### Various blur depending on the speed (magnified)







Camera used: Sony Alpha 7 (24MP FF) Lens: 35mm Exposure: 1/30s

#### Walkers speed: 1m/s (3.6km/h) Distance to people: 22m



#### Various exposure and number plates @ 50km/h

## 1/30s

A

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## 1/1000s



### Damjanovski "Motion blur formula"

 $p_V$  = projected object speed on the sensor expressed in pixels blur during the sensor exposure

$$p_v = (f \cdot v \cdot t) / (d \cdot p_s)$$



Observed scene W V (m/s)

 $p_v = moving objects appearing on that many pixels$  f = focal length of a lens (mm) d = distance to the observed scene (m) w = width of the observed scene at a distance d (m) v = velocity of the moving objects (m/s) t = exposure of the sensor (s), typically 1/25s or 1/30s s = imaging sensor width (mm) 1/4" => s = 3.2mm 1/3" => s = 4.8mm 1/2" => s = 6.4mm 1/2.5" => s = 5.7mm (5MP mode) 1/2.5" => s = 4.2mm (1080 HD mode) $p_s = pixels size = s/p_h, e.g. 4.2mm/1920 = 2.1875 \mu m$ 

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### Vehicle movement at an angle



# **Example:**

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**v = 60 km/h** at an angle  $\alpha$  = 30° => sin 30° = 0.5 => v<sub>v</sub> = 30 km/h



#### Person running at an angle



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