

## **Video Enhancement and Analysis**

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**Barbara Worsham** is a Vice President at Rimkus Consulting Group, Inc., with more than 25 years of experience in forensic animation, graphics, and video services. She graduated from the Art Institute of Houston in 1987 with emphasis in Visual Communication. Barbara's expertise includes enhancing video using state-of-the-art computer software.

She has 100 hours of forensic enhancement training plus an advanced level security camera course. Her video enhancement projects have included security video footage, cell phone, digital camera videos, and YouTube videos. She has developed animations, graphics, and enhanced security videos for mediations, arbitrations and trials.

Barbara has testified in depositions and trials at the state and federal levels, regarding the methods used to create forensic animations or enhance evidentiary videos.

**Rimkus Consulting Group, Inc.** is a full-service, forensic engineering consulting firm established in 1983. We offer a wide array of technical consulting services worldwide. Over the years Rimkus has investigated thousands of losses within the hospitality industry. We advise our clients in the resolution of complex claims, incidents, and disputes.

Rimkus employs professionals whose broad range of expertise assists clients in understanding the complex issues that led to a catastrophic event. Our in-depth site investigations and consistent analysis enable our professional staff to render opinions and conclusions based on scientific facts.

The Rimkus team is fully prepared to advise clients throughout the litigation process when necessary, whether in mediation, arbitration, or by giving expert witness testimony.

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### I. Enhancement in Movies and TV

- A. The CSI Effect
  - 1. Unrealistic expectations of image quality. “It’s possible to get a clear image from a reflection on a door handle; I saw it on CSI...”

### II. Why Doesn’t Security video show the detail that is in TV and Movies?

- A. Quality vs. Storage costs

### III. 5 ways Businesses try to save Costs

- A. Record a Smaller size image
  - 1. 320 x 240 resolution
- B. Compress the Video – Lossy Compression
  - 1. Lowers level of detail
  - 2. More pixels equals more information
  - 3. Compression artifacts can lead to incorrect conclusions
    - a) *Close up of compression artifacts – “blocking” or “quilting”*
- C. Record full frame then discard half of the scan lines – 2CIF
  - 1. Storage cost cut in half
- D. Lower the frame rate
  - 1. Additional storage savings
  - 2. Frame Rate (How many frames are displayed in 1 second of video) Frame Rate Pros/Cons
    - a) *Low frame rate (1 fps) – may miss detail - slip/fall*
    - b) *High frame rate (30 fps) – costly storage*
    - c) *5-10 fps good for most scenes*
    - d) *15+ fps for best fast moving object (cars)*
- E. Cameras set on Motion Detection. Camera records only when it detects movement
  - 1. Many times incident not recorded due to sensitivity settings.

### IV. If CSI enhancement is not real, what can I expect from enhancement?

- A. Virtually any type of video format can be enhanced – proprietary formats as well as common formats can be enhanced.
- B. Common Video Enhancement Filters
  - 1. Resolution
  - 2. De-blur
  - 3. De-interlace
  - 4. Contrast
  - 5. Noise
  - 6. Stabilization

**V. Security video VHS and low quality digital video can benefit from enhancement**

- A. Slow Motion
- B. Still Images
- C. VHS video - Real Time – may Miss details
- D. Still Image exported from video
- E. Mark areas on floor and mark locations of mopping

**VI. How security video can aid the engineer's analysis**

- A. Speed and Location of vehicles
- B. Slip and fall?
- C. What caused subject to fall?

**VII. License Plate Identification Issues**

- A. Cameras that aren't set to capture license plates rarely capture license plates.
- B. Cell phone video was able to capture license plate – video held on license plate for several seconds

**VIII. Case Study - Security video captured fall**

- A. Was subject reaching for the handrail when she fell?
- B. Unique stone pattern
- C. Outline of Stone pattern over video
- D. Location of subject

**IX. Crosswalk Case**

- A. Security Camera Captured Accident
- B. Computer camera matched to Security camera view. Computer humanoids location matched to security camera  
Computer overhead view
- C. Truck Driver's View

**X. Best Practices**

FBI Best Practices -<https://www.fbi.gov/news/videos/caught-on-camera>  
SWGIT - Scientific Working Group Imaging Technology, Recommendations and Guidelines for Using Closed-Circuit Television Security Systems in Commercial Institutions <https://www.swgit.org/>

- A. Correct Backlit Lighting Issues
- B. Lights that are on timers must be checked. Are lights coming on at correct time?

**XI. Best Practices for Enhancement**

- A. Review recordings = verify time and camera that captured the incident. Verify that incident is in exported video.
- B. Get ALL camera views available
  - 1. 2 hours before through 2 hours after the incident
- C. Collect native file with proprietary player
- D. Don't save video to a Different File Format - (AVI to MOV or DVD/vob file format)

E. Don't change the frame rate (original 7 frames per second changed to 15 frames per second)

NOTE: (Videotaping the computer monitor with your cell phone does not count as retrieving the video.)

F. Operator may be Untrained. Does not know how to export best quality  
1. If operator unsure of export procedure, suggest calling the supplier to retrieve best quality.

## **XII. Documenting Video Enhancement/Enhanced Video in the Courtroom**

- A. Enhancement process must be thoroughly documented
  - 1. Type of video, codec, player, MD5 Hash (digital signature)
- B. Report from Enhancement software shows all settings used in enhancement
  - 1. Replicate the results 100% of the time
- C. How enhanced video can be presented in the courtroom
  - 1. Original unenhanced video
  - 2. Can show the enhancement process step by step
  - 3. Enhanced video shown side by side with original
  - 4. Enhanced video only

## **XIII. Summary**

- A. Security Cameras and Cell Phone Cameras are everywhere – there is a good chance of retrieving video of incident
- B. Many security cameras are not set correctly or designed to correctly capture event – enhancement and analysis required
- C. Check YouTube –video of incident may be uploaded
- D. Don't judge enhancement possibilities on how the video appears on your screen
- E. The "CSI" enhancement is for movies and television
- F. Enhancement and analysis can provide valuable information beneficial to the case.

## **Additional Best Practices**

**FBI Best Practices** -<https://www.fbi.gov/news/videos/caught-on-camera>

- G. Resolution – enough for facial recognition?
- H. Camera position – clear view of subject?
- I. Lighting setup – capture clear images both day and night?
- J. Recorder – setup for the best image detail?
- K. Maintenance – is the system maintained so that it can do its job when it is really needed?
- L. Minimum resolution = 640 x 480
  - 1. Majority security video is 320 x 240
- M. For ID = subject's head should fill 15% of screen
- N. Line of sight critical = make sure there are no obstructions**
- O. Site plan of camera positions and coverage. Good camera overlay. No blind spots where someone is not visible
- P. Camera height = close to eye level as possible.