NOTES FROM THE iRAP INNOVATION WORKSHOP

TRL, CROWTHORNE, BERKSHIRE, UK – 21-22 JUNE 2012
A primary focus of the workshop was to bring together the experts in road safety engineering from iRAP Centres of Excellence and the active iRAP programmes around the world to share knowledge and innovation from their local programmes. The workshop enabled a focus on developments to the Road Assessment Programme model and its presentation platform ViDA.

Invitees included iRAP Global Technical Committee members, representatives of existing or prospective iRAP Centres of Excellence, engineers from countries where the Road Assessment Programme is active, entities with whom RAP shares common goals, plus other individual experts.

The programme included:

- examples from around the world of where iRAP has been used to guide road safety infrastructure investment
- developments to the iRAP model and software
- training priorities in the model’s use
- performance indicators in use around the world
- designing roads to a minimum iRAP Star Rating
- innovation frameworks and getting the best out of models, assessment tools and knowledge about countermeasures
- two-way knowledge transfers between countries
- innovation in delivery of training and assessment involving Centres of Excellence, suppliers and other partners

A zipped folder of pdf files of the slides presented is at:

https://dl.dropbox.com/u/39860646/iRAP%20Innovation%20Workshop%20pdf.zip
## Workshop participants

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Day One

Welcome and introduction

Susan Sharland, TRL Chief Executive and John Dawson, iRAP Chairman welcomed participants to TRL, reflecting on the long and important history of TRL in road safety and the collaboration with iRAP as a Centre of Excellence.

Comparisons were drawn between the New Car Assessment Programme (NCAP) and the Road Assessment Programme (RAP). After 15 years, Euro NCAP is able to estimate lives saved due to its programme and iRAP will be able to do the same in the near future.

Several distinct phases of development have been observed. In the first five years there was emphasis on research and then measurement of risk (as seen in the EuroRAP report “From Arctic to Mediterranean”). Safer Roads Investment Plans marked an evolution to answering the question “what do we do”? Next year iRAP will inspect three times as many roads as in the past five years and the emphasis will be on turning inspections into effective countermeasures.

Recent reports from Sweden have shown the dramatic contribution of road engineering to casualty reduction. Fatalities may be reduced by 95% as result of behavioural and engineering approaches. It requires unsafe behaviours to be removed by ensuring that all vehicle occupants use seat belts and road-users have not consumed alcohol and do comply with the speed limit. Then, on those parts of the network where it is possible and viable, opposing flows must be separated, good run-off protection implemented and well-designed junctions provided.

Workshop Chairman – Rob McInerney

Innovation – implementation snapshots

Saving lives through road upgrading and rehabilitation: the Kampala–Masaka highway in Uganda
John Mumford (iRAP) on behalf of Racheal Nganwa, Uganda National Roads Authority

Eliminating 1- and 2-star roads in Paraguay – José Gómez (Unidad de Seguridad Vial. Ministerio de Obras Públicas y Comunicaciones. Paraguay)

KiwiRAP – Minimum 4-star for new national roads of significance and use of the KiwiRAP Analysis Tool – Fergus Tate (New Zealand Transport Authority)

These presentations illustrated where iRAP surveys had been completed and the steps being taken to implement measures based on the Safer Roads Investment Plans, with local review and adjustment of the detailed design and civil works. The emphasis had been on improving 1- and 2-star roads (eg 7% fewer 1-star roads in Uganda after implementation) although it was recognised that upgrading from 3-star to 4-star may also be beneficial if the savings in serious casualties warranted it.

In Paraguay, it was reported that 73% had score 3-star and therefore emphasis had been on improving those roads that rated 2-star. The Safer Roads Investment Plan and countermeasure
costs had been assessed road section by road section. Investment on road sections with low volumes showed estimated costs versus benefits with an anticipated BCR around 4. Higher investment on medium and high volume roads showed anticipated BCRs of as much as 35.

The Paraguay work had driven an investment of 5 million dollars, now being looked after by a team -- programme director, geometric design specialist, junior engineers and a civil engineer student, thereby providing capacity-building.

Three separate pieces of work in New Zealand were described – the application of the KiwiRAP model; emphasis on improving seven roads of national significance and infrastructure spending in general.

Good relationships had been found between crash rates and Star Rating using a model based on the AusRAP system. New Zealand have set a target of a minimum of 4-star for roads of national significance. They had asked “What does a 3-star single carriageway look like?” and recognised that there are many ways to achieve that goal, creating innovation amongst engineers and looking beyond simply design standards. It also recognised that aspirational goals have to be affordable – eg “What would it cost to raise by one star rating band?”.

The New Zealand KAT system had been developed to provide site selection using location maps – eg “Find me sections without barrier with 10k AADT etc.”. The Road Protection Score summary was incorporated in this although it was acknowledged that some still prefer historical crash data rather than using a risk management. All of these tools are integrated within integrated within road authority practice.

**Innovation in the iRAP technology**

*The iRAP Innovation Framework and safe system developments – Rob McInerney (iRAP)*  
*Innovation and the updated iRAP protocols platform: ViDA – Richard Thornton (iRAP)*

The range and extent of iRAP’s existing programme was illustrated using a Google fly-through of roads that had been inspected. A case study using video footage from Bangladesh asked “How many ways could we die on that road?” – over a length of 200km there was 1 death per km per year and about 3:1 deaths unreported. China and Philippines were given as examples of countries of where diverse developments had taken place in the past year.

The iRAP work in East Africa had shown good involvement with local engineers. There is innovation potential in South Africa. In Latin America the programme has extended to 16 countries with major nationwide assessments of Mexico and Columbia underway and excellent progress meaning that there were no 1- or 2-star roads in Paraguay. There was recognition of the links between safety, economics, poverty reduction, and sustainable transport.

Innovation is of course an ongoing process and all the RAPs have evolved, from EuroRAP onwards but 5-star in one country must be the same as 5-star in another. The model governance is maintained though the iRAP Global Technical Committee. Innovation and local ownership is
encouraged. iRAP “x” (eg iRAP Kenya) will use the existing tools, typically be externally funded, may not have capacity for research and will focus on the existing iRAP protocols.

“X” RAP (eg KiwiRAP and ChinaRAP) will typically have a strong local team, a technical working group and be able to explore enhancement of the model.

Innovation and the updated iRAP protocols platform: ViDA – Richard Thornton (iRAP)

ViDA is a new suite of web-based tools and expands on the existing features of iRAP Tools to provide for innovation of the RAP protocols, models and reports. Road Assessment Programmes have the ability to customise elements of the international model to their local environment using their own expertise and research. By using state-of-the-art cloud-computing technology, ViDA provides tools, services and workflows to manage the RAP data lifecycle, from initial dataset pre-processing to on-screen and downloadable reports. ViDA also takes a new approach to reporting by allowing users to drill down through and analyse assessments using a flexible filter and search tool.

Major features of ViDA:

- Step-by-step analysis guidance to enable suppliers and government staff easily to apply the protocols
- Data validation and quality assurance
- Model enhancements and customisations to suit local environments
- What-if analysis to calculate changes to existing conditions
- Cross-project reporting
- Report customisations and flexible filters

ViDA will facilitate sharing and collaboration, connecting like-minded engineers and members. It will provide flexibility – eg ability for project leaders to set their own countermeasure triggers and economic criteria. There was strong representation to ensure that cost-effectiveness must always be at the core of decision-making on packages of countermeasures (eg maximum lives saved per dollar spent).

ViDA will also offer a gateway to training packages and the potential to links to other packages such as iMAAP.

Innovation in the iRAP models

How iRAP reached this point: evolution of the Star Rating models – Steve Lawson (iRAP) and Doug Harwood (Midwest Research Institute)

The original work had evolved from a desire to “...do for roads what Euro NCAP had done for cars” and to derive a Star Rating for safety. Risk Maps were used initially to provide a spatial description of risk and then the question was asked “Why do these roads look as they do?” The main crash types (head-on, run-off, at intersections, involving vulnerable road users) were then assessed as those contributing to risk. In Europe and across the world, experts and leading practitioners helped
In V3 one of the component scores, the Star Rating Score (SRS) includes speed and demand at the location. Intersection design also takes into account number of entering vehicles in a more meaningful way than earlier versions. Pedestrian crossing design takes into account through-vehicle flow per lane.

The model has been developed from first principles – it is a probabilistic model built on hypotheses that will be confirmed with use and with comparison with crash data. Preliminary validation is underway with US data.

Rear-end fatalities are increasing in relative importance in some countries (eg Australia) and yet the model does not yet include them. Such crashes are determined in part by likelihood of queues especially at junctions, motorway congestion, slow vehicles (eg carts) and percentage of trucks in the traffic. But countermeasure options are limited – primarily improving skid resistance and using ITS. “Queue protection” has been assessed. Including rear-end crashes may make the model more accurate when calibrated but this option has not been included up to now as the definitive evidence base on cause and effect is still maturing. ChinaRAP may add this attribute in its surveys but there is general agreement that the evidence base is small.

The cyclist model in V3 will be stronger than in V2.2. There is interest in the incidence of cyclist run-off deaths and the difference between “along”, “intersection” and “run-off” deaths. Crash data show large numbers of cyclist casualties at intersections where cyclists and cars meet and it is known that the frequency of cyclist “single vehicle” deaths are also high, especially where road-users are frail, but that non-fatal single-vehicle cyclist crashes are highly under-reported. With the recent network assessments in the Netherlands and good crash data, discussions are underway with ANWB, government about how to improve and validate the bicycle model. The SWOV will be involved to join these discussions.

It was recognised that the iRAP model is a crash allocation rather than a crash prediction model. It can guide large-scale investment and provide the business case for road investment. There is a balance between ensuring that iRAP is a simple easily-applied model, collecting readily-available data, and something that is more complex.

Other V3 related-issues that were discussed included:
The model will use the higher of maximum of speed limit or operating speed in 5km/h (and 5mph) increments to assess the Star Rating.

Some attributes may not be a clear-cut component in the model in all situations – eg the effect of shoulder width and surface type – recovery on a smooth surface may be better, but the severity goes up because vehicle is slowed less.

The richer data in V3 would place more demand on coders than in V2.2. This had already been encountered in the quality checking process in the Netherlands.

Skid resistance will be included in the V3 model – with evidence that very poor skid resistance is associated with a substantial increase in crashes and that in general identification of road sections with visibly flush road sections capture the worst of skid resistance on sealed roads. (Guidance on more detailed skid resistance will be suggested for high risk sites and road lengths.)

Speed differential – one slow moving vehicle overtaking another slow-moving vehicle can be a key cause of raised risk but it was recognised that this could not be reliably incorporated within the model, although impacts of traffic mix on Overtaking Demand will be included.

At present there is no routine collection and use of the percentage of trucks within the traffic.

V3 incorporates the reduction in risk when there are improvements to travelled paths through junction due to channelization. Site distances are also improved. This is reflected in the risk to individual road user on the through-route but does not influence the side-road risk.

Innovation in enabling others

Methods and tools to equip practitioners with breadth, depth and understanding of Road Assessment Programmes – John Mumford, James Bradford and Neil Moss (iRAP)

There has been substantial investment in 2012 in e-training packages in recognition that iRAP will need to enable others to understand the theory behind the model and to develop, analyse, and use the iRAP results. Training will be tailored to specific end-user needs.

Several audiences for the iRAP material are likely – policy makers, project leaders, engineers, coders, planners and analysts. Material will be web-based and also available in more traditional formats.

There were illustrations of some of the component parts of the material and how it would be delivered.
Common performance measures – what measure are being used in participants’ countries

Discussion including the following:

Innovation in policy setting and common performance measures and Fergus Tate (NZTA – New Zealand Transport Authority)

Update on supporting Multilateral Development Bank initiatives on common performance indicators – Tawia Addo-Ashong (World Bank Global Road Safety Facility) and Rob McInerney (iRAP)

There has been monitoring of crash results in New Zealand between the data periods 2002-06 and 2007-11. Star Rating results are now being used to compare vehicle kilometres travelled in each of the star categories (rather than the length of each Star Rating) and agreement that this should be the main policy driver (eg 50% of vehicle kilometres travelled is on 4-star roads or better). The New Zealand KAT tool enables year-to-year comparison.

Design for a minimum 3-star has been a guiding principle to reduce risk over the network. iRAP data has been useful in developing a safety improvement programme at a county/local level. It is particularly useful on roads with sparse or no crash data available.

In the US much more attention on performance (target of zero fatalities) and attention given to performance measures such as crashes/km.

In Australia there has been attention to the Safe System Approach and also considering how to incorporate serious injury levels into targets but the definitions of serious injuries vary between states.

In the Netherlands there is concern that V2.2 results may differ from v3 and this would need to be managed. Sensitivity testing would be required between V1.0, V2.2 and V3 and this is currently being undertaken. There was discussion of the means by which 2-star rating of provincial roads could become 3-star. The poorest roads would also have to be upgraded with 1-star sections becoming 2-star. In the Netherlands, there are targets for reductions of fatal and serious injuries.

China has targets for the reduction of fatal casualties. (Post meeting note: these are available at – http://onlinepubs.trb.org/onlinepubs/shrp2/2011SafetySymposiumWang.pdf). Compared with the level of safety 3-5 years before project implementation, the target level of safety of a demonstration road network will show a 20% decrease in the annual deaths (and a 50% deaths in the number of severe accidents).

In Lebanon reporting of accidents is poor, there is substantial under-reporting and there is no uniform reporting mechanism.

There was discussion about the distribution of crashes across the network – in Australia about a third of crashes occur at known hazardous locations – that is, two-thirds of fatal crashes occur where there was no previous crash history.

Interim targets are being set and those based upon iRAP work. In Serbia the roads included in the 2008 survey are being monitored and the number killed and seriously injured monitored. Traffic
data are being collected too but it is noticeable that in Serbia as whole there is missing data for motorcycle riders. At a national level there is no national target and no road safety strategy at present. Some crash density indicators are being used and countermeasures have been implemented.

In **New Zealand** there is a report to the minister each week – number of deaths on low-star roads, when on a 1-star road, and whether the person killed was in a high-risk group.

Countries are beginning to use before and after star ratings to provide an immediate measure of the success of an improvement. (For example, a Minister cutting the ribbon for a road going from 1-star to 3-star.)

The benefits of using the Star Rating to rates success are that it is possible to assess success straight away with no need to wait for several years for crash data. Discussion highlighted that this might incorrectly encourage small improvements where Star Ratings are near the change points.

There was comment that for those who believe “2-star is enough” it would be to compare this with statement with a picture of a 2-star car and indeed one that had been in a crash.

Where budgets are small and there is very little infrastructure spending – eg 2-3% spending on road safety – it may be possible to fund improvement using investment in maintenance budgets. There needs to be greater awareness of cross-sectoral costs to different parts of the community and third-party compensations (eg health, insurance and social security costs). Health and finance ministers should be involved alongside the transport minister.

In **Spain** there has been EuroRAP Risk Mapping for the past 10 years and assessment of the percentage of high-risk roads over the network. Initially 39% of the network was either black or red (higher risk) and now the figure is 7%. It is one of the few regular indicators used in Spain. In some specific regions there are regional disaggregations of risk.

In **Paraguay** there is a government approved road safety national plan requiring a reduction of 20% deaths from 2008-13. There has been identification of 21 hazardous locations and a target of no iRAP 2-star road sections.

**OECD** is working on international comparisons between IRTAD-member countries and working on research into “What does implementing a Safe System mean and how can it be achieved?”

The **Development Banks** are working towards a consensus around Star Rating for safety and this has yet to be achieved. Common performance indicators are under development.

In **Mexico** there are 24,000 motor vehicle deaths per year and increasing. 5000 are on the on the Federal roads and 5% are reported as directly related to infrastructure with it playing a large role in a substantial proportion of the remainder. The vehicle fleet is old and driving standards are poor. The road is widely seen as a small part of the challenge but self-explaining and forgiving roads become even more important when the behaviour and vehicles are poor. The current iRAP assessment of 46,00km of roads in Mexico will provide an initial benchmark of current performance and a guide to investment for a Decade of Action.
In the UK there has been 20 years of national targets as good indicators but this has recently been dropped. The meeting was surprised at this. Well-targeted investment is crucial – recent Road Safety Foundation work has mapped crash costs in Britain.

In Iceland there has been debate about targets and use of the Star Rating results and recognition that roads with different volumes may require different Star Rating targets. This has led to discussion about whether it is OK to have 1-star in one situation and 4-star in another? It some situations there could be mis-investment if you do not spend when you see and have the opportunity.

Design plans and minimum Star Ratings in India and Moldova – Luke Rogers and Steve Lawson (iRAP)

An innovation in engineering design practice has been piloted in India on the Karnataka State Highway Improvement Project (550km) and in Moldova (the M2-R7 corridor – 116km). The projects were supported by the Global Road Safety Facility and the Millennium Challenge Corporation respectively, and by local and international partners.

The work shows how the iRAP Star Rating protocol may be used to rate the safety of a road prior to construction or rehabilitation with information drawn from the road design plans. This methodology offers a step-change in current practice in the way designs are produced and assessed and places greater emphasis on reduction of severe injuries.

- The iRAP Star Ratings score how road infrastructure influences the likelihood of crashes occurring and the severity of the crashes that do occur:
- assessing the most common and severe types of crash for four road-users – vehicle occupants, motorcyclists, cyclists and pedestrians.
- providing a simple and objective measure of the relative level of risk associated with road infrastructure for the movements and manoeuvres that these road users make.

The case studies show how to assess the future safety of a road and have several applications:

- to benchmark for safety – for example, “...road sections should be set a target of not lower than 3-star for safety”
- to compare different designs prior to implementation – “...how much will the safety of this section be increased by adding barrier and sealed shoulders?” or “...what is the likely casualty reduction in villages if speed limits are enforced at 50km/h?”
- to assess different policy priorities – “...how do we best provide for the safety of pedestrians?”
- to estimate the potential reduction in death and serious injuries for competing designs.
The iRAP model shows benefits from shoulder treatment, installation of barriers, provision of a range of pedestrian and bicycle facilities, improved signing and delineation, 5m safety zone, turn lanes and pavement surfacing, some re-alignment and speed reducing measures.

Final designs for construction are anticipated to provide a reduction in severe injuries of 40% per year in Moldova and 45% in India. On the larger, busier, Indian network, this approximates to saving more than 100 deaths per year on just 550km of road.


**Group Discussion Doug Harwood (Midwest Research Institute)) on how to support widespread application of minimum star ratings and including issues related to:**

- Incorporation into standards, training and practice
- Incorporation into standard design packages in use around the world

The impact of countermeasures was discussed and questions asked – “To what extent are CMFs directly transferable from one country to another? Why look at target groups? Is a 3-star target enough? What would the additional benefit of going for a fourth star?”.  

It was recognised that the risk factors and economic benefits had been based initially on a global scan by TRL (Europe), and include Australian research (from ARRB for Asia-Pacific), and work from MRI Global (North America experience). The “price of being wrong” when viewing network-level recommendations is relatively small. Crash reduction studies vary from place to place. Site-by-site results average out over a network, the nature of these sites varies and the evidence base is only ever likely to be a general average for most road-users.

It was also accepted that, ultimately, practitioners will decide upon the cost-effectiveness of the tool for design. Star Rating may not be appropriate everywhere – for example it may not be appropriate to spend high on low-volume roads. High volume roads are where spend is likely initially, focusing on where most deaths occur. The role of lower speeds on lower quality roads was discussed.

iRAPtools and those used in uSRAP are a network-wide planning-level tool for a top-down approach. HSM/IHSDM is for the design of individual schemes. It may be too simplistic to say: “…eliminate 1- and 2-star roads”. This may lead to mis-investment. “Eliminate 1- and 2-star roads where it is cost-effective” is a better line. Categorisation of road type and allocation of speed limit will guide this process and there may be speed management opportunities. The value of iRAP is in its quantification of impact. The more we can quantify that, the better, because it is creating the compelling business case.

There was discussion of the data requirements for the design of individual projects. Pedestrian provision priorities are often difficult to ascertain. The roads where most pedestrians are dying are those with most flows. Generally, the intention is to make the highest risk 10% safe. Good data
typically does not exist for pedestrian volumes but to eliminate 1- and 2-star roads from the highest volume roads will achieve good casualty reductions. It is important to assess the travel ("VKT") on the 1-star and 2-star roads and include high pedestrian volume roads in countermeasure planning.

**Group Discussion John Barrell (TRL) on how to support widespread application of minimum star ratings and including issues related to road safety audit:**

Auditors operate under a wide variety of conditions and take account of highway design, road-user behaviour and vehicle elements. The auditor makes informed judgements on aspects of road layout and where compromises on design and can and cannot be made without large increases in risk. The auditor must have an awareness of the cost implications of these decisions.

Audit comes in at well-defined stages. iRAP operates at a “network level” – providing descriptions of a high standard road and the constituent features of that. Many features (such as gradient or land-use) cause immediate compromises for the auditor. Minimising crash risk within these compromises is important. There is an interaction between what is known to cause crashes and assessing individual sections. The question is to assess what compromise can safely be achieved.

iRAP’s influence can be in setting the base principles for the safety auditor to work within. The auditor works (only) within known parameters. In situations where data do not exist, judgement can be used to know if the parameters are still valid. Auditors will assess according to experience and make subjective decisions. For example, if the detailed design has a pedestrian crossing on a 120km/h, will speed humps be appropriate? “No”. It requires an holistic approach and an intuitive and expert eye.

It is important not to lose sight of the iRAP message as high-level and often for the network as a whole, but a message that could be a screening tool for individual parts where detailed expert planning and review is essential.

**Day Two**

**The best of all worlds – innovation frameworks (90 minutes – presentations of 15 minutes each and then time for discussion)**

_Austroads, ANRAM and AusRAP and the Safe System approach – Dave Jones (RACV – Royal Automobile Club Victoria) and Blair Turner (ARRB Group, Australia)_

AusRAP is a combined activity of the Australian Automobile Association on behalf of its members. It has routinely produced risk mapping and led development of the likelihood factors in the Road Protection Score model. Recent developments have seen a search for synergy and integration with the activities of Austroads the Australian road authorities and the Australian National Road Assessment Model (ANRAM). Important elements are the model’s technical credibility, the consumer message, media, and results for engineers, bureaucrats, and politicians. The AusRAP demonstrator was shown and it was requested that the link be generally available for training purposes: [http://www.ausrap.org/ausrap/saferroads/](http://www.ausrap.org/ausrap/saferroads/) -- “Star Rate My Roads”. There was discussion of the various models being used and the need for convergence.
ARRB recently completed projects include: Roadside Safety; Rural Speed Management; Safe Intersection Approaches; Asset management and Safe System framework; National risk mode; Update of crash reduction factors. There will be continuing ANRAM and iRAP convergence in the Crash Prediction module, Risk assessment module, Crash validation module, ANRAM tool treatments.

The ARRB new project list includes work on the Safe System approach and also on key crash types – head-on and run off.

A demonstration of the iRAP Demonstrator followed – participants may request a password and access to their own data by contacting steve.lawson@irap.org.

Successful outcomes: countermeasure implementation effectiveness and transferability – Jari Kauppila (OECD)

The International Transport Forum of OECD has 54 member countries and is developing an international framework for crash modification factors. In order to justify expenditure on safety it is necessary to argue convincingly for countermeasures.

The OECD peer review process has been stimulated by a lack of reliable knowledge in this area, by the variability in CMF (crash modification factor) values. There is the prospect of rapid advances by sharing information. Countries require proof that measures will work in their context – eg NCHRP and roundabouts in the United States – but we must accelerate use of proven measures.

CMF is dependent upon the circumstances in which it was developed/implemented – rural two-lane road example, making any CMF a function of the circumstances in which it was developed. But CMFs are a necessary part of performance and efficiency evaluation and should be part of all before and after studies. Essential reporting elements requires coordination, a transnational database and its use as vehicle to publicise the benefits of CMFs.

It is sometimes difficult to assess which studies are good – sample sizes, place of publication, control sections, originator etc all play a part. The OECD documentation will have a section “Defining a good crash evaluation report” – use pages at the back to define.

There is over-caution in some countries because methods or measures were – “not invented here” although there may be a lot more in common than we know.

Not all measures are appropriate everywhere – some roundabouts in low and middle income countries are being replaced possibly because they are not good designs. Others countries do not believe in unsignalised pedestrian crossings. A full study is required of how much can be transferred from one location to another. Not much has been done on this and a framework needed.

Using the best parts of available methods: what we need to know – Govert Schermers (SWOV – Dutch Road Safety Research Institute)

The Dutch situation and network is unique. The “Sustainable safety” approach has been adopted with the human at the centre of everything and the emphasis on prevention instead of cure.
Functionality is part of this model – it provides for safety-conscious planning and distinction between through-roads, distributor roads, access roads. This design values homogeneity, predictability, forgivingness and a state of awareness. There has been re-engineering of residential areas so that 70% is now compliant with 30km/h self-enforcement. Making provincial roads compliant with a Safe System is difficult. There is not enough space due to water channels and other constraints.

There are several approaches being used by Dutch provinces, proactive and reactive – EuroRAP V1 and V2, the Sustainable Safety test; Safe and credible speed limits (SaCred); Ranking the roads (South Arnhem); Audits/inspections; Internal design checks; Reactive – network screening/blackspots/BSM.

The network has seen many changes in the past 40 years (traffic calming, sweeping alignment (where opportunities for overtaking may be clearer), crash protection devices, turning pockets, rumble strips etc). What opportunities are there for the future? New insights in road function and land-use planning (e.g., locations of new schools in towns) may provide opportunities.

The ChinaRAP innovation framework: the RIOH model and research – Tang Chengcheng, Zhang Tiejun (Research Institute of Highways, China) and Greg Smith (iRAP)

RIOH has a large and wide-ranging assessment programme. There is a massive road building programme in China. Road-user behaviour as a cause of crashes remains a big issue although road infrastructure is a factor in many. Many of the safety problems in China are those experienced elsewhere and RIOH has a good collection of example before and after studies. RIOH has been using both iRAP and RIOH protocols on a pilot survey in Anhui province. Economic analyses of these studies show Benefit:Cost Ratios of 6.

A ChinaRAP team is being assembled and Anhui province is a practical demonstration project. A ChinaRAP technical community is being assembled and there is a willingness to participate in international iRAP projects. All will work hard to overcome any difficulties.

iRAP in high-income countries – two-way knowledge transfers

EuroRAP and the pan-European approach – Caroline Moore and Jo Marden (EuroRAP)

There has been Risk Mapping in 20 countries and Performance Tracking of these data in 8 countries. Changes in risk by road type have been observed for examples of road for vehicle kilometres travelled. Examples were provided of some of the most improved roads in Europe and the reasons for this – generally improvements in infrastructure. A hard core of persistently high risk roads remain.

Introduction of freeway-style bypasses have been done around the world but it was acknowledged that, on separating traffic, often only the freeway results have been monitored and not enough has been done to measure the safety of the remaining roads. The UK’s Bypass demonstration project in the 80s and 90s was described as a good example of monitoring where economically viable treatments had been provided for the roads in the towns.
Netherlands policy targets “No 2-star national roads by 2020” and provincial roads update – Richard van den Hout (ANWB – Royal Dutch Touring Club)

The ANWB has a long history of provision on travel-related matters and is the largest club of any kind in the Netherlands.

The Dutch minister Eurlings had promised no 2-star Dutch national roads by 2020 and plans are well in hand to accomplish this before that date.

Provincial roads are a priority. 22% of fatal casualties of all kinds occur on 6% of network.

The EuroRAP Netherlands study of provincial roads shows mainly 2-star roads.

Increasing number of casualties in the Netherlands are cyclists. There are an estimated 46,000 single-vehicle bicycle accidents, 6000 in hospital, 50 deaths – all in one year. Reporting rates are considered low.

Provision for cyclists is good but some cycle paths encourage high speeds, (they are “dual carriageways”) and there needs to be greater understanding of risk factors on these sections.

United States – Strategic Highway Safety Plans and Transportation Research Board focus for international safety: Kim Kolody (CH2M) and Doug Harwood (Midwest Research Institute)

In 1997 AASHTO produced the 1st national strategic highway safety plan. In 2005, new Federal Transportation Legislation, providing a platform for:

- Strategic highway safety plans
- Setting new goals
- A philosophy of Toward Zero Deaths (TZD) as per the current strategy

Building on momentum and the ethos provided by TZD, more sophisticated tools such as IHSDM are being developed and the Highway Safety Manual has been re-launched. usRAP is now active in 8 states.

Among the usRAP activities, there is a movement towards Safer Roads Investment Plans and work with local agencies. The usRAP model is particularly useful to agencies that lack good data (particularly counties).

usRAP is seeking Federal Highway Administration support to encourage broader use of usRAP Tools. There is a demonstration county project in Kane County and in Genesee County, Michigan – the latter coding to V3. usRAP will decide which of V2.2 and V3 to use.

Illinois has had a seven-county study – risk mapping and Safer Roads Investment Plans. Studies are being made of automated coding from other mobile mapping data systems thereby reducing survey costs.

Validating results will be an important feature of future work. Google Street View is being assessed for coding – roadside material most difficult. OECD has had high-level contact with Google about principle of cooperation and will link with iRAP in these discussions.
Validation of V3 is ongoing and there will be opportunities to develop this in data collected from Mexico, Netherlands and many other places.

**KiwiRAP now and in the future – Fergus Tate (NZTA)**


60% of fatal and serious crashes occur at sites with no previous crash history.

A new framework has been developed for “best treatment strategies” based upon priorities highlighted by crashes per kilometre versus Star Rating versus crashes per vkt. Treatment priorities vary dependent upon the metric and vary from simple maintenance actions to provision of safer corridors through route action and mass action. Behavioural interventions are also highlighted.

Case studies are powerful and KiwiRAP has been telling the good news stories. Case studies – before and after – using Wire Rope Safety Fence median barrier to increase from 2- to 4-star. The NZTA rural roads work has shown substantial reductions in fatal crashes. The methodologies are being developed and the protocols are being worked on – there is revision of the intersection model. More work is required on how speed affects the Star Rating and V3 is expected to improve this. There is the opportunity to add case studies to the iRAP Toolkit (as has been done with the New Zealand work).

The width of carriageway in the New Zealand work involved a 3.5 m lane in each direction with medians of 1.5m – 0.75 each side of the Wire Rope Safety Fence, with a very narrow shoulder before a drop-off. This limits the need to expensive pavement works in the provision of median barriers.

**Sharing information through mapping risk – the iMAAP system : John Fletcher (TRL)**

TRL has experience over many years of establishing crash database systems from about 1975 onwards. iMAAP is the latest generation of these.

Often there is no good location data. Good data enables positive, effective, and instant actions.

iMAAP provides answers to the question “What should a well-functioning road authority want to do or should it be doing? It can be both proactive and reactive (responding to recorded crash data), is a repository for all safety-related data and includes detail accounting for regression-to-mean and cost benefit analysis.

It has already started to map iRAP and EuroRAP data. iMAAP could be linked to ViDA using an API (application program interface) link. It is hosted on Amazon (as iRAP V3 will be). Countries using it include Botswana, Fiji, and Sri Lanka.

The iMAAP system was demonstrated [http://www.trl.co.uk/software/software_products/imaap.htm](http://www.trl.co.uk/software/software_products/imaap.htm) – queries, dashboard facilities. Reporting – standard outputs and flexible options are available. Stick diagram analysis is provided. Charts use a lot of existing software tools. The system can be used in a standard browser. There is auditing of the “who when and where” of use. It can be linked to ESRI
data and to UK Ordnance Survey sources. The system can be put on a hand-held device or installed or accessed over the internet.

There have been some sales and pilot users in the UK. Previous versions are in widespread use.

**Innovation in delivery of iRAP training and assessments**

*What role can the iRAP Centres of Excellence play and what support do they need? – John Fletcher (TRL), Alberto Mendoza (Instituto Mexicano del Transporte, Mexico), Blair Turner (ARRB Group) and Tang Chengcheng with Zhang Tiejun (RIOH China)*

The session considered a variety of issues including what Centres of Excellence (CoE) are for, what will they do, what do we need?

Training for CoE is essential and they can also provide training for local practitioners – “nuts and bolts” – how to score, analyse, making sense of outputs and results, wider road safety context., inter-rater reliability

Supporting the iRAP Global Technical Committee is important – providing wider knowledge, research, digesting the wider literature, developments of the models, testing.

Communicating the iRAP methods and goals more widely; sense-checking results, promoting and talking to visitors and existing clients/partner about iRAP.

Centres of Excellence can support countries where iRAP projects are ongoing and can be involved in implementation support – engineering detail sense-checking.

Involvement of CoEs with the GTC as appropriate; there can be close involvement with iRAP core team and projects, looking at ways to collaborate/network efficiently with other CoEs.

Development of clear common training for training is essential and is being tackled by iRAP. It is important that iRAP knows about CoE competencies. CoEs can provide innovation and research and support of projects.

There needs to be ways to help support through funding of research and by acting as a focal point. Promoting iRAP is also possible – eg doing training through ADB. It may be possible for CoEs to steer internal budgets to help iRAP research needs, adding value where it is possible, if there are clear wider befits to CoEs.

iRAP is keen to secure non-project funding so that CoEs can be supported for specific tasks if appropriate. Currently iRAP is not in a position to fund directly substantial research components although this will change if funding streams become available. Opportunities will exist to ask CoEs to supply training. iRAP wants to help CoEs “supply and apply”.

This is a world of different sets of schedules and tight timeline delivery. There needs to be definition of the skill sets available. CoEs can contribute at different levels. They can do the data work but doing research and adding to overall process will not always be possible although local risk factor assessment will be useful and for some CoE it is the R&D that is the important bit – eg MRI would
like to be more involved in V3 development and interaction with the core team is stimulating and valuable and personal visits of iRAP to the CoEs adds value.

There is a twin challenge to improve the technical rigour and to drive costs down. Risk descriptions must be fit for purpose and there is the difficulty of the conflict between sustainability and complexity. CoEs can provide careful scrutiny of data collection – quality control in and out. A bad project will damage the image and reputation of iRAP. Club networks mean that there is an added incentive for all participants to maintain quality.

It is very good that CoEs are eager to provide training. There needs to be a structure for this. Some kind of Global Capacity Committee (Training) may be an option.

Other agencies are keen to be involved – eg Southern Illinois. What will the procedure be for bringing these agencies in? The current accreditation system will be extended so that suppliers for all iRAP elements are assessed – from field data collection to coders to analysts, the latter separately. Full accredited suppliers across all the areas a priority.

The supplier perspective and innovation in helping others to help iRAP – Milan Bozic (AMSS) and Blair Turner (ARRB)

AMSS has been involved in iRAP Serbia, has experience of work in Slovenia, Moldova, Maryi-El Netherlands and in the Ukraine. The AMSS-CMV road inspection system and mobile road safety laboratory is sophisticated – it can collect data related to reflection, goniometrics (trigonometry and locationing), direct luminance, has a road signs recognition system, camera calibration system, automatic line recognition, luminance measurement system and much else.

AMSS has been helping others -- AMZS Slovenia, proposed pilots in Montenegro, Albania, Macedonia and the first European training at the University Belgrade.

It is crucial for suppliers to have a good understanding of the iRAP methodology. Documents are available but a “5-minute training package” is also required.

Much of this work is country-by-country and person-by-person persuading. There are issues of scaling up. It can be low margin work and there are issues of automation versus manual coding and complexities in the flow of data; contracts; associated issues of collection of data for asset management; innovation costs – seed funding is required or there has to be a strong demand.

Standard terms of reference are valuable – “this is how you do an iRAP project”. Supplier and government need to get the same documentation.

Supporting iRAP with training packages – Mike Dreznes (International Road Federation)

IRF Washington has a strong focus on training and in presenting packages on the crash types relevant to iRAP – head-ons, run-offs, intersections and for vulnerable road users. There are opportunities for IRF and iRAP to learn from each other.

iRAP is seen as providing a “view from 30,000 feet”. IRF may be able to help with a closer view and in implementation support with local engineers. It also provides “Training and technology transfer” via IRF scholarships.
The IRF safer roads by design provides comprehensive programmes – full detail of typical packages were provided. The hazard of turned-down ends on barriers was provided as one examples of poor design requiring attention in Low- and Middle-income countries (and indeed in High-income countries too).

The Decade of Action for Road Safety provides opportunities for a decade of change.

Innovation for the future: free discussion session on what the priorities are for the next 12 months

What do the Development Banks and IFIs need for the future? – Tawia Addo-Ashong, World Bank Global Road Safety Facility

4-6bnUSD is committed annually by the Development Banks purely to road investment. Are there enough skilled people around to service this need? The IFIs need to see that no one agency has a monopoly and the policy of enabling others and building a supplier network to work competitively within procurement rules is supported. Funds and opportunities need to be distributed in a competitive and equitable way so as to achieve best results for customers.

World Bank Global Road Safety Facility welcomes the efforts being made to ensure that the iRAP methodology is shared and understood. Further work may be required amongst higher-level policy makers.

Urbanisation in Low- and Middle-income countries is extensive and there is a need for modelling to cope adequately with this element of road safety.

Implementation based on iRAP surveys is a huge priority. There is a need to increase this and focus on available countermeasures. IFIs are committed to road safety activity. Most of their input is on infrastructure. Where possible, this should be tied in with wider asset management priorities.

Careful resource planning will be necessary.

If there are lots of countries and widespread activity, tendering will be important and the India work has demonstrated the success of this. Typically, in any project two-thirds is the video coding. In India, Indian consultants were used and they demonstrated massive capacity from a large number of consultants. Consultants can deliver a Terms of Reference. But there is the issue of which comes first – does iRAP build capacity before it knows that there is demand? Large scale capability is possible.

The training material that will support this activity will be in beta version in around three months’ time. Scaling up will apply to the quality and to the process. The coming years will see extensive additional collection of data and iRAP will provide a spur and framework for other road safety activity that may not otherwise take place.

iRAP’s internal focus is on enabling others. Often the cost of procurement is a barrier to success. iRAP wants to be a charity enabling action. For MDBs, a successful way of operating has been to put out a Terms of Reference and for a bid to be made. A unified “parcel of suppliers” approach could be used although this is difficult because of Bank procurement policies. This would reduce the costs
of procurement and encourage a substantial number of bidders. For example, iRAP CoEs would be a panel and bid for the survey, coding. The political engagement part of any road safety activity could be kept free-standing and costs covered in other ways.

It is clear that procurement must be equitable. It needs to be clearly justified if there is any bias. Procurement differs from Bank to Bank and opportunities for unification are very limited.

It may be useful to explore parallels with HDM4. Third parties may ask why a particular methodology is being requested as essential to them and must be used by their client. But the status quo is that people are dying – leadership demands that in principle some kind of safety rating has to provide dividends. Banks do want to be able to say that there is this common indicator. Example abound of how upgrading roads has led to increased deaths and it is necessary to have the tools that will stop this happening – a new 6-lane highway with children running across to get to school is unjust and unacceptable.

Model development priorities – heavy vehicles, public transport features etc) – Steve Lawson and James Bradford (iRAP)

The iRAP model was originally built for car occupant safety and critical values the risk factors and protection elements will reflect the characteristics of these vehicles even though heavier vehicles may not have been specifically excluded from such data as before and after studies.

Heavy vehicles have particular characteristics – other road users colliding with these vehicles typically suffer severe injuries although the occupants of heavy vehicles may benefit from the protection they provide.

Trade routes are a priority for iRAP and are often where heavy vehicles are concentrated. There are issues of conspicuity, vehicles driving in the middle of the road after dark, issues of relative speed, overtaking hazards. Heavy vehicles that carry many passengers (buses, coaches or overloaded trucks) often cause multiple fatalities. It was recognised that the accurate representation of risk provided and experienced by cars and heavy vehicles within the model is “...more than one research project away”. Emphasis should be on modelling trade routes in an adequate manner and then provide a scoping study of the issues of modelling heavy vehicle risk within the iRAP model. Other RAP work on motorcycles (see EuroRAP’s “Barriers to change”) has shown how difficult modelling detailed elements of particular road users can be.

Feeds to and from other models: HDM-4 and IHSDM – Doug Harwood (MRI)

IHSDM and Safety Analyst use a crash data approach and may be a complementary approach to iRAP at the detailed project level. It may also be used in identifying issues first detected in an initial screening by iRAP. IHDSM carries on where iRAP leaves off – eg in assessing before and after studies and in performing evaluation. The information provided by a weak before-and-after study using small numbers may be strengthened if iRAP data covering the same location can point to an objective reduction in risk. This will be enhanced if iRAP is able to provide a set of tools that enables the tracking of performance. A system that can check the difference in likely between the “before” risk, the recommendations, and then what is built would be valuable. For example, to go back to a country and repeat the survey and see the comparison over time. If it is possible to have before and after data (with three years between) and assess the recommended against what is actually built
and when, this would be useful. This is the basis of the KAT tool, used in New Zealand for monitoring. A good steer is for engineers to get used to what the tool is offering before asking for even greater improvements – work on a 80:20 rule, not 99:1.

Chairman

The Chairman thanked TRL as the iRAP Innovation Workshop hosts, said that he hoped the workshop would become an annual event, shared among other iRAP Centres of Excellence. He appreciated the effort that has been made by people who had travelled a long way and the people who had presented and contributed to discussion. He thanked the organisers and looked forward to meeting colleagues in the future.

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About iRAP

The International Road Assessment Programme (iRAP) is a charity (Number 1140357, registered in England) with the vision for a world free of high risk roads. The charity is dedicated to saving lives through safer roads. iRAP works in partnership with government and non-government organisations. iRAP aims to enable

- assessment and Safety Rating of road networks where road deaths are likely to be concentrated
- identify high-risk roads and develop Safer Roads Investment Plans with high benefit cost ratios
- provide training, technology and support that will build and sustain national, regional and local capability
- performance tracking so that funding agencies can assess the benefits of their investments.

Road Assessment Programmes are now active in more than 70 countries throughout Europe, Asia, Australasia and the Pacific, North and South America and Africa. This includes both locally-managed and supported programmes in Europe (EuroRAP), Australia (AusRAP), China (ChinaRAP), New Zealand (KiwiRAP), US (usRAP) and Korea (KoRAP) and regionally-supported country-specific programmes such as iRAP Argentina, iRAP Mexico, iRAP Kenya, iRAP Malaysia, and iRAP India. All countries contribute to the global programme in a spirit of mutual support.

For more information

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To find out more about iRAP visit www.irap.org. You can also subscribe to ‘WrapUp’, the iRAP e-newsletter, by sending a message to icanhelp@irap.org.

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