

Developing a Competency Model for Highway Safety Engineers: A Delphi Method

Garrett Wheat, Ph. D.



Rationale

- Vehicles are the most used method of transportation
- Highway crashes remain too high
- Crashes are very expensive and should be avoided
- Fatalities from crashes are excessive
- Who designs the roads to mitigate crashes?
- Are the current measures meeting the needs?
- Will they change in 10 years?



Purpose of the Study

The primary purpose of this study was to determine the core competencies needed by State DOT Highway Safety engineers as perceived by Highway Safety experts in the United States.



Objective 1

1. Identify a list of suggested competencies based on current literature, job descriptions, personal interviews, and matched training objectives that should be necessary for all Highway Safety engineers.



Objectives 2 and 3

2. Determine the importance of each identified competency for effective job performance of Highway Safety Engineers in the year **2020** as perceived by forward thinking Highway Safety Experts in the U.S.
3. Determine the competencies needed for effective job performance of Highway Safety Engineers in the year **2020** for which consensus of perception among Highway Safety experts can be achieved.



Objectives 4 and 5

4. Determine the importance of each identified competency for effective job performance of Highway Safety Engineers in the year **2030** as perceived by forward thinking Highway Safety Experts in the U.S.
5. Determine the competencies needed for effective job performance of Highway Safety Engineers in the year **2030** for which consensus of perception among Highway Safety experts can be achieved.



Methodology

- Target population
 - Road Safety Professionals in the US
- Accessible population
 - DOT Highway Safety Managers for every State's DOT
- Sample
 - Recommended Highway Safety Experts suggested by the Highway Safety Managers and those who chose to participate



Methodology

- Survey utilized Qualtrics
- Executed over 3 rounds via the Delphi Method
- Initially included 50 competencies in 5 competency areas found through:
 - Researching current literature
 - Comparing with job descriptions
 - Personal interviews with the researcher
 - Matched to STP training's objectives



Round 1

Is the given specific Highway Safety Engineering competency important for the years 2020 and 2030?

	2020		2030	
	Yes	No	Yes	No
Strategic Highway Safety Plan (SHSP)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Role of SHSP Major Partners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you have any competencies to add? <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Round 2

How important is the given specific competency is for today's Highway Safety engineers (year 2020) and in the future (year 2030)?

- 5-point anchored scale
 - 1 – No importance
 - 2 – Low importance
 - 3 – Moderate importance
 - 4 – Substantial importance
 - 5 – High importance



Round 3

Participants were shown the panel's median score from Round 2 and:

- If their rating was within 1 point of the median and they wanted to keep it the same (or within one point), make the change accordingly or do nothing
- If their rating was outside of 1 point of the median, either:
 - Change their rating to within 1 point of the group median
 - OR
 - Justify their answer



Round 3

	2020					2030				
	1	2	3	4	5	1	2	3	4	5
Strategic Highway Safety Plan (SHSP) [3, 4]	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Role of SHSP Major Partners [2, 4]	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Data Collection

- A list of items for the survey was composed
- The panel members were selected
- Round 1 survey was sent to the panel
- Data was collected via Qualtrics
- Data from Round 1 was used to add or remove items appropriately



Data Collection (continued)

- An updated Round 2 survey was sent to the panel
- Data was collected via Qualtrics
- Data was summarized for each item, including:
 - Mean
 - Median
 - Standard deviation



Data Collection (continued)

- Data from Round 2 was used to update items
- An updated Round 3 survey was sent to the panel
- Data was collected via Qualtrics
- Data was summarized for each item, including:
 - Mean
 - Median
 - Standard deviation
- Items were ranked by overall mean panel rating



Objective 1

Identify a list of suggested competencies based on current literature, job descriptions, personal interviews, and matched training objectives that should be necessary for all Highway Safety engineers.



Findings – Objective 1

- 50 previously found competencies confirmed as important for inclusion in Round 2
 - All received >50% “Yes” ratings for one or both years
 - 9 of those received editing suggestions
 - 9 competencies received 100% for 2020
 - 1 competency received 100% for 2030
- 18 new competencies were suggested and included in Round 2
- 21 Panel Members



Findings – Objective 1

- 9 competencies received 100% for 2020
 - HS/D–Crash Analysis Tool
 - HS/D–Interpreting Site Specific Crash Data
 - HS/D–Quantitative Safety Analysis Using the Highway Safety Manual (HSM)
 - HS/D–Safety Data Collection & Sources
 - SI–Benefit Cost Analysis
 - SI–Designing Safe Systems: Infrastructure and Operations Countermeasures
 - SI–Principles of Roadway Departure
 - ST/D–Highway Safety Improvement Program (HSIP)
 - ST/D–Safety Culture & Policies



Findings – Objective 1

- 1 competency received 100% for 2030
 - SI–Designing Safe Systems: Behavioral Countermeasures



Objective 2

Determine the importance of each identified competency for effective job performance of Highway Safety Engineers in the year **2020** as perceived by forward thinking Highway Safety Experts in the U.S.



Interpretive Scale used for Rounds 2 and 3

No Importance (NI) = 1.0–1.50

Low Importance (LI) = 1.51–2.50

Moderate Importance (MI) = 2.51–3.49

Substantial Importance (SI) = 3.50–4.49

High Importance (HI) = 4.50–5.00



Findings – Objective 2

2020

- All competency areas were represented at least twice in the 14 highest rated competencies
 - 3 = High Importance
 - 48 = Substantial Importance
 - 17 = Moderate Importance
- 23 Panel Members



Findings – Objective 2

2020

- 3 competencies rated as High Importance
 - HSD–Interpreting Site Specific Crash Data
 - SI–Designing Safe Systems: Infrastructure and Operations Countermeasures
 - ST/D–Road Safety Theory



Objective 3

Determine the competencies needed for effective job performance of Highway Safety Engineers in the year **2020** for which consensus of perception among Highway Safety experts can be achieved.



Findings – Objective 3

2020

- All competencies achieved consensus as established a' priori at greater than 50%.
- 11 competencies received 100% consensus
- All competencies received 78% consensus or higher
- 4 competencies received zero comments
- 23 Panel Members



Findings – Objective 3

2020

- 11 competencies received 100% consensus
 - HSD–Crash Data Query Tools
 - HSD–Data Integrations with GIS
 - HSD–Microsoft Excel
 - IP–Planning & Traffic Policy
 - IP–Resources and Partners
 - SI–Understanding Driver Behavior [new]
 - ST/D–DOT Influence [new]
 - ST/D–Local Road Safety Program (LRSP)
 - ST/D–Role of SHSP Major Partners
 - ST/D–Safety Culture & Policies
 - TE–Highway Plans

Objective 4

Determine the importance of each identified competency for effective job performance of Highway Safety Engineers in the year **2030** as perceived by forward thinking Highway Safety Experts in the U.S.



Findings – Objective 4

2030

- All competency areas (except TE) were represented at least twice in the 10 highest rated competencies
(TE is included in the 20 highest rated competencies)
 - 11 = High Importance
 - 48 = Moderate Importance
 - 8 = Substantial Importance
 - 1 = Low Importance
- 23 Panel Members



- 11 competencies rated as High Importance
 - SI–Designing Safe Systems: Infrastructure and Operations Countermeasures
 - SI–Non-motorized Road Users Safety
 - HSD–Safety Data Usage Application
 - ST/D–Safety Culture & Policies
 - HSD–Safety Data Collection & Sources
 - IP–Building Relationships/Networking [new]
 - SI–Designing Safe Systems: Behavioral Countermeasures
 - ST/D–Road Safety Theory
 - HSD–Quantitative Safety Analysis Using the Highway Safety Manual (HSM)
 - IP–Verbal Communications
 - HSD–Interpreting Site Specific Crash Data



Findings – Objective 4

2030

- 1 competency rated as Low Importance
 - HSD–Microsoft Access



Objective 5

Determine the competencies needed for effective job performance of Highway Safety Engineers in the year **2030** for which consensus of perception among Highway Safety experts can be achieved.



Findings – Objective 5

2030

- All competencies achieved consensus as established a' priori at greater than 50%.
- 17 competencies received 100% consensus
- All competency areas were represented at least twice in the 17 highest rated competencies
- All competencies received 78% consensus or higher
- 4 competencies received zero comments
- 23 Panel Members



Findings – Objective 5

2030

- 17 competencies received 100% consensus
 - SI–Designing Safe Systems: Infrastructure and Operations Countermeasures
 - SI–Non-motorized Road Users Safety
 - HSD–Alternative Sources of Data [new]
 - HSD–General Statistics Analysis (Theories)
 - HSD–Technical Report and Correspondence Writing [new]
 - IP–Meeting Facilitation
 - IP–Planning & Traffic Policy
 - SI–Benefit Cost Analysis
 - SI–Effects of Infrastructure on Behavior [new]
 - SI–Principles of Roadway Departure
 - SI–Principles of Speed Management [new]
 - SI–Understanding Driver Behavior [new]
 - ST/D–DOT Influence [new]
 - ST/D–Local Road Safety Program (LRSP)
 - ST/D–Role of SHSP Major Partners
 - TE–Complete Streets
 - TE–Highway Plans



Conclusions and Recommendations

- A set of core competencies were identified in this study that are essential to the role of a Highway Safety engineer currently and for the future.
- These competencies are consistent with:
 - a review of current literature
 - interviews conducted by the researcher
 - reviews of job descriptions and duties
 - reviews of professional, state, and national organizational trainings

Conclusions and Recommendations

- A majority of competencies received a mean rating of 3.50 or higher:
 - 2020 = 51/68
 - 2030 = 59/68
- All competencies received a minimum of 78% consensus

Conclusions and Recommendations

- Competencies rated high importance and consensus should be included as the employment of practice.
- State and national highway safety programs should identify or design training programs to fill gaps.
- FHWA should update the SHSP requiring states to mandate identified training.

Conclusions and Recommendations

- The panel was shown to be effective and forward-thinking for accomplishing the purpose of the study.
- The Delphi method allowed these experts to rate, rank, and gain consensus of competencies currently found in the literature and new ones identified by the panel.
- The Delphi method's power lies in its ability to provide "the most reliable consensus of opinion of a group of experts" (1996, p. 186).

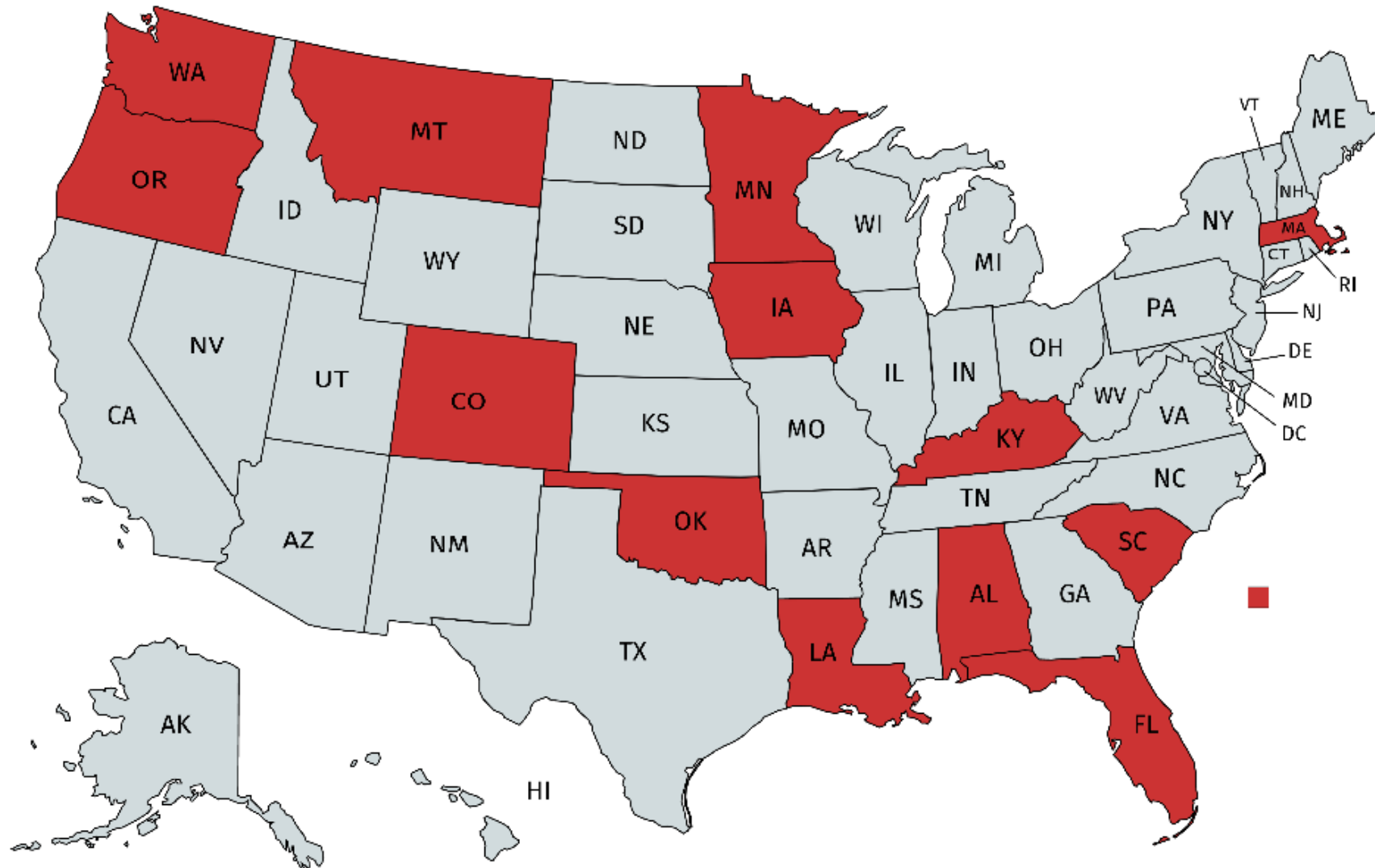


Conclusions and Recommendations

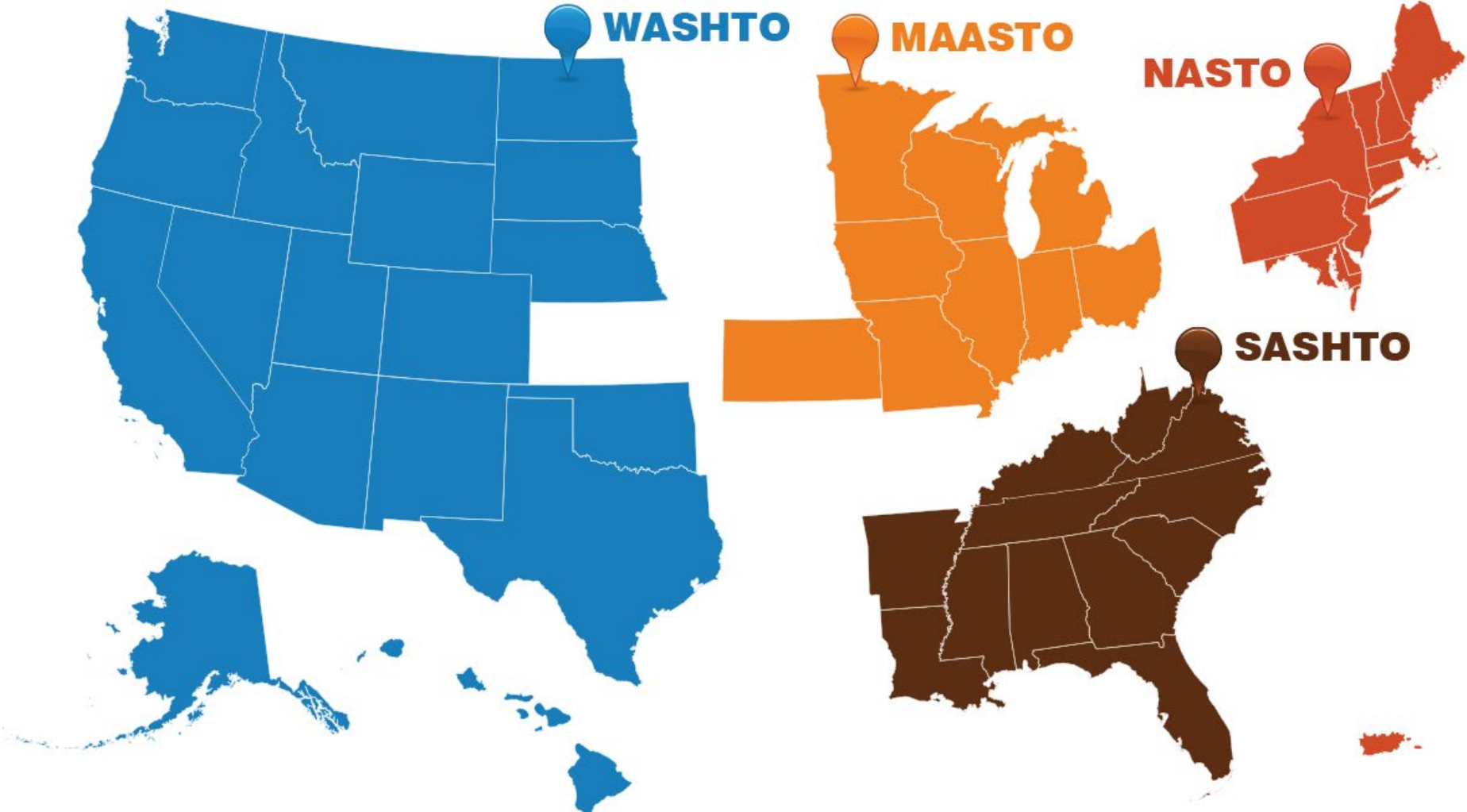
- Current listed competencies were identified as important.
- Edits and newly defined competencies were suggested.
 - Repeated items show similar views.
 - Unique items provide forward-thinking ability.
- Panel was consistent in their ratings.
- Ratings and rankings changed from the year 2020 to 2030.
- All items reached consensus.
- All AASHTO regions were represented.



Representation of Panel Members in Round 3



AASHTO Regions



Thank you!

A full copy of the dissertation can be downloaded via:

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Garrett Wheat, Ph.D.
Garrett.Wheat@la.gov

