Using enDAQ Sensors to Investigate Motorcycle Impact Into a Vehicle

SNAPSHOT:

Challenge
Accurately calculate speed loss in a motorcycle during impact

Solution
enDAQ sensors were installed at the center of gravity in both the motorcycles and the cars and three crash tests were performed

Result
Momentum Engineering Corp. found that the EDR data predicted the motorcycle ΔV within a range of -5.9 mph to +3.1 mph.

Challenge

For an accident reconstruction firm like Momentum Engineering Corp. (MEC), the data that comes from an event data recorder (EDR) inside a vehicle when the airbag control module deploys an airbag is crucial to investigating a crash. From the information garnered from an EDR, accident reconstructionists can calculate speeds and impact forces that were experienced by another vehicle in a crash. This information is essential to constructing an accurate picture of what happened during impact.

But what about investigating a motorcycle-vehicle accident? How does that differ from a vehicle on vehicle crash? When reconstructing motorcycle-vehicle crashes, the rider's mass can significantly impact a crash investigation and the efficacy of the calculated results. Ed Fatzinger of MEC wanted to investigate what the correct effective mass for motorcycle/rider combinations should be to accurately calculate speed loss in a motorcycle during impact as well as how the EDR data in the struck vehicle can accurately be used to calculate the motorcycle speed loss.

About Momentum Engineering Corp.

Momentum Engineering Corp. (MEC) is a consulting firm specializing in accident reconstruction, forensic engineering, heavy truck safety, graphics and animation. With over 50 years of accident reconstruction experience, they offer accident reconstruction and investigation services ranging from rapid response to final trial testimony. They will provide clients with state-of-the-art accident reconstruction services in a cost-effective manner.

Website:
https://www.momentum-eng.com/

Email:
info@momentum-eng.com

Read Momentum Engineering Corp.'s technical paper in SAE International:

Using Vehicle EDR Data to Calculate Motorcycle Delta-V in Motorcycle-Vehicle Lateral Front End Impacts

Solution

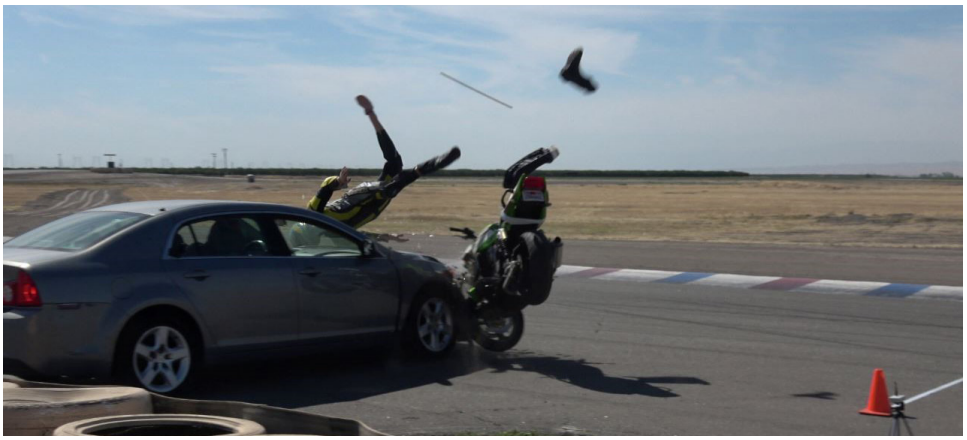
Because of the enDAQ sensor's portability and convenient small size, they were able to be directly affixed to both the motorcycles and vehicles. The team installed the sensors (the S4-R500D40, formerly Slam Stick S) near the center of gravity of three sport bike style motorcycles and at the center of gravity of three vehicles (the S4-E25D40, formerly Slam Stick X). The sensors were also strong and robust enough to survive the impact of a motorcycle crashing into a car and reliably capture data that accident reconstruction engineers have been unable to directly measure before. For these tests, the enDAQ sensors in the vehicles were used to corroborate EDR data within the cars. The vehicle data was secondary to comparing the airbag module data from the car with the enDAQ sensor data from the motorcycle.

MEC then performed three motorcycle to car crashes with a dummy in full gear weighing approximately 200 pounds colliding with the front right corner of a passenger vehicle. The vehicle-motorcycle pairings were:

Kawasaki ZRX1200R vs. Chevrolet Malibu

Yamaha YZF-R6 vs. Ford Focus

Kawasaki Ninja EX300 vs. Nissan Sentra



After the crashes, they extracted the airbag module data from the vehicle, and used that for the comparative analysis. "We compared that to the enDAQ sensor data to see how reasonable it would be to use the airbag module data to get motorcycle speed," said Nick Famiglietti, an engineer who worked on the project.

"What we did was we pretended as if this were a crash that we were investigating so we used the airbag data from the car to calculate what we thought the severity of the motorcycle would be. And then the sensor data from the motorcycle told us what the severity actually was," said Famiglietti.

Contact

Feel free to contact us for more information about our enDAQ products.

Email: www.endaq.com/contact
Phone: +1 781 306-0634

Results

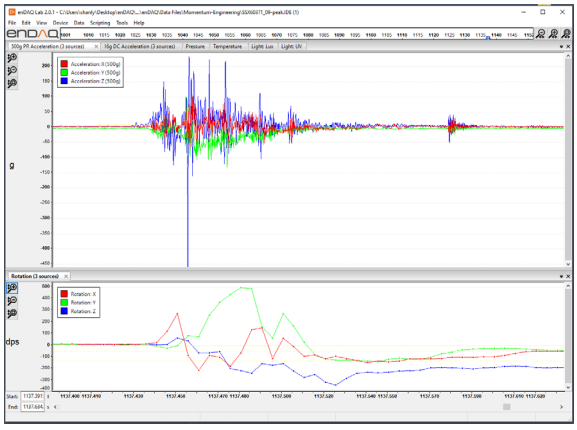
With the many onboard sensors (two triaxial accelerometers including a piezoresistive and variable capacitance along with a gyroscope to measure rotation), MEC could measure multiple parameters across multiple tests with one configurable and adaptable enDAQ device. Some of the metrics recorded by the enDAQ sensor were:

- Velocity change caused by crash of ~37 mph or 650 in/s
- ΔV pulse duration of around 0.1 second
- Peak acceleration levels of ~500g

	Kawasaki vs Malibu	Yamaha vs Focus	Kawasaki vs Sentra
Motorcycle ΔV Resultant	37	38.9	38.8
Pulse Duration	0.073	0.094	0.145

They also used the filtering functionality in enDAQ Lab in their analysis. The data from the enDAQ sensors attached to the motorcycle were filtered using the 5th order Bessel filter that is installed in the enDAQ sensor. The cutoff frequency was set to 1/5th the sample rate.

Through the data gathered during these crash tests, MEC established the relationship between the predicted and actual severity experienced by a motorcycle during a broadside impact with a vehicle. MEC found that the EDR data predicted the motorcycle ΔV within a range of -5.9 mph to +3.1 mph. The underpredicted values were calculated based on the weight of the motorcycle and the weight of the crash test dummy, and the overpredicted values were calculated using the weight of the motorcycle and half the weight of the crash test dummy. They found that the impact severity measured by the enDAQ sensor was between those two values.



Data from Kawasaki (with the enDAQ sensor mounted near the center of gravity) when it impacts the Malibu