SINTRA
ENGINEERING INC

SPRING EDITION NEWSLETTER

2004

IN THIS ISSUE

INFORMATION UPDATE:

Sintra Engineering presented another peer reviewed paper. This biomechanical paper provides a mathematical model for the motion of restrained occupants in frontal collisions. The paper was presented in March 2004 at the Society of Automotive Engineers World Congress in Detroit.

UPCOMING SEMINAR:

Sintra Engineering is presenting a seminar for lawyers, insurance adjusters and risk managers. The title of the seminar is *The Biomechanics of Injury* and will be presented at Grant MacEwan College in Edmonton on May 6, 2004. For further details please call 780-420-1551.

ACCIDENT RECONSTRUCTION

Night-time Visibility Studies

Often, two of the questions put forward in night-time motor vehicle collisions are: what could the driver have seen in the time leading up to the collision, and when could he or she have seen it?

These can be difficult things to assess, particularly if the lighting at the time of the incident was less than optimal. Resolution of these questions often entails a night-time visibility study.

It may seem reasonable to simply go to the site at the same time of the day that the incident occurred and, using either a regular or digital camera, take a picture. The photograph you get will show how things appeared, right? Unfortunately, this approach doesn't work.

While the photograph will probably turn out, particularly in light of the photographic technology now available to us, such a photograph is almost never useful in demonstrating the visibility conditions that would have been present at the time of the incident. Consequently, such a simplistic approach is not appropriate when you need to determine what a driver who was involved in a collision could have seen.

To understand how a night-time visibility study works, one needs to understand that there is a difference between how eyes work and how cameras function. Photography involves passing light through a lens to expose photosensitive chemicals, producing a negative, and then using the negative to produce a paper image. However, the way a camera records an image is different from how the eye sees.

Within the eye, visibility is a function of two processes: sensation and perception. Sensation refers to the issue of whether the light from the object was sufficient to reach a physiological level needed for detection.

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PROFILE

CAM JORAWSKY
PROPERTY INVESTIGATIONS

Cam Jorawsky is an engineering intern at Sintra Engineering who specializes in failure and fire investigations. His current focus at Sintra deals mainly with equipment and vehicle investigations (property). Cam received his Mechanical Engineering degree at the University of Calgary in 2000 with a focus on materials and mechanical systems; he has been with Sintra since late 2000.

He has been involved with vehicles since secondary school and was able to use his skills to coordinate the U of C's 2000 SAE Mini-Baja 7 design team. The team designed and built a single-seater off-road vehicle and competed against other engineering schools from around the world.

Cam grew up on a farm near Calgary and spent his summers during university in an oilfield near Drumheller. When not at Sintra, Cam can be found playing volleyball, working on his project car, or playing his guitar.

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Perception has more to do with the viewer's attention, memory and other cognition functions. For example, an object might be detectable, but still not seen because the viewer's attention was not engaged.

One of the goals of a visibility study focuses on sensation. The aim is to determine the lighting conditions present at the time of a motor vehicle collision in order to assess whether certain hazards should have been visible.

Sintra Engineering has developed a qualitative technique that accurately reproduces, in photographic form, the lighting, contrasts, and visibility levels that were present on the night of the incident in question. This technique calibrates the resulting photographic images by considering how and what our eyes actually see.

While other more quantitative methods of performing a visibility study exist, they more typically involve the assessment of the illuminance. The results from this type of visibility assessment can be difficult to understand and compare to the incident involved.

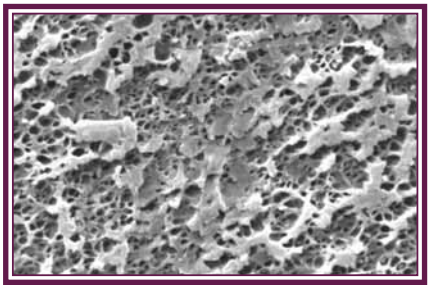
The photographs produced through our proven qualitative technique permit our clients to observe the visibility conditions present at the time of the incident without having to attend the scene or interpret complex illuminance parameters.

FAILURE INVESTIGATION

Materials Science and Engineering

Materials Engineering: What is it? How is it beneficial? Most importantly, how can it be used in insurance or legal claims?

Materials science investigates the structure and properties of materials. The closely related field of materials engineering uses the findings of materials science in order to design and analyze real-world materials applications. Once called metallurgical engineering, materials engineering has expanded to include the production and engineering application of both metallic and non-metallic substances, including polymers, ceramics, composites, electronic materials and biomaterials.



Materials engineers work primarily in three sectors. The first is concerned with the conversion of raw resources into useful engineering materials; it includes mineral processing, aluminum smelting and steel making. The second sector is manufacturing, which extends from the rolling and rod mills found in metal forming plants, to the manufacturing of various products used in automotive, aerospace, electronics and petrochemical industries. Finally, we come to the sector in which Sintra Engineering operates: the service industries that specialize in fracture mechanics, failure investigation, wear and corrosion.

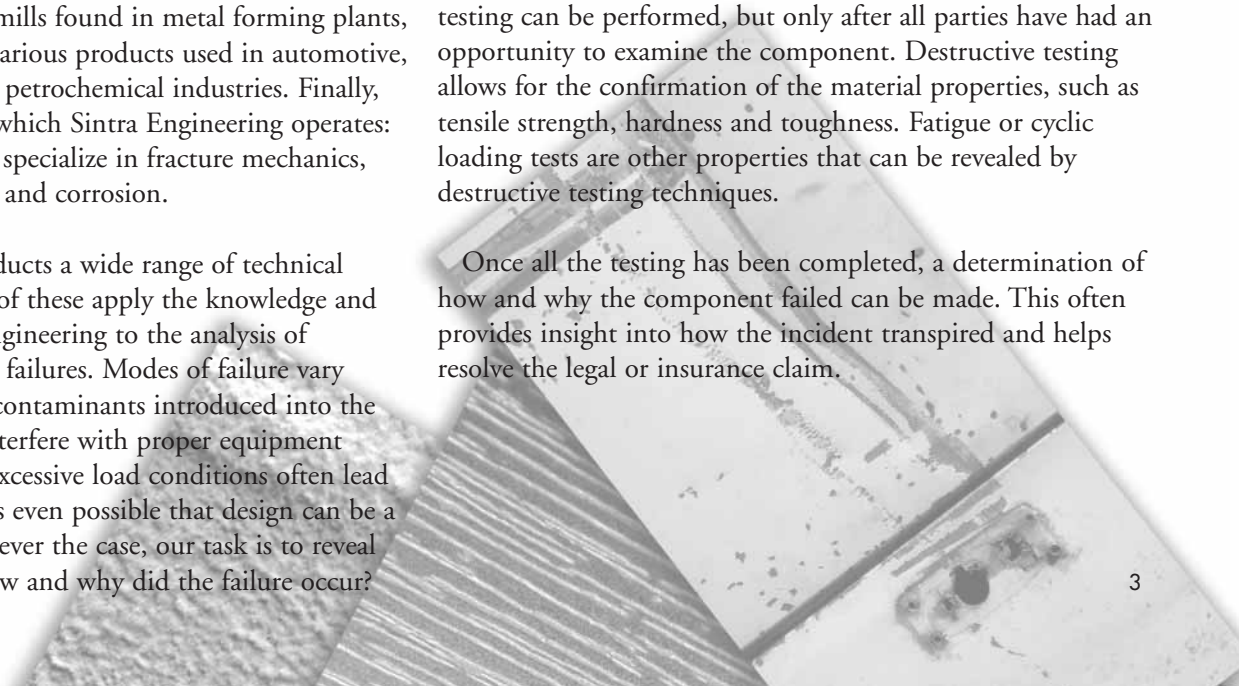
Sintra Engineering conducts a wide range of technical investigations, and many of these apply the knowledge and techniques of materials engineering to the analysis of equipment or component failures. Modes of failure vary considerably. Sometimes contaminants introduced into the operating environment interfere with proper equipment operation. Alternatively, excessive load conditions often lead to component failure. It is even possible that design can be a contributing factor. Whatever the case, our task is to reveal the underlying factors: how and why did the failure occur?

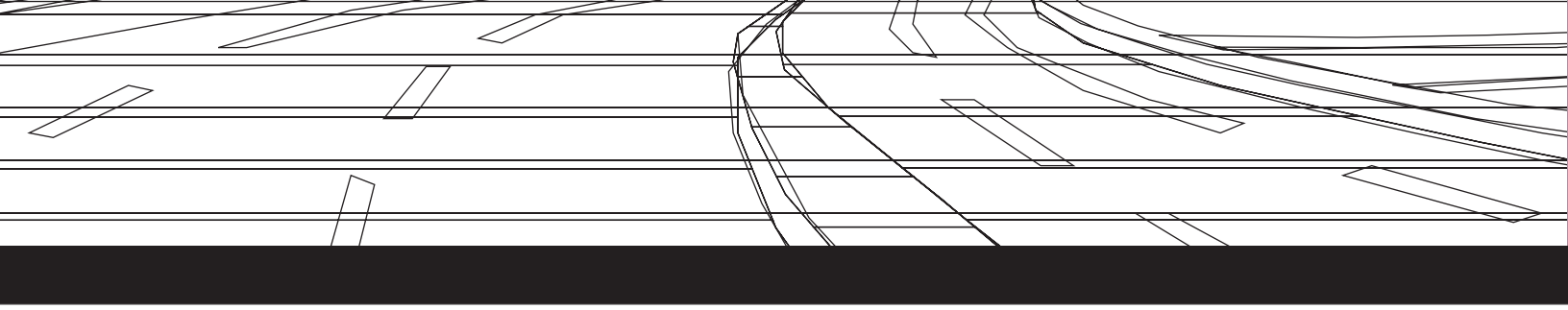
While each investigation is unique, all involve a thorough and systematic approach. The first step is to collect background information, including the time and place of the failure, identification of the component that failed, material specifications, service life of the component, operating conditions, and inspection/maintenance schedules. Once the background information has been collected, a visual examination is performed either at the site of the failure or at Sintra Engineering's facilities. In many cases, the visual inspection can diagnose the type of failure, but further testing may be necessary to evaluate these initial findings.

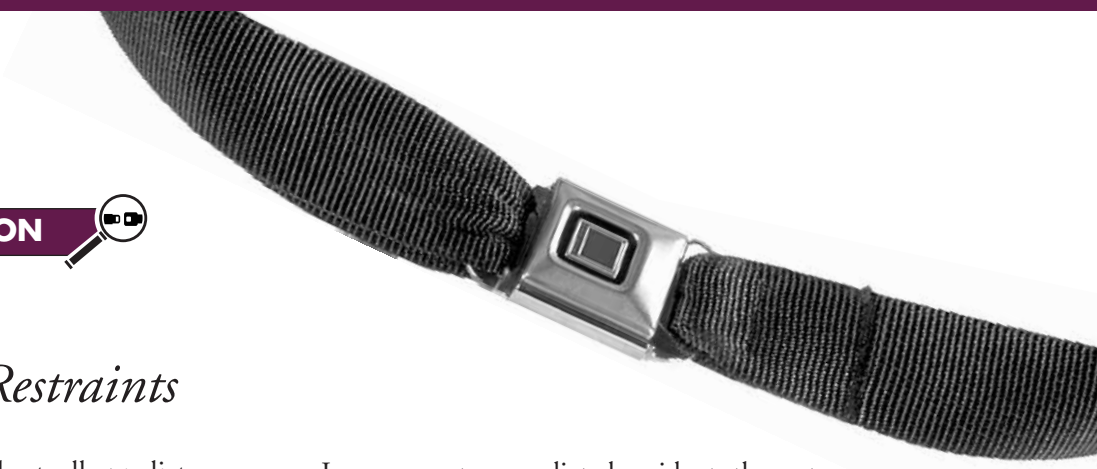
In addition to the visual inspection, we can employ various methods of non-destructive testing. This testing leaves the component or equipment intact. Examples of non-destructive testing include inspection under high magnification, determination of chemical composition using energy dispersive spectroscopy, and x-ray examination. This type of evidence can often provide strong evidence of the cause of the failure.

When more exhaustive testing is necessary, destructive testing can be performed, but only after all parties have had an opportunity to examine the component. Destructive testing allows for the confirmation of the material properties, such as tensile strength, hardness and toughness. Fatigue or cyclic loading tests are other properties that can be revealed by destructive testing techniques.

Once all the testing has been completed, a determination of how and why the component failed can be made. This often provides insight into how the incident transpired and helps resolve the legal or insurance claim.







ACCIDENT RECONSTRUCTION

The Future of Occupant Restraints

Wouldn't it be great if vehicles could actually predict collisions or dangerous situations before they actually happened? With this capability, occupants could be better prepared and made safer for an impending collision.

Well, the future may be here. DaimlerChrysler has developed a passive safety system that prepares occupants for an impending collision. When vehicle sensors detect an imminent collision, *Pre-Safe*, DaimlerChrysler's name for their new system, tensions seat belts, re-aligns seats to safer positions and closes open sunroofs. If no collision occurs, then the seat belts automatically reset themselves, while other settings can be reset by the driver.

***Pre-Safe* will recognize three crucial situations:**

- emergency braking
- oversteering/understeering (which occurs before almost 75% of lateral collisions)
- avoidance maneuvers

Pre-Safe uses existing system sensors to monitor vehicle speed, braking torque, brake pedal application speed, wheel slip, acceleration, steering speed and other important parameters. The system will recognize three crucial situations: emergency braking, oversteering/understeering (which occurs before almost 75% of lateral collisions) and avoidance maneuvers.

In response to a predicted accident, the system uses "reversible" seat belt tensioners rather than the more common pyrotechnic pre-tensioners, which use a small explosive charge to retract an occupant back into the seat. Also, the system moves the seat along its track away from the dashboard and rotates the seat back and cushion to a more favourable position in order to reduce the risk of the occupant submarining under the seat belt assembly. For example, when a passenger is sleeping with the seat reclined, *Pre-Safe* adjusts the seat back to a more upright position. It also closes the sunroof to reduce the risk of injury during rollovers by avoiding external penetration and occupant ejection.

Further developments of this safety system will include closing of side windows, using seat shaping to keep occupants firmly in place and using padded elements that extend from the car's interior.

Currently, this system is standard on the Mercedes-Benz S-Class luxury sedans, but as the technology improves and becomes more affordable, expect to see *Pre-Safe* and other predictive safety systems included on more vehicle models.

SINTRA ENGINEERING INC

www.sintraeng.com

EDMONTON
10620 – 105 Avenue
Edmonton, AB T5H 0L2
PHONE: (780) 420-1551
FAX: (780) 420-1556

CALGARY
Suite 203, 1135 - 64 Ave SE
Calgary, AB T2H 2J7
PHONE: (403) 230-2344
FAX: (403) 230-2355
TOLL FREE: 1-877-244-6251