“Capacity Building Workshop on Sustainable Urban Transport Index”


Piloting Sustainable Urban Transport Index in Kathmandu Valley towards Implementation of Sustainable Urban Transport.

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- Ministry of Urban Development,
  - Government of Nepal.
Introduction:

- Kathmandu Valley Development Authority; Planning, Developing, Monitoring, Regulating and Prohibiting agency; has a mandate to prepare and implement an integrated physical development plan for Kathmandu Valley, which encompasses 16 municipalities with estimated permanent population of 3 million and floating population of another Two and a half millions.

- It’s mission is to develop “Kathmandu Valley as a Safe, Clean, Organized, Prosperous and Elegant (SCOPE) National Capital Region”, so as to foster the global image of Kathmandu Valley as a “livable city with the synergy and harmonization of nature, society and culture”.

In Figures:

- National Population = 26.49 Million = 26,494,504 People
- National Population growth rate = 1.35%
- Human Development Index = 0.490
- Per Capital Income = US$1160.
- Population growth rate in Ktm Valley = 4.63%
- Population growth rate in new municipalites in ktm valley = 5.7%
- Kathmandu District
  - Population = 1.74 Million = 1,744,240 People
  - Human Development Index = 0.632
  - Per Capital Income = US$ 2764.
- Lalitpaur District
  - Population = 0.46 Million = 468,132 People
  - Human Development Index = 0.601
  - Per Capital Income = US$ 1894.
- Bhaktapur District
  - Population = 0.30 Million = 304,651 People
  - Human Development Index = 0.532
  - Per Capital Income = US$ 1379.

Data Source: Nepal Human Development Report 2014
Kathmandu valley (722 sq.km.)
Urban Growth Scenario

- **Land Use 1990**
  - Others: 5.28%
  - 58.40%
  - 34.10%

- **Land Use 2000**
  - Others: 9.22%
  - 54.60%
  - 34.12%

- **Land Use 2010**
  - Others: 16.44%
  - 47.39%
  - 34.78%

Legend:
- Agricultural
- Forest
- Open space
- Shrubs
- Builtup area
- Water
- Airport
- Palace
- Road

Maps showing urban growth from 1990 to 2010.
Challenges

- **Unbalanced Mono centric Urban Structure**: Economic activities primarily concentrated in Kathmandu and periphery and large urban centres, large number of municipalities still exhibit rural characteristics.

- **Weak Rural-Urban Linkage**: Small towns suffer from the minimal investment from public and private sectors resulting into inadequate development of physical infrastructure.

- **Environmental Degradation**: With the encroachment to the public land and natural resources, inefficient or inadequate transport networks, shortage of drinking water, unscientific dumping of solid wastes, loss of agriculture land, squatters problems.

- **Ambiguous National Policy**: No horizontal linkage with the Ministry of Local Development, Ministry of Physical infrastructure and Transport and National Planning Commission resulting ambiguity in the policy formulation and implementation.

- **Weak Municipal Capacity**: The capacity of the municipalities, with respect to administrative, technical and financial capabilities, have not developed to cope with the increasing demand for additional or improvement of services. Moreover, there has been total absence of elected body for several years.

- **Mono-centric radial road network**: Existing road network system basically radial road network system. This system accelerates the congestion in city center and traffic passing through city center cannot divert city center.
**Urban Form of Kathmandu Valley**

**Development Zones: Macro Level Of Planning & Policy Decisions**

1. **Old City Core (till 1950):** Culturally Important
2. **Extension of city core - ring road (1950-1990):** Economically Important
3. **Zone beyond ring road - up to proposed outer ring road (ORR); (1990-till date):** Important for standard living environment
4. **Zone beyond ORR to foothills (mostly rural; Service zone):**
5. **Hills/ Rural:** Ecologically important

- Based on their characteristics on density and building typology.
- Referred for macro level of planning and policy decisions.
### 20 Years Strategic Development Master Plan for KV

#### 11 Strategies included by 20 years Strategic Development Master Plan:

| Planning at two Levels: Macro Level (Valley) & Micro (Municipal Level) |
| Constraints/sensitivity based zoning and Risk Sensitive Land use plan |
| **Risk Resilient Urban Infrastructure** |
| Environmental Friendly and Resilient Planning Approach |
| Urban Regeneration of Historic City Core |
| Identification of Economic Opportunities and Growth areas |
| Gender Equity and Social Inclusion |
| Safety and Security in urban development |
| Private Sector Involvement in urban development activities |
| Information, Communication and Advocacy |
| Youth Mobilization and Participatory In Urban Decision Making Processes and Development Activities |
Comprehensive Risk Sensitive Land Use Plan

Major Basis

- Urban Growth Trend
- Multi-Hazard Vulnerability Analysis

Identification of Construction promotion and Restriction area

Legend
- ORR Alignment
- Fast Track
- TIA Approach Funnel
- Urban Central Area
- Traditional Settlement
- Old Settlement Buffer
- Periphery of Urban Core (Constraint Free)
- Periphery of Urban Core (1st level of Constraint)
- Periphery of Urban Core (2nd level of Constraint)
- Urban Extension (Constraint Free)
- Urban Extension (1st level of Constraint)
- Urban Extension (2nd level of Constraint)
- Suburbs (Constraint Free)
- Suburbs (1st level of Constraint)
- Suburbs (2nd level of Constraint)
Color Zones: Risk Sensitive Regulations

Risk Sensitive Land Use Planning

Residential Promotion Area
- Priority to Land Pooling, Organized Housing
- Few High Rise Buildings in South
- Large & Medium Scale Industries
- Low Permit fee/ Land Transaction Tax

Agricultural Area Promotion zone
- Restriction of Buildings on Agricultural Land
- High rise apartments on South East
- Promotion of Non-Polluting Industries
- Low Permit fee/ Land Transaction Tax

Medium Alert Zone
- Stringent Building Bye laws
- Few High rise Buildings on selected area
- No large scale Industries
- Medium permit fee/ Land Transaction Tax

High Alert Zone
- Stringent Building Byelaws
- Restriction to High Rise Apartments
- No Large Scale Industries
- Heavy Permit fee / Land Transaction Tax

- Reflect the availability of ward wise risks and constraint free area.
- To have policies to AVOID or CONTROL or PROMOTE uses.
Possible Development Areas
Institutional arrangements and agencies involved in planning, development assessment and monitoring of urban transport systems / projects

- Ministry of Urban Development.
- Ministry of Physical Infrastructure and transport.
- Ministry of Federal Affairs and Local Development.
- Department of Roads. (Major roads)
- Department of Railways.
- Department of Transport Management. (Vehicle license)
- Road Board Nepal.
- Department of Urban development and Building Construction. (Urban small scale roads)
- Department of Local Infrastructure Development and Agricultural Roads, DoLIDOR, (Local rural roads)
- 2 Metropolitan cities, 14 Municipalities. (Urban small scale roads less than 8m roads)
- 3 District Coordination Committees (Rural small scale roads)
Relevant legal and policy provisions

- Kathmandu Valley Development Authority Act 2045
- The Thirteenth Plan (2070/71-2072/73) 2014
- Guidelines for Works in Kathmandu Valley, 2007
- National Transport Policy, 2002
- The Long Term Development Concept of Kathmandu Valley (2020), 2002
- Road Boards Act, 2001
- Local Self Governance Act, 1998
- Vehicles and Transport Management Regulations, 1996
- The Study on Kathmandu Valley Urban Road Development, 1993
- Public Roads Act, 1993
- Vehicles and Transport Management Act, 1990
- Town Development Act, 1987
- Ancient Monuments Preservation Act, 1956
20 Years Strategic Development Master Plan For KV, Integration Of Land Use and Transportation

New Urban Structure: Disaster Resilient Green Satellite Cities

Transport Connectivity Plan

LEGEND
- Central Business District
- Sub City Center
- District Center
- New Urban Area with High Density
- New Urban Area with Medium Density
- Central Station
- Arterial Road Network
- New Public Transport System
Integration of Multipolar and linear & nodal development.
Feasible new urbanizing area with Proposed Outer Ringroad.
Future Road Network System  
- Conversion to Radial-Circumferential road network

Development of Inner Ring Road enables vehicles to divert congested CBD area.

Outer Ring Road services suburban areas.
 Proposed Distribution of Emergency Transport Road Network

Red: First Emergency Transport Rod Network
Black: Second Emergency Road Network
Activities of KVDA

- More than 350 km strategic roads widened as per GLD and Byelaws focused on Emergency transport road network.
- Eastern North to south corridor of Proposed Inner ring road: Dhobikhola corridor development project = 9.5km x 2 = 19km (95% completed).
Proposed Outer Ring Road.
Trip distribution Result

Mono centric pattern in 2011
(One CBD and suburb)

Integration of multi polar and liner in 2030
(One CBD, one sub-center and multi polar)
Introduction of New Public Transport System

In Kathmandu, peak hour passenger per direction would range between 8,000 and 12,000 Peak Hour Peak Direction Traffic (PHPDT). Even in the current demand for 100,000 persons/day on the link.

Mode Characteristics

Future Demand would Require for Mass Transit System for Katmandu Valley

Source: JICA Study Team made this figure referring to the document written by Japan Transportation Planning Association and other related documents
<table>
<thead>
<tr>
<th>Item</th>
<th>MRT</th>
<th>Monorail</th>
<th>AGT</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolling Stock</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
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<tr>
<td>Station</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
<tr>
<td>Capacity (PHPDT)</td>
<td>More than 25,000</td>
<td>10,000 - 35,000</td>
<td>5,000 - 23,000</td>
<td>5,000 - 15,000</td>
</tr>
<tr>
<td>Speed</td>
<td>More than 30 (km/h)</td>
<td>28 - 42 (km/h)</td>
<td>25 - 37 (km/h)</td>
<td>25 - 35 (km/h)</td>
</tr>
<tr>
<td>Construction and Operation Cost</td>
<td>Largest</td>
<td>Large-middle</td>
<td>Middle</td>
<td>Middle-small</td>
</tr>
<tr>
<td>Necessary Space</td>
<td>Small (Underground)</td>
<td>Large-middle (Viaduct)</td>
<td>Large-middle (Viaduct)</td>
<td>Large (Dedicated Lanes on Road)</td>
</tr>
<tr>
<td>Impact on Environment</td>
<td>Small / None / None</td>
<td>Small / Small / Small</td>
<td>Small / Middle / Middle</td>
<td>Small / Middle / Small</td>
</tr>
<tr>
<td></td>
<td>(Air / Noise / Aesthetic)</td>
<td>(Air / Noise / Aesthetic)</td>
<td>(Air / Noise / Aesthetic)</td>
<td>(Air / Noise / Aesthetic)</td>
</tr>
<tr>
<td>Maximum Gradient</td>
<td>35‰</td>
<td>60‰</td>
<td>60‰</td>
<td>--</td>
</tr>
<tr>
<td>Minimum Curve</td>
<td>R = 170m – 200m</td>
<td>R = 60m – 100m</td>
<td>R = 30m – 60m</td>
<td>--</td>
</tr>
<tr>
<td>Note</td>
<td>Mass Transit High Speed</td>
<td>Mass – middle transit Road traffic is affected by the viaduct structure Environmental friendly in landscape, sunlight, and air circulation</td>
<td>Mass – middle transit Road traffic is affected by the viaduct structure Driverless Operation Flexible horizontal alignment</td>
<td>Mass – middle transit Road traffic is severely affected by dedicated lanes Less Investment Cost</td>
</tr>
</tbody>
</table>

**Source:** Prepared by JICA Study Team based on various WEB sites information
The Project on Urban Transport Improvement for Kathmandu Valley

**Line-1 North-South Line**
- AGT System
- Dedicated Viaduct Structure

**Line-2 East-West Line**
- AGT System
- Dedicated Viaduct Structure

**Line-3 Circle Line**
- Full scale BRT System
- Dedicated Lanes on Road

**Line-4 Inner Circle Line**
- BRT System
- Dedicated Lanes on Road

Image for MRT Network for Kathmandu CBD
Transit Oriented Development (TOD)

Lainchaul Area TOD

West Station area TOD

Central Station Area Redevelopment as TOD

Patan Area Redevelopment as TOD

East Station area TOD

East New Town Development as TOD
Piloting the SUTI indicators in Kathmandu Valley.

The Ten indicators of SUTI are as follows.

- Indicator 1: Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active transport.
- Indicator 2: Modal share of active and public transport in commuting.
- Indicator 3: Convenient access to public transport service.
- Indicator 4: Public transport quality and reliability.
- Indicator 5: Traffic fatalities per 100,000 inhabitants.
- Indicator 6: Affordability – travel costs as part of income.
- Indicator 7: Operational costs of the public transport system.
- Indicator 8: Investment in public transportation systems.
- Indicator 9: Air quality (PM10).
- Indicator 10: Greenhouse gas emissions (CO2eq tons/year).
Piloting the SUTI indicators in Kathmandu Valley.

Indicator 1: Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes.

As per the expert meeting held in Ministry of Physical Infrastructure and Transport, Government of Nepal in presence of Act. Secretary Mr. Keshab Sharma, Transport Experts Er. Kamal Pande, Dr. Surya raj Acharya, Er. Sushil Babu Regmi, Dr. Madan Bandhu Regmi and Mr. Bhagawat B. Khokhali.

- Walking network
- Cycling network
- Intermodal transfer facilities
- Public transport
- The minimum to maximum range was 0 to 16.

So indicator value which is derived is 7 that denotes 43.75% value which means below average range.

- There are lots of transport master plan built but either they are not implemented or most of them deals with any one modes only. Most of the plans are done in sectoral aspects only. Some covers only few municipalities, some covers only few modes etc.
- From this result it has been identified that one single authority has to be given the sole authority for the overall planning, designing and implementing the transport plans and programs within the Kathmandu valley as one administrative unit.
Piloting the SUTI indicators in Kathmandu Valley.
Indicator 2: Modal share of active and public transport in commuting

For this the study of JICA Experts in traffic improvement in Kathmandu valley done in 2011/2012 has been used. This is the latest data available so far. And The trip calculated is disjointed trips.

In public transport, we only have road transport.

The minimum to maximum range of percentage of share of active and public transport with total was 10 to 90. So here 69.77 % value denotes 74.71% after normalization value which means good share of active and public transport modes.

- The Average daily trip within KTM valley is around 5km.
- But in the other hand the highest walking population can also mean that not sufficient availability of the proper and enough active transport mode and since less travel distance within Kathmandu ring road area so people usually walk within shortest distance. From the city center to any location in the ring road takes about 60 minutes’ walk for average people’s speed.
- However, congestion and suffocation to travel in bus in the peak hours seems logical due to insufficient mode of transport for peak load i.e. high numbers of low capacity vehicles and less number of high passenger capacity vehicles.
Piloting the SUTI indicators in Kathmandu Valley.

Indicator 3: Convenient access to public transport service

Bus Stations are very nearby within 500m distance and multiple modes of transport use similar stations nearby the city areas.

Hence as per the Data Collection Survey on Traffic Improvement in Kathmandu Valley (2012) and Detailed Planning Survey (2013) conducted by JICA in coordination with the Government of Nepal 85% of population have easy access to public transport.

The minimum to maximum range of percentage of population with easy access to public transport was 20 to 100. So here 85% denote 81.25% after normalization which means good accessibility.
Piloting the SUTI indicators in Kathmandu Valley.
Indicator 4: Public transport quality and reliability

Population satisfied with the public transportation is calculated with the random survey of the public transport users:
- About 21.61% are only satisfied with the service provided.
- About 16.52% populations have average opinion.
- The minimum to maximum range of satisfaction was 30 to 95. So here 21.61 is below lowest, hence minimum value is kept as 31.
- If we keep 30 as minimum value the geometric mean will be zero.
- This values shows that we are far beyond the minimum range and we should consider improving this immediately.
- Most of the people demanded to focused on safe and proper pedestrian networks.
Piloting the SUTI indicators in Kathmandu Valley.

Indicator 5: Traffic fatalities per 100,000 inhabitants


From that data last fiscal year have 182 deaths, 201 seriously injured, 3914 slightly injured and total number of road accidents is 5530. From this the value of 6.33 is derived and the minimum to maximum number of fatalities is 35 to 0 and the value 6.33 is normalized in range so it comes out about 81.91% which is better result for this indicator.
Piloting the SUTI indicators in Kathmandu Valley.
Indicator 6: Affordability – travel costs as part of income

In many cases the family with 5 numbers are prominent in Kathmandu valley with only one person with regular income, hence national mean household income standard is not being used. In case the mean income is based on a single income in household with minimum government salary. (Targeted to lowest income groups.)

- First disjointed trip = Rs.15 and Second disjointed trip after interchange of vehicles = Rs. 15 so the base is Rs 30 per one full trip with one interchange
- Average trip of 5km per day
- Minimum value= 35
- Maximum value= 3.5
- Hence the indicator value for weighted monthly cost comes out to be 11.1 which after normalizing comes out to be 75.87% which is near to maximum range.
Calculating bus fare revenue with its transport operating costs

- Average monthly income per bus: Rs. 291,866,
- Average operation cost of Rs. 2,82,266 is used in a bus which is 96.68% of ticket income.
- The fare box ratio is 102.4% which is close to minimum range of about 52.55%. This shows the profit margin in a public bus service is pretty low.

- Break down of income:
Piloting the SUTI indicators in Kathmandu Valley. 
Indicator 8: Investment in public transportation systems

- Only road network available in KV with 12.30% of total national transport budget invested in Kathmandu valley.
- Very nominal direct Govt. investment in transport and only focused in PPP model as 99% public road transport (Vehicles) is done by Private parties.
- Here regarding the transport improvement expenses, KSUTP project’s annual expenses is used to compare with Kathmandu’s total expenses.
- the share of ktm valley’s public transport expenses with total values transport expenses comes out to be 17.84 which after normalizing comes out to be 35.68% which seems pretty low for the government investment and priority.
Annual Mean of PM10 = 88 micro gram per cu. m in 2013.
Annual Mean of PM2.5= 49 microgram per cu.m.
Minimum value = 150
Maximum value= 10
normalizing the data the value of 44.29 %
This shows the pollution level in kathmandu valley. However, the Total suspended particles are much worst in the valley than PM10.
Piloting the SUTI indicators in Kathmandu Valley.
Indicator 10: Greenhouse gas emissions (CO2eq tons/year)

- From the fuel consumption within the Kathmandu valley, the CO2 emission is 1643.39 Gg.
- And the carbon dioxide emission per capita indicator value comes to be 0.57 hence this value has been used.
- After normalizing this value comes to be 79.27 % which is good till now.
Conclusion:

From all these indicators the SUTI result comes out as follows.

<table>
<thead>
<tr>
<th>INDE X</th>
<th>Arithmetic</th>
<th>57.08</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDE X</td>
<td>Arithmetic using weights</td>
<td>57.08</td>
</tr>
<tr>
<td>INDE X</td>
<td>Geometric mean</td>
<td>41.91</td>
</tr>
</tbody>
</table>
Conclusion:

- Firstly the public transport quality and reliability has a biggest problem in Kathmandu valley and this should be considered by the authority immediately.

- Secondly the Investment in public transportation system has to be revised and updated and clear focus should be given to modes of transport and as per the trips we came to know that major mode is walking and wide pedestrian friendly roads need to be built and modified. Now Vehicles are getting 1st priority, but from the results it came to note that pedestrian should get first priority.

- Active modes of transport has to be prioritized in the city planning, our plans and programs should be focused as per the modal shares and public transport facilities.
Conclusion:

- Though the farebox ratio of the transport sector is 102.4%, there are lots of private companies sustaining in Kathmandu valley and they are flourishing as well. They have reduced the expenses and maintained the profit of about 15-20% as per the expert review discussion held in the ministry.

- Air quality needs to be improved by using environment friendly vehicles. Though here we have considered PM10 in the indicators, the Total suspended particles in our roads are much worse than PM10. Huge projects like Melamchi water supply pipe line installment project, Upcoming Underground utility duct projects will ultimately contribute to the rise in Total suspended particles in the roads while construction all over the Kathmandu valley.

- Greenhouse gas emission is pretty satisfactory as the emission is less by vehicles which seems that transport sector contributes around 17% of total carbon emissions within the valley. From the various studies we came to know that carbon emission is low in least developed countries than the developed countries.
Conclusion:

- Overall result of SUTI of Kathmandu valley is 41.91 in geometric mean and 57.08 in arithmetic mean. This is pretty low in average. Only 2 indicators show good performance. This data has been approved through the expert group meetings as well.

- In conclusion, SUTI indicators helps the city authorities to do the SWOT analysis (Strength, Weakness, Opportunities, and Threats) of the transport infrastructures and management so it is very much helpful to identify the needs of the people and cities to be based on the indicators.
As there is a saying 'A chain is only as strong as its weakest link'. So it is best to focus on each and every single indicators for good and sustainable transport system.

Thank you.