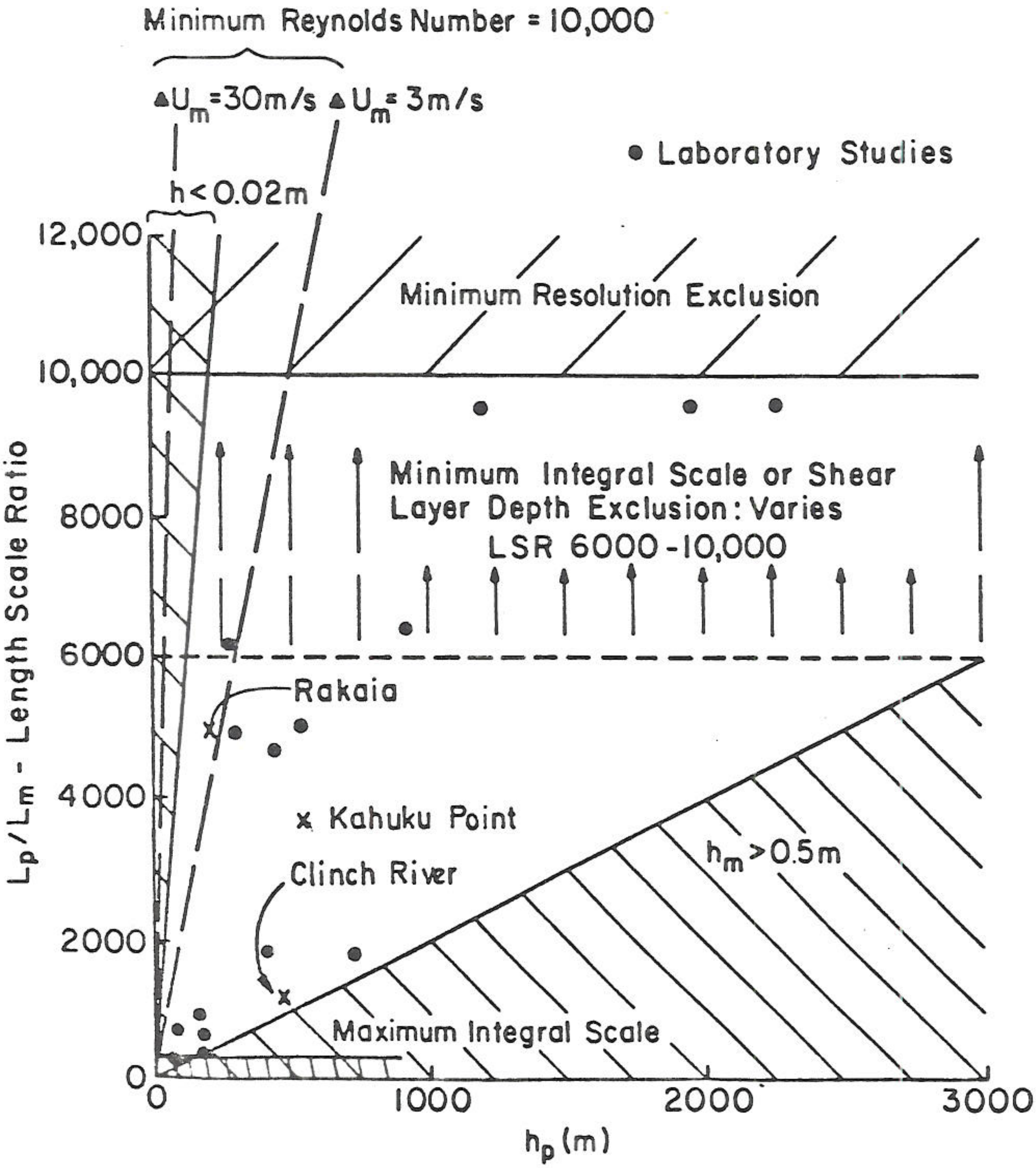


Figure 1 Performance envelope for physical modeling of shear flows over complex terrain in a typical boundary-layer wind tunnel

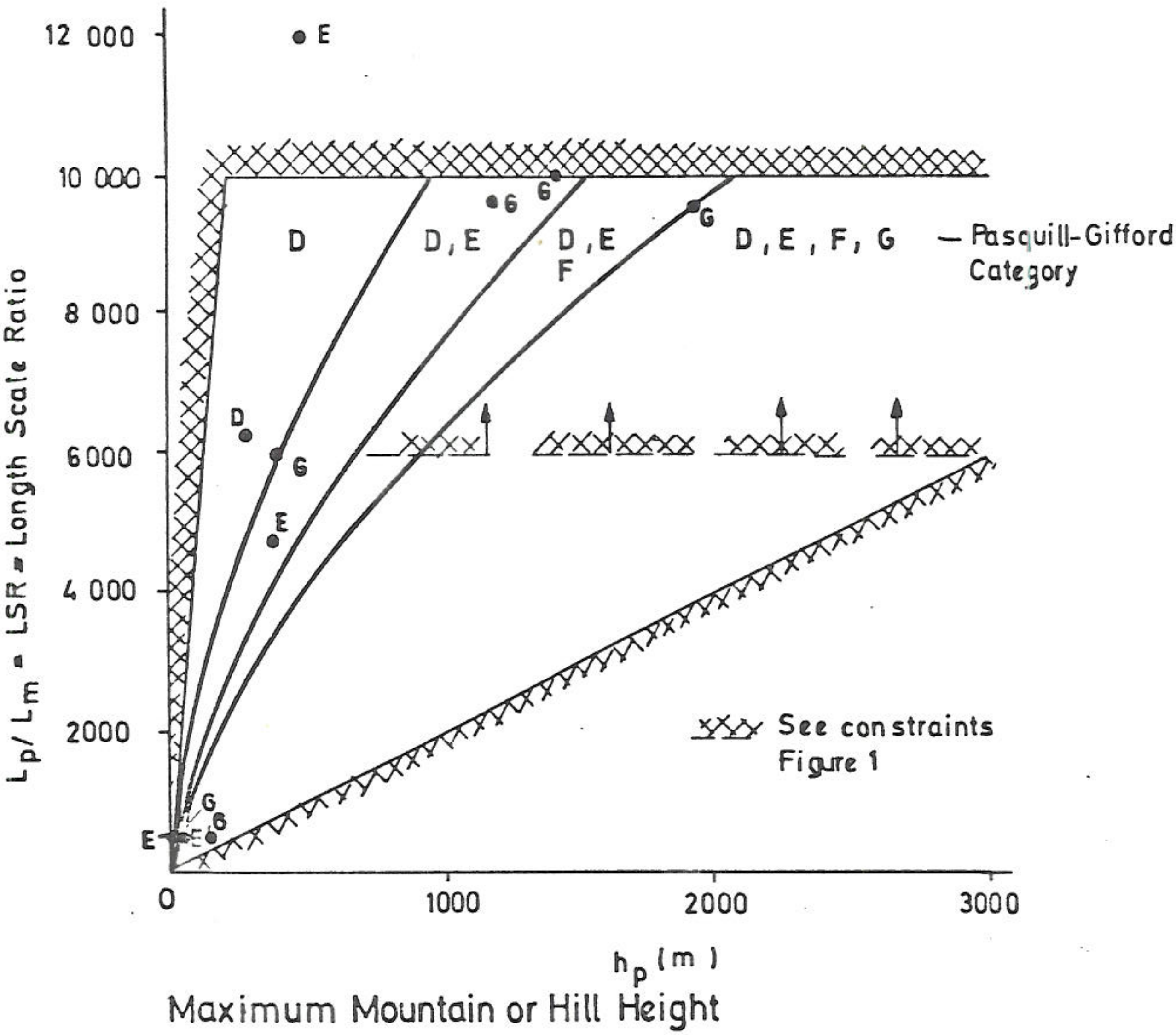


Figure 2   Performance envelope for physical modeling of stratified shear flows over complex terrain in a typical boundary-layer wind tunnel

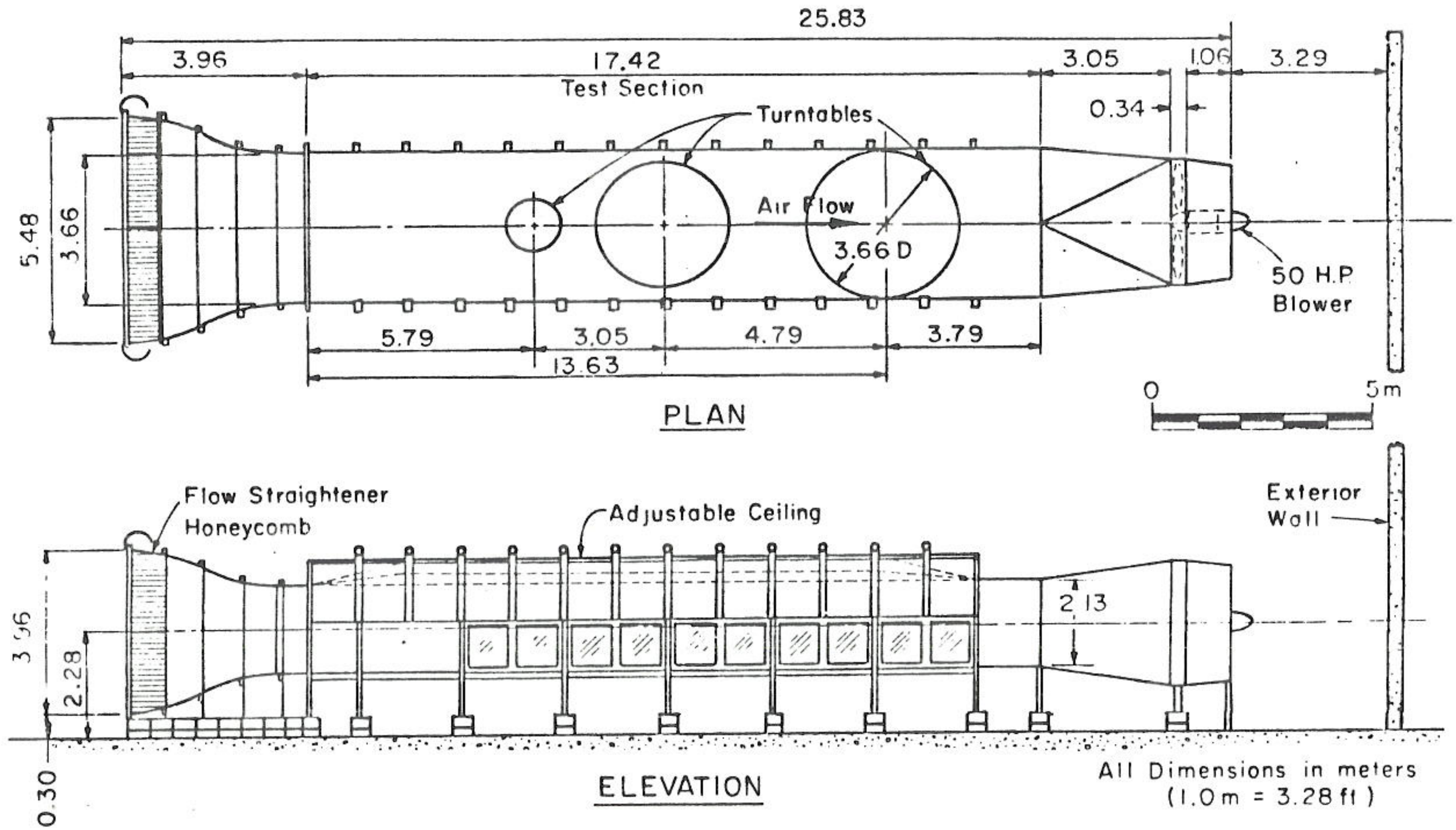
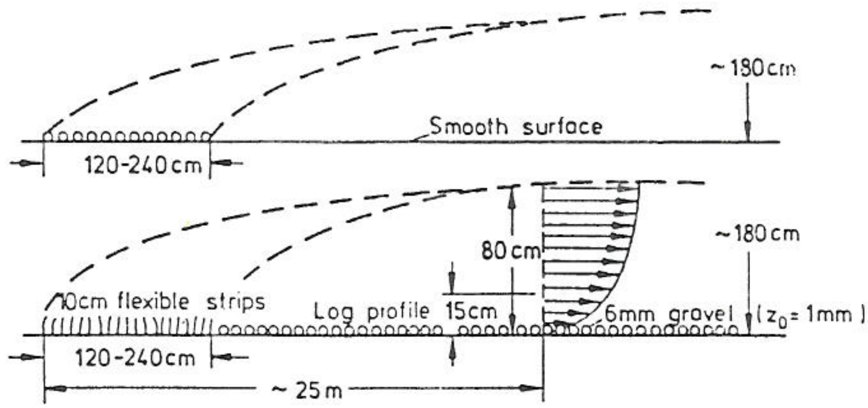
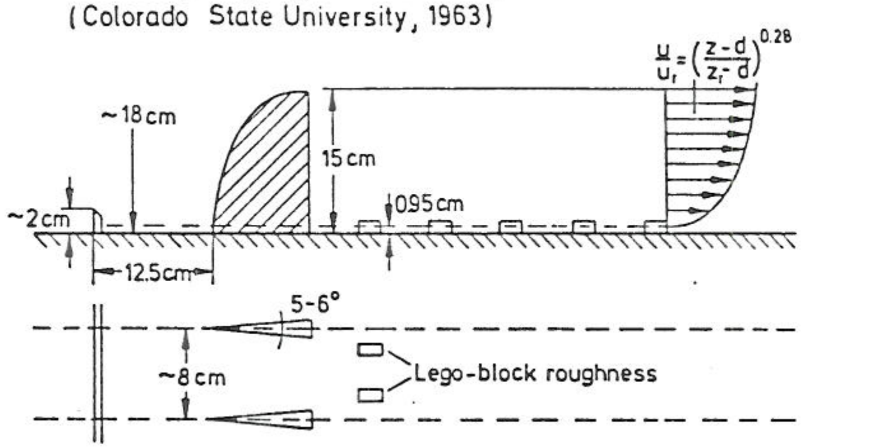


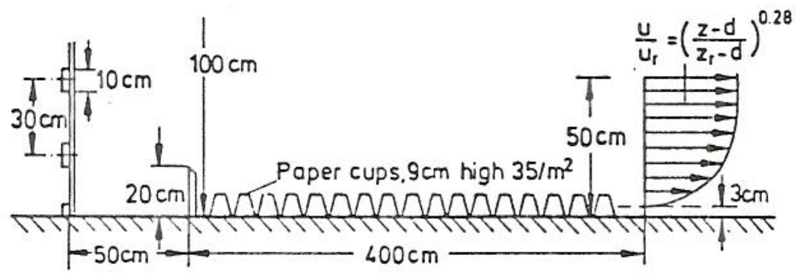
Figure 3 Open circuit meteorological wind tunnel (Fluid Dynamics and Diffusion Laboratory, Colorado State University)



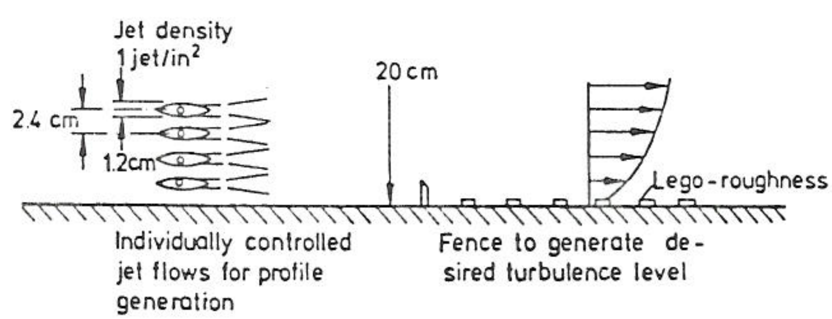
a. Boundary layer generation along test section floor (Colorado State University, 1963)



b. Boundary layer generation with vortex generators (Counihan, 1971)



c. Boundary layer generation with fence (Cook, 1973)



d. Boundary layer generation with jets (Teunissen, 1974)

Figure 4 Alternative methods for generating boundary layer flows in a meteorological wind tunnel (Plate, 1982)

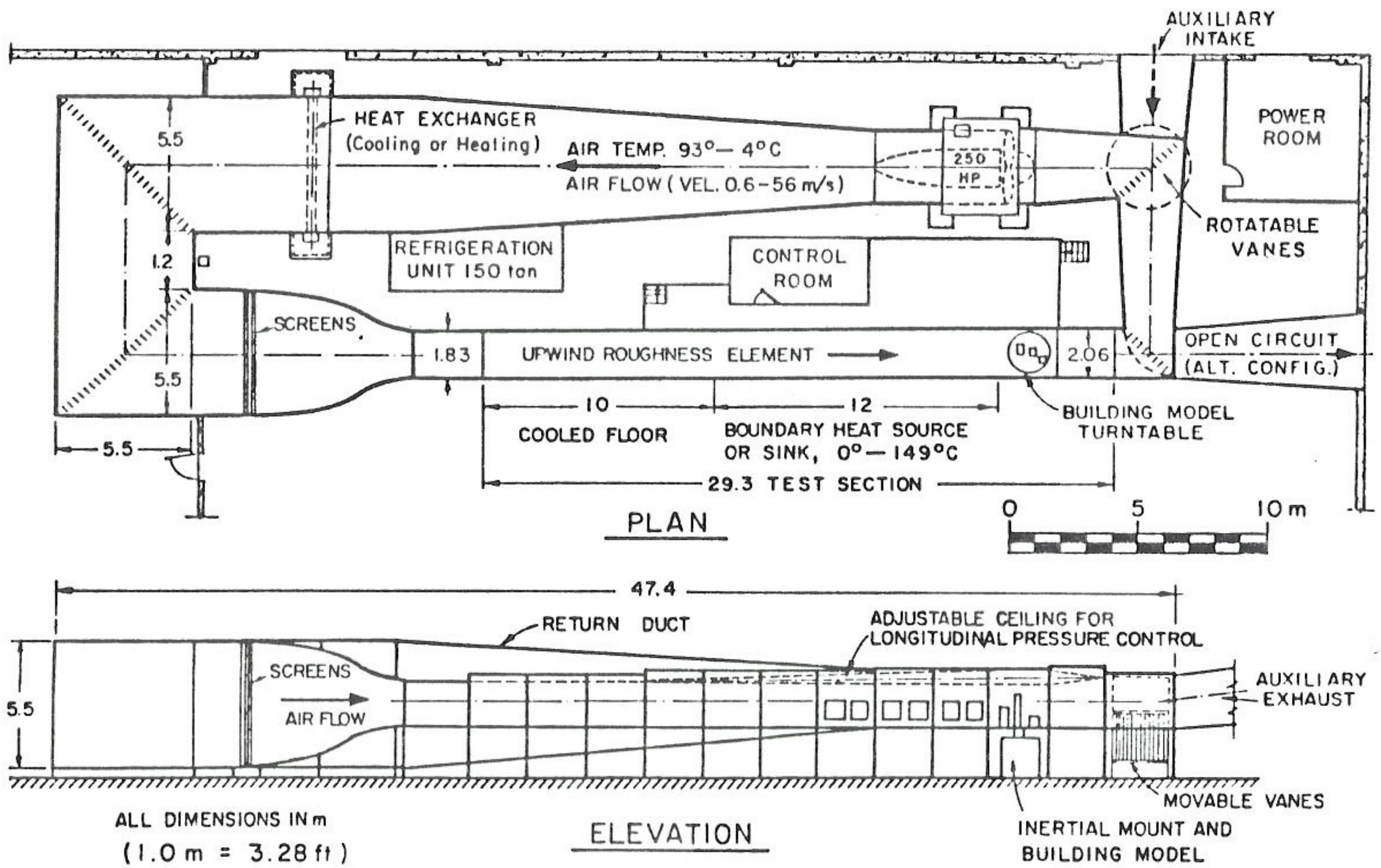


Figure 5 Closed circuit meteorological wind tunnel with stratification (Fluid Dynamics and Diffusion Laboratory, Colorado State University)

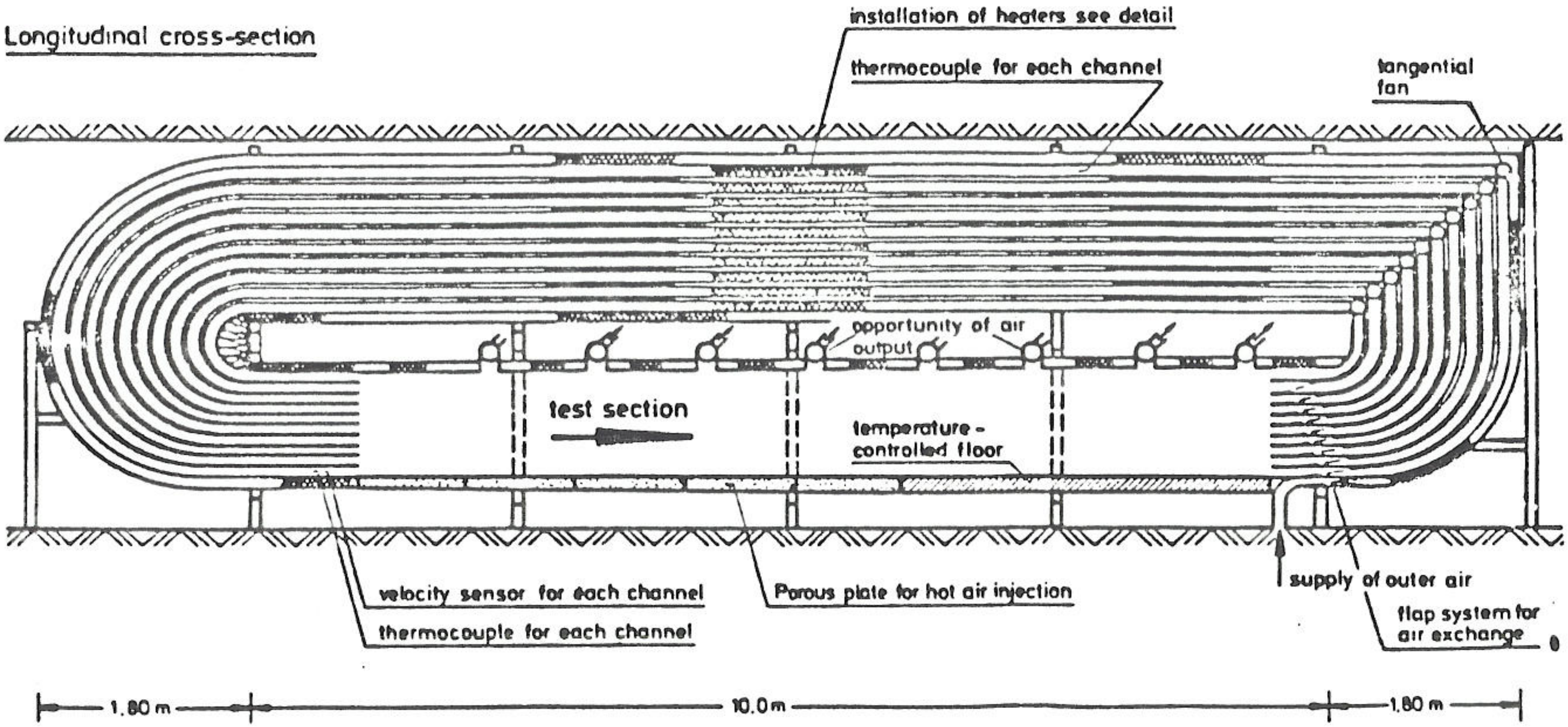
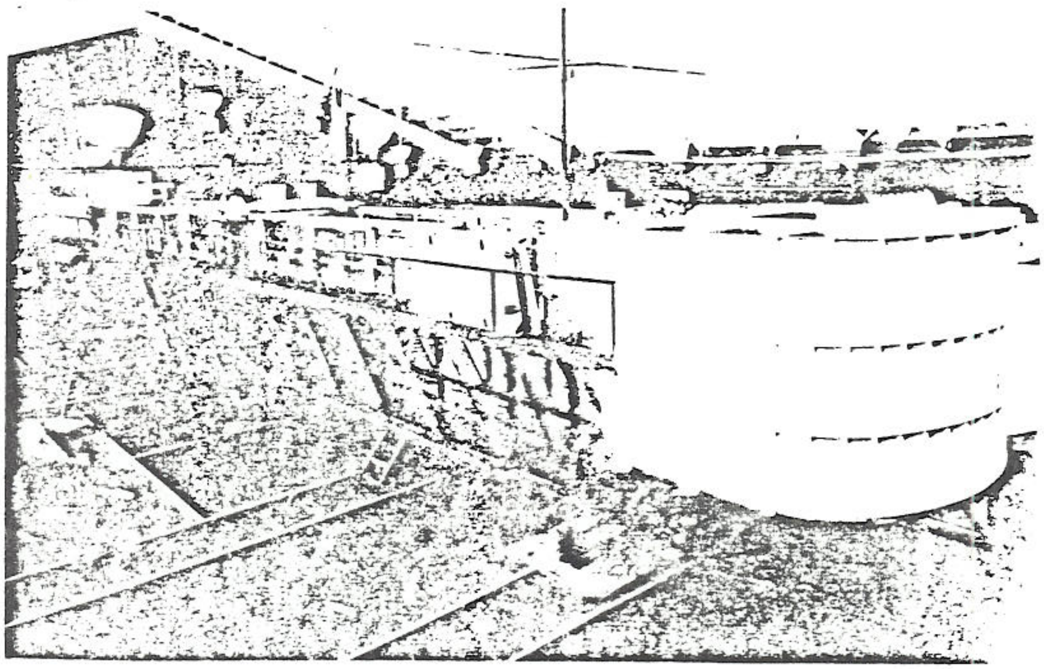


Figure 6 Ducted thermally stratified boundary layer wind tunnel (Rau and Plate, 1986)



(A) THE EPA WATER CHANNEL/TOWING TANK.

Figure 7 Large stratified water channel/towing tank (Environmental Protection Agency, Raleigh, NC)

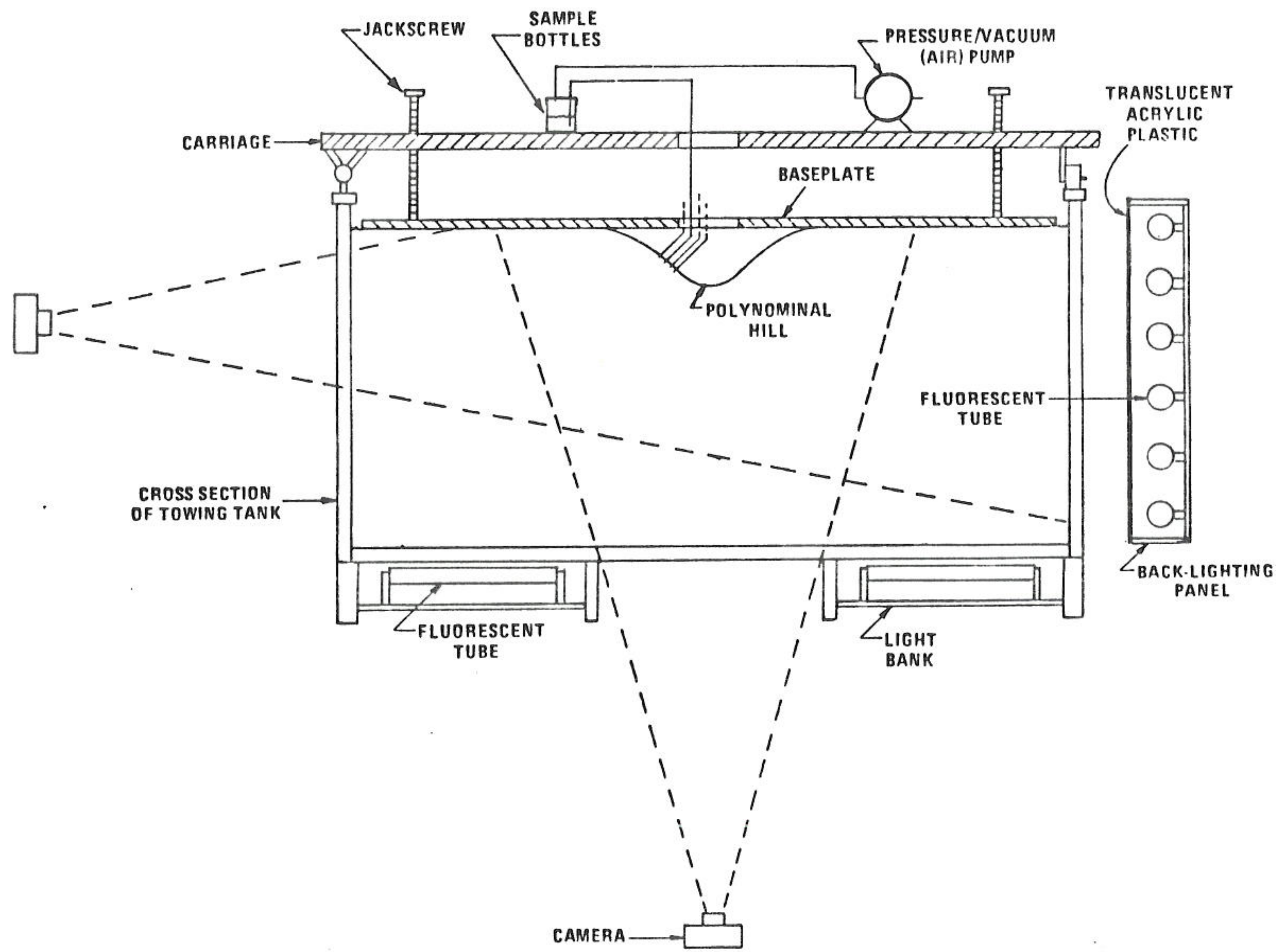


Figure 8 Water channel traverse with lighting and photographic arrangement for dye visualization during two tank experiments (Hunt et al., 1978)