

# news of engineering forensics

# MDE Inc.

## The Science of Forensic Building Defect Evaluations

by Susan Evans, CIH, CSP, PE  
& Mark G. Nordstrom, PE

Buildings may be constructed in a way where construction defects, deficiencies, omissions, or incompatibilities (hereafter collectively referred as defects) are present. The defects may include design deficiencies, material deficiencies, construction or installation defects, some of which lead to complete failures or a reduction in performance. Some outward signs that a defect may be present include (but are not limited to):

- Cracks in walls
- Separations or gaps in materials
- Windows or doors that do not open or close properly
- Bulging, sagging, or shifting of surfaces
- Soil against untreated wood components
- Peeling or curling materials
- Loose materials, fittings, fixtures, that usually are tight in other parts of the building or similar buildings
- Water temperature problems
- Clogged sewage/drainage pipes
- Repeated water condensation in select locations
- Water leakage or water damage
- Water leakage or condensation on windows
- Undermined soil cavities below concrete slabs
- Flickering lights
- Circuit breakers that repeatedly trip
- Malfunctioning exhaust fans

Building science investigations, conducted by experienced forensic engineers, scientists and technicians, such as those at MDE Inc. can evaluate conditions that may be associated with building defects. The investigations include identifying the presence of the defects, their frequency (repetition), and degree of seriousness. If included in the scope of the work, recommendations can be made on the nature of needed repairs, and cost estimates for the work provided.

Evaluations typically begin by obtaining

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#### Building Science Investigations

Construction defects; building condition consultations following fires, or natural disasters.

the history of the building. This may include reviewing plans and specifications, contract documents, governmental building inspection documents and placards, correspondence with builders, etc. Additionally the initial aspects of the evaluation include interviews or written documentation from owners, building operators, vendors (such as ventilation system maintenance company), and / or tenants to understand their perspective of the problems, and the history of the problems and repairs.

Forensic engineers or technical specialists will also conduct a visual assessment of the



building. The objective is to identify if visual evidence of reported problems are present, and, if within the scope of the work, to look for signs of additional defects or deficiencies. Photographic records, sketches, etc. are made of the building conditions that were observed.

Non-intrusive measurements, sampling or other assessments of affected building areas may be made during the visual assessment, or scheduled for another site visit. In general, non-intrusive evaluation components are generally those that do not deface the conditions inside or outside of the building during or following the evaluation, and do not require disturbance of the building surfaces to obtain the measurements. Non-intrusive measurements may include (but are not limited to):

- Temperature and relative humidity
- Moisture measurements within walls, roofs, or concrete slabs (considered non-intrusive only if non-penetrating (pinless) moisture meters are used)
- Thermographic imaging
- Air sampling
- Ventilation flow measurements
- Dimensions of various components and areas
- Voltage/ampereage measurements
- Water temperatures and/or water sampling
- Borescope observations through existing

penetrations, pipes, ducts, etc.

- Sampling of surface dusts or conditions using non-intrusive means

Depending on the problem that is being evaluated, intrusive evaluations may also be necessary. These evaluations generally require detailed scheduling as tradespeople are typically utilized to open up (deconstruct) and then repair any openings that are required to evaluate components not readily visible without such means. Several examples of intrusive evaluations are the removal of exterior siding to evaluate window flashing details and opening an interior wall to evaluate drain pipe sloping.

Destructive sampling involves the physical removal of sections of building material for laboratory evaluation. Most samples collected are no longer functional after the analysis as

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## Upcoming Seminars

MDE professionals are scheduled to speak at the following courses/seminars:

- February 10, 2005 Susan Evans, CIH, CSP, PE - Oregon Construction Law Seminar, The Seminar Group, Portland, OR
- May 23, 2005 Susan Evans, CIH, CSP, PE - Mold Exposure Assessment and Evaluation at the American Industrial Hygiene Conference and Exposition (AIHCE), Anaheim, CA

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the material is sectioned, stained to highlight material contrasts, or otherwise cut up. Some of the materials, such as carpet or drywall are physically collected by the forensic expert, and other materials, such as siding, flashings, or pipe sections are procured utilizing the services of tradespeople. Considerable forethought and planning is required prior to collection of these samples in occupied buildings. Affected parties are contacted, schedules determined, and replacement materials and labor needs are obtained.

The forensic professional utilizes the evaluation findings to assess the nature and extent of the building defect. The defects identified are documented as to why the material or constructive practice is deficient, relative to:

- Building code violations
- Violations in standards, consensus documents or written recommendations
- Violations of manufacturers requirements which affect the material warranties
- Defects in design or construction which affect the integrity, usability, or durability of the building

MDE Inc. has experienced civil, mechanical, metallurgical and electrical engineers and technicians on staff that can provide building science evaluation consultations.

## Investigating Automobile Theft Involving Transponder Keys

by Mike Schoenecker, CVFI

Transponder key systems are electronic devices that are integrated into automobile keys by the automobile manufacturers as a theft deterrent. Transponder key systems consist of two basic components. One is the transmitter which sends a signal, and the second is the receiver/transponder unit which receives the signal.

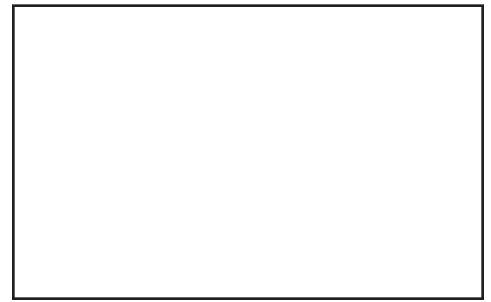
Once the key is turned in the ignition switch, the key sends a signal (transmits) to the second unit, which is located within the automobile. The second unit can be an independent control unit or incorporated into some other device, such as the engine control unit (ECU). The ECU is the computer that controls the electronic devices such as ignition and fuel injection. When the transponder unit receives the correct signal from the key it then sends a signal to a relay which supplies power to the ECU. There are many variations to the method of interrupting power to the ECU. Some systems are so sophisticated that it interrupts the electrical pulse to the fuel injector.

Initially, the transponders were included with cars such as the Corvette in the early 1980's. Over time, more types of vehicles, and a wider variety of models were equipped with the transponders culminating in 2000 when the presence of the transponder systems were considered quite common. Today most high end cars and trucks are equipped with a transponder key system. Surprisingly many inexpensive vehicles are now also being equipped with a similar system. Approximately 75% of all new passenger vehicles sold in 2005 will be equipped with a transponder system. The manufacturers are including transponder systems with little fanfare, and little or no notice to the purchaser of the vehicles.

In order for auto thieves to successfully defeat the security system of vehicle, five anti-theft deterrent devices must be overcome:

- Door lock
- Steering wheel lock
- Ignition switch
- Gear selector
- Transponder

Each of the security features requires time, force or knowledge to overcome.



Additionally, some manufacturers are beginning to develop security systems that interact with other devices in the vehicle. Some transponders can detect a defeat and send a signal via the GPS, reporting the location to police vehicles that have specialized locator equipment. Many police vehicles in larger cities are already using this technology which has proven successful by recovering stolen vehicles and apprehending thieves.

The next generation vehicle security system is already being installed in some high end vehicles -- the keyless system. The keyed door lock and keyed ignition lock are eliminated in this system. Currently the keyless system involves transponders in remote controls. The next version of the keyless system may be biomechanical--voice recognition, fingerprints, eye retina scan, or something yet to be thought of. These systems are customized for the individual assigned the key and will unlock the door, start the engine and then set all comfort adjustments such as driver seat position, climate control or sound system preferences.

Transponder key systems add one more element to be examined during a vehicle theft investigation. At MDE Inc. our experts are experienced, informed and knowledgeable when dealing with the latest automotive technology. For more information or consultation call MDE today.



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