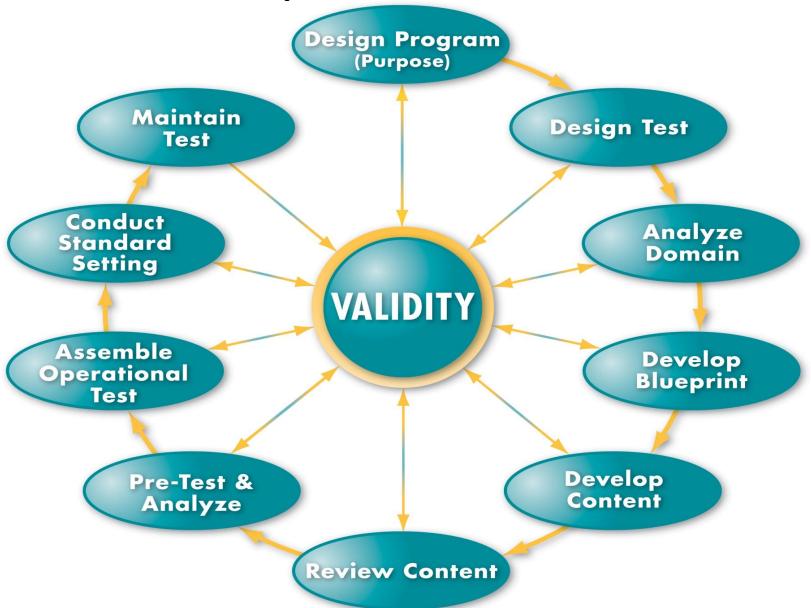# Developing A Validity Framework

Test Development Process

Fictitious Case Study and Resources

Introduction

In response to a sharp increase in the number of nationwide traffic fatalities due to malfunctioning automotive safety systems and devices, The Licensed Automotive Safety System Inspector program was created via mandate by the National Highway Safety Administration in 1999. Pursuant to Federal Crash Avoidance, Crash Worthiness, and Post Crash standards, the mandate requires all licensed vehicle repair facilities to retain a sufficient number of LASSIs on staff to ensure at least one licensed inspector on duty at all times during business hours or face significant consequences—up to and including site closure.

Although the licensure examination content is based upon federal automobile safety standards, the design and development of the test is performed under the auspices of the individual states (on a state-by-state basis)—as is the delivery of the examination itself. Furthermore, each of the states may elect to mandate the addition of content standards for the licensure examination, provided all of the federal standards remain intact. Finally, each state's licensure program must be reciprocal in all other states.

Introduction (continued)

Recent national press attention, however, has centered around complaints of unqualified candidates being licensed, qualified candidates being unable to pass the examination, and of stolen test content being circulated on the internet. Further bolstering these concerns is the ever-increasing volume of aberrant test data being received at the state level.

In light of these reports, you have been called, on behalf of your state, to testify in front of a congressional subcommittee regarding your state's compliance with testing best practices as they relate to the valid use and interpretation of LASSI candidate test scores, as well as to offer suggestions for the improvement of the program as a whole.

Introduction (continued)

Attached is a description of your state's LASSI test development process as it relates to the content domain/content development/test structure/standard setting procedures. Please review and discuss these procedures with your group and be prepared to answer questions regarding:

1. Problems that relate to the valid use and interpretation of your state's LASSI test results.
2. Suggestions for strengthening your state's test validity argument.
3. Federal-level requirements that might impact your state's test validity argument.
4. Suggestions for mitigating federal-level impediments to state-level validity arguments.

Federal Automotive Safety Standards Excerpt

Standard No. 208 - Occupant Crash Protection This standard originally specified the type of occupant restraints (i.e., seat belts) required. It performance requirements for anthropomorphic test dummies seated in the front outboard seats of passenger cars and of certain multipurpos and buses, including the active and passive restraint systems identified below. The purpose of the standard is to reduce the number of fatalitie of injuries to occupants involved in frontal crashes. Generally, the requirements are as follows:

Passenger Cars (Effective 1-1-68)
Lap or lap and shoulder seat belt assemblies for each designated seating position. Except in convertibles, lap and are required in each front outboard seating position.

Passenger Cars (Effective 1-1-72), Multipurpose Passenger Vehicles, Trucks and Buses - Options A and B only Passenger cars, multipurpose passenger vehicles and trucks with a gross vehicle weight rating of 4,536 kg (10,00 (driver's seat only) shall have:

A. A complete passive protection system, or

B. Lap belts, belts warning and meeting 48 km/h (30 mph) crash test requirements, or

C. Lap or lap and shoulder belts, seat belt warning; outboard seats shall have a single-point pushbutton release a automatic-locking seat belt retractors.

Passenger Cars (Effective 1-1-73)
Requirements same as above except upper torso restraints shall have an emergency-locking retractor.

Multipurpose Passenger Vehicles, Trucks and Buses (Effective 9-1-95)
The lap portion of each seat belt in a forward-facing seat or a seat that can be adjusted to forward-facing shall h lockable.

Front, outboard designated seating positions for Passenger Cars and Multipurpose Passenger Vehicles, Trucks

State Automobile Standards Excerpt

B. MINIMUM SAFETY EQUIPMENT REQUIREMENTS:

1. Hydraulic service brakes on all wheels with current vehicle brake and stopping standards.

2. Parking brake operating on at least two (2) wheels on the same axle.

3. Seat belts for all passengers.

4. Sealed beam or halogen headlamps.

5. Brake Lamps.

6. Turn signal lamps and switch.

7. AS-1 safety glass or Lexan.

8. Electric or vacuum windshield wiper in front of the drivers view.

Content Domain Process

The LASSI test content domain for your state was defined using the following process:

1) Acme, Incorporated—the state's leading Automotive Maintenance Training provider—was contracted by the State Highway Safety Office to oversee the design, development, and administration of the LASSI test program for your state. The statement of work for which the company was contracted, dictates that all test content must strictly adhere to federal and state safety guidelines.
2) Steve Ray, the most senior Automotive Maintenance Training Technician in the company, was handpicked by company executives to manage the project.
3) Ray promptly chose a fellow training technician—Nick Davies, whom he trained himself—to assist in the creation of the test blueprint.
4) Ray and his colleague drew upon federal and state guidelines, Acme-sanctioned training material, as well as their own personal expertise, and—after significant debate and compromise—derived the LASSI test blueprint for your state, complete with weightings. Of note: One of the sections within the blueprint was dedicated specifically to the state's safety guidelines, and was weighted at 30% of the test.

LASSI Test Blueprint Excerpt

State of <NAME OF STATE OMITTED>

Licensed Automotive Safety System Inspector Test Blueprint

Section 1 -- Restraints (35%)

- A. Seatbelts
  1. Lap
  2. Slash
  3. Three-point
  4. Five-point
  5. Six-point
  6. Seven-point
  7. BIS
- B. Supplemental
  1. Frontal
  2. Side
  3. Knee
  4. Rear Curtain
  5. Center

Section 2 – Vehicle Flammability (10%)

- A. System Integrity
  1. Passenger Cars
  2. Multipurpose Passenger vehicles
  3. Trucks and buses
- B. Interior material burn resistance

Content Development Process

The LASSI test content for your state was developed using the following process:

Acting on behalf of Acme, Inc, Ray and Davies constructed a 400-item test item pool over the course of a two week period. Before beginning work on the pool, however, it was agreed that:

- Each item must correlate directly to a sub-topic or sub-sub topic of the test blueprint.

- The key for all items must be directly reference-able by chapter, page, and paragraph in the Acme student training modules.

Content Development Process (continued)

- Items should vary in difficulty in order to ensure a few "gimmes" in the pool, since, in the real world of automotive safety systems, not all situations are difficult or obscure in nature.

- Each item should have, among its response options:
  - ✓ at least one correct option
  - ✓ at least one option referencing a non-existent standard or part
  - ✓ a humorous option, when possible (in order to alleviate test-induced candidate anxiety).

Content Development Process (continued)

- Acceptable Item formats:
  - Question/Response: Fill-in-the Blank
  - Complete-the-sentence: Fill-in-the-Blank
  - Multiple Choice Single Response/Multiple Choice Multiple Response.
- Examples of stems from the LASSI exam:
  - "Which restraint system types utilize carriage bolts?"
  - "Fuel system integrity should be checked every (Fill In The Blank) miles."
  - Which of the following statements is true about rear passenger airbag installation?"
  - All of the following are ineffective ways to secure harness fittings, EXCEPT:"

Exam Structure Process

The LASSI exam structure for your state came into being in the following manner:

1. 200 items—out of a pool of 400—were pilot tested over a two-week period at all twenty-two Acme training centers statewide, using an online test delivery vendor's computerized testing engine. Fifty-seven volunteers made up the pilot testing population—each of whom were granted licensure, regardless of performance. Acme Automotive Maintenance Training Technicians acted as proctors.
2. Ray and Davies conducted an analysis of the items using classical statistics.
3. Based upon an average proportion of beta candidates answering given sets of respective items correctly, two static forms were populated with 100 items each. Neither form contained overlapping items, and each form's item grouping had nearly-identical correct response averages from the pilot testing population.
4. The exam was then released into production, once again using Acme training centers, since, Ray and Davies reasoned, the largest number of potential LASSI candidates are graduates of Acme—most of whom would find it convenient to attempt the exam at the conclusion of the training program.

Exam Structure Process (continued)

5. Several months into the test administration, Ray and Davies conducted a review of the test's statistics and were taken aback to learn that Test Form A showed a 97% pass rate among first time test takers, while Test Form B showed a less alarming 74% pass rate.

6. Assuming that the Test Form A must have been compromised, Ray and Davies decided it would be in the interest of test security to re-release the two hundred items, along with the previously-unreleased items in the item pool, on a single test form in which one hundred items were randomly selected to correlate to the test blueprint's sectional weightings. (i.e.: Section 1 is weighted at 35%, so 35 items were to be randomly generated which covered sub topics and sub-sub topics within that section). In this way, they concluded, it would be much more difficult to cheat, since nobody could memorize 400 items. Finally, in a further attempt to thwart cheaters, Ray and Davies identified four "gimme" items to be used as "critical error" devices—for which an incorrect response would immediately trigger exam event cessation and a failure mark. Each of these measures was approved at the state level.

7. Six months after shifting to the single-randomize form approach, Ray and Davies conducted another data analysis, and were elated that the overall passing rate was now hovering at a more reasonable 77%—if not somewhat perplexed by the fact that average individual raw scores tended to vary by as much as +/- thirty points.

Standard Setting Process

The standard for the LASSI test was set using the following process:

1) A panel of officials from the federal agency that mandated the creation of the licensure examination concluded that a standard must be set that underscores the criticality of the nature of work performed within the domain of practice, with regards to general public livelihood.

2) The panel then conducted a survey of the test standards set for other federal licensure programs whose domains they identified as falling at a similar level of criticality with regards to general public livelihood, including the Federal Aviation Administration, the Nuclear Regulatory Commission, and a host of medical practitioner exams.

3) From the results of the survey, the panel yielded an average test standard of 74%—from which they then adopted the policy that the test standard for each respective LASSI exam, nationwide, must be set at no less than 74%.

4) Ray and Davies briefly considered recommending a higher standard for their state's exam, since, in their opinions, the state safety standards were more stringent than those at the federal level. However, figuring it was easier to start with a lower standard and adjust it upward, rather than the other way around, Ray and Davies ultimately sought—and received—state approval to set the initial passing score of the LASSI exam at 74 correctly-answered items out of 100.

5) Months later, in conjunction with the conversion from static equated forms to a single, randomized form, Ray and Davies made a recommendation—for which they received approval—that the state exercise its ability to adjust the LASSI exam passing score upward to 80 correctly-answered items out of 100.