

## Aerodynamics: Streamlined vs. Bluff body

- Airfoils, flat plate and wings are considered to be streamlined bodies. On the other hand, cylinder, sphere, trucks are bluff bodies.

- The flow around streamlined and bluff bodies is significantly different.

- The flow over streamlined body is usually smooth and the wake behind the body is small.

- The flow over bluff body, however, exhibits a large wake downstream the body. This wake is caused by separating flow from the body surface with a low-energy recirculating flow inside the wake as shown in the figure below.

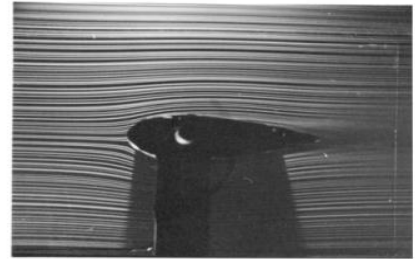
- The skin friction drag is due to the shear forces acting on the body and the pressure drag is due to flow separation from the body surface.

- Therefore, if the body is streamlined, the flow separation is minimal and one would expect that the friction drag is much greater than the pressure drag.

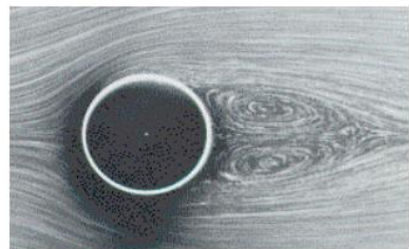
- Since skin friction drag is smaller for laminar than for turbulent flow, laminar flow is desirable for streamlined bodies.

- On the other hand, the pressure drag which is due to flow separation is much greater for bluff body than skin friction drag.

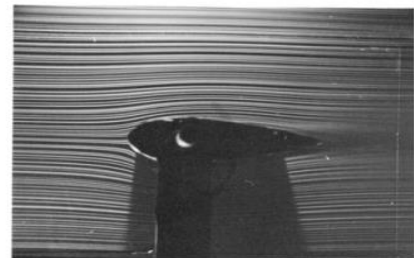
- In this case, the turbulent flow is desirable because the pressure drag for turbulent flow is smaller than for laminar flow.



Streamlined body- small wake

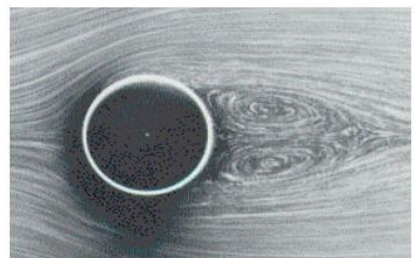


Bluff body- large wake



$$D_f \gg D_p$$

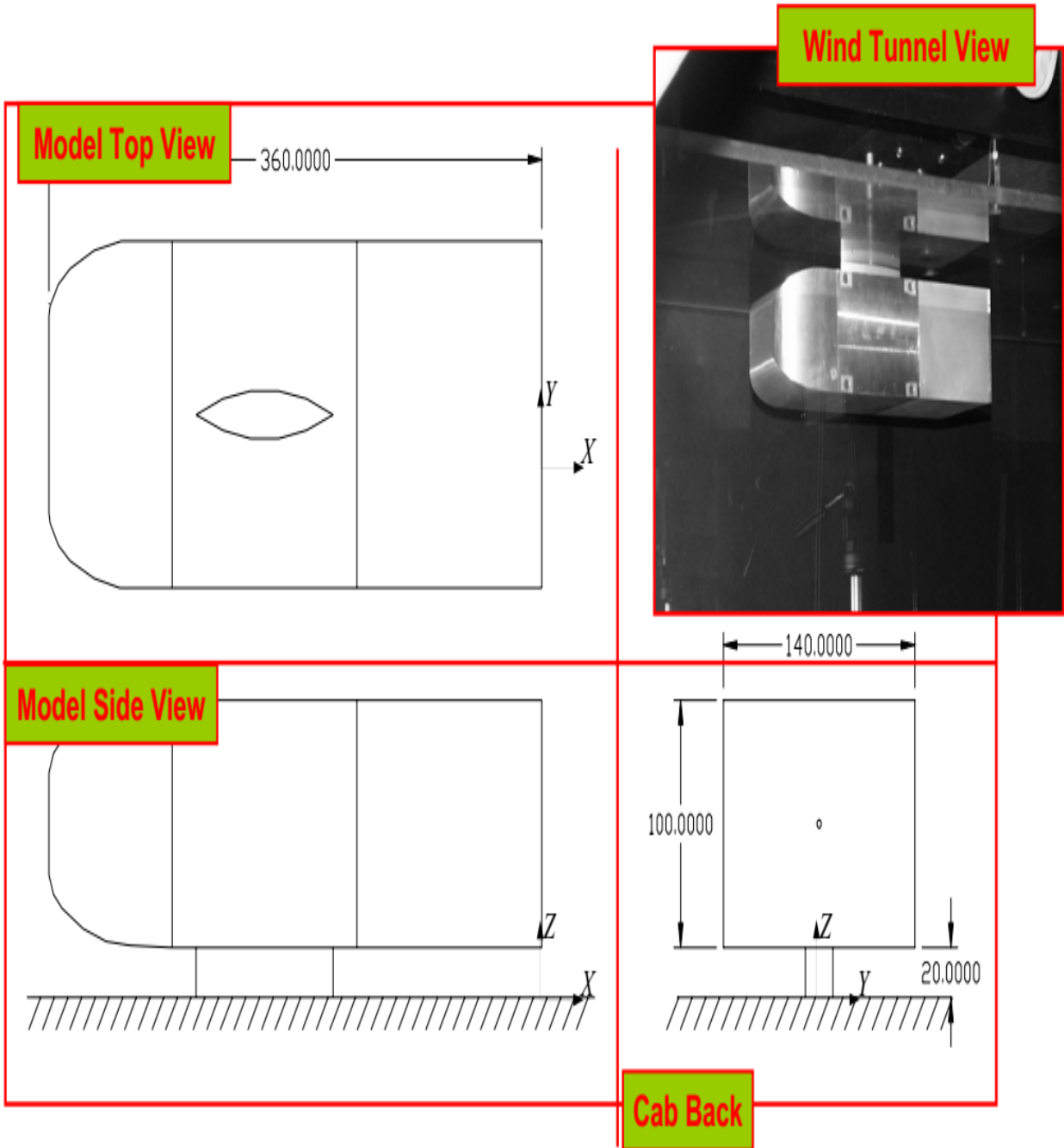
Laminar flow is desirable



$$D_p \gg D_f$$

Turbulent flow is desirable

# Bluff body: Square Back (SB) Model



# PIV Results

