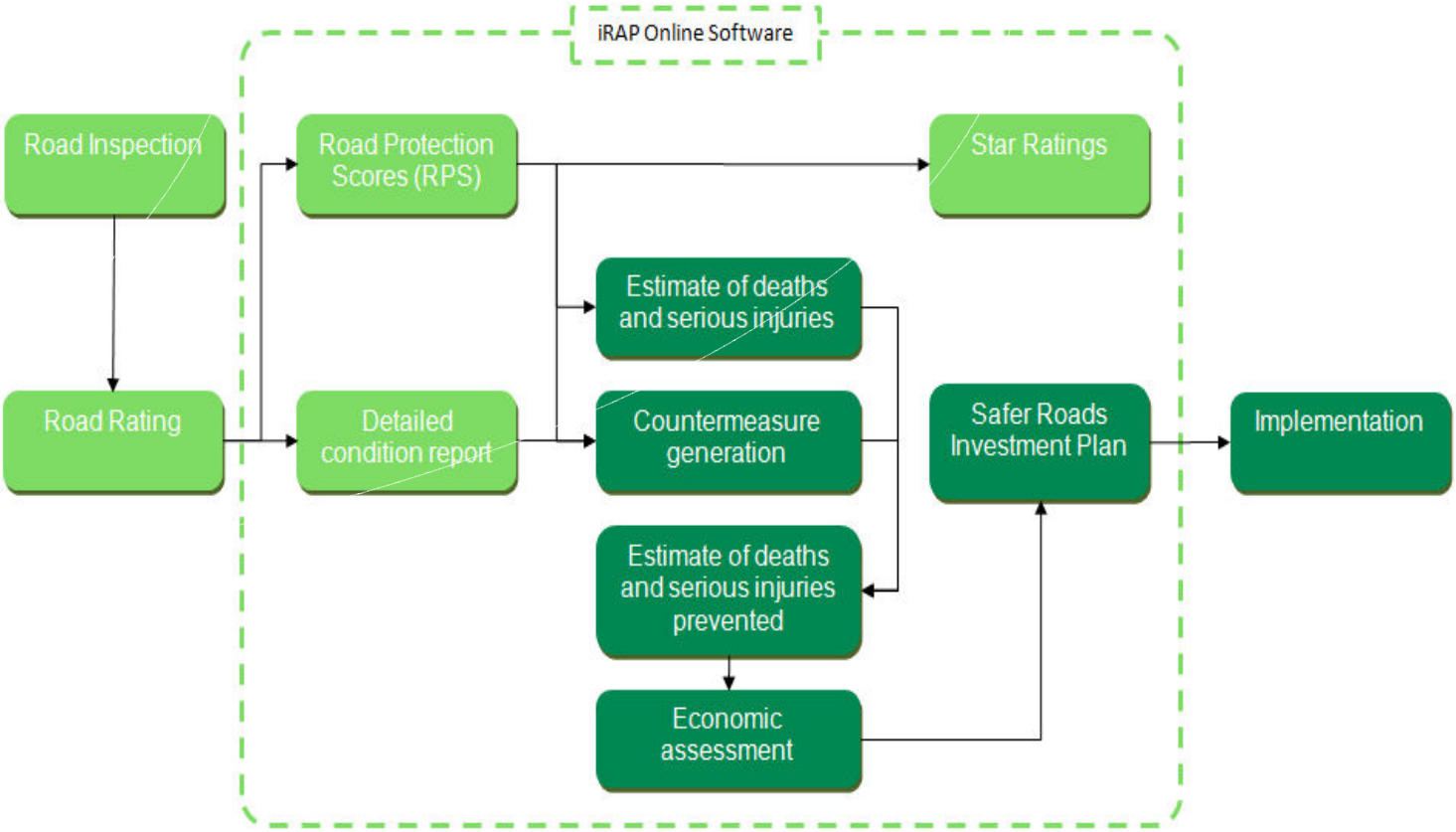
The iRAP Worting House Workshop 2010

Review of the iRAP Road Protection Score model and Star Ratings



12-13 May 2010

Basingstoke, UK

iRAP
INTERNATIONAL ROAD ASSESSMENT PROGRAMME

About iRAP

The International Road Assessment Programme (iRAP) is a not-for-profit organisation dedicated to saving lives through safer roads.

iRAP works in partnership with government and non-government organisations to:

- assess high-risk roads and develop Star Ratings and Safer Road Infrastructure Plans
- provide training, technology and support that will build and sustain national, regional and local capability
- track road safety performance so that funding agencies can assess the benefits of their investments.

Road assessment programmes are now active in more than 50 countries throughout Europe, Asia, the Pacific, North and South America and Africa.

iRAP is supported by the FIA Foundation for the Automobile and Society. Its projects receive support from the World Bank Global Road Safety, regional development banks and donors.

National governments, automobile associations, charities, the motor industry and institutions such as the European Commission also support road assessment programmes in the developed world (EuroRAP, AusRAP, usRAP and KiwiRAP) and encourage the transfer of technology to iRAP. Many senior individuals donate their time and expertise to support iRAP.

Workshop purpose and participants

In May 2010 a high-level workshop was organised to assess and peer review the iRAP Road Protection Score and associated Star Ratings. The workshop addressed issues such as the structure of the iRAP model and the influence of different variables within it. It included a detailed review of the way in which iRAP includes the role of speed within the model as a contributor to crash likelihood and severe injury generation.

The workshop was targeted at a small group of independent global road safety experts with a strong background in research and policy. The iRAP Global Technical Committee and iRAP Technical Working Group also contributed to the workshop.

Participants:

John Dawson (iRAP Chairman and Workshop Chairman)

Nimmi Candappa, Monash University Accident Research Centre *(representing Professor Fred Wegman (SWOV and chair of World Bank GRSF Core Advisory Group))*

Peter Daly (RACV, Australia)

Professor Rune Elvik (Institute of Transport Economics, Norway) – first day only

Dr Sangjin Han, (Centre for Green Growth Research, Korea Transport Institute)

Doug Harwood (Midwest Research Institute, US)

Eric Howard (Independent Consultant, Australia)

Ben Johnson (TRL) – first day only

Dr Steve Lawson (Technical Director, iRAP)

Rob McInerney (iRAP CEO)

Dr John Mumford (International Director, iRAP)

Lluis Puerto (RACC, Spain)

Caroline Starrs (Research Analyst, iRAP)

Richard Thornton (IT and Programming Manager, iRAP)

Blair Turner (ARRB)

Apologies:

James Bradford (Engineering Manager, iRAP)

Said Dahdah (World Bank Global Road Safety Facility)

Dr Jo Hill (Programme Director, EuroRAP)

Greg Smith (Regional Director, Asia-Pacific, iRAP)

Julio Urzua (Regional Director, Latin America, iRAP)

Contents

Workshop purpose and participants 2

1 Overview of Model Review 4

2 Summary of improvement issues 4

3 Chairman's introduction and welcome – John Dawson 5

4 Star Rating roads for safety: the IRAP model and its evolution – Rob McInerney 5

5 The IRAP RPS model: overview – Dr Steve Lawson 5

6 Discussion – model characteristics 6

7 Application and validations of the iRAP model in a series of countries – Rob McInerney, Doug Harwood, Peter Daly and Dr Sangjin Han 7

8 The role of speed in injury generation and within the iRAP model – Eric Howard 9

9 Latest knowledge on speed and safe systems – Professor Rune Elvik 9

10 The proposed iRAP Speed Management Policy and model implications – Rob McInerney 10

10.1 Speed Policy 12

10.2 Recommendations for update to policy 12

11 The value of the iRAP model as a political, investment and communication tool: discussion forum led by Dr John Mumford, with Peter Daly and Dr Sangjin Han 14

12 Learning from, and overlapping with, other models and approaches – Nimmi Candappa 16

13 References 17

For more information 18

1 Overview of Model Review

The primary aim of the workshop was to open up the iRAP star rating model to independent review and comment. Feedback from the workshop participants included:

- "…impressive, comprehensive and systematic"
- "...provides researchers with a strong platform to guide research needs globally"
- recognition that the model is not perfect – but that much of the global data and research is not perfect either.
- general support for the multiplicative nature of the model but recognition that further work is needed to understand the inter-dependency of variables.
- the proposal that the inclusion of additional, less important factors (in terms of statistical explanation of risk) is not a priority – the preference is for efforts to focus on the interaction of factors as highlighted above.
- the understanding that further work is needed to investigate the sensitivity of the model and to understand the primary attributes of interest (and the cost of not knowing).
- recognition that iRAP seeks to work where data may be limited (eg existing crash, traffic data) and therefore is a combination of science, and the consensus of experience and judgment.
- encouragement of iRAP to publish further details of the model. Workshop participants supported iRAP plans to do this as the global membership structure is rolled out and include a planned and responsible release of Intellectual Property.
- support for inclusion of FAQs (Frequently Asked Questions) to assist the openness and transparency of iRAP activities (eg relationship to audits; what iRAP is).

2 Summary of improvement issues

Enhancement of model characteristics (see mainly section 6 and parts of section 7)

Professional acceptance of the model and means of explaining its functions and operation; the proposal for a "frequently asked questions" list (see mainly section 7)

Consideration of speed and its influence in injury generation (sections 8 and 9)

Actions proposed to ensure that the model's use of speed measures reflects severe risk to road users as closely as reasonably possible (section 10)

The context and opportunities provided by potential partners in the iRAP process in low- and middle-income countries (section 11)

The overlapping approaches taken by other crash reduction models and strategies (section 12)

Enhancement of the model's estimation of pedestrian exposure, the description of risks and incorporation of the countermeasures available to reduce pedestrian injury (sections 5, 9 and 11).

3 Chairman's introduction and welcome – John Dawson

The Chairman welcomed participants and outlined the Road Assessment Programme (RAP) evolution over the past 10 years from the motoring club-centred development of EuroRAP as a consumer-focused rating of roads, through to the extension of the programme to low and middle income countries through the partnership with FIA Foundation, World Bank GRSF and others. He explained that within any national iRAP project implementation, there is typically a stakeholder group including relevant government departments and the national motoring organisation. Rather than simply rating roads for safety, as in EuroRAP, the proposition is to provide a list of countermeasures and demonstrate the benefit of implementing these (a "Safer Roads Investment Plan").

The RAP programme had been successful in putting a narrative around the relevant issues, in illustrating how people were being killed and what must be done to stop this. The Chairman described the "attribute of interest" as those high-level features that distinguished between poor single carriageway roads, good dual carriageways and the best of motorway design. This provides easily-understood information about how to upgrade roads and which to target.

4 Star Rating roads for safety: the IRAP model and its evolution – Rob McInerney

RM explained the progression from a pilot study funded by 14 motoring organisations in 1999, to published work from Britain, Netherlands, Spain and Sweden, the official formation of EuroRAP in 2002, AusRAP in 2003 and usRAP in 2004. He outlined the Risk Rate Maps, the evolution of the Road Protection Score from a protection-only measure used in EuroRAP, to the addition of crash likelihood elements in AusRAP and the development of the iRAP model for low- and middle-income countries (where 85-90% of road deaths occur) and the pilot studies in Chile, Costa Rica, Malaysia and South Africa.

The iRAP model deals with car occupants and motorcyclists in head-on crashes, side impacts at intersections and run-offs and with pedestrians and cyclists as they move along or cross the road. RM provided examples of the outputs from the software, referring to the iRAP toolkit, and to the process of convergence of the models around the world.

5 The IRAP RPS model: overview – Dr Steve Lawson

SDL outlined the nature of the multiplicative models for the four road-user groups listed above and the factors that were included in each of the models and the research, literature and knowledge that lay behind this. He drew on a case study from South Korea to illustrate how a particular stretch of road would be rated. He noted the imprecise nature of this science but drew attention to the "attribute of interest" as being critical. He referred to David Lynam's comment that "The huge accident toll meant that uncertainty in casualty estimates was not critical and models focused on the main accident factors that would be useful, even if some of the safety relationships were only poorly understood". As with any model, there was an ongoing need to maintain elements and ensure that

they are working correctly, a current example being a component of the pedestrian model identified by World Bank's Said Dahdah.

6 Discussion – model characteristics

RE described the iRAP process as impressive and meaningful and the best way of approaching the problem. Some proposals for developing the process were offered:

- Collect data on a mixture of traffic so as to assess the role that it had in generating crashes (eg the vastly greater mass of trucks leading to the deaths of other road users in impacts) or user-group casualties (eg motorcyclists or slow-moving traffic being the subject of heightened risk).
- It was suggested that it was important to use the model to explore and not to wait until the model was perfect. There are parallels about learning from incomplete crash data. It may be possible to give a rating to quality of knowledge available to feed into the model. The Highway Safety Manual in the US faces similar issues in deciding which information is of sufficiently high quality to include in its processes.
- The multiplicative model was described as the only appropriate model to use but interaction effects between risk factors should be considered since clearly some risk factors are not independent of each other. A good first step may be to group some of these and assess where correlations are likely to be strongest. A rule-based assessment might then be used within the model so that double-counting of the benefits of treatment would be minimised.

DH described how the iRAP model had not been developed as a predictive tool but rather a combination of science and judgement, based upon considerable experience, had been applied to the issue. In the US Highway Safety Manual a multiplicative model was also assumed and the risk factors again assumed to be independent.

Other suggestions for work on the model included – provision of low and high estimates of casualty savings; reducing potential errors by focusing less on results for individual locations and more on the overall network; sensitivity-testing on the effectiveness of countermeasures and the length of life of measures; constructing confidence limits around BCRs; taking an incremental approach to some of these proposals and investigating outputs.

The paper by Lynam (2010) was described as very powerful (EH) and there was encouragement for iRAP to be as open as possible with its methodology, although there was recognition that some would "make mischief" with it and that it would be impossible to maintain its status as a standard technique. Once allowed out, "the genie could not be put back in the bottle" and the model and process could be abused. The iRAP board has agreed to discuss and consider how best these issues may be addressed at its next planning day.

It was recognised that the development banks may have a role in maintaining the role of the iRAP process as a common global standard and that establishing centres of excellence across the developing world from where surveys could be conducted may be a means of moving forward. iRAP wishes to be a facilitator of this process, rather than the body actually conducting the surveys.

7 Application and validations of the iRAP model in a series of countries – Rob McInerney, Doug Harwood, Peter Daly and Dr Sangjin Han

RM commented on the work that had been done in New Zealand and Australia in validating the models by comparing measures of crash risk with the RPS. Although the match between these measure is imprecise for individual sections of road, mean values of crash rates for particular groups of roads (eg dual carriageways) show that decreasing star rating is associated with increasing crash rates.

DH showed work from Iowa and Washington State that showed similar crash patterns for various highway types, for all fatal and serious injury crashes and for particular crash types. All crash types except one showed the intuitively-correct direction of the relationship (of decreasing star rating associated with increasing crash rates).

SH explained the interest in KoRAP about the interactions between variables and a wish for wider understanding of the various scaling factors among technical colleagues. He spoke of the value there would be in giving summary case studies of roads of different star ratings and the variation caused by different combinations leading to similar star ratings.

There was discussion of the potential for adding variable to the model and valuing diversity where practice between countries differs. More information on how scoring can vary by situation will be welcomed. Some testing of reliability will be helpful, as would descriptions that would enhance its academic standing. There is general recognition that iRAP cannot wait until it is 100% happy with the model before using it, but researchers need to be happy with the output and understand it before recommending it. There is much to be learned from NCAP and how it deals with similar issues.

In Korea, many highway engineers are not keen to “rate for safety”. They argue that they are already keeping to the safety guidelines in designing roads. But crashes are still happening so obviously the guidelines are not the complete answer. Similar problems of professional acceptance were encountered when road safety audit was first introduced. There is a need to make more within the profession of the positive aspects of being involved in iRAP. It would be valuable, for example, to have more information on the issues involved in moving from 4-star to 5-star roads – shortcomings on run-off, narrow shoulders and road condition were common deficiencies in lower-scoring roads.

Some elements of the role of junction density within the model were discussed and the relevance of countermeasure costs explored. There was recognition that the influence of smoothing was not perfect and that junction frequency may disproportionately affect the output in this respect.

There are similarities between RAP safety criteria and design guidelines across a range of countries. iRAP will identify high-level deficiencies and isolated examples of these. The model and the presentation of the information that it provides will be refined over time. “Institutionalisation” would be important as a means of context-setting for practitioners – understanding where the RAP sits within design and construction regulations and with sister programmes.

A list of “frequently asked questions” was beginning to appear and this could be formalised as a means of communicating the model and process.

There was discussion as to whether 100m sight distance could be incorporated as an additional variable but reservations were expressed about the significance of this variable as a major contributory factor to crashes unless associated with accesses. Nevertheless, it was recognised that existing survey technologies such as the MIDAS system in Korea offered opportunities for iRAP and that these should be explored.

The iRAP Safer Roads Investment Plans (the countermeasure proposals) are becoming more important within the process of implementing iRAP than the star rating – the star rating had begun as the “signature product” of iRAP but was now an interim step in the process. It was agreed that it was important to demonstrate the validity of the model (by means of comparison with crash data and where possible to compare with 100m data.

There was discussion of the relative safety of clear zone and barriers – a clear zone is the preferred design in the US whereas in Sweden barriers are favoured. BT reported that in Australia median widths up to 30m is the maximum. It was reported that vehicles in Australia are typically leaving the carriageway at less acute angles than those reported in many studies (and that therefore there are benefits in having wide clear zones).

Setting policy targets to move from 1-star to 2-star and from 3- to 4-star was seen as a good use of the iRAP model but it was not always clear which factors could be addressed to improve the rating. Some factors appeared to influence disproportionately. There was recognition of the role of NCAP in setting aspirational goals and driving up car safety from 3-star to 4-stars. Civil society had a part to play. Once the detail of the iRAP rating is more generally and widely understood by both professionals and the population at large, then, as with the public demand for safer cars, it would become more common for the public to press for infrastructure safety.

Shunt accidents are not currently in the iRAP model. The meeting heard that they typically account for 15-20% of deaths, but more on motorways. However, the features that lead to these deaths are often transient and generally not related to infrastructure. It was agreed to maintain a watching brief on this crash type and assess over the longer-term whether it could be modelled within iRAP. It is possible that road safety auditing or a proxy behavioural measure could be used, but there was concern that this is not iRAP’s core area of expertise. There was also concern that incorporating these crash types in the model might shift the emphasis away from dealing with the network over long sections to focusing on individual high-risk sites (“blackspots”).

8 The role of speed in injury generation and within the iRAP model – Eric Howard

Eric Howard quoted the 2006 OECD/ITF report and commented that: "Excessive and inappropriate speed is the number one road safety problem in many countries, often contributing to as much as one third of fatal accidents and an aggravating factor in all accidents". He commented on the role of good governance and how poor management of speed is often a sign of public policy failure. Small changes in mean speeds result in measurable and significant changes in outcome. Severe crashes are more sensitive to speed changes than crashes in general and at higher speeds the effect of small changes on injury generation can be substantial. (The slides provided by Eric Howard are an invaluable resource for anyone seeking a background to the theory in this area of work.)

Eric Howard concluded that impact of use in the iRAP model of a multiplicative factor to power of 3 as basis for speed factor calculation for fatal and serious injury crash effects is broadly consistent with the Nilsson Theory and represents acceptable practice for calculation of crash risk. However, use of the multiplicative factor to power of three to calculate the potential fatal & serious injury reduction benefits of lower speeds should be reviewed. It may overstate the benefits at lower speeds – reductions in speed may not provide the predicted injury reductions and therefore the countermeasure benefits may not be as great. Broadly, the iRAP model's treatment of speed is satisfactory but it may need some revision at lower ends of the speed spectrum. In addition, in congested conditions, rating at the posted speed limit may overstate the risk and therefore the benefit of countermeasures.

There was discussion of the relationship between poor standards of governance in a country and excessive and inappropriate speed on that country's roads. Enforcement of speed limits by the police is critical. A useful rule of thumb might be "Half of all the harm is caused by outliers and the other half by those travelling 10 km/h above the posted speed limit".

Compliance with speed limits is a factor in the fatal:serious severity ratio. The 1:10 ratio used in the iRAP model was questioned – some felt that it may be nearer to 1:15 – and it was recognised that this would vary from country to country, but not in a way that could be easily understood and incorporated within the model.

9 Latest knowledge on speed and safe systems – Professor Rune Elvik

Rune Elvik drew on a review published in 2009 of 117 reviews and studies that had provided 526 estimates of the effect of (changes in) speed on road safety. He reviewed the Nilsson power model (published in 1981) and provided estimates of exponents by different traffic environments. He summarised areas needing further research: The Power model is adequate as far as accidents are concerned (accidents increase exponentially as speed increases) but may not be adequate as far as killed or injured victims are concerned (a logistic function of impact speed may be more appropriate; there are floor and ceiling effects giving what is often referred to as an "S-shaped" relationship). He commented that TRL research (Taylor *et al*. 2000) suggests that both speed

dispersion and rate of violations influence safety in addition to the mean speed of traffic and that new evidence suggests that fatality risks for pedestrians have been overestimated.

In concluding he said that: speed remains a very important risk factor both with respect to the number of accidents and with respect to injury severity. There is evidence suggesting that:

speed may have become slightly less important over time; improved vehicle crashworthiness may have contributed to this; prior studies may have overestimated the risk of fatal injury to pedestrians at a given impact speed; traffic environment (i.e. initial speed) is an important moderator variable influencing the relationship between speed and road safety; in urban areas, safety may be influenced by speed dispersion in addition to mean speed.

RE confirmed that statistical models describing the relationship between speed and safety: the number of accidents is likely to increase monotonically as speed increases; the Power Model is consistent with this; all else being equal, the number of victims will increase as the number of accidents increases and that the probability of sustaining and injury of a given severity when involved in an accident is best modelled as a logistic function. He said that there does not seem to be a need for drastic revision of the treatment of speed in the iRAP-model for obtaining a road protection score.

10 The proposed iRAP Speed Management Policy and model implications – Rob McInerney

Rob McInerney outlined the role of speed measurement in the iRAP model, relating the protection and likelihood elements to the curves of Nilsson to the third and fourth power. He summarised the finding that the iRAP model is supported by peer review and may if anything understate the benefits to be gained by reducing speed. He commented on the rudimentary nature of assessing speed within the model and that speed may have different influences on different types of road, at different times of day, and about speed's differential effect on different road users. He commented on the intention to address these issues and how to align the iRAP model better with Safe System Speeds in the future.

A key focus of the workshop was to provide advice on the most appropriate measure of speed in the model – eg posted speed limit, mean speed, and 85th percentile – and the necessity of collecting speed data during iRAP studies. Such information would be useful to the work in the iRAP model and useful in its own right as a road safety message within the countries in which iRAP is active.

A "speed management review" had been incorporated in the countermeasure options of the iRAP model but this had been switched off because it was believed that there is too much in the speed management process to capture this completely and model it within iRAP.

iRAP has the potential to produce a list of road sections where speeds might be reviewed and in this way the model might inform a speed management programme as a whole especially if they are related to behavioural change. Beyond this the model probably lacks the precision to target particular measures.

Again, good governance and police enforcement are key to any speed management process, but the advice of the meeting was that it would unwise to assume that a speed reduction of more than

20km/h at any location could ever be achieved. iRAP would have a role in saying "This is the current speed and compliance position on this network" and "This is the speed distribution and compliance that is required to achieve the injury reduction target that has been set". The speed management review output from any model would need to be included in a separate report – it would overwhelm, and possibly conflict with, other information if provided in a standard Safer Roads Investment Plan.

A uniform process could be established by iRAP. Posted speed limits on particular group of roads would be assessed in relation to the mean speed. Specific speed reduction measures (such as those referred to in the iRAP Tool Kit) could be matched against the characteristics of the location. For example, this could involve removing centre-lines on single-carriageway roads and painting on medians. Using vehicle-activated signs may provide a similar speed reduction effect, as might introducing a barrier-separated 2+1 on a very wide 4-lane carriageway. These measures could form part of a "speed environment upgrade" by systematically assessing whether any features known to reduce speed could be implemented at that site. Some existing iRAP model risk factors may have a role in affecting speed and notionally their effectiveness could be compared against different speed scenarios using the star rating as the discriminator.

There was concern that the model may not be sufficiently sensitive in triggering countermeasures on some 1-star road sections. When the star rating is poor and speeds are high, the model is not providing enough information about what needs to be done. It is possible that more could be done with perceptual countermeasures that provide a "closed in feeling" and that these could be a component in self-enforcing speed limits.

There were questions about whether "developed-country methodologies" such as delineation would work in low and middle-income countries. There is a need to be more confident in the efficacy of countermeasures and to be sure that countermeasure efficacy trials conducted in high-income countries are applicable in low and middle income countries.

Maintaining awareness of countermeasure research is important, monitoring updates and making input via the iRAP Global Technical Committee will ensure that the iRAP retains its leading edge approach. There was understanding too of how measures could change in effectiveness over time as a public became more accustomed to their purpose – a speed cushion (a traffic calming device placed on the carriageway and slowing vehicles by changing the vertical alignment over a short distance) on a 6-lane highway in Korea was a success when drivers became aware of, and accepted, its purpose.

Before any changes to posted speed limits are considered, or changes to posted speed limits at any site, a key question to be asked is: "Can your police force get the operating speeds down to the current speed limits with enforcement?"

For there to be substantial casualty reduction, speed reduction measures must focus on urban arterials and enforcement will be key to this. iRAP will seek to provide evidence for the existing situation on such roads and promote countermeasures at appropriate locations. It is recognised that the core iRAP expertise will not extend to the full speed management range of actions and must be coordinated with relevant experts (eg the Speed Management Good Practice Guide). It will be important to gain support for such work at the highest possible political level in any country. The arguments and language used must be carefully marshalled.

10.1 Speed Policy

The key outcomes of the speed management discussions during the week are summarised below:

- Provide additional narrative in the speed policy so that it can be understood by general practitioners
- Include some further discussion on the speed curves and a statement of limitations and known issues – particularly those issues at lower speeds
- Include a discussion on speed measurements – note that thjs will form part of the "Guidelines for in-country teams" and associated quality documents.
- Require the measurements / sourcing of data on both mean and 85th percentile speeds.
- Results will be rounded to the nearest 5km/h or 5mph as appropriate.
- Further development needed in understanding critical speeds for different users (eg car / truck head-on or car / motorcycle). The 70km/h safe speed is not relevant. The percent of heavy vehicles will become an important attribute here.
- Belief that iRAP model countermeasure benefits for small changes in speed – but not large (eg going from 100 – 60). Agreed that any calculation of benefit associated with "speed" changes are limited to a mximum of 20km/h
- We need to include more about WHY speed is important in our reports.
- We need to undertake a review of countermeasures to ensure that they do need to unsafe increases in speeds; plus also provide links to Nillson work etc if not there already – the Toolkit info should be reviewed in this regard.
- Limitations of fourth power rule – particularly at very high speeds – where death is basically certain. Risk factor review in this regard should be reviewed

10.2 Recommendations for update to policy

- Record speed limit; mean speed and 85th percentile speed to the nearest 5km/h or 5 mph as appropriate
- Speed as a countermeasure steps generally agreed but should be presented in a separate report to take account of the multi-sectoral needs
- Agreed speed policy positions outlined in the slide below.
- RM and EH to update and finalise speed policy ready for inclusion in V3 specification
- JB to update data file specification to reflect additional data needs

iRAP & Speed

	Speed limit	Mean Speed	Operating Speed*	Suggested speed limit
RPS			✓	
Star rating			✓	
Casualty estimate		✓		
Countermeasure Triggers			✓	Optional
Countermeasure Benefits		✓		

* Operating speed = Greater of speed limit and 85th %ile (to nearest 5km/h)

11-39

Speed Management Review Countermeasure

Step 1: EXISTING STAR RATING & (ambitious) INVESTMENT PLAN

↓

Step 2: EXISTING RISK MAPS crashes/km (or Fatality Estimation Model)

↓

Step 3: Determine STAR RATING AFTER NETWORK IMPROVEMENT

↓

Step 4: Speed Management Countermeasure Triggers (85th %ile > SPEED LIMIT; STAR RATING AFTER; RISK MAP Categories)

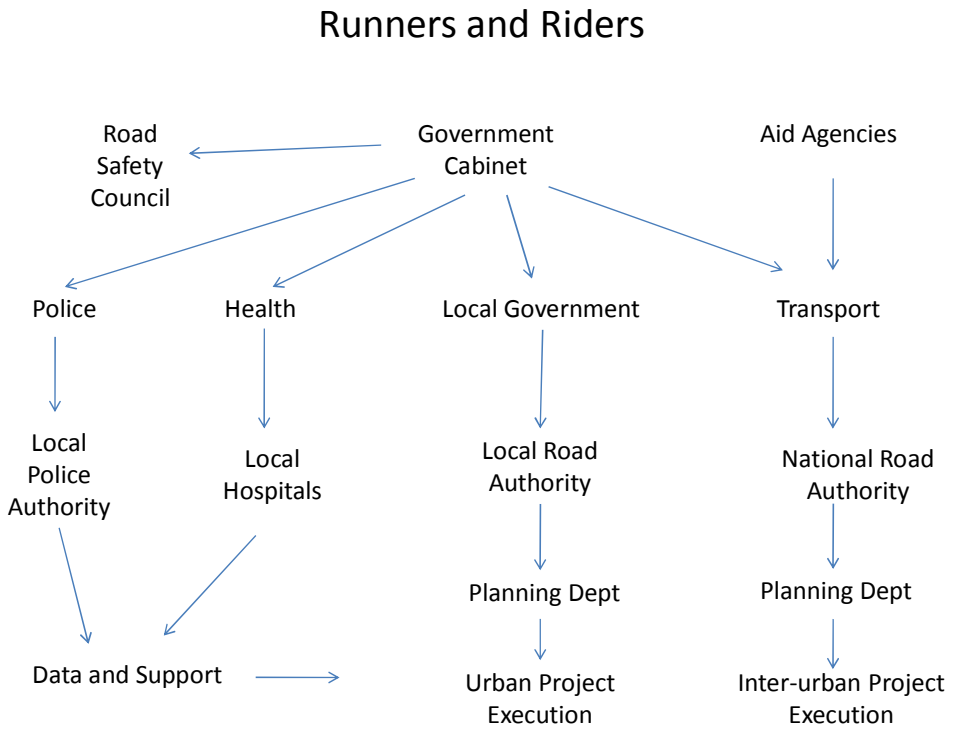
↓

Step 5: OPTIONAL Calculate operating speed required to meet minimum STAR RATING & estimate the potential KSI's saved (NO countermeasure cost or BCR) – separate report only

12-39

11 The value of the iRAP model as a political, investment and communication tool: discussion forum led by Dr John Mumford, with Peter Daly and Dr Sangjin Han

John Mumford reviewed the various participants in the road safety world in low and middle-income countries, drawing on his experience in Africa (figure below – "Runners and Riders").



Those in the top tier of this diagram have the national view and provide the high-level policy direction. Practitioner involvement is typically at and below the level of planning departments, with the road authorities providing prioritisation of spend. Road safety activity may fall within any one of several departments. Urban arterials, for example, typically belong to the national road authority but are operated by the local authorities. In low- and middle-income countries, transport as a policy tool is generally more directly driven by what will win votes than in high-income countries – priorities are typically ports, through routes and international trade. There is concern that aid agencies are typically not mixing with local practitioners and that road safety councils will only engage with what are perceived to be the "soft options" of education, training and publicity.

With the value of life in, for example, Kenya, about one-thirtieth of that in the UK, some imported countermeasures are prohibitively expensive. Simple and cheap systems that work must be a priority – these may vary from cattle-fencing to direct and "shepherd" pedestrians away from risk, to systems that work on cheap computers in circumstances where broadband connections are weak.

The iRAP road safety input is likely to be a relatively minor input within this grand scale model and there is a need to give a very detailed specification of what is required for it to have any impact. Within this there is a need to understand the performance metrics for funders – ie what will constitute a success for them and how can the road safety effort be best targeted to meet this. There was recognition that Disability Adjusted Life Years (DALYs) may be relevant in some quarters, but that use of this metric was not widespread.

There are two areas where the economics within the iRAP model needs further examination. In the mobility improvement component there is concern that the iRAP Safer Road Investment Plan proposal should triggering the type of large-scale inter-urban mobility improvements often being promoted as large-scale urban transport improvements after corridor studies. There should also be some assessment of what the economy of a particular country is likely to be able to afford within a proposed package and how this ties into local perception on how much it costs to save a life.

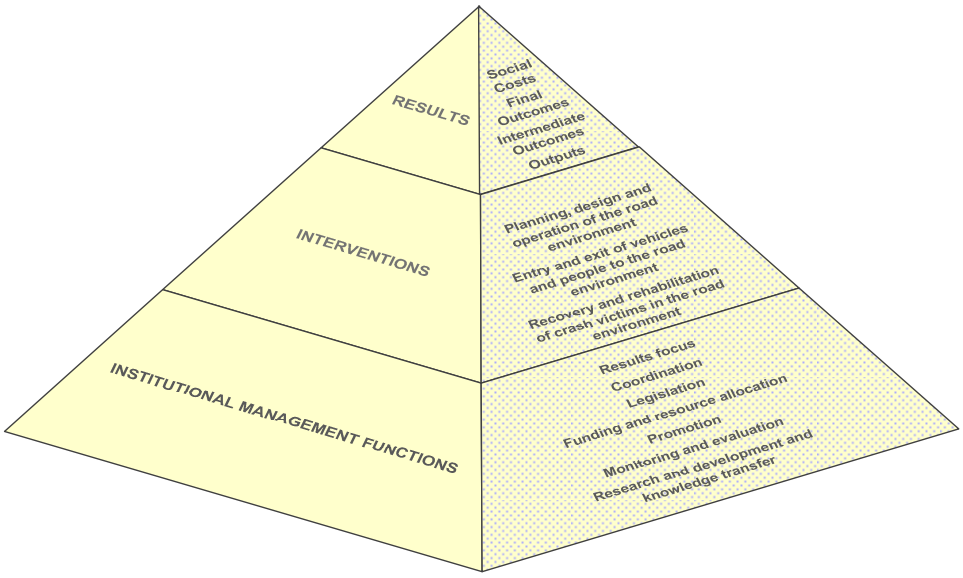
JM's observations were that it is often those most economically active and better-off who are being killed – for example, those actually in work who are being killed on the journey walking to work.

Typically in low- and middle-income countries there is less action on the left hand columns of the figure above (from health and police services) – enforcement, data and trauma care are limited. The OECD has highlighted these issues in various recent reports.

Other models are also being used to assess transport input and investment (project appraisal, road network programming) in low- and middle-income countries. The HDM-4 model is one such. It has a relatively low-level road safety input but iRAP should make contact with those at PIARC and within ARRB and the World Bank to ensure that there is synergy and linkages between the models. It may be possible to institutionalise models through trials at a micro-level. Rehabilitation and maintenance programmes often provide good opportunities and substantial budgets for such trials. They could also be tied in with substantial projects, such as was happening in Moldova.

There was discussion about the reluctance of some road authorities to provide data and open up to the public about crash problems on its network. In the US (and in Germany) there is reluctance to share and publish data used in crash maps. Data used in risk maps in the US is not subject to Freedom of Information legislation. Often there is concern about legal liability although often this is more a perception than reality and in the UK it is likely that test cases will eventually set precedent for openness and action. The Safe System is based upon principle of shared responsibility.

EH spoke about the need for capacity building and used the pyramid provided by Bliss and Breen (2009), shown below, to illustrate who needs to be involved and how.



It was recognised that iRAP had a role in each part tier of this pyramid, making a range of contributions from results and countermeasure programmes to high-level policy impetus.

12 Learning from, and overlapping with, other models and approaches – Nimmi Candappa

Nimmi Candappa compared iRAP with other safety approaches – their common aspects, what could be learned from them, what the conflicts were and anything that might lead to an improved iRAP programme. She compared elements of the Dutch Sustainable Safety Programme (quoting Wegman), Vision Zero and the Safe System approach (Tingvall), using work conducted in Western Australia (Corben and colleagues) to illustrate this. Some common threads were obvious – the forgiving road concept and the need to design for the likely and foreseeable driver errors. It was possible to construct a comparative assessment of the various methods based on the approaches each took and the crash elements they considered (the “aims” and “means”).

NC commented that there was very little tightly-targeted evaluation of the effectiveness of the various approaches but used what evidence was available to illustrate the potential benefits that could be achieved in theory. For example, results from the Sustainable Safety programme:

- “It is estimated that in 2008 the construction of 30 km/h roads prevented approximately 51 to 77 fatalities, and that the construction of 60 km/h roads prevented approximately 60 fatalities compared to the situation in 1998.
- During the period 1998-2007, the fatality rate also fell by an average of 5.6% per annum from 7.3 fatalities per billion kilometres travelled in 1998 to 4.7 fatalities per billion kilometres travelled in 2007.”

…and from Vision Zero

- "A theoretical a cost-benefit and cost-effectiveness study showed significant financial benefits could come from the implementation of the Vision Zero policy. According to the study, "Theoretically, Vision Zero brings with it a 10-year stream of benefits that can be valued at 11 billion" (Vision 84). (Tingvall)"

Her presentation stressed the need for careful monitoring of results, of associating "effect" with "cause" and disaggregating crash types as part of this process. iRAP was valued for its potential role as a platform for comparison of performance across countries, its ability to track progress and for its ability to highlight the interplay between road infrastructure, road users and vehicles. The strengths of the other approaches were highlighted and comment made on where they may usefully complement each other.

13 References

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