

Spatial Analysis of Indian Railways

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Why a project on RAILWAYS

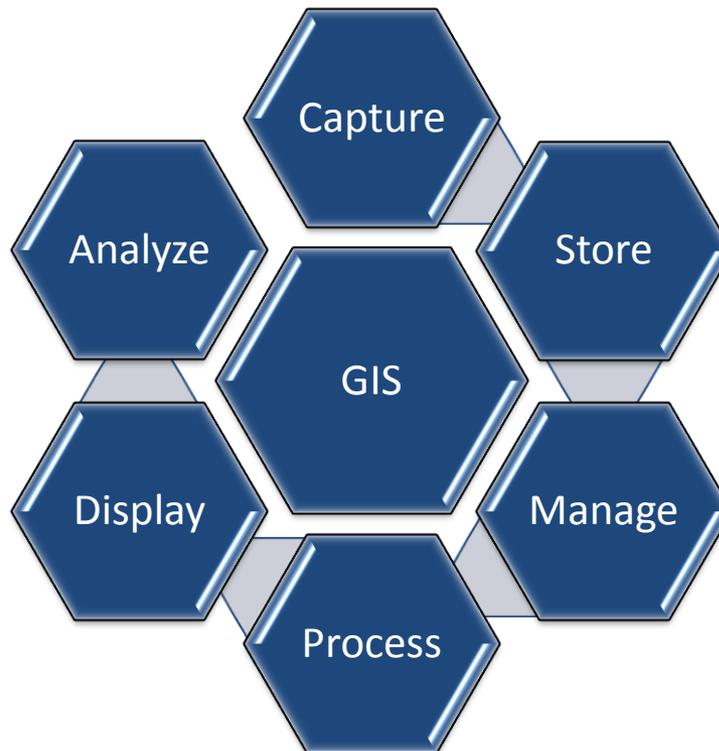
- Railway is the biggest public sector of India.**
- We need a platform for analyzing rapid advancements.**
- Some tool that can affect our policy making.**

Moreover

- Country growth is a direct consequence of transport development.**

How can GIS help ?

- ❑ Repository of database is necessary for the growth of sector.
- ❑ GIS helps in populating this repository.



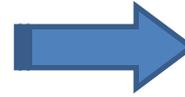
Our Objectives

- Budget analysis of an entire decade.
- Creation of open access repositories for conducting the spatial analysis.
- Major disasters analysis : Places and patterns.

Data

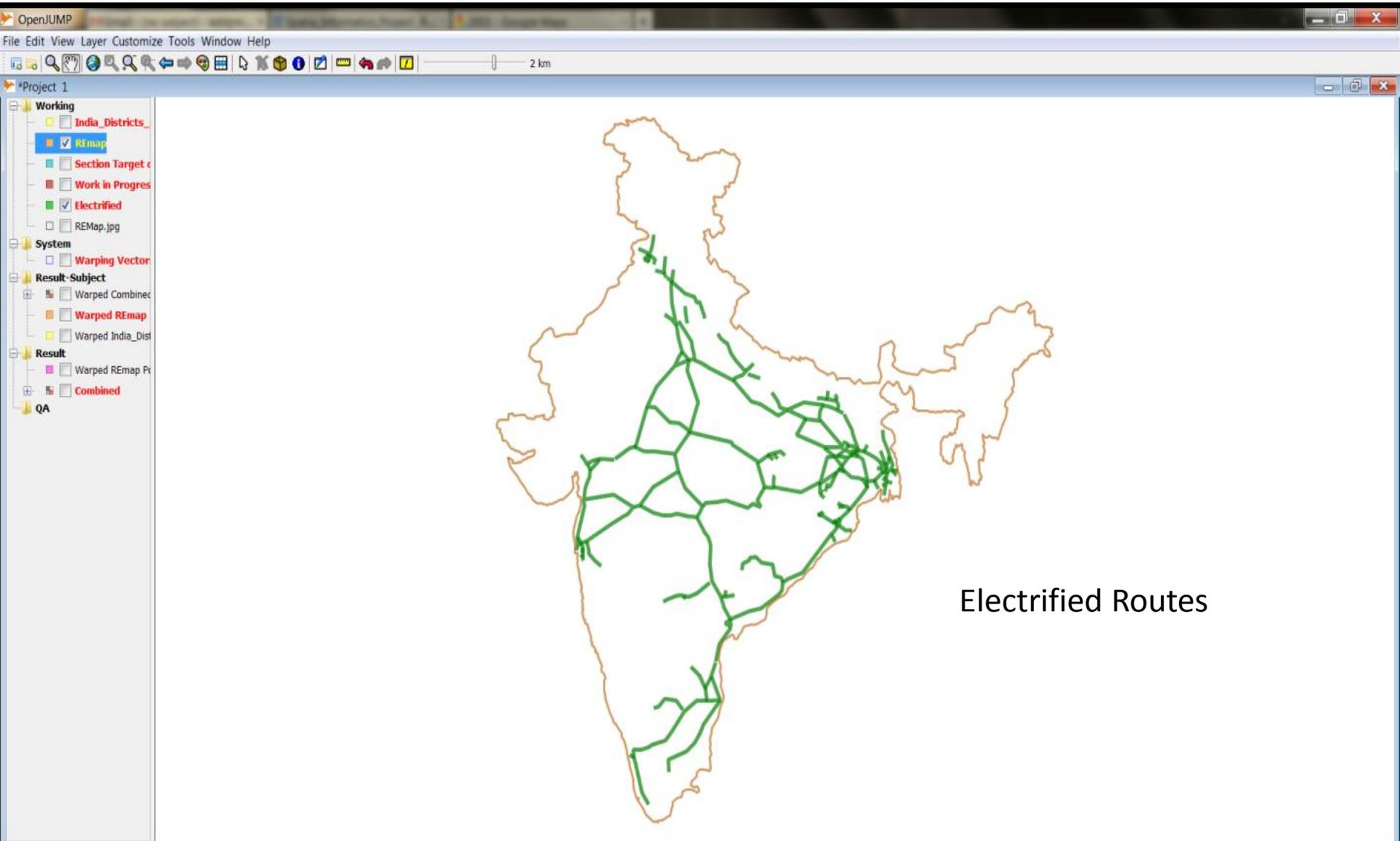
- ❖ Railway budgets for financial years 2000 to 2009.
- ❖ Official Data
- ❖ Height variations data for various districts of the states.
- ❖ List of the major rail accidents over last decade

Workflow



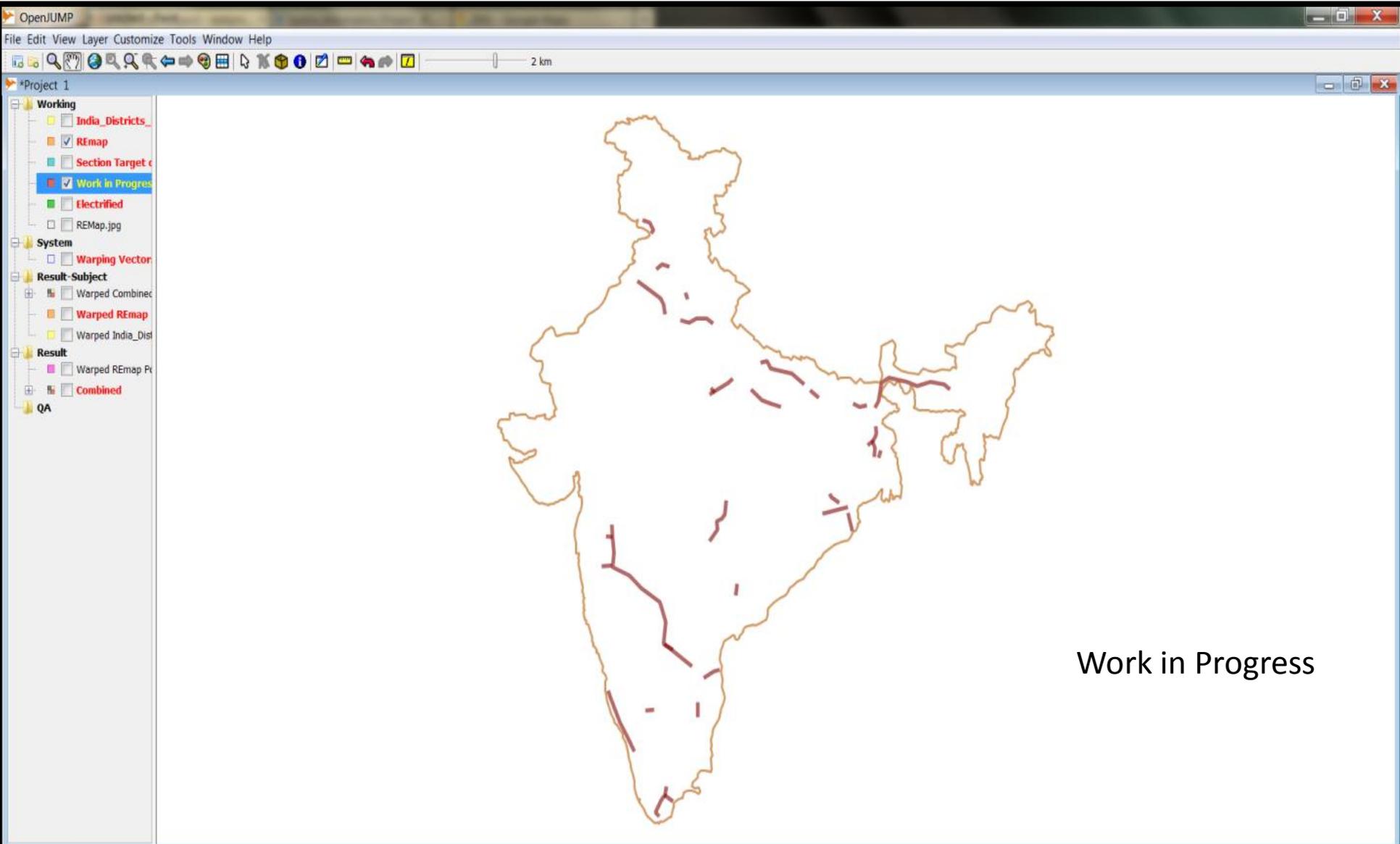
Development of Repository

- Using open source library GDAL and its OGR toolkit
- Over a district-wise geo-referenced map of India in form of Shape (.shp) files.
- District -> Polygon
- Railway lines -> Lines
- Railway Station -> Point
- Centroid of Polygon : `int OGRGeometry::Centroid (OGRPoint * poPoint) const [virtual]`
- Lines : `OGRLineString ()`
- Vertex point : `Void setPoint (int, OGRPoint *)`



Electrified Routes





Work in Progress

Number Selected: 0 [0, 0] 0 pts | 209 MB Committed Memory | (-570.1, -477)

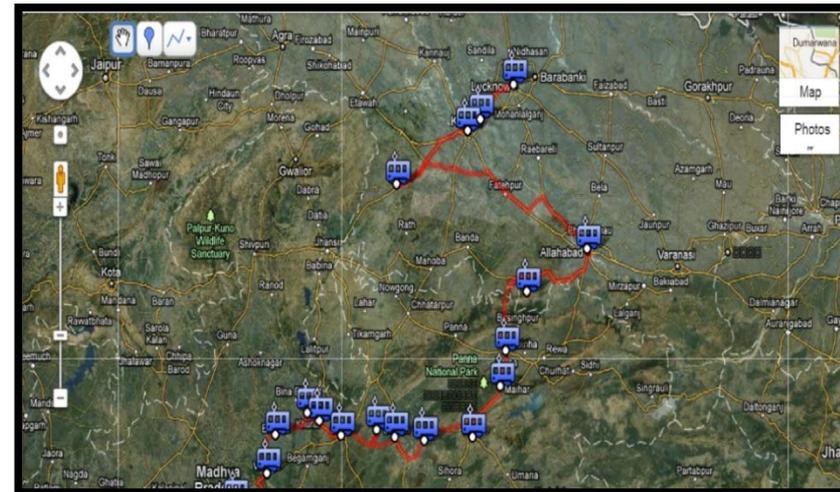
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Limitation:

This only looks at the district level information and overlooks the sub district stations that come in the network.

Other Repository

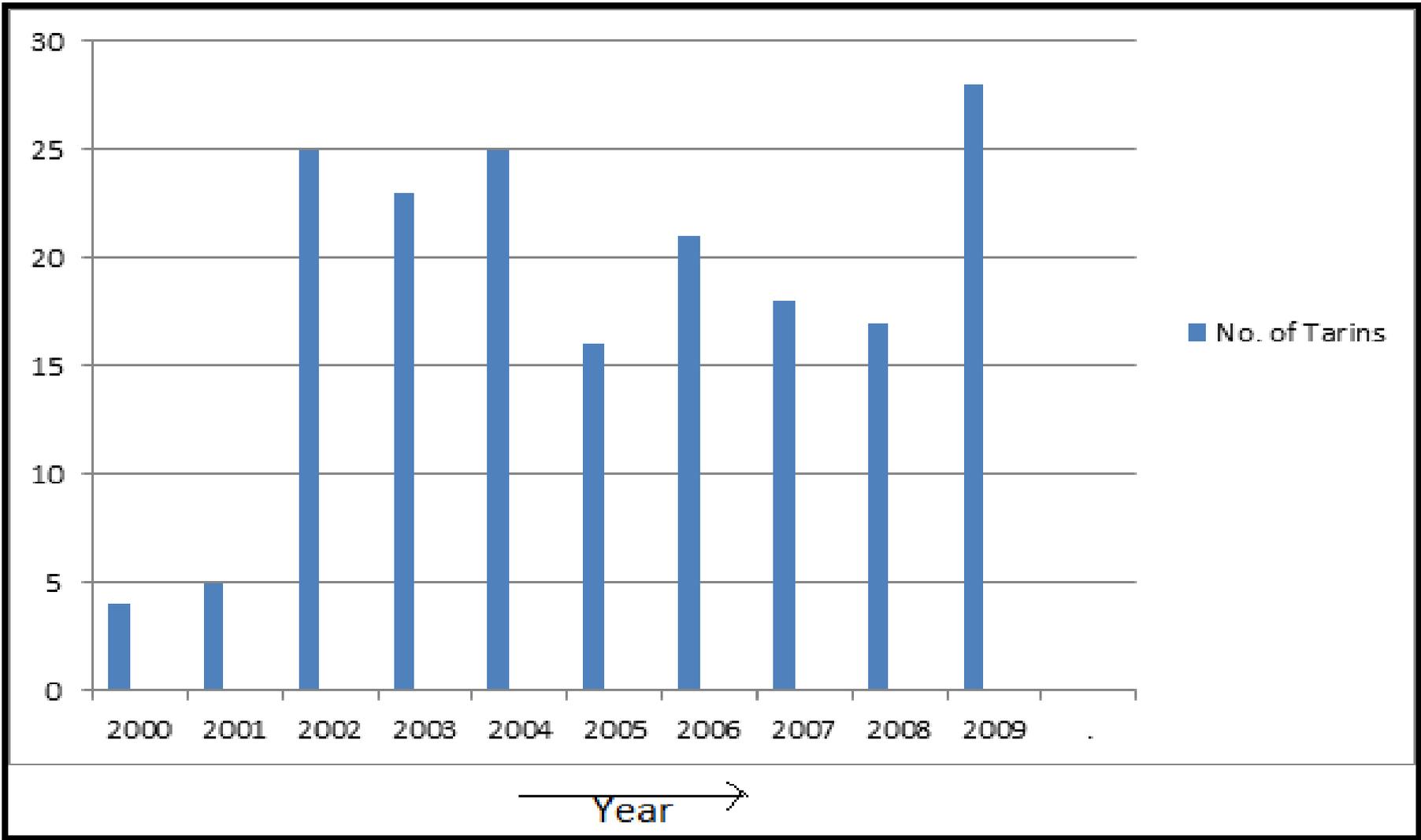
- open access Google Earth repository.
- Verification of existence of proposed train
- Finding route of train if it exists.
- Tagging important stoppages of the train along its route.
- Can be imported to the local system that can be accessed offline.

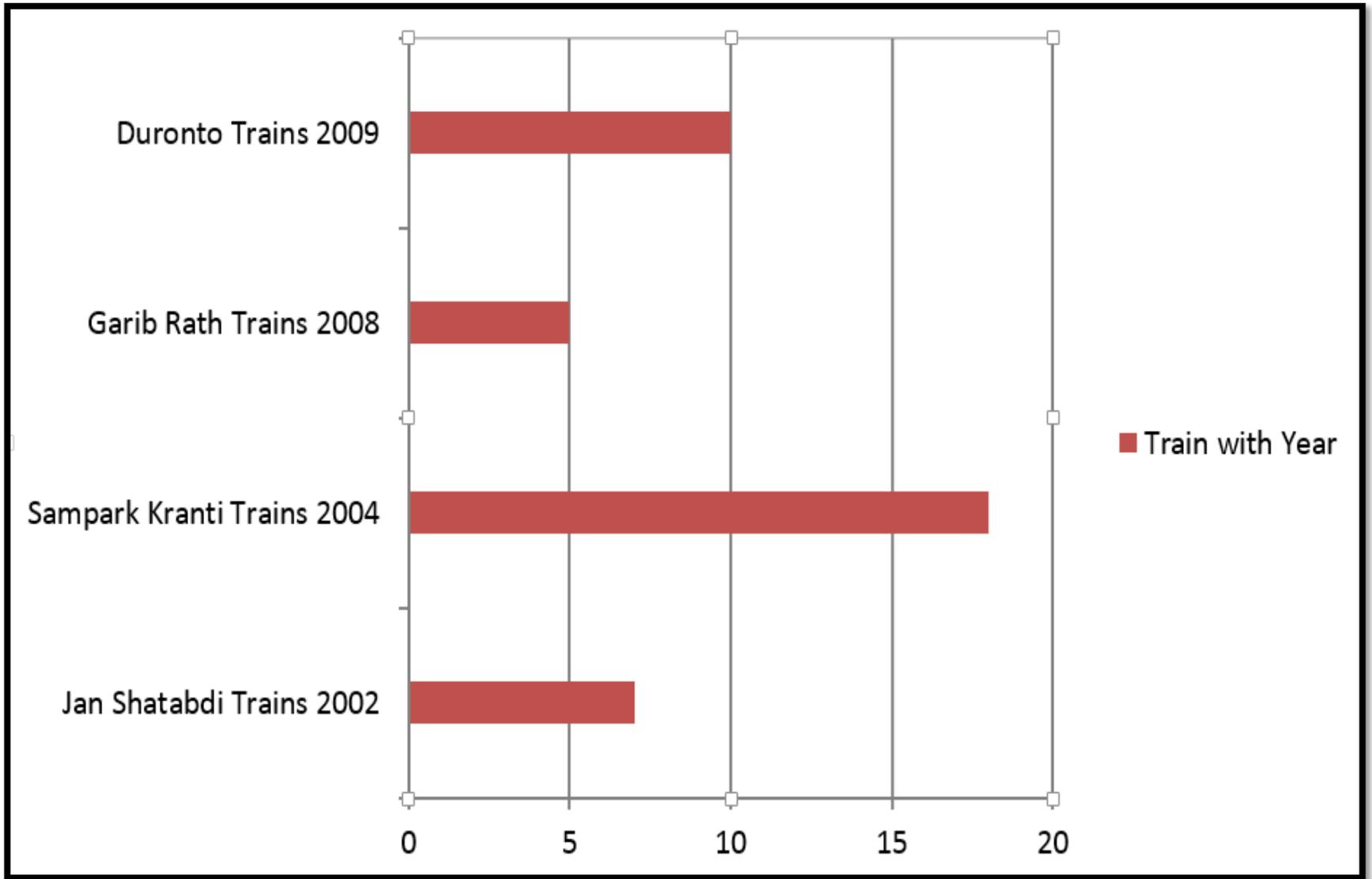


Limitation:

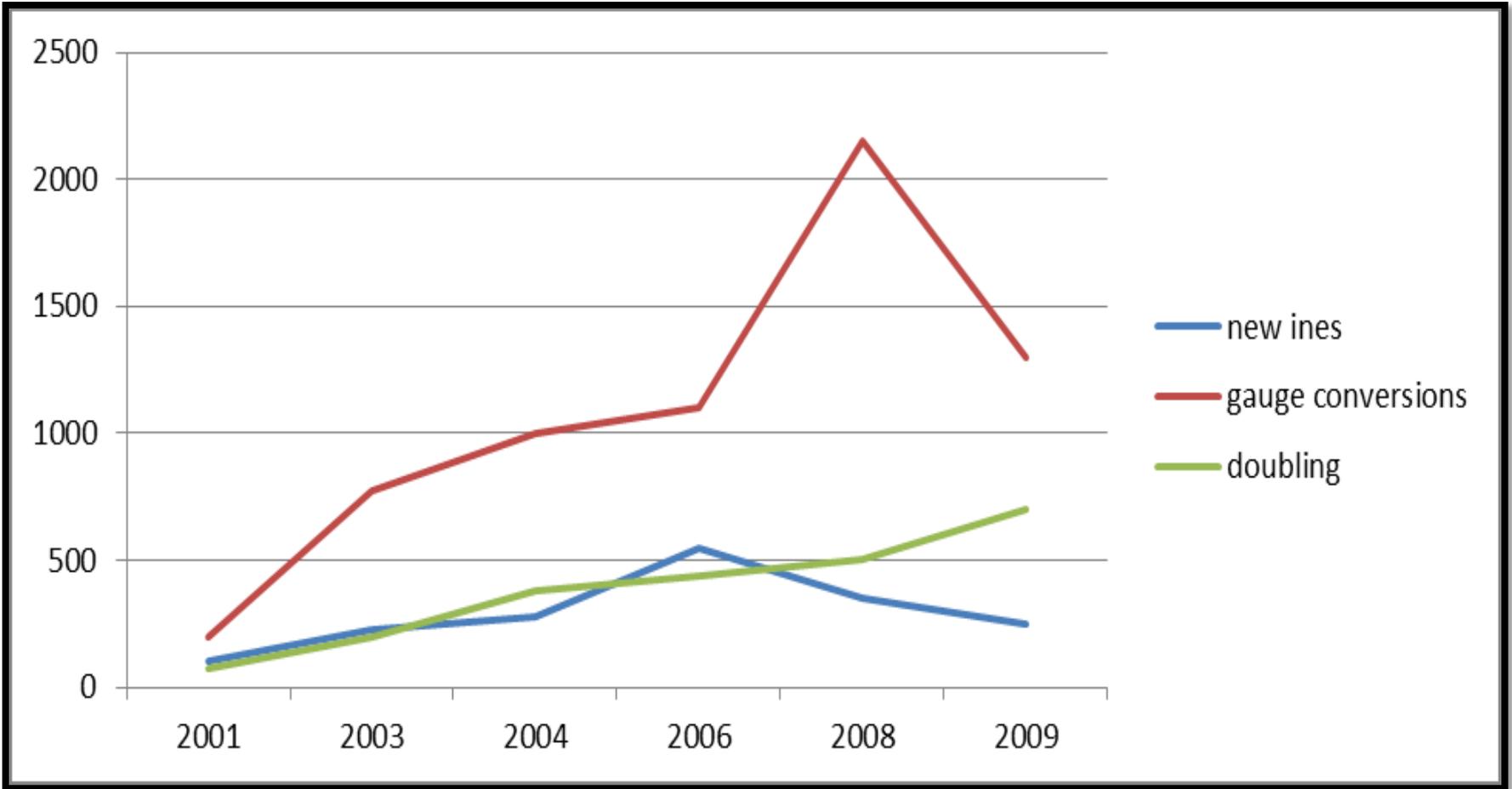
It does not follow the actual railroads rather the road transit system which is assumed to be parallel to the rail network and thus solving the purpose.

Inclusion of new train services and their impacts for decade 2000 to 2009

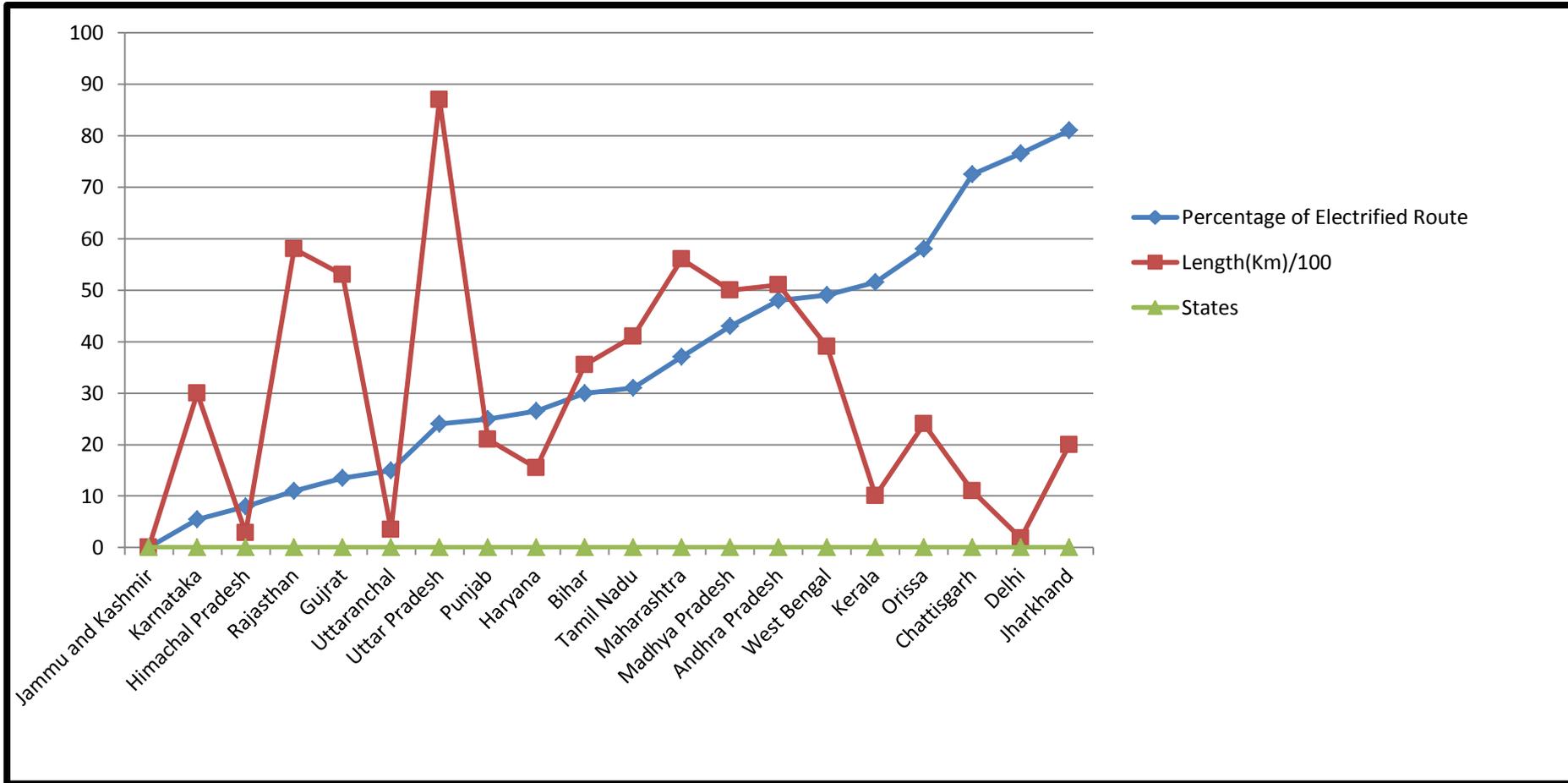




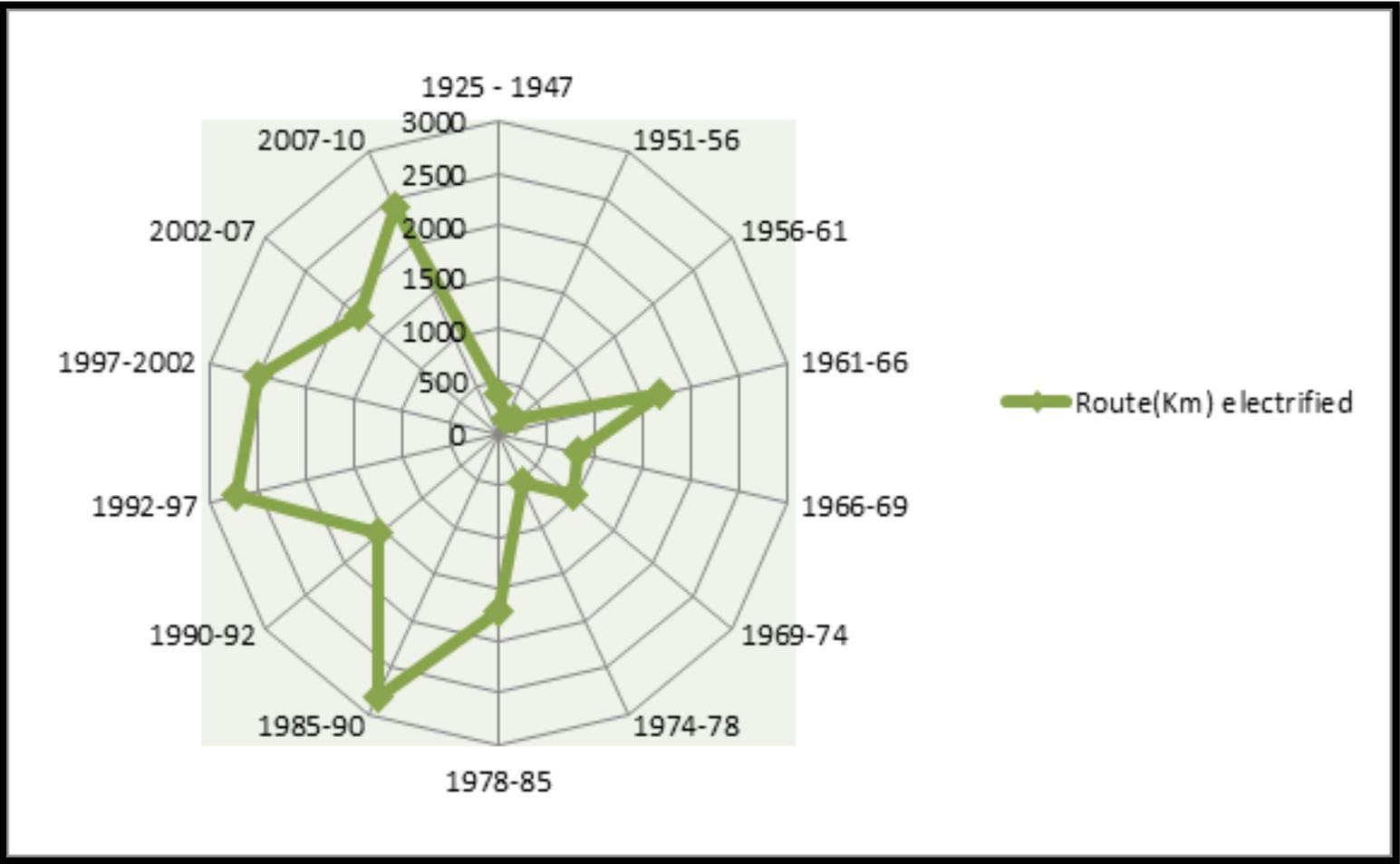
Relation of increase in no. of trains with new lines, gauge conversion and doubling



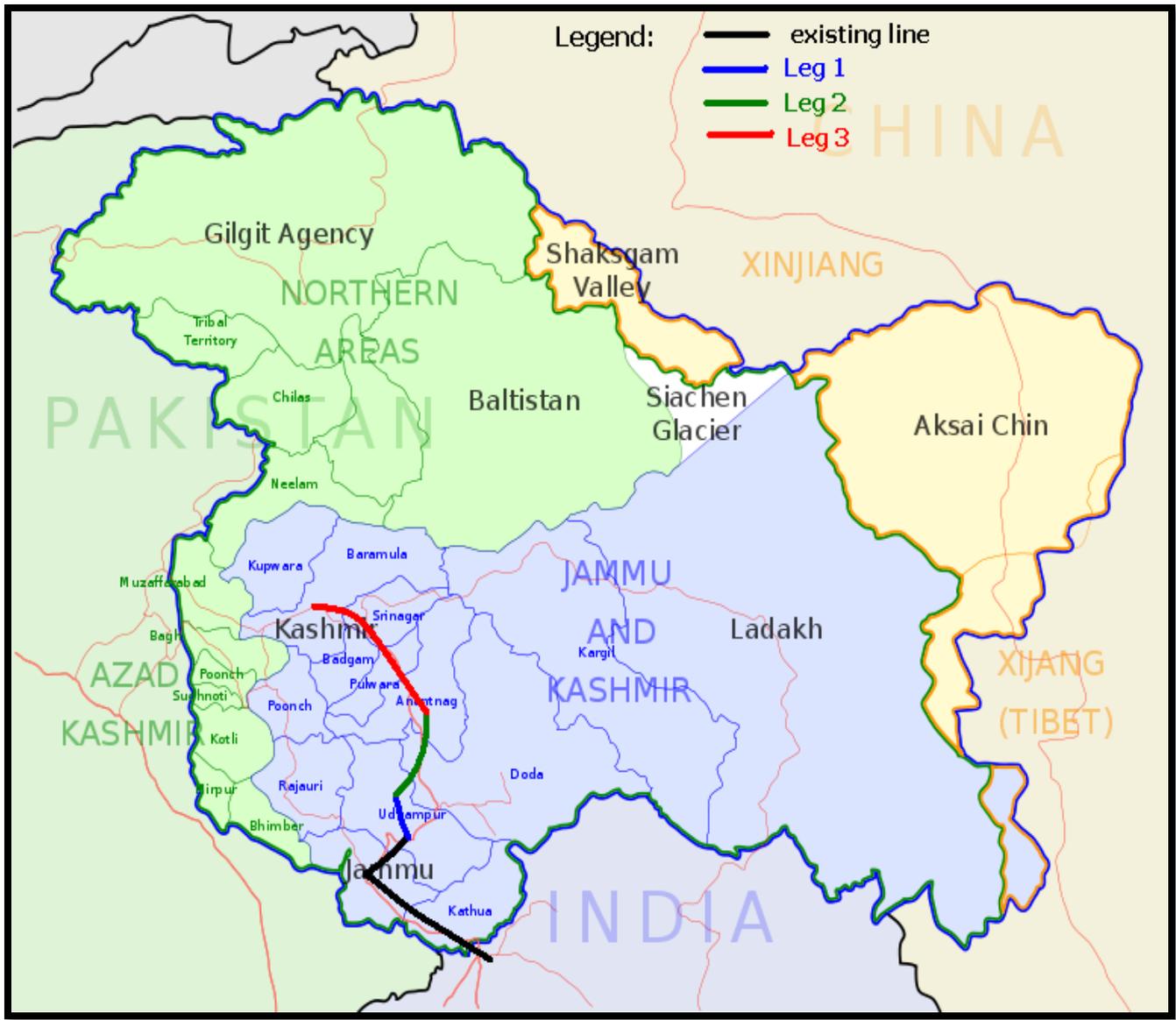
State wise distribution of electrified network



Predictive model based on gradual increase in length of electrified network across country for the past 85 years:



Topographic limitations in specific regions of India:



- Variation in height = 2000m
- Distance = 100km
- Slope = Height/Distance
- Slope = 1/50

In the extreme cases the value of tangent of angle reaches **1/20** and it is not only difficult but **impossible** to grant a permit to establish rail network in such regions.

Repository of Rail accidents :

OpenJUMP

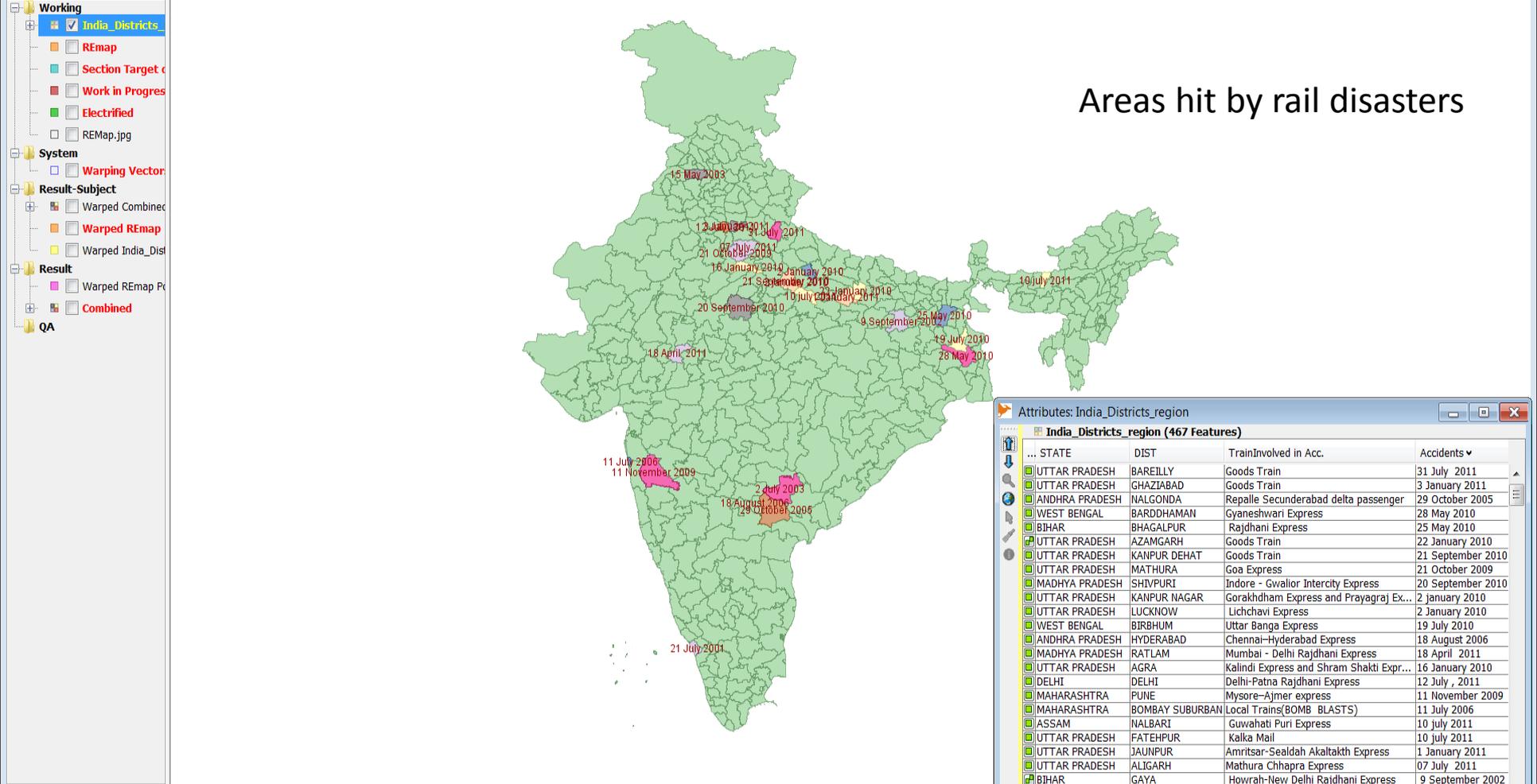
File Edit View Layer Customize Tools Window Help

Attributes: India_Districts_region

India_Districts_region (467 Features)

FID	AREA	PERIMETER	STATE	DIST	Accidents	TrainInvolved in Acc.
937	3.79957745E9	799644.74	UTTAR PRADESH	BAREILLY	31 July 2011	Goods Train
933	2.59187642E9	606414.91	UTTAR PRADESH	GHAZIABAD	3 January 2011	Goods Train
599	1.41516022...	1704280.42	ANDHRA PRADESH	NALGONDA	29 October 2005	Repalle Secunderabad delta passenger
621	7.32299522E9	1297798.14	WEST BENGAL	BARDDHAMAN	28 May 2010	Gyaneshwari Express
954	5.84415902E9	846007.34	BIHAR	BHAGALPUR	25 May 2010	Rajdhani Express
899	3.96027716...	850138.2	UTTAR PRADESH	AZAMGARH	22 January 2010	Goods Train
913	5.05975418E9	939654.3	UTTAR PRADESH	KANPUR DEHAT	21 September 2...	Goods Train
925	3.82629069E9	822354.73	UTTAR PRADESH	MATHURA	21 October 2009	Goa Express
549	1.03184278...	1410490.21	MADHYA PRADESH	SHIVPURI	20 September 2...	Indore - Gwalior Intercity Express
888	1.0646777E9	192570.23	UTTAR PRADESH	KANPUR NAGAR	2 January 2010	Gorakhdham Express and Prayagraj Express
908	2.55875469E9	632491.6	UTTAR PRADESH	LUCKNOW	2 January 2010	Lichchavi Express
625	4.7335772E9	876934.73	WEST BENGAL	BIRBHUM	19 July 2010	Uttar Banga Express
590	1.7850837E8	65027.45	ANDHRA PRADESH	HYDERABAD	18 August 2006	Chennai-Hyderabad Express
570	4.82186196E9	811177.74	MADHYA PRADESH	RATLAM	18 April 2011	Mumbai - Delhi Rajdhani Express
924	3.53401362E9	947191.42	UTTAR PRADESH	AGRA	16 January 2010	Kalindi Express and Shram Shakti Express
984	1.5043555E9	214380.34	DELHI	DELHI	12 July , 2011	Delhi-Patna Rajdhani Express
757	1.56476452...	3111232.22	MAHARASHTRA	PUNE	11 November 20...	Mysore-Ajmer express
766	6.02155968...	566827.03	MAHARASHTRA	BOMBAY SUBURBAN	11 July 2006	Local Trains(BOMB BLASTS)
915	4.2068682E9	627781.43	UTTAR PRADESH	FATEHPUR	10 July 2011	Kalka Mail
855	2.4111478E9	300071.19	ASSAM	NALBARI	10 July 2011	Guwahati Puri Express
893	4.08683846E9	900464.42	UTTAR PRADESH	JAUNPUR	1 January 2011	Amritsar-Sealdah Akaltakh Express
926	5.0522165E9	966360.45	UTTAR PRADESH	ALIGARH	07 July 2011	Mathura Chhapra Express
963	6.71790948...	907959.17	BIHAR	GAYA	9 September 2...	Howrah-New Delhi Rajdhani Express
777	2.33189936...	501678.89	KERALA	KOZHIKODE	21 July 2001	Mangalore Mail commuter train
603	1.28782205...	1611196.22	ANDHRA PRADESH	WARANGAL	2 July 2003	Golconda Express
700	3.78239554E9	725506.61	PUNJAB	LUDHIANA	15 May 2003	Golden Temple Mail
718	1.3846899E9	213903.23	NAGALAND	ZUNHEBOTO		
742	1.35571707...	2727140.76	MAHARASHTRA	YAVATMAL		
985	3.8354744E7	39465.11	PONDICHERRY	YANAM		
813	1.3075812E9	196311.59	HARYANA	YAMUNANAGAR		
717	1.7808758E9	243710.7	NAGALAND	WOKHA		
632	3.21020743E9	546598.6	TRIPURA	WEST TRIPURA		
869	1.3472281E10	846182.81	ARUNACHAL PRA...	WEST SIANG		
566	1.34844113...	2442310.4	MADHYA PRADESH	WEST NIMAR		
727	5.5808799E9	427267.78	MEGHALAYA	WEST KHASI HILLS		
875	7.9187338E9	554016.0	ARUNACHAL PRA...	WEST KAMENG		
607	7.85279932E9	1396775.53	ANDHRA PRADESH	WEST GODAVARI		
728	5.5831726E9	483199.97	MEGHALAYA	WEST GARO HILLS		
627	5.6351127E9	893360.24	WEST BENGAL	WEST DINAJPUR		
655	1.2506732E9	177757.92	SIKKIM	WEST		
778	2.12887149E9	433181.97	KERALA	WAYANAD		
741	6.3262631E9	1273959.96	MAHARASHTRA	WARDHA		
610	5.69149395E9	1313128.47	ANDHRA PRADESH	VIZIANAGARAM		
609	1.16136734...	1995107.24	ANDHRA PRADESH	VISHAKHAPATNAM		
551	7.31575998E9	1201415.26	MADHYA PRADESH	VIDISHA		
891	5.1683388E9	918118.0	UTTAR PRADESH	VARANASI		
831	5.22635812...	1823646.05	GUJARAT	VALSAD		
946	2.0568284E9	248648.75	BIHAR	VAISHALI		
835	7.77618578...	1987721.35	GUJARAT	VADODARA		
536	7.3335358E9	925153.0	UTTARANCHAL	UTTARKASHI		
793	1.01835302...	2211257.12	KARNATAKA	UTTAR KANNAD		
872	6.9846692E9	497045.88	ARUNACHAL PRA...	UPPER SUBANSIRI		
912	4.628856E9	850100.44	UTTAR PRADESH	UNNAO		



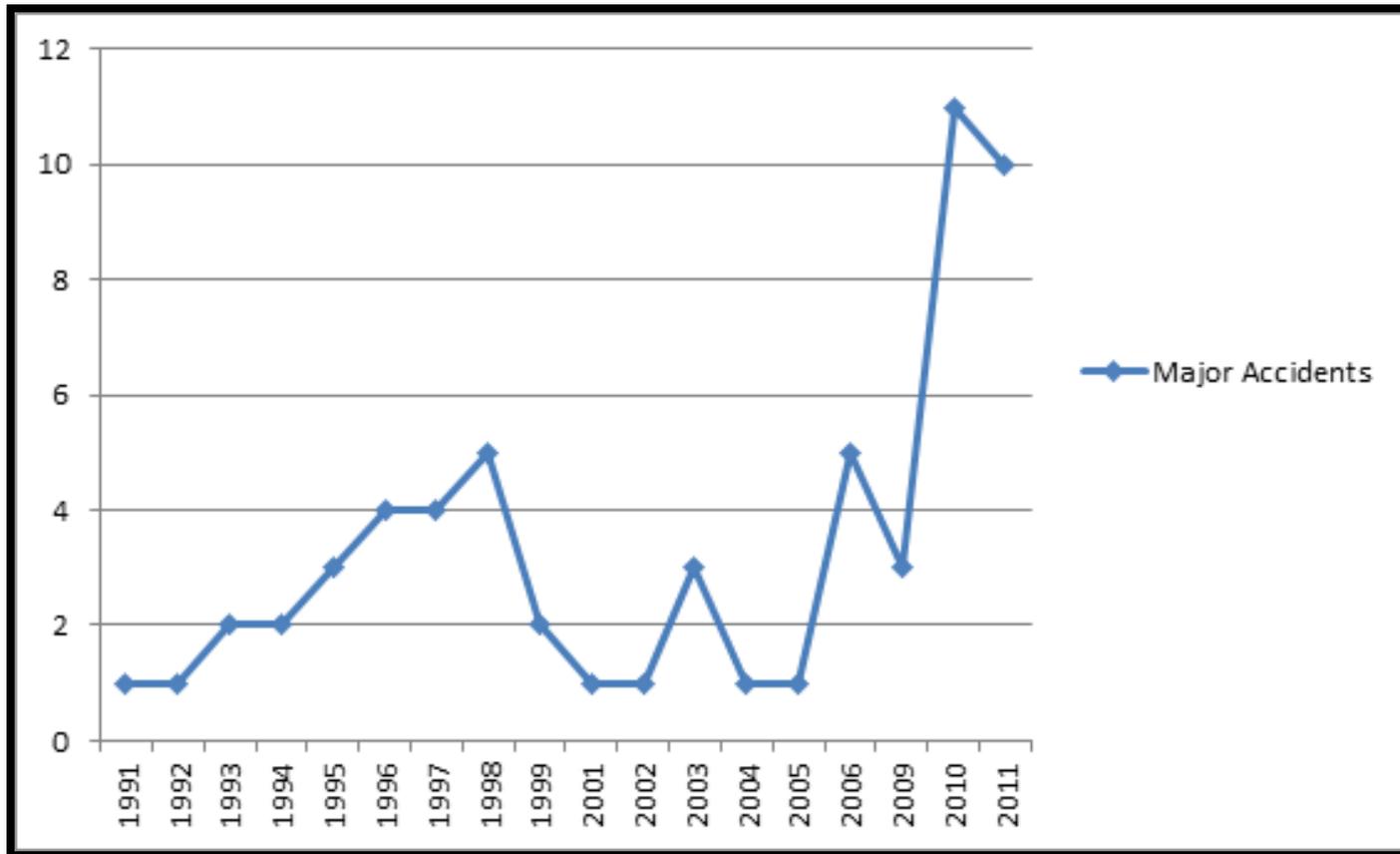


Areas hit by rail disasters

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UTTAR PRADESH	BAREILLY	Goods Train	31 July 2011
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UTTAR PRADESH	JAUNPUR	Amritsar-Sealdah Akaltakth Express	1 January 2011
UTTAR PRADESH	ALIGARH	Mathura Chhapra Express	07 July 2011
BIHAR	GAYA	Howrah-New Delhi Rajdhani Express	9 September 2002



Reasons for the sudden shoot might be:

- introduction of large number of trains in year 2002
- heavy traffic on nearly the same length of route length



Climatic Analysis on major accidents:

Frequency of rail disasters is more in the months of winter or monsoon the reasons cited are :

- Dense fogs in the northern parts of the country.
- Heavy rainfall causing damage to machinery and flooding of tracks

Both of these cause mismanagement and difficulty in operations of signals and instructions to the rail drivers.

Conclusions:

- Visualization of Indian Railways has been made very effective through the integration of geospatial technology in data storage
- Existing schematic view of Indian railways that displays just the network without any coordinates attached to the nodes and edges.
- The Budget Viewer gives the user a better insight of the works done during the year.
- GIS has brought a transparency in the management and functioning of works in the sector.
- For Government it serves for Policy making and for end user Decision making.

Future Work

- Sharing of the repository information through the development of a web portal assisted with a feedback system
- A query based applications for users to fetch information of their use from the large pool of data.

The essence of feedback systems is from usability perspective of the stakeholder, this feedback information may be anything – the type of data that user frequently visits, the design of elements, the query result format and what not.

Thanks