

**- ADDENDUM -**

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**PROCEEDINGS**

22nd Annual International Workshop on Human Subjects  
for Biomechanical Research  
Fort Lauderdale, Florida

30 October 1994



# THE DEVELOPMENT OF A PROTOCOL FOR DOCUMENTING VEHICULAR SITTING POSTURE OF CAR OCCUPANTS INVOLVED IN REAR-END COLLISIONS

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*Paper was presented at the 22nd Annual Workshop on Human Subjects for Biomechanical Research. This paper has not been screened for accuracy nor refereed by any body of scientific peers and should not be referenced in the open literature.*

## INTRODUCTION

This paper describes the development of a protocol for documenting the sitting posture of passenger vehicle occupants which can be used to examine the relationship between vehicle seat design and soft tissue neck and back injuries resulting from rear-end collisions. The protocol is being developed as part of a research program at the Insurance Corporation of British Columbia (ICBC) and with support from Transport Canada. Each year, soft tissue neck and back injuries account for approximately 70% of all ICBC injury claims. These so-called "whiplash" injuries include any complaint of pain and significant discomfort in the neck and back region. The pain may be minor but persistent and the claimant may present with one or more of the following symptoms: sore neck, sore back, headache, nausea, insomnia, dizziness, restricted head and neck motion.

## INITIAL REPORTING OF INSURANCE CLAIM

In British Columbia, every insurance claim starts with a telephone call to the "Dial-a-Claim" Centre of ICBC. Basic accident and vehicle information is recorded and an appointment is made for the claimant to visit a local Claim Centre with their vehicle (if drivable) to assess any vehicle damage. In the case of reported injuries the claimant meets with a bodily injury adjuster.

In an initial assessment of the process of documenting claims at a local Claim Centre it was observed that it was theoretically possible to quantify the vehicle sitting posture of the claimant at the time of their first appointment. The majority of claimants who have sustained a soft tissue neck or back injury in a rear impact, or are submitting a claim for vehicle damage following a low speed rear-end collision, drive their vehicle to the Claim Centre for inspection during their first appointment.

## **STUDY PROTOCOL**

The work was conducted with the full cooperation of the Insurance Corporation of British Columbia for Transport Canada by RONA Kinetics, an independent research group in Vancouver. The support of ICBC for the work was given on the understanding that any data collection during the study would be used for research purposes only and would be stored in an anonymous format and could not be linked with individual claimants. In addition each claimant approached to participate in the study was advised of the nature of the study and that their participation was voluntary. It was also important that the documentation of the claimant's sitting posture did not take "too long" and did not interfere with the claim process.

## **SAMPLE SELECTION CRITERIA**

The vehicle sitting posture of two groups of 50 claimants was examined. One group comprised claimants reporting a soft tissue neck or back injury. The other group comprised claimants seeking reimbursement for vehicle damage only and with no soft tissue injuries. The selection criteria for all subjects were as follows:

- Claimant's first appointment at the Claim Centre;
- Claimant was the driver of a struck vehicle involved in a low speed rear-end collision. In this study, a "low speed" impact was one in which the struck vehicle was drivable after the collision, but there was physical damage to the bumper assembly, sheet metal or frame/substructure of the vehicle. Stroking of the isolators or cosmetic scuffs did not constitute "physical damage". A rear impact was defined as an impact between the rear of a passenger vehicle and the front or front corner of a following vehicle. Impacts between more than two vehicles were not included.
- Claimant was aged over 16 years and drove the accident vehicle to the Claim Centre.
- No possible rear loading of the claimant.
- Claimant had not previously suffered a soft tissue neck injury and had no medical predisposition to such injuries.

## **SELECTION OF SUBJECT**

During a daily visit to the Claim Centre, the accident notification forms for all appointments for the following day were checked. Claimants who appeared to meet the selection criteria were "tagged". A bright coloured sheet was inserted in their file to advise the vehicle estimator or bodily injury adjuster that this claimant had been selected for the sitting posture study. If the selected claimant was injured, after their injury claim had been documented by the claims adjuster, the adjuster would ask the claimant if he or she would be available to talk with the study investigator regarding a sitting posture project being conducted for Transport Canada. Claimants presenting with no injury were similarly approached by the vehicle estimator. If available, the

claimant was introduced to the study investigator. Hereafter, the study investigation was conducted independently of the ICBC adjuster and vehicle examiner.

The participation of the claimant in the study was sought as follows. The purpose of the study was outlined as the development of a procedure to document the sitting posture of occupants relative to their vehicle seat structure. The process involved was described, namely the taking of photographs and measurements as well as the estimated time to complete this documentation. Finally the planned use of the information for research purposes only and the procedures to ensure individual confidentiality were described. If the claimant agreed to participate in the study, he or she was asked to sign a simple statement acknowledging their understanding of the purpose of the study and confirming their agreement that the data collected would not be available to them, their representatives or ICBC.

## **DATA COLLECTION**

### **Interview with Subject**

Basic data was requested from the subject on their age, height and weight, seat belt use at the time of the collision and a basic description of the accident. At the same time it was confirmed through questioning that the subject did meet the selection criteria. The subject was also asked to provide details of the vehicle occupancy, including the presence of any animals or large objects and whether the driver's seat position had been changed or used by anyone else since the accident. Respecting the sensitivity of any injury claim, details on the claimant's injuries were not actively sought during the interview and the claimant was not asked if he or she had any pre-existing soft tissue neck or a back injuries. Rather the claimant was asked if he or she had ever suffered an injury or had an operation which may influence their sitting posture.

### **Documentation in Vehicle**

After the brief interview, the subject was asked to sit in the driving position of his or her vehicle looking directly ahead with their hands on the steering wheel and their seat belt secured. After the subject was "positioned", he or she was asked to clear the front passenger seat of objects and papers and to confirm that the passenger door was unlocked for the photographic session. This request was an attempt to "relax" the subject's sitting posture.

Photographs were then taken of the seated subject from the driver's door opening and around the vehicle at 45° intervals. The photographs were taken "in-line" with the subject's head and at least one lateral photograph (on each side) was taken perpendicular to the vehicle seat back. The position of the subject's head was then measured relative to the top and front surface of the head restraint. The subject's sitting height, thigh length, and the distance from their chest to the steering wheel were also measured. The subject was then asked to get out of their vehicle and the vehicle/seat dimensions as shown in figure 1 were recorded with the help of a 2D H-point template.

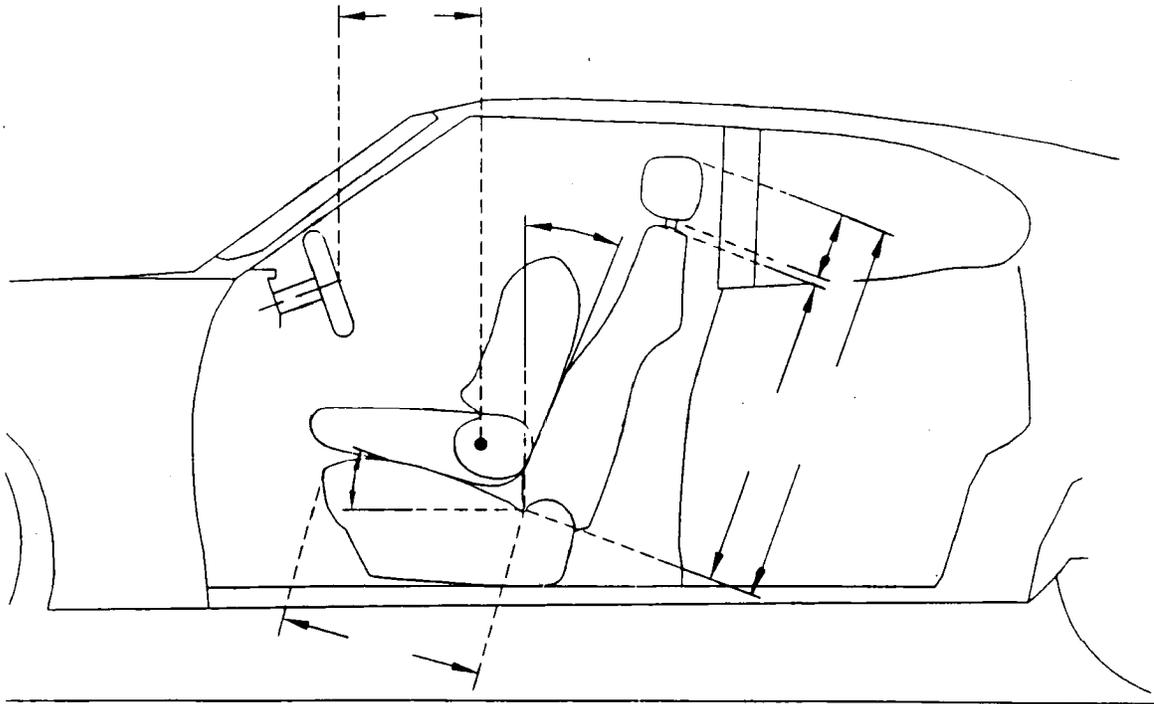


Figure 1: Schematic Showing Vehicle/Seat Dimensions Recorded

Adjustable features of the vehicle seat and any add-on vehicle seat covers or cushions as well as wear damage to the seat itself, were recorded. The position of the adjustable head restraint was noted, it was then moved and the seat back height was measured for the minimum and maximum head restraint height position. Finally the vehicle damage was documented photographically.

## REVIEW OF PROTOCOL

### Cooperation

Without exception, the cooperation of the staff at the Claim Centre was excellent. Of the claimants approached by the adjuster or estimators less than 10% refused or were not available (for time reasons) to be introduced to the study investigator. Only three of the claimants introduced to the investigator declined to participate in the study. Approximately 120 subjects were approached to obtain 100 that satisfied the selection criteria.

### Documentation Time

Each case was documented in 10-20 minutes from the time the claimant was first introduced to the investigator to the completion of the sitting posture and vehicle documentation. The varying time largely reflected conversations with the subjects. Some subjects sought additional

information about the study and extra time was taken to explain the study to subjects with poor English speaking skills. In retrospect "live" documentation of no more than 15 minutes was acceptable to the claimants and minimised the disruption to the claim process at the Claim Centre.

### **Interview with Subject**

The claimants were usually most forthcoming. All subjects reported they were wearing their seat belt at the time of the collision. Although there was no attempt to confirm seat belt use it should be noted that routine seat belt observations conducted by Transport Canada indicate that over 90% of drivers in British Columbia use their seat belt.

Subject reported weight and height were at best approximations with some subjects obviously over-estimating their height. If possible, the weight and height of the subject should be measured in future studies of this kind.

### **Documentation of Sitting Posture**

The sitting posture of the subjects as measured in this study is undoubtedly more "erect" than that which might be observed in a population of drivers on the road. The attempt to "relax" the driver's sitting posture by asking each subject to check the passenger's door lock did seem to help. It would have been useful however, to document the sitting posture of the subjects as they were driving to the Claim Centre. Given the cooperative nature of this study, and respecting the confidentiality of the claimants, this was not possible.

The static documentation of the driver's vehicle sitting posture did, however, provide more precise information than would be available from a moving vehicle. The greatest shortcoming of the latter is the obstruction of the relative position of the driver's head to the head restraint by such exterior vehicle structures as the B-pillar. Of all the photographs taken during the current study, the lateral view from the front seat passenger door opening usually provided the best documentation of the driver's sitting posture relative to the seat back and head restraint. As the study progressed, permission was sought and always given to move the front passenger seat to provide an unobstructed view of the driver's head neck and back profile and the seat/head restraint position.

The photographs were taken both with and without flash. The overhead fluorescent lighting in the vehicle inspection area and the varying position of the subject's vehicle relative to these lights resulted in the selection of flash photography for most cases. Manual focusing was preferred for immediate focus of the feature of interest. For speed, the flash was mounted on the camera. An extended arm to hold and angle the flash with automatic focusing capabilities within the camera lens would likely enhance the photographic definition.

"Realistic" head offset measurements were difficult as the drivers often "held" their head more upright when the investigator made this measurement. Sitting height measurements were best taken in two stages by firstly measuring the distance between the top of the head restraint and the

top of the driver's head and secondly the height from the depressed seat to the top of the head restraint. The H-point template was modified to facilitate seat back angle measurements and measurements to the steering wheel hub. As speed was of the essence, any efforts to reduce the time of documentation were worthwhile.

### **Vehicle Damage**

The damage to each vehicle was documented photographically. This was adequate to determine the primary area of the impact and whether or not the impact was distributed or rear offset. For insurance purposes, full details of the damage to each vehicle component is routinely recorded by the insurance estimator together with photographs of the damage. Such data was also available for the striking vehicle and was collected for the study to confirm the nature of the impact and to identify the physical characteristics of the impacting vehicle.

### **Injury Reports**

After the sitting posture was documented, the nature of any reported soft tissue neck and back injury was sought from the ICBC case file. Contrary to the claimant's reported plans at the time of their first appointment, he or she did not always seek formal medical consultation so an objective description of their symptoms was often not available. In many cases there were however reports of previous soft tissue neck or back injury which had not been elicited during the investigator's interview with the claimant. The sensitivity of soft tissue neck injury claims precluded a direct question by the investigator as to whether or not the claimant had sustained previous injuries of this type. In the procedures adopted to select subjects, the exclusion of claimants with pre-existing neck injuries was not possible at the time of "live" case documentation for the study.

### **CONCLUDING REMARKS**

The correct position of the available head restraint is recognised as one potential means of reducing the incidence of soft tissue neck injuries. The protocol developed in the present study for the documentation of vehicle sitting posture provides an effective means of determining the position of the driver's head and back relative to the head restraint and vehicle seat. Although it is recognised that the sitting posture of the driver as documented during the study is probably more "erect" than normal, the procedure provides a means of evaluating the relationship between head restraint position, the characteristics and severity of the rear-end collision with the incidence and severity of soft tissue neck and back injuries. Static photographs through opened vehicle doors overcome the problem of obstructed lateral view of the occupant's sitting posture which occurs during film of vehicle occupants in traffic. The cooperation of the claimants approached to participate in the study was good and promoted by the confidentiality of the information collected and the complete independence of the investigator from the insurance claim process.

## **ACKNOWLEDGEMENTS**

The study was possible through the cooperation and assistance of Messrs. George Anstee, Bill Dyer and their colleagues at the Lloyd Avenue Claim Centre of the Insurance Corporation of British Columbia. Their support of this work is gratefully acknowledged.

