

# **(2A) Introduction to Design (and Nepal Rural Road Standards)**

*Presentation for RAP3 Senior Technical  
Management Course*

*Ram Prasad Thapaliya, LRN Construction Specialist*

*August 2016*

# Module Contents

- ❖ Introduction to Design
- ❖ Design Principles
- ❖ Nepal Rural Road Standards
- ❖ Summary

# Introduction to Design

- ❖ More than 50% of Nepal's LRN is unusable
- ❖ 2 Distinct steps:
  - Route selection & alignment – make the right commitment, and
  - Detailing (structures, drainage, etc.)
- ❖ Nepal Rural Road Standards (1<sup>st</sup> Rev, 2013 & 2<sup>nd</sup> Rev, 2014) – emphasis on proper alignment and geometry

# Introduction to Design Contd.

## ❖ Other Standards include:

- ❑ Nepal Road Standard (DoR, 2070)
- ❑ DoR Guidelines (e.g. Construction, Geotechnical etc.)
- ❑ Technical Manuals (Indian, TRL, etc)
- ❑ Handbooks e.g. ICIMOD (Mountain Risk Engineering)
- ❑ TRL ORN16 – ‘Principles of low cost road engineering in mountainous regions, etc.

# DESIGN PRINCIPLES



**Rural Access Programme**  
Development through access

# Design Affects all Interventions

## ❖ New Construction

- ❑ Affects the road's performance and maintenance obligations over its life

## ❖ Improvements / Upgrading

- ❑ Bring an existing road to all-weather and fully engineered standard (i.e. meets NRRS)
- ❑ To upgrade a poorly engineered road often requires new construction not reconstruction

# Design Affects all Interventions

## Contd.

### ❖ Maintenance

- ❑ 'Specific Maintenance' features e.g. gabion retaining walls should adopt same design considerations as new construction
- ❑ A poorly designed new road will lead to a major maintenance burden

# Stages of Design

- ❖ Desk Study – concepts, corridors
- ❖ Site reconnaissance
- ❖ Walk-over survey, comparison of options
- ❖ Detailed Design (Stage 1) – ‘basic level’ design
- ❖ Detailed Design (Stage 2) – detailing, confirmation, corrections based on findings



# Key Design Considerations

- ❖ **Environment** – minimise impact, avoid protected areas
- ❖ **Social** – avoid dwellings, agricultural land
- ❖ **Terrain** – steepness affects necessity for costly structures
- ❖ **Geotechnical** – difficulty of rock cutting, unstable ground
- ❖ **Cost** – economics, value for money
- ❖ **Competing requirements** – a balanced solution

# Design – A Holistic Process

- ❖ Integrate Survey with Design – the designer should be the survey leader, not the head office academic.
- ❖ Combination of Disciplines (environment, geology, hydrology, etc.) – ‘designer’ as team leader
- ❖ The Design Engineer cannot surrender his responsibility to a piece of software – the engineer is the decision driver
- ❖ The ‘bigger picture’ - microscope vs. the ‘eagles view’

# Key Design Elements

- ❖ **Alignment** - geometric (vertical, horizontal, cross-section)
- ❖ **Drainage** – erosion & flooding / Climate Change
- ❖ **Structures** (excluding bridges) – avoid ‘thumb rule’ unless supported by respected official document
- ❖ **Others** (bio engineering, environment, traffic safety, etc.)

# NEPAL RURAL ROAD STANDARDS



**Rural Access Programme**  
Development through access

# Background and Ambition

- ❖ Originally developed in 1998 by MoFALD & DoLIDAR
- ❖ 1<sup>st</sup> Revision 2069 dated January 2013 because original was targeted only at agricultural roads
- ❖ 2<sup>nd</sup> Revision 2071 dated December 2014 introduced intermediate lane in Hill and Terai and local road bridge standard.
- ❖ Covers DRCN and Village Roads (separate characteristics) and differentiates between Hill & Terai locations
- ❖ Intended to be used by all LRN stakeholders and provide uniformity and consistency across the network

# Key Contents

- ❖ Road Classification – DRCN / Village; Hill / Terai
- ❖ Traffic – projected / equivalency / determines x-section (e.g. carriageways of 3m / 3.75m, 5.5m etc.)
- ❖ Horizontal Alignment – curve radii (linked to ‘ruling’ design speed), widening on tight curves, super elevation on tight bends, etc.

# Key Contents Contd.

- ❖ Vertical Alignment – various limitations (12% in Hills), reduced at hairpins (4% max), recovery sections on long climbs (>7%)
- ❖ Ancillary Features – passing zones (5.5m wide for 2 trucks to pass) related to sight distance / gradient; laybys / bus stops etc.
- ❖ Safety & Signage – a feature of all geometric limitations, warning signs, (DoR Traffic Manual 1997); edge markers / physical barriers at large drops; sight distance at junctions etc.

# Relaxation

- ❖ ‘Ruling’, limiting’, ‘exceptional’ (e.g. gradients)
- ❖ ‘Desirable’ (e.g. ‘100m spacing is desirable but may be less as per site condition’)
- ❖ Clause 19 – Relaxation of Rural Road Design Standard: *‘Intended to provide guidance for designers rather than to be considered rigid minima. Standards may be relaxed by DoLIDAR to meet special circumstances such as very difficult terrain or high cost of construction’*





**RAP 3**

**Rural Access Programme**  
Development through access



**Rural Access Programme**  
Development through access

**END**



**Rural Access Programme**  
Development through access