International Transport Forum

The Safe System Approach in Action

Highway improvements in Karnataka State, India

Case study

This case study is part of a package of materials accompanying the final report of a joint International Transport Forum–World Bank Working Group, entitled *The Safe System Approach in Action*.

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Introduction

This case study was prepared by a joint International Transport Forum–World Bank Working Group convened in 2020–2021. The case study forms part of a package of materials accompanying the Working Group's final report, *The Safe System Approach in Action* (ITF, 2022a).

The Safe System approach to road safety takes as its starting point the ethical position that there is no acceptable level of road deaths and serious injuries. The report proposes a framework for designing, implementing and assessing projects with a Safe System focus. It draws on lessons from real-world case studies to offer guidance on implementing Safe System interventions.

The Working Group analysed 17 case studies in total, paying special attention to their Safe System content. While not every case study was a perfect example of the Safe System approach, all contained valuable lessons. In addition, several common themes emerged. A separate ITF Working Paper (2022b) sets out the thematic analysis.

This case study contains four parts. First, it provides context for the specific intervention and the road-safety problems it aimed to solve. Second, it outlines the interventions implemented to solve these problems and the results. The analysis is structured according to the five key components of the Safe System framework outlined in the main report (ITF, 2022a), namely:

1. Establish robust institutional governance. Permanent institutions are required to organise government intervention covering research, funding, legislation, regulation and licencing and to maintain a focus on delivering improved road safety as a matter of national priority.
2. Share responsibility. Those who design, build, manage and use roads and vehicles and provide post-crash care have a shared responsibility to prevent crashes resulting in serious injury or death.
3. Strengthen all pillars. When all road-safety pillars are stronger, their effects are multiplied; if one part of the system fails, road users are still protected.
4. Prevent exposure to large forces. The human body has a limited physical ability to tolerate crash forces before harm occurs; the system should prevent those limits from being exceeded.
5. Support safe road-user behaviour. While road-user errors can lead to serious harm, the Safe System focuses on roads and vehicles designed for safe interaction with road users. It supports humans not to make mistakes and tune their tasks as much as possible to their competencies.

Third, the case study identifies lessons from the project, again structured according to the five key components of the Safe System framework. Fourth, it offers conclusions.

Access the full set of case studies on the ITF website: https://www.itf-oecd.org/safe-system-in-action.

Context

The second Karnataka State Highway Improvement Project (KSHIP-II) was a partnership between India's Karnataka state and the World Bank to improve the core state road network. The project identified safe demonstration corridors to show how targeted improvements can improve safety. It emphasised a whole-of-government approach to road safety in policy, planning, design, construction and operational activities.

Road-safety themes: Speed management, Safety performance indicators, Infrastructure improvements

To ensure a level of safety is built into road design, the World Bank and Karnataka Public Works Department (PWD) set a target of 3-star safety ratings for each road user group: pedestrians, bicyclists, motorcyclists, and vehicle occupants. To assess the role of infrastructure on road safety risk for the existing road, a baseline Star Rating assessment was carried out by the IndiaRAP team at the start of the project. Just 1% of the road length (before improvement) achieved 3-star or better for vehicle occupants. Pedestrians, motorcyclists and bicyclists fared even worse, with the entire road network receiving a 1 or 2-star rating.

The programme involved co-ordinating resources from several governmental agencies and with the road users. The implementing agency held regular project meetings to align the goal of improving road safety and reducing fatalities and injuries on this corridor. The engineering team identified hazards to the road users and prepared mitigation measures. These measures were shared with stakeholders for feedback.

As an example of the impact of the project, the Belgaum-Yaragatti corridor, which is about 60 kilometres long, reported on average 27 fewer deaths and 124 fewer injuries per year after the project was implemented, representing a 50% reduction which also aligned with IndiaRAP's forecast reductions.

During the planning stage the management of vehicle speeds was considered to reduce the severity of crashes. This incorporated:

- The data collected as part of the baseline assessment was used to help identify road stretches where the drivers were speeding;
- Identification of locations such as bus stops and intersections where pedestrian cross the road so that they could be targeted with traffic-calming measures to reduce speed of vehicles; and
- Engagement with police personnel to understand their needs as part of providing better enforcement of speed limits.

The planning stage was also used to extend the baseline Star Rating assessment to generate an investment plan, which was used to help identify priority safety countermeasures and their locations, including:

- Traffic calming to support lower speeds at key intersections
- Better line marking and signs
- Median and refuge islands
- Safety barriers
- Pedestrian sidewalks and crossings
- Management of vehicle and bus parking

To integrate post-crash care to crash victims as part of the project, the planning stage was used to ensure that post-crash care was included in future road-maintenance contracts.

Road design

The road designers worked with the IndiaRAP team to utilise the Star Rating for Design (SR4D) process to assess the level of risk built into the road design, identify safety issues and revise the designs to improve the level of safety built into the road. The SR4D process also enabled an estimation of reduction in number of fatalities and severe injuries as a result of improved road infrastructure.

The safety audit of design and SR4D process enabled the inclusion of road-safety engineering measures to ensure corridors comply with standards, through improved junctions and geometrics, signage, road markings, bus stops, truck parking areas, and protection structures. The safety enhancements made during the design process enabled improvements to the end road with minimal impacts on the project budget.

Training and road user engagement

The project involved capacity building of the police department through provision and training in the use of surveillance cameras to monitor vehicle speed and enforce speed limits. The community adjacent to the road project was trained to raise understanding of safer infrastructure, post-crash services and police support. In addition, initiatives were used to promote safety through social media campaigns (using Facebook and Instagram), alongside education for both vehicle drivers and children.

Operation

Following the construction of the road, the project team reassessed the road to provide a measure of change in the contribution of infrastructure to the road's safety risk. The post-construction assessment revealed a significant increase in the road length achieving a 3-star rating or better.

Funding

The project was funded by the World Bank, and the development of the SR4D web application was funded by the Global Road Safety Facility.

Actors and leadership

This multi-sectoral safety programme involved the World Bank team of transport and road-safety specialists, road-safety engineers from iRAP and the Karnataka PWD, together with several government departments, including the Home (police enforcement), Health (post-crash care services), Education and Transport (driver licensing and promotion; road safety promotion for school children and teachers near the highway) departments, to improve road safety on a pilot corridor along SH-20.

Interventions and results

Establish robust institutional governance

As part of the project a special road safety cell was setup to prepare an annual road-safety improvement programme along with a budget proposal based on the data collected by the field offices and the police department. This has spurred the government to provide a dedicated budget for future road-safety works.

Share responsibility

The road crash details recorded by police would generally mention driver error as a reason for a crash. At the planning stage, the team conducted detailed crash analysis to identify the time of crash, types of vehicles involved, speed, and the surrounding environment. This helped to identify interventions such as road-infrastructure improvements, speed enforcement, promotion of road safety to road users, and a post-crash care system.

Strengthen all parts

This key component was addressed via infrastructure design of safer roads with speed-management features, forgiving roadsides, and the SR4D process. Road-safety considerations were also introduced during the design and construction and post-crash care phases for crash victims, as was the enforcement of speed limits using modern equipment.

Prevent exposure to large forces

The safer road design included forgiving roadsides by installing crash barriers on the roads with curvy alignment and on the hilly sections. The field officers observed that while vehicle run-off crashes continued to occur post-construction, the crash barrier saves vehicle occupants from severe injuries and fatalities. Victims often receive only minor injuries or no injury at all from such crashes. The increased speed enforcement and safer road design help in reducing vehicle speeds at intersections and in populated areas, thereby reducing the energy in crashes that do occur and so minimising the resultant injuries.

Support safe road-user behaviour

The increase in safe behaviours through education and mass media campaigns, along with driver education, was targeted to support use of the road. More powerfully, the installation of safer road design such as road delineation (visibility) and streetlights increase driver compliance and safety for all users.

Lessons

The key takeaways of this project is the importance of setting measurable and ambitious targets, in this case to lift the demonstration corridors to 3-star ratings or better.

Establish robust institutional governance

It is highly valuable to utilise pilot projects to explore and demonstrate what a Safe System implementation means, as well as might look like and what its impacts will be.

Setting an achievable policy target (i.e. a 3-star rating for all road users of the road infrastructure) provided a focus and measurable objective for the level of safety built into the road. This resulted in the road design going through cycles of refinement to improve safety. The introduction of an achievable policy target also enabled the framework to be established, with the potential for future work to be carried out to a 4 or 5-star rating to better align with the Safe System.

Share responsibility

The combination of improvements in enforcement, road design and promotion of road safety provided strong benefits. The pilot increased co-operation between the police, engineers, local administration, public representatives, transport operators, and health officials. This demonstration corridor approach provides a good basis for scaling up to focusing on area-wide projects, then on to standalone state projects.

Prevent exposure to large forces

The use of the SR4D process to estimate safety benefits in terms of reduction of crashes and saving of lives of road users provided the road designers with real-world understanding of the impact of their decisions.

Conclusions

The SR4D process worked well to provide guidance for safety improvements at the design stage. The SR4D web application is freely available from the iRAP website.

Evaluation of this project based on safety star ratings and on reductions in deaths and injuries clearly demonstrates success. The project did also work partly as a demonstration project, spurring the government to provide a dedicated budget for future road-safety works. Ensuring an evaluation process is planned strongly aids advocacy for subsequent change.

However, more needs to be done to really have such successes act as demonstrations with the successful elements adopted at scale in subsequent projects.

The demand to include education and "awareness raising" in broad engineering programmes is common. The right engineering interventions (which can be based on changes in safety star ratings) will improve safety. Thus, there is a risk that the improvements will be misinterpreted as evidence that awareness raising on risks works.

References

ITF (2022a), *The Safe System Approach in Action*, Research Report, OECD Publishing, Paris, https://www.itf-oecd.org/safe-system-in-action.

ITF (2022b), ITF (2022), "Safe System Implementation in Practice", ITF Working Paper, OECD Publishing, Paris, available on request.

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