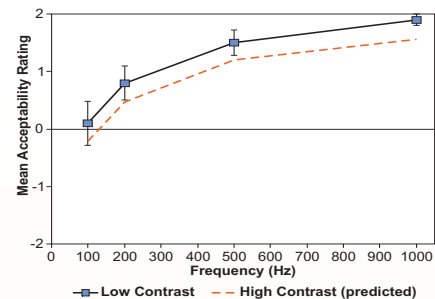


# ASSIST recommends...

## Light Source Flicker: Application Considerations

The Alliance for Solid-State Illumination Systems and Technologies (ASSIST) has published a guide describing experimental data that illustrate how detection and acceptability of stroboscopic effects change under different conditions that might be more applicable to certain lighting applications. The guide, “ASSIST recommends... Application Considerations Related to Stroboscopic Effects from Light Source Flicker,” provides a framework for evaluating different applications based on the importance of flicker, with several examples included.

The ASSIST recommends document describes several sets of experimental data. In order to understand how flicker frequency and the amount of modulation affect the perception and acceptability of stroboscopic effects, a high-speed, high-contrast task was used. Subsequently, a similar experiment was performed but with a low-speed, low-contrast visual task (see figure). Finally, a third study was conducted using both high- and low-speed tasks to compare the flicker index and percent



Acceptability ratings ( $\pm$ s.e.m.) for stroboscopic effects (squares) after waving a white rod against a white background and viewing the metronome. Also shown (dashed line) are the predicted acceptability ratings after waving a white rod against a black background (a high-speed, high-contrast task) (Bullough et al. 2012).

flicker metrics. The ASSIST recommends publication describes data from other studies focusing specifically on flicker at 100 and 120 Hz, corresponding to power line frequencies for electrical power. Recommendations for limiting perceptions of stroboscopic effects are given for different classes of applications, ranging from those with little visual motion where sensitivity to flicker is low, to those with rapid, high-contrast visual motion where sensitivity is high (see table).

### For More Information

The ASSIST recommends publication is available for free download:

<http://www.lrc.rpi.edu/programs/solidstate/assist/recommends/flicker.asp>



Bullough, JD, Sweater Hickcox K, Klein TR, Lok A and Narendran N. 2012. Detection and acceptability of stroboscopic effects from flicker. *Lighting Research and Technology* 44: 477-483.

Bullough, JD, Skinner NP and Sweater Hickcox K. 2013. Visual task performance and perceptions of lighting quality under flickering illumination. *Journal of Light and Visual Environment* 37: 189-193.

Bullough JD and Marcus D. 2015. Influence of flicker characteristics on stroboscopic effects. *Lighting Research and Technology*, doi: 10.1177/1477153515599566.

### Sponsor

Alliance for Solid-State Illumination Systems and Technologies (ASSIST)



Application	Visual Task	Relative Importance of Flicker	Justification
Industrial facilities	Work on high-speed equipment	High	Stroboscopic effects can be visible at frequencies exceeding 1000 Hz when rapid motion is present (Bullough et al. 2012b)
	Stationary work or work on low-speed equipment	Medium	When speed of motion is low or moderate, stroboscopic effects can be difficult to see at frequencies above 160 Hz
Office/school facilities	Computer-based work	Low	Flicker/stroboscopic effects were barely detectable at 100-120 Hz when working on computer (Bullough et al. 2011) and rated very acceptable
	Paper-based work	Medium	Visual performance of some tasks is reduced under high-modulation flicker at 100-120 Hz (Veitch and McColl 1995; Jaen et al. 2011; Bullough et al. 2013)
Outdoor locations	Basic orientation	Low	Flicker/stroboscopic effects were barely detectable at 100-120 Hz when viewing stationary objects and scenes (Bullough et al. 2011)
	Vehicle driving	Low	Flicker modulation at 100-120 Hz is high with commonly used high pressure sodium lamps (Navigant 2012) but not judged to be problematic (Lehman and Wilkins 2014)
Retail/gallery spaces	Viewing art / merchandise	Low	Flicker/stroboscopic effects were barely detectable at 100-120 Hz when viewing stationary objects and scenes (Bullough et al. 2011)
Sports facilities	Playing sports	Medium	High-modulation flicker at 120 Hz can be objectionable to players and/or spectators (Rea and Ouellette 1988); reducing modulation at these frequencies increases acceptability.

Relative importance of flicker and stroboscopic effects for visual tasks performed in several different applications. (See the ASSIST recommends publication for details on the references noted in the table.)

