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TO STOP OR TO GO

Making Sense of a “Who Ran the Red Light?” Case

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How does an attorney thoughtfully evaluate a case when the only witnesses seem to tell stories that are diametric to one another?

Should You Accept This Case?

This is often the quandary in a “Who Ran the Red Light?” case. Fortunately, the traffic signal system itself can “testify” through the evaluation of a forensic traffic engineer who is familiar with the wrinkles and nuances of how a traffic signal system operates. Let’s consider an example.

A crash occurs at a signalized intersection. One of the drivers, Mr. Northcutt, contacts your office and asks you to help him recover the money he has spent to fix his car and lost earnings due to his back injuries. You agree to investigate the collision and let Mr. Northcutt know if you can help him. As is often the case, the drivers’ statements along with the witnesses’ provide some curious contradictions.

- Mr. Northcutt provides a statement to the investigating police officer and is certain that the traffic signal was green in his northbound direction. He was driving along when the traffic signal turned from red to green a few seconds before he reached the intersection. He says he slowed down a bit but entered the intersection on a green light without stopping.

- The other driver, Ms. Southwick, who was making a left turn in the opposite direction, reports that she is certain that she entered the intersection when the traffic signal was showing her a green left-turn arrow, but it turned to a yellow left-turn arrow soon after she entered the intersection.

-A witness, Ms. Norturner, says she turned left on a northbound green arrow; she saw a vehicle turning left in the opposite direction, but it was not the one involved in the collision. After she finished her turn, she looked in her rearview mirror and saw the collision.

-Another witness, Mr. Preeock, describes approaching the intersection on the cross-street as the signal changed to yellow, then red, about fifteen seconds prior to the collision. He stopped and was texting when the collision occurred and did not know what direction the vehicles were going or what the traffic signal was doing.

- Yet another witness, Ms. Walken, tells the officer that she witnessed the collision as she was walking across the intersection with a “walk” indication when she heard the collision; she had just stepped off the curb after receiving the “walk” indication three or four seconds before the collision; she did not see the collision nor who had a green light.

The investigating officer is familiar with the subject intersection and signal. She’s driven the intersection many times and knows that both parties couldn’t have had a green light. Ultimately, she concludes that one of the drivers ran a red light, but she is unable to determine which is at fault.

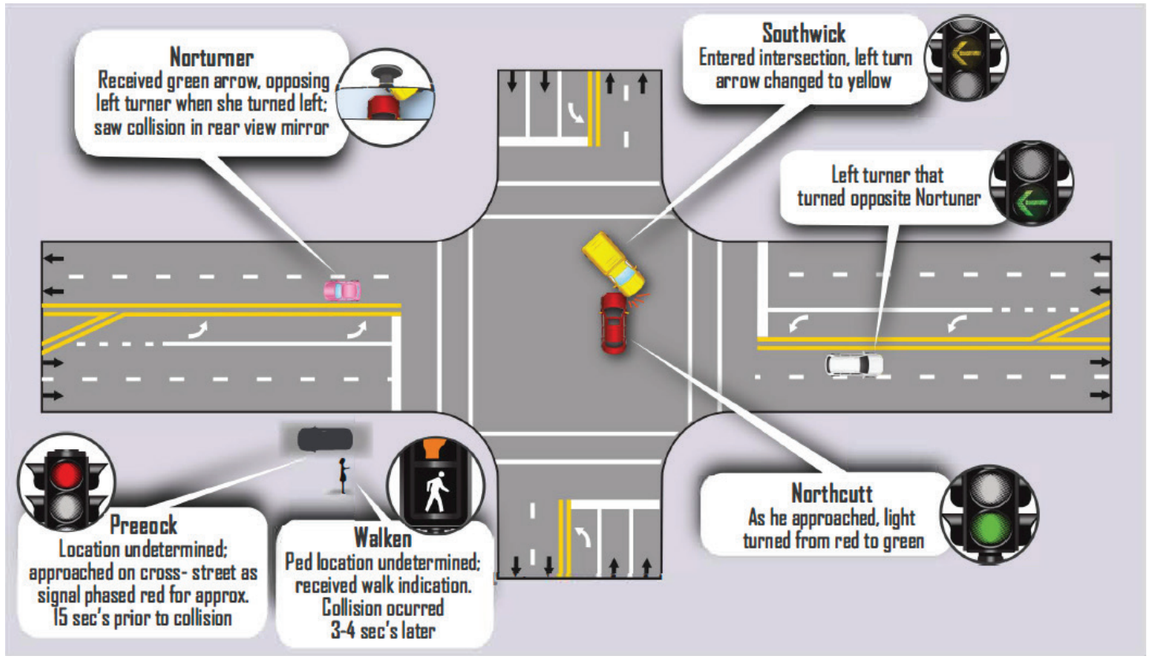
Now it is up to you to make heads or tails of what happened on behalf of Mr. Northcutt. Although not always reliable, driver and witness statements are often the only source of information regarding a collision. It is important to gather the location and

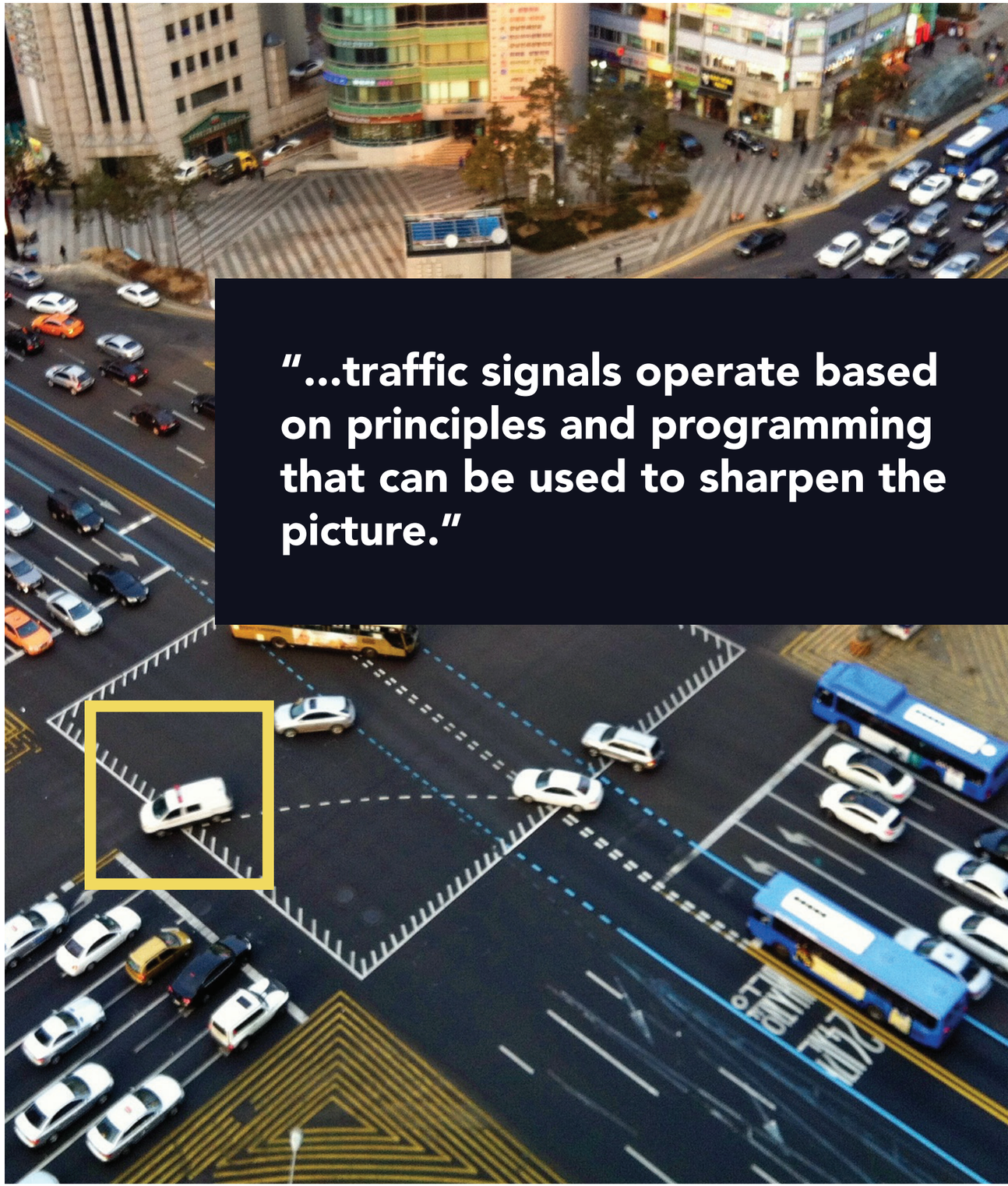
direction of each witness when they observed the collision. One way to evaluate the witness' statements is to illustrate each statement on a diagram showing an overhead view of the intersection (see Figure 1). Through the diagram, you can get a feel for where each person was when they witnessed the incident. Based upon the position of the witness, statements can sometimes be eliminated due to the fact that the witness did not have a clear line of sight to the collision or signal indication.

The scenario in Figure 1 is all too common. In such cases, attorneys are often left with disparate testimony and inconsistent facts. What is the best way to draw more certain conclusions about what really happened? The witnesses, credible or not, paint an abstract and difficult picture to discern. Fortunately, traffic signals operate based on principles and programming that can be used to sharpen the picture.

Specifically, every traffic signal is equipped with standard elements including a conflict monitor, and every traffic signal operates based upon a specific signal phasing and timing plan. Traffic Engineers are able to discern whether a given scenario is possible, plausible, or probable by comparing the driver and witness statements to the phase diagram and the signal timing plan.

Figure 1.

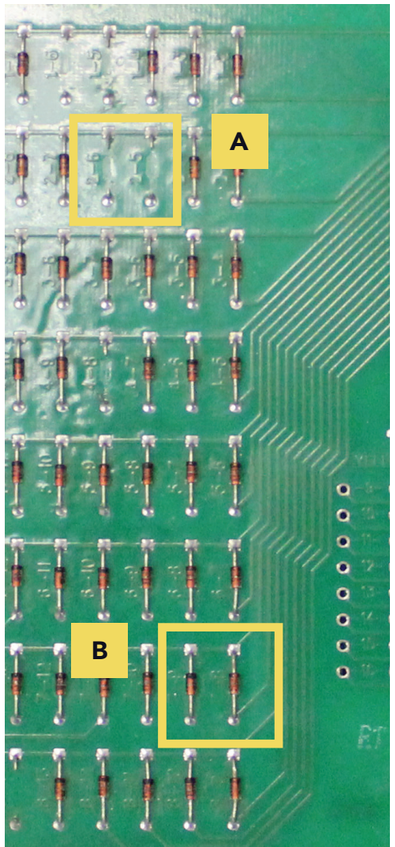




"...traffic signals operate based on principles and programming that can be used to sharpen the picture."

CONFLICT MONITORS

A conflict monitor is a physical device installed into each traffic signal cabinet that prevents the signal from displaying conflicting movements.



For instance, a southbound driver cannot receive a green left turn signal at the same time as a northbound driver receives a circular green indication. In the event that a conflicting display is detected, the conflict monitor shuts the system down and places the signal in a flashing red mode until the signal controller is reset by a technician.

Each conflict monitor is configured specifically for the intersection at which it is installed. Most commonly, an individual diode must be removed from a circuit board for each allowable combination of signal displays. When first received, all diodes are present; the traffic signal is ready for operation only once a qualified installer has removed the appropriate diodes. In this way, the likelihood that the conflict monitor is properly configured for the specific intersection is maximized. A configured conflict monitor with appropriate diodes removed is shown in the photo to the left.

With a properly configured conflict monitor in place at the signalized intersection, the potential for Mr. Northcutt and the other driver to both have had green lights that conflicted with each other is eliminated for all practical purposes.

(A) Removed Diode
(B) Intact Diode

PHASE DIAGRAM

Each signalized movement within the intersection is assigned a phase.

Typically, left turning movements are assigned odd numbered phases and through movements are assigned even numbered phases. Each signal has a specific phase diagram associated with it. The phase diagram illustrates which phases are assigned to which movements as well as the general order of operations.

Figure 3a shows a typical phase diagram for an 8-phase intersection like the one which Mr. Northcutt's collision occurred. In our example, Ms. Southwick would be represented by phase 7 while Mr. Northcutt is represented by phase 8. The pedestrian phases are denoted with open arrow heads and dashed lines as well as a "P" next to the phase number.

The phase diagram shows what phases are allowed concurrently and in what general order. As shown in Figure 3b, there is no instance where a phase 7 (Southwick/ southbound left turn) is allowed to move at the same time as a phase 8 (Northcutt/northbound through).

The diagram shows that either phase 7 can go at the same time as phase 3, or phase 7 can go concurrently with phase 4. The phase diagram also shows that phase 8 can either go concurrently with phase 3, or it can go at the same time as phase 4.

The phase diagram, along with the conflict monitor, demonstrate that both Mr. Northcutt and Ms. Southwick could not have received green at the same time.

Figure 3a.

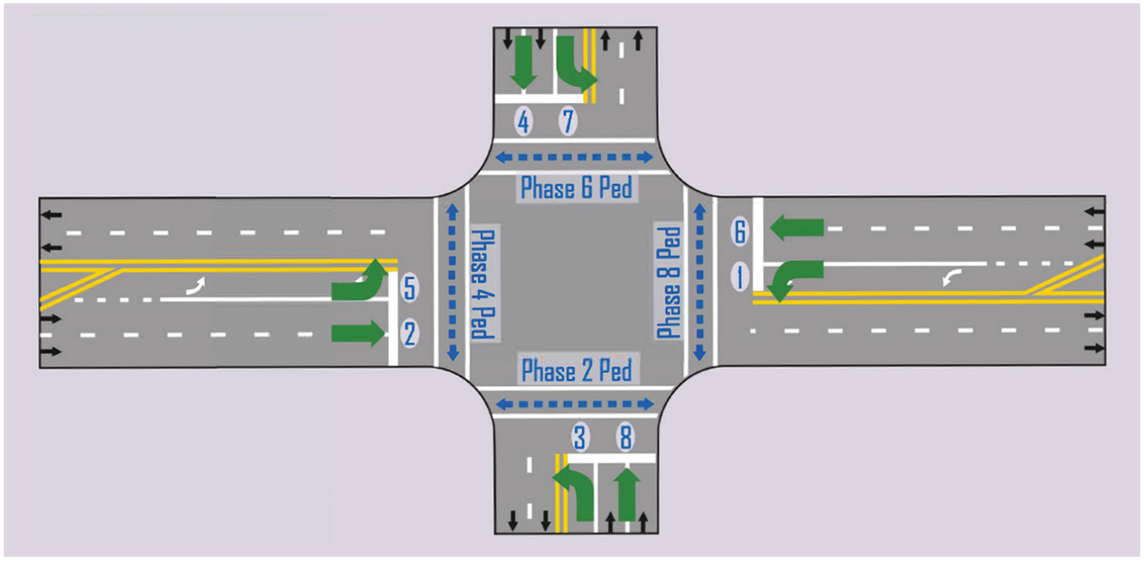
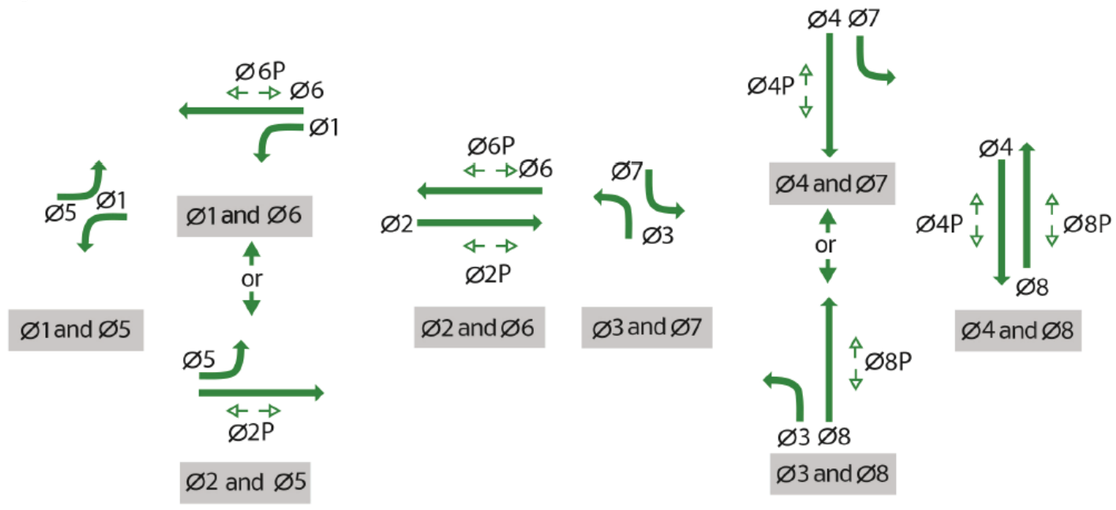


Figure 3b.



“Each signal has a specific phase diagram associated with it.”

SIGNAL TIMING

Each signal is programmed with a signal timing plan. The signal timing plan controls how much time is to be allocated to each phase.

Pedestrian “walk” times and flashing “don’t walk” times are defined. The duration of each yellow light is set. Some traffic signals include periods of time when all directions receive a red light–referred to as an “all-red interval.” The signal timing plan documents how long each all-red interval lasts and after which phases they occur.

Most traffic signals are demand responsive, so the duration of each green light will vary depending upon how many vehicles are present. Even though the green time will vary, the signal timing plan establishes the minimum time that will be provided each time a phase receives a green.

Further, each phase is programmed with a maximum time that it will stay green while drivers in other directions are waiting to travel through the intersection. The collection of these, and many other timing parameters contained in the signal timing plan, provide the framework through which the driver and witness statements can be evaluated.

Making Sense of Mr. Northcutt's Case - Evaluating Driver & Witness Statements

In the case of the scenario involving Mr. Northcutt, let's revisit the witness statements one-by-one in light of what we can discover based on the phase diagram and signal timing at the intersection.

01

Mr. Northcutt stated that the traffic signal turned from red to green as he approached the intersection. He, therefore, entered the intersection after slowing a bit, but without stopping.

Nothing about Mr. Northcutt's statement is remarkable other than that he entered the intersection in or near the beginning of the northbound green phase.

02

The other driver, Ms. Southwick, stated that she entered the intersection when the traffic signal was showing her a green left-turn arrow, but it turned to a yellow left-turn arrow soon after she entered the intersection.

This statement raises two issues to be considered and verified. First, a left-turn arrow is claimed. A site inspection and police photos confirm that a left-turn arrow is provided at the intersection. Review of the phase diagram reveals that southbound left turn drivers receive a green arrow immediately after east-west traffic receives a red light. Second, it is claimed that a yellow arrow was displayed shortly after the driver entered the intersection. Review of the signal timing plan reveals that the southbound left-turn receives between 5 and 15 seconds of green followed by 3 seconds of yellow time.

03

The first witness, Ms. Norturner, saw the collision in her rearview mirror after turning left on a green northbound arrow. Further, she saw a vehicle turning left in the opposite direction, but it was not the vehicle involved in the collision.

This statement reveals that the northbound left-turn arrow was green for some period of time prior to the collision. In addition, a southbound left-turner had traveled through the intersection prior to the collision. The phase diagram and a site inspection indicate that the northbound and southbound left-turn arrows turn green at the same time when vehicles are present for both left-turns. This witness statement indicates that the southbound left-turn arrow had been green for an undefined period of time before the collision occurred; while undefined, it was enough time for at least one vehicle to turn left both northbound and southbound prior to the collision.

04

The second witness, Mr. Preeock, was approaching the intersection on the east-west cross-street as the signal went to yellow and then red about fifteen seconds prior to the collision. He was texting when the collision occurred and did not know what direction the vehicles were going or what the traffic signal was doing.

This statement confirms that east-west traffic had been green prior to the collision. As indicated by the phase diagram, the northbound and southbound left-turns would receive a green immediately after this. Further, the east-west traffic signal had transitioned from green to red about fifteen seconds prior to the collision. Based on the signal timing plan, this fifteen second timeframe fits well with the 5 to 15 second green light plus the 3 seconds of yellow that the southbound left-turn would receive. However, since the green time will vary within this range, it still cannot be determined with specificity if Mr. Northcutt most probably had a green light or if the southbound left-turner did.

05

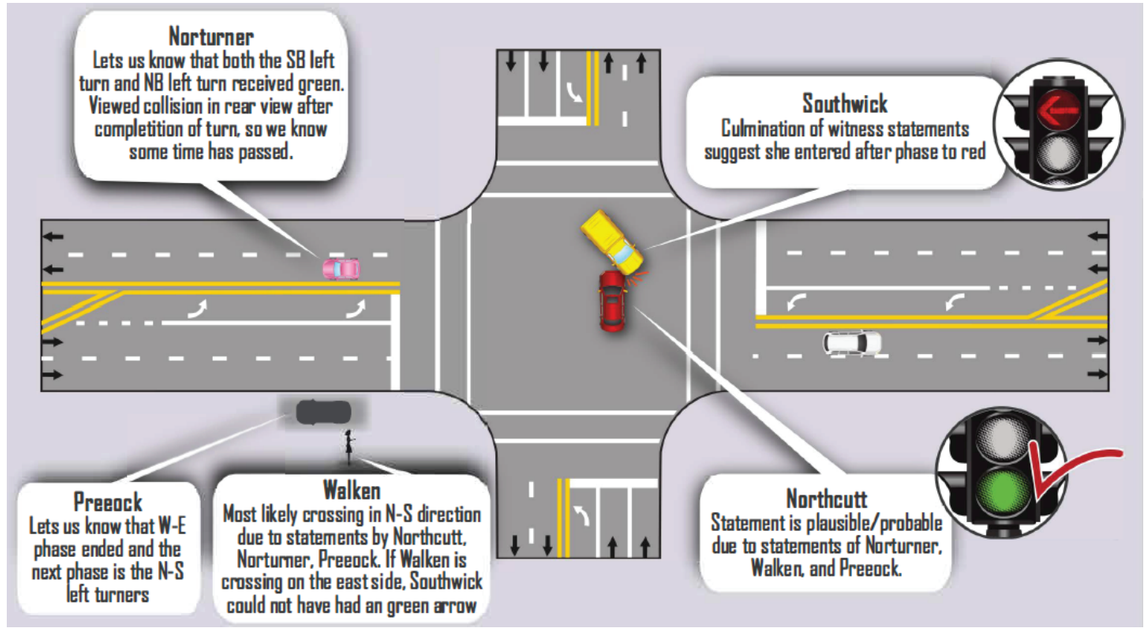
The final witness, Ms. Walken, was a pedestrian who witnessed the collision while she was starting to walk across the intersection; she had just stepped off the curb after receiving the walk indication, three or four seconds before the collision; she did not see the collision nor who had a green light.

This witness's statement in some ways seems quite non-specific - it does not indicate which crosswalk the pedestrian was crossing within nor the direction that the pedestrian was walking. However, the statement still provides a critical piece of evidence. A walk indication had come on a second or two before the collision. The phase diagram shows that one of two crosswalks would receive a walk indication following the northbound and/or southbound left-turns - either the crosswalk on the west side of the intersection, which conflicts with the northbound left-tum, or the crosswalk on the east side of the intersection, which conflicts with the southbound left-tum. If the pedestrian were crossing in the crosswalk on the east side of the intersection, the southbound left-turn would have had to have been red when the walk indication was received. In that case, the southbound left-turn would have received a red light three or four seconds before the collision. In addition, northbound drivers, including Mr. Northcutt, would have received a green light a second or two before the collision. However, this is only true if it can be shown that the pedestrian was crossing on the east side of the intersection.

When considered in their totality and in light of the phasing plan and signal timing plan, the driver and witness statements coalesce into a scenario that may very well enable you to help Mr. Northcutt. Simply stated:

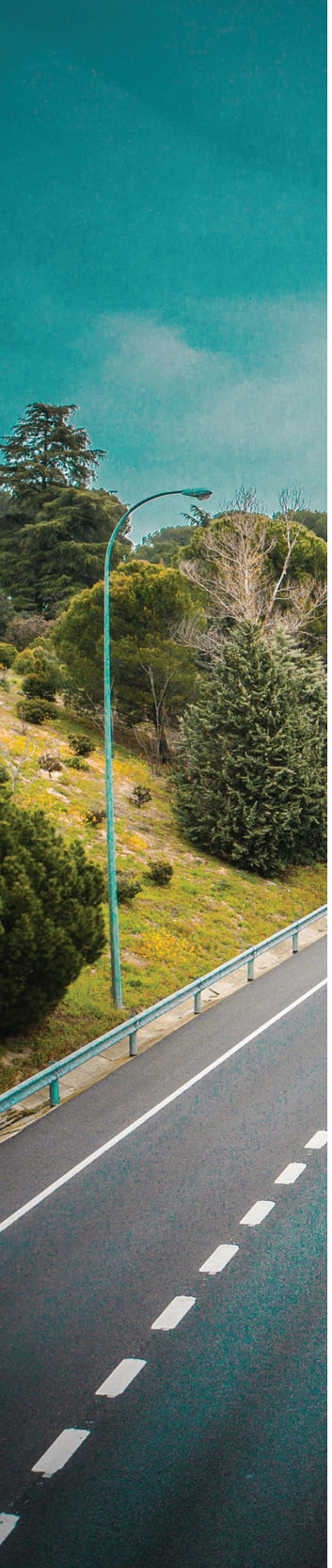
"Mr. Northcutt entered the intersection very soon after receiving a green light while the southbound left-turning driver entered the intersection soon after receiving a red left-turn arrow."

Figure 4.



While not yet conclusive, this finding would support taking your investigation beyond this initial evaluation. The final witness could be interviewed to determine the crosswalk in which she was crossing. If she would credibly testify that she was crossing on the east side of the intersection, the above conclusion would solidify from simply a possibility to the most probable explanation of the circumstances surrounding Mr. Northcutt's collision.

Further, an accident reconstructionist could overlay these signal sequence and timing parameters with their findings related to the speed of both vehicles to perform an analysis of the time and distance for both vehicles as they approach the area of impact. If this time and distance analysis shows that this scenario fits well with the physical evidence and the resulting reconstruction of the collision, you would be well-positioned to successfully help Mr. Northcutt recover from his damages as he so rightly deserves.



WRINKLES & NUANCES

This sample shows a very simple and straightforward intersection, a textbook intersection if you will.

There are however, a number of different configurations to signal phasing and timing that could greatly affect the outcome of this scenario. Some examples are:

01 Lead/Lag Left Turns - A situation where one left goes first with its corresponding through and then the opposing left “lags” with it’s corresponding through movement second.

02 Exclusive Pedestrian Phase - A situation where all the vehicles receive a red indication and pedestrians are allowed to cross. This is more common in downtown city areas with heavy pedestrian traffic.

03 Protected/Permissive Left Turns - This is where a left turn receives a green arrow (protected) to begin the phase for a few seconds then moves into a circular green (permissive) for the rest of the phase. During the permissive phase, a left turner is required to yield to oncoming through traffic prior to making the left turn.

04 Time-of-Day Timing (TOD) Plans settings can have drastic effects on signal operations. TOD settings are typically used to adjust the phasing and timing to most efficiently serve fluctuating traffic demands throughout the day. For instance, longer green times may be present on the heavy movements during rush hour. We have seen an instance where a protected permissive left-turn movement turned into a permissive only movement after 9 pm. In that case, a driver who was familiar with the intersection thought she received a left arrow and turned in front of the opposing through driver instead of yielding. Upon reviewing the timing, there was no way for that driver to have received a green arrow.

Some major cities, such as Los Angeles, have Sabbath settings built into their signal systems. These TOD settings automatically call the pedestrian crossing phases every cycle so that the pedestrian will not have to push the button on a day when no work is to be done. Other TOD settings are used to accommodate sporting events or school release hours.

05 Adaptive Signal Systems -Adaptive signal systems constantly gather real-time data regarding the intersection (vehicle speed, volume, queues) and adjust the signal functions accordingly to provide the most efficient operations. This system can re-order phasing and change timing in real time to adapt to the current demands. Due to the ever–changing operational characteristics of an adaptive signal, it can offer up its own unique set of challenges when evaluating a particular situation.

Any of the above special conditions could have had great influence on our evaluation. Knowing these functions exist and how to look for them is critical in evaluating the situation properly. If the TOD plan stated that Ms. Southwick was in a “lagging” left, it would be more probable that Mr. Northcutt ran the red light. If the timing plan called for an exclusive pedestrian phase, both drivers would have been guilty of running the red lights. Knowing precisely what features are in place and how to apply the signal controller rules allows for the clearest possible evaluation of a “who ran the red light” matter.

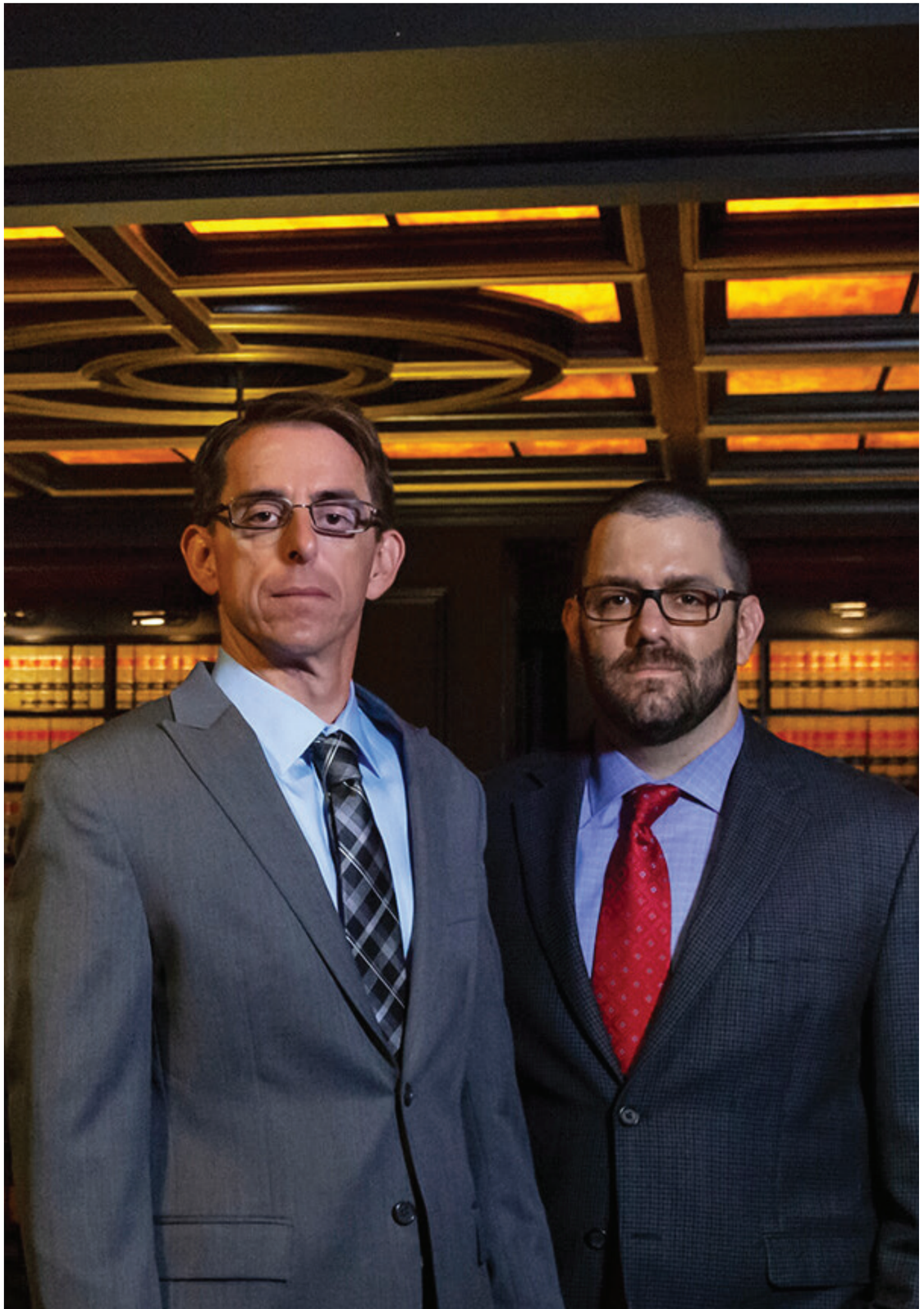
PRINCIPAL CIVIL & TRAFFIC ENGINEER

Matthew Manjarrez, PE

Matthew is an experienced transportation professional, licensed as both a Civil Engineer and a Traffic Engineer, with over 23 years of consulting experience. He serves as a technical expert in various legal matters involving vehicular, transit, bicycle, and pedestrian safety issues.

Matthew has qualified and testified at trial as a highway design and traffic engineering expert in courts within the State of California. In addition, he has provided deposition testimony and written declarations in support of clients' motions before the court.

Performing technical evaluations of freeways, interchanges, local roadways, bikeways, and parking lots, he determines if these transportation elements have been reasonable and appropriately designed and operated. He focuses on educating attorneys and the trier of fact in basic transportation engineering concepts to enable them to effectively evaluate, execute, and decide the cases.



SENIOR CIVIL & TRAFFIC ENGINEER

Allen Bourgeois, PE

Allen has over 18 years of civil and traffic engineering experience. He has served as a court-qualified expert providing findings and opinions regarding the design and operation of transportation facilities. He has extensive experience evaluating existing transportation infrastructure, determining the need for safety enhancement, and identifying appropriate safety improvements.

Having worked as a contract staff engineer for several local governmental agencies, Allen's knowledge of transportation safety is considerable. He holds licenses as a Civil Engineer and a Traffic Engineer.

His work has included implementation of transportation safety programs, conducting site-specific safety investigations, and designing bicycle and pedestrian facilities. He also designed the implemented temporary traffic control installations and oversaw state-of-the-practice transportation analyses.

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