MIDWEST ASSOCIATION OF TECHNICAL ACCIDENT INVESTIGATORS

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MATAI Member Receives Award at 2000 Governor's Highway Traffic Safety Conference

Sgt. Phillip Baskerville, Black Hawk County Sheriff's Office, serves as a training officer there and has an extensive background in accident reconstruction merging it with traffic safety. He taught defensive driving to 120 Black Hawk County employees as well as to many reserve police officers, volunteer EMT and fire personnel. Sgt. Baskerville uses Accident Investigation photos in his lessons. He is the driving force in several pre and post-prom activities and has served with the Arrive Alive community traffic safety program.

Iowa Department of Public Safety Director
Penny Westfall presents Phil Baskerville with his award

Are You Ready For A Rocky Mountain High?

Jeff Groves and Guy Carroll are in the planning stages of MATAI 2001 in Fort Collins, Colorado. Preliminary plans are for the last week of May or the first week of June. This would accommodate the majority of members to make a family vacation out of the conference. Motorcycle Accidents will be the focus of the training.

A question was raised about chartering a bus to take to Fort Collins. This would save time and some money. People would still have to drive to a pick up site along the route. The possibility of a charter is being explored now. We would need enough interest from members to make this happen. If you are interested in doing this, e-mail , call or write to any of the board members.

ELECTION OF DIRECTORS.....

The terms of the following members of the Board of Directors will expire:

Steve Hasstedt (ISU DPS), Jim Johnson (Ames PD), R. Allan Mebus (Iowa City PD)

Anyone with interest or questions regarding serving as a member of the Board of Directors can contact any of the current Board members at the addresses listed in this newsletter.

Please remember the amended by-laws regarding the Election to the Board of Directors. Any current member wishing to nominate another current member for a three year term to the Board of Directors will notify the President, in writing, no later than September 1, 2000. The President and/or Secretary will notify the nominee, in writing, no later than September 15, 2000. The nominee will notify the President, in writing, no later than October 1, 2000 as to acceptance or declination of the nomination.

This will allow time for the nominees to provide a short biography for publication in the Winter Newsletter for review by the membership. An election ballot will be part of the "Check-in Packet" at the 2001 Conference in Ft. Collins, CO. Any current member that will not be able to attend the 2001 Conference will be able to request, in writing, an absentee ballot. The absentee ballot will be returned to the Secretary no later than May 1, 2001. All ballots will be counted on the opening day of the conference and the results will be announced at the Membership Business Meeting.

NOTE: Written notification can be either letter (via snail mail), E-mail which can be printed to hard copy, or facsimile. Please use the following address information for the election process:

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Life is like a Car-wash and I'm on a bicycle!

From The President. . .

Well, for those who could not attend the 2000 Conference in Eau Claire, WI, you missed a "smashing time". Our old friend Rusty Haight skidded in for the three day event that included 40 hours of information crammed into a few; nine, yes count them nine low speed impacts (in just one afternoon), and more fun and frivolity than you could shake the bumper off at. Analysis of Low Speed Impacts (TEEX) brought to many a much clearer understanding of investigating the "little fender bender" collisions that we all encounter on a daily basis. As one can imagine, the jokes about "letting the Insurance Company handle it" ran around the room. Most landed squarely on the shoulders of a fellow by the name of Richard Lesniewski? You remember him, the former officer from Milwaukee PD that defected, no, I mean quit, no, I mean retired, yeah that's it retired and started working for Progressive Insurance Company. Richard took it all in good stride and was responsible for buckets of hand-outs for everyone. Thanks Richard!

Co-hosts, Sgt. Rodney Stearns and Sgt. Jeffrey Pettis (Eau Claire Co Sheriff's Dept.) were in charge of the weather on crash day. Talk about having connections. These two fellows brought in people from around the world, found cars to crash, a great place to crash them, lined up tents, benches, beverages, local media coverage, and still had enough change left to buy a warm sunny day. Gotta love it. I am looking for the line item in the budget for the crash dummies though. Well, I guess looking at my notes there was none. So…….I guess it's "our sincerest thanks" that go to the two 'dummies'. First up was a relative new comer (to our crash tests that is) Mr. William Bogett (TBX Associates). I still can't quite understand how a fellow with a Ph.D., PE, and CFE after his name could still voluntarily get into the front seat of a little car, KNOWING that our old friend Rusty Haight was just moments away from taking another car (bigger of course) and attempt to defy the laws of Physics by "insisting" that the two cars occupy the same space. When Mr. Bogett was all done with the crashes he assured me that he was "OK" and that there were "no problems". However, when he kept calling for Obi-wan to guide him, I wondered. The second "dummy" was no stranger to this danger. When out of the ditch he jumped and a hearty, "Oh, it's not a big deal", jumps Troy Kelsay (Iowa City PD) into the driver's seat for the second round of crash tests. Troy talks to Obi-wan regularly…….(ok maybe not but it might help the story). Troy still says he "gets a kick out of it". All in all no one was injured and without the efforts of our dummies, it just would not have happened. Thank you both for stepping up and sitting in for the benefit of all of us. The finale of the afternoon was an attempt to allow all to witness the deployment of an airbag. In the grandest of tradition, with the boldness he is known for, Rusty (I've been in a bunch of collisions) Haight rounded the corner of the track in his speeding 1987 Mercury Topaz heading for his target, a 1988 Ford Festiva. There were more cameras crowded around the area of impact than we've seen in quite a while. All, wanting to get the perfect photo of the airbag in active deployment. The engine roared on the Topaz as Rusty got up to speed. With only a fraction of a second left, all cameras focused on the Festiva. Just at the right instant, all the shutters began clicking and clicking and clicking…..to see our hero simply to a drive by. Comments such as "I just wasted six frames" to "What the hell was that?" were clearly heard as Rusty pulled up with a smile. I do recall him talking about an old biography he watched on A&E the night before about Evil Kneval or something.

There was quite a bit of business conducted during our stay in Eau Claire. At the Board meeting Vice-President Carroll Kienol (Waterloo PD) presented his ideas on ways to increase membership. During the conference he asked for input and help to accomplish the goal. Deputy Jerry Allen (Marshall Co Sheriff's Dept.) was there to assist. This newly formed position will work with the current Membership Committee to contact various agencies in our geographical area to offer information and answers to potential new members. Our thanks to VP Kienol for the initiative and to Deputy Allen for jumping on board the project. Go get 'em boys. Before our conference, we have made arrangement to be the host of an ACTAR Exam. This year was no different. What was different started at 0900 hrs. the day before the ACTAR Exam. Sec/Treas Greg Vandenberg (Nebraska State Patrol) proposed the idea of a review session to be offered to those wanting to take the exam. He got together with Greg Graveson (Polk Co Sheriff's Dept., WI), and put together some simple ideas of how to evaluate and solve various situations and threw in some wisdom on how to keep confusing ideas simple. That's twice I used the word "simple" in one sentence. That best describes what Greg Squared (that's Greg x Greg) presented in the day long session, finding the simple solution or explanation in the jumble words and numbers presented. I personally attended the session and was quite pleased with the information the Gregs provided. Thank you both for your time and effort. I can say that due to their effort there are at least three or four persons that may not have to repeat a section of the ACTAR Exam. I will also say that after the Board of Directors, meeting the review session will become a part of every MATAI Conference the ACTAR Exam is offered.

We have always considered ourselves a regional association. In years past we have had the pleasure of hosting various investigators from around the country and even the world. This year was no exception. Our good friend Mike Turner made to voyage across the pond to visit the colonies. Mike is an Accident Analyst from Crumlin, North Ireland and has attended our conference a number of times in recent years. It is always good to see Mike and listen to a story or two. Mike was very gracious and presented me gift of Irish Whiskey. A wee nip was enjoyed by many after the banquet and the stories seemed to get a bit better. Mike, thank you very much for the gift and your friendship.

For some time now, we have offered as a door prize at the banquet: a scholarship to any accident related school in the country. This year the recipient of the MATAI Scholarship was won by John Fichtel (Aurora PD, IL). Before, the night was done, I had the pleasure of another announcement from our friend and colleague, Stan Ogelsby (Midwest Accident Reconstruction Services). Stan is associated with Central Missouri State University in Warrensburg, MO. Through his work with them he was able to offer a scholarship to their Accident Reconstruction course in August of this year. The winner of the CMSU Scholarship was Guy Carroll (Loveland PD, CO). When we thought the night was drawing to a close I had yet another announcement to make. Rusty Haight (TEEX) stepped up with a scholarship offer for any class offered by the Texas Engineering Extension Service (Texas A&M). Chuck Berg (Minnesota State Patrol- Retired) was the winner.

Congratulations to John, Carroll and Chuck. Please keep in touch as to which class you attend and let us know just how things went. Many thanks to our benefactors, Central Missouri State University and Texas Engineering Extension Service and to Stan and Rusty for making it happen. Your gifts are very much appreciated.

The boys in Colorado are hard at it, getting next years conference up and running. Rather than try to put all the information here, we will be sending a flyer later this summer. Jeff and Guy have some great ideas

and plans (OK no pressure now, fellas) to get us all headed west next spring.

In closing, I think back to our time in Eau Claire and try to think of what was missing. There were friends: old and new, there was bucket seats full of information, lots of stories: good and even better, great food, golf, running, biking, nice hotel. There was even magic in the air at the banquet followed by belly bouncing hilarity. What more could anyone of us asked for. Ya know, I never did see those dancing girls…….

Stay safe, keep the faith and search for the truth……

R. Allan Mebus, President
MATAI

You know, it doesn't take a rocket scientist to calculate the trajectory probabilities of a two-stage... Wait a minute... It does take a rocket scientist. Sorry!

You Can't Escape MATAI

This last January my wife and I took a little vacation to Hawaii. While "hanging loose" on the sandy beach of Waikiki, we ran into this catamaran with the MATAI (MAITAI) name on it. It struck me as funny and I just had to snap a photo. Before you say it, it was cold there, around 75 degrees the ten days we were there. -Steve Hasstedt

Psychoceramics: The study of crackpots!

TO: MATAI Board of Directors
FROM: John Outzen, Bettendorf Police Dept.
RE: School Critique, Scholarship
DATE: May 16, 2000

By the time you receive this, you will be preparing for the 2000 conference. I am writing to fulfill the requirement of the scholarship I was awarded at the 1999 conference. The class I attended was at TEES, and coincidently, was Analysis of Low Speed Collisions.

I found the class to be very informative and challenging, providing a different style of thought dealing with the low speed collision. Not having a lot of experience using delta-V, I gained a lot since the delta-V is pivotal in the analysis of the lower speeds (under 10 mph delta-V). The effects of a 1-2 mph difference is significant compared to the 50+ mph collision. Although the reconstruction portion of the class provided me with new equations and methodology, the second portion on biomechanics provided ammunition for refuting charges of neck, back, and other injuries. The equations and findings were compared to data from crash testing to help understand injury thresholds and the kinematics involved in "reported" injuries in the low speed collisions. Our own crash testing provided true and calculated speeds, compared to speed determined by using damage assessment and the published date and equations.

The instructors (Rusty Haight and Tom Szabo) were well versed in the subject, informative and easy to question. The presentation was creative and well organized, and it kept attention levels high. Downtime was minimal, and the crash tests were also well organized and quickly performed. The crash tests and subsequent calculations provided real world experience in handling these cases.

I would recommend this class, possibly followed by an occupant kinematics class, to assist in the mechanics of injury for all accidents. I appreciate the change to attend this class, and I thank the board for their consideration.

Thanks...jgo

'I haven't committed a crime. What I did was fail to comply with the law.' — David Dinkins, New York City Mayor, answering accusations that he failed to pay his taxes.

"Tact is the ability to describe others as they see themselves." - Abraham Lincoln

Midwest Association of Technical Accident Investigators Board of Directors

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An Examination of the Critical Speed Problem

Continued from previous issue

There are other publications that set one value for dry asphalt. Collins indicates .80[5]. Limpert in an earlier edition of his book indicated a .85 value. In the latest edition this value has been expanded to include both dry asphalt and concrete surfaces described as polished to new resulting in a range of .65 to .90[6]. Testing has been done to validate previous findings and to narrow the range of values discussed previously. The society of Automotive Engineers-Wet & Dry Braking Traction Task Force conducted numerous tests on both public roads and test track surfaces. In their summary, dry slide friction values ranged from .45 to .87 on public roads, with an average value of .69[7]. In 1989 testing by Verifact Corporation for accident reconstruction purposes provide a range of .60 to .92 for an asphalt surface with an average value of .77 and .76 (at 30 miles per hour and 50 miles per hour respectively)[8]. This finding correlates well with S.A.E. task force findings and are within the ranges specified in reference number 4.

If the road surface has substantially changed from the time of the accident, or is not available for testing, the only option available to the reconstructionist is the use of table values, Whether to use the minimum value or average, or both, providing a range of speeds may be the only course of action for the reconstructionist. Using a range of values, will further complicate calculations if additional interpretive data must be utilized (i.e., crush damage, etc.).

A more accurate method would be to conduct actual testing on the surface involved at the accident site. This also has its own problems. Many roads cannot be closed to traffic for any substantial amount of time to conduct testing, and those roads that can be closed to traffic, will require cooperation from the state or local authorities.

The methodology used to obtain test results must also be considered. Some methods may be easier than others, but errors in accuracy may result. The ideal scenario is to conduct the testing the identical vehicle involved in the accident equipped with a measuring device. In the majority of cases this vehicle has been damaged beyond the capability to utilize it as the test platform. The options then become:

1-using another vehicle of similar construction,
2-utilize any vehicle to provide distinct marks on the surface,
3-equip the test vehicle with instrumentation,
4-utilize a drag box or sled or skid trailer,
5-various combinations of the above.

Testing using another vehicle similar in construction will not prevent questions as to the suitability of that vehicle, but using a similar vehicle is not essential in the critical speed equation. The second option is the most commonly used method. Inherent in the use of the vehicle without any additional instrumentation are possible errors in speedometer readings, measurement of the total length of the tire marks and full instantaneous application of the brakes until a complete stop is effected.

Equipping the vehicle with a bumper gun to mark the road surface, a decelerometer such as the G-ANALYST™, VERICOM™ or other similar device and if possible, a radar unit to record the speed at the start of the test will provide accurate results. The primary consideration in equipping the vehicle in this manner is cost and the opportunity to calibrate the device(s) for the surface being tested.

Utilizing a portable skid testing trailer is usually difficult if next to impossible. The portable skid trailers were not designed for accident reconstruction, but for the state highway department to determine the wet coefficient of friction value of road surfaces. The results provide a reliable indicator of when the surface friction value has degraded to require road resurfacing. The state test trailer is usually not available for immediate use at the accident scene and usually has a predetermined schedule by the State Traffic Engineers.

The skid drag box or sled is usually a homemade device consisting of a tire section weighted with lead or concrete, or a weighted metal box with a tire section affixed to the bottom. The device is pulled across the highway utilizing a spring scale, with the force vs. weight measurement resulting in a coefficient of friction value. If the scale is not pulled parallel to the highway surface, or if the scale is not attached to the sled where the force is pulled through the center of mass, measurement errors can result, It has been my experience that this type of device provides a coefficient of friction value closer to peak value than a sliding value.

Comparisons have been made using the sled and the decelerometers mentioned previously. In a majority of cases, a 10% to 15% reduction of the results obtained using the sled will provide the sliding friction value. One possible reason for this difference os that the vertical forces from a skidding vehicle and temperatureinterface between the road and tire cannot be duplicated using a tire sled. This difference has been referred to as "Speed Gradient"[5]. Collins suggests that if the speed is in excess of 40 miles per hour a reduction of 3% to the coefficient of friction be made. This reduction rises to 18% if the speed is in excess of 90 miles per hour. Limpert[6] also indicates an adjustment to the coefficient of friction by multiplying the speed above 40 miles per hour by .0005 and subtracting the results from the sliding friction value.

Charts appearing in references 4 and 8 also show a upper an lower range of values with 30 miles per hour as the dividing point. Deceleration histories of skid tests using the G-ANALYST™ also show this peak and leveling off value.

The critical speed formula utilizes the friction value for a sliding vehicle. This is the minimum value of friction available on the road surface. It is also the minimum lateral friction available to the tire(s). Lateral friction during a locked wheel situation has a zero value. Steering to provide directional change cannot be initiated by the driver. The minimum kinetic friction value is used within the formula because of the nonlinear relationships affecting these forces and other related differences. This generally results in a tire being capable of developing slightly more lateral force than longitudinal force for a given coefficient of friction value.

As the longitudinal friction value increases to peak, it them drops off to a relatively constant level upon reaching 100% slip. The corresponding lateral friction starts higher and will diminish as the wheel continues to cease rotation. A wheel at 100% slip is locked and sliding when referenced to the road surface. The ideal area to maintain lateral friction and longitudinal slip is at the 20% slip value. This area is where anti-lock braking utilizes the best friction performance of both directions. Thus, a driver of an ABS equipped vehicle can initiate an evasive steering input and utilize maximum braking effort during an emergency event.

The friction value used in the critical speed formula is the sliding friction value (or minimum friction value) determined on the section of

Continued on the next page. . . .

road where the vehicle deposited the tire marks. Some documentation on this subject are adamant that the sliding friction obtained not be adjusted no matter what reason[10]. However, Limpert in reference 6 states that the friction value be reduced 10% to 20% for modern cars and 20% to 30% for older cars. This reduction should only take place when high speeds are involved and the rotation angle of the vehicle is minimal to the longitudinal direction. Although not specifically stated by Limpert, the difference in friction reduction between older and newer cats may be due to the older cats being equipped with bias-ply tires.

However, radial and bias-ply tires did not make an appreciable difference in friction values during critical speed tests[11].

In a field test conducted by the National Association of Traffic Accident Reconstructionsts and Investigators (NATARI)[12], instruments in the vehicle recorded the following friction values in a critical speed situation:

Instrument Test Results

Type Mark	Peak Friction	Average Friction
Skid Mark	.86	.70
Yaw Mark	.84	.78
Drag Sled	---	.87

In calculating the speed of the vehicle after measuring for the radius, the closest comparison to the radar speed was after using the peak friction value from the skid test in the formula. A time and deceleration plot from a test is shown in Figure 18. The test vehicle was placed into a critical speed turn at 52 miles per hour. Note that the lateral friction rises slightly higher than .8 within the first half-second and generally remains there until near the end of the test. The longitudinal friction also initially rises to a much lower level (.3) and increases slightly at the end of the test. Use of only the longitudinal friction value in the critical speed formula would be a gross error and give a low speed.

If the drag sled is used to determine the coefficient of friction value of the surface, the sled must be pulled across the highway surface in the same direction as the striations. This will give the most accurate value as the vehicle would have been moving in this direction.

MISCELLANEOUS PROBLEMS

There are several difficulties expressed form results obtained using the Critical Speed Formula. A discussion of each subject follows.

Vehicle Type

There is the contention that the seed results obtained using this formula are based on a standard size American passenger vehicle. Sports cars with stiffer suspension are actually travelling faster than indicated by the formula. The reverse, the speed obtained from large luxury cars with softer suspension is actually travelling less than its true speed. This problem is cited by Collins in reference 5. Collins states that the formula only places an upper bound on the automobile's speed. He also claims that using the kinetic friction value is incorrect, that the static friction value should be utilized. Testing done by Collins indicates that the formula gives results not far different from the actual speed when the vehicles tested were standard American sedans. Speed was over predicted in tests with luxury vehicles and under predicted in tests with sportscars having a stiffer suspension. No date is provided to validate the findings.

Tire Inflation

Tire inflation pressure has also been a factor in whether or not a vehicle deposits the unique tire marks on the highway surface while in a sideslip. It is true that an under-inflated tire will allow the tires sidewall to flex and thereby depsoit a yaw mark at slower speeds. The tire pressure should be measured for all four wheels. Even if one or two tires are subsequently deflated, a reasonable reading of those remaining inflatred will reveal the average tire pressures on the vehicle.

Braking or Acceleration Durring Critical Speed

Braking or accelerating in a critical speed situation will cause a miscalculation in the results. Actual testing using the formula provides results $\pm$ 10% of the actual speed[13]. Tests reveal that during acceleration there was a slight overestimation of speed (+5%). during moderatre braking the overestimation was +10%. Additional testing by the Traffic Institute at Northwestern Iniversity[4] uding both standard and sport style American cars resulted in only minor differences berween radar and the formula 97% to 12%) less than the actual speed). Their findings state that "investigations of actual cases indicate that a vehicle in a sideslip maneuver rarely has any braking or power added." Tests referred to in this chapter suggest that, in most cases, adding power has very little effect on velocity estimates for moderate to high velocut situations. The tests also indicate that substantial braking, short of locking the tires, does not effect the the velocity estimates significantly One must also rreakize, that depending on the entry speed into a critical speed situation, the driver nust react to the developing situation. This requires a finite period of time before power or braking is utilized. Often the vehicle has substantially side-slipped at this point. If the measurements are obtained from the marks left on the highway during this intial phase, power or braking will not have an effect on the speed obtained.

Anti-Lock Brakes

there has only been limited testing conducted with vehicles wquipped with anti-lock brake systems. However, four vehicles wquipped with ABS systems were utilized and results indicate an underestimation of speed ny (-10%)[13]. The marks left on the road surface did not display the cyclical pattern as found in normal emergency braking, but were similar in appearance to non-ABS vehicles during a critical speed mode. The only otable difference was the rear wheel of tracking distance from the front wheels was less than non-ABS equipped vehicles. ABS critical speed testing by NATARI while under heavy brake applicatons at radar speed use of the formula gave the closest result when the sliding friction value was used[12].

Slip Angle Consideration

The tire slip angle is very small at the beginning of a critical speed situation. Limpert states that during a normal turn the slip angle varues from 3^o to 5^o. Slide force saturation takes place between a 10^o to 15^o angle. Beyond this point the side foece capabilities of the tires cannot maintain the inteded path of the vehicle. There is some concern that this slip angle must be accounted for in determining the speed of the vehicle in a sideslip situation. Revensdale[14] suggests that the angle of thes striations be measured in relation to the path of the vehicle. The cosine value of the angle then is applied in the following manner:

Where f_{red} = Reduction %

$Cos\phi$ = Value of angle measured

The speed obtained using the formula is multiplied by the reduction value obtained to arrive at the true speed. The greater the angle the more reduction in speed. This si to account for the tires(s) scrubbing off speed as the vehicle rotation progresses through slideslip. The NATARI field test did not validate this theory. Speed results obtained using this reduction percentage were 10+ miles per hour lower than the radar speed.

Average Deceleration

Testing by Stephens and Daily[15] suggest that between 30 and 70 miles per hour a passenger vehicle will decelerate at a rate of .2g during a critical speed maneuver. This deceleration value can be utilized in the various speed change formulas to arrive at a subsequent impact speed at the conclusion of the critical speed situation.

Reliance on Advisory Speed Signs

Advisory speed limit signs are posted along with the appropriate warning signs in accordance with the Manual of Uniform Traffic Control Devices. The use of an advisory speed sign is posted based on the basis of comfort for the vehicle occupants. It does not predict the critical speed of the curve. The signs are posted based on side friction coefficients of .21 for 20 miles per hour and below and .18 for speeds between 25 and 30 miles per hour[16]. In most cases the advisory speed is one-third to one-half the slideslip speed for standard passenger vehicles[17].

Summary

This paper has sought to explore the Critical speed situation and the various problems that may arise from use of the critical speed formula. Many of the problems highlighted have little or no effect on the use of equation results. From tests done by the author and others[18,19], the formula is relatively accurate in determining the speed at which a passenger vehicle begins a critical speed scuff.

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Albert T. Baxter is a Lieutenant with the Philadelphia Pennsylvania Police Department. He is an adjunct instructor with IPTM. He is vice president of NATARI and editor of their newsletter.

"During your life, everything you do and everyone you meet rubs off in some way. Some bit of everything you experience stays with everyone you've ever known, and nothing is lost. That's what's eternal, these little specks of experience in a great, enormous river that has no end." — Harriet Doerr

Minutes of the General Membership Meeting

Eau Claire Conference, May 22, 2000

President Mebus called the meeting to order at 1604.

First business was the election of board members. Nominations to fill three vacancies due to the expiration of terms for Carroll Kienol, Ray Knight and Rich Yoder were called for. Rick Harned nominated Carroll Kienol with a second from Troy Kelsay. Duane Schomer nominated Rich Yoder with a second from Troy Kelsay. Mike Adams nominated Ray Knight with a second from Rich Lesniewski. Guy Carroll made a motion to cease nominations with a second from Duane Schomer.

After the three nominees were named, Kienol, Knight and Yoder, Jeff Groves made a motion that the ballot be decided by acclimation. Rick Harned provided the second to Groves motion. A voice ballot was taken with an overwhelming AYE. As a result, Carroll Kienol, Ray Knight and Rich Yoder will return to the board for another three year term.

Secretary/Treasurer Greg Vandenberg read the minutes of the last meeting. Phil Baskerville motioned to accept the minutes with a second from Jeff Groves. Next, a treasurer's report was given indicating the association's checking account balance as of May 18, 2000 to be $21,686.30. Jeff Groves motioned to accept the minutes with a second from Guy Carroll.

Secretary Vandenberg read a recently received letter from member Brad Cherry. Brad and Linda moved to Benson, AZ in December 1999 after Linda accepted a promotion to Supervisory Deputy with the US Marshal Service. Brad says there is plenty of room on his 25.5 acre ranch and that Big Sky Consulting is seeking new clients in AZ. Brad reported that he wouldn't make it to Wisconsin, but plans to make next year's conference. Brad gave the following e-mail address: bigskyconsulting@aol.com For those wishing to communicate with Brad, he can be reached by phone or snail mail as well.

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H 520-586-1890
W 520-586-0952

President Mebus reported that the next newsletter had a target distribution date of July 15, with an article submission date of July 1. Members were encouraged to provide newsletter editor Steve Hasstedt with material for inclusion in the newsletter.

President Mebus addressed WREX 2000. The membership was reminded of our contractual agreement with the organizers to provide to delegates, or workers, to assist with administering the conference. Mebus reported that because there was no response to an appeal in the spring newsletter for letters of interest in serving as a delagate by the general membership, the Board of directors had selected Mebus and Vendenberg as MATAI representatives to the september 25 through 29 conference.

President Mebus announced that the 2001 MATAI Conference would be held in Colorado, most likely Fort Collins. Dates were yet to be determined, but co-hosts Guy Carroll and Jeff Groves were seriously considering the month of June after school and graduations so that members might consider a family vacation to Colorado in combination with the conference. The topic for the conference would be motorcycles with some added topics, perhaps.

President Mebus announced that the 2002 MATAI Conference would be in Minnesota as Chuck Berg had indicated a willingness to undertake the responsibility of host.

Mebus called for any business from the floor. Troy Kelsay inquired about the status and/or availability of the crash test videotape from last year's conference in Bettendorf, IA. Conference host Warren Beine reported that production of the tape had been delayed due to damage to the department's video equipment. Beine reported further that he would work to have the tape completed as soon as some remodeling was completed at the station.

Rich Yoder offered a motion to have the association pay for the WREX 2000 delegate's lodging expenses while attending the conference. Considerable discussion was had on the issue. It was clarified that the registration fee for both delegates is waived because of the "worker" status of the delegates. Yoder's motion was amended. When presented for a second the motion was for the association to pay for transportation and lodging expenses incurred by the two delegates, Mebus and Vandenberg. Guy Carroll provided the second to the motion and a voice ballot was taken. Mebus and Vandenberg were opposed to the motion, the motion carried due to the overwhelming support by the other members in attendance.

Ron Pexa, the association's trinket vendor, reported that he was running low on the new screen printed MATAI tee shirts. Pexa suggested that anyone who was considering a purchase should do so quickly.

Rich Lesniewski made a motion to adjourn the meeting with a second from Rich Yoder. The meeting was adjourned at 1634.

Your mother's worst nightmare.

'We don't like their sound, and guitar music is on the way out.' — Decca Recording Co. rejecting the Beatles, 1962

Never enough time, unless you're serving it. — Anu's Word Server

The Junk Drawer
July 2000

Well I hope everyone had a safe trip home after the conference. I for one, took a great deal of information home with me. I want to thank Rod and Jeff again for their great Wisconsin hospitality and all the work they put into the conference. Also congratulations to all that passed the ACTAR exam, and to anyone that may not have passed it, don't give up.

Our Dept. recently purchased a laser radar gun similar to the one that was being displayed by one of the vendors at the conference. As most of you know these guns can also measure distances quite accurately. Some models can be hooked up to a small computer in order to store the measurements for plotting a scale diagram if a crime scene or accident. The computer and software can be an expensive addition however.

Using a basic trigonometric relationship called the Law of Cosines one can convert the readings gathered from the range finder into a set of rectangular coordinates that are more easily plotted in most drawing programs. The Law of Cosines expresses the lengths of the sides of any shape triangle to the measure of any of the interior angles of the triangle. It is usually expressed in the following form.

$$a^2 = b^2 + c^2 - 2ab \cdot \cos$$

Where a, b and c are the lengths of the sides and A is the measure of the angle opposite side a.

When measuring an accident scene we can set up two reference points that are a lnown distance apart. The location of roadway evidence can be measured by finding the distances to each reference point. The distance between the two reference points and the two measurements from the data poin to the reference points form the sides of a triangle.

Rearranging the equation and substituting our known quantities, the x and y coordinates of any point can be expressed in terms of its triangulation measurements.

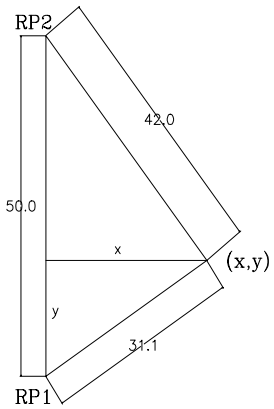
Where

$$y = \frac{l_1^2 + D^2 - l_2^2}{2D} \quad \text{and} \quad x = \sqrt{l_1^2 - y^2}$$

l_1 and l_2 are the lengths to RP_1 and RP_2 respectively.
And D is distance between the two reference points.

As an example suppose a point is measured, and we find the x and y coordinates at the point using the above method. The problem is shown as follows:

D = 50'



l_1 = 31.1'

l_2 = 42.0'

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Crash Data Recorders – The Automobile Black Box

By Greg Vandenberg

In response to a National Transportation Safety Board recommendation that automobile manufacturers and NHTSA work cooperatively to gather information on automotive crashes using on-board collision sensing and recording devices, General Motors (GM) has partnered with private industry to make this data available to the general public.

Since 1974, GM airbag equipped production vehicles have recorded airbag status and crash severity data for impacts that caused a deployment. Many of these systems also recorded data during “near-deployment” events, i.e., impacts that are not severe enough to deploy the airbag(s). Beginning with the 1999 model year, the capability to record pre-crash vehicle speed, engine RPM, throttle position, and brake switch on/off status has been added to some GM vehicles.

To make Event Data Recorder data available to all interested researchers, GM selected Vetronix Corporation of Santa Barbara, California to develop software and interface cables allowing the data to be downloaded directly to laptop computers. Data useful to reconstructionists (Delta V, belt use, pre-impact data, etc.) is stored and displayed in a standard format using engineering units while data requiring expert knowledge to interpret is stored in hexadecimal format. The new Crash Data Retrieval System (CDR) also allows the user to input other pertinent information (e.g., investigator’s name) and to export the data to a remote database. Interface cables are provided for vehicles that cannot be powered up after a crash. GM is currently the only manufacturer striving to make the data and data recovery tools available to the general public.

GM introduced the first driver/passenger airbag systems as an option in selected 1974 production vehicles. They incorporated electromechanical g-level sensors, a diagnostic circuit that continually monitored the readiness of the airbag control circuits, and an instrument panel Readiness and Warning lamp that illuminated if a malfunction was detected. The data recording feature utilized fuses to indicate when a deployment command was given and stored the approximate time the vehicle had been operated with the warning lamp illuminated. In 1990, a more complex Diagnostic and Energy Reserve Module (DERM) was introduced with the added capability to record closure times for both the arming and discriminating sensors as well as any fault codes present at the time of deployment.

For the 1994 model year, the multiple electromechanical switches previously used for crash sensing were replaced by the combination of a single solid state analog accelerometer and a computer algorithm integrated in a Sensing & Diagnostic Module (SDM). The SDM also computed and stored the change in longitudinal vehicle velocity (Delta V) during the impact to provide an estimate of crash severity. This feature allowed GM engineers to obtain restraint system performance data when a vehicle was involved in a deployment event or experienced an impact related change in longitudinal velocity but did not command deployment (i.e. a near-deployment event). The SDM also added the capability to record the status of the driver’s belt switch (buckled or unbuckled) for deployment and near-deployment events.

Continued on next page . . .

Then:

$$y = \frac{l_1^2 + D^2 - l_2^2}{2D} = \frac{31.1^2 + 50^2 - 42.0^2}{2 \cdot 50} = 17.0$$

and

$$x = \sqrt{l_1^2 - y^2} = \sqrt{31.1^2 - 17.0^2} = 26.0$$

I’ll leave it to the reader to prove that the two are equivalent.
The equations can easily be incorporated into a spreadsheet program if a lot of points are used.

Stay safe,

Jim

No one can make you feel inferior without your consent. — Eleanor Roosevelt

Certain 1999 model year GM vehicles have the added capability to record vehicle systems status data for a few seconds prior to an impact. Vehicle speed, engine RPM, throttle position, and brake switch on/off status are recorded for the five seconds preceding a deployment or near-deployment event. Almost all GM vehicles will add that capability over the next few years.

Parameter	1990 DERM	1994 SDM	1999 SDM
State of Warning Indicator when event occurred (ON/OFF)	X	X	X
Length of time the warning lamp was illuminated	X	X	X
Crash-sensing activation times or sensing criteria met	X	X	X
Time from vehicle impact to deployment	X	X	X
Diagnostic Trouble Codes present at the time of the event	X	X	X
Ignition cycle count at event time	X	X	X
Maximum Delta V for near-deployment event		X	X
Delta V vs. time for frontal airbag deployment event		X	X
Time from vehicle impact to time of maximum Delta V		X	X
State of driver's seat belt switch		X	X
Time between near-deploy and deploy event (if within 5 seconds)		X	X
Passenger's airbag enabled or disabled state			X
Engine speed (5 sec before impact)			X
Vehicle speed (5 sec before impact)			X
Brake status (5 sec before impact)			X
Throttle position (5 sec before impact)			X

For years, airplane crash investigators have had the benefit of retrieving data from the flight-data recorder, or "black box". This data has proven invaluable for helping to determine what happened in the seconds before a crash. Now, in order to improve vehicle safety, GM is using similar technology to record pre-crash data in many of its vehicles.

Current software allows investigators to utilize the Vetronix CDR system on several 1998 through 2000 GM products. An update to the software, which may be available as early as August, will expand the list of vehicles from which data can be obtained to select 1996 and 1997 models with further expansion of the 1998 through 2000 model year vehicles.

Although there are several nuances and limitations to the CDR data, availability of this data provides one more puzzle piece to the accident reconstructionist when he or she is working to put the pieces of the crash puzzle together. In the end, the CDR data is just "more data" requiring proper interpretation and application in one's overall analysis of the collision event. But the data is event specific and as technology continues to evolve, the CDR system will revolutionize how crash investigations are performed.

The author has purchased a CDR system and is willing to share this technology with other members of MATAI who may have need of Sensing & Diagnostic Module data to further their crash investigations.

For additional information on this topic, you may want to read a paper authored last year by Augusts "Chip" Chidester (NHTSA) and others. The article is available on the web at http://www.ntsb.gov/Events/symp_rec/proceedings/authors/chidester.htm You may also want to visit the Vetronix web site, www.vetronix.com