RMSS White Paper Series

Holland®

Gauge Face Angle

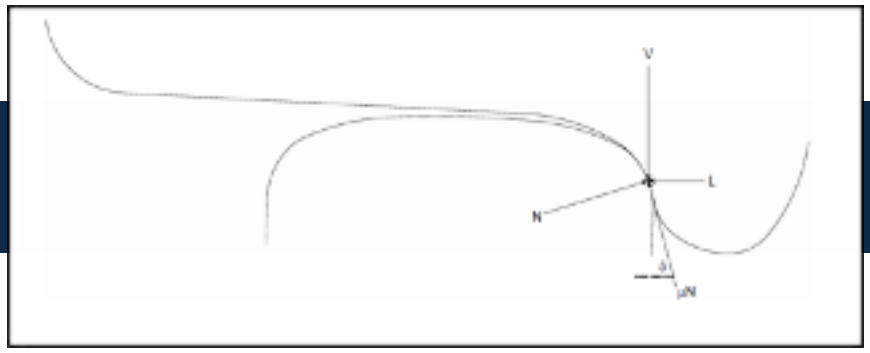

Figure 1
Wheel Flanging Schematic with
Force and Contact Angle Diagram

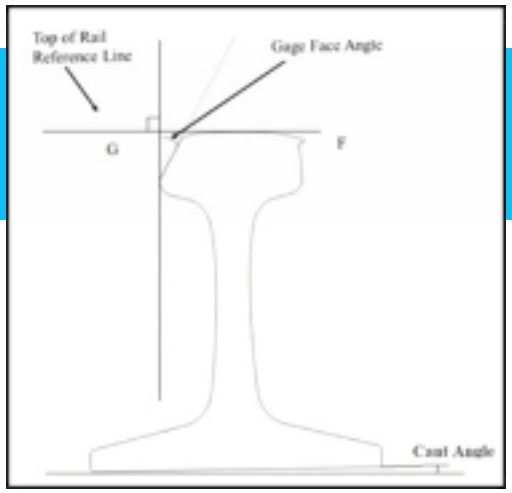

Figure 2
GFA Schematic with Rail Cant Angle

What is Gauge Face Angle (GFA)?

Rail gauge face angle (GFA) is a key component of the contact angle formed between wheel flange and rail gauge faces. GFA is measured at 5/8-inch below the top of rail (gauge point), typically where wheel flange engages rail. Straight line is formed between 2 mm above and below the gauge point and the angle between this line and vertical line with respect to track level is typical defined as GFA.

Why is Gauge Face Angle (GFA) important?

Wheel and Rail Interface (WRI) management is essential for a safe and profitable railway operation. Undesired wheel and rail contact geometry and friction environment can result in derailments (wheel flange climb and gauge widening) and premature wheel and rail failures (rolling contact fatigue, corrugation and excessive wear).

Desired wheel and rail contact geometry during flanging is a “conformal” one as shown in Figure 3. Wheel flange angle is high (72^0 - 75^0) and GFA is low (0^0 - 2^0).

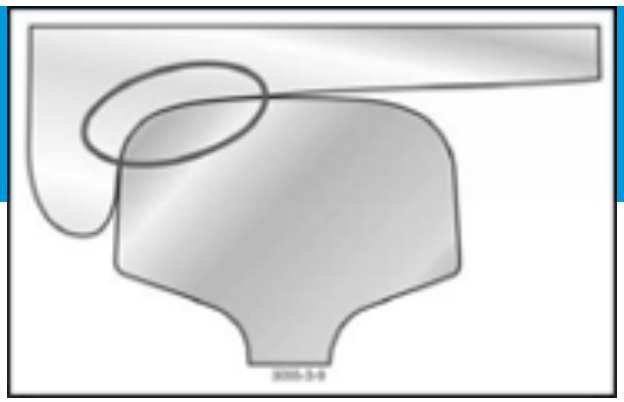

Figure 3
Conformal Flange Contact Geometry

If wheel flange and rail gauge profiles are not monitored, undesired combinations occur over time due to wear. GFA can change from 0^0 (new rail on a 1:40 cant) up to 30^0 and that can create a two-point contact combination with a high flange angle wheel geometry. Two-point contact will result in accelerated wear and fatigue in both wheels and rails.

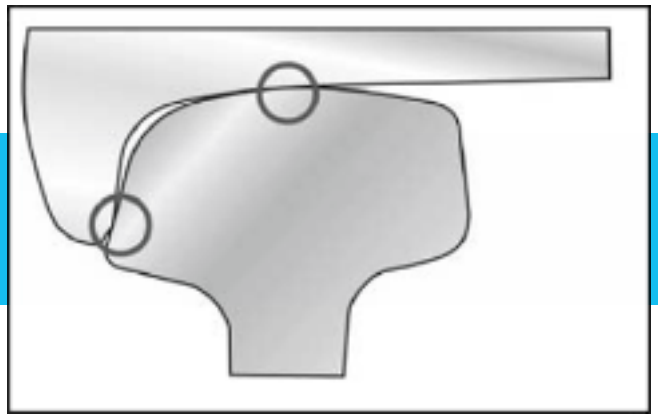

Figure 4
Two-Point Contact Condition for Excessive Wear and Rolling Contact Fatigue

Another undesired scenario is when wheel flange angle reduces over time and when coupled with a low rail GFA, it can form a single gage corner contact which results in gage corner fatigue. In addition, lower wheel flange angle can result in flange-climb derailment under sufficient lateral-to-vertical (L/V) force ratio and friction coefficient.

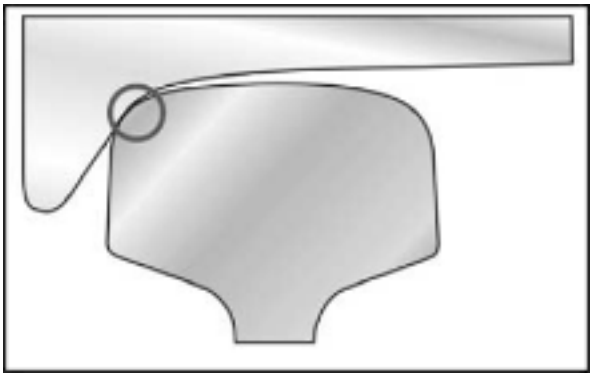

Figure 5
Low Contact Angle Condition for Flange-Climb Derailment

Figure 6 Argus Autonomous Track Geometry and Rail Measurement System

Rail GFA is calculated from a full rail profile and cant angle measurements. Argus system provides full track geometry, rail profile and cant measurements with a compact, low-power and lightweight unit. Argus units can be deployed from different size hi-rails, rail-bound vehicles and locomotives.

Figure 7
Rangecam Rail Measurement Example with a GFA (13.2^0 Left Rail, 0^0 Right Rail)

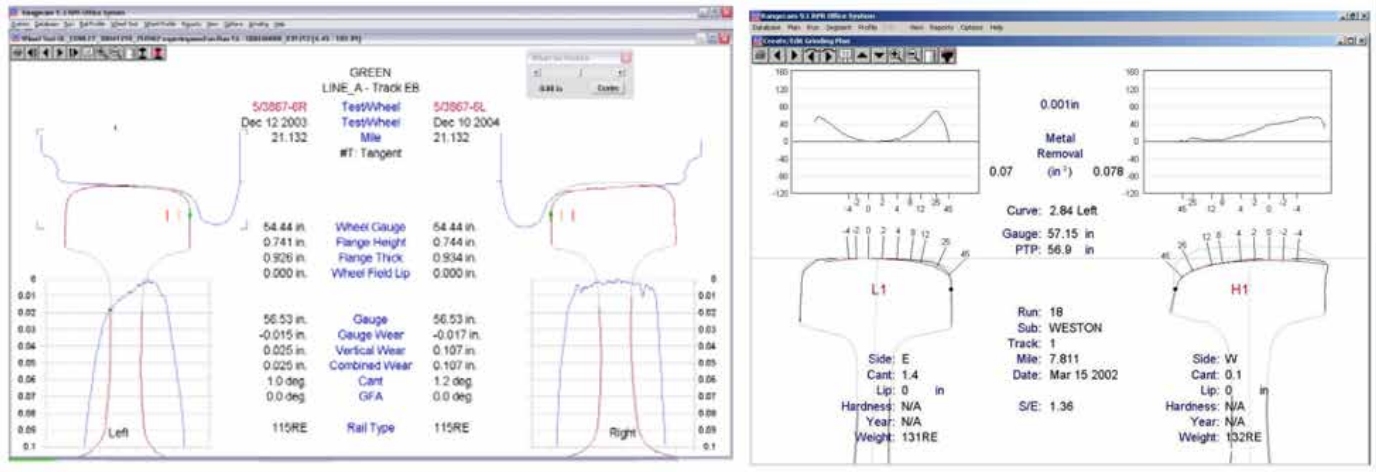

Figure 8
Rangecam Wheel&Rail Interface Analysis and Grinding Planning Tools

Rangecam software can use Argus and 3rd party rail profile measurement data, identify rail weight, calculate rail wear parameters and calculate GFA. In addition, Rangecam provides trend analysis, rail grinding planning, and wheel and rail interface analysis tools. Holland's Rail Measurement Systems and Services (RMSS) group provides track geometry measurement, rail measurement and track testing products and services with TrackSTAR fleet, Argus measurement technology and Rangecam track data analysis software. RMSS has served to Class I, Regional and Short Lines, and Transit Agencies in North America for more than 25 years successfully.

Email sales@hollandco.com and let us help you learn more about how Holland helps you make the most of your testing and data requirements

Holland®

Gauge Face Angle

1000 Holland Dr. Crete, IL. 60417

hollandco.com
708.672.2300