APPENDIX A
Additional Statistical Graphs

Many more statistical graphs appear in a separate Excel© spreadsheet. This appendix merely contains some graphs referenced in the text.

Regarding the possibility of a bias in military taxiway and runway ratings, the comparison of military ratings with ratings by other pilots versus weighted RMS appear in Figures A1 and A2.

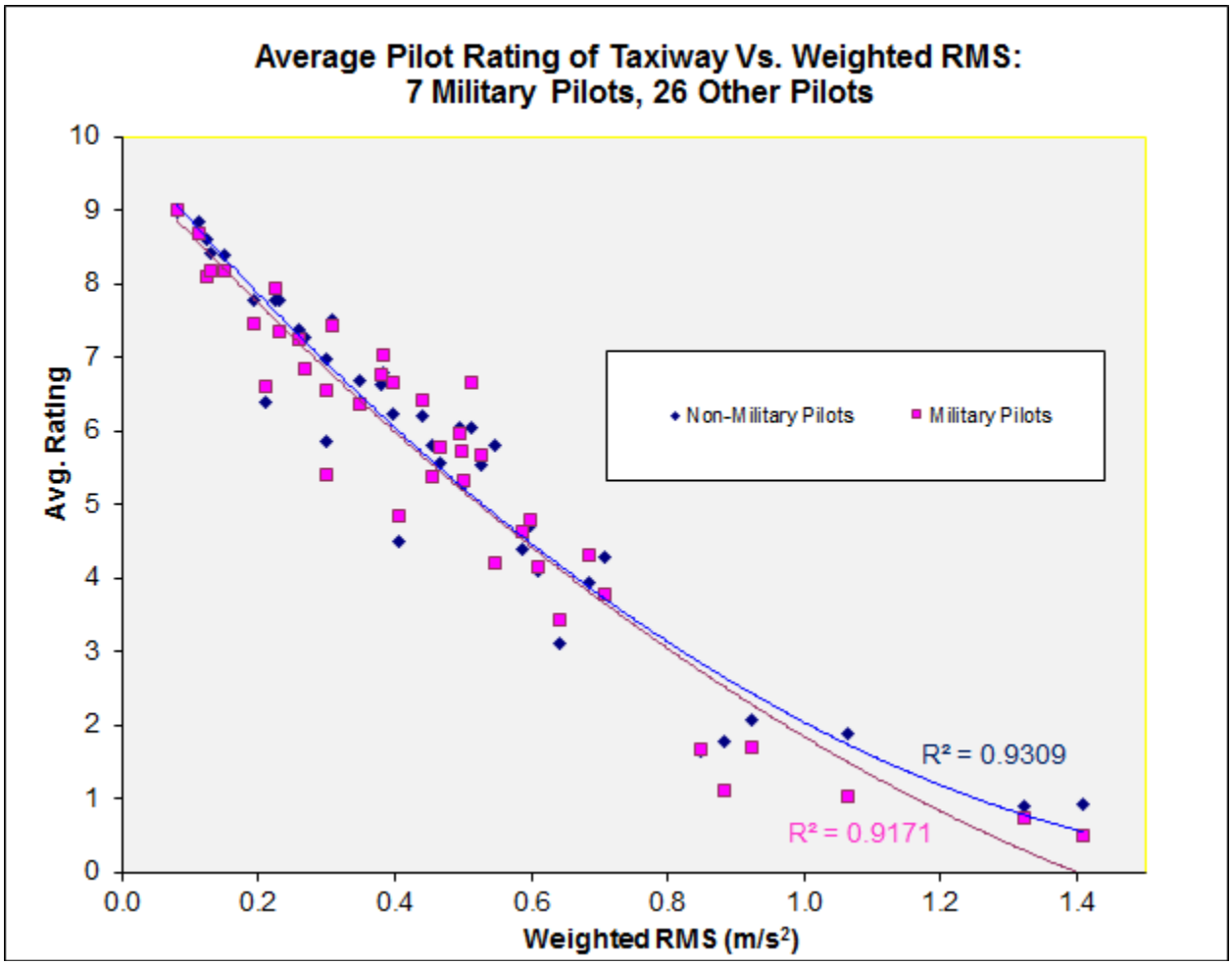

Figure A1. Military and Non-Military Average Pilot Numerical Taxiway Ratings Vs. Weighted RMS

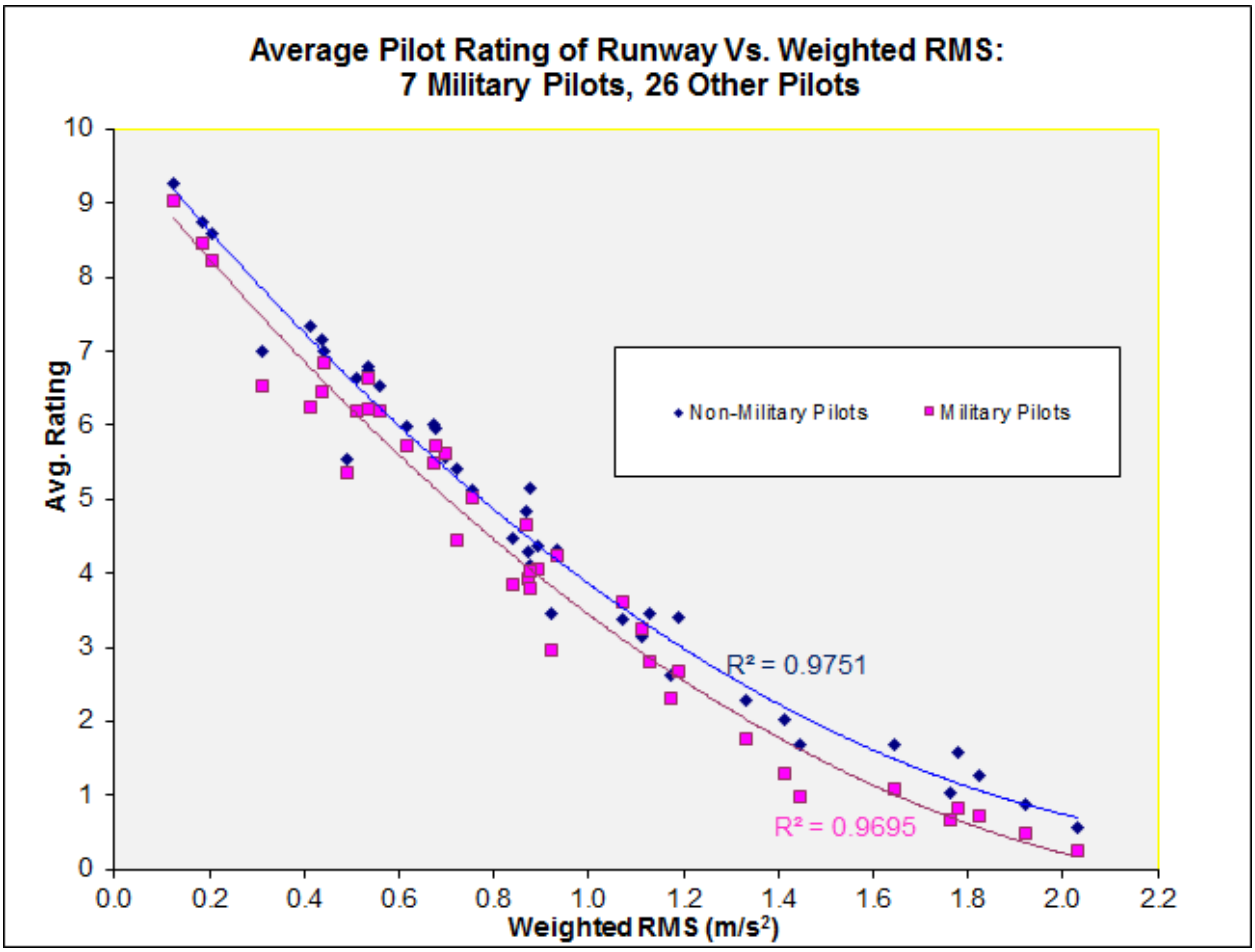

Figure A2. Military and Non-Military Average Pilot Numerical Runway Ratings Vs. Weighted RMS

These runway data fits are separated similarly to the linear fits to runway data versus weighted VDV (Section 4.5), similarly suggesting a slight bias between military and non-military pilots. The R^2 values are as similar as would be expected since only seven sample points for military pilots were available, and indicate reasonable fits were accomplished.

Regarding the possibility of a bias in taxiway and runway ratings by pilots who had participated in a simulator evaluation before, the comparison of these "repeat" ratings with ratings by other pilots versus weighted RMS appear in Figures A3 and A4 with similar apparent biases in the slope of the fits to those encountered in the weighted VDV case.

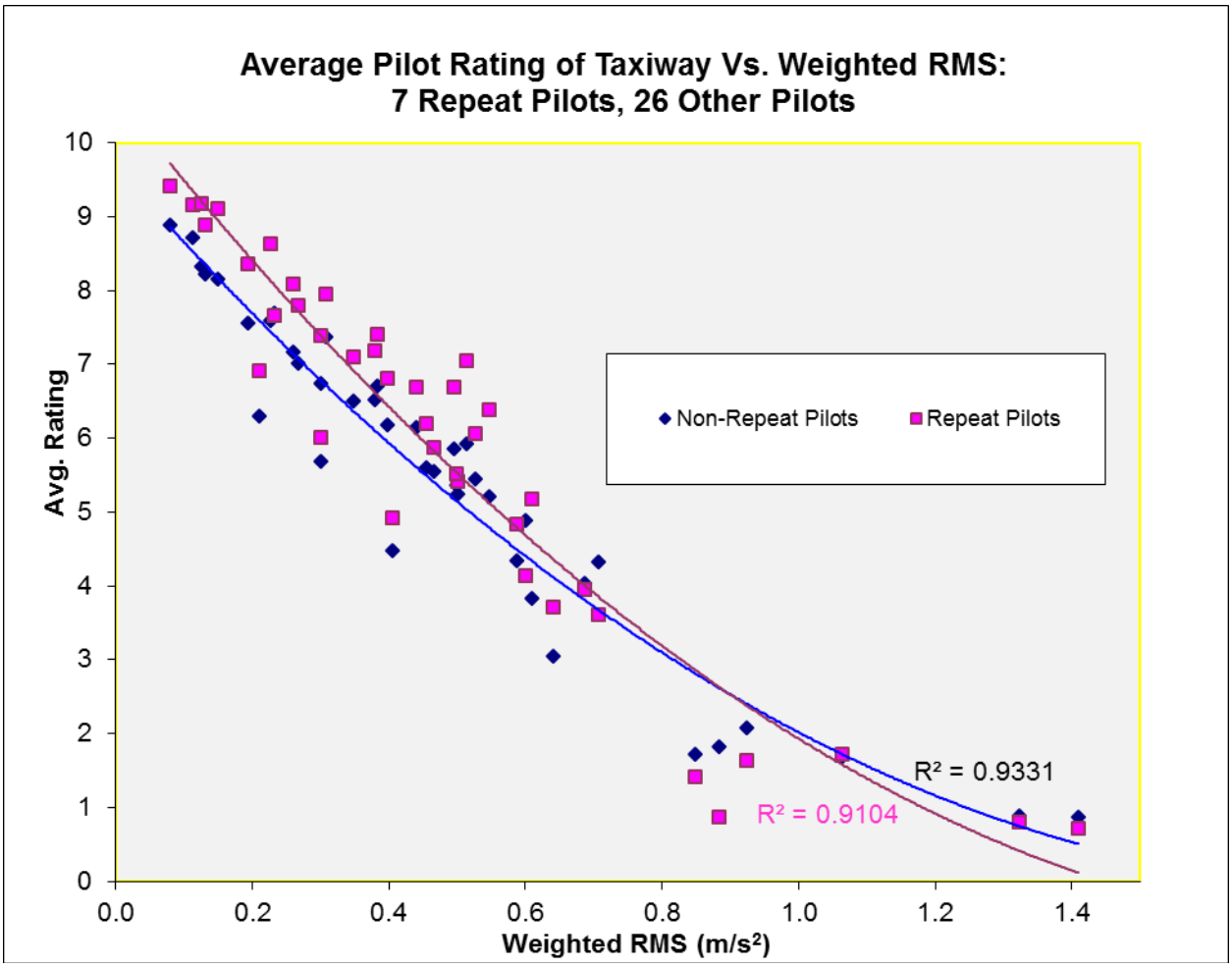

Figure A3. Repeat and Non-Repeat Average Pilot Numerical Taxiway Ratings Vs. Weighted RMS

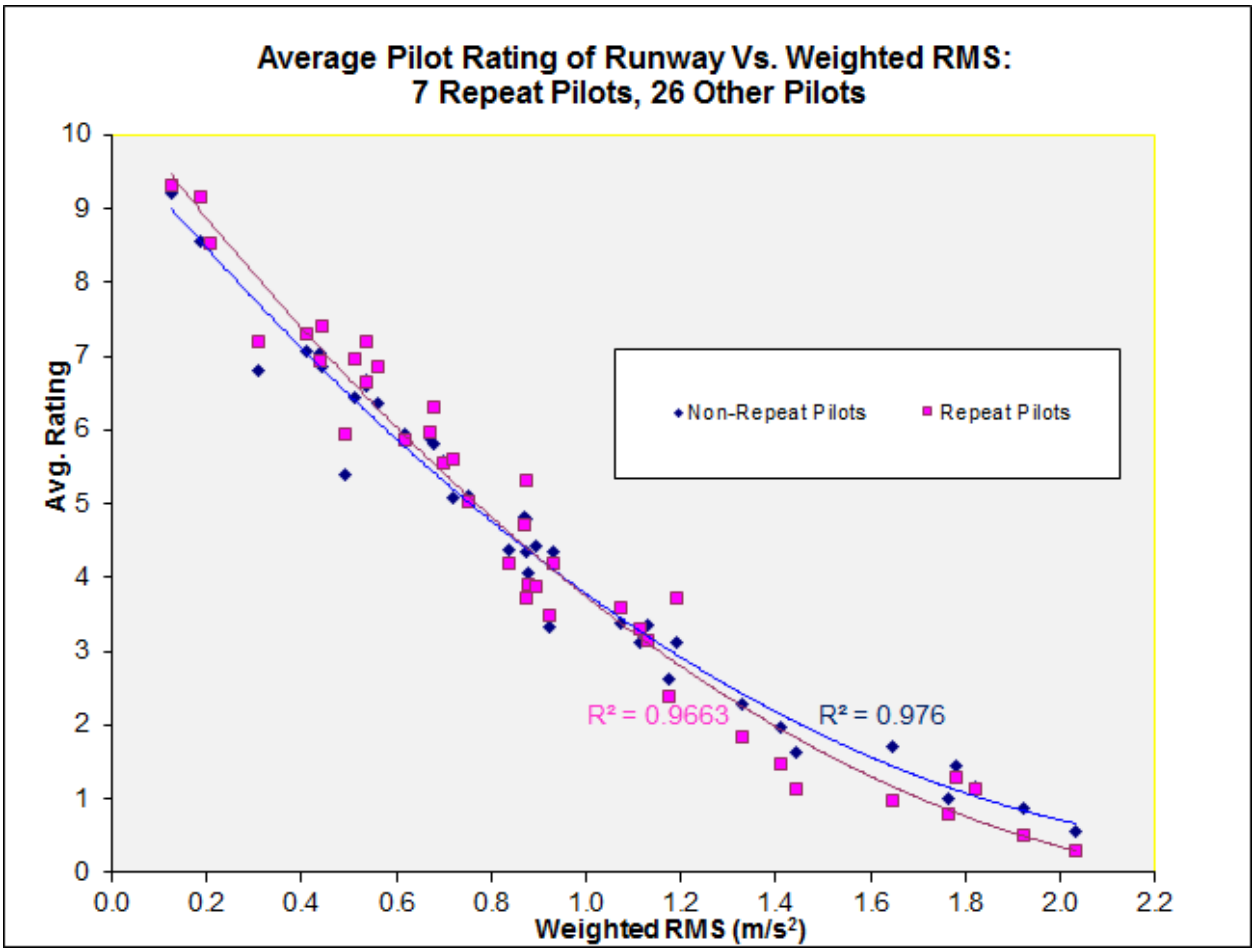

Figure A4. Repeat and Non-Repeat Average Pilot Numerical Runway Ratings Vs. Weighted RMS

(Recall that an analysis of bias of the linear fit of pilot rating to weighted VDV had graphs with similarly differing slopes that were evaluated for bias by hypothesis tests.)

Regarding the possibility of bias in ratings as a function of simulator seating position, in addition to the correlation coefficients that appear in the text the following graphical comparisons (Figures A5 and A6) of average ratings by seat number were made. It is concluded that approximately the same numerical rating vs. weighted RMS curve fits –regardless of seating position.

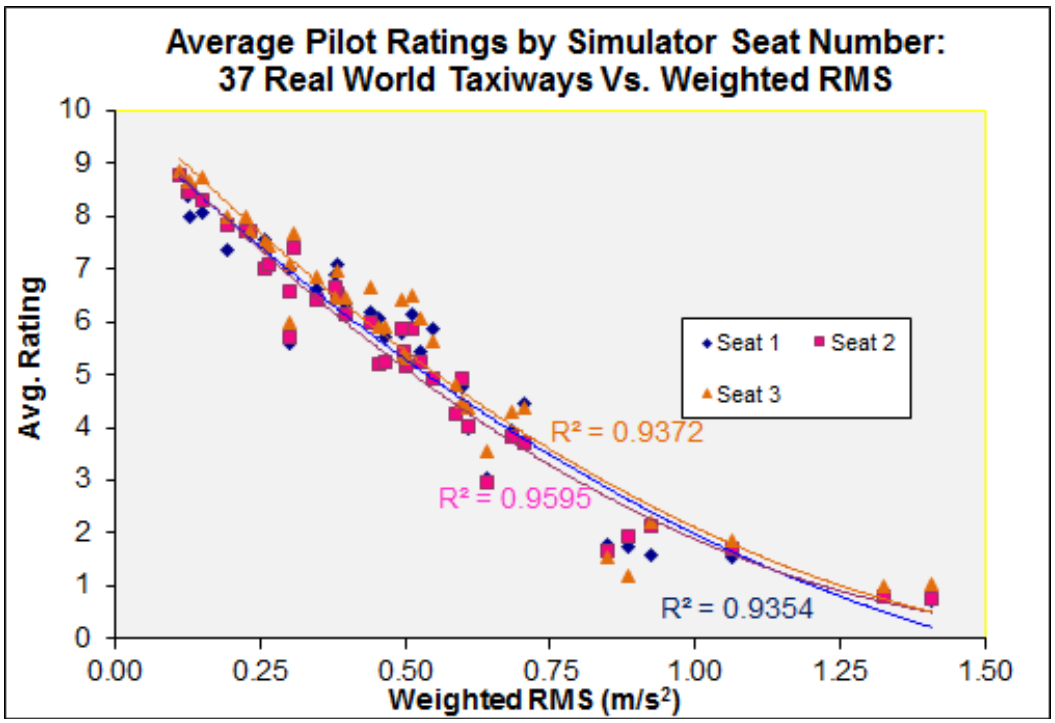

Figure A5. Average Pilot Numerical Taxiway Ratings Vs. Weighted RMS by Seat Number

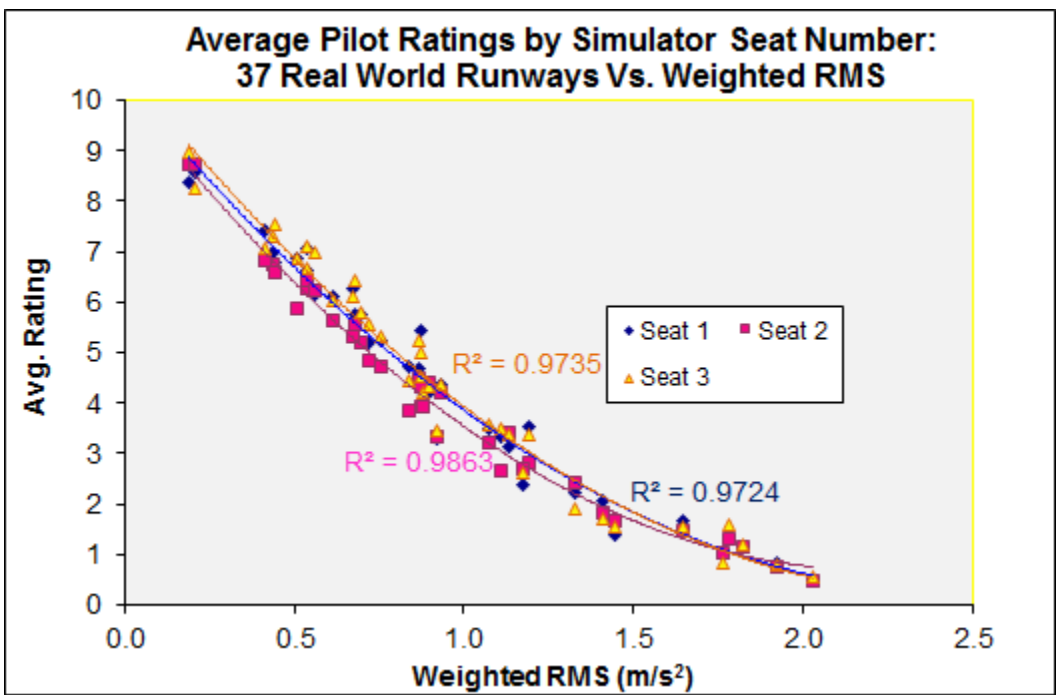

Figure A6. Average Pilot Numerical Runway Ratings Vs. Weighted RMS by Seat Number

When generic taxiway and runway data was combined with real world data the following graphs resulted.

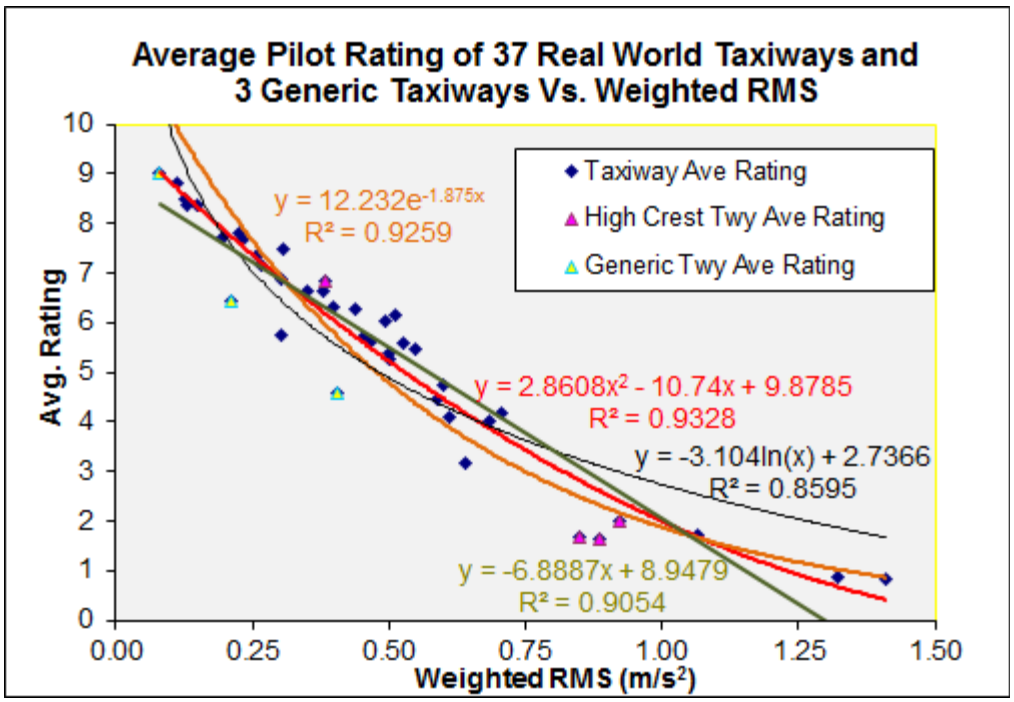

Figure A7. The Off-Trend Behavior of Generic Taxiway Average Ratings Vs. Weighted RMS

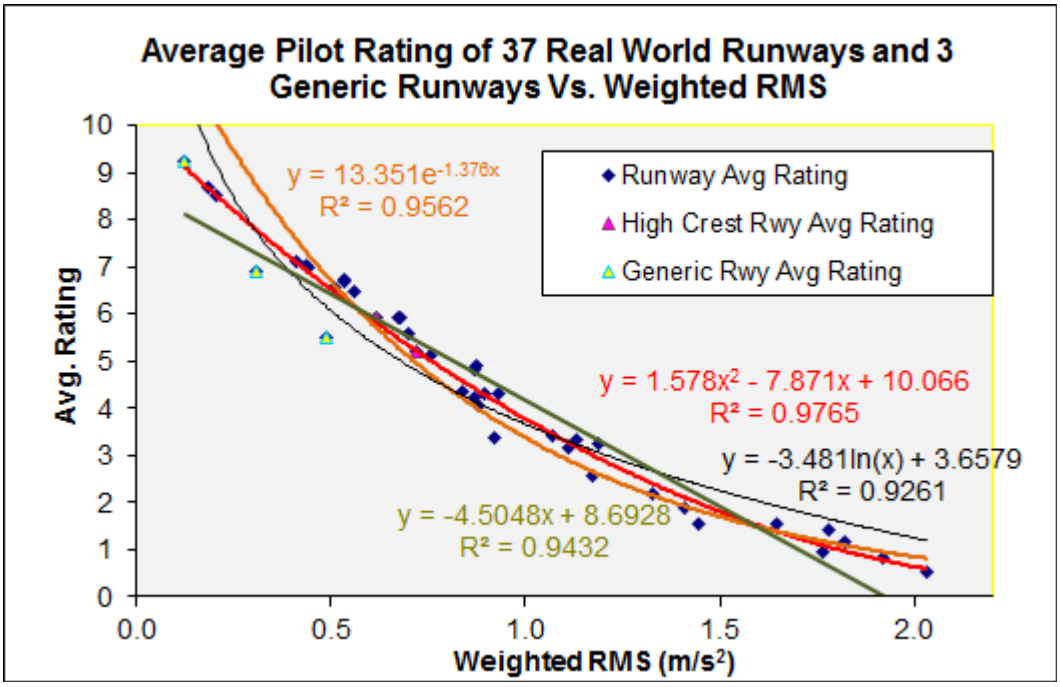

Figure A8. The Off-Trend Behavior of Generic Runway Average Ratings Vs. Weighted RMS

Simple (cubic) polynomial fits were made for comparison with the logistic regression to fit percent of pilots rating a taxiway or runway acceptable (y) as a function of pilot average numerical rating (x). For taxiways the polynomial fit was

$$y = \begin{cases} 100 & (0 \le x < 0.2132) \\ 0.4222x^3 - 5.1001x^2 + 1.068x + 100 & (0.2132 \le x \le 7.3447) \\ 0 & (x > 7.3447) \end{cases} \tag{1}$$

and for runways the fit was

$$y = \begin{cases} 100 & (0 \le x < 0.3940) \\ 0.3479x^3 - 4.5896x^2 + 1.7543x + 100 & (0.3940 \le x \le 7.7315) \\ 0 & (x > 7.7315) \end{cases} \tag{2}$$

Graphs of these appear in the figure below - in which the second graph is a close up view of the first graph in the critical region.

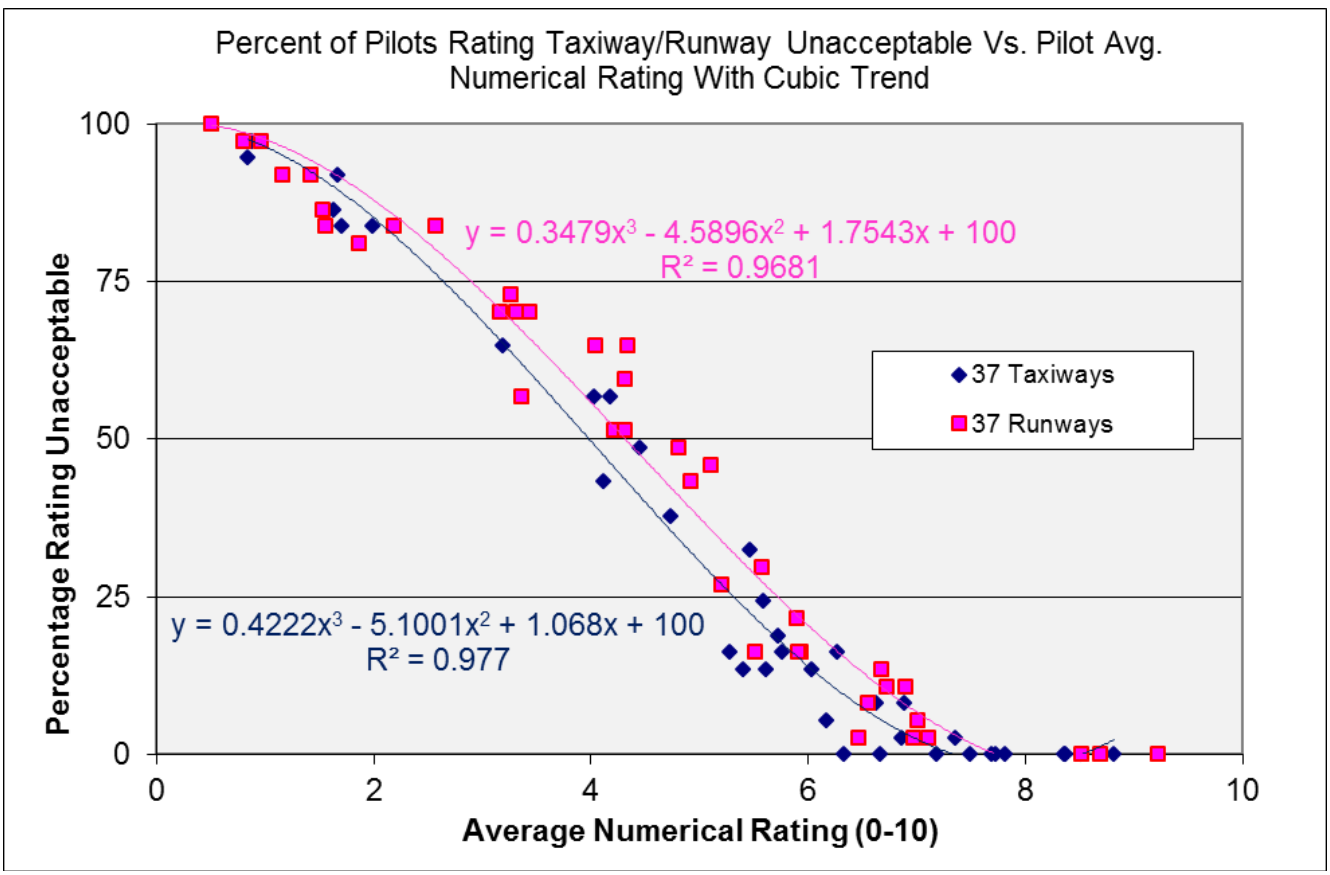

Figure A9. Cubic Polynomial Fits to Percent Acceptable Ratings Vs. Numerical Ratings

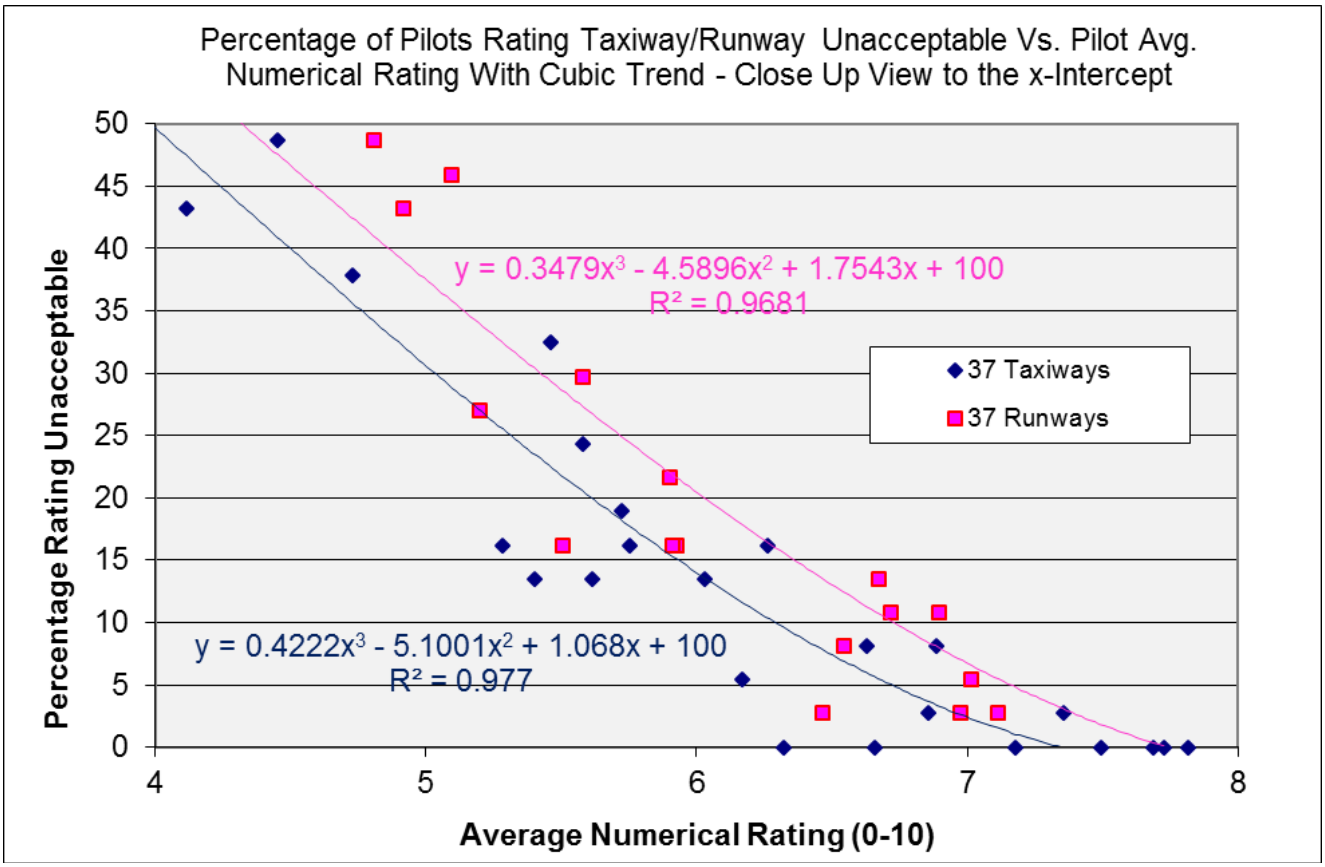

Figure A10. Close-Up of Cubic Polynomial Fits to Percent Acceptable Ratings Vs. Numerical Ratings

Table A1 extracts some specific numerical ratings at which rides become unacceptable by these polynomial fits.

Table A1. Pilot Average Numerical Rating of a Taxiways or Runway When 5%, 10%, or 50% of Pilots Rate the Ride as Unacceptable Estimated by Cubic Polynomial Fits

Amount Unacceptable	Taxiway Rating (0-10)	Runway Rating (0-10)
5%	**6.7188**	**7.1574**
10%	6.2904	6.7282
50%	3.9841	4.3186

Hence, if taxiways and runways are considered unacceptable when 5% of pilots rate them as unacceptable then by means of polynomial approximation a taxiway becomes unacceptable at a pilot average numerical rating of about 6.7 and a runway becomes unacceptable at a pilot average numerical rating of about 7.2. If the 5% criterion is used as a threshold for calling a taxiway or runway unacceptable and the polynomial fit of percent unacceptable versus average numerical rating is applied then Table A1 provides the ranges of unacceptable ISO index values.

Table A1 is to be compared with Table 2 of Section 4.3.1, in which the (usual) logistic regression was made to the same data points. The actual function to fit human unacceptability versus numerical rating is unknown; so this alternative interpolation is provided in order to provide an estimate of the uncertainty in Table 2.

Table A2. ISO Index Values at Which 5%, 10% and 50% of Pilots Are Estimated by Cubic Polynomial Fit to Rate a Taxiway or Runway as Unacceptable

ISO Roughness Index	Index Value When 5% of Pilots Rate the Taxiway as Unacceptable	Index Value When 10% of Pilots Rate the Taxiway as Unacceptable	Index Value When 50% of Pilots Rate the Taxiway as Unacceptable	Index Value When 5% of Pilots Rate the Runway as Unacceptable	Index Value When 10% of Pilots Rate the Runway as Unacceptable	Index Value When 50% of Pilots Rate the Runway as Unacceptable
Weighted RMS (m/s^2)	***0.33***	***0.38***	***0.69***	***0.41***	***0.47***	***0.90***
Weighted MTVV (m/s^2)	***0.76***	***0.90***	***1.77***	***0.85***	***1.00***	***1.91***
Weighted VDV ($m/s^{1.75}$)	***4.38***	***5.13***	***9.55***	***4.95***	***5.74***	***10.84***
DKup (m/s^2)	***1.95***	***2.30***	***4.59***	***2.07***	***2.44***	***4.79***

Table A2 should be compared with Table 3 of Section 4.3.2, which was computed using logistic regression. The different values here are the result of using a cubic polynomial instead of a logistic regression to fit pilot unacceptability percentage versus ISO indices. This method of interpolation is provided to give the reader an idea of how much uncertainty is possible in the numbers of Tables 3 and 4, since the exact form of an interpolating function to subjective human response is unknown. Table 3 is preferred to Table A2 because the logistic fit has better end behavior (better behavior for large and small pilot percentages). Confidence intervals to better quantify uncertainty in the index values shown in Table 3 are considered unreliable and were not calculated.