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Concerning Trajectories of Possible Head Shots:

Much needless speculation has arisen as a result of not knowing the precise trajectories of possible shots at point 313 as marked by the F.B.I. to indicate the position of the President's head in Zapruder frame 313. By examining precise measurements in relation to these trajectories, certain points can be ruled out as being a source of the head shot.

The first trajectory considered was that of a shot originating from the southeast corner, sixth floor window of the TSB. To simulate this trajectory, a red line was drawn from the window to point 313 (which will be referred to only as 313) on the Dealy Plaza plat map (see illustration #1-A). As a reference line for measurements, the line on top of the map indicating north was chosen and extended. A line was then drawn which was parallel to this "north line" but was made to pass through 313 for purposes of directing all lines to one point. A line was sought to represent the lengthwise axis of the Presidential limousine in frame 313. Since at this time the car was approximately parallel to the sixth pair of roadstripes, a line was drawn through the lower sixth stripe to represent the lengthwise axis of the car. Another line was drawn parallel to this one but, again, was made to pass through 313. Next a line was drawn from Zapruder's position to 313 and extended towards the northwest. A line perpendicular to this line would represent the lengthwise axis of President Kennedy's head in the position where, at 313, Zapruder would get a direct profile of the head. Since in frame 312 it can be seen that the head is turned slightly away from Zapruder (toward what would be the President's left), an allowance was made for this and a line was drawn 15 degrees from the perpendicular to Zapruder's line of sight thus representing the lengthwise axis of the head in its turned position. Finally, another reference line was drawn perpendicular to the north line.

A set of perpendicular lines was then drawn on a separate paper. These were to represent the north line and its perpendicular. Angular measurements were then taken of all lines drawn on the map in relation to the two reference lines (see illustration #1-B). Using these measurements, the lines were transferred to the separate paper. The following information was ascertained:

1. the angle of the bullet path to the lengthwise axis of the car at 313 was approximately 6 degrees on a right to left trajectory when considered from a position in the car;
2. the angle of the bullet path to the lengthwise axis of the head at 313 was approximately 12 degrees on a left to right trajectory when considered from a position in the car;
3. the angle on which Zapruder filmed the President's head at 312 - 313 was approximately 75 degrees;
4. the angle of the lengthwise axis of the President's head to the same axis of the car was approximately 18 degrees. The significance

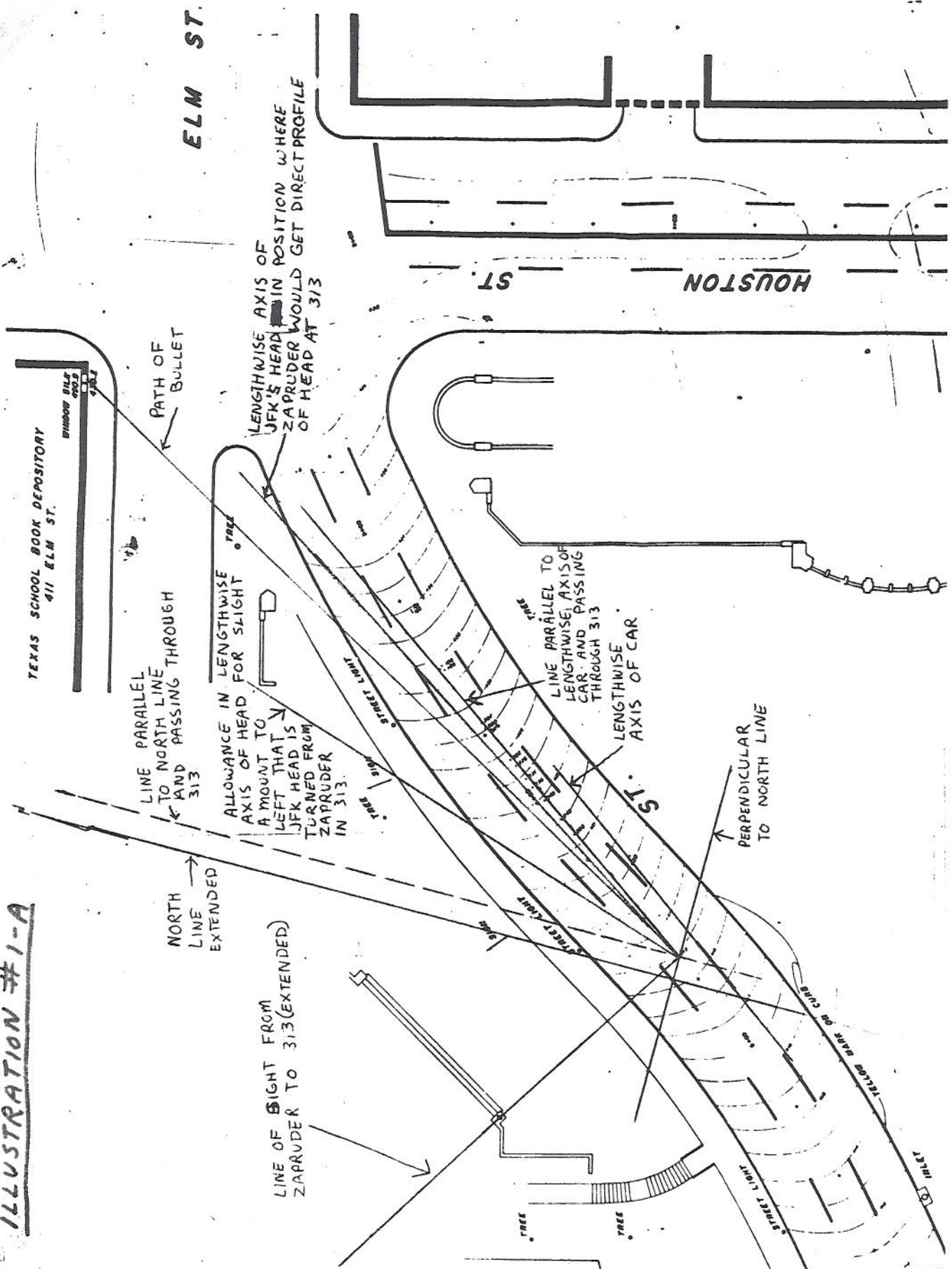
of these measurements is that they establish that a bullet fired from the window in question if entering the back of the skull near the midline would follow a left to right trajectory of 12 degrees through the head although it would still be maintaining a right to left trajectory in relation to Dealy Plaza.

This same procedure was employed in considering a possible shot from the grassy knoll. An alleged gunman is found to the immediate right of the tree on the knoll in the Moorman picture (see Six Seconds, pp. 126-129). If a line is drawn on the plat map from Moorman's position to the tree and extended to the fence on the knoll, the position of the alleged gunman can be found (see illustration #2-A). Lines were drawn then on this map similar to that of illustration #1-A. The two reference lines, the Zapruder line of sight, the car axis lines, and the head axis lines were all used. The path of the bullet was drawn in red from the gunman to 313. Angular measurements were taken and all lines were transferred onto a separate sheet on which the two perpendicular reference lines had been drawn (see illustration #2-B). The following information was ascertained: 1. the angle of the alleged bullet path to the lengthwise axis of the car would have been approximately 130 degrees on a right to left trajectory when considered from a position in the car; 2. the angle of the alleged bullet path to the lengthwise axis of the head at 313 would have been approximately 112 degrees on a right to left trajectory when considered from a position in the car. Since several positions east of the one employed have been suggested as firing points, this was also considered. It was found that at approximately 22 degrees east of the position marked, a shot fired would hit the head straight on at a 90 degree angle. Any position further east than this one would have struck the head from a position behind it.

A shot from the TSBD window entering the back of the head near the midline would produce a para-sagittal laceration of the right hemisphere of the brain and considering fragmentation and deflection would probably exit in the area of the right front side of the skull (see illustration #1-B). A shot from the grassy knoll at the point described and further east striking the head in the area between the right ear and temple would produce a laceration across or through the brain from right to left hemispheres (see illustration #2-B). There would have to be almost a 90 degree deflection of the bullet for it to exit from the back or occipital region of the skull unless the shot originated from a point so far west of the area studied that it would be very close to the overpass. This shot would also cause a significant amount if not all of the skull matter to explode into the head wound or would cause a gaping wound of the left side of the head. It seems, then, that shot from the TSBD window is most consistent with the medical evidence.

Howard Roffman

ILLUSTRATION #1-A



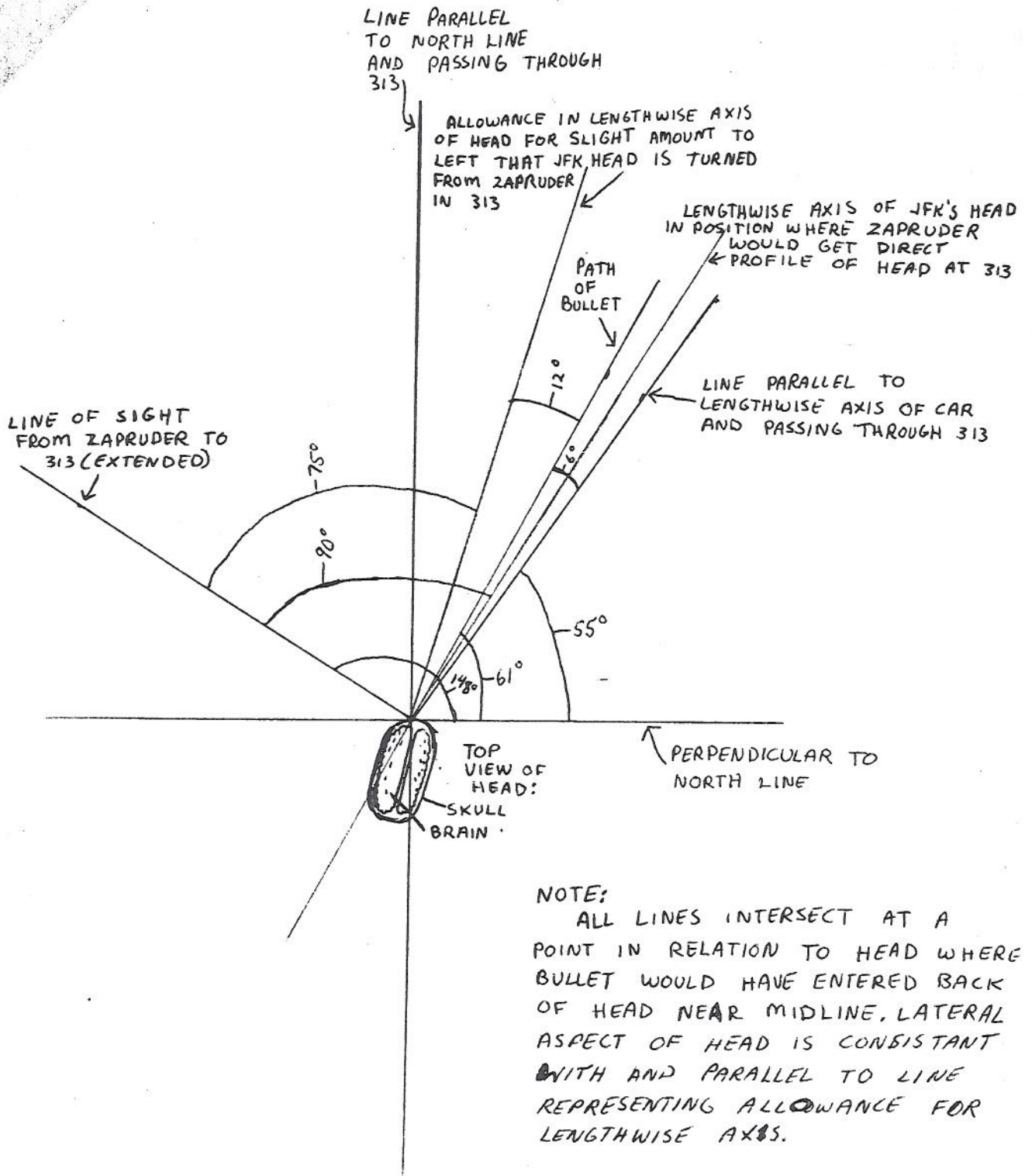


ILLUSTRATION #1-B

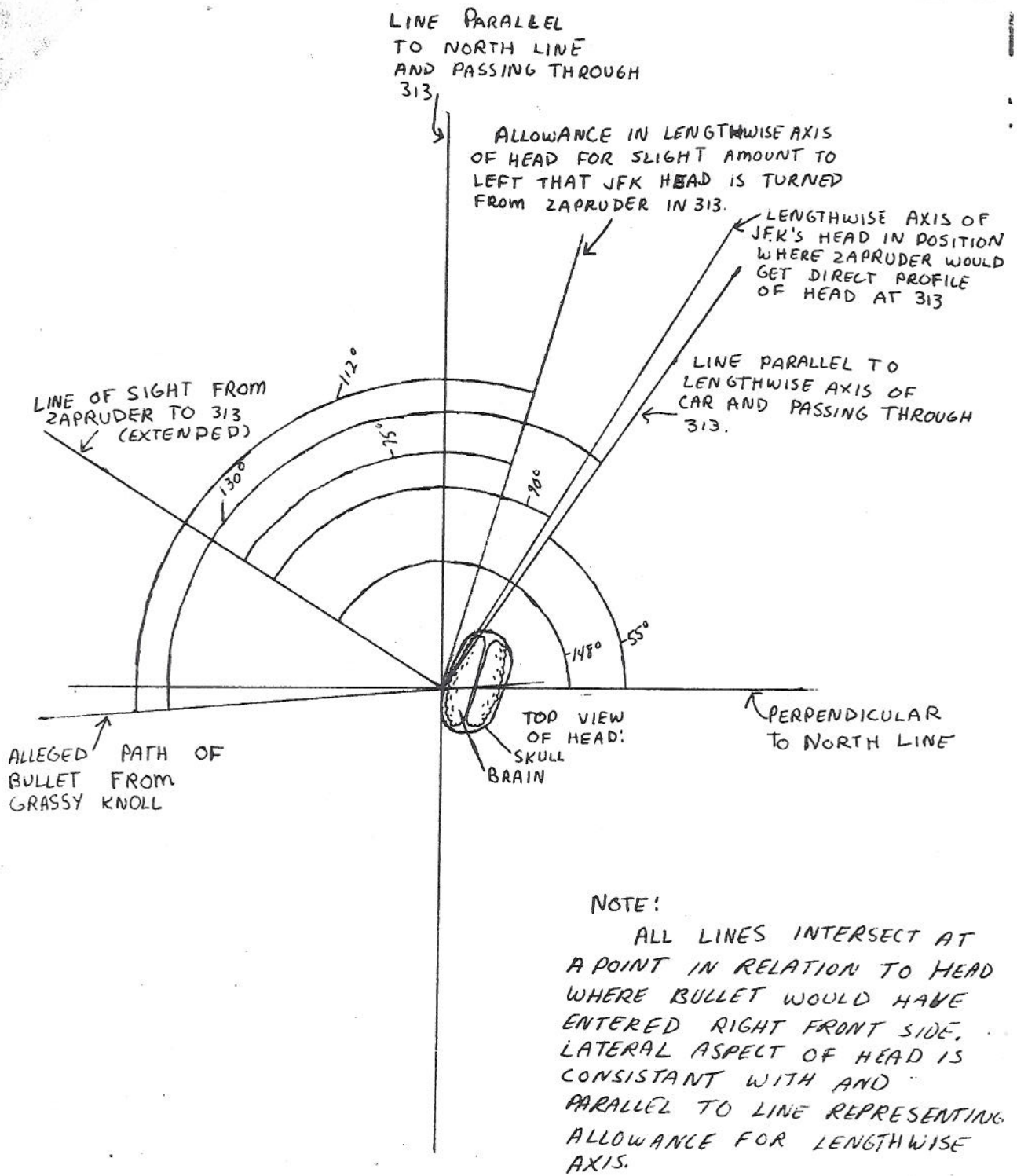


ILLUSTRATION #2-B