

Workplace Safety Personality Indicator (WSPI-36): A Behavioral Approach to Understanding Occupational Safety Risk

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Abstract

The present study examined the preliminary psychometric performance of the Workplace Safety Personality Indicator (WSPI-36), a 36-item exploratory instrument designed to assess six psychological dimensions relevant to occupational safety behavior in highway maintenance work. Data were collected in two SurveyMonkey waves within a single U.S. highway maintenance organization: a preliminary pilot administration ($n = 61$) and a subsequent company-wide administration ($n = 126$), yielding a merged analytic sample of 187 respondents. Internal consistency for the full scale was $\alpha = 0.669$. Subscale alphas were 0.559 for Action Orientation, 0.591 for Pattern Processing, 0.801 for Human-Driven Motivation, 0.456 for Flexibility Under Pressure, 0.842 for Protective Orientation, and 0.695 for Risk Amplifiers. Exploratory factor-analytic evidence provided partial support for the proposed multidimensional structure, although several items showed weak or overlapping loadings, especially within Flexibility Under Pressure and Pattern Processing. Protective Orientation was specified as a negatively weighted buffering factor in the Safety Risk Index and functioned inversely in the scoring model, consistent with the study's conceptual framework. Most respondents were classified in the Moderate-risk band. Findings suggest that the WSPI-36 captures potentially meaningful safety-related behavioral tendencies, but additional refinement and external validation are needed before broader psychometric or operational use.

Keywords

Occupational Safety, Workplace Safety, Personality, Risk Perception, Safety Behavior, Psychometrics, Highway Maintenance

1. Introduction

Workplace safety continues to present a significant challenge across industries despite advances in engineering controls, equipment, and formal safety-management systems. Human behavior remains central to many incidents, near misses, and procedural deviations, particularly in dynamic environments in which workers must interpret changing conditions under production pressure. Highway maintenance work is especially relevant in this regard because employees routinely operate around live traffic, temporary traffic control, mobile equipment, changing weather, fatigue, and time-sensitive operational demands.

Research in occupational safety has shown that safety-related behavior is shaped by a combination of cognitive, social, and self-regulatory processes. Risk perception influences whether hazards are noticed and acted upon; intuitive, rapid decision making can override slower analytical processing under pressure; and safety climate and social norms influence whether employees comply with procedures or speak up about risk (Christian et al., 2009; Kahneman, 2011; Slovic, 1987; Zohar, 1980). Likewise, fatigue, stress, and production pressure can impair attention and increase susceptibility to error (Williamson et al., 2011).

Broader safety literature also links safety outcomes to safety-specific leadership, safety climate, and supervisor- and group-level influences, including research on transformational safety leadership, construction safety climate, safety motivation, lagged safety behavior, and multilevel climate effects (Barling et al., 2002; Beus et al., 2010; Clarke, 2013; Dedobbeleer & Béland, 1991; Griffin & Neal, 2000; Hofmann & Stetzer, 1996; Johnson, 2007; Neal & Griffin, 2002, 2006; Zohar, 2000; Zohar & Luria, 2005).

Related research further suggests that personality, self-regulation, trust, psychological safety, self-assessment bias, job demands, and human-error processes are important for understanding why workers recognize, normalize, or act on risk in different ways (Carver & Scheier, 1982; Clarke, 2006; Clarke & Robertson, 2005, 2008; Conchie et al., 2006; Edmondson, 1999; Kruger & Dunning, 1999; Nahrgang et al., 2011; Reason, 1990; Slovic, 1984).

Despite this literature, many existing approaches examine these influences separately rather than within a single integrated framework. The Workplace Safety Personality Indicator (WSPI-36) was developed as an exploratory instrument intended to capture multiple psychological contributors to safety-related behavior in one measure. In the present framework, Action Orientation reflects a tendency to act quickly rather than pause and assess hazards; Pattern Processing reflects a tendency to rely on broad task patterns rather than fine-grained hazard cues; Human-Driven Motivation reflects sensitivity to social and production pressures that may affect rule adherence; Flexibility Under Pressure reflects a tendency to improvise or deviate from structure under changing conditions; Protective Orientation reflects a tendency toward stop-work behavior, checking, reporting, and personal safety responsibility; and Risk Amplifiers reflect susceptibility to rushing, fatigue, frustration, and overconfidence.

Accordingly, the present study addressed three research questions. First, what level of internal consistency reliability would be observed for the overall WSPI-36 and its six subscales? Second, to what extent would exploratory factor analytic evidence support the proposed six-factor structure? Third, would Protective Orientation function inversely within the Safety Risk Index, consistent with its theorized buffering role? It was expected that the full scale would show at least preliminary internal consistency appropriate for early exploratory work, that factor-analytic results would provide partial rather than complete support for the six-factor structure, and that Protective Orientation would show an inverse role in the computation and interpretation of overall risk.

2. Method

Participants were drawn from a single highway maintenance and infrastructure-services company operating across the United States. Employees represented field, operational supervisory, and support roles within a geographically broad organizational context. Data were collected in two SurveyMonkey waves. Wave 1 functioned as a preliminary pilot administration ($n = 61$), and Wave 2 was distributed companywide ($n = 126$), producing a merged analytic sample of $N = 187$. Administrative distribution counts were not retained in the archived source materials, so formal response rates could not be calculated for either wave.

The WSPI-36 was developed by the researcher and distributed through the organization's Human Resources department using SurveyMonkey. Access was provided through company email and the organization's payroll and communication platform, Paylocity. Participants responded to all WSPI items on a 5-point Likert-type scale ranging from Strongly Disagree (1) to Strongly Agree (5). Both waves used the same platform, item wording, response anchors, and coding direction. Prior to merging the two waves, archived exports were checked for item correspondence, response-format consistency, and score-range comparability; no discrepancies in item order or coding structure were identified, which supported combining the two waves for exploratory psychometric analyses. **Table 1** presents the gender distribution of the available demographic sample, showing that the respondent group was predominantly male (73.8%), with females representing 26.2% of participants. It also summarizes the age distribution of the demographic sample, indicating that the workforce was concentrated primarily in the 35 - 64 age range, with the largest group represented by employees ages 45 - 54 (see **Table 1**). As shown in **Table 2**, the majority of respondents clustered in the Moderate risk category, suggesting that safety-related psychological risk in this sample was distributed along a continuum rather than concentrated only among a small number of extreme cases (**Table 2**).

The 36 items were organized into six six-item subscales: Action Orientation (Items 1 - 6), Pattern Processing (Items 7 - 12), Human-Driven Motivation (Items 13 - 18), Flexibility Under Pressure (Items 19 - 24), Protective Orientation (Items 25 - 30), and Risk Amplifiers (Items 31 - 36). Subscale scores were computed by

summing the relevant items, producing a possible range of 6 to 30 for each subscale. No individual items were reverse scored before subscale calculation. Instead, Protective Orientation was treated as a negatively weighted buffering factor when the composite Safety Risk Index (SRI) was calculated.

Table 1. Demographic characteristics for the merged sample (N = 187).

	Gender Category	n	%
1	Male	138	73.8
2	Female	49	26.2
	Age Group Category	n	%
1	18 - 24	3	1.6
2	25 - 34	21	11.3
3	35 - 44	44	23.4
4	45 - 54	57	30.6
5	55 - 64	47	25.0
6	65+	15	8.1

Note. Demographic information was available for the SurveyMonkey wave of the study. Of the respondents who provided demographic data, 138 participants (73.8%) identified as male and 49 participants (26.2%) identified as female. With respect to age, 3 participants (1.6%) were between 18 and 24, 21 (11.3%) were between 25 and 34, 44 (23.4%) were between 35 and 44, 57 (30.6%) were between 45 and 54, 47 (25.0%) were between 55 and 64, and 15 (8.1%) were 65 years of age or older. These results suggest that the available demographic sample was predominantly male and skewed toward mid-career and later-career employees.

Table 2. Safety risk index band distribution (N = 187).

	Risk Band	n	%
1	Low	37	19.8
2	Moderate	130	69.5
3	Elevated	19	10.2
4	High	1	0.5
5	Critical	0	0.0

Note. Risk-band classification was calculated across the full merged sample of 187 respondents. Of these participants, 37 (19.8%) were classified in the Low-risk range, 130 (69.5%) were classified in the Moderate risk range, 19 (10.2%) were classified in the Elevated risk range, and 1 participant (0.5%) fell in the High-risk range. No participants were classified in the Critical risk range. Overall, these findings indicate that many employees were concentrated in the Moderate risk category, with a smaller proportion falling into Low or Elevated ranges and very few demonstrating high-risk profiles.

The exact scoring procedure for the SRI was specified as $SRI = (0.20 \times AO) + (0.20 \times PP) + (0.20 \times HM) + (0.15 \times FU) + (0.15 \times RA) - (0.30 \times PO)$. Based on the instrument scoring sheet, SRI scores below 5 were classified as Low risk, scores from 5 to 9 as Moderate risk, scores from 10 to 14 as Elevated risk, scores from 15 to 19 as High risk, and scores of 20 or greater as Critical risk. Thus, higher scores on Action Orientation, Pattern Processing, Human-Driven Motivation, Flexibility Under Pressure, and Risk Amplifiers increased the SRI, whereas higher Protective Orientation scores reduced it.

The procedure was structured to promote transparency and participation. Several days before survey distribution, the researcher sent a video message explaining the purpose of the study, the voluntary nature of participation, the intended organizational and research value of the project, and the safeguards in place to protect confidentiality. The survey remained open for two weeks, and two reminder messages were sent: one at the midpoint of the collection period and one the day before closing.

Analyses were conducted on the 187 usable cases retained in the scored merged dataset. The archived working files did not preserve a standalone missing-data log or wave-specific imputation record, so missing-data treatment can be described only at the level of the analytic dataset used in the manuscript revision. Reliability was evaluated with Cronbach's alpha for the overall scale and each subscale. Item-level diagnostics included item-total correlations and alpha-if-deleted indicators. Exploratory factor-analytic output preserved in the archived analysis files retained primary and secondary loadings for the six-factor solution; however, the manuscript source available for the present revision did not preserve the exact KMO, Bartlett test, extraction method, rotation setting, or factor-retention rule in narrative form. Accordingly, the present revision reports the preserved loading evidence and interpretive findings while noting this reporting limitation explicitly.

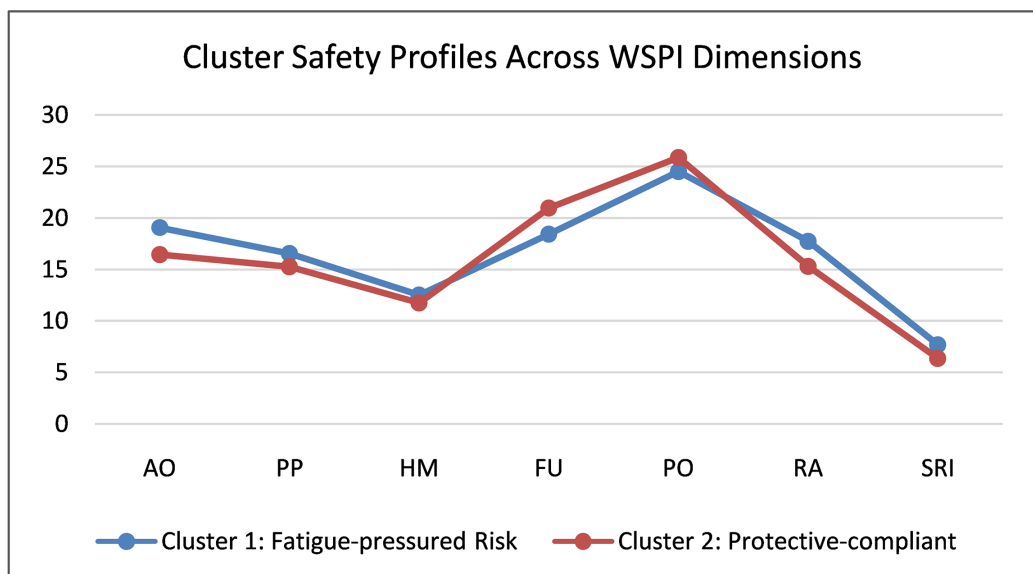
3. Results

The WSPI-36 was evaluated using the combined two-wave sample of 187 respondents. Internal consistency for the overall 36-item instrument was $\alpha = 0.669$, indicating moderate reliability for an exploratory instrument. Reliability varied across the six subscales: Action Orientation, $\alpha = 0.559$; Pattern Processing, $\alpha = 0.591$; Human-Driven Motivation, $\alpha = 0.801$; Flexibility Under Pressure, $\alpha = 0.456$; Protective Orientation, $\alpha = 0.842$; and Risk Amplifiers, $\alpha = 0.695$. Thus, Human-Driven Motivation and Protective Orientation demonstrated the strongest internal consistency, Risk Amplifiers showed acceptable preliminary performance, Action Orientation, Pattern Processing, and especially Flexibility Under Pressure appeared to require additional refinement. As shown in **Figure 1**, Action Orientation, Pattern Processing, and Human-Driven Motivation each showed positive unstandardized coefficients of 0.20, Flexibility Under Pressure and Risk Amplifiers each showed coefficients of 0.15, and Protective Orientation showed a negative coefficient of -0.30 , consistent with its theorized buffering role. Specifically, the regression coefficient plot showed positive unstandardized coefficients for Action Orientation ($b = 0.20$), Pattern Processing ($b = 0.20$), Human-Driven Motivation ($b = 0.20$), Flexibility Under Pressure ($b = 0.15$), and Risk Amplifiers ($b = 0.15$), whereas Protective Orientation showed a negative coefficient ($b = -0.30$), indicating an inverse association with SRI (see **Figure 1**).

Item-level diagnostics were generally consistent with this pattern. Within Protective Orientation, item-total correlations ranged from 0.476 to 0.717, and primary loadings ranged from approximately 0.540 to 0.778 for Items 25 through 30,

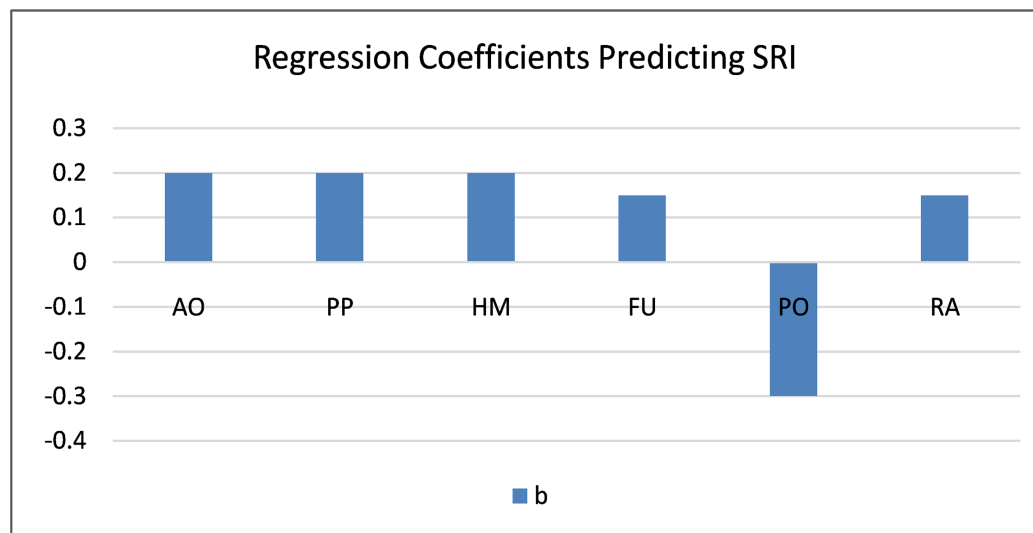
indicating comparatively strong coherence in this domain. Within Pattern Processing, Item 10 showed a weaker item-total correlation of 0.257 and a lower primary loading of 0.295 and was later flagged for removal in subsequent refinement work. Additional evidence of construct overlap was visible in items such as Item 16, which showed a primary loading of 0.402 and a nearly equivalent secondary loading of 0.393, and Item 19, which showed a very weak primary loading of 0.088, suggesting poor alignment with a distinct factor. As shown in **Figure 2**, Cluster 1 demonstrated relatively higher mean scores on Action Orientation, Pattern Processing, Human-Driven Motivation, Risk Amplifiers, and SRI, whereas Cluster 2 showed stronger Protective Orientation and lower overall SRI, suggesting meaningfully different combinations of safety-related psychological tendencies across employees. Cluster 1 (“fatigue-pressured risk”) showed mean scores of 19.07 on Action Orientation, 16.56 on Pattern Processing, 12.53 on Human-Driven Motivation, 18.42 on Flexibility Under Pressure, 24.51 on Protective Orientation, 17.74 on Risk Amplifiers, and 7.70 on SRI, whereas Cluster 2 (“protective-compliant”) showed corresponding means of 16.45, 15.25, 11.75, 20.95, 25.85, 15.30, and 6.37 (see **Figure 2**).

Exploratory factor-analytic results provided only partial support for the proposed six-factor structure. The preserved loading matrix indicated that several items loaded in the expected general direction, but a number of items showed either weak primary loadings or meaningful secondary loadings on competing factors. This pattern was most apparent in Flexibility Under Pressure and in some Human-Driven Motivation and Pattern Processing items, suggesting that the domains were not yet fully differentiated in the present version of the instrument.



Note. Lines represent mean scores for each identified employee cluster across the WSPI subscales and the Safety Risk Index (SRI). The profiles illustrate distinct constellations of psychological risk and protective characteristics within the workforce.

Figure 1. Cluster safety profiles across workplace safety personality indicator dimensions.



Note. Bars represent unstandardized regression coefficients (b) for each Workplace Safety Personality Indicator (WSPI) subscale in relation to the Safety Risk Index (SRI). Error bars represent standard errors. Positive coefficients indicate that higher scores on the subscale are associated with higher SRI values, whereas negative coefficients indicate an inverse association with SRI.

Figure 2. Regression coefficients predicting safety risk index.

Consistent with the scoring model, Protective Orientation functioned inversely in the Safety Risk Index. Because the SRI formula subtracts 0.30 times the Protective Orientation score, higher Protective Orientation values reduced the overall composite risk score by design. Descriptively, this inverse role was also reflected in the stronger reliability and coherence of the Protective Orientation items relative to several of the risk-activating subscales. As shown in **Table 2**, most respondents were classified in the Moderate-risk range (69.5%), followed by Low risk (19.8%), Elevated risk (10.2%), and High risk (0.5%); no respondents were classified in the Critical range.

4. Discussion

The present study provides preliminary evidence that the WSPI-36 captures multiple psychological and behavioral tendencies relevant to occupational safety risk in a highway maintenance context. The most defensible conclusion from the current results is not that the instrument is fully validated, but that it shows enough internal differentiation and conceptual coherence to justify further refinement and external testing.

A central finding was the comparatively strong performance of Protective Orientation and Human-Driven Motivation. Protective Orientation was both theoretically important and psychometrically promising: its items cohered more strongly than those in several other domains, and the negative weighting of this subscale in the SRI reflected the broader proposition that protective behaviors can buffer otherwise risk-prone tendencies. In contrast, Flexibility Under Pressure emerged as the least stable subscale, suggesting that it may currently combine multiple pro-

cesses, such as adaptive flexibility, ambiguity tolerance, and risk tolerance, that should be disentangled in future versions.

The factor-analytic evidence also suggests that the proposed six-dimensional framework is promising but not yet cleanly resolved. Several items showed weak or overlapping loadings, which is common in early-stage measure development but nonetheless indicates that the current item pool includes construct redundancy and insufficient differentiation in some domains. The clearest implication is that future revisions should focus on refining weaker items, especially within Flexibility Under Pressure, Action Orientation, and Pattern Processing, while preserving the stronger core represented by Protective Orientation and Human-Driven Motivation.

From an applied standpoint, the current distribution of SRI scores suggests that safety risk may be better understood as a continuum of everyday behavioral tendencies than as a trait possessed only by a small subgroup of extreme workers. This interpretation aligns with the practical value of examining time pressure, fatigue, social influence, and checking behavior as part of a broader safety-management conversation. Even in exploratory form, the WSPI framework may help organizations think more deliberately about where behavioral safety interventions, coaching, and communication efforts should be focused.

5. Limitations of the Study

Several limitations should be considered. First, the study relied exclusively on self-report survey data, which introduces the possibility of social desirability, impression management, and other response biases. Second, the sample came from a single highway maintenance organization, which limits generalizability beyond this particular industry and organizational culture. Third, although the merged sample size was adequate for preliminary exploratory analysis, the instrument remains in an early stage of development, and several subscales demonstrated only modest internal consistency.

Fourth, the present manuscript revision was constrained by the contents preserved in the attached manuscript and archived analysis outputs. Although item loadings and reliability coefficients were available, the exact KMO statistics, Bartlett test, extraction method, rotation, and factor-retention rule used in the original exploratory factor analysis were not preserved in the manuscript source file supplied for revision. Those details should be restored from the original statistical output before formal external submission if available. Fifth, the study did not include objective criterion outcomes such as incident data, near-miss records, or safety observations, so predictive validity cannot yet be evaluated.

6. Recommendations for Future Research

Future research should prioritize item revision and replication of the factor structure in an independent sample. Confirmatory factor analysis, item response modeling, and additional item-development work may help clarify whether the present

six-domain structure is retained or whether some domains should be collapsed, split, or rewritten. Particular attention should be given to weak or overlapping items identified in the current diagnostic outputs.

Further studies should also incorporate objective safety-related outcomes to evaluate criterion-related validity. Linking WSPI scores to incidents, near misses, safety observations, or other archival performance indicators would allow researchers to determine whether the instrument predicts meaningful real-world safety outcomes. In addition, longitudinal and mixed-methods research would help determine whether the measured tendencies are stable over time and how employees interpret the more ambiguous items under actual field conditions.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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