

ZAPRUDER CAMERA AND FILM

Mr. Abraham Zapruder, Dallas, Texas, made photographs of the presidential motorcade in an area on Elm Street just west of the intersection of Elm and Houston Streets, using a Bell & Howell 8 millimeter Zoom lens camera loaded with color film. He started photographing the motorcade after it made the turn onto Elm Street. He started taking pictures prior to the first shot that was fired and continued making pictures until the motorcade disappeared to his right.

He took the film to Jamieson Film Company in Dallas for processing and stayed with it during the processing. From the original print he had three copies made. He subsequently turned over two copies to the Secret Service and sold the original and one copy to Life Magazine.

Mr. Zapruder's camera was examined in the Laboratory and found to operate at an average speed of 18.3 frames per second.

LIFE MAGAZINE SLIDES

On 2/25/64 Mr. Herbert G. Orth, Assistant Chief of Life Magazine's Photographic Laboratory, provided the original of the Zapruder film for review at The President's Commission by representatives of the Commission, Secret Service and FBI. As a result of this conference, Mr. Orth offered to make 35 mm slides of pertinent frames (171 through 343). Three sets of these slides were prepared and one copy provided to the Commission, one copy to Secret Service and one copy to FBI.

NIX CAMERA AND FILM

Mr. Orville O. Nix made a series of 8 mm color motion pictures at the corner of Elm and Houston Streets as the motorcade turned north on Houston. He was in a position near the curb on the southwest corner of the intersection and made pictures of the left side of the presidential car. After the car went by he proceeded to a point about 20 feet on the south side of Main Street and made a series of pictures using the Zoom lens completely open.

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ENCLOSURE

Mr. Hix's camera was a Keystone Auto-Zoom 8 mm movie camera and was examined by the Laboratory and found to operate at an average speed of 18.5 frames per second.

MUCHMORE CAMERA AND FILM

Mrs. Marie Muchmore made 8 mm color motion pictures from a position on the northwest corner of the intersection of Main and Houston Streets where she had a view of the motorcade as it turned west from Houston into Elm Street. She stated that after hearing the first shot fired she panicked and did not take any other pictures.

From a review of the UPI book "Four Days," representatives of the Bureau determined that reproductions of photographs from motion picture film in this book were other than those from the Hix and Zapruder films. On the basis of this information, a copy of a roll of film exposed by Mrs. Muchmore was obtained from United Press International in New York City. Mrs. Muchmore's camera was obtained and is a Keystone K7 8 mm motion picture camera. This camera was examined in the Laboratory and found to operate at an average speed of 18.5 frames per second.

FILM REVIEW

The amateur assassination films taken by Mr. Abraham Zapruder, Mr. Orville Nix and Mrs. Marie Muchmore, including 35 mm color slides made by Life Magazine from the original Zapruder film, were reviewed extensively at the Commission by representatives of the Commission, Secret Service and FBI. Doctors who attended the President and Governor Connally, wound ballistics experts and Governor and Mrs. Connally also reviewed the films on occasions. The film reviews were made to establish the location on the film where the shots occurred that struck the President and Governor. It is noted that only the shot that struck the President in the head can be definitely established on all three films. Extensive background material was developed, such as the speed of the 8 mm cameras used in making the films. To assist in the recording of the material developed, each individual frame of each motion picture film was assigned a number. The frames of the Zapruder film were numbered beginning with 1 at the point of the film where the presidential motorcade pictures actually begin. This same system was used in numbering the Nix and Muchmore films. The 35 mm slides were numbered to conform to the frame numbers of the Zapruder film. During the film review, all aspects of the films were studied for any evidence that would contribute to the location of the shots, other than the head shot. Such things as visual observations of the reaction of the President and Governor Connally, as well as other occupants in the car, were considered. Action of Secret Service Agents riding in the follow-up car and motorcycle policemen riding behind the presidential car were checked for possible evidence.

REVIEWS OF ASSASSINATION FILMS AT THE COMMISSION

On January 23, 1964, Commission members Joseph Ball, David Belan, Melvin Eisenberg and Norman Redlich and Secret Service Inspector Thomas Kelley met with Inspector Leo J. Gauthier of the FBI at the Commission for review of the visual aids that had been prepared by the FBI.

On January 27 and 28, 1964, the following individuals attended the initial review of a copy of the Zapruder film: Representatives of the Commission; Inspector Leo J. Gauthier and staff and SA Lyndal L. Shaneyfelt of the FBI; and Inspector Thomas Kelley and Special Agent John Joe Hawlett of Secret Service.

On January 29, 1964, representatives of the Commission met with Inspector J. R. Malley (FBI) and Inspector Leo J. Gauthier and aids (FBI) for a further review of the Zapruder film and the initial review of the Nix film.

On February 25, 1964, Commission representatives met with Secret Service Inspector Thomas Kelley and FBI representatives J. R. Malley, Leo J. Gauthier and Lyndal L. Shaneyfelt for a further review of the Zapruder and Nix films and an initial review of the Muchmore film. Mr. Herbert G. Orth from Life Magazine made available the original of the Zapruder film which was reviewed. On this occasion, Mr. Orth volunteered to make 35 mm slides of each of the pertinent frames of the Zapruder film.

On April 14, 1964, representatives of the Commission met with FBI representatives Malley, Gauthier and Shaneyfelt for a review of the slides made by Life Magazine from the Zapruder film, as well as the Zapruder, Nix and Muchmore films. The following individuals were also present: Commander James J. Humes, U. S. Navy Hospital, Bethesda, Maryland; Commander J. Thornton-Boswell, U. S. Navy Medical School, Bethesda, Maryland; Colonel Pierre A. Finck, Chief of Wound Ballistics Pathology of the Armed Forces Institute of Pathology; Dr. A. G. Olivier, Chief of Wound Ballistics Branch, Edgewood Arsenal; Dr. F. W. Light, Jr., Deputy Chief of Biochemistry and Chief of Wound Assessment Branch, Edgewood Arsenal. The purpose of this review was to relate the knowledge of the doctors to the events depicted in the films.

On April 21, 1964, representatives of the Commission met with FBI representatives Malley, Gauthier and Shaneyfelt for a further review of the Zapruder, Nix and Muchmore films, as well as the 35 mm slides of the Zapruder film. The following individuals were also present at this review: Dr. Gregory and Dr. Shaw, who examined Governor Connally at Parkland Hospital in Dallas; Dr. Light and Dr. Olivier from the Wound Assessment and Wound Ballistics Sections of Edgewood Arsenal; Dr. Joseph Dolce, Consultant to the Biochemistry Division of Edgewood Arsenal; and Governor and Mrs. Connally. The purpose of this review was to relate the knowledge of the doctors and the recollection of the Connallys to the events depicted in the films.

RE-ENACTMENT IN DALLAS, TEXAS, ON MAY 24, 1964

On May 23 and 24, 1964, a survey was made of the assassination site in Dallas, Texas, including a detailed re-enactment. SA Lyndal L. Shaneyfelt, Laboratory Photographer R. E. Triplett and Mr. Roy Rose of the Exhibits Section made a preliminary survey on 5/23/64 at which time plans were formulated for the method to be followed in re-enacting the assassination at which time preliminary information was developed. Since the amateur films made by Mr. Zapruder, Mr. Nix and Mrs. Muchmore were to be the primary basis on which the re-enactment was to be made, it was essential that their exact camera positions be developed. The position of Mr. Zapruder was known, since he was on a specific projection of a nearby structure. Since the positions of Mr. Nix and Mrs. Muchmore during the filming of their pictures were not known, these positions were re-established through use of their cameras and photographs made from their films.

On Sunday, May 24, 1964, the re-enactment was started at approximately 6:00 AM. The Commission was represented by General Counsel J. Lee Rankin, Norman Redlich and Arlen Specter. SA Lyndal L. Shaneyfelt, SA R. A. Frazier and Laboratory Photographer R. E. Triplett were present from the FBI Laboratory. Inspector Leo J. Gauthier and Mr. Roy Rose were present from the Administrative Division and Inspector James R. Malley was present from the Investigative Division. Inspector Thomas Kelley and Agent John Joe Hawlett of Secret Service were present. A sufficient number of Dallas Agents were also present to assist the above individuals and two-way radio communications were in effect from all essential points.

The Dallas Police Department completely blocked off the portion of Elm Street where the assassination occurred. Secret Service representatives had available a car closely approximating that in which the President was riding and the variations between the car used for the re-enactment and the President's car were known and taken into account. Agents of the Dallas Office, who were the approximate sizes of President Kennedy and Governor Connally were used in the car to re-establish as accurately as possible the films of the assassination, including positions of the car in the street

and the positions of the individuals in the car. SA J. Doyle Williams was used in Governor Connally's position and SA James W. Anderton occupied the position of President Kennedy in the car.

SA Frazier was stationed at the sixth floor window of the Texas School Book Depository (TSBD) Building with the rifle recovered from the building immediately after the assassination. It is noted that the presidential car proceeded down Main Street to Houston Street, turned right on Houston Street toward the TSBD Building and at the corner of the TSBD Building turned left into Elm Street. The assassination occurred along Elm Street. The view from the sixth floor window of the TSBD Building is partially blocked by a tree for a portion of the area of Elm Street.

The re-enactment was based primarily on the Zapruder film and for the purpose of restaging specific frames of the Zapruder film a book of black and white photographs of the pertinent frames was available. The first position established was the location of the car in the street at the point where the person aiming the rifle would have the last opportunity for a clear shot before the car passed under the tree. This location was established through the Zapruder film and through advice from SA Frazier in the sixth floor window. It has been determined that this was frame 161 of the Zapruder film. The next location was at a point in the street where there was a clear shot through an opening in the tree. This position was found to be frame 185 of the Zapruder film. The next position located was at a point where there was the first clear shot after the car emerged from under the tree and this was frame 207. Other frames established were based on pertinent frames developed during the numerous film reviews that had been made at the Commission and they were frames 222, 225, 231, 235, 240, 249, 255 and 313. Frame 313 is the frame depicting the shot that hit President Kennedy in the head. All of the re-establishment of frame numbers after frame 207 were made on the basis of the Zapruder film, using known reference points in the background of the photographs, except frame 313. This frame in the Zapruder film does not have any fixed reference points for the establishment of the location. Frame 24 of the

Nix film and frame 42 of the Muchmore film both depict the shot that hit the President in the head and both have fixed reference points on which this frame could be re-established. As each of the positions was fixed along Elm Street, SA Frazier made studies of the possible bullet path at each frame. Measurements were also taken and a surveyor calculated the distances from the point of the wound in Kennedy's back to the window and to a fixed reference point in the street, as well as the angle to the window. In addition, photographs were made first with 4" by 5" Polaroid film to check the accuracy against the Zapruder photographs, then with 4" by 5" black and white film for permanent record after which the position was photographed on 35 mm black and white film, 35 mm color film, and with Zapruder's 8 mm motion picture camera on 8 mm color film. After frame 313 was established, the car was returned to the corner of Houston and Elm Streets where it was located in a position where there would be the first clear shot after the car turned the corner at Houston and Elm Streets. This point was recorded photographically with measurements and is referred to as point "A," since the Zapruder assassination films do not include this portion of the actual assassination route.

After the fixed positions were determined, the car was driven along the route at the previously estimated speed of 11 miles per hour of the presidential motorcade and while being followed through the rifle scope by SA Frazier was photographed from the camera positions of Zapruder, Nix and Muchmore, using their cameras. This run was re-enacted two times.

Following the above portion of the re-enactment, SA Shaneyfelt and Photographer Triplett went to the sixth floor window of the TSBD Building and mounted an Arriflex 16 mm motion picture camera behind the telescopic sight of the assassination rifle. This was mounted on a tripod and positioned approximately in the position believed to have been used by the assassin. The car was then returned to the corner of Houston and Elm Streets and relocated in the previously determined fixed position and motion pictures were made at each of the points through the telescopic sight of the rifle. Inspector Leo J. Cauthier handled the re-establishment of the car and individuals in the

car as related to the Zapruder film during this portion of the re-enactment. In addition, Mr. Redlich observed the car from the triple overpass under which the presidential car traveled immediately after the assassination. Mr. Redlich found that a shot could be fired from the triple overpass at President Kennedy without going through the windshield. After the motion pictures were made through the rifle scope of the fixed positions on Elm Street, black and white motion pictures were made of the car traveling at the estimated 11 miles per hour on the assassination route with the scope of the rifle and the camera following the car. This was then repeated and filmed on color film.

This concluded the on-sight survey of the assassination and the street was again opened to traffic at approximately 1:00 PM.

In the afternoon of 5/24/64, studies were made in a garage near the assassination site. These studies were made to determine the approximate angle of a bullet traveling through the President's neck and through Connally's chest to determine whether or not there was any basis for the theory that one shot could have gone through both individuals. This angle was re-established based on the Zapruder photographs and the known location of the wounds on both Kennedy and Connally and was found to be approximately 17° . It is noted that the angle from the rifle to the wound in the President's back in the area near frame 222 is also approximately 17° . Photographs were made at the garage of the alignment of the wounds using a rod to show the wound alignment and a string along the wall in the background that had been placed by the surveyor at 17° . This concluded the survey in Dallas.

SPEED OF CAR AND ELAPSED TIME BETWEEN SPECIFIC FRAMES

The speed of the presidential car was calculated for the area between frames 161 and 313, which is a distance of 136.1 feet. This represents 152 frames which are exposed at the rate of 18.3 frames per second totaling 8.3 seconds. Based on this, it has been calculated that the presidential car was traveling at an average speed of 11.2 miles per hour from position 161 to 313.

The following is the listing of the elapsed time between the various frame numbers established during the re-enactment:

From frame 161 to frame 313 is 152 frames totaling 8.306 seconds

"	"	166	"	"	"	147	"	"	8.032	"
"	"	185	"	"	"	128	"	"	6.934	"
"	"	186	"	"	"	127	"	"	6.939	"
"	"	207	"	"	"	106	"	"	5.792	"
"	"	210	"	"	"	103	"	"	5.628	"
"	"	222	"	"	"	91	"	"	4.972	"
"	"	225	"	"	"	88	"	"	4.808	"
"	"	231	"	"	"	82	"	"	4.480	"
"	"	235	"	"	"	78	"	"	4.262	"
"	"	240	"	"	"	73	"	"	3.939	"
"	"	249	"	"	"	64	"	"	3.497	"
"	"	255	"	"	"	58	"	"	3.169	"

SURVEYOR'S REPORT

The following table is a listing of the measurements obtained on site by County Surveyor Robert West as a result of points located along the assassination route that were established through the re-enactment:

FRAME NO.	STATION NO.	ELEV.	RIFLE IN WINDOW		TOP BRIDGE HANDRAIL	
			ANGLE TO HORIZON R-K-H	LINE OF SIGHT DIST. K-R	ANGLE TO HORIZON B-K-H	LINE OF SIGHT DIST. K-3
A		431.97	40°10'	91.6	-0°27'	447.0
161	3+29.2	429.25	26°58'	137.4	-0°07'	392.4
166	3+30.1	429.20	26°52'	138.2	-0°07'	391.5
185	3+49.3	428.13	24°14'	154.9	+0°03'	372.5
186	3+50.8	428.05	24°03'	156.3	+0°03'	371.7
207	3+71.1	427.02	21°50'	174.9	+0°12'	350.9
210	3+73.4	426.80	21°34'	176.9	+0°22'	248.8
222	3+85.9	426.11	20°23'	188.6	+0°24'	336.4
225	3+88.3	425.98	20°11'	190.8	+0°26'	334.0
231	3+93.5	425.69	19°47'	196.0	+0°28'	329.0
235	3+36.8	425.52	19°26'	199.0	+0°30'	326.8
240	4+02.3	425.21	19°01'	204.3	+0°34'	320.4
249	4+10.0	424.79	18°32'	211.9	+0°40'	313.1
255	4+16.4	424.46	18°03'	218.0	+0°44'	307.1
313	4+65.3	421.75	15°21'	265.3	+1°28'	260.6