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Endwall Flow Effects in a Tumbler[1] NICHOLAS A. POHLMAN, JULIO M. OTTINO, RICHARD M. LUEPTOW, Northwestern University — The flow of granular material in rotating tumblers is limited to the thin flowing layer at the free surface. Particle tracking velocimetry was used to measure the surface velocity for 1 mm and 2 mm glass particles and sand in cylindrical tumblers of various diameters, lengths, and rotation rates. Friction at the end walls slows the streamwise surface velocity, yet material just in from the end wall flows faster than that in the center of the tumbler. Although the axial velocity in the center of a long tumbler is negligible, a non-negligible axial velocity exists near the end walls of cylindrical tumblers. The axial flow and increase in streamwise velocity are likely a result of the conservation of mass of particles passing through the flowing layer near the endwall. Increasing the end wall friction slows particles adjacent to the end wall, further enhancing the axial flow near the end wall. Decreasing the total axial length of the cylinder to quasi-two-dimensional causes the axial flow regions near the endwalls to merge and generates an even higher streamwise velocity than for three-dimensional tumblers.

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