2016 HOSPITALITY LAW CONFERENCE

FEBRUARY 22-24, 2016,

VIDEO ENHANCEMENT & ANALYSIS

Presented by:

Barbara Worsham, PI
Rimkus Consulting Group, Inc.

HospitalityLawyer.com®
worldwide legal, safety and security solutions

PRESENTER

Barbara Worsham, PI

Vice President Animation, Graphics & Video

Rimkus Consulting Group, Inc.

- More than 25 years experience in animation, graphics, and video for litigation.
- Expertise includes enhancing video using state-of-the-art computer software.
- Has testified in depositions and trials at the state and federal levels regarding forensic animation or video enhancement.

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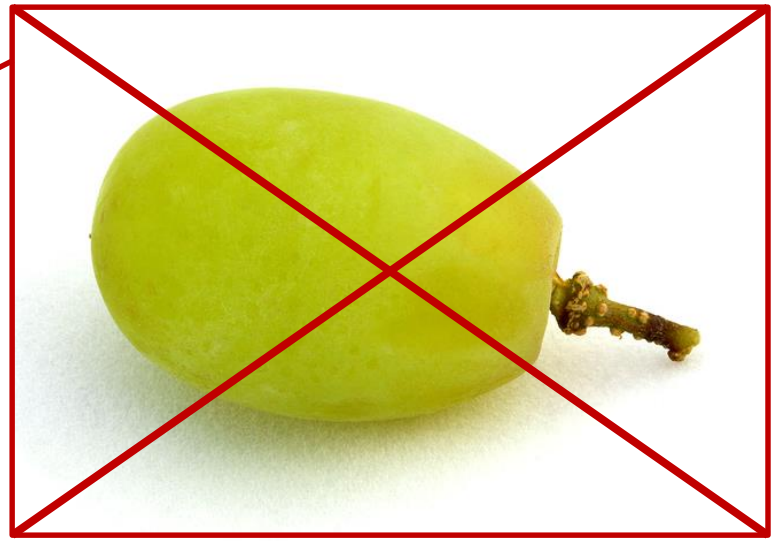
ENHANCEMENT IN MOVIES AND TELEVISION

THE CSI EFFECT

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…"

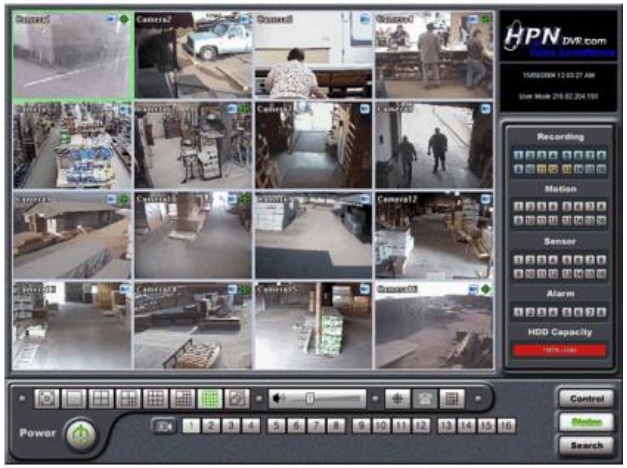


WHY DOESN'T SECURITY VIDEO SHOW THE DETAIL THAT IS IN TV AND MOVIES ?

HIGH QUALITY VIDEO COSTLY

Store Video
xxx Days?

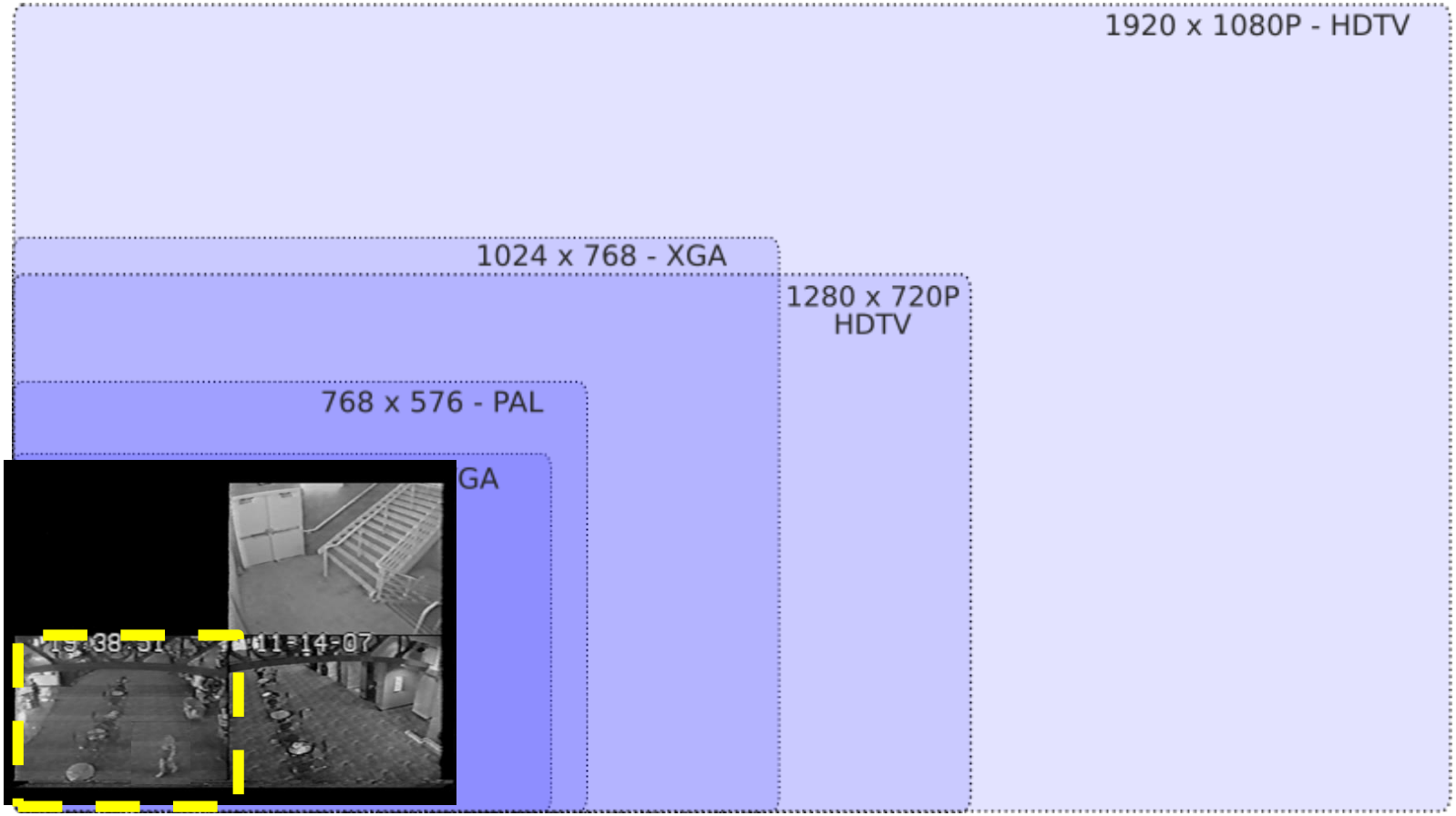
How Many
Cameras?



VIDEO QUALITY vs. STORAGE COSTS

5 WAYS BUSINESSES TRY TO SAVE COSTS

#1 Record a Smaller size image



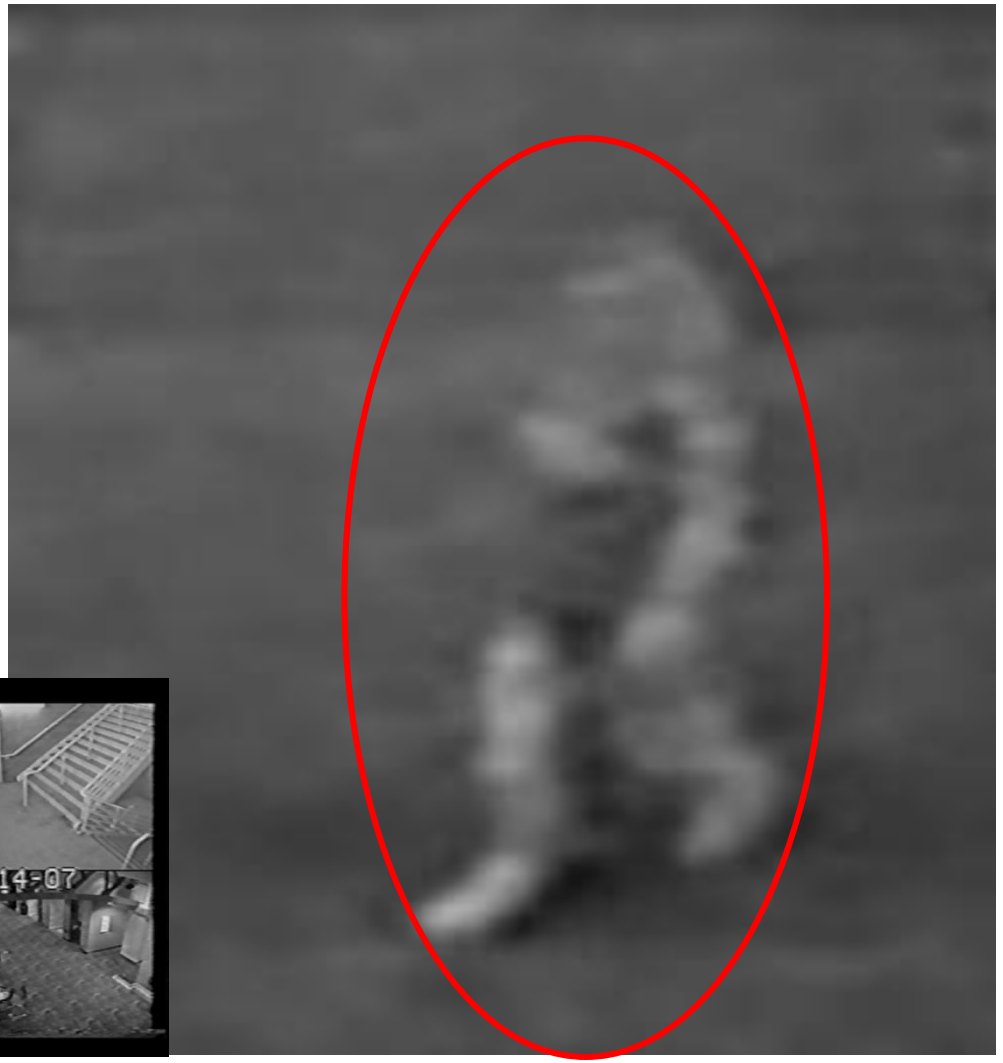
5 WAYS BUSINESSES TRY TO SAVE COSTS

#2 Compress the Video – Lossy Compression

Details are lost

IPVM.com resolution vs compression tested

SUBJECT IN 320 X 240 SECURITY VIDEO ENLARGED



MORE PIXELS = MORE INFORMATION

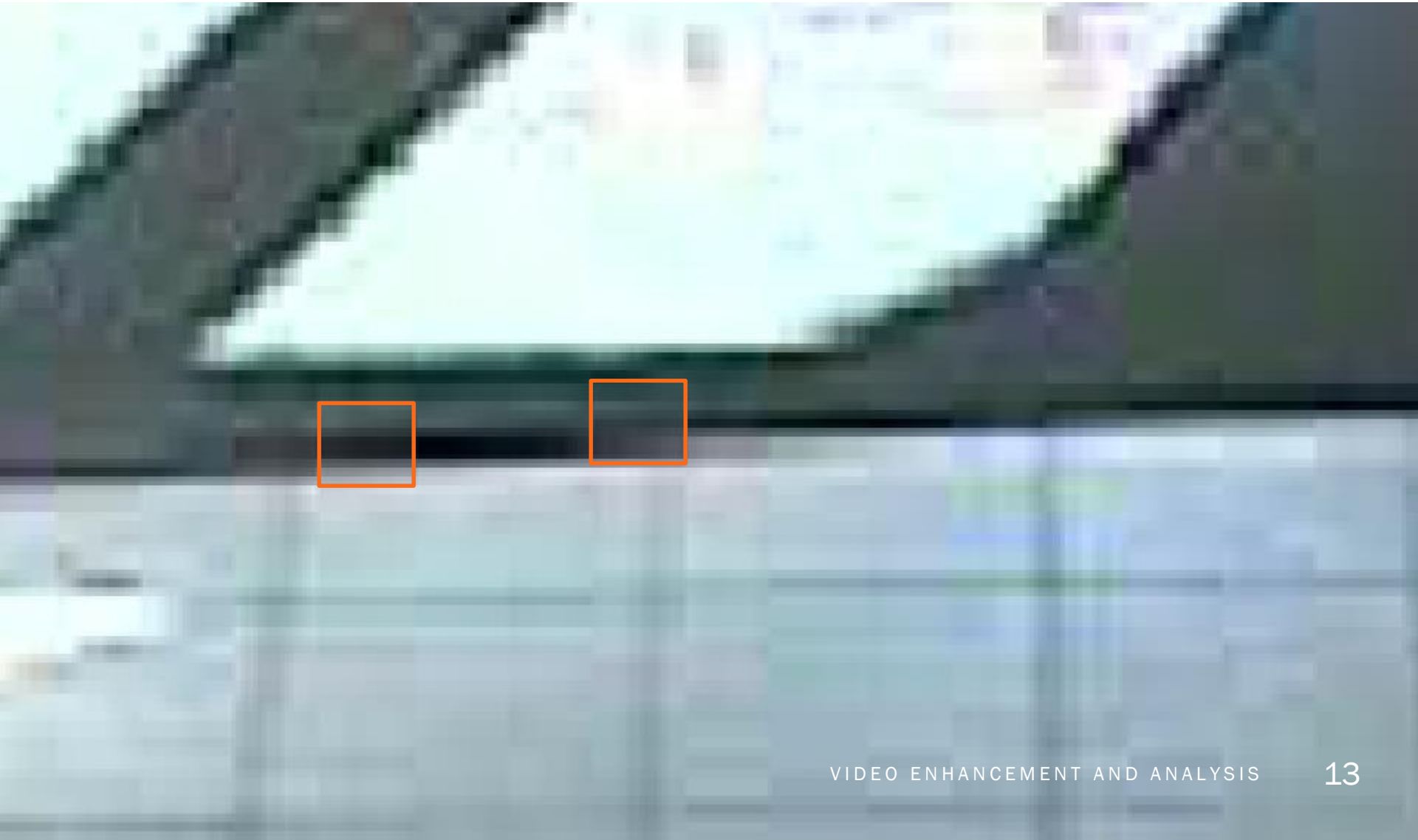
324 pixels

223,104 pixels

COMPRESSED VIDEO EXAMPLE

Compression artifacts can lead to incorrect conclusions

Close up of compression artifacts – “blocking” or “quilting”



BUSINESSES TRY TO SAVE COSTS

#3 Discard half of the scan lines

Storage cut in half

5 WAYS BUSINESSES TRY TO SAVE COSTS

#4 Lower the frame rate

Additional storage savings

Frame Rate	Standard Video	Security Video
• How many images are displayed in 1 second of video	• 30 frames per second	• 30 frames per second to 1 frame per second or LESS.

DIFFERENT FRAME RATES ANALYZED

Slip/Trip or turned ankle?

1 frame per second
56 KB

5 frames per second
142 KB

10 frames per second
212 KB

30 frames per second
353 KB

10 frames per second is adequate to capture slip/fall
212 KB

FRAME RATE PROS/CONS

Low

- Low frame rate (1 fps) –
  - may miss detail - slip/fall

High

- High frame rate (30 fps) – Costly Storage

OK

- 5-10 fps good for most scenes
- 15+ fps for best fast moving object (cars)

5 WAYS BUSINESSES TRY TO SAVE COSTS

#5 Cameras set on Motion Detection

Camera records only when it detects movement

CAMERAS SET FOR MOTION DETECTION

Camera set to capture 1 frame per second **AFTER** motion is detected

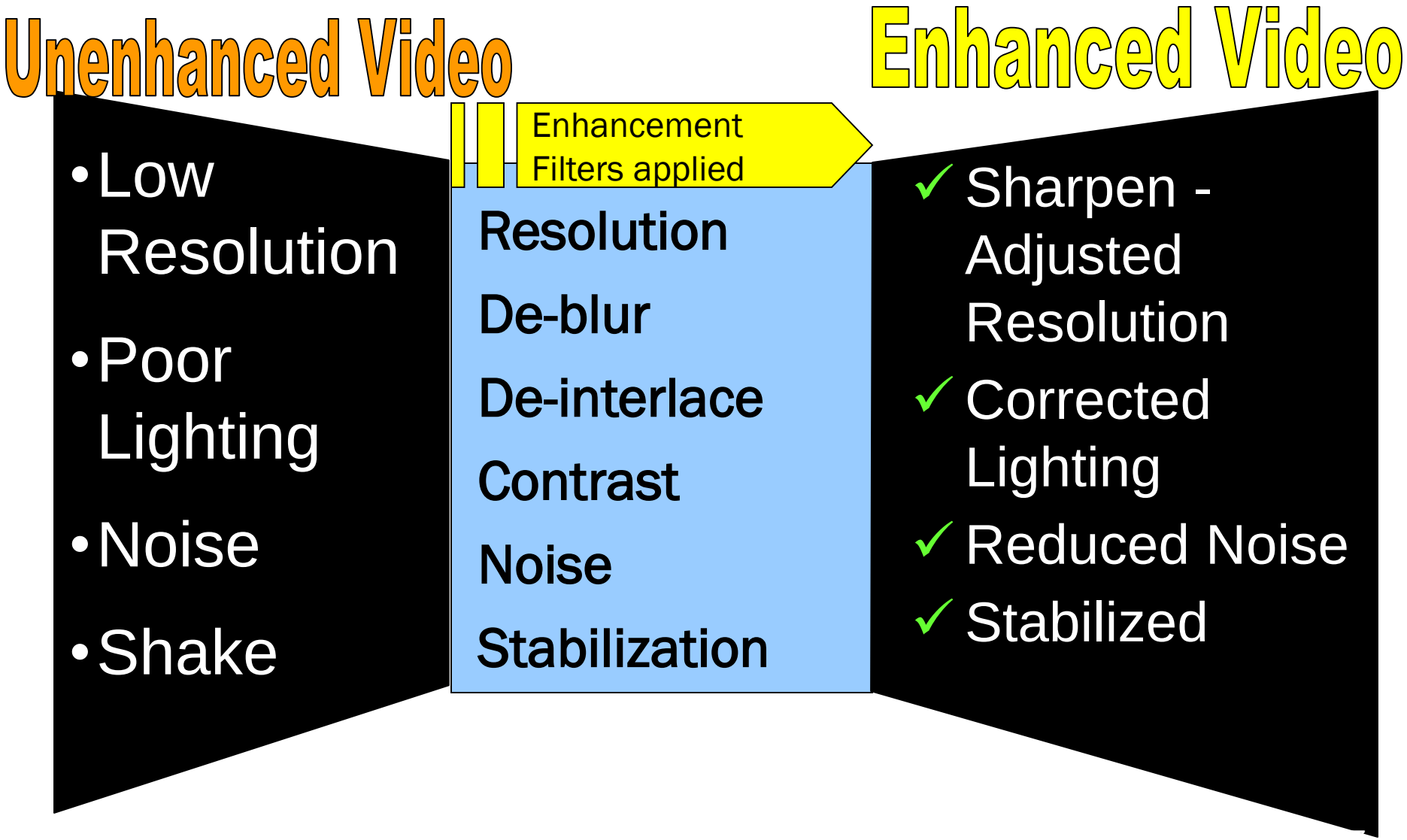
1 hour of standard continuous video.
1 hour long.

1 hour recorded using motion detection
4 minutes long.

If “CSI” enhancement is not real - What can I expect from Enhancement?

What types of video can be enhanced?

WHAT IS VIDEO ENHANCEMENT?



ENHANCEMENT

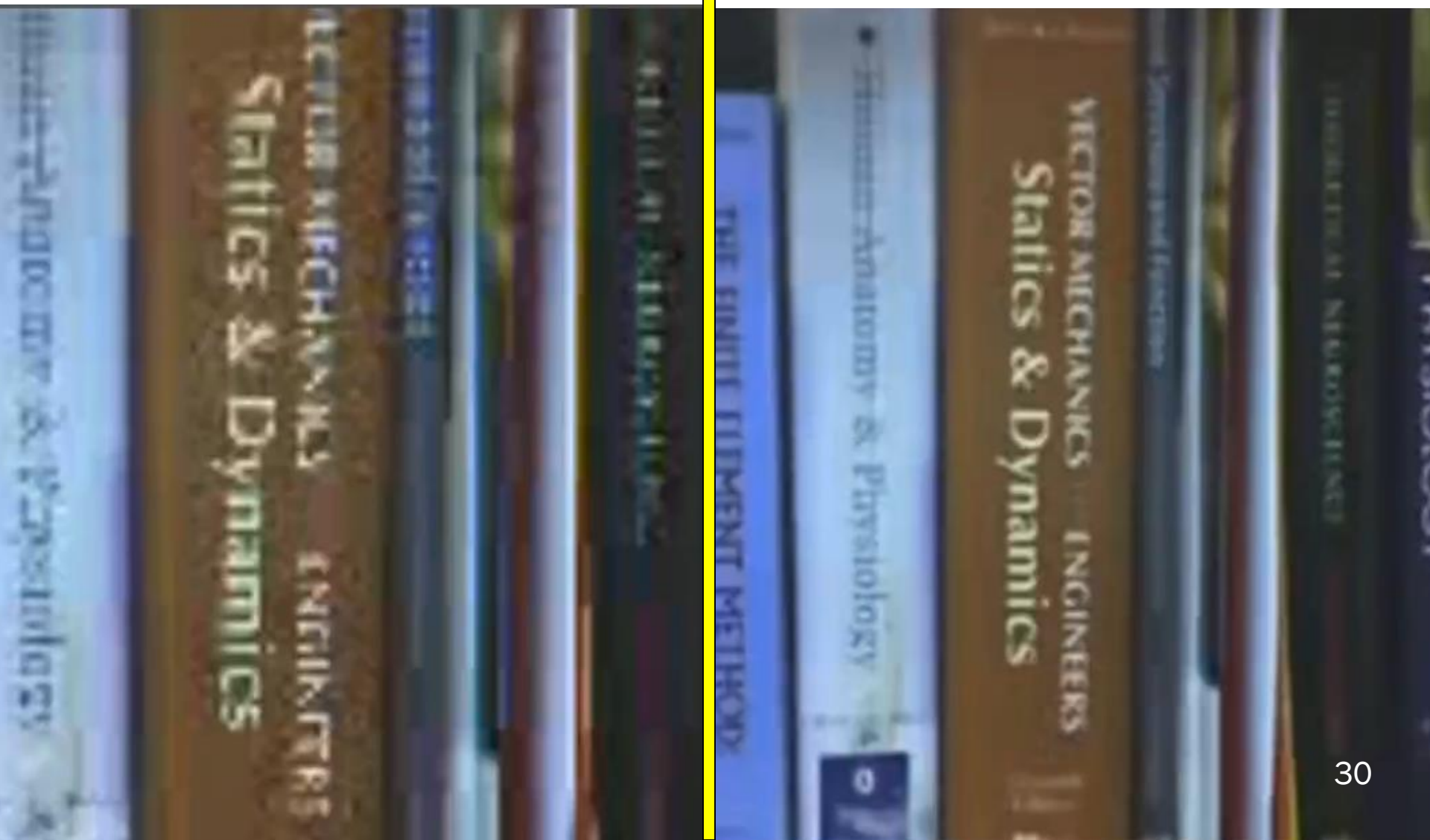
If the information is in the photo or video, then enhancement can make detail more clear

Enhancement does NOT create information

BASIC ENHANCEMENT EXAMPLES

Low Resolution
and Noise
Unenhanced

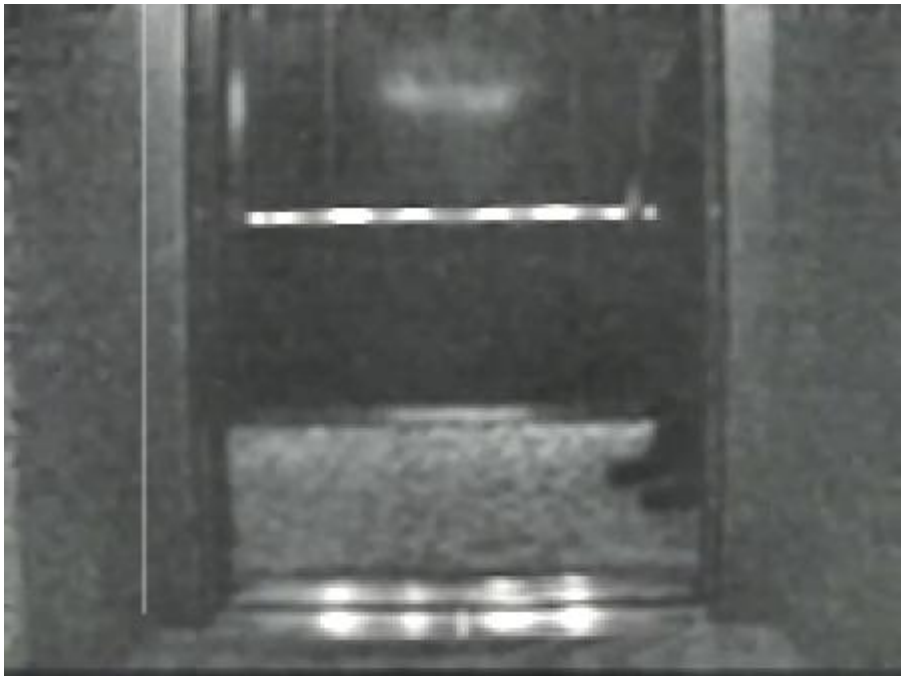
Low Resolution
and Noise
Enhanced



Unenhanced Image from Video

Enhanced Image from Video

Low Light



Unenhanced
Image from Video

Enhanced
Image from Video

Unenhanced
Stabilization
Enhanced

SURVEILLANCE VIDEO – VHS TAPE FORMAT

Surveillance Video - VHS Tape

SLOW MOTION

VHS VIDEO - REAL TIME – MAY MISS DETAILS

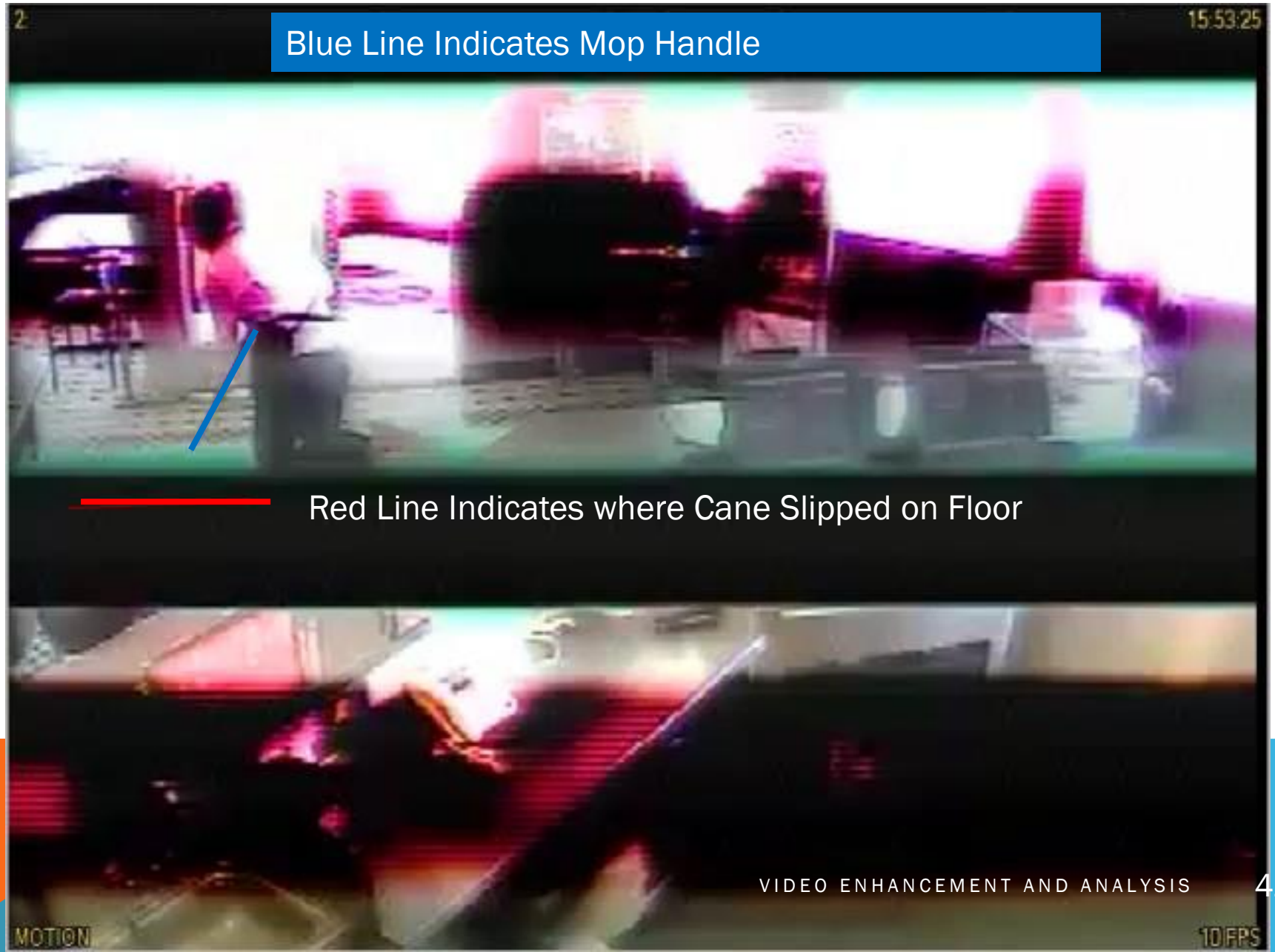
STILL IMAGE EXPORTED FROM VIDEO

ORIGINAL UNENHANCED VIDEO

FALL OCCURS

LOCATION OF CANE TIP ON FLOOR

EMPLOYEE MOPPED AREA TOWARDS DOOR



EMPLOYEE MOPPED AREA TOWARDS COUNTER

How surveillance video can aid the engineer's analysis

Speed and Location of vehicles	Did Slip and fall Occur?	What caused the slip/fall?

VIDEO – VIEW LOOKING SOUTH

VIDEO – VIEW LOOKING NORTH

- Frames per second
- Distance traveled

Locations and Speeds of Vehicles When light Turned RED

[07]
11/03/2014 14:21:51

[07]
11/03/2014 14:21:53

Shoes worn at time of fall

Shoes supplied by Claimant

LICENSE PLATES

Cameras that aren't designed to capture license plates will rarely capture license plates.

CONVENIENCE STORE VIDEO IMAGE

HOME SECURITY VIDEO OF DRIVEWAY

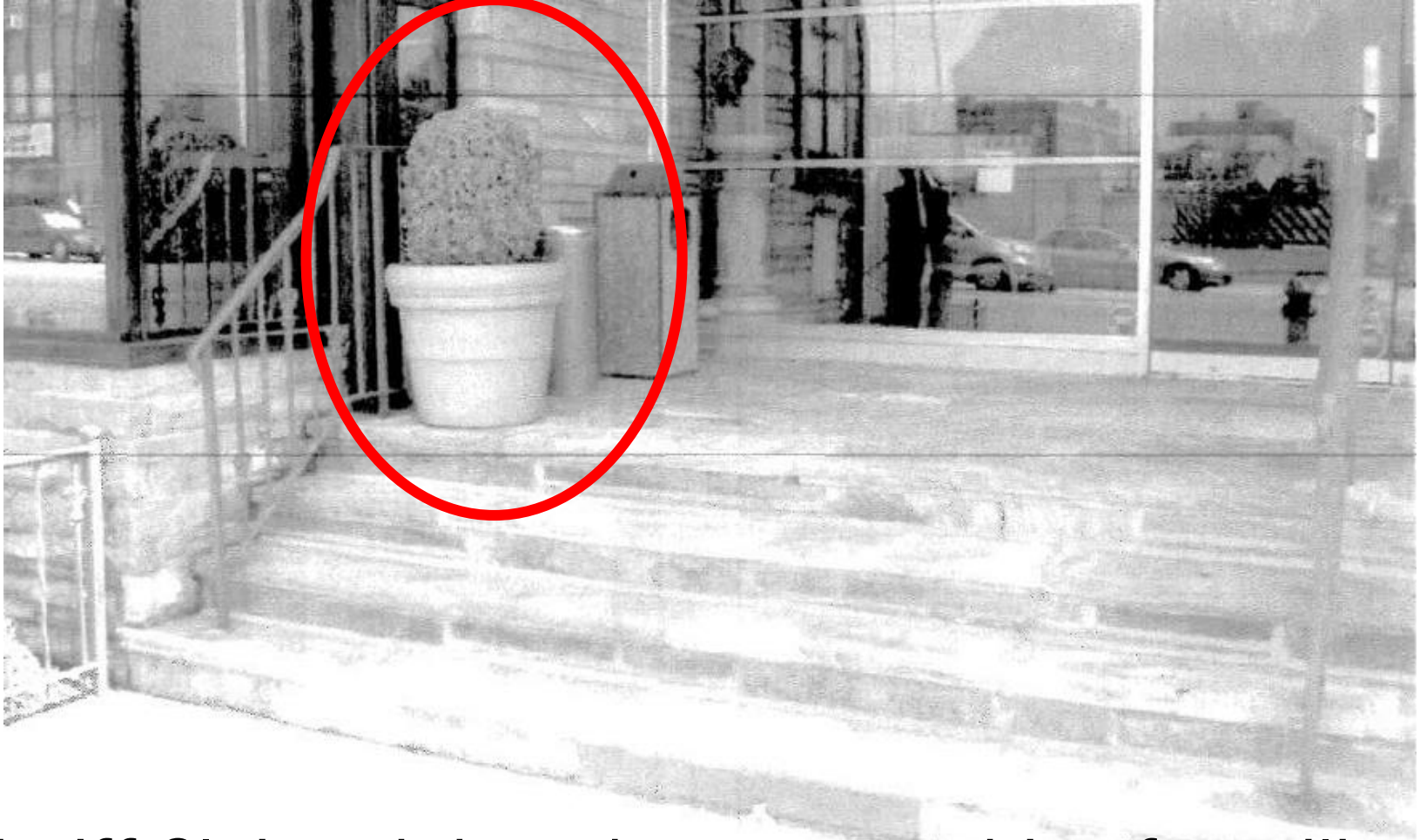
Cell phone video – video held on license plate for several seconds

Unenhanced Video Image

Enhanced Video Image

Even Specialized Cameras have Difficulty Capturing License Plates at Night

SECURITY VIDEO CAPTURED FALL



Plaintiff Claimed that she was reaching for railing
Planter blocked her access to railing

WAS SHE REACHING FOR THE HANDRAIL WHEN SHE FELL?

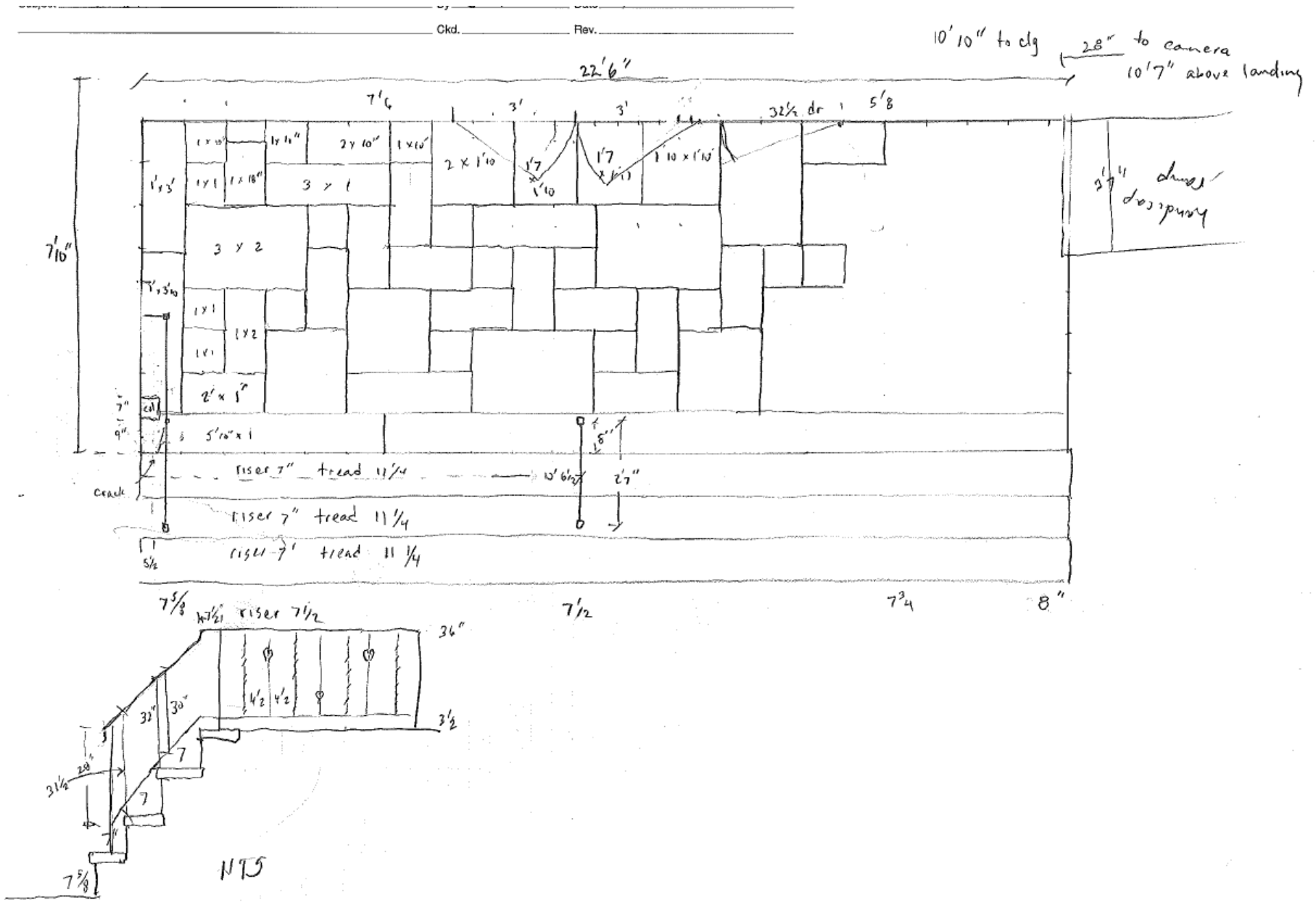
Position foot on top step.

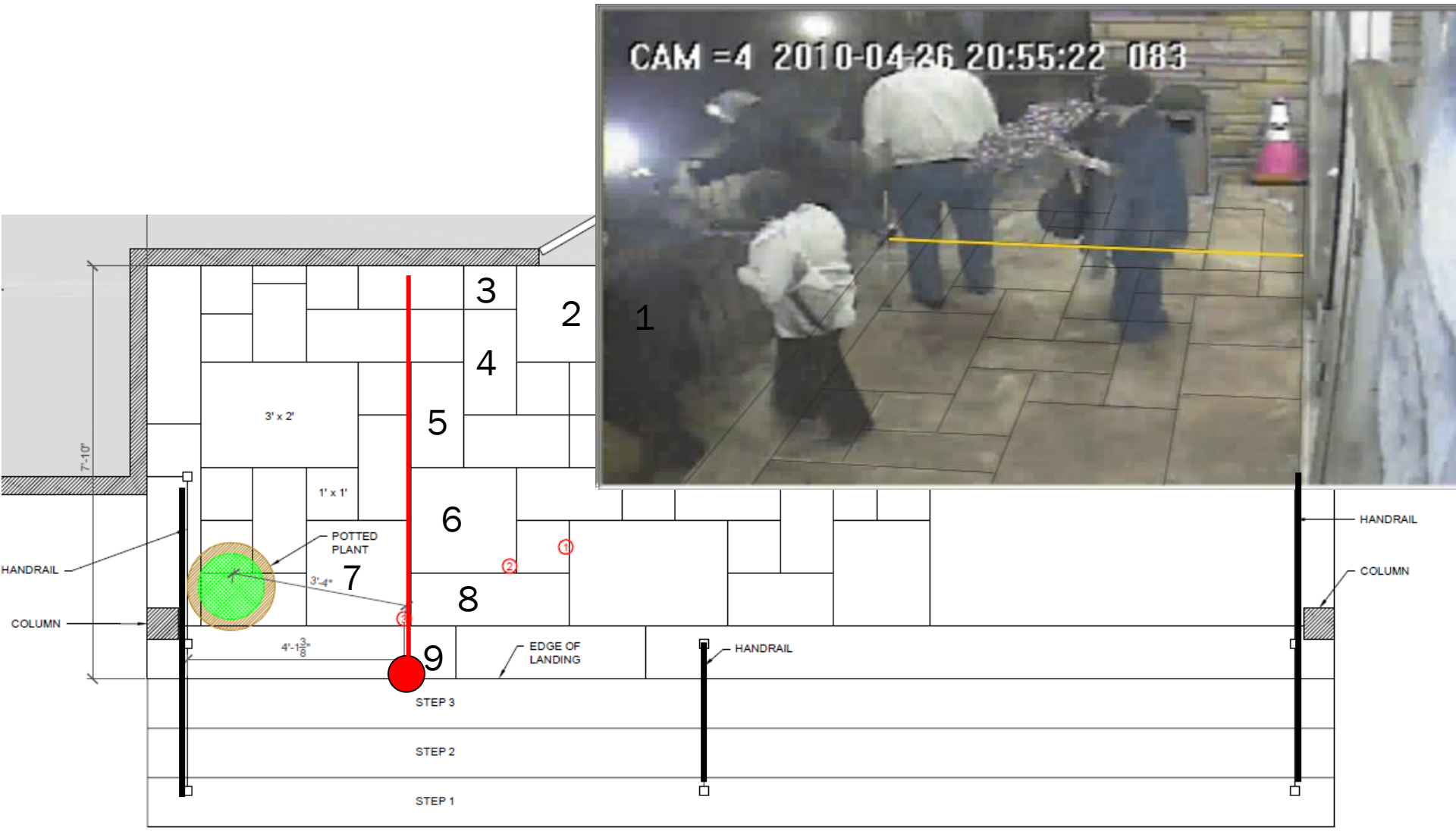
UNIQUE STONE PATTERN

OUTLINE OF STONE PATTERN OVER VIDEO

CAM =4 2010-04-26 20:54:49 458

FIELD SKETCH WITH DIMENSIONS





LEGEND

① -20 55 17 177 Foot Position

② - 20 55 18 474 Foot Position
20 55 19 989 Head Motion Begins
20 55 20 677 Head Moves Off Landing

③ - 20 55 21 489 Foot Position

④ - 20 55 21 989 Foot Position

49 ½ “ from railing

SCALE (FEET)

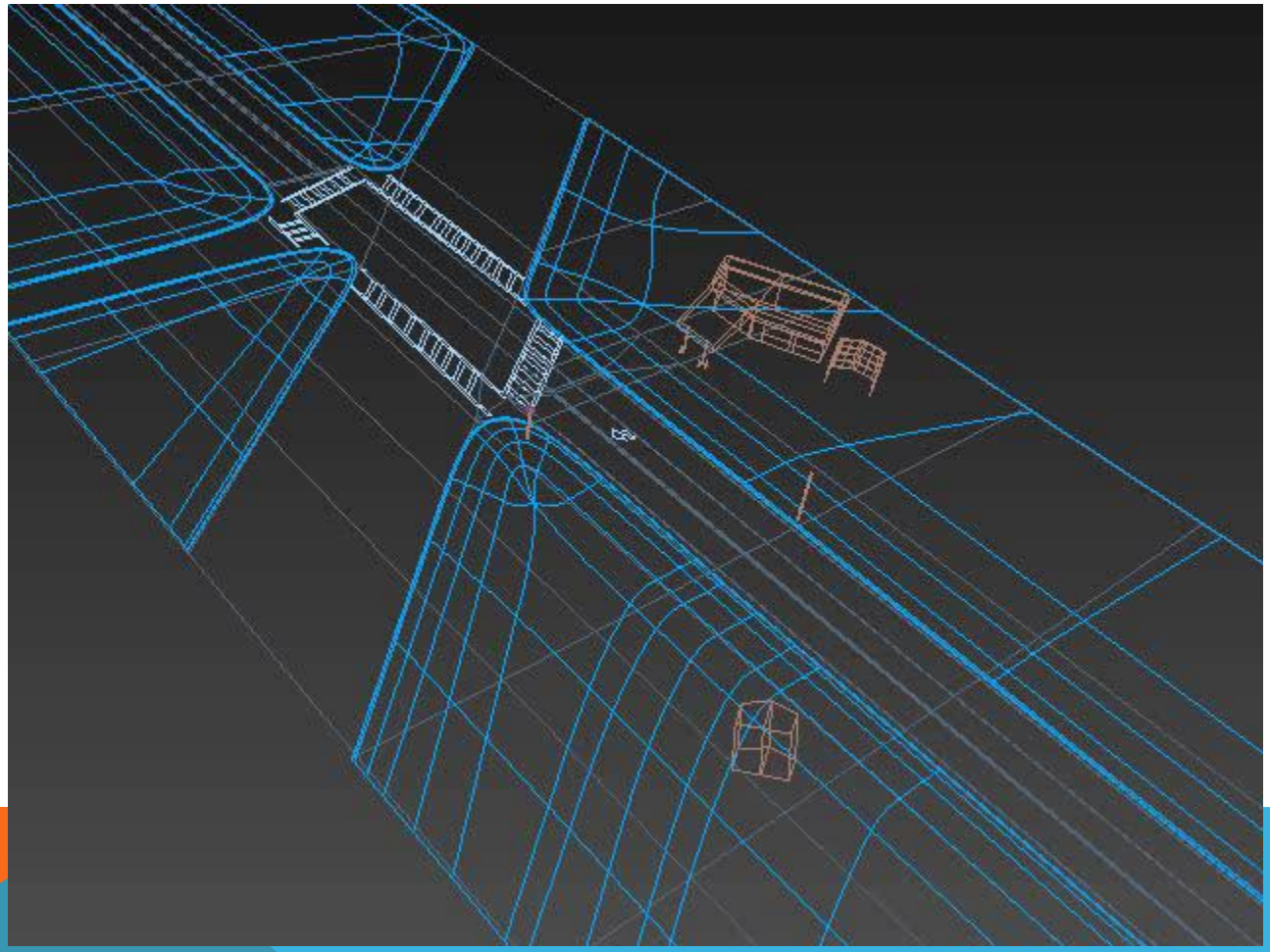
0 1 3

SECURITY CAMERA VIDEO OF ACCIDENT

Tanker Truck Ran Over Pedestrian

Pedestrian – claimed she was in the crosswalk.
Driver - claimed he did not see pedestrians before pulling forward.

The intersection was modeled in 3D.
The computer's camera was placed in the same location as the security video camera

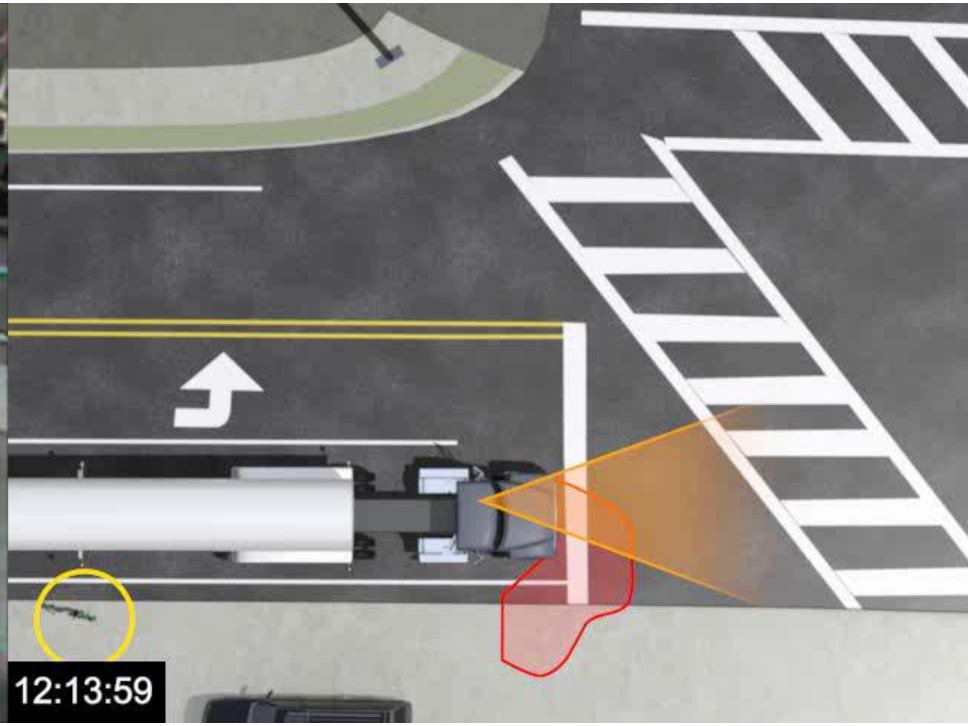


The 3D computer model matched the exact location and timing of the pedestrians in the security video.

Computer camera matched to security camera's view rotates to overhead view

3D Model View

Security Video View

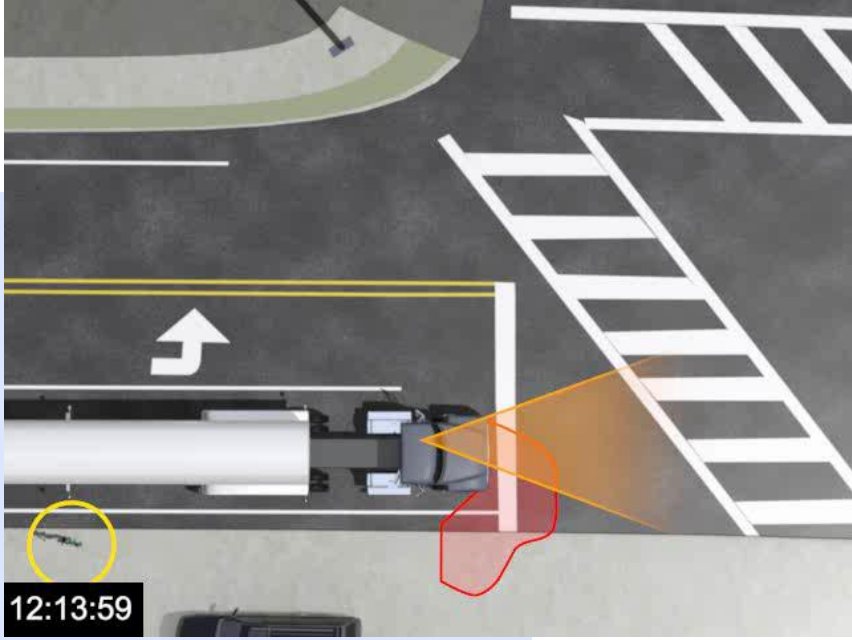


3D Model View

RED ZONE = AREA WHERE 4’9” PEDESTRIAN NOT VISIBLE TO TRUCK DRIVER

TRUCK DRIVER'S VIEW

TRUCK DRIVER'S VIEW

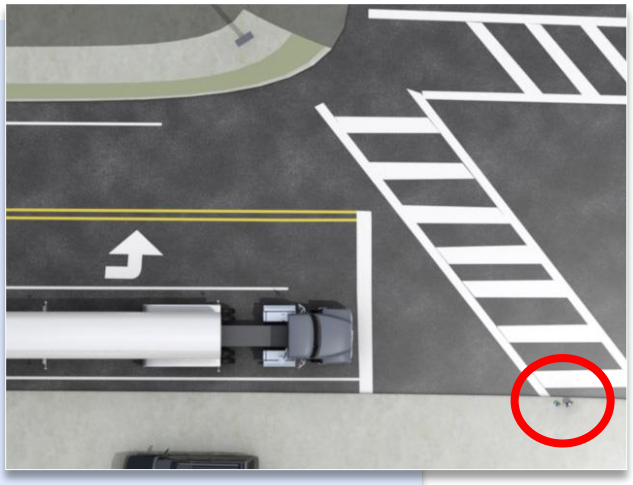


Security Video

Pedestrians feet/lower legs were visible in front of truck

3D Model

Scenario According To Plaintiff Testimony



Best Practices

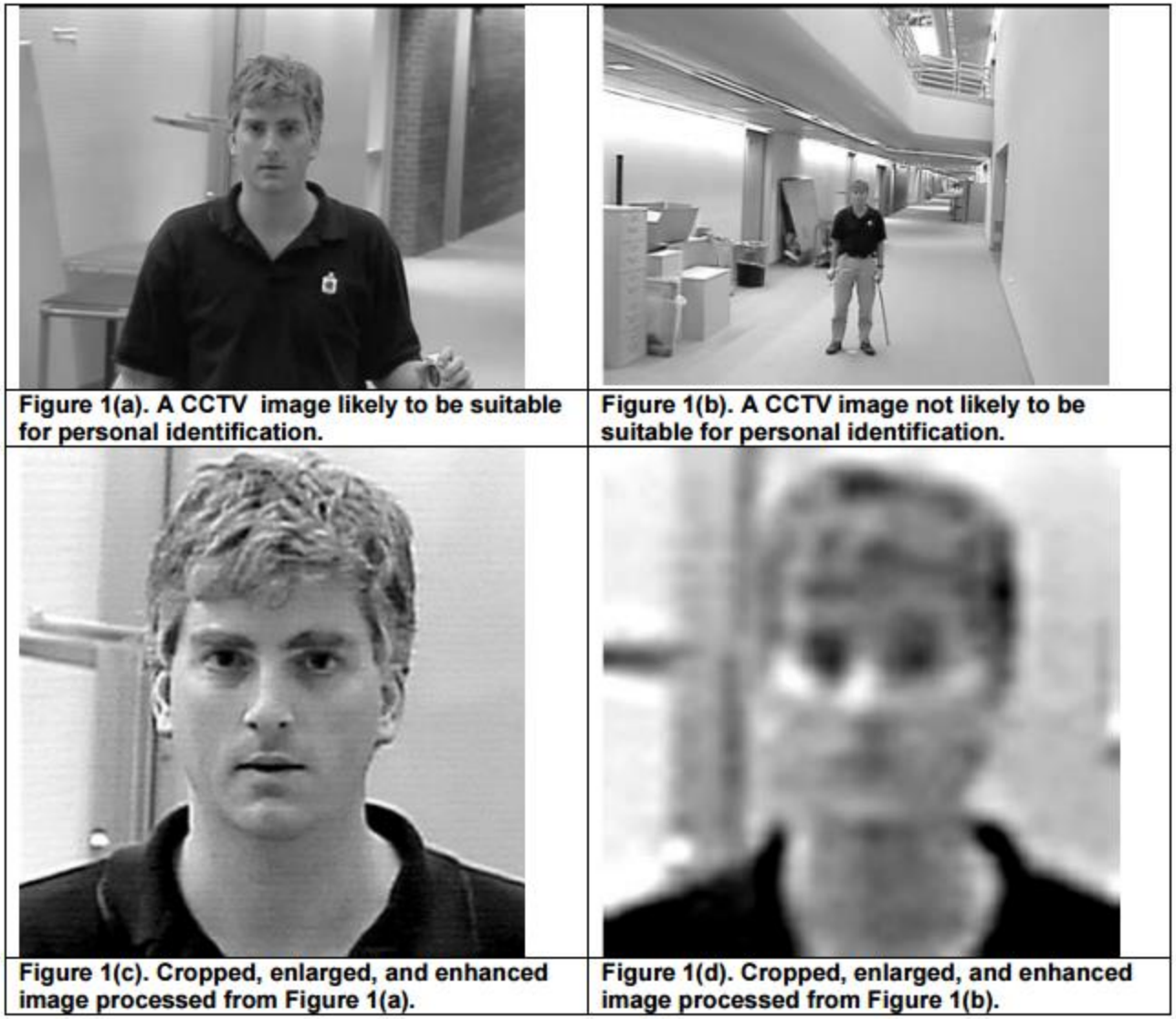


Figure 1(a). A CCTV image likely to be suitable for personal identification.

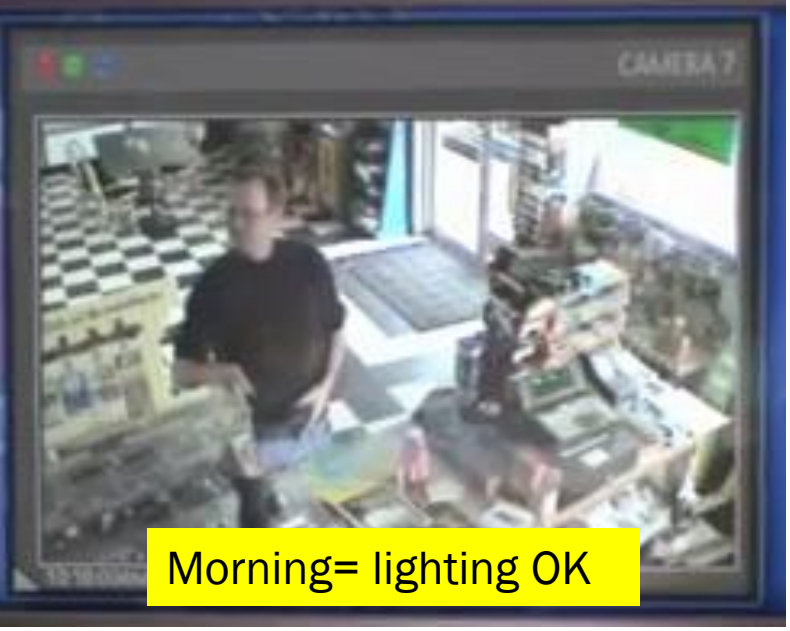
Figure 1(b). A CCTV image not likely to be suitable for personal identification.

Figure 1(c). Cropped, enlarged, and enhanced image processed from Figure 1(a).

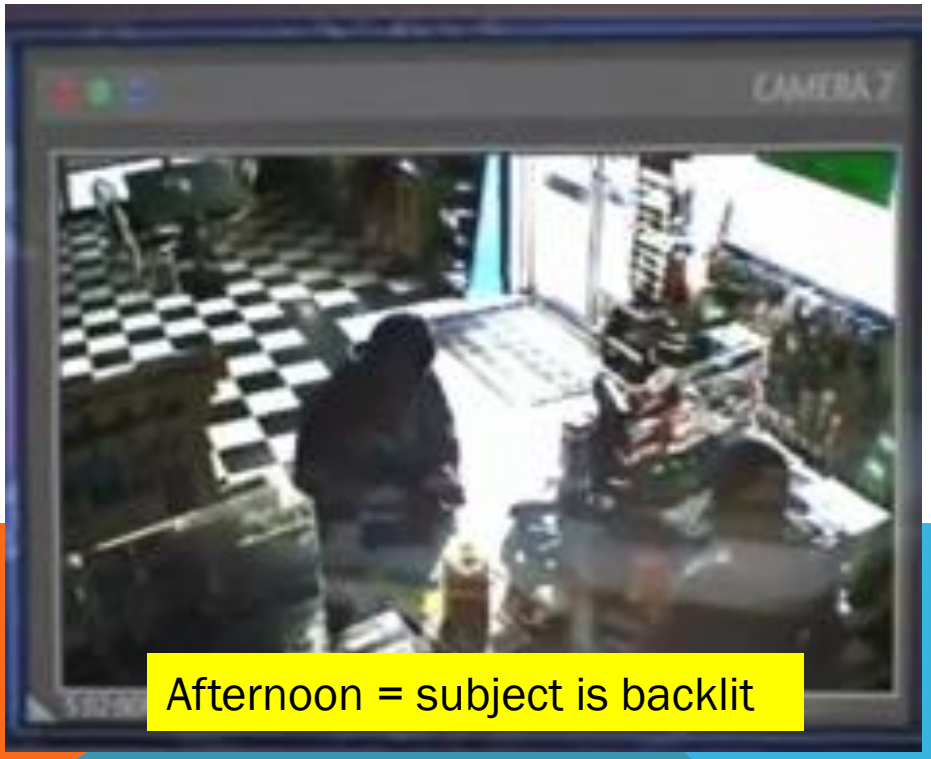
Figure 1(d). Cropped, enlarged, and enhanced image processed from Figure 1(b).

SWGIT - Scientific Working Group Imaging Technology, Recommendations and Guidelines for Using Closed-Circuit Television Security Systems in Commercial Institutions

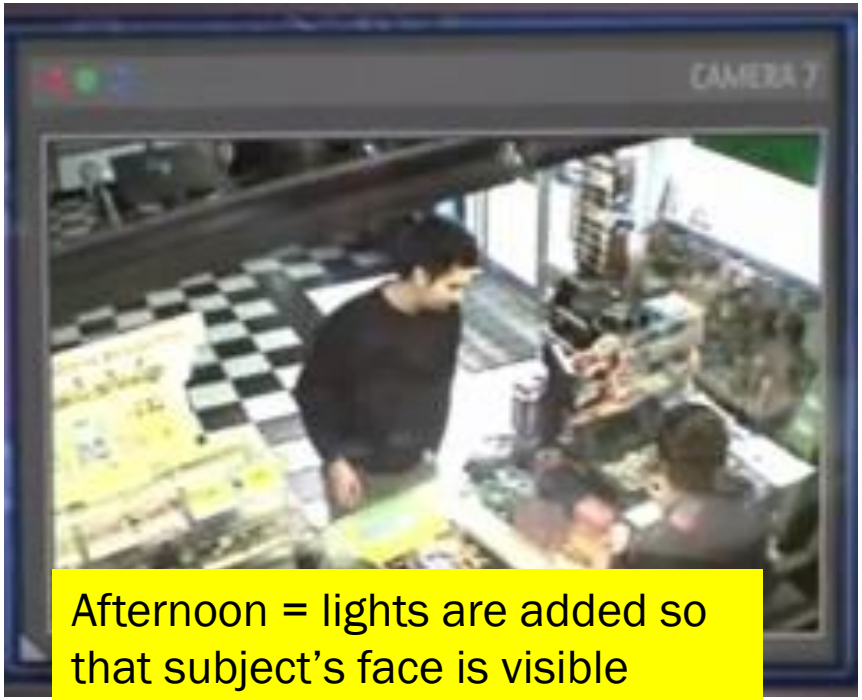
LIGHTING ISSUES



Morning= lighting OK



Afternoon = subject is backlit



Afternoon = lights are added so that subject's face is visible

from https://www.fbi.gov/news/videos/caught-on-camera

Lights that are on timers must be checked. Are lights coming on at correct time?

from https://www.fbi.gov/news/videos/caught-on-camera

Best Practices for Video Enhancement

Review recordings

- Verify time and camera of the incident.
- Verify that incident is in exported video file.

NOTE:

- Videotaping the computer monitor with your cell phone does not count as retrieving the video

Collect native file with proprietary player

- Don’t Save to a Different File Format
- (AVI to MOV or DVD/vob file format)

Best Practices for Video Enhancement

Don't change the frame rate	• Original 7 frames per second changed to 15 frames per second)
Get ALL camera views available	• 2 hours Before through 2 hours after the incident
Operator may be Untrained	• Exports low quality video • If operator unsure, suggest calling the supplier to retrieve best quality.

Documenting Video Enhancement

Document Enhancement	• Type of video, codec, player, MD5 Hash
Enhancement Software Report	• Replicate the results 100% of the time

Start Time:	0:00:00.00
Resolution:	368x148
Duration:	0:00:12.17
Frame Rate:	29.97 fps
File Size:	62473216 bytes
File Date:	Wednesday, February 02, 2011
MD5 Hash:	68C03FF6FF362282C8BB00983B184FC1
Aspect Ratio:	Default

Settings:	
Resolution:	
Matching level:	15
Super resolution:	2
Fusion level:	0
Stabilization:	off
Debluring:	
Level:	114
Focus:	1.32
Motion debluring:	off
Denoise:	0.50
Camera type:	Gauss
Contrast:	
Level:	92
Sensitivity:	3
Light & Color:	
Auto Levels:	on
Gamma:	1
Saturation:	1
Color:	0.146
Deinterlacing:	
Fast:	off
Masking:	off
ROI:	off

Processed Videos:

Start Time:	0:00:00.00
Resolution:	640x480
Duration:	0:20:51.78
Frame Rate:	0.00 fps
File Size:	9149992448 bytes
File Date:	Friday, May 20, 2011
MD5 Hash:	B0BA74CCF6EE3BA5F23E974CE030090A
Aspect Ratio:	Default

Settings:

Resolution:	
Matching level:	7
Super resolution:	1
Fusion level:	0
Stabilization:	off
Debluring:	
Level:	40
Focus:	2.00
Motion debluring:	off
Denoise:	0.50
Camera type:	Gauss
Contrast:	
Level:	127
Sensitivity:	3
Light & Color:	
Auto Levels:	on
Gamma:	1
Saturation:	1
Color:	0.146
Deinterlacing:	
Fast:	off
Masking:	
Type:	None
Meta data:	keep
ROI:	off

Enhanced Video in the Courtroom

Original unenhanced video

Enhanced video

- If needed, show enhancement process step by step. Each enhancement step explained

Enhanced video shown side by side with original

Show Enhanced video only

Summary

Security Cameras and Cell Phone Cameras	• Good chance of retrieving one or more videos of incident
Cameras are not set correctly–	• Enhancement and analysis required
Check YouTube –	• Video of incident may be uploaded
Don't Judge Original Video	• Enhancement possibilities on how the video appears on your screen
"CSI"	• For movies and television
Enhancement and Analysis	• Can provide valuable information beneficial to the case.

Camera Positioning Issues

FBI VIDEO
"CAUGHT ON CAMERA" EXCERPT

https://www.fbi.gov/news/videos/caught-on-camera

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