Department of Infrastructure and Regional Development, consultation on "Guidance Note 3A Probabilistic Contingency Estimation".

Engineers Australia Submission

14 July 2017

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Forward

In May 2017, the Department of Infrastructure and Regional Development invited members of the public and relevant organisations, including Risk Engineering Society (RES)—which is a technical society of Engineers Australia—to provide review and comment on the draft version of *Guidance Note 3A – Probabilistic Contingency Estimation* during the consultation period.

The consultative document aims to establish the principles for determining an appropriate project contingency allowance using a probabilistic methodology, noting that the Department requires a probabilistic cost estimation process be used for projects for which Commonwealth Government funding is sought with a total anticipated Outturn P90 cost (including contingency) exceeding $25 million.

Engineers Australia, through the national executive committee of RES, has prepared this response. The response addresses parts of the Guidance Note 3A that fall within the area of expertise of RES and refers, where appropriate, to other relevant reference documents.

To discuss the contents of this submission further or to arrange a meeting, please contact the NSW President of the Risk Engineering Society:

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Introduction

Engineers Australia and the Risk Engineering Society (RES) appreciate the opportunity to respond to the Department of Infrastructure and Regional Development consultation on "Guidance Note 3A Probabilistic Contingency Estimation".

The Institution of Engineers Australia (Engineers Australia) is the not-for-profit professional association for engineers. Established in 1919, Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

Engineers Australia is the trusted voice of the profession. We are the global home for engineering professionals renowned as leaders in shaping a sustainable world.

The Guidance Note 3A aims to establish the principles for determining an appropriate project contingency allowance using a probabilistic methodology, noting that the Department requires a probabilistic cost estimation process be used for projects for which Commonwealth Government funding is sought with a total anticipated Outturn P90 cost (incl. contingency) exceeding $25m.

The objective of this Guidance Note is to provide guidelines for probabilistic contingency estimating that it is expected most practitioners would consider good practice and that will provide a consistent approach to contingency estimation where a probabilistic approach has been used. Hence, RES noted the key objectives of this consultative document as below:

a. good practice of probabilistic contingency estimation
b. consistent approach to contingency estimation

For clarity on RES overall opinion as well as highlighting the key areas of concern, this response has been structured against the two key objectives above. However, some additional comments have been also included in Appendix A.

It should be noted that RES provided its response to those parts that fall within the area of competence of RES and refer, where appropriate, to other relevant reference documents and guidelines including the list below.

a. (2015) HM Treasury Infrastructure UK – Guidance '*Early financial cost estimates of infrastructure programmes and projects and the treatment of uncertainty and risk*'
b. (2009) USA Government Accountability Office (GAO) Cost Estimating and Assessment Guide – Best Practices for Developing and Managing Capital Program Costs (March 2009, GAO-09-3SP)
c. (2014) USA Joint Agency Cost Schedule Risk and Uncertainty Handbook, the Joint CSRUH serves as a reference for USA Navy, Marine Corps, Army, Air Force, Missile Defense Agency and NASA cost analysts for incorporating risk and uncertainty within cost estimates. The handbook also incorporates consideration of schedule uncertainty, risk registers, historical uncertainty in input parameters, improved risk expert, elicitation, and other recent areas of innovation. (JA CSRUH, 12 March 2014)
d. (2007) USA Department of Transportation – Federal Highway Administration, Major Project Program Cost Estimating Guidance (January 2007)
e. (2016) Risk Engineering Society Contingency Guideline
f. Book, S, (2006), A Theory of Modelling Correlations for Use in Cost-Risk Analysis
g. (2015) NASA (2015) Cost Estimating Handbook Version 4.0
h. (2013) NASA Analytic Method for Probabilistic Cost and Schedule Risk Analysis

i. UK HM Treasury, The Green Book, Appraisal and Evaluation in Central Government
j. (2009), US Army Corps of Engineers, Cost/Schedule Risk Analysis Guidance, USACE.

General Comments

RES found the current structure and content of the document is quite difficult to follow, e.g. chapter 2 'Introduction to Probabilistic Cost Estimation', then chapter 3 'Contingency Estimation' and then back to 'Quantitative Risk Assessment' in chapter 4.

RES suspects that most Project Managers and Risk Managers may not be able to utilise this test regularly and efficiently due to it reading like an academic text book. In order to target the necessary audience, the text should be simplified, using simple English and simplified process models as well as a logical structure of contents.

A number of definitions have been used inconsistently across the document, e.g. 'Probabilistic Estimating' vs 'Probabilistic Cost Estimation' vs 'Quantitative Risk Assessment', etc.

Since the introduction of the 'Risk-Driver' terminology for estimation of project cost risks in early 2000 by a number of individuals and organisations including Evin Stump P.E. in 2000, David Hulett in 2001 and Asian Development Bank in 2002, there have been quite a wide range of different interpretations of this method and its applications especially between the resource and transport sectors.

RES believes that although the proposed 'risk-factor' approach by this consultative document is referring to the original 'Risk Driver' methodology introduced by both Evin Stump and David Hulett, in fact it's actually a different method and should be only named as 'risk-factor' which is also aligned with the 'risk-factor' module within the Pertmaster software, currently known as Oracle Primavera Risk Analysis, as a quick and easy high level schedule risk modelling approach.

Similar to any other high level top-down approach, while the proposed risk-factor method may be reasonable at early project development phases and optioneering assessment especially for self-contained projects, it may not pass the scrutiny required at the key investment decision points, e.g. Final Business Case, particularly from government perspective and best value for public money.

RES is not aware of any key government organisation in USA, UK or APAC which has implemented or recommended this 'risk-factor' methodology, for cost contingency estimation of major infrastructure investments as per the recommendations of this consultative document.

RES would also like to highlight that the proposed 'risk-factor' methodology is fundamentally different with methodologies being currently used/recommended by many government agencies across Australia for projects seeking federal, state or local government funding. While most good industry practices recommend a bottom-up approach, especially at the critical investment decision points e.g. Final Business Case, this new proposed high level top-down risk-factor approach may cause more inconsistency between agencies.

While the consultative document refers to some good industry practices, e.g. *NASA (2010) Risk-informed Decision Making Handbook*, to support its argument in some sections, it seems deliberately neglects the other relevant documents from the same source, e.g. *NASA (2015)*

Cost Estimating Handbook Version 4.0, which actually recommends a different approach to the probabilistic cost estimation.

While the consultative document provides some references to few guidelines and industry recommended practices on this risk-factor approach, e.g. notes from *Stump (2000)* or *AACEi (2008) PR No. 41R-08 Risk Analysis and Contingency Determination Using Range Estimating*, it provides recommendations which in fact are not made by those reference documents.

Evin Stump P.E. (August 2000) was clearly trying to challenge the most commonly used approach to quantitative estimation of project cost risks at the time – which was *'to estimate a "nominal" cost for each work element of the project's work breakdown structure, subjectively assign cost risk distributions to those nominal values, then run a Monte Carlo simulation to obtain a risk distribution of the cost sum.'*

a. Evin's proposed 'Risk Driver' methodology, had a common architecture for treatment of each risk driver. These were its main features below.
   i. Statement of risk
   ii. Statement of outcomes and probabilities
   iii. Statement of work element cost impacts
   iv. Monte Carlo treatment

b. It is obvious that the proposed risk-factor approach by this consultative document is actually different with the original risk-driver methodology by Evin Stump (2000). The method is actually well aligned with the risk-factor module in Pertmaster software.

c. Similarly, the proposed risk-factor approach by this consultative document is actually different with the proposed risk-driver methodology by David Hulett (2001).

AACEi (2008) PR No. 41R-08 Risk Analysis and Contingency Determination Using Range Estimating clearly states that the key to performing risk analysis using range estimating is to properly identify those items that can have a critical effect on the project outcome and in applying ranges to those items and only to those items.

a. It continues by clarifying that a critical item is one whose actual value can vary from its target, either favourably or unfavourably, by such a magnitude that the bottom line cost (or profit) of the project would change by an amount greater than its critical variance.

b. It is obvious that the proposed risk-factor approach by this consultative document is actually different with the proposed methodology by *AACEi (2008) PR No. 41R-08 Risk Analysis and Contingency Determination Using Range Estimating*.

Overall it seems the consultative document and its recommended risk-factor approach may have been strongly influenced by the personal opinions of some individuals or private organisations and to have chosen not to consider a number of good industry guidelines currently being used and recommended by similar public organisations across the world. RES would also like to highlight that there are 17 references, excluding the section of 'References and further reading', to *Mr. John Hollmann* and *Broadleaf Capital Pty Ltd* (or its employed individuals) across the document.

In RES' view, the focus of consultative document is strongly on the cost. Schedule impacts have been only included as an extension of cost. However, RES believes that schedule contingencies are equally important and should be included in the project schedule and for cash flow purposes. The schedule impacts can be captured at the package level in cost model to inform a more accurate impacts of risks at the package level.

The guidance note heavily focuses on the risk factors within the estimate and less on the risk events, i.e. contingent risks. RES believes the contingent risks are also equally important and the management's attention is required in managing the contingent risks by lowering the likelihood and/or consequences if they cannot be avoided. As such, depending on the stage of project lifecycle, it is not only important to include the key contingent risks in the model for contingency assessment purposes, but also for wider objective of risk assessment and treatment actions.

While RES definitely believes there are many opportunities to improve the maturity of cost risk modelling in our profession nationally, RES does not certainly believe that the proposed risk-factor methodology, with possibly higher contingency allowance outcomes especially at the P90 level, would be the best step towards that direction for achieving the best value of investment along the project lifecycle (especially at the Final Business Case) for the Department, industry and eventually the People of Australia.

Considering the critical impact of this consultative document not only on major projects but across the industry, RES is definitely more than happy to support the Department for further review and development of this important document prior to its final publication.

Objective 1 – good practice of probabilistic contingency estimation

RES does not believe that the recommended risk-factor approach by the consultative document achieves the *Objective 1, good practice of probabilistic contingency estimation* for being the good practice of probabilistic contingency estimation, especially within the infrastructure sector during project lifecycle, due to the key reasons described below.

RES is not aware that the proposed risk-factor approach has actually been recommended/used by any other key government and public organisations globally since the introduction of concept.

A number of key current references and industry good practices, including the documents below, have been unexpectedly and surprisingly excluded during the development of this consultative document. RES would like to highlight that none of the key references below support or recommend the proposed risk-factor methodology.

a. (26/Mar/2015) HM Treasury Infrastructure UK – Guidance '*Early financial cost estimates of infrastructure programmes and projects and the treatment of uncertainty and risk'*
b. (2009) USA Government Accountability Office (GAO) Cost Estimating and Assessment Guide – Best Practices for Developing and Managing Capital Program Costs
c. (2014) USA Joint Agency Cost Schedule Risk and Uncertainty Handbook, the Joint CSRUH serves as a reference for USA Navy, Marine Corps, Army, Air Force, Missile Defense Agency and NASA cost analysts for incorporating risk and uncertainty within cost estimates. The handbook also incorporates consideration of schedule uncertainty, risk registers, historical uncertainty in input parameters, improved risk expert, elicitation, and other recent areas of innovation. (JA CSRUH, 12 March 2014)
d. (2007) USA Department of Transportation – Federal Highway Administration, Major Project Program Cost Estimating Guidance (January 2007)

e. (2016) Risk Engineering Society Contingency Guideline
f. Book, S, (2006), A Theory of Modelling Correlations for Use in Cost-Risk Analysis
g. NASA (2015) Cost Estimating Handbook Version 4.0
h. NASA (2013) Analytic Method for Probabilistic Cost and Schedule Risk Analysis
i. UK HM Treasury, The Green Book, Appraisal and Evaluation in Central Government
j. (2009), US Army Corps of Engineers, Cost/Schedule Risk Analysis Guidance, USACE.

While the proposed risk-factor methodology may be adequate for the projects that are relatively self-contained or at the early stage of development, e.g. projects within the resource sector or at the initiation or optioneering phase, RES does not believe that it fully addresses all requirements of infrastructure projects due to the nature of infrastructure cost uncertainties. *HM Treasury Infrastructure UK Guidance of cost estimate* states that the contingency element of any cost estimate needs to account for the likelihood and cost impact of three groups of factors:

- specific risks that are measured uncertainties,
- defined but unmeasured uncertainties around the estimate
- unknown uncertainties that at a given time are not known or understood

The United Kingdom's HM Treasury Infrastructure UK Guidance of cost estimate clearly affirms that for projects that are relatively self-contained, contingency is primarily concerned with the first two of these. In the early stages of large infrastructure projects, a significant proportion of the risk exposure comes from the last bullet above. These may derive from complex interfaces with the physical environment into which the infrastructure is to be built (i.e. the route of the transport link or the site of a flood defence) and the unpredictable responses and requirements of stakeholders affected by the siting or performance of the infrastructure assets.

a. Hence, the Guidance strongly recommends the number of undefined uncertainties should be regularly challenged and ultimately reduced through the application of quantified risk assessments as design and project maturity develops.
b. By undermining the last bullet above and simplifying the requirements to the first two bullet points, the proposed risk-factor methodology by this consultative document is actually discouraging the good practice of proactive qualitative and quantitative risk management, e.g. refer to Section '4.3: Risk Events'.
c. RES believes that similar to other aspects of development and delivery of complex infrastructure projects, *Wave Planning* is definitely a good practice as the number of undefined uncertainties, e.g. new schedule activities, risks, etc., should be regularly challenged, quantified and managed as design and project maturity develops.

The risk-factor approach does not consider the phase of project lifecycle e.g. initiation, optioneering, FBC or during delivery. While this high level top-down approach may result in reasonable cost contingency allowance at the early phases of project development, i.e. initiation and Strategic Assessment, it may not necessarily generate an optimum allowance for the best value for money at the later phases, e.g. FBC.

The proposed methodology has not been tested by similar government agencies for generating the best value for money, i.e. optimum cost contingency for Commonwealth's desired confidence level.

Objective 2 – consistent approach to contingency estimation

RES does not believe that the recommended approach by the consultative document achieves the *Objective 2* for driving a consistent approach to contingency estimation due to the key reasons described below.

Similar to any other high level top-down approach, the selection and modelling of risk-factors are very subjective, e.g. the uncertainty of labour rate can be modelled as one factor impacting all construction disciplines for example earthwork, structure and demobilisation activities or it can be modelled as three different factors for each construction discipline. This subjectivity will increase the risk of inconsistency between models and their outcomes between agencies and even their different teams.

The proposed risk-factor methodology is fundamentally different with most existing methodologies being currently used/recommended by many government agencies across Australia. While the proposed GN3A aims to establish the principles for a probabilistic cost estimation process for projects for which Commonwealth Government funding is sought with a total anticipated Outturn P90 cost exceeding $25m, RES believes this may result in more inconsistency due to current capabilities and models being/will be used for other projects for which different funding is sought.

RES would also like to highlight the possible challenges for benchmarking purposes nationally and globally considering that the proposed risk-factor methodology has not been actually recommended by any other major similar government organisations within the infrastructure and transport sectors.

Mitigation cost is another contentious subject in project contingency modelling; often not applicable or even necessary to be quantified as the exercise is often primarily about creating a contingency rather than a qualitative treatment. But obviously for discrete risk events they should stem from a qualitative assessment/register and in that regard have a treatment. Closing the loop back to the source qualitative risks after quantitative modelling is always as aspect RES is recommended on.

RES Key Recommendations

RES also supports Evin Stump P.E. (Aug 2000) view on associated challenges to the most commonly used quantitative risk analysis – *'to estimate a "nominal" cost for each work element of the project's work breakdown structure, subjectively assign cost risk distributions to those nominal values, then run a Monte Carlo simulation to obtain a risk distribution of the cost sum.'.*

However, while the recommended risk-factor approach by this consultative document may address some of these issues as a high level top-down approach, RES does not actually believe that the risk-factor method, through experience and research, has enough evidence to reliably lead to an optimum cost contingency for the Department, as an Australian Government organisation especially at the critical phase of Final Business Case.

RES strongly recommend the Department to consider other good practices currently being used by similar government organisations globally for further development/amendment of this Guidance Note 3A prior to its publication.

To address these challenges, including consistency not only between Australian government agencies but also their counterpart organisations globally, and to ensure an optimum cost contingency will be assessed, especially for transport projects with many complex interfaces at the Final Business Case, RES briefly recommends the assessment of cost contingency estimation as below:

a. there are two types of risk drivers:
   i. Key uncertainties at the lowest level of first principles estimate, against sub-contract, material, labour, equipment, etc.
   ii. Top 20 contingent risks

b. for inherent risks, the key risk drivers should be identified by the size of their impact on the project cost by using a number of recommended impacts, e.g. AACEi's PR 41. The ranges will then be allocated to those items, against sub-contract, material, etc.

c. the overall impact of these key risk drivers will be then combined to a higher level of the project WBS, e.g. WBS L4. The inherent risk will be then modelled at this level.

d. to assess, quantify and model contingent risks:
   i. global experience, supported by HM Treasury Infrastructure UK Guidance of cost estimate, shows the same categories of contingent risks tend to recur across similar infrastructure projects. Therefore, the effective use of appropriate reference risk data should allow the cost impacts to be sufficiently well understood to form part of a reasonably robust estimate - even at early stages in the infrastructure project life cycle.
      - There are a number of good lists, e.g. prepared by Mott MacDonald, which are a good starting point to undergo a structured assessment of the areas under which reference data should be sought. RES definitely recommends the Department to further review and revise the proposed methodology and its position on risk management including 'risk events'. Top 20 risks will be quantified and modelled against the project WBS, e.g. WBS L4.

e. to review, quantify and model correlations:
   i. to identify key direct dependent variables within the estimate, e.g. if design has been estimated as 8% of direct cost, then correlate these by using links and formulas between variables.
   ii. for inherent risks – to develop approximate correlation coefficients between appropriate WBS level, e.g. WBS L4 by using Low=-+0.02, Mild=-+0.2, Moderate=-+0.6, and High=-+0.8. This can be as simple as determining whether two WBS elements are correlated by a small amount or by a large amount and whether that correlation is positive or negative.
      - this approach has been also recommended by US Government Accountability Office (GAO) Best Practices for Developing and Managing Capital Program Costs (Mar 2009) as well as NASA's Cost Estimating Handbook Version 4 (Feb 2015).
   iii. for top 20 contingent risks:
      - correlations between contingent risks: a 20X20 correlation matrix to be developed. This can be similarly done by using approximate correlation coefficients between contingent risks, e.g. Low=-+0.02, Mild=-+0.2, Moderate=-+0.6, and High=-+0.8.
      - correlations between the impact of contingent risks on WBS, e.g. at WBS L4: a table of top 20 risks against an appropriate WBS level, e.g. L4 to assess the potential impact on WBS element if the risk

occurs – for example BC (95%)-ML (105%)-WC (130%). It should be noted that considering the potential impact of contingent risk on WBS element by using % on its Base Estimate, the BC and ML impacts on specific WBS level can be more than 100% too.

- this approach has been also recommended by the original Risk Driver methodology introduced by both Evin Stump (2000) and David Hulett, (2001).

iv. such an approach will also support further education of estimators and risk modellers for the good practice of probabilistic estimation and required different correlation modelling for both inherent and contingent risks.

f. to develop appropriate distributions to the inherent risks, at appropriate WBS level e.g. L4, and the contingent risks.

g. to run Monte Carlo Simulation.

h. to review the outcomes and finalisation of assessment.

Conclusion

For the benefits of the risk engineering profession and also to ensure the best value for money and optimum cost contingencies will be assessed to meet Australian Government requirements, RES would welcome an opportunity to discuss its views, comments and recommendations with the Department for further development of this Guidance Note 3A prior to its publication.

To discuss the contents of this submission further or to arrange a meeting, please contact the NSW President of the Risk Engineering Society:

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Appendix 1 – Additional Comments

The following are comments on specific points within the draft Guidance Note.

#	GN3A	RES Comment / Recommendation
1	Page 10 – definition of AACEi	The legal corporate name is AACE International, Inc. AACEi previously referred to the Association for the Advancement of Cost Engineering International.
2	Page 10 – definition of 'Contingent Risk'	Not necessarily attached to unmeasured items, e.g. the Base Estimate may already have some allowance for volume of contaminated soil with a range due to uncertainty associated with current available data, however there is still a risk of 5% chance with 200% additional cost due to its poor site management. RES Contingency Guideline defines 'Contingent Risk' as type of risk caused by unmeasured items outside the Base Estimate, which may or may not materialise. The likelihood of occurrence of a contingent risk is always less than 100%.
3	Page 10 – definition of 'Correlation'	Not necessarily one variable's probability distribution related to another – correlation is a statistical measure that indicates the extent to which two or more variables rise and fall together.
4	Page 12 – 'PCB'	The term has not been used in the document.
5	Page 12 – definition of 'Risk Factor'	As defined by Evin Stump P.E. (2000), 'A risk driver is any root cause that MAY force a project to have outcomes different than the plan.' 'Risk Factor' is an interpretation of 'Risk Driver' method and is not actually the same as 'Risk Driver' suggested by Evin Stump.
6	Page 22 – 'Infrastructure Investment Programme (IIP)'	Needs to be defined.
7	Page 22 – portfolio theory	Needs to be clarified and explained.

8	Page 30 – Quantitative Risk Assessment	Needs to be defined.
9	Page 31 – Robust decision	This is more relevant to the risk-based decision making not the probabilistic cost estimation.
10	Page 32 – Figure 8	What is the Deterministic model? It is confusing and may be misleading to deterministic contingency calculation. The process is an iterative process not linear. Also there are some additional key elements/inputs e.g. schedule risk, correlations, Also it should be noted that it's expected to use the 'Residual Risks' for the purpose of QRA. Some treatment costs may need to be pushed back to the Base Estimate. RES suggests this process to be re-drawn and developed further.
11	Page 33 – definition of 'Risk Factor'	Risk Driver versus Risk Factor, as highlighted above.
12	Page 34 – paragraph 3 – "Where is insufficient time or an approximate answer will be sufficient, ..."	This is exactly the critical point. While the high level top-down approaches might be sufficient and reasonable at the early stages of infrastructure development, e.g. initiation or strategic assessment stages, RES does not believe they can produce the most optimum and best value for money outcomes for Government at the Final Business Case phase.
13	Page 35 – paragraph 2 – "The key principle when selecting risk factors is to ..."	In practice, this will cause more inconsistency between models, assumptions and outcomes making benchmarking and sharing knowledge between projects more challenging.
14	Page 36 – paragraph 4 – "Aside from the problems of modelling a large number ..."	This is a personal opinion of Mr John Hollmann and not supported by other good industry risk management practices. Similar to most management tools, a proactive and ongoing application of tools and methods is recommended, e.g. Wave Planning methodology. RES believes this section considerably undermines the importance of

		proactive and ongoing risk management in accordance with Government's risk management policies.
15	Page 36 – paragraph 8 – "…, the need for a large number of separate small and medium sized event risks falls away."	Even if this statement is true from the cost variation purposes, the key reason almost all good industry practices recommend to assess and quantify contingent risks is to encourage the conversation between a wide range of teams, including estimators, planners, risk managers, benefit managers, etc. to fully understand and assess risks and opportunities as well as the possible treatments and action plans.
16	Page 40 – paragraph 1 – "… generates broadly the same type of outcome as is …"	Comment as above.
17	Page 40 – paragraph 4 – "Experience with this method shows that the …"	RES is not aware of any similar government organisation globally which is using or recommending this method. References to mentioned experiences is needed.
18	Page 40 – section 4.4: 'Uncertainty that should not be captured'	RES suggest these key uncertainties to be captured and documented from risk management point of view but only some of them should be 'quantified'.
19	Page 44 – Unknown unknowns	RES believes this statement is only a personal opinion of Mr. John Hollmann. As stated by a number of good industry practices, e.g. HM Treasury Infrastructure UK Guidance of cost estimate, this might be the case for projects that are relatively self-contained, however in the early stages of large infrastructure projects, a significant proportion of the risk exposure comes from the unknown unknowns. These may derive from complex interfaces with the physical environment into which the infrastructure is to be built (i.e. the route of the transport link or the site of a flood defence) and the unpredictable responses and requirements of stakeholders affected by the siting or performance of the infrastructure assets.
20	Page 53 – section 5.5	RES believes these approaches are rarely, if ever, being used in undertaking probabilistic cost estimation of infrastructure projects. In addition to their applications in practice, it should be also noted the unbalanced level of approaches recommended by the document.

21	Page 56 – paragraph 2, first bullet point	While having a simple model is recommended, however, RES believes the level of details in the cost risk model and should be also a function of project complexity and the stage of project investment.
22	Page 60 – paragraph 4	This statement is obviously different with the Risk Driver method originally suggested by Stump (2000). The proposed Risk-Factor method is not actually following the original recommended Risk- Driver methodology by Stump.
23	Page 90 – last bullet point	While the proposed risk-factor methodology is suggesting this method as a way of accounting for correlation in cost-risk analysis, RES believes this has not been recommended or used by any other good industry practices and/or similar government organisations.
24	Page 100 – paragraph 3	A detailed appendix on the subject of 'correlation' while at the end the document recommends that the proposed risk-factor method describes cost uncertainty in a way that minimises the amount of correlation between model components that has to be modelled using correlation factors.
25	Page 105 – paragraph 3, "… The tails of the triangular distribution are also …"	Another top-down and conservative assumption to just generate a number rather than supporting the good practice to improve certainty of tails of the distribution.
26	Page 106 – paragraph 4	A number of industry practices, including GAO-09-3Sp, recommend that the triangular, lognormal, beta, uniform, and normal distributions are the most common distributions that cost estimators may use to perform an uncertainty analysis.
27	Page 107 – paragraph 9	RES disagree with this statement. As recommended by other good practices, while the uncertainties can be allocated to key items (risk driven approach), then correlations can be assessed and modelled at appropriate WBS level for a more accurate and optimum bottom-up approach to cost contingency calculation.

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